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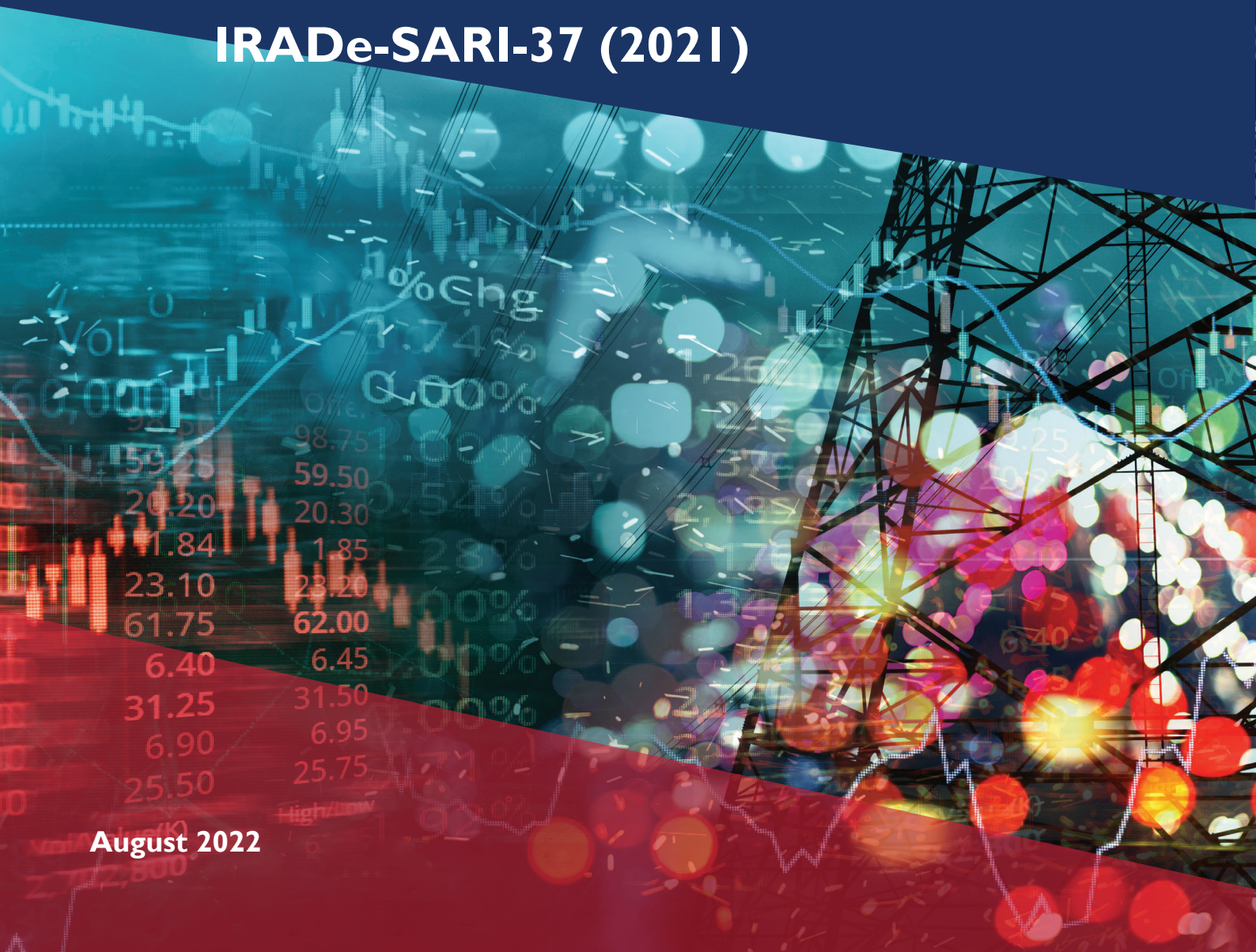
SOUTH ASIA REGIONAL INITIATIVE FOR ENERGY INTEGRATION (SARI/EI)

STUDY ON THE TRANSITION TO TRILATERAL AND MULTILATERAL POWER TRADE IN SOUTH ASIA

IRADe-SARI-37 (2021)



August 2022

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INTEGRATED RESEARCH AND ACTION FOR DEVELOPMENT (IRADE)

AUGUST 2022

Prepared by:

SARI/EI Project Secretariat

Mr. Pankaj Batra, Project Director, SARI/EI – IRADe

Mr. Vinod Kumar Agrawal, Technical Director, SARI/EI–IRADe

Mr. Rajiv Ratna Panda, Ex-Associate Director, SARI/EI–IRADe

Ms. Maitreyi Karthik, Ex-Research Analyst, SARI/EI–IRADe

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Executive Summary

1. Introduction

This report is part of the study undertaken on "The transition to trilateral and multilateral power trade in South Asia", under USAID's South Asia Regional Initiative for Energy Integration (SARI/EI) program. Since in many other regions across the globe, the trades on the principles of trilateral and multilateral approach are already in vogue and are being carried out successfully for quite some time, the study seeks to learn from international experience in this respect and use such learnings towards the development of a model regional framework to facilitate transition towards trilateral and multilateral power trade in South Asia.

The objective of the study is to assist in the transition to cross border trilateral and multilateral power trade among the South Asian countries, which will eventually enable increase in the volume being traded. This calls for regional cooperation and the development of a Model Regional Framework based on stakeholders' consensus, followed by preparation of country wise Roadmap and Action Plan.

2. Key learning from review of international experience

There are other regions of the world, where the transition to trilateral and multilateral cross border power trade has already taken place. Review of the international best practices and study of the existing frameworks in South Asia from the perspective of transition to Cross Border Trilateral and Multilateral Power Trade (CBTMPT), has provided the basis for the preparation of a Model Regional Framework for Trilateral and Multilateral Power Trade (MRFTMPT) for South Asia to establish CBTMPT. A summary of review of international experience is provided below.

A. Key drivers and enabling factors

The key drivers and enabling factors behind the transition to CBTMPT in other power pools were the strong political support, regional coordination mechanisms and institutions, flexible commercial agreements and availability of market platforms. The role of strong political support can be especially seen in the case of SAPP and GCCIA, where the countries undertook cross border investments within their own territories towards the overall vision of interconnected grid for trade. The power market platforms (power exchanges and markets run by market operator) have played a key role in enabling multilateral power trade in Europe, Nord Pool, SAPP, Central America and GCCIA. Meanwhile, progress in ASEAN region was mainly owing the development of flexible and good-faith commercial agreements. For example, under the LTM PIP agreements, Laos supplies power to Malaysia if it has surpluses. There is neither a commitment from Laos to supply the contracted power at all times, nor a commitment from Malaysia to offtake all the surplus power offered to it from Laos.

Regional institutions act as a key driver of regional power trade. This could be in the form of strong regional entities (CRIE and EOR in Central American Interconnection, ENTSO-E in Europe) or regional entities with an advisory and coordination role (RERA in SAPP, RPTCC in GMS, APGCC in ASEAN) etc.

B. Benefits that can be expected

The benefits of CBTMPT as seen in other regions can be categorized into the following groups:

a. Sharing of reserves, reduction of need for marginal generation capacity, increasing security of supply – GCCIA, Europe, Nord Pool

b. Sharing of non-firm surplus – LTM PIP, Central America

c. Power trade to make use of resource complementarities – SAPP

d. Increasing competition and choice – Europe, Nord Pool

C. Overcoming barriers and challenges

Other regions can be seen to have adopted various key steps to overcome challenges in the transition to CBTMPT. For example, to solve the issue of financing of transmission investments and promotion regional trade, SAPP is planning to establish a Regional Transmission Infrastructure Financing Facility (RTIFF). A similar model of "Projects of Common Interest" is already adopted in Europe. The role of pilot studies for market based trade is also crucial, as was adopted by SAPP and GCCIA. In addition, a common thread on how the regions have solved challenges is their willingness to adapt and change the relevant frameworks.

D. Strategic and political framework

In the international power pools / regions, a **strong political support in the form of an existing regional arrangement (SADC, GCC, ASEAN, GMS) and/or an intergovernmental agreement / MoU** is seen as a common factor, creating the enabling conditions, and driving the CBTMPT. The political support is also linked with the regional co-operation strategy, and/or the country specific strategies of management of deficits/surplus. There are also examples of detailed protocols succeeding the intergovernmental treaty, such as the case of MER in Central America.

E. Legal, policy and regulatory framework

Most of the international power pools/ regions are supported by an **Inter-governmental agreement/ MoU, and a set of detailed agreements**/ procedures/ guidelines/ rules that govern the power trade.

For example:

- SAPP's intergovernmental and inter-utility MoUs, and Operating Guidelines;
- Marco treaty and Regional Electricity Market Regulations (REMR) in Central America;
- GCC General Agreement and Power Exchange and Trading Agreement (PETA), for GCCIA;
- GMS Inter-Governmental Agreement (IGA) on Regional Power Trade;
- Memorandum of Understanding on the ASEAN Power Grid; and
- Directives, rules and guidelines of European Commission for European common market.

F. Technical and operational framework

All the international / regional power pools can be found to have some form of regional level coordination in planning and operations. This also includes the development of a **regional planning document, and development of operational procedures and guidelines** for regional level management of transmission corridors. A multilateral planning document / vision, such as ASEAN masterplan for energy cooperation and SAPP Pool Plan can go a long way in improving the technical and operational framework also.

G. Commercial framework

The key commercial aspects adopted by the regional pools to support trilateral and multilateral trade includes:

1. Market products / platforms such as spot market through power exchanges;
2. Mechanism for wheeling of power, along with determination of charges for such wheeling;
3. Coordination in financing and cost recovery of regional transmission lines;
4. Congestion management mechanisms; and
5. Deviation settlement mechanisms.

As national frameworks on the above vary from country to country, there are example such as Europe where an overall guidance on these aspects are provided, and countries can adopt different variations as long as those are within the overall guidance.

H. Institutional framework

Regional institutions form a key facilitator and driver of regional power trade. This could be in the form of strong regional entities (CRIE and EOR in Central American Interconnection, ENTSO-E in Europe) or regional entities with an advisory and coordination role (RERA in SAPP, RPTCC in GMS, APGCC in ASEAN) etc. There are also institutions playing the role of market operator / power exchange related to regional trade, such as the case of GCCIA and Nord Pool. The regional institution is also in many cases supported by Intergovernmental forums such as CDMER in Central America and GCC Ministerial Committee.

	SAPP	GCC	Central America	European Union	ASEAN
Inter-governmental coordination	Energy Ministers of SADC	GCC Ministerial Committee	Steering Committee of the Regional Electricity Market (CDMER)	European Commission	ASEAN Ministers on Energy Meeting
Regional regulatory mechanisms	Regional Electricity Regulators Association of Southern Africa (RERA)	Advisory and Regulatory Committee (ARC)	Comisión Regional de Interconexión Eléctrica (CRIE)	Agency for the Cooperation of Energy Regulators (ACER)	HAPUA working group on policy and commercial development
Regional technical mechanisms	SAPP Coordination Centre	GCC Interconnection Authority (GCCIA)	Ente Operador Regional (EOR)	European network of transmission system operators for electricity (ENTSO-E)	Head of ASEAN Power Utilities (HAPUA) and ASEAN Power Grid Consultative Committee (APGCC)
Other key institutions	Southern African Development Community (SADC)	GCC Supreme Council	Empresa Propietaria de la Red (EPR)	Regional Security Coordination Initiatives (RSCI)	ASEAN Center for Energy

I. Sustainability framework

Many of the regional power arrangements play a key role in facilitating the use of clean energy, thereby aiding in environmental sustainability. Nearly 21% of power traded in SAPP is renewable energy. [1] In case of central American interconnection, it was even higher at 68%.[2] In ASEAN, the energy cooperation between Laos and Thailand had already benefitted both countries, where Thailand has been able to tap into vast hydropower resources of Laos, with the alternative being increase of thermal capacity within Thailand. The way in which Denmark's surplus wind power is balanced through hydropower in neighbouring Norway in Nord Pool is also a well-known example.

J. Investments and other aspects

International experience

Most of the regions, which did not have a dedicated regional transmission infrastructure (thereby excluding models such as MER and GCCIA) can be seen to have **grown in phases** in terms of market products and options. For example:

- GCCIA initially served as a mechanism to provide reliability, and sharing of reserves. Power trade through an exchange platform was initiated in pilot phase only after multiple years of operation.
- GMS has a clear roadmap for transitioning from bilateral to multilateral model in phases.
- ASEAN power market was initially under only bilateral model. Trilateral transactions started with the commencement of LTMS PIP in 2018.
- While SAPP ran day ahead spot market since 2009, forward physical products were introduced only in 2016.

Further, the countries seem to have agreed to finance investments within their own territories, without any binding commitments from the other side ensuring utilization of such lines. Instead, the rationale adopted by other regions was that the regional lines will in turn spur regional trade.

3. Summary of current framework for CBET in South Asia

A review of the policy, legal, regulatory, technical and commercial framework of South Asian countries relating to CBET reveals major shortcomings in the regulatory, technical and commercial aspects. In addition, the absence of a clear policy guideline on the manner of approving and regulating CBET is also a concern in countries other than India. Framework dealing with key aspects such as transmission pricing, open access and deviation settlement are either partly or entirely not available in countries other than India, though such aspects are at least mentioned in policy and legal documents in case of some of the other countries also.

Requirement for CBET	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Strategic and political framework	✓	✓	✓	✓	✓	✓	✓
Policy and legal framework	◯	◯	◯	✓	◯	✓*	◯
Regulatory framework	✗	◯	◯	✓	✗	✓*	✗
Technical and operational framework	✗	◯	✓	✓	◯	✓*	◯
Commercial framework: Transmission line development methodology	✗	◯	✓	✓	◯	✓	◯
Commercial framework: Transmission pricing and loss accounting	◯	✓	◯	✓	✗	✓	◯
Commercial framework: Open access / wheeling of power	◯	◯	◯	✓	✗	✓	✗
Commercial framework: Deviation settlement	✗	✗	✗	✓	◯	✓	✗
Institutional framework	◯	◯	◯	✓	◯	✓	◯

✓ *Available* ◯ *Partially Available* ✗ *Not Available*

** Maldives not considered due to its geographical constraints in participating in CBET with rest of South Asia. For Pakistan, legal, regulatory, technical and operational framework for competitive market under CTBCM is available. It is up to Government to decide if it wishes to have those replicated in the cross border electricity trade context.*

4. Preparedness of South Asian countries for transition to CBTMPT

From the previous table it can be seen that there are certain elements of strategic, policy and legal framework already present in all the countries that would facilitate the transition to CBTMPT. For example, all the countries have signed SAARC Framework Agreement for Energy Cooperation (Electricity) in 2014. There are also various bilateral intergovernmental agreements for energy cooperation, such as the Power Trade Agreement between India and Nepal. The legal framework is well developed in India, even in other countries, cross border electricity trade is allowed, as long as such trade is undertaken by the national power utilities, or undertaken under agreements with the Government.

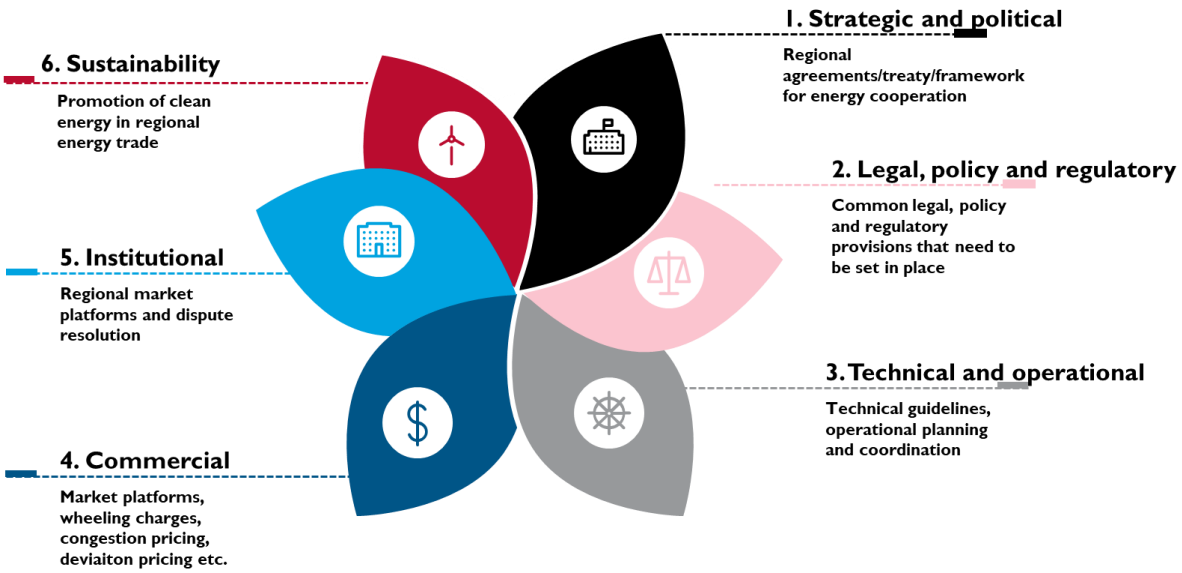
In some cases, the framework will be partially available, which also need to be captured. However, there are also barriers in various other factors that could impede the implementation of CBTMPT. A few such key areas that should be focused to avoid such impediments for implementation of CBTMPT are listed below:

1. **Regulatory framework**: Regulatory framework for CBET is yet to evolve in Afghanistan and Sri Lanka.

2. **Transmission line development methodology**: Currently, transmission lines are developed and maintained by the government owned transmission utility in countries other than India. In most countries, while there is a transmission planning process, clear guidelines on which lines to be developed and mode of development etc. are not available. In the absence of such information, any line that will be developed, even for cross border trade will have its costs distributed across all the beneficiaries within the system.
3. **Open access and wheeling**: All countries other than India and Pakistan continues to be on single-buyer model. In other countries, while policy or law may refer to open access (Bhutan, Nepal), in actual practice, open access is not yet operationalized.
4. **Deviation settlement**: Mechanism for settlement of deviations is yet to evolve in countries other than India and Pakistan.
5. **Other operational frameworks:** Regional level technical, operational and commercial frameworks are required to support the transition to trilateral and multilateral trade arrangements. This includes a broad consensus on aspects such as transmission pricing methodology, loss sharing, scheduling, network access approvals etc. Such commonly accepted frameworks / practices are currently not present in South Asia.

5. Model regional framework for Trilateral and Multilateral Power Trade (MRFTMPT) in South Asia

The model regional framework presents a template that can be adopted by the South Asian countries, so that it is easier to undertake trilateral and multilateral trade in the region. Such a model regional framework can serve as an alternative to the signing of a robust and binding regional agreement for energy cooperation and trade. In comparison to a regional level agreement, a model framework offers flexibility for the countries in South Asia to put in place harmonious provisions for cross border electricity trade, for moving to trilateral and multilateral models, while not compromising on their own need for country-specific adjustments. The presence of a model regional framework is also expected to reduce the risk perception and improve investor attractiveness for regional energy projects in South Asia, as the ambiguity in applicable frameworks can be reduced. The model regional framework consists of six crucial components:



Component 1: Strategic and political framework

This model regional framework for trilateral and multilateral power trade may be adopted by the South Asian countries as a template framework for enabling and facilitating the transition to CBTMPT. Once the framework is discussed among the key transmission utilities, system operators and regulators of the South Asian countries,

the same may be reviewed by the respective governments and the policy guidelines on the level of harmonisation to be maintained in respective national framework for CBET may be issued in line with the model regional framework.

Component 2: Policy, legal and regulatory framework

The South Asian countries may put in place the policy, legal and regulatory framework for CBET, including CBTMPT as per their own strategic and operational requirements, while complying with the following minimum criteria:

1. **Key institutional framework**

   Each country is required to designate / identify the following key institutions:

   a. Approving Authority - The Governmental entity which shall undertake Governmental policy level approvals related to specific CBET transactions or CBET infrastructure. (For example, Designated Authority in India);

   b. Regulatory Authority - The entity which shall regulate CBTMPT transactions and infrastructure. (This is expected to be the electricity regulatory commission in most cases;

   c. Entity that will serve as the System Operator;

   d. Entity that will serve as the Transmission Planning Agency; Entity that will serve as the National Transmission Utility; and

   e. Entity that will serve as the Settlement Nodal Agency (SNA) for the settlement of grid operation- related charges with market participants from other countries.

   In case of countries intending to limit the market intermediaries, the entities who are allowed as traders may also be specified.

2. **Nature of approval**

   Each country to clearly specify the following:

   a. Whether approval for CBET is provided in the form of a license, or a concession, or an administrative approval?

   b. Duration of CBET approvals; and

   c. Whether CBET approval process is of one-time nature, or recurring nature?

3. **Eligibility for approval**

   Each country to clearly specify the following:

   a. Which type of market entities shall be eligible for CBET? (Single-buyer only, Single-buyer and IPPs, generation utilities, power traders, etc.)

   b. What are the minimum eligibility requirements, to allow an entity within the country to undertake CBET?

   c. What are the minimum eligibility requirements, to allow an entity outside the country to undertake CBET with the country?

4. **Process for approval of cross-border electricity trade and cross-border interconnections**

   a. Each country to specify the broad parameters for providing governmental level approvals for CBET, including CBTMPT. For example, impact on security of supply, compliance with government policies, environmental impacts etc.

b. Each country to specify the broad parameters for providing utility level approvals for CBET, including CBTMPT. For example, adequacy/requirement in domestic market, impact on reliability, compliance with operational codes, transmission capacity availability etc.

5. Market intermediaries

Each country to specify the allowed type of market intermediaries, who will serve as interface points for entities outside the country, to undertake CBET with the country. (For example, power traders, single-buyer etc.)

6. Open access, and transmission pricing

Each regulator shall specify the process for obtaining approval for access to the transmission grid of a country, to undertake CBTMPT. This can be in the form of open access (example: India) for clearly defined short, medium and long term periods, or any other prevalent corridor booking mechanisms (for example: purchase of capacity rights to the transmission system).

The regulator shall also specify the transmission pricing methodology applicable for CBTMPT transactions, including pure transit transactions.

The regulator shall also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity.

7. Approval in transit countries

Each country (Government/regulator) to specify the process and conditions of approval for cross border electricity trade transit transactions through it. For example, transit through a country may be approved if security of supply is not adversely impacted, transmission capacity is available, and if transmission payments cover the associated capital costs, and the variable costs of transmission service

Component 3: Technical and operational framework

In terms of operational framework, the countries may put in place the following:

1. **Regional transmission plan**: Cross border transmission plans for each country may be discussed and harmonized to arrive at a regional transmission plan, which shall lay out the mutually agreed transmission interconnection plans between each set of countries. (In the longer term, the aspiration shall be to get also large generation projects covered under a regional plan mechanism). The plans may preferably be updated every 2-3 years, to optimize resource sharing and leveraging of diversities. The development of such plans may be coordinated by the national transmission utilities, under institutional mechanism discussed under Component 5.
2. **Regional operational procedure:** The existing agreed-upon bilateral operational procedures and guidelines developed under intergovernmental mechanisms may be consolidated to develop the regional operational procedures. The development of such plans may be coordinated by the national system operators, under institutional mechanism discussed under Component 5.
3. **Harmonized grid codes**: For harmonization of grid codes, overall compliance with the "Common Minimum Grid Code template" being developed for South Asian countries may be strived for.

Component 4: Commercial framework

1. Market platform and products

All countries that have a functioning power exchange or other similar market platforms in place, may allow entities in other countries also to participate in the market, through market intermediaries in the domestic market, such as power traders or national utility. The market intermediary so involved will be in charge of

coordination with the entity in other country in all matters such as scheduling, dispatch, and settlement of charges.

The respective electricity regulator in the country where the market platform is located may decide on the markets where involvement of entities from other countries are to be allowed, procedure for approval etc. Any government level approval for entities may preferably be limited to one-time approval rather than transaction specific approval.

In the longer term, options such as a regional power exchange, or market coupling of multiple power exchanges in the region could be explored.

2. Wheeling fees for transit arrangements

The wheeling fees for transit arrangements and CBTMPT may consist of two components:

i. A domestic component, which is the wheeling charge, for wheeling of power within the country. This may be determined by the respective electricity regulator of each country. While the regulatory methodology for such charge determination is better left to the respective regulators, it may be ensured that such charges are not lesser than similar transactions if undertaken entirely within the country.

   Similar to such wheeling charges, the regulators shall also determine the mechanism for allocation of losses, for such transactions.

ii. A regional component, which is the charge for use of cross border networks. If the charge of such networks are predetermined under an agreement/arrangement, the same may be applicable. Alternatively, the charges for such network may be decided mutually by the respective countries / their utilities. Similar treatment shall apply in the case of transmission losses also, in the cross border network.

If new transmission system is required for a specific CBET transaction, there will be additional requirements such as the need for one of the parties to bear the cost for such enhancement of transmission system. For example, a country may require a utility from neighbouring country to provide commitment on recovery of charges, before agreeing to invest in a cross border line.

3. Financing and cost recovery of regional transmission lines

Since this is a matter of policy, it can be left to be dealt at intergovernmental level, and pinpointing any single option among the above can be averted.

4. Congestion pricing

Considering that each of the South Asian countries have their own principles and procedures for congestion management, it will not be prudent to fix any single congestion management mechanism applicable for all countries.

The country owning the transmission network is responsible for monitoring the level of line loading and declaration of available margins for transactions. In case of congestion in any network, it can be left to the relevant entity managing such networks (system operator) to decide whether the CB transactions are to be curtailed first or to be treated at par with the other transactions and dealt accordingly. While evaluating cross border transactions in this context, the different types of transactions shall be separately considered based on the transaction duration such as short, medium and long term. The respective system operator will be free to adopt various long-term and short-term congestion management mechanisms such as corridor booking/capacity allotment through e-bids, real time curtailment etc. However, priority should be given to long term transactions over the other types.

5. Deviation pricing

Considering that deviations are calculated at peripheries of respective countries, it will be better to allow those countries to decide on the applicable deviation settlement mechanism for each such peripheries (for example: India-Nepal, India-Bhutan etc.), rather than trying to impose a common mechanism. However, the countries may also start coordinating between themselves and, work towards devising and implementing the mechanisms.

Component 5: Institutional framework

1. Overall institutional framework

Considering the complexity involved, and the need for a wider acceptance of the overall framework for CBTMPT, a hybrid approach is proposed, where there are two levels of institutional framework for coordination:

1. Level 1 consists of coordination and consultations at inter-utility and inter-regulator level; and
2. Level 2 consists of the intergovernmental coordination mechanisms such as JSC, JWG and JTT.

The level 1 activities may preferably be undertaken under regional platforms/forums such as South Asia Forum of Transmission Utilities (SAFTU), South Asia Forum of System Operators (SAFSO) and South Asia Forum of Electricity Market (SAFEM). However, even if such platforms/forums are not in place due to any reason, the activities may still be undertaken through inter-utility and inter-regulator discussions. Those utilities/regulators may coordinate among themselves to organize the necessary discussion sessions at a regular level, till specific regional platforms / forums are in place.

2. Dispute resolution framework

In terms of institutional framework for dispute resolution, there may be a variation to the above suggested mechanism.

1. For transactions undertake under cross border agreements, the dispute resolution provision specified in respective agreements will have to be followed, such as dispute resolution under any specific regulatory commission, or through arbitration.
2. Matters of intergovernmental nature, which are also not covered under sl no. 1, may be discussed at intergovernmental levels, under JSC and JWG arrangements.
3. Matters of purely commercial nature, which are also not covered under sl no. 1 and 2, may be resolved through international arbitration, preferably at a neutral country.

   Note: Matters that fall entirely within the borders of a country may also be decided by respective regulatory commissions or courts, depending on legal framework of the country.

Component 6: Sustainability framework

The countries may strive to ensure that inherent intermittencies in renewable energy do not prevent their access to regional power market and regional trade, wherever regulatory and operational mechanisms can be modified to obtain a level playing field for renewable energy transactions in regional power trade. The promotional measures for clean energy (which includes hydropower) can be decided by the respective countries, in terms of aspects such as transmission access and dispatch priority. However, any such promotional measures shall also be subject to limitations on account of system security.

In addition, the countries may also consider arriving at a separate reserve sharing agreement, rather than each country building its own dedicated reserves to manage clean energy sources. A commercial mechanism for such reserve sharing may also be determined, so that the country offering such reserves get compensated from the countries that utilize such reserves.

6. Country-wise initiatives required to implement the model regional framework

While the model framework for trilateral and multilateral power trade has proposed six components, it may be noted that the framework itself is not a single document that can be directly implemented as it is. The components of framework are to be put into use, by utilizing them to modify the applicable strategic, policy, regulatory, legal, technical, commercial and operational frameworks within the countries. Therefore, in order to implement the proposed model framework for trilateral and multilateral power trade, the countries will need to undertake initiatives to make certain modifications/additions in their country level frameworks. Therefore, a minimum set of strategic, policy, regulatory, legal, technical, commercial and operational changes have been suggested, vis-a-vis it's provisions/sections relating to CBET in laws/regulations/rules/standards prevailing in each of the South Asian nations.

The country wise summary of these modification are provided below.

Country	Summary of suggested modifications
Afghanistan	• Policy guidelines for CBET to be issued by Govt. of Afghanistan • Grid code to be developed • Transmission planning mechanism and operational procedures for CBET to be established through regulatory provisions • Process for obtaining approval for access to the transmission grid, to undertake CBTMPT to be developed • The Ministry of Energy and Water (MEW) may consider issuing a notification that will allow the utility, DABS, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation. • While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources. • Further, all clean energy sources, including hydro may be considered as must-run sources (except reservoir based hydro).
Bangladesh	• Policy guidelines for CBET to be issued by Govt. of Bangladesh. • In order to deal with regional planning of transmission lines, and development of regional operational procedures, amendments in chapter 4 (transmission planning) and chapter 7 (scheduling and dispatch) may be considered in BERC (Electricity Grid Code) Regulations, 2019. • Open access regulations to be prepared • Transmission pricing to be extended to 400 KV voltage • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BERC • The Ministry of Power, Energy and Mineral Resources may consider issuing a notification that will allow the utilities, BPDB and PGCB, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.

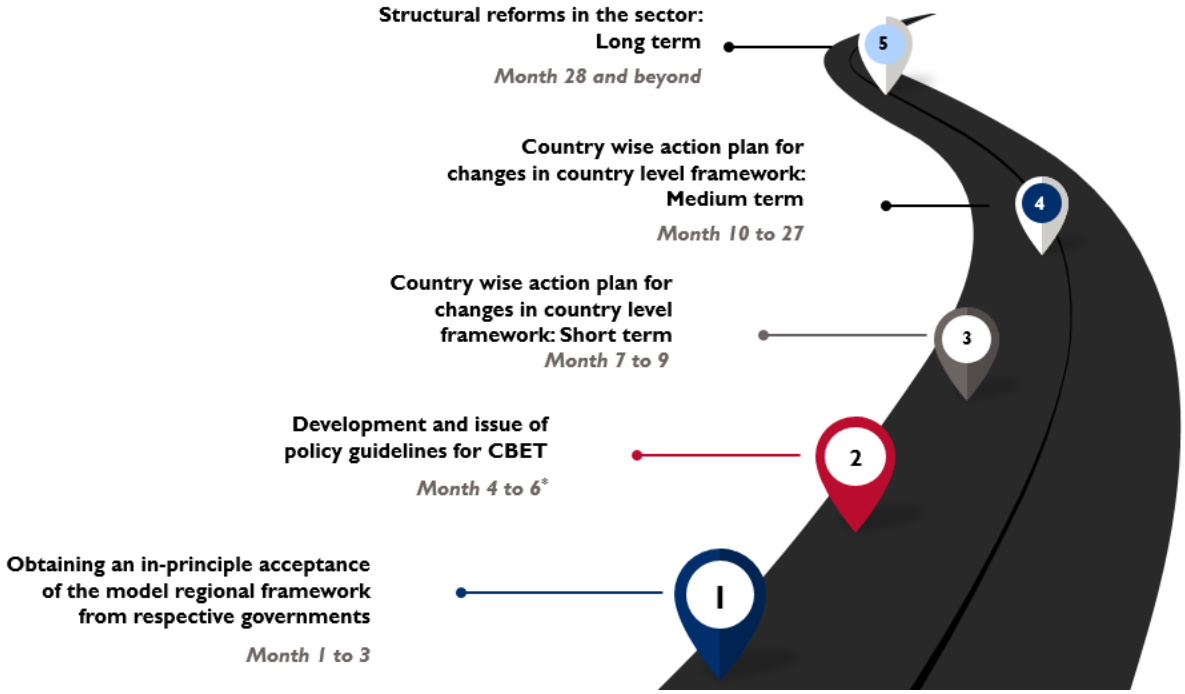
Country	Summary of suggested modifications
	• All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). Amendments to that effect may be undertaken on the grid code, by adding a clause 7.4.2 a under chapter 7.4 (Generation Dispatch).
Bhutan	• Policy guidelines for CBET to be issued by Govt. of Bhutan • Open access regulations to be prepared to define procedure to obtain access to the transmission grid for undertaking cross border electricity trade. • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BEA. • The Ministry of Economic Affairs may consider issuing a notification that will allow DHPS, and the utilities, BPC and BPSO, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation. • All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). Amendments to that effect may be undertaken on the grid code, by adding a clause 7.4.4 a under chapter 7 (Scheduling and Dispatch code).
India	• Possibility towards determining a separate transmission tariff for third party wheeling transactions can be explored. • The Ministry of Power may consider supporting the institutional mechanism whereby the utilities in the power sector such as the system operator and the transmission utility etc. may interact with the counterpart utilities belonging to the other countries in the region, so as to allow sharing of best operational practices and promoting harmonization and excellence in the technical matters related to power system and transmission network.
Nepal	• Electricity Act, 1992 to be amended for incorporating the provision associated with power trading and CBET. • Policy guidelines for CBET to be issued by Govt. of Nepal • Electricity Rules, 1993: Section 42 and 43 to be amended • The utility may consider publishing revised master plan at least once in every three years. To that extent, amendments may be made in NEA's Grid Code, in chapter 3 (Grid planning). • Open access directives to be issued by ERC • Transmission pricing framework to be prepared by ERC • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC • The regulator may specify the manner in which deviation charges billed by India on Nepal, are further distributed among entities within Nepal, if entities other than NEA are allowed to undertake CBET.

Country	Summary of suggested modifications
	• The Ministry of Energy, Water Resources and Irrigation may consider issuing a notification that will allow the utilities, NEA, RPGCL, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation. • While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources. • All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code.
Pakistan	• Policy guidelines for CBET to be issued by Govt. of Pakistan • NEPRA's Grid code regulations, 2005 to be amended (PC 4.2 - Procedure for Transmission System Expansion) to ensure that the revised Transmission System Expansion plan is published at least once in every three years; and to ensure that the plan is discussed with relevant neighboring countries. • Wheeling of electric power regulations of NEPRA to be amended, to clarify further on open access for CBTMPT transactions. • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by NEPRA. • The Ministry of Energy may consider issuing a notification that will allow WAPDA, Central Power Purchasing Agency –Guaranteed (CPPA-G), NTDC and the regulator (NEPRA) to interact with other similar institutions in the region, so as to allow greater regional energy cooperation. • To promote clean energy sources with low capacity utilization/load factor as compared to thermal plants, the regulator may consider a purely kWh linked use of system charge (instead of KW), or a discounted use of system charge, for clean energy sources. • All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated by amending the Scheduling and Dispatch code, of Grid Code, 2005.
Sri Lanka	• Amend section 43 of Electricity Act, to enable Transmission Licensee to participate in CBET • Policy guidelines for CBET to be issued by Govt. of Sri Lanka • PUCSL's Grid code (2014) to be amended (Chapter 2, Grid Planning Code) to ensure that Transmission Development plan for CBET lines is discussed with relevant neighboring countries. • Open access regulations to be issued • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC.

Country	Summary of suggested modifications
	• The Ministry of Power and Renewable Energy may consider issuing a notification that will allow CEB and the regulator (PUCSL) to interact with other similar institutions in the region, so as to allow greater regional energy cooperation. • While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources. • All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated by amending the Grid Code.

7. Roadmap and action plan for implementation

The overall country wise roadmap for implementing the model regional framework is depicted below. The initial step relates to the respective governments agreeing internally in principle to the core idea of a model framework, and providing policy guidance on which components of the framework are to be fully or partially implemented. The process is thereafter taken forward through the development of a governmental policy guideline for CBET (for countries other than India and Maldives). Thereafter, the identified country level changes can be adopted.



The overall roadmap consists of four key steps:

1. As a first step, it would be preferable for the national transmission utilities and regulators to seek an in-principle concurrence on the regional framework, from the respective governments. Given the nature of involvement of Government and other entities, this process may take up to 3 months.
2. Once there is an in-principle acceptance of the framework, policy guidelines for CBET for the countries would be required to be developed and issued over the next 3 months. Successful completion of these two activities would pave the way for implementation of country wise action plans, which have been divided into short term and medium term.

3. Based on the guideline document, some of the key regulatory, operational and commercial modifications required in the respective frameworks to support trilateral and multilateral trade, as identified in the previous chapter, will have to be undertaken initially. These will mostly relate to amendments in existing documents, rather than the creation of a new document. Most of these are expected to be implementable within three months from issue of the policy guidelines.
4. Post this, during the next 18 months (i.e., medium term) various relevant regulations and mechanisms (for example, transmission pricing) would be developed and issued to create the required regulatory framework for enabling and supporting CBET.
5. Thereafter, long term sectoral reforms can be focussed upon by the respective countries in the long term.

Once the guidelines are in place, the detailed country wise action points for the short term (3 months from issue of CBET policy guidelines) and medium term (beyond 3 months, but within 21 months from issue of CBET policy guidelines) is listed below:

Country	Short term action items	Medium term action items
Afghanistan	• Order allowing regional institutional corporation issued by Governments	• Grid code to be developed • Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions, as part of the grid code • Open access regulations to be issued • Must run status for clean energy sources to be provided
Bangladesh	• Order allowing regional institutional corporation issued by Governments • Transmission pricing to be extended to 400 KV voltage • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BERC	• Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions • Open access regulations to be issued • Must run status for clean energy sources to be provided
Bhutan	• Order allowing regional institutional corporation issued by Governments • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BEA	• Open access regulations to be issued • Must run status for clean energy sources to be provided
India	• Supporting institutional mechanism allowing utilities in power sector to interact with counterpart utilities in other	• Possibility towards determining a separate transmission tariff for third party wheeling transactions can be explored

Country	Short term action items	Medium term action items
	countries towards bringing excellence in technical matters	
Nepal	• Electricity Act, 1992 to be amended for incorporating the provision associated with power trading and CBET. • Order allowing regional institutional corporation issued by Government • Electricity Rules, 1993: Section 42 and 43 to be amended • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC	• New Electricity Act to be passed • Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions • Open access directives to be issued • Transmission pricing framework to be prepared by ERC • Must run status for clean energy sources to be provided
Pakistan	• Order allowing regional institutional corporation issued by Governments • Wheeling of electric power regulations of NEPRA to be amended, to clarify further on open access for CBTMPT transactions	• Must run status for clean energy sources to be provided • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by NEPRA (could also be shifted to a longer term)
Sri Lanka	• Order allowing regional institutional corporation issued by Governments • Amend section 43 of Electricity Act, to enable Transmission Licensee to participate in CBET	• Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions • Open access regulations to be issued • Must run status for clean energy sources to be provided • Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC

In parallel, regional level discussions shall continue to be undertaken, on potential regional institutional mechanisms, and on regional level understanding on treatment of clean energy sources, regional reserve sharing mechanisms etc.

Once the proposed model regional framework is adopted and implemented by the South Asian countries, there will be greater harmony and interoperability on the key provisions relating to cross border trade among the countries, thereby facilitating ease of undertaking trilateral and multilateral power trade. It is expected to reduce the risk perception and improve investor attractiveness for regional energy projects in South Asia, as the ambiguity in applicable frameworks will be reduced. On the other hand, the presence / absence of the model regional framework should in no way prevent the countries to try for adoption of new and binding regional agreements for energy cooperation and trade, or for the implementation of regional institutions.

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Foreword

The U.S. Agency for International Development (USAID) has been working to enhance regional energy cooperation in South Asia since the year 2000, through its South Asia Regional Initiative for Energy (SARI/E) program. The first three phases of the program took place during the years 2000-2012. These initial phases focused on building trust, raising awareness, and assessing potential transmission interconnections. The current and fourth phase of the program, South Asia Regional Initiative for Energy Integration (SARI/EI), was launched in 2012. It focuses on three developmental outcomes. These include: the establishment of a Policy, Legal and Regulatory Framework, the advancement of Transmission Systems Interconnection and the establishment of the South Asia Regional Electricity Market. This phase is being implemented by the Integrated Research and Action for Development (IRADe).

Currently, most of the power trade in the South Asian region is through bilateral arrangements. However, cross-border power trade is likely to substantially increase in the region by initially transitioning to a trilateral model, with a third country offering wheeling facilities for the buyer and seller countries, who are otherwise not directly interconnected. With the opening of India's power exchanges for cross-border electricity trade, and potential market reforms in other countries, multilateral power trade is also expected to increase in the future. Keeping this in context, the SARI/EI program initiated a study to assist in the transition of the region from bilateral to trilateral and multilateral power trade among the South Asian countries. As a result, we expect to see an increase in the volume of power being traded in the region. The report presents similar case studies from across the globe on regional power integration and presents specific actions and frameworks for each of the countries to support in this transition.

I would like to take this opportunity to acknowledge the excellent work done by the SARI/EI team at IRADe and Deloitte India, in developing this report. I hope that the findings of this report will be useful for all the countries in the region.

Sincerely,

MaryTyler Holmes

MaryTyler Holmes
Acting Director, Indo Pacific Office
USAID/India

Preface

We are pleased to present our study report on 'The transition to trilateral and multilateral power trade in South Asia' developed under the South Asia Regional Initiative for Energy Integration (SARI/EI) project supported by USAID.

The objective of the study is to assist in the transition to trilateral and multilateral power trade among the South Asian countries, which will eventually enable increase in the volume being traded in the region. The study aims to achieve this through the development of a Model Regional Framework for Trilateral and Multilateral Power Trade (MRFTMPT), along with a country wise Roadmap and Action Plan.

The model regional framework prepared under this study presents a template that can be adopted by the South Asian countries, so that it is easier to undertake trilateral and multilateral trade in the region. Such a model regional framework serves as an alternative to the signing of a robust and binding regional agreement for energy cooperation and trade. In comparison to a regional level agreement, a model framework offers flexibility for the countries in South Asia to put in place harmonious provisions for moving to trilateral and multilateral trade, while not compromising on their own need for country-specific adjustments. The presence of a model regional framework is also expected to reduce the risk perception and improve investor attractiveness for regional energy projects in South Asia, as the ambiguity in applicable frameworks can be reduced.

The study documents and analyses the international best practices in Trilateral and Multilateral Power Trade across the globe, and utilizes the corresponding learning and inferences for developing the Model Regional Framework for South Asia. Further, based on this model regional framework, the country wise framework and action are also prepared and finalized based on stakeholders' feedback and comments as well as taking in to account the conditions prevailing in different countries in the South Asia.

I hope that this study will provide adequate guidance material for the policymakers and utilities in South Asia who work towards enhancement of existing regional energy cooperation and energy trade.

I am grateful to USAID for supporting the study. I also take this opportunity to thank the Technical team at SARI/EI Secretariat /IRADe, and Deloitte Touche Tohmatsu India LLP who have worked diligently and enthusiastically to complete this study.

Jyoti Parikh

Dr. Jyoti Parikh

Executive Director, IRADe

Acknowledgments

At the outset we are extremely thankful to the different stakeholders for providing their valuable inputs, suggestions and support, without which it would not have been possible to complete this report. We are grateful to the United States Agency for International Development (USAID) for its generous support, and specially like to express our sincere thanks to Mr John Smith-Sreen, Director, Indo Pacific Office, USAID/India and Ms. Monali Zeya Hazra, Regional Energy Manager and Clean Energy Specialist, USAID, India, for their support and valuable inputs and suggestions, throughout the development of this report. We sincerely thank Dr Kirit S. Parikh, Former Member, Planning Commission, India and Chairman, IRADe and Dr Jyoti Parikh, ED, IRADe, for their support and cooperation.

We express our firm gratitude to the following persons and their organisations, for providing us adequate time for discussions on international case studies on trilateral and multilateral power trade:

European Network of Transmission System Operators for Electricity (ENTSO-E)

- Mr. Christophe Cesson, Market Specialist
- Ms. Nino Vakhtangishvili, Market Specialist
- Mr. Luca Nuvoli, Communication Analyst

GCC Interconnection Authority (GCCIA)

- Yousef Al Marwan, Executive Secretary
- Dr. Nasser Al-Shahrani, Chief Operations Officer
- Dr. Mohamed Y. Al-Hamad, Market Operations Manager
- Mr. Ehsan Shareif, Executive

Greater Mekong Subregion (GMS) Secretariat / Asian Development Bank (ADB)

- Dr. Bui Duy Thanh, Principal Energy Economist
- Dr. Aruna Kumuduni Wanniarachchi, Senior Energy Specialist
- Dr. Pradeep Tharakan, Principal Energy Specialist (Climate Change) and Unit Head, Sovereign Energy Operations (GMS), Asian Development Bank

Department of Energy Policy and Planning, Ministry of Energy and Mines, Laos

- Dr Chansaveng Boungnong, Director General
- Dr. Santisouk Phimphachanh, Deputy Director General

South African Power Pool

- Eng. Stephen Dihwa, Executive Director
- Alison Chikova, Chief Engineer, Planning and Operations
- Elisha Mutambudzi, DAM Market Finance Officer
- Mziyanda Mbuseli, Market Surveillance Manager

We are also grateful to all the SARI/EI taskforce members and other country / utility representatives who took time and effort to review the study report, and provide their comments and suggestions. We would especially like to thank the following experts for providing their views and suggestions on the report:

- Mr. Mohammad Hossain (Director General, Power Cell), Bangladesh
- Mr. Sahbun Nur Rahman (Power Grid Company of Bangladesh Limited), Bangladesh

- Ms. Dawa Chhoedron (Chief Engineer, Department of Hydropower and Power Systems), Bhutan
- Mr. Samir C Saxena (Chief General Manager, Power System Operation Corporation), India
- Mr. Pramod Thakur (South Asia Regional Energy Partnership), India
- Mr. Dilli Bahadur Singh (Chairperson, Electricity Regulatory Commission, Nepal)
- Mr. Madhu Prasad Betuwal (Joint Secretary, Ministry of Energy, Water Resources and Irrigation), Nepal
- Mr. Prabhal Adhikari (Director-Power Trade, Nepal Electricity Authority), Nepal
- Mr. Gamini Herath (Deputy Director General, Public Utilities Commission of Sri Lanka), Sri Lanka

Ministry of Power, Government of India

We render our sincere thanks to Ministry of Power, Government of India for their comments of dated 10th August 2022 on the draft Report and Model Regional Framework, and for ready reference, the same are reproduced below:

(i) There is already an institutional mechanism of multilateral trade among BIMSTEC countries. Government of India has already signed MoU in this regard with BIMSTEC countries which inter-alia provide a broad framework for the Parties to cooperate towards the implementation of grid interconnections for the trade in electricity. The MoU is aimed at facilitating power exchange through cross border interconnections. Besides, the BIMSTEC Energy Centre (BEC) is being set up in India in order to act as a Centre of Excellence in research and sharing of experience to strengthen the cooperation in energy sector among BIMSTEC Member States. Keeping in view the already existing institutional mechanism for multilateral trade among BIMSTEC countries, another framework is not required at this stage.

(ii) Besides, Ministry of Power has issued comprehensive Guidelines for Import/Export (Cross Border) of Electricity-2018, which provides for both bilateral and trilateral cross border trades of electricity between India with neighbouring countries.

We acknowledge and express our thanks to Ministry of Power, Government of India for bringing out the above facts related with the subject of the present study and are sure that the above information shall be of much relevance to the stakeholders while considering the outcome and recommendations from this study.

We also acknowledge and express our appreciation for all those individuals whose names cannot be penned here but who offered invaluable insights and generous support throughout this exercise.

Technical Team

SARI/EI Project Secretariat

1 Introduction

1.1 Background

This report is part of the study undertaken on "The transition to trilateral and multilateral power trade in South Asia", under USAID's South Asia Regional Initiative for Energy Integration (SARI/EI) program. Since in many other regions across the globe, the trades on the principles of trilateral and multilateral approach are already in vogue and are being carried out successfully for quite some time, the study seeks to learn from international experience in this respect and use such learnings towards the development of a model regional framework to facilitate transition towards trilateral and multilateral power trade in South Asia.

Currently the cross border power trade in the South Asian region is mostly in the form of bilateral trade. However, with the prospects towards substantial enhancement of cross border electricity trade in the region, the regional power trade market is expected to initially have transition to a trilateral model, with a third country offering wheeling facilities for the buyer and seller countries, who are otherwise not directly interconnected. Further, with the opening up of India's power exchanges for cross border electricity trade, and potential market reforms in other countries, multilateral power trade is also expected to commence in the region in the future.

1.2 Objective of the study

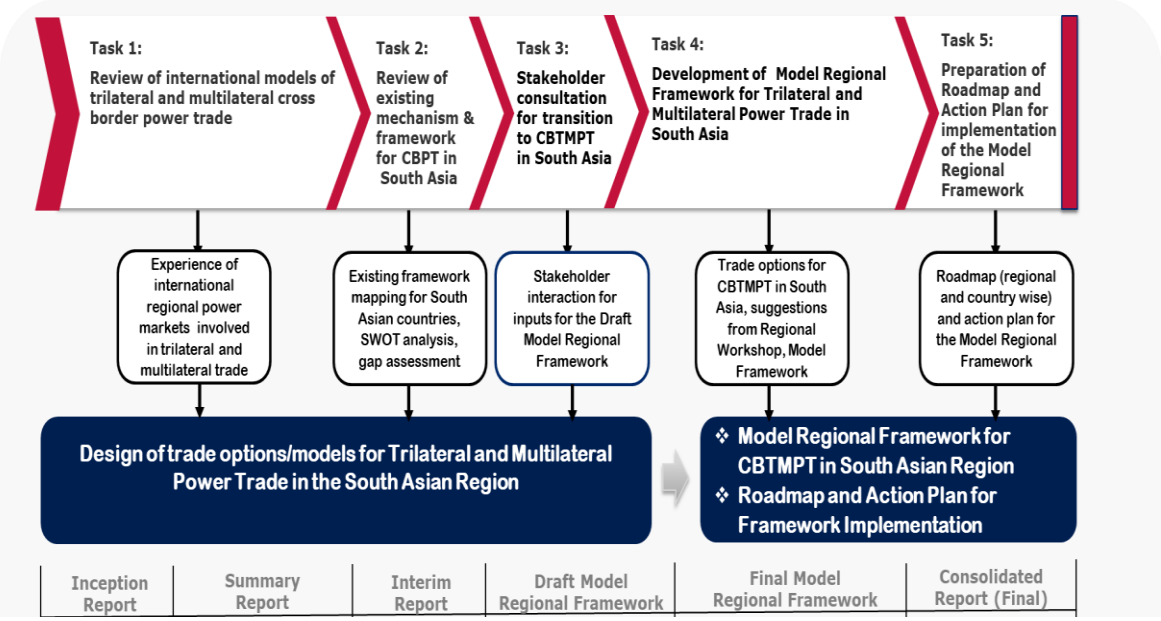
The objective of the study is to assist in the transition to trilateral and multilateral power trade among the South Asian countries, which will eventually enable increase in the volume being traded in the region. This calls for regional cooperation and the development of a Model Regional Framework for Trilateral and Multilateral Power Trade (MRFTMPT), to be followed by preparation of country wise Roadmap and Action Plan. The study aims to document and analyze the international best practices in Trilateral and Multilateral Power Trade across the Globe to identify learning and inferences for developing the Model Regional Framework for South Asia. Further, based on this model regional framework, the country wise framework and action are also prepared and finalized based on stakeholders' feedback and comments as well as taking in to account the conditions prevailing in different countries in the South Asia.

The model regional framework presents a template that can be adopted by the South Asian countries, so that it is easier to undertake trilateral and multilateral trade in the region. Such a model regional framework can serve as an alternative to the signing of a robust and binding regional agreement for energy cooperation and trade. In comparison to a regional level agreement, a model framework offers flexibility for the countries in South Asia to put in place harmonious provisions for moving to trilateral and multilateral trade, while not compromising on their own need for country-specific adjustments. The presence of a model regional framework is also expected to reduce the risk perception and improve investor attractiveness for regional energy projects in South Asia, as the ambiguity in applicable frameworks can be reduced.

1.3 Approach

Considering the multi-stakeholder nature of this engagement, while carrying out this study, a collaborative approach is being undertaken, as explained further. The assignment starts with review of international models of Cross Border Trilateral and Multilateral Power Trade (CBTMPT) and review of existing mechanism and framework in the different South Asian countries. This was followed by stakeholder consultations and a South Asia Regional Workshop. Key findings, analysis and all the stakeholder inputs were considered to finalize the Model Regional Framework for Trilateral and Multilateral Power Trade for South Asia. Finally, the regional and country wise Roadmap were prepared based on the Model Regional Framework and then the Action Plan to implement the Roadmap.

Figure 1: Detailed approach for undertaking the study



1.4 Aspects studied

While carrying out review and analysis of the international best practices to identify learnings and inferences for developing the Model Regional Framework for South Asia, the study focuses on the following aspects relating to each of the regional power market / power pool arrangements:

1. Key drivers and enabling factors towards trilateral and multilateral power trade across different models of Cross Border Trilateral and Multilateral Power Trade (CBTMPT).
2. Barriers, key challenges and issues faced, and how these challenges and barriers were mitigated for making the transition to trilateral and multilateral power trade.
3. Details of the strategic, policy, regulatory, legal and institutional framework which have been put in place, to enable smooth transition to trilateral and multilateral form of power trade, across different models.
4. Details of the technical, commercial and operational framework agreed to for smooth implementation of Cross Border Trilateral and Multilateral Power Trade.
5. Various instruments /mechanism which were used or put in place to build consensus amongst different parties and how various policy, regulatory, technical and operational issues were reconciled amongst participating countries.
6. The philosophy and way forward, towards joint investment and development of cross-border transmission systems for Cross Border Trilateral and Multilateral Power Trade, and what principles and mechanisms were devised towards recovering of the cost of the same.
7. How the different key aspects, such as transmission pricing, transmission losses, identification of transmission capabilities and mechanism for open access, wheeling methodology, deviation settlement and congestion management etc., are addressed and settled among participating countries.
8. Similarities/commonalities and differences amongst the different models of Cross Border Trilateral and Multilateral Power Trade (CBTMPT) and based on that whether any classification/categorization of different models can be arrived at.
9. Details of the benefits due to the trilateral and multilateral power trade under different models and how these are shared amongst the different participating countries.
10. How the Cross Border Trilateral and Multilateral Power Trade helped in deepening renewable energy grid integration.

11. What specific roles were played by regional institutions/institutional mechanisms towards smooth transition to CBTMPT.
12. Key common elements, minimum requirements and key ingredients required for CBTMPT across strategic, political, policy, regulatory, legal, technical, commercial and operational levels based on the above analysis from points 1 to 11.

In the context of this study, we are considering **trilateral power trade** as transactions involving entities in three countries: buyer entity in one country, seller entity in another entity, and an entity that provides wheeling service between these two countries through a third country. This also includes instances where the country that offers wheeling service, may also offtake a portion of the power. In other words, Power Purchase Agreements (PPAs) involving buyers and sellers in three countries under a common agreement will also be classified under trilateral power trade. The study also treats "tripartite power trade", as similar to "trilateral power trade", as long as the parties in the trade belong to different countries.

Arrangements in which multiple buyers and sellers of different countries participate in a common market (for example: Nordpool, South African Power Pool), or where multiple buyer-seller trade arrangements of different entities in different countries are concluded under a common agreement (for example, Laos-Thailand-Malaysia-Singapore Power Interconnection Plan), are considered as **multilateral power trade**. This covers all transactions where the number of parties involved cover more than three countries, or where trade is conducted through collective platforms where multiple buyers and sellers trade their power.

When discussing intra-country power pools (for example, PJM, New England Power Pool, Australia NEM), the above definitions may be modified as those involving multiple entities in different states/regions, within the same country.

2 Review and analysis of international experience

2.1 Introduction

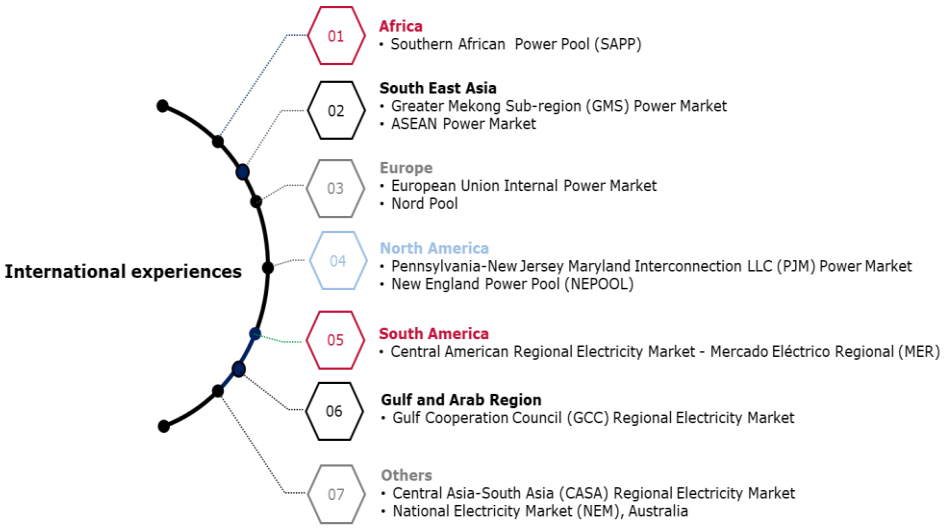
There are other regions of the world, where the transition to trilateral and multilateral cross border power trade has already taken place. Learnings of the international best practices through review and analysis of the practices prevalent in these regions and study of the existing frameworks in South Asia from the perspective of transition to Cross Border Trilateral and Multilateral Power Trade (CBTMPT), would provide the basis for the preparation of a Model Regional Framework for Trilateral and Multilateral Power Trade (MRFTMPT) for South Asia to establish CBTMPT.

While selecting the regions for study, the following aspects have been considered:

1. Geographical representation;
2. Different market models;
3. Different regional transmission models; and
4. Different levels of market maturity.

Considering the above aspects, the following 11 nos. of regional / intra-country arrangements have been studied:

Figure 2: List of regions/power pools reviewed



Three of the selected regions are also of intra-country nature, where the trade is between various states/regions within the same country. These are included considering the maturity of these markets, and the possibility of deriving additional learnings, which are otherwise not covered in the international models.

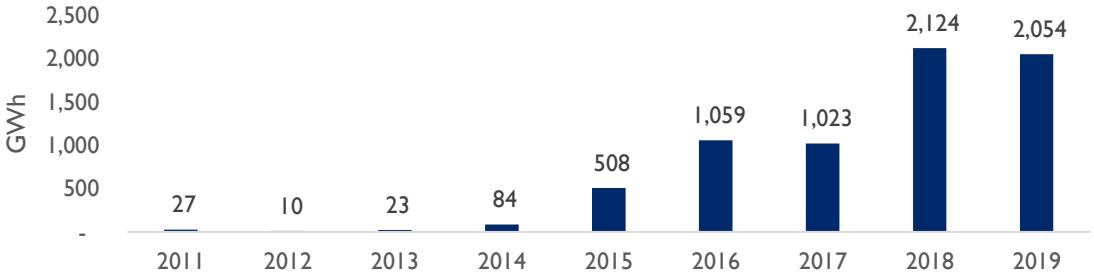
2.2 Southern African Power Pool

The Southern African Power Pool comprises 12 Southern African Development Community (SADC) member countries (Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe) of which nine are operating members whose interconnected grid carries about 97% of the power produced by SAPP countries. SAPP is the most advanced power pool in Africa. It was established in 1995 based on intergovernmental and inter-utility memorandum of understandings (MOUs) and, agreement between the operating members. Electricity trading is facilitated through the cross border interconnectors (transmission networks) among the operating members and consists of 110 kV to 533 kV transmission lines[3].

2.2.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

In addition to bilaterally negotiated contracts, there also exists **multilateral power trade** (day ahead, intraday, forward physical market - monthly and forward physical market – weekly). The competitive trade is executed through a market trading platform SAPP Market Trading Platform (SAPP-MTP).

Figure 3: Volume of power trade in the competitive market



Source: SAPP [4]

Note: In addition to the above trade in competitive market, there also exists bilateral trade transactions in SAPP. In 2019, the bilateral trade was 4308 GWh.

The following interconnections have been planned that could enable future trilateral and multilateral trade in the region.

- ZIZABONA (Zimbabwe-Zambia-Botswana-Namibia) Interconnector Project- will connect the power grids of Zimbabwe, Zambia, Botswana and Namibia
- MoZiSa Transmission Project- transmission interconnection to link three SADC countries - Mozambique, Zimbabwe and South Africa
- ZTK Interconnector- this project will connect the two SAPP countries of Zambia and Tanzania with Eastern Africa Power Pool (EAPP) country of Kenya

2.2.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

The primary objective of the SAPP is to create a common electricity market in the SADC region for their consumers to benefit from the advantages associated with this market. It aims to provide reliable supply of electricity at an economical rate, also ensuring efficient utilisation of the natural resources with minimum adverse effect on the environment. ***One of its vision is to facilitate the development of a competitive electricity market in the Southern African region.***

The SAPP's guiding structure is based on intergovernmental memorandum of understanding (MOU) that authorises and guarantees inter-utility MOU and operating agreements. The SAPP is governed by the following five agreements:

- The inter-Governmental Memorandum of Understanding, which enabled the establishment of the SAPP
- The Inter-Utility Memorandum of Understanding, which established the SAPP's basic management and operating principles
- Agreement Between Operating Members, which established the specific rules of operations and pricing
- Operating Guidelines, which provide standards and operating guidelines
- SAPP Coordination Centre (CC) Constitution

In addition, there are two key documents that further provide the regulatory framework for competitive trade. These are the:

- Market book of rules – A set of rules governing SAPP market operations; and
- Participation agreement – Agreement between each market participant and Market Operator (SAPP).

In terms of institutional structure, the SAPP has four working sub-committees: Environmental Sub-Committee, Markets Sub-Committee, Operating Sub-Committee and Planning Sub-Committee under a common Management Committee. The Management Committee reports to the Executive Committee, which is under the SADC Directorate of Infrastructure and Services. Besides the four working committees/sub-committees, in April 2007 the Coordination Centre Board was created to govern the activities of the SAPP Coordination Centre. ***The Markets Sub-Committee is responsible for the continued development of an appropriate electricity market in this SADC region and assumes the responsibility for all market operations in SAPP.*** The other key responsibilities of the Markets Sub-Committee are as follows:

- Design and recommend a suitable market structure for SAPP
- Determine criteria to authorize members to trade
- Admit and authorize members to trade; undertake risk management, research and benchmarking
- Present all findings and recommendations to the Management Committee and, carry out any other functions and activities as assigned or approved by the Management Committee

Along with SAPP which manages the pool, another key entity is the Regional Electricity Regulators Association of Southern Africa (RERA). RERA was set up to facilitate the harmonization of regulatory policies, legislation, standards and practices and to be a platform for effective cooperation among energy regulators within the SADC region.

RERA has developed their Guidelines on Cross Border Power Trading in Southern Africa in 2010. The regulatory bodies of Lesotho, Malawi, Mozambique, Namibia, South Africa, United Republic of Tanzania, and Zambia have been reported to have adopted these guidelines for implementation. The RERA Guidelines aim to provide an enabling framework for cross-border trade and investment in infrastructure that will reduce some of the uncertainties deterring investment and undermining efforts to improve security of supply through cross-border trading. The RERA Guidelines cover the following areas:

1. Regulator's powers and duties in cross-border trading
2. Working to ensure compatible regulatory decisions
3. Timing of regulatory interactions for proposed cross-border transactions
4. Licensing cross-border trading facilities, imports and exports
5. Approving cross-border agreements in importing countries
6. Approving cross-border agreements in exporting countries
7. Approving cross-border agreements in transit countries
8. Approving transmission access and pricing and ancillary services
9. Promoting transparency in the regulation of cross-border trading

The guidelines require the national regulators to issue licenses for import and export of electricity, subject to the following conditions:

a. The application complies with the applicable legal and regulatory framework;
b. The applicant has demonstrated the technical expertise to construct, operate and maintain any

associated power facility in compliance with any national grid code;

c. The applicant has demonstrated sufficient financial resources to properly construct, operate and maintain the facility or to undertake the cross-border trading activity; and

d. Issuing a licence would not undermine national security of electricity supply.

The guidelines mandate the country level regulators / decision making authorities to oversee access to transmission for cross-border transactions to ensure that access is non-discriminatory to the greatest extent possible under the law.

2.2.3 Technical, commercial and operational framework for implementation of CBTMPT

Under the SAPP market framework, only excess generation is traded. The member countries first ensure that they are able to cover their own demand before selling power to the SAPP regional market. SAPP supports arrangements where you have members who can transfer energy even when they are not neighbouring countries In addition, power can also be traded through SAPP on an emergency basis, to help meet unexpected shortfalls.
The following types of instrument/trading arrangements are operating in the competitive market, which currently includes only physical products:

- Among SAPP's competitive markets, the most developed market is the day ahead market (DAM), which was set up in 2009. Auctions take place daily through the SAPP trading platform for hourly energy contracts for the next trading day.
- After the day ahead auction, hourly contracts can be struck between matching bids and offers on the intraday market (IDM). The IDM was established in 2013.
- New forward products were introduced by SAPP in 2016, through the Forward Physical Market (FPM). Baseload, peak, and off-peak contracts can be struck at the week-ahead (FPM-Weekly) and month-ahead (FPM-Monthly) stage.

SAPP is also in the process of introducing a balancing market.

Besides the present structure as mentioned above, ***in order to trace the evolution of the competitive market***, it can be noted that the SAPP regional market platform started in 2001 with the Short Term Energy Market (STEM), a collaborative market structure within the SAPP. This had been set up to facilitate short term electricity trading between the SAPP members. Owing to the reducing surplus capacity in South Africa and the aging infrastructure, this short term market through STEM became dormant after 2006. It was eventually discontinued and replaced by DAM.

SAPP has an 'Operating Guidelines' which is a functional document that emphasises on following the same set of rules, standards and procedures for smooth and fair operations. It also provides guidance on specific operations such as schedule ramping, inadvertent energy payback, frequency bias measurement intervals and calculations, control performance criteria, etc.[5]

2.2.4 Consensus building mechanism

The SAPP has established a permanent ***Coordination Centre*** in Harare, Zimbabwe. The Coordination Centre officials report to the Coordination Centre Board, which is under the Management Committee. Initially, the board had been made up of utility representatives of the Operating Sub-Committee, but since 2008 the Coordination Centre Board has been an independent body[6]. The following are the key responsibilities of the Coordination Centre with respect to operations of the power market and consensus building:

- Act as ***the nodal centre/body*** for SAPP activities
- Facilitate the operation of the energy market

- Monitor the operations of SAPP transactions between the Operating Members and between Members and Non-members
- Convene, following a disturbance affecting the parallel operation of the pool, a post disturbance committee
- Monitor the availability of the communication links between the Control Centers of the Operating Members and between these Control Centres and the Coordination Center

All the sub-committees and the Coordination Centre are under the Management Committee, which in turn reports to the ***Executive Committee***. The Executive Committee is composed of the Chief Executives of only the member power utilities who generate wholesale and retail power to end-user customers. A country with more than one utility meeting these requirements is required to designate one utility to represent it on the Executive Committee. The Executive Committee acts as the Board of SAPP. It is the authority governing the coordination and formulating the objectives of the SAPP. The key duties of the committee include the following:

- Specifies and amends from time to time the duties of the Management Committee, the Sub-Committees and any Working Group or Task Force, which may be established.
- Decides within sixty days on any matter referred to it by a member(s) or by the Management Committee, including the exclusion of a member(s). Upon the approval of the SADC Energy Ministers, The Committee accepts new members into the SAPP according to the conditions of membership.
- Each member has one vote of the Executive Committee. Only members who are signatories of the Agreement Between Operating Members can vote on service and operational issues.
- Decisions are made by consensus or, failing this, by a two-thirds majority of the members present at the meeting, unless otherwise stated in the Memorandum of Understanding. The presence of two thirds of the members at a meeting constitutes a quorum.
- Decisions made by the Committee are binding on all members, including those who did not attend the meeting.
- In case of a dispute between operating members, the matter will be referred for arbitration in accordance with the Agreement of Members unless the members agree upon another procedure.

RERA also plays a key role on consensus building, especially through its guidelines. However, RERA's regulations and recommendations are not automatically binding on the national level regulators. It is for the regulators to decide upon whether and how they want to implement RERA's regulations, guidelines and recommendations. In view of this, RERA's guidelines are kept simple, with details left to the regulators to decide upon.

2.2.5 Financing for development of CBTMPT transmission infrastructure

The transmission interconnectors which are in place so far have been constructed as a part of bilateral agreements. The tariff that was discovered/the basis of trade in itself- was attractive that the return from such trade compensates for the transmission investments.

The funding for the transmission interconnections to facilitate trilateral and multilateral trade are primarily being undertaken with support from the multilateral development banks (MDBs). The primary financial model being adopted is the SPV arrangement, however, aspects like debt-equity ratio varies from project to project.

- ZIZABONA Interconnector Project- Initially balance sheet financing approach was adopted, where the utilities would finance the portion of the interconnector within their territorial area. However, this did not work out and the sponsors wanted to adopt a viable financial model which would be able to recover the transmission investment. Therefore, the ZIZABONA sponsors finally decided to adopt

project finance approach by creating an SPV of which all the ZIZABONA sponsors will be shareholders, including other possible third parties. Key funding parties are (for debt financing):

- Multilateral Development Banks (USAID, JICA, DGCS, BMZ, DFID IBRD, IDA, ADB, ADF, EIB, JBIC, KfW, AFD, IFC)
- Development Financing Institutions (Actis, DEG, Globeleq, IFC, FMO, PROPARCO)
- Other institutions (Cotonou Investment Facility, emerging Africa Infrastructure Fund, etc.)[7]

An Inter-governmental MoU was signed for the project between the Governments of Zimbabwe, Zambia, Botswana and Namibia, which agreed to create a special purpose vehicle (SPV) by the participating utilities, to develop the project. As per the agreed SPV principles, Participating Utilities each Participating Utility shall have equal Shareholding in the SPV. The SPV will transfer assets within each country to the respective Participating Utilities upon commissioning at no cost. However, the SPV shall retain exclusive right of use of the total capacity of the Project for the duration of the loan.

- MoZiSa Transmission Project- project financing undertaken by Development Bank of Southern Africa (DBSA) and KfW. SADC's Project Preparation and Development Facility (PPDF), managed by DBSA approves the loans towards the development of the multi country regional interconnector transmission line project[8].
- ZTK Interconnector- the project was initiated after the signing of an Intergovernmental Memorandum of Understanding between the three countries and provision of seed capital by the European Union for preparatory activities[9]. Funding is being provided by the World Bank for construction of the Zambia and Tanzania Interconnection part (which falls under SAPP)[10]. Under the proposed structure, Zambia and Tanzania intend to first raise long term concessionary loans and grants from MDBs, which will be supplemented by commercial loans if a funding gap exists. These loans will be passed onto the two utilities, ZESCO and TANESCO, by their respective Governments. Both Zambia and Tanzania have committed to provide the necessary guarantees and counterpart funding[11].

2.2.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

The 2017 SAPP Pool Plan has identified a detailed list of priority generation and transmission projects to accommodate for rapidly rising electricity demand in the region. The objective of the SAPP Pool Plan is to **"identify core set of generation and transmission investments of regional significance that can provide adequate electricity supply to the region under different scenarios, in an efficient and economically, environmentally and socially sustainable manner and support enhanced integration and power trade in the SAPP region".** [12]

B Development and management of transmission corridors

The planning sub-committee of SAPP board updates common planning and reliability standards, reviews integrated generation and transmission plans, evaluates software and other planning tools, determines transfer capability between systems amongst other aspects of power system operation. The transmission corridors are managed by the utility companies of each country. The ownership of the transmission line may be by a single or multiple utility based on licensing arrangement:

Table 1: Licensing Arrangement of Transmission Line[13]

Ownership of Transmission Line	Owned by One country	Owned by Multiple Countries
License	Single license License acquired by the utility of the country	Multiple license Each required acquired by each utility on the project

C Transmission pricing/wheeling methodology

Out of SAPP's twelve member countries nine are operational. Transaction can take place from one wheeling member country up to five wheeling member countries. The transactions are decided by the members and the buyers pay for all the related charges.

The pricing methodology depends on the following modalities:

- Wheeling charges are determined centrally by the SAPP. Transaction based load flow analysis is carried out, where the assets used for wheeling of power from one border to another border is determined. Then SAPP determines the wheeling charge for each particular country and not the countries themselves. SAPP publishes these charges on an annual basis.
- Initially when the power pool started, it was agreed that the wheeling charge will be a percentage of the energy charge. If there is one wheeling entity, then 7.5 percent[14] of the energy charge will go to that wheeling entity. If there are more than two wheeling entities, then the total wheeling charge will be a maximum of 15 percent[15] of the energy charge and will be split among the wheeling entities. Then SAPP shifted to the transaction based method of determining the wheeling charge.
- Wheeling path is reserved in advance. The buyer negotiates the wheeling path (For Ex: Power from Country A to Country B via Country C).
- There is wheeling charge for each particular country. Each part will have specific charge as these are transactions based
- Transmission infrastructure identification in country of origin.
- Wheeling Fees are incremental costs for the use of transmission infrastructure.
- A 'rent' is also to be included for the provision of wheeling services, including O&M costs.
- Transmission losses are not included in the wheeling charges and considered over and above these charges.
- However, SAPP is developing a new transmission pricing model to address the limitations of the transaction based model it is currently using because it considers that it may not be fair for the buyers to pay all the charges. It plans to introduce a mechanism where there will be sharing of the wheeling charges between the buyers and the sellers.
- For the DAM, the transaction counterparties are not known, hence it will introduce a revised approach will try to resolve the issues pertaining to the current model.

In order to address any country's issue regarding the wheeling charge determined by SAPP centrally, SAPP includes all the members in the computation process. Member entities from the wheeling countries submit their asset database. SAPP determines the unit cost for each asset i.e., for transformer, transmission line, capacitor, etc. Both the database and asset costs are agreed upon upfront, to avoid issues arising later.

D Transmission losses accounting

For losses accounting SAPP follows market rulebook which has clear set of rules including distribution, confirmation of trade, invoicing, settlement and dispute resolution. The invoices include wheeling losses, which are part of the market clearing algorithm. The invoices are generated and distributed by the market operator to the participating members on a daily basis. MW/km approach is adopted for determining the wheeling losses. The wheeling entity is paid back the amount of losses by the purchaser of wheeled power in-kind according to the time of use that the losses were incurred; peak times or off peak times.

E Congestion management

- To manage available capacities and avoid congestion, power trade is prioritised based on the purpose and type of transaction. First preference is given to trading related to energy support, followed by

bilateral transactions (day ahead), the common bilateral contracts (longest contracts are between 3-5 years) and then the market transactions.

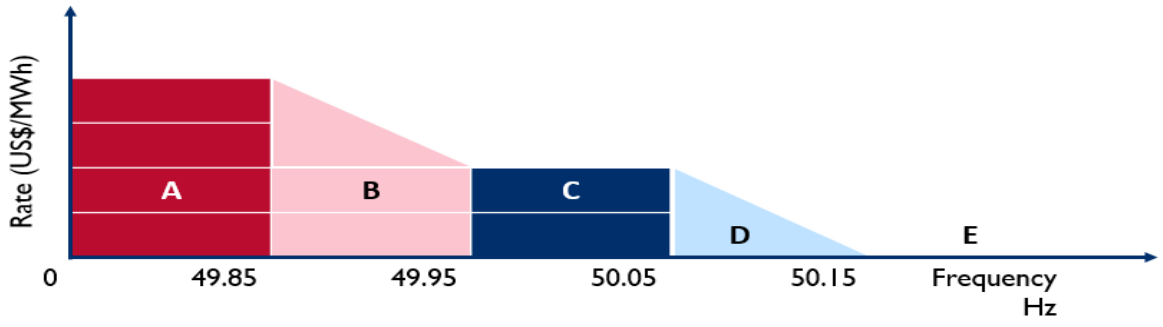
- Transmission constraints are updated and published each year- it includes daily transmission constraints, voltage collapses and mitigation measures.
- Bilateral Agreements are given priority. However, if congestions occur, it will be economic to utilise all available transmission capacity from the surplus area to the deficit area.
- The utilisation can be obtained by practicing the "use it or lose it" principle for firm transmission rights and make the remaining capacity available for market participants.
- The available capacity is allocated in a neutral way, by explicit or implicit auction
- An algorithm is followed where the system calculates capacities for two scenarios:
    - The system calculates on basis of unconstrained market i.e., assuming that there are no congestions. It gives the prices and the quantum in MW.
    - The system also calculates constrained markets results after available considering the market capacity within the SAPP network.
- Loss factors are applicable for bilateral contracts and DAM transactions. Charges are determined based on the time of use.
- The market spitting mechanism is adopted where the two areas have different prices after market splitting. The congestion income is then collected by the market operator i.e., SAPP.

F Deviation accounting and settlement

Energy accounting and imbalance settlement are carried out based on schedules and not by the metered values. On the day of trading, if there is imbalance, then the imbalance settlement is undertaken between the three control areas- South Africa, Zimbabwe and Zambia. Imbalance settlement is done on a monthly basis. SAPP follows an imbalance settlement mechanism, where imbalance settlement varies between price bands. Accordingly, there are different imbalance prices blocks. Currently these are based on generation prices. However, SAPP has plans to move to market based pricing for imbalances:

- **Block A (Frequency of 49.85 Hz or below):** Highest generation cost, with plans to switch over to 2 times block C prices
- **Block B (Frequency between 49.85 Hz and 49.95 Hz):** Slope between blocks A and C
- **Block C (Frequency between 49.95 Hz and 50.05 Hz):** Pool average generation costs, with plans to switch over to maximum daily average market clearing price
- **Block D (Frequency between 50.05 Hz and 50.15 Hz):** Slope between blocks C and E
- **Block E (Frequency above 50.15 Hz):** Zero

Figure 4: SAPP imbalance energy rate calculation (Illustration)



Source: CERC[16]

2.2.7 Benefits of CBTMPT and sharing among the member countries

SAPP has enabled the use of surplus power in South Africa to be used in other countries in the pool that required additional power. This arrangement also made sense, as many of the other countries were hydro dependent, leading to power shortages in case of draught. In comparison, South Africa had a large thermal generation mix which was less susceptible to seasonal risks. As the corresponding benefits were reasonably expected, the countries were ready to take infrastructure upgrades within the respective territories to enable operation of SAPP.

According to SAPP Pool Plan 2017, it is estimated that the full integration of the SAPP countries' power systems and the development of power trade could bring cumulative savings of over US$42 billion[17] (NPV) in investment and operating costs for the region till 2040, as compared to the option of implementing individual country plans. These savings would be achieved through investments of USD3 billion (NPV) in power transmission corridors.

The benefits of SAPP are in terms of reducing the overall investment requirements in each of the countries, and in reducing the supply deficits / surpluses which also reduces the costs. Thus, there is no separate and explicit benefit sharing mechanism. The activities of SAPP coordination unit, such as running of market trading platform creates some revenues, which are utilized for SAPP's own expenses, with surpluses retained within SAPP.

2.2.8 Role of CBTMPT in assisting RE integration

SADC countries have plans to harness energy potential from various renewable technologies. SADC has a vision of 100% renewable energy by 2050. In order to achieve this, the share of renewable energy in the regional grid is targeted to increase from 21% in 2017 to 37% by 2027.[18] Considering that SAPP's initial role was to support seasonal hydropower of some of the countries, a similar role but in balancing of renewable energy intermittencies can also be envisaged for SAPP.

2.2.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

- SAPP CC: The SAPP Coordination Centre, based in Zimbabwe, is responsible for administering pool monitoring activities, carrying out operating and planning studies, determining transfer limits on tie-lines, administering a regional database, disseminating maintenance schedules, and providing technical advice
- SADC: The Energy Ministers of SADC are responsible for resolving major policy issues in the SAPP and for admitting new members to the pool. The SADC Secretariat's Technical and Administrative Unit provides secretarial and other services to the SAPP executive committee, acting as liaison to SADC and seeking funding.
- Regional Electricity Regulators Association of Southern Africa (RERA): Harmonise the regulatory framework as well as provide an enabling environment for investment in the region's power sector

2.2.10 Key drivers enabling CBTMPT

The following aspects are believed to have played a role in enabling CBTMPT in SAPP:

- Energy sector reforms and liberalisation of national grids of member states
- Initial interest from the member countries' power utilities to establish a regional power market when they realised the requirement for power trade. (For example, hydro dominant mix in many of the South African countries viz-a-viz coal based generation in South Africa, allows South Africa to provide energy to other countries during draught).
- Government interests in the energy sector, after the utilities approved their respective governments.

- Presence of Southern African Development Committee (SADC) under which SAPP operates. The utilities had to deal with the Governments, however since it involved several countries, the utilities took the assistance of SADC, which is the regional economic community. It is a political organization which aims to foster cooperation in trade, energy, industrial development, agriculture, security, political areas. It has a fully functioning secretariat and within this there is a unit which deals with infrastructure, which includes energy related issues. The power utilities had to approach the governments for approvals, following which inter-Governmental MoU was signed under the umbrella of SADC. This document then mandated the power utilities to sign the Inter-Utility MoU.
- Limitations in fixed volumes of electricity trade in bilateral power arrangements that that was in place since the 1950s and 1960s provided the ambition to go towards trilateral and multilateral approaches
- A well-established regional regulatory framework for pooling energy resources, including the establishment of common standards, rules and monitoring mechanism of systems performance
- A well-functioning cross border market mechanism along with sufficiently advanced interconnections and switching infrastructure
- SAPP Coordination Centre is a well-run and transparent organisation that effectively promotes the regional energy agenda and regional energy cooperation

2.2.11 Challenges faced in transition to CBTMPT and mitigating actions

In SAPP, initially the transition beyond bilateral power trade was driven by the country-specific requirements. SAPP faced the following challenges in its initial period during the transition to trilateral and multilateral models.

- Transmission capacity constraints – to address this key issue SAPP deliberately reserved 50 MW[19] for promotion of auction market. Priority allocation approach was adopted. Priority was accorded to bilateral contracts which had a huge bearing on market transactions. SAPP tried to strike the balance between asset owners and market.
- Security of power supply – member countries were sceptical about the introduction of regional power market. The primary concern being that auction would result in unmet demand. Therefore, SAPP introduced the month ahead and week ahead markets to take care of the longer time period, providing more options to the member countries and enabling to focus on arrangements beyond the short bilateral contracts.
- Inadequate participation by the member countries – the power market started with three members and witnessed lack of participation from the other member countries. This was owing to the issue regarding security of supply and lack of confidence in the regional power market. Also, the region was experiencing generation deficit during that period. To address the lower level of confidence, SAPP created a market development working group, which was complemented by the traders' forum. This provided the members a platform to express their views and the type of products they wanted in the power market. Accordingly, the forward monthly and weekly products, DAM and IDM were introduced. Currently, SAPP is trying to develop its balancing market.

In addition to the challenges encountered during the transition period, SAPP has also been experiencing the following issues:

The SAPP has noted that one of the main challenges in transmission project implementation is difficulties in securing long term bilateral power purchase agreements (PPAs) that can be committed to fund transmission projects' cash flow repayments. The SAPP market, though it has significant transactions, have not been used to anchor new transmissions investments as these are short term and also not easily predictable. The SAPP therefore is planning to establish a Regional Transmission Infrastructure Financing Facility (RTIFF) that can be used to promote transmission investments.[20] The key objective of this facility is to enable the members to

increase and improve power trading volumes, alleviate congestion in the existing network, improve power supply reliability and create adequate redundancy in the regional system. This is a sector specific investment fund, for which SAPP has been working closely with SADC, World Bank and Pegasus. Currently, the priority projects have been identified and, the financial structure and the revenue model are to be finalized. Structuring of the fund is on-going, which involves finalizing the requirements and different modalities along with the various stakeholders such as the members, DFID, other MBDs and banks. The first phase is almost complete and the second phase is about to start soon, which will involve the design and implementation of the facility and deciding its operational structure. For now, only the SAPP members can avail of this facility. In the future it might be considered if private players can join and if the terms and conditions for them will be similar to those for the SAPP members. When finalizing the financial structure, SAPP will look at the option to address the gap in funding through grants.

SAPP also had to change its membership categories to accommodate the changing market characteristics. Till 2019, the membership was categorized as "Operating Member", "Non-Operating Member" (entities in countries which are not interconnected with SAPP grid), Independent Power Producer (IPP) and Independent Power Transmission Company (IPTC). In 2019, this was changed to the following categories:

1. National Power Utility Member category— to implement the mandate from the SADC member states as provided for in the Inter-Governmental MOU;
2. Operating Member category provided for players (public or private), including 'PPS, ITCs whose operations would have an impact in the operation of the SAPP grid; and
3. Market Participant Member category— provided for those players who intend to trade on the SAPP market and should meet certain minimum thresholds as determined by SAPP and includes IPPs and market service providers.

SAPP has also faced challenges in financing some of its interconnections. Initially, when ZIZABONA interconnector was planned, it was decided that each country will develop its own portion of the line, based on on-balance sheet financing by respective transmission utilities. However, this also meant none of the intervening countries were ready to take any financing/project risks, and the expectation was that end buyer Namibia will have to bear all risks. However, as this was not acceptable, the project later changed to an SPV based model, where all the ZIZABONA countries invested in the SPV.

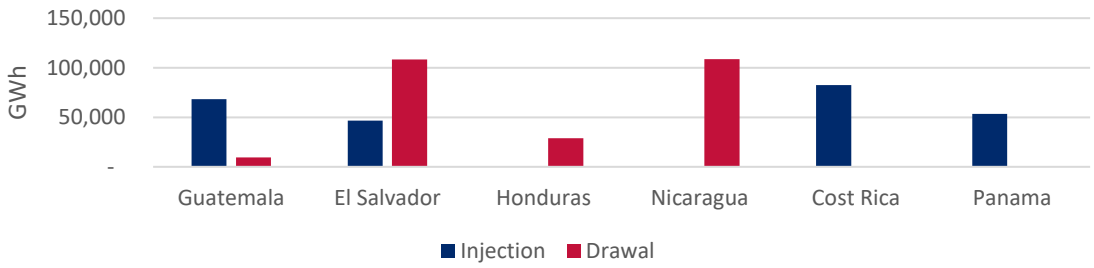
2.3 Regional Energy Market (MER) in Central American Interconnection

Sistema de Interconnexion Eléctrica para los Países de América Central (SIEPAC), popularly known as the Central American Interconnection, is a high voltage regional transmission network, which connects six Central American countries - Guatemala, El Salvador, Honduras, Costa Rica, Nicaragua and Panama. The 230 KV interconnection, with a length of 1790 KM, was commissioned in stages, between November 2010 and October 2014.[21] The interconnection facilitates the operation of Regional Energy Market (MER) among the member countries.

2.3.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

The Central American Interconnection facilitates **multilateral power trade**, enabling the connected countries to import or export power through the interconnection. The trade is a combination of **multiple bilateral medium/long term trades**, and trade through a **short-term opportunity market**. The total energy injected and withdrawn by each of the countries through the interconnection for August 2020 is illustrated below.

Figure 5: SIEPAC - Energy injection and drawal in August 2020



Source: CRIE[22]

The market consists of both **medium to long term contract market** (Regional Contract Market - MCR) and **short-term opportunity market** (Regional Opportunity Market – MOR).

2.3.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

Regional coordination in electricity in the Central American region has a long history. In 1958 the Central American Economic Cooperation Committee, created under the auspices of the Economic Commission for Latin America (ECLAC), established the Central American Subcommittee on Electrification and Hydraulic Resources (SCERH). The SCERH created the Regional Group for Electrical Interconnection (GRIE), composed of the planning and operation managers of the electricity companies of the region, which were all state-owned at the time. Its purpose was specifically to promote electrical integration in Central America. These two entities (ECLAC and GRIE) became spaces for dialogue and exchange between the sectoral authorities of each Central American country, aimed at promoting regional electricity integration.

Initially, it was GRIE which led the studies to establish benefits of regional interconnection and associated legal aspects, which led to construction of the interconnection line between Honduras and Nicaragua, which began operations in 1976. ECLAC encouraged the presidents of state-owned electricity companies to hold annual meetings. These meetings were later institutionalized, with the formation of an organization of public international law called the Central American Electrification Council (CEAC), created in 1979, though formal operations started only in 1985.

Meanwhile, the countries decided to conduct a new study on regional interconnection with the aim of improving the use of hydroelectric and geothermal resources available in the region, and named it the Regional Study on Electrical Interconnection of the Central American Isthmus (ERICA). Based on the considerable benefits of electrical integration between countries estimated in ERICA, the countries agreed on the Regional Interconnection Program between the bordering countries of the region, with the aim of laying the foundations to gradually arrive at an integrated regional system for generation and distribution of electrical energy.

In around 1987, Spain organized a meeting of heads of the state-owned electricity companies of Central America, where a protocol of formal agreement was signed, to undertake a study to build a new high voltage Central American electrical interconnection. In 1992, the Central American electricity companies updated the previous studies and presented them to the international community, seeking its support. This was responded favourably by Inter-American Development Bank (IDB) after the IDB undertook its own studies.[23]

In December 1996, the presidents of six Central American countries signed an intergovernmental treaty, named the "**Marco treaty for Central American Electricity Market**". In the treaty, the countries agreed to establish the conditions of growth of a regional electricity market (MER), and to promote the necessary interconnection infrastructure for such market. The treaty specified the creation of following entities:

- Comisión Regional de Interconexión Eléctrica (CRIE) as the regulator for regional electricity market;
- Ente Operador Regional (EOR) as the transmission system operator for the SIEPAC interconnection; and

- Empresa Propietaria de la Red (EPR) to develop, design, finance, construct and maintain the SIEPAC interconnection.[24]

The treaty was further detailed through two protocols (1997 and 2007) which were also signed between the external affairs ministers of the Central American countries. The First Protocol introduced formal amendments to some of the precepts in the Framework Treaty, to harmonize the interests of the signatory countries and prevent misinterpretations of aspects related primarily to the operation of the MER and the structure and operation of the EPR and EOR. The Framework Treaty and the First Protocol were passed and ratified by the congresses of the six Central American countries between 1997 and 1998.

As the SIEPAC Project developed, it was deemed necessary to introduce amendments and expand on relevant aspects that affected the Treaty and First Protocol. Accordingly, the ministers of foreign affairs of the Central American countries signed a Second Protocol to the Framework Treaty on April 10, 2007, in Campeche (Mexico). The Second Protocol reinforces the legal soundness of the MER to make it operate effectively, and is primarily concerned with defining significant aspects of the market and the authorization of agents. It introduces relevant aspects such as: a penalty system; the scope and means for resolving disputes and mechanisms for this; a method of payment for MER services; the obligation of national agents to be regional agents, the obligation to harmonize and update national regulatory frameworks with regional regulation; the activities of regional transmission companies and their remuneration; the functions of the CRIE, and the creation of the CDMER.

The regional regulator – CRIE, initially published the transitional regulations for regional electricity market (RT-MER) in 2002, and the final regional electricity market regulations (RMER) in 2005. [25]

2.3.3 Technical, commercial and operational framework for implementation of CBTMPT

The regional electricity market regulations (RMER) deals with aspects such as:

- Eligibility requirements, rights and obligations of market agents;
- Types of market;
- Nodal pricing;
- Ancillary services;
- Reconciliation, billing and settlement procedures;
- Operations planning;
- Transmission rights; and
- Dispute resolution.

CRIE has also developed detailed operational procedures, such as Procedure for processing requests for connection to the Regional Transmission Network (RTR) and Procedure for the Application of Firm Contracts and Firm Rights.

The regional operator EOR has developed its own regulations that govern its organizational structure and functions. These deal with aspects such as planning for five-year periods, annual operational planning, and development of quality, safety and performance standards.

2.3.4 Consensus building mechanism

The consensus building and coordination mechanisms are built at three levels:

1. The Second Protocol to the Marco Treaty established the Steering Committee of the Regional Electricity Market (CDMER), which is located in Costa Rica. CDMER brings the National Energy Ministers/Secretaries of the Central American countries together, CDMER is responsible for

promoting the development of the MER, and taking decisions to achieve the objectives of the Marco Treaty and its protocols. To this end, it has set up co-ordination mechanisms with the CRIE and the EOR.

2. The regional regulator CRIE provides dispute resolution, and also undertakes coordination with the national regulators.
3. The regional transmission system operator EOR undertakes coordination with the respective national transmission agencies.

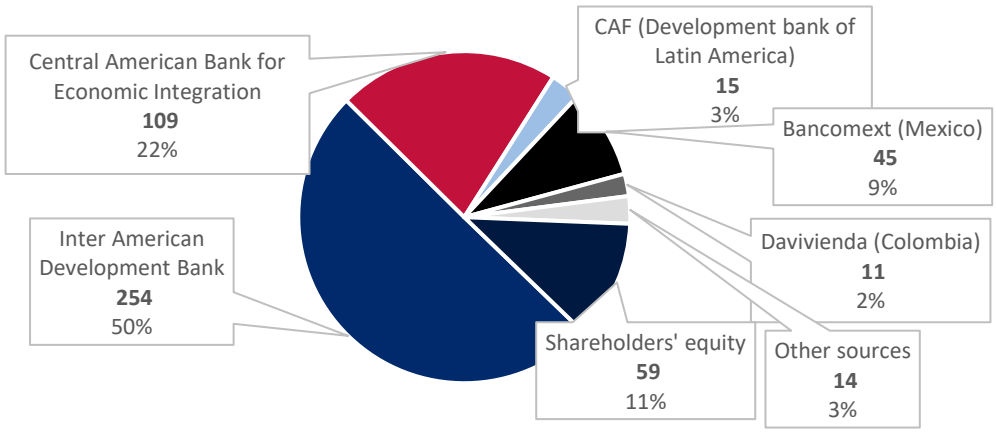
2.3.5 Financing for development of CBTMPT transmission infrastructure

To construct, own and maintain the SIEPAC line, a private company - Empresa Propietaria de la Red (EPR) was set up. The total project was 505 million USD, which was funded mostly with loans. Equity funding was for 58.5 million USD, forming 11.6% of the project cost.

Loans from Inter-American Development Bank (IADB) formed more than 50% of the project cost. These loans were granted to the six electricity companies in the SIEPAC countries, with the respective governments acting as guarantors. In turn, the electricity companies transferred the funds directly to EPR for construction of the line. EPR assumed the entire cost of servicing the loans taken out by the electricity companies with the Bank on its behalf.[26]

The overall financing of the line was through the following sources:

Figure 6: Financing of SIEPAC infrastructure (in million USD)



Source: Inter-American Development Bank[27]

2.3.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

As per REMR, the approved market agents will have open access to the regional transmission line. EOR will determine the 'Operational Transmission Capacity' of regional transmission line, based on evaluation of respective national system/market operators, and its own evaluation of various operating scenarios.

SIEPAC uses the concept of "Transmission Right" which gives the holder of the same, the right to use the network. The EOR will organize monthly auctions for these transmission rights, for monthly and annual validity periods. The auctions will specify the available capacity for auctions, after considering existing committed transmission rights, and scheduled maintenance.

B Development and management of transmission corridors

Being a regional transmission line spanning multiple countries, development of the line is undertaken through discussions and agreements at a very high level. The existing line was agreed to be developed based on the treaty signed by the respective governments.

Extensions to existing regional transmission line will need to be authorized by the CRIE. CRIE will authorize such extensions only if the expansion is part of EOR's long term planning report or medium-term diagnosis report; and if the technical economic studies show that expansion increases the social benefit at regional level.

C Transmission pricing/wheeling methodology

The allowed income/revenue for the SIEPAC line is approved by CRIE considering the following components:

- Cost of debt service;
- Rate of return on the equity investment, at 11%, or as determined by CRIE separately;
- O&M cost, calculated as 3% of standard costs, or as determined by CRIE separately;
- Value towards compensation of planned unavailability of line; and
- Taxes.

This income is recovered through regional transmission rates, which consist of Variable Transmission Charge (CVT), the Toll and the Supplementary Charge.

- The CVT is paid implicitly in the Market of Regional Opportunity or explicitly in the Regional Contract Market (the revenue from Transmission Right auctions).
- The Toll is calculated based on actual flows on the lines, and its relationship with overall flows, and national contribution for the regional transactions etc.
- Rest of the unrecovered charge is recovered through the Complementary Charge, levied on all the market participants.[28]

The CVT/nodal price residual reflects short-run marginal costs but is only sufficient to partially recover the revenue requirement of the transmission owners. The remaining long-run cost of the network is recovered from the Toll and Complementary Charge. The Toll, calculated on the basis of actual power flows (MW), also allows for some locational signaling.[29]

D Transmission losses accounting

The EOR manages the energy accounting, including loss accounting for import and export of power through the SIEPAC line.

E Congestion management

On a monthly basis, EOR publishes the maximum transmission capacity between each of the corridors. If there is a need to modify the awarded transmission rights, due to any changes in network capacity, the entities who hold the rights are offered a reduced transmission right. For those entities who do not agree for such reductions, for the corresponding capacity, a new auction will be conducted.

For more near term, and real time congestions, EOR calculates congestion rent for the transactions, through a nodal pricing mechanism.

F Deviation accounting and settlement

The deviation accounting is undertaking by considering the net deviation for each time period (hourly), between programmed and actual transaction. The net deviation is multiplied by an average price (determined hourly) to arrive at the deviation charges. However, no compensation is paid for excess injection.

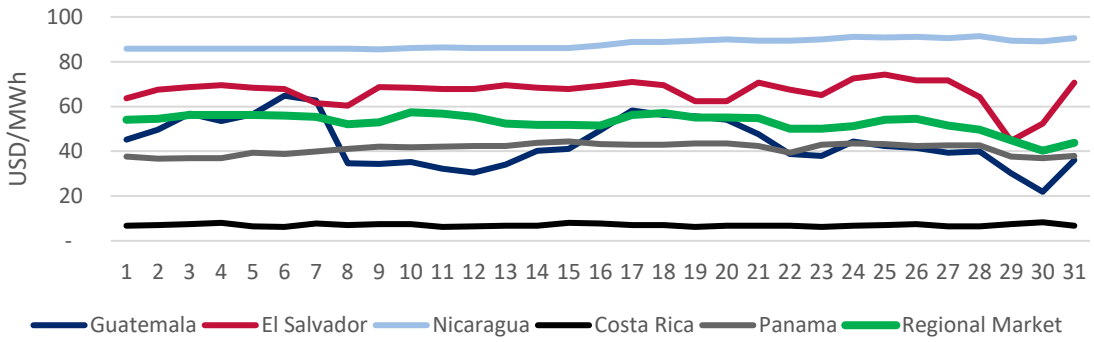
2.3.7 Benefits of CBTMPT and sharing among the member countries

Due to the relatively small size of the power system in each country, the opening of a regional market was seen as a means for creating a larger market that would enhance competition among power producers. The prices discovered in the regional market of SIEPAC has mostly been beneficial to all participants, with countries

which export getting a more attractive price than their national markets, and countries which import getting cheaper power than available from their national markets.

A comparison of national and regional prices in some of the SIEPAC countries, for August 2020 is illustrated below. It can be seen that countries such as Nicaragua and El Salvador can import electricity from the regional market at a cheaper rate than their domestic market, whereas countries such as Guatemala, Panama and Costa Rica can obtain a higher rate by selling their power to regional market.

Figure 7: Average daily pre-dispatch price, by national electricity system - August 2020



Source: CRIE[30]

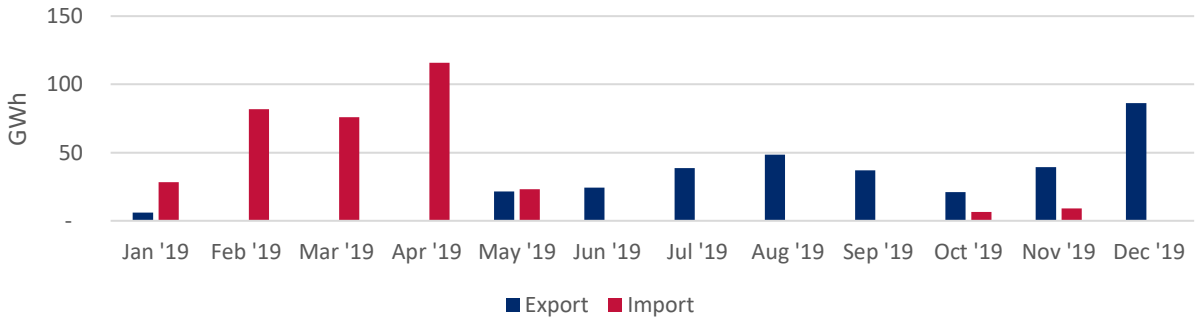
The owner of transmission line - Empresa Propietaria de la Red SA pays dividends to its shareholders, most of whom are the electricity utilities of Central American countries.

2.3.8 Role of CBTMPT in assisting RE integration

The availability of day ahead opportunity market provides some comfort to the national utilities, to accommodate the day-to-day variations of renewable energy. In 2016, CRIE issued a separate resolution specifying conditions for connection of variable renewable energy plants directly with the regional line, which mostly focused on standards, ramp rates, safety measures during contingencies etc.

Even as early as 2015, 67.8% of the electricity in the region was generated from renewable energy sources.[31] Therefore, it is also fair to infer that a substantial part of the trade through SIEPAC is also from electricity generated from renewable sources. A case in example is Costa Rica, which has an abundance of hydro and other renewable sources in most months. For example, in 2020, 98.71% of the electricity was generated from renewable energy sources.[32] However, due to seasonal nature of hydropower, the country imports power from MER in some of the months (usually January to May) and exports power to MER in other months.

Figure 8: Costa Rica - Export and import from regional electricity market (MER)



Source: CENCE[33]

2.3.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

The specific role of each of the institutional mechanisms are summarised below:

CDMER	Coordination at intergovernmental level
CRIE	Development of regulations Dispute resolution
EOR	Development of commercial and operational procedures and reports Operation of regional transmission line Undertake transmission right auctions Manage contingencies and network congestions
EPR	Build and maintain the regional transmission network
National system / market operators	Coordinate with EOR on scheduling and operations
Market agents	Undertake transactions in the regional energy market

CDMER

The MER's Steering Committee (CDMER) is the body that represents the governments in the MER. It is responsible for promoting development of the MER and making the necessary decisions to achieve the comprehensive objectives and aims of the Treaty and its Protocols. For this, the CDMER establishes mechanisms for coordinating with the CRIE and EOR within the purview of each. The responsibilities that the Second Protocol to the Framework Treaty ascribes to the CDMER include:

a) Evaluating the evolution of the MER in conjunction with the CRIE;

b) Creating conditions that are conducive to the development of regional power plants;

c) Promoting gradual changes to national regulations to harmonize them with the regional regulations so that the MER can function properly;

d) Examining the audits to which the CRIE is subjected and, if necessary, commissioning special audits to be conducted on its expenses as an oversight mechanism;

e) Facilitating compliance with the responsibilities of the governments established in the Framework Treaty and its Protocols.

The CDMER is composed of representatives from each of the signatory countries of the Treaty, appointed by the executive branch. The headquarters of the Executive Secretary's Office of the CDMER is in Costa Rica.

CRIE

The Regional Commission for Electricity Interconnection (CRIE) is the body responsible for regulating the operation of the MER and relations between market agents. The CRIE is a distinct legal entity with legal capacity in public international law, economic independence, functional independence and technical expertise. The CRIE is responsible for enforcing the Treaty and its Protocols, the regulations, and other supplementary instruments; endeavouring to develop and consolidate the Market, and ensuring its transparency and proper operation, as well as promoting competition among market agents.

Under regional legislation, the CRIE has the following powers:

a) To regulate the operation of the Market, issuing the necessary regulations;

b) Taking general and specific measures to ensure conditions of competition and non-discrimination in the Market;

c) Adopting decisions designed to develop the Market, ensuring both its initial operation and its gradual evolution toward more competitive conditions;

d) Approving the regulation of physical and economic dispatch, at EOR's proposal;

e) Regulating aspects concerned with regional transmission and generation;

f) Deciding on the authorizations established by the Treaty, pursuant to its regulations;

g) Adopting measures conducive to preventing an agent's abuse of a dominant position in the Market;

h) Imposing the penalties established by the Protocols relating to breaches of provisions of the Treaty and its regulations;

i) Approving the tariffs for the use of the regional transmission system under the relevant regulations;

j) Settling disputes between market agents, national bodies, System and Market Operators (SOs/MOs), regulatory bodies of the Parties, and EOR, arising from the application of the Framework Treaty, its Protocols, regulations, and the CRIE's resolutions;

k) Approving the charges for system operation services provided by EOR under the relevant regulations;

l) Evaluating the evolution of the Market periodically and proposing any measures it deems appropriate to the Parties to advance the Market's consolidation;

m) Requesting audited accounting information from the business units set up under Article5 of the Framework Treaty; and

n) Coordinating with the national regulatory agencies the necessary measures for the proper functioning of the Market,

EOR

Ente Operador Regional Operating Agency (EOR) is the body that directs and coordinates the technical operation of the regional electricity system and conducts the commercial management of the MER, considering technical and economic criteria, in accordance with regional regulations. EOR is a distinct legal entity with legal capacity in public international law, economic independence, functional independence and technical expertise. The functions assigned to EOR under regional legislation and regulations, in coordination with the System and Market Operators of the MER member countries, include:

a) Proposing to the CRIE the procedures for operating the Market and using regional transmission networks;

b) Ensuring that the operation and regional dispatch of energy conform to economic criteria, endeavouring to attain appropriate levels of security, quality and reliability;

c) Carrying out business operations for trades among the market agents;

d) Supporting the processes of the Market's evolution through the supply of information; and

e) Drawing up the indicative expansion plan for generation and regional transmission. [34]

EPR

Empresa Propietaria de la Red (EPR) is a public-private joint venture company, that was set up to construct, own and maintain the SIEPAC line. EPR maintains the line, while the technical operation is undertaken as per the directions of EOR. The owners of EPR includes electricity companies of the member and associated countries. The EPR is based in San José, Costa Rica.

Other entities

The national system/market operators take care of the scheduling and system operation aspects within the respective countries, for the transactions undertaken through SIEPAC.

The market agents in each country undertake the energy trade transactions. This includes generators, traders and large users, depending on the individual country's regulatory framework. For example, in Guatemala, there are private traders and large users also as market agents, whereas in Honduras, there is only the national electric utility which is the sole market agent.

2.3.10 Key drivers enabling CBTMPT

The key drivers which enable multilateral power trade within SIEPAC includes:

1. Availability of SIEPAC interconnection as a continuous grid element running through all the member states, managed by a separate entity (EPR and EOR);
2. Political will of the countries to enter into MARCO treaty;
3. Institutional framework for regional market, through CDMER, CRIE, EOR, and EPR;
4. Well defined Regional Energy Market Regulations of CRIE; and
5. Surpluses/deficits of respective countries.

2.3.11 Challenges faced in transition to CBTMPT and mitigating actions

In the initial phase, there was no clarity on the market model and related aspects, even though the countries agreed to develop a regional electricity market. The Inter-American Development Bank (IADB) made $12.5 million in grants to support the design of the regional electricity market, the formulation of its operational rules and the establishment of a regional regulating agency and a regional market operator.

Since the development of regional market rules is a time consuming and involved process, CRIE decided to adopt an interim market rule so that market operations can commence. The transitional rules were adopted in 2002, and the final market rules were adopted in 2005.

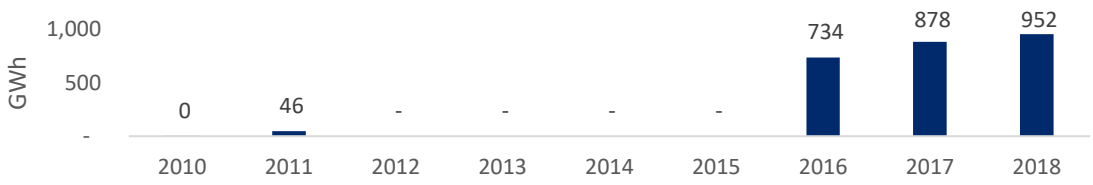
2.4 Gulf Co-operation Council (GCC) interconnection

The GCC interconnection consists of a 400 kV transmission backbone, connecting the GCC states of Bahrain, Kuwait, Oman, Saudi Arabia, Qatar and United Arab Emirates. The interconnection is operated by GCC Interconnection Authority (GCCIA), a joint stock company, subscribed by the six member states. The operations of GCC commenced in 2009-2010. Currently five of the six countries are actively trading energy, while Oman is yet to sign access conditions.

2.4.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

The GCC interconnection initially started off as a mechanism of grid interlinking, to share the system reserves of individual GCC member states, and protect them from loss of load, thereby improving system reliability and stability. Planned electricity trade, as such was limited in the initial years of GCCIA. However, since 2016, the electricity trade has been increasing.

Figure 9: Power trade on GCCIA interconnection



Source: GCC Interconnection Authority[35]

GCC interconnection currently supports **multilateral power trade**, with the commencement of operation of GCC Power Exchange. These consist of multiple transactions cleared through the power exchange. GCC Power Exchange operates Day Ahead Continuous and Intra-Day Continuous Market.[36]

The interconnection serves the following four key purposes:

- Sharing the capacity reserves;
- Sharing the spinning reserves;
- Sharing during emergencies; and
- Providing a platform for competitive power trade for additional utilization of the network.

2.4.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

In 1981, the six gulf states came together to sign the GCC charter. In the charter, one of the objectives was: *"To effect co-ordination, integration and inter-connection between member states in all fields in order to achieve unity between them."* [37]

The decision to go ahead with an electricity interconnection was communicated in the 18th session of GCC Supreme Council, held in December 1997:

"Emphasizing the need to tie and coordinate the economic interests of member states in the area of infrastructure projects, the supreme Council directed to start the implementation of the first stage of the electric network project. The Council agreed that the project will be owned and operated by an independent authority run on a commercial basis."[38]

The GCC member states have signed the **General Agreement** of Power Interconnection Grid with the GCCIA. The General Agreement lays out the fundamental agreement between member states with regard to use of the interconnection. The General Agreement includes provisions relating to connection fees, rights of interconnection, performance, defaults, termination, and governing law, as well as the regulatory principles committed to by the parties.

In addition to the General Agreement, state utilities enter into a **Power Exchange and Trading Agreement (PETA)** which sets out the terms on which the parties may connect and have access to the grid and the terms by which parties may schedule transfers of power. The document is comprised of four sections , namely:

a. Common Legal Terms & Conditions;
b. Connectivity and Usage;
c. Trading Terms; and
d. Interconnector Transmission Code (including the Metering Code).

The institutional mechanisms for cross border trade through GCCIA have been set up at the following levels:

1. The **GCC Ministerial Committee** comprises ministers of electricity and water from each of the member countries. This committee, with inputs from the Regulatory Advisory Committee, guides the GCCIA board of directors on its policies and procedures. The board itself is nominated by the six member countries.
2. The GCCIA board together with the planning committees and the operating committees (also nominated by GCC member states) form a **General Assembly**, which makes decisions on codes and agreements governing trade among member utilities and governing the activities of the GCCIA itself.
3. **GCCIA, together with the operating committees**, has also been responsible for coordinating the development of the contractual and trading arrangements governing the operation of the scheme.

2.4.3 Technical, commercial and operational framework for implementation of C5BTMPT

Along with the Power Exchange and Trading Agreement (PETA), GCCIA has developed various detailed operational procedures such as:

- GCCIA Market Procedures;
- GCCIA Exchange Market Terms and Conditions;
- Procedure for sharing of losses; and
- Procedure for conducting tests on the interconnection system etc.

Figure 10: Snapshot of GCCIA operational procedures

GCCIA has three markets:

1. Capacity market;
2. Spinning reserves; and
3. Energy market.

The current focus is more on the capacity market because a basic objective of the interconnector was to share the capacity in order to reduce the investment of the member states to build capacity. However, since all the member countries are self-sufficient, there is not much trade happening in the capacity market. The spinning reserves market is witnessing the same trend. These two markets exist but not much transaction has taken place.

The energy market started with bilateral trades involving In-kind transactions. The main reason for having in-kind transactions initially was because the member countries were hesitant to determine the price of the power (buy and sell). However, there has been significant progress and currently member countries have started doing power trade in cash also.

2.4.4 Consensus building mechanism

The discussions and consensus building mechanisms are spread across multiple levels:

1. GCC Ministerial Committee which comprises ministers of electricity and water from each of the member countries guides the GCCIA board of directors on its policies and procedures.
2. An Advisory and Regulatory Committee provides inputs to the GCC Ministerial Committee.
3. GCCIA conducts "round table meeting" with agents and heads of the executive bodies of electricity of the GCC member states, to discuss plans for power trade and power market within GCC.
4. The GCCIA board of directors have two nominees from each of the member countries.

5. Within GCCIA, there are committees such as planning committee, operating committee and electricity market committee, consisting of nominees from member states. The GCCIA board along with the committees form a General Assembly, which makes decisions on codes and agreements governing trade among member utilities and governing the activities of the GCCIA itself.
6. GCCIA, together with the operating committees, has also been responsible for coordinating the development of the contractual and trading arrangements governing the operation of the scheme.

The basic reconciliation of regulatory, technical and operational issues related to CBTMPT gets handled at the level of basic agreements and documents of GCCIA, such as the General Agreement, PETA, Market Procedures and the Exchange Market Terms and Conditions. In the creation of market rules, the inputs of various committees with representation from member countries play a key role, thereby facilitating a collaborative approach. In key matters such as transmission pricing, the role of 'Advisory and Regulatory Committee' is also crucial. Further, in case of substantial matters of disagreement, or need for a higher level of dispute resolution, the matter can be taken to the GCC Supreme Council, consisting of heads of state of the GCC member countries.

2.4.5 Financing for development of CBTMPT transmission infrastructure

The member countries decided to self-finance the GCCIA project, by sharing the costs in proportion to the present value of reserve capacity savings. Each country was responsible for sourcing their share of the capital required, which could be from combinations of debt or equity as decided by each member state. As the project was developed in three phases, the cost sharing also varied as per the phases. The capital cost was paid in advance at the start of the project. The cost sharing was decided as per the below proportion.

Table 2: GCC interconnection cost sharing

Country	Phase I	Phase I & III*
Kuwait	33.8%	26.7%
Saudi Arabia	40.0%	31.6%
Bahrain	11.4%	9.0%
Qatar	14.8%	11.7%
UAE	-	15.4%
Oman	-	5.6%
Total	100.0%	100.0%

** Phase II was related to internal strengthening and connectivity within UAE grid, that was to be financed by UAE.*

Source: GCC Interconnection Authority[39]

For any project by any of the member states, the budget is structured depending upon the utilisation of the asset, which is determined as per the countries' directions. Cost benefit analysis is done for each of the new identified projects.

Utilities of member countries took the responsibility for repayment of loans relating to GCC interconnection construction costs in their respective territories. Member states also pay an annual subscription fee to the GCCIA. which covers the operational cost of the interconnector. GCCIA is trying to identify options to become self-sufficient and going forward how it can repay its shareholders.

In terms of potential extension of the interconnector in the future, there have been plans on interconnecting Iraq in the future. GCCIA is evaluating the various options from financing point of view.

2.4.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

Access to the GCC is limited to the national electricity utilities (PETA parties). Those utilities can make planned energy transfers between their systems, as long as they can secure a) bilateral contracts arranged

between them; b) allocation of available Interconnector capacity. Prior to a proposed scheduled exchange between Member states the following steps will have to be taken:

- Obtain the necessary Interconnector capacity from GCCIA;
- Agree the terms of the proposed energy exchange between themselves;
- Notify the Authority;
- Obtain confirmation of the proposed exchange from the Authority

B Development and management of transmission corridors

The GCC interconnection is operated and maintained by GCCIA, which serves as the transmission and system operator for the interconnection. The Operations Committee of GCCIA aims to coordinate operational matters between the GCCIA network and the networks of member states. The Committee also discusses on aspects such as Special Protection Schemes to be implemented by the member states to protect the interconnection.

C Transmission pricing/wheeling methodology

The transmission prices are approved by the Advisory and Regulatory Committee (a regional regulatory body), based on the recommendations of GCCIA. This regulatory body looks into all the tariffs and charges. Hence, the responsibility of estimating transmission charges lies with the regulatory authority. In order to promote cross border power trade, the transmission charge had been waived for a period of around 3-4 years. Tariff was introduced step by step. The current tariff is USD 0.5/MWh, with minimum limit of USD 10,000 for each transaction.

D Transmission losses accounting

GCCIA has developed its own 'Procedure for sharing of losses on the GCC interconnected system'.

Also, for non-trade related exchange of energy (such as use of reserve capacity), the exchanged energy is to be returned in-kind, and losses are also scheduled to settle mutually as energy in-kind between the member states.

E Congestion management

The energy transactions are enabled, only after confirming the availability of interconnector capacity. Further details may be available in the market and exchange rules and procedures documents.

F Deviation accounting and settlement

GCCIA takes the responsibility of preparing the settlement of unscheduled deviations of power between member states, on a weekly basis. The method of compensation has been proposed to be through 'repayment in-kind' and 'cash' transaction between the parties based on quantum of deviation. Deviation less than 25 MW is settled on "in-kind" basis every week. Deviation more than 25 MW is settled by cash at a regulated price.

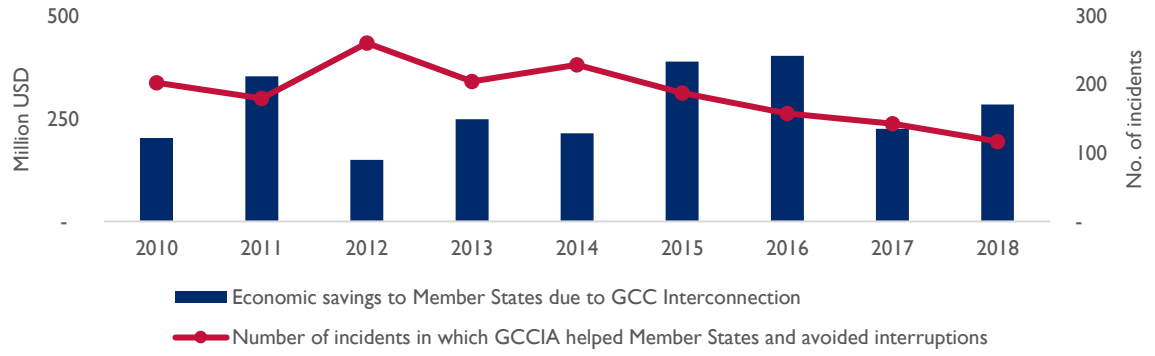
2.4.7 Benefits of CBTMPT and sharing among the member countries

The GCC interconnection provide stability to the electricity system, owing to the larger size of interconnected grid. In case of outage of major elements in any country, reserve support is readily available through the interconnection. Thus, avoidance of outages due to emergency support provided by the interconnection provides significant economic savings. The project has also resulted in economic savings by reducing the installed capacity, operational reserves, and carbon emissions. Sharing of capacity has benefitted all the member countries. Before GCC interconnection, the GCC member states used to face issues in their power system, including a blackout in 2004. However, since the GCCIA interconnector has been operational, a more robust system has been developed with less power interruptions, and no more instances of wider blackouts.

Sharing the spinning reserves among the countries is also beneficial, which is done through a mechanism to address each other's requirements. GCCIA estimates annual savings of over 200 million USD due to the GCC

interconnection, with the interconnection providing support during more than 100 network incidents every year.

Figure 11: Estimated benefits of GCC interconnection



Source: GCC interconnection authority[40]

2.4.8 Role of CBTMPT in assisting RE integration

The share of renewable energy in GCC countries as on 2018 was estimated to be only 0.8%.[41] However, in the future, as share of RE increases, the availability of GCC interconnection is expected to allow countries to handle the RE more reliably, in comparison to the scenario of stand-alone grids, as balancing and reserve capacities can be shared. Already, the GCC member states have agreed to share the level of RE availability on week ahead, day ahead and real-time basis, and to include existing and planned RE to the network model considered by GCC's Operations Committee in their studies.[42]

2.4.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

The power trading initiative in GCC was coordinated by GCCIA primarily through its Electricity Market Committee, and through round table meetings. Specifically, the role of various key entities was as below:

- The initial draft of Market Procedures and Exchange Rules were developed by GCCIA.
- The draft was shared with the Electricity Market Committee, and GCC Board of Directives, for their comments and feedback.
- The modified draft was then submitted to the Advisory and Regulatory Committee (ARC) for their approval.
- ARC also approves the tariff for usage rights of the interconnector, which will be revised annually based on the recommendations of GCCIA.
- GCCIA also conducts "round table meeting" with agents and heads of the executive bodies of electricity of the GCC member states, to discuss plans for power trade and power market within GCC. Till 2019, seven round table meetings have been held.

2.4.10 Key drivers enabling CBTMPT

The key drivers which enable trilateral / multilateral power trade within GCCIA includes:

1. Availability of GCC interconnection as an almost continuous grid element, running through all the member states, managed by a separate entity (GCCIA);
2. Political will of GCC and its member states for cooperation in electricity;
3. Well established framework for sharing of reserves in the initial years, which thereby enabled further transition to scheduled energy trades;

4. Facilitation by various committees such as Electricity Market Committee and Advisory and Regulatory Committee of GCCIA;
5. Availability of seasonal generation surpluses in various GCC member states; and
6. Commencement of operation of trading system for GCC power market.

2.4.11 Challenges faced in transition to CBTMPT and mitigating actions

Quantum of power trade

In the initial years of GCC interconnection, quantum of power trade was very negligible. Member countries traded only during emergencies as all of them had sufficient power in normal scenario. This situation continued until 2014[43]. Besides the emergency situations, all the countries had over capacity and hence there was no shortage of electricity. Therefore, the member states were not required to purchase from outside. Additionally, they also had access to very highly subsidized fuel. To promote power trade, a sequence of initiatives were taken to address this such as creation of forums, listening to the representatives from the member countries, creation of committees to look into the issues of all the countries. A comprehensive study was conducted to list down all the issues and initiatives were developed to resolve these issues. These initiatives were carried out for two years (2014 and 2015) and through these some actions were undertaken to unlock the power market step by step. Creation of awareness among the members was important at this stage. Hence a lot of programmes were arranged, for example, building capacities and changing some regulations to introduce competitive power markets. In 2016, the first bilateral power trade started. Henceforth, more tools and activities to build a new system were undertaken.

Transmission charges

The utilization rate of the cross-border transmission interconnection capacity developed by the GCCIA has been less than 5%. In order to incentivize power trading, the GCCIA waived carriage charges for using its interconnectors during 2016-2018. It reinstated a nominal charge in 2019 of USD 0.5 per mega watthour (MWh), a 90% discount off the previous rate of USD5/MWh established in 2010.[44]

Power trading pilot

The scheduled power trading was not significant in the initial years of GCCIA, and detailed procedures for market trading was also not available. Therefore, a pilot of trading of power commenced in 2015, to demonstrate the feasibility, and available options. The pilot project in 2015 resulted in one contract between two member states. Based on this experience, the project was further extended and expanded in the future years.

Initially when power trading started, it was based on power requirement for the peak period. From 2017 onwards gradually there was power requirement during the off-peak (i.e., wintertime) time too and member countries purchased power during the months of October through March as well. This indicated that the countries wanted to optimize their resources and this paved the way to start a continuous power market on the GCCIA power exchange platform. Countries wanted to trade on a longer period, therefore trade was introduced on day ahead and week ahead basis. This was extended to a three month period. GCCIA opened a platform where the countries could submit their requirements based on one week to three months.

2.5 Greater Mekong Sub-region (GMS) Power Market

The Greater Mekong Sub-region (GMS) covers 8 regions in 6 countries, namely-Cambodia, the People's Republic of China (PRC) (Yunnan Province and Guangxi Zhuang Autonomous Region), Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand and Vietnam. The Inter-Governmental Agreement (IGA) on Regional Power Trade in the GMS was signed in November 2002. After this, there has been two Memorandums of Understanding (MoUs), in 2005 and 2008. There are multiple cross border transmission lines, such as Lao PDR-Thailand and Cambodia-Vietnam. Overall, there are 10 interconnections, with a total capacity of about 5000 MW, at 220/230 kV and 500 kV[45].

2.5.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

At present there exists **only bilateral power trade** in the GMS. However, the plan is to ensure a gradual evolution of the regional market from bilateral contracts to a more complex, centralized regional trading system i.e. enable multilateral power trade. The roadmap for development of power market in the GMS has been laid out by the World Bank and ADB in four stages[46]:

- Stage 1 – Enabling country to country trading through bilateral transactions
- Stage 2 – Enabling trading between any two GMS countries using transmission lines of a third country (but limited based on available capacity of lines linked to PPAs)
- Stage 3 – Third parties other than national power utilities are allowed to utilize regional interconnections
- Stage 4 – Establishment of multi-buyer and multi-seller regional competitive market

The GMS market is currently in transition from stage 1 to stage 2. No timeline seems to have been specified for the shift to stage 3, when third parties such as trading licensees will be allowed to participate in the regional market.

2.5.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

The agreements/documents establishing the legal status and governing the operations of the GMS regional power market are:

- The Inter-Governmental Agreement (IGA) on Regional Power Trade (November 2002))
- The Guidelines for the Regional Power Trade Coordination Committee (RPTCC) (July 2004)
- The MoU on the Guidelines for the Implementation of the Regional Power Trade Operating Agreement-Stage 1 (July 2005)
- The MoU on the Road Map for Implementing the Greater Mekong Subregion Cross Border Power Trading (March 2008)
- The Regional Power Trade Operating Agreement (RPTOA)
- The Inter-Governmental MoU for the Establishment of the Regional Power Coordination Centre (RPCC)

The IGA established ***the Regional Power Trade Coordination Committee***, which is responsible for managing regional power trade in the GMS region. The key functions are:

- Provide recommendations of overall policy and management of regional power trade, including bodies and coordination
- Establish short, medium and long term initiatives to achieve the objectives of regional power trade within a specified timeframe
- Identify steps for implementation including means for financing

The RPTCC operates through the GMS Secretariat and was formed in 2005. It is supported by Asian Development Bank. RPTCC comprises officials from the energy departments and ministries of the GMS countries. RPTCC has a Chairperson and Vice Chairperson elected from among the members. There are two Working groups, the Focal Group (FG) and the Planning Working Group (PWG). One of the primary roles of the PWG is to prepare a regional interconnection plan.

CBTMPT in GMS and ASEAN: Laos-Thailand-Malaysia-Singapore (LTMS) Power Interconnection Project

A cross border power trade project (LTMS) between Lao PDR and Thailand and two ASEAN member countries of Malaysia and Singapore (LTMS) has been initiated as the first multilateral cross border power trade[1] during a special Senior Officials Meeting on Energy (SOME) in Manado, Indonesia in December 2013. (This is covered in more detail in the following section on ASEAN). There is also a plan for power trade between Myanmar and Cambodia through Thailand.

2.5.3 Technical, commercial and operational framework for implementation of CBTMPT

Currently there are two types of existing cross border interconnections in the GMS[47].

- High voltage interconnections (220/230 kV and 500 kV) – these interconnectors are primarily for transporting power from specific power projects located in one country to another country. Such interconnectors are at high voltage levels and represent the majority of the cross-border interconnections in the GMS at present (e.g., Lao PDR and Thailand, Lao PDR and Viet Nam and Myanmar and PRC
- Medium and low voltage interconnections (110/115 kV and 22 kV) – cross border interconnections for power exchanges in the GMS exist at medium and low voltage levels. In these cases, either the importing grid is either synchronised with the exporting grid or switching operations are performed to effectively connect load to a foreign grid. Interconnections exist between PRC and Viet Nam, Cambodia and Viet Nam, Cambodia and Thailand, and Thailand and Lao PDR, PRC and Viet Nam are examples of where the grids are not synchronised. Cambodia and Viet Nam are an example of synchronised operations.

The two Working groups of the RTPCC deal with technical and regulatory aspects and have the following functions respectively[48], –

- Working group 1: primary task is to prepare and adopt –
  - common performance standards for GMS
  - transmission regulations
  - standard regional metering arrangements
- Working group 2: primary task is to prepare GMS Grid Code/Regional Power Trading Operating Agreement (RPTOA)

RPTCC had undertaken the preparation of harmonized grid code with the assistance of Asian Development Bank (ADB), and the member countries have accepted the same. Their national grids codes are currently harmonized with GMS' grid code, to address the technical gaps. ADB supported a study for the preparation of the Regional Power Trade Operating Agreement during 2003 to 2007. The objective of the study was to help GMS members prepare a regional power trade operating agreement, considering the IGA and desirable forms of power trade. Overall objectives were to provide reliable and economical supply of electricity to consumers, develop sustainable energy resources and enhance economic cooperation. The Regional Power Trade Operating Agreement (RPTOA) lays down the operating rules and guidelines supporting the creation of a regional power market in this region. The RPTCC coordinates with and represents countries involved in the regional power trade, agreeing on operating rules and guidelines for the creation of a regional power market, as mentioned in the RPTOA. Planning for the construction of various cross border power interconnection projects is done in line with the RPTOA.

2.5.4 Consensus building mechanism

[1] *Details of LTMS will be discussed under ASEAN Power Market*

The RPTCC provides a platform to bring together the members for discussions and is responsible for coordination. It also facilitates the exchange of information on energy sector plans and projects. It holds either biannual or annual meetings and there have been 26 meetings so far[49]. Each member countries has minimum two representatives in the RPTCC – one each from the ministry and power utility respectively to ensure fair representation. Their responsibility is to adopt the recommendations and findings of studies and convey to the higher level, which is generally the ministerial level for final adoption, post deliberations.

If RPTCC is unable to resolve any issue, then it will be resolved at the deputy minister level in the respective governments.

Besides, RPTCC meetings, issues are also deliberated on during Senior Officials Meeting on Energy (SOME) and, the annual Ministerial meetings that review the work and discuss regional integration issues. There is also the Sub regional Electric Power Forum, which serves as an advisory body to the GMS Ministerial Meetings on sub regional power issues.

ADB is trying to promote the establishment of the Regional Power Coordination Centre (RPCC) which will have a permanent secretariat. The proposal is to have a two tier organization structure – technical staff and higher level staff aiding policy-making among the GMS member countries. This will allow the member countries to gradually take over the functions that ADB is undertaking under RPTCC to develop the regional power market.

2.5.5 Financing for development of CBTMPT transmission infrastructure

Asian Development Bank (ADB) is the main external agency supporting the GMS Programme and together with the World Bank are funding the construction of regional interconnectors. The ADB also provides funding for the upgrading of existing medium voltage (MV) interconnectors. At times, the government themselves also provide funding and carry out activities on their own. Some transmission projects also adopt the PPP funding route. In Stage 1, where the IPP sells power to the neighbouring country, the PPA usually includes the cost of the IPP power plant and transmission investment. This assists the member countries to allocate the cost. Various models are adopted – at times the IPP just invests for the construction of the power plant and in some cases, it also invests in the transmission infrastructure to be more secure.

In order to move to Stage 2, the spare capacity will be utilized and, a wheeling charge method has been developed based on the load flow analysis, available capacity and congestion. In this case no new investment will be required or investment will only be required for the network used for wheeling of power. However, this approach is yet to be tested and is in a very initial stage.

For the development of new regional interconnectors, short term projects are currently being discussed among the GMS countries. For example, an agreement between Laos and Myanmar, for supply of power to Myanmar is in an advanced stage. Bilateral discussions are ongoing and the interconnection is expected to be completed by 2022. Besides this, as part of ADB's technical assistance, a master plan has been prepared. It is based on generation (2022-2035) and transmission (2022-2032) planning. It provides recommendations on potential power trade among the members and the investment required for building the transmission infrastructure. However, the mechanisms for financing of the infrastructure are not included in this plan.

Examples of some ADB funded TA projects for the development of transmission infrastructure for trading in this region have been provided below[50].

Table 3: Examples of ADB funded Technical Assistance for regional transmission infrastructure development

Loan	Year	Technical Assistance and ADB/Government contributions
LOAN 2052-CAM: GMS Transmission Project, USD 44.30 million	2003	• Preparing the Power Distribution and GMS Transmission Project. ADB: USD 730,000, Cambodia: USD 180,000 • Preparing the GMS Power Interconnection Project, Phase I. ADB: USD 800,000, GMS governments: USD 160,000.

LOAN 7256/2337-CAM. Cambodia Power Transmission Lines Co., USD 8 million	2007	• Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the GMS. Sweden: USD 5 million, GMS governments: USD 5 million. • Na Bong–Udo Thani Power Transmission. ADB: USD 760,000, Lao PDR: USD150,000.

2.5.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

'Indicative Power Interconnection Master Plan' is followed which include "priority new interconnection projects" for undertaking feasibility studies. One of the key tasks of the Planning Working Group is planning and prioritizing the addition of new transmission capacity, including recommendations regarding ownership and financing for the Greater Mekong Sub Region. The master plan identifies the potential for power trade. It also includes points for improving bilateral transactions, point to point transactions.

B Development and management of transmission corridors

The following table shows the agencies responsible for development and management of transmission corridors in each country in the GMS region:

Table 4: Management of Transmission Corridors in Different Countries of GMS[51]

Country	Agency responsible for Development & Management of Transmission Corridor
Cambodia	Cambodia Power Transmission Lines Co
Lao People's Democratic Republic	Electricité du Laos (EDL), a state-owned corporation
Myanmar	Ministry of Electric Power No. 2
People's Republic of China	China Southern Power Grid state-owned enterprise
Thailand	Electricity Generating Authority of Thailand (EGAT)
Vietnam	National Power Transmission Corporation (NPT)

C Transmission pricing/wheeling methodology

Prices for bilateral cross-border trade are set under negotiated PPAs on a case-by-case basis. Contracting parties can mutually determine whether to apply transit charges. Existing cross-border trades mainly use interconnectors dedicated to specific power plants and take place between countries sharing a border in common. Revenues to recover the costs of these transmission lines are included under the terms of power purchase agreements (PPAs).

D Transmission losses accounting

Since most of the trading in the region occurs on a bilateral mechanism- the transmission losses accounting depends on case-to-case basis by the contracting parties. However, Regional Power Coordination Centre (RPCC) has been encouraged to take responsibility for calculating wheeling charges and transmission losses associated with regional power trading. In this regard, a Transmission Charges and Transmission Loss Factors Report is recommended to published by the RPCC at the start of each trading year in the near future.

E Congestion management

Congestion is managed on a first-come-first-served basis. The latest signed regional bilateral trade will be the first to be curtailed.

F Deviation accounting and settlement

It has been proposed for the RPCC to play a key role in performing settlement on behalf of buyers and sellers, and playing the role of a market operator should the short-term electricity market evolve in the future.

Two options are being envisaged for settling imbalances[52]:

- "In-kind" repayment of energy at times of days and seasons of the year that correspond to those when the imbalance occurred.
- A cash-based settlement mechanism, based on an understanding of which power plant(s) provided the balancing service and, therefore, the cost of the energy supplied

2.5.7 Benefits of CBTMPT and sharing among the member countries

- According to a 2012 ADB study[53], global cost savings for the GMS of $14.3 billion was estimated (discounted value over the 2010–2030 period) and a reduction of carbon emissions of 14.2 metric tons per year in 2020 was estimated.
- The national energy efficiency action plans of the five countries in the GMS identify energy efficiency savings potential in the 30%–50% range for energy-intensive industries, such as the glass, cement, and steel industries. Overall energy efficiency savings for the five countries could amount to almost 60 million tons of oil equivalent (Mtoe) yearly by 2030.[54]
- The GMS countries envisage substantial energy efficiency savings over the next 15–20 years, with Thailand projected to score the highest savings, ranging from 20% to 40%, in its industry and transport sectors. For Cambodia, the Lao PDR and Myanmar, the residential and commercial sectors are expected to be the major source of savings. For Viet Nam, energy savings are expected to be greatest in the industrial sector

2.5.8 Role of CBTMPT in assisting RE integration

All the GMS countries have introduced measures to promote renewable energy, and most have ambitious targets for further development. Renewable energy sources are expected to play an important role in meeting individual country targets of providing electricity to rising populations. The share of renewables, particularly solar, is expected to increase considerably in all of the GMS countries. All the GMS countries have a renewable energy plan which involves accelerating the deployment of renewable technologies particularly wind, solar and biomass using policy mechanisms including renewable energy targets. For example,

- Laos - The Government aims to increase the share of renewable energies to 30% of the total energy consumption in 2025;
- Vietnam – 21% of installed electricity generation capacity from renewables, under Power Development Plan 7; and
- Thailand - 35% of energy from non-fossil fuels by 2037.

2.5.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

- RPTCC (The Regional Power Trade Coordination Committee): Manages regional power trade in the Greater Mekong Subregion and provides recommendations on overall policy in this area. It also facilitates the exchange of information on energy sector plans and projects. RPTCC comprises officials from the energy departments and ministries of the six countries in the subregion.

- Economic Corridors Forum: Transform transport corridors into economic corridors and connect dynamic hubs of economic activity. It serves as a single body focusing on economic corridor development and helps improve interaction between the public and private sectors, and between central and local governments
- LTMS PIP working group (WG): With four technical task forces looking into Technical, Legal and Regulatory, Commercial and Tax and tariff aspects of the projects in GMS
- Asian Development Bank (ADB): ADB continues support regional integration through regional power interconnections and development for mutual benefits, enable harmonization: technical and regulatory, promote integrated resource planning, assist in mobilization of financing for projects, institutional development, physical infrastructure development etc

2.5.10 Key drivers enabling CBTMPT

- Effective institutional arrangements with strong government ownership (e.g., RPTCC) and the establishment of an appropriate policy framework for power trading in the GMS via multiparty agreements.
- Diversified Resources: availability of abundant of natural resources like hydro along with abundance of fossil resources in the region.
- A well-established GMS Regional Master Plan which identified levels of energy demand and the priority interconnection projects up to 2020 necessary to support regional power trade. It evaluated the potential for power trade in terms of volume and cost-benefit, which aids in decision making by the member countries.
- A very comprehensive methodological programme laying out the regulatory and technical frameworks will be required to transition completely to Stage 2. The key requirements to enable wider participation in cross border power trade apart from direct bilateral PPAs are as follows.
  - harmonization of regulatory framework
  - harmonization of regulatory framework and an independent regulator
  - harmonization of grid codes

  In 2014, technical assistance was provided by ADB, which provided harmonization of regulatory framework, technical performance centres and grid codes.

2.5.11 Challenges faced for transition to CBTMPT and mitigating actions

There is limited connectivity in the power systems of the GMS. Most of the high-voltage transmission lines are simply power lines that run from power stations in host countries to substations in importing countries. In this case, the intervening transmission line cannot be used for third-party access, and in some cases the power purchase agreements (PPAs) forbid third-party access. Thus, new cross border interconnections are under different stages of implementation, to support future enhanced trade.

There is also an institutional challenge, as RPTCC is only a forum. ADB is trying to establish an organization (RPCC) which will take over their activities and be the custodian. This organization should be able to continue with the activities while ADB provides the technical. financial and advisory support. However, the plan has not been successful yet.

There have also been concerns raised by larger grids such as that of Thailand, on potential increased vulnerability in connecting with grid of other countries at higher voltage levels. For removing such concerns, proper technical standards should be in place in all the GMS countries, and investment will be required to upgrade the smaller power systems to the level of the larger ones. Support from the governments is also essential for this. RPTCC had started working on these aspects. Initially, a harmonized grid code was prepared

whose provisions were then incorporated by the respective member countries in their grid codes. The current area of focus is strengthening the physical infrastructure, including adding sufficient protection mechanisms.

2.6 ASEAN Power Market

The ASEAN member states started working on the goal of integrating their power systems several years back. The overarching aim is to develop the ASEAN Power Grid (APG). Cooperation for APG was initiated in 1997 to establish cross-border electricity interconnections between 10 ASEAN member countries, namely Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The MoU of the Heads of ASEAN Power Utilities/Authorities (HAPUA) and the new structure of HAPUA organization was signed by all member countries in the 20th Meeting of the HAPUA held in May 2004 in Cambodia.[55].

The APG is composed of a series of cross-border alternating current (AC) and direct current (DC) interconnecting transmission lines. It is an initiative to construct a regional power interconnection to connect the ASEAN region. It is one of the physical energy infrastructure projects in the Master Plan of the ASEAN Connectivity, which is expected to enhance electricity trade across borders that would provide benefits to meet the rising electricity demand and improve access to energy services in the region[56].

2.6.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

Power trade across the APG lines that currently exist is primarily bilateral. The ASEAN Power Grid comprises 16 cross-border transmission projects that are divided into the Northern, Southern and Eastern development corridors. Electricity transfer of up to 28 GW between South-east Asia countries is enabled through the networks[57]. Power connections will first be developed on cross-border bilateral terms, then expanded to a sub-regional basis before being upgraded into an integrated regional power architecture[58].

Cross border power trade is primarily in the form of bilateral trade and Laos has been a frontrunner in initiating such arrangements. Laos' primary source is hydro power besides some solar and wind. While it imports power from China and Vietnam, it has signed the following contracts for export of power[59]:

- MoU with Thailand for trade of 9000 MW
- MoU with Vietnam for 1000 MW by 2020, 3000 MW by 2025 and 5000 MW by 2030
- MoUs with Cambodia for 3000 MW – there are three separate agreements. The transmission line approved will be of 500 kV.
- MoU with Vietnam for 200 MW

A study is ongoing to enable export of power from Laos to Myanmar. The first stage will involve a capacity of 35 MW. There is a possibility to construct a 230 kV or 500 kV for this power trade, which will be supported by ADB[60].

However, more recently efforts have been undertaken to transition to multilateral power trading through the Lao PDR–Thailand–Malaysia–Singapore Power Integration Project (LTMS–PIP). This is **the single pilot project involving multilateral power trade** at present. The aim of this feasibility study is to provide guidance to the ASEAN members regarding establishment of multilateral power trading, considering both international best practices and ASEAN's unique circumstances.

For other multilateral trade opportunities, Laos is having discussions with Cambodia and may also be undertaking discussions with Vietnam in the future.

2.6.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

On 24 June 1986, Agreement on ASEAN Energy Cooperation was signed in Manila, Philippines which emphasised cooperation among the Member Countries in developing energy resources to strengthen the

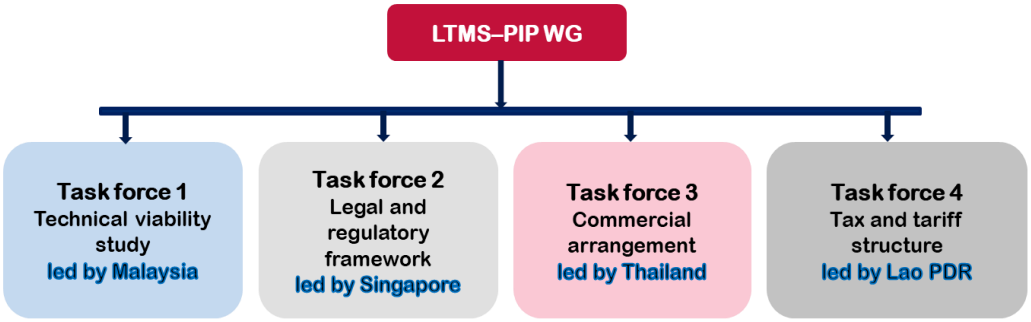
economic resilience of the individual Member Countries as well as the economic resilience and solidarity of ASEAN, and developing strategies to promote energy-related trade within the ASEAN region. The ASEAN Vision 2020 adopted by the ASEAN Leaders on 15 December 1997 at the Second ASEAN Informal Summit in Kuala Lumpur, Malaysia, called for the establishment of electricity interconnecting arrangements within ASEAN through the ASEAN Power Grid, (hereinafter referred to as the "ASEAN Power Grid").

The ASEAN Plan of Action for Energy Cooperation (APAEC) 1999-2004 adopted at the 17th ASEAN Ministers on Energy Meeting (AMEM) held in Bangkok, Thailand on 3 July 1999, and the ASEAN Plan of Action for Energy Cooperation (APAEC) 2004-2009 adopted at the 22nd AMEM in Makati City, Metro Manila, Philippines on 9 June 2004, called for instituting policy framework and implementation modalities and facilitating the implementation of the ASEAN Interconnection Master Plan, with the view towards the early realisation of the ASEAN Power Grid. On 23 August 2007, the ASEAN Member Countries signed an MoU for the establishment of ASEAN Power Grid, in which they agreed to strengthen and promote a broad framework for the Member Countries to cooperate towards the development of a common ASEAN policy on power interconnection and trade, and ultimately towards the realisation of the ASEAN Power Grid to help ensure greater regional energy security and sustainability on the basis of mutual benefit.

The LTMS-PIP has been one of the key projects under ASEAN's regional energy cooperation initiatives. The idea of LTMS-PIP originated during a special Senior Officials Meeting on Energy (SOME) in Manado, Indonesia in December 2013[61]. As a pilot project, the focus is primarily on identifying and resolving issues that could affect cross border electricity trading among the ASEAN member countries.

For project implementation a LTMS–PIP Working Group (WG) was formed in 2015 with four technical task forces dealing with technical, commercial, legal and tariff aspects of the project, as shown below[62].

Figure 12: Institutional structure of the LTMS-PIP Working Group



Each of the countries are in charge of a work stream for project implementation. The project has been divided into two phases. The LTMS governments signed an MoU on in September 2016 at the 34th ASEAN Ministers on Energy Meeting (AMEM) held in Myanmar for implementation of Phase 1, which is valid for 5 years[63].

2.6.3 Technical, commercial and operational framework for implementation of CBTMPT

The LTMS-PIP followed a well-structured approach. As the first step, each country developed a grid study in 2016 to confirm that it would be technically possible to transfer 100 MW of electricity from Lao PDR to Singapore using existing transmission facilities. Based on the recommendation of a technical task study, the LTMS–PIP implementation was divided into two phases[64]:

- ***Phase 1-2018-2019 (LTM-PIP)***
  - At present power trade of up to 100 MW between takes place between Lao PDR & Malaysia via Thailand, only utilizing existing network & interconnections. The plan is to extend the volume of power trade up to 300 MW, to avoid overloading.
- ***Phase 2-2020 or beyond (LTMS-PIP)***
  - Possible expansion will include Singapore when second interconnection cable between Singapore and Malaysia will be back in service.

- Exporting country will need to establish a local subsidiary to sell electricity directly in Singapore's market. Singapore's completely liberalized electricity market will be an advantage for enabling this cross border trading project.

Further, the Energy Purchase and Wheeling Agreement (EPWA)[2] was signed by Electricite du Laos (EDL), Electricity Generating Authority of Thailand (EGAT) and TNB (Tenaga Nasional Bhd) of Malaysia at the 35th AMEM held in Manila in September 2017, for implementation of Phase 165. The EPWA will govern the obligations of the parties in the selling, wheeling and purchase of energy in the project. The duration of these contracts is two years and are renewed[66]. The agreement is flexible, in the sense that in case of excess power, it can be sent back to Thailand. It includes three components – commercial, technical and wheeling charge. The EPWA covers the following key aspects of the LTMS-PIP:

- Energy payments from TNB (Malaysia) to EDL (Laos)
- Wheeling charge payments from EDL (Laos) to EGAT (Thailand). These are payments made by the energy seller to the wheeling service provider only.
- Transit charges

The EPWA is for two years because it does not involve firm power and there is no penalty on either side in case of shortfall of power. Based on ASEAN and APG's policies, this project is more to cater to the needs of the requirements of the member countries. Hence the flexibility is inbuilt in the agreement.

Trade under the LTMS–PIP started in January 2018. As of March 2019, around 25 GWh of power had been traded under this project[67]. ***However, this power trade was unidirectional in nature.***

2.6.4 Consensus building mechanism

The APG's lead coordination body is ***the HAPUA***. HAPUA Council consists of heads of Electricity Departments / Government owned Electricity Utilities. HAPUA also collaborates with numerous dialogue partners and international organizations, including Japan, Korea, China, Australia, US, Russia, ASEAN Secretariat, ASEAN Center for Energy (ACE) etc.

ASEAN Power Grid Consultative Committee (APGCC) is an organization under HAPUA, established in 2007. Its focus is to enhance the cooperation to execute the development of 16 interconnection projects with 27 links. Thirteen links have been operating. The role of APGCC is to facilitate and assist the HAPUA Council in the implementation of Memorandum of Understanding on the ASEAN Power Grid.

The HAPUA working groups and APGCC were entrusted with the task of developing a common grid code for ASEAN, and planning criteria. One of the HAPUA working groups (WG2 and WG5) were entrusted with harmonization of common technical standards/codes/guidelines, and harmonization of legal and regulatory framework for cross border power interconnection and trade.

There are also coordination mechanisms such as ***ASEAN Ministers of Energy Meeting (AMEM)***. For example, ASEAN Power Grid's Roadmap for Integration was approved at the 20th AMEM Meeting in Bali, Indonesia on 5 July 2002. The final report of the ASEAN Interconnection Master Plan Study (AIMS) was endorsed by 21st AMEM in Langkawi, Malaysia on 3rd July 2003 to be the reference document for the implementation of the power interconnection projects in the ASEAN region.

For the LTMS project, the role of LTMS–PIP Working Group (WG) is also very crucial.

2.6.5 Financing for development of CBTMPT transmission infrastructure

ERIA (Economic Research Institute for ASEAN and East Asia) estimates the cost of proposed future interconnectors on the LTMS route (which are listed under ASEAN Interconnection Master Plan Study II) to be USD 2 billion[68].

[2] *Since this is for multilateral trade and involves more than two countries, instead of PPA, the term EPWA has been adopted.*

Funding for the proposed LTMS route will likely be a mixture of public and private sources, comprising national utilities, IPPs and third-party investors. Considering relatively high per capita income of the member countries (except for Lao PDR) and the significant expected benefits of the interconnection, obtaining direct funding from development agencies would be difficult. However, the involvement of dominant government owned utilities in LTMS and Singapore's strong credit rating could improve the perception of transmission system investments in this case.

In the case of bilateral trade, project financing is typically undertaken by beneficiaries of the interconnectors which are national utility companies, independent transmission system operators (TSOs) or third-party investors[69]. For example, for the interconnector between Laos and Cambodia, each country developed the line within their border. This is based on long term agreements[70].

The LTM phase of LTMS project did not involve the creation of any new transmission infrastructure, as the idea was to utilize the existing available margins. However, as the grid of Thailand is used to supply power to Malaysia, there is a wheeling charge mechanism to compensate Thailand for its use of grid. The wheeling charge mechanism is further detailed in the EPWA.

2.6.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

The development of physical interconnection and transmission capabilities follows recommendations outlined in ASEAN Interconnection plan Master Studies. According to the plan there is a vision of establishment of over 20,000 MW of interconnectors. 60% of this capacity links between Thailand and Myanmar. The following table shows the planned interconnection projects in ASEAN beyond 2020:

Table 5: Planned Interconnection Projects in ASEAN Beyond 2020[71]

Project	MW
P. Malaysia – Singapore	600
Thailand - P. Malaysia	300
Sarawak - P. Malaysia	4 x 800
Batam – Singapore	3 x 200
Philippines – Sabah	500
Sarawak - Sabah - Brunei	100
Thailand - Lao PDR	1000 +
Lao PDR – Vietnam	TBC
Thailand – Myanmar	13000 +
Vietnam – Cambodia	TBC
Thailand – Cambodia	2,200
E. Sabah - E. Kalimantan	TBC
Singapore – Sumatra	600
Total:	22,274 - 25,424

B Development and management of transmission corridors

The development of physical interconnection and transmission capabilities follows recommendations outlined in ASEAN Interconnection plan Master Studies. These documents contain guidelines on design of an optimal interconnection system by achieving lowest system costs, subject to technical, policy and resource constraints of the member states.

C Transmission pricing/wheeling methodology

The Heads of ASEAN Power Utilities/Authorities (HAPUA) work to alleviate cross-border barriers in support of the implementation of the APG. These include the harmonisation of technical standards and systems, as well as an effective framework for harmonisation of business regulations including **legal, taxation and pricing regulations** to facilitate cross-border trade. It has been recommended in a study by the International Energy Agency study in 2019[72] that to support the commercial trading of electricity across multiple countries, it is important that transparent wheeling methodology and loss compensation regime are developed to compensate grid owners for their transmission services. This should ideally be developed and defined on an ASEAN level, ensuring transparency and providing a common transmission pricing methodology for the region as a whole.

For the LTM-PIP, a formula was used to determine the wheeling charge to be paid by Laos, for use of Thailand's grid, which will also recover the O&M expenses and is based on the distance (km). because the ultimate transfer of power takes place at the border of Malaysia and Thailand and Malaysia is the off-taker of the power.

D Transmission losses accounting

Only losses directly related to the wheeled power should generally be covered by the methodology. Developing a methodology that incentivises TSOs to minimise their losses is also being looked upon.

E Congestion management

Transmission costs could increase for some countries because of investments to implement cross-border trade, increased congestion on some transmission paths requiring incremental transmission investment. Also, Transmission costs could increase for some countries because of investments to implement cross-border trade, increased congestion on some transmission paths requiring incremental transmission investment.

F Deviation accounting and settlement

Settlement of contracted volumes directly between the involved parties, including wheeling charges and compensation for losses and imbalances is undertaken as agreed in the respective contracts. The EPWA agreement between Malaysia, Laos & Thailand contains guidelines for deviation settlement.

Since the agreement between Laos and Thailand is flexible, the excess/shortfall can be settled with exchange of power as required. For example, if Laos is unable to sell power (or shortfall of supply) to Malaysia when they require, Thailand sells power to Malaysia. Whatever power has been sold to Malaysia will be later settled by Laos. The balance is offset at the end of the year.

2.6.7 Benefits of CBTMPT and sharing among the member countries

New Interconnection capacity proposed could help in achieving savings of USD 1.87 billion. The following table shows the breakup of the same:

Table 6: Cost savings of interconnection projects[73]

Costs	Expenses (in mUSD)		Savings
	Without Interconnection	With Interconnection	
Cost structure	83,699	81,980	1,719
Capacity costs	253,025	252,871	154
Fuel costs	336,724	334,851	1,873

However, the savings need not be seen to be restricted to cost savings. There are additional positive impacts created by CBTMPT in ASEAN. Trilateral projects such as LTM creates a precedent of regional coordination, for further adoption of similar principles in future projects. Such projects also open up markets, or allow

access to new markets. For example, LTMS PIP is envisaged to allow Laos access to Singapore's competitive power market. The trade in the region also makes use of differentials in resource endowments, as there are limitations for countries such as Thailand to develop hydropower plants within their territory, as compared to the case of countries such as Laos.

While the interconnection grids in ASEAN are developed under a vision of ASEAN power grid, contracts are still negotiated separately between the parties, and therefore the sharing of benefits of such transactions are also dependent on the overall commercial negotiations.

2.6.8 Role of CBTMPT in assisting RE integration

In 2017, renewable energy represented 20%[74] of the total in ASEAN's Total Primary Energy Sources. With increasing shares of variable renewable energy in ASEAN, multilateral power trade can benefit the ASEAN Member States in terms of both increased system security and economic efficiency due to resource sharing. For example, the energy cooperation between Laos and Thailand had already benefitted both countries, where Thailand has been able to tap into vast hydropower resources of Laos, with the alternative being increase of thermal capacity within Thailand. This has led to a further extension involving Malaysia under the LTM project, which is then expected to expand to LTMS involving Singapore.

Multilateral power trade, which is being envisaged in future for ASEAN, can increase system security and increase economic efficiency, and prove as an enabler of meeting renewable goals in line with the decarbonisation agenda.

2.6.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

- HAPUA (Heads of ASEAN Power Utilities/Authorities): HAPUA is a Specialised Energy Body which promotes cooperation among its members to strengthen regional energy security through interconnection development, enhancing private sector participation, encouraging standardisation of equipment, promoting joint project development, and to enhance quality & reliability of electricity supply system
- ASEAN Power Grid Consultative Committee (APGCC): is an organization body under HAPUA whose responsibility is to strengthen and promote a broad framework for Member Countries to cooperate towards the development of a common ASEAN policy on power interconnection and trade, and ultimately towards the realization of the ASEAN Power Grid to help ensure greater regional energy security and sustainability on the basis of mutual benefit.
- ACE (ASEAN Centre for Energy): It supports the broad range of AMS interests in the energy sector.
    - Act as a think tank for the AMS by identifying and disseminating innovative policy, legal, regulatory and technical solutions for ASEAN's energy challenges.
    - Act as a catalyst to unify and strengthen ASEAN energy co-operation and integration through relevant capacity-building programmes and projects.
    - Act as the energy data centre and knowledge hub for the AMS.
- AERN (ASEAN Energy Regulatory Network): Focus on regional regulatory issues, in particular ones related to power and gas. In particular, the AERN has been tasked with the following functions:
    - Collaborate on regulatory issues related to ASEAN flagship integrated energy projects such as the APG and the Trans ASEAN Gas Pipeline.
    - Promote consistency in energy regulation in the region through information exchange and dialogue.

- Develop a channel for communications among ASEAN energy regulators to promote mutual understanding and mutual benefit to energy regulation and regional economic development.
- Promote knowledge sharing and capacity building among ASEAN energy regulators on regulatory issues and best practice

- LTMS PIP working group (WG): It has four technical task forces looking into Technical, Legal and Regulatory, Commercial and Tax and tariff aspects of the projects in ASEAN.
- Asian Development Bank (ADB): ADB continues to support regional integration through regional power interconnections and development for mutual benefits, enable harmonization, promote integrated resource planning, assist in mobilization of financing for projects, institutional development, physical infrastructure development etc.

2.6.10 Key drivers enabling CBTMPT

The following are found to have played a key role in enabling the ASEAN power trade:

- Adoption of the ASEAN Interconnection Master Plan Study (AIMS) and the updated AIMS II, which serves as a reference guide for the implementation of the ASEAN interconnection projects;
- Signing of a Memorandum of Understanding on the ASEAN Power Grid (MOU on the APG) to serve as a reference document for the coordination and facilitation of programmes to implement the APG;
- Restructuring of HAPUA to streamline operations and the establishment of a permanent HAPUA Secretariat, which rotates every three years; and
- Establishment of the APGCC to oversee the overall development and implementation of APG projects.
- For the LTMS-PIP project, the existing transmission infrastructure is being utilized, therefore additional investment for building of transmission lines was not required. Interconnector already exists between Laos and Thailand because of ongoing transfer of power between the two countries through 115 kV and 500 kV transmission lines. A HVDC line exists between Thailand and Malaysia[75]. The line between Thailand and Malaysia might be required to upgrade when the power trade capacity is increased from 100 MW to 300 MW, to avoid overloading.

2.6.11 Challenges faced for transition to CBTMPT and mitigating actions

- Coordination for infrastructure development: Contracts are signed purely on bilateral terms and often involve creating separate infrastructure retained only for these contracts. Power generation projects are often locked from selling power to entities other than the contracted party either through physical transmission lines or through power purchase agreement. In comparison, APG envisages new interconnections that are not linked to a specific generation project.
- Different technical standards: Different technical standards of power system operations between ASEAN member states is another limiting factor.
- Market design: The market design should be able to give correct price signals for investment in both power generation capacities and cross-border transmission infrastructure which is a challenging task even in mature markets such as Nord Pool. These issues are very difficult to resolve without establishing institutions promoting cooperation between transmission system operators and regulators which are still missing in ASEAN.
- Regulatory hindrances: The procedure and costs associated for obtaining regulatory approvals from authorities for registration and license for participating in the power trade proved to be a hindrance for trading with Singapore. In order to sell power in Singapore, registration in their power market is required. Singapore did not participate in the Phase I of the LTMS-PIP, since the export to Singapore could not be initiated at that time. Therefore, in Phase I only three countries were involved and LTM-

PIP was initiated. Currently discussions with Singapore are underway to decide the best approach, which will be accepted by both Laos and Singapore.

- Multiple wheeling charge in case of LTMS-PIP: At present Laos is paying a wheeling charge to Thailand and if they export power to Singapore, a wheeling charge is required to paid to Malaysia. The transmission line between Malaysia and Singapore is not commercial in nature, as it was developed as part of the policy to ensure energy security. Therefore, an additional charge - Malaysia-Singapore interconnector fee is required to be paid to use that line.

2.7 Nord Pool

Nord Pool, the Nordic Power Exchange, is the world's first international commodity exchange for electrical power. At present it operates in Norway, Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Germany and the UK. It is the world's first multinational electricity exchange power pool. The Nord Pool is also the Nominated Electricity Market Operator (NEMO) in 15 European countries.

2.7.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

Nord Pool supports **multilateral power trade** with utilities in multiple countries being able to trade through the spot market.

The Nord Pool market was established in 1993 based on electricity liberalisation by the Norwegian Government in 1991. In 1996 bilateral power trade was established between Norway and Sweden. Following addition of Finland and Denmark, the market became the Nordic power market in 2000. Following this, it extended growth to include the Baltic States and the UK, in addition to becoming a service provider for other markets in Europe. The Nord Pool is identified as **world's first multinational electricity exchange**.

Nord pool offers the following market products:

- In the **day-ahead market** customers can sell or buy energy for the next 24 hours in a closed auction. Orders are matched to maximize social welfare while taking network constraints provided by transmission system operators into consideration.
- The **intraday market** works together with the day-ahead market to help secure the necessary balance between supply and demand, as one can trade closer to the physical delivery within the intraday markets. This is a continuous market, with trading taking place every day around the clock until one hour before delivery, and in some cases right up until the delivery hour.
- The **balancing market** is trading in automatic and manual reserves used by the Nordic transmission system operators (TSOs) in order to maintain power balance during the hour of operation. Nord Pool Spot is responsible for the day-ahead market and the intra-day market, while the TSOs (Svenska kraftnät, Statnett, Fingrid and Energinet) are responsible for the balancing market.

Nord Pool has various derivatives (traded in NASDAQ exchange) such as:

- Base and peak load Futures – Standardized contracts with cash settlement;
- Deferred Settlement Futures (DS Futures) – Futures, with cash settlement on the 20th day of the immediately following calendar month;
- Monthly DS Futures - Base, Peak, Off Peak and hourly block Monthly DS Futures contracts;
- Nordic Electricity Base Future Year and Future Quarter Options - Base, Peak, Off Peak and hourly block Monthly DS Futures contracts; and
- Nordic EPAD Electricity Base Year Future - Allows to hedge against area price risks related to constraints in the transmission grid.[76]

2.7.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

Nord Pool is licensed by the Norwegian Water Resources and Energy Directorate (NVE) to organise and operate a marketplace for trading power, and by the Norwegian Ministry of Petroleum and Energy to facilitate the power market with foreign countries.

The framework for an integrated Nordic power market contracts was presented to the Norwegian Parliament in 1995. Together with Nord Pool's license for cross-border trading, this report made the foundation for spot trading at Nord Pool. In 1996, a joint Norwegian-Swedish power exchange was established, named as Statnett Marked AS. The exchange was later renamed Nord Pool ASA. In 1998, Finland joined in the power exchange, followed by Denmark in 2000.

There are separate regulatory authorities in the Nordic countries controlling the monopoly functions like network owners and system operator responsibilities. The 5national authorities also regulate trading in the physical and financial markets.

European Network of Transmission System Operators for Electricity (ENTSO-E) rules are followed in the Nordic Pool on matters such as developing network codes, TSO compensation when hosting cross-border flows of electricity, regional TSO cooperation, principles for information sharing and congestion management etc.

The Nordic Pool also follows the rules 'Regulation (Eu) No 1227/2011 of the European Parliament and of the Council' on wholesale energy market integrity and transparency.

2.7.3 Technical, commercial and operational framework for implementation of CBTMPT

Nord Pool follows rulebooks developed which applies across all the markets part of Nord Pool. A few such rules are listed below.

- Specific Market Regulations: Includes Day Ahead Market Regulations, Intraday Market Regulations, Special Regulations for Trading in Areas Like Russia, Belarus, Kaliningrad etc.;
- Product Specifications for different regions: These relate to the physical markets organised by Nord Pool for the various regions where Wordpool operates;
- Clearing: Clearing Rules, Transfer Fee Agreements and Rating Requirements for Guarantee & Letter of Credit Issuers;
- Fee Schedules;
- Specimen Agreements: Participant and Client Agreements; and
- Specimen Collateral Documentation: Bank Guarantee Rules, Collateral Security Deed, Pledged Settlement Account Agreements.

A Nordic Grid Code was also developed, to achieve coherent and coordinated Nordic operation and planning between the companies responsible for operating the transmission systems, in order to establish the best possible conditions for development of a functioning and effectively integrated Nordic power market. A further objective was to develop a shared basis for satisfactory operational reliability and quality of delivery in the coherent Nordic electric power system. The code laid down fundamental common requirements and procedures that govern the operation and development of the electric power system. The Nordic Grid Code consists of

- General provisions for cooperation;
- Planning Code;
- Operational Code (System Operation Agreement);

- Connection Code; and
- Data Exchange Code.

The Operational Code and the Data Exchange Code are binding agreements with specific dispute solutions. The Planning Code and the Connection Code are rules that should be observed.

In 2017, Nordic balance settlement (NBS) was introduced. As per NBS, the balance settlement for Finland, Norway and Sweden was to be handled by a settlement center.

2.7.4 Consensus building mechanism

All activities in the Nord Pool market are ultimately driven by planning. By having the TSO as an owner, connection and cooperation are ensured directly. There is an advisory board with broad representation from all the parties in the market – meaning that most of the business development is driven by the market itself. NVE (Norwegian Directorate for Energy and Water Resources) is the operational regulatory body for Nord Pool Spot, but of with support from the other regulators. All the National Regulatory Authorities (NRAs) have access to the same information and have equal rights.

NordREG is a cooperative body between the Nordic energy regulatory authorities, which was formed from the traditional close cooperation on energy between the Nordic countries. The Nordic Council of Ministers supports the plans for realizing a common Nordic energy market. Their mission is to actively promote legal and institutional framework and conditions necessary for developing the Nordic and European electricity markets.

Till the establishment of ENTSO-E, there was also an association of system operators called NORDEL which dealt with issues related to technical harmonization. For example, in 2006, NORDEL came up with Principles for determining transfer capacities. In 2007, Nordel decided to harmonize the Gate Closure times for production plans and bids in the regulating power market.

As the market model for CBTMPT was primarily exchange driven, the countries were able to subscribe to the overall market rules and act as per it, creating lesser challenges for separate policy or legal harmonization. However, some of the key requirements such as unbundling of transmission was a key requirement which the participant member states had to adopt before becoming part of Nord Pool market.

2.7.5 Financing for development of CBTMPT transmission infrastructure

Earlier (pre-Dec 2019), the Nordic Pool was 100 % owned by Nordic and Baltic transmission system operators (TSO). The ownership of Nord Pool Spot was divided between the TSOs in underlying markets according to the following proportion:

Table 7: Nord Pool Ownership Shares Pre Dec- 2019[77]

Transmission System Operator (TSO)	Country	Share
Statnett	Norway	28.2%
Svenska Kraftnät	Sweden	28.2%
Fingrid	Finland	18.8%
Energinet.dk	Denmark	18.8%
Elering	Estonia	2.0%
Litgrid	Lithuania	2.0%
Latvenergo	Latvia	2.0%
Total		100.0%

However, in Dec 2019, it was announced that **Euronext**, the pan-European stock exchange has entered into a binding agreement to **acquire 66%**[78] of the share capital. The **TSOs will retain a 34% ownership** through a joint holding company.

For establishment of a new interconnection, each of the infrastructure projects will have its own business case and based on that the TSOs will typically be the ones to build these interconnections. Another of the key reasons for TSOs to build interconnections is that there is a regulation requiring that the congestion rent between the market areas will be given to the owners (normally the TSOs). In return, the regulation specifies that all the income from congestion rent shall be used in improving the network. In the Nordic market, all the Nordic TSOs cooperate and use this income to decide the best place for these investments. The pricing system for the access to the grid is more or less similar among the Scandinavian countries, each using a point-of-connection tariff to compute the access charges. These charges are more or less intended to recover the costs for managing the transmission network and are controlled by country specific regulatory offices.

2.7.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

- Each TSO is responsible for the operation and development of the national systems. Regional transmission planning is realised based on the Nordic Grid Development Plan, which is a planning document created under the cooperation of the Nordic TSOs.
- European Network of Transmission System Operators for Electricity (ENTSO-E) provides planning guidance through Ten Year Network Development Plans (TYNDP). These are non-binding plans for network expansion based on a Union-wide system analysis. They include a list of infrastructure projects deemed beneficial for the overall economic welfare as per a cost benefit analysis

B Development and management of transmission corridors

- The development and management of transmission corridors lies with the TSOs.
- The Nordic Grid Code concerns the TSOs, the operation and planning of the electric power system and the market actors' access to the grid. The code lays down fundamental common requirements and procedures that govern the operation and development of the electric power system. The Nordic Grid Code consists of:
    - General provisions for cooperation
    - Planning Code
    - Operational Code (System Operation Agreement)
    - Connection Code
    - Data Exchange Code (Data Exchange Agreement between the Nordic TSOs)

C Transmission pricing/wheeling methodology

Point of connection-based tariff system is followed for transmission pricing in the Nord Pool market. Here the producers and consumers pay a fee for the kWh injected or drawn from the system. The distance or transmission path between the seller and buyer is of no significance to the transmission price. The actual transmission price depends on where (what point in the grid) the power is injected or consumed and how much power is injected or consumed. The charges are determined by the individual TSOs and paid to the TSO to which the connection is made[79].

D Transmission losses accounting

The loss management mechanism varies between various Nordic countries. Norway and Sweden use a loss pricing mechanism, where there is a differentiated tariff based on marginal loss rates at each connection point. Denmark and Finland use a postage stamp-based loss pricing methodology.

E Congestion management

The Nord Pool follows the EU Regulation 2015/1222 guidelines on Capacity Allocation and Congestion Management (CACM). The guidelines provide a clear legal framework for an efficient and modern capacity

allocation and congestion management system. CACM provides the legal basis for the designation of nominated electricity market operators (NEMOs), outlines their tasks associated with market coupling and provides a framework for their cooperation with TSOs. The power exchange uses a market splitting mechanism to manage congestions.

F Deviation accounting and settlement

For settling imbalances as a result of power delivery the Nordic power market, the Balancing Power Market (BPM) settlement is followed[80]. Two types of settlements are followed:

- A settlement between countries: balancing power between two countries is priced and settled in the BPM. This is known as a TSO-TSO market.
- Balancing settlement within a particular country: this is a settlement between the respective TSO and the parties responsible for balancing. It is governed by national balance agreements

2.7.7 Benefits of CBTMPT and sharing among the member countries

Nord Pool delivers efficient, simple and secure power trading across Europe. The company offers day-ahead and intraday trading, clearing, settlement, power system and market data transparency and distribution services, and power market trainings, to its many customers and stakeholders. Nord Pool operates day-ahead and intraday markets in the Nordic and Baltic regions, the UK and across Central Western Europe encompassing Austria, Belgium, France, Germany, the Netherlands and Luxembourg and finally intraday in Poland. About 360 companies from 20 countries trade on Nord Pool's markets. Some of the key benefits of CBTMPT in Nord Pool are listed below:

- The total volume of power traded through Nord Pool stood at 494 TWh in 2019[81]
- Nord Pool generated 8.63 USD million operating profit and net income of 3.07 USD Million in 2019.
- Dividend of 5.81 USD Million was decided to be distributed in 2019.
- With futures and forward contracts on electricity, market participants can more easily predict their future costs and revenues, and they are better protected against large future losses. A
- The Nord pool allows Nordic power plants to be utilized in a more efficient way.

In terms of benefit sharing, the use of proceeds towards congestion rents is a good example. As discussed earlier, congestion rent collected by the TSOs are used in improving the network, by deciding the best place for these investments.

2.7.8 Role of CBTMPT in assisting RE integration

The Nordic power system is dominated by renewable energy sources, especially large hydro. Nordic regions use of cross border energy cooperation for RE integration is a model case study. For example, Denmark has seasonal surplus of wind power, which can be balanced with decrease / increase of hydropower in neighbouring Norway, with which there are multiple transmission interconnections.

Denmark has a generation mix consisting of more than 41% of wind power capacity (6 GW in 2019). Its electricity grid is connected to the Nordic grid (with Sweden and Norway) and to the European continental grid (with Germany). The electricity generation mix of Sweden and Norway is dominated by large hydro stations. Norway had a generation mix consisting of 91% hydro capacity (33 GW in 2019), and Sweden (16 GW) had about 43% hydro capacity.

During time of high wind generation in Denmark, the excess generation is accommodated by reducing the generation from hydro stations in Sweden and Norway. This also helps in reducing the drain on the water reservoirs in the hydro power plants of Sweden and Norway. When the wind calms down, the hydropower stations in Norway and Sweden step up production, often transmitting electricity to Denmark as and when required.

The Capacity Allocation and Congestion Management Guideline (CACM) followed by the Nord Pool advocates the use of interconnectors for trading in pan-European markets. As renewable generation rises across Europe, trading electricity between countries, through Interconnectors is advocated due to the intermittent nature of renewables which leads to a need to be able to sell surplus electricity and cover shortfalls on a continuous basis in real time

2.7.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

- The countries in the Nord Pool have their own regulators:
    - Danish Energy Regulatory Authority (DERA) – Denmark
    - Energy Market Authority (Energiamarkkinavirasto) – Finland
    - Norwegian Water Resources and Energy Directorate (NVE) – Norway
    - Energy Markets Inspectorate– Sweden
- NordREG, a cooperative body between the Nordic energy regulatory authorities handles the regional level cooperation, actively promotes legal and institutional framework and conditions necessary for developing the Nordic and European electricity markets.
- The Agency for the Cooperation of Energy Regulators (ACER) handles the pan European level cooperation and coordinates regulation by the European regulators, monitors regional collaboration between TSOs in the electricity and gas sectors

2.7.10 Key drivers enabling CBTMPT

The key drivers which enable multilateral power trade within Nord Pool includes:

1. Market liberalisation- Deregulation of energy markets by member countries and integration of individual market into the Nordic Pool.
2. Strong Political Will of the member countries which has led to conducive legal, regulatory and policy framework for Cross Border Electricity Trade.
3. A well-established regional planning for transmission infrastructure: The Ten Year Network Development Plan (TYNDP) provides a clear roadmap for integration of other geographical areas into a common market structure and centralized transmission system planning platform, which is continuously revised.
4. Decentralised Regulation: With each country having its own internal country regulator, and for regional level cooperation having NordREG, a forum of regulator of participating countries, makes it easy for all the stakeholders of the Nordic Pool to coexist whilst achieving their individual goals.
5. Nordic Cooperation: Nordic cooperation among the countries remains an important driver for further market improvement. This has led to integration of many markets in the market with the goal of a pan-European electricity market.

2.7.11 Challenges faced for transition to CBTMPT and mitigating actions

In its initial days, Nord Pool faced issues related to its financial products markets. The financial market was leading to high valuation of the company, thereby requiring countries to pay a substantial amount to buy equivalent shares to join the Nord Pool. This was initially solved by splitting financial markets into another company, and ultimately transferring the ownership of financial market operations to a totally different entity.

Integration with European markets has also been challenging as the process has been very resource-intensive and has required a lot of careful management. Therefore, for several years, the business development unit was renamed “European integration”.

At the same time, one of the success factors behind Nord Pool was that the regulation of the market is based on principles, not detailed rules. This gives the power exchange the possibility of developing its offerings within these principles. The Nord Pool Spot market licence is five pages long, and just lists a set of principal requirements. The detailed rules for the market can therefore be defined (and maintained) in the market participant agreements that include much more information. This means, for example, that all the detailed bidding rules, order forms, settlement calculations, order types offered in the market, security requirements, and other operational requirements are defined in the participant agreements and can thus be adapted relatively easily as long as the main operation of the market is within the licence's requirements.

Nord Pool expanded its footprint outside the Nordic region, by linking more markets to it. For example, in 2006, Nord Pool Spot's intra-day trading system Elbas was successfully launched in the German bidding area of KONTEK, allowing power to be traded through Kontek HVDC Interconnection between Denmark and Germany.[82] Nord Pool was also successful in implementing regional price coupling with other power markets/regions, such as OMIE (Spain-Portugal), HENEX (Greek) and OPCOM (Romania).

2.8 European Union (EU) Internal Power Market

The European Union (EU) is an economic and political union between 27 EU countries that together cover much of the European continent. The countries together constitute a single market (also known as the 'internal' market) through a standardized legal system that applies to all member states. The internal market of European Union also contains a single internal market for electricity.

The European internal market may be considered as a market of markets, as there are multiple regional markets (Central West Europe, Central Eastern Europe, Baltic market, Iberian market etc.) and power exchanges (European Power Exchange, Energy Exchange Austria, Independent Bulgarian Energy Exchange etc.) within it. There exists a detailed legal framework for energy cooperation, issued as a set of directives by the European Commission. The EU market consists of member states, the EU, Agency for the Cooperation of Energy Regulators (ACER) & regulators and ENTSO-E.

2.8.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

The market focuses on providing market access to third parties and ensuring competition on wholesale and retail markets. **Multilateral trade** exists among the well-harmonized power markets of the member countries. Member countries while retaining full control over domestic power system operations and planning, are also able to trade with one another utilizing their different power exchanges (as the power market platforms), which are functionally identical. The market hosts day ahead, intra-day, forward and balancing products.

In addition, various derivatives are traded in the market through NASDAQ exchange:[83]

- Monthly Deferred Settlement (DS) Futures are available for the following markets: Germany, France, Netherlands, Italy, Spain, Belgium & UK. All European Power Monthly DS futures are settled in EUR or GBP (UK power). Their settlement date is the 20th calendar day of the following delivery month. Contract base is average of the hourly prices from the day-ahead auction for the country specific price zone.
- Base futures and peak futures – For example German Base Futures are standardized electricity future contract with cash settlement. Contract base is average of the hourly prices from the day-ahead auction for the German price zone. Contract Price is as agreed by the purchaser and seller and expressed in EUR/MWh.
- Options - Standardized option contract on corresponding Contract base. For example German Options.

2.8.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

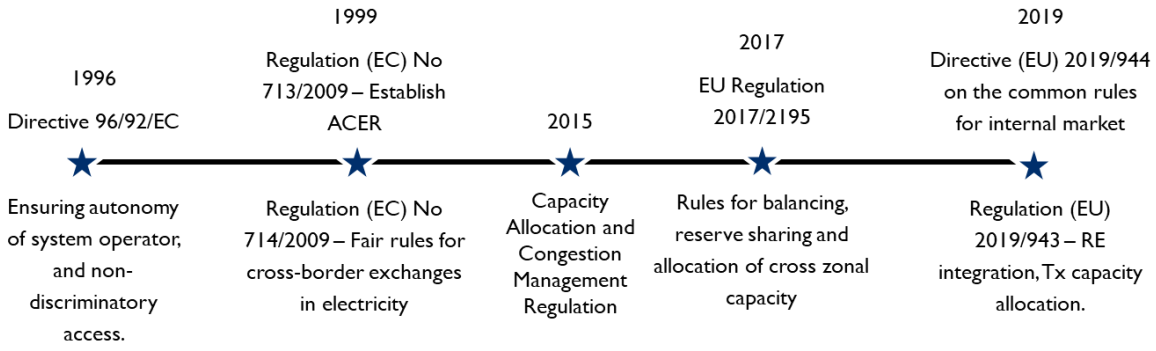
The key coordination body on transmission within the EU internal power market is the European network of transmission system operators for electricity (ENTSO-E). ENTSO-E was established in 2009 and was given legal mandates by the EU's Third Legislative Package for the Internal Energy Market, which aims to further liberalize the gas and electricity markets in the EU[84]. ENTSO-E serves as a mandatory platform for TSOs to collaborate.

The common set of rules for developing the competitive internal energy market i.e. the network codes are a technical rulebook that complements existing legislation by defining a common 'code of conduct' for all. Generators, grid operators, traders and all other players in the sector will adopt the same practices and business processes. These rules are drafted by ENTSO-E with guidance from the Agency for the Cooperation of Energy Regulators (ACER). Starting in 2009, eight network codes have been developed. The market rules for trading in the region have been prepared through a long procedure where Members States, the European Commission, ACER and regulators were involved.. ENTSO-E is a platform for TSOs to collaborate. ENSTO-E members draft rules which are then forwarded to ACER and regulators for approval.

The guiding framework for single internal market for electricity in Europe evolved through a set of directives and regulations of European Union, issued between 1996 and 2009. Besides the network codes, the following are the overarching agreements among the EU member countries regarding cross border trading.

- Capacity Allocation and Congestion Management Regulation (EU, 2015)
- Forward Capacity Allocation (EU, 2016)
- Energy Balancing Regulation (EU, 2017)
- Regulation on the internal market for electricity (EU, 2019)
- Directive on the common rules for the internal market for electricity (EU, 2019)

Figure 13: Key timelines on evolution of regulatory framework in European Union



ENTSO-E is governed by an Assembly representing the 42 Transmission System Operators and by a Board consisting of 12 elected members. Other bodies of the association are:

- Committees - Research Development & Innovation Committee, System Development Committee, System Operations Committee and Market Committee
- Legal and Regulatory Group
- Regional Groups
- Secretariat

2.8.3 Technical, commercial and operational framework for implementation of CBTMPT

The EU member countries are quite diverse in terms of operations and products offered in their respective power markets. Northwestern Europe is in a more advanced stage with multiple power exchanges, while power trading in Southeastern Europe is primarily through long term contracts. Electricity trading takes place in both physical and financial markets. Physicals contracts involve the physical delivery of electricity or balancing

services. Financial contracts are mostly instruments for hedging risk and can be traded by non-energy sector participants like banks and trading houses. Balancing is taken care of by the transmission system operators (TSOs) independently, according to the respective country guidelines, while greater integration is being sought in the energy market. TSOs assisted by ENTSO-E exchange real time information for better cross border coordination for balancing. The types of market segments and products for power trading in the EU are as follows:

Table 8: EU power trading – market segments and products

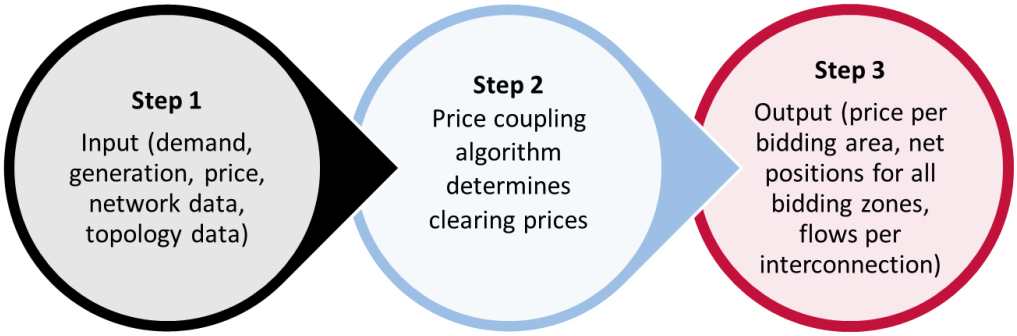
Physical Markets	Financial Markets
Balancing Markets	Derivatives Markets • Financial forwards • Futures • Swaps • Options
Spot Markets • Intraday products • Day ahead products • Weekend, weekly or block products till the end of the current month	
Physical Forward Markets	

Europe's energy union consists of member countries, EU, ENTSO-E, ACER and the regulators. ENTSO-E helps in preparing reports on market design, network development, designs the network codes and, operates on framework guidelines based on the EU market. New projects are initiated by ENTSO-E members.

ENTSO-E's operations activities are overseen by the System Operation Committee (SOC), which is currently presided by an official from Austrian Power Grid as Chairman and by an official from RTE (TSO of France) as Vice-Chairman. The Committee reports to the ENTSO-E Board and Assembly. All activities of the ENTSO-E SOC are supported by the ENTSO-E Operations Secretariat team. The five permanent Regional Groups based on the synchronous areas (Continental Europe, Nordic, Baltic, Great Britain and Ireland/Northern Ireland, are a part of SOC.

Markets in the EU follow market coupling mechanism. Earlier, volume coupling (volume decides the basis for what kind of exchange is done between two countries) was followed predominantly and currently price coupling (price decides the basis for what kind of exchange is done between two countries) is being followed. The objective of market coupling is to achieve a European wide price formation through price coupling. It allows for the efficient use of the transmission grid through strong interactions between local markets. Hence, a single price coupling algorithm is always strived across Europe. The region follows a Price Coupling Algorithm which calculates the clearing prices, net positions for all bidding zones and cleared orders. This also enables the optimal use of electricity network constraints,

Figure 14: Price coupling mechanism



Price Coupling of Regions (PCR) is a project operated by eight power exchanges to harmonize European electricity markets. It is used to couple Austria, Belgium, Czech Republic, Croatia, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and UK. The PCR project follows an algorithm that takes in input parameters such as network data, topology data and market order data to give the final output which includes:

- Price per bidding area;
- Net position per bidding area;
- Flows per interconnection; and
- Matched energy for each block orders.

2.8.4 Consensus building mechanism

The key entity for coordination, ENTSO-E's members share the objective of setting up the internal energy market and ensuring its optimal functioning. ENTSO-E is committed to develop the most suitable responses to the challenge of a changing power system while maintaining security of supply. Its key agendas are broadly – adopting innovation, a market-based approach, customer focus, stakeholder focus; ensuring security of supply, flexibility, and regional cooperation. ENTSO-E is supported by its four Committees. Its two key functions related to consensus building are:

- Ensuring regional cooperation through the Regional Security Coordination Initiatives (RSCIs). A RSCI is a scheme established by TSOs to make possible a coordinated provision of a service mentioned in a specific geographic region. The role of an RSCI for the different services is to provide coordination services for the secure operation of the European transmission system, build consistent regional data, perform analyses and make recommendations to help serve TSOs to maintain security of supply. However, the responsibility for secure system operation remains with the TSOs.
- Facilitating technical cooperation between TSOs

The regional coordination centres play a pivotal role in consensus mechanism. They are tasked with the responsibilities of developing working arrangements in order to address planning and operational aspects related to the tasks to be carried out, in efficient manner whilst maintaining consensus.

The decision making process is quite comprehensive and includes all the related entities. It is based on a combination of two approaches i.e., top-down and bottom-up approach. These two approaches are used parallelly to deduce findings before taking the final decision.

- Top-down approach: EU level discussions are held with all entities about what the target model should be
- Bottom-up approach: Information from local projects is analysed and, inferences and strategies are drawn from local project experiences.

The region also has a robust dispute resolution mechanism with specific regulations already in place which can be referred to in case of any dispute or disagreement. The regulations can address the issues.

2.8.5 Financing for development of CBTMPT transmission infrastructure

Funding of the cross border power transmission infrastructure is primarily undertaken by MDBs/donor agencies. The following are a few key examples:

- ***The European Commission (EC)*** assists in financing some of the interconnector projects. For example, the EC funded the Celtic Interconnector, a high-voltage electricity cable linking Ireland and France[85].

- Spain and France are connected by means of four high voltage lines. The ***European Investment Bank (EIB)*** provided a loan of EUR 350 million to the two operators of the French and Spanish power grids (RTE in France and REE in Spain). The total budget was EUR 700 million. The power interconnector is also received a EUR 225 million ***EU grant under the European Energy Programme for Recovery***[86].
- The Polish-Lithuanian power link integrates the power systems of the Baltic States into the continental European grid. The link between the Polish and Lithuanian grids completes the Baltic Ring, a chain of electricity interconnections around the Baltic Sea. Total investment for the Polish – Lithuanian power link project is EUR 494.40 million. The ***EU's European Regional Development Fund*** contributed EUR 244.50 million through the "Infrastructure and Environment" Operational Programme.

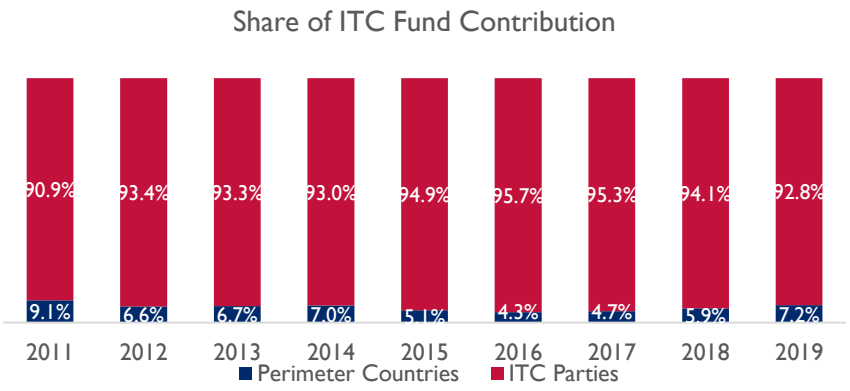
For compensation of Transmission System operators (TSOs), there is a provision of Inter-Transmission System Operator Compensation ("ITC") fund. TSOs or groups of TSOs participating in the ITC mechanism receive compensation from the ITC Fund based on the transits they carry and contribute to the ITC Fund based on their net import and export flows. Since 2012, ACER has been preparing a yearly monitoring report on the implementation of the Inter-Transmission System Operator Compensation ("ITC") mechanism and the management of the ITC Fund. The ITC fund was set up by ENTSO-E. the ITC fund consist of two parts:

- Costs of the incurred transmission losses,
- Costs of making infrastructure available

Non-participating countries (perimeter countries) connected to the ITC Parties' networks pay a transmission system use fee for their scheduled imports from and scheduled exports to the ITC Parties' networks. The Perimeter countries' fee for 2019 was calculated and approved by ENTSO-E at the value of 0.8 EUR/MWh. In 2019, Perimeter countries paid 20.9 million EUR to the ITC fund, which is their highest contribution ever since the fund was established. In 2019, the ITC Fund amounted to 289.8 million EUR[87], consisting of 100 million EUR related to the costs of the transmission infrastructure which is made available for transits and 189.8 million EUR related to the costs of the incurred transmission losses due to transits.

The contribution to ITC fund is based on each ITC Party contributing to the ITC Fund based on its share of the total absolute amount of net imports and net exports of all ITC Parties. The following figure shows the share of ITC fund by member and non-member countries (perimeter).

Figure 15: Share of ITC fund contribution



European Union: Projects of common interest (PCI)

Projects of common interest (PCIs) are key cross border infrastructure projects that link the energy systems of EU countries. They are intended to help the EU achieve its energy policy and climate objectives: affordable, secure and sustainable energy for all citizens, and the long-term decarbonisation of the economy. Article 4 of Regulation (EU) No. 347/2013 defines a Project of Common Interest (PCI) as one that has

significant benefits for at least two member states, contributes to the integration of the electricity markets and to greater competition within the European Union, improves the security of energy supply, increases the amount of electricity generated from renewable energy sources (RES) and reduces CO2 emissions.

PCI projects have the right to apply for funding from the Connecting Europe Facility (CEF), the EU's €30 billion fund for boosting energy, transport, and digital infrastructure. A total of €998 million in CEF grants was allocated to 10 PCIs in 2020, 2 for electricity transmission, 1 for smart electricity grids, 6 for CO2 transport (including 5 studies), and 1 for gas.[88]

In order for an electricity transmission and/or storage project to be eligible as a PCI, it must be included in the Ten-Year Network Development Plan (TYNDP) drawn up by ENTSO-E. The list of PCIs is reviewed every two years, through a consultative process of European Commission, followed by review of European Parliament and European Council. Some of the examples of PCI projects are listed below:[89]

- **COBRAcable:** It is a new offshore link, completed in 2019, stretching approximately 350km and with a capacity of 700 megawatts, that connects Denmark and the Netherlands. This interconnection enables the integration of more renewable energy and is designed to enable the connection of an offshore wind farm at a later stage. It will also ensure energy security by increasing energy exchanges between the two countries and providing a back-up for other connections in the event of failure.
- **The Biscay Gulf Interconnector:** The new 370 km-long electricity link through the Bay of Biscay will strengthen the interconnection between Spain and France and improve security and guarantee of supply. As interconnection capacity is increased, the volume of renewable generation will be maximized and even redistributed within neighboring systems to where it is needed most. The project is part of the priority corridor for North-South interconnection in Western Europe and is expected to be completed in 2022.

2.8.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

Regulation (EC) no. 714/2009 of the European Commission states adoption of non-discriminatory rules for access conditions to the network for cross-border exchange and rules on capacity allocation and congestion management for interconnections and transmission systems affecting cross-border electricity flow. The directives also specify that measures should be taken in order to ensure transparent and non-discriminatory tariffs for access to networks. Also, European Network of Transmission System Operators for Electricity (ENTSO-E) provides planning guidance through Ten Year Network Development Plans (TYNDP). It helps the National Transmission operators by defining what should be network development, investment plans etc.

The transmission planning in the region follows three broad steps:

- Scenario building: It includes the scenario building activity where in each scenario, the key factors of potential development in technology, economic growth, generation, demand, are detailed.
- Screening: This includes methodology on how to fit the current system to the scenarios presented in the previous step. It includes the system stability analysis and identification of system needs
- CBA (Cost benefit analysis): The cost benefit analysis is done for individual projects for assessing their feasibility

The new projects come from the ENTSO-E members (TSOs). The project that is selected is the one looks the most interesting from a project of common interest (PCI) point of view. For implementation of the project. it is a national development problem- a task which a TSO has to ensure. Since market coupling is the target model- the projects are developed such that, it tackles all aspects to deliver market coupling .

B Development and management of transmission corridors

The ENTSO-E guidelines on Capacity Allocation and Congestion Management sets out the methods for calculating how much space can market participants use on cross border lines without endangering system security. It also harmonises how cross border markets operate in Europe to increase competitiveness but renewables' integration. CACM is the cornerstone of a European single market for electricity. The available capacity is determined by considering reliability margin, operational security limits, contingencies and allocation constraints.

C Transmission pricing/wheeling methodology

Each country is free to adopt its own transmission pricing and methodology as long as it is within compliance of the overall EC directives. TSO's cost may be divided into three parts, namely -

- Infrastructure
- System services
- Losses

TSO's cost is invoiced based on energy and power. The cost split between energy and power varies from one country to another. Non-TSO costs such as renewable energy support (RES) schemes are also sometimes included in TSO's invoice.

ENTSO-E also supports an Inter TSO compensation mechanism. It is designed to compensate parties for costs associated with losses resulting with hosting transits flows on networks and for the costs of hosting those flows. The Inter transmission system Operator Compensation for Transits (ITC) is governed by Article 13 of Regulation EC 714/2009.

D Transmission losses accounting

In addition to country wise loss accounting adopted in respective countries, ENTSO-E separately calculates losses on account of inter-TSO transfers. Specific agreements are followed that are based on losses due to generation by the surrounding TSO. The ITC fund discussed in section 2.8.5 provisions for compensation of transmission losses borne by member parties. The members receive compensation for losses incurred due to hosting cross-border flows and for making their infrastructure available to host these flows.

E Congestion management

In the case of congestion, market coupling decides where the cheaper power should go and it depends on the price difference.

Regulation (EC) No 714/2009 of EU specified "Guidelines on the management and allocation of available transfer capacity of interconnections between national systems". The guidelines stipulated the following:

Guidelines on the management and allocation of available transfer capacity of interconnections between national systems

- When there is no congestion, there shall be no restriction of access to the interconnection.
- No transaction-based distinction shall be applied in congestion management.
- TSOs shall not in normal course, limit interconnection capacity, merely in order to solve congestion attributable to their own control area.
- Congestion-management methods shall be market-based (auctions) in order to facilitate efficient cross-border trade.' In cases of congestion, the market coupling algorithm decides where the cheaper electricity will go.

- The national regulatory authorities shall regularly evaluate the congestion-management methods.
- The access rights for long and medium-term allocations shall be firm transmission capacity rights. They shall be subject to the use-it-or-lose-it or use-it-or-sell-it principles at the time of nomination.
- With a view to promoting fair and efficient competition and cross-border trade, coordination between TSOs within the regions shall include all the steps from capacity calculation and optimization of allocation to secure operation of the network, with clear assignments of responsibility. Coordination shall also include the exchange of information between TSOs.
- TSOs shall publish all relevant data related to network availability, network access and network use, including a report on where and why congestion exists, the methods applied for managing the congestion and the plans for its future management.
- TSOs shall publish all relevant data concerning cross-border trade on the basis of the best possible forecast. In order to fulfil that obligation the market participants concerned shall provide the TSOs with the relevant data. The manner in which such information is published shall be subject to review by the regulatory authorities. TSOs shall publish at least:
    a. annually: information on the long-term evolution of the transmission infrastructure and its impact on cross-border transmission capacity;
    b. monthly: month- and year-ahead forecasts of the transmission capacity available to the market, taking into account all relevant information available to the TSO at the time of the forecast calculation (for example, impact of summer and winter seasons on the capacity of lines, maintenance of the network, availability of production units, etc.);
    c. weekly: week-ahead forecasts of the transmission capacity available to the market, taking into account all relevant information available to the TSOs at the time of calculation of the forecast, such as the weather forecast, planned network maintenance work, availability of production units, etc.;
    d. daily: day-ahead and intra-day transmission capacity available to the market for each market time unit, taking into account all netted day-ahead nominations, day-ahead production schedules, demand forecasts and planned network maintenance work.
- All information published by the TSOs shall be made freely available in an easily accessible form. The data shall include information on past time periods with a minimum of two years, so that new market entrants may also have access to such data.
- The use of congestion income for investment to maintain or increase interconnection capacity shall preferably be assigned to specific predefined projects which contribute to relieving the existing associated congestion and which may also be implemented within a reasonable time.

Further, the Explanatory document to all TSOs' proposal for the implementation framework for a European platform for the exchange of balancing energy lays out following rules for congestion management:

- TSOs shall continuously update the availability of cross-zonal capacity for the exchange of balancing energy or for operating the imbalance netting process
- All TSOs of a capacity calculation region shall develop a methodology for cross-zonal capacity calculation within the balancing timeframe for the exchange of balancing energy or for operating the imbalance netting process. Such methodology shall avoid market distortions and shall be consistent with the cross-

zonal capacity calculation methodology applied in the intraday timeframe

F Deviation accounting and settlement

The EU Regulation 2017/2195 of 23 November 2017 lays down detailed rules on electricity balancing, including establishing common principles for the procurement, activation and exchanges of balancing energy, the procurement and exchange of balancing capacity and sharing of reserves, including the allocation of cross-zonal capacity. It strives to implement an integrated balancing market, which will allow TSOs to procure, exchange and use balancing energy and capacity in an economically efficient and market-based manner. Each TSO may also develop a proposal for an additional settlement mechanism separate from the imbalance settlement, to settle the procurement costs of balancing. It is the responsibility of each TSO to estimate within its scheduling area; the allocated volume, the imbalance adjustment and the imbalance for each party in the said period. However, the detailed balancing mechanism varies with countries. The 'methodology for a co-optimised allocation process of cross-zonal capacity for the exchange of balancing capacity or sharing of reserves' in accordance with Article 40(1) of the Commission Regulation (EU) 2017/2195 lays down the guidelines for the methodology to be adopted for a co-optimised allocation process of cross-zonal capacity for the exchange of balancing capacity or sharing reserves. It specifies how to allocate cross-zonal capacity for the exchange of balancing capacity or sharing of reserves, which is based on the actual market values of cross-zonal capacity for the exchange of energy and for the exchange of balancing capacity or sharing of reserves.

2.8.7 Benefits of CBTMPT and sharing among the member countries

The EU member countries benefit from the multilateral trade in the region in the following ways:

- Increased resilience offered by larger grids;
- Availability of multiple market avenues such as spot markets, and intra-day markets;
- Availability of ancillary services which can even be procured from other countries;
- Availability of more options for system and market operators for balancing.

One of the ways in which the socialization of costs and benefits happen in Europe is through Projects of common interest (PCIs). These are key cross border infrastructure projects that link the energy systems of EU countries. PCI projects have the right to apply for funding from the Connecting Europe Facility (CEF).

2.8.8 Role of CBTMPT in assisting RE integration

While the direct cross border trade of renewable energy is mostly seen in the Nordic region, the overall European Market is believed to have a supporting role for development of renewable energy in the individual countries, due to the availability of multiple capacity, balancing and intra-day products that allow the management of RE variability.

Some of the examples of CBTMPT projects assisting in RE integration are listed below:[90]

- **700 MW COBRAcable HVDC interconnection between Denmark and Netherlands:** The construction of the COBRAcable will facilitate the integration of renewables, particularly wind energy generated in Denmark, into the grid in both the Netherlands and Denmark. It has been designed to enable the connection of an offshore wind farm at a later stage. This will help improve the structure of the Danish electricity grid by making Dutch capacity available, and vice versa. The 350 KM project promoters are the transmission operators of Netherlands (TenneT TSO B.V.) and Denmark (Energinet.dk). This project will not just safeguard the security of electricity supply in these two countries, but also support the further integration of the northwest European electricity market, thereby strengthening the internal EU electricity market as a whole.
- **The 2000 MW Biscay Gulf Interconnector:** Maximizes the volume of renewable generation and evenly redistributes it within neighboring systems to where it is needed most. The line will nearly

double the interconnection capacity between Spain and France, which currently stands at 2800 MW. The project promoters are the transmission utilities in Spain (Red Eléctrica de España S.A.) and France (Réseau de Transport d'Electricité).

2.8.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

The specific role of each of the institutional mechanisms are summarised below:

European Commission	Issue directives as part of 'Energy Packages' and other guidance Undertake studies on cross border market and interconnections
ENTSO-E	Development of network codes, regional planning
ACER	Approval of network codes
Regional Security Coordination Initiatives (RSCI)	Initiatives for Inter-TSO coordination among TSOs in various countries in the region.
Multiple power exchanges such as European Power Exchange (EPEX)	Facilitate spot markets and financial trading of electricity derivatives

European Commission

The European Commission is the EU's politically independent executive arm. It is alone responsible for drawing up proposals for new European legislation, and it implements the decisions of the European Parliament and the Council of the EU.

ENTSO-E

ENTSO-E promotes closer cooperation across Europe's TSOs to support the implementation of EU energy policy and achieve Europe's energy & climate policy objectives, which are changing the very nature of the power system. The main objectives of ENTSO-E centre on the integration of renewable energy sources (RES) such as wind and solar power into the power system, and the completion of the internal energy market (IEM), which is central to meeting the European Union's energy policy objectives of affordability, sustainability and security of supply. ENTSO-E was established and given legal mandates by the EU's Third Package for the Internal energy market in 2009, which aims at further liberalising the gas and electricity markets in the EU.

ACER

The European Union Agency for the Cooperation of Energy Regulators (ACER) was established in March 2011 by thee Third Energy Package legislation as an independent body to foster the integration and completion of the European Internal Energy Market for electricity and natural gas. ACER is one of the EU decentralised agencies. By fostering cooperation among National Regulatory Authorities (NRAs), ACER ensures that the integration of national energy markets and the implementation of legislation in the Member States are met according to the EU's energy policy objectives and regulatory frameworks.

Regional Security Coordination Initiatives (RSCI)

Regional Security Coordinators (RSCs) are companies owned by their clients, the TSOs. They perform services for the TSOs, such as providing a regional model of the grid or perform advanced calculations to tell TSOs which remedial actions are the most cost-efficient, without being constrained to national borders.

On 10 December 2015, European TSOs and ENTSO-E had signed a Multilateral Agreement on Participation in RSCIs. The agreement requires ENTSO-E members to participate in RSCs or to contract five essential services from them (Operational planning security analysis, Outage planning coordination, Coordinated capacity calculation, Short and very short term adequacy forecasts, and Common Grid Model). The agreement ensures also that RSCs develop in a harmonised, interoperable and standardised way under ENTSO-E's coordination, tools, standards, and methodologies.[91]

Currently, there are multiple RSCs in Europe such as CORESO (Germany, Ireland, Belgium, UK, Spain, Portugal, France, Italy and Northern Ireland), TSCNET (Germany, Austria, Czechia, Slovenia, Croatia, Hungary, Poland, Slovakia, Switzerland, Netherland and Romania) and the Nordic RSC (Finland, Norway, Sweden and Denmark).

European Power Exchanges

Various power exchanges operate in the EU. One of the key examples is European Power Exchange (EPEX) Spot. t operates the power spot markets for short-term trading in Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Luxembourg, the Netherlands, Norway, Poland, Sweden and Switzerland.

2.8.10 Key drivers enabling CBTMPT

The following factors are believed to be the key drives supporting multilateral power trade in the European common market:

- A long history of regional energy cooperation, supported by EU's vision for regional cooperation;
- The existence of regional bodies such as ACER and ENTSO-E for coordinated development of regional frameworks and documents such as the network codes;
- Issuance and updating of 'Energy Package' legislations /directives of the European Commission;
- Political will of the countries is also a key factor. Strong legislations of EU has made it possible for multilateral trade to bloom in the region. Initially the France- Netherland- Belgium project started on a voluntary basis, owing to the interest of these member countries. This was done in coordination with member countries' political establishment. Political willingness was important as it created the right environment to develop the project.
- Development of competitive markets and power exchanges within countries and sub-regions of EU.
- Since market coupling is followed across the region- this leads to increased liquidity, transparency, efficiency in the integrated European market.

2.8.11 Challenges faced for transition to CBTMPT and mitigating actions

In 2016, an Expert Group was constituted by the European Commission (EC) to review the development of regional interconnectors and regional trade. The study report of the Expert Group noted the following issues:

- Functioning of the European electricity market should be improved and based on clear, stable and non-discriminatory regulatory rules to send consistent signals
- The existing interconnectors should be used efficiently and the capacity available to the market significantly increased compared to the current utilisation.
- Development of additional interconnections should be considered if any of the following three thresholds is triggered: minimising price differentials, ensuring that demand can be met around the year, and enabling export potential of RE.
- Each new interconnector must be subject to a socioeconomic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs. [92]

Some of the above challenges have already been addressed by EC. For example, to improve the utilization of interconnectors, a minimum target of 70% capacity is reserved for cross-zonal trade, which is applicable since 1 January 2020.

Meanwhile, ACER is currently approving a number of regional methodologies for coordinated redispatching and countertrading. Once implemented, they are expected to increase the ability of relevant TSOs and Member States to efficiently use remedial actions in order to alleviate congestion and avoid unnecessary restrictions to cross-zonal trade.[93]

2.9 Central Asia-South Asia (CASA) Regional Electricity Market

Central Asia-South Asia (CASA-1000) electricity transmission project is a 1,227 km long cross-border transmission project under implementation. The project aims to establish an electricity trade involving the transfer of surplus hydropower available in Central Asia to electricity deficit countries in South Asia. The participating countries are Kyrgyzstan, Tajikistan, Afghanistan and Pakistan. The project is being developed by the participating countries under an inter-governmental agreement (IGA) signed in 2008.

2.9.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

CASA-1000 project will enable **multilateral power trade** among these countries. The primary objective of this transmission project is to facilitate the transfer of surplus summer power (approximately 1.30 GW) from Kyrgyzstan and Tajikistan to Pakistan via Afghanistan[94]. This power trade will be enabled by putting in place the commercial and institutional arrangements and, the transmission infrastructure.

2.9.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

As a part of the broader Central Asia South Asia dialogue on energy, the Central Asian countries of Kyrgyzstan and Tajikistan and, the South Asian countries of Afghanistan and Pakistan began a series of discussions on the creation of a regional electricity market i.e., the Central Asia South Asia Regional Electricity Market (CASAREM). The objective was to link the Central Asian countries' surplus power with the South Asian countries' unmet demand for electricity. In May 2006, a ministerial level meeting was held in Islamabad, Pakistan at which the four countries together declared their intention of pursuing electricity trade opportunities[95]. The declaration also left open the possibility that other countries could join the initiative as the trade expands.

As the next step, at a conference in Dushanbe, Tajikistan in October 2006, the four countries signed a MoU, to pursue the development of the first phase of CASAREM by establishing the necessary transmission and trading infrastructure and, systems to enable a trade of approximately 1.30 GW of electricity between Central Asia and South Asia, including 1,000 MW to Pakistan and 300 MW to Afghanistan[96]. This project was called CASA-1000.

In August 2008, the four countries entered into a formal inter-governmental agreement to set up an Inter-Governmental Council (IGC) and an associated Secretariat to steer the development of the project[97]. Since then, cooperation between the four countries has increased.

CASA-1000 Secretariat is located in Almaty, Kazakhstan. The implementing agencies for this project are Da Afghanistan Breshna Sherkat, National Electric Grid of Kyrgyzstan, Barki Tajik, National Transmission and Despatch Company (NTDC) of Pakistan.

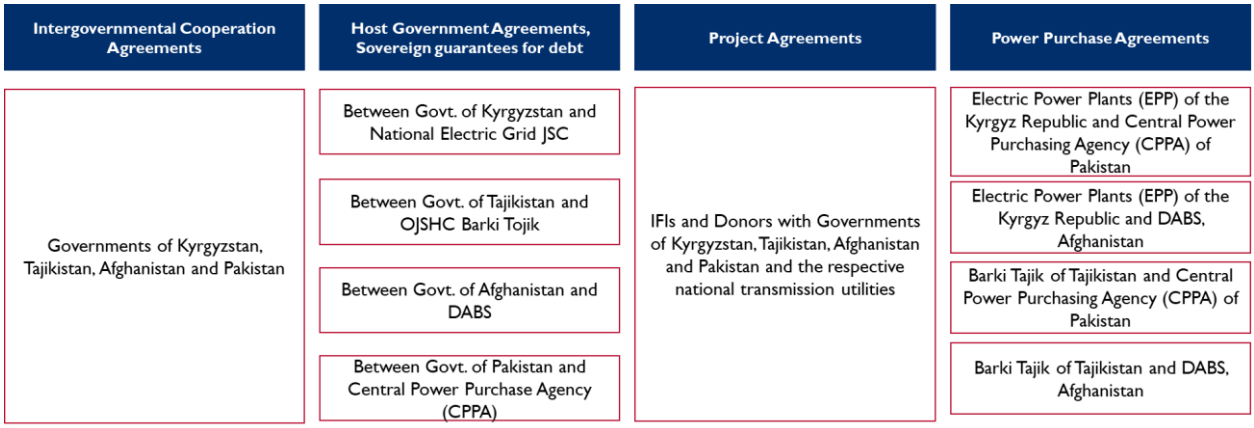
2.9.3 Technical, commercial and operational framework for implementation of CBTMPT

The MDBs play a major role at this stage in terms of development of the required frameworks for implementing this multilateral power trade project as follows[98]:

- Working closely with international partners including the MDBs, the IGC has spearheaded the conduct of required analytical work to establish the technical, economic, environmental, social and commercial feasibility of the CASA-1000
- The ADB funded the original Feasibility Study for CASA-1000. It also provided support for the update of the Feasibility Study in 2011 and subsequent studies with other development partners. With the objective to enable broader regional integration, ADB is earmarking resources originally proposed for this project to other regional initiatives developed under the Afghanistan Power System Master Plan that are complementary to CASA-1000.
- In 2011, the four countries requested the International Finance Corporation (IFC) to actively participate in project structuring and implementation. Following this, in 2012 the four countries each signed a Financial Advisory Services Agreement with IFC to act as lead advisor for the selection of the developer and operator for the project.

The various commercial and other agreements for this project are as illustrated and explained below.

Figure 16: Commercial framework and other agreements



Source: World Bank website-Project Appraisal Document (2014)

The Contractual Joint Venture within the countries comprises a number of commercial agreements, referred to as the Core Project Agreements. These are as follows:

- Four Power Purchase Agreements (PPAs):
  i. Between Electric Power Plants (EPP) of the Kyrgyz Republic and NTDC / Central Power Purchasing Agency (CPPA) of Pakistan
  ii. Between EPP of the Kyrgyz Republic and DABS of Afghanistan
  iii. Between Barki Tajik of Tajikistan and NTDC / Central Power purchasing Agency (CPPA) of Pakistan
  iv. PPA between Barki Tajik of Tajikistan and DABS of Afghanistan
- PPA between DABS of Afghanistan and NTDC/CPPA of Pakistan that will cover the sale of electricity generated in Afghanistan, and provide for the on-sale of electricity purchased by DABS from EPP of the Kyrgyz Republic and Barki Tajik of Tajikistan
- Master Agreement between the designated Parties from all four countries
- Coordination Agreement between entities designated by the governments of the Kyrgyz Republic and Tajikistan. This agreement will provide for all technical and commercial aspects of the wielding of power for the project and for operational coordination with the operator of the DC facilities ("DC operator")
- A Technical Code (under development) to cover all operational requirements such as dispatch, metering, curtailments, and others

- Account Bank Agreement between the Account Bank and the parties to the PPAs, and the coordination agreement between the entities designated by the governments of the Kyrgyz Republic and Tajikistan. All payments under the PPAs are to be made into designated bank accounts with the Account Bank, envisaged to be located in a jurisdiction outside any of the four participating countries and having a long-term credit rating from a reputable credit rating agency (such as Standard & Poor's, Moody's, or Fitch)
- An agreement between each government and its designated entities (Host Government Agreements or HGAs). Each HGA will, among other things, reflect the obligations of the governments to each other under the IGA.

2.9.4 Consensus building mechanism

The Inter-Governmental Council (IGC) and an associated Secretariat play important role to build consensus among the participants. The IGC Secretariat is providing central executive, technical and administrative support to the IGC and is comprised of Ministers from the four countries. It is responsible for deciding on high level strategic issues regarding the project and, for ensuring that the necessary steps to implement and operate it are being undertaken. It has to maintain a highly collaborative, consensus-building relationships with and among the project implementers, owner's engineers, donors, MDBs, and the IGC which represents the interests of the governments and people of the four countries and the wider region.

The IGC has established a Joint Working Group (JWG) and working-level committees (Procurement and Financial Committees and, a Legal Subcommittee), comprised of governmental officials and experts, to negotiate agreements and provide detailed project oversight. For the implementation phase, the IGC will establish additional working-level committees (Technical, Implementation and Operational).

2.9.5 Financing for development of CBTMPT transmission infrastructure

The project has seven financiers[99]:

- The World Bank (through the International Development Association (IDA)
- European Investment Bank (EIB)
- Afghanistan Reconstruction Trust Fund (ARTF)
- Islamic Development Bank (IsDB)
- The UK Department for International Development (DFID) now known as Foreign, Commonwealth & Development Office (FCDO)
- The United States Government
- European Bank for Reconstruction and Development (EBRD)

The United States Government and FCDO contributions are channelled through a World Bank administered Multi-Donor Trust Fund to consolidate funding support from donors who have expressed interest in supporting the project. The total project cost is USD 1.17 billion[100]. Currently, there is a small financing gap for Pakistan and Kyrgyz Republic that may be filled by additional financing from the World Bank once the final costs have been established after receipt of the bid prices.

2.9.6 Key aspects of CBTMPT

The CASA-1000 lines are being built considering a trade of 1000-1300MW between the national utilities of the respective countries. The wheeling charge for Tajikistan, and transit charges for Afghanistan is commercially negotiated between the parties, and indexed with inflation. For example, the Afghanistan Transit Fee to be paid by Pakistan is calculated based on the following formula:

*Afghanistan Transit Fee = 1.25 US cents/kWh * US CPI REV / 236.916*

Where US CPI REV is the revised US consumer price index (All Urban Consumers), and 236.916 is the US CPI as of January 2016.[101]

Rest of the technical aspects such as management of transmission corridors, loss accounting, congestion management and deviation management are expected to evolve as the project implementation progresses.

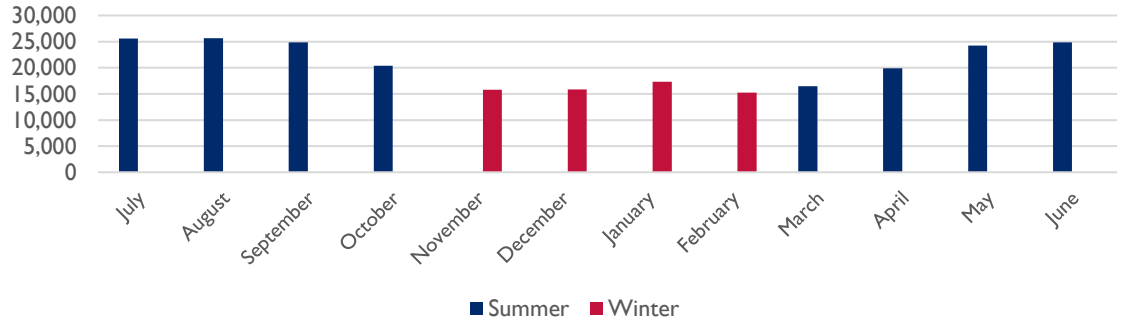
2.9.7 Benefits of CBTMPT and sharing among the member countries

For the two exporting countries, the project will generate valuable foreign exchange revenues from export of surplus summer electricity – it is expected that appropriate and transparent mechanisms will be in place to monitor that these revenues are optimally used for the benefit of the people of Tajikistan and the Kyrgyz Republic. The project will also create a direct transmission link between these two countries, and this will improve the overall transmission network in the region.

For Afghanistan, the project will provide a valuable source of additional clean summer energy that could be used for meeting domestic demand and/or for re-export to Pakistan.

For Pakistan, shortage of electricity is a major constraint to economic growth and consumers are subject to frequent and extended blackouts. The peak demand in Pakistan is in the summer and thus the CASA1000 imports will be quite beneficial.[102]

Figure 17: Pakistan - Monthly peak demand, 2018-19



Source: SARI/EI[103]

2.9.8 Role of CBTMPT in assisting RE integration

The CASA project aims to transfer the surplus hydropower available in summer season to be imported to Pakistan and Afghanistan. Thus, the cross-border trade is directly related to use of more clean energy.

2.9.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

After the signing of intergovernmental agreement, various national entities played a key role in facilitating the future commencement of trade. This includes utilities signing the PPA, the respective transmission companies in each country acting as the Project Implementing Agencies and the National Electric Power Regulatory Authority (NEPRA) approving the PPA and transit charge rates.

2.9.10 Key drivers enabling CBTMPT

The key drivers of CASA-1000 project are believed to be:

- Power deficits in Pakistan, coupled with seasonal surplus in Tajikistan and Kyrgyzstan;
- Signing of intergovernmental agreement;
- Ability to negotiate a transit fee with Afghanistan; and
- Strong support from development financial institutions such as ADB, World Bank and USAID.

2.9.11 Challenges faced for transition to CBTMPT and mitigating actions

USAID has provided the funding and institutional support for the project's Inter-Governmental Council Secretariat since 2014. This facilitates establishing commercial and institutional arrangements and, power transmission infrastructure for CASA-1000 to enable regional electricity trade.

The project PPA rates and Afghanistan transit fees had to be renegotiated between the governments, requiring Pakistan to take a revised approval from their regulator, NEPRA. In addition, there is a risk of Afghanistan declining to offtake its portion of power and preferring to stay only as a wheeling supplier.

2.10 New England Power Pool (NEPOOL)

New England region, in the northeast of the United States, is made up of six states: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. These states formed the New England Power Pool (NEPOOL) in 1971 to co-ordinate regional dispatch. Today, the market is among the most advanced in the world, with active trading by hundreds of participants within New England as well as substantial trading with an external US market (New York Independent System Operator) and several Canadian provinces.

2.10.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

Within NEPOOL, there is multilateral trade between market participants (but within the same country), undertaken through two energy market products:

- The **Day-Ahead Energy Market** lets market participants commit to buy or sell wholesale electricity one day before the operating day, to help avoid price volatility.
- The **Real-Time Energy Market** lets market participants buy and sell wholesale electricity during the course of the operating day. The Real-Time Energy Market balances the differences between day-ahead commitments and the actual real-time demand for and production of electricity.

The region also undertakes power trade with neighbouring Canadian provinces. This includes import of power (mostly hydropower) from Quebec, New Brunswick and Newfoundland & Labrador provinces. [104]

There are also various financial and ancillary markets such as Forward Capacity Market, Financial Transmission Rights, Forward Reserve Market, Regulation Market, voltage support, black start service etc.

The Forward Capacity Market (FCM) ensures that the New England power system will have sufficient resources to meet the future demand for electricity. Forward Capacity Auctions (FCAs) are held annually, three years in advance of the operating period. Resources compete in the auctions to obtain a commitment to supply capacity in exchange for a market-priced capacity payment. These payments help support the development of new resources. Capacity payments also help retain existing resources.[105]

Financial Transmission Rights (FTRs) are a financial instrument that allows market participants to acquire an annual or monthly share of excess "congestion revenues" collected by the ISO. This revenue comes from congestion costs—the price difference between the least-expensive electricity available and a more expensive option that has to be used instead due to system constraints. Congestion costs can lead the ISO to collect more revenue from demand in congested areas than it will pay to generators supplying electricity to those areas. The ISO conducts annual and monthly auctions to allow eligible bidders to acquire annual or monthly FTRs, and to allow FTR holders to sell FTRs. [106]

The Forward Reserve Market is designed to:

- Acquire commitments from resources ahead of time to provide reserve capacity in real time
- Attract investments in resources that provide the least-cost solution for satisfying off-line reserve requirements—typically, fast-start units that run infrequently throughout the year

The ISO conducts two competitive FRM auctions: one for the summer reserve period (June through September) and one for the winter reserve periods (October through May).[107]

The Regulation Market is the mechanism for selecting and compensating market participants to provide regulation—the capability of specially equipped generators and other energy sources to increase or decrease output or consumption every four seconds. Participants allow their Automatic Generation Control (AGC) resources to be controlled by the ISO using automated signals to balance both second-by-second variations in demand and the system frequency, which must be kept constant. Two regulation clearing prices are calculated: one for capacity and one for actual service mileage.[108]

Voltage Support - For electricity to flow continuously and reliably, the ISO must ensure that voltage on the transmission system is always maintained within an acceptable range. Voltage is regulated through reactive power dispatch, and resources on the grid may be compensated for providing this reactive power capability.[109]

Black start service is necessary to facilitate a stable and orderly restoration of the power system in the event of a partial or complete shutdown of the system. The ISO selects and compensates specific participating generators interconnected to the transmission or distribution system at strategic locations that can be called upon to re-energize the transmission system. These units must meet certain requirements, including having the ability to quickly restart without an outside electrical supply.[110]

2.10.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

In September 1971, various power utilities in New England region came together to sign the NEPOOL Agreement, for the establishment of a bulk power system. This was later amended multiple times, including major revisions to accommodate the changing regulatory provisions of Federal Electricity Regulatory Commission (FERC).

The Independent System Operator for New England (ISO-NE) was established in 1997. It got more wider powers as a 'Regional Transmission Operator' (RTO) in 2005. It is governed by the following key agreements:

Participants Agreement and NESCOE MOU	Documents that outline the collaborative process, rights, and responsibilities established between the ISO and New England Power Pool (NEPOOL), and between the ISO, NEPOOL, and the New England States Committee on Electricity (NESCOE)
Transmission Operating Agreements (TOAs)	Agreements that set the terms under which transmission owners transfer operational authority of their facilities to the ISO in its role as the Regional Transmission Organization
Inter-Area Operating Agreements and Asset Owner Agreements	Agreements (including emergency energy pricing) between the ISO and operators of neighbouring balancing authority areas, and related agreements
NEPOOL Agreement	Operating agreement outlining NEPOOL's governance

As ISO-NE got more power under various FERC rules, the erstwhile NEPOOL remodelled itself as an association of market participants and stakeholders.

For the trade of power with Canada, there are additional legal provisions under Federal Power Act. Exports of electricity from the United States to a foreign country are regulated and require authorization from US Department of Energy (DOE) under section 202(e) of the Federal Power Act (FPA) (16 U.S.C. §824a(e)).

2.10.3 Technical, commercial and operational framework for implementation of CBTMPT

The following terms, rules, and operating procedures govern New England's wholesale electricity markets and power system.

Transmission, Markets, and Services Tariff (ISO Tariff)	The ISO Tariff stipulates the rates, terms, and conditions for transmission, market, and other services provided by ISO New England

ISO Manual	Procedures for market participant responsibilities related to the region's wholesale electricity markets and power system
ISO Operating Procedures	Procedures that outline steps the ISO takes to control and manage the high-voltage power system in the six-state New England area
System Operating Procedures	Procedures that detail the ISO's day-to-day operation of New England's power system
Master/Local Control Center Procedures	Procedures that establish coordinated operations between the ISO's master control center and local control centres
Generator and Non-Generator VAR Capability	Documents that outline procedures for maintaining desired and/or reliable voltage and reactive capabilities
Planning Procedures	Requirements related to regional transmission planning, including reliability standards, pooled transmission facility cost review, and notice of intent to change facilities
NERC and NPCC Compliance guidance	Guidance for market participants on compliance with reliability standards set by the North American Electric Reliability Corporation (NERC) and Northeast Power Coordinating Council (NPCC)
Interconnection Operators Agreement	Provide for the reliability and operability of the Interconnection Facilities with Canada, and for coordinated scheduling of the Interconnection Facilities.

2.10.4 Consensus building mechanism

At government level

New England States Committee on Electricity (NESCOE) is a not-for-profit entity that represents the collective perspective of the six New England Governors in regional electricity matters. NESCOE recommends policies and comments on proposed rule and tariff changes related to resource adequacy, demand response, and energy efficiency. With respect to system planning and expansion, NESCOE recommends policies designed to ensure that resources are available to provide regional electric reliability and, where it is feasible and cost-effective, to eliminate persistent and costly congestion over transmission lines and enable interconnection of generation resources.

At regulator level

The New England Conference of Public Utilities Commissioners (NECPUC) is a not-for-profit corporation, established in 1947. NECPUC provides regional regulatory assistance on matters of common concern to public utilities commissions of the six New England states.

At market level

The New England Power Pool (NEPOOL) Participants Committee (PC) is the principal governing body through which the members of NEPOOL act as an organization. This key committee seeks to ensure the representation of all market participants, coordinate and clarify input to ISO New England, and facilitate the formation of consensus positions that have both practical and legal significance to the administration of New England's wholesale electricity markets and power system.

NEPOOL meetings are attended by ISO-NE representatives and State representatives, including representatives of the NESCOE and NECPUC, who participate actively in discussions.

2.10.5 Financing for development of CBTMPT transmission infrastructure

For new regional transmission infrastructure, the Pooled Transmission Facility (PTF) owners will need to submit the cost estimates and supporting details, which will be reviewed by ISO-NE and the Reliability Council of NEPOOL.[111] However, the owners have to arrange financing on their own, and on this regard, there will be no support from ISO-NE as such.

(PTF or Pool Transmission Facilities are the transmission facilities owned by PTOs, over which the ISO shall exercise Operating Authority in accordance with the terms set forth in the TOA, rated 69 kV or above required to allow energy from significant power sources to move freely on the New England Transmission System.)

The recovery of investments is through Open Access Transmission Tariff (OATT) which is mentioned in the following section.

2.10.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

ISO-NE calculates the Available Transmission Capacity (ATC) of transmission corridors after subtracting a Transmission Reliability Margin (TRM) from the Total Transmission Capacity (TTC). The TTCs on all of the New England Control Area external interfaces are calculated using the NERC Standards. TTC is the amount of electric power that can be moved or transferred reliably from one area to another area of the interconnected transmission systems by way of all transmission lines (or paths) between those areas under specified system conditions. TTCs for the New England Control Area external interfaces are studied by the ISO based on thermal, voltage and stability limitations of the transmission lines that comprise the interface. Power flow and transient stability analysis is used to ensure that the interface's physical limits will not be violated for credible system contingencies per Northeast Power Coordination Council (NPCC) and ISO reliability criteria. TRM is the amount of transmission transfer capability set aside to provide reasonable assurance that the interconnected transmission network will be secure.

Internal generation is dispatched in an economic, security-constrained manner by the ISO rather than utilizing a system of physical rights, advance reservations and point-to-point transmission service.

In addition to offers from generation within New England, entities may submit External Transactions to move energy into the New England Control Area, out of the New England Control Area or through the New England Control Area. The Real-Time Energy Market clears these External Transactions based on forecast LMPs and the transfer capability of the associated external interfaces. The process for submitting External Transactions into the Real-Time Energy Market does not require an advance physical reservation for use of the PTF.

B Development and management of transmission corridors

The manner of operation of transmission system is covered in ISO-NE's Operating Procedure No. 19, which specifies the time frame, stability levels and corrective actions. This is framed considering the relevant NPCC and NERC standards also. [112] Meanwhile, Operating Procedure No. 3 deals with transmission outage scheduling.[113]

C Transmission pricing/wheeling methodology

Open Access Transmission Tariff (OATT), which provides the rights for electric energy suppliers and describes their responsibilities and fees for accessing the region's transmission system to transport electricity throughout New England. The terms and conditions of the OATT provide for non-discriminatory open-access transmission service over the New England transmission system.

Through-or-out Transmission (TOUT) service is a transmission service offered under Schedule 8 of the ISO New England OATT. Transmission customers purchase TOUT service to move power through or from New England to another balancing authority area.

TOUT charges are based on the megawatts of reserved transmission capacity. The OATT's TOUT charge equals a customer's megawatts of reserved transmission capacity for each hourly TOUT purchase multiplied by the TOUT hourly rate. A customer's total charge for the month equals the sum of the TOUT charges associated with all its transmission reservations. The TOUT revenues are distributed among the transmission owners.

Rate for Through or Out Service ("TOUT Rate"): The rate per hour for Through or Out Service shall be the annual Pool PTF Rate divided by 8760. The Pool PTF Rate shall be the rate determined annually. Customers who purchase TOUT also pay for OATT Schedule 1 service, which relates to the scheduling, system control, and dispatch costs.

For example, in 2019, the Pool PTF Rate was 112 USD/KW-year, and Schedule 1 rate was 1.6 USD/KW-year.[114]

D Transmission losses accounting

Market Participants with settlement accounts for the Energy Market are charged/credited for losses on the PTF portion of the New England Transmission System in both the Day-Ahead Energy Market and Real-Time Energy Market on the basis of the Loss Component of the Day-Ahead and Real-Time LMPs. Other Transmission Customers are charged/credited for losses on the PTF portion of the New England Transmission System in Real-Time Energy Market on the basis of the Loss Component of the Real-Time LMPs

The Loss Component of Day-Ahead and Real-Time LMPs is calculated by the ISO's security constrained dispatch software and represents the cost of Marginal Losses, in $/MWh, at each Location relative to the reference point.[115]

E Congestion management

When the Transmission System is scheduled Day-Ahead under constrained conditions or is operating in Real-Time under constrained conditions, the ISO calculates Congestion Costs for each Market Participant or Transmission Customer. The basis for the Congestion Cost is the Congestion Component of the applicable Day-Ahead or Real-Time LMP at each location. [116]

F Deviation accounting and settlement

Deviations are settled for both energy deviations, and deviations to be adjusted on loss and congestions calculations. A Market Participant's Real-Time Energy Market Deviation Energy Charge/Credit is the sum of the product of the Market Participant's Real-Time Locational Adjusted Net Interchange Deviation and the Energy Component of the Real-Time LMP for each Location for that settlement interval. Similarly, calculations are undertaken for adjustment of losses and congestion charges also, to compensate against the deviations.

Emergency purchase Charges (costs in excess of the costs that would have been incurred using the Real-Time LMP at the External Node or Nodes as the price for the Emergency purchase from Market Participants or directly from other Control Areas) are allocated among Market Participants in proportion to their negative deviations (as defined below) during the hour (excluding deviations requested by the ISO). Emergency purchase Credits associated with a purchase from another Control Area at a price less than the Real-Time LMP are also allocated using this negative deviation determination. These deviations are based on Self-Schedule deviations, deviations created through a failure to follow a Dispatch Instruction, deviations at External Nodes and load deviations. Market Participants with negative deviations are allocated the Emergency purchase Charges or applicable Credits. [117]

2.10.7 Benefits of CBTMPT and sharing among the member countries

Some of the benefits of ISO-NE include:

- Improved reliability as opposed to stand-alone grids in each state;
- Availability of real time and day ahead energy markets;
- Availability of advanced market products such as Forward Capacity Market (FCM) and other ancillary services;
- Development of regional system plan; and
- Ability to undertake power transactions with neighbouring countries (Canada) and regions.

2.10.8 Role of CBTMPT in assisting RE integration

In the ISO-NE region, renewables contributed to 9% of electrical energy, and hydropower contributed to 7% of electrical energy in 2019.[118] Most of the energy imported by ISO-NE from Canada is from hydropower plants. Various market mechanisms provide tools for utilities and planners to manage variable renewable energy. This includes a suite of competitive markets—the energy, ancillary, and capacity markets—that attract and sustain the resources needed to operate the grid reliably and deliver economic and environmental benefits to the region.

2.10.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

The specific role of each of the institutional mechanisms are summarised below:

ISO-NE	It is the independent system operator, which undertakes the following tasks: ▪ Develop market rules, transmission rules etc. ▪ Operate the Day Ahead and Real Time Energy markets ▪ Develop and implement energy accounting procedures, congestion management, deviation management etc.
NEPOOL	It is a forum of utilities and market participants; It facilitates the formation of consensus positions that have both practical and legal significance to the administration of New England's wholesale electricity markets and power system.
NESCOE	It is a is a not-for-profit entity that represents the collective perspective of the six New England Governors in regional electricity matters. It recommends policies designed to ensure that resources are available to provide regional electric reliability and, where it is feasible and cost-effective, to eliminate persistent and costly congestion over transmission lines and enable interconnection of generation resources
Northeast Power Coordinating Council, Inc. (NPCC)	Undertakes development of regional reliability standards and compliance assessment and enforcement of continent-wide and Regional Reliability standards, coordination of system planning, design and operations, and assessment of reliability. It is one of six regional electric reliability councils under North American Electric Reliability Corporation authority.
North American Electric Reliability Corporation (NERC)	The North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the bulk power system through

	system awareness; and educates, trains, and certifies industry personnel. NERC's area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico. NERC is the Electric Reliability Organization (ERO) for North America, subject to oversight by the Federal Energy Regulatory Commission (FERC) and governmental authorities in Canada. NERC's jurisdiction includes users, owners, and operators of the bulk power system, which serves nearly 400 million people. It undertakes the following key activities: ▪ Develops and enforces Reliability Standards ▪ Annually assesses seasonal and long-term reliability
NECPUC	New England Conference of Public Utilities Commissioners is a not for profit association, that provides regional regulatory assistance on matters of common concern to public utilities commissions of the six New England states. NECPUC meets regularly throughout the year and sponsors an annual symposium on regulatory issues.
Federal Energy Regulatory Commission (FERC)	The Federal Energy Regulatory Commission, or FERC, is an independent agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects. In the context of ISO-NE, the areas where FERC plays a key role are related to the regulation of interstate transmission, including Open Access Transmission Tariff.

2.10.10 Key drivers enabling CBTMPT

The key drivers which enable multi-state power trade within ISO-NE includes:

1. A long history of regional energy cooperation, spanning from establishment of New England Power Pool in 1971;
2. Development of ISO-NE under FERC rules;
3. Role of NEPOOL as a key market advisory agency;
4. Supporting institutional framework, such as NESCOE;
5. Development of well-defined market products and market rules by ISO-NE; and
6. Geographical location, allowing trade with Canada.

2.10.11 Challenges faced for transition to CBTMPT and mitigating actions

The need for a more coordinated transmission plan was solved, with the development of regional transmission plan in 2000. The plan summarized results of reliability and economic-related studies, generator studies, and other transmission projects. In later years, the process developed into the current system of developing Regional System Plan.

In 2003, ISO launched market redesign with locational pricing, day-ahead and real-time markets to more accurately reflect cost of wholesale power and provide clearer economic signals for infrastructure investment, as market expanded, new market products were also required. This included:

- Launch of new Regulation Market in 2005, for more efficiently and precisely price regulation service;

- Launch of locational Forward Reserve Market in 2006, for better valuation of reserves to reflect where demand is heaviest, thereby providing price signals for investment in local quick-start plants on generator availability and use; and
- Commencement of Forward Capacity Market (FCM) auction in 2008, designed to purchase enough qualified resources three years in advance to satisfy region's future needs and allow enough time to construct new capacity resources.

In 2014, ISO also launched the first annual 10-year forecast of regional solar photovoltaic (PV) resources to better understand impact of increased amounts of distributed generation on grid operations and future grid planning.

2.11 Pennsylvania-New Jersey-Maryland (PJM) interconnection

The Pennsylvania-New Jersey-Maryland (PJM) interconnection, which is a regional transmission organisation (RTO) serves more than 84,200 miles of transmission at 100 kV and above. The PJM interconnection connects 13 states (Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia) of the United States of America and the District of Columbia. The PJM was founded in 1927 as a power pool. PJM opened its first bid-based energy market on April 1, 1997.

The Federal Energy Regulatory Commission (FERC) approved PJM as USA's first fully functioning independent system operator (ISO). ISOs operate, but do not own, transmission systems in order to provide open access to the grid for non-utility users. Later, PJM became United States' first fully functioning RTO in 2002. As an RTO, PJM acts independently and impartially in operating and planning the regional transmission system and in overseeing the wholesale electricity market.

PJM operates the following market products and ancillary services:

- Financial Transmission Rights (FTRs) allow market participants to offset potential losses related to the price risk of delivering energy to the grid. FTRs are a financial contract entitling the FTR holder to a stream of revenues (or charges) based on the day-ahead hourly congestion price difference across an energy path. FTRs are a method to bypass congestion charges associated with PJM's Locational Marginal Pricing or LMP. They give market participants the ability to attain a better price certainty when delivering energy across the grid.
- Synchronized Reserve – The amount of power (connected to the grid) that can be received within 10 minutes.
- Regulation Market - As an ancillary services product, regulation provides market-based compensation to resources that have the ability to adjust output or consumption in response to an automated signal. It is a reliability product that corrects for short-term changes in electricity use that might affect the stability of the power system. In technical terms, the main goal of regulation is to keep the system's area control error (ACE) within acceptable bounds. ACE is the difference between scheduled and actual electrical generation, accounting for variations in the system's frequency.[119]
- Black Start Services - Black Start Capability is necessary to restore the PJM transmission system following a blackout. It shall enable PJM, in collaboration with the Transmission Owners to designate specific generators whose location and capabilities are required to re-energize the transmission system. These designated resources, called Black Start Units, are generating units that are able to start without an outside electrical supply; or the demonstrated ability of a unit with a high operating factor (subject to PJM approval) to remain operating, at reduced levels, when automatically disconnected from the grid.[120]

Certain derivatives linked to PJM such as futures are also traded in ICE exchange.

2.11.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

The PJM initially started as a power pool, in 1927 and it opened its first bid-based energy market on April 1, 1997. PJM then became a regional transmission organization (RTO), as FERC encouraged the formation of RTOs to operate the transmission system in multi-state areas as a means to advance the development of competitive wholesale power markets.

PJM currently supports **multilateral power trade**, where generators and utilities in multiple states of PJM trade power in physical market. It includes the sale or purchase of energy in PJM's **Real-Time Energy Market** (five minutes) and **Day-Ahead Market** (one day forward). There is also a capacity market, called the Reliability Pricing Model. In addition, there are financial products and ancillary services such as Financial Transmission Rights, Synchronized Reserve, Regulation and Black start.

Certain derivatives linked to PJM such as futures are also traded in the Intercontinental Exchange (ICE).

2.11.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

PJM's members comprise of transmission and generation owners, electricity suppliers and end use consumers (for example industries). PJM's **Operating Agreement** must be signed by all organizations which want to become a member of PJM. It contains provisions that establish how PJM operates as a regional transmission organization. It defines the roles and responsibilities of the PJM Board of Managers, the Members Committee and the Office of the Interconnection (PJM management and staff.).

There is also a **Reliability Assurance Agreement**, signed by all the organizations in PJM that sell electricity to end-use customers, establishes obligations and standards for maintaining the reliable operation of the electric grid. It includes provisions that deal with ensuring adequate capacity resources, aiding during emergencies and planning for the future needs of the system.

PJM's governance structure was set up in such a way as to allow the ISO to have independence from the pressures of market participants in its decision-making process. To achieve independence, PJM relies on a two-tiered structure that includes a fully independent non-stakeholder Board of Governors (the PJM board) and a sectoral Members Committee to provide advisory support.

Under FERC's guidance, PJM runs the wholesale physical power market in 13 states. PJM follows various interconnection procedures of its member states. The fundamental regulatory framework behind the functioning of PJM comes from a series of FERC orders. In April 1996, in Order Nos. 888and 889, the FERC established the foundation necessary to develop competitive bulk power markets in the United States: non-discriminatory open access transmission services by public utilities and stranded cost recovery rules that would provide a fair transition to competitive markets.

In 2000, FERC issued its ruling to advance the formation of Regional Transmission Organizations (RTOs) (such as PJM), by amending its regulations under the Federal Power Act (FPA). The regulations require that each public utility that owns, operates, or controls facilities for the transmission of electric energy in interstate commerce make certain filings with respect to forming and participating in an RTO. The Commission also codified minimum characteristics and functions that a transmission entity must satisfy in order to be considered an RTO.

2.11.3 Technical, commercial and operational framework for implementation of CBTMPT

PJM has developed various manuals which detail the rules, procedures and requirements for PJM market operations and for member companies who buy, sell, schedule and deliver electricity through the Energy & Reserve Markets within the PJM region. This includes the following:

- Pre-Scheduling Operations;
- Energy & Ancillary Services Market Operations;
- Balancing Operations; and

- Cost Development Guidelines.

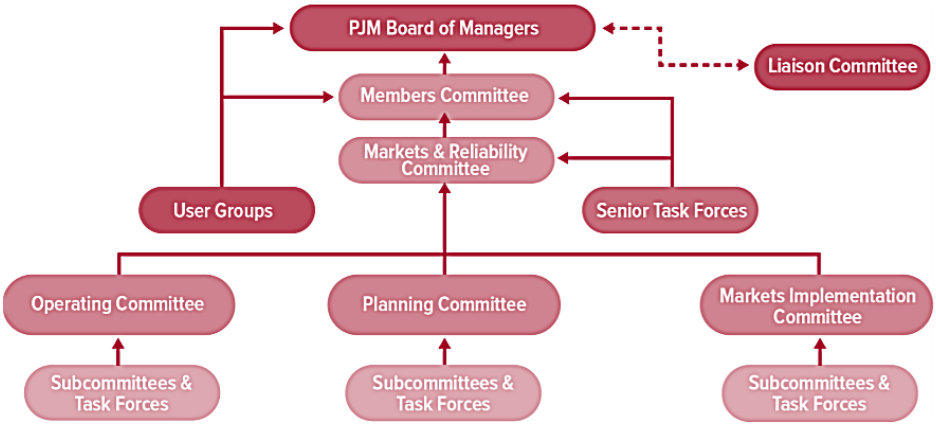
Apart from these, PJM also has various manuals in the following fields.

- Regional Transmission Planning Process Manuals: These manuals identify transmission system upgrades and enhancements to preserve the reliability of the electricity grid
- Transmission Manuals: These manuals provide resources, guidelines and requirements for Transmission Operations in the PJM region
- Reserve Manuals: These manuals provide the rules, procedures, and requirements for PJM Market Operations and Capacity Adequacy Planning
- Accounting & Billing Manuals: These manuals include Open Access Transmission Tariff Accounting, Operating Agreement Accounting and Billing details
- Administration Manuals: These manuals include Administrative Services for PJM Interconnection Agreement and stakeholder process details
- Miscellaneous Manuals: These include Nuclear Plant Interface Coordination and Certification & Training Requirements manuals

2.11.4 Consensus building mechanism

There are well-established PJM committees and groups which play an integral role in developing and refining PJM's rules, policies and processes. These groups provide a forum for members to share their positions and for issue resolution. Market committees are essential to PJM's governance structure for administering an open grid and transparent markets. The discussions and consensus building mechanisms are Consensus Based Issue Resolution at the Standing Committee Level.

Figure 18: Stakeholder Process Structure PJM



Source: PJM[121]

The Members Committee and the Markets and Reliability Committee are identified as Senior Standing Committees, with the Markets and Reliability Committee reporting to the Members Committee. Three Standing Committees are identified as reporting to the Markets and Reliability Committee, each with separate duties and responsibilities: The Operating Committee, the Planning Committee and the Market Implementation Committee.

- The Task Force and Subcommittee levels are tasked for carrying out problem investigation, proposal development, decision-making
- The Task Force or Subcommittee shall provide both periodic reports and a final report to the Parent Committee

- The standing committee tries to reach as much agreement as possible on a single proposal. When consensus cannot be reached, voting method is adopted
- Any proposal/option that passes a simple majority threshold is forwarded to the Senior Standing Committee for consideration

Apart from the consensus process at PJM, there are various committee that have set responsibilities delegated for them and review on various parameters on the working of PJM market:

- Audit Advisory Committee: Review and monitor external audits of PJM's market settlement process.
- Finance Committee: Review PJM's consolidated financial statements, budgeted and actual capital costs as well as operating budgets and expenses
- Liaison Committee: Provide for direct communication between the members and the PJM Board.
- Market Implementation Committee: Initiate and develop proposals to advance and promote competitive wholesale electricity markets in the PJM region
- Market Monitoring Unit: Advise the PJM Board of Managers on the scope of the annual market monitoring plan
- Market & Reliability Committee: Ensure the continuing viability and fairness of the PJM markets as well as the reliable operation and planning of the PJM grid
- Members Committee: Reviews and decides upon all major changes and initiatives proposed by committees and user groups
- Operating Committee: Review system operations from season to season, identifying emerging demand, supply and operating issue
- Planning Committee: Review and recommend system planning strategies and policies as well as planning and engineering designs for the PJM bulk power supply system

2.11.5 Financing for development of CBTMPT transmission infrastructure

PJM has no financial or ownership interest in any PJM member. PJM's role as a federally regulated regional transmission organization means that it acts independently and impartially in operating and planning the regional transmission system and in overseeing the wholesale electricity market. **Designated developers become responsible** for project construction, ownership, operation, maintenance and **financing.**

The costs for constructing transmission facilities in PJM are based on the capacity of the line and the estimated total cost of the project.

- For transmission lines rated at 500 kV and above, financing is done through postage-stamp rates where costs are assigned region-wide on an annual load-ratio share basis. A postage stamp rate is a fixed charge per unit of energy transmitted within a particular zone, regardless of the distance that the energy travels. Postage stamp rates are based on average system costs.
- For transmission lines below 500 kV, for reliability upgrade projects rated below 500 kV:
    - Projects costing $5 million or less – the cost is allocated to the zone the project is located in.
    - Projects costing more than $5 million – costs are allocated to the relevant market participants (typically load) according to their relative contribution to the reliability violation that is being addressed by the project, as determined by PJM's modelling.

2.11.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

Basically, PJM provides two categories of transmission services:

1. Point-to-Point Transmission Service is the use of transmission facilities for the transmission of capacity and energy between a Point of Receipt (POR) and a Point of Delivery (POD). Firm and Non-Firm Point-to-Point transmission service are offered for terms of various durations. Point-to-Point transmission service can be used for the transmission of capacity and/or energy into, out of, through or within the PJM RTO.
2. Network Transmission Service (PJM Network Integration Transmission Service) allows network customers to utilize their network resources to serve their network load located in the PJM RTO. The customer purchasing Network Transmission Service must also obtain or provide Ancillary Services. Network Transmission Service is used for the transmission of capacity and energy from network resources within or deliverable to PJM RTO and energy from the PJM energy market to network loads.

Once a Transmission Service Request is received the evaluation process begins. Each request for transmission service is evaluated by PJM to determine if there is sufficient capability to accept the request and ensure reliable service to all transmission customers.

Available Transfer Capability (ATC) is the capability remaining in the network above that which is already committed. The ATC process is administered by the Transmission Service Department. All Transmission Service Requests are evaluated by PJM based on posted ATC and other reliability analysis. If there is available transmission capability and there are no known reliability problems, the transmission service request is accepted. Once PJM has accepted the request, the ATC posting is adjusted to reflect the new transmission service reservation. [122]

B Development and management of transmission corridors

PJM operates the transmission grid in compliance with standard utility practices, NERC standards, and PJM policies, guidelines and operating procedures. The facilities of the PJM transmission grid, while operated by PJM, encompass the physical facilities owned by various transmission owners. While the facilities of transmission owners are operated by PJM as a fully interconnected transmission network, the physical facilities of each individual transmission owner are designed to the particular engineering and construction standards of that owner and maintained by them according to standard utility practices.

Total Transfer Capability (TTC) and ATC serve as indicators of the adequacy of the transmission system to reliably transfer energy over transmission facilities. PJM determines and posts TTC, Firm, and Non-Firm ATC for all valid posted paths, on hourly, daily, weekly and monthly basis. Two processes are used to calculate ATC:

1. AFC Calculator /Model Builder (calculates Available Flow gate Capability); and
2. AFC-ATC Converter (translates AFC values to ATC values).

On the TTC, margins are applied to protect against the over allocation of the transmission system. [123]

C Transmission pricing/wheeling methodology

Network customers pay daily demand charges to PJM transmission owners using the applicable zonal or non-zone Network Integration Transmission Service (NITS) rates. Firm point-to-point transmission customers pay demand charges for reserved capacity at the applicable tariff rates based on the term of the reservations. Non-firm point-to-point transmission customers pay demand charges for reserved capacity at the discounted rate. NITS rates for a few of the transmission utilities in PJM as of January 2021 is listed below.

Table 9: PJM NITS rates

Transmission Owner	AECO	Come	Dayton	Duke	Dominion
Network Integration Transmission Service Rate ($/MW-Year)	45,693	34,281	9,175	32,143	62,045

Source: PJM[124]

In addition, there is also a Transmission Enhancement Charge. All network customers serving load in a responsible zone pay for that zone's applicable projects' revenue requirements in proportion to their network service peak load share in that zone.

D Transmission losses accounting

The Office of the Interconnection of PJM calculates transmission loss charges for each network service user, market participant in the PJM Interchange Energy Market, and each transmission customer. The increased costs of energy due to transmission losses represented in the PJM network model are assessed to market participants based on the loss component of Locational Marginal Prices (LMPs), and the revenues collected are allocated to market participants' serving load and delivering PJM exports (that pay for PJM transmission service).

E Congestion management

PJM has developed requirements that Transmission Owners must follow in order for PJM to operate generation to control loading or voltage on transmission facilities. All facilities under congestion management are observed in the PJM Energy Management System (EMS) with sufficient telemetry to provide accurate and reliable state estimation.

Transmission congestion is managed financially rather than physically. The increased energy costs due to redispatch during the applicable interval when the PJM transmission system is constrained are assessed to market participants based on the congestion price component of LMPs. Day-Ahead revenues collected are allocated as credits to FTR holders.

F Deviation accounting and settlement

Net real-time deviations from day-ahead energy positions are charged at one-twelfth the PJM-wide real-time system energy price for each five minute interval. Charges may be positive or negative depending on the direction of the real-time deviation from the day-ahead energy position, and totals are summed for each hour.[125]

2.11.7 Benefits of CBTMPT and sharing among the member countries

PJM members share the benefits of power pooling and wholesale electricity markets (that allow them to sell each other power when they need it) because of the interconnected grid. Power pooling provides PJM members the benefit of drawing from electricity resources across a broad geographic area. This means that if one area is short on resources, resources can be brought in from a different area, even miles away, to ensure grid reliability.

In addition, the large size of PJM's market area increases the diversity of resources available to meet consumer need, providing benefits to both market participants and consumers and enhancing the reliability of the grid. By providing open and fair access to the grid for buyers and sellers of all kinds, PJM assures that the competitive market delivers the lowest-cost power available to meet customer demand at any given time.

PJM operations, markets and planning result in annual savings of $3.2−4 billion, including the following:[126]

- Reliability savings $300 million a year by alleviating congestion
- Generation investment savings of $1.2–1.8 billion due to lower reserve margin and presence of large and varied resource fleet
- Savings of $1.1–1.3 billion a year due to replacement of less efficient resources
- Production cost savings of $600 million a year due to expanded dispatch area

Meanwhile, annual emissions within the PJM footprint have declined by 30% over the last decade.[127] Over 32 000 MW of new cleaner generation replaced an equivalent amount of older generation that retired because of new environmental requirements.

2.11.8 Role of CBTMPT in assisting RE integration

Renewable sources- wind, solar and battery storage resources have grown from 2 percent to 6 percent of total capacity between 2010-2019—primarily due to large-scale investment in wind resources. The share of renewable energy in PJM states as of 2019 was estimated to be 6%[128]. The energy transition will continue, most likely with an increased amount of renewable energy.

Regional markets typically reduce intermittent RE integration costs due to wider balancing areas, geographical spread and other aspects. PJM also supports RE integration through a centralized wind power forecast service. The availability of capacity market and ancillary services are also enablers for RE integration. One of the previous PJM studies revealed that the interconnection can support up to 30% of RE, with additional reserves and transmission buildout.[129]

2.11.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

- FERC, an independent agency that regulates the interstate transmission of electricity in US played a pivotal role to liberalise the electricity sector by promoting ISOs. The Federal Energy Regulatory Commission (FERC) approved PJM as the nation's first fully functioning independent system operator (ISO). Later FERC also authorised PJM to become US's first fully functioning RTO
- Every FERC-approved RTO can operate and run a spot market for electric energy similar to the market design adopted by the PJM Interconnection
- For transmission expansion in PJM, the transmission companies propose their plans about the construction of new transmission lines or capacity increase to the RTO, FERC and the Department of Energy (DOE). When a transmission expansion plan is approved, FERC can offer incentive-rate treatment to reduce regulatory risk

2.11.10 Key drivers enabling CBTMPT

The key drivers which enable multilateral power trade within PJM includes:

1. Adoption of a collaborative process to establish systems and rules that ensure that the market operate fairly and efficiently;
2. A well-established Regional Transmission Expansion Plan (RTEP), which forecasts up to 15 years for future needs of the grid – such as upgrades, maintenance, new generation and new transmission systems;
3. System that efficiently accommodates all players- marketers, independent power producers, regional transmission organizations and independent system operators and integrating all of their needs and all solutions in the Regional Planning Process;
4. Fair allocation of costs between generators and load for interconnection of new generation;
5. Regulatory incentives by various institutions such as FERC and Department of Energy such as standardization of market design;
6. Strong institutional framework with various streamlined roles for various committee to oversee various responsibilities and for resolution of issues through discussion and negotiation;
7. Political will of members of PJM for cooperation in electricity;

8. A well-established Market Monitoring Unit- that assesses the state of competition in each of PJM markets, identifies specific market issues and recommends potential enhancements to improve competitiveness and market efficiency; and
9. Well established market for reserves and other ancillary services.

2.11.11 Challenges faced for transition to CBTMPT and mitigating actions

PJM has been managing the various challenges in multilateral trade through rule and procedure changes initiated by it, and also through regulatory reforms of FERC.

2.12 Australia's National Electricity Market (NEM)

The National Electricity Market (NEM) is a wholesale market through which generators and retailers trade electricity in eastern and southern Australia. It interconnects the six eastern and southern states and territories (Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania and South Australia), with over 40,000 km of transmission lines and cables. NEM delivers around 80% of all electricity consumption in Australia. The NEM supplies about 200 terawatt hours of electricity to businesses and households each year. [130]

2.12.1 Overview of the type of cross border power trade existing/planned, i.e., trilateral or multilateral

NEM's wholesale market operates around a common pool, or spot market, for wholesale trading in physical electricity. This process determines an electricity spot price which reflects physical supply and demand across the NEM. There are around 30 retailers and over 100 generation companies spread across the regions in the NEM wholesale market. Thus, trade happening in NEM is in the nature of **multilateral trade, between entities in different region**.

There is both **physical market and contract market**. The physical spot market works on the basis of region wise spot market prices determined based on supply and demand, for each 30 minute intervals.

Financial markets sit alongside the wholesale market and involve retailers and generators entering into contracts to buy and sell electricity at an agreed price. The financial markets enable retailers to manage the risk of volatile wholesale prices for their customers. Contracts in the NEM are traded either on the Australian Stock Exchange (ASX) or bilaterally. The contracts traded in ASX includes the following:

- ASX futures contracts allow a party to lock in a fixed price (strike price) to buy or sell a given quantity of electricity at a specified time in the future. Available products include quarterly base contracts (covering all trading intervals) and peak contracts (covering specified times of generally high energy demand). Futures contracts are settled against the average quarterly spot price in the relevant region—that is, when the spot price exceeds the strike price, the seller of the contract pays the purchaser the difference, and when the spot price is lower than the strike price, the purchaser pays the seller the difference.
- Caps are contracts setting an upper limit on the price that a holder will pay for electricity in the future. Cap contracts on the ASX have a strike price of $300 per MWh. When the spot price exceeds the strike price, the seller of the cap (typically a generator) must pay the buyer (typically a retailer) the difference between the strike price and the spot price. Alternative (higher or lower) strike prices are available in the OTC market.
- Floors are contracts that operate on the opposite principle of a cap contract because they set a lower price limit. They are typically purchased by generators to ensure a minimum level of revenue for output.
- Options are contracts that give the holder the right—without obligation—to enter a contract at an agreed price, volume and term in the future. The buyer pays a premium for this added flexibility.[131]

In addition, Ancillary services are used by Australian Energy Market Operator (AEMO) to manage the power system safely, securely, and reliably. These services maintain key technical characteristics of the system, including standards for frequency, voltage, network loading, and system restart processes.

AEMO operates eight separate markets for the delivery of Frequency Control Ancillary Services (FCAS), and purchases Network Support Control Ancillary Services (NSCAS) and System Restart Ancillary Services (SRAS) under agreements with service providers. Payments for ancillary services include payments for availability and delivery of the services. SRAS are reserved for contingency situations in which there has been a major supply disruption or where the electrical system must be restarted.[132]

2.12.2 Strategic, policy, regulatory, legal and institutional framework enabling transition to CBTMPT

The NEM began operating across the eastern seaboard states of Australia in 1998. Tasmania physically joined the market in 2005 through an interconnection with Victoria.

The National Electricity Act, 1996 is the primary legislation governing NEM. The Act specifies NEM, key institutions and their rules. [133] As per the Act, operation of wholesale power market can only be undertaken by the Australian Energy Market Operator (AEMO). Participants for market can apply to AEMO to allow their participation. At the same time, Australian Energy Regulator (AER) is entrusted with market monitoring and regulatory functions.

The National Electricity Rules govern the operation of the NEM. Changes to the National Electricity Rules are made by the Australian Energy Market Commission (AEMC). The rules:

- govern the operation of the wholesale electricity market - the market arrangements for the commercial exchange of electricity from the electricity producers (generators) through to the electricity retailers;
- govern the economic regulation of the services provided by monopoly transmission and distribution networks; and
- govern the way in which the AEMO manages power system security.

The institutional framework consists of the following key entities:

- The Council of Australian Governments (COAG) Energy Council is the key decision maker with policy and governance responsibility.
- The Australian Energy Market Commission (AEMC) develops the rules by which the market must operate. AEMC also provides strategic and operational advice to the COAG Energy Council.
- The Australian Energy Market Operator (AEMO) handles the day-to-day operations of the electricity and gas markets.
- The Australian Energy Regulator (AER) enforces the rules and makes judgements on the regulatory proposals of monopoly network operators.

2.12.3 Technical, commercial and operational framework for implementation of CBTMPT

Detailed technical, commercial and operational framework for multilateral trade in NEM is laid out through procedures and guidelines documents, such as the following:

- Procedure for determining Loss Factors - process for determining Loss Factors;
- Settlement Procedure - financial settlement of trading through the wholesale market;
- Balancing Market Forecasts Procedure - information requirements from System Management to enable the Forecast Balancing Merit Order and Balancing Forecast to be prepared;

- Ancillary Services – Procedure for ancillary services; and
- Dispatch Rules - Rule for Participants to meet dispatch of wholesale market, including dispatch schedule, dispatch order, exemptions etc.

2.12.4 Consensus building mechanism

The Council of Australian Governments (COAG) Energy Council (the Council) is a Ministerial forum for the Government of Australia, states and territories and New Zealand, to work together in the pursuit of national energy reforms. The Council was established by COAG in December 2013. The Council consists of ministers from the Government of Australia, each state and territory, and New Zealand, with portfolio responsibility for energy and resources. It meets twice a year.

The Energy Council provides a forum for collaboration between jurisdictions on matters of national significance requiring joint action by the Commonwealth, state and territory governments, including developing and implementing an integrated and coherent national energy and mineral resources policy. There are also opportunities to engage with both the Council and its Senior Committee of Officials. Stakeholders, including industry and community representatives, are invited to Council meetings and their advice is sought throughout the development of responses to key issues through roundtables and submissions.[134]

2.12.5 Financing for development of CBTMPT transmission infrastructure

AEMO, the system planner, provides a system-wide overview about what is needed and when in its Integrated System Plan. The Integrated System Plan is developed in consultation with transmission businesses, as well as the broader industry.

Transmission businesses, drawing on their local knowledge, choose the best project to meet the network need identified in the Integrated System Plan. This project must undergo a cost-benefit assessment (the regulatory investment test for transmission or RIT-T) that includes considering if non-network solutions like demand response may be more efficient. Australian Energy Regulator (AER) approves the RIT-T and sets network prices so customers are only paying for investment that is efficient. Financing pattern is decided by the respective transmission utilities. [135]

The recovery of investment costs are through transmission charges approved by AER. AER determines the maximum allowed revenue that transmission businesses may earn. Based on this revenue cap, and pricing methodology of AER, individual transmission utilities calculate the transmission prices and bill the same, so that their costs are recovered.

2.12.6 Key aspects of CBTMPT

A Identification of transmission capabilities and Open Access mechanism

Due to the nature of NEM, where all large generators and retailers operate in a single pool, the generators also have a right of open access. The transmission charges are ultimately paid by the retailers / end-consumers.

B Development and management of transmission corridors

Inter-regional constraints get reflected through the difference in spot prices. In addition, the system operator can control generation resources, and transmission elements to manage network constraints.

C Transmission pricing/wheeling methodology

AER determines the maximum allowed revenue that transmission businesses may earn. Based on this revenue cap, and pricing methodology of AER, individual transmission utilities calculate the transmission prices.

An Inter-regional Transmission Use of System Charges is also calculated separately for each of the regions.

D Transmission losses accounting

Transmission loss factors are calculated each year by the AEMO.

The NEM adopted an approximate version of nodal pricing for transmission losses. This approximate method involves the calculation of Marginal Loss Factors (MLF) to reflect the marginal cost of network losses. Regions have been defined between which flow constraints are modelled and the inter-regional loss factors vary from one dispatch interval to the next. These dynamic loss factors are defined between specific connection points in each region referred to as "regional reference nodes" (RRNs).

Within each region, static marginal loss factors are calculated that approximately represent the impact of marginal network losses on nodal prices at the transmission network connection points at which generation and loads are located. These static marginal loss factors are average values calculated from historical network flow data from the previous financial year

Inter-regional loss factor equations describe the variation in MLFs across the notional links. Integration of the (inter-regional loss factor-1) equation is used to determine the average losses on each notional interconnector:

Inter-regional loss = $\int$(inter-regional MLF – 1) dflow. [136]

E Congestion management

The market sets a separate spot price for each NEM region. When the interconnectors linking NEM regions are unconstrained, trade brings prices into alignment across all regions (apart from variations caused by physical losses that occur when transporting electricity). However, congestion causes these regional prices to deviate. Therefore, the regional spot market reflects not just the demand-supply based price, but also the congestion price. In addition, congestion also may bind generators to commit to non-economic transactions, which they will have to commit, through a system called as constraint equations.

F Deviation accounting and settlement

AEMO is responsible for settlement of the NEM, and acts as the principal for all electricity that is bought and sold through the wholesale electricity pool. Retailers and wholesale customers pay AEMO on a weekly basis, and AEMO subsequently pays generators.

AEMO also procures ancillary services from market participants to keep the power system secure. Frequency control ancillary services maintain system frequency within a safe range. 'Regulation' services correct for minor deviations in load or generation within each five minute dispatch interval. AEMO procures 'contingency' services to maintain safe power flows and voltage levels following a major disturbance such as the loss of a transmission line. These services are offered by generators (including battery storage) that can rapidly adjust output and industrial customers able to rapidly adjust their energy use. If a serious power system threat cannot otherwise be avoided, AEMO may direct generators to provide additional supply. If all other avenues have been exhausted and insufficient generation is available (or cannot be dispatched quickly enough), AEMO may instruct a network business to 'load shed'—temporarily cut power to some customers. [137]

2.12.7 Benefits of CBTMPT and sharing among the members

Trade enhances the reliability and security of the power system by allowing each region to draw on generation plant from across the market, and it allows for more efficient use of the generation fleet. For example, Queensland has surplus generation capacity, making it a net electricity exporter. Tasmania's trade position varies with environmental and market conditions. Key drivers include local rainfall (which affects dam levels for hydrogeneration), Victorian spot prices, and the availability of the Bassline interconnector.[138]

Figure 19: Inter-regional trade in NEM

Source: AER[139]

A 2019 study on effectiveness of NEM[140], undertaken by Economic Regulatory Authority (ERA) noted the following:

- To date, the market objective of providing a safe and reliable electricity supply has been met. The market objective of encouraging competition among generators and retailers is not being fully met. The market is always dependent on its market power mitigation mechanisms to prevent the misuse of market power and the resultant higher energy prices.
- The market objective of avoiding discrimination against generation technologies is not being met, due to the exclusion of storage technologies, like large batteries, from the WEM.
- The market objective of managing electricity demand has been met only partially to date. There are incentives in the WEM for large customers and retailers to reduce their demand in peak periods with consequent cost savings across the electricity system.

2.12.8 Role of CBTMPT in assisting RE integration

The variability of wind and solar farm output is partly offset by a negative correlation between the two: that is, decreasing wind generation is often observed during the morning ramp of rooftop and grid scale solar PV generation, and the opposite is observed in the afternoon. Dispersing wind and solar resources over a wide geographic base covering different weather zones can also have a balancing impact. NEM allows a more geographic dispersion of RE plants, thereby facilitating better RE integration.

The presence of electricity market also aids in competition, by ensuring mechanisms are in place that aim to ensure the most efficient and lowest-cost generators are used to supply electricity.

2.12.9 Specific roles of regional institutions/institutional mechanisms towards smooth transition to CBTMPT

The COAG Energy Council is guided by its Terms of Reference and its work covers the following broad themes, thereby playing a key role in enabling multilateral energy cooperation:

- Overarching responsibility and policy leadership for Australian gas and electricity markets;
- Promotion of energy efficiency and energy productivity in Australia;
- Australian electricity, gas and petroleum product energy security;

- Cooperation between Commonwealth, state and territory governments; and
- Facilitating the economic and competitive development of Australia's mineral and energy resources.

In addition, the market rules prepared by AEMC play a key role in facilitating the multilateral market operations.

2.12.10 Key drivers enabling CBTMPT

The multilateral trade under NEM is driven by the following key factors:

- A common National Electricity Law adopted by all the regions, for operations under NEM;
- Geographical factors resulting in regional surpluses/deficits which can be traded;
- Seasonal factors such as variability of hydropower in Tasmania;
- Well defined institutional framework; and
- Well defined operational framework and market procedures of AEMC.

2.12.11 Challenges faced for transition to CBTMPT and mitigating actions

AEMC keeps on changing the market rules to address the various challenges in operation of NEM. This includes a planned transition of settlement interval to 5 minutes, from current level of 30 minute, and change in congestion management principles.

In addition, AEMO maintains oversight over the market, and intervenes if necessary. AEMO is empowered to order forcing of generation schedules through direct interventions in times of crisis. It is also empowered to suspend spot market operations in special circumstances. Such a scenario was triggered in June 2022. A nation wise energy crisis forced AEMO to suspend the operations of NEM from 15 June 2022. As per AEMO, the following factors played a key role in the energy crisis, and the suspension of NEM:

- A large number of generation units out of action for planned maintenance;
- Planned transmission outages;
- Periods of low wind and solar output;
- Around 3000 MW of coal fired generation out of action through unplanned events; and
- An early onset of winter - increasing demand for both electricity and gas.[141]

The market suspension, which started on 15 June 2022, was lifted on 24 June 2022.

3 Key lessons in the context of enabling CBTMPT in South Asia

3.1 Introduction

Based on lessons from regional power pools, an analysis is presented in the below sub-sections to initially classify the various CBTMPT models/arrangements based on their similarities and differences, and then evaluate the common minimum pre-requisites that would enable the transition to CBTMPT. These inputs are then used to evaluate their suitability in the context of South Asia, in the form of recommendations. The recommendations will be utilized later in the design of draft framework for CBTMPT and the associated stakeholder discussions.

3.2 Classification of international models based on similarities/differences

Regional pools studied in this report has various models of power trade. In order to allow a grouping based on commonalities and differences within these models, the various models are classified and studied, based on power trade models and offered power trade products in this section. The classification based on power trade model will provide insights on whether the trade has moved beyond bilateral PPAs or not. The classification based on power trade products will provide information on whether there are market products beyond long term PPAs, such as spot market/ancillary products/derivatives. In addition, the markets also vary in terms of their commercial and operational framework, which is captured separately under this section.

3.2.1 Classification based on power trade models

The regional pools studied in this report at different stages of power trade model, ranging from the most conventional form of bilateral PPA based trade to the most advanced multilateral trade through exchange/market platforms. Power trade models with bilateral PPA consists of entities in two countries/regions trading power based on fixed term PPAs. In some cases, bilateral arrangements are not mainly for power trade, but for bilateral sharing of generation reserves, especially in emergencies. In comparison, trilateral power trade consists of trade transactions involving more than two parties, with the third party being part of the transaction as a wheeling service provider, and may also serve as one of the off takers of power. In multilateral trade, which are mostly undertaken through power exchanges or similar market platforms, there is a multi-buyer, multi-seller market (MBMS) where transactions are determined collectively rather than on bilateral basis.

The classification of regional power pools / regional power arrangements based on power trade models are described further below.

Table 10: Classification of international models – Power trade models

No	Region	Stage of power trade model		
		Bilateral	Trilateral	Multilateral
1	South African Power Pool (SAPP)	Bilateral PPAs		Exchange / market platform based
2	Regional Energy Market (MER) in Central American Interconnection	Bilateral PPAs		Exchange / market platform based
3	Gulf Co-operation Council (GCC) interconnection	Reserve sharing and bilateral PPAs		Exchange / market platform based
4	Greater Mekong Sub region (GMS) power market	Bilateral and trilateral PPAs		
5	ASEAN power market	Bilateral and trilateral PPAs		
6	Nord Pool	Bilateral and trilateral PPAs and exchange / market platform based multilateral trade		

No	Region	Stage of power trade model		
		Bilateral	Trilateral	Multilateral
7	European Union internal power market	Bilateral and trilateral PPAs, and multiple multilateral power exchange platforms		
8	Central Asia-South Asia (CASA) regional electricity market	Bilateral and trilateral PPAs		
9	New England Power Pool (NEPOOL)	Bilateral and trilateral PPAs		Exchange / market platform based
10	Pennsylvania-New Jersey-Maryland (PJM) interconnection	Bilateral and trilateral PPAs		Exchange / market platform based
11	Australia's National Electricity Market (NEM)	Bilateral and trilateral PPAs		Exchange / market platform based

** Transactions in which power is wheeled through a specific third country are categorized as trilateral*

3.2.2 Classification based on power market products

The regional pools studied in this report also differ in terms of the power market / power trade products that are available, ranging from the most conventional product – PPA, to the most advanced market products such as ancillary services (for example: black start, regulations reserves etc.) and derivatives. Between these fall the physical spot/forward markets, where spot trading typically refers to intra-day and day-ahead trades, and forward markets typically refer to markets where product delivery is within 7 days or greater. In comparison, in case of derivatives, there is no need for physical settlement of transactions, as the transactions are settled on a financial basis. Broadly, the following criteria is used in the segregation of market products.

Table 11: Criteria adopted for categorization of power market products

Power purchase agreement	Bilateral or trilateral agreement for sale or purchase of power
Physical spot market products / forward market products	Physical spot market – Market for day-ahead and intra-day products, cleared through a power exchange platform, for physical delivery of electricity Physical forward market – Product traded either through power market platforms, or through brokers or over the counter deals. Delivery for weekly or monthly durations. [142] ** Forwards can also be settled financially, as explained in the below section on derivatives market*
Ancillary services	Ancillary services help to balance and support the transmission system.[143] This usually consists of: 1. Regulation power - to control small mismatches between load (the electricity being consumed) and generation (the electricity being produced), adjusting for small tips to either side of the scale; 2. Reserves – Quick acting sources that help to recover system balance by making up for generation deficiencies if there is loss of a large generator, resulting in a large tip in the scale; 3. Black start – Initial starting power to restart power plants after a grid outage; and 4. Reactive power support.
Derivatives	Derivatives are contracts based on (derived from) an underlying electricity asset. There is a wide variety of types of derivatives, though the key examples can be summarized as below: 1. Forwards (Financial delivery) – Electricity forward derivatives represent the obligation to buy or sell a fixed amount of electricity at a pre-specified

	contract price, known as the forward price, at certain time in the future (called maturity or expiration time), settled on financial basis. Typically traded on over the counter; 2. Futures – Standardized contracts for financial settlement, typically traded on the organized exchanges; 3. Swaps - Electricity swaps are financial contracts that enable their holders to pay a fixed price for underlying electricity, regardless of the floating electricity price, or vice versa, over the contracted time period. They are typically established for a fixed quantity of power referenced to a variable spot price; and 4. Options - Options offer their purchasers the right, but not the obligation, to buy or sell a fixed amount of underlying electricity at a pre-specified strike price by the option expiration time.[144]

The classification of regional power pools/power arrangements based on power market products are illustrated below.

Table 12: Classification of international models – Power market products

No	Region	Power market products			
		PPAs	Physical spot market / forward markets	Market for ancillary services	Derivatives market
1	South African Power Pool (SAPP)		Day ahead, intraday, forward physical market - monthly and forward physical market – weekly [145]		
2	Regional Energy Market (MER) in Central American Interconnection		Medium to long term contract market (Regional Contract Market - MCR) and short-term opportunity market (Regional Opportunity Market – MOR) [146]		
3	Gulf Co-operation Council (GCC) interconnection		Day Ahead Continuous and Intra-Day Continuous Market [147]		
4	Greater Mekong Sub region (GMS) power market				
5	ASEAN power market				
6	Nord Pool		Day ahead market, intraday market[148]	Balancing market (Regulating power)	Base and peak load Futures, Deferred Settlement Futures (DS Futures), Monthly DS Futures, Options and Electricity Price Area Differentials (EPADs) [149]

No	Region	Power market products			
		PPAs	Physical spot market / forward markets	Market for ancillary services	Derivatives market
7	European Union internal power market		Day ahead market, intraday market[150]	Balancing market (Regulating power)	Base and peak load Futures, Deferred Settlement Futures (DS Futures), Monthly DS Futures, Options and Electricity Price Area Differentials (EPADs) [151]
8	Central Asia-South Asia (CASA) regional electricity market				
9	New England Power Pool (NEPOOL)		Day ahead market and real time energy market[152]	Regulation Market, voltage support, black start service[153]	Forward Capacity Market, Financial Transmission Rights, Forward Reserve Market
10	Pennsylvania-New Jersey-Maryland (PJM) interconnection		Day ahead market, real time energy market, reliability pricing model (capacity market)[154]	Synchronized Reserve, Regulation and Black start[155]	Financial Transmission Rights Certain derivatives linked to PJM such as futures are also traded in ICE exchange.
11	Australia's National Electricity Market (NEM)		Spot market[156]	Frequency Control Ancillary Services (FCAS) Network Support Control Ancillary Services (NSCAS) and System Restart Ancillary Services (SRAS)	ASX futures, caps, floors and options[157]

3.2.3 Common classification based on power trade models and power market products

The above classifications of regional power pools based on power trade models and power market products can be combined by plotting them in varying degrees of power trade and market models as below.

Figure 20: Classification of power trade and market models

Stage of power	Bilateral	Trilateral	Multilateral

trade model / Power market products			
PPA, spot/forward physical markets, ancillary services market and financial derivatives			Nord Pool EU internal market New England power pool PJM interconnection Australia NEM
PPA and spot/forward physical markets			SAPP MER (Central America) GCC interconnection
PPA only	GMS power market	ASEAN power market CASA power market#	

#CASA is somewhere between trilateral and multilateral trade, in that there are two suppliers (Kyrgyzstan and Tajikistan) and two buyers (Afghanistan and Pakistan), with wheeling through Tajikistan and Afghanistan.

In the above classification, the varying levels of power market/trade and their transition can also be seen, with GMS, ASEAN and CASA in initial market stages, whereas MER, GCC and SAPP in an intermediate stage, and rest of the markets in a more advanced stage.

Many of these markets have also progressed in a phase wise manner. For example, ASEAN power market was initially under only bilateral model. Trilateral transactions started with the commencement of LTMS PIP in 2018. While SAPP ran day ahead spot market since 2009, forward physical products were introduced only in 2016.

There are variations from the perspective of other parameters also:

- Based on transmission line: Separate regional line through multiple countries (GCC, Central America) vs the rest.
- Based on participating entities: Regions that allow participation of both buyers and sellers from private sector (European Union, Nord Pool, PJM, NEPOOL, NEM) vs regions that allow participation of only national power utilities (SAPP, Central America, ASEAN, GMS, CASA-1000, LTMS) [IPPs with dedicated export line will be a separate category in this]

There are also variations in terms of transmission pricing, deviation settlement and other aspects, as illustrated below. These mechanisms have been detailed earlier in chapter 2.

Table 13: Summary of variation on commercial and operational frameworks

No	Region	Commercial and operational frameworks		
		Transmission Pricing	Deviation Settlement	Congestion management
1	South African Power Pool (SAPP)	Wheeling charges are determined centrally by the SAPP	Imbalance price blocks linked to frequency and average generation price	Transmission capacity auctions and market splitting
2	Regional Energy Market (MER) in Central American Interconnection	Regional transmission rates, which consist of Variable Transmission Charge (CVT), the Toll and the Supplementary Charge	Net deviation is multiplied by an average price (determined hourly) to arrive at the deviation charges	Congestion rent
3	Gulf Co-operation Council (GCC) interconnection	Transmission prices are approved by the Advisory and Regulatory Committee	Deviation less than 25 MW is settled on "in-kind" basis every week. Deviation more than 25 MW is settled by cash at a regulated price	energy transactions are enabled, only after confirming the availability of interconnector capacity
4	Greater Mekong Sub region (GMS) power market	Depends on agreements	Depends on agreements	Depends on agreements
5	ASEAN power market	Depends on agreements	Depends on agreements	Depends on agreements
6	Nord Pool	Point of connection-based tariff system	balancing power between two countries is priced and settled in the Balancing Power Market	EU Regulation 2015/1222 guidelines on Capacity Allocation and Congestion Management (CACM)
7	European Union internal power market	Country wise pricing along with Inter TSO compensation mechanism	The EU Regulation 2017/2195 of 23 November 2017 lays down detailed rules on electricity balancing	EU Regulation 2015/1222 guidelines on Capacity Allocation and Congestion Management (CACM)
8	Central Asia-South Asia (CASA) regional electricity market	Depends on agreements	Depends on agreements	Depends on agreements
9	New England Power Pool (NEPOOL)	Through-or-out Transmission (TOUT) charges	A Market Participant's Real-Time Energy Market Deviation Energy Charge/Credit is the sum of the product of the Market Participant's Real-Time Locational Adjusted Net Interchange Deviation and the Energy Component of	Congestion cost calculation and locational marginal pricing

No	Region	Commercial and operational frameworks		
		Transmission Pricing	Deviation Settlement	Congestion management
			the Real-Time LMP for each Location for that settlement interval	
10	Pennsylvania-New Jersey-Maryland (PJM) interconnection	Zonal or non-zone Network Integration Transmission Service (NITS) rates	Net real-time deviations from day-ahead energy positions are charged at one-twelfth the PJM-wide real-time system energy price for each five minute interval	Transmission congestion is managed financially rather than physically, though Financial Transmission Rights
11	Australia's National Electricity Market (NEM)	Transmission price approved by AER, along with Inter-regional Transmission Use of System Charges	Managed through procurement of regulation and contingency services by the market operator	Included in the spot market price discovery

3.3 Evaluation of common minimum pre-requisites and mechanisms for CBTMPT

Based on the review of international experience, the following minimum mechanisms have been identified for CBTMPT.

1. Strategic and political: The overarching regional level agreement / treaty that governs CBET and regional energy cooperation
2. Legal, policy and regulatory: Legal, policy and regulatory framework for CBET
3. Technical and operations: Aspects such as technical guidelines, standards, grid codes etc.
4. Commercial: Energy accounting, energy settlement, deviation management, loss accounting etc.
5. Institutional: Regional institutional framework for CBET.

The summary of these mechanisms among the regional pools are provided below. Some of these, such as the underlying strategic and political framework also serve as the key prerequisite that enabled the regional trade in those pools.

Table 14: Summary of CBTMPT mechanisms

No	Region	CBTMPT mechanisms				
		Strategic and political	Legal, policy and regulatory	Technical and operations	Commercial	Institutional
1	South African Power Pool (SAPP)	Intergovernmental memorandum of Understanding (MOU)	Inter-Utility MoU Agreement Between Operating Members	Operating Guidelines	Market products Transmission pricing methodology Imbalance settlement	SAPP Coordination Energy Ministers of SADC Regional Electricity Regulators Association of Southern Africa (RERA)

No	Region	CBTMPT mechanisms				
		Strategic and political	Legal, policy and regulatory	Technical and operations	Commercial	Institutional
2	Regional Energy Market (MER) in Central American Interconnection	Marco treaty for Central American Electricity Market and the accompanying protocols in 1997 and 2007	Regional Energy Market Regulations (REMR)	Procedure for processing requests for connection to the Regional Transmission Network (RTR) and Procedure for the Application of Firm Contracts and Firm Rights	Market products Transmission Rights management Transmission tariff mechanism Deviation pricing	CDMER (Coordination at intergovernmental level) CRIE (Development of regulations, dispute resolution)
3	Gulf Co-operation Council (GCC) interconnection	GCC charter	General Agreement Power Exchange and Trading Agreement (PETA)	GCCIA Market Procedures; GCCIA Exchange Market Terms and Conditions; Procedure for sharing of losses; and Procedure for conducting tests on the interconnection system etc.	Market platform Transmission pricing	GCCIA board GCC Ministerial Committee
4	Greater Mekong Sub region (GMS) power market	The Inter-Governmental Agreement (IGA) on Regional Power Trade (2002), MoU on RPTOA-Stage 1 and the MoU on the Road Map for Implementing the GMS Cross Border Power Trading	Regional Power Trade Operating Agreement	Regional Power Trade Operating Agreement	Defined within PPAs	Regional Power Trade Coordination Committee (RPTCC)
5	ASEAN power market	ASEAN Plan of Action for Energy	Memorandum of Understanding on the	ASEAN Interconnection	Defined within PPAs	Heads of ASEAN Power Utilities (HAPUA)

No	Region	CBTMPT mechanisms				
		Strategic and political	Legal, policy and regulatory	Technical and operations	Commercial	Institutional
		Cooperation (APAEC)	ASEAN Power Grid	Master Studies (AIMS)		ASEAN Power Grid Consultative Committee (APGCC)
6	Nord Pool	Strong political will among the countries	Agreed together by the countries	Nordic Grid Code	Market products, platforms and market regulations	Erstwhile and NordREG ENTSO-E and ACER
7	European Union internal power market	'Energy Package' directives by the European Commission	EU regulations and directives	Rules and guidelines prepared by ENTSO-E and approved by ACER	Energy exchanges and market products Rules and guidelines prepared by ENTSO-E and approved by ACER ENTSO-E guidelines on Capacity Allocation and Congestion Management EU Regulation 2017/2195 (balancing) ENTSO-E Inter-TSO loss allocation mechanism	ENTSO-E and ACER
8	Central Asia-South Asia (CASA) regional electricity market	Intergovernmental MoU	Defined within PPA	Defined within PPA	Defined within PPA	Inter-Governmental Council (IGC) CASA-1000 Secretariat
9	Intra-country power pools – New England, PJM, Australia NEM	Not applicable (being within same country)	Defined by respective legislative and regulatory authorities	Detailed guidelines/procedures issued by the pools	Transmission rights, transmission pricing, congestion pricing, congestion management and market platforms	Pools and in some cases market forums, for example: NEPOOL forum in New England Power Pool

How each of these mechanisms have been attained in the different regional pools are detailed further in the following subsections.

3.3.1 Strategic and political

All the key regional pools can be seen to have a regional level agreement / MOU / treat that defines the regional energy trade and regional energy infrastructure mechanisms.

Southern African Power Pool

In case of Southern African Power Pool, the Intergovernmental memorandum of Understanding (MOU) governs the inter-utility MOU and operating agreements. Even though the market is dominated by South Africa, strong political will of other SADC member countries has contributed to the rise of market. For ex: countries such as Zimbabwe's interest in SAPP has been driven by the need to secure electricity supply due to shortages . The Markets Sub-Committee is responsible for the continued development of an appropriate electricity market in this SADC through its planning activities.

Regional Energy Market (MER) in Central American Interconnection

In case of MER in Central American interconnection, there is a strong political and intergovernmental support for regional power trade in the form of Marco treaty for Central American Electricity Market and the accompanying protocols in 1997 and 2007.

Gulf Co-operation Council (GCC) interconnection

GCC interconnection is supported right from the original GCC charter signed by the member states in 1981, followed by decision of the 18th session of GCC Supreme Council in 1997. This high level political consensus enabled the signing of various agreements such as General Agreement and Power Exchange and Trading Agreement, and the establishment of GCCIA as a joint stock company.

Greater Mekong Sub-region (GMS) Power Market

In GMS Power Market, the regional trade initiatives have been supported by the Inter-Governmental Agreement (IGA) on Regional Power Trade (2002), MoU on the Guidelines for the Implementation of the Regional Power Trade Operating Agreement-Stage 1 and the MoU on the Road Map for Implementing the Greater Mekong Subregion Cross Border Power Trading.

ASEAN Power Market

Abundant energy resources present in the member countries, (like hydropower in Cambodia & Vietnam, rich fossil reserves in Brunei, Indonesia & Malaysia, rich solar and wind in almost all countries) provide a compelling cause that drives the member countries to coordinate utilisation of available resource through energy integration. This coupled with a good history of regional cooperation among the member states in various energy integration initiatives provides a strong basis of increased political will for establishment of multilateral cross border trade in the near future.

The overall political consensus within the ASEAN for regional coordination, followed by ASEAN Plan of Action for Energy Cooperation (APAEC) has provided the political and strategic foundation for regional power trade.

Nord Pool

Strong political will of the member countries and continued cooperation amongst the Nordic countries in striving towards a liberalised market has facilitated the power exchange market to a large extent.

European Union internal power market

While the overall political consensus at EU to coordinate on all markets including electricity, and a history of regional cooperation that precedes EU provided the foundation, this was strengthened by a set of 'Energy Package' directives by the European Commission, which were issued in various timelines, depending on the needs of the market at that stage. It was these directives that also led to the establishment of supporting regional mechanisms such as ENTSO-E and ACER.

CASA regional electricity market

The foundations of CASA project were laid by the ministerial level meeting of the four countries held in May 2006, intergovernmental MoU signed in October 2006 and the formal inter-governmental agreement to set up an Inter-Governmental Council (IGC) and an associated Secretariat, signed in August 2008.

Intra-country power pools – New England, PJM, Australia NEM

The regional power pools within USA and Australia have their own history of market formation, and the supporting strategic and political framework. However, they do not have the complexity of coming under different national laws, and therefore the corresponding complexity of strategic and political issues are comparatively lesser.

3.3.2 Legal, policy and regulatory

The legal, policy and regulatory framework for regional energy trade is typically established through regional agreements, and regulations of regional regulators. These typically provide the basic framework which is then detailed further in technical and commercial documents.

Southern African Power Pool

The Inter-Utility Memorandum of Understanding among the member countries laid the foundation for the establishment of SAPP. Apart from these, there are three other regulations- SAPP's basic management and operating principles; the Agreement Between Operating Members which provide the specific rules of operation and pricing; and the Operating Guidelines, which provide standards and operating guidelines. These guidelines provide a strong bedrock for the legal and regulatory apparatus for functioning of the market.

Regional Energy Market (MER) in Central American Interconnection

MER owes a lot of its success to the decision of the member countries to treat MER as a separate seventh market, and establish new regional electricity regulator – CRIE specifically for this market. In addition, the Regional Energy Market Regulations (REMR) provided the overall regulatory framework for the regional market.

Gulf Co-operation Council (GCC) interconnection

The GCC member states have signed the General Agreement of Power Interconnection Grid with the GCCIA. The General Agreement lays out the fundamental agreement between member states with regard to use of the interconnection. The General Agreement includes provisions relating to connection fees, rights of interconnection, performance, defaults, termination, and governing law, as well as the regulatory principles committed to by the parties.

In addition to the General Agreement, state utilities enter into a Power Exchange and Trading Agreement (PETA) which sets out the terms on which the parties may connect and have access to the grid and the terms by which parties may schedule transfers of power.

Greater Mekong Sub-region (GMS) Power Market

Regional power trade in the GMS region has been facilitated by some well-built agreements like the Regional Power Trade Operating Agreement, and MoU like Road Map for Implementing the Greater Mekong Subregion Cross Border Power Trading which form the foundations for the overall regulatory framework in the market. The RPTCC under GMS has also worked on regulatory harmonization efforts such as harmonization of grid codes.

ASEAN Power Market

The Memorandum of Understanding on the ASEAN Power Grid serve as a master guideline document for the member states to follow a common policy, regulatory standards for cross-border interconnection trade.

Nord Pool

Separate regulatory authorities in the Nordic countries taking ownership of controlling the monopoly functions like network owners and system operator responsibilities have resulted in delegation of important tasks. The national regulators taking an active role in the physical and financial market have ensured market integrity and transparency.

EU internal power market

EU internal power market is supported by the various directives and regulations of European Commission, such as:

- Regulation (EC) no. 714/2009 (non-discriminatory access);
- EU Regulation 2017/2195 (balancing);
- Regulation (EU) 838/2010 (inter TSO compensation);
- Regulation (EU) 347/2013 (trans European energy infrastructure);
- Regulation on the internal market for electricity (EU, 2019); and
- Directive on the common rules for the internal market for electricity (EU, 2019).

CASA regional electricity market

Being a wheeling mechanism for PPA, CASA operates under the legal and regulatory regime of respective countries.

Intra-country power pools – New England, PJM, Australia NEM

The regional power pools within USA and Australia basically come under the common national legal framework, and some of the regulatory framework is also common. For example, in USA, the inter-state electricity trade is regulated by FERC. Therefore, associated complexities of legal, policy and regulatory harmonization are comparatively lesser in these pools.

3.3.3 Technical and operations

The technical and operational guidelines typically deal with aspects such as technical standards, imbalance management, congestion management etc., which are again mostly decided at a regional level.

Southern African Power Pool

The technical operations and management of transmission corridors are managed by utility companies of each country which is based on a licensing arrangement. This arrangement accompanied by the 'Operating Guidelines'- which provide standards and operating requirements is followed in the market helps in smooth functioning of the system.

Regional Energy Market (MER) in Central American Interconnection

The establishment of a separate transmission operator – EOR for the regional transmission network enabled MER to operate seamlessly in the six countries. This was then accompanied by various technical arrangements and documents such as Procedure for processing requests for connection to the Regional Transmission Network (RTR) and Procedure for the Application of Firm Contracts and Firm Rights.

GCC interconnection

The GCC interconnection is operated and maintained by GCCIA, which serves as the transmission and system operator for the interconnection. Along with the Power Exchange and Trading Agreement (PETA), GCCIA has developed various detailed operational procedures such as:

- GCCIA Market Procedures;
- GCCIA Exchange Market Terms and Conditions;

- Procedure for sharing of losses; and
- Procedure for conducting tests on the interconnection system etc.

Greater Mekong Sub-region (GMS) Power Market

The technical operations in the respective countries are taken care by respective state owned enterprises which paves the way for dedicated management of the transmission lines. Furthermore, The Regional Power Trade Operating Agreement (RPTOA), prepared by the Working Groups of RTPCC, lay down the operating rules and guidelines, facilitating smooth operation and management.

ASEAN Power Market

ASEAN Interconnection Master Studies (AIMS) provides the guidelines for design of an optimal interconnected grid keeping in consideration the policy and resource constraints of the member states. Establishment of Task forces for the LTMS-PIP project with defined responsibilities for each country (Singapore, Malaysia, Lao PDR, Thailand each heading a task force) makes way for a smooth project implementation process to be achieved in over two phases.

Nord Pool

The Nordic Grid Code's guidelines on the operation and planning of the electric power system and the market actors' access to the grid assists in meeting fundamental common requirements and procedures that govern the operation and development of the electric power system

EU internal power market

The technical and operational matters in EU internal power market are governed by the rules and guidelines prepared by ENTSO-E and approved by ACER.

CASA regional electricity market

There will be greater clarity on technical and operational framework for CASA once the project nears to its commissioning timeframe.

Intra-country power pools – New England, PJM, Australia NEM

Intra-country power pools such as ISO-NE, PJM and NEM has detailed technical and operational mechanisms.

Table 15: Technical and operational framework of intra-country power pools

New England Power Pool	PJM interconnection	Australia NEM
▪ Transmission, Markets, and Services Tariff (ISO Tariff) ▪ ISO Manual ▪ ISO Operating Procedures ▪ System Operating Procedures ▪ Master/Local Control Center Procedures ▪ Generator and Non-Generator VAR Capability	▪ Pre-Scheduling Operations manual ▪ Energy & Ancillary Services Market Operations manual ▪ Balancing Operations manual ▪ Cost Development Guidelines ▪ Regional Transmission Planning Process Manuals ▪ Transmission Manuals	▪ Procedure for determining Loss Factors ▪ Settlement Procedure ▪ Balancing Market Forecasts Procedure ▪ Ancillary Services ▪ Dispatch Rules

- Planning Procedures
- NERC and NPCC Compliance guidance
- Interconnection Operators Agreement
- Reserve Manuals
- Accounting & Billing Manuals

3.3.4 Commercial

The commercial framework deals with aspects such as market mechanisms, market rules, energy accounting, deviation accounting etc.

Southern African Power Pool

In SAPP, three types of trading arrangements: DAM, IDM & FPM are operational. The DAM supports an auction trading model where all sales & demand bids are aggregated at a fixed time.

The transmission pricing methodology is based on identification of wheeling path, where the Wheeling Fees are incremental costs for the use of transmission infrastructure and a wheeling rent towards provisions such as O&M costs.

The wheeling entity is paid back the amount of losses by the purchaser of wheeled power in-kind according to the time of use that the losses were incurred; peak times or off peak times. There is a capacity auction mechanism for congestion management.

SAPP follows an imbalance settlement mechanism, where imbalance settlement varies between price bands. Accordingly, there are different imbalance prices blocks. Currently these are based on generation prices. However, SAPP has plans to move to market based pricing for imbalances.

Regional Energy Market (MER) in Central American Interconnection

MER has a well-developed mechanism of market, transmission rights management, transmission pricing mechanism and deviation settlement.

The trade is a combination of multiple bilateral medium/long term trades, and trade through a short-term opportunity market.

SIEPAC uses the concept of "Transmission Right" which gives the holder of the same, the right to use the network. The EOR will organize monthly auctions for these transmission rights, for monthly and annual validity periods. The auctions will specify the available capacity for auctions, after considering existing committed transmission rights, and scheduled maintenance.

The regional transmission rates consist of Variable Transmission Charge (CVT), the Toll and the Supplementary Charge. The deviation accounting is undertaking by considering the net deviation for each time period, between programmed and actual transaction. The net deviation is multiplied by an average price to arrive at the deviation charges. However, no compensation is paid for excess injection.

GCC interconnection

Access to the GCC is limited to the national electricity utilities (PETA parties). Those utilities can make planned energy transfers between their systems, as long as they can secure a) bilateral contracts arranged between them; b) allocation of available Interconnector capacity.

The transmission prices are approved by the Advisory and Regulatory Committee, based on the recommendations of GCCIA. GCCIA has developed its own 'Procedure for sharing of losses on the GCC interconnected system'.

The energy transactions are enabled, only after confirming the availability of interconnector capacity.

Deviation less than 25 MW is settled on "in-kind" basis every week. Deviation more than 25 MW is settled by cash at a regulated price.

Greater Mekong Sub-region (GMS) Power Market

Since only bilateral trading is prevalent currently, PPA is the predominant commercial arrangement for projects. In high voltage interconnections, third party access is not permitted in these transmission lines due to the PPA contracting, which prove to be a significant barrier to higher levels of integration. However, for medium and low level voltage levels, cross-border interconnections for power exchanges exist where the grid synchronisation is achieved.

ASEAN Power Market

A well-built Energy Purchase and Wheeling Agreement (EPWA) signed by the countries of the LTMS-PIP participating countries provide clear rules on payment of wheeling and energy charges thereby facilitating a smooth commercial design of the pilot project.

Nord Pool

The Nord Pool market has a highly developed physical and financial market – which can be attributed to the transparency of the system. Equal information access for all market participants is ensured. Also, a well-developed mechanism of market, transmission rights management, transmission pricing mechanism and deviation settlement proves conducive for the hassle-free operation of both the markets. Specific Market Regulations for each market product is followed across the Nord Pool Market.

EU internal power market

EU supports non-discriminatory access to transmission infrastructure through Regulation (EC) no. 714/2009 of the European Commission. The ENTSO-E guidelines on Capacity Allocation and Congestion Management sets out the methods for calculating how much space can market participants use on cross border lines without endangering system security.

Each country is free to adopt its own transmission pricing and methodology as long as it is within compliance of the overall EC directives. However, in addition, ENTSO-E also supports an Inter TSO compensation mechanism. In addition to country wise loss accounting adopted in respective countries, ENTSO-E separately calculates losses on account of inter-TSO transfers. The EU Regulation 2017/2195 of 23 November 2017 lays down detailed rules on electricity balancing, including establishing common principles for the procurement, activation and exchanges of balancing energy, the procurement and exchange of balancing capacity and sharing of reserves, including the allocation of cross-zonal capacity.

CASA regional electricity market

The PPA rates are negotiated between the parties, and indexed with various inflation indices. The wheeling charge for Tajikistan, and transit charges for Afghanistan is commercially negotiated between the parties, and indexed with inflation.

Intra-country power pools – New England, PJM, Australia NEM

The commercial mechanism of intra-country power pools such as New England, PJM and NEM are mostly power market/power exchange oriented, with mechanisms such as Open Access Transmission Tariffs, Transmission Service Fees/Charges, and Loss Factors.

Table 16: Commercial framework for intra-country power pools

Parameter	New England Power Pool	PJM interconnection	Australia NEM
Open access/ transmission rights	Through-or-out Transmission (TOUT) service	Point-to-Point Transmission Service and Network Transmission Service	All generators have open access rights
Transmission fees	TOUT charges	Network Integration Transmission Service (NITS) rates, separately for zonal (network users) and point-to-point users Transmission Enhancement Charge	Inter-regional Transmission Use of System Charges
Congestion management	Congestion cost calculation by ISO	Through Financial Transmission Rights	Congestion prices incorporated in spot price
Deviation management	Settled based on Real Time Locational Marginal Pricing	Based on PJM-wide real-time system energy price	Managed through procuring balancing services

3.3.5 Institutional

All the regional pools can be seen to have a robust regional level institutional framework to deal with CBET.

Southern African Power Pool

The institutional design of SAPP is considered to be well run by the SAPP Coordination Centre which is in charge of coordinating activities of planning and expanding generation, transmission and distribution among member countries.

The Energy Ministers of SADC are responsible for resolving major policy issues in the SAPP and for admitting new members to the pool. Regional Electricity Regulators Association of Southern Africa (RERA) provides recommendations on harmonization of the regulatory framework as well as provide an enabling environment for investment in the region's power sector.

Regional Energy Market (MER) in Central American Interconnection

MER has a strong regional institutional framework in the form of CDMER (Coordination at intergovernmental level), CRIE (Development of regulations, dispute resolution), EOR (Development of commercial and operational procedures and reports, operation of regional transmission line, undertake transmission right auctions, manage contingencies and network congestions) and EPR (Build and maintain the regional transmission network).

GCC interconnection

GCCIA develops, operates and maintains the interconnection, and undertake coordination through its various committees. The GCCIA board together with the planning committees and the operating committees (also nominated by GCC member states) form a General Assembly, which makes decisions on codes and agreements governing trade among member utilities and governing the activities of the GCCIA itself.

The GCC Ministerial Committee comprises ministers of electricity and water from each of the member countries. This committee, with inputs from the Regulatory Advisory Committee, guides the GCCIA board of directors on its policies and procedures.

Greater Mekong Sub-region (GMS) Power Market

The GMS power market is supported through Regional Power Trade Coordination Committee (RPTCC), which is comprised of officials from the energy departments and ministries. A more permanent institution -

Regional Power Coordination Center (RPCC) is planned. RPCC will serve as a permanent institution to enhance regional power trade and implement regional power interconnection in the GMS; (ii) provide updates on the Greater Mekong Subregion (GMS) countries' power development plans focusing on cross-border projects; (iii) review the Updated Articles of Association of the RPCC; and (iv) discuss the continuing assistance of development partners to promote power trade in the GMS.

ASEAN Power Market

ASEAN already has the presence of various institutions having a strong foothold in the member states working together to facilitate the transition of the market into a full-fledged regional power market. These include Heads of ASEAN Power Utilities (HAPUA), ASEAN Power Grid Consultative Committee (APGCC), ASEAN Centre for Energy (ACE), ASEAN Energy Regulatory Network, and LTMS PIP working group.

Nord Pool

In the initial days, Nord Pool was supported by Nordel, founded in 1963 as a body for co-operation between the transmission system operators of Nord Pool. Once ENTSO-E was established, this function was taken over by ENTSO-E. The Agency Cooperation of Energy Regulators (ACER) approves the network codes, and coordinates the work of national regulatory authorities. Meanwhile, a more region specific association of regulators is also present, in the form of NordREG, which is an organisation for the Nordic energy regulators.

The official Nordic co-operation is channelled at governmental level through two organisations: the Nordic Council and the Nordic Council of Ministers. There is also a Nordic Energy Research platform for cooperative energy research and analysis under the Nordic Council of Ministers.

EU internal power market

The key coordination body on transmission within the EU internal power market is the European network of transmission system operators for electricity (ENTSO-E). ENTSO-E was established in 2009 and was given legal mandates by the EU's Third Legislative Package for the Internal Energy Market. The Agency Cooperation of Energy Regulators (ACER) approves the network codes, and coordinates the work of national regulatory authorities.

CASA regional electricity market

In August 2008, Kyrgyzstan, Tajikistan, Pakistan and Afghanistan entered into a formal inter-governmental agreement to set up an Inter-Governmental Council (IGC) and an associated Secretariat to steer the development of the project. The CASA-1000 Secretariat is located in Almaty, Kazakhstan.

Intra-country power pools – New England, PJM, Australia NEM

The institutional mechanism of intra-country power pools such as New England, PJM and NEM are mostly in the form of working groups/committees/sub committees formed to look after specific aspects such as planning, operations and market development. Additional coordination mechanisms exist in some cases. For example, New England has NEPOOL which is an association of market agents in the region.

4 Review of Current Framework for CBET in South Asian Countries, and their preparedness for transition to CBTMPT

4.1 Introduction

The current framework for CBET in South Asian countries, and their preparedness for transition to CBTMPT is detailed out further in this chapter. The preparedness for transition to CBTMPT is assessed in terms of the key mechanisms for CBTMPT identified earlier in this document, which consists of the following:

- Strategic and political framework
- Legal, policy and regulatory framework
- Technical and operational framework
- Commercial framework (including Transmission line development methodology, Transmission pricing and loss accounting, open access / wheeling of power, deviation settlement etc.)
- Institutional framework

Any specific provisions related to sustainability viz-a-viz CBET is also being covered within the above five elements.

The country wise analysis of the same, along with a regional overview is provided in the following sections. This looks at three key aspects: (1) the existing framework for CBET, (2) a SWOT analysis for transition to CBTMPT considering the existing CBET framework, and (3) a gap analysis on framework for CBET. These three together provide signals on the preparedness of the countries for transition to CBTMPT in the future.

4.2 Afghanistan

4.2.1 Current Framework of CBET

Parameters related to CBET	Comments
Strategic and political framework	• Afghanistan is one of the participating countries of Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000), wherein available summer electricity surpluses from Tajikistan and Kyrgyz Republic will be transmitted to Pakistan and Afghanistan through HVDC lines. • The country is also one of the signatories of SAARC Framework Agreement for Energy Cooperation (Electricity), signed between the South Asian countries in November 2014. • Afghanistan currently has arrangements to import power from Iran, Tajikistan, Uzbekistan and Turkmenistan.
Legal policy and regulatory framework	• The Power Services Regulation Act, 2016 allows awarding of import licenses and export licenses, for a maximum period of 15 years. • No specific instances of regulatory framework to support CBET could be found

Parameters related to CBET	Comments
Technical and operational framework	• Afghanistan has three distinct geographically separate transmission networks: Northeast Power system (NEPS), Southeast Power System (SEPS) and Herat (Presently covered by imports from Iran and Turkmenistan) • Northeast Power System of Afghanistan (NEPS) is supplied by existing hydropower and diesel projects of Afghanistan and imported power from Uzbekistan and Tajikistan • Under the CASA-1000 project, Afghanistan is entitled to obtain a wheeling charge, for use of its transmission network, for transmission of power from Tajikistan and Kyrgyz Republic to Pakistan.
Commercial framework	• No specific commercial framework for transmission tariffs, open access etc. except for commercial provisions under the CASA-1000 project.
Institutional framework and stage of power sector reform	• Afghanistan is under a vertically integrated single buyer model of power sector where most of the generation, and the entire transmission and distribution of electricity is carried out by the Government owned Da Afghanistan Breshna Shekat (DABS). Private sector involvement is limited to generation sector.

4.2.2 SWOT analysis for transition to CBTMPT

Strengths	Weaknesses
• Experience in undertaking CBET with nearby countries such as Iran, Tajikistan, Turkmenistan, and Uzbekistan under bilateral arrangements. • Import and Export activities are defined as licensed activities, as per the laws.	• Lack of a robust and unified national grid • Existing cross border transmission interconnections are limited to 220KV
Opportunities	**Threats**
• Afghanistan can provide an important link between South Asia and Central Asia for energy cooperation, such as the planned CASA-1000 project. • A wheeling tariff mechanism is already proposed in CASA-1000.	• Political stability and peace within the country are uncertain in the current geopolitical context.

4.2.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, and existing trade with Iran and Central Asia
Legal and policy and regulatory framework	✓	The Power Service Regulation Act, 2016 recognizes import and export of electricity as licensed activities. Regulatory framework for CBET is yet to evolve.

Requirement for CBET	Availability	Comments
Technical and operational framework	✗	No grid code, planning methodology regulations etc.
Commercial framework	◐	The wheeling arrangement under CASA-1000 can be a precursor for similar arrangements in future. Wheeling tariff under CASA-1000 is based on negotiations. Transmission tariff under CASA-1000 is currently estimated, based on anticipated amortization costs of loans. Mechanism for settlement of deviations is yet to evolve.
Institutional framework and stage of power sector reform	◐	Institutional framework is not fully developed (mostly vertically integrated), and power market reforms are also at a basic level.

✓ *Available* ◐ *Partially Available* ✗ *Not Available*

4.3 Bangladesh

4.3.1 Current Framework of CBET

Parameters Defining CBET	Comments

Strategic and political framework	• Bangladesh has signed bilateral agreements with India and Nepal, for regional cooperation in electricity.
	  ▪ India-Bangladesh: MoU for Cooperation in Power sector, January 2010.
	  ▪ Nepal-Bangladesh: MoU for Cooperation in Power sector, August 2018.
	• The Power Sector Master Plan of Bangladesh envisages up to 15% of generation capacity from imports.[158]
	• The country is also one of the signatories of SAARC Framework Agreement for Energy Cooperation (Electricity), signed between the South Asian countries on November 2014; and the MoU for establishment of the BIMSTEC Grid Interconnection, signed in August 2018.

Legal policy and regulatory framework	• The Quick Enhancement of Electricity and Energy Supply (Special Provisions) Act, 2010 agrees on the need for quick implementation of the plan to import electricity and energy from abroad. • The Electricity Act 1910 also has provisions for enabling cross border trade provision to obtaining sanction from the government. • As per 'Policy Guidelines For Enhancement Of Private Participation In The Power Sector, 2008', PGCB and all Distribution Licensees shall provide non-discriminatory open access, to their transmission and/or distribution system for use by any Generation Licensee subject to payment of transmission/distribution wheeling charges determined by BERC. • Regulations on cross border trade have not yet evolved.

Parameters Defining CBET	Comments
Technical and operational framework	• BERC has approved the 'Grid Code', which mentions the transmission system planning, security standards, scheduling, frequency management, metering and protection aspects. • As per the Grid Code, a Power System Master Plan is to be prepared, updated periodically (preferably once in every five years) which covers both generation and transmission system expansion plan.
Commercial framework	• Regulatory framework already has other enabling provisions such as transmission pricing and grid code.
Institutional framework and stage of power sector reform	• Bangladesh has an unbundled power sector, where generation, transmission and distribution of electricity is undertaken by different entities. The Bangladesh Power Development Board (BPDB) plays the role of single buyer in the electricity market. • The Power Grid Company of Bangladesh (PGCB) undertakes transmission of electricity, while a National Load Despatch Center operated by it undertakes system operation.

4.3.2 SWOT analysis for transition to CBTMPT

Strengths	Weaknesses
• Experience in undertaking CBET with India. • Presence of multiple cross border interconnections. • Availability of a detailed grid code.	• Nil
Opportunities	**Threats**
• Open Access is specified in policy, while transmission pricing is also available. Thus, regulatory initiatives to enabled multilateral trade will be comparatively lesser. • Potential trade with Myanmar, and with countries that do not share border with Bangladesh, such as Bhutan and Nepal.	• Nil

4.3.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, BIMSTEC interconnection MoU, existing trade with India, bilateral MoUs with India and Nepal, long term import vision provided in power sector master plan

Requirement for CBET	Availability	Comments
Legal and policy and regulatory framework	🗸	A few policy provisions supporting power import are there
Technical and operational framework	🗸	Currently, the transmission line development is undertaken by PGCB, while an overall transmission system plan form part of the country's PSMP. Grid code regulations are also present.
Commercial framework	🗸	Transmission pricing mechanism is available, under BERC (Power Transmission Tariff) Regulations, 2016. There is policy provision for non-discriminatory open access. PGCB already provides wheeling service to the distribution licensees. Coherent commercial mechanism to treat system imbalances from scheduled transaction is absent
Institutional framework and stage of power sector reform	🗸	Institutional framework is well developed though power market remains on single buyer model

✓ *Available* 🗸 *Partially Available* ✗ *Not Available*

4.4 Bhutan

4.4.1 Current Framework of CBET

Parameters Defining CBET	Comments

Strategic and political framework	• Bhutan has signed various agreements with India for cooperation in power sector such as:
	  ○ Treaty of Friendship and Cooperation (signed in 1949 and revised in 2007);
	  ○ 2006 Agreement on Cooperation in Hydropower and the Protocol to the 2006 agreement signed in March, 2009 (10,000 MW hydropower to be developed, with surpluses exported to India); and
	  ○ Inter-Governmental Agreements for development of four HPPs of 2120 MW, signed in April 2014.
	• The country is also one of the signatories of SAARC Framework Agreement for Energy Cooperation (Electricity), signed between the South Asian countries on November 2014; and the MoU for establishment of the BIMSTEC Grid Interconnection, signed in August 2018.

Legal policy and regulatory framework	• The Electricity Act 2001 covers aspects relating to licensing, system operations, non-discriminatory access to transmission and distribution. • The Act recognises export and import of electricity as licensed activities. The Act also allows the Bhutan Electricity Authority (BEA) to designate a bulk

Parameters Defining CBET	Comments
	supplier who will be responsible for the wholesale supply, including import and export of electricity. • A corporation can apply to the Authority for the issue of a licence authorizing trade, and for import and export of electricity, according to the Electricity Act of Bhutan, 2001
Technical and operational framework	• Bhutan's Grid code has provisions which specify the principles, procedures and criteria for the planning and development of the transmission system and promote coordination among all licensees • The Grid Code covers all important aspects of transmission system operation, including operation planning. The system is considered to be in a normal state when the transmission system frequency is within the limit of 49.5 Hz to 50.5 Hz.
Commercial framework	• There are tariff regulations, though transmission tariff is embedded within the overall tariff.
Institutional framework and stage of power sector reform	• Bhutan's power sector is mostly a monopoly, where only entities which are either fully or partly owned by the Government undertakes large generation projects, transmission and distribution of electricity. Bhutan Power Corporation (BPC) acts as the single buyer, transmission utility and distribution utility. • The power sector is regulated by Bhutan Electricity Authority. Bhutan Power System Operator (BPSO), which works under BPC, is entrusted to coordinate and regulate power system operation.

4.4.2 SWOT analysis for transition to CBTMPT

Strengths	Weaknesses
• Bhutan has developed mechanisms for sharing the benefits of power export in a mutual manner which allows lower retail tariffs for residential consumers. Hence power export projects receive public support. • Bhutan has strong strategic cooperation agreements with India for development of trade oriented hydropower projects. • Long history and experience on CBET with India.	• 100% private sector involvement in large generation projects is not allowed.
Opportunities	**Threats**
• With a clearly identified pipeline of ongoing and planned projects, it is easier for Bhutan to proceed with its plans for export oriented projects,	• Nil

including potential projects for export to Bangladesh.	

4.4.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, BIMSTEC interconnection MoU and existing trade and various agreements with India on energy cooperation
Legal and policy and regulatory framework	◯	The Electricity Act mentions licensing of import and export of electricity, and authorizing of bulk supplier to undertake import and export. Regulatory framework for CBET is yet to evolve.
Technical and operational framework	◯	Grid code regulations are available. The Grid code specifies the transmission system development process and operation.
Commercial framework	◯	The tariff framework allows calculation of costs separately for wheeling services, though currently at the end the tariffs are bundled as BPC undertakes both transmission and distribution. Though the Electricity Act mentioned open access, in reality, private investment itself has limitations, thereby not leading to further question of open access.
Institutional framework and stage of power sector reform	◯	Institutional framework is comparatively well developed though power market remains at a single buyer model.

✓ *Available* ◯ *Partially Available* ✗ *Not Available*

4.5 India

4.5.1 Current Framework of CBET

Parameters related to CBET	Comments
Strategic and political framework	• India has been undertaking CBET with Bangladesh, Bhutan, Myanmar and Nepal under Intergovernmental Agreements / MoUs, such as the following: ▪ India-Bangladesh: MoU for Cooperation in Power sector, January 2010. ▪ India-Bhutan: Agreement on Cooperation in Hydropower, July 2006; and Framework Inter-Governmental Agreement for Joint Venture Hydropower Projects, April 2014. ▪ India-Myanmar: MoU for Cooperation in Power sector, October 2016. ▪ India-Nepal: Agreement on electric power trade, cross-border transmission interconnection and grid connectivity, October 2014. • India is also one of the signatories of SAARC Framework Agreement for Energy Cooperation (Electricity), signed between the South Asian countries on November 2014;

Parameters related to CBET	Comments
	and the MoU for establishment of the BIMSTEC Grid Interconnection, signed in August 2018.
Legal policy and regulatory framework	• The policy framework for CBET is defined in Government of India's Guidelines for Import/Export (Cross Border) of Electricity, 2018. These guidelines have laid down the broad principles for eligibility, approval process, institutional framework, tariff, and transmission aspects for CBET. The guidelines have enabling provisions for trilateral power trade, and trade through power exchanges. • Currently, the legal framework, provided through Electricity Act, 2003 does not directly refer to CBET. However, a proposed amendment to the Act, introduced in 2020 seeks to define CBET, and define the role of Central Government and Central Electricity Regulatory Commission (CERC) in relation to CBET. • Based on Government of India's Guidelines for Import/Export (Cross Border) of Electricity, 2018, the CERC has issued its regulations on Cross Border Trade of Electricity in 2019.
Technical and operational framework	• As per the provisions of the guidelines, the Designated Authority [Member (Power Systems) of Central Electricity Authority] has issued its 'Procedure for approval and facilitating import/export (cross border) of electricity' in 2021. • The detailed procedure documents of National Load Despatch Center deals with procedure for determination of total transmission capacity (TTC). available transmission capacity (ATC), and congestion management.
Commercial framework	• Open Access – Open access to lines is allowed under Electricity Act, 2003 with its implementation as per detailed regulations issued by CERC in inter-state level. • Deviation Settlement – Deviation Settlement Mechanism and related matters Regulations, 2014 provide the guidelines for deviation/imbalance charges and settlement. For cross border transactions, deviation settlement is also in some cases related to the intergovernmental agreements. For example, energy from Tala, Kurichhu HPPs in Bhutan are deemed to have always generated as per schedule, for their actual injection to India. In comparison, for Dagachhu HPP, there is an energy accounting and deviation settlement mechanism separately specified by CERC. • Transmission line development – To be undertaken under Tariff Based Competitive Bidding, as per Govt. of India's Tariff Policy. However, there are a few exceptions for development of lines in the conventional regulated tariff route also (*Exceptions can be allowed for specific category of projects of strategic importance, technical upgradation etc. or for works required to be done to cater to an urgent situation*). • Transmission pricing – Nodal pricing, sensitive to distance, quantum and direction under 'Point of Connection' methodology. • Transmission loss accounting – Transmission loss determined under 'Point of Connection' methodology, with losses revised on a weekly basis.

Parameters related to CBET	Comments
	• Power exchange – The Power Market Regulations of CERC deals with eligibility requirements, approval processes and compliance requirements for power exchanges. The power exchanges have their business rules and bylaws which are approved by CERC. The Open Access in inter-State Transmission Regulations specify the procedure for scheduling of bilateral and collective (exchange) transactions, along with associated fees, charges and curtailment rules.
Institutional framework and stage of power sector reform	• There is a well-developed institutional structure. The power market has wholesale competition, enabled through competitive bidding, power traders, power exchanges and open access. There is also retail competition in some of the areas.

4.5.2 SWOT Analysis for transition to CBTMPT

Strengths	Weaknesses
• Clear definition of policy, institutional and regulatory framework for CBET • Presence of two power exchanges • Presence of multiple power trading licensees • Strong national grid • Well defined technical, commercial and operational framework for power trade	• There could be concerns on inadequate recovery of transmission costs through wheeling mechanism under trilateral power trade • Detailed operational and commercial procedures for CBTMPT is yet to evolve
Opportunities	**Threats**
• Facilitate CBET through power exchanges (Already started with Nepal, for export of power from India) • Setting up a South Asia Regional Power Exchange • Allow trilateral trade which allows wheeling through Indian grid	• India's guidelines for import/export of electricity still allows Government of India to decline approval for CBET transactions based on ownership, which may cause dissatisfaction among other countries, in case any such approvals are denied on ownership grounds.

4.5.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, BIMSTEC MoU, bilateral cooperation agreements with multiple countries and existing trade with multiple countries.
Legal and policy and regulatory framework	✓	GoI guidelines enable trilateral power trade, and trade through power exchanges. CERC regulations on Cross Border Trade of Electricity, 2019 has defined the regulatory framework for CBET

Requirement for CBET	Availability	Comments
Technical and operational framework	✓	There is a well-defined grid code, overall transmission planning process etc.
Commercial framework	✓	Mechanisms for transmission loss accounting, energy accounting, transmission pricing, deviation pricing etc. are well developed. For cross border lines, different modalities are available – Development under regulated tariff mechanism, development through tariff based competitive bidding and development under intergovernmental agreements.
Institutional framework and stage of power sector reform	✓	Institutional framework is fully developed, and power market reforms are at a comparatively advanced level.

✓ *Available* ✓ *Partially Available* ✗ *Not Available*

4.6 Maldives

Due to its geographic location, surrounded by ocean, with nearly 1000 kms to the nearest mainland, cross border electricity trade is not a viable option for Maldives. Therefore, legal/regulatory framework for CBET, of preparedness for transition to CBTMPT is not currently relevant in the context of Maldives.

4.7 Nepal

4.7.1 Current Framework of CBET

Parameters Defining CBET	

Strategic and political framework	• Nepal has signed agreements with India and Bangladesh, for cooperation in power sector:
	  ○ India-Nepal: Agreement on electric power trade, cross-border transmission interconnection and grid connectivity, October 2014.
	  ○ Nepal-Bangladesh: MoU for Cooperation in Power sector, August 2018.
	• Country is one of the signatories to SAARC Framework Agreement for Energy Cooperation (Electricity), signed in 2014; and the MoU for establishment of the BIMSTEC Grid Interconnection, signed between BIMSTEC countries in August 2018.
	• Government of Nepal's white paper issued in 2018 has set a target of developing 5000 MW of export oriented capacity in ten years.

Legal policy and regulatory framework	• Nepal's Electricity Act has a dedicated section covering import and export of electricity. ○ Licensees can import electricity after obtaining the approval of Government of Nepal.

Parameters Defining CBET	
	○ The licensee desiring to export electricity generated on its own to the foreign country may do so by entering into an agreement with Government of Nepal. • Draft Electricity Bill 2019 mentions that for import/export of power, approval from the Ministry of Energy (MoEWRI) has to be taken. • Nepal's Hydropower Development Policy of 2001 has stated support for export-oriented projects. • An independent electricity regulatory commission started functioning in Nepal only from May 2019. The regulatory framework is in its initial stages, and therefore regulatory framework for CBET remains to be developed.
Technical and operational framework	• Transmission System Development Plan of Nepal, 2018 includes the six Nepal-India cross-border connection points in the Terai Region and two Nepal-China cross-border connection points in the Himalayan Region. • The hydropower plants are required to provide monthly forecasts of energy to be delivered. For shortfall in actual energy delivery, there are penalties imposed upon them.
Commercial framework	• The Electricity Regulatory Commission Act, 2017 envisages open access to electricity system, and establishment of wholesale market.
Institutional framework and stage of power sector reform	• Nepal has a mostly bundled structure of power sector, with private sector involvement only in power generation. Part of the power generation, entire transmission, and almost entire distribution of electricity is undertaken by the government owned Nepal Electricity Authority (NEA). NEA also acts as the single buyer for all PPAs. • The sector is regulated by Electricity Regulatory Commission (ERC) while licensing is undertaken by Department of Electricity Development (DOED). • Currently, a department within NEA is the custodian of all power trading related activities in Nepal. A dedicated entity - Nepal Power Trading Company Limited (NPTC') was incorporated in March 2017, with NEA as the major shareholder (51 percent). License for power trading has already been issued to NPTC. However, it is still not operational, due to lack of cross border guidelines.

4.7.2 SWOT Analysis for transition to CBTMPT

Strengths	Weaknesses
• Strong level of cooperation with India on energy trade. • Have already identified various new cross border lines with India and China, as part of the Transmission System Master Plan.	• There are ambiguities in institutional framework for CBET and licensing. • The grid code is prepared by NEA, though not separately reviewed and approved by regulator yet.

• Have started participation in undertaking CBET through India's power exchange.	
Opportunities	**Threats**
• Energy banking agreement with India • Trilateral arrangements with Bangladesh and India can set the foundation for future trilateral and multilateral trades in the region • ERC Act has enabling provisions for open access and wholesale market • Proposed draft of Electricity Act has provisions for trading licensees and approval of CBET transactions.	• There are concerns on cost competitiveness of hydropower from Nepal, especially if concessional financing or grants are not available for projects.

4.7.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, BIMSTEC MoU, bilateral cooperation agreements with India and Bangladesh and existing trade with India
Legal and policy and regulatory framework	◊	Electricity Act has provisions relating to approval of import and export of electricity. Hydropower Development Policy promotes export oriented projects. However detailed guidelines / Rules relating to CBET are not available.
Technical and operational framework	◊	Grid code developed by Nepal Electricity Authority (NEA) is being used. Transmission System Development Plan of Nepal, 2018 has identified the new lines required for CBET. However, financing modalities, cost recovery mechanisms etc. are decided on a case by case basis for cross border lines.
Commercial framework	◊	Open access for wheeling of power is not yet operationalized. NEA continues as the single buyer. Mechanism for settlement of deviations is yet to evolve. However, to promote responsibility in scheduling, there is a penalty mechanism for hydropower generators with monthly and weekly schedule declarations.
Institutional framework and stage of power sector reform	◊	Institutional framework is not fully developed (mostly vertically integrated, except for generation), and power market reforms are on a basic level.

✓ *Available* ◊ *Partially Available* ✗ *Not Available*

4.8 Pakistan

4.8.1 Current Framework of CBET

Parameters Defining CBET	
Strategic and political framework	• Pakistan is one of the participating countries of Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000), wherein available summer electricity surpluses from Tajikistan and Kyrgyz Republic will be transmitted to Pakistan and Afghanistan through HVDC lines. • Country is one of the signatories to SAARC Framework Agreement for Energy Cooperation (Electricity), signed in 2014 • Pakistan currently has arrangements to import power from Iran.
Legal policy and regulatory framework	• National Electric Power Regulatory Authority's (NEPRA) Import of power regulations of December 2017 lays down principles of power import and covers aspect such as approval of rate of import, and execution of PPA. • Pakistan has recently transitioned from a single buyer plus model to the wholesale/competitive electricity market model. • In 2020, NEPRA had approved the detailed design and implementation plan of the Competitive Trading Bilateral Contract Market (CBTCM), which enables a competitive environment in the power sector. The CTBCM implementation has started on June 2022, on a test-run basis for the initial six months. Post the test-run period, financial transactions will commence under the CTBCM to achieve the benefits of affordable, reliable, and sustainable electric power for the consumers of the power sector of Pakistan. • NEPRA's Electric Power Trader Regulations of 2022 provides the regulatory framework for licensing and operation of electric power traders. These Regulations also allow a **Power Trader to be provided license for "import of export of power".** • NEPRA's Market Operation Regulations of 2022 defines the regulatory framework for the licensing and operation of Market Operator. •
Technical and operational framework	• The Grid Code specifies the detailed planning code, connection code and scheduling code. For wind and solar power plants, there is day ahead, four hourly and hourly scheduling requirements. Deviation in actual generation from hourly schedule will necessitate a rebate to be offered by the generator to the buyer.
Commercial framework	• There are regulations for transmission tariff determination (NEPRA Guidelines to Lay Down the Methodology & Process for Determination of Revenue Requirement and Use of System Charges for Transmission Licensee, 2017). • NEPRA's 'Wheeling of Electric Power' Regulations of 2016 require transmission licensees and distribution companies to offer non-discriminatory open access to their networks.

Parameters Defining CBET	
	• NEPRA has approved Market Operator Commercial Code which includes commercial framework for bilateral power trade. As per the code, both transmission service provider and distribution service provider are mandated to provide open access to their network to market participants under CTBCM.
Institutional framework and stage of power sector reform	• Pakistan has taken major steps towards the unbundling, privatization and regulation of the power sector, as well as allowing competition. • The sector is regulated by NEPRA. • Pakistan has recently shifted from a single buyer model to a wholesale/competitive electricity market model called as Competitive Trading Bilateral Contract Market (CBTCM). NEPRA has granted the market operator licence under CTBCM to the Central Power Purchasing Agency (Guarantee) Limited (the CPPA-G). The market operator will be responsible to administer its operations, standards of practice and business conduct of market participants in accordance with the market commercial code approved by the Authority. • Transmission is undertaken by the National Transmission Dispatch Company (NTDC). • Under CTBCM, there are two types of electric suppliers – competitive electricity supplier, and provider of last resort. Further, the bulk power consumers (BPC) have the option to buy electricity from a competitive supplier of his choice, or from wholesale market.

Competitive Trading Bilateral Contract Market (CTBCM) Commences in Pakistan[159]

In a landmark decision that will usher in a new era of competition and help address the woes of the power sector, on June 2022, NEPRA has granted the market operator licence under CTBCM to the Central Power Purchasing Agency (Guarantee) Limited (the CPPA-G). The market operator will be responsible to administer its operations, standards of practice and business conduct of market participants in accordance with the market commercial code approved by the Authority.

To enable CTBCM, after the final design of CTBCM was approved by NEPRA in 2020, the relevant regulations were approved and notified within due timelines of 18 months. Further, all the critical actions including deployment of IT system, operationalization of market departments (MIRAD) in DISCOs etc. were also completed within 18 months.

The CTBCM is expected to improve the governance of the power sector through institutional reforms, improved procurement and payment discipline, utilization of merchant generators without take-or-pay contracts, bilateral contracting by DISCOs based on demand forecasts and capacity obligations gradually moving away from sovereign guarantees, resulting in billions of rupees of saving, deployment of IT tools, automation of business processes, capacity building of human resources, etc. The successful implementation of the CTBCM has the potential to turn around the overall technical, financial, commercial, and legal climate of the power sector. Further, large consumers will now be able to purchase electric power from the suppliers of their choice at the cheaper and bilaterally agreed rates rather than purchase from DISCOs at regulated tariff.

4.8.2 SWOT Analysis for transition to CBTMPT

Strengths	Weaknesses

• Detailed regulatory framework for grid code, transmission pricing, wheeling of power, **Market Operator Commercial Code**, etc. • Experience in undertaking CBET with Iran. • Commencement of competitive wholesale market operations under CTBCM framework	• There is no government level guidelines / policy for CBET.
Opportunities	Threats
• Competitive market operations are expected to develop and mature under CTBCM • Pakistan plays a key role in linking South Asia and Central Asia for energy cooperation, such as the planned CASA-1000 project.	• Having Iran as a key partner for CBET makes such CBET subject to potential future international sanctions on Iran.

4.8.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, existing trade with Iran and CASA-1000 agreement
Legal and policy and regulatory framework	✓	Presence of basic regulatory framework covering approval for rate of import of power Regulatory framework for competitive market is already available under CTBCM. If the Government wishes, the same can easily be extended to cover cross border electricity trade transactions also.
Technical and operational framework	✓	Well-developed grid code and other technical frameworks. Deviation settlement mechanism is available for wind and solar power plants. The regulatory framework relating to transmission planning could improve further.
Commercial framework	✓	Transmission investments are recovered through transmission and use of system charges determined by regulator – NEPRA Guidelines to Lay Down the Methodology & Process for Determination of Revenue Requirement and Use of System Charges for Transmission Licensee, 2017 NEPRA's 'Wheeling of Electric Power' Regulations of 2016 require transmission licensees and distribution companies to offer non-discriminatory open access to their networks. Competitive market participation is allowed for bulk power consumers, power traders etc. under CTBCM. Open access is mandated for transmission and distribution network service providers. For wind and solar power plants, there is day ahead, four hourly and hourly scheduling requirements. Deviation in actual generation from hourly schedule will necessitate a rebate to be offered by the generator to the buyer.
Institutional framework and stage of power sector reform	✓	Institutional framework is well developed, and power market reforms have shifted to competitive markets. Market Operator Commercial Code covering commercial framework for bilateral power trade has been approved by NEPRA.

✓ *Available* ✓ *Partially Available* ✗ *Not Available*

4.9 Sri Lanka

4.9.1 Current Framework of CBET

Parameters Defining CBET	Comments
Strategic and political framework	• In June 2010, an agreement on conducting a feasibility study for the interconnection of the Indian and Sri Lankan electricity grids was signed between the respective Governments.[160] The proposed India-Sri Lanka grid interconnection involves the construction of a submarine or overhead connection between Madurai in South India, and Anuradhapura in central Sri Lanka, through the Palk Strait • Country is one of the signatories to SAARC Framework Agreement for Energy Cooperation (Electricity), signed in 2014; and the MoU for establishment of the BIMSTEC Grid Interconnection, signed between BIMSTEC countries in August 2018. • In 2017, a Memorandum of Understanding (MoU) was signed with India on economic co-operation. Sri Lanka and India also undertakes Secretary level Joint Working Group meetings on cooperation in power sector.
Legal policy and regulatory framework	• The regulatory framework specific to cross border electricity trade is not available. Framework for open access is also not available as CEB continues to be the single buyer for electricity.
Technical and operational framework	• The grid code published in 2014 lays down rules for transmission planning, system modelling and operation, generation planning, grid connection etc. • Ceylon Electricity Board (CEB) publishes its Long Term Transmission Development Plan (LTTDP) at regular intervals.
Commercial framework	• Transmission pricing is partially covered under PUCSL's 'Tariff Methodology' which defines the manner for arriving at revenue requirement for transmission function.
Institutional framework and stage of power sector reform	• The Public Utilities Commission of Sri Lanka (PUCSL) regulates the energy sector, while larger policy decisions are undertaken by the Ministry of Power and Energy. The Ceylon Electricity Board (CEB), which is a legacy vertically integrated utility acts as the single buyer, procuring power from all generating stations, for supply to distribution companies.

4.9.2 SWOT Analysis for transition to CBTMPT

Strengths	Weaknesses
• Sri Lanka's dependence on liquid fuel based generation increases on draught years. CBET	• Legal and policy framework for CBET is not available.

offers a way to reduce such costly liquid fuel based power.	
Opportunities	**Threats**
• The existing Tariff Methodology can be leveraged to result in a separate transmission tariff to be specified, if required.	• Nil

4.9.3 Gap analysis and preparedness for transition to CBTMPT

Requirement for CBET	Availability	Comments
Strategic and political framework	✓	SAARC Framework Agreement, and BIMSTEC interconnection MoU. Agreements and intergovernmental arrangements with India on cooperation in power sector
Legal and policy and regulatory framework	◊	Key and supporting regulatory framework for CBET is yet to be developed.
Technical and operational framework	◊	Presence of rules for transmission planning, system modelling and operation in Grid Code
Commercial framework	◊	Revenue requirement for transmission covered in Tariff Methodology. There is no direct reference to open access. Commercial mechanism to deal with the calculation and settlement of imbalances post-delivery of the scheduled amount of power is absent.
Institutional framework and stage of power sector reform	◊	Institutional framework is not fully developed (mostly vertically integrated), and power market reforms are also at a basic level.

✓ *Available* ◊ *Partially Available* ✗ *Not Available*

5 Potential and long term prospects and benefits of CBTMPT in South Asia region

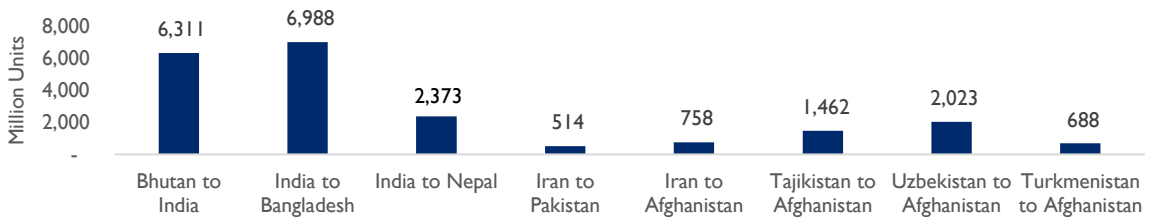
While developing the regional framework for CBTMPT, it is also important to consider the current scenario of electricity trade in South Asia, and the future prospects of its growth, including the transition to trilateral and multilateral trade. Meanwhile it is also important to have a look at the potential benefits of trilateral/multilateral power trade, which can be considered by the policy makers whole developing any framework / guideline related to CBTMPT. This chapter seeks to cover these aspects, and also to identify the key opportunities and challenges for South Asia's transition to CBTMPT.

5.1 Current status of power trade

The power trade in South Asia is predominantly bilateral, be it in the eastern region between India – Bangladesh/Bhutan/Nepal, or in the western region, between Iran – Pakistan, Iran – Afghanistan, Tajikistan – Afghanistan, Turkmenistan – Afghanistan and Uzbekistan – Afghanistan. The trade is undertaken mostly under medium term and long term power purchase agreements.

The annual overall power trade of the South Asia countries presently is approximately 21,117 MU. If converted to MW on round the clock basis, this corresponds to a capacity of 2411 MW. However, actual capacity could be higher, as power trade is not on a constant round the clock basis. The sum of maximum power trade between Bhutan-India, India-Nepal and India-Bangladesh itself is nearly 3400 MW, as of 2020.

Figure 21: CBET within South Asia

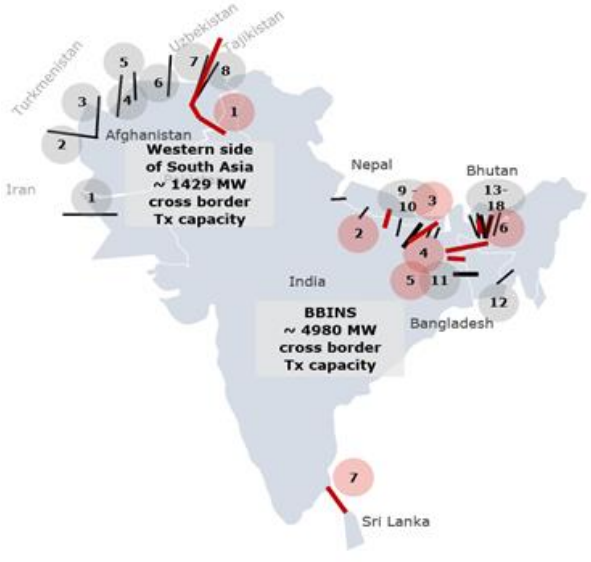


India and Pakistan data are for 2020. Afghanistan import is for 2019. Source: POSOCO, NEPRA, NSIA[161]

5.2 Current status of regional electricity interconnections

CBET occurs through the various power grid interconnections present between the trading countries.

Figure 22: Key existing and planned (new) cross border electricity lines in South Asia



Existing lines (110 KV or more)	
1	132KV Sistan – Mend
2	132KV Iran – Herat (Afgh)
3	220KV Turkmenistan - Herat (Afgh)
4	110KV Turkmenistan – Badhgis (Afgh)
5	110KV Turkmenistan – Andhkoy (Afgh)
6	220KV Uzbekistan – Naibabad (Afgh)
7	220KV Tajikistan – Kunduz (Afgh)
8	110KV Tajikitan – Kinduz (Afgh)
9	400KV Dhalkebar (Nepal) – Muzaffarpur (India)
10	Five 132KV lines between Nepal and India
11	400KV Baharampur (India) – Behramara (Bangladesh) HVDC
12	132KV Tripura (India) – Comilla (Bangladesh)
13	400KV Tala (Bhutan) – Siliguri (India)
14	400KV Malbase (Bhutan) – Siliguri (India)
15	400KV Bhutan – Alipurduar (India)
16	220KV Chukka (Bhutan) – Birpara (India)
17	220KV Malbase (Bhutan) – Birpara (India)
18	Two 132KV lines between Bhutan and India

Planned new lines	
1	500KV CASA 1000
2	400KV Butwal (Nepal) – Gorakhpur (India)
3	400KV Arun-III (Nepal) – India
4	400KV Adani power plant (India) – Bangladesh
5	765KV Bornagar(India) – Parbatipur (Bangladesh) – Katihar (India)
6	400KV Punatshangchu (Bhutan) – India
7	400KV (HVDC) India – Sri Lanka interconnection

The current status of these interconnections is shown below:

Table 17: Status of power grid interconnections

Countries	Power grid interconnection	Nature of power trade
India – Nepal	One 400 KV line, and multiple lines at 132 KV and lower voltages connected under synchronous mode. This includes: ▪ 400 KV D/c Dhalkebar-Muzzaffarpur line ▪ 132 KV lines: Kataiya – Duhabi, Raxaul-Parwanipur, Kataiya-Kushaha, Gandak East – Gandak/Surajpura, Tanakpur – Mahendranagar	▪ On an annual net basis, power is imported by Nepal from India. The line can also support export of seasonal surpluses from Nepal to India. ▪ Net export from India to Nepal in April 2019 to March 2020 was 2373 MU.[162]
India – Bangladesh	Primarily connected through an HVDC link. However there is also another AC interconnection at 132 KV. ▪ 400 KV Bheramara – Baharampur HVDC (2x500 MW) ▪ 132 KV Surjyamaninagar - South Comilla AC line	▪ Bangladesh buys power from India under medium and long term PPAs. ▪ Net export from India to Bangladesh in April 2019 to March 2020 was 6988 MU. [163]
India – Bhutan	Multiple lines at 400 KV, 220 KV, 132 KV and lower voltages connected under synchronous mode. This includes: ▪ 400 KV Tala HEP - Siliguri (Two lines) ▪ 400 KV Malbase – Siliguri (LILO of one of the Tala – Siliguri lines) ▪ 400 KV Jigmeling - Alipurduar ▪ 220 KV Chukha HEP – Birpara ▪ 220 KV Malbase - Birpara ▪ 132 KV Geylephu – Salakati ▪ 132 KV Deothang – Rangia	▪ Net export from hydro power plants in Bhutan to India on an annual basis. ▪ However, during dry season when river flows reduce due to low temperature, there is import of power from India. ▪ Net export from Bhutan to India in April 2019 to March 2020 was 6311 MU. [164]
Iran – Pakistan	▪ 132 KV Sistan Baluchistan (Iran) – Mend ▪ 20 KV Mir Jawa - Saravan 2 lines	▪ Import of power, from Iran
Central Asia - Afghanistan	Iran – Afghanistan ▪ 132 KV Iran - Afghanistan Tajikistan - Afghanistan ▪ 220 KV Sangtuda (Tajikistan) - Pul-i Khumri (Afghanistan) Turkmenistan - Afghanistan ▪ 220 KV Turkmenistan - Afghanistan Uzbekistan – Afghanistan ▪ 220 KV Uzbekistan – Afghanistan	▪ Import of power from Iran, Tajikistan, Turkmenistan and Uzbekistan

5.3 Key regional CBET arrangements in operation

India – Bangladesh

Bangladesh Power Development Board (BPDB) imports power from India through the Indian trading entities PTC India and NTPC Vidyut Vyapar Nigam Ltd. (NVVNL). The supply has commenced from October 2013

after completion of Bheramara (Bangladesh)–Baharampur (India) 400 KV HVDC transmission link between India and Bangladesh. The initial line capacity of 500 MW was later enhanced by adding an additional line, to 1000 MW. There is also a 132 KV transmission line from Tripura in India to Bangladesh, through which nearly 160 MW of power is imported by Bangladesh.

Bhutan – India

Various power plants were developed by Bhutan under Inter-governmental arrangements with India, including 336 MW Chukha HPP, 60 MW Kurichhu HPP, 1020 MW Tala HPP and 750 MW Mandhechu HPP. There is also a 126 MW Dagachhu HPP in Bhutan, which is a PPP with private investment from one of India's private sector generation companies.

The cooperation between India and Bhutan in the Hydropower sector is covered under the 2006 Agreement on Cooperation in Hydropower and the Protocol to the 2006 agreement signed in March, 2009. Under this Protocol, Government of India has agreed to assist Royal Government of Bhutan in developing a minimum of 10,000 MW of hydropower and import the surplus electricity from this to India by the year 2020. Currently, there are two Inter-Governmental (IG) model HPPs - 1200 MW Punatsangchhu-I and 1020 MW Punatsangchhu-II under implementation. The 720 MW Mangdechhu, which is also under this protocol, has already been commissioned.

In April 2014, an Inter-Governmental Agreement was signed between India and Bhutan for development of four more HEP's of capacity 2120 MW (600 MW Kholongchhu, 180 MW Bunakha, 570 MW Wangchhu and 770 MW Chamkharchhu) under the Joint Venture Model. These projects will have both the JV partners owning 50:50 shareholdings each in the JV- company. Debt-equity ratio would be 70:30, with equity shared equally between JV partners. Further, India is providing Druk Green Power Corporation's (Bhutanese) share of equity as grant.[165]

India - Nepal

On February 2016, the 400 KV Dhalkebar (Nepal) - Muzaffarpur (India) was commissioned. There are also multiple 132 KV cross border lines. The import of power by Nepal from India is under various bilateral treaties / contracts under Government-to-Government mode, and a few commercial PPAs through Indian power traders.

Iran – Pakistan

Pakistan has been importing electricity from Iran since October 2002. However, the quantum has remained restricted, especially as the transmission capacity is also limited.

Central Asia – Afghanistan

Afghanistan imports power from Iran, Tajikistan, Turkmenistan and Uzbekistan, using 132 KV and 220 KV transmission lines. These imports serve almost 80% of the electricity requirements of the country.

5.4 CBET lines under planning/development

To support CBET in future, new power grid interconnections are also being planned in the region. Following are the proposed CBET interconnections that are expected to be developed:

1. **India – Bhutan**
   - Punatsangchu HEP – Alipurduar 400 KV Double Circuit (D/c): 170 km (under construction)
2. **India – Nepal**
   - 400 KV D/C (Quad Moose) New Butwal-Gorakhpur
   - 400 KV D/C (Quad Moose) Sitamarhi (POWERGRID) – Dhalkebar (Nepal) Transmission Line, for Arun III evacuation (Work under progress)[166]
   - 400 KV evacuation line for Upper Karnali HPP

- 400 KV D/C (Quad Moose) Inaruwa- Purnea (New) by 2025-26
- 400 KV D/C (Quad Moose) Dododhara-Bareilly (New) by 2026-27

3 **India – Bangladesh**

- 400 KV dedicated evacuation line from Godda thermal power plant to Bangladesh border[167]
- 765 KV Bornagar (India NER) – Parbotipur (Bangladesh) – Katihar (India ER)

4 **India – Sri Lanka**

- Undersea HVDC cable or overhead transmission line, from Madurai in India to Anuradhapura in Sri Lanka, with a planned capacity of up to 1000 MW

5 **Central Asia - Afghanistan**

- 500 KV CASA-1000 network from Tajikistan and Kyrgyzstan to Pakistan, through Afghanistan. Proposed capacity of up to 1300 MW (under construction).

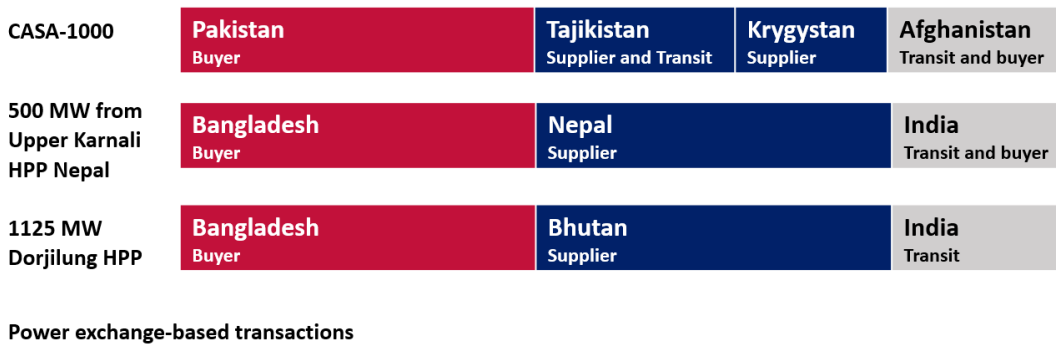
5.5 Plans for development of regional power market, through trilateral and multilateral power trade

Since most of the power trade in South Asia is bilateral, this unlocks only a limited trading regime. However, the regional power trade market is expected to transition to a trilateral model, with a third country offering wheeling facilities for the buyer and seller countries, who are otherwise not directly interconnected.

For future CBET, the respective governments in have identified a set of projects for the gradual transition to trilateral trade. This includes the following:

- CASA-1000 project, where Tajikistan and Kyrgyzstan will supply power of up to 1000 MW to Pakistan and 300 MW to Afghanistan. About 15% of transmission line work was completed as of October 2021.[168]
- Bhutan has identified 1125 MW Dorjilung HPP as one of the potential power plants for supply to Bangladesh.[169]
- Bangladesh's PSMP envisages additional 4500 MW of import between 2025 and 2035, and another 4500 MW of import between 2036 and 2041. Some of this could be from countries beyond India, such as Nepal and Bangladesh. The document also mentions that Bangladesh can import about 5,000 MW hydro power mainly from Bhutan, Nepal and North-Eastern part of India around 2041.[170]
- Bangladesh has agreed to import 500 MW of power from the 900 MW Upper Karnali hydropower project in Nepal. Considering the involvement of Indian developer, rest of the power may be considered to be off taken in India.
- In addition, there will be transactions facilitated through India's power exchanges, as India's cross border guidelines and regulations have allowed such trade through power exchanges. For example, Nepal has already commenced undertaking purchase of power from Indian power exchanges.

Figure 23: Potential new trilateral power trade in South Asia



5.6 Potential benefits of trilateral/multilateral power trade

While the benefits of bilateral power trade are widely known, there are additional benefits that are brought together by trilateral and multilateral power trade. This has also been proven in the international context. Some of the key potential benefits of trilateral/multilateral power trade are listed below.

Table 18: Benefits of trilateral/multilateral power trade

Benefits	Examples
Make use of seasonality in generation and demand	CASA-1000 project is planned to make use of surplus power available in summer months in the Central Asian countries of Tajikistan and the Kyrgyz Republic for sale to Pakistan. For Pakistan, shortage of electricity is a major constraint to economic growth and consumers are subject to frequent and extended blackouts. The peak demand in Pakistan is in the summer and thus the CASA1000 imports will be quite beneficial. This would not be possible with the facilitation by Afghanistan, which provides wheeling facility for the power.
Allow access to additional markets	As access to India's power exchange platforms are allowed, the same provides an opportunity to other South Asian countries to manage their day ahead excess or surplus power to be traded in the multilateral power market. This allows a more economic utilisation of generation assets.
Allow access to clean power	Trilateral and multilateral power trade allows countries more access to clean power, such as the case for plans of Bangladesh to import hydropower from Nepal and Bhutan.
Generate foreign exchange earnings	The trilateral and multilateral power trade increases the options for countries such as Nepal and Bhutan to earn foreign exchange through sale of power to markets other than the neighbouring countries.

5.7 Opportunities and challenges in the transition to trilateral/multilateral power trade

In South Asia, there are various opportunities in the transition to trilateral/multilateral power trade. The eastern side of South Asia, comprising of Bangladesh, Bhutan, India and Nepal already have high voltage electricity interconnections. The countries in the region have also signed various bilateral power trade agreements / MoU such as those between India and Bangladesh, India and Nepal and Nepal and Bangladesh.

Another opportunity is the ready availability / presence of large power exchanges in India, which can also support expansion of the market area by adding new regions, subject to approval of governmental and regulatory authorities. These exchanges offer week-ahead, day-ahead, intra-day and real time markets. This should also be seen in the context of presence of traders as market intermediaries who can facilitate trilateral/multilateral trade involving India and other countries in the region.

Another key opportunity is the progress in development of explicit guidelines, regulations and rules relating to regional power trade, as is happening in the case of India. Such clarity in policy and regulatory provisions allow investors to better plan for utilizing the market opportunities in the region. Then there is also the potential for utilizing platforms such as South Asia Forum of Infrastructure Regulation (SAFIR) for regional discussions, till more dedicated regional regulatory cooperation frameworks are put in place,

Such opportunities can be tapped to further develop various trilateral/multilateral power trade arrangements such as:

- Planned new network under CASA-1000 from Central Asia to Pakistan through Afghanistan;
- Planned / future power trade between Nepal to Bangladesh and Bhutan to Bangladesh through India;
- Development of regional power plants and regional mechanisms for reserve sharing;

- Potential development of South Asian Power Exchange which can support the development of a multilateral power market in the region; and
- Potential linking of South Asian grid with Southeast Asia, through Myanmar.

However, there are also a few barriers / challenges that need be tackled, in order to make optimum use of the opportunities for trilateral and multilateral power trade. A few such challenges are described below.

1. **Physical connectivity**

   The cross transmission links are not adequate in the western side of South Asia. There are no high voltage, high capacity interconnections between Afghanistan and Pakistan (till CASA-1000 gets commissioned), and between these countries and rest of South Asia. Even in the eastern side of South Asia, while there are multiple lines, there are issues relating to delays in implementation. Even after finalization of lines, the implementation time for the lines have been historically longer, usually around three years or more.

2. **Institutional frameworks**

   Compared to initiatives such as Greater Mekong Sub region (GMS), and Association of Southeast Asian Nations (ASEAN), the institutional frameworks for regional energy cooperation have not fully realised their potential in the case of South Asia. For example, ASEAN has ASEAN Power Grid Consultative Committee (APGCC), Greater Mekong Subregion has Regional Power Trade Coordination Center (RPTCC) and SAPP has SAPP coordination center and Regional Electricity Regulators Association (RERA). In comparison, similar institutional arrangements are lacking in South Asia.

3. **Dynamic Political Climate**

   The government-to-government model for cross-border trade typically involves lengthy political as well as technical negotiations, and this has not fully translated into political will for cooperation amongst the countries.

4. **Platform for Cross-Border Regulatory Coordination**

   The platform for cross-border regulatory coordination is needed and reflected upon management of key technical aspects such as rules and procedures concerning transmission access and its pricing, congestion management, operational codes and protocols for system operation, energy accounting and payment, and for seamless and stable operation of the transmission systems.

5. **Technical, operational and commercial frameworks**

   Regional level technical, operational and commercial frameworks are required to support the transition to trilateral and multilateral trade arrangements. This includes a broad consensus on aspects such as transmission pricing methodology, loss sharing, scheduling, network access approvals etc. Various operational procedures are also required, that will cover aspects such as:

   a. Determination of total transmission capacity (TTC), transmission reliability margin (TRM) and available transmission capacity (ATC) of key cross border transmission corridors;
   b. Mechanisms for booking of transmission capacity, and for auction/curtailment in case of congestions; and
   c. Energy accounting and deviation settlement mechanisms.

   Such commonly accepted frameworks / practices are currently not present in South Asia.

6 Review of suitability and recommendations in the context of South Asia

Based on the review of international experience, and comparing the same with relevant policy, regulatory and operational provisions for CBTMPT in South Asia, the key learnings for South Asia is summarized below.

6.1 Key drivers and enabling factors

International experience

The key drivers and enabling factors behind the transition to CBTMPT in other power pools were the strong political will and support, regional coordination mechanisms and institutions, flexible commercial agreements and availability of market platforms. The role of strong political support can be especially seen in the case of SAPP and GCCIA (sections 2.2 and 2.4), where the countries undertook cross border investments within their own territories towards the overall vision of interconnected grid for trade. The power market platforms (power exchanges and markets run by market operator) have played a key role in enabling multilateral power trade in Europe, Nord Pool, SAPP, Central America and GCCIA. Meanwhile, progress in ASEAN region was mainly owing the development of flexible and good-faith commercial agreements. For example, under the LTM PIP agreements, Laos supplies power to Malaysia if it has surpluses. There is neither a commitment to Laos to supply the contracted power at all times, nor a commitment to Malaysia to offtake all the surplus power offered to it from Laos.

One of the key drivers of regional power trade, including trilateral and multilateral power trade is the potential for leveraging regional diversities in supply sources, and the potential for resource sharing. For example, availability of thermal power in South Africa vis-à-vis hydro power in neighbouring countries was a key driver in the case of SAPP. GCCIA's rationale was built on the concept of reserve sharing.

Regional institutions act as a key driver of regional power trade. This could be in the form of strong regional entities (CRIE and EOR in Central American Interconnection, ENTSO-E in Europe) or regional entities with an advisory and coordination role (RERA in SAPP, RPTCC in GMS, APGCC in ASEAN) etc.

Learnings for South Asia

A strong political support and regional strategic cooperation framework is required for the transition to CBTMPT, which can be achieved through implementation and scaling up of existing regional agreements and mechanisms along with creation of new institutional mechanisms. In case of regional agreements that require further expansion for implementation provisions, there have been cases of signing "protocols to treaty agreements" as follow up measures, as has been seen in the case of Central America.

The power market platform is also a key necessity for allowing multilateral trade, though it is for the countries to choose if they want to leverage India's power exchanges or to consider developing a larger regional power exchange platform. A few specific commercial agreements for trilateral power trade will also build a confidence for other countries to indulge in such power trade. In developing such agreements, it is important to ensure that such agreements be fair and equitable to all parties to the agreement.

The potential for leveraging regional diversity can be expected to play the role of an accelerator in the case of trilateral and multilateral power trade in South Asia, with abundant solar and thermal power in India, hydropower in Bhutan and Nepal, and energy requirement in countries such as Bangladesh and Sri Lanka. The region may also have potential for sharing of reserves at a regional level in a more economic manner, rather than each country developing its own dedicated reserves.

In line with the political support, if some formal or informal institutional framework can also be set up, the same will thereafter play a key role in driving CBTMPT.

6.2 Benefits that can be expected

International experience

The benefits of CBTMPT as seen in other regions can be categorized into the following groups:

a. Sharing of reserves, reduction of need for marginal generation capacity, increasing security of supply – GCCIA, Europe, Nord Pool

b. Sharing of non-firm surplus – LTM PIP, Central America

c. Power trade to make use of resource complementarities – SAPP

d. Increasing competition and choice – Europe, Nord Pool

Learnings for South Asia

The benefits of CBTMPT is well established in other regions which can form the basis for discussions within South Asia for eventual transition to CBTMPT. Many of the established use cases such as reserve sharing, sharing of non-firm surplus, resource complementarities etc. are equally relevant in South Asia.

6.3 Overcoming barriers and challenges

International experience

Other regions can be seen to have adopted various key steps to overcome challenges in the transition to CBTMPT. For example, to solve the issue of financing of transmission investments and promotion regional trade, SAPP is planning to establish a Regional Transmission Infrastructure Financing Facility (RTIFF). A similar model of "Projects of Common Interest" is already adopted in Europe. The role of pilot studies for market based trade is also crucial, as was adopted by SAPP and GCCIA. In addition, a common thread on how the regions have solved challenges is their willingness to adapt and change the relevant frameworks.

Learnings for South Asia Each region will have its own challenges and ways to solve those challenges. In South Asia, the key challenges are expected to be relating to the harmonization in commercial frameworks, and the absence of regional market platform and regional institutions. At the same time, there is a way forward on tackling such challenges, as shown by other regions such as SA**P**P, ASEAN, GMS, GCCIA, Europe, Nord Pool and Central America. Some of the key solutions that will be of interest to South Asia will include:

- Adoption of a harmonized grid code (ASEAN, GMS);
- Mechanisms for socialization of cross border investments (SAPP RTIFF, Europe PCI);
- Development of regional power exchanges and regional institutions;
- Transmission pricing methodology based on point of connection, and usage of transmission elements (SAPP); and
- Use of pilot projects (SAPP, GCCIA).

6.4 Strategic and political framework

International experience

In the international power pools / regions, a **strong political support in the form of an existing regional arrangement (SADC, GCC, ASEAN, GMS) and/or an intergovernmental agreement / MoU** is seen as a common factor, creating the enabling conditions, and driving the CBTMPT. The political support is also linked with the regional co-operation strategy, and/or the country specific strategies of management of deficits/surplus.

There are also examples of detailed protocols succeeding the intergovernmental treaty, such as the case of MER in Central America.

Learnings for South Asia

An intergovernmental agreement signed by the South Asian countries can play a facilitating role in transition to trilateral and multilateral trade.

In South Asia, such a regional level agreement was made in 2014 - the SAARC Framework Agreement for Energy Cooperation (Electricity). However, the SAARC framework agreement requires the member countries to allow CBET on a **voluntary basis, subject to laws, rules and regulations of respective countries** and based on bilateral / trilateral / mutual agreement between member countries. In other words, the agreement does not make it compulsory for any of the countries to facilitate CBET, but makes it voluntary, and makes it also subject to intergovernmental agreements.

Signing of a new intergovernmental regional agreement with more supporting provisions may be an ideal scenario. However, since the South Asian countries have already signed the SAARC Framework Agreement for Energy Cooperation (Electricity) in 2014, a more feasible and less time consuming option will be the signing of follow-on protocols by the South Asian countries, with a view to arrive at a few commonly agreeable solutions for regional power trade, including potential regional framework for institutional coordination.

6.5 Legal, policy and regulatory framework

International experience

Most of the international power pools/ regions are supported by an **Inter-governmental agreement/ MoU, and a set of detailed agreements**/ procedures/ guidelines/ rules that govern the power trade.

For example:

- SAPP's intergovernmental and inter-utility MoUs, and Operating Guidelines;
- Marco treaty and Regional Electricity Market Regulations (REMR) in Central America;
- GCC General Agreement and Power Exchange and Trading Agreement (PETA), for GCCIA;
- GMS Inter-Governmental Agreement (IGA) on Regional Power Trade;
- Memorandum of Understanding on the ASEAN Power Grid; and
- Directives, rules and guidelines of European Commission for European common market.

Learnings for South Asia

In the absence of a common set of legal, policy and regulatory guidelines, each transaction will have to be negotiated separately by the member countries. For example, the negotiation of wheeling tariff for CASA-1000 interconnection.

A common framework / guideline for legal, policy and regulatory matters can be drafted for regional power trade, without affecting the independence and rights of national institutions. For example, regulations of RERA in SAPP are not as such binding on the member countries. Similarly, South Asian countries can strive to agree upon a minimum common framework for legal, policy and regulatory matters that can support trilateral and multilateral power trade.

6.6 Technical and operational framework

International experience

All the international / regional power pools can be found to have some form of regional level coordination in planning and operations. This also includes the development of a **regional planning document, and development of operational procedures and guidelines** for regional level management of transmission corridors. A multilateral planning document / vision, such as ASEAN masterplan for energy cooperation and SAPP Pool Plan can go a long way in improving the technical and operational framework also.

Learnings for South Asia

There needs to be coordination in regional power trade, including planning and operation of regional interconnections. This could be achieved through development of regional planning documents, and common operational procedures/ guidelines for system operators.

Established bilateral mechanisms can be further leveraged for implementing trilateral and multilateral power trade. Bilateral grid interconnections, and bilateral agreements / understanding on technical and operational frameworks can be used to facilitate trilateral transactions also, provided the corresponding commercial framework is updated.

6.7 Commercial framework

International experience

The key commercial aspects adopted by the regional pools to support trilateral and multilateral trade includes:

1. **Market products / platforms** such as spot market through power exchanges;

SAPP – Day ahead, Intraday, and Forward trading through SAPP Market Trading Platform
MER in Central America – Regional Contract Market and Regional Opportunity Market
GCC interconnection - Day Ahead Continuous and Intra-Day Continuous Market
Nord Pool – Day ahead, intra-day markets, balancing markets, derivatives
European internal power market – Day ahead, intra-day, forward and balancing products, derivatives
Inter-country power pools (NEPOOL, PJM, NEM) – Spot markets, forward markets, ancillary services, derivatives

2. Mechanism for **wheeling of power**, along with determination of charges for such wheeling;

SAPP - Wheeling fees, based on wheeling path, along with rent for wheeling
MER in Central America - Regional transmission rates, which consist of Variable Transmission Charge (CVT), the Toll and the Supplementary Charge
GCC interconnection – USD 0.5/MWh, with minimum limit of USD 10,000 for each transaction
Nord Pool - Point of connection-based tariff system
European internal power market - Inter TSO compensation mechanism
CASA – Negotiated wheeling tariff, with inflation-based indexing
New England Power Pool - Through-or-out Transmission (TOUT) service fees, based on annually determined Pool PTF rates
PJM interconnection – Zonal charges (for network users such as distribution utilities), and point-to-point charges (users other than network users), along with Network Enhancement Charges
Australia NEM – Transmission charges based on 'Allowed Revenue' approved by the regulator; and an Inter-regional Transmission Use of System Charges approved by the regulator.

3. Coordination in **financing and cost recovery of regional transmission lines**;

SAPP – Joint SPV for ZIZABONA interconnection for financing

MER in Central America – Establishment through a separate private company, Empresa Propietaria de la Red (EPR).

GCC interconnection – Establishment of joint stock company, with sharing of costs between countries in proportion to the present value of reserve capacity savings

4. **Congestion management** mechanisms; and

SAPP – Capacity allocation through auctions

MER in Central America – Capacity reductions, auctions and congestion rents

Nord Pool – Market splitting for congestion management

European internal power market - Capacity Allocation and Congestion Management guidelines of ENTSO-E

New England Power Pool – Congestion cost calculation based on Day-Ahead or Real-Time LMP at each location

PJM interconnection – Congestion cost calculation based on LMP

Australia NEM – Spot market prices reflect congestion costs also

5. **Deviation settlement** mechanisms.

SAPP – Settlement price based on frequency and generation costs/market clearing price

MER in Central America – Net deviations settled at an hourly average price, with no compensation for excess injection

GCC interconnection - Deviation less than 25 MW is settled on "in-kind" basis every week. Deviation more than 25 MW is settled by cash at a regulated price

Inter-country power pools (NEPOOL, PJM, NEM) –

New England Power Pool – Net deviations settled based on Real-Time LMP

PJM interconnection - Net real-time deviations from day-ahead energy positions are charged at one-twelfth the PJM-wide real-time system energy price for each five-minute interval

As national frameworks on the above vary from country to country, there are example such as Europe where an overall guidance on these aspects are provided, and countries can adopt different variations as long as those are within the overall guidance.

Learnings for South Asia

Availability of market platforms such as power exchange can easily facilitate multilateral power trade. In the South Asian context, this can happen through:

1. The establishment of a South Asian power exchange; or
2. Expanding the operational area of existing power exchanges in India; or
3. Allowing trading through existing power exchanges, through trade intermediaries.

While there is variety in manner of financing of cross border lines, there could still be commonly agreed procedures for ultimate cost recovery through transmission tariffs. A common transmission tariff methodology for regional interconnections, coupled with nation specific intra-country wheeling arrangements could be a potential solution. It may be noted that even SAPP is transitioning to a point of connection based transmission tariff, which is already adopted in South Asia.

Similarly, there could be a regionally agreed treatment of congestion and deviation in the regional interconnections, coupled with nation specific mechanisms for treatment of congestions and deviations within each country.

6.8 Institutional framework and consensus building mechanisms

International experience

Regional institutions form a key facilitator and driver of regional power trade. This could be in the form of strong regional entities (CRIE and EOR in Central American Interconnection, ENTSO-E in Europe) or regional entities with an advisory and coordination role (RERA in SAPP, RPTCC in GMS, APGCC in ASEAN) etc. There are also institutions playing the role of market operator / power exchange related to regional trade, such as the case of GCCIA and Nord Pool. The regional institution is also in many cases supported by Intergovernmental forums such as CDMER in Central America and GCC Ministerial Committee.

Figure 24: Summary of key institutional mechanisms

	SAPP	GCC	Central America	European Union	ASEAN
Inter-governmental coordination	Energy Ministers of SADC	GCC Ministerial Committee	Steering Committee of the Regional Electricity Market (CDMER)	European Commission	ASEAN Ministers on Energy Meeting
Regional regulatory mechanisms	Regional Electricity Regulators Association of Southern Africa (RERA)	Advisory and Regulatory Committee (ARC)	Comisión Regional de Interconexión Eléctrica (CRIE)	Agency for the Cooperation of Energy Regulators (ACER)	HAPUA working group on policy and commercial development
Regional technical mechanisms	SAPP Coordination Centre	GCC Interconnection Authority (GCCIA)	Ente Operador Regional (EOR)	European network of transmission system operators for electricity (ENTSO-E)	Head of ASEAN Power Utilities (HAPUA) and ASEAN Power Grid Consultative Committee (APGCC)
Other key institutions	Southern African Development Community (SADC)	GCC Supreme Council	Empresa Propietaria de la Red (EPR)	Regional Security Coordination Initiatives (RSCI)	ASEAN Center for Energy

Learnings for South Asia

Presence of permanent regional coordination bodies for transmission utilities, system operations, regulators etc. could enable quicker decision making on arriving at harmonized procedures for regulatory, technical, operational and commercial management of trilateral / multilateral power trade. In this context, existing ideas / plans for organizations such as South Asia Forum of Transmission Utilities, South Asia Forum of System Operators and South Asia Forum of Regulators can be taken forward.

6.9 Sustainability framework

International experience

Many of the regional power arrangements play a key role in facilitating the use of clean energy, thereby aiding in environmental sustainability. Nearly 21% of power traded in SAPP is renewable energy. [171] In case of central American interconnection, it was even higher at 68%.[172] In ASEAN, the energy cooperation between Laos and Thailand had already benefitted both countries, where Thailand has been able to tap into vast hydropower resources of Laos, with the alternative being increase of thermal capacity within Thailand. The way in which Denmark's surplus wind power is balanced through hydropower in neighbouring Norway in Nord Pool is also a well-known example.

Learnings for South Asia

On the lines of these international example, the role of clean energy in South Asian regional energy cooperation is also expected to be prominent. Therefore, any model framework for trilateral and multilateral

power trade in the region may consider specific provisions to promote the use of clean energy in cross border trade, or at least to ensure that clean energy is not at a disadvantage as compared to thermal energy.

6.10 Investments, transition and other aspects

International experience

Most of the regions, which did not have a dedicated regional transmission infrastructure (thereby excluding models such as MER and GCCIA) can be seen to have **grown in phases** in terms of market products and options. For example:

- GCCIA initially served as a mechanism to provide reliability, and sharing of reserves. Power trade through an exchange platform was initiated in pilot phase only after multiple years of operation.
- GMS has a clear roadmap for transitioning from bilateral to multilateral model in phases.
- ASEAN power market was initially under only bilateral model. Trilateral transactions started with the commencement of LTMS PIP in 2018.
- While SAPP ran day ahead spot market since 2009, forward physical products were introduced only in 2016.

Further, the countries seem to have agreed to finance investments within their own territories, without any binding commitments from the other side ensuring utilization of such lines. Instead, the rationale adopted by other regions was that the regional lines will in turn spur regional trade.

Learnings for South Asia

In the South Asian context, a phased roadmap for power trade market may be considered in the form of supporting trilateral trade in the initial phase, and then moving to multilateral trade in the form of power exchanges or through trading intermediaries such as power traders. A more open approach towards financing of cross border investments will also be desired, without necessarily compromising on commercial viability. It is only natural that many of the cross border investments may not have an identifiable long term use case at the time of its conceptualization. However, when a line is proposed, there will be further clarity on its applications, leading to better clarity at a later stage.

7 Approach for design of model regional framework

7.1 Introduction

Considering that various international examples of CBTMPT framework were reviewed, and the similar framework/provisions in South Asia were studied, to arrive at a set of parameters that are crucial from the perspective of CBTMPT, the same is thereafter leveraged for the development of a model regional framework for CBTMPT. However, before the actual development of the model framework, it is crucial to also obtain the views of key stakeholders on some of the aspects where there is a wide variety of opinion in the region, so that the framework can be designed in such a manner that the same is acceptable to most of the regional stakeholders. This chapter seeks to arrive at the overall approach for developing the regional framework considering the key findings of the study, and to identify some of the key aspects for stakeholder consultation.

7.2 Key findings of the study so far

7.2.1 Lessons from review of international experience and existing scenario in South Asia

Strategic and political support: Within the countries, all of them are signatories to SAARC Framework Agreement. Most of the South Asian countries have also signed the MoU for establishment of BIMSTEC grid interconnection. Then there are bilateral cooperation agreements/MoU between countries such as India-Nepal, India-Bhutan, India-Bangladesh, Nepal-Bangladesh etc., and power trade arrangements between various countries.

An intergovernmental agreement signed by the South Asian countries can play a facilitating role in transition to trilateral and multilateral trade. However, since the South Asian countries have already signed the SAARC Framework Agreement for Energy Cooperation (Electricity) in 2014, a more feasible option will be the signing of follow-on protocols by the South Asian countries, with a view to arrive at a few commonly agreeable solutions for regional power trade, including potential regional framework for institutional coordination.

Legal, policy and regulatory framework: Within the countries, the legal, policy and regulatory framework for CBET is only partially covered, except for India. There are some provisions relating to import-export licensing (Nepal, Bhutan) and some regulations covering import of power (Pakistan).

In the absence of a common set of legal, policy and regulatory guidelines, each transaction will have to be negotiated separately by the member countries. For example, the negotiation of wheeling tariff for CASA-1000 interconnection. A common framework / guideline for legal, policy and regulatory matters can be drafted for regional power trade, without affecting the independence and rights of national institutions. For example, regulations of RERA in SAPP are not as such binding on the member countries. Similarly, South Asian countries can strive to agree upon a minimum common framework for legal, policy and regulatory matters that can support trilateral and multilateral power trade.

Technical and operational framework:

Technical and operational framework for CBET in South Asia is mostly evolving, except for India where it is well developed. Most of the South Asian countries other than Afghanistan and Maldives also has a grid code.

There needs to be coordination in regional power trade, including planning and operation of regional interconnections. This could be achieved through development of regional planning documents, and common operational procedures/ guidelines for system operators.

Commercial framework:

Commercial framework in the form of market platforms for wholesale energy, transmission pricing, deviation pricing, open access etc. are at an evolving stage in South Asian countries, except for India where it is fully developed.

Availability of market platforms such as power exchange can easily facilitate multilateral power trade. In the South Asian context, this can happen through:

1. The establishment of a South Asian power exchange; or
2. Expanding the operational area of existing power exchanges in India; or
3. Allowing trading through existing power exchanges, through trade intermediaries.

While there is variety in manner of financing of cross border lines, there could still be commonly agreed procedures for ultimate cost recovery through transmission tariffs. A common transmission tariff methodology for regional interconnections, coupled with nation specific intra-country wheeling arrangements could be a potential solution.

Similarly, there could be a regionally agreed treatment of congestion and deviation in the regional interconnections, coupled with nation specific mechanisms for treatment of congestions and deviations within each country.

Institutional framework:

At a country level, most of the countries have an institutional framework that suits their current market structure. However, presence of permanent regional coordination bodies for transmission utilities, system operations, regulators etc. could enable quicker decision making on arriving at harmonized procedures for regulatory, technical, operational and commercial management of trilateral / multilateral power trade. In this context, existing ideas / plans for organizations such as South Asia Forum of Transmission Utilities, South Asia Forum of System Operators and South Asia Forum of Regulators can be taken forward.

7.2.2 Preparedness of South Asian countries for transition to CBTMPT

A review of the policy, legal, regulatory, technical and commercial framework of South Asian countries relating to CBET reveals major shortcomings in the regulatory, technical and commercial aspects. In addition, the absence of a clear policy guideline on the manner of approving and regulating CBET is also a concern in countries other than India. Framework dealing with key aspects such as transmission pricing, open access and deviation settlement are either partly or entirely not available in countries other than India, though the same is mentioned in policy and legal documents in some cases.

Table 19: Gap analysis and preparedness of transition to CBTMPT

Requirement for CBET	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Strategic and political framework	✓	✓	✓	✓	✓	✓	✓
Policy and legal framework	0	0	0	✓	0	✓*	0
Regulatory framework	✗	0	0	✓	✗	✓*	✗
Technical and operational framework	✗	0	✓	✓	0	✓*	0
Commercial framework: Transmission line development methodology	✗	0	✓	✓	0	✓	0

Requirement for CBET	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Commercial framework: Transmission pricing and loss accounting	〇	✓	〇	✓	✗	✓	〇
Commercial framework: Open access / wheeling of power	〇	〇	〇	✓	✗	✓	✗
Commercial framework: Deviation settlement	✗	✗	✗	✓	〇	✓	✗
Institutional framework	〇	〇	〇	✓	〇	✓	〇

✓ *Available* 〇 *Partially Available* ✗ *Not Available*

** Maldives not considered due to its geographical constraints in participating in CBET with rest of South Asia. For Pakistan, legal, regulatory, technical and operational framework for competitive market under CTBCM is available. It is up to Government to decide if it wishes to have those replicated in the cross border electricity trade context.*

7.2.3 Extent to which existing strategic, policy, regulatory, legal, technical, commercial and operational framework shall facilitate or impede the implementation of CBTMPT in the South Asian Region

From the previous table it can be seen that there are certain elements of strategic, policy and legal framework already present in all the countries that would facilitate the transition to CBTMPT. For example, all the countries have signed SAARC Framework Agreement for Energy Cooperation (Electricity) in 2014. There are also various bilateral intergovernmental agreements for energy cooperation, such as the Power Trade Agreement between India and Nepal. The legal framework is well developed in India, even in other countries, cross border electricity trade is allowed, as long as such trade is undertaken by the national power utilities, or undertaken under agreements with the Government.

In some cases, the framework will be partially available, which also need to be captured. However, there are also barriers in various other factors that could impede the implementation of CBTMPT. A few such key areas that should be focused to avoid such impediments for implementation of CBTMPT are listed below:

1. **Regulatory framework**: Regulatory framework for CBET is yet to evolve in Afghanistan and Sri Lanka.
2. **Transmission line development methodology**: Currently, transmission lines are developed and maintained by the government owned transmission utility in countries other than India. In most countries, while there is a transmission planning process, clear guidelines on which lines to be developed and mode of development etc. are not available. In the absence of such information, any line that will be developed, even for cross border trade will have its costs distributed across all the beneficiaries within the system.
3. **Open access and wheeling**: All countries other than India and Pakistan continues to be on single-buyer model,. In other countries, while policy or law may refer to open access (Bhutan, Nepal), in actual practice, open access is not yet operationalized.
4. **Deviation settlement**: Mechanism for settlement of deviations is yet to evolve in countries other than India and Pakistan.
5. **Other operational frameworks:** Regional level technical, operational and commercial frameworks are required to support the transition to trilateral and multilateral trade arrangements. This includes a broad consensus on aspects such as transmission pricing

methodology, loss sharing, scheduling, network access approvals etc. Various operational procedures are also required, that will cover aspects such as:

a. Determination of total transmission capacity (TTC), transmission reliability margin (TRM) and available transmission capacity (ATC) of key cross border transmission corridors;

b. Mechanisms for booking of transmission capacity, and for auction/curtailment in case of congestions; and

c. Energy accounting and deviation settlement mechanisms.

Such commonly accepted frameworks / practices are currently not present in South Asia.

7.3 Potential approaches for design of a framework for transition to CBTMPT

Most of the regions, which did not have a dedicated regional transmission infrastructure (thereby excluding models such as MER and GCCIA) can be seen to have **grown in phases** in terms of market products and options. Therefore, in the South Asian context, a phased roadmap for power trade market may be considered in the form of supporting trilateral trade in the initial phase, and then moving to multilateral trade in the form of power exchanges or through trading intermediaries such as power traders.

A potential framework for transition to trilateral/multilateral power trade can be designed after study of the following four key pillars:

1. Coordination mechanisms / institutions at regional level;
2. A minimum level of harmonization of legal, regulatory, technical and commercial aspects;
3. Agreement on various modes of development of physical infrastructure for cross border trade; and
4. Adoption of market platforms for multilateral trade.

However, design of such a framework will be dependent on potential willingness and acceptance of South Asian countries on various aspects, some of which are listed below:

1. Willingness of South Asian transmission utilities, system operators and regulators to set up and participate in regional coordination mechanisms, such as South Asia Forum of Transmission Utilities (SAFTU), South Asia Forum of System Operators (SAFSO) and South Asia Forum of Electricity Regulators (SAFER).
2. The vision of the countries on the kind of participants who will be allowed to undertake CBTMPT, such as:
    a. Only national power utilities;
    b. Only national power utilities, government owned power trading entities and independent power plants; or
    c. Open to all market participants.
3. In case of countries that already have a transmission pricing methodology (India, Bangladesh, Pakistan), their views on whether the same pricing can be adopted for wheeling transactions, or whether a separate mechanism will be required.
4. Preference of the countries towards setting up a separate Regional Power Exchange / Market Platform for multilateral power trade, viz-a-viz allowing expanded operation of similar platforms in India.
5. Preference on the kind of deviation settlement mechanisms to be adopted at cross-border interconnections.

The view of key stakeholders of South Asian countries on the above matters, and any additional relevant suggestions from them forms a key component in the design of a draft Model Regional Framework for Trilateral and Multilateral Power Trade (MRFTMPT) in the South Asia Region.

Web-based questionnaire for obtaining the views of key regional stakeholders

As part of the study, a detailed questionnaire was shared with key regional stakeholders, and their response was summarized and studied. The objective of the exercise was to obtain an initial view of the key stakeholders on some of the key aspects that will have a bearing on the development of model regional framework for CBTMPT. These summary of response to the key questionnaire, and associated regional preferences arising out of it were considered, while developing the model regional framework for CBTMPT. In total, 38 responses were collected from the South Asian countries.

The questionnaire and the summary of responses are available in Annexure 1.

8 Model Regional Framework for Trilateral and Multilateral Power Trade (MRFTMPT) in South Asia

8.1 Introduction

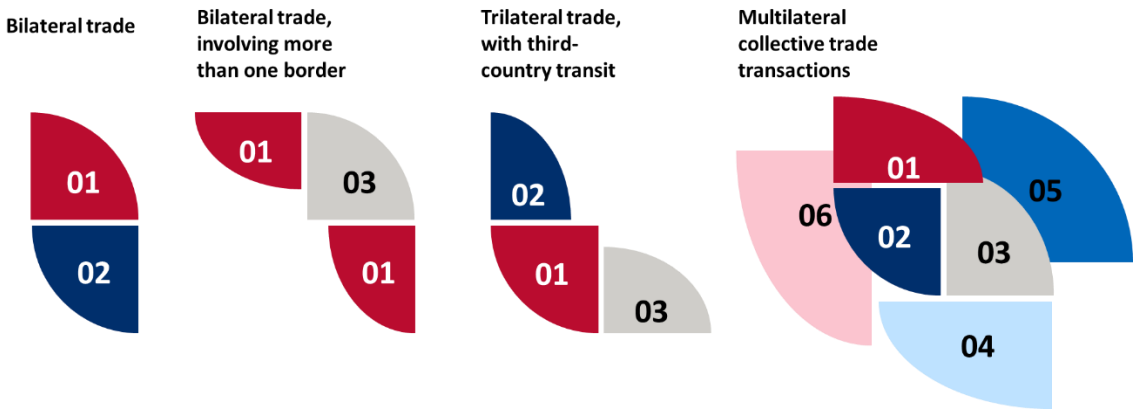
A review of various examples of international power pools and power trade arrangements where trilateral and multilateral trade takes place reveals that in most cases, there is a clear underlying framework for such trilateral and multilateral trade, in the form of regional level agreements, regulations, guidelines and codes. In comparison, the review of South Asian region indicates the lack of a robust regional framework for CBTMPT. At an individual country level, most South Asian countries lack a proper framework for CBTMPT, except for a few basic legal provisions that enable import and export licensing. Notwithstanding such absence of framework at individual country level, the power trade in the region is bound to progress further from the existing bilateral mechanisms to trilateral and multilateral mechanisms. Therefore, it is imperative to develop a basic framework under which CBTMPT operates under, in South Asia.

8.2 Proposed trade options / models in South Asia

While developing the model regional framework for trilateral and multilateral power trade in South Asia, it is also important to consider the potential trade options or models that are expected to be implemented in the region. Looking at the current market environment, the following key trade options are anticipated:

1. Bilateral trade (Already in place);
2. Bilateral trade, involving more than one border (For example: India's North-eastern region to India's Eastern region, through Bangladesh);
3. Trilateral trade, with third-country transit (For example: Nepal to Bangladesh through India); and
4. Multilateral collective trade transactions, through power exchanges / market platforms.

Figure 25: Potential trade models in South Asia for CBTMPT



Under each of the above trade models, various power market products can be traded, such as long/medium/short term PPAs, spot-market products, forward market products, ancillary services etc., depending upon the product offerings of the power exchange / market platforms. However, at a functional level, it is the overall trade arrangement that matters the most, for the purpose of developing modal regional framework.

8.3 Need for Model Regional Framework

The model regional framework presents a template that can be adopted by the South Asian countries, so that it is easier to undertake trilateral and multilateral trade in the region. Such a model regional framework can

serve as an alternative to the signing of a robust and binding regional agreement for energy cooperation and trade. In comparison to a regional level agreement, a model framework offers flexibility for the countries in South Asia to put in place harmonious provisions for moving to trilateral and multilateral trade, while not compromising on their own need for country-specific adjustments. The presence of a model regional framework is also expected to reduce the risk perception and improve investor attractiveness for regional energy projects in South Asia, as the ambiguity in applicable frameworks can be reduced.

At the same time, it may be noted that the model framework also clearly takes into account the sovereign right of respective governments and related institutions to decide on the applicable legal, policy, regulatory and operational frameworks within their country's territory. Therefore, the framework is kept as flexible to the extent possible, while still aspiring to maintain a structure which is interoperable among multiple countries. Due consideration has also been given to avoid conflict with any of the existing legal/regulatory framework for CBET in the South Asian countries.

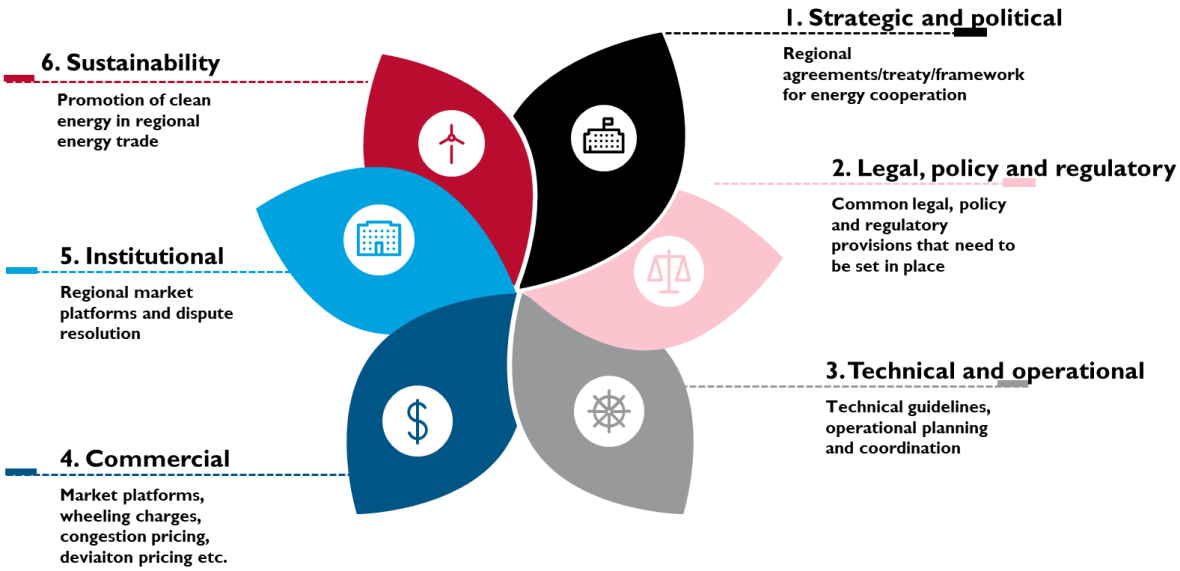
8.4 Components of Model Regional Framework

The model regional framework consists of six crucial components:

1. Strategic and political framework: The overarching regional level agreement / treaty / model framework that governs or defines regional energy trade and regional energy cooperation
2. Legal, policy and regulatory framework: Applicable Legal, policy and regulatory framework
3. Technical and operational framework: Aspects such as technical guidelines, standards, grid codes etc.
4. Commercial framework: Energy accounting, energy settlement, deviation management, loss accounting etc.
5. Institutional framework: Regional institutional mechanism for CBTMPT; and
6. Sustainability framework: Promotion of clean energy in regional energy trade

These components do not necessarily stand alone, but may interact within themselves. For example, many of the aspects in commercial framework may ultimately be implemented through the regulatory framework.

Figure 26: Key components of model regional framework for CBTMPT



The context and available options for putting in place each of the components of the model framework, and suggestion options for the same, are described further in the following paragraphs.

8.5 Component 1: Strategic and political framework

8.5.1 Context

In the international power pools / regions, a strong political support in the form of an existing regional arrangement (SADC, GCC, ASEAN, GMS) and/or an intergovernmental agreement / MoU is seen as a common factor, creating the enabling conditions, and driving the CBTMPT. The political support is also linked with the regional co-operation strategy, and/or the country specific strategies of management of deficits/surplus. There are also examples of detailed protocols succeeding the intergovernmental treaty, such as the case of MER in Central America.

An intergovernmental agreement signed by the South Asian countries can play a facilitating role in transition to trilateral and multilateral trade. In the initial stakeholder interactions based on questionnaire, nearly half (47%) of the respondents also of the opinion that there is a need for a new regional trade agreement for South Asia, that defines a common framework for CBTMPT.

8.5.2 Available options

Strategic and political support for CBTMPT in the region can be facilitated through various ways such as:

1. **Get the South Asian countries to sign an entirely new regional level agreement, with binding provisions to enable and facilitate CBTMPT**

   A new regional level agreement with more binding provisions for regional energy cooperation will be in line with similar regional level agreements/arrangements under regional pools such as SAPP and Central American Interconnection. However, in case of South Asia, CBET on bilateral basis has already been taking place without any such new agreements. This indicates the possibility to go ahead with CBTMPT also without a totally new agreement. However, the option can be explored in the longer term, as CBTMPT also evolves in the region, leading to more complex transactions.

2. **Develop follow-on rules/protocols to the already signed SAARC Framework Agreement on Energy Cooperation (Electricity), which may enable and facilitate CBTMPT**

   Similar to the case of follow-on protocols to Marco treaty in case of Central America, follow-on rules/protocols may be prepared under the already signed SAARC Framework Agreement on Energy Cooperation (Electricity).

   However, similar to the case discussed under previous option, CBET has already been taking place without any such new rules/protocols. In addition, the time taken to negotiate such a regional level rule/protocol may be substantial, while implementation mechanism for trilateral transactions will need to be in place more rapidly. Hence in the longer term, as CBTMPT also evolves in the region, leading to more complex transactions, this option can also be explored.

3. **Develop a model framework for CBTMPT, which may then be modified and adopted on a case-by-case basis by the countries**

   A model framework allows certain level of flexibility to the individual countries to define their own rules and policies for CBTMPT as per their own strategic and operational requirements, while still allowing for interoperability with other countries on harmonious principles. Such an option is favourable from the perspectives of flexibility, ease of acceptance and implementation timelines.

8.5.3 Suggested option for South Asia

This model regional framework for trilateral and multilateral power trade may be adopted by the South Asian countries as a template framework for enabling and facilitating the transition to CBTMPT. Once the framework is discussed among the key transmission utilities, system operators and regulators of the South Asian countries, the same may be reviewed by the respective governments and the policy guidelines on the level of harmonisation to be maintained in respective national framework for CBET may be issued in line with the model regional framework.

8.6 Component 2: Policy, legal and regulatory framework

8.6.1 Context

Most of the international power pools/ regions are supported by an **Inter-governmental agreement/ MoU, and a set of detailed agreements**/ procedures/ guidelines/ rules that govern the power trade.

For example:

- SAPP's intergovernmental and inter-utility MoUs, and Operating Guidelines;
- Marco treaty and Regional Electricity Market Regulations (REMR) in Central America;
- GCC General Agreement and Power Exchange and Trading Agreement (PETA), for GCCIA;
- GMS Inter-Governmental Agreement (IGA) on Regional Power Trade;
- Memorandum of Understanding on the ASEAN Power Grid; and
- Directives, rules and guidelines of European Commission for European common market.

As there are no such regional level regulations/procedures in South Asia, the views of stakeholders were sought on the various available options. Most of the respondents (34%) suggested to use an existing regional institution such as South Asia Forum of Infrastructure Regulation (SAFIR) to bring the countries together to develop common minimum guidelines and framework for CBTMPT.

8.6.2 Available options

In the absence of a common set of legal, policy and regulatory guidelines, each transaction will have to be negotiated separately by the member countries. For example, the negotiation of wheeling tariff for CASA-1000 interconnection. This will not be practical in case of South Asia, due to the higher quantum of transactions and diversity in trade. Thus, a common policy and regulatory framework may instead be explored.

A common framework / guideline for legal, policy and regulatory matters can be drafted for regional power trade, without affecting the independence and rights of national institutions. For example, regulations of RERA in SAPP are not as such binding on the member countries. Similarly, South Asian countries can strive to agree upon a minimum common framework for legal, policy and regulatory matters that can support trilateral and multilateral power trade.

8.6.3 Suggested option for South Asia

The South Asian countries may put in place the policy, legal and regulatory framework for CBET, including CBTMPT as per their own strategic and operational requirements, while complying with the following minimum criteria:

1. **Key institutional framework**

   Each country is required to designate / identify the following key institutions:

   a. Approving Authority - The Governmental entity which shall undertake Governmental policy level approvals related to specific CBET transactions or CBET infrastructure. (For example, Designated Authority in India);

   b. Regulatory Authority - The entity which shall regulate CBTMPT transactions and infrastructure. (This is expected to be the electricity regulatory commission in most cases;

   c. Entity that will serve as the System Operator;

   d. Entity that will serve as the Transmission Planning Agency;

   e. Entity that will serve as the National Transmission Utility; and

f. Entity that will serve as the Settlement Nodal Agency (SNA) for the settlement of grid operation- related charges with market participants from other countries

In case of countries intending to limit the market intermediaries, the entities who are allowed as traders may also be specified.

2. Nature of approval

Each country to clearly specify the following:

a. Whether approval for CBET is provided in the form of a license, or a concession, or an administrative approval?

b. Duration of CBET approvals; and

c. Whether CBET approval process is of one-time nature, or recurring nature?

3. Eligibility for approval

Each country to clearly specify the following:

a. Which type of market entities shall be eligible for CBET? (Single-buyer only, Single-buyer and IPPs, generation utilities, power traders, etc.)

b. What are the minimum eligibility requirements, to allow an entity within the country to undertake CBET?

c. What are the minimum eligibility requirements, to allow an entity outside the country to undertake CBET with the country?

4. Process for approval of cross-border electricity trade and cross-border interconnections

c. Each country to specify the broad parameters for providing governmental level approvals for CBET, including CBTMPT. For example, impact on security of supply, compliance with government policies, environmental impacts etc.

d. Each country to specify the broad parameters for providing utility level approvals for CBET, including CBTMPT. For example, adequacy/requirement in domestic market, impact on reliability, compliance with operational codes, transmission capacity availability etc.

5. Market intermediaries

Each country to specify the allowed type of market intermediaries, who will serve as interface points for entities outside the country, to undertake CBET with the country. (For example, power traders, single-buyer etc.)

6. Open access, and transmission pricing

Each regulator shall specify the process for obtaining approval for access to the transmission grid of a country, to undertake CBTMPT. This can be in the form of open access (example: India) with clearly defined short, medium and long term periods, or any other prevalent corridor booking mechanisms (for example: purchase of capacity rights to the transmission system).

The regulator shall also specify the transmission pricing methodology applicable for CBTMPT transactions, including pure transit transactions. (Further discussed in section 8.8 (Component 4).

The regulator shall also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity.

7. Approval in transit countries

Each country (Government/regulator) to specify the process and conditions of approval for cross border electricity trade transit transactions through it. For example, transit through a country may be approved if security of supply is not adversely impacted, transmission capacity is available, and if transmission payments cover the associated capital costs, and the variable costs of transmission service.

8.7 Component 3: Technical and operational framework

8.7.1 Context

All the international / regional power pools can be found to have some form of regional level coordination in planning and operations. This also includes the development of a regional planning document, and development of operational procedures and guidelines for regional level management of transmission corridors. A multilateral planning document / vision, such as ASEAN masterplan for energy cooperation and SAPP Pool Plan can go a long way in improving the technical and operational framework also.

8.7.2 Available options

Overall operational framework

There needs to be coordination in regional power trade, including planning and operation of regional interconnections. This could be achieved through development of regional planning documents, and common operational procedures/ guidelines for system operators. These translate to the development of the following:

1. **Regional planning documents:** Either covering only transmission, or covering both transmission and large generation projects, and preferably updated every 2-3 years, to optimize resource sharing and leveraging of diversities; Developed either under a bottom-up approach (initially decided at country level, and then discussed at regional level) or under a top-down approach (initially decided at regional level, and then adopted at country level).
2. **Regional operational procedures/guidelines:** Developed by system operators and transmission utilities.
3. **Harmonized grid codes:** While each country will have its own grid code, some of the key technical aspects will still have to be harmonized, to enable cross border trade.

The above elements will ideally be required even in the case of bilateral transactions. Therefore, the level of formal/informal procedures/guidelines/practices that cover the above aspects with respect to bilateral trade can also be customized and adopted in the case of CBTMPT.

8.7.3 Suggested option for South Asia

Overall operational framework

In terms of operational framework, the countries may put in place the following:

1. **Regional transmission plan**: Cross border transmission plans for each country may be discussed and harmonized to arrive at a regional transmission plan, which shall lay out the mutually agreed transmission interconnection plans between each set of countries. (In the longer term, the aspiration shall be to get also large generation projects covered under a regional plan mechanism). The development of such plans may be coordinated by the national transmission utilities, under institutional mechanism discussed under section 8.9 (Component 5).
2. **Regional operational procedure**: The existing agreed-upon bilateral operational procedures and guidelines developed under intergovernmental mechanisms may be consolidated to develop the regional operational procedures including common minimum grid codes. The development of such

plans may be coordinated by the national system operators, under institutional mechanism discussed under section 8.9 (Component 5).

3. **Harmonized grid codes:** For harmonization of grid codes, overall compliance with the "Common Minimum Grid Code template" being developed for South Asian countries may be strived for.

8.8 Component 4: Commercial framework

8.8.1 Context

The key commercial aspects adopted by the regional pools to support trilateral and multilateral trade includes market products/platforms, mechanism for wheeling of power, financing and cost recovery of regional transmission lines, congestion management, and deviation settlement.

1. **Market products / platforms**

The practices/variations among regional power pools among market products/platforms are summarized below.

SAPP – Day ahead, Intraday, and Forward trading through SAPP Market Trading Platform

MER in Central America – Regional Contract Market and Regional Opportunity Market

GCC interconnection - Day Ahead Continuous and Intra-Day Continuous Market

Nord Pool – Day ahead, intra-day markets, balancing markets, derivatives

European internal power market – Day ahead, intra-day, forward and balancing products, derivatives

Inter-country power pools (NEPOOL, PJM, NEM) – Spot markets, forward markets, ancillary services, derivatives

In the initial stakeholder interactions, a majority of the respondents (58%) supported the idea of developing a separate regional power exchange for CBTMPT in South Asia in the future, which could be jointly owned by the South Asian power utilities. A few respondents (21%) were also of the opinion that similar to the case of India, other countries in South Asia may come out with similar power exchanges to be governed by the policy and regulations as laid by them, and that the possibility of some sort of inter-exchange trading/coupling may be explored.

2. **Mechanism for wheeling of power, along with determination of charges for such wheeling**

The practices/variations among regional power pools among mechanisms for wheeling of power and determination of wheeling charges are summarized below.

SAPP - Wheeling fees, based on wheeling path, along with rent for wheeling

MER in Central America - Regional transmission rates, which consist of Variable Transmission Charge (CVT), the Toll and the Supplementary Charge

GCC interconnection – USD 0.5/MWh, with minimum limit of USD 10,000 for each transaction

Nord Pool - Point of connection-based tariff system

European internal power market - Inter TSO compensation mechanism

CASA – Negotiated wheeling tariff, with inflation-based indexing

New England Power Pool - Through-or-out Transmission (TOUT) service fees, based on annually determined Pool PTF rates

PJM interconnection – Zonal charges (for network users such as distribution utilities), and point-to-point charges (users other than network users), along with Network Enhancement Charges

Australia NEM – Transmission charges based on 'Allowed Revenue' approved by the regulator; and an Inter-regional Transmission Use of System Charges approved by the regulator.

In the initial stakeholder interactions, the most popular suggestion among respondents (34%) on the matter of wheeling charges were to let the transmission and wheeling charges for cross border network infrastructure be negotiated bilaterally, while allowing the respective regulators to identify the average charges for use of rest of the overall grid for transmission/wheeling service. The second most popular opinion was to let the regulator in each country determine usage charges for cross border elements, in addition to the domestic transmission charges.

3. Coordination in financing and cost recovery of regional transmission lines

The practices/variations among regional power pools among financing and cost recovery of regional transmission lines are summarized below.

SAPP – Joint SPV for ZIZABONA interconnection for financing

MER in Central America – Establishment through a separate private company, Empresa Propietaria de la Red (EPR).

GCC interconnection – Establishment of joint stock company, with sharing of costs between countries in proportion to the present value of reserve capacity savings

In the initial stakeholder interactions, the most popular opinion (29%) among the countries on the issue of financing and cost recovery of regional transmission lines were to let the countries develop the transmission lines within their territory under competitive/regulatory tariff mechanisms in line with the regulatory framework of that country. However, a similar share of respondents (24%) suggested to let the countries decide these matters on a case-by-case basis.

4. Congestion management mechanisms

The practices/variations among regional power pools among congestion management mechanisms are summarized below.

SAPP – Capacity allocation through auctions

MER in Central America – Capacity reductions, auctions and congestion rents

Nord Pool – Market splitting for congestion management

European internal power market - Capacity Allocation and Congestion Management guidelines of ENTSO-E

New England Power Pool – Congestion cost calculation based on Day-Ahead or Real-Time LMP at each location

PJM interconnection – Congestion cost calculation based on LMP

Australia NEM – Spot market prices reflect congestion costs also

As part of the initial stakeholder consultations, a majority of the respondents (50%) opined that the country owning the transmission network is responsible for monitoring the level of line loading

and declaration of available margins for transactions. In case of congestion, management of the same can be left to the owner country, which may decide whether the CB transactions are to be curtailed first or to be treated at par with the other transactions and dealt accordingly. While evaluating cross border transactions in this context, the different types of transactions shall be separately considered based on the transaction duration such as short, medium and long term.

5. **Deviation settlement** mechanisms.

   The practices/variations among regional power pools among deviation settlement mechanisms are summarized below.

   SAPP – Settlement price based on frequency and generation costs/market clearing price

   MER in Central America – Net deviations settled at an hourly average price, with no compensation for excess injection

   GCC interconnection - Deviation less than 25 MW is settled on "in-kind" basis every week. Deviation more than 25 MW is settled by cash at a regulated price

   Inter-country power pools (NEPOOL, PJM, NEM) –

   New England Power Pool – Net deviations settled based on Real-Time LMP

   PJM interconnection - Net real-time deviations from day-ahead energy positions are charged at one-twelfth the PJM-wide real-time system energy price for each five-minute interval

   As part of the initial stakeholder consultations, a majority of the respondents (34%) suggested to allow countries at each of the transmission interconnection points to decide on applicable deviation settlement mechanism for that interconnection.

As national frameworks on the above may vary from country to country, there are example such as Europe where an overall guidance on these aspects are provided, and countries can adopt different variations as long as those are within the overall guidance.

8.8.2 Available options

1. Market platforms

Availability of market platforms such as power exchanges or other similar market platforms can easily facilitate multilateral power trade. In the South Asian context, this can happen through:

1. The establishment of a South Asian power exchange;
2. Expanding the operational area of existing power exchanges in India;
3. Allowing trading through existing power exchanges, through trade intermediaries (as allowed by India currently); or
4. Allow multiple power exchanges to be developed, and undertake market coupling of those multiple power exchanges.

In the analysis of the above options, the practicality of implementation, current market scenario etc. will also need to be considered. Currently power exchanges are present only in India. The primary legal framework for electricity in other South Asian countries also do not refer to any power exchanges. The establishment of a South Asian power exchange, jointly owned by South Asian power utilities may be a long term aspirational vision. However, in the current market scenario, as power exchanges are well established only in India, and cross border trading through power exchanges through trading licensees in India are also allowed, the same option may be considered as part of the framework, with a provision of a regional exchange as a long term vision.

2. Mechanism for wheeling of power, along with determination of charges for such wheeling

In terms of wheeling mechanisms for CBTMPT, the following options are available:

1. Let each country use their domestic transmission and wheeling charge for CBTMPT transactions also.
2. Let the regulator in each country determine the transmission and wheeling charge for CBTMPT transactions in a framework that is separate from domestic pricing, considering the assets that are identified for the use of CBTMPT.
3. Let the regulator in each country determine usage charges for cross border elements, in addition to the domestic transmission charges.
4. Let the transmission and wheeling charges for cross border network infrastructure be negotiated bilaterally, while allowing the respective regulators to identify the average charges for use of rest of the overall grid for transmission/wheeling service.

The key principle in this matter is that CBTMPT transactions shall not be subsidized/cross subsidized with the domestic transactions, so far as wheeling charges are concerned. This is especially important in case of transit transactions, as the transit country is not benefitting either as a buyer, or as a seller. This rules out the direct adoption of merely the existing domestic transmission charges for the purpose of wheeling also, in case of CBTMPT.

Therefore, the wheeling charges should reflect the true cost of wheeling of power, including the true cost of infrastructure utilized for such wheeling. Therefore, a mechanism in which transmission and wheeling charges for cross border network infrastructure are negotiated bilaterally, while allowing the respective regulators to identify the average charges for use of rest of the overall grid for transmission/wheeling service may be preferred.

3. Financing and cost recovery of transmission lines

For financing and cost recovery of regional transmission lines, the following options are available:

1. Let the countries develop the transmission lines within their territory under competitive/regulatory tariff mechanisms in line with the regulatory framework of that country.
2. Let the countries develop the transmission lines jointly with the involvement of entities in the participating countries of CBET through creation of joint ventures or any other such arrangement, and the financing responsibility also shared in the ratio of the ownership share.
3. Let the countries get together to identify some transmission lines as regional assets and explore and invite participation from private sector to develop the line on build, own and operate basis.
4. Let the countries decide on a case-by-case basis.

Since this is a matter of policy, it can be left to be dealt at intergovernmental level and pinpointing on any single option among the above can be averted.

4. Congestion management mechanisms

For congestion management in case of CBET transactions including CBTMPT, the following options are available:

1. The country owning the transmission network is responsible for monitoring the level of line loading and declaration of available margins for transactions. In case of congestion, it can be left to the owner country to decide whether the CB transactions are to be curtailed first or to be treated at par with the other transactions and dealt accordingly.
2. For the congested corridors, the owner country to invite e-bids for use of transmission line and the participant with the higher bid gets the opportunity to use the corridor.

3. In case of congestion, the corridor capacity is apportioned on the basis of quantum under the contracts, on pro rata basis.

Considering that each of the South Asian countries have their own principles and procedures for congestion management, it will not be prudent to fix any single congestion management mechanism applicable for all countries. However, priority should be given to long term transactions over the other types.

5. Deviation settlement

For deviation settlement in case of CBET transactions including CBTMPT, the following options are available:

1. Use the existing deviation settlement mechanism of India, as it is the largest country in the pool, and almost all the transactions will have to physically happen through it.
2. Adopt a separate deviation settlement mechanism for CBTMPT transactions, linked to parameters such as frequency of interconnected grid, and the average or marginal price of cross border electricity trade transactions.
3. Allow countries at each of the transmission interconnection points to decide on applicable deviation settlement mechanism for that interconnection.

Considering that deviations are calculated at peripheries of respective countries, it will be better to allow those countries to decide on the applicable deviation settlement mechanism for each such peripheries (for example: India-Nepal, India-Bhutan etc.), rather than trying to impose a common mechanism. However, the countries will be required to start coordinating between themselves and, work towards devising and implementing the mechanisms.

8.8.3 Suggested option for South Asia

1. Market platform and products

All countries that have a functioning power exchange or a similar market platform in place, may allow entities in other countries also to participate in the power market, through market intermediaries in the domestic market, such as power traders or national utility. The market intermediary so involved will be in charge of coordination with the entity in other country in all matters such as scheduling, dispatch, and settlement of charges.

The respective electricity regulator in the country where the market platform is located may decide on the markets where involvement of entities from other countries are to be allowed, procedure for approval etc. Any government level approval for entities may preferably be limited to one-time approval rather than transaction specific approval.

In the longer term, options such as a regional power exchange, or market coupling of multiple power exchanges in the region could be explored.

2. Wheeling fees for transit arrangements

The wheeling fees for transit arrangements and CBTMPT may consist of two components:

1. A domestic component, which is the wheeling charge, for wheeling of power within the country. This may be determined by the respective electricity regulator of each country. While the regulatory methodology for such charge determination is better left to the respective regulators, it may be ensured that such charges are not lesser than similar transactions if undertaken entirely within the country.

   Similar to such wheeling charges, the regulators shall also determine the mechanism for allocation of losses, for such transactions.

2. A regional component, which is the charge for use of cross border networks. If the charge of such networks is predetermined under an agreement/arrangement, the same may be applicable. Alternatively, the charges for such network may be decided mutually by the respective countries / their utilities. Similar treatment shall apply in the case of transmission losses also, in the cross border network.

If new transmission system is required for a specific CBET transaction, there will be additional requirements such as the need for one of the parties to bear the cost for such enhancement of transmission system. For example, a country may require a utility from neighboring country to provide commitment on recovery of charges, before agreeing to invest in a cross border line.

3. Financing and cost recovery of regional transmission lines

Since this is a matter of policy, it can be left to be dealt at intergovernmental level, and pinpointing any single option among the above can be averted;

4. Congestion pricing

Considering that each of the South Asian countries have their own principles and procedures for congestion management, it will not be prudent to fix any single congestion management mechanism applicable for all countries.

The country owning the transmission network is responsible for monitoring the level of line loading and declaration of available margins for transactions. In case of congestion in any network, it can be left to the relevant entity managing such networks (system operator) to decide whether the CB transactions are to be curtailed first or to be treated at par with the other transactions and dealt accordingly. The respective system operator will be free to adopt various long-term and short-term congestion management mechanisms such as corridor booking/capacity allotment through e-bids, real time curtailment etc.

5. Deviation pricing

Considering that deviations are calculated at peripheries of respective countries, it will be better to allow those countries to decide on the applicable deviation settlement mechanism for each such peripheries (for example: India-Nepal, India-Bhutan etc.), rather than trying to impose a common mechanism.

8.9 Component 5: Institutional framework

8.9.1 Context

Regional institutions form a key facilitator and driver of regional power trade. This could be in the form of strong regional entities (CRIE and EOR in Central American Interconnection, ENTSO-E in Europe) or regional entities with an advisory and coordination role (RERA in SAPP, RPTCC in GMS, APGCC in ASEAN) etc. There are also institutions playing the role of market operator / power exchange related to regional trade, such as the case of GCCIA and Nord Pool. The regional institution is also in many cases supported by Intergovernmental forums such as CDMER in Central America and GCC Ministerial Committee.

In comparison, in South Asia, while there are regional organizations such as SAARC and BIMSTEC, focused regional platforms are limited to only a forum of infrastructure regulators under SAFIR. There is potential for similar market platforms for transmission utilities, system operators, market participants etc. There is also potential for focused platforms such as a forum for promoting regional energy investments.

In the initial stakeholder interactions, a substantial share (41%) of participants were supportive of setting up regional platforms for transmission utilities and system operators. There was also some support for similar platforms for electricity market participants and electricity regulators. In comparison, a small number of respondents (7%) were also of the option that there is no need for any new regional platform for electricity in South Asia.

8.9.2 Available options

Presence of permanent regional coordination bodies for transmission utilities, system operations, regulators etc. could enable quicker decision making on arriving at harmonized procedures for regulatory, technical, operational and commercial management of trilateral / multilateral power trade. In this context, there are only two options to consider:

1. **Existing ideas / plans for organizations such as South Asia Forum of Transmission Utilities, South Asia Forum of System Operators and South Asia Forum of Regulators can be taken forward.**

   The presence of regional platforms/forums are expected to enable more rapid development of implementation framework for CBTMPT which are not transaction specific, but are of more broad based nature. Their presence is not expected to impinge upon the scope or powers of intergovernmental forums in any manner.

2. **Let the framework be independent of any regional forums/platforms.**

   In this case, even after the adoption of model framework, the implementation of the same, operational coordination etc. will have to be undertaken under intergovernmental arrangements, which are mostly bilateral in nature. As these intergovernmental arrangements are of a periodic nature, it is desired that more regular discussions may happen at the level of regional platforms to be created, while final decision on any matter will still be decided at the governmental and intergovernmental level.

8.9.3 Suggested option for South Asia

Overall institutional framework

Considering the complexity involved, and the need for a wider acceptance of the overall framework for CBTMPT, a hybrid approach is proposed, where there are two levels of institutional framework for coordination:

1. Level 1 consists of coordination and consultations at inter-utility and inter-regulator level; and
2. Level 2 consists of the intergovernmental coordination mechanisms such as JSC, JWG and JTT.

The level 1 activities may preferably be undertaken under regional platforms/forums such as South Asia Forum of Transmission Utilities (SAFTU), South Asia Forum of System Operators (SAFSO) and South Asia Forum of Electricity Market (SAFEM). However, even if such platforms/forums are not in place due to any reason, the activities may still be undertaken through inter-utility and inter-regulator discussions. Those utilities/regulators may coordinate among themselves to organize the necessary discussion sessions at a regular level, till specific regional platforms / forums are in place.

Dispute resolution framework

In terms of institutional framework for dispute resolution, there may be a variation to the above suggested mechanism.

1. For transactions undertake under cross border agreements, the dispute resolution provision specified in respective agreements will have to be followed, such as dispute resolution under any specific regulatory commission, or through arbitration.
2. Matters of intergovernmental nature, which are also not covered under sl no. 1, may be discussed at intergovernmental levels, under JSC and JWG arrangements.
3. Matters of purely commercial nature, which are also not covered under sl no. 1 and 2, may be resolved through international arbitration, preferably at a neutral country.

Note: Matters that fall entirely within the borders of a country may also be decided by respective regulatory commissions or courts, depending on legal framework of the country.

8.10 Component 6: Sustainability framework

8.10.1 Context

Many of the regional power arrangements play a key role in facilitating the use of clean energy, thereby aiding in environmental sustainability. Nearly 21% of power traded in SAPP is renewable energy. [173] In case of central American interconnection, it was even higher at 68%.[174] In ASEAN, the energy cooperation between Laos and Thailand had already benefitted both countries, where Thailand has been able to tap into vast hydropower resources of Laos, with the alternative being increase of thermal capacity within Thailand. The way in which Denmark's surplus wind power is balanced through hydropower in neighbouring Norway in Nord Pool is also a well-known example.

On the lines of these international example, the role of clean energy in South Asian regional energy cooperation is also expected to be prominent. In the initial stakeholder interactions, a substantial share of participants supported various renewable energy use-cases in South Asia, such as allow cross border trade of hydro and non-hydro renewables as a separately identifiable transactions (23%), making regional generation reserves or balancing products available through CBTMPT so that each country can manage the variability of renewable energy within their grids (23%) and allowing trade of renewable energy linked instruments, such as renewable energy certificates for supporting clean energy and managing offsets (34%).

8.10.2 Available options

The exact manner in which renewable energy will get utilized in South Asian power grids will depend on the type of transactions, and the future growth of regional balancing arrangements and ancillary products. However, one of the fundamental aspects to be considered include whether the cross border trade arrangements involving clean energy should have some priority over thermal energy. In this key question, there are broadly two options for consideration:

1. **Do not distinguish between clean energy and thermal energy trade; and**

   Many of the regional power arrangements do not have any specific promotional mechanism for clean energy that have resulted in clean energy getting utilized in regional trade. Rather, the use of clean energy was driven by the diversity in natural resources, demand requirements and commercial aspects. For example, the clean energy trade in SAPP and ASEAN,

2. **Facilitate promotional treatment of clean energy trade.**

   In some of the regional power arrangements such as European internal market, there are specific mechanisms that promote and facilitate clean energy trade. For example, funding is available for transmission lines under the 'Projects of Common Interest (PCI)' mechanism, for projects that are intended to help the EU achieve its energy policy and climate objectives: affordable, secure and sustainable energy for all citizens, and the long-term decarbonisation of the economy.

   Further, various European Commission directives have also specified various promotional measures for renewable energy in the European internal market. As per EU Directive 2019/944 dated 05 June 2019, regulatory authorities are required to remove barriers that could prevent access for electricity from renewable sources. As per EU Regulation 2019/943 dated 05 June 2019, Member States shall ensure that when dispatching electricity generating installations, system operators shall give priority to generating installations using renewable energy sources to the extent permitted by the secure operation of the national electricity system, based on transparent and non-discriminatory criteria.

In addition, there are more operational aspects that may be considered for trade of clean energy, as such transactions are distinct from typical CBET transactions. For example, a line built specifically for solar power

evacuation will have a utilization rate of only 20%. A large quantum of renewable energy transaction between two countries may also introduce the need for a corresponding amount of reserve/balancing power to manage the intermittency.

8.10.3 Suggested option for South Asia

The countries may strive to ensure that inherent intermittencies in renewable energy do not prevent their access to regional power market and regional trade, wherever regulatory and operational mechanisms can be modified to obtain a level playing field for renewable energy transactions in regional power trade. The promotional measures for clean energy sources (which includes hydropower) can be decided by the respective countries, in terms of aspects such as transmission access and dispatch priority. However, any such promotional measures shall also be subject to limitations on account of system security.

In addition, the countries may also consider arriving at a separate reserve sharing agreement, rather than each country building its own dedicated reserves to manage clean energy sources. A commercial mechanism for such reserve sharing may also be determined, so that the country offering such reserves get compensated from the countries that utilize such reserves.

9 Country-wise initiatives required to implement the model regional framework

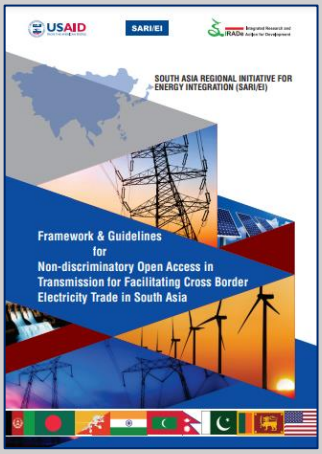
9.1 Introduction

While the model framework for trilateral and multilateral power trade has proposed six components, it may be noted that the framework itself is not a single document that can be directly implemented as it is. The components of framework are to be put into use, by utilizing them to modify/fine-tune the applicable strategic, policy, regulatory, legal, technical, commercial and operational frameworks within the countries. The objective is to undertake and implement the requisite additions/modifications in the already existing documents of the countries to bring in harmony with the model regional framework ensuring standardization in the respective laws, provisions and regulations as related to the cross border transactions. Therefore, in order to implement the proposed model framework for trilateral and multilateral power trade, the countries will need to incorporate the suggested additions/modifications required in their country level frameworks.

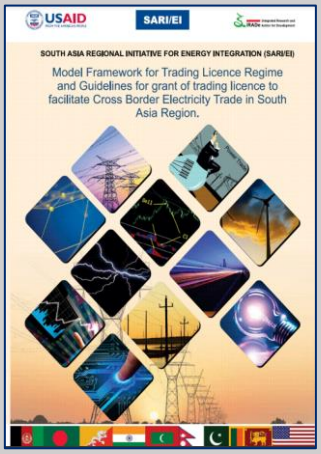
It may be noted that the minimum required additions/modifications are suggested, instead of recommending an overhaul of the entire framework, or development of a new legislation, keeping the ease and time required for implementation in mind. Further, the "institutional framework" related aspects at regional level is not covered in this section, as the same does not relate to country level frameworks. Once the harmonized country level frameworks are in place, it would be easier for the countries to collaborate and develop the regional institutional framework. The country wise recommendations relating to the remaining five components are covered in this chapter.

It may also be noted that some of the countries may require the development of regulatory frameworks for open access and trading. In some cases, development/modification of grid code may be required. In such cases, the countries may refer to the following SARI/EI studies, for model framework/model regulations relating to these aspects, which could be adopted.

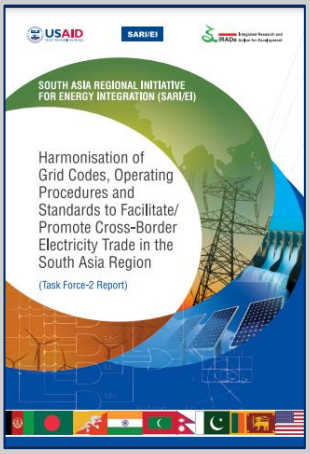
Figure 27: Other relevant SARI/EI studies



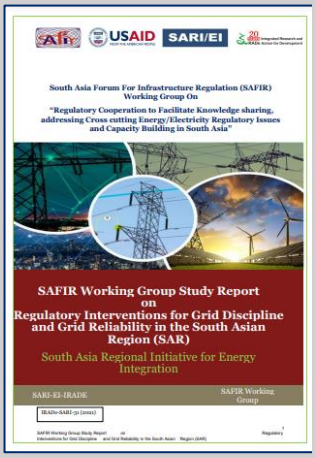
[SARI/EI study on model framework for open access]



[SARI/EI study on model framework for trading license]



[SARI/EI study on harmonization of grid codes, operating procedures and standards]



[SARI/EI and SAFIR study on regulatory Interventions for grid discipline]

Among the components of the framework, component 1, on strategic and political framework is common for all South Asian countries, other than India (which has its own policy guidelines/rules on CBET) and Maldives (due to geographical reasons). This is further explained in the following section, followed by country wise recommendations for the remaining components in the subsequent sections.

9.2 Strategic and policy guidelines to be prepared by all South Asian countries (other than India and Maldives)

Due to the absence of detailed provisions related to CBET in the legal framework, the respective Governments may prepare a "policy guideline" for CBET, covering the key aspects related to CBET, especially focusing on the strategic and policy priorities of respective governments. The key aspects to be covered in those guidelines are suggested below.

1. **Identification of institutional framework**

   The guidelines may identify the entities which will take upon the following roles:

   a. Approving Authority - The Governmental entity which shall undertake Governmental policy level approvals related to specific CBET transactions or CBET infrastructure. (For example, Secretary, Ministry of Energy, Water Resources and Irrigation in Nepal);

   b. Entity that will serve as the System Operator (For example, Bhutan Power System Operator, in Bhutan, National Load Despatch Center in Nepal);

   c. Entity that will serve as the Transmission Planning Agency (For example, Planning Directorate of Nepal Electricity Authority and Rastriya Prasaran Grid Company Ltd. (RPGCL) in Nepal);

   d. Entity that will serve as the National Transmission Utility (For example, Power Grid Company of Bangladesh, and Nepal Electricity Authority in Nepal); and

   e. Entity that will serve as the Settlement Nodal Agency (SNA) for the settlement of grid operation-related charges with market participants from other countries (For example, Nepal Electricity Authority, though not officially appointed as the Settlement Nodal Agency, dealing with India's Settlement Nodal Agency).

2. **Nature of approval**

   The guidelines may specify the following:

   a. Whether approval for CBET is provided in the form of a license, or a concession, or an administrative approval?

   b. Duration of CBET approvals; and

   c. Whether CBET approval process is of one-time nature, or recurring nature?

3. **Eligibility for approval**

   The guidelines may specify the following:

   a. Which type of market entities shall be eligible for CBET? (Single-buyer only, Single-buyer and IPPs, etc.)

   b. What are the minimum eligibility requirements, to allow an entity within the country to undertake CBET?

   c. What are the minimum eligibility requirements, to allow an entity outside the country to undertake CBET with the country?

4. **Process for approval of cross-border electricity trade and cross-border interconnections**

   The guidelines may specify the following:

a. The broad parameters for providing governmental level approvals for CBET, including CBTMPT. For example, impact on security of supply, compliance with government policies, environmental impacts etc.

b. The broad parameters for providing utility level approvals for CBET, including CBTMPT. For example, adequacy/requirement in domestic market, impact on reliability, compliance with operational codes, transmission capacity availability etc.

5. **Market intermediaries**

   Specify the allowed type of market intermediaries, who will serve as interface points for entities outside the country, to undertake CBET with the country. (For example, power traders, single-buyer etc.)

6. **Approval in transit countries**

   Each country (Government/regulator) to specify the process and conditions of approval for cross border electricity trade transit transactions through it. For example, transit through a country may be approved if security of supply is not adversely impacted, transmission capacity is available, and if transmission payments cover the associated capital costs, and the variable costs of transmission service.

While developing such a guideline will deal with component 1 of the framework, implementing the remaining components will require a country specific approach. Additional modifications required for the implementation of model framework in each of the key South Asian countries are described in following sections.

9.3 Afghanistan

Additional modifications required for implementation of model framework in Afghanistan

9.3.1 Existing framework

In Afghanistan, the Power Service Regulation Act, 2016 recognizes import and export of electricity as licensed activities. The Act also envisages non-discriminatory access of the electricity energy service providers to the market. However, regulatory framework for CBET is yet to evolve. Thus, policy guidelines as per section 9.2 are suggested to be developed.

There are no regulations relating to grid code, transmission planning methodology etc.

While there is no specific transmission pricing methodology, there is a separate wheeling arrangement under CASA-1000, which can be a precursor for similar arrangements in future. Wheeling tariff under CASA-1000 is based on negotiations. Transmission tariff under CASA-1000 is currently estimated, based on anticipated amortization costs of loans. Mechanism for settlement of deviations is yet to evolve.

9.3.2 Potential modifications in legal, policy and regulatory framework (component 2)

- No specific amendment is proposed on the existing laws and rules.
- As per Article 52 of Power Service Regulation Act, 2016, the Ministry of Energy and Water (MEW) may propose regulations and impose procedures not contrary to the provisions of this Act for the better implementation of the law. This article can be used to specify the rules / policy guidelines for CBET.

9.3.3 Potential modifications in technical and operational framework (component 3)

Grid code

- A detailed grid code for the country will have to be developed, which will have to ensure compliance with specifications of Central Asian networks to which Afghanistan's grid is already connected.

  The proposed interconnection with Pakistan under CASA1000 is using HVDC lines.

Transmission Planning

- The utility may consider preparing and updating the master plan at least once in every five years. The plan relating to cross border lines is to be discussed with relevant planning agencies of the corresponding border countries. These clauses could be included as part of the new grid code that could be developed for the country.

  Note: Considering that Afghanistan is expected to continue with single buyer model, no separate recommendations are proposed regarding determination of transmission charges, sharing of deviation charges etc.

Operational Procedures

- The load despatch centre shall develop regional operational procedures for cross border transactions, in coordination with system operators in the relevant neighbouring countries. This clause could be included as part of the new grid code that could be developed for the country.

9.3.4 Potential modifications in commercial framework (component 4)

Open access and transmission pricing

- The Power Service Regulation Act, 2016 envisages non-discriminatory access for electricity service providers to the market. However, this also requires open access to networks, for which regulations have not been prepared by the Energy Services Regulatory Authority (ESRA). Therefore, the ESRA may specify the process for obtaining approval for access to the transmission grid, to undertake CBTMPT.
- The regulator may also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity. (For cross border lines, Government may decide the methodology of financing and cost recovery on a case by case manner). However, considering the single buyer model in the country, this aspect may not need to be considered in the near term.

9.3.5 Potential modifications in institutional framework (component 5)

- The Ministry of Energy and Water (MEW) may consider issuing a notification that will allow the utility, DABS, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
- A suggestive version of draft order is provided below. The respective countries may customize and finalize the same:

  "The Ministry of Energy and Water *hereby accords approval to the utility (DABS) and the electricity regulator (Energy Services Regulatory Authority) to undertake the following activities. However, these activities have to be carried out while informing the Ministry, and the Ministry of Foreign Affairs.*

  1. *Attend meetings (virtual or physical) with electricity utilities and regulators of other countries within South Asia, on matters relating to regional energy cooperation;*
  2. *Become a member of regional grouping of electricity utilities / electricity market participants / electricity sector regulators in South Asia; and*

3. *Incur reasonable expenses towards logistics and membership fees related to activities relating to regional energy cooperation."*

9.3.6 Potential modifications in sustainability framework (component 6)

- While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources.
- Further, all clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.

9.3.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Policy guidelines for CBET to be issued by Govt. of Afghanistan
2	Legal, policy and regulatory framework	Nil
3	Technical and operational framework	Grid code to be developed Transmission planning mechanism and operational procedures for CBET to be established through regulatory provisions
4	Commercial framework	Process for obtaining approval for access to the transmission grid, to undertake CBTMPT to be developed
5	Institutional framework	The Ministry of Energy and Water (MEW) may consider issuing a notification that will allow the utility, DABS, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
6	Sustainability framework	While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources. Further, all clean energy sources, including hydro may be considered as must-run sources (except reservoir based hydro).

9.4 Bangladesh

Additional modifications required for implementation of model framework in Bangladesh

9.4.1 Existing framework

In Bangladesh, a few policies and legal provisions supporting power import are already available. For example, the Quick Enhancement of Electricity and Energy Supply (Special Provisions) Act, 2010 agrees on the need for quick implementation of the plan to import electricity and energy from abroad. However, regulations/ guidelines on cross border trade have not yet evolved. Thus, policy guidelines as per section 9.2 are suggested to be developed.

Currently, the transmission line development is undertaken by PGCB, while an overall transmission system plan form part of the country's Power System Master Plan (PSMP). Grid code regulations are also present. Transmission pricing mechanism is available, under BERC (Power Transmission Tariff) Regulations, 2016.

As per 'Policy Guidelines For Enhancement Of Private Participation In The Power Sector, 2008', PGCB and all Distribution Licensees shall provide non- discriminatory open access, to their transmission and/or distribution system for use by any Generation Licensee subject to payment of transmission/distribution wheeling charges determined by BERC. PGCB already provides wheeling service to the distribution licensees.

Commercial mechanisms to treat system imbalances from scheduled transactions are absent.

As per Grid Code, 2019, variable RE sources are allowed to generate based on their availability, rather than a day ahead schedule.

"7.4.2. In absence of any dispatch instructions by the System Operator, Generators shall generate according to the day ahead generation schedule, or in the case of VRE Generators, according to the available primary resources."

9.4.2 Potential modifications in legal, policy and regulatory framework (component 2)

- No specific amendment is proposed on the existing laws and rules. However, the country may also opt to provide a supporting legal framework for CBET, by defining CBET and identifying the relevant approving authorities for CBET as part of the Electricity Act, if required.
- As per Section 59 of Electricity Act, 2018, the Government of Bangladesh has powers to make rules for carrying out the purpose of the Act. This clause can be used to specify the rules / policy guidelines for CBET.

9.4.3 Potential modifications in technical and operational framework (component 3)

Transmission planning and operational procedures

- In order to deal with regional planning of transmission lines, and development of regional operational procedures, the following amendments may be considered in BERC (Electricity Grid Code) Regulations, 2019:

  The following clause may be added in chapter 4. TRANSMISSION SYSTEM PLANNING

  "4.3.4 While preparing the long-term plan for the expansion of the Transmission System, in the case of cross border transmission interconnection, the System Planner and Licensee shall discuss the same with relevant entities in the neighbouring countries also, so that there is efficiency in the planning of regional interconnections."

  The following clause may be added in chapter 7. SCHEDULE AND DISPATCH

  "7.9 CROSS BORDER ELECTRICITY TRADE

  7.9.1 The System Operator shall specify the key timelines and procedures for scheduling and despatch of cross border electricity transactions.

  7.9.2 The System Operator shall develop operational procedures for cross border electricity transactions, after discussing the same with system operators in relevant neighbouring countries."

9.4.4 Potential modifications in commercial framework (component 4)

Open access and transmission pricing

- The transmission utility PGCB currently makes its network available for wheeling of power from generation stations to distribution companies, on payment of a wheeling charge. However, for CBTMPT, market participants will also need open access to cross border networks, for which adequate regulations may be issued by BERC.

- The regulator shall also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity. (For cross border lines, Government may decide the methodology of financing and cost recovery on a case by case manner).

Transmission Pricing

- The wheeling charge of PGCB was approved by BERC in 2020.[175] The order specifies wheeling charge for only 33 KV, 132 KV and 230 KV lines. Therefore, BERC may also specify charges for 400 KV level.

Deviation settlement

- BERC may specify the manner in which deviation charges billed by India on Bangladesh, are further distributed among entities within Bangladesh, if entities other than BPDB are allowed to undertake CBET. This could be incorporated as part of the open access regulations to be developed by BERC.
- A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also.

  "The overall deviation charges paid/received by Bangladesh to/from India will be distributed between BPDB and other market participants within Bangladesh, who have participated in CBET, in proportion to their respective individual deviation from their schedule."

9.4.5 Potential modifications in institutional framework (component 5)

- The Ministry of Power, Energy and Mineral Resources may consider issuing a notification that will allow the utilities, BPDB and PGCB, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
- A suggestive version of draft order is provided below. The respective countries may customize and finalize the same:

  "The Ministry of Energy and Water *hereby accords approval to BPDB, PGCB and BERC to undertake the following activities. However, these activities have to be carried out while informing the Ministry, and the Ministry of Foreign Affairs.*

  1. *Attend meetings (virtual or physical) with electricity utilities and regulators of other countries within South Asia, on matters relating to regional energy cooperation;*
  2. *Become a member of regional grouping of electricity utilities / electricity market participants / electricity sector regulators in South Asia; and*
  3. *Incur reasonable expenses towards logistics and membership fees related to activities relating to regional energy cooperation."*

9.4.6 Potential modifications in sustainability framework (component 6)

- All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.
- The above could be incorporated by adding the following clause in chapter 7.4 (Generation Dispatch) of Grid Code, 2019:

  "7.4.2 a: Clean energy sources, including hydro shall be treated as must-run, and shall not be curtailed, except in case of the following reasons:

i. Curtailment in the interest of grid security;

ii. Source being reservoir based hydro; or

iii. Source wherein compensation of fixed charges are assured under a two part tariff or take-or-pay PPA."

9.4.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Policy guidelines for CBET to be issued by Govt. of Bangladesh.
2	Legal, policy and regulatory framework	Nil. However, to avoid ambiguities, the country may also opt to provide a supporting legal framework for CBET, by defining CBET and identifying the relevant approving authorities for CBET as part of the Electricity Act, if required.
3	Technical and operational framework	In order to deal with regional planning of transmission lines, and development of regional operational procedures, amendments in chapter 4 (transmission planning) and chapter 7 (scheduling and dispatch) may be considered in BERC (Electricity Grid Code) Regulations, 2019. *The following clause may be added in chapter 4. TRANSMISSION SYSTEM PLANNING* *"4.3.4 While preparing the long-term plan for the expansion of the Transmission System, in the case of cross border transmission interconnection, the System Planner and Licensee shall discuss the same with relevant entities in the neighboring countries also, so that there is efficiency in the planning of regional interconnections."* The following clause may be added in chapter 7. SCHEDULE AND DISPATCH *"7.9 CROSS BORDER ELECTRICITY TRADE* *7.9.1 The System Operator shall specify the key timelines and procedures for scheduling and dispatch of cross border electricity transactions.* *7.9.2 The System Operator shall develop operational procedures for cross border electricity transactions, after discussing the same with system operators in relevant neighboring countries."*
4	Commercial framework	Open access regulations to be prepared Transmission pricing to be extended to 400 KV voltage Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BERC. A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also. *"The overall deviation charges paid/received by Bangladesh to/from India will be distributed between BPDB and other market participants within Bangladesh, who have participated in CBET, in proportion to their respective individual deviation from their schedule."*
5	Institutional framework	The Ministry of Power, Energy and Mineral Resources may consider issuing a notification that will allow the utilities, BPDB and PGCB, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.

Sl	Category	Suggested key modifications
6	Sustainability framework	All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). Amendments to that effect may be undertaken on the grid code, by adding a clause 7.4.2 a under chapter 7.4 (Generation Dispatch).

9.5 Bhutan

Additional modifications required for implementation of model framework in Bhutan

9.5.1 Existing framework

In Bhutan, the Electricity Act 2001 covers aspects relating to licensing, system operations, non-discriminatory access to transmission and distribution. The Act recognises export and import of electricity as licensed activities. The Act also allows the Bhutan Electricity Authority (BEA) to designate a bulk supplier who will be responsible for the wholesale supply, including import and export of electricity. A corporation can apply to the Authority for the issue of a licence authorizing trade, and for import and export of electricity, according to the Electricity Act of Bhutan, 2001. However, regulations/guidelines on cross border trade have not yet evolved. Thus, policy guidelines as per section 9.2 are suggested to be developed.

Bhutan's Grid code Regulations of 2008 has provisions which specify the principles, procedures and criteria for the planning and development of the transmission system and promote coordination among all licensees. The Grid Code covers all important aspects of transmission system operation, including operation planning.

The regulator, BEA has issued its tariff regulations. The transmission tariff (wheeling tariff) is determined separately for high voltage (above 33 KV).

9.5.2 Potential modifications in legal, policy and regulatory framework (component 2)

As export and import licensing is already covered in Electricity Act, 2001 the legal framework as such does not need any specific amendment.

9.5.3 Potential modifications in technical and operational framework (component 3)

As per the Grid Code, clause 4.4.8, the planning of the Transmission System for export of power from the generating stations to neighbouring countries shall be discussed and reviewed with the concerned agencies of the neighbouring countries.

Further, under the "Scheduling and Dispatch code" within grid code, procedure for scheduling of transactions with India are also covered. Considering these, no further changes are proposed.

9.5.4 Potential modifications in commercial framework (component 4)

Open access and transmission pricing

- As per Electricity Act 2001, the regulator has a duty to ensure non-discriminatory access to the transmission and distribution system. However, detailed directives regulations relating to the same has not been prepared by ERC. Therefore, the ERC shall specify the process for obtaining approval for access to the transmission grid, to undertake CBTMPT.

  The regulator shall also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity. (For cross border lines, Government may decide the methodology of financing and cost recovery on a case by case manner).

Deviation settlement

- The regulator may specify the manner in which deviation charges billed by India on Bhutan, are further distributed among entities within Bhutan.
- A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also.

  "The overall deviation charges paid/received by Bhutan to/from India will be distributed between BPC, DGPC and other market participants within Bhutan, who have participated in CBET, in proportion to their respective individual deviation from their schedule."

9.5.5 Potential modifications in institutional framework (component 5)

- The Ministry of Economic Affairs may consider issuing a notification that will allow DHPS, and the utilities, BPC and BPSO, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
- A suggestive version of draft order is provided below. The respective countries may customize and finalize the same:

  "The Ministry of Economic Affairs hereby accords approval to DHPS, BPC, BPSO and BEA to undertake the following activities. However, these activities have to be carried out while informing the Ministry, and the Ministry of Foreign Affairs.

  1. *Attend meetings (virtual or physical) with electricity utilities and regulators of other countries within South Asia, on matters relating to regional energy cooperation;*
  2. *Become a member of regional grouping of electricity utilities / electricity market participants / electricity sector regulators in South Asia; and*
  3. *Incur reasonable expenses towards logistics and membership fees related to activities relating to regional energy cooperation."*

9.5.6 Potential modifications in sustainability framework (component 6)

- All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.
- The above could be incorporated by adding the following clause in Scheduling and Dispatch code of Grid Code regulations, 2008:

  "7.4.4 a: Clean energy sources, including hydro shall be treated as must-run, and shall not be curtailed, except in case of the following reasons:

  i. *Curtailment in the interest of grid security;*
  ii. *Source being reservoir based hydro; or*
  iii. *Source wherein compensation of fixed charges are assured under a two part tariff or take-or-pay PPA"*

9.5.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Policy guidelines for CBET to be issued by Govt. of Bhutan
2	Legal, policy and regulatory framework	Nil

Sl	Category	Suggested key modifications
3	Technical and operational framework	Nil
4	Commercial framework	Open access regulations to be prepared to define procedure to obtain access to the transmission grid for undertaking cross border electricity trade. Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BEA. A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also. *"The overall deviation charges paid/received by Bhutan to/from India will be distributed between BPC, DGPC and other market participants within Bhutan, who have participated in CBET, in proportion to their respective individual deviation from their schedule."*
5	Institutional framework	The Ministry of Economic Affairs may consider issuing a notification that will allow DHPS, and the utilities, BPC and BPSO, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
6	Sustainability framework	All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). Amendments to that effect may be undertaken on the grid code, by adding a clause 7.4.4 a under chapter 7 (Scheduling and Dispatch code).

9.6 India

Additional modifications required for implementation of model framework in India

9.6.1 Existing framework

In India, the policy framework for CBET is defined in Government of India's Guidelines for Import/Export (Cross Border) of Electricity, 2018. These guidelines have laid down the broad principles for eligibility, approval process, institutional framework, tariff, and transmission aspects for CBET. The guidelines have enabling provisions for trilateral power trade, and trade through power exchanges.

Based on Government of India's Guidelines, the CERC has issued its regulations on Cross Border Trade of Electricity in 2019. Further, as per the provisions of the guidelines, the Designated Authority [Member (Power Systems) of Central Electricity Authority] has issued its 'Procedure for approval and facilitating import/export (cross border) of electricity' in 2021.

There is also a well-defined grid code, overall transmission planning process etc. Mechanisms for transmission loss accounting, energy accounting, transmission pricing, deviation pricing etc. are also well developed.

9.6.2 Potential modifications in legal, policy and regulatory framework (component 2)

As the policy guidelines under Guidelines for Import/Export (Cross Border) of Electricity, 2018 is comprehensive, no amendment is proposed on the legal and policy framework.

9.6.3 Potential modifications in technical and operational framework (component 3)

As CERC's regulations on Cross Border Trade of Electricity in 2019 are quite comprehensive, no further amendment or addition is proposed.

9.6.4 Potential modifications in commercial framework (component 4)

Transmission pricing framework for transit transactions

For third party wheeling transactions through India using two other countries, the possibility to determine a separate transmission pricing framework or transmission tariffs, so as to insulate the consumers within the country from any additional commercial impact, on account of such transactions can be explored.

9.6.5 Potential modifications in institutional framework (component 5)

The Ministry of Power may consider supporting the institutional mechanism whereby the utilities in the power sector such as Power System Operator and Transmission Utility may interact with other similar utilities belonging to the other countries in the region, so as to allow sharing of best operational practices and promoting harmonisation and excellence in the technical matters related to power system and transmission network.

9.6.6 Potential modifications in sustainability framework (component 6)

Renewable energy plants are already treated as must-run power plants in India. Therefore, no further modification is proposed.

9.6.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Nil
2	Legal, policy and regulatory framework	Nil
3	Technical and operational framework	Nil
4	Commercial framework	For third party wheeling transactions through India using two other countries, the possibility to determine a separate transmission tariffs can be explored,
5	Institutional framework	The Ministry of Power may consider supporting the institutional mechanism whereby the utilities in the power sector such as Power System Operator and Transmission Utility may interact with the counterpart utilities belonging to the other countries in the region, so as to allow sharing of best operational practices and promoting harmonization and excellence in the technical matters related to power system and transmission network.
6	Sustainability framework	Nil

9.7 Nepal

Additional modifications required for implementation of model framework in Nepal

9.7.1 Existing framework

In Nepal, Electricity Act, 1992 has provisions relating to approval of import and export of electricity. Hydropower Development Policy, 2001 promotes export oriented hydropower projects. However detailed guidelines / Rules relating to CBET are not available. Thus, policy guidelines as per section 9.2 are suggested to be developed.

Grid code developed by NEA is being used in the country. Transmission System Development Plan of Nepal, 2018 has identified the new lines required for CBET. However, financing modalities, cost recovery mechanisms etc. are decided on a case by case basis for cross border lines.

Open access is allowed as per Electricity Regulatory Commission Act, 2017. However, directives/regulations for open access have not yet been developed. Mechanism for settlement of deviations is also yet to evolve. However, to promote responsibility in scheduling, there is a penalty mechanism for hydropower generators with monthly and weekly schedule declarations.

9.7.2 Potential modifications in legal, policy and regulatory framework (component 2)

Electricity Act, 1992

- The Electricity Act, 1992 may be amended to bring in an additional clause that enables Ministry of Energy, Water Resources and Irrigation to define rules/guidelines for CBET. The amendment may also cover the definition of CBET.

Electricity Rules, 1993

- As per section 43 of Electricity Rules, 1993, the frequency band available against 50 Hz is +/- 2.5%, which will need to be narrowed down further to a +/-0.5%, in the interest of harmonization of technical parameters among the countries in South Asia.
- Similarly, as per section 42 of Electricity Rules, 1993, the voltage fluctuation allowed in high voltage transmission system (33 kV to 400 kV) is +/- 10%, which will need to be narrowed down to +/- 5%.

Note: Nepal also has a draft version of new Electricity Act, which is under the consideration of Parliament of Nepal. The Act, once passed, will clarify if a few further aspects such as the role of trading licensees. The bill, which recognizes Electricity Trading as a separate licensed activity, once passed shall clarify few other aspects such as, the rights and responsibilities of trading licensees.

9.7.3 Potential modifications in technical and operational framework (component 3)

Transmission Planning and operational procedures

- The last transmission master plan was published in 2018. The utility may consider publishing the revised master plan at least once in every three years. To that extent, the following amendments are proposed in NEA's Grid Code:

  The following clause may be added in Chapter 3: Grid Planning:

  "3.5.5.3: The revised Power System Master Plan and Transmission Development Plan must be published at least once in every three years.

  3.5.5.4: While preparing the Transmission Development Plan, in the case of cross border transmission interconnection, the System Planner and Licensee shall discuss the same with relevant entities in the neighbouring countries also, so that there is efficiency in the planning of regional interconnections."

  The following clause may be added in chapter 7. SCHEDULE AND DISPATCH

  "7.9 CROSS BORDER ELECTRICITY TRADE

  7.9.1 The System Operator shall specify the key timelines and procedures for scheduling and despatch of cross border electricity transactions.

  7.9.2 The System Operator shall develop operational procedures for cross border electricity transactions, after discussing the same with system operators in relevant neighbouring countries."

9.7.4 Potential modifications in commercial framework (component 4)

Open access, transmission cost recovery and pricing

- The Electricity Regulatory Commission Act, 2017 envisages open access to electricity system, and establishment of wholesale market. However, detailed directives (regulations) relating to the same has not been prepared by ERC. Therefore, the ERC shall specify the process for obtaining approval for access to the transmission grid, to undertake CBTMPT.
- The regulator shall also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity. (For cross border lines, Government may decide the methodology of financing and cost recovery on a case by case manner).
- The ERC shall also specify the transmission pricing methodology for the national grid, including Nepal portion of the cross border lines.

Deviation settlement

- The regulator may specify the manner in which deviation charges billed by India on Nepal, are further distributed among entities within Nepal, if entities other than NEA are allowed to undertake CBET.
- A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also.
- *"The overall deviation charges paid/received by Nepal to/from India will be distributed between NEA and other market participants within Nepal, who have participated in CBET, in proportion to their respective individual deviation from their schedule."*

9.7.5 Potential modifications in institutional framework (component 5)

- The Ministry of Energy, Water Resources and Irrigation may consider issuing a notification that will allow the utilities, NEA, RPGCL, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
- A suggestive version of draft order is provided below. The respective countries may customize and finalize the same:

  "The Ministry of Energy, Water Resources and Irrigation hereby accords approval to NEA, RPGCL and ERC to undertake the following activities. However, these activities have to be carried out while informing the Ministry, and the Ministry of Foreign Affairs, if required.

  1. *Attend meetings (virtual or physical) with electricity utilities and regulators of other countries within South Asia, on matters relating to regional energy cooperation;*
  2. *Become a member of regional grouping of electricity utilities / electricity market participants / electricity sector regulators in South Asia; and*
  3. *Incur reasonable expenses towards logistics and membership fees related to activities relating to regional energy cooperation."*

9.7.6 Potential modifications in sustainability framework (component 6)

- While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources.
- All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest

of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.

- The above could be incorporated by adding the following clause in Chapter 7 - Scheduling and Dispatch, of Grid Code:

> *"7.3.11: Clean energy sources, including hydro shall be treated as must-run, and shall not be curtailed, except in case of the following reasons:*
>
> *i. Curtailment in the interest of grid security;*
>
> *ii. Source being reservoir based hydro;*
>
> *iii. Source wherein compensation of any types is assured under a two-part tariff or take-or-pay PPA; or*
>
> *iv. Source wherein buyer and seller themselves have agreed through PPA for curtailing power/energy for any reasons."*

9.7.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Policy guidelines for CBET to be issued by Govt. of Nepal
2	Legal, policy and regulatory framework	The Electricity Act, 1992 may be amended to bring in an additional clause that enables Ministry of Energy, Water Resources and Irrigation to define rules/guidelines for CBET. Electricity Rules, 1993: Section 42 and 43 to be amended
3	Technical and operational framework	The last transmission master plan was published in 2018. The utility may consider publishing revised master plan at least once in every three years. To that extent, amendments may be made in NEA's Grid Code, in chapter 3 (Grid planning). Further, amendments are proposed in "Chapter 7. SCHEDULE AND DISPATCH", of Grid Code to deal with scheduling and operational procedures related to CBET.
4	Commercial framework	Open access directives to be issued by ERC Transmission pricing framework to be prepared by ERC Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC The regulator may specify the manner in which deviation charges billed by India on Nepal, are further distributed among entities within Nepal, if entities other than NEA are allowed to undertake CBET. A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also. *"The overall deviation charges paid/received by Nepal to/from India will be distributed between NEA and other market participants within Nepal, who have participated in CBET, in proportion to their respective individual deviation from their schedule."*
5	Institutional framework	The Ministry of Energy, Water Resources and Irrigation may consider issuing a notification that will allow the utilities, NEA, RPGCL, and the regulator to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.

Sl	Category	Suggested key modifications
		While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources.
6	Sustainability framework	All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest of grid security and specific PPA provisions, if any, cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.

9.8 Pakistan

Additional modifications required for implementation of model framework in Pakistan

9.8.1 Existing framework

In Pakistan, the National Electric Power Regulatory Authority's (NEPRA) Import of power regulations of December 2017 lays down principles of power import and covers aspect such as approval of rate of import, and execution of PPA. However, this covers only approval on the rate of import and PPA. It does not cover any additional aspects related to CBET such as institutional mechanisms and approvals for CBET etc. Thus, policy guidelines as per section 9.2 are suggested to be developed.

NEPRA's Grid Code specifies the detailed planning code, connection code and scheduling code. For wind and solar power plants, there is day ahead, four hourly and hourly scheduling requirements. Deviation in actual generation from hourly schedule will necessitate a rebate to be offered by the generator to the buyer. NEPRA has approved Market Operator Commercial Code which includes commercial framework for bilateral power trade.

There are regulations for transmission tariff determination (NEPRA Guidelines to Lay Down the Methodology & Process for Determination of Revenue Requirement and Use of System Charges for Transmission Licensee, 2017). Further, NEPRA's 'Wheeling of Electric Power' Regulations of 2016 require transmission licensees and distribution companies to offer non-discriminatory open access to their networks.

Pakistan has recently transitioned from a single buyer model to the wholesale/competitive electricity market model • In 2020, NEPRA had approved the detailed design and implementation plan of the Competitive Trading Bilateral Contract Market (CBTCM), which enables a competitive environment in the power sector. The CTBCM implementation has started on June 2022, on a test-run basis for the initial six months. Post the test-run period, financial transactions will commence under the CTBCM to achieve the benefits of affordable, reliable, and sustainable electric power for the consumers of the power sector of Pakistan.

9.8.2 Potential modifications in legal, policy and regulatory framework (component 2)

Need for any specific amendment in the legal framework is not envisaged. However, to avoid ambiguities, the country may also opt to provide a supporting legal framework for CBET, by defining CBET and identifying the relevant approving authorities for CBET as part of the Electricity Act, if required.

9.8.3 Potential modifications in technical and operational framework (component 3)

Transmission Planning and operational procedures

- In Chapter (e) of Grid Code, 2005, under PC 4.2 (Procedure for Transmission System Expansion), the following may be added:

  "3.5.5.3: The revised Transmission System Expansion plan must be published at least once in every three years.

3.5.5.4: While preparing the Transmission System Expansion plan, in the case of cross border transmission interconnection, NTDC shall discuss the same with relevant entities in the neighbouring countries also, so that there is efficiency in the planning of regional interconnections."

The following clause may be added in Scheduling and Despatch code within Grid Code 2005

"SDC 1.4.3.14 CROSS BORDER ELECTRICITY TRADE

The System Operator shall specify the key timelines and procedures for scheduling and despatch of cross border electricity transactions.

The System Operator shall develop operational procedures for cross border electricity transactions, after discussing the same with system operators in relevant neighbouring countries."

9.8.4 Potential modifications in commercial framework (component 4)

Wheeling regulations

- NEPRA's 'Wheeling of Electric Power' Regulations of 2016 specifies the procedure for obtaining access to electricity network. As per clause 5 of these regulations,) **wheeling may be availed by generation companies** who are already connected with a Transmission Licensee or DISCO system or those who have yet to establish connection with a Transmission Licensee or DISCO system. This clause will not enable utilities in other countries (say Afghanistan) to obtain access to the network for wheeling transactions, for third party transit, or for sale to entities other than Central Power Purchasing Agency (CPPA). This is not in line with proposed competitive market transition also. Therefore, definition of eligible entities for wheeling and open access as per clause 5 of NEPRA's 'Wheeling of Electric Power' Regulations of 2016 may be expanded to cover utilities in neighbouring countries also.

  "5: Application Process for Wheeling of Power.– (1) Wheeling may be availed by generation companies who are already connected with DISCOs system or those who have yet to establish connection with DISCOs system. Wheeling may also be availed on the transmission grid by market participants, in case of cross border electricity trade."

Deviation settlement

- The regulator may specify the manner in which deviation charges billed by India, if any, are further distributed among entities within Pakistan, in a scenario where there is interconnection and trade with India. However, in the short and medium term, such a requirement is not expected to arise.
- A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also.

  "The overall deviation charges paid/received by Pakistan to/from neighbouring countries will be distributed between WAPDA and other market participants within Pakistan, who have participated in CBET, in proportion to their respective individual deviation from their schedule."

9.8.5 Potential modifications in institutional framework (component 5)

- The Ministry of Energy may consider issuing a notification that will allow WAPDA, Central Power Purchasing Agency –Guaranteed (CPPA-G), NTDC and the regulator (NEPRA) to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
- A suggestive version of draft order is provided below. The respective countries may customize and finalize the same:

  "The Ministry of Energy hereby accords approval to WAPDA, CPPA-G, NTDC, and NEPRA to undertake the following activities. However, these activities have to be carried out while informing the Ministry, and the Ministry of Foreign Affairs.

1. *Attend meetings (virtual or physical) with electricity utilities and regulators of other countries within South Asia, on matters relating to regional energy cooperation;*
2. *Become a member of regional grouping of electricity utilities / electricity market participants / electricity sector regulators in South Asia; and*
3. *Incur reasonable expenses towards logistics and membership fees related to activities relating to regional energy cooperation."*

9.8.6 Potential modifications in sustainability framework (component 6)

Promotion of clean energy

- The existing transmission use of charge consist of a two part tariff, with fixed tariff designated in PKR/KW/Month and variable charge designated in PKR/kWh. To promote clean energy sources with low capacity utilization/load factor as compared to thermal plants, the regulator may consider a purely kWh linked use of system charge (instead of KW), or a discounted use of system charge, for clean energy sources.
- All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.
- The above could be incorporated by adding the following clause in Scheduling and Dispatch, of Grid Code:

  "SDC 1.4.3.15: Clean energy sources, including hydro shall be treated as must-run, and shall not be curtailed, except in case of the following reasons:

  i. *Curtailment in the interest of grid security;*
  ii. *Source being reservoir based hydro; or*
  iii. *Source wherein compensation of fixed charges are assured under a two part tariff or take-or-pay PPA"*

9.8.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Policy guidelines for CBET to be issued by Govt. of Pakistan
2	Legal, policy and regulatory framework	Nil. However, the country may also opt to provide a supporting legal framework for CBET, by defining CBET and identifying the relevant approving authorities for CBET as part of the Electricity Act, if required.
3	Technical and operational framework	NEPRA's Grid code regulations, 2005 to be amended (PC 4.2 - Procedure for Transmission System Expansion) to ensure that the revised Transmission System Expansion plan is published at least once in every three years; and to ensure that the plan is discussed with relevant neighboring countries. Further, amendments are proposed in scheduling and dispatch code of Grid Code, to deal with scheduling and operational procedures related to CBET.
4	Commercial framework	Wheeling of electric power regulations of NEPRA to be amended, to clarify further on open access for CBTMPT transactions. Definition of eligible entities for wheeling and open access as per clause 5 of NEPRA's 'Wheeling of Electric Power' Regulations of 2016 may be expanded to cover utilities in neighboring countries also.

Sl	Category	Suggested key modifications
		"5: Application Process for Wheeling of Power.– (1) Wheeling may be availed by generation companies who are already connected with DISCOs system or those who have yet to establish connection with DISCOs system. Wheeling may also be availed on the transmission grid by market participants, in case of cross border electricity trade." Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by NEPRA. A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also. *"The overall deviation charges paid/received by Pakistan to/from neighboring countries will be distributed between WAPDA and other market participants within Pakistan, who have participated in CBET, in proportion to their respective individual deviation from their schedule."*
5	Institutional framework	The Ministry of Energy may consider issuing a notification that will allow WAPDA, Central Power Purchasing Agency –Guaranteed (CPPA-G), NTDC and the regulator (NEPRA) to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
6	Sustainability framework	To promote clean energy sources with low capacity utilization/load factor as compared to thermal plants, the regulator may consider a purely kWh linked use of system charge (instead of KW), or a discounted use of system charge, for clean energy sources. All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed. This could be incorporated by amending the Scheduling and Dispatch code, of Grid Code, 2005.

9.9 Sri Lanka

Additional modifications required for implementation of model framework in Sri Lanka

9.9.1 Existing framework

The Electricity Act of 2009 is the primary legislation governing the electricity sector in Sri Lanka. Any specific legal or regulatory framework relating to cross border electricity trade has not yet been developed. Thus, policy guidelines as per section 9.2 are suggested to be developed.

Framework for open access is also not available as Ceylon Electricity Board (CEB) continues to be the single buyer for electricity.

The grid code published in 2014 lays down rules for transmission planning, system modelling and operation, generation planning, grid connection etc.

CEB publishes its Long Term Transmission Development Plan (LTTDP) at regular intervals.

Transmission pricing is partially covered under PUCSL's 'Tariff Methodology' which defines the manner for arriving at revenue requirement for transmission function.

9.9.2 Potential modifications in legal, policy and regulatory framework (component 2)

No specific need for amendment in applicable laws and rules are envisaged to support CBTMPT, other than the development of policy guidelines on CBET. However, in the interest of avoiding ambiguities, a few enabling clauses on CBET may be provided. For example, the legal framework for procurement of electrical capacity and energy based on single buyer model is provided in the section 43 of the Sri

Lanka Electricity Act No 20 of 2009 and Sri Lanka Electricity (Amendment) Act No 31 of 2013 as amended. Procurement of capacity and energy by the transmission licensee through CBET is not provided under the section 43. Therefore, an amendment to section 43 of Electricity Act may be undertaken, to allow the Transmission Licensee (CEB) to participate in CBET.

9.9.3 Potential modifications in technical and operational framework (component 3)

Transmission Planning and operational procedures

- In Chapter 2 (Grid Planning Code) of Grid Code, 2014, the following may be added in section 2.15 (Transmission Development Plan):

  While preparing the Transmission Development plan, in the case of cross border transmission interconnection, Transmission Licensee shall discuss the same with relevant entities in the neighbouring countries also, so that there is efficiency in the planning of regional interconnections."

  The following clause may be added in Chapter 5 (Generation Despatch code) within Grid Code 2014

  "5.10 CROSS BORDER ELECTRICITY TRADE

  The System Operator shall specify the key timelines and procedures for scheduling and despatch of cross border electricity transactions.

  The System Operator shall develop operational procedures for cross border electricity transactions, after discussing the same with system operators in relevant neighbouring countries."

9.9.4 Potential modifications in commercial framework (component 4)

Open access and transmission pricing

- The regulator PUCSL may specify the process for obtaining approval for access to the transmission grid, to undertake CBTMPT.
- The regulator shall also specify the manner of cost recovery in case specific transmission infrastructure need to be developed within the country, to support the CBTMPT capacity. (For cross border lines, Government may decide the methodology of financing and cost recovery on a case by case manner).

Deviation settlement

- The regulator may specify the manner in which deviation charges billed by India on Sri Lanka, are further distributed among entities within Sri Lanka, if entities other than CEB are allowed to undertake CBET. This envisages a scenario where there is interconnection and trade with India.
- A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also.

  "The overall deviation charges paid/received by Sri Lanka to/from India will be distributed between CEB and other market participants within Sri Lanka, who have participated in CBET, in proportion to their respective individual deviation from their schedule."

9.9.5 Potential modifications in institutional framework (component 5)

- The Ministry of Power and Renewable Energy may consider issuing a notification that will allow CEB and the regulator (PUCSL) to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
- A suggestive version of draft order is provided below. The respective countries may customize and finalize the same:

"The Ministry of Power and Renewable Energy hereby accords approval CEB and PUCSL to undertake the following activities. However, these activities have to be carried out while informing the Ministry, and the Ministry of Foreign Affairs.

1. *Attend meetings (virtual or physical) with electricity utilities and regulators of other countries within South Asia, on matters relating to regional energy cooperation;*
2. *Become a member of regional grouping of electricity utilities / electricity market participants / electricity sector regulators in South Asia; and*
3. *Incur reasonable expenses towards logistics and membership fees related to activities relating to regional energy cooperation."*

9.9.6 Potential modifications in sustainability framework (component 6)

- While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources.
- All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). This could be incorporated as part of the grid code. However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed.

  The above could be incorporated by adding the following clause in Chapter 5 (Generation Despatch code) within Grid Code 2014.

  "5.11 Clean energy sources, including hydro shall be treated as must-run, and shall not be curtailed, except in case of the following reasons:

  i. *Curtailment in the interest of grid security;*
  ii. *Source being reservoir based hydro; or*
  iii. *Source wherein compensation of fixed charges are assured under a two part tariff or take-or-pay PPA"*

9.9.7 Summary

Sl	Category	Suggested key modifications
1	Strategic and policy guidelines	Policy guidelines for CBET to be issued by Govt. of Sri Lanka
2	Legal, policy and regulatory framework	Nil. However, to avoid ambiguities, an amendment to section 43 of Electricity Act may be undertaken, to allow the Transmission Licensee (CEB) to participate in CBET.
3	Technical and operational framework	PUCSL's Grid code (2014) to be amended (Chapter 2, Grid Planning Code) to ensure that Transmission Development plan for CBET lines is discussed with relevant neighboring countries. Further, amendments are proposed in scheduling and dispatch code of Grid Code, to deal with scheduling and operational procedures related to CBET.
4	Commercial framework	Open access regulations to be issued Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC. A potential clause to deal with this aspect is provided below. However, the same is only suggestive, and there could be alternate options also. *"The overall deviation charges paid/received by Sri Lanka to/from India will be distributed between CEB and other market participants within Sri Lanka, who have*

Sl	Category	Suggested key modifications
		participated in CBET, in proportion to their respective individual deviation from their schedule."
5	Institutional framework	The Ministry of Power and Renewable Energy may consider issuing a notification that will allow CEB and the regulator (PUCSL) to interact with other similar institutions in the region, so as to allow greater regional energy cooperation.
6	Sustainability framework	While developing the transmission pricing methodology, the regulator may consider a kWh linked tariff (instead of KW), or a discounted tariff for solar power, due to its low utilization factor vis-à-vis other sources. All clean energy sources, including hydro may be considered as must-run (except reservoir based hydro). However, curtailment in the interest of grid security cannot be avoided. Further, in case of commercial compensation such as take-or-pay arrangements or two-part tariffs, lower scheduling of clean energy sources may be allowed. This could be incorporated by amending the Grid Code.

10 Implementation roadmap for the model regional framework

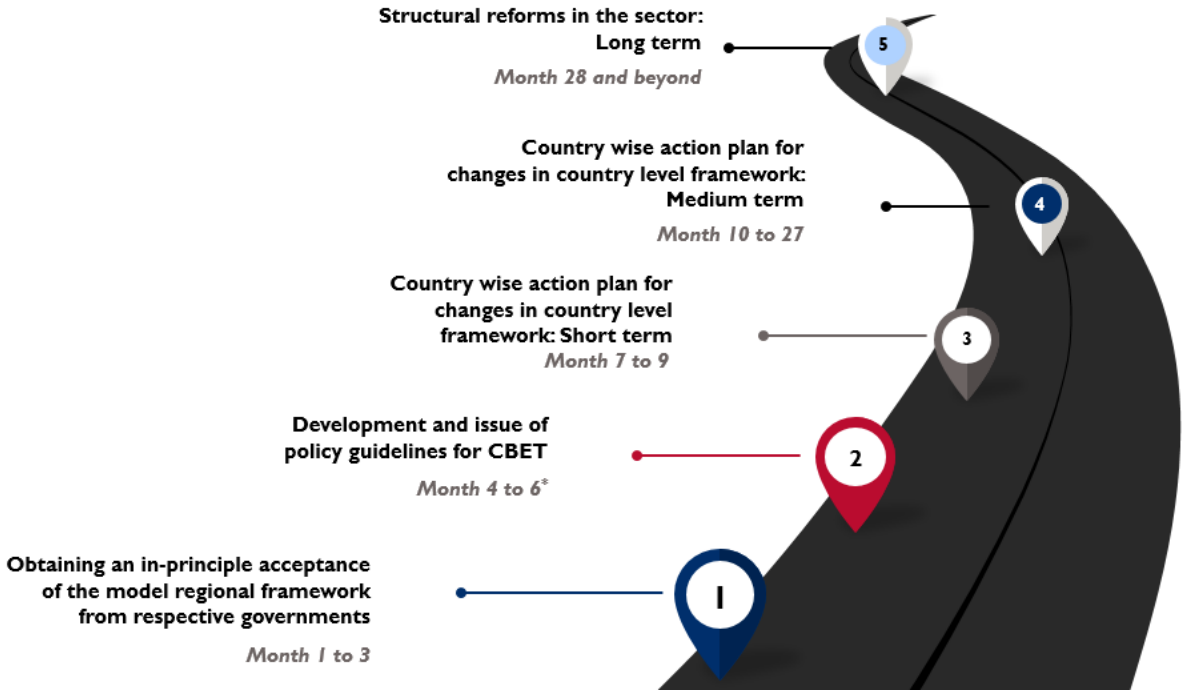
10.1 Country wise roadmap and action plan

10.1.1 Overall roadmap

The model regional framework for cross border trilateral and multilateral trade presents a template that can be adopted by the South Asian countries, so that it is easier to undertake trilateral and multilateral trade in the region. At the same time, the framework is kept as flexible to the extent possible allowing countries to accommodate their strategic priorities, while still aspiring to maintain a structure which is interoperable among multiple countries. Most of the detailed implementation modalities relating to the framework are left to the respective countries to decide. At the same time, an overall roadmap for implementing the key aspects of the framework is depicted in this chapter.

The overall roadmap for implementing the model regional framework is illustrated in the following figure. The implementation actions will have to be primarily initiated by the national transmission utilities and national electricity sector regulator in each of the countries. These implementation actions pertains to activities that are to be undertaken within each of the countries, by the respective policy makers, regulators and utilities.

Figure 28: Country wise roadmap for implementing the model framework



** In some specific cases, there will be overlap of steps 2 and 3. For example, in Nepal, issue of policy guidelines for CBET is linked to a prerequisite of Electricity Act amendment to be passed in Parliament.*

The overall roadmap consists of four key steps:

1. As a first step, it would be preferable for the national transmission utilities and regulators to seek an in-principle concurrence on the regional framework, from the respective governments. Depending on the nature of decision making process in each country, this may also involve discussions with additional relevant stakeholders in this sector. Given the nature of involvement of Government and other entities, this process may take up to 3 months.

2. Once there is an in-principle acceptance of the framework, policy guidelines for CBET for the countries would be required to be developed and issued over the next 3 months. Successful completion of these two activities would pave the way for implementation of country wise action plans, which have been divided into short term and medium term. It has been suggested that the policy guidelines of CBET be officially issued within three months after drafting is complete.
3. The guideline document would serve as the foundation or basis for implementation of the various components required for CBET through issue of regulations, which would follow after this. This is a pre-requisite. Based on the guideline document, some of the key regulatory, operational and commercial modifications required in the respective frameworks to support trilateral and multilateral trade, as identified in the previous chapter, will have to be undertaken initially. These will mostly relate to amendments in existing documents, rather than the creation of a new document. Most of these are expected to be implementable within three months from issue of the policy guidelines.
4. Post this, during the next 18 months (i.e., medium term) various relevant regulations and mechanisms (for example, transmission pricing) would be developed and issued to create the required regulatory framework for enabling and supporting CBET.
5. Thereafter, long term sectoral reforms can be focussed upon by the respective countries in the long term.

These steps are further described in detail, in the following sections.

10.1.2 Obtaining an overall acceptance of the model regional framework (Months 1 to 3)

The model regional framework has been already discussed at regional level among the regulators, system operators, transmission utilities and other key stakeholders as part of the stakeholder interaction workshop organized by SARI/EI on 23 March 2022. Based on their comments and suggestions, the framework has already been revised.

However, the regulators and utilities by themselves may not be able to take decision on actual implementation of the framework, as there may be policy level issues to be decided by the respective Governments. Therefore, the regulators, system operators and transmission utilities may put forward their view of the model regional framework to the respective governments, who may then decide on the components of the framework which they may like to put in place, and the corresponding implementing mechanisms. If desired by the respective utilities, and agreed by the respective governments, the framework may also be taken up for discussion at the level of the intergovernmental arrangements such as Joint Working Group and Joint Steering Committee meetings for discussions with the respective bilateral counterparts.

Based on the policy guidance received by the respective countries, the relevant entities in each of the countries will be able to put in place/amend the necessary policy, legal, regulatory and operational framework to support CBTMPT in line with the model regional framework. The process is expected to take around three months.

10.1.3 Development of policy guidelines for CBET (Months 4 to 6)

After obtaining an in-principle acceptance of the proposed model framework by the respective countries, the respective ministries (dealing with energy/electricity) may start the activities for the development of a policy guideline relating to CBET. This is a key feature of the proposed country wise action items for countries other than India and Maldives. The policy guideline will deal with aspects such as:

1. Identification of institutional framework;
2. Nature of approval;
3. Eligibility for approval;

4. Process for approval of cross-border electricity trade and cross-border interconnections;
5. Market intermediaries; and
6. Approval in transit countries.

While the methodology for development of policy is best left to the respective countries, it is recommended that a joint team with representatives from Ministry of Power/Energy/Electricity, Ministry of Law, Ministry of Foreign/External Affairs, National power transmission utility, single buyer utility (if different from transmission utility) and National level planning body may be constituted to develop, finalize and issue the policy document.

The process is expected to take around three months. However, in cases of countries such as Nepal where legislative amendments are a prerequisite for issue of CBET rules/guidelines, the process may take up to 6 months or more.

10.1.4 Country wise action plan for modifications in country level framework : Short Term and Medium Term (Months 7-9 and 10-27)

Once the policy guidelines for CBET are in place, the respective regulators, transmission utilities and system operators will be able to prepare various amendments or additions to the relevant regulatory, commercial and operational framework. These pertains to the implementation of actions that have been listed in chapter

The country wise action plan for implementation of modifications in the country level framework, in order to promote the transition for bilateral to trilateral and multilateral power trade are summarized below. Action plan items have been further segregated as short term (3 months from issue of CBET policy guidelines) and medium term (beyond 3 months, but within 21 months from issue of CBET policy guidelines).

While developing the below action plan, the segregation of activities under short term and medium term were undertaken considering the following methodology:

1. Activities that can be implemented through minor amendments to existing documents, or through short executive / regulatory orders are selected for implementation as part of short term actions; and
2. Activities that require development of new documents, methodologies or frameworks (for example, development of open access regulations), or activities that require wider stakeholder consultations and institutional changes are selected for implementation as part of medium term actions.
3. In some countries, some actions will not be required in the short term considering the current state of cross border infrastructure. For example, in Sri Lanka, there is no immediate need for defining mechanism for deviation settlement in cross border trade, as there is no cross border transmission line that is under construction. Such country specific aspects have also been considered while defining the short term and medium term actions.

The detailed country wise action points for the short term (3 months from issue of CBET policy guidelines) is listed below:

Table 20: Country wise action plan for modifications in country level framework – Short term

Country	Short term action items	Responsibility for implementation
Afghanistan	Order allowing regional institutional corporation issued by Governments	Ministry of Energy and Water, Government of Afghanistan
Bangladesh	Order allowing regional institutional corporation issued by Governments	Ministry of Power, Energy and Mineral Resources, Government of Afghanistan
	However, the country may also opt to provide a supporting legal framework for CBET, by defining CBET and identifying the relevant approving authorities for CBET as part of the Electricity Act, if required.	

Country	Short term action items	Responsibility for implementation
	Transmission pricing to be extended to 400 KV voltage	
	Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BERC	Bangladesh Energy Regulatory Commission (BERC)
Bhutan	Order allowing regional institutional corporation issued by Governments	Department of Hydropower and Power Systems (DHPS), Government of Bhutan
	Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by BEA	Bhutan Electricity Authority (BEA)
India	Supporting the institutional mechanism whereby the utilities in the Power Sector may interact with counterparts in other SA countries towards sharing best operational practices and promoting harmonization and excellence in technical matters	Ministry of Power, Government of India
Nepal	Order allowing regional institutional corporation issued by Government	Ministry of Energy, Water Resources and Irrigation, Government of Nepal
	Electricity Act, 1992 to be amended for incorporating the provision associated with power trading and CBET.	
	Electricity Rules, 1993: Section 42 and 43 to be amended	
	Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC	Electricity Regulatory Commission
Pakistan	Order allowing regional institutional corporation issued by Governments	Ministry of Energy, Government of Pakistan
	The country may also opt to provide a supporting legal framework for CBET, by defining CBET and identifying the relevant approving authorities for CBET as part of the Electricity Act, if required.	
	Wheeling of electric power regulations of NEPRA to be amended, to clarify further on open access for CBTMPT transactions	National Electric Power Regulatory Authority (NEPRA)
Sri Lanka	Order allowing regional institutional corporation issued by Governments	Ministry of Energy, Government of Sri Lanka
	Amend section 43 of Electricity Act, to enable Transmission Licensee to participate in CBET	

The detailed country wise action points for the medium term (beyond 3 months, but within 21 months from issue of CBET policy guidelines) is listed below:

Table 21: Country wise action plan for modifications in country level framework – Medium term

Country	Medium term action items	Responsibility for implementation
Afghanistan	Grid code to be developed	Energy Services Regulatory Authority (ESRA)
	Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions, as part of the grid code	

Country	Medium term action items	Responsibility for implementation
	Open access regulations to be issued	
	Must run status for clean energy sources to be provided *(subject to curtailment in the interest of grid security)*	
Bangladesh	Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions	Bangladesh Energy Regulatory Commission (BERC)
	Open access regulations to be issued	
	Must run status for clean energy sources to be provided *(subject to curtailment in the interest of grid security)*	
Bhutan	Open access regulations to be issued	Bhutan Electricity Authority (BEA)
	Must run status for clean energy sources to be provided *(subject to curtailment in the interest of grid security)*	
India	Possibility towards determining a separate transmission tariff for third party wheeling transactions can be explored.	Central Electricity Regulatory Commission (CERC)
Nepal	New Electricity Act to be passed	Ministry of Energy, Water Resources and Irrigation, Govt. of Nepal
	Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions	Electricity Regulatory Commission
	Open access directives to be issued	
	Transmission pricing framework to be prepared by ERC	
	Must run status for clean energy sources to be provided *(subject to curtailment in the interest of grid security and specific PPA provisions)*	
Pakistan	Must run status for clean energy sources to be provided *(subject to curtailment in the interest of grid security)*	National Electric Power Regulatory Authority (NEPRA)
	Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by NEPRA (could also be shifted to a longer term)	
Sri Lanka	Transmission planning mechanism and operational coordination mechanism for CBET to be established through regulatory provisions	Public Utilities Commission of Sri Lanka (PUCSL)
	Open access regulations to be issued	
	Must run status for clean energy sources to be provided *(subject to curtailment in the interest of grid security)*	

Country	Medium term action items	Responsibility for implementation
	Mechanism for sharing of deviation settlement mechanism charges on account of CBTMPT transactions, to be specified by ERC	

The above action plan refers to the minimum list of activities for implementation of the model framework in the short and medium terms. In the long term, the countries may also consider initiating further power sector reforms and introduction of competition, in line with the policy goals and targets set by the respective Governments.

10.1.5 Country wise action plan for modifications in country level framework : Long Term (Months 28 and beyond)

In this phase, the countries focus on implementing long term structural reforms in their respective power sectors. Many of these reforms may probably be initiated well before month 28, as reforms typically require a substantial time for development, stakeholder consultations, legislative requirements etc.

10.2 Regional roadmap and action plan

The model regional framework has been purposefully developed in such a manner that most of the implementation aspects are left to the respective countries to decide and adopt. However, there are two aspects that are to be decided at a regional level. These consist of the following:

10.2.1 Overall institutional framework

As per component 5 of the model framework, a hybrid approach is proposed, where there are two levels of institutional framework for coordination:

1. Level 1 consists of coordination and consultations at inter-utility and inter-regulator level; and
2. Level 2 consists of the intergovernmental coordination mechanisms such as JSC, JWG and JTT.

The level 1 activities may preferably be undertaken under the proposed regional platforms/forums such as South Asia Forum of Transmission Utilities (SAFTU), South Asia Forum of System Operators (SAFSO) and South Asia Forum of Electricity Market (SAFEM), which are being discussed. However, to start with, the existing platforms and associations such as SAFIR, SASEC. etc. may be utilized. More importantly, the utilities and regulators have to proactively come forward to initiate dialogues, identify areas of collaboration given the modifications required and the overall regional requirements and, implement the activities as per the mutually agreed plans. Dispute resolution should also be a part of this.

Level 2 mechanisms are already active among most of the South Asian countries on a bilateral level. These level 2 mechanisms can be leveraged further in the implementation of activities to support the transition to trilateral and multilateral trade in the region. For example, in the development of operational procedure for CBET, system operators of multiple countries will have to discuss together. Another area is dispute resolution, which could not be resolved the Level 1. The Level 2 mechanisms provide a well-defined framework for such discussions, and related decision making.

10.2.2 Sustainability framework

As per component 6 of the model framework, countries may strive to ensure that inherent intermittencies in renewable energy do not prevent their access to regional power market and regional trade, wherever regulatory and operational mechanisms can be modified to obtain a level playing field for clean energy transactions in regional power trade. Considering this in mind, measures to ensure that transmission cost mechanism is fair to the renewables also, and suggestion to provide must-run status for clean energy sources are proposed as part of the country level suggested modifications. However, there are aspects that go beyond

country level, such as preferential treatment for clean energy while deciding on power purchase sources etc., which may be debated at a regional level.

In addition, discussions are also required to explore regional level reserve sharing agreement, rather than each country building its own dedicated reserves to manage clean energy sources. This aspect is being explored further in an analytical and modelling study being undertaken by SARI/EI that will ultimately provide recommendations on regional level ancillary services.

10.3 Conclusion

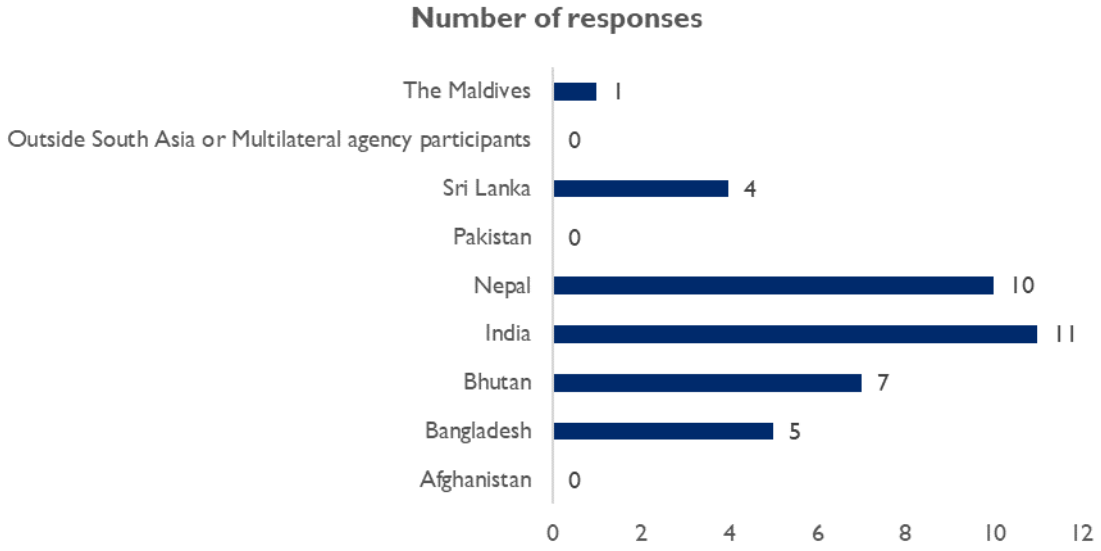
Once the proposed model regional framework is adopted and implemented by the South Asian countries, there will be greater harmony and interoperability on the key provisions relating to cross border trade among the countries, thereby facilitating ease of undertaking trilateral and multilateral power trade. It is expected to reduce the risk perception and improve investor attractiveness for regional energy projects in South Asia, as the ambiguity in applicable frameworks will be reduced. On the other hand, the presence / absence of the model regional framework should in no way prevent the countries to try for adoption of new and binding regional agreements for energy cooperation and trade, or for the implementation of regional institutions.

In the past few years, various market developments have already resulted in the region progressing further on multilateral trade. A good example is the fact that both Nepal and Bhutan is currently able to trade through Indian power exchanges, subject to the restrictions laid out in the relevant approvals. Aided by the model regional framework, trilateral and multilateral energy transactions, market platforms etc. a robust South Asian electricity market can be expected to evolve. This can then form the basis for further regional collaboration, with Central Asian and Southeast Asian electricity groupings also.

11 Annexure 1: Summary of stakeholder consultation

As part of the study, a detailed questionnaire was shared with key regional stakeholders, and their response is summarized below. The objective of the exercise was to obtain an initial view of the key stakeholders on some of the key aspects that will have a bearing on the development of model regional framework for CBTMPT. These summary of response to the key questionnaire, and associated regional preferences arising out of it were considered, while developing the model regional framework for CBTMPT.

In total, 38 responses were collected from the South Asian countries.



1. In the international power pools / regions, a strong political support in the form of an existing regional arrangement (for example, South African Development Community, Gulf Cooperation Council, Greater Mekong Subregion etc.) and/or an intergovernmental agreement / memorandum of understanding (MoU)s is seen as a common factor, creating the enabling conditions, and driving the cross border trilateral and multilateral power trade (CBTMPT). In comparison, in South Asia, while there is a SAARC Framework Agreement on Energy Cooperation signed by the countries, the power trade has been mostly driven by bilateral / intergovernmental agreements. For eventual transition to trilateral and multilateral trade, the basic framework will have to be guided through a set of intergovernmental agreements, or a single regional framework agreement. If a regional framework is to be implemented, there will also be a question of whether the same can be brought forward as an extension of the existing SAARC Framework Agreement, or as a separate agreement. What is your view on the manner of specifying the strategic and policy framework for cross border electricity trade (CBET) in South Asia, so as to enable it to support trilateral and multilateral power trade transactions? *

- Existing bilateral agreements, SAARC Framework Agreement on Energy Cooperation, and India's guidelines for import/export are adequate. Each transaction can be separately negotiated under these. However, a model framework can be prepared, which may then be modified and adopted on a case-by-case basis by the countries.
- Existing bilateral agreements, SAARC Framework Agreement on Energy Cooperation, and India's guidelines for import/export are adequate, but there is a need for follow-on protocols and implementation guidelines to be developed.

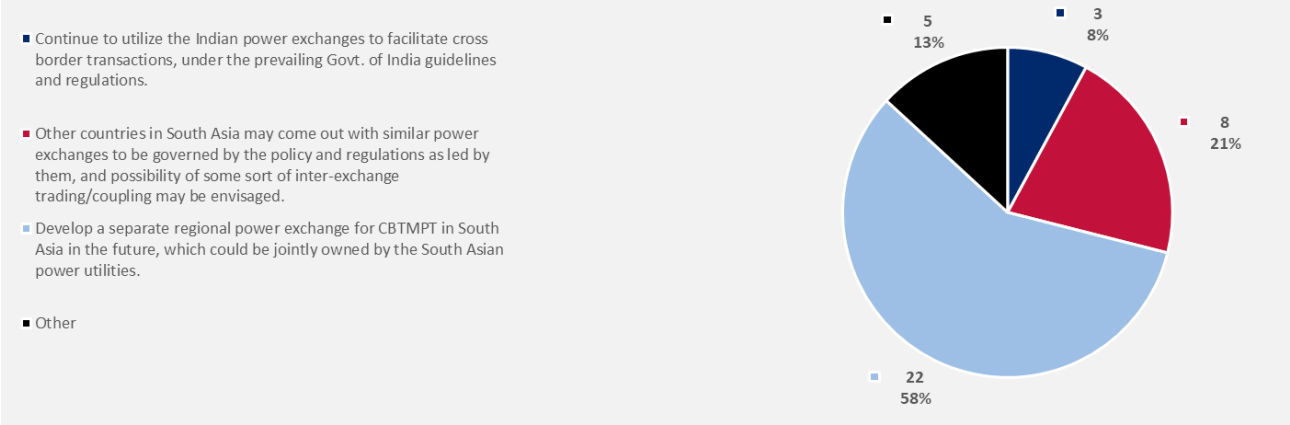
- There is a need for a new regional trade agreement for South Asia, that defines a common framework for CBTMPT.
- Other

Other responses

- *India shall be the center point for trilateral trades in the region due to geographical advantage. A new framework particularly between Nepal-India-Bangladesh and Bhutan-India-Bangladesh may be prepared for adoption.*
- *While second option "Existing bilateral agreements, SAARC Framework Agreement on Energy Cooperation, and India's guidelines for import/export are adequate, but there is a need for follow-on protocols and implementation guidelines to be developed" is be my answer out of the option given , but I would like to add "Going forward new Regional/Sub-Regional/Trilateral Agreement will be required in line which defines Common Framework for CBTMPT.*
- *Existing bilateral agreements, SAARC Framework Agreement on Energy Cooperation, and India's guidelines for import/export are though adequate, but the need based modification(s) may be made with consensus for CBMPT and there is also a need for follow-on protocols and implementation guidelines to be developed*

2. One of the key drivers and enabling factors behind the transition to CBTMPT in other power pools were the availability of market platforms. The power market platforms (power exchanges and markets run by market operator) have played a key role in enabling multilateral power trade in Europe, Nord Pool, South African Power Pool (SAPP), Central America and Gulf Cooperation Council Interconnection Authority (GCCIA). In South Asia, power exchanges are present in India, though technically, there are no regional power exchanges / market platforms. Meanwhile, under India's guidelines and regulations, access to Indian power exchanges is allowed for the neighbouring countries, through power traders registered in India, after seeking specific approvals for the given transactions and quantum from the Designated Authority (Central Electricity Authority – an organization under direct control of Government of India). This is substantially different from the examples from other power pools or regional arrangements. In such a context, what could be the long term target for developing market platforms to support CBTMPT in South Asia? *

- Continue to utilize the Indian power exchanges to facilitate cross border transactions, under the prevailing Govt. of India guidelines and regulations.
- Other countries in South Asia may come out with similar power exchanges to be governed by the policy and regulations as led by them, and possibility of some sort of inter-exchange trading/coupling may be envisaged.
- Develop a separate regional power exchange for CBTMPT in South Asia in the future, which could be jointly owned by the South Asian power utilities.
- Other

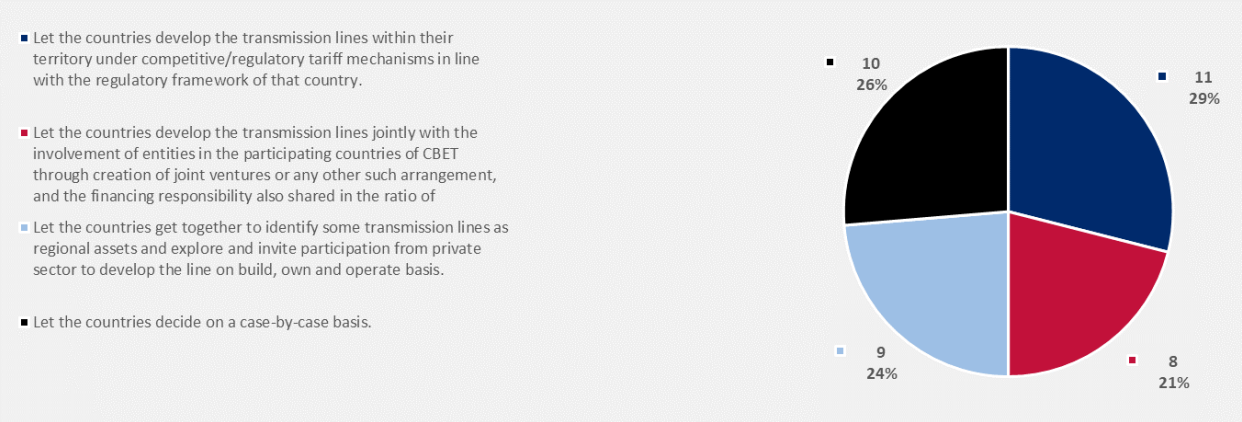


Other responses

- *Market maturity levels in other countries need to improve such as implementation of basics like unbundling, scheduling, metering, accounting, settlement.*
- *While first option is fine " Continue to utilize the Indian power exchanges to facilitate cross border transactions, under the prevailing Govt. of India guidelines and regulations", I would like to add that " It may be suitable for immediate future , however going forward there is a need for other countries to develop their own exchange or collectively come together for a regional exchange for cross border electricity trade as there are different model for Regional Exchange. It also may be noted that other SA countries can develop their own Domestic Power Exchange (who have sizeable power system) which can be coupled for cross border transactions.*
- *Continue to utilize the Indian Power Exchange and develop a separate regional power exchange later on.*

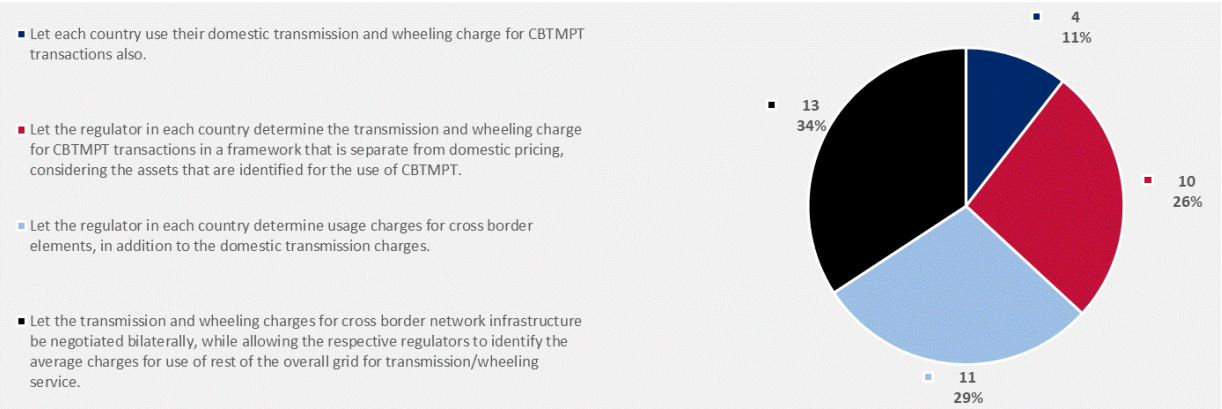
3. For development and financing of regional transmission lines, the most commonly adopted practice in other regions is to allow each country to develop transmission infrastructure within their own territory, and recover the costs through a transmission/wheeling charge. In the context of South Asia, how can the mode of development and financing of regional transmission lines within the territory of each country be determined? *

- Let the countries develop the transmission lines within their territory under competitive/regulatory tariff mechanisms in line with the regulatory framework of that country.
- Let the countries develop the transmission lines jointly with the involvement of entities in the participating countries of CBET through creation of joint ventures or any other such arrangement, and the financing responsibility also shared in the ratio of the ownership share.
- Let the countries get together to identify some transmission lines as regional assets and explore and invite participation from private sector to develop the line on build, own and operate basis.
- Let the countries decide on a case-by-case basis.



4. For facilitating CBTMPT, there needs to be an established mechanism for pricing of transmission/wheeling services for the use of transmission infrastructure. Internationally, there are cases such as that of SAPP and GCCIA wherein such charges are calculated centrally by an authority. There are also examples such as that of Europe where each country can have its own transmission pricing framework. For wheeling transactions such as CASA-1000 there can also be negotiated transmission and wheeling tariffs. In South Asia, a centralized solution is not feasible, as the trade is not controlled by a single regional entity / organization, unlike the case of SAPP and GCCIA. The regulators in each country are expected to deal with the aspect of pricing of transmission/wheeling within their own territory. In such a context, what can be a potential way forward for determination of transmission and wheeling charges for such CBTMPT? *

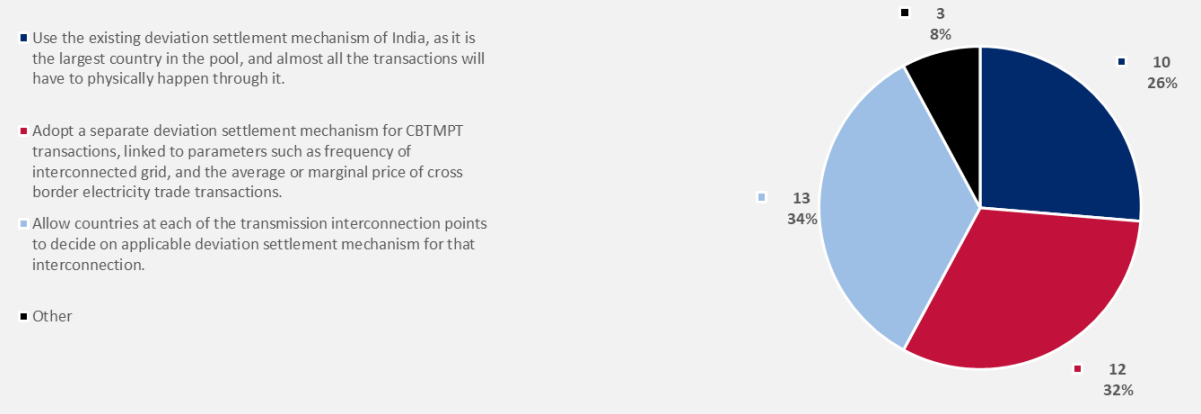
- Let each country use their domestic transmission and wheeling charge for CBTMPT transactions also.
- Let the regulator in each country determine the transmission and wheeling charge for CBTMPT transactions in a framework that is separate from domestic pricing, considering the assets that are identified for the use of CBTMPT.
- Let the regulator in each country determine usage charges for cross border elements, in addition to the domestic transmission charges.
- Let the transmission and wheeling charges for cross border network infrastructure be negotiated bilaterally, while allowing the respective regulators to identify the average charges for use of rest of the overall grid for transmission/wheeling service.



5. In CBET transactions, some amount of variation is bound to happen between scheduled volumes and actual volumes. There are mechanisms for deviation settlement, linked to parameters such as average generation

price and frequency (South African Power Pool), hourly average price (Central America) etc. There is also a deviation settlement mechanism in India, linked to average day ahead market price and frequency. In the context of enabling CBTMPT in South Asia, what mode of deviation settlement mechanism can be adopted? *

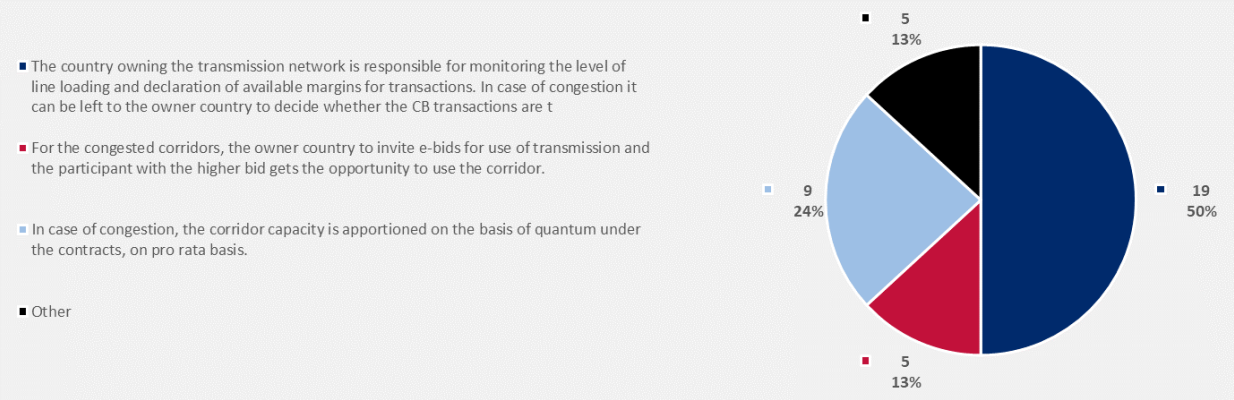
- Use the existing deviation settlement mechanism of India, as it is the largest country in the pool, and almost all the transactions will have to physically happen through it.
- Adopt a separate deviation settlement mechanism for CBTMPT transactions, linked to parameters such as frequency of interconnected grid, and the average or marginal price of cross border electricity trade transactions.
- Allow countries at each of the transmission interconnection points to decide on applicable deviation settlement mechanism for that interconnection.
- Other



Other responses – Adopt a separate mechanism for CBTMPT

6. In electricity trade, identification of transmission capabilities and managing congestion is a key aspect that is responsible to provide signals to trade participants and investors, for both short term and long term. There are multiple models adopted internationally for congestion management. For CBTMPT in South Asia, in case of transmission congestion, what could be the desired way to manage such network congestions? *

- The country owning the transmission network is responsible for monitoring the level of line loading and declaration of available margins for transactions. In case of congestion, it can be left to the owner country to decide whether the CB transactions are to be curtailed first or to be treated at par with the other transactions and dealt accordingly.
- For the congested corridors, the owner country to invite e-bids for use of transmission and the participant with the higher bid gets the opportunity to use the corridor.
- In case of congestion, the corridor capacity is apportioned on the basis of quantum under the contracts, on pro rata basis.
- Other

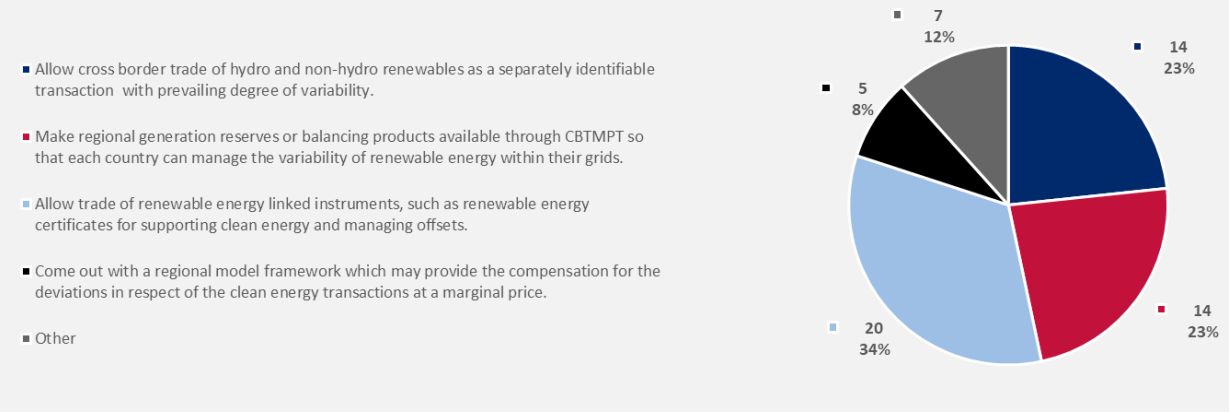


Other responses:

- *For the congested corridors, the owner country to invite e-bids for use of transmission and the participant with the higher bid gets the opportunity to use the corridor. But there may be a need to establish co-ordinating entity to resolve issue if any with consensus.*
- *Market maturity at both end is needed for any competitive process / non-discriminatory open access to be used in the participating countries.*
- *It should be governed by the prevailing trading agreements, which should have factored in the transmission related conditions/charges.*
- *Individual countries can decide on the congestion management and then come to consensus for adoption of an appropriate mechanism as decided.*

7. In regions such as Nord Pool, Europe, Central America and SAPP, there are instances of CBTMPT supporting clean energy, either through allowing clean energy to be traded, or through allowing excess energy / deficits on account of intermittent energy to be compensated through CBET. In the context of South Asia, what could be the preferred use case scenarios for use of CBTMPT for RE integration? (Multiple options can be selected) *

- ☐ Allow cross border trade of hydro and non-hydro renewables as a separately identifiable transaction with prevailing degree of variability.
- ☐ Make regional generation reserves or balancing products available through CBTMPT so that each country can manage the variability of renewable energy within their grids.
- ☐ Allow trade of renewable energy linked instruments, such as renewable energy certificates for supporting clean energy and managing offsets.
- ☐ Come out with a regional model framework which may provide the compensation for the deviations in respect of the clean energy transactions at a marginal price.



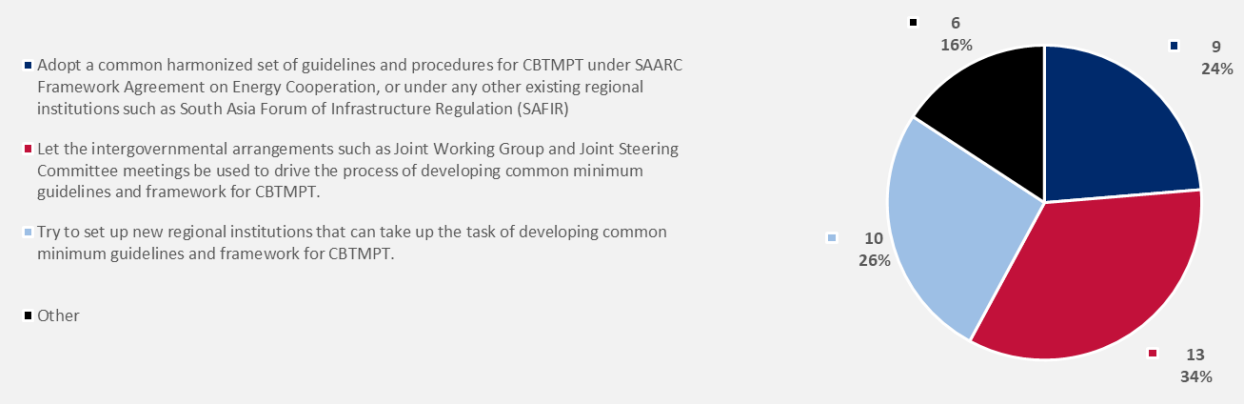
Other responses:

- *Each transaction is required to be scheduled separately with identified source and sink.*

- *Allow cross border trade of renewable energy (hydro, solar, wind, etc) through appropriate mechanisms for balancing products as well as variabilities*
- *All of the above*
- *Factor in carbon credits will help improve in monetary terms*
- *AI based digital technology to help in RE trade*
- *Come out with a region model framework which may provide the compensation for the deviations in respect of the clear energy transactions at a marginal price*

8. Most of the international power pools/ regions are supported by an Inter-governmental agreement/ MoU, and a set of detailed agreements/ procedures/ guidelines/ rules that govern the power trade. In the absence of a common set of legal, policy, regulatory and technical guidelines, each transaction will have to be negotiated separately by the member countries. As discussed in this questionnaire, there are multiple options related to transmission pricing, congestion management, deviation settlement etc. As there is no regional level entity coordinating on these aspects, what could be the most preferred way forward for countries in South Asia to adopt a common harmonized set of guidelines and procedures? *

- Adopt a common harmonized set of guidelines and procedures for CBTMPT under SAARC Framework Agreement on Energy Cooperation.
- Use an existing regional institution such as South Asia Forum of Infrastructure Regulation (SAFIR) to bring the countries together to develop common minimum guidelines and framework for CBTMPT.
- Let the intergovernmental arrangements such as Joint Working Group and Joint Steering Committee meetings be used to drive the process of developing common minimum guidelines and framework for CBTMPT.
- Try to set up new regional institutions that can take up the task of developing common minimum guidelines and framework for CBTMPT.



Other responses:

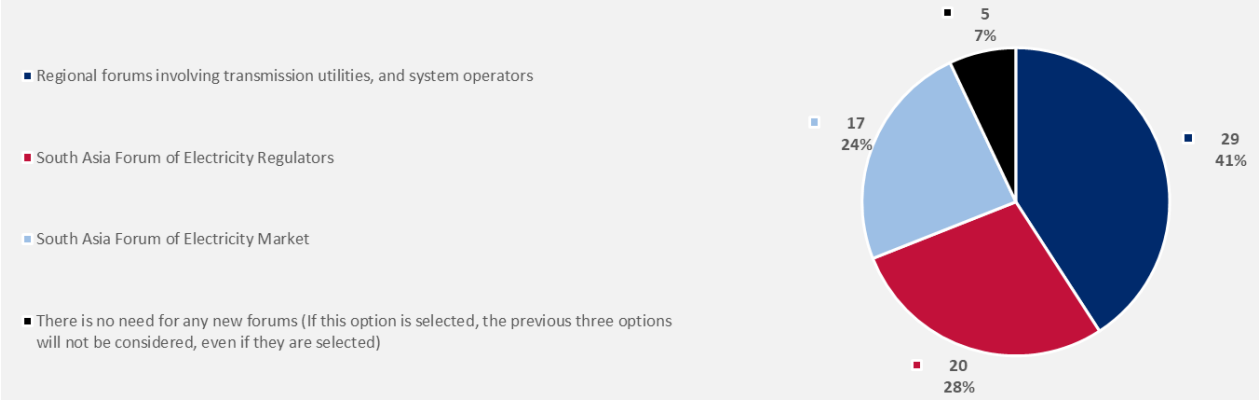
- *Use an existing regional institution such as South Asia Forum of Infrastructure Regulation (SAFIR) to bring the countries together to develop common minimum guidelines and framework for CBTMPT.*
- *Let the intergovernmental arrangements such as Joint Working Group and Joint Steering Committee meetings be used to drive the process of developing common minimum guidelines and framework for CBTMPT. But for effective implementation, there may be a mechanism or a professional forum for addressing various issues such as Technical, Operational, Commercial, etc.*
- *I would say Option 2 to begin with i.e., " Let the intergovernmental arrangements such as Joint Working Group and Joint Steering Committee meetings be used to drive the process of developing common minimum guidelines and framework for CBTMPT. However, going in future at least broad principle should be agreed under " SAARC and BIMSTEC" and "common harmonized set of guidelines and procedures" under the "SAFIR" only if it is officially recognized by SA country Governments as a "Regional Institutions for Regulatory Coordination and Harmonization for Electricity under any Regional /Sub-Regional Agreements. Otherwise, there is no Harm in setting of New Institutions but the credible and well-functioning ones. One should not*

have the argument that we have x,yz institutions so enough, however having dedicated institution brings focus, rigors, transparency, fairness and sense of mutual cooperation, shared understanding which build trust. These values should not be compromised in the sight of feasibility, practicability question in current context. I some who thinks things evolve. Who knew that CERC will have dedicated regulation on CBET some 9 years ago? If you have done such questionnaire that time, response would have been vastly different. My answer is in the overall context of institutions, for CBTMPT. I mean one does not create an institution just only for CBTMPT and I understand that this is not the intent here also.

- *Adopt a common harmonized set of guidelines and procedures for CBTMPT under SAARC Framework Agreement on Energy Cooperation.*

9. Presence of permanent regional coordination bodies for transmission utilities, system operations, regulators etc. could enable quicker decision making on arriving at harmonized procedures for regulatory, technical, operational and commercial management of trilateral / multilateral power trade. They can also play a key role in consensus building and in development of regional plans. This could be in the form of strong regional entities (CRIE and EOR in Central American Interconnection, ENTSO-E in Europe) or regional entities with an advisory and coordination role (RERA in SAPP, RPTCC in GMS, APGCC in ASEAN) etc. In that context, whether creation of some regional institution/platform could be considered to support CBTMPT in South Asia? (Multiple options can be selected) *

- ☐ Regional forums involving transmission utilities, and system operators
- ☐ South Asia Forum of Electricity Regulators
- ☐ South Asia Forum of Electricity Market
- ☐ There is no need for any new forums (If this option is selected, the previous three options will not be considered, even if they are selected)



10. Please suggest any potential options/comments/suggestions on how you view the framework for South Asian countries may be developed, for eventual transition of bilateral power trade to trilateral and multilateral power trade. (Please provide up to 100 words)

1. *Direct dialog of 3 countries needs to be initiated and framework/mechanism needs to be developed in accordance.*

2. *Power system master plan of each country is to be studied first to see whether the master plan of each country facilitate for regional integration of transmission network system.*

3. *First, bilateral agreements shall be established. Based on the bilateral negotiation concluded, try to enter in the trilateral which are the related ones. Then, sub-regional or regional mechanism can be established.*

4. *As political consensus is very much important for multilateral power trade, government of all concerned country should come up with common minimum understanding for these kinds of trade otherwise it is highly unlikely*

that this can be realized. Creation of permanent regional body would be useful to guide and assist utility of participating country to move forward. This type of body shall formulate regulations, adopt common minimum grid code and formulate plan for operational issues, make a plan for recovery procedure if grid fails, set a rule for information flow among the participating country .

5. *A forum should be formed separately for regulator, system operator or transmission system utility without duplicating the roles of existing Forum(s) in the region. This would help to harmonize the policies and bring about uniformity to technical standards. This will also help secure regional cooperation in terms of buy and sale of electricity. In the present current geo-political context in South Asia, such forum may possibly be more effective as an advisory forum rather than one with power to issue binding resolutions. So, rather than creating an institution that is forceful, we can create an advisory institution, which, based on the necessity of the region, can evolve into a more authoritative in the long run.*

6. *India has a pivotal role in trilateral and multilateral power trading. Governments of South Asian countries need to have trust to each other and strong commitment for this. India's Cross Border Guidelines do not have provisions for developing dedicated transmission system in the Indian territory to trade power generated in the third countries. It should be allowed in the Guidelines. Further, the DA Procedure of India contradicts with the Guidelines regarding the generation plant to be owned or developed or controlled. It needs to be revisited.*

7. *Because of geographical location and relative size of power system, India is a central hub for transition of bilateral power trade to trilateral and multilateral power trade in the region. In India's Guidelines on import and export of electricity 2018, there is a provision for trilateral power trade among the neighbouring countries. such a provision would certainly promote trilateral and multilateral power trade if it was implemented in the interest of all the neighbouring countries. Therefore, the transition of bilateral power trade to trilateral and multilateral power trade in the region depends on willingness and commitment of India for regional power trade.*

8. *To sort out any outstanding/pending/emergency issues (to be decided at political level) , a coordination committee of Joint Secretary of Ministry of Power of the participating countries should be formed*

9. *Please go through the work done in the previous phase of SARI/EI project. Most of these issues have been addressed in the activities related to SARPEX*

10. *For confidence building in developing the power trade in the South Asia Region, there may be a need to establish Consensus Regional Professional Forum for resolving various issues with consensus like National Power Committee in India to resolve Indian National Grid and issues related to various stakeholders of Inter-regional in the Regional Grid. In my opinion, for achieving the success implementation of power trade with transparency, make use of digital Technology with adequate mechanism of digital recording for approval process of legal, policy, regulatory and technical issues and for operational and commercial management of trilateral / multilateral power trade.*

11. *A market driven process for cross-border power trading in South Asian Countries together with a well-developed regulatory framework across the region that enforce a strong development of interconnection power system among the countries.*

12. *Increase and incentivize bilateral and then go for multilateral power exchanges, parties need to build confidence and then go for full trading.*

13. *Three important parts are to be developed for the successes of CBTE. !. Governance, Infrastructure and Market. Governance part may be cope by a empowered group involving regulators of all participating countries. Infrastructure i.e., transmission system can be developed on case by case basis. Market may be a joint organization with members from all participating countries.*

14. *Platform other than trading platform is necessary for the potential sellers (e.g., generators) and potential buyers (e.g., utilities and consumers) to discuss/explore/advertise possibilities of business opportunities. Online and physical Platform has to be created under an appropriate reginal institution.*

15. *It is suggested to first review the existing SAARC Framework Agreement on Energy Cooperation and check the relevance. Second, to develop common understanding on the electricity trade because the existing practice adopted in one particular country may be irrelevant to the other.*

16. *Currently even bilateral trade is not smooth due to lack of integration (common regulations, approvals days, political will, transmission bottleneck etc). Trilateral is envisioned in CBET rules of India but requires all three or more governments to clearly agree. IV of all involved countries is necessary for taking up projects to ensure involvement , stake and strategic interest*

17. *The provisions of existing regulations shall be fully utilized prior to trying a new forum or regulation, to understand challenges associated with these provisions.*

18. *Need strong political commitment for regional cooperation, India should take the lead to gain more confidence about its sincere willingness to create a win-win situation.*

19. *In South Asia we have SAARC Framework Agreement for Energy Cooperation (Electricity) and we have Memorandum of Understanding (MoU) for the Establishment of the BIMSTEC Grid Interconnection. So political consensus is there for cross border power trade. But we need strong political will for promoting CBET. Proper legal and regulatory frameworks also have to be developed for facilitating the CBET. Existing bilateral and trilateral agreements could be the basis for developing common regulatory and legal frameworks for multilateral agreement. There is also need for engaging & improving human resource to be capable of handling sophisticated exchanging mechanism with professionalism.*

20. *In consultation with all the participating countries, all endeavours needed to expedite CBTMPT is of utmost importance so that all the countries could be benefitted with this arrangement.*

12 Abbreviations

ACE	ASEAN Center for Energy
ACER	Agency for the Cooperation of Energy Regulators
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulatory
AERN	ASEAN Energy Regulatory Network
AIMS	ASEAN Interconnection Master Plan Study
AMEM	ASEAN Ministers on Energy Meeting
APAEC	ASEAN Plan of Action for Energy Cooperation
APG	ASEAN Power Grid
APGCC	ASEAN Power Grid Consultative Committee
ARC	Advisory and Regulatory Committee
ASX	Australian Stock Exchange
ATC	Available Transmission Capacity
BPM	Balancing Power Market
BPM	Balancing Power Market
CACM	Capacity Allocation and Congestion Management
CASA	Central Asia-South Asia
CASAREM	CASAREM Regional Electricity Market
CBTMPT	Cross Border Trilateral and Multilateral Power Trade
CDMER	Steering Committee of the Regional Electricity Market
COAG	Council of Australian Governments
CPPA	Central Power Purchasing Agency
CRIE	Comisión Regional de Interconexión Eléctrica
CVT	Variable Transmission Charge
DAM	Day Ahead Market
DBSA	Development Bank of Southern Africa
DERA	Danish Energy Regulatory Authority
DOE	Department of Energy
EAPP	Eastern Africa Power Pool
EDL	Electricité du Laos
EGAT	Electricity Generating Authority of Thailand
EMS	Energy Management System
ENTSO-E	European Network of Transmission System Operators for Electricity
EOR	Ente Operador Regional
EPR	Empresa Propietaria de la Red
EPWA	Energy Purchase and Wheeling Agreement
EU	European Union
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act

FPM	Forward Physical Market
GCC	Gulf Cooperation Council
GCCIA	Gulf Cooperation Council Interconnection Authority
GMS	Greater Mekong Subregion
HAPUA	Heads of ASEAN Power Utilities/Authorities
HGA	Host Government Agreements
IADB	Inter-American Development Bank
IDM	Intra Day Market
IGA	Inter-Governmental Agreement
ISO	Independent System Operator
ISO-NE	Independent System Operator - New England
JWG	Joint Working Group
LMP	Locational Marginal Pricing
LTMS PIP	Lao PDR, Thailand, Malaysia and Singapore Power Interconnection Project
MCR	Regional Contract Market
MDB	Multilateral Development Banks
MER	Regional Electricity Market
MLF	Marginal Loss Factor
MOR	Regional Opportunity Market
MOU	Memorandum of Understanding
MRFTMPT	Model Regional Framework for Trilateral and Multilateral Power Trade
MTP	Market Trading Platform
NECPUC	New England Conference of Public Utilities Commissioners
NEM	National Electricity Market
NEMO	Nominated Electricity Market Operator
NEPOOL	New England Power Pool
NERC	North American Electric Reliability Council
NESCOE	New England States Committee on Electricity
NITS	Network Integration Transmission Service
NPCC	Northeast Power Coordinating Council
NPT	National Power Transmission Corporation
NPV	Net Present Value
NRA	National Regulatory Authorities
NTDC	National Transmission and Despatch Company
NVE	Norwegian Water Resources and Energy Directorate
OASIS	Open-Access Same-Time Information System
OATT	Open Access Transmission Tariff
OFO	Operational Flow Orders
OTC	Over The Counter
PETA	Power Exchange and Trading Agreement
PJM	Pennsylvania-New Jersey-Maryland (PJM) interconnection
POD	Point of Delivery

POR	Point of Receipt
PPDF	Project Preparation and Development Facility
PTF	Pooled Transmission Facility
PTO	Pooled Transmission Owner
RERA	Regional Electricity Regulators Association of Southern Africa
RIT-T	Regulatory Investment Test - Transmission
RMER	Regional Electricity Market Regulations
RPCC	Regional Power Coordination Center
RPTCC	Regional Power Trade Coordination Committee
RPTOA	Regional Power Trade Operating Agreement
RRN	Regional Reference Node
RTEP	Regional Transmission Expansion Plan
RTMR	Regional Transitional Market Regulations
RTO	Regional Transmission Operator
RTR	Regional Transmission Network
SADC	Southern African Development Community
SAPP	South African Power Pool
SARI/EI	South Asia Regional Initiative for Energy Integration
SCADA	Supervisory Control and Data Acquisition
SIEPAC	Sistema de Interconexión Eléctrica para los Países de América Central
SPV	Special Purpose Vehicle
STEM	Short Term Energy Market
TNB	Tenaga Nasional Bhd
TNYDP	Ten Year Network Development Plan
TOA	Transmission Operating Agreement
TOUT	Through-or-out Transmission
TRM	Transmission Reliability Margin
TSO	Transmission System Operator
TTC	Total Transmission Capacity
ZIZABONA	Zimbabwe-Zambia-Botswana-Namibia

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Due acknowledgment is provided to all the below sources and their authors, for providing enabling inputs for this study.

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About SARI/EI

The US Agency for International Development (USAID) initiated the South Asia Regional Initiative for Energy (SARI/E) program in the year 2000 to promote Energy Security in the South Asia region, working on three focus areas: Cross Border Energy Trade (CBET); Energy Market Formation; and Regional Clean Energy development. The program covers the eight countries in South Asia, viz. Afghanistan, Bangladesh, Bhutan, India, The Maldives, Nepal, Pakistan and Sri Lanka. The fourth and current phase of the program, called South Asia Regional Initiative for Energy Integration (SARI/EI), is aimed at advancing regional grid integration through cross border power trade. This phase is being implemented by Integrated Research and Action for Development (IRADe), leading South Asian Think Tank. SARI/EI program was extended to 2022 and is a key program under USAID's Asia EDGE (Enhancing Growth and Development through Energy) Initiative. In its extended phase, SARI/EI will focus on moving the region from bilateral to trilateral and multilateral power trade, and establishing the South Asia Regional Energy Market (SAREM).

About USAID

The United States Agency for International Development (USAID) is an independent government agency that provides economics, development and humanitarian assistance around the world in support of the foreign policy goals of the United States. USAID's mission is to advance broad-based economics growth, democracy, and human progress in developing countries and emerging economies. To do so, it is partnering with governments and other actors, making innovative use of science, technology, and human capital to bring the profound results to a greatest number of people.

About IRADe

IRADe, located in Delhi, is a non-profit and fully autonomous institute for advance research. IRADe's multidisciplinary research and policy analysis aid action programs. It is a hub for a network of diverse stakeholders. Established in 2002, the institute is recognized as an R&D organization by the Department of Scientific and Industrial Research and Ministry of Science and Technology of the Government of India. The Ministry of Urban Development has accorded IRADe the status of Centre of Excellence for Urban Development and Climate Change. Through the SARI/EI program, IRADe is pushing the envelope for sustainable energy access through experts and members from South Asia.

For more information, please visit the SARI/EI project website:
https://sari-energy.org/