ANNUAL REPORT
2018 - 19

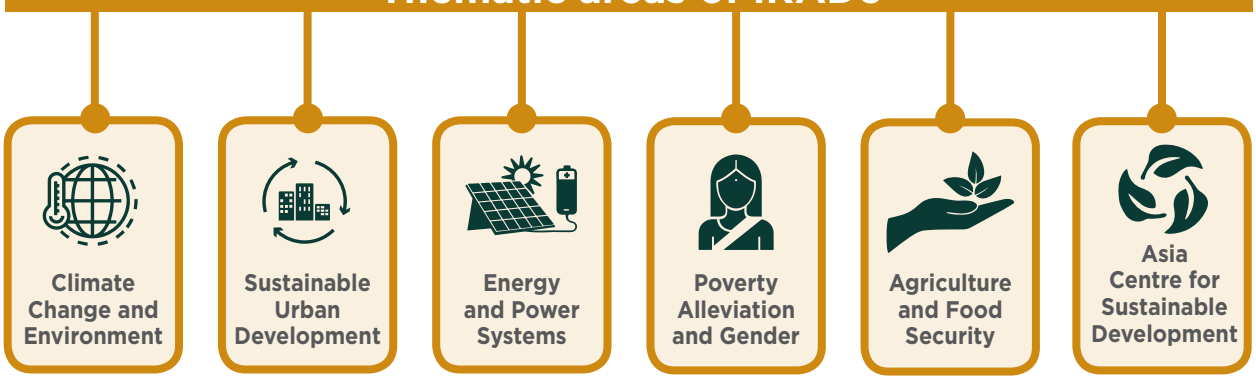
Integrated Research and Action for Development

About IRADe

IRADe is an independent non-profit, advanced research institute which aims to conduct research and policy analysis to engage stakeholders such as government, non-governmental organisations, corporations, academic and financial institutions. Energy, climate change, urban development, poverty, gender equity, agriculture and food security are some of the challenges faced in the 21stcentury, IRADe's research covers these issues, as well as the policies that affect them. IRADe's focus is effective action through multi-disciplinary and multi- stakeholder research, to arrive at implementable solutions for sustainable development and policy research that accounts for the effective governance of techno-economic and socio-cultural issues.

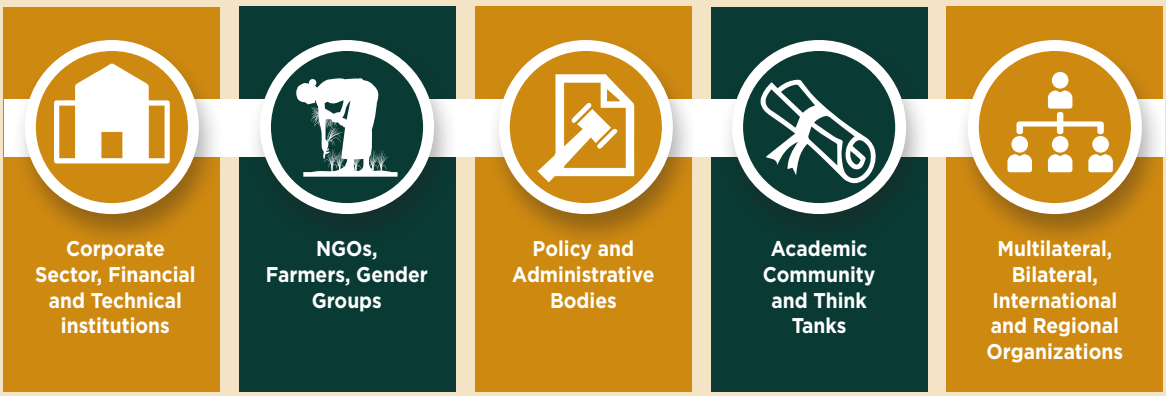
IRADe was established under the Society's Act, in 2002 at New Delhi. It is certified as a Research &Development Organisation by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MoST), Government of India. It has also been selected as a Centre of Excellence by the Ministry of Urban Development (MoUD), Government of India for urban development and climate change. In addition, it provides expertise to other ministries, national and international institutions and partners with other reputed organisations.

Thematic areas of IRADe



Our Partners in development

Integrated Research and Action for Development (IRADe)



Our Vision

To be a leading Global independent policy research Think Tank that provides and enables implementable policy solutions for sustainable and inclusive development.

Our Mission

To carry out policy analysis from multi-stakeholder and multi-disciplinary perspectives for decision makers and vulnerable groups in thematic areas of climate change and environment; energy and power systems; sustainable urban development; agriculture and food security; poverty alleviation and gender. Using policy research and analysis, consensus building and dialogues, capacity building, monitoring and evaluation.

Our Objectives

Integrate multi-disciplinary and multi-stakeholder perspectives concerning issues of development.

- Promote wider consensus, through research and analysis, on effective policies.
- Engage and work at local, district, state, national, South Asia regional and global levels.
- Provide research support to developing countries for development and for negotiation process for international agreements.
- Carry out policy research that accounts for the political economy of the society and effectiveness of governance.

IRADe's activities in the above areas have cross-cutting themes such as technology assessment and policy reforms. The key activities are:

1. Policy Dialogues and Dissemination
2. Training and Capacity Building
3. Research and Analysis for Decision Support
4. Research in Action, Monitoring and Evaluation Projects

Preface

I am happy to share this IRADe annual report for 2018-19 highlighting new developments.

IRADe received extension of SARI (South Asia Regional Initiative for Energy Integration) project by USAID for another 4 years. This phase will be led by two highly talented professionals viz. Shri Pankaj Batra, former chairman of CEA (Central Electricity Authority) and Shri V.K. Agarwal, former Executive Director of POSOCO (Power System Operation Corporation). The first phase of SARI concluded with the regional conference for Energy cooperation in South Asia after 6 years of SARI programme supported by the USAID.

To celebrate completion of 15 years of IRADe, we organized 3 workshops; one each in Odisha, Gujarat and Assam. We also commenced a MacArthur Foundation funded project in these 3 states which is about the state level Climate Mitigation actions to achieve NDC goals promised in the Paris agreement. In addition, several ongoing projects are completing their interim activities especially on Himalayan cities of Shillong and Gangtok (National Mission for Himalayan Studies), Heat Stress project (International Development Research Centre) in the 3 cities of Rajkot, Bhubaneswar and New Delhi. IRADe's work on heat stress due to climate change was covered by New York Times which highlighted its study on impact of heat stress on productivity, livelihood and health.

IRADe has been featured in five categories in the Global Go to Think Tank Index Report released by the Think Tanks and Civil Societies Program (TTCSP) of the University of Pennsylvania. It was ranked 2nd in India and 32nd globally among think tanks with annual operating budgets of less than 5 Million USD. It was ranked 2nd in 6th in 4 categories in India. IRADe's Chairman, Dr. Kirit Parikh and I participated in CoP 24 at Katowice, Poland in several panel discussions including one by IPCC 6th assessment for 1.5-degree report.

My earnest thanks to all our sponsors, collaborators, the Governing Council of IRADe and our networks for their continued support and encouragement. I congratulate IRADe's staff for our achievements.

My special thanks to Ms. Ananya Bhatia, Research Associate, IRADe for completing the task of preparing this report.

I convey my best wishes to the readers.

Professor Jyoti Parikh, PhD
Executive Director, IRADe

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1 Energy and Power Systems

1.1 Inter-model Comparisons of Different Transportation Sector Policies in India-

Recognizing the importance of energy modelling in effective policy making for low-carbon growth, the Governments of India and the United States have formed a Sustainable Growth Working Group (SGWG) as a part of the bilateral energy dialogue. In SGWG, NITI Aayog is representing the Government of India. The project team comprised of four Indian modelling teams: Integrated Research and Action for Development (IRADe), Centre for Study of Science and Technology and Policy (CSTEP), Council on Energy, Environment and Water (CEEW) and The Energy Research Institute (TERI). As a Common Modelling Platform (CMP) This project was to use a set of models to explore a set of technology and policy options to reduce energy consumption and emissions, increase access and solve mobility issues in the transport sector. This was to help evolve a roadmap for the transport sector in the light of India's announced Nationally Determined Contributions (NDCs), towards commitments towards Paris Agreement (PA).

India is committed through its NDCs to reduce the CO2 intensity of its GDP by 33-35 per cent by 2030 as compared to the 2005 level. India's transport sector contributed to 14 per cent (75 Mtoe) of final energy consumption and contributed about 10 percent of Greenhouse Gas (GHG) emissions in 2013. The road transport sector consumes 90 per cent of the total transport sector fuel and passenger transport accounts for 60 per cent of the total fuel consumed by the road transport (68 Mtoe, 2013). Of the total transport sector emission of 188 MT of CO2 equivalents, the road transport sector contributed 87 percent.

Policymakers in the U.S., Asia and Europe increasingly rely on inter-model comparisons, it simultaneously builds capacity for modelling in the country in integrating results from different models into policy making.

The CMP detailed 5 strategies to reduce air pollution in the road transportation sector –

1) Electrification of transportation sector
   a. Penetration of EV vehicle
   b. Electrification of railways
2) Energy efficiency
   a. Introduction of emission standards
   b. Introduction of fuel standards
3) Use of alternative fuels
   a. Use of bio petrol and bio diesel
4) Shift to public transport
   a. Shift from road to rail
   b. Shift from private vehicles to public buses
5) Reduction in transport demand
   a. Cities with better urban design
   b. Use of non-motorised transport

The CMP was agreed upon for two scenarios for analysis 1) New Policy Scenario and 2) High Ambition scenario. The New policy scenario was based on current and announced government policies in the five strategies mentioned above while in the High Ambition scenario, the policy rates assumed in the new scenarios were simply jacked up to represent higher ambitions for air pollution mitigation.

The comparison of the results showed that the share of private transport is going to increase in the future due to increased car ownership by private households. Energy efficiency is the most cost-effective way to mitigate air pollution followed by a shift to public transport. Even ambitious penetration of EV does not result in a significant impact on air pollution, due to a large stock of previous and ongoing purchase of vehicles. Shifting to public transport is cost effective but a relatively difficult strategy to implement compared to energy efficiency. A

joint paper by the four teams on transport sector modelling which was published.

Duration: *October 2016 – July 2018 (Completed)*

Supported by: *Shakti Sustainable Energy Foundation*

1.2 Implications of Declining Costs of Solar, Wind and Storage Technologies on Regional Power Trade in South Asia (BBIN Countries)

IRADe linked EEG (Energy and Economic Growth) Programme will undertake a modelling study on the implications of declining costs of Solar, Wind and Storage Technologies on regional power trade in South Asia particularly in Bangladesh, Bhutan, India and Nepal (BBIN Countries). IRADe will develop a regional electricity model that will comprise of reference energy systems focusing on electricity capacity addition in Bangladesh, Bhutan, India and Nepal using the bottom up technology based TIMES (The Integrated MARKAL-EFOM System) model generator. The regional electricity model will be run with various scenario assumptions, assuming there will be regional trade on least cost principles to answer the following:

- What will be the capacity of transmission network required?
- What will be the possible capacity mix and fuel consumption by the power sector in the region?
- What will be the impact of declining cost of solar, wind and storage technologies on the regional power trade on annual quantum, seasonality and hourly trade volumes?
- What will be the implications on regional hydro potential utilization? How much of flexible hydro is utilized in the region for balancing renewables with declining storage cost?
- What will be the environmental benefits in terms of lower CO2 emissions?

Duration: *March 2019 – December 2020 (Ongoing)*

Supported by: *Energy and Economic Growth Programme (Funded by UK aid from the UK government)*

1.3 Study to Develop Roadmap for Implementation of India's NDC goal 3

The study assessed to what extent current policies may reduce emissions intensity and further actions required to achieve NDC Goal 3 of 33-35% emissions intensity and further actions required for reduction at the national level by 2030. In the process, the study intends to calculate the financial cost for implementing current policies and also for the incremental effort to implement NDC Goal 3 for transport, industry, power and agricultural sectors.

The total emissions intensity of GDP and sectoral demands up to 2030 were obtained from IRADe's macroeconomic model. Supply side for responses for Power, Industry (Cement and Iron & Steel), Transport, Agriculture have been modelled using spreadsheet. Various policy options were examined for each sector to assess their impacts on emissions and costs.

Duration: December 2018 – July 2019 (Ongoing)

Supported by: Ministry of Environment, Forest and Climate Change (MoEFCC)

1.4 Long Term Strategy for Low Carbon Development

This project is a sub grant to IRADe by CSTEP for providing them outputs of various economic sectors which are drivers of energy demand for their project titled "Long Term Strategy for Low Carbon Development" funded by MOEFCC. In this project IRADe team has provided outputs of sectors like transport, Cement, Iron& Steel, Mining & Quarrying, Agro Processing, Textiles, Fertilizers, Agriculture, Buildings for low and High GDP scenarios for various scenarios.

To make the socio-economic projections consistent with the energy sector implications of the CSTEP model, the cost assumption of the energy sector in IRADe model are assumed to be the same as CSTEP's model. For this CSTEP shared the cost coefficients assumptions for the energy sector with IRADe and also the coefficients for the power sector.

Duration: *January 2019 – March 2019 (Ongoing)*

Supported by: *Ministry of Environment, Forest and Climate Change (MoEFCC)*

1.5 South Asia Regional Initiative for Energy Integration (SARI/EI), USAID/ India

Integrated Research and Action for Development (IRADe) is the implementing partner for the fourth phase- October 2012 to September 2018, which based on the outcome of the work has been extended to September 2022, of USAID's South Asia Regional Initiative for Energy Integration (SARI/EI) programme for advancing regional energy integration and Cross-Border Energy Trade (CBET) in eight South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Pakistan, Nepal, Sri Lanka and the Maldives). The SARI/EI programme addresses policy, regulatory, legal, technical, market aspects of advancing regional energy integration and CBET.

1.5.1 SARI/EI

Under the USAID's SARI/EI programme, IRADe carried out comprehensive analytical macroeconomic studies to critically assess the need for CBET that involves iteration between two models.

A macro model and a detailed power technology model were used for each country. The technology model balances power demand-supply on an hourly basis with limited or expanded trade. Iterations between Macro and Technology Models provides consistent results, in terms of resources to invest, impact on growth, electricity demand, surplus for trade etc.

IRADe had completed earlier two bilateral trade studies which estimated the potential for power trade and economic benefits to the countries:

a) Economic Benefits from Nepal-India Electricity Trade

b) Economic Benefits from Bangladesh-India Electricity Trade.

Gains from Multilateral Electricity Trade among BBIN Countries

We extended their analysis to cover multilateral trade. The BBIN (Bangladesh, Bhutan, India and Nepal) trade study integrates the power system model of each country that was developed for the above bilateral studies to explore the benefits of multilateral trade from all the BBIN countries. The study highlight is that, all the countries in the BBIN region gain from electricity trade some in terms of lower capacity requirements and some in terms of additional export revenues from electricity trade. Multilateral trade in the BBIN region leads to more efficient use of fossil fuel resources in the region and reduces cumulative emissions of the region. The Report was released on 30th August 2018, in Session V- "Electricity Trade in BBIN region- Long-term trading volume and prospects" at the Regional Conference on Enhancing Energy Cooperation & Integration in South Asia, New Delhi.

Apart from focusing on power sector, IRADe has also started working on the integration of Gas markets in SAARC Region.

Global and BBIN Region Perspective Report on Gas Scenario

For the gas market integration, IRADe has initiated a regional gas assessment study under the SARI/EI initiative. The study will focus on the BBIN region particularly and will cover global aspects too.

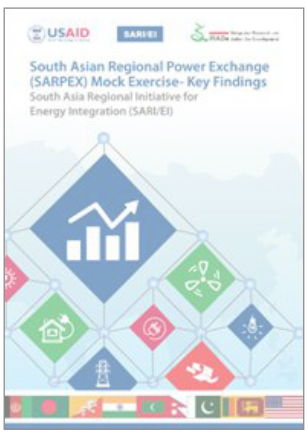
Duration: *2018– 2020 (Ongoing)*

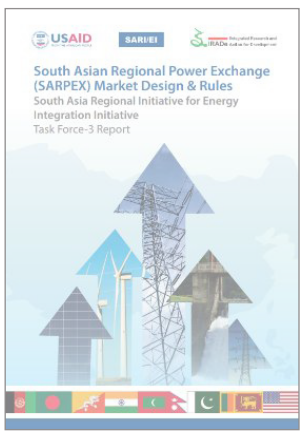
Supported by: *USAID, India*

1.5.2 SARI Publications

SARPEX Power Market Design and Rules" and Key Findings of SARPEX

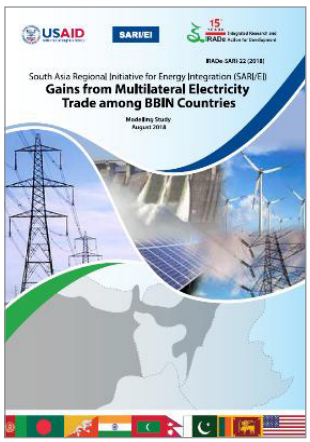
Two main reports – "Power Market Design and Rules" and "Key Findings of SARPEX" – were developed under the SARPEX (South Asia Regional Power Exchange) mock exercise and





a web portal was created for mimicking the regional power exchange. These reports cover the key recommendations for setting up and operating a regional power exchange between India, Bangladesh, Bhutan, and Nepal. The findings show that a regional power exchange for BBIN countries, regardless of the operating mode, not only would help in the management of day-ahead demand and supply positions but would also benefit the member countries in buying their marginal power requirements at a cost lower than their production cost or selling surplus power in a larger market of a price higher than their production cost. The region has gained enough confidence on CBET and the mock exercise clearly showcases the win-win situation for all countries. The report was released at the SARPEX final workshop held on July 6, 2018 in India.

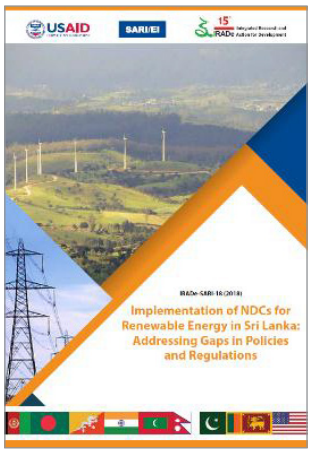
Gains from Multilateral Electricity Trade among BBIN Countries



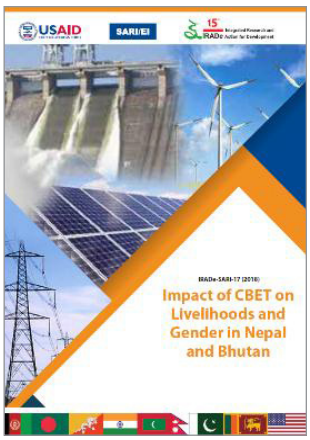
A Report was developed from the experience of past SARI/EI studies – "Economic Benefits from Nepal – India Electricity Trade" (released in January 2017) and "Economic Benefits of Bangladesh – India Electricity Trade" (released in January 2018). While the earlier studies examined the status of bilateral trade at that time, this study examined trade in a unified manner and focused on the integration of the power sectors of Bangladesh, Bhutan, India and Nepal (BBIN) at a regional level.

Implementation of NDCs for Renewable Energy in Sri Lanka Addressing Gaps in Policies and Regulations

This report was published under the SARI/EI Think Tank Forum. The Slycan Trust, one of the think tanks in SARI/EI Think Tank Forum in the region, has undertaken the above study. This report provides analysis and need for policy enhancement, or creation of new policies or laws to implement the NDCs and CBET as a potential outcome of the increase of renewable energy production through NDC commitments, as well as already existing initiatives taken by the SAARC in the previous years.



Impact of CBET on Livelihoods and Gender in Nepal and Bhutan

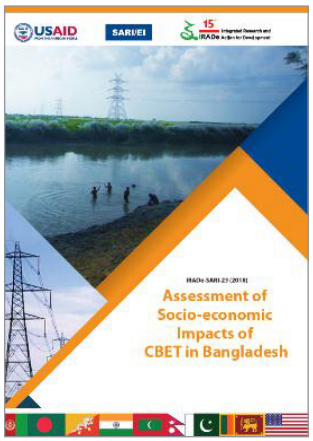


The report on "Impact of CBET on Livelihoods and Gender in Nepal and Bhutan" was published under the SARI/EI Think Tank Forum. CUTS International, carried out the study to assess the impact of CBET on gender and livelihood in the South Asian region. The key findings of the report suggest that, in addition to creation of jobs due to increased energy access, various other job opportunities arise for both women and men in the project development and construction activities. Access to electricity enhances the rural economic activities, such as growth in the hospitality business. Good road conditions, easy transport facilities and the availability of health centers in close proximity have encouraged more patients to visit the health centers.

Assessment of Socio-Economic Benefits of CBET in Bangladesh

A report was published under the SARI/EI on potential and macroeconomic benefits for both the countries for three different trade scenarios – reference scenario (imports limited by the interconnection built by 2018), Power Sector Master Plan 2016 scenario (Bangladesh limiting to 15% electricity import in its electricity sup-

ply by 2040) and TRADE-30 scenario (enhanced electricity import scenario of 30% in the total supply). The study shows that power trade is a win-win for both the countries. While Bangladesh benefits from the cheaper electricity imports from India to sustain its desired economic growth, India also gains from the export earnings. For Bangladesh, the aggregate expenditure for household consumption increased by 1.5% (USD 523 billion) in the TRADE-30 scenario from 2011 to 2045 compared to the reference scenario. India's cumulative GDP gain is 0.3% (USD 636 billion at 2011-12 market exchange rate) between TRADE-30 and reference scenario. For Bangladesh, the total foreign exchange for imports of fuels and electricity was lowest in TRADE – 30 scenario.



Policy briefs:

Policy Brief on a) Non-Discriminatory Open Access Policy and Regulatory Framework for promoting CBET in South Asia b) Harmonization of Grid Codes, Operating Procedures and Standards to Facilitate/Promote CBET in the South Asia Region c) Framework for Trading License Regime to facilitate CBET in South Asia Region d) Socio-economic benefits of CBET in South Asia e) Electricity Trade in the BBIN Region: Economic benefits and Technological Implications f) South Asian Regional Power Exchange (SARPEX) g) Regional Dispute Resolution Mechanism in South Asia Region for long term sustainable cross border power trade h) Institutionalizing the regulatory process of CBET in South Asia Region were finalized and published. The same was circulated in the SARI/EI Regional conference on "Enhancing Energy Cooperation and Integration in South Asia", 30th-31st August' 2018, Hotel Le Méridien, New Delhi

SARI Regional Conference Proceedings: "Conference on Enhancing Energy Cooperation and Integration in South Asia"

SARI Regional Conference Proceedings of the "Conference on Enhancing Energy Cooperation and Integration in South Asia" was finalized and published. It captures the deliberations of all the sessions covering various aspects, such as Policy, Regulatory requirements, Investments, Coordinated Interconnection Transmission Planning, Technical and Market (South Asian Regional Power Market) aspects of Regional Energy Cooperation and CBET in the SA region. It also covers Electricity Trade in BBIN Region–Long-Term Trading Volume: Linking South Asia with South-East Asia and Role of think tanks in Enabling Conducive Environment and Consensus Building for CBET in South Asia.

2 Climate Change & Environment

2.1 Climate Adaptive Action Plans to Manage Heat Stress in Indian Cities

IRADe is working to assess impact of heat stress on livelihoods, productivity and health of vulnerable population in three Indian cities viz. Delhi, Rajkot and Bhubaneswar. The project aims to develop and support implementation of Heat Stress Action Plans for the selected cities. IRADe is working in collaboration with the Indian Institute of Public Health (Gandhinagar and Bhubaneswar), Odisha State Disaster Management Authority (OSDMA) and the municipal corporations of the respective cities.

Heat Hotspots Delineation

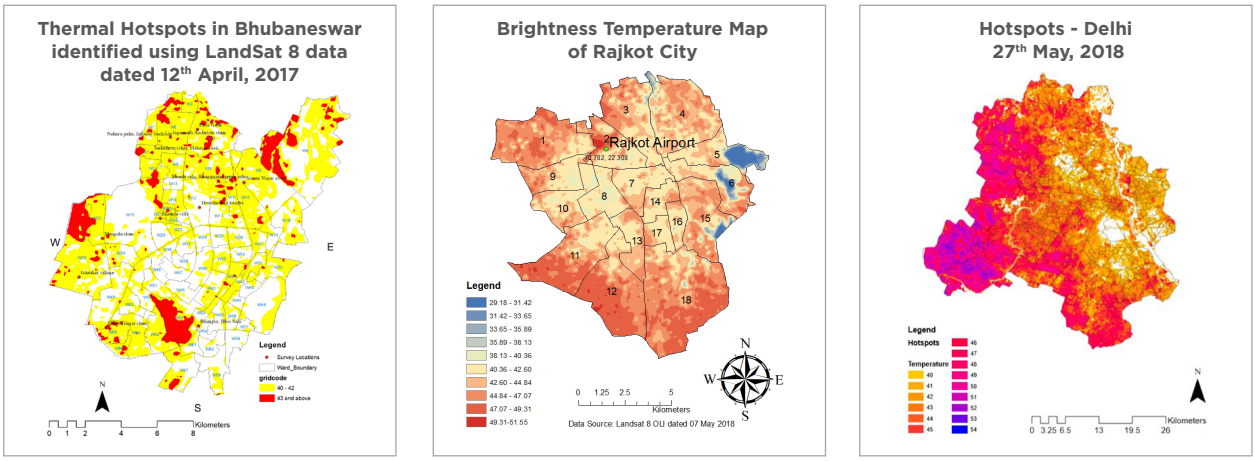
Thermal hotspot maps using LANDSAT 8 imageries, for the three project cities were prepared and wards with temperature above 40OC were delineated across these cities. The existing Thermal Hotspot maps for Delhi, Rajkot and Bhubaneswar were updated and finalized.

Surveys and Analysis

To capture the impact of heat stress on health, livelihood and productivity of the vulnerable groups, socio-economic surveys were conducted in three cities through household surveys. Detailed research questionnaires were prepared for the same and Thermal Hotspot maps were used to delineate vulnerable hot spots at each city level marking the slums and squatter settlements. Eleven such hot-spots were marked across each city where household field surveys were conducted. Using stratified random sampling technique, 3 set of surveys; one primary and two fortnightly (F1 & F2) were conducted in identified vulnerable hotspots of the city.

Surveys conducted	Numbers
Primary and Fortnight Surveys in 3 Cities	397 HHs (Delhi), 300 HHs (Bhubaneshwar) & 304 HHs (Rajkot)
High Exposure Vulnerable (Occupational & Gender Specific)	300 Individuals – vendors/ hawkers, construction workers etc 100 Female Occupation workers – vendors, maids, middle income groups etc

The study outputs and findings were presented to the City administrators, policy makers and related stakeholders in Bhubaneswar, Ahmedabad and Delhi.



Hotspot Maps of Bhubaneswar, Delhi and Rajkot

Heat Wave Prevention and Management Pamphlets

City level awareness for prevention of heat related illnesses several initiatives have been taken; like preparation and distribution of heat stress prevention and management pamphlets across more than 10, 000 households in Rajkot, sharing the heat stress advisory with URJA (United Residents Joint Action) of Delhi for heat stress management in RWAs (Resident Welfare Associations) and awareness campaigns in over 100 plus Delhi schools. In addition, key short term actions have been recommended to the municipal corporations of the three cities to be implemented on an immediate basis for management of heat related illnesses. Strategies for management of heat stress and capacity building plan was developed for Rajkot city.

Duration: November 2017- November 2020 (Ongoing)

Supported by: International Development Research Centre, Canada

2.2 Enabling State Level Strategic Actions for Achieving NDC

It is necessary that state level actions take place to achieve India's NDC. This study with support from MacArthur Foundation is to suggest market based solutions and business models for state level implementation to reduce CO2 emissions and increase renewables share in power and energy, transport and agriculture sectors which are high emitters. IRADe will work on effective state action plans consistent with national plan to fulfill NDC targets particularly by high emitter states who are likely to grow by 2030.

A recent IRADe paper by Parikh K. et. Al (2018) "Can India grow and live within a 1.5 degree CO2 emissions budget?" in Energy Policy, suggests a combination of renewable energy and energy efficiency that will be needed for NDC. Many sectors require state level decisions. The solutions will be state and sector specific. The selected states are an advanced state, Gujarat, a growing one, Odisha and a North East state, Assam. GHG (Green House Gases) intensities, per capita consumption, economic growth patterns of sectors viz. power, agriculture, industry, transport, poverty schemes etc., will be analyzed in detail. We will look for key enablers in various sectors:

a) Power & Energy: Examine supply and demand structures and scope for coal, gas, hydro, nuclear and renewables. How to promote renewables?

b) Transport: How to reduce carbon intensity with a combination of technological options such as EV, public transport and policies? What financing schemes will encourage cheaper EV with battery swapping provided by private sector?

c) Agriculture: Energy efficient solar irrigation can reduce water intensity through drip irrigation to promote it, we will design financing mechanisms for farmers and DISCOMs who guarantee surplus power purchase.

To achieve the study objectives, IRADe, will require high-level outreach strategy to communicate study outputs to state level stakeholders and at the same time seek their inputs to improve the study outcome. In this regard, IRADe has organized inception meetings in the three states namely Odisha, Gujarat, and Assam selected for intensive case studies. The inception meetings provided an opportunity to bring relevant stakeholders which includes policy

makers, academia, civil societies, researchers and practitioners on a common platform to discuss, deliberate, inform and get benefitted with their rich knowledge about the local situation to come up with market based solutions for the three selected sectors to meet India's NDC target.

Duration: September 2018 – March 2021 (Ongoing)

Supported by: MacArthur Foundation

2.3 Framing the Debate on Climate Change

The overall goal of this project was to raise climate change awareness among students of eight North Indian Universities across seven states through holding lectures and debates. The North Indian Universities that participated were Kurukshetra University, Central University Rajasthan, Chandigarh University, Kumaun University, Himachal Pradesh University, Banaras Hindu University, Allahabad University and Jamia Milia Islamia University.

The program was envisaged such that the first two days of the symposium held lecture sessions followed by a debate competition among the selected students on the third day. This project was a step forward to raise climate awareness and understanding involving the youth, the most vibrant and motivated community who will propagate the knowledge across society. While the lectures covered areas ranging from the drivers of climate change, its indicators to impact on environment, society, lifestyle to issues such as climate change policies in India, mitigation and adaptive measures, global frameworks on combating climate change etc. University level programs were conducted in University of Allahabad at Allahabad and Jamia Milia Islamia University, Delhi.

At across eight Universities, altogether 1000 students, 75 research scholars and nearly 60 faculty members participated in the symposia. A final event was held on 29th May, 2018 at American Centre, New Delhi. This event saw participation of University winners from each of the university campuses where programme was conducted initially. The University winners from Kurukshetra University and Banaras Hindu University were jointly awarded the winners of the inter university debate competition.

Duration: *June 2017 – May 2018 (Completed)*

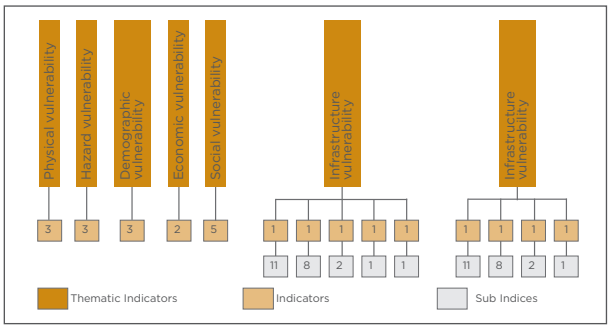
Supported by: *US Embassy, New Delhi*

2.4 Developing the Urban Climate Vulnerability Index for 6 Cities

Indian cities are highly vulnerable to climate induced natural hazards that lead to disruption of basic urban services. along with loss of human life. Cities need preparedness for quick response, recovery and risk reduction to check the loss to life and property in case of adverse events. There is thus a need for developing a methodology to assess climate vulnerability of cities.

IRADe developed an Urban Climate Vulnerability Index (UVI) to assess and understand climate vulnerabilities and associated risks. UVI was developed for the cities of Srinagar, Shillong, Chennai, Mumbai, Bengaluru & Delhi. The cities were selected on the basis of geographical location, population and ecosystem types and vulnerability to the climate induced hazards.

The climate vulnerability assessment framework covers seven thematic indicators- Physical, hazard, social, demographic, economic, infrastructure and administration vulnerabilities and seventy sub indicators and indices lying under the respective thematic heads. The prevailing vulnerability and preparedness of a specific city is a weighted aggregation of sub-indicators which were quantified, normalized and aggregated to obtain composite vulnerability indices of seven thematic indicators. The final climate vulnerability score is calculated for six



Representative diagram of thematic indicators and sub indicators

cities and a consolidated climate vulnerability score card has been prepared comparing the vulnerabilities of each city.

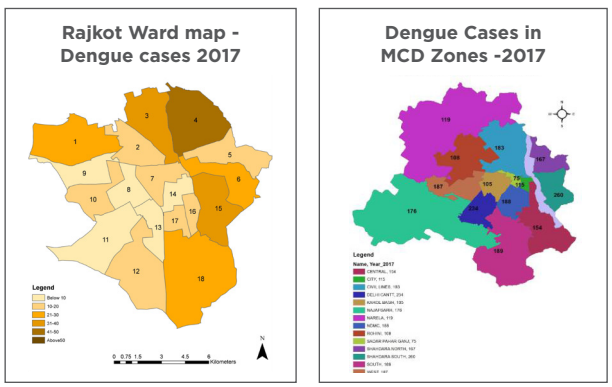
City specific recommendations for reducing the hazard vulnerability were made. The urban climate vulnerability index so devised, can serve as a decision support system to the Government of India for formulating adaptation and mitigation strategies for Indian cities.

Duration: *October 2017- March 2019 (Completed)*

Supported by: *Ministry of Environment, Forest and Climate Change (MoEFCC)*

2.5 Prediction of Dengue with Climate Change for Delhi and Rajkot: A statistical analysis and development of warning system

Spatial maps showing ward level Dengue incidences in Delhi and Rajkot were prepared using Geographic Information System (GIS) for showing the trends of Dengue incidences in the last decade as per data collected from the city Municipal Corporations. Dengue hotspots were identified for both the cities.



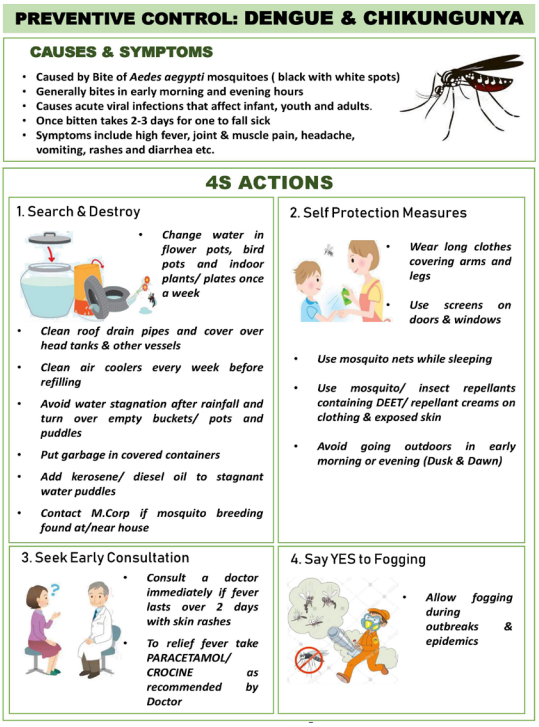
Spatial distribution of Dengue cases in Rajkot and Delhi in 2017

Primary surveys were carried out to collect information about incidences, possible local factors and their effects and impacts. In addition, we have initiated survey in collaboration with Rajkot Municipal Corporation on ward wise number of daily breeding sites detected, daily number of cases reported to further assess the linkages between climate variables and Dengue incidences.

Trend analysis of Dengue cases in Rajkot were carried out at ward level for incidences that occurred during 2011-2017 and their relationship with the slum locations were studied.

Climate data has been collected for the city of Rajkot and further week wise cases of vector borne diseases have been collected. Regression model is being run to assess the relationship between the climate variables and Mosquito borne cases.

Awareness material for strategy for Dengue prevention and management for Rajkot city was also drafted.



4S Strategy for Dengue prevention and management

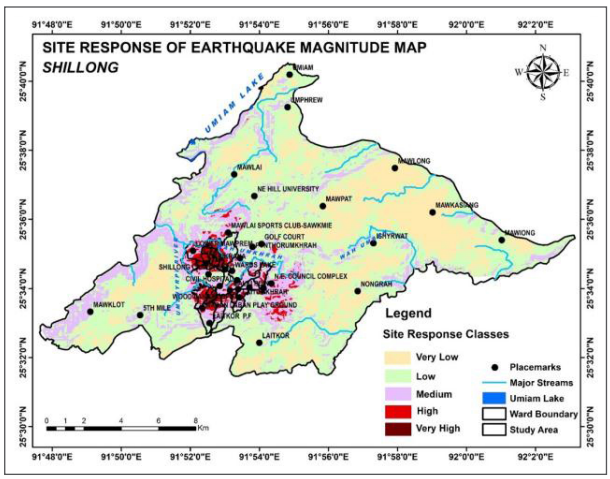
Duration: *August 2017- January 2020 (Ongoing)*

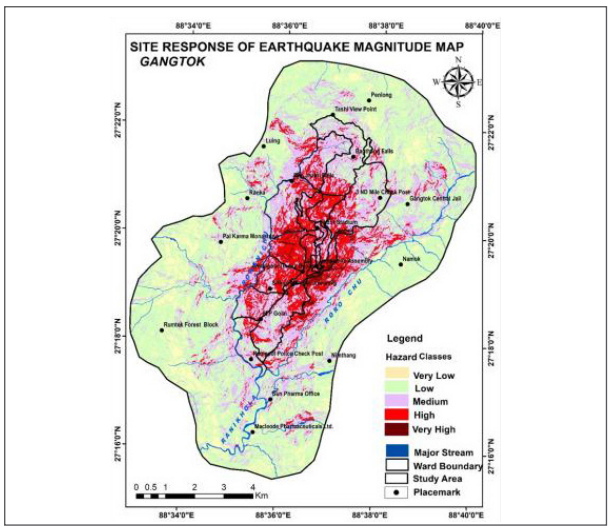
Supported by: *Department of Science & Technology, Government of India*

3 Sustainable Urban Development

3.1 Developing Disaster Resilience Action Plan for Shillong & Gangtok

The project work involved field level surveys, stakeholder consultations, data procurement & analysis to assess the impacts of urbanisation on natural ecosystems in Shillong and Gangtok. Worldview 2/3 images were procured for both the project cities. Building Footprint maps and Road Network maps for Shillong and Gangtok were made. Land Use/Land Cover for Gangtok was made.





Earthquake magnitude maps of Shillong and Gangtok prepared by NESAC

Primary surveys were carried out in both the cities to assess the impact of urbanization on natural ecosystems, with a view to assess the role of urbanization on the mass hazard vulnerability. Urbanization induced vulnerable areas were identified through surveys. GPS co-ordinates of such disaster-affected areas were recorded.

A research paper on "Disaster Resilience Assessment in Himalayan Cities" was prepared and submitted to NMHS secretariat. The paper provided recommendations for enhancing the disaster resilience of IHR (Indian Himalayan Region) cities.

Duration: *March 2017- March 2020 (Ongoing)*

Supported by: *Ministry of Environment, Forests and Climate Change (MoEFCC) under National Mission on Himalayan Studies (NMHS) programme*

3.2 Process, Analysis, Observations and Modelling: Integrated Solutions for Cleaner Air for Delhi (PROMOTE)

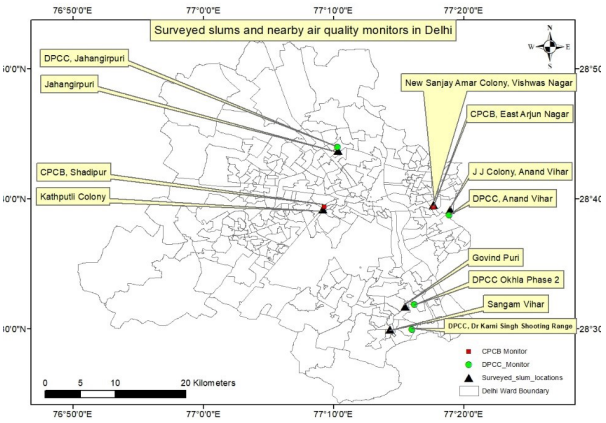
Four air quality measurement monitors procured from University of Hertfordshire (UH) were installed: Two at IRADe, Malviya Nagar (residential, road side) and the other two at The Mother's International School, Sri Aurobindo Marg (road side, heavy traffic area). The data from the monitors was averaged to hourly calculations and was analysed.

IRADe developed a health advisory in the form of a poster "Delhi Air Quality Forecast and Health Advisory". The posters were distributed among school children and RWAs (Resident Welfare Associations) to raise awareness on AQI (Air Quality Index) and preventive measures for air pollution

Ground surveys have been conducted in slums and low-income areas of Delhi to assess the

socio-economic and health impacts of air pollution on the marginalised and lower-income citizens. Surveys have been carried out at six locations, viz., Anand Vihar, Vishwas Nagar, Govind Puri, Sangam Vihar, Kathputli Colony, and Jahangir Puri, dispersed in all directions (East, West, North and South) around Delhi. These locations were selected as pollution levels in these areas frequently cross the permissible limits of pollutants and also these areas have dense slum populations.

Poster developed to raise awareness about air quality and associated health impacts



Map showing surveyed slum locations along with nearby air quality monitoring station

To understand different mitigation strategies in transport sector, a transport model was developed. Pilot run was made and results were compared with fuel consumption and emissions data.

The Graded Response Action Plan (GRAP) published by CPCB (Central Pollution Control Board) was reviewed.

Duration: October 2017- March 2022 (Ongoing)

Supported by: Ministry of Earth Sciences (MoES)

Group photograph of participants of the stakeholder consultation titled "Consultation for choices & pathways

4 Poverty & Gender

4.1 Gender Analysis for Project Appraisal

This study aimed to analyse the gender component in the energy sector for the appraisal of IGEN IV (Indo-German Energy programmes) and IGEF (Indo-German Energy Forum) programmes. The goal of the project was to develop a cross-cutting gender strategy to address the deficiencies in energy sector programme and support female empowerment for maximizing the program impact. Stakeholder interviews were conducted to understand the current situation of women in the energy sector and recommendations were given for achieving gender mainstreaming in the energy sector within the boundaries of IGEN IV and IGEF programmes. Further, gender markers and gender indicators were identified and defined. The analysis for gender rating will help to develop gender strategy that moves beyond simply accounting for equal representation of female and male beneficiaries in all activities. The major recommendations that were suggested were gender neutral language, formation of women only forums, more workshops on sensitisation and more focus on identifying the role of women in propagating cleaner energy in their localities.

Duration: *January 2019 – February 2019 (Completed)*

Supported by: *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)*

4.2 Energy Sector Reforms in India – Clean Cooking Energy

The study aimed to provide gender-based evidence in an effort to understand the gap between clean cooking energy access to LPG (Liquefied Petroleum Gas- assumed to be a clean and convenient cooking fuel in India) for cooking and its impact on the role of women. This study carried out an extensive survey over April to May 2017 on cooking energy consumption and related attributes of total 810 households in Raipur and Ranchi.

The study found that biomass is a dominant source of cooking energy and women bear most of the burden of biomass collection, processing and cooking with it. LPG can relieve them from this burden and also from health problems due to indoor air pollution. Apart from income criteria and LPG access, several other factors like education level, years of use, door-step delivery, gender composition of household etc. seem to be responsible for LPG usage. Improving the LPG supply infrastructure and door-step delivery in rural area will increase LPG usage. The availability of freely collected biomass and local cooking practices also affect the choice of cooking fuel. In terms of "final useful energy" for cooking, LPG costs less as compared to purchased biomass and coal. However, several households including less well-off continue to purchase biomass and coal for cooking due to lack of availability and lump sum amount required for LPG cylinder refill. The capital subsidy for LPG kit under PMUY (Pradhan Mantri's Ujjwala Yojana) scheme had promoted LPG usage and therefore women's wellbeing in poor households. Among the LPG consumer households in our sample, 14 %, revealed they will stop using LPG if subsidy is removed and switch back to biomass. On the other hand, 86 % LPG consuming households revealed that they will continue to use LPG; though 39 % said they would reduce its usage. Increasing usage of LPG for cooking reduces "time poverty" of women, hardship associated with biomass collection and processing and health hazards.

Duration: *May 2015 – December 2018 (Completed)*

Supported by: *DFID/ENERGIA*

4.3 Study on the Implications of Climate Change on Human Development and Poverty in India

IRADe contributed to five sub-section for their study being carried out by UNDP. 1. Multidimensional poverty – spatial and temporal distribution in India, 2. Framing the interlinkages between climate change, human development and poverty. 3. Private Cost-do the poor pay more.4 Projected impacts on poverty and human development and 5. State Ranking Index and Indicators. United Nations Development Programme financially supports these studies.

The first study provides the hotspots of the vulnerable and marginalized population in India, prone to impacts of climate change on multidimensional poverty and human development. The second study provides an integrated and comprehensive vision of climate change interlinkages with ecosystem and vulnerable groups with focus on gender aspects. The third study gives a holistic view of the additional private cost which is being induced on poor and marginalized population of the country by the changing climatic conditions. The fourth study provides an all-inclusive picture of projected impacts of climate change on human development, poverty, GDP growth and potential. The fifth study provides the State Ranking Index which had a combination of five sub-indices: Environment, Health, Poverty & Inequality, Economy and General Demography. Each sub-index had various indicators for the estimation.

Duration: *March, 2019 – June, 2019 (Ongoing)*

Supported by: *United Nations Development Programme (UNDP)*

5 Agriculture & Food Security

5.1 Assessment of Impacts on Food Security and Livelihoods due to Climate Change in Uttar Pradesh, Himachal Pradesh and Odisha

In India, nearly 58% of rural households were estimated to be agricultural households (National Sample Survey Office report 2012-2013) who are directly dependent on the agriculture sector for livelihood. Therefore, climate change impact on agriculture production in India will adversely affect the livelihood of large number of agricultural households and will increase their vulnerability to food insecurity. Small and marginal farmers having limited alternative options would be more vulnerable to food security and risk to livelihood. The present study aims to assess the impacts of climate change on food security and associated livelihoods in three states namely Himachal Pradesh, Uttar Pradesh and Odisha. The broad objectives of the study are as follows:

- To assess the vulnerability of food security and livelihoods due to socio-economic and other environmental stresses in the current climate and its likely exacerbation due to climate change for a short, medium and long term time period
- To develop a framework for adaptation.
- To devise adaptation options and prioritise the same.

The impact of climate change on production of major crops for the selected states for 2030, 2050 and 2080 has been analysed. This study used crop sensitivity to climate parameters from the available peer reviewed studies for India for selected crops. The assessment was carried out at the district level for each of the aforesaid states by uniformly applying available national-level crop specific yield response functions with temperature and precipitation variables as explanatory ones. District wise crop area and production data was extracted from the website of Directorate of Economic and statistics (https://eands.dacnet.nic). The latest crop data available for HP was for the year 2011-12 and UP for year 2014-15 and Odisha for year 2015-16. The temperature and precipitation data for future year were obtained from IPCC's RCP (Representative Concentration Pathway) 4.5, downscaled for India by IITM (Indian Institute of Tropical Meteorology), Pune.

The analysis suggests that in Himachal Pradesh as compared to 2011-12 rice output may decrease by 9.4%, wheat output decreases by 5.9% and maize output increases by 5.1% in 2080. In Uttar Pradesh, by 2080, rice output declines by 11% and wheat output decreases by 1.4%. In Odisha, by 2080, rice output decreases 9.8%. Improving resilience of Indian farming community requires measures to address climatic risks and development deficits. Constraints to adaptation such as institutional, technological, socio-economic and infrastructural needs to be addressed for sustainable food-security and rural livelihood.

Based on the analysis of climate parameters we developed and prioritized the adaptation strategies and linked it to ongoing Government of India schemes to prepare adaptation matrix. The ongoing schemes and programmes by the Government of India has a great potential to address the food security and livelihood for rural households. A coherent climate adaptation plan with convergence of the ongoing schemes and programme to combat climate change can be effective, Government of India schemes are required to cover the large agriculture dependent rural population for achieving effective outcome. This also indicates that for an inclusive adaptation, more funds will be required to fund these programmes.

Duration: *November 2016 - December 2018 (Completed)*

Supported by: *Ministry of Environment, Forest and Climate Change (MoEFCC)*

6 Asia Centre for Sustainable Development

6.1 Soft Landings for Indian Renewable Integration through Balancing Technologies

This project is a sub grant to IRADe by The Asia Foundation for raising the pitch on the subject of storage technologies in India, and their necessity in enabling integration of further renewable energy generation in the Indian grid. Considering the large capacity of renewables ultimately to be integrated, it is essential that adequate balancing sources, including storage energy devices, be deployed in the grid to smoothen the variability of renewable generation like wind and solar power.

The first roundtable was on 27 March 2019 at India Habitat Centre, New Delhi, with experts from think tanks, working in the energy space, participating in the discussions. The roundtable had a presentation via video call from Australian National University about their Pumped Hydro Energy Storage (PHES) project site atlas. Inputs received from this shall be taken forward for deliberations in the next year as part of the project. Various representatives from the Ministry of Power attended the roundtable. The discussion will help us identify a strategy for renewable integration.

Duration: March 2019 - June 2019 (Ongoing)

Supported by: The Asia Foundation

First Roundtable of The Asia Foundation held on 27 March 2019 at the India

7 Conferences, Workshops and Meetings

Poverty Alleviation and Gender

GENI workshop: 2nd April 2018, New Delhi

As part of the Gender & Energy Network India (GENI), with support from the International Network on Gender and Sustainable Energy (ENERGIA) and the Low Carbon Energy for Development Network (LCEDN), IRADE hosted a workshop in New Delhi to promote the exchange of ideas and collaboration on the theme of gender inclusion and sustainable energy access.

ENERGIA-LCEDN workshop 3 April 2018, New Delhi

LCEDN and ENERGIA hosted a workshop for international researchers, policy-makers and practitioners with expertise on gender and renewable energy in development. One of the workshop output targets was to produce a briefing note summarizing key points from the workshop.

GENI workshop Chennai - April 26, 2018

IRADe presented findings from a study investigating the gender perspectives of clean cooking policies in Chhattisgarh where many women spend close to 8 hours per week collecting wood and more time in firewood processing and meal preparation. LPG access has the potential to reduce time poverty. Study showed that for households purchasing biomass, purchasing LPG would be cheaper. Main outputs were that household income was an important parameter in the switch to LPG. It also showed that a higher education level of both men and women increased the likelihood of switching to LPG. However, for schemes such as Ujjwala to increase and meet its targets, there needs to be better infrastructure for LPG delivery.

GENI meeting Bangalore - May 22, 2018

GENI meeting deliberated on interim hosting structure and expanding GENI networks. It discusses requirements and mechanisms for membership of GENI, expectations of new members, role of new members in forming GENI, and undertaking activities and democratizing GENI. All the non-founding organizations outlined their interests in gender and energy theme and what they would hope to gain from the network and what they would be able to offer the network.

Workshop by IRADe at Raipur on 12th October, 2018

A joint event by IRADe and TERI took place at Raipur which discussed the theme "What drives the switch to modern energy? Linkages and Gender Implications".

Climate Change and Environment

Framing the Climate Change Debate, 6-8 April 2018, Department of Geography, Jamia Millia Islamia University, New Delhi

The symposia "Framing the Climate Change Debate" were organized by Integrated Research and Action for Development (IRADe) in selected University campuses in North India with the host University as a local programme partner. The last of the series was held at Jamia Millia Islamia University, New Delhi.

Methodology Workshop on Climate Adaptive Action Plans to Manage Heat Stress in Indian Cities- Delhi, Bhubaneshwar & Rajkot, IIP-Bhubaneshwar, Odisha, 19- 21 April, 2018

A workshop was held with participants from Indian Institute of Public Health (IIPH) Gandhinagar and Bhubaneshwar and IRADe along with Odisha State Disaster Management Agency (OSDMA) representatives, Dr. Pradeep Nayak (GM) and Dr. BN Mishra (GIS Specialist). With the finalization of the two sets of questionnaire to capture the impact of heat

stress on the health, livelihood and productivity of the vulnerable groups of the urban slum areas, field surveys were initiated in all the three cities. The slums were shortlisted according to their location within the spatially distributed thermal hotspots of the city. Surveys are in progress in the three cities of Rajkot, Bhubaneswar and Delhi.

CoP24 Katowice, Poland, 2nd-14th December 2018

Dr. Jyoti Parikh was invited to join the IPCC panel discussion and comment on Chapter 5 of IPCC 1.5 report. While complimenting the IPCC authors for Chapter 5, she highlighted the inclusive growth story of IPCC over the years, thereby bringing in different stakeholders, experts and scientists. Dr. Parikh emphasized on the significance of gender issues in regular IPCC work, highlighting the role of women in bearing majority of the burden of vulnerable ecosystems, while struggling to provide basic needs for their families. She also stressed upon the limited opportunities available to women for education, decision making and technology engagement, thereby limiting access to the on-going revolution in the field of renewable technologies and energy efficiency. Dr. Parikh concluded by suggesting IPCC to address these gender issues in future reports in every chapter, through well-articulated and already published gender studies.

Policy Dialogue on Climate Change and Development in Odisha, Bhubaneswar, 29-30 January 2019

IRADe hosted a series of Policy Dialogues on "Environment & Climate Change". The first round was in Bhubaneswar.

Policy Dialogue on Climate Change and Development in Gujarat, IIM, Ahmedabad 6-8 March 2019

IRADe organised a Policy dialogue on Climate Change and Development. More than 75 participants from Gujarat ministries, state departments, research institutes, private companies and academic organizations attended the event.

Energy and Power Systems

Dissemination Meeting of SARPEX Key Findings, Report Release and Stakeholder Consultation Meeting on "South Asian Regional Power Exchange" May 10, 2018 , Dhaka, Bangladesh

In an effort to boost cross-border electricity trade in the South Asia region, SARI/EI, IRADe and Power Cell (Bangladesh) jointly conducted a meeting and stakeholder consultation with the key decision makers of Bangladesh to discuss the South Asian Regional Power Exchange (SARPEX) Mock Exercise. Prominent representatives from Bangladesh Power Development Board (BPDB), Power Grid Corporation of Bangladesh (PGCB), Power Cell, Ministry of Power, Energy & Mineral Resources, and Dhaka Power Distribution Corporation participated in the meeting from Bangladesh. A power exchange market is capable of addressing the Bangladesh power deficit scenario and would, additionally, result in a social welfare benefits are estimated at 7-8 billion INR. A Report on "South Asian Countries Power Pricing Mechanism & Recommendation for CBET" was also released. The objective of this report is to provide national regulators/empowered entities input in the direction of reforming the tariff mechanism for CBET and developing a course of action that can be referred to for decision making on CBET in their respective countries.

First Meeting of South Asia Forum for Infrastructure Regulation (SAFIR) Working Group, Sri Lanka, May 15 – 16, 2018

The meeting on "Regulatory Cooperation to Facilitate Knowledge Sharing, Addressing Cross-cutting Energy/ Electricity Regulatory Issues and Capacity Building in South Asia" was held. Mr. Saliya Mathew, Chairman, Public Utility Commission of Sri Lanka and Chairperson

of SAFIR delivered the keynote address in the inaugural session of the meeting. The meeting was attended by the nominated working group members from Bangladesh, Bhutan, India, Pakistan, and Sri Lanka. The "Model Framework for Trading License Regime and Guidelines for Grant of Trading License to facilitate CBET in SA Region" report was also released at this meeting.

Consultation on BBIN Power System Model Results on 23rd May 2018, New Delhi

Consultation with CEA's Power System Planning & Appraisal team was undertaken on the BBIN power system model results. We presented our result findings to the team and took their feedback for further updation of the model.

SARPEX Mock Exercise Results Dissemination at Urja Vichar Manch (by India Energy Forum) , May 30, 2018 in New Delhi

Prominent representatives from Central Electricity Regulatory Commission (CERC), Central Electricity Authority (CEA), Tata Power Trading Corporation Limited, Power System Operation Corporation (POSOCO) and other Indian stakeholders attended. IRADe SARI/EI team presented the key findings of the SARPEX mock exercise on behalf of the Urja Vichar Manch program.

Workshop and Report on 'Market Design and Rules' Release on 6th July, 2018, New Delhi, India

Mr. Pankaj Batra, Chairman, CEA released the Report and gave a brief on the evolution of the Indian power market and power exchange development in India. He mentioned that the SARPEX exercise is the first of its kind in the SAARC Region, involving the respective country representatives' continuous involvement, and prospective power market design in South Asian region. Two reports namely "Power Market Design and Rules" and "Key Findings of SARPEX" were published, based on learnings from the SARPEX mock exercise, and a web portal was also created, for mimicking the regional power exchange. More than 50 participants attended the workshop from Central Electricity Authority (CEA), Central Electricity Regulatory Commission (CERC), POSOCO, Power Trading Corporation (PTC), Tata Power Trading Corporation Limited (TPTCL) etc.

Regional Conference: "Enhancing Energy Cooperation & Integration in South Asia under SARI/EI", 30th - 31st August 2018 at Hotel Le Meridien, New Delhi.

In celebration of the work undertaken in Phase IV of the SARI/EI program, a regional conference was held. The conference organized by IRADe brought together stakeholders from across the region, to discuss the roadmap toward an integrated South Asian energy system. Participants shared key lessons from South Asian governments and strategy from donor agencies to pave the future for regional grid integration. The Honorable Prime Minister of India, Shri Narendra Modi, sent his message and best wishes for successful conduct of the conference. Shri Suresh Prabhu, Hon'ble Minister of Commerce and Industry, GoI sent a video message for the South Asian country participants and mentioned that South Asia has a shared destiny, and hence must work on shared ideas and work together to provide energy access and energy security. Honorable Minister of Power, Government of India, Shri R K Singh, and Honorable U.S. Ambassador to India Mr. Kenneth I. Juster inaugurated the conference. More than 150 guests from South

Asian ministries, planning agencies, donor organizations, electricity traders, and other energy sector stakeholders participated in the two-day event. The conference showcased the key highlights and achievements of the program over the last six years. SARI/EI has played a pivotal role for creating a conducive environment through its technical studies, peer exchange, capacity building programs, and awareness activities. More than eighty events including Task Force meetings, consultations, report releases, and capacity building programs have been organized under SARI/EI. More than 30 reports have been published and around 2,000 participants have been engaged in SARI/EI through various channels in the South Asian countries. The U.S. Ambassador acknowledged the work undertaken by SARI/EI and announced its extension by four years till 2022.

Report Release "Gains from Multilateral Electricity Trade among BBIN Countries" in session V at Regional Conference on Enhancing Energy Cooperation & Integration in South Asia on 30th August 2018, New Delhi

The report was released in session V- "Electricity Trade in BBIN Region- Long-term Trading Volume and Prospects" at the Regional Conference on Enhancing Energy Cooperation & Integration in South Asia, New Delhi.

SARI/EI/IRADe Participation in the South Asia Forum for Infrastructure Regulators (SAFIR), 22nd November 2018, Bhutan

SARI/EI/IRADe delegation presented "SAFIR Working Group activities and implementation of the annual work plan/action Plan of SAFIR Working Group" at the SAFIR Executive Committee Meeting (ECM) and SARI/EI/IRADe inception meeting with Bhutan stakeholders for gathering support and cooperation for extended phase of SARI/EI program on 23rd November 2018. The delegation also visited the Punatsangchu I and II hydro power project sites to get a first-hand understanding about the progress of the above hydro power projects and issues/challenges being faced by these two large hydro projects.

SARI/EI/IRADe Visit to Bangladesh along with USAID and United States Energy Association (USEA) on 11th -12th December 2018

SARI/EI/Integrated Research and Action for Development (IRADe) along with USAID and United States Energy Association (USEA) visited Bangladesh along with key stakeholders in its inception meeting for discussion and development of the new scope for SARI/EI extended phase, under a new umbrella program of USAID- Asia EDGE (Enhancing Development and Growth through Energy).

SARI/EI Inception Meeting for the Extended Phase of SARI/EI (2018-2022) on 27th, 28th February, 2019 and 1st March, 2019 at Kathmandu, Nepal.

USAID, India and SARI/EI/IRADe delegation briefed about the scope of work for the SARI/EI extended phase under the new umbrella program of USAID- the Asia EDGE (Enhancing Development and Growth through Energy).

USAID, Nepal also joined the delegation. The USAID,India, SARI/EI/IRADe and USAID, Nepal delegation had detailed discussions with various stakeholders, such as Hydroelectricity Investment and Development Company Limited (HIDCL), Director, Power Trading Department , Nepal Electricity Authority (NEA), Independent Power Producers' Association, Nepal (IPPAN), Nepal Hydropower Development Project (NHDP), Secretary, Ministry of Energy, Water Resources and Irrigation, CEO, Investment Board Nepal, Director, Energy, Transport, Science and Technology (ETS), SAARC Secretariat, Kathmandu, Nepal, Managing Director, NEA, Load Dispatch Center, NEA, ED, Institute for Integrated Development Studies (IIDS) and ED, Alternative Energy Promotion Centre, Nepal.

Sustainable Urban Development

PROMOTE: Process, Analysis, Observations and Modelling - Integrated Solutions for Cleaner Air for Delhi, Organization of 'Air Pollution Dialogue' at the MIS on 24 April 2018.

As an outreach activity of PROMOTE, IRADe organized an 'Air Pollution Dialogue' at The Mother's International School (MIS), the purpose of the dialogue was to sensitize the school community (especially children) about the project and receive perspectives from the community regarding reducing air pollution in Delhi. PROMOTE researchers had a meeting to discuss the progress of the project as well as chart future strategies at the Ministry of Earth Sciences.

APHH Program Meeting on 25 April 2018 and Stakeholders Workshop on 26th April 2018

Various projects under the APHH (Atmospheric Pollution and Human Health) programme presented the work done so far and discussed the future course of actions. The progress of the projects was evaluated by external expert Dr. Alexander Baklanov of WMO (World Meteorological Organization). The stakeholders' consultation on 26th April focused to bring together people from various backgrounds in the fields of Transport and Low Emission Development building technologies. The consultation was attended by more than 60 stakeholder representatives, Civil society bodies, research institutes and academia.

Stakeholders' Workshop at NEHU, Shillong, 12 June, 2018

As a part of the project, IRADe in collaboration with NESAC (North Eastern Space Applications Centre), Meghalaya, GBPNIHESD (G.B. Pant National Institute of Himalayan Environment and Sustainable Development) -Sikkim Unit and NEHU organised stakeholder's workshop at NEHU (North Eastern Hill University), Shillong. The workshop was attended by participants from various departments of the urban local bodies and organizations.

Meeting with Project Collaborators and City-level Officials and Stakeholders in Shillong, 28 August to 01 September 2018

Dr Mohit Kumar visited Shillong to meet project collaborators and city officials and stakeholders. He had discussions with Dr Devesh Walia, HOD, Dept. of Environmental Sciences, NEHU; Dr Diganta Barman and his colleagues at NESAC; Shri Manoj Kaistha, Director, Geological Survey of India-North-eastern Region (GSI-NER); Shri P W Ingty, IAS, Additional Chief Secretary, Govt. of Meghalaya; and Prof. A Bhattacharjee, Dr C Marthong and Dr Yogita of NIT Meghalaya. The meetings were targeted to assess the progress of the project and collect data and documents from local agencies such as GSI-NER and NIT-Meghalaya.

PROMOTE Meeting in IITM Pune- 06-07 December 2018

A meeting was convened to discuss the project PROMOTE (Process, Analysis Observations and Modelling: Integrated Solutions for Cleaner Air for Delhi) and chart the future courses of action. Dr Mohit Kumar represented IRADe in this meeting. He gave a brief presentation about various activities being carried out by IRADe in the project. He informed that ground-survey to assess the health and socio-economic impacts of air pollution on slum dwellers has been initiated in Delhi. Survey locations were mapped along with various air quality monitoring stations in Delhi. The locations were selected from all parts of Delhi (East, West, North and South) and keeping in mind that the selected locations are within 3 km of the nearest monitoring station. The preliminary outcomes from pilot survey were highly appreciated.

Think Tanks and SDGs: Catalysts for Ideas, Analysis and Implementation, January 7, 2019, New Delhi

Launched in 2015, the SDGs are intended to complete the goals set by the MDGs. Given the magnitude of the task, think tanks are expected to support government efforts by providing area expertise, data based research, law & policy recommendations, and assist with designing innovative strategies to "meet the needs of the present without compromising the needs of future generations". This panel discussed the role of think tanks in this regard, and the assistance needed in analysing new ideas, analysis of and methods for implementation of SDGs. Speakers included:- Rohit Magotra, Deputy Director, Integrated Research and Action for Development (IRADe) Manoj Panda, Director, Institute of Economic Growth Arunabha Ghosh, Chief Executive Officer, Council on Energy, Environment and Water (CEEW) (Moderator)

National Seminar-cum-Monitoring and Evaluation Workshop, Almora, 4-7 February 2019

A National Seminar-cum-Monitoring and Evaluation Workshop was held at GBPNIHESD, to evaluate the progress of the project. The project progress was presented in this seminar by Mr Rohit Magotra and Dr Mohit Kumar. The NMHS panel rated the project progress and performance as "good". A manuscript titled "Disaster Vulnerability Assessment of Himalayan Cities - Shillong & Gangtok" was also submitted to this seminar.

PROMOTE Science Meeting at The MoES on 26 February 2019

A meeting of all the PROMOTE partners were convened to discuss the project progress.

8 Professional Activities

Dr. Jyoti Parikh, Executive Director:

- Discussant on Economic Benefits of Power Trade in BBIN region, Organized by The World Bank, 04th May, 2018; New Delhi
- Speaker on "Clean Air with Launching of Breathing Cities Network" at 4th South Asian Cities Summit 2018. Organized by All India Institute of Local Self Government, 05th May, 2018, New Delhi
- Speaker at Round Table on "Evidence Uptake to Action Funder & Researcher Perspectives." Organized by the Campbell Collaboration, 09th May, 2018; New Delhi.
- Panelist on "Women, Children and Climate Change: Designing an economic policy research agenda" at PEP Annual Conference. Organized by Partnership for Economic Policy, 13th June, 2018, Bangalore
- Panelist at Round Table consultation on Framing a National Action Plan on deteriorating air quality. Organized by ORF; 25th July, 2018, New Delhi
- Chaired Climate Conference. Organized by TISS; 08th August, 2018, Mumbai
- Chaired a Panel Discussion at XXVII Gender and Economic Policy forum on "Gender and Air Pollution"; organized by ISST; 05th October, 2018, New Delhi
- Panelist on "Climate Resilient Cities" at workshop on "Role of Cities in addressing climate change"; organized by WWF, 12th November, 2018, New Delhi
- Speaker on "Innovative Financing tools and procurement challenges in WASH" at National WASH Summit; organized by NIUA; 20th November, 2018, New Delhi
- Guest Speaker at Panel Discussion: "Cross Border Trading: Bringing South Asia Together" at Power Conference 2019. Organized by Elekore Systems Pvt. Ltd.; 17th January, 2019, New Delhi
- Keynote Speaker in the Plenary Session on "Resilient Cities". Organized by Disaster Management, Govt. of Maharashtra; 1st February, 2019 at IIT, Mumbai
- Guest speaker at inaugural session at "State level consultative workshop on Swachh Bharat Mission." Organized by ERAF India, Environmental Research Foundation, Mumbai; 02nd February, 2019, Mumbai
- Speaker at Energy Innovation Summit at Vijayawada, AP at Powering Andhra Pradesh Energy Innovation Summit; organized by AP Government; 05th February, 2019, Vijayawada, AP
- Speaker at Thematic Session of Air Pollution at WSDS 2019. Organized by TERI; 11th February, 2019, New Delhi
- Speaker in session 6 on 29th on Removing Barriers How Barriers are preventing the development of regional grids? How can they be overcome?". Organized by Wilton Park, 28-31st March, 2019, Sussex, UK

Mr. Rohit Magotra

- Speaker at International Conference on Resilience and Sustainability of Cities in Hazardous Environments, 26-30 November 2018, Naples, Italy.
- Panelist in Urban Reality show on CNBC TV 18, 20th December 2018, New Delhi. He shared his perspectives on CoP24 and implications of Global warming.
- Speaker for the session "Think Tanks and SDGs: Catalysts for Ideas, Analysis and Implementation" at 3rd India Think Tank Forum, 7th January 2019, Taj Mahal Hotel, New Delhi.
- Speaker in the session on "Urban Sector and Adaptation" at the National workshop on impacts, vulnerability and adaptation on 18-19 February 2019, New Delhi.

- Speaker at Environment and Climate Resilience in The Asia Foundation, India Program in the Strategy meeting, 18-19 March, 2019, IHC, New Delhi.

Mr. Pankaj Batra

- Speaker at the panel discussion on "Forgotten Trinity - Hydro, Gas, Nuclear", in the Power Line Summit 2018, organized by India Infrastructure on October 9 at The Leela Palace, New Delhi.
- Speaker at the Inaugural Session of the Conference on Regulatory Reforms: Redesigning the Indian Power Markets, October 24th, 2018 at Hotel Le Meridien, New Delhi.
- Speaker at the India Power Conference 2019 on the Session on "RE Generation and Grid Stability" on January 17, 2019.
- Speaker at the India Infrastructure conference on "Evacuation and Integration of Renewable Energy" which at Le Meridien, New Delhi, on "System Level Implications of Renewable Energy" on February 25, 2019.
- Participated in the roundtable on Soft Landings for Indian Renewable Integration through Balancing Technologies conducted by Asia Foundation/IRADe on 27 March 2019 at India Habitat Centre, New Delhi.

Mr. Rajiv Panda

- Delivered the Plenary Address on "Trans-Regional Energy Connectivity Between the ASEAN Power Grid and the South-Asia Power Grid: Prospects and Opportunities" `Hotel Crowne Plaza 22 – 23 May 2018 Vientiane, the Lao People's Democratic Republic (Lao PDR)
- Chaired the session on "ASEAN Power Grid Business and Investment" in the "ASEAN Power Grid Summit 2018- Enhancing APG Investment Towards Regional Energy Optimization "-Hotel Crowne Plaza 22 – 23 May 2018 Vientiane, the Lao People's Democratic Republic (Lao PDR)

Dr. GN Qasba

- Gave recommendations on Post Flood Mitigation at Urban Flood Resilience Consultation Workshop at NIUA on 11th October 2018 and shared the handling of "Srinagar flood-September 2014".
- Panelist at National Workshop "Making Livable Cities" in National Workshop and Regional Policy Dialogues on 'Making Liveable Cities', 25 October, 2018

Dr. Probal Ghosh

- Presented his paper with Dr. Kirit Parikh and Dr. Jyoti Parikh titled "Can India Grow and Live Within a 1.5 Degree GHG Emissions Budget?" in the poster session at Eleventh Annual Meeting of the IAMC, Spain 13– 15 November, 2018. In the oral presentation session, he presented the results on "Integrated Assessment of Economic Benefits from Nepal–India Electricity Trade. He also represented IRADe at a meeting of the Indian modelling groups with the European Union Commission on climate change and researchers at the Joint Research Center at Seville, Spain.

Dr. Mohit Kumar

- Delivered a lecture at Dept. of Environmental Studies, North Eastern Hill University (NEHU), Shillong on the topic "Developing Disaster Resilience Action Plan for Shillong", 30 August 2018
- Participated in Science and Training Workshop on Climate Change over High Mountains of Asia, at IITM, Pune during 08-12 October 2018

9 Reports, Journals, Articles, Newspaper Op-eds and Project Reports

Journal/Articles :

- **"Bangladesh power supply scenarios on renewables and electricity import**"-Anjana Das, Arideep Halder, Rahul Mazumder, Vinay Kumar Saini, Jyoti Parikh, Kirit S.Parikh, *Energy Section, Science Direct, Volume 155, 15 July 2018, Pages 651-667*
- **"A Multi-Model Assessment of Energy and Emissions for India's Transport Sector through 2050",** Anantha Lakshmi. P et al, page 10-18, vol-116, Energy Policy (2018).
- **"Let There Be Light" – Infraline Plus**: Case Study by Mr. Rohit Magotra, Deputy Director, IRADe on "Electrification brought Economic & Technological prosperity (in Bangladesh villages), with India-Bangladesh cross border electricity trade".
- **"Can India grow and live within a 1.5 degree CO2 emissions budget?"-** Kirit S.Parikh, Jyoti K.Parikh, Probal P.Ghosh, *Energy Policy-Volume 120, September 2018, Pages 24-37*

Newspaper Op-eds :

- **"Fuel for Thought",** Kirit Parikh, The Indian Express, June 5, 2018
- **'In India Summer Heat May Soon Be Literally Unbearable'** – Somini Sengupta, The New York Times, July 17, 2018 (Surveys and studies from IRADe were covered)
- **"GRAP only kicks in during air pollution emergency"** Jyoti Parikh, Times of India, August, 1, 2018
- "**Managing Ujjwala in the times of volatile fuel prices"-** Jyoti Parikh- Business Standard, 29 September 2018
- **"The oil & rupee problem"**, Kirit Parikh, The Indian Express, November 16, 2018
- **"Urban Reality Interview – CNBC: An interview of Mr. Rohit Magotra, Deputy Director, IRADe appeared during the Urban Reality show**" on CNBC on 20 December 2018.
- **"Budget's how Question",** Kirit Parikh, The Indian Express, February 4, 2019
- **"A meaningful safety net for the poor"**- Kirit Parikh, The Indian Express, March 7, 2019
- **"Getting more women MPs: How about an affirmative action system that doesn't get entrenched but liquidates itself?"** Kirit S Parikh in Times of India, March 23, 2019

Project Reports

S.No.	Project Report No. & Year	Title of Project	Funding Agency
1	IRADe-PR-63(2019)	Gender and Fossil fuel subsidy reform: Findings from and recommendations for India, Bangladesh and Nigeria	IISD
2	IRADe-PR-62(2019)	Gender Analysis for the Project Appraisals of IGEN IV and IGEF	GIZ
3	IRADe-PR-61(2019)	Assessment of food security and livelihood due to climate change in Uttar Pradesh, Himachal Pradesh and Odisha	MoEFCC
4	IRADe-PR-60(2019)	'Developing urban climate vulnerability index (VI) and asses the vulnerability of six selected cities using the VI '	MoEFCC
5	IRADe-PR-59(2019)	Study to develop Roadmap for Implementation of India's NDC Goal 3	MoEFCC
6	IRADe-PR-58 (2018)	Framing the debate on Climate Change	U.S. Embassy, New Delhi
7	IRADe-PR-57(2018)	Viability of Electricity as a cooking solution on a large scale for Rapid Cooking Energy Access	NABARD
8	IRADe-SARI-23 (2018)	Assessment of Socio-economic Impacts of CBET in Bangladesh	USAID
9	IRADe-SARI-22 (2018)	Gains from Multilateral Electricity Trade among BBIN Countries	USAID
10	IRADe-SARI-21,20,19 (2018)	Volume-1, 2 and 3 - Compendium of Electricity Regulations	USAID
11	IRADe-SARI-18 (2018)	Enhancing Renewable Energy in Sri Lanka: Addressing Gaps in Policies & Regulations & Promoting Regional Cooperation	USAID
12	IRADe-SARI-17 (2018)	Impact of CBET on Livelihoods and Gender in Nepal and Bhutan	USAID
13	IRADe-SARI-16 (2018)	SARPEX-Key Findings of the SARPEX Mock exercise.	USAID
14	IRADe-SARI-15 (2018)	SARPEX-Market Design and Rules	USAID

10 LISTS OF PROJECTS-2018-19

S.No.	Title	Funding Agency	Status
Energy and Power Systems			
1	Inter-model Comparisons of Different Transportation Sector Policies in India	Shakti Sustainable Energy Foundation	Completed
2	Partnerships for Skill Development LCEDN Program	Loughborough University	Completed
3	Advanced Coal Technologies for Power Generation	DST/GTWG	Completed
4	South Asian Regional Initiative for Energy Integration (SARI/EI)	USAID	Ongoing
6	Implications of declining costs of Solar, Wind and Storage Technologies on regional power trade in South Asia (BBIN Countries)	EEG	Ongoing
7	Study to Develop roadmap for implementation of India's NDC goal 3	MoEFCC	Ongoing
8	Socioeconomic scenarios and outputs to CSTEP for their project titled "Long Term Strategy for Low Carbon Development"	MoEFCC	Ongoing
Poverty Alleviation and Gender			
9	Gender & Energy Sector Reforms in India	DFID/ENERGIA	Completed
10	Electricity as a Clean Cooking Option for Rapid Scale Cooking	NABARD	Completed
11	Gender Analysis for Project Appraisal of IGEN-IV and IGEF	GIZ	Completed
12	Study on the Implications of Climate Change on Human Development and Poverty in India	UNDP	Ongoing
Climate Change and Environment			
13	Developing the urban climate vulnerability index and assess the vulnerability of 6 selected cities using the vulnerability index	MoEFCC	Completed
14	Framing the Debate on Climate Change	US Embassy	Completed
15	Prediction of Dengue with climate change over Delhi	DST	Ongoing
16	Climate Adaptive Action Plans to Manage Heat Stress in Indian Cities	IDRC	Ongoing
17	Enabling state level strategic actions for India's NDC	MacArthur	Ongoing
Agriculture and Food Security			
18	Assessment of Food Security & Livelihoods due to climate change in UP,HP & Odisha	MoEFCC	Ongoing
Sustainable Urban Development			
19	Developing Disaster Resilience Action plan through GIS and prioritizing actions for National Disaster Risk Reduction in Urban Agglomerations of Shillong & Gangtok	MoEFCC	Ongoing
20	Process Analysis, observations and modeling – Integrated solutions for cleaner air for Delhi (PROMOTE)	MoES-NERC	Ongoing
Asia Centre for Sustainable Development			
21	Soft Landings for Indian Renewable Integration through Balancing Technologies	The Asia Foundation Department of Foreign Aid and Trade, Government of Australia	Ongoing

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C-80, Shivalik, Malviya Nagar, New Delhi – 110017
Tel.: +91 11 2667 6181, 2667 6180, 2668 2226
Website: www.irade.org