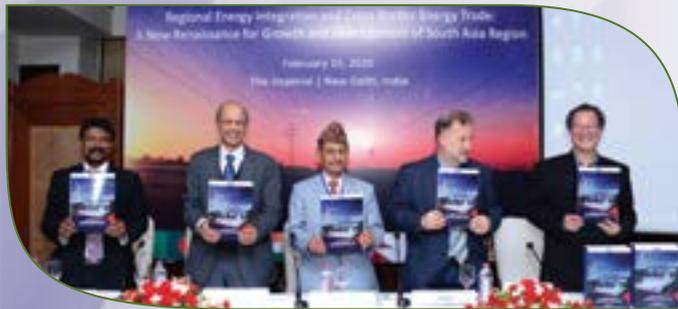


ANNUAL REPORT 2019-20



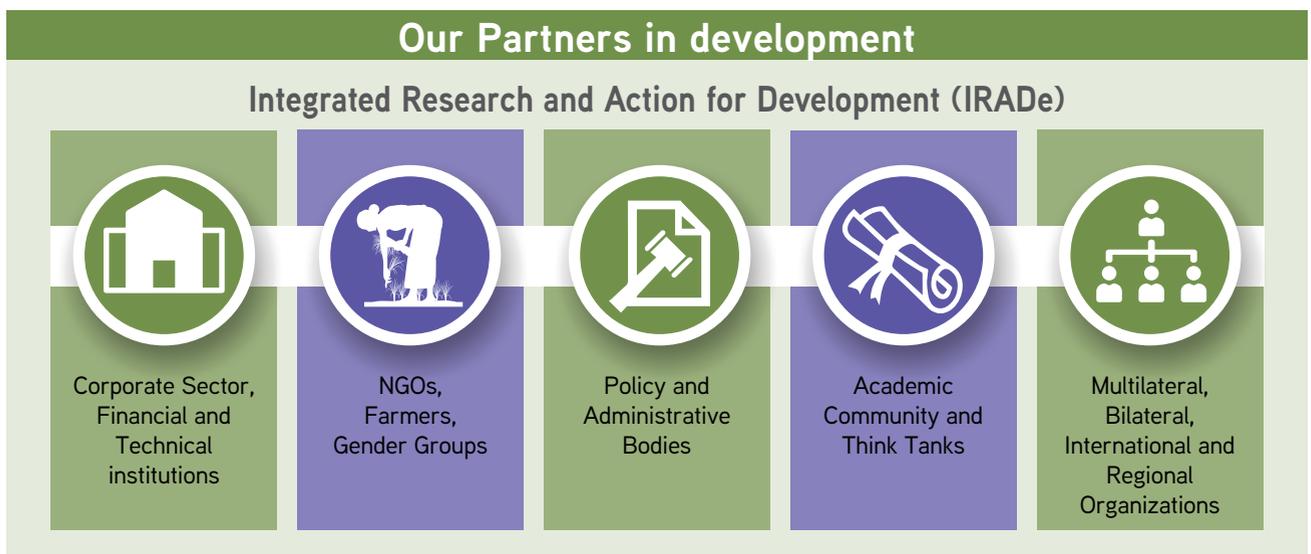
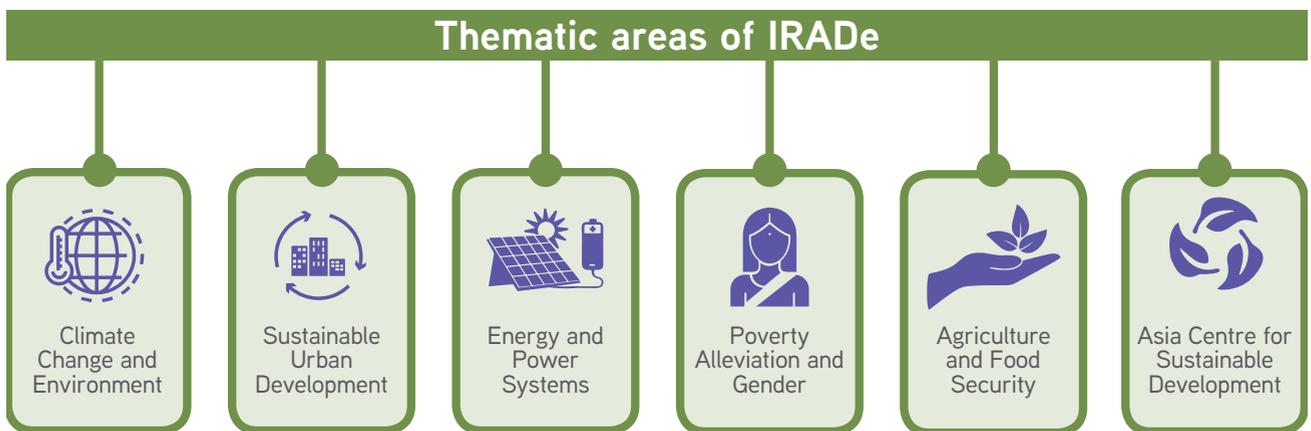
FOUNDING MEMBERS	INTERNATIONAL ADVISORY BOARD	CURRENT MEMBERS OF THE GOVERNING COUNCIL
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About us

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 21st century. IRADe's research covers these issues, as well as the policies that affect them. IRADe's focus is on effective action through multi-disciplinary and multi-stakeholder research to arrive at implementable solutions for sustainable development policy research and effective governance that accounts for

techno-economic and socio-cultural issues. It also provides expertise to several ministries, national and international institutions, and partners with reputed organisations.

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 Housing and Urban Affairs (MoHUA), Government of India, for urban development and climate change.



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 the thematic areas of climate change and environment; energy and power systems; sustainable urban development; agriculture and food security; poverty alleviation and gender. This is accomplished 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 the negotiation process for international agreements
- Carry out policy research that accounts for the political economy of the society and the 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 of Projects



IRADe staff at the inauguration of IRADe's new conference hall

Preface



I am happy to present the IRADe Annual Report for the year 2019-2020, highlighting the developments and our contribution in this period. As usual, we have either strengthened our current work or expanded in new directions.

We have strengthened our presence in the health and transport sector this year as cross-cutting themes. Our engagement with the cities of Bhubaneswar, Rajkot and Delhi on advocacy and action on heat stress management was successful with first ward level heat action plan developed for Rajkot. IRADe's research on impacts of heat stress on health, livelihood and productivity was included in Odisha Heat Action Plan 2020 and training program.

Our presence at the Conference of the Parties (COP25) meeting at Madrid reflected in the release of our Report on Urban Resilience in 10 cities at the India Pavilion and on Capacity Building at sub-national levels at UNFCCC Pavilion, where we covered a gamut of our work at the state level, sector level and University level for climate mitigation and adaptation.

In the transport sector, we assessed the existing EV user profiles, charging patterns and developed a format to enable distribution utilities to estimate the demand through a case study on Delhi.

Our SARI/EI project conducted successful stakeholder consultations on the Common Minimum Grid Code with stakeholders in South Asia. We also organized Workshops on Power market and Power Trade through Power Exchange Platform for stakeholders in Nepal, Bhutan and Bangladesh, in the respective countries. Our background paper on "Prospects of Regional Energy Cooperation and Cross Border Energy Trade in the BIMSTEC Region" was released at the Workshop held in Dhaka by high-level decision-makers of Bangladesh, and the BIMSTEC Secretariat.

As I write this preface, the world is gradually coming to terms with the "new normal" post COVID scenario. The economy is slowly opening up with the different phases of unlocking. As we recover from this challenging phase, it may be pertinent to look at the lessons from this pandemic, especially in terms of impact on climate change, building resilient cities, gender and energy cooperation in the South Asia region. Check out our IRADe Covid Newsletters for our thoughts on the impact on various issues ranging from power system management, gender, energy access and on lockdown management.

I would like to thank Rohit Magotra, Ananya Bhatia, Reema Bardhan and Sharmishtha Ghosh for their contributions in bringing out this Annual Report.

I convey my best wishes to the readers.

Professor Jyoti Parikh, PhD

Executive Director, IRADe

Obituary

It is with deep grief and shock we report that, in November 2019, Gaurav Jain, who had been with IRADe for more than 5 years left us suddenly due to Dengue at a young age. He was not only an asset to the organization but also a much loved person. Polite, respectful, helpful, kind and compassionate and always ready to work and help - that is how we would always remember him. We miss him and remember him with fondness.

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1.1 Enabling State Level Strategic Actions for Achieving NDC

The project envisages in-depth study to identify state-level low carbon growth and strategic policy options, such as business models, market-based and policy delivery solutions for the selected states and sectors. The selection of the three states viz. Assam, Gujarat and Odisha, and the three sectors viz. Power, Transport and Agriculture.

1.1.1 Actions for Achieving NDCs in Gujarat

State Action Report – Gujarat

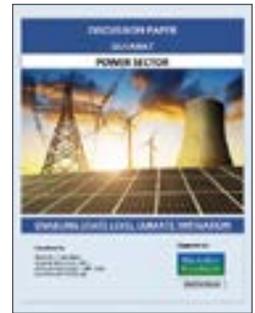
In order to formulate strategies for reducing the overall emission intensity of the economy, the understanding of the existing Greenhouse Gas (GHG) emission intensities and trends from major contributing states and different sectors is critical. Power, transport and agriculture are vital developmental sectors that are likely to grow and contribute significantly to India's GHG emissions in the near future. These sectors are critical from the climate perspective, and hence have been considered for carrying out a detailed study for the state of Gujarat, as representative of developed states of India. This analysis has enabled us to come up with an effective state-level action plan for high growth states that is consistent with India's NDC targets.



a) Power Sector

Power sector, one of the major contributors to the GHG emissions, necessitated a detailed analysis into the complete value chain of generation, transmission

and distribution. With a strong network and low losses in transmission system, focus was given primarily to the distribution sector and generation sector for which multiple stakeholder engagements were carried out, especially with Gujarat Urja Vikas Nigam Ltd. (GUVNL), State Load Dispatch Centre (SLDC), Gujarat Energy Development Agency (GEDA), State Climate Change Department, as well as private players in both generation and distribution sector.



The analysis covered technological, operational and policy impediments to the absorption of renewables into the grid, need for Renovation & Modernisation (R&M) of old thermal power plants, policy issues with incentivising plant modernisation, reduction of Transmission & Distribution (T&D) losses in Paschim Gujarat Vij Company Ltd (PGVCL), as well as the scope to improve in operational aspects viz. reliability of the system. The distribution companies (DISCOMs) do not always meet their Renewable Portfolio Obligation (RPO), largely due to long term power purchase agreements signed with existing plants. With growing demands and advanced intimation of future RPOs, the absorption of Renewable Energy (RE) should be easier. However, with the Central Government pushing for a national electricity market and the likelihood of steep increase in RPO, there will be a need to have an efficient market design that can be adopted in both the short and long terms. While the suggestion will only improve RE absorption over time, short term recommendations include adoption of strong grid balancing market and aligned policy measures so that less carbon intensive generation can be safely integrated into the system.

b) Transport Sector

IRADe has analysed three strategies to reduce emissions in Gujarat transport sector - 1) Electrification; 2) Modal shift from private to public; 3) Increasing efficiency through fuel and emissions standards. Increasing vehicle efficiency through improving fuel and emissions standards turns out to be the most effective, but costlier, mitigation strategy of all the above. Policies like emission standards, coupled with Vehicle Rating Program and Buyback Scheme, can really push the old and inefficient vehicles off the road, which contribute to major proportion of CO₂ emission. The modal shift strategy does not achieve as much emissions reduction as efficiency, but is the most efficient in terms of costs. Increasing accessibility of public transport can reduce a huge chunk of private vehicle off the road and could improve the rider experience. Electrification is the least effective and costlier strategy for reduction of emissions in transport sector. However, its effectiveness can be increased by combining it with a scheme for buy back of all polluting vehicles.

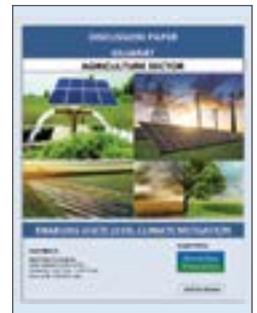


The parameters and results from the model were discussed and vetted with stakeholders like Gujarat Government's Climate Change department and Transport Commissionerate, Pandit Deen Dayal Petroleum University (PDPU) and Centre for Environmental Planning and Technology (CEPT). Currently, the research for the transport sector is focussed on analysing market measures to incentivise efficient vehicles, public transport and electric vehicles.

c) Agriculture Sector

A market model was developed for the shift to solar energy through the deployment of solar water pumps. In Gujarat, irrigation currently is primarily dependent on electricity. To understand the farmers' perspectives, a survey with around 100 farmers was conducted, majority of whom are beneficiaries

of SKY (Suryashakti Kisan Yojana) scheme implemented by the Gujarat government on a pilot basis. Financial implications of the shift for farmers, government and State DISCOMs have been analysed to design a set of policies concerning the level of subsidy and the purchase price of solar generation by the DISCOM, which is win-win for the farmers, the government and the DISCOMs.



September 2018 – March 2021; Supported by: MacArthur Foundation

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

IRADe is developing a spatially differentiated and gender-sensitive Heat Stress Action Plans (HSAPs) for Delhi, Bhubaneswar and Rajkot.

The study was done to assess the climatological variations in summer months (March, April, May and June), for a period ranging from 2001-2018, in three project cities. Daily data of climate parameters: Maximum Temperature (Tmax), Minimum Temperature (Tmin), Relative Humidity measured at 8:30 AM [RH (830)], and Relative Humidity measured at 5:30 PM [RH (1730)], was collected from Indian Meteorology Department (IMD). The climatology data was analysed further by comparing with the city's long-term climatological mean Tmax and Tmin (mean of 1905 to 2000) for the corresponding months, to determine the deviation in the city's temperature and humidity.

It was observed that March is getting hotter in Delhi at a relatively faster rate as compared to the rest of summer months, with an average rise in Tmax by +1.2 degrees C in the period of 2010-18. Bhubaneswar also showed a similar trend with the average rise in T Max by +1.4 degree C in March for the period 2008-18. In Rajkot, there was an average rise of temperature by +1.2 degree C in April during 2001-17. RH [8:30] for Bhubaneswar has also shown

an increase of 2.65% during the period 2008-18. For Rajkot, RH [8:30] showed a maximum increase of 1.12% in April during 2004-17. RH, measured at 17:30 hrs, showed a maximum spike of 2.94% for June during 2008-18 in Bhubaneswar. For Rajkot, RH [1730] showed a maximum increase of 2.46% for June during 2004-17. No significant trend in RH was observed in the project cities.

The work done up until now has been recognized by city, state, and national government, including the National Disaster Management Agency. These HSAPs will help prevent heat-related mortality, enable governments to protect poor and vulnerable citizens, improve the preparedness of hospitals/health centres, mitigate economic losses, and make Indian cities climate resilient.

Updating Thermal Hotspot Maps for Delhi, Rajkot & Bhubaneswar

Land Surface Temperature (LST) maps and the ambient air temperature measured by Automatic Weather Stations (AWS), were mapped and analysed

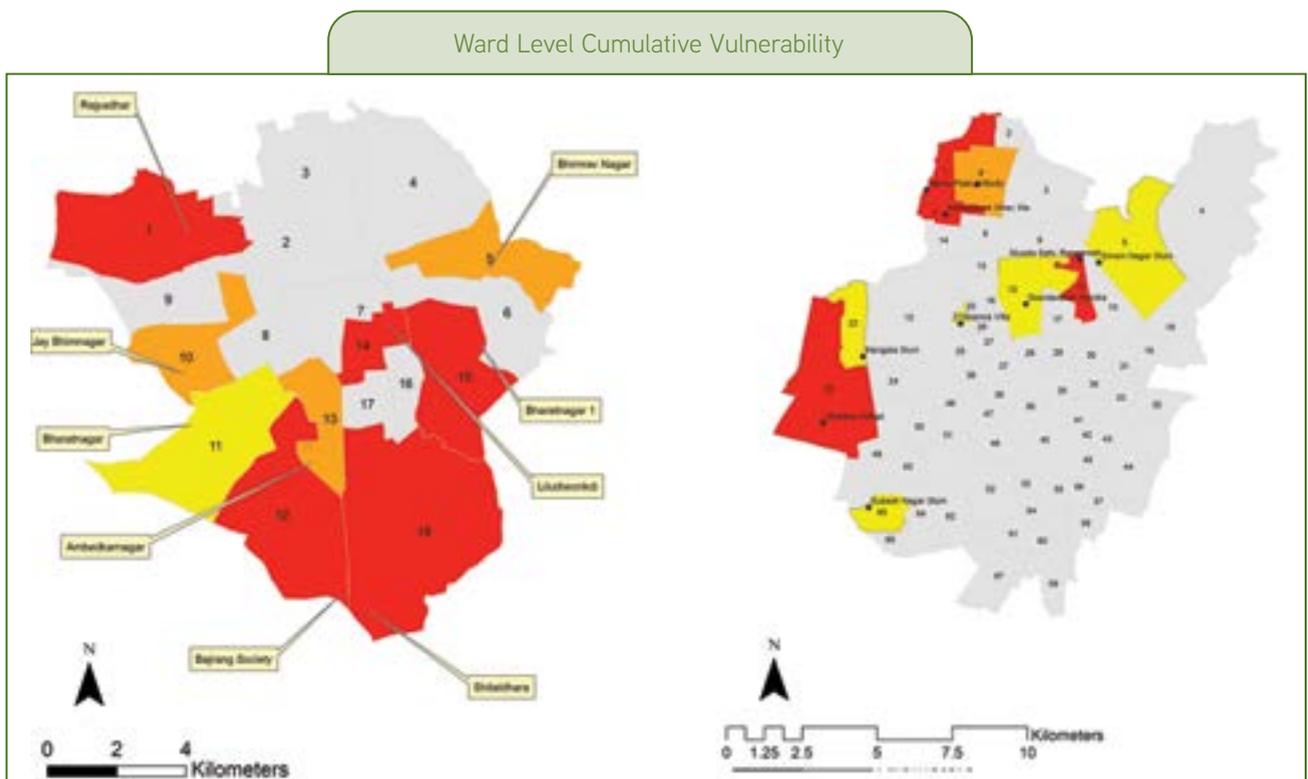
to identify the spatial distribution of air temperature in Rajkot, Bhubaneswar & Delhi for 2018-2019 summer.

Identification of Ward-level vulnerability- Delhi, Rajkot & Bhubaneswar

Ward level Heat stress vulnerability in Delhi, Rajkot and Bhubaneswar was analysed using a comprehensive index comprising nine sectors - Sanitation, Water, Electricity, Health, Transportation, Housing, Cooking, Awareness and Heat symptoms, and their respective sub-sectors. The cumulative ward wise heat stress vulnerability was categorised into low, medium and high stages. The ward level vulnerability map for Rajkot and Bhubaneswar city is highlighted in the following map. Assessment of ward level vulnerability will help cities to prioritise focussed actions on the vulnerable areas and vulnerable groups.

Dissemination & Outreach

Consultations with stakeholders at the city level (Bhubaneswar, Rajkot and Delhi) were done to sensitize them about the need for Heat Stress



Ward level Cumulative Vulnerability maps of Rajkot and Bhubaneswar

Action Plans. Also, the stakeholders - City Health Departments, Rajkot Municipal Corporations, Bhubaneswar Municipal Corporation, New Delhi Municipal Corporation, Smart City departments, Town planning departments, were approached for relevant data, discussion of project activities and work plan. A meeting with the Honourable Minister of Environment and Forests, Govt. of Delhi, Mr. Imran Hussain, was held to discuss the design and implementation of Heat Stress Action Plan for Delhi.



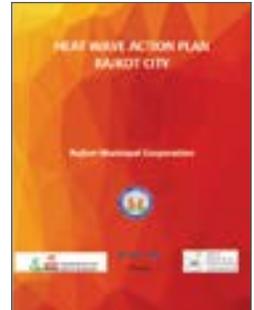
Meeting with Mr. Imran Hussain, Environment and Forest Minister, Govt. of Delhi

A **Heat Stress Advisory** was prepared in collaboration with the medical services department of New Delhi Municipal Corporation and it was distributed among the Medical Services Department of NDMC. The preventive measures that can be taken to avoid heat-related illnesses were also incorporated on the prescription slips of NDMC Charak Palika hospital and associated dispensaries.



Heat Wave Advisory, NDMC

In Rajkot, IRADe in collaboration with the **Rajkot Municipal Corporation (RMC)**, actively implemented the Heat Stress Action Plan (HSAP) in the city. Some of the key public awareness initiatives like Hoardings at public places, LED Screen to display Heat Advisory, distribution of more than 15,000 posters and pamphlets in regional language and initiating Early warning systems using 20 temperature sensors across the city.



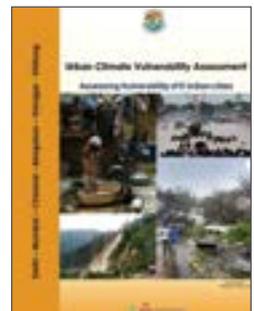
A **Medical Stakeholders Training Module** has also been developed to aid in the training. The Heat Stress Action Plan for Rajkot was accepted by the Rajkot Municipal Corporation. In Bhubaneswar, a **Draft Heat Stress Action Plan** has been prepared and discussed with city level stakeholders. The Odisha State Disaster Management Authority has already incorporated research and action inputs from IRADe into the Odisha Heat Action Plan for 2020.



November 2017 – November 2020; Supported by: International Development Research Centre (IDRC), Govt. of Canada

1.3 Developing the Urban Climate Vulnerability Index for Six Cities

IRADe developed an Urban Climate Vulnerability Index (UVI) to assess and understand climate vulnerabilities and associated risks for the cities of Srinagar, Shillong, Chennai, Mumbai, Bengaluru and Delhi. The report was submitted to the Ministry of Environment, Forests and Climate Change (MoEFCC). A request for developing Urban climate vulnerability index for the Ahmedabad city and dissemination of the



project results through a national workshop was considered favourably by MoEFCC.

The work on the UVI profile of Ahmedabad city was initiated and the collection of secondary data through numerous available published sources was completed. The process of finalizing the vulnerability score for the City is in process. A National Level workshop involving relevant stakeholders was postponed due to the COVID-19 pandemic.

October 2017 – September 2020; Supported by: Ministry of Environment, Forest and Climate Change (MoEFCC)

1.4 Linkage of Spread of Dengue and Climate Change for Delhi and Rajkot: A statistical Analysis and Development of Warning System

Extensive literature on early warning systems for dengue prevention was reviewed to develop indices needed for developing an early warning system for dengue management. Subsequently, a research paper titled “Early warning system for Dengue in India: An updated systematic literature review” was finalised.

Regression analysis was employed to develop a model for predicting the number of dengue cases in Rajkot using Maximum Annual Average Temperature (Tmax). This model shall be further validated and refined by including more climatic parameters such as Minimum Annual Average Temperature, Annual Average Rainfall and Annual Average Relative Humidity.

Hotspot mapping (ward-wise) of dengue cases registered in Rajkot from 2011–2017, and in Delhi from 2014–2017 was carried out. As compared to previous years, 2016–18 recorded higher dengue incidences in the Eastern Zone of Rajkot. Incidentally, the Eastern zone has a higher number of slums within the city as well. A similar study is being carried out for Delhi, the data for which has been procured from North Delhi Municipal Corporation,

New Delhi Municipal Council, South Delhi Municipal Corporation, East Delhi Municipal Corporation and Delhi Cantonment.

September 2017 – 31 January 2021; Supported by: Department of Science and Technology (DST), Government of India

1.5 Climate Change: India's Perceptions, Policies and Expectations

The book on “Climate Change: India's Perceptions, Policies and Expectations” is edited jointly by Dr. J. R. Bhatt of Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, and Dr. Kirit Parikh of Integrated Research and Action for Development (IRADe). For this, MoEFCC and IRADe requested many research scholars and practitioners with long involvement and work in the area of climate change, for contribution to this book. The book comprises four chapters contributed by IRADe.

The book covers a wide range of issues, beginning with a status report on India's INDCs. It explores options for further actions, the importance of technological development, the role of sustainable consumption patterns. The critical role of education and building awareness, need for capacity building, and sharing the burden of adaptation. In the later part, the book discusses India in the international context. It underlines the importance of the Talanoa dialogue that listens to all voices. It explains the evolution of the process of negotiations and transparency, and where India has reached. It goes on to discuss the importance of equity and climate justice for any acceptable global agreement, the role of the global stock take, and highlights the role of monitoring, evaluation and verification in ensuring implementation. In addition, the book underscores the vital need for finance as well as the options of the market and non-market instruments for implementation of projects.

The book is expected to be released in 2020.

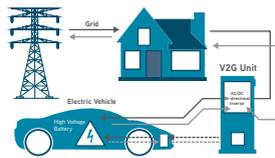
2018 – 2020; Supported by: Ministry of Environment, Forests and Climate Change (MoEFCC)

2.1 EV Charging Patterns and Impact on DISCOM

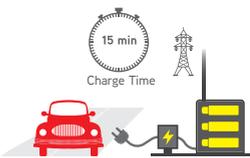
Electric Vehicle (EV) penetration is expected to grow soon, with the right kind of business models and Government policies acting as enablers. Two-wheelers and private four-wheelers have increased exponentially in the country, and in Delhi too, their use is likely to grow in the future. When EV penetration increases, the impact on power distribution companies (DISCOM) can be significant. Currently, electric-rickshaws already comprise fifty percent of the three-wheeler sales in Delhi. This provides an opportunity to understand the profile of existing EV users, their preferences, charging pattern, and anticipate the future behaviour pattern of EV consumers. The existing Government policies, consumer preferences, and various technological and economic aspects of Delhi will be studied to develop scenarios for assessing the future EV growth, the impacts on DISCOMs, and to suggest policies for enabling faster penetration of EVs.



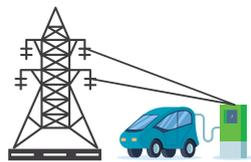
Analyse EV Owners Profile



Electricity Demand due to EVs



Charging Time of EVs



Impact of EVs on Local Grid

EV Scenarios selected for the project study

Objectives

The objective of this study is to assess the existing EV user profiles, their charging patterns and develop

a format to enable distribution transformer level demand estimates in localities of Delhi.

Questions Posed

1. What are the international best practices that can be adopted for Delhi to promote EV usage? 2. How to project the hourly electricity demand on the grid at DT level? 3. Can the EV demand be used to flatten the load curve at the DT level? 4. What is the charging and transport behaviour of the existing EV users that can inform our projections for future EV demand? 5. What are the likely scenario of EV demand in Delhi, and their impact on the grid?

IRADe's Approach

- Literature review to understand the international experiences and suggest policy measures applicable in Delhi's context.



Literature survey and documentation of international experiences for framing EV policies for the US, Europe, and China, have been completed. The alternative possible policy measures in the context of Delhi have been identified. Relevant stakeholder consultations done with Energy Efficiency Services Limited, BSES Yamuna Power Limited, BSES Rajdhani Power Ltd. Assessment of the impact of EV growth on electricity demand and grid, and the DT level half-hourly data provided by both

DISCOMS - BYPL & BRPL, have been analyzed to estimate the usual load pattern for Delhi.

- Survey of consumer preferences of EV users- 2-wheeler, 4-wheeler, e-rickshaws, and prospective consumers.

Cost of EV & driving range; Availability of public charging, mode of charging-home/public/office, type of charging (slow/fast), and charging pattern; Vehicle users' preference for charging strategies; Factors (social and economic) influencing EV choice; Growth of EV's under various techno-economic scenarios; Assessment of impact of EV growth on electricity demand and grid.

- Development of template to estimate the electricity demand and change in existing load patterns due to EV growth.

Questionnaires have been developed by the IRADe team to assess the consumer preference, covering four different segments; two-wheelers (2w), Four-wheelers (4w), private owned/taxi/institutional drivers) & prospective EV consumers. The questionnaires seek to understand the several aspects of EV user's experiences, like the cost of EV & driving range, availability of public charging, mode of charging-, home/public/office, type of charging (slow/fast), and the charging pattern. Vehicle user preference for charging strategies and socio-economic factors that influence the choice will be identified. A primary survey of existing EV users has been initiated. It will cover 500 respondents in a total of five segments of EV users - 2W (120), 3W (120), 4W private owners (70), 4W institutional users (70), and prospective customers (120).

Anticipated Results of the project:

- EV user preferences for the type of charging (home/office), mode of charging (slow/fast), time of charging, vehicle range, price, performance, operating cost, etc.
- International EV policies relevant for Delhi.
- Factors impacting EV demand and growth.
- Impact of EV on electricity demand.

May 2019 – November 2020; Supported by: Shakti Sustainable Energy Foundation, India

2.2 South Asia Regional Initiative for Energy Integration (SARI/EI/USAID)

The SARI/EI programme addresses issues of policy, regulation, legal, technical and market aspects of advancing regional energy integration and Cross Border Electricity Trade (CBET) in South Asia. Some of the key studies undertaken as part of the programme are as follows:

i) Global Perspective Report on Gas Scenario for the BBINS Region

The Report on regional gas assessment study under the SARI/EI initiative will focus on the BBINS (Bangladesh, Bhutan, India, Nepal and Sri Lanka) Region particularly, and will also cover the global scenario. It will assess the potential for exploration, production and trade of gas in the BBINS region, with the ultimate objective of energy cooperation, as well as to have a say in dictating the mechanics of the international gas market. The Report will assess the potential gas and alternate energy resources and demand across the BBIN countries, as well as its economics till 2040, to assess the trade potential, including that of multilateral trade, within the BBINS Region, as well as trade with other Regions.

ii) Building consensus and developing a strategy paper on creating regional technical institutional mechanism in the South Asia Region, for promoting Cross Border Electricity Trade (CBET)

The study aims to review, analyse and assess the various regional institutional mechanisms for transmission system coordination, that exist in South Asia, related to coordinated system planning, integrated system/network development, system operation and grid code harmonization from the perspective of CBET in South Asia, as well as such institutional mechanisms that exist internationally. Based on extensive review and analysis, the study will recommend a suitable regional technical institution/body/association for the South Asia region. It will also suggest its role, functions, operating structure (including working groups, expert committee etc.) and legal status, for coordinated system planning and operation, etc. in the region. Considering and

recognizing the importance of building consensus, the study is being conducted in a highly consultative and participative manner. As a part of the study, there would be extensive countrywide stakeholder consultation meetings, followed by a South Asia Regional Transmission Utility workshop.

iii) Study on regulatory interventions for grid discipline and grid reliability in the South Asian Region (SAR)

The study will review and analyse all the existing relevant electricity regulations, mechanisms and technical frameworks with respects to Grid discipline and Grid reliability of each South Asian Countries (SACs), both from the perspective of the domestic power system of a country as well as integration/unification of the country grids. It will then suggest regulatory measures/interventions needed for ensuring Grid discipline and Grid reliability in SAR. The study will also involve country-wise stakeholder consultation meetings and interactions with SAFIR Working Group members. Requested by South Asia Forum for Infrastructure Regulation (SAFIR) Steering Committee, the report will comprehensively cover

- In-depth review of grid discipline and grid reliability in South Asian region;
- Key indicators defining grid discipline and grid reliability;
- Assessment of level of implementation and identification of gaps;
- International experiences on regulatory interventions for improving grid discipline and grid reliability;
- Specific technical capacity-building measures needed, and
- Suggested regulatory measures/interventions needed to improve grid discipline and grid reliability in SAR countries

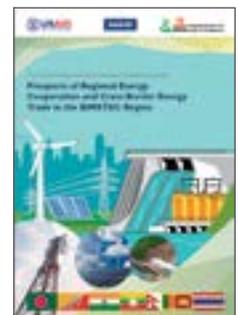
iv) Developing the Second Edition of the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) Energy Outlook (A biennial report)

The second edition of the Report will analyse, review and update the energy sector (power, gas and oil) outlook for the seven BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) countries and provide BIMSTEC energy sector outlook till 2035. It will cover the past, present

and future trends/projections in the energy value chain, including generation, transmission and consumption sectors. It will also review and update the past and current initiatives for the regional energy cooperation within BIMSTEC countries, including challenges and opportunities and future outlook for cross-border energy trade. Considering that energy integration is relatively new under the BIMSTEC process, the study is being conducted in a highly consultative and participative manner, in consultation with BIMSTEC secretariat and BIMSTEC member states.

v) Background Paper on “Prospects of Regional Energy Cooperation and Cross Border Energy Trade in the BIMSTEC Region”

A background paper on “Prospects of Regional Energy Cooperation and Cross Border Energy Trade in the BIMSTEC Region” was prepared based on the review, research and analysis of the energy sector of BIMSTEC countries. The paper presented an overview



of the prospects of regional energy cooperation and cross-border energy trade (CBET) in the BIMSTEC region, describing the potential synergies in energy cooperation such as the diverse energy mix, diversities in demand and generation pattern, and sustainable energy generation that would result in improved economics. It was released during the inaugural session of the “Conference on Enhancing Energy Cooperation in the BIMSTEC Region” on 25-26 February in Dhaka, Bangladesh.

vi) “Assessing the Potential Benefits of Cross Border Electricity Trade for Affordable Supply of Electricity, Facilitating Grid Balancing of Renewable Energy Integration, and Suggesting a Framework for Ancillary Service Market in the South Asia Region”

The study will assess the extent of a potential reduction in the average cost of supply of electricity in South Asian countries due to increased cross border trade of electricity for optimal utilization of generation

assets in South Asia, as well as due to reduction of reserves, and quantification of the overall economic benefits to the region over the next ten years. It will also assess the role of cross-border electricity trade in the context of accelerating the renewable energy integration in South Asian countries presently and in the future, considering the rapid expansion in renewable energy in the region, for reduction of carbon emissions. It will quantify the benefits of regional grid balancing due to net fluctuations of demand and variable renewable energy. It will also propose the optimal capacity addition in each country, considering regional energy cooperation. It will analyse the various market mechanisms in vogue internationally, for grid balancing and ancillary services, and propose an appropriate fair, transparent market structure suitable for South Asia, and the broad framework for ancillary service market in the Region. The study was commissioned by the SAFIR Steering Committee and is being conducted by SARI/EI, IRADe, under the SAFIR Working Group on “Regulatory Cooperation to Facilitate Knowledge sharing, addressing Cross-Cutting Energy/Electricity Regulatory Issues and Capacity Building in South Asia.

vii) Strategy/White Paper on Creating Regional Technical Institutional Mechanism ‘South Asian Forum of System Operators (SAFSO)’ in South Asia Region for Promoting Cross Border Electricity Trade

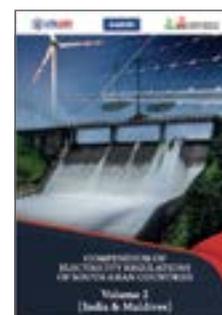
The white paper aims to critically review and analyse hierarchical structures, organizational set-ups and prevailing practices related to system operation and market operation in the different South Asian Countries (SACs), as well as relevant international practices in different regions, such as European Network of Transmission System Operators for Electricity (ENTSO-E) of Europe, Southern African Power Pool, West Africa Power Pool, Gulf Cooperation Council Interconnection Authority (GCCIA). Based on extensive review and analysis, the study will recommend detailed strategy along with the details on the function, structure, mode of operation and creation of SAFSO, as well as the detailed road map and action plan for implementation and roll-out of SAFSO.

viii) Strategy paper for creating the South Asia Forum for Electricity Market (SAFEM) for promoting cross-border electricity trade

The paper aims to review, analyse and assess the electricity market structure, market design, instruments and trade situation in the South Asian region. It will analyse any existing regional forums/institutional mechanisms, on their role, responsibilities, structure, function etc., from the perspective of the proposed SAFEM. The Paper will also take into account the international experiences of formation of a forum or regional association of electricity market players such as Europe, South Africa, Western Africa, U.S. (PJM and other markets), Central America, Asia (GMS and ASEAN) and Australia. Based on extensive review and analysis, the Paper will propose the role, functions, operating structure (including working groups, expert committee etc.) for SAFEM. The SAFEM is expected to help in the adoption and implementation of guidelines and policies in the South Asian countries on power trade and markets in the region.

ix) Compendium of Electricity Regulations of South Asian countries

The Compendium of Electricity Regulations of South Asian countries (in three volumes) was prepared by the SARI/EI team, at the behest of South Asia Forum for Infrastructure Regulation (SAFIR). The Compendium is a compilation of Electricity Regulations of the



SAARC countries - Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka - up to 31st December 2019, which would be updated every six months. It endeavours to provide a platform to keep all the stakeholders updated with the latest electricity regulations in South Asian countries. The Compendium was released at a joint conference with SAFIR in New Delhi, India on 19th February 2020, and is now uploaded on the SARI/EI website for ready reference of all stakeholders.

October 2018 – September 2022; Supported by: USAID, India

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

IRADe is doing an energy modelling study to assess the long-term implications of declining costs of Solar, Wind and Storage technologies on the volume and direction of regional power trade among Bangladesh, Bhutan, India and Nepal (BBIN) countries. The work involves the development of Bhutan Electricity Model, updating of IRADe's existing 'Bangladesh, India and Nepal's Electricity Model', and running the regional integrated BBIN Electricity model.

The electricity model and the Reference Energy System (RES) in Answer TIMES software has been developed for Bhutan, and updated for Nepal. The Bhutan model consists of five existing and 17 upcoming hydropower plants. Some test runs were made to generate results for the inception meeting (June 2019), followed by a stakeholder consultation (November 2019), where representatives from Bhutan department of Hydro Power Systems, Bhutan Electricity Authority, Druk Green Power and Bhutan Power System Operator participated.

In addition to this, work on updating the IRADe's Nepal electricity model was undertaken and an inception-cum-stakeholder meeting took place in February 2020 with key agencies in Kathmandu, such as Nepal Electricity Authority (NEA), Planning Commission of Nepal, Alternative Energy Promotion Centre (AEPCC) and Investment Board Nepal (IBN). Both the Bhutan and Nepal electricity models were run (independently) with different marginal export prices (assumed prices) to assess the implication of export on the capacity mix, the volume of trade, transmission capacity requirements, investment

requirements, etc. for each country. Work on updating the IRADe's Bangladesh electricity model is also under progress.

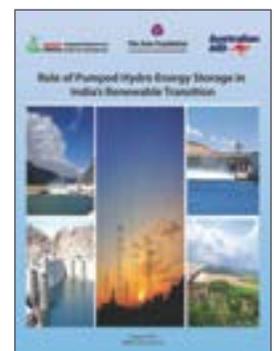
March 2019 – December 2020; Supported by: Energy and Economic Growth (EEG) research program of the UK Department for International Development (DFID)

3.2 Role of Pumped Hydro Energy Storage in India's Renewable Transition

IRADe, in collaboration with The Asia Foundation (TAF), carried out this study to deliberate on the various options for renewable energy integration, grid balancing and storage technologies. Technical policy interventions on pragmatic grid-balancing options for India were discussed, including new surveying technologies for pumped storage that could chart a cost-effective and sustainable roadmap for renewable integration.

The IRADe report recommended, that to arrive at the true cost of PHES for balancing power, due weightage should be given to flexibility options which include ramp-up/ramp-down rates, start/stop ability, reliability, resilience and black start capabilities etc. among others.

The report highlighted that there is significant potential in South Asia for off-river PHES projects, and exploiting such potential on a regional basis, can help all countries economically as well as towards renewable energy integration to the regional grid.



March 2019 – June 2019; Supported by: The Asia Foundation

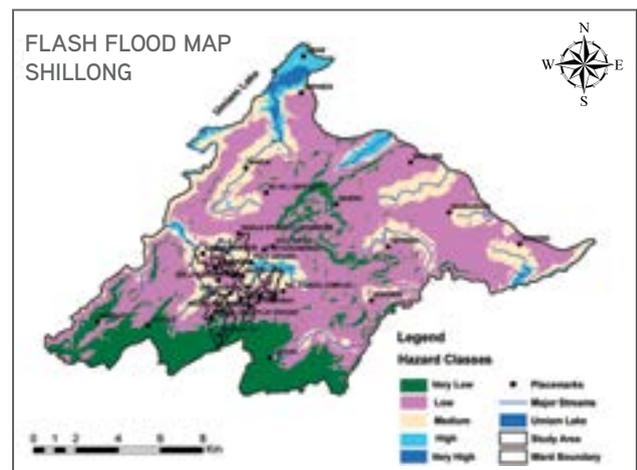
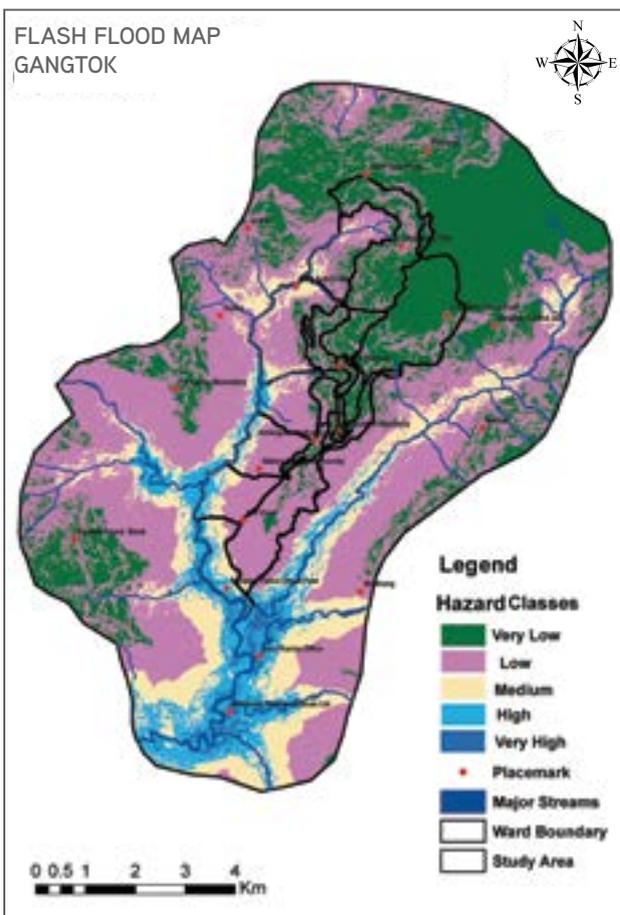
4.1 Developing Disaster Resilience Action Plan for Shillong & Gangtok

Ward level maps were developed for both Shillong and Gangtok (1:4000 scale). Primary household surveys in the project cities for assessing the impact of urbanization on natural ecosystems, have been carried out. Secondary data and information have been collected from the urban local bodies and government departments, including on solid waste management reports, earthquake inventory, AWS (Automated Weather Stations) inventory, maps etc. Disaster resilience action plan for Gangtok and Shillong and an Urban Vulnerability Index for Shillong are being developed. 18 maps each for Shillong and

Gangtok were prepared for Critical Infrastructure, Building footprint, Building density, Road network, Road density, Slope, Drainage, Drainage density, Aspect, Lineament buffer, Inventory buffer, Elevation, Land use and land cover, Landslide hazard zonation, Landslide inventory, Potential areas susceptible to flash flood, Inundation depth, Site Response of Earthquake.

Satellite imageries have been used to assess the impact of urbanization on the natural ecosystem in the last 30 years in Shillong. Compared to 1989, the built-up area in 1999 increased by a drastic 13%, followed by 1% for 2009, and 3% for 2019. The analysis shows that during the last forty years, the built-up area increased by a significant 17%, taking up the area under the vegetation cover which decreased by the same percentage. It was observed that the Southern and the Eastern part of the city had a much longer increase in the built-up areas. According to the analysis, Ward nos. 1, 2, 5, 8, 22, 23, 26 and 27 have shown more than 50% increase in the built-up area over the last 40 years.

March 2017 – March 2020; Supported by: Ministry of Environment, Forests and Climate Change (MoEFCC) under National Mission on Himalayan Studies (NMHS)



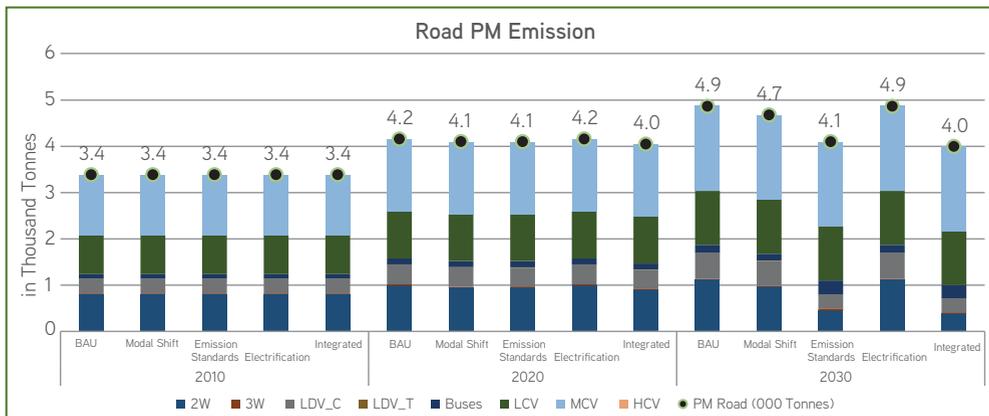
4.2 Process, Analysis, Observations and Modelling: Integrated Solutions for Cleaner Air for Delhi (PROMOTE)

IRADe has developed a model to project energy consumption and emissions from the transport sector and demand and supply policy options for mitigation of long-term emissions. Some of the mitigation strategies that can be analysed using the developed model are: (i) Shift from private to public transport within road; (ii) Shift from road to rail/metro; (iii) Fuel efficiency with projected cost numbers of future efficient vehicles; (iv) Introduction of EVs; (v) Use of alternate fuels; and (vi) Reduction in transport demand.

The model parameters were calibrated and current emissions projections made consistent with the

latest SAFAR (System of Air Quality and Weather Forecasting And Research) report. Based on the calibrated model, the emission intensity of Delhi, NCT, under the Business as Usual (BAU) scenario is the highest, as no policy interventions & technological improvements are undertaken after 2015. Emission intensity under the Fuel Efficiency scenario was found to be the lowest as the efficiency of the vehicle has improved under further iteration of Auto Fuel Policies. The impact of electrification in 2030 was not found to be substantial as the considered percentage of sales target in public and private vehicles accounts to a very small share of electric vehicles on road compared to conventional Internal-Combustion Engine (ICE) vehicles.

October 2017 – March 2022; Supported by: Ministry of Earth Sciences (MoES)



PM Emissions under various scenarios in 2010, 2020 and 2030

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

IRADe contributed to five sub-sections of a large study carried out by UNDP on the human impacts of climate change in India. IRADe carried out five interlinked studies: 1) Multidimensional poverty – spatial and temporal distribution in India; 2) Framing the inter linkages between climate change, human development and poverty; 3) Private Cost-do the poor pay more; 4) Projected impacts of climate change on poverty and human development; and 5) State Ranking Index and Indicators.

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 inter linkages with the ecosystem and vulnerable groups with a focus on gender aspects. The third study gives a holistic view of the additional private cost which is being imposed on the poor and marginalized population of the country, by the changing climatic conditions. The fourth study provides an all-inclusive picture of the 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 and Inequality, Economy and General Demography. Each sub-index had various indicators for the estimation.

The findings will be published in the UNDP report **“Everything has turned upside down, the human impact of climate change in India”**.

March 2019 – June 2019; Supported by: United Nations Development Programme (UNDP) through Professional Development Associates (PDA)

5.2 Impact Assessment of Electricity Access on Health and Education

This study is being done to assess the impact of the electricity access in public health and public education sector in India, using a case study for Bihar and Jharkhand. A list of “tracer indicators” to gauge the status of key infrastructure and instruments require electricity for service delivery in the PHCs and schools in rural and peri-urban Jharkhand and Bihar, was collected.

Facilities survey was conducted at fifteen health centres and fifteen schools in three districts namely, Ranchi, East Singhbhum, and Deoghar in Jharkhand. Ranchi being the state capital district, was selected as a reference district for the state, whereas the other two other districts were randomly selected with replacement - one from the list of aspirational districts as per NITI Aayog, and one from the remaining districts. Five blocks from each district were randomly selected to draw a framework for measuring energy access status and to track the impacts of reliable electricity supply. Service satisfaction surveys of 150 patients, non-patients (medical and administrative staffs), and 150 students and teachers have been carried out in these districts. Further, to support the findings from the primary data, a focus group discussion at six health facilities and six education institutes in Ranchi and Deoghar was carried out.

Based on this information, a brief report was prepared which provides a detailed multi-tier framework assessment for the energy supply across the state at the community health centres, primary health centres and the government-run secondary schools. It also highlights the underlying reasons for irregular electrification at these facilities, their service readiness, and the impact of stable electricity provision on the service delivery.



Facility survey conducted at the health facility; Student satisfaction survey at the education facility

This study will come out with a set of policy suggestions for possible interventions by the Government to improve the service delivery by health and education facilities, especially in the rural and semi-urban areas utilizing electricity. Findings

will also provide inputs for energy planning in community health centres and schools in the states having similar socio-economic setup.

September 2019 – August 2020; Supported by: SHAKTI Sustainable Energy Foundation

Electric Cooking: Needs, Challenges and Way Forward

There are range of possibilities for cooking with clean, modern energy which is increasing rapidly on a global basis. With current expansion (through investment and infrastructure) and strengthening of policies around electrification occurring globally, electricity is anticipated to be both a readily available and widely adopted clean household energy source in future, with the potential for surpassing LPG as a modern energy cooking solution.

To explore the prospects of electric cooking and assess the areas of policy development IRADe along with researchers from UK Low Carbon Energy for Development Network carried out a review of selected recent experiences in promoting electric cooking in India and Ecuador and suggested the ways forward to upscale electric cooking. The study also identified research problems at the interface between electric cooking and the consumer.

November 2019 – February 2020; Collaboration between IRADe and Modern Energy Cooking Services (MECS), Loughborough University, UK



6

Conferences, Workshops, Trainings, Consultations and Meetings

Climate Change and Environment

1. Medical Stakeholders Training in Rajkot, Gujarat (3 May 2019)

IRADe, in collaboration with Rajkot Municipal Corporation (RMC) and Indian Institute of Public Health, Gandhinagar (IIPH-G), organized a one-day workshop at Rajkot, with wide participation of more than 50 doctors and public health professionals from the city. The discussions focused on heat waves and interpretation of heat alerts, diagnosis and treatment protocol for heat exhaustion & heat stroke, and overall preparedness for prevention and management of heat stress during heatwave days.

2. Policy Dialogue on Energy & Climate Change at IIT Guwahati (9 May 2019)

More than 70 participants from Indian Institute of Technology (IIT), Guwahati; National Power Training Institute (NPTI); Tezpur University, Central University of Assam; Irrigation Department, Govt. of Assam; Assam State Electricity Regulatory Commission (ASERC); Public Works Department (PWD), Roads; PWD (EAP); Assam Science Technology and Environment Council, (ASTEC); Assam Energy Development Agency (AEDA); Assam Power Generation Corporation Ltd (APGCL); WRI India; Civil societies and other independent researchers, attended the event.



3. Medical Stakeholders Training in New Delhi (11 May 2019)

IRADe conducted a training in collaboration with New Delhi Municipal Corporation (NDMC) and Indian Institute of Public Health, Gandhinagar (IIPH-G) to enhance capacities of medical officers in Delhi and to sensitize them about the need for heat-related illness reporting. The workshop was attended by more than 50 stakeholders, including doctors and medical professionals of New Delhi Municipal Corporation. This was the first-of-its-kind training workshop for the medical community in Delhi.



4. Interactive Stakeholders workshop for Evolving Rajkot Heat Stress Action Plan, Rajkot, Gujarat (26 June 2019)

In collaboration with Rajkot Municipal Corporation (RMC) and Indian Institute of Public Health, Gandhinagar (IIPH-G), IRADe conducted a workshop, attended by 75 plus city/state level officials, including



city Municipal Commissioner, Deputy Commissioners and Assistant Municipal Commissioners and officials from various departments.

5. Policy Dialogue on Climate Change and Development, Goa (10–12 October 2019)

Dr. Kirit Parikh, Dr. Jyoti Parikh and Dr. Probal Ghosh were invited to the MacArthur India Climate Grantee Meeting held on 10-12 October, 2019 at Taj Fort Aguada, Goa.

6. Dissemination workshop on “Enabling State Level Strategic Actions for India’s NDC - Gujarat Chapter”- Vadodra, Gujarat (28 November 2019)



IRADe is working on a detailed study to formulate effective state actions consistent with the national plan, particularly for energy-intensive sectors viz. power, agriculture, and transport, and suggest policies for state-level implementation to reduce CO₂ emissions and increase the share of renewables in the state energy mix by 2030.

IRADe organised a dissemination workshop in Vadodara for extensive sectoral discussions on draft study results with the concerned stakeholders representing state-level policymakers, implementing organization, researchers and civil societies, public and private sector representatives. The moderated discussion brought a new dimension and policy perspective to help strengthen the strategic policy framework to achieve India’s NDCs.

7. South Asia Heat Health Summit – Global Heat Health Information Network, IITM, Pune (14 February 2020)

IRADe co-organised the South Asia Heat Health Summit, in association with Global Heat Health



Information Network, the Indian Institute of Tropical Meteorology and others. The Summit aimed to build capacity, promote sharing and encourage evidence-based policy and actions to improve the management of extreme heat risks. IRADe organised a session on ‘Local Interventions in South Asia: Impact of heat stress on Livelihoods, productivity, and Health’.

8. Medical Stakeholders Training Needs Assessment of Heat Stress Management for Bhubaneswar, Odisha (24 February 2020)

IRADe, in collaboration with IIPH-B, organised the workshop to assess the need on Heat Stress Management among the medical officers in Bhubaneswar, to enhance capacities of Medical Officers for better management of heat-related illnesses and aid developing a list of topics to be included in the Heat Stress Management Manual. The training was attended by more than 30 medical officers.

Energy and Power Systems

9. SARI/EI, IRADe Inception Meeting in Colombo, Sri Lanka (17–18 April 2019)

USAID, India along with SARI/EI, IRADe representatives, visited Colombo, Sri Lanka, to meet various key stakeholders after the extension of phase IV of the SARI/EI Program. The team 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).

10. SARI/EI 7th Combined Project Steering & Task Force Meeting, New Delhi, India (28 June 2019)

The 7th Combined meeting of SARI/EI Project Steering Committee & Task Force meeting was attended by members from Bangladesh, Bhutan, Nepal, India and Sri Lanka, along with the representatives from SAARC Secretariat, SARI/EI Project Secretariat, IRADe, and BIMSTEC representative.



The key activities planned for the extended phase of SARI/EI (2018-2022) and advancing regional energy cooperation and cross border of electricity trade in South Asia, were discussed at the meeting.

The meeting sought to build consensus among the members on the strategy and approach of SARI/EI for enhancing cross border energy trade in South Asia, as well as agreement on the Annual Work Plan for the program period 2018-19 and 2019-2020. It also concurred that SARI/EI should provide a single platform for distribution companies, transmission companies and power producers to deliberate on issues of the overall transformation.

11. Workshop on “Power Trade through Power Exchange” for Ministry of Energy, NEA at Kathmandu, Nepal (23 July 2019)



The Workshop was attended by representatives from across the power sector of Nepal, including - Ministry of Energy, Water Resources and Irrigation, Nepal Electricity Authority, Nepal Hydropower Development Program and Independent Power Producers of Nepal.

The SARI/EI, IRADe team made presentations on various topics covering Policy and Regulatory framework on Cross Border Electricity Trade (CBET), Power Transmission and integrated System Operation in the scenario of CBET, trading in the Regional Power exchange.

12. Workshop on “Enhancing Energy Cooperation between India-Nepal” Nepal Electricity Authority, Kathmandu (24 July 2019)

The Workshop, attended by some key members from Nepal’s power sector, focused on the financial models for the development of cross-border transmission lines and sharing of charges of the same based on international best practices, coordinated Transmission Planning in the South Asia Region, followed by break-out sessions and way forward for Trilateral and Multilateral framework for CBET, Policy and Regulatory mechanism, cross border transmission system development and Power Market development in South Asia region.

13. Regional Investment Roundtable on Energy Opportunities, New Delhi, India (3 September 2019)

The round table, held in partnership with Industry Advisory Council – US India Strategic Partnership Forum (IAC-USISPF), was conceptualized with the dual objectives of enabling cross-border learning opportunities as well as promoting private investment in clean energy.

Opportunities for investment in South Asia, as well as the laws governing the same in different countries and private investment which has taken place in these countries, were discussed.

14. Power Market and Power Trade through Power Exchange Platform, Thimphu, Bhutan (17–18 September 2019)

The two-day workshop, attended by key stakeholders of Bhutan such as policymakers, power utilities, private sector, regulators, saw presentations on 'Evolution of power trading in India'; 'Regional grid integration and the role of independent system operator'; Models of trilateral/multilateral trade and case study of Lao PDR, Thailand, Malaysia, Singapore (LTMS) Trade Project; and Power Market regulations; instruments, products and pillars of the power market, as well as POC mechanism of sharing of transmission charges and losses and Deviation Settlement Mechanism.

The Workshop was followed by a one-day consultation meeting with senior officers from Bhutan Power Corporation, Bhutan Electricity Authority and Department of Hydropower and Power Systems, MOEA, on the Common Minimum Grid Code.

15. Workshop for South Asian countries on Power System Operation, Trading & Exchange Platform, New Delhi, India (5–7 November 2019)



The workshop aimed to provide an in-depth understanding of the Power System Operations, Trading and working of a Power Exchange in India through presentations in the morning, followed by visits to a system operator, a trader and a power exchange in the afternoons. Presentations were made on Operation and Products of the Power Exchange, Power market Regulations and Open Access. The Workshop proved extremely useful for the participants from the South Asia nations, where such practices are in the developing stage.

16. Consultation Meeting on Common Minimum Grid Code, Dhaka, Bangladesh (12 November 2019)

Stakeholder consultation meetings on the Common Minimum Grid Code were held with officials from Bangladesh Electricity Regulatory Commission, Power Cell, National Load Dispatch Centre and Power Grid Company of Bangladesh, at their respective offices, to get comments on the Grid Code. The meetings were fruitful as the stakeholders understood the Grid Code and assured that they would route their comments through the heads of their respective organizations.

17. Workshop on Power market and Power Trade through Power Exchange Platform, Dhaka, Bangladesh (13–14 November 2019)

The objective of the workshop was to impart knowledge about the operations and practices followed in the Indian power market, power trading through Power Exchange platform which could pave way for developing a model for trading to start happening in the South Asian region. Discussions were held to provide clarity on the instruments and pillars of the Power Market. This workshop was attended by delegates from Power Cell, Bangladesh Power Development Board, Bangladesh Electricity Regulatory Commission, National Load Dispatch Centre and Power Grid Company of Bangladesh. The workshop was inaugurated by Dr. Ahmad Kaikaus, Secretary, Power Division, Ministry of Power, Energy & Mineral Resources, Government of Bangladesh.



18. Participation at Power Summit, Nepal, as the Lead Sponsor, Kathmandu, Nepal, (21–22 November 2019)

IRADe conducted the Session on ‘Transition of South Asia from Bilateral to Tri and Multilateral Cross Border Electricity Trade’. USAID was also the Lead Sponsor of the event. The session was moderated by Mr. Michael Satin, Regional Energy Director, Clean Energy Office, USAID India, and Mr. Pankaj Batra, Project Director, SARI/EI/IRADe, gave the keynote presentation.

19. Second Meeting of SAFIR Working Group on “Regulatory Cooperation to Facilitate Knowledge sharing, addressing Cross-cutting Energy/Electricity Regulatory Issues & Capacity Building in South Asia, Dhaka, Bangladesh (4 December 2019)

The meeting was inaugurated by Honourable Mr. Monowar Islam, then Chairman, Bangladesh Energy Regulatory Commission, and then Chair, SAFIR, as well as members of the SAFIR Working Group from Bangladesh, Bhutan and India. Mr. Monowar Islam appreciated the contribution of SARI/EI and commended the work being done under the SAFIR Working Group.



The SAFIR Working Group members made presentations on their respective country’s Energy/Electricity Regulatory framework shared their perspectives on regulatory cooperation to facilitate knowledge sharing and addressing cross-cutting Energy/Electricity regulatory issues. Mr. Pankaj Batra, Project Director, and Mr. Rajiv Ratna Panda, Technical Head, SARI/EI, IRADe, presented on the draft Common Minimum Grid Code for facilitating cross border electricity trade in the South Asia region.

20. 18th SAFIR Executive Committee Meeting (ECM), Dhaka, Bangladesh (5 December 2019)

Mr. Pankaj Batra, Project Director, and Rajiv Ratna Panda, Technical Head, SARI/EI, IRADe presented on the Common Minimum Grid Code for facilitating cross border electricity trade in the South Asia region and the status of key activities programmed to be done for the SAFIR Working Group. The SAFIR ECM were highly appreciative of the activities and the Common Minimum Grid Code, as both these will play a strong role in enhancing regulatory cooperation and cross border energy trade in the region. ECM members urged SARI/EI, IRADe to implement the activities for the SAFIR Working Group in an accelerated manner.



It was decided in the ECM that, as the next step, the Chairperson of each national regulator would form an expert committee, consisting of all the stakeholders of the respective country, to study and review the Common Minimum Grid Code. The SARI/EI, IRADe team would meet this committee for each country to discuss the various features of the draft Common Minimum Grid code for finalisation and handing over to the ECM for review and issuance.

21. South Asian Energy Regulators Exchange: Towards Institutionalizing a Regional Electricity Regulators’ Forum, New Delhi, India (16 December 2019)

At the request of South Asian regulators from Bhutan, Nepal and Bangladesh, SARI/EI, IRADe organized a face-to-face interaction with the Central Electricity Regulatory Commission (CERC) senior team, including its Chairman Shri P.K. Pujari, as well as attendance to a live hearing, which was highly appreciated.

This was preceded with a briefing on the operation of CERC by SARI/EI, IRADe, as well as proposing an institutional mechanism for national electricity regulators in South Asia, i.e. South Asia Forum of Electricity Regulators (SAFER). The proposal was welcomed by all the South Asian Regulators. Discussions were held on the required steps for achieving the same. The reports underlining the need for a neutral forum of Electricity Regulators in South Asia, were well appreciated by all the dignitaries.

It was decided to form a regional Electricity Regulators' Forum in the form of a committee, to be supported by a Working Group. Further, SARI/EI would be providing technical knowledge, secretariat and other support towards operationalizing the committee of "Electricity Regulators of South Asian Countries".

22. Stakeholder Consultation meeting with Sri Lanka Utilities and SARI/EI, IRADe, Colombo, Sri Lanka (14 January 2020)



Consultation meetings on Cross Border Energy Trade (CBET) were held with officials from Sri Lanka Sustainable Energy Authority, Public Utilities Commission of Sri Lanka, at their respective offices, to get comments on the Common Minimum Grid Code.

Points related to the feasibility of CBET between India and Sri Lanka were pondered upon, wherein the need for more interactive sessions between the two countries was pointed out by the Sri Lankan officials. Discussions the Grid Code were held and comments from the stakeholders taken, for incorporating towards further enhancement of the study.

23. Workshop on Harnessing Regional Cooperation in Energy Sector and Energy Trade, Colombo, Sri Lanka (16 January 2020)

This workshop was held to discuss among the officials of Member States of SAARC and SARI/EI to discuss and finalize the key activities and possible areas of cooperation including Technical Support to SAARC Council of Experts of Energy (Electricity) Regulators; SAARC Comprehensive Plan for Regional Energy Cooperation in SAARC Countries; SAARC Clean Energy Transition-2040; Knowledge Sharing, Capacity building on best practices etc.

24. SARI/EI participates at the Fourth Meeting of SAARC Energy Regulators, Thimpu, Bhutan (6-7 February 2020)

IRADe team members participated in the Fourth Meeting of SAARC Energy Regulators, presenting on - Emerging Trends in Cross-border Electricity Trade (CBET) in South Asia and Future Outlook: Regulatory Implications and Roadmap; Common Minimum Grid Code for facilitating CBET in South Asia; and Open access in Transmission and Trading License Frameworks for advancing CBET and development of regional power trade in South Asia.

25. SARI/EI, IRADe and SAFIR Conference on "Regional Energy Integration and Cross Border Energy Trade" (19 February 2020)

The conference brought together more than 50 experts and decision-makers from the power sector across South Asia, including the Chairpersons and CEOs of Regulatory Commissions of Bangladesh, Bhutan, Nepal and Sri Lanka, and Chairpersons of several State Electricity Regulatory Commissions in India.



The conference witnessed high-level deliberations on key policy and regulatory frameworks, challenges and need for coordinated policies and regulation for regional energy integration for advancing cross-border energy trade and creating a conducive environment for investment in regional energy infrastructures projects in South Asia. A comprehensive Compendium of Electricity Regulations of SAARC Countries, prepared by SARI/EI, IRADe team, was released at the conference.

26. Workshop on Enhancing Energy Cooperation in the BIMSTEC Region, Dhaka, Bangladesh (25–26 February 2020)



IRADe, under the SARI/EI program, along with the BIMSTEC Secretariat, organized this workshop to facilitate the efforts of BIMSTEC in achieving the common goal of promoting regional energy cooperation and advancing cross border energy trade in the region. Representatives from power ministries, regulators, diplomats, industry, think tanks, multilateral financing agencies and academia from BIMSTEC countries (Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, and Thailand), attended the two-day conference. Two former Ambassadors of Bangladesh attended the Workshop, as did senior officers of World Bank and ADB in Bangladesh. Dr. Tawfiq-e-Elahi Chowdhury, Adviser to the Prime Minister (Power, Energy and Mineral Resources) of the People’s Republic of Bangladesh, was the Chief Guest at the Inaugural Session. Others who adorned the Inaugural Session were, Ambassador M. Shahidul Islam, Secretary-General of BIMSTEC and Derrick S. Brown, Mission Director of USAID/Bangladesh. A background paper on ‘Prospects of Regional Energy Cooperation and Cross Border Energy Trade in the BIMSTEC

Region’, prepared by the SARI/EI, IRADe team, was released at the inaugural Session.

27. Roundtable on Interconnection of Regional Grids in Asia: SAARC GRID - GCC GRID - ASEAN GRID, New Delhi, India (6 March 2020)

IRADe and SARI/EI jointly organised the second Roundtable on Interconnection of Regional Grids in Asia: SAARC GRID - GCC GRID - ASEAN GRID along with India Smart Grid Forum (ISGF), as part of the India Smart Utility Week (ISUW) 2020. The Roundtable was chaired by Mr. Pankaj Batra, Project Director, SARI/EI, IRADe. Nine Participants, including Ministry of Power, Govt. of India, a power utility, System Operator, United Nations, a major Think Tank, representatives from the Government of Bhutan and Sri Lanka and Private Sector active in the area of Cross border electricity trade, participated in the round table discussion. The discussion focused around the benefits of regional cooperation, the recent changes in the Government of India guidelines and the subsequent issue of CBET regulations by the CERC, the status of the interconnection of grids in ASEAN, SAARC/BIMSTEC and GCC regions, identified and new interconnections, feasibility study for identified interconnections, and other enabling conditions interconnecting different conditions and establishing power markets and future steps.

Asia Centre for Sustainable Development

28. Stakeholder inception meetings in Nepal (25–27 February 2020)

Stakeholder inception meetings were held with Nepal Electricity Authority, Alternative Energy Promotion



Centre, Planning Commission, Investment Board Nepal during 25-27 February 2020.

29. Inception meetings for “Implications of Declining Costs of Solar, Wind and Storage Technologies on Regional Power Trade in South Asia”, Bhutan (18–20 June 2019)



The meetings were held with key stakeholders such as representatives of Druk Green Power Corporation, Bhutan Electricity Authority (BEA), Bhutan Power System Operator under Bhutan Power Corporation, Department of Hydropower & Power Systems (DHPS) under Ministry of Economic Affairs, among others.

30. Stakeholder consultation on Soft Landings for Indian Renewable Integration through Balancing Technologies, New Delhi (27 March 2019)

IRADe, with support from The Asia Foundation (TAF), conducted a series of interactions involving different stakeholders and experts to deliberate on grid integration needed to achieve India’s Renewable Energy targets. The first roundtable in this series was attended by energy experts from across think tanks, academic institutions and industry bodies, Department of Foreign Aid and Trade, Government of Australia, as well as by Professor Andrew Blakers



from Australian National University (ANU), Australia (through video conferencing). The IRADe team made a presentation on the technology options and Australian National University (ANU) about potential sites for setting up Pumped Hydro Energy Storage (PHES) projects in India, including a PHES atlas tool.

31. Stakeholder consultation on Soft Landings for Indian Renewable Integration through Balancing Technologies, New Delhi (16 April 2019)

The roundtable focused on evaluating the potential of PHES atlas tool in policy making and working out a business model for PHES in the country. There was high-level participation from the Ministry of Power, Central Electricity Authority, Power System Operation Corporation (POSOCO), besides other stakeholders from Government agencies.

32. Regional Conference on Soft Landings for Indian Renewable Integration through Balancing Technologies, New Delhi (12 June 2019)



The regional conference was organised to discuss the potential for South Asian cooperation on grid balancing and the potential for power trade to improve the quality of energy mix in the region. Dr. Andrew Blakers (ANU) participated in this event and made a presentation on the PHES Atlas tool and the potential of sustainable pumped hydro in India. The regional conference saw participation from Government representatives from India, Bhutan, Nepal and Bangladesh; India’s private renewable sector players; India’s hydropower sector; key representatives from the energy policy community; multilateral agencies and other experts on renewable integration and grid transitions.

33. Stakeholder Workshop for “Implication of declining costs of solar, wind and storage technologies on Regional Power Trade in South Asia”, Thimphu, Bhutan (25 November 2019)

The purpose of this workshop was to discuss the Bhutan Electricity model results with the key stakeholders in Bhutan, and to take their views and feedback. More than 25 representatives from government agencies such as Druk Green Power Corporation, Bhutan (DGPC); Bhutan Electricity Authority (BEA), Bhutan; Bhutan Power Corporation (BPC); Department of Hydropower & Power Systems (DHPS) and Department of Renewable Energy under Ministry of Economic Affairs (Bhutan), participated in the meetings.

Sustainable Urban Development

34. IRADe in COP25, Madrid (5–6 December 2019)

IRADe presented on “Climate Adaptation Action: Climate Resilience and Smart Cities”, at the India Pavilion on 5th December, organised by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, on the



Ministry of Rural Development’s (MoRD) session “Climate Adaptation Action”. IRADe also released its Report on ‘Sustainable and Disaster Resilient Urban Development - A Comparative Study of 10 Indian cities’, at the side-lines of the UNFCCC COP25 Chile-Madrid. The report, released by Shri Rohit Kumar, Joint Secretary, Department of Rural Development, Government of India, assesses the state of resilience in 10 Indian cities. On 6th December, IRADe presented on “Capacity Building Knowledge to Action: Mobilising stakeholders at sub national levels” at the “Capacity

building; Knowledge to Action” at Capacity Building Hub, organized by United Nations Framework Convention on Climate Change (UNFCCC).

35. INSEE-CESS International Conference on Climate Change and Disasters: Challenges, Opportunities and Response, INSEE Biennial Conference, Hyderabad (6–8 November 2019)



IRADe organised a session on ‘Climate & Disaster Resilient Urban Development’ at the INSEE-CESS International Conference. The session elaborated on the impact of Heat Stress on health, work productivity and livelihoods of vulnerable populations, and the need for developing Climate Adaptive Heat Stress Action Plans for Indian cities - appropriate, innovative and affordable climate adaptation measures - for improving health and livelihood resilience in the cities.

36. Experts Consultation on Developing Disaster Resilience Action Plan for Shillong and Gangtok at North Eastern Space Applications Centre (NESAC), Shillong (30 July 2019)

An Experts’ Consultation was conducted to bring together various sectoral experts and discuss the project progress, attended by more than 20 experts.





THE TIMES OF INDIA



- Budget suggestions for climate action | ET EnergyWorld | Jan 28, 2020
- South Asian power grid will require an investment of Rs 45,000 crore by 2030: Pankaj Batra, SARI/ EI | ET EnergyWorld | March 24, 2020
- Cross-Wiring to illuminate South Asia Region | Infrastructure Today (cover story) | Edition: January – March 2020
- It would be a win-win for all South Asian countries | Infrastructure Today | January - March 2020
- Increasing Connectivity - Decoding the Common Minimum Grid Code for South Asia | Powerline | January 2020
- Doubling Farmers' Income Requires Increase in Demand - Kirit S. Parikh | Indian Journal of Agricultural Economics | January – March 2020
- Budget 2020: Dr. Kirit Parikh wants Finance Minister to put more money in the hands of people | Devdiscourse | January 31, 2020
- ADB, AIIB keen to invest in BIMSTEC regional power grid | The Daily Star | February 26, 2020
- Experts call for regional grid connecting BIMSTEC nations
- India has 98 pc of Coal resources among BIMSTEC nations
- Moderating the Oil Price shock | The Times of India | September 19, 2019
- Electricity for Peace and Development: South Asian Grid Connectivity is an idea whose time has come | The Times of India | April 30, 2019
- BIMSTEC seeks integrated regional power management
- A short documentary by #GuardianDividedCities featuring IRADe's work on Heat Action Plan funded by IDRC
- Combating Climate Change in India – one urban city at a time – By Rohit Magotra in India CSR Network
- INSEE-CESS International Conference on Climate & Disaster Resilient Urban Development, Hyderabad. IRADe organised a session on Climate Resilient Urban Development
- Coverage in “Poor urban neighbourhoods more vulnerable to extended effects of heat” – Mongabay
- IRADe's Heat Stress Action Plan News Coverage in Delhi Jagran

Dr. Jyoti Parikh

- Speaker at National Consultation workshop on loss & damage, MoEFCC, 16 April 2019, New Delhi
- **Attended “Deep Dive” workshop on Asia Clean Energy Forum, 2019, organized by Asian Development Bank (ADB) on 16 June 2019, Manila, Philippines.**
- **Attended meeting of Global Commission on Adaptation, organized by GCA on 8 July 2019, Dhaka, Bangladesh.**
- Speaker at the Workshop on Role of Industries in Achieving Sustainable Development Goals in Chhattisgarh, 26 August 2019, Raipur.
- Invited as a Thought and Opinion Leader, gave a TEDx talk on “International Climate Negotiations”. She also explained what the youth can do about climate change at TEDxBangalore on 21 December 2019, IIM, Bangalore.
- **Key Speaker in the India Pavilion’s session on “Climate Resilience and Smart Cities” as well as UNFCCC’s session on “Capacity building; Knowledge to Action”, at COP25 from 3-10 December 2019, Madrid, Spain.**
- Panelist at the Waste Management Series of Summits with a focus on Sustainable Waste Management & Circular Economy complement each other. Where are we? Are we even close to the targets? If not what needs to be done? 30 January 2020, New Delhi.
- Speaker at the International Conference on Sustainable Cities and Communities (ICSCC-2020) on the topic “Sustainable Solutions for Modern and Healthy Living” organised by The School of Engineering and School of Basic and Applied Sciences at GD Goenka University, (Gurgaon/Delhi NCR) in association with Arizona state university, USA.
- **The only Indian who was extended a special invitation from the Govt. of UK to attend a strategic planning retreat on COP26. This event was organised as an opportunity to share the thinking ahead of COP26 by all Presidents of all past COPs, to create a shared vision for COP26 on 20-21 February 2020, Wilton Park, UK.**

Mr. Pankaj Batra

- Chaired the Session on Solving the grid integration issue to accelerate the uptake of solar energy on 22 May 2019 at Solar India / 5th Smart Cities India 2019 Expo, 22-24 May 2019, New Delhi.
- **Speaker on “Innovation – the energy transition, ‘smarter’ grid and GESI” and on the Indian experience and new developments related to power market design a the Deep Dive Workshop “Next-gen Utilities for a Smart Energy Future” at Asia Clean Energy Forum (ACEF) 2019 on 19-21 June 2019, Manila.**
- Chaired Session on ESS for Stationary Applications for grid balancing, RE support and energy access in the India Energy Storage & EV Policy Forum organized by IESA and GESA on the occasion of World Energy Storage Day, on 24 September 2019, New Delhi.
- Panelist in the Session on “Future of Power Systems and the Grid” in the Power Line Summit 2019 on 23 October 2019, New Delhi.
- Panelist at the Session on Power Transmission Sector – Challenges and the Way Forward in the Conference on Power Sector Agenda Beyond 2020: Challenges and Imperatives organized by the 22nd India Power Forum 2019 on 27 November 2019, New Delhi.
- Chaired the Session on EV - Future Game Changer of India-Status & Perspective and jury member for

- utility awards in the ICC 13th India Energy Summit on India's Energy Transition- The Way Forward, 6-7 November 2019, New Delhi.
- Chairman of the Electrical Energy Storage Systems Sectional Committee, ETD 52 of Bureau of Indian Standards. Chaired the 5th Meeting of ETD 52 held at BIS Office, New Delhi and 6th Meeting of ETD 52 held at IEEMA Office on 27 August 2019, New Delhi.
 - Speaker-Expert member in Plenary Session in International Conference on "Water, Energy and Biodiversity for sustainable development of BIMSTEC Countries" 12-14 December 2019, Agartala, Tripura.
 - Member of Advisory Committee for the World Utility Summit on 20-21 January 2020, Greater Noida.
 - Chaired the 15th Meeting of the LITD 10 Power system control & associated communications Sectional Committee of Bureau of Indian Standard on 28 January 2020, NRLDC, POSOCO, Delhi.
 - Panelist at the World Energy Policy Summit on "Energy: New Fundamentals, New Opportunities" in the Session on The Age of Electricity or The Age of Natural Gas on 6 February 2020, New Delhi.
 - Panelist at the 8th Green Energy Summit on 11 February 2020, New Delhi.
 - Speaker at 6th Edition of India Smart Utility Week-2020 on "Global Perspectives on Energy Transition and Smart Grids" organised with Global Smart Grid Federation on 4 March 2020, New Delhi.
 - Panelist at Focussed Group Discussion on Renewable Energy Strategies for Master Plan Delhi - 2041 on 4 March 2020 at NIUA, New Delhi.
 - Speaker at the Indo-Swiss Smart Grid Roundtable jointly curated by India Smart Grid Forum and Swissnex, India and Chaired the Roundtable on Interconnection of Regional Grids in Asia: SAARC Grid - GCC Grid - ASEAN Grid as part of ISUW 2020 on 5-6 March 2020, New Delhi.
 - Power talk in the International Conference on Sustainable Cities and Communities 2020 organized by GD Goenka University, Gurugram, in collaboration with Arizona State University.

Mr. Rohit Magotra

- Panelist for the session on Building Climate Resilience through nature-based solutions at 4th Asia-Pacific Forum on Urban Resilience and Adaptation (RCAP 2019) on 17 April 2019, New Delhi.
- Speaker at Medical Stakeholders Training for Heat Stress Management & Action Plan organized by IRADe, RMC and IIPH-G on 3 May 2019, Rajkot.
- Speaker at Medical Stakeholders Training for Heat Stress Management & Action Plan organized by IRADe, NDMC and IIPH-G on 11 May 2019, IHC, New Delhi.
- Panelist at the Final Stakeholders Workshop to discuss draft Heat Action Plan for Rajkot city, 26 June 2019, Rajkot.
- Speaker in the Experts Consultation on Developing Disaster Resilience Action Plan through GIS and Prioritizing Actions for Natural Disaster Risk Reduction in Urban Agglomerations of Shillong and Gangtok on 30 July 2019, NESAC Outreach Facility, NESAC, Umiam, Shillong.
- Speaker and made a presentation on "Local Interventions in South Asia: Impact of heat stress on Livelihoods, productivity, and Health" in the sessions on Local Interventions in South Asia and Impacts, Hotspots and Information at South Asia Heat Health Summit on 14 February 2020, IITM, Pune.
- Panelist at Multi-Sectoral Lab and Science-based decision support framework to address Urban Environment issues at the one day workshop on "Urban Integrated Environment Modeling and Services for Indian Cities" on 19 February 2020, Rajib Bhawan, Bhubaneswar.

- Lead speaker Heat Stress Action Plan (HSAP) for the city of Bhubaneswar at the 2nd Steering Committee Meeting on Preparation of Heat Wave Action Plan-2020, 24 February 2020, Rajiv Bhawan, Bhubaneswar.
- Lead discussant in the “Discussion on India’s response to Environment, Climate Change and Energy Security” at the IDRC Asia Regional Office, on 3 March 2020, New Delhi.

Dr. Probal Pratap Ghosh

- Presented in COP25 in the India Pavilion’s session on “Climate Resilience and Smart Cities” and “Development and Climate days” supported by IDRC and speaker at the UNFCCC’s session on “Capacity building; Knowledge to Action”, 3-10 December 2019, Madrid, Spain.
- Participated in the COP25 briefing event, “Costa Rica’s Decarbonisation Plan: Road to Carbon Neutrality” with H.E. Ambassador Claudio Ansorena, Ambassador of Costa Rica to India and Ms Renata Lok-Dessallien, UN Resident Coordinator, 20 January 2020 at the United Nations House.

- Expert at the invitation of the Shakti Sustainable Energy Foundation in the “Consultative workshop with experts on developing a roadmap for Low Carbon and Sustainable Mobility Ecosystem in India” on 6 March 2020, at FICCI, Federation House, New Delhi.

Dr. Mohit Kumar

- Speaker on “Developing Disaster Resilience Action Plan for the City of Gangtok, Sikkim” at the Conference “Challenges on Disaster Risk Reduction of Hill Towns” organized by Sikkim State Disaster Management Authority (SSDMA) at Chintan Bhawan, Gangtok on 18 September 2019.
- Presenter with Dr. Ajit Tyagi at ISG-ISRS 2019 Conference titled “National Symposium on Innovations in Geospatial Technology for Sustainable Development with special emphasis on NER” held at NESAC, Shillong during 20-22 November 2019.

Mr. Rajiv Ratna Panda

- Expert speaker in the 4th Meeting Fourth Meeting of SAARC Energy Regulators, 6-7 February 2020, Thimphu, Bhutan.

Project Reports

S.No.	Project Report No. & Year	Title of Project	Funding Agency
1	IRADe-PR-67(2020)	Heat Wave Action Plan - Rajkot City	IDRC
2	IRADe-PR-66(2020)	Training Manual on Management of Heat Related Illness and Orientation to Heat Stress Action Plan.	IDRC
3	IRADe-PR-65(2019)	Sustainable and Disaster Resilient Urban Development India: A comparative study of 10 cities to draw lesson for South Asia	Ministry of Housing and Urban Affairs
4	IRADe-PR-64(2019)	Working Report: Global and Regional (BBINS) Perspective on Natural Gas	USAID
5	IRADe-PR-63(2019)	Role of Pumped Hydro Energy Storage (PHES) in India's Renewable Transition	The Asia Foundation

Lists of Projects - 2019-2020

S.No.	Title	Funding Agency	Status
Climate Change and Environment			
1.	Climate Adaptive Action Plans to Manage Heat Stress in Indian Cities	IDRC	Ongoing
2.	Enabling state-level strategic actions for India's NDC	MacArthur	Ongoing
3.	Developing the urban climate vulnerability index and assess the vulnerability of 6 selected cities using the vulnerability index	MoEFCC	Ongoing
4.	Prediction of Dengue with climate change over Delhi	DST	Ongoing
5.	Long Term Strategy for Low Carbon Development	CSTEP	Completed
6.	Climate Change: India's Perceptions, Policies and Expectations	MoEFCC	Ongoing
Energy and Power Systems			
7.	EV charging patterns and impact on Discom	Shakti Foundation	Ongoing
8.	South Asian Regional Initiative for Energy Integration (SARI/EI)	USAID	Ongoing
Asia Centre for Sustainable Development			
9.	Role of Pumped Hydro Energy Storage in India's Renewable Transition	TAF/DFAT	Completed
10.	Implications of declining costs of Solar, Wind and Storage Technologies on regional power trade in South Asia (BBIN Countries)	EEG	Ongoing
Sustainable Urban Development			
11.	Developing Disaster Resilience Action plan through GIS and prioritizing actions for National Disaster Risk Reduction in Urban Agglomerations of Shillong & Gangtok	MoEFCC/NMHS	Ongoing
12.	Process Analysis, observations and modeling – Integrated solutions for cleaner air for Delhi (PROMOTE)	MoES-NERC	Ongoing
Poverty Alleviation and Gender			
13.	Gender Analysis for Project Appraisal of IGEN-IV and IGEF	GIZ	Completed
14.	Assessing the potential and impact on electricity access in improving health and education facilities in rural India	Shakti Foundation	Ongoing
15.	Study on implications of Climate Change on Human development and poverty in India	UNDP	Completed

SPONSORS



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