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EU-INDIA
CLEAN ENERGY & CLIMATE PARTNERSHIP

Evolving Energy Landscapes – Planning for the Present and Future

6th EU-India workshop series on Energy Regulation

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Project Report

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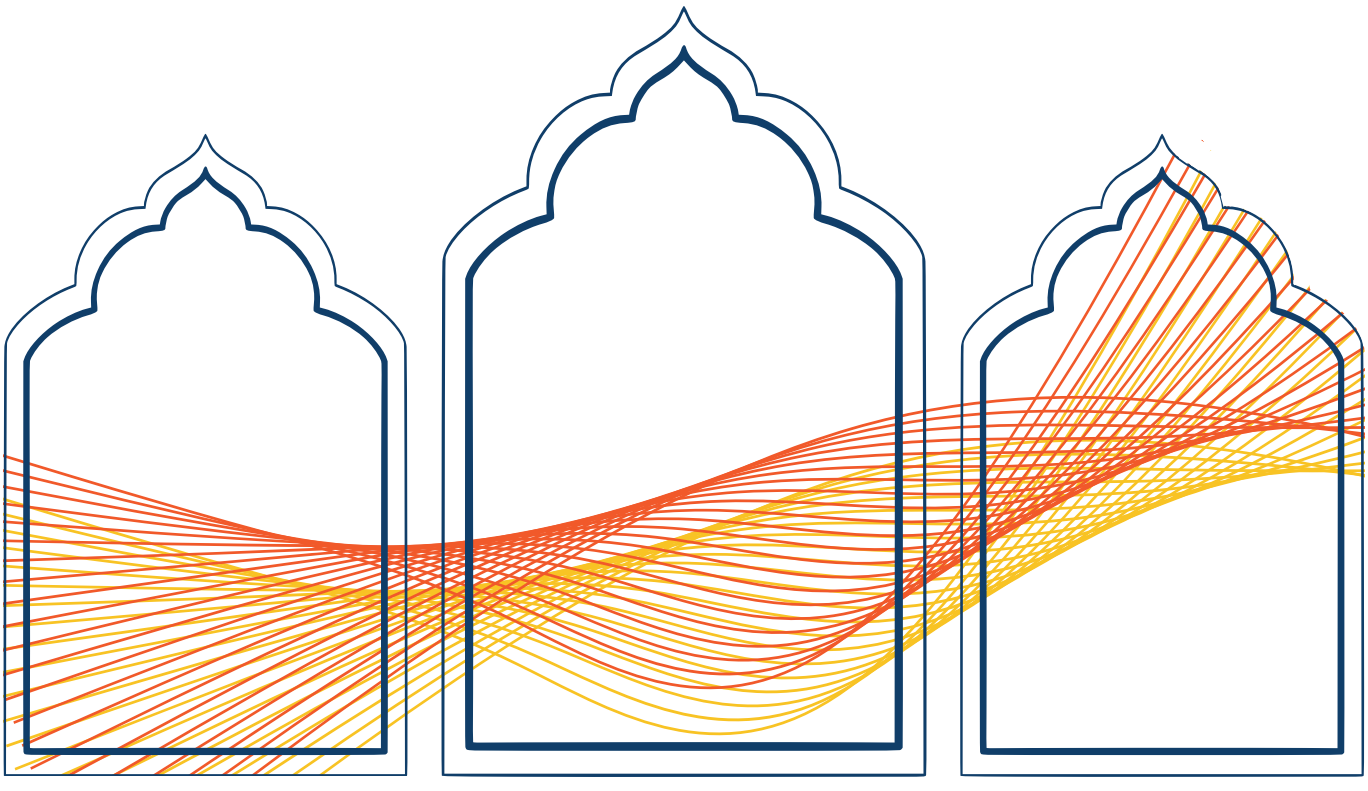

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Background

EU-India Energy Regulatory Workshop Series

The current relationship between the EU and India regarding climate and energy is framed by the India-EU Clean Energy and Climate Partnership, established during the EU-India Summit on 30 March 2016. This partnership aims to enhance cooperation between the two entities on clean energy and climate action. Its primary objectives include ensuring a secure, clean, affordable, and reliable energy supply for all and advancing the implementation of the Paris Agreement. The partnership's significance was reaffirmed in the joint statements issued at the EU-India Summits in October 2017 and July 2020.

In line with its commitment to clean energy transition, India has implemented several key measures within its power sector. These include setting ambitious targets for renewable energy generation capacity and introducing new regulations for market design. The country has also focused on network planning to facilitate both national and cross-border trade. These developments underscore the evolving landscape of the Indian power sector, with opportunities for leveraging European experiences to avoid potential pitfalls, draw insights from various Member States, and navigate the journey towards energy transition more effectively.

As part of the annual EU-India policy dialogues, the European Commission's EU-India Clean Energy and Climate Partnership (CECP), in collaboration with FSR Global, has been organizing a series of online and offline events. These events aim to address pertinent topics within the Indian power sector and bring together experts from both the EU and India. The discussions draw upon valuable insights from the EU's Clean Energy Package, interconnection targets, ten-year network development plan, regional electricity markets, and electricity network codes, among others. This initiative provides an open platform for experts from both regions to engage in an open dialogue, fostering mutual learning and collaboration.

6th Cycle of EU-India Energy Regulatory Workshop Series

This report presents the outcomes of the 6th cycle of the 'EU-India Energy Regulatory Workshop Series,' which took place in 2024. The workshop series comprised three online sessions focusing on key topics relevant to both the Indian and European energy landscapes: Interoperability, Resource Adequacy, and Offshore Wind Energy.

The session on 'Interoperability' highlighted the importance of standards for smart appliances to enable their integration into energy markets and planning. While smart devices can connect and interact with users and other devices, the lack of common standards hinders seamless communication. The session emphasized the need for standardization in automating appliances and managing energy usage. Additionally, it underscored the importance of data standardization in the IoT ecosystem for effective energy management and citizen engagement.

The 'Resource Adequacy' session discussed the challenges and strategies for ensuring a reliable power supply in the transition to a renewable-heavy power system. With India aiming to achieve 450 GW of renewable energy capacity by 2030, resource adequacy becomes crucial to maintain supply reliability amidst increasing variability from renewable sources. The session highlighted

the need for a resource-adequate system to ensure sufficient generation, transmission, and storage to serve electricity demand.

The 'Offshore Wind Energy' session explored the potential of offshore wind energy for both the EU and India. While the EU has been a leader in offshore wind energy, with ambitious targets for capacity expansion, India is still in the early stages of development. India's extensive coastline offers significant potential for offshore wind farms, and the government has initiated plans to auction projects. Collaboration between the EU and India in offshore wind energy can lead to mutual benefits, with the EU sharing its expertise and India offering learning opportunities from its growing market.

Each chapter of this report will delve into the key takeaways from the webinars, providing detailed insights into the discussions and recommendations put forth by experts from both regions. Through these insights, the report aims to contribute to the ongoing dialogue on energy transition and regulatory frameworks in the EU and India.

Also, all video recordings and presentations from the webinars are available in open access on the FSR Global website and YouTube channel, ensuring that the insights and discussions are accessible to a wider audience interested in the topics covered.

Chapter 1

Need for standardization to enable interoperability in the power sector: A consumer centric view

Interoperability plays a crucial role in integrating smart appliances, promoting electricity market participation, and ensuring effective planning in the market for smart appliances and related technologies. Despite the development of smart devices by multiple manufacturers, the lack of seamless communication due to varying IP (internet protocol) platforms poses a significant challenge. Standards for smart appliances are thus essential for facilitating interoperability and enabling these devices to connect, share, and interact with users and other smart devices. This requires strategic planning and coordination to ensure that these standards are implemented effectively, allowing for seamless integration and operation within the energy ecosystem.

The Twin Transition

The twin transition involving both energy and digital sectors has emerged as a critical focus area for the energy industry. Emphasizing the need for a digital foundation, it highlights its role in integrating intermittent renewable energy technologies and improving system efficiency. Despite this, challenges such as limited awareness and funding pose significant obstacles to the pace of this transition. Key points include the importance of interoperability and data standards in enhancing system efficiency, the necessity of robust data governance for accurate modeling, and the potential benefits and concerns associated with interoperability and data standards.

Digitalization is seen as a cornerstone for enhancing both the efficiency and security of energy systems in today's landscape. And the evolving nature of the power sector, transitioning from a simpler to a more complex system, underscores the need for robust interoperability. Regulators are thus urged to adapt their policies to accommodate digitalization, aligning them with evolving system objectives. Additionally, the importance of open data tools, asset visibility, customer control, consent, and market significance are seen as crucial components for a more resilient regulatory framework.

On the other hand, challenges of digitalization in the power sector, including the clash between traditional engineering and digital-native approaches, the scarcity of digital skills, and the need for a comprehensive transformation of processes are critical factors to be considered. The proactive stance of regulators like Ofgem in the UK and the International Energy Agency's efforts to establish global standards for digitalization are some of the ongoing positive steps in addressing these challenges. Moreover, the concept of a "digital spine," serving as the backbone for digitalization efforts in the power sector, can be seen as a key enabler for seamless integration and efficiency improvements.

The Role of Standards in Energy Transition and Digitalization

There are two definitions of interoperability: narrow, which focuses on technical system-level communication, and broad, which looks at how different organizations interact to enable an environment. Furthermore, there are different devices in an average home based on their function and interaction with the power sector. The challenge lies in ensuring that these devices are interoperable and can communicate seamlessly with each other, which can be addressed through standards.

Standards are essential for interoperability, reliability, and safety in power systems. They provide a common language for devices and systems to communicate effectively. Most standardization efforts in today's time focus on the information layer, while the hardware and operational layers are fairly standardized. The need for protocols and standards is thus to enable creativity, innovation, and system efficiency. Standards provide a common language for different devices and systems to communicate effectively, enabling seamless integration and operation. Their importance lies in facilitating innovation, reducing costs, and ensuring compatibility across different technologies.

However, there are multiple challenges associated with developing and implementing standards especially in the power sector. These challenges include the complexity of power systems, the rapid pace of technological change, and the need to balance innovation with stability and safety. It is thus noted that standards development requires collaboration among various stakeholders, including industry players, regulators, and standards development organizations. The need of the hour is for a flexible and adaptive approach to standards development to keep pace with evolving technologies and market needs.

Matter and the Sunspec consortium are working on open standards that enable innovation and common communication standards across technologies. These efforts aim to go beyond individual devices and explore new business models in the Internet of Things (IoT) space. Open common standards give consumers more choices and insights into their device usage. It also empowers them to participate in demand response programs initiated by utilities. However, consumer awareness and data protection are crucial for regulatory support in these initiatives. Smart appliance manufacturers can focus on core product enhancements and IoT platforms by adopting open connectivity standards. This shift can lead to innovative business models such as product as a service. For the power sector, open standards provide better visibility into consumer usage, improved grid reliability, and informed decision-making for infrastructure enhancement and power procurement. Regulatory support is essential to create a level playing field for new entrants and enable cost-effective product innovation. Overall, the challenges of achieving interoperability and implementing open standards are significant but manageable.

Data Governance and Interoperability

Another key focus is data governance and its role in enabling interoperability in power systems. The importance of data governance frameworks is that they ensure the quality, security, and privacy of data used in power systems. Effective data governance is essential for enabling seamless data exchange and interoperability between different systems and devices.

Nonetheless, the challenges related to data governance in energy systems, include the fragmentation of data across different systems, the lack of standardized data formats, and the need to balance data access with privacy and security concerns. There is therefore the need for

collaborative efforts among industry stakeholders, regulators, and standards development organizations to develop robust data governance frameworks that address these challenges effectively.

Funding Challenges in Energy Transition and Digitalization

Funding has been identified as a critical challenge in both energy transition and digitalization efforts. Particularly, the need for significant investment in infrastructure, technology, and workforce development to support the transition to a more digitalized and decentralized energy system. Funding for digitalization initiatives is often fragmented and lacks a systematic approach, making it challenging for organizations to access the resources they need.

A holistic approach to funding that takes into account the interconnected nature of energy transition and digitalization would be important. This approach involves identifying and prioritizing key areas for investment, leveraging public-private partnerships, and exploring innovative financing mechanisms. Policymakers and regulators will need to create a supportive environment for investment in energy transition and digitalization, including providing incentives and removing barriers to entry for new technologies and business models.

Cultural Shift and International Experiences

A prerequisite for the successful digitalization of the energy sector would be the need for a cultural shift. For example, the clash between traditional engineering approaches and digital-native perspectives, highlights the need for a cultural change that embraces digital innovation and agility. This will need to be supported by digital skills development and capacity building to support this cultural shift, ensuring that the workforce has the skills and knowledge needed to drive digital transformation in the energy sector.

Looking into international experiences and best practices in the adoption of smart grid technologies and digital standards we find examples from countries such as the UK (integrated approach and digital twin linkages), Australia (effective grid management), Ghana (leadership in standardization and energy efficiency), and the EU (work on data sharing), showcasing diverse approaches to addressing challenges related to smart grid technologies and digitalization. We must learn from these international experiences and adapt the best practices to local contexts to drive progress in the energy sector.

Conclusion: Policy-Driven Transformation

In conclusion, there is a need for a policy-driven transformation in the energy sector, emphasizing the importance of supporting consumers' active engagement through standards and interoperability. While automation can liberate consumers from becoming energy experts, a lack of digital advancements in the energy sector could lead to frustration among consumers. It must be kept in mind that the cost of not having standards would far exceed the cost of implementing them. Participation is also crucial for achieving great standards and successful implementation, and there is also a need for investment in infrastructure to pave the way for future interoperability. Thus, for future action, we must look into a holistic approach that addresses the complex interplay of technical, regulatory, and financial factors in the energy sector's transformation.

If this topic is of interest to you, and for more details on the topic, you may like to read FSR Global's Policy Brief *"Interoperability and open standards for home connected devices: Unlocking benefits for the power sector"*

This chapter draws from the discussions held under the webinar on the topic of "Interoperability" as part of the 6th EU-India Regulatory Workshop Series conducted under the EU-India Clean Energy Climate Partnership. The speakers were Andrei Covatariu, Co-Chair, Digitalization in Energy Task Force, United Nations Economic Commission for Europe (UNECE); Laura Sandys CBE, Former Chair, UK Government's Energy Digitalisation Taskforce; Swetha Ravi Kumar, Executive Director, FSR Global; Vimal Mahendru, Vice President and Chair of the Standardization Board, International Electrotechnical Commission (IEC); Sridhar Ponugupati, CEO and Founder, Blaze Automation and was moderated by Dr. Parul Bakshi, Research Fellow, FSR Global.

Chapter 2

Navigating Resource Adequacy in Low-Carbon Energy Systems

Resource adequacy is a fundamental concept in the power sector that ensures that the power system can supply enough electricity reliably and efficiently to meet demand. This becomes particularly critical during periods of significant change, such as the ongoing transition to a more renewable energy-oriented grid. The Central Electricity Authority of India has recently issued draft guidelines to tackle the challenge of integrating renewables into the grid while maintaining reliability.

In contrast, the European Union has long grappled with integrating renewables and harmonizing diverse national electricity systems into a unified European system. Europe has thereby developed the sophisticated European Resource Adequacy Assessment (ERAA), which forecasts power system adequacy up to a decade ahead. This system covers all EU member states, as well as other European countries like Switzerland and Norway. Using advanced methodologies and probabilistic assessments, it models events that could impact the supply-demand balance in the future, aiding policymakers in making strategic decisions. As we delve into the Indian proposals, drawing from the European experience could help ensure the stability and equilibrium of power systems, given their intricacy and challenges.

Evolving Approaches in Resource Adequacy Planning

The topic of resource adequacy has evolved significantly over the past few decades, particularly with the increasing integration of intermittent renewables into the energy system. One key aspect for discussion has been on how to approach resource adequacy planning within the framework of this energy transition, considering the influx of new technologies. Traditionally, resource adequacy planning has been more supply heavy. However, with the emergence of multi-directional flow of electricity, there is a need to reconsider this approach. How can we factor in these new dynamics when assessing resource adequacy?

Another important question is whether resource adequacy planning should be centralized or decentralized. Perhaps the optimal approach lies in finding the right mix of both to ensure security of supply at both country and regional levels. Data availability and transparency are also crucial for effective planning. The European experience here can offer valuable insights into how to improve data transparency platforms. India, which has just begun its journey in this area, can learn from these experiences to develop effective planning tools. Furthermore, as we transition more towards market-based procurement, it's essential to consider market dynamics in resource adequacy planning. This means moving beyond just capacity expansion models to include network considerations and market dynamics in future assessments.

Adapting to Change: India's Dynamic Resource Adequacy Planning Approach

India's approach to resource adequacy planning has evolved significantly over the years, reflecting the country's changing energy landscape and priorities. Initially, the focus was on addressing the energy deficit by rapidly adding resources to the system. However, this led to stress on some assets and negative signals to investors. Recognizing the need for a more

balanced strategy, India shifted its focus to ensure both adequacy and reliability in its energy resources. This shift is crucial, especially considering the energy sector's diverse and decentralized nature, with each state having demand profiles comparable to the European countries.

Resource adequacy planning in India has evolved from a focus on peak demand to a more holistic view that considers factors like diversity, market dynamics, and demand response. This shift is crucial, especially considering India's diverse energy needs, which vary seasonally. Balancing centralized and decentralized approaches has been a key challenge, leading to a hybrid approach where responsibilities are shared between distribution companies and regulatory bodies.

To achieve this balance, India has adopted a dynamic planning approach, moving away from static plans made every five years to rolling plans revised annually. This new approach includes detailed planning for one to five years and a perspective plan for up to 10 years. Responsibility for resource adequacy planning is distributed among various entities, including distribution companies, regional load dispatch centers, and the national load dispatch center.

One critical aspect of India's resource adequacy planning is its consideration of the transmission network's adequacy. This is crucial, as a lack of proper transmission infrastructure can lead to inefficiencies and supply issues despite adequate generation capacity. India has already started revising its transmission plan every six months to accommodate the fast-paced nature of renewable energy projects and ensure the efficient integration of these resources into the grid.

Moreover, India is also exploring bi-directional grid interactions and concepts like vehicle-to-grid to enhance grid flexibility and efficiency. This involves shifting from a unidirectional grid to a bidirectional one, where consumers also play an active role in balancing the grid. Data and tools also play a crucial role in resource adequacy planning, with the need for skilled human resources to analyze and visualize complex datasets. As the energy landscape evolves with the introduction of new technologies like e-mobility and solar rooftops, the need for accurate and dynamic planning becomes even more critical.

Dynamic Resource Advocacy Planning: Ensuring Energy Security and Sustainability

The draft resource advocacy guidelines propose a strategic procurement approach, with 70% of procurement focused on long-term (10 to 20 years) contracts, 10% on medium-term contracts, and the remainder on short-term procurement. This aligns with existing practices, including the use of long-term Power Purchase Agreements (PPAs), providing stability to the energy market.

In the resource advocacy framework, emphasis is placed on securing power resources to meet both national peak demand and individual consumer needs. Each Distribution Company (DISCOM) is required to secure 100% of the power necessary to meet national peak demand, ensuring a reliable energy supply for all consumers. The importance of robust IT infrastructure for DISCOMs is also emphasized, as resource advocacy studies have become increasingly data-driven. These studies are now expected to be annual exercises, demonstrating the DISCOM's ability to meet peak demand and ensuring transparency before the State Commission.

Resource advocacy studies differ from other planning exercises due to their dynamic nature. These studies consider factors such as Loss of Load Probability (LLP), energy not served, and capacity credit, making judgments also based on economic and financial considerations. This

dynamic approach enables planners to adapt to evolving demand patterns and technological changes. Decentralized solutions, such as rooftop solar, are recognized for their potential to contribute significantly to resource adequacy. By reducing the reliance on traditional transmission and distribution infrastructure, these solutions offer a more sustainable and flexible approach to meeting energy demand.

To address uncertainties in demand patterns arising from Distributed Renewable Energy (DRE), Electric Vehicles (EVs), and other technological changes, planners advocate for regular updates to resource advocacy plans. This approach allows for the incorporation of real-time data and ensures that plans remain responsive to changing conditions.

Challenges in Resource Adequacy Planning

Resource adequacy planning faces several challenges, including the need to address forecast errors, equipment failures, and evolving demand levels and profiles. Additionally, integrating demand flexibility into planning poses a significant challenge, as assessing the reliability of demand-side resources, such as industrial processes and electric vehicles, can be complex. To address these challenges, planners use a variety of tools. Dispatchable generators are essential for short-term needs, while flexible and interruptible loads help balance the system. Storage capacity and interconnection capacity are also crucial, along with reserve and peak capacity considerations.

European Resource Adequacy Assessment (ERAA) and Future Considerations

In Europe, the ERAA is a crucial tool for assessing resource adequacy and ensuring compliance with energy targets and regulations. It helps identify potential capacity shortfalls and informs decisions on capacity mechanisms. Future resource adequacy planning will need to consider evolving market rules, regulatory frameworks, and technological advancements. Demand flexibility and the integration of renewable energy sources will continue to be key focus areas, highlighting the dynamic nature of resource adequacy planning in low-carbon energy systems.

The ERAA model, while not a capacity expansion model as a whole, includes an Economic Viability Assessment (EVA) component that considers capacity expansion over a 10-year planning horizon. This component ensures that capacity expansion aligns with economic and financial considerations. The transition to EU-level energy planning involves translating EU targets into national plans (NECPs) and ensuring compliance through data collection and public consultation. This transition aims to streamline planning processes and improve coordination among member states.

While flattening the load curve is a key objective, maintaining flexibility is essential, particularly in managing intermittent generation sources. Tariff structures and contracts can incentivize consumers to flatten their consumption, but allowances should be made for peak demands when necessary to ensure reliable supply. To manage uncertainties in demand patterns, contracted demand response mechanisms, such as industrial consumers rescheduling production to shed load, are recommended. It is believed that over time, experience with decentralized solutions will help refine planning approaches and improve the overall reliability of the system.

These points underscore the complexities and considerations involved in modern energy resource planning. Transitioning to more dynamic and flexible systems is essential to meet changing

demands, incorporate decentralized solutions, and ensure the long-term sustainability and security of the energy supply.

A Holistic Approach

Addressing the challenges in energy planning requires a comprehensive approach, involving data, tools, and skill development. It's crucial to have a clear understanding of reliability criteria and the capability to simulate and analyze different scenarios rigorously. The cost of improving planning processes is minimal compared to the costs of capacity expansion, highlighting the need for a cultural shift towards prioritizing investment in planning and skill development.

Benchmarking or mandating transmission import/export capability for each state can maximize the advantages of an interconnected system. Interconnection capacity depends on system characteristics and political dynamics, highlighting the need for careful consideration.

On the other hand, funding for capacity building is essential, as it can cover the lifetime needs for effective energy planning, and policymakers should allocate resources for tools, hardware, people, and skill development. Policymakers must not only focus on regulations but also provide resources and support for utilities to develop the necessary tools and skills.
Demand response is also a crucial tool that deserves more attention, requiring changes in transactional systems, political frameworks, and societal behaviors. Lastly, modeling transmission connections and incorporating flexible resources are key, as is considering the impact of global warming in energy planning. Developing a country-specific modeling tool requires collaboration, standardization of data, and capacity building among experts. It's a complex process that, if done effectively, can greatly enhance energy planning efforts, ensuring a reliable, sustainable, and efficient energy system for the future.

This chapter draws from the discussions held under the webinar on the topic of "ResourceAdequacy" as part of the 6th EU-India Regulatory Workshop Series conducted under the EU-India Clean Energy Climate Partnership. The speakers were Ghanshyam Prasad, Chairperson of the Central Electricity Authority; Sushil Kumar Soonee, Former CEO & Founder of POSOCO/Grid India; Yaser Tohidi, Adequacy Modelling Specialist at ENTSO-E; Christine Brandstatt, Assistant Professor at the Copenhagen School of Energy Infrastructure (CSEI); Swetha Ravi Kumar, Executive Director, FSR Global and was moderated by Dr. Parul Bakshi, Research Fellow, FSR Global.

Chapter 3

Harnessing the Wind: Challenges, Opportunities, and Lessons Learned

India and the EU are at a crucial juncture in their cooperation, with the drafting of the EU-India Strategic Roadmap 2030 laying the groundwork for strategic collaboration in the next five years. The EU has been a leader in offshore wind energy, with countries like Germany and Denmark pioneering large-scale projects that contribute significantly to their renewable energy portfolios. The EU aims to reach 300 gigawatts (GW) of offshore wind capacity by 2050, a core component of its European Green Deal strategy. India, on the other hand, has set ambitious targets for renewable energy generation capacity and has implemented new market designs, regulations, and network planning strategies. India's National Offshore Energy Policy marks a major step in harnessing its offshore wind potential, with identified sites along the coastlines of Gujarat and Tamil Nadu being developed in collaboration with Denmark.

The collaboration between India and the EU on offshore wind projects is crucial for both regions, offering economic and environmental benefits. The recently established Trade and Technology Council (TTC) will explore synergies in Indian supply chains for offshore wind, contributing to the resilience of supply chains. The EU-India Clean Energy and Climate Partnership, agreed upon in 2016, focuses on promoting policy and regulatory approaches, business solutions, cooperation, and research in offshore wind and green hydrogen. Together, the EU and India are driving ambitious offshore wind initiatives, unlocking new opportunities for sustainable development and a greener future.

India's Journey in Offshore Wind Energy

India embarked on its journey in wind energy around 1986. Since then, significant progress has been made, with the latest figures showing the installation of 3,253 megawatts (MW) of wind power in the last financial year, alongside solar installations. This resulted in a total renewable energy addition of over 18 GW in the country. India has set a target to achieve 100 GW of wind capacity out of this, with a total installed capacity of around 46,000 MW and projects totaling about 15,000 MW in the pipeline. India's trajectory aims to reach this target by 2024-25. The Ministry of Shipping has announced building assistance, offering a 20% capital subsidy for specialized vehicles used in offshore projects. Additionally, the inclusion of offshore wind carbon trading under Article 6 of the Paris Agreement signifies India's commitment to advancing offshore wind energy.

Offshore Wind's Crucial Role in India's Renewable Energy Strategy

Offshore wind plays a crucial role in India's renewable energy strategy, particularly as the country faces the challenges of grid stability and variability associated with wind and solar power. With over 7,500 kilometers of coastline, India has significant potential for offshore wind development. Initial studies suggest that the capacity factor for offshore wind in India could exceed 50 percent, leading to a reduction in the levelized cost of electricity (LCOE) and ensuring a consistent power supply.

Offshore wind offers several advantages, including high reliability and adequacy, lower storage requirements, reduced balancing needs, and a high potential for employment generation. The scale of offshore wind projects is substantial, with 1GW requiring approximately 250-400 square kilometers. However, to manage costs and build developer confidence, initial projects in India will be closer to shore.

Despite progress, key challenges remain, including high costs and the lack of human experience in the Indian context. As per global trends for 2050, the estimated installed cost per kilowatt is around 2100 USD plus additional costs and LCOE is 0.050USD per kwh, posing a challenge for widespread adoption. Furthermore, there is limited on-ground data and experience, highlighting the need for more studies and data collection to support the industry's growth.

Policy Support and Industry Development

India has also made strides in policy to support the industry and reduce the burden on developers. The exclusive economic zone (EEZ) along the Indian coast is available for offshore wind development, offering vast potential for growth. The strategy paper for leasing offshore wind sites has outlined three models to facilitate development, with the first model focusing on initial data and survey sharing with prospective developers. This model aims to auction 500 MW each off the coasts of Gujarat and Tamil Nadu.

Infrastructure development is a key focus, with plans for port development in Tuticorin and Kandla to support offshore wind projects. Research and resource assessment activities are being conducted in collaboration with Denmark, with the expectation that once the market matures, India will see a reduction in the cost of wind turbines and the transmission infrastructure required for offshore wind projects. India is setting up Renewable Energy Management Centers (RMCs) to manage the increasing share of renewable energy, ensuring that the integration of offshore wind does not significantly impact the grid.

Moreover, states play a crucial role in offshore wind development, and there is a need for further guidance and coordination at the state level. Clarity on roles, infrastructure development, and capacity building are essential for states to actively participate in offshore wind projects. Coordination between central and state agencies is crucial to streamline project approvals and facilitate the implementation of offshore wind projects.

Challenges and Opportunities in Offshore Wind

Developing offshore wind projects faces several challenges, including port development, which can take between seven to ten years. Assessing available ports early in the development process is crucial. Supply chain constraints, such as vessel availability, pose challenges, with contracts for vessels in offshore wind projects often contracted five years ahead. Balancing grid stability and power delivery from intermittent wind sources is another challenge, requiring sector coupling. The offshore wind industry globally has faced challenges related to increasing costs and inflation, leading to some projects being withdrawn. Competition for resources and competencies in the growing industry remains high, emphasizing the need for knowledge sharing and collaboration in emerging markets like India.

European Market Development and Lessons Learned

Europe has made significant strides in offshore wind energy, with over 2.5 GW of offshore wind capacity installed in 2022. In 2021, Denmark received six bids for offshore wind projects, all at zero cost, indicating a mature market with strong competition. The Danish government's focus on the pro-market approach and close dialogue with developers has been instrumental in driving market competition. Economic de-risking and financing mechanisms have also supported market development. Denmark's Maritime Spatial Planning has played a crucial role in identifying suitable areas for offshore wind development. Strategic environmental assessments have been conducted to identify risks and minimize environmental impacts. The country has also implemented a public window to facilitate coordination with other agencies and ensure a transparent process. Denmark has introduced new regulations requiring a minimum of 20% ownership by the state in each offshore wind project. Minimum requirements for environmental impact assessments have also been introduced to ensure sustainable development. These measures aim to improve project quality and reduce environmental impacts.

Future Plans and Qualification Requirements

The future of offshore wind in Europe includes plans for introducing standard support mechanisms and qualification requirements for developers. These requirements may include technical expertise in offshore energy projects and a proven track record in the sector. The aim is to ensure the safety and efficiency of offshore wind projects while maintaining high environmental standards. Many offshore wind farms in Europe are now fully commercial without the need for subsidies, indicating the increasing commercial viability of offshore wind energy. This trend could potentially be mirrored in India as the market matures.

Europe's offshore wind sector has evolved significantly, with a focus on market competition, environmental sustainability, and stakeholder engagement. The lessons learned from Europe's experience can provide valuable insights for other regions, including India, looking to develop their offshore wind capabilities.

This chapter draws from the discussions held under the webinar on the topic of "Offshore Wind Energy" as part of the 6th EU-India Regulatory Workshop Series, conducted under the EU-India Clean Energy Climate Partnership. The speakers were Lalit Bohra, Joint Secretary, Ministry of New and Renewable Energy, Government of India; Alp Gunsever, Head of Secretariat, Centre of Excellence for Offshore Wind and Renewable Energy; Thor Uglevig Petersen, Vice President for Wind Power, NIRAS; Rajendra Kharul, Managing Partner and CEO, ClimateHub India; Johanna Mansson-Delerce, Policy Officer, European Union Delegation to India and Swetha Ravi Kumar, Executive Director, FSR Global The session was moderated by Dr. Parul Bakshi, Research Fellow, FSR Global.

FSR Global

FSR Global is an independent and neutral regulatory hub of excellence focused on the global south. We foster collaborations with energy stakeholders from around the world to improve the quality of infrastructure regulation and policy by co-creating knowledge that is accessible and actionable. FSR Global was established in India in 2019 by the European University Institute – Florence School of Regulation to help strengthen the global south-south and north-south transcontinental knowledge exchange.

Complete information on our activities can be found online at: www.fsrglobal.org

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