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EU-INDIA
CLEAN ENERGY & CLIMATE PARTNERSHIP

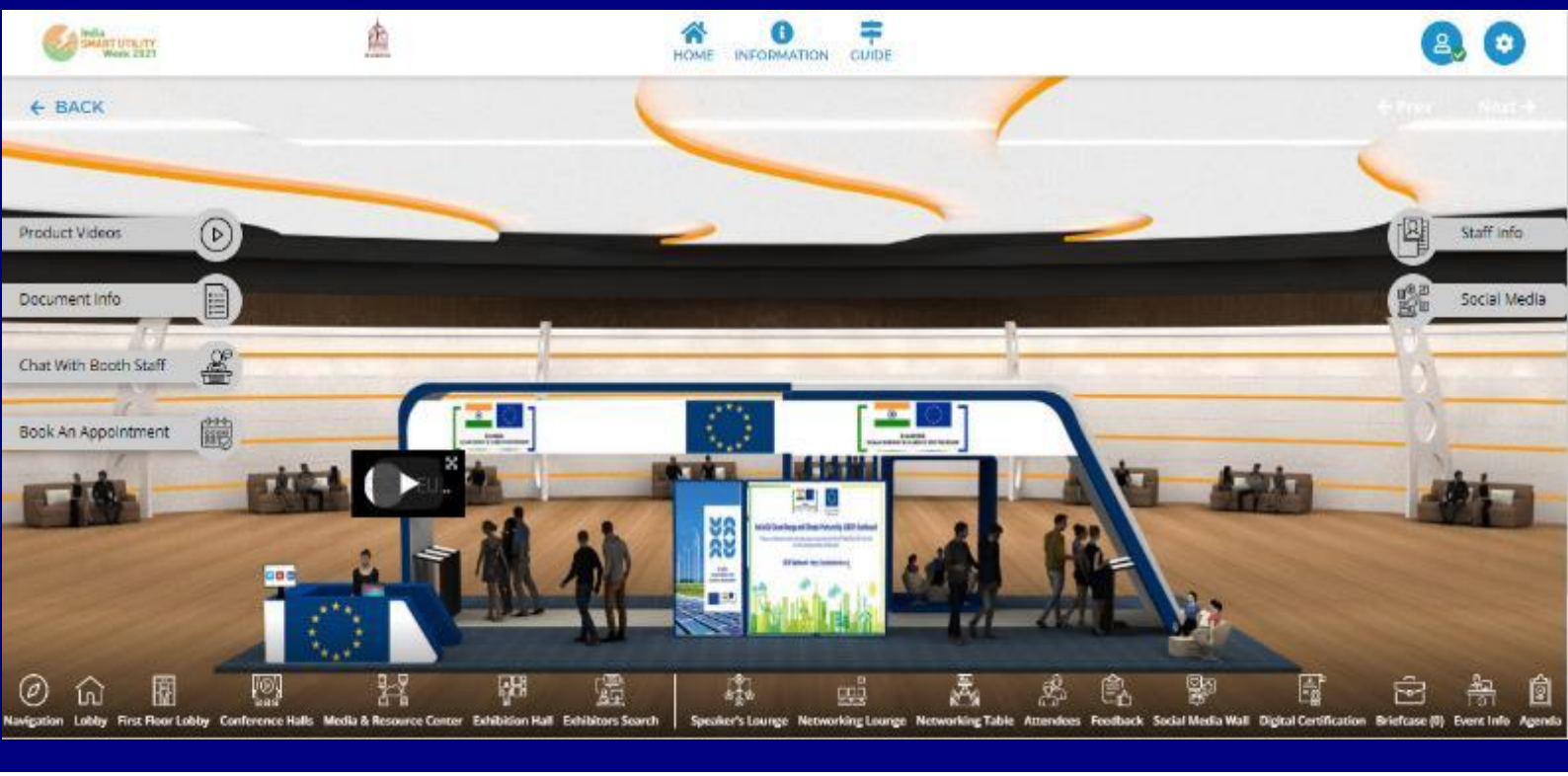
Report on EU-India CECP

at

India Smart Utility Week (ISUW) 2021

(Digital Conference)

March 2021



India SMART UTILITY Week 2021

pwc

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1. Introduction

This report is developed under the project "Support to the India – EU Clean Energy and Climate Partnership (CECP)", which is financed from the Partnership Instrument of European Union (EU) General Budget and managed by the EU Delegation to India. It is carried out as part of the contract titled "Provision of Technical Assistance Services to the Programme Clean Energy and Climate Partnership".

India Smart Grid Forum (ISGF) has been organizing its flagship annual event, India Smart Utility Week (ISUW) since 2015. ISUW 2021 was scheduled from 2-5 March 2021 and conducted on a Digital platform as an International Conference and Exhibition on Smart Energy and Mobility for Smarter Cities. Also, this year the EU partnered with the ISUW. This report covers the EU activities during ISUW 2021.

In this conference, the 10th EU-India workshop on Smart Grids was organized, addressing the emerging trends in the area of regulation for renewable energy development, grid scale energy storage, renewable energy integration, cyber security, digitization and automation of electric utilities. The workshop hosted regulators, policy makers, electricity utilities, investors, smart energy experts, and researchers.

- **Part A** of the "10th EU-India workshop on Smart Grids" was conducted on 2nd March 2021, with a Panel Discussion on Competition and Market Design for the Power Sector in India: Enablers for India's Energy Transition.

- **Part B** of the "10th EU-India workshop on Smart Grids" was conducted on 3rd March 2021, hosting a Presentation and panel discussion on the EU-India High Level Platform on Smart grids, followed by presentations from various EU-India Energy Cooperation Projects.

An EU Zone was set up in the exhibition section of ISUW 2021, showcasing EU technologies, solutions and advancements in the field of Smart grids, with participation from EU Member States EU-India joint projects and EU industry associations.

1.1 Address from European Union Ambassador to India at the Inaugural Session of ISUW 2021

HE Ugo Astuto, EU Ambassador to India, welcomed the participants and thanked ISGF for the organization of this important event. He set out how the world now focuses more and more on how to recover from the fallout of the pandemic. It is known that over the next couple of years, governments are expected to spend significant amount of funds to address the economic implications of the pandemic. This provides a great opportunity to re-build our economies to address the green, digital and resilient needs of the 21st century. The policies that can be put into place now can make a difference in the life of future generations. The European Green Deal together with the Digital transformation agenda will be at the core of the recovery in the EU. The growth model would be more sustainable, inclusive, and would make the economy more resilient.

The objective of the European Green Deal is to have Europe as the first climate neutral continent by 2050. The Green Deal has energy and climate action as the center for its domestic as well as international policy. In order to succeed in the global endeavor to combat climate change, the international community needs to collaborate and work together. With this objective, the EU and India have been working together under the Clean Energy and Climate Partnership- focusing on energy efficiency, renewable energy, storage, climate mitigation and adaptation and also smart grids. Both the EU and India have ambitious targets for increasing the share of renewable energy and energy efficiency, to ensure access to clean, reliable and affordable energy. Smart grids and power market designs are crucial and indispensable part for this transition, as smart and efficient networks enable us to optimally use the installed capacity of renewable

energy. In this context, the EU-India cooperation is focusing on the exchange of knowledge and expertise through technology demonstration projects, workshops and studies to replicate the success that the EU has seen in India.

In the running up to CoP15 and CoP26 now eminent, the existential challenges of climate change and biodiversity loss will be at the top of the agenda. The Ambassador wished everyone a fruitful week of deliberations at the conference and hoped that by the next year, the delegates can again meet in person.

2. 10th EU India Smart Grid Workshop at ISUW 2021

On 2nd and 3rd of March 2021, the 10th EU-India workshop on smart grids took place at ISUW 2021, deliberating on the emerging trends in the area of grid scale energy storage, renewable energy integration, digitization, automation of electric utilities, regulations, etc. The workshop was attended by regulators, policy makers, electricity utilities, investors, solution providers, smart energy experts, researchers.

2.1 10th EU India Workshop on Smart Grids (Part A, 2nd March 2021)

2.1.1 Inaugural Session

HE Ugo Astuto, European Union Ambassador to India, mentioned the ambitious targets set by the EU and India for the adoption of clean energy and ensuring access to sustainable and reliable energy resources. Smart and efficient power markets are essential for this transition. International cooperation through exchange of best practices, technologies, and experiences will aid this transition for both EU and India. The high level EU India workshops like these on Smart Grids are very useful to increase such cooperation.

The cooperation between the EU and India will be presented over the course of these workshops and several EU-India projects will be showcased. His Excellence also invited the participants to visit the EU Zone in the digital conference hosting EU Member States, associations and EU-India cooperation projects. Under the EU India Clean Energy and Climate Partnership, the cooperation between the two regions has been growing particularly well in the energy sector.

Tackling biodiversity loss and climate change requires both political decisions as well as an understanding of technical and regulatory challenges. Smart grids and power market design are key enablers towards a clean energy transition.

Mr. PK Pujari, Chairman, Central Electricity Regulatory Commission (CERC): In India, the unbundling of the vertically integrated utilities by de-licensing generation and mandating procurement through competitive bidding has introduced competition in the power sector. However, this is just a step in the evolution of the Indian power sector. The introduction of renewables and other disruptive technologies has again stressed the need for further market reforms and development. Creation of wholesale electricity markets and retail electricity markets is the biggest challenge that the power sector in India faces.

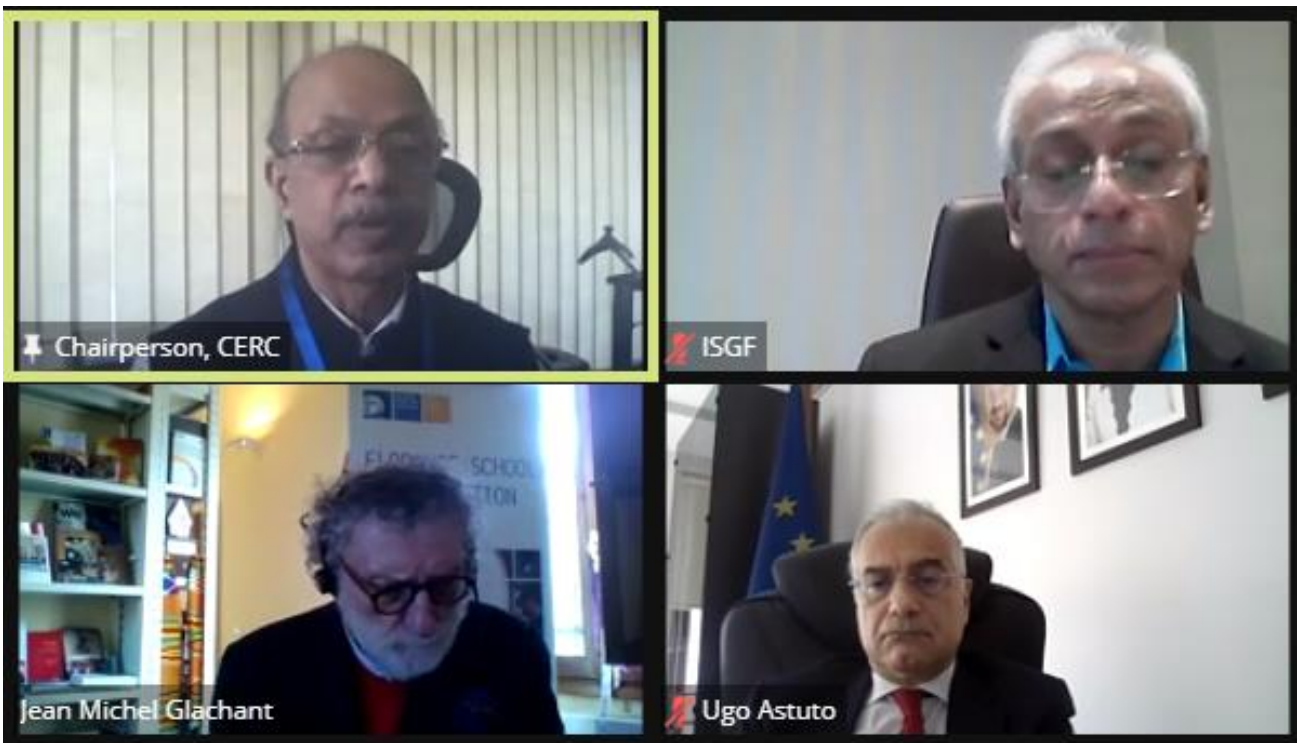
Both the central and state regulatory commissions are working towards putting in place the reforms to foster competition and growth in the power sector. Regulators are working to seamlessly facilitate power transactions and have been working with various international regulators and thinktanks to understand the international best practices and processes to redesign the Indian power sector.

The CERC has recently notified the revised power market regulations 2021, which have been framed with a long-term vision for futuristic market design. The government has articulated the intention of bringing in competition to the distribution sector and introducing retail supply business.

To introduce necessary reforms in Indian power sector, the regulators would require inputs, experiences and expertise, which is where a forum, like this EU-India workshop, provides opportunity for experts to deliberate upon ways to introduce and implement reforms on ground. The Indian power sector is on the threshold of significant market based reforms and the deliberation through these workshops with the expert panel and international experience will throw up solutions for possible challenges to make this transition less disruptive and more effective.

Mr. Reji Kumar Pillai, President - India Smart Grid Forum welcomed the participants and panelist to the inaugural session of the 10th EU-India India smart grid workshop and introduced the esteemed panelists setting the tone for the workshop ahead. He spoke about the Indian government's plan to privatize

distribution utilities and bring in retail competition to the electricity sector. India in this regard could take the experience and expertise from the EU.



2.1.2 Presentation on EU-India Webinar Series 'Enablers for India's Renewable Transition'

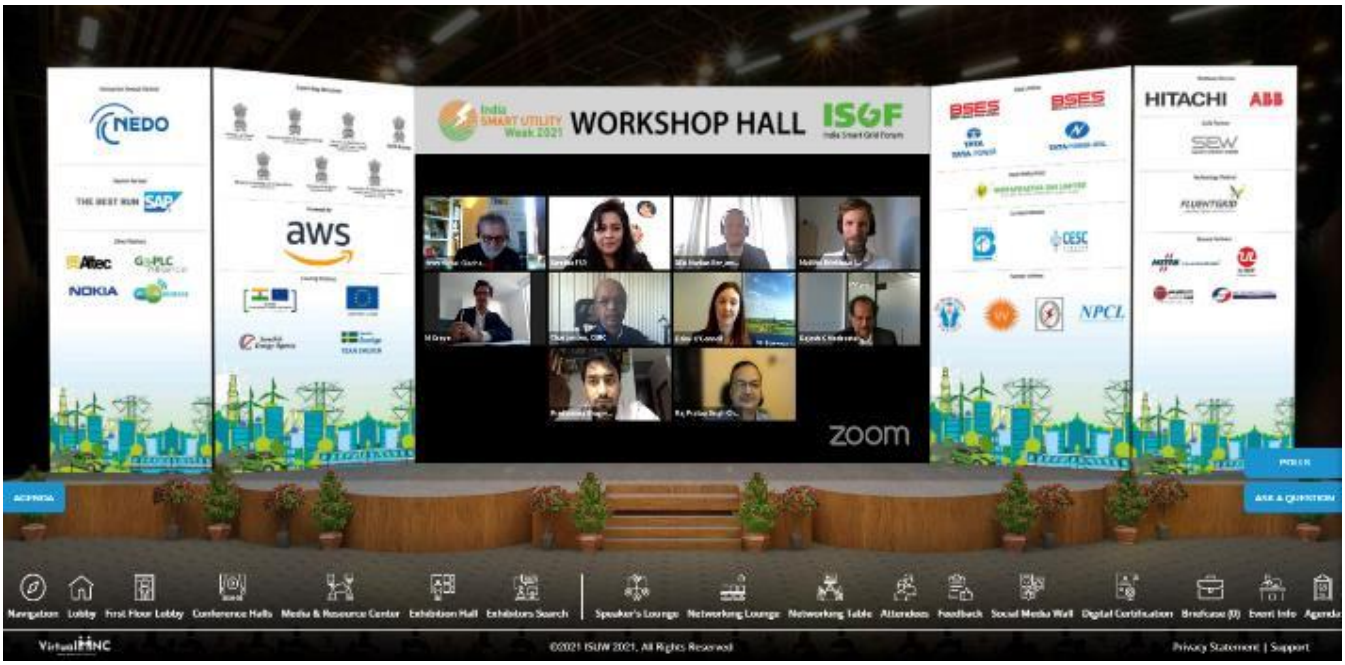
Ms. Swetha Bhagwat, Head of FSR Global, Florence School of Regulation: Keeping in line with the ambitious targets for renewable energy addition for India, the EU along with the Florence School of Regulation (FSR) have been discussing with the Ministry of Power (MoP), POSOCO and CERC to arrive at 6 key topics that could be discussed. The focus of the webinar series on these 6 topics would be on developing competition and market design for not just India but also connection with neighboring countries. The webinar series has been laid out as follows:

- Webinar 1 - Electricity Trade: What does the future hold?
- Webinar 2 - Distributed Energy Resources: What is their role in India's energy transition?
- Webinar 3 - Electricity Trade Beyond borders: What is the scope for India?
- Webinar 4 - What is the future of renewable support in India?
- Webinar 5 - How can ancillary services be procured more efficiently?
- Webinar 6 - Does India need retail electricity competition?

This session would act as the kick-off for the webinar series which would be conducted on alternate weeks and shall serve as a platform for discussions and brainstorming sessions for all the relevant stakeholders to voice their opinions and priorities for the improving and developing competition and market design in the Indian power sector.

2.1.3 Panel Discussion on Competition and market functioning in the Power sector: enablers for India's renewables transition

Participant	Designation	Role
P K Pujari	Chairman, Central Electricity Regulatory Commission (CERC)	Panel Chair
Pradyumna Bhagwat	FSR Global Advisor	Moderator
R P Singh	Chairman, Uttar Pradesh Electricity Regulatory Commission	Panelist
Jean-Michel Glachant	Director, Florence School of Regulation	Panelist
Rajesh K Mediratta	Director-Strategy and Regulatory Affairs, Indian Energy Exchange (IEX)	Panelist
Markus Benjamin Janitzek	Advisor, Danish Energy Agency	Panelist
Matthis Brinkhaus	Energy Brainpool	Panelist
Elaine O'Connell	Policy Expert Electricity, Internal Market Unit, DG ENER, European Commission	Panelist



Key Messages from the Workshop

- Innovation in the electricity sector is happening at a rapid pace and the introduction of renewables and electric mobility have opened new opportunities and challenges in the electricity sector. These transitions would mean that the regulations and legislation also need to adapt and change as the market design and participation evolves.
- The SAARC nations must work together to form an intergovernmental panel to promote cross border trading of electricity. The region has mostly bi-lateral power exchange taking place, regional power exchange and private participation must be promoted between these countries.
- Power exchanges in India are slowly gaining traction, it has become more economical for utilities and industries to procure power from the exchanges rather than entering into a long term contract. As the industry progresses, more legislation and regulation will make the power exchanges the primary source of power procurement.

- For commercial and technical cooperation between the various regional markets there has to be the establishment of a common market mechanism/framework with appropriate regulatory controls to enable efficient and economically viable usage of electricity. Power exchanges can be incentivized to created products for increased trade of renewable energy.
- In order to scale the implementation of renewables, it is crucial that investor concerns related to market transparency, market monitoring, short term and open market power trading, price information, etc. are addressed through robust legislation and regulation.
- The European green deal laid out a framework for the increased adoption of renewables into the power system by enabling legislation at the appropriate levels (central and state) to be all inclusive of the stakeholders in the power market. India can also work to similarly design its power market reforms to enable an efficient transition.

Panelist Comments

Elaine O'Connell, Policy Expert Electricity, Internal Market Unit, DG ENER, European Commission: The clean energy transition in the EU requires deliberation with all the involved stakeholders. India is currently going through the same process. The objective and drive for creating the clean energy package in Europe focused on ways to create a well-functioning power market and to design the system to support the massive transition to renewables. The electricity regulations and directives set in the EU are setting out rules to ensure the legislation is equipped to handle the energy transition and support the net zero target by 2050. This is planned to be achieved through:

- Making a conducive market for renewable energy adoption;
- Increasing the involvement of consumers in the energy market;
- Integration of renewable energy technologies through market design.

Markus Benjamin Janitzek, Advisor, Danish Energy Agency: The DEA has been partnering with the Ministry of New and Renewable Energy (MNRE) on off-shore wind since 2017. In 2020, the Indo-Danish collaboration was further expanded to long term energy planning and flexibility and integration of renewables with the Ministry of Power (MoP). The Indo-Danish cooperation and Green Strategic Partnership can contribute to the cost-effective integration and achieving the renewable energy target of India. As India plans to transition from long-term physical contracts to short-term markets, there are a lot of challenges that stakeholders will need to address.

Transparency and monitoring of power markets is important for fair competition and market efficiency. Publicly available information will increase investor willingness to participate in the power sector and reinforce confidence in the sector, also price information is key for investor decisions for all sources of generation and clear regulation around the same must be introduced. Lastly, regarding the question of support schemes for renewables in the future from a Danish perspective, it is stated that renewables will become cost-competitive without support.

Matthis Brinkhaus, Energy Brainpool: Electricity markets have been liberalized in Europe since the late 90s, which has led to the creation of various markets, for e.g.; the futures market, day ahead market as well as control reserves. The EU has various regional grids which are involved in both market cooperation and technical cooperation for reliable and efficient functioning.

Power trading in the EU is spread across multiple power exchanges, each offering different products and services. While these are privately owned companies, they offer various products including futures, spot market trading and even carbon emission certificates. New products can thus be created through legislation to enable the increased penetration of renewables in these power markets.

Rajesh K Mediratta, Director-Strategy and Regulatory Affairs, Indian Energy Exchange (IEX): The current power exchanges in India are mostly trading on the day ahead markets and a brief term ahead market (upto a week). Real time markets have also been introduced recently and there is also a very limited ancillary

market in power trading currently. In contrast to the EU, India has a green term ahead market that allows for the sale of scheduled renewable power.

IEX is expanding its product portfolio and will soon have a future's market for power delivery, which is currently awaiting legislative and legal approval. Participation in the real time and day ahead market is increasing and has witnessed a trade of 456 GWh of electricity. Price of the power on the markets is also quite competitive compared to the long term contracts which is a positive sign for the power exchanges.

RP Singh, Chairman, Uttar Pradesh Electricity Regulatory Commission: India has the potential for trading power with its neighbors including Nepal and Bhutan which have huge hydro power reserves as well as Bangladesh and Sri Lanka which are dependent on traditional fossil fuel. For India to tap into this trading potential, there has to be intergovernmental framework and strong agreements between these nations.

The SAARC nations must work together to form an intergovernmental panel to promote cross border trading of electricity. The region has mostly bi-lateral power exchange taking place, regional power exchange must be promoted between these countries. A common template can be developed for the commercial and technical parameters that the system operators can adopt. While India is already trading power with Nepal, Bangladesh and Bhutan, further progress can be made in this regard since the CERC has already notified regulations for cross border trade.

Jean-Michel Glachant, Director, Florence School of Regulation: The sandbox approach has worked great for brining innovation to scale in the power sector, this approach has enabled us to characterize the social and economic benefits of various technologies and their benefits to various stake holders. Various parameters like high initial cost and performance can be tackled with price caps and performance based regulation.

Electricity systems over the past 5 years have faced 3 fundamental changes:

- Electricity is no longer a centrally controlled system; it is becoming more decentralized;
- There are multiple layers now in electricity systems and more are being added as transport and heating get electrified;
- Digitization in the electricity system is happing at a rapid rate and is need of the hour.

These transitions would mean that the regulations and legislation also adapt and change as the market design and participation evolves.

2.1.4 Key Takeaways and Closing Remarks

Mr. Matthieu Craye, International Relations Officer, DG Energy, European Commission, thanked the organizers, speakers and participants for attending the session, he elaborated on how the various topics explored by the panelists can be discussed in further detail in the upcoming webinar series. The perspective on how the European and Indian power markets differ can offer valuable insights into the further possible developments of the electricity sector in India.

2.2 10th EU India Workshop on Smart Grids (Part B, 3rd March 2021)

2.2.1 Welcome Address

Mr. Edwin Koekkoek, Counsellor, Energy and Climate Action, EU Delegation to India, welcomed all the participants and panelists for the Part B of the workshop. The 10th edition of the workshop on Smart Grids highlights the importance of the EU India cooperation on Smart Grids.

The EU India Smart Grids workshops are being organized since 2015 across various cities including, New Delhi, Vienna, Florence, and Paris. These workshops have brought together policy makers, network operators, regulators, system integrators, academia on the same platform.

All these activities are taking place in the context of the EU India CECP, which was agreed upon in 2016 and reconfirmed in 2017 at the highest level.

Mr. Reji Kumar Pillai, President - India Smart Grid Forum, welcomed that the EU India partnership is going strong with the 10th Edition of the Smart Grid Workshops, and further reinforced with the launch of high level Platform on Smart grids comprising of key stakeholders like regulators from both India and the EU.

Mr. Pillai informed participants that the Indian government is pushing for privatization of distribution utilities and amending the electricity regulatory landscape to promote retail competition. The workshop will offer learnings on transitioning from vertically integrated and regulated companies to a more diverse and de-regulated power sector.

Mr. Pillai explained that energy storage shall be a key areas of focus and the workshop can be utilized to deliberate upon various business models and the associated regulatory and policy landscape evolution. There are also two blockchain based pilot projects that are under implementation in India for peer-to-peer trading of rooftop solar. These pilots have been deployed with international collaborations in Lucknow, Uttar Pradesh and New Delhi. The deregulation of energy utilities and distributed energy resources will create a conducive environment for the adoption of blockchain technologies to enable peer-to-peer trading of electricity in India.

2.2.2 Presentation on EU-India High Level Platform on Smart grids

Ms. Swetha Bhagwat, Head of FSR Global, Florence School of Regulation introduced the EU India High Level platform on Smart Grids, which has been established under the EU-India CECP, with the Florence School of Regulation, Université Pontificale Comillas and ISGF as the main knowledge partners. The high level platform brings together key experts from India and the EU with representation from regulators, distribution utilities and industry partners. The platform focuses on projects, studies and expertise from the EU that can be replicated in India. The output of this high level platform would be the development of a living document / manual that would be updated as further platform meetings are convened.

The initial round of discussion held by the high level platform in Oct 2020 aimed at addressing four major aspects of smart grids:

- What is the technology that can be deployed in Smart grids?
- How will the project be financed?
- What could be the social acceptance of the project?
- Would it be conducive to the policy and regulatory conditions?

Various smart grid applications were discussed between the EU and India experts to understand the requirements on the Indian side and to provide viable and concrete recommendations.

The second round of discussion focused at identifying a set of use cases by developing a framework. This was done to narrow down and select the most implementable use cases for smart grids in India. This framework included identifying and prioritizing the benefits of each use case and then quantifying the impact of the use case based on experiences and expertise from both EU and India. The shortlisted use cases as a result of this activity have been highlighted below:

- Demand response and consumption optimization
- LV supervision and control (including AMI)
- MV grid automation and re-configuration

These use cases were further studied using a scalability, replicability and benefit analysis, in an India context. The EU experiences in these use cases and the lessons learnt that could be applicable to the India scenario were then applied to the study. Over this year, the high level platform would explore further intricacies of the use cases in-depth to develop the handbook of recommendations.

2.2.3 Discussion on the EU-India High Level Platform (Moderated by Swetha Bhagwat)

Participants	Designation
Donal Cannon	Head, Regional Representation in South Asia, European Investment Bank
Tomas Gomez	Universidad Pontificia Comillas, Spain
Anoop Singh	Indian Institute of Technology, Kanpur
Vikram Gandotra	Head of Marketing & Strategy, Energy Automation and Smart Grids, Siemens
Mayank Sharma	CEN/ CENELEC
Shivani Sharma	Power Consulting, Hitachi ABB Power Grids

Key Messages from the Workshop

- Technology adoption through digitalization and smart grids presents the opportunity for the electricity sector in India to address the needs of the growing economy. To identify the appropriate use cases of this technology as well as determine the legislative and regulatory implications, the EU-India high level platform is formulating a handbook taking inputs from concerned stakeholders.
- The methodology and approach for presenting the socio-economic benefits of each of the use cases have been adopted based on similar studies conducted in the EU. These studies would be replicated and assessed for scalability in the Indian context to quantify the benefits and impacts of smart grid technologies.
- The high level platform for smart grids is a democratic forum seeking representation from various stakeholders in the power sector, including academia, regulators, systems operators and technology suppliers.
- The decision of the regulator has to ensure that there is improvement in the efficiency and performance of the utilities while realizing tangible benefits for the consumers. The critical point for addressing the acceptability of the technology is not only demonstrating the benefits to the utilities but to also convince the wider consumer base, since consumers would also be paying for this technology
- Understanding the implementation and project experience for smart grid projects from international markets is essential for the Indian power sector. One of the major outcomes of this platform would be establishment of a business case of smart grid applications
- Smart grid applications in India calls for a methodical and standardization based approach to tackle this issue. Solution like the smart grid architecture model would allow Indian stakeholders to identify the various roles, actors and business values within the energy value chain, this can greatly strengthen the distribution gird and enable the transition to a smart grid.

Panelist Comments

Mr. Tomas Gomez, Universidad Pontificia Comillas: The challenge that the University is trying to solve is the adoption of the European experience that has been accumulating for over a decade through research projects, pilots and demonstrations, to the India context. Technology adoption through digitalization and smart grids presents the opportunity for the electricity sector in India to address the needs of the growing economy. Methodology for this platform has been centered around establishing the European expertise and experience for replicability and scalability in India. Thus, the members have arrived at the three use cases as mentioned above i.e.: a) Demand response and consumption optimization, b) LV supervision and control (including AMI) and c) MV grid automation and re-configuration.

Advanced Metering Infrastructure (AMI) will help distribution utilities increase service quality of their low voltage networks and reduce their losses (commercial and technical) as consumers become more aware of their power consumption leading to more retail participation. Automation and re-configuration of medium voltage systems is critical for increasing power quality and service as well as integration of renewables. These aspects will be the focus of platform discussions to arrive at the relevant technologies, their functionalities and benefits.

Two different methodologies that have been extensively tested in Europe are being applied to study the impacts of these use cases in the Indian grid systems. The first one is based on identifying the dependent factors for the cost benefit analysis, here we start from the assets on the generation side, listing the functionalities for these assets and identifying the benefits and avenues for monetization of these assets. This methodology has been used across member states in the EU to study and optimize their electricity networks. The project partners endeavor to replicate these approaches to the Indian context while also factoring in the additional externalities in the Indian power sector for providing our recommendations.

The second methodology is more recent, which was developed to standardize demo projects in Europe to achieve scalability and replicability. This methodology was developed under the BRIDGE initiative, for studying and comparing projects in a standardized manner. It is based on the smart grid architecture model where we are identifying the various layers within the power markets such as the policy and regulatory layers, technology adoption, socio-economic layers and business models, which are influencing the market design. These are the activities that are being planned under the high level platform for smart grids and the platform hopes to provide some concrete recommendations by the end of this year.

Mr. Vikram Gandotra, Head of Marketing & Strategy, Energy Automation and Smart Grids, Siemens: European technology is well accepted in India due to its reliability; and companies and organizations from the EU are highly respected for their technology innovation and adoption in smart grids. The approach for the high level platform was a democratic process where all the stakeholders were provided a platform for voicing their priorities and bringing in their contributions. The upcoming rounds of discussions in collaboration with the various stakeholders will decide how the recommendations would be developed for the handbook. The utilities being one of the most important stakeholders need to be flexible in their approach and make use of this platform to voice their requirements while taking responsibility and ownership of this upgradation/transition process. This engagement between the EU and India stakeholders including academia, financing bodies, utilities, regulators and technology providers is the most appropriate platform for these relevant discussions on power quality, distribution automation, customer engagement and reliability in operation.

Mr. Anoop Singh, Indian Institute of Technology, Kanpur: Understanding the implementation and project experience for smart grid projects from international markets is essential for the Indian power sector. When regulators take the decision to pass on the cost of smart grid implementation to the consumers, it has two broad implications i.e.; Is the investment justified for the utility and can the investment be recovered through the benefits that would be accessible though the implementation of smart grids, and finally how much of these benefits can be passed onto the consumers.

The decision of the regulator has to ensure there is improvement in the efficiency and performance of the utilities while realizing tangible benefits for the consumers. The critical point for addressing the acceptability of the technology is not only demonstrating the benefits to the utilities but to also convince the wider consumer base, since consumers would eventually pay for this technology. The buy-in from the consumer must be accessed by quantifying the tangible benefits that they would also avail from the smart grids. This buy-in can be achieved through constant consumer engagement to address issues like privacy, technology standardization, etc.

Mr. Donal Cannon, Head, Regional Representation in South Asia, European Investment Bank: The EU-India high level platform is an original contribution to the technically difficult and complex power market. One of

the major outcomes of this platform would be establishment of a business case of smart grid applications. The EIB views smart grid technologies from a climate and sustainability perspective with acceleration of the transition of the energy systems serving as justification for EIB investment. Establishing a marketplace for prosumers is a great way to accelerate the business case for smart grids. The EIB is investing almost $4 billion a year in financing smart grid based projects/technologies which is about 1/3rd of the EIB's investment in energy, making it an important area for the EIB as well.

Broadly speaking, this investment falls into two areas- firstly the generation side, looking at the implementation of meshed grids for improving the connectivity between regions with variable generation and load centers. The business case here is reducing the cost of implementing the network as well as improving the reliability and efficiency. Secondly, the distribution side where EIB serves though investments in smart meters. While there is still some lack of demand from the consumer side, there are also some technical and regulatory hurdles in the marketplace that are to be addressed. This high level platform through the handbook can work to resolve these issues on the distribution side and EIB look forward to it.

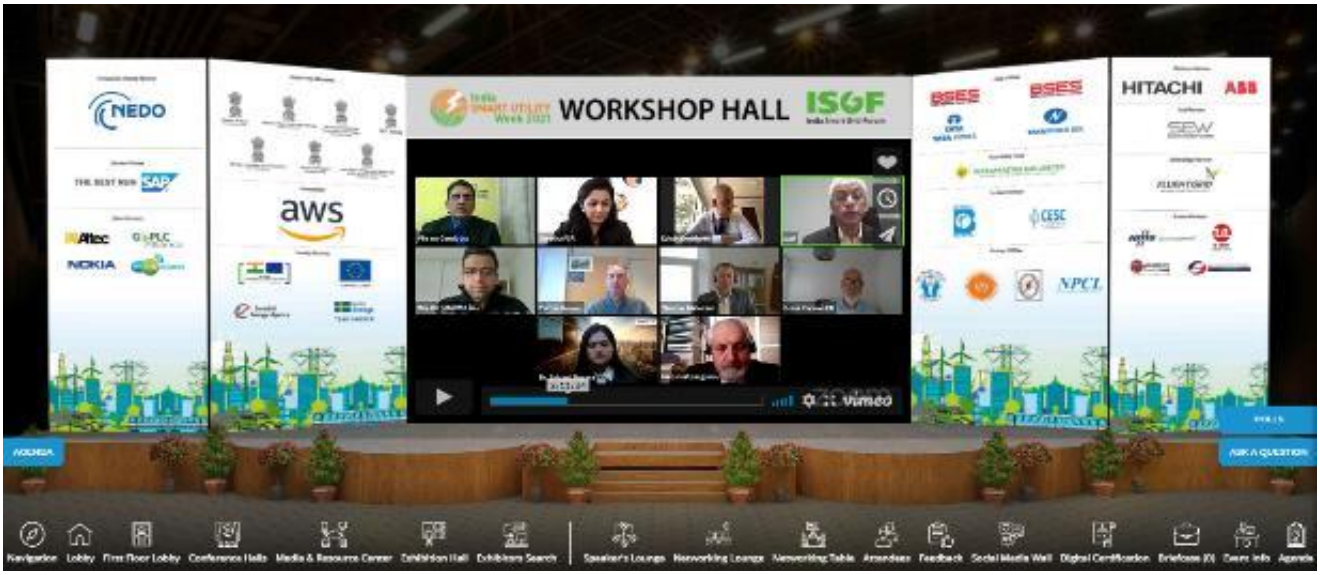
Mr. Mayank Sharma, CEN/ CENELEC: The organization CEN -CENELEC is a European standardization organization. The members of our CEN-CENELEC are the national standardization agencies of 34 European countries, working with an objective to develop common standards and technical specifications for adoption across member countries in Europe. CEN-CENELEC have significant overlap with the ISO and IEC standards, and have international collaboration with various international geographies and organizations. CEN -CENELEC are also working on an MoU with the Bureau of Indian Standards (BIS) for cooperation and development of standards in India.

The European Commission issued the smart grid mandate in 2011 which was adopted by the TSO's, to ensure the standardization of activities related to smart grid adoption, a Coordination Group on Smart Energy Grids (CG-SEG) was setup. This group was instrumental in setting the standards, approaches and methodologies for expressing the smart grid interoperability and requirements in Europe. India has one of the largest electricity grid system with a fairly robust transmission system that meets IEC standards, but the Aggregate technical and commercial losses are still on the higher side, averaging around 24%. Given the commitment of India towards increasing the capacity of renewables and energy efficiency, there are some policy, regulatory and standardization hurdles that need to be overcome.

The smart grid equation for India is being shaped by the growing demand for electricity, reducing associated carbon emissions while reducing the constraints on the electricity network. This calls for a methodical and standardization based approach to tackle this issue. Solution like the smart grid architecture model would allow Indian stakeholders to identify the various roles, actors and business values within the energy value chain, this can greatly strengthen the distribution gird and enable the transition to a smart grid.

From the European based experience, the approach that India could take is first to strengthen the distribution grid by addressing the gaps in the smart grid sector and then adding in the necessary elements including the software, technology, analytics and automation to transition to a more active grid that is all clean and efficient and all-inclusive of its stakeholders.

Ms. Shivani Sharma, Power Consulting, Hitachi ABB Power Grids: The use cases presented by the high level platform on DER's LV and MV grids is one of the most interesting spaces within the electricity sector currently. With the developments of bi-directional power grids, electric vehicles, and mini-grids, the integration and automation requirement is very critical. Load forecasting for these latest applications in the energy sector presents an opportunity especially in a country like India due to varied demography, population and load patterns. While the use cases from Europe provides a great base to begin with, it is necessary that we also study and analyze the Indian scenario through pilots and demonstration projects for customization to aid replicability and scalability.



2.2.4 Presentations by EU India Cooperation Projects (Moderated by Thomas N. Mikkelsen)

Sector	Project Name	Representative
Energy Storage	iElectrix	Pierre Jacques Le Quelec
Blockchain technologies and customer engagement	eDreams	Croce Vincenzo
	Beneffice	Bonnie Murphy
Energy vectors optimization	Eland	Farhan Farrukh
	Merlon	Katerina Valalaki
Energy Smart Grids	MUSEgrids	Alessandra Cuneo
New Projects 2021	SUSTENENCE	Jayakrishnan Pillai
	RE-EMPOWERED	Nikos Hatziargyriou

1. **Mr. Pierre Jacques** Le Quelec: IELECTRIX (Enedis), discussed:

IELECTRIX (https://ielectrix-h2020.eu/) is a project combining smart grid demonstrations in EU and Indian networks by ENEDIS and Tata Power Delhi Distribution Ltd. IElectrix works on the LV automation and digitization, energy islands and outage management, prosumer communities, upgradation of assets, space and capital. Salient features of the project are as follows:

- 15 EU partners, 1 Indian partner (TPDDL), 42 months duration and 10.7 million euros
- Demonstration Projects in partnership with the local DSO: Germany (e.dis), Hungary (2 demonstrations), India (TPDDL), Austria (E.On)
- Geography covered: Germany (High RE, Lack of flexibility and storage), Austria (existing energy communities), Hungary (new voltage regulation limits, high peak load), India (Urban center with PV penetration, grid Islanding)

2. **Mr. Croce Vincenzo**: eDreams, discussed:

eDream (https://edream-h2020.eu/en/) is a project to enable traditional market approaches and smart grid operations into novel decentralized and community-driven energy systems fully exploring local capacities, constraints, and Virtual Power Plants-oriented optimization in terms of local and secure grid nodes stabilization. Salient features of the project are as follows:

- 10 partners (ICT Players, Energy system Operators (DSO), Academia)
- 3 pilots currently ongoing: UK (integration of smart consumers, DERs, asset management and demand response planning), Italy (securing micro grid environment for participation in block chain driven Demand response program), Greece (Lab based validation of technology and tools)
- Validation of blockchain applicability to demand response control and prototype implementation of P2P trading complete.

3. **Ms. Bonnie Murphy**: Beneffice, addressed:

Beneffice (http://www.beneffice.eu/) provides an easy to deploy solution for residential consumers to track their energy usage and incentivize long term energy consumption savings. The project is aiming to create business models that stimulate the supply/demand for CO_2 credits. Salient features of the project are as follows:

- 7 partners across 6 countries with a budget of EUR 2.4 million
- 3 pilots currently ongoing: Verbund, Austria (Customers of utility), Kafkas, Greece(customers of large scale retailer), Compte, France (Customers of CO2 coin operator))

4. **Mr. Farhan Farrukh**: E Land, discussed:

E-LAND (https://elandh2020.eu/) aims to provide through a toolbox, modular set of methodologies and ICT tools to optimize and control multi energy islands and isolated communities. The modular toolbox can be customized to meet local requirements and expandable to incorporate new tools as new challenges arise. Salient features of the project are as follows:

- Multi vector energy management objectives – multi energy foundation on advanced data analytics and advanced ICT technologies with strong consumer engagement and business models
- Pilots in India- (Small, medium and community based storage and solar PV rooftop systems), Romania (RES integration and maximize efficiency through building interconnection and energy management tools), Spain (grid islanding and mini grid), Norway (integration of renewable energy sources)

5. **Ms. Katerina Valalaki**: Merlon, addressed:

Merlon (https://www.merlon-project.eu/) is developing an integrated modular local energy management framework for the holistic operational optimization of local energy systems in presence of high shares of volatile distributed renewable energy sources. Salient features of the project are as follows:

- 13 project partners across 6 countries and 10 cities
- 2 pilot demonstrations: Strem (Austria), Crevillent (Spain)
- Design and development of integrated modular energy systems and local flexibility trading for neural islands.

6. **Ms. Alessandra Cuneo**: RINA, MUSE GRIDS, discussed:

MUSE GRIDS (https://www.muse-grids.eu/) offers a set of both technological and non-technological solutions targeting the interaction of local energy grids (electricity grids, district heating and cooling networks, water networks, gas grids, electrical mobility etc.) to enable maximization of local energy independency through optimized management of the production via end user driven control strategies, smart grid functionality, storage, CHP and RES integration. Salient features of the project are as follows:

- 18 project partners across Europe and 1 partner from India
- 2 demonstration projects (Belgium and Italy) and 4 virtual demo projects (2 in Spain, 1 in Israel and 1 in India)

- Demonstration of energy communities as frontrunners for the transition to high RES local grids in rural and urban area both in EU and Indian context

2.2.5 New Projects - starting 2021

1. **Mr. Jayakrishnan Pillai**: SUSTENENCE, discussed:

SUSTENANCE: The Sustainable Energy System for Achieving Novel Carbon Neutral Energy Communities project is to create novel sustainable and carbon neutral energy communities. The project focusses on the development of smart technological concepts to ensure a green transition of the energy systems with higher shares of local renewable energy. Salient features of the project are as follows:

- 13 partners from EU (Denmark, Netherlands and Poland) and 11 partners from India
- 4 demo projects in Denmark, India, Netherlands and Poland. India demonstrator projects include the following states targeting the energy vectors Jharkhand (electricity, water, clean transport and cooking, heating & cooling and energy storage), Assam (electricity, water, irrigation and, energy storage) Mumbai (clean transport, heating/cooling).

2. **Mr. Nikos Hatziargyriou**: RE-Empowered, addressed:

RE-Empowered: The Renewable Energy empowering European and Indian communities project is aimed at developing and demonstrating solutions for energy transition of local energy systems based on multi energy micro grids, interconnecting multiple energy vectors. Salient features of the project are as follows:

- 7 partners from EU (Denmark, Greece, UK and Spain) and 6 partners from India
- 4 pilot projects (2 in EU and 2 in India) to demonstrate the following; 1. Increased RES penetration, energy efficiency and reliability (Denmark), 2. Fostering sustainable economic and community development (Greece), 3. Exchange replicability and scalability in EU and India (India).

2.2.6 Country Projects - France

Francisco da Silva Passos, Business Development Manager, Bolloré - Blue Storage: discussed

Blue Storage, a Bolloré Group company, is the only manufacturer of all-solid-state batteries commercially available for transportation and stationary applications. Salient features of the project are as follows:

- Only commercial producer of solid state technology batteries (Lithium metal polymer chemistry) with Production facilities in Canada and France.
- Currently offering the 1st solid state battery solution in India. A pilot project with a 250 kWh storage solution with EV charging will be installed in India with the support of Solar Energy Corporation of India Limited (SECI).

2.2.7 Key Takeaways and Next Steps

Mr. Matthieu Craye, International Relations Officer, DG Energy, European Commission, thanked the organizers, speakers and participants and welcomed all the concrete ideas shared in the webinar, including the pilot project implementation focusing on broader picture of policy support and harmonization of certification and standards. The 10th Edition of EU India Smart Grid workshop has shown great progress done under the EU India CECP. The handbook to be published as an outcome of the high level platform and replication studies along with the EU India projects that were presented today holds great importance for scalability and replicability in the Indian context. He stressed the importance of joining forces in additional multilateral and bilateral initiatives and to have further exchanges between EU and India stakeholders on smart grids.

3. EU participation in the Roundtable on Interconnection of Regional Grids:

3.1 Session: European Experience of Interconnection of Regional Grids

Introductory Remarks

Matthieu Craye, International Relations Officer, European Commission Directorate-General for Energy:

The EU and India have been cooperating in the field of energy under the EU India CECP, which also shares knowledge and expertise on the interconnection of regional grids. The EU has one of the largest interconnected grid networks in the world, and through this climate and energy partnership, EU endeavors to share these experiences with Indian counter parts.

Thomas Bregeon, Team Leader Infrastructure and Regional Cooperation - Electricity, European Commission Directorate-General for Energy briefed the participants on the EU's policies to support Interconnections. The regulations for establishing an interconnection grid rose from the ideation of the EU where all the member states of the EU could develop infrastructure together on a common template. This was taken up to increase security of energy supply across the EU, improving market integration instead of individual markets. The policy framework allowed for the development of projects with EU interest or funded by the EU in any member state to be accessible to neighboring member states as well. These included power generation technologies of coal, gas, oil and now renewables.

By defining priority corridors for interconnection among the member states, all the stakeholders in that sector including TSO's, system operators, power project developers can now more efficiently conduct business and operate the grid while realizing the lowest cost to the consumers. Creating the interconnection framework harmonized the electricity sector across the member states, while also increasing the competition, thus bringing in maximum efficiency to the system.

The interconnection framework also enabled the development of financial tools (CEF-Connecting Europe Facility) that member states could access to build the necessary infrastructure for the electricity transmission. Grants are also provided for development studies as well as for project development. Regional cooperation among the member states and various stakeholders has led to the development of the interconnection grid in EU, benefiting all the actors involved.

Elaine O'Connell, Policy Expert Electricity, Internal Market Unit, DG ENER, European Commission briefed the participants on EU's Regulatory Framework for Electricity Interconnections. As the interconnection grid was built, it became necessary to create a marketplace for electricity trade between all the EU member states for achieving full integration. Cross border energy trading was essential in the context of decarbonizing and renewable energy integration, this enabled the establishment of renewable projects irrespective of location and transmit the electricity through the grid to various load centers.

Cross border energy trading also plays a role in electricity security and supply, given the intermittency of renewable energy generation, it is necessary for the TSO's to be able to respond on a much smaller timescale. Interconnection regulations with other EU member states allow all the participants to import cheap excess generation or export energy when there is a power surplus/deficit to balance their grids.

Interconnection allows for more flexibility to evacuate power much more efficiently, allowing the member states to rely on each other for energy security. Having strong cross border trade and interconnection regulations is leading to huge capacity savings for member states, which can be transferred to the consumers.

Arnold Weiss, Head of Vienna Office, EPEX Spot briefed participants on Electricity market coupling in the European Union. Market coupling allows for the optimization of power exchange/trading across cross

border capacities. The market coupling operators render their services to the system operators to maximize the efficient allocation of capacity across markets. This allows for the allocation of power to those market participants that value the power the most.

Market coupling allows for greater supply to the exporting marketing while also increasing availability of power to the importing market. This has an interesting effect on the price of electricity as it tends to mute any abrupt variations in the cost of electricity over a period of time. If sufficient capacity is available on the market then the price would remain stable and the problem of insufficient capacity/congestion can be reduced by market coupling.

Market coupling in the EU was primarily pushed to address capacity constraints but over the recent decade it was renewables that lead to higher levels of regulated/mandated market coupling. The intermittency of solar and wind generation from Germany and the Nordic regions meant that, cheap renewable power could be accessed by other parts of the EU which would have otherwise been curtailed.

4. EU Zone at ISUW 2021

From 2nd to 5th March 2021, the EU hosted an EU Zone at the virtual exhibition part of the ISUW 2021,.

One EU Member State (Indo-Germany Energy Forum), two EU Associations (SolarPower Europe, AVERE) and sixteen EU H2020 projects showcased their innovative solutions. The EU Zone was prominently visible during the virtual event as well as on social media and the EU projects attracted several visitors to their respective booths.

The profiles of the EU projects and EU Associations that participated in the EU Zone are as follows:

1. **inteGRIDy:** inteGRIDy aims to integrate cutting-edge technologies, solutions and mechanisms in a Framework of replicable tools to connect existing energy networks with diverse stakeholders, facilitating optimal and dynamic operation of the Distribution Grid (DG), fostering the stability and coordination of distributed energy resources and enabling collaborative storage schemes within an increasing share of renewables. http://www.integridy.eu
2. **Interconnect:** Interconnect is a European project which aims to develop and demonstrate advanced solutions for the digitalisation of the electricity sector. The solutions developed within the scope of InterConnect will allow a digitalisation of the power system based on an Internet of Things (IoT) architecture which, by including digital technologies (artificial intelligence, Blockchain, Cloud and Big Data), ensures the interoperability between equipment, systems and privacy/cybersecurity of user data. The energy users in buildings, whether residential or of services, the operators of the distribution grid and the energy distributors will have the opportunity to take advantage of these solutions. https://interconnectproject.eu
3. **ebalance-plus:** ebalance-plus develops an energy management platform equipped with balancing and resilience services which increase and unlock the electric flexibility by means of generation and storage solutions, power electronics and grid control technologies, to provide ancillary services for new markets. https://www.ebalanceplus.eu
4. **MERLON:** MERLON introduces an integrated modular local energy management framework for the holistic operational optimisation of local energy systems in presence of high shares of volatile distributed renewable energy sources. Optimisation in MERLON applies to multiple levels spanning optimal coordination of local generation as well as flexibility provision to facilitate maximum integration of renewable energy, avoidance of curtailment and satisfaction of balancing/ancillary grid needs. In this sense MERLON will also enable the realisation of novel business models, allowing local energy communities to introduce themselves in local flexibility markets, while assigning to local Distribution System Operators the tools for the provision of added value services to the overlay distribution grid. https://www.merlon-project.eu
5. **Renaissance:** Renaissance project is an Innovation Action **(IA)** whose aim is to deliver a community-driven scalable and replicable approach, to implement new business models and technologies supporting clean production and shared distribution of energy in local communities. https://www.renaissance-h2020.eu/about/
6. **ROBINSON:** ROBINSON aims to develop an integrated energy system to help decarbonise industrialised islands. To this end, the project will develop and deploy an integrated, smart and cost-efficient energy system that couples thermal, electrical and gas networks, which will optimise the utilisation of local renewable energy sources. Through the development of a smart, modular and optimised Energy Management System (EMS), ROBINSON will integrate existing and newly developed technologies, such as a small gas turbine based combined heat and power, an anaerobic digester assisted by bioelectrochemical systems to enable the conversion of liquid waste into biomethane, a mobile innovative wind turbine, a gasifier to convert bio-waste, as well as hydrogen-related technologies (electrolyser and storage system). This integrated system will ensure a reliable, cost-efficient and

resilient energy supply contributing to the decarbonisation of the European islands by helping to decrease CO_2 emissions. https://www.robinson-h2020.eu

6. **MEISTER:** The project MEISTER is demonstrating and establishing innovative business models that will help cities, charging infrastructure operators and e-mobility service providers to reduce costs for Electric Vehicles (EV) infrastructure deployment, therefore enabling large-scale EV usage/ownership. MEISTER is changing the paradigm in the electromobility market by providing interoperable platforms and services for an easy, convenient and barrier-free access to charging, billing and smart grid services, including an increase of the use of RES and self-generation to power EVs. The project is expected to increase by 15% the demand for EVs and to reduce by 20% the installation costs of EVSE infrastructure; these achievements will help to reduce charging prices by 20%. MEISTER results will be tested and validated in Southern, Central and Northern Europe: Málaga (Spain), Berlin (Germany), and Gothenburg (Sweden). https://meisterproject.eu

7. **TRINITY**: **TRINITY** is a project that enhances cooperation and coordination among the Transmission System Operators of South-Eastern Europe (SEE) in order to support the **integration** of the **electricity markets** in the region, whilst promoting higher penetration of **clean energies**. http://trinityh2020.eu

8. **X-FLEX**: **X-FLEX project** will design, develop and demonstrate a set of tools in order to integrate the emerging **decentralized ecosystem of Renewable Energy Sources (RES) and flexibility systems** intothe existing European energy system, in an efficient and cost-effective manner, in order to create more stable, secure and sustainable smart grid, with special attention to extreme weather conditions. http://xflexproject.eu

9. **FLEXnCONFU:** The EU-funded FLEXnCONFU project will develop innovative, economical, viable and replicable power-to-X-to-power solutions to be integrated to existing and new power plant to level the load, and to un-tap their flexibility, converting electricity into hydrogen or ammonia to be in turn locally re-used in the same power plant to respond to varying demand, thus reducing time their environmental impact. A 1MW scale power-to-hydrogen-to-power system will be integrated in a real operational environment in Portugal (EDP's Ribatejo power plant) while a small-scale power-to-ammonia-to-power solutions will be coupled with a mGT properly modified to burn ammonia in Savona Smart Microgrid laboratory. https://flexnconfu.eu

10. **Synergy:** SYNERGY will attempt to unleash the data-driven innovation and collaboration potential across currently diversified and fragmented electricity actors, acting as a multiplier of the "combined" data value that can be accrued, shared and traded, and re-conceiving real-time data sharing against traditionally bilateral contracting applied in the electricity sector, to enable holistic optimization of the operation of electricity networks and the energy performance of their constituent components (RES plants, buildings, districts). https://www.synergyh2020.eu/

11. **PoSeID-on:** PoSeID-onwill develop and deliver an innovative intrinsically scalable platform, as an integrated and comprehensive solution aimed to safeguard the rights of data subjects , exploiting the cutting-edge technologies of Smart Contracts and Blockchain, as well as support organizations in data management and processing while ensuring GDPR compliance. https://www.poseidon-h2020.eu

12. **IElectrix:** IElectrix started in response to the growing need for creating innovative technical solutions and business models that facilitate the implementation of Local Energy Communities (LEC) and the integration of distributed Renewable Energy Sources (RES).

    IElectrix contributes to the European ambition by adopting a consumer-centered approach and increasing its involvement, particularly through LEC. This project is also a way to accelerate the integration of RES into the distribution networks and the decarbonisation of the energy system. In this context, Distribution System Operators play an important role by ensuring the integration of RES within the grid and facilitating the energy transition.

The project brings together 15 European partners and one Indian partner in order to experiment, through 5 real-scale demonstrators, the technical and economical relevance of LEC in different regulatory and ecosystem contexts. There will be two demonstration sites in Hungary, one in Austria, one in Germany and one in India. Website: www.ielectrix-h2020.eu

13. **E-Land:** The continued decarbonisation of the energy sector through the use of renewable energy sources provides both interesting opportunities for local energy systems and challenges for existing electricity networks. Mainland regions such as isolated villages, small cities, urban districts or rural areas oftentimes have issues with weak or non-existing grid connections. These areas are known as energy islands.

    The goal of the European-funded H2020 project E-LAND is to provide a synergistic solution between technological, societal and business challenges that the energy sector faces. The main concept is the E-LAND toolbox – a modular set of methodologies and ICT tools to optimize and control multi energy islands and isolated communities. The modular toolbox can be customized to meet local requirements and expandable to incorporate new tools as new challenges arise. Website: www.elandh2020.eu

14. **CROSSBOW** (CROSS BOrder management of variable renewable energies and storage units enabling a transnational Wholesale market) is an EC funded project led by ETRA GROUP, whose goal is to propose the shared use of resources to foster cross-border management of variable renewable energies and storage units, enabling a higher penetration of clean energies whilst reducing network operational costs and improving economic benefits of clean energies and storage units.

    These benefits will be achieved by fostering regional cooperation among the system operators in South Eastern Europe. The project will provide 9 different tools to help the Regional Coordination Center in the region to facilitate higher RES penetration, whilst reducing operational costs for individual operators – both at transmission and distribution layers. Website: http://crossbowproject.eu/

15. **MUSEGRIDS:** MUSE Grids project aims to demonstrate, system-wide and in real-life operational conditions, a set of both technological and non-technological solutions adapted to local circumstances targeting local urban energy grids to enable maximization of affordable local energy independency thanks to optimized management of the production via end users' centred control strategies, smart grid functionalities, storage and energy system integration with the objective of paving the way for their introduction in the market in the near future. https://www.muse-grids.eu

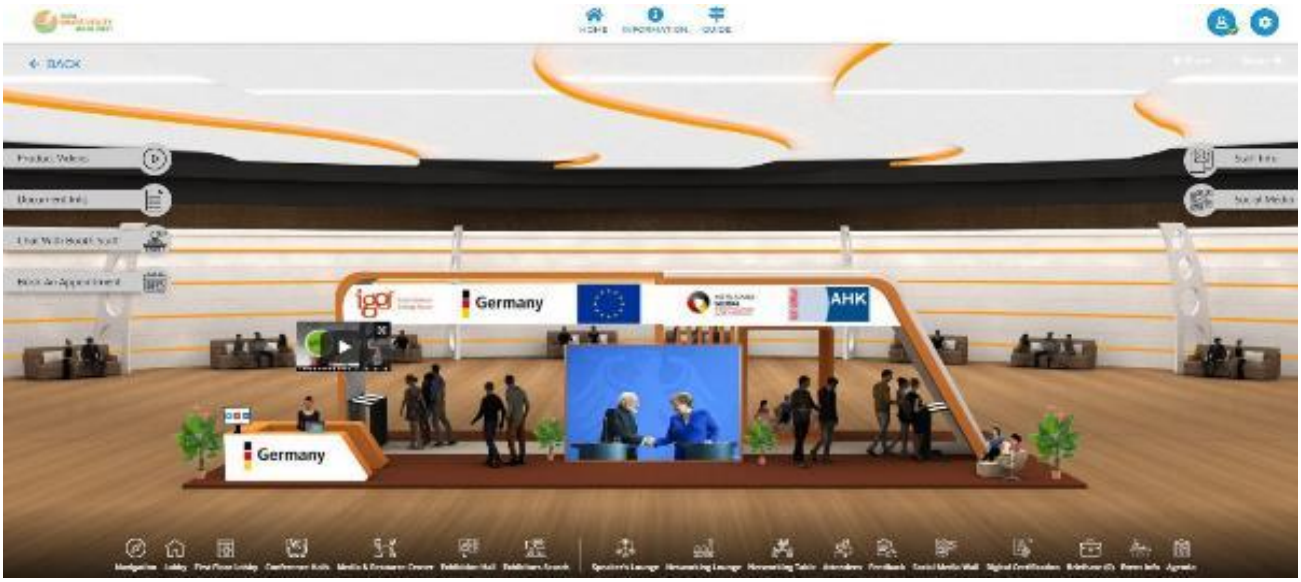
16. **SolarPower Europe:** SolarPower Europe's is a member-led association representing major companies and SMEs active all along the Solar value chain. It's aim is to ensure that more energy is generated by solar than any other energy source by 2030 and to lead our members to make solar the core of a smart, sustainable, secure and inclusive energy system in order to reach carbon neutrality before 2050. www.solarpowereurope.org

17. **AVERE:** AVERE (The European Association for Electromobility) is the European association that promotes electromobility and sustainable transport across Europe. Our Members consist of National Associations supporting and encouraging the use of Electric Vehicles and electromobility across Europe. We currently have active members in 17 European countries, notably some of the most successful EV countries like Norway, France, The Netherlands and Belgium.

    Within these Associations, there are close to 1000 members, ranging from SME's, OEM's, and other companies with a commercial interest in electromobility. https://www.avere.org/

4.1 EU Zone in pictures

EU Zone at ISUW2021



Indo-German Energy Forum

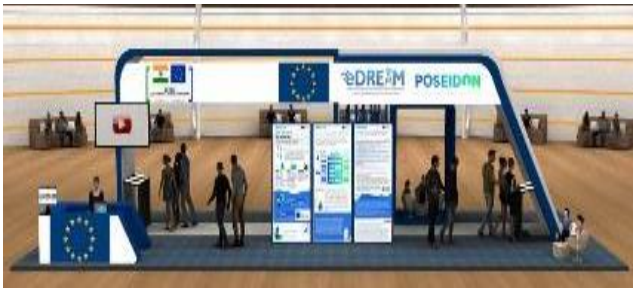
EU-India Clean Energy and Climate Partnership Project

interGridy

The European Association for Electromobility

SolarPower Europe

Crossbow + Meister + Trinity + T-Flex



eDream + PoSeID-on

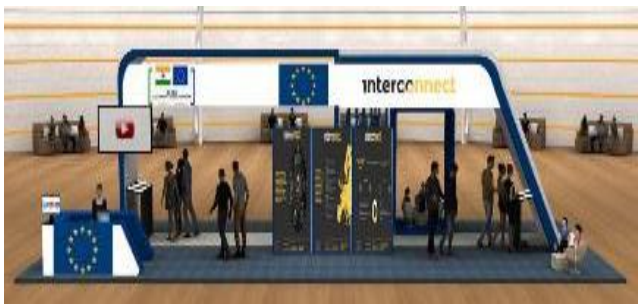
FlexnConfu + Synergy

Renaissance + ebalanceplus

Merlon + iElectrix

MuseGrids

Robinson + E-Land



InterConnect

About EU-India CECP

The EU-India CECP aims to reinforce cooperation between the EU and India on climate change and energy with a view to ensure a secure, clean, affordable and reliable energy supply for all and to progress in the implementation of the Paris Agreement.

For more details, please visit: www.cecp-eu.in

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