

Flexibility for Resilience in integrated systems

in cooperation with IEA's [Digital Demand Driven Electricity Networks \(3DEN\) Initiative](#)

ISGAN WG 6

Irina Oleinikova, NTNU Norway

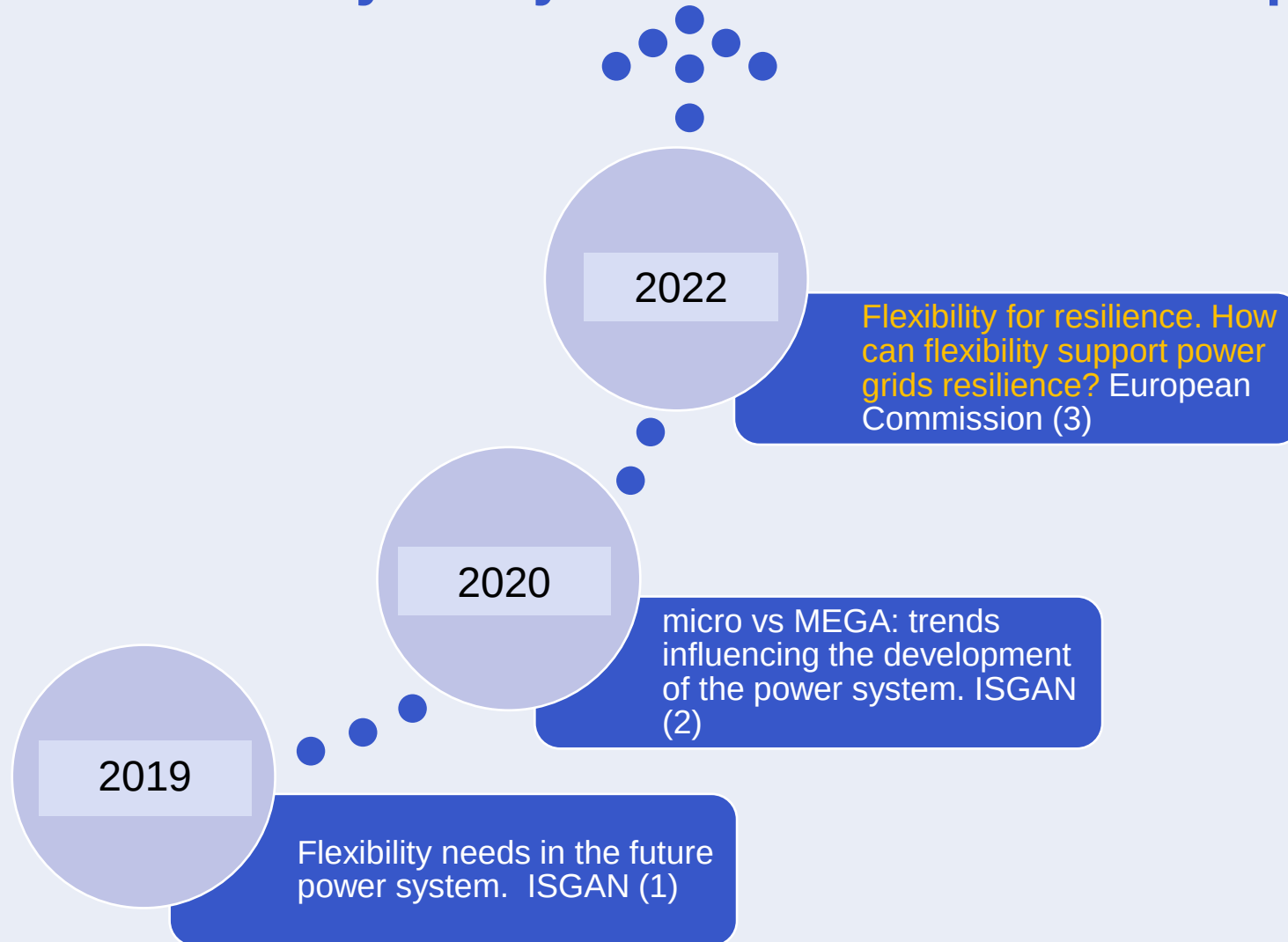
3-4 October 2022, Paris

ISGAN WG6: Power Transmission & Distribution Systems



Flexibility study

International cooperation



(1) <https://www.iea-iscan.org/flexibility-in-future-power-systems/>

(2) https://www.iea-iscan.org/wp-content/uploads/2020/05/ISGAN_DiscussionPaper_Annex6_microVsMEGA_2020.pdf

(3) <https://op.europa.eu/en/publication-detail/-/publication/54d9c702-dc9c-11ec-a534-01aa75ed71a1>

Flexibility benefits for resilience

How can flexibility support power grid resilience?

As zero operational-cost variable RES are foreseen to dominate the future energy mix, the abundance of green electricity will allow the replacement of fossil fuels in sectors such as heating, cooling, industrial processes, and transport. The intermittency of such energy resources implies significant systemic requirements for flexible solutions; thus, developments of the energy sector in general, and the power system, instigate significant innovation activities in the fields of power system flexibility.

- A collaborative effort between of **ISGAN WG 6** and **ETIP SNET WG1**.
- Considering the increased societal needs of a secure electricity supply
- Editors: Irina Oleinikova, Emil Hillberg, & Antonio Iliceto
- Contributing authors:
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Flexibility meeting Resilience

- *Flexibility and Resilience* have been developed for grid operation with high vRES penetration and starts being considered in system planning.
- The term *Resilience* is based on reliability, risk analysis, system interactions analysis, and could be achieved through a set of key actionable measures to be taken before, during and after the occurrence of adverse events.

Resilience areas: Anticipation, Preparation, Containment & Mitigation, Rapid recovery, Adaptation

Novel Resilience solutions: increase possibilities with integration of DER & controllable assets

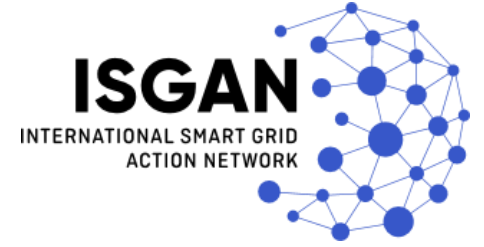
Resilience solutions (*conventional containment and restoration*): diminish with decommissioning of primary energy reserves

Resilience requirements: increase with grid utilization, climate change/ severe weather, data handling/cybersecurity

3 Perspectives: **Digitalization, Flexibility & Resilience**

Next level of Flexibility

- Fully deployed and utilized for operation and planning of the power system, being integrated in procedures for long-term planning as well as in tools for stability support



Power System Flexibility area

Technical area

- ✓ *The ability to manage the technical structure of the network in the most effective way, allowing to create conditions for connecting new users, while maintaining the stability and continuity of supplies*

Users behavior area

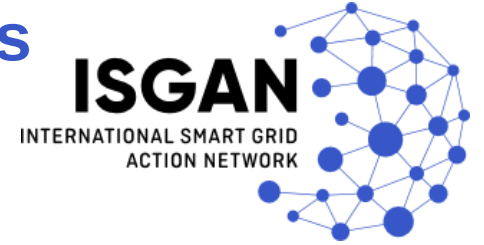
- ✓ *The ability of users to reduce or increase consumption or generation, offering services ensuring stable operation of the system, also, behaviors resulting from everyday needs and habits*

Introduction to workshop ...



- The **purpose** of this workshop is to collect information and expert to:
 - Discuss the societal transformation where a new generation of stakeholders will provide power flexibility services for and its importance for energy policy and regulation
 - Explore best practices and innovative approaches for leveraging active demand side flexibility.
 - Provide input to advance key policy messages related to the nexus of flexibility, resilience and digitalisation.
 - Identify synergies and possibilities for future international collaboration.
- The **results** of the workshop will be used for:
 - Consolidation of the ISGAN key policy message: "Flexibility for Resilience in integrated systems"
- **Needed competences:** flexibility resources and tools, system operation related experience, system planning, market & policy, cross-sectoral view, ...

How to design and exploit flexibility sources and mechanisms for increasing the resilience of the overall system?



System services

Sharing grid information - topology

Different flexibility needs

System observability

Regulatory provisions

Business models for flexibility provision

DSO role in flexibility

Data Exchange

Lack of TSO-DSO coordination

Critical infrastructure development

Markets Design

Communication Systems

EV's and Storage

Power System
Transformation

Cyber-security

Local energy markets

Not fully formed regulatory framework

Insufficient incentives for consumers and aggregators to participate

Integrated systems and increased complexity

Next steps

Discuss flexibility aspects for power system and societal transformations important for energy policy and regulation

Workshop results and follow up



Conduct deeper analysis into the workshop results to obtain a holistic understanding of perspectives



**Further development of the key policy message:
'Flexibility for Resilience in integrated systems'**

Submit to ISGAN EXCO

Thank you!

ISGAN WG 6

Irina Oleinikova

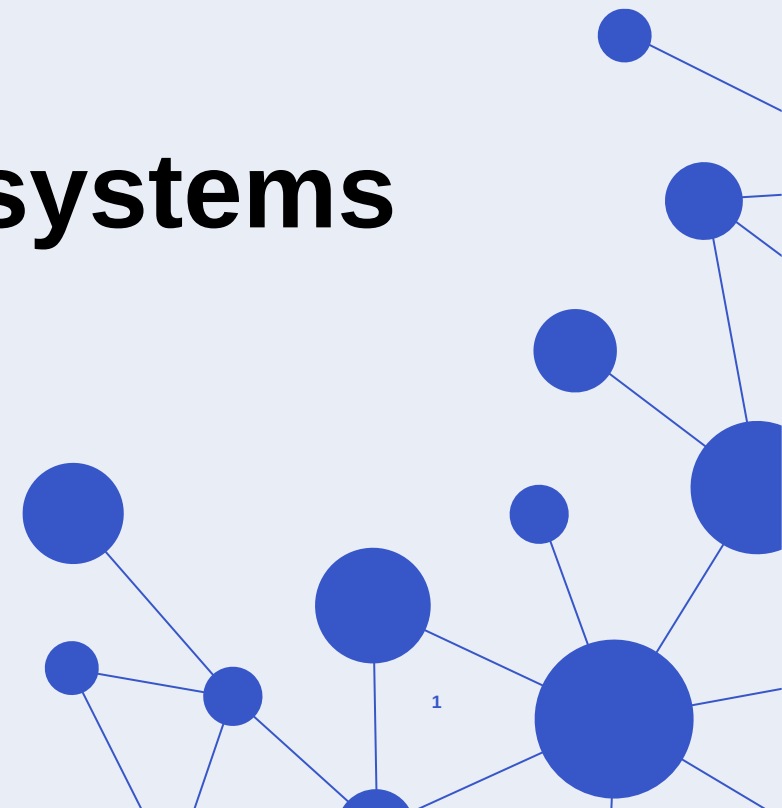
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ISGAN Working Group 6

Transmission and distribution systems

Joni Rossi – RISE/ISGAN WG6



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ISGAN Working Group 6

The power grid is an enabler for energy efficiency and a sustainable energy system, but a holistic approach is needed.

→ WG 6 focuses on the potential system-related challenges in the development of future smarter grids by:

- Improving the understanding of Smart Grid technologies + accelerating their deployment
- Promoting solutions that enable power grids to maintain and improve the security, reliability and quality of electric power supply
- Promoting adoption of related enabling regulatory and government policies

→ Goal: facilitate the application of advanced technologies needed for power grids to contribute to the attainment of clean energy and climate goals and sustainable energy access to all.



WG6 main themes

Expansion planning and market analysis

Study the functioning of electricity markets and analyse the evolution of the T&D networks and their planning modalities.

Grid planning under uncertainty, with new tools and methodologies

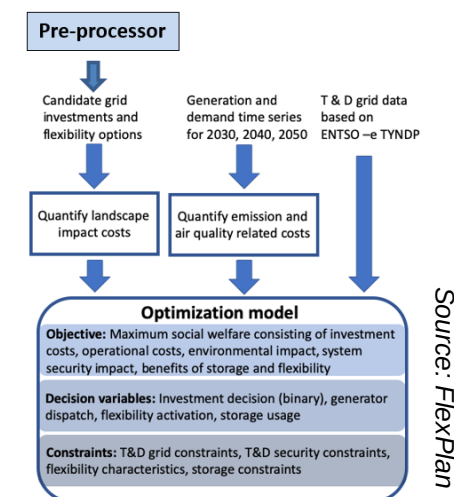
- Planning processes are complex and involve interaction between a large number of stakeholders at different levels.
- In light of the urgency of the energy transition it is critical that these processes are efficient, transparent, legitimate, and based on sound principles and steering mechanisms.
- Further integration of RES requires maximizing flexibility and adaptation of tools and methods.

Coupling of systems

- Co-optimization of electricity, gas and heat.

Coordinated markets for the provision of system services

- Improve incentives for system operators to establish flexibility markets.
- Expand market access and flexibility service provider engagement.



Key policy messages

To enable the potential of flexibility, planning processes should be optimized, coordinated with storage and RES deployment, consider real-time market architectures and products, and engage multiple stakeholders.

WG6 main themes

TSO-DSO-stakeholder interaction

Study how distribution and transmission networks could interact in the future to ensure stable grid operation under high levels of RES.

Stakeholders are important in grid support

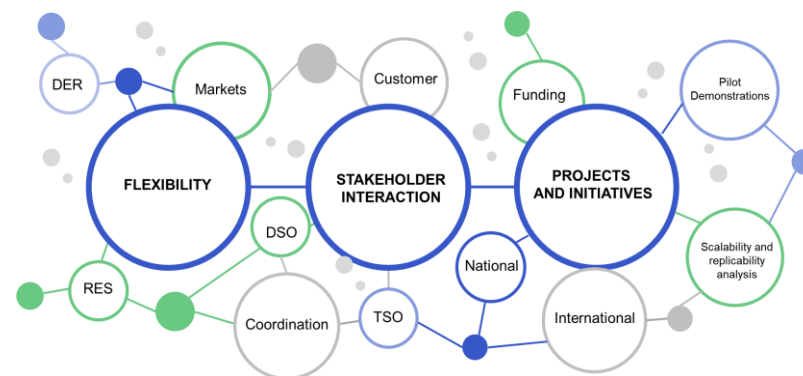
- Digitally-enabled grid benefit potential from promising DER technologies.
- Local energy communities also play an important role in the future.
- Industrial and commercial users are important flexibility providers.
- Aggregator role in facilitating relevant services → need for assistive tools & solutions.

Need for coordinated TSO-DSO markets for the provision of System Services

Large-scale TSO-DSO-Consumer demonstrations have been tested.

→ barriers still exist: regulatory, market, technological and social

→ need for consolidation of project results and support of knowledge transfer.



Key policy messages

Regulatory provisions are needed on the national level to facilitate market implementation of innovative network services support replication / upscaling.

TSO-DSO coordination is a key enabler to create financial gains for all stakeholders through value stacking, without jeopardizing grid stability.

WG6 main themes

System operation and security

To assess available methods and identify new needs for operational monitoring & control

Flexibility for resilience

Greater resilience to climate change impact, cyber attacks, ... and **critical delivery chains** is essential.

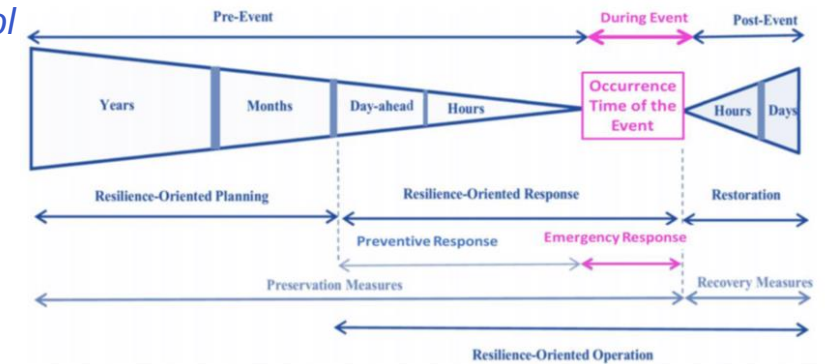
A system becomes resilient from proper risk-management practices but many risks cannot be solved only by extra assets.

- system planning must embrace a wide range of network and non-network options.
- grids need to be flexible and resilient **by design**.

Flexibility resources can also facilitate resilience in operational time frame

- importance of **TSO-DSO-stakeholder** interaction.

Appropriate **assessment** of resilience level leads to effective strategies.



Key policy messages

Flexibility can support power grid resilience through support for system operation, grid planning and risk management.

Economic values of large scale flexibility solutions motivates resilience-enhancing investments.

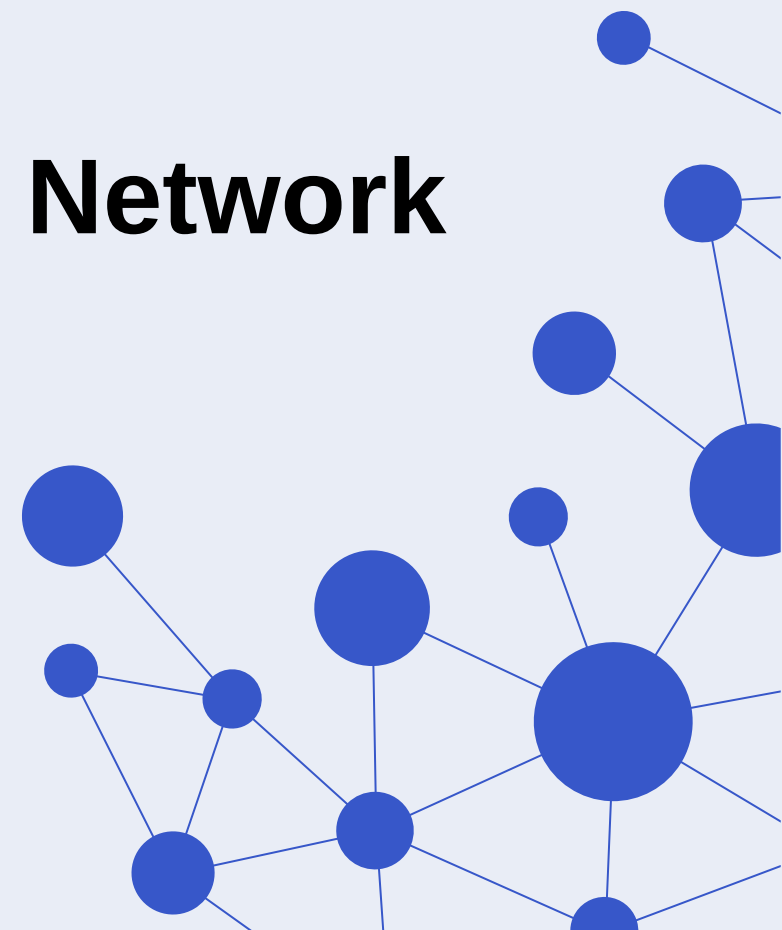
ISGAN

International Smart Grid Action Network

Luciano Martini, *Chair*

IEA & ISGAN Workshop:
Flexibility for resilience in integrated systems

3 - 4 October 2022, Paris



ISGAN in a Nutshell

ISGAN is the short name for the *International Energy Agency (IEA) Technology Collaboration Programme (TCP)* for a Co-operative Programme on Smart Grids (ISGAN – *International Smart Grids Action Network*).

It is also an initiative of the *Clean Energy Ministerial (CEM)* and was formally established at CEM2 in Abu Dhabi, in 2011 as an Implementing Agreement under a framework of the *International Energy Agency (IEA)*.

The *International Smart Grid Action Network (ISGAN)* creates a **strategic platform** to support high-level government attention and action for the **accelerated development and deployment of smarter, cleaner electricity grids around the world.**



ISGAN in a Nutshell



ISGAN currently consists of 27 Contracting Parties. Their nominated representatives form the Executive Committee headed by the Presidium, assisted by two co-Secretariats and the Operating Agent of ISGAN.

The work of ISGAN is divided into 6 active Working Groups (WG).

Co Secretariat
& Operating
Agent

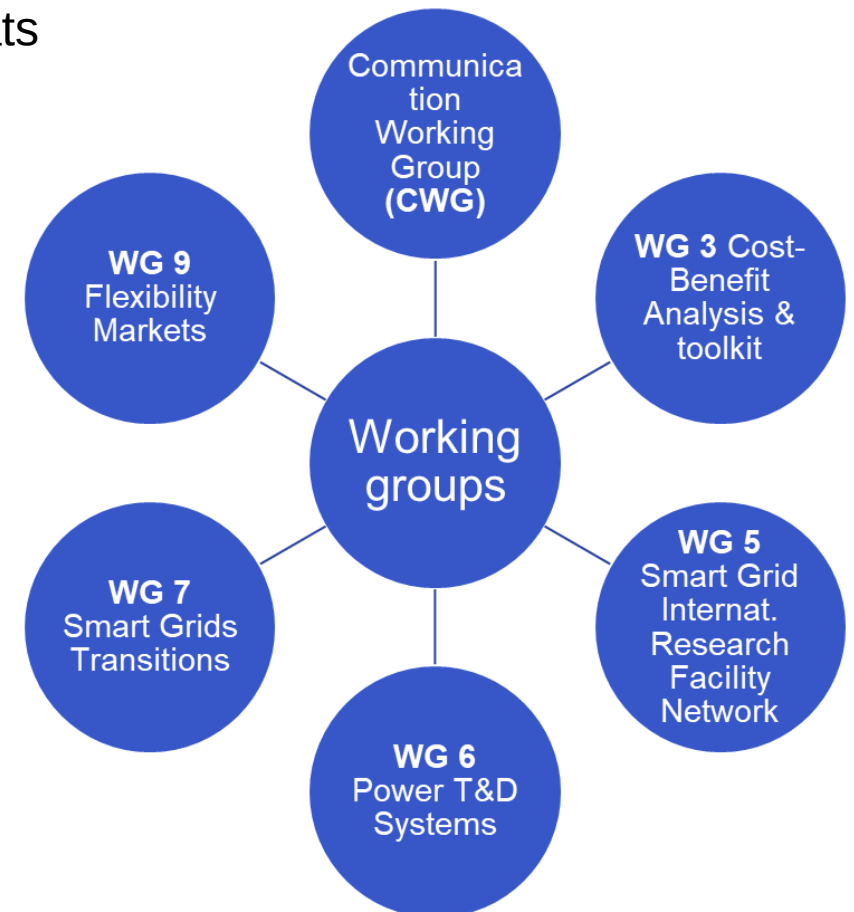


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ISGAN Presidium

ISGAN Executive Committee



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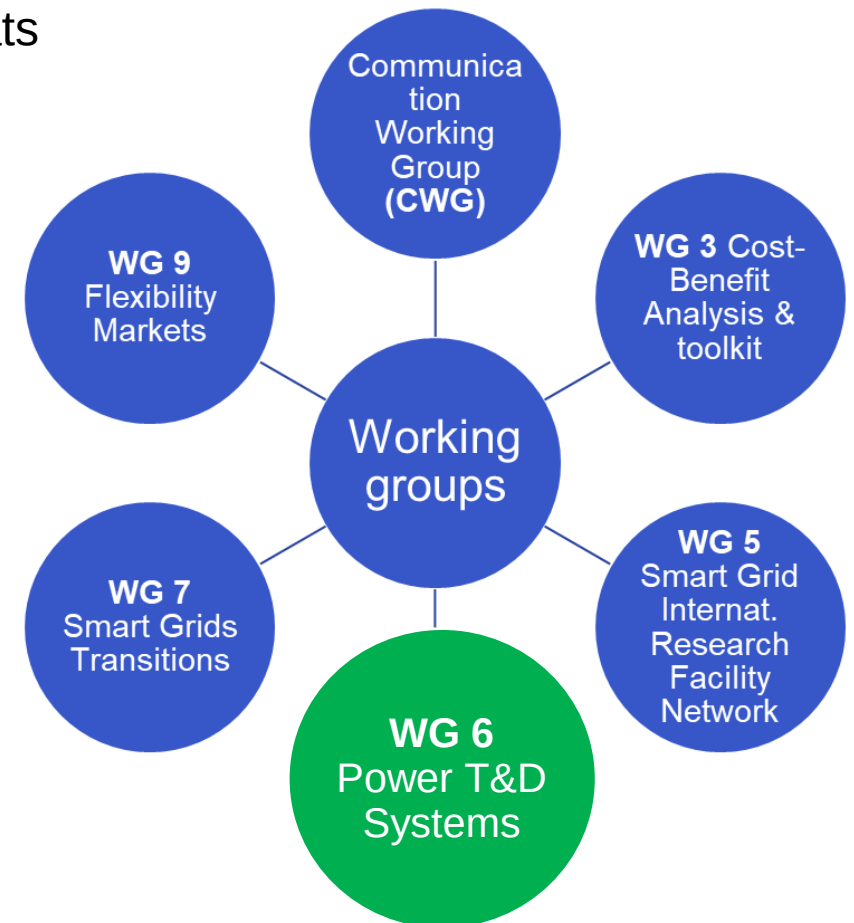


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ISGAN Executive Committee



Vision



ISGAN's vision is to accelerate progress on **key aspects of smart grid policy, technology, and investment** through voluntary **participation by governments** and their designees in specific projects and programs. Its activities center foremost on those aspects of the smart grid where governments have regulatory authority, expertise, convening power, or other leverage, focusing on five principal areas:

- Policy standards and regulation
- Finance and business models
- Technology system development
- Workforce skills and knowledge
- Users and consumers engagement

ISGAN facilitates dynamic knowledge sharing, technical assistance, peer review and, where appropriate, project coordination among its Contracting Parties.

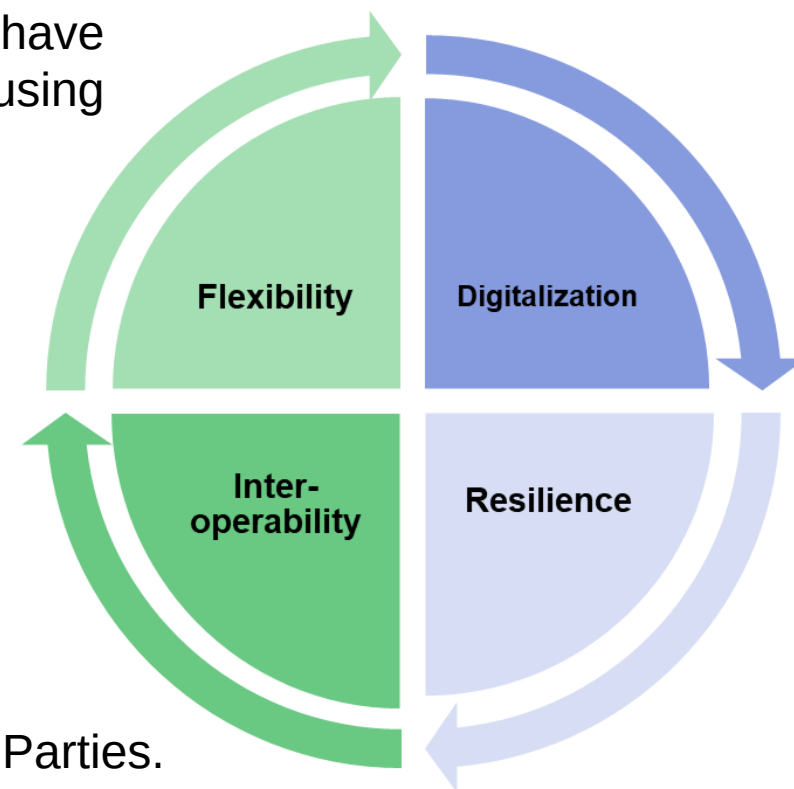
Vision



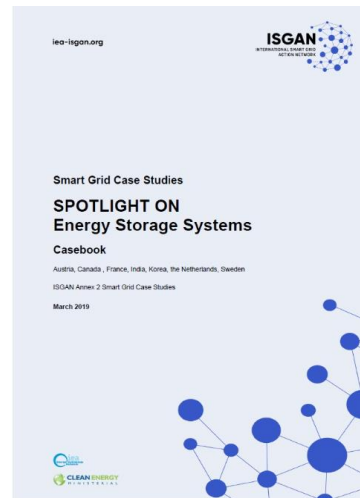
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Value proposition

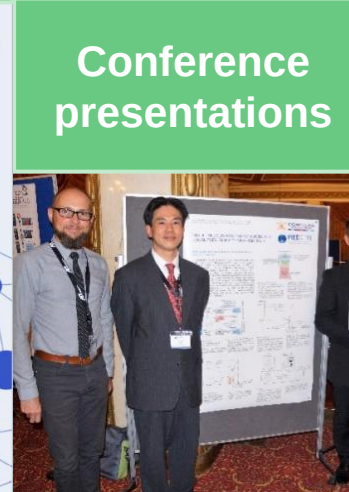
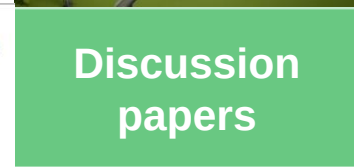


Casebooks

Technology
briefs

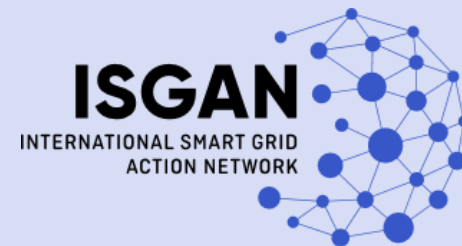


Policy briefs



International collaboration: Main partnerships

ISGAN continues to build **collaborative ties** with other relevant fora, aligning and differentiating activities as appropriate, in a mutual effort to attain the real outcomes needed in energy systems.



ISGAN at the Global Clean Energy Action Forum (GCEAF)



ISGAN has successfully participated to the **Global Clean Energy Action Forum** in Pittsburgh, PA, U.S. on 21-23 September 2022.



The event, organized by the **Clean Energy Ministerial** and **Mission Innovation**, has seen the participation of thousands of clean energy leaders from all over the world, featuring the acceleration towards decarbonization and clean energy transition.

Family photo of high-level delegates present in Pittsburgh

The GPFM–ISGAN joint side event at the GCEAF



At the **GCEAF**, **ISGAN** has organized the joint side event “*Boosting the Power System Transition: Innovation through GPFM and ISGAN*” in collaboration with the **Green Powered Future Mission** (GPFM), one of the seven Missions launched by Mission Innovation.



**MI-GPFM and CEM-ISGAN
Joint Side Event**

*Boosting the
Power System Transition:
Innovation through GPFM and ISGAN*

Pittsburgh, PA - 23 September 2022



**GREEN POWERED
FUTURE**
MISSION



The 8th Annual ISGAN Awards Ceremony at the GCEAF



The **ISGAN Award of Excellence** seeks to leverage leadership and innovation in smart grids to accelerate the global exchange of best practice and promote replication or adaptation of proven concepts in other markets, countries, and regions.

Themes of the 8th Annual ISGAN Awards Ceremony

**EV Integration
in Smart Grid**



**Smart Grid
Workforce
Development**
for an Inclusive
Energy Transition



International collaboration: MoU with *GPFM* and *GSEF*



At the GCEAF,
ISGAN has signed two fruitful
Memorandum of Understanding



Thank you for your kind attention!

Contact:

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Principal Challenges Considered in ISGAN

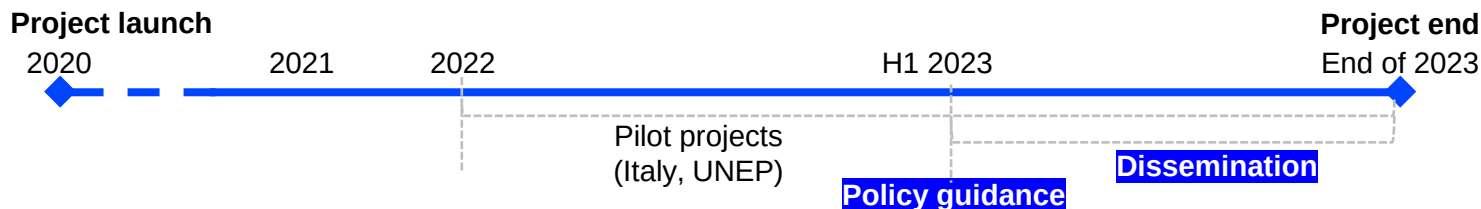
- **Increasing complexity of power systems:**
Complex systems of systems with many discrete but interconnected and mutually reliant domains and components
- **Increasingly crowded multilateral ecosystem:**
ISGAN TCP, CEM 21st Century Power Partnership, Mission Innovation GPF Mission, UK's new G7/COP26 power system efforts, Global Power System Transformation Consortium, IEA's Renewable Integration and Secure Electricity (RISE) Unit
- **Differentiation and return on investment from ISGAN:**
What are today's clear objectives and ambitious targets (national or collective) that will attract and sustain key stakeholders' attention and support?



IEA and ISGAN workshop: Flexibility for resilience in integrated systems

Vida Rozite, 3DEN Project Manager, Energy Efficiency Division, IEA
Paris, 3 October 2022

- **Aim of the Project** - providing **actionable guidance** to policy makers on the policy, regulatory, technology and investment context needed to accelerate progress on **power system decarbonisation and modernisation** and **effective utilisation of demand side resources**
- **Outputs**
 - **2 Policy guidance reports** (release H1 2023), tools and intermediate outputs, including articles and commentaries
 - Thematic and regional events and workshops
 - **G20 Report “Empowering Cities toward Net Zero Emissions: Resilient, smart and sustainable cities towards a sustainable energy future”**, released in July 2021
- **Global scope, geographic focus**, including but not limited to **Brazil, Colombia, India, Indonesia, Morocco, South Africa, Tunisia, and Latin America, Africa, South East Asia** regions. Ongoing engagement with a **Consultative Group of Experts** (37 members from 14 countries)
- Italy / UNEP are supporting **pilot projects** that will be implemented **in 2022/23** to test new approaches on demand side and distributed energy resources in (1) Urban contexts, (2) Islanded systems, (3) Existing grid assets – **learnings will feed into 3DEN analysis**.
- **Project timeline**



Agenda – Day 1: Monday 3 October 2022

13:30 – 14:10	Welcoming remarks - Dr. Brian Motherway, Head of the Energy Efficiency Division, IEA Introductory remarks - Luciano Martini, Executive Committee Chair, ISGAN - Joni Rossi, Researcher, Research Institutes of Sweden (RISE) and Operating Agent of ISGAN WG6 on Power Transmission & Distribution Systems - Irina Oleinikova, Professor, Norwegian University of Science and Technology and ISGAN WG6 on Power Transmission & Distribution Systems - Vida Rozite, 3DEN Project Manager, Energy Efficiency Division, IEA	
14:10 – 15:00	Scene setting: Moderated by Vida Rozite, 3DEN Project Manager, Energy Efficiency Division, IEA - Dr. Martha Symko-Davies, Accelerating Clean Energy at Scale Program, Laboratory Program Manager, NREL - Jagabanta Ningthoujam, Principal, Electricity and Energy Storage, RMI India Q&A session.	
15:00 – 15:30	Coffee break	
15:30 – 16:30	Panel 1: Key issues, opportunities and experience. Moderated by Emi Bertoli, Energy Analyst, Energy Efficiency Division, IEA - Pauline Henriot, Energy Analyst, Energy Efficiency Division, IEA Digitalisation and benefits in the power system - Barbara Herndl, Research Engineer, Austrian Institute of Technology AIT, ISGAN WG6 on Power Transmission & Distribution Systems - Marcos Venicius Leite Vasconcelos, Specialist at the Superintendence of Distribution Services Regulation - Bruno Goulart de Freitas Machado, Specialist at the Superintendence of Generation Services Regulation, Brazilian Energy Regulatory Agency ANEEL - Hossein Farahmand, Professor, Norwegian University of Science and Technology and ISGAN WG9 on Flexibility Markets Q&A session.	
16:30 – 17:30	Moderated discussion with workshop participants (plenary) Moderated by Vida Rozite, 3DEN Project Manager, Energy Efficiency Division, IEA Kick off view: - Dr. Hannele Holttinen, Operating Agent, Grid Integration Task 25 of IEA Wind TCP <u>Guiding questions:</u> - What is your organisation doing, planning to do, or considering doing in this space? - What are the policy, regulatory and market changes needed to leverage flexibility for resilience? - What are the opportunities offered by digitalization and what are the persisting challenges? - How can flexibility potential and opportunity be quantified and communicated to different stakeholders? What is the role of digitalisation on this? - How can international collaboration, including through IEA and ISGAN help to accelerate the deployment of flexibility measures to support resilience? Are there any priority areas where guidance and recommendations from organisations such as the IEA would be most helpful?	
17:30 – 17:40	Introduction to Day 2 breakout group work and related logistics. - Irina Oleinikova, Professor, Norwegian University of Science and Technology and ISGAN WG6 on Power Transmission & Distribution Systems - Emi Bertoli, Energy Analyst, Energy Efficiency Division, IEA	
17:40 – 19:30	Reception at IEA Café	
19:30	End of Day 1	

Agenda – Day 2: Tuesday 4 October 2022

8:30 – 9:00	Welcome coffee		
9:00 – 10:45	Breakout group discussion and reporting back Topics: A. Planning and investment in power system resilience. Group 1 Moderator Irina Oleinikova, Norwegian University of Science and Technology and ISGAN WG6 on Power Transmission & Distribution Systems Room: 0108 Group 2 Moderator Jacques Warichet, Power System Transformation Analyst, Renewable Integration and Secure Electricity unit Room: 2109 B. Pathways to implementation: balancing short and long term needs in the current energy and climate crisis. Group 3 Moderator Pauline Henriot, Energy Analyst, Energy Efficiency Division, IEA Room: 3101 Group 4 Moderator Jinsun Lim, Energy and Environment Policy Analyst, Energy and Climate Change, IEA Room: 3106	Reporting back: Moderated by Irina Oleinikova, Norwegian University of Science and Technology and ISGAN WG6 on Power Transmission & Distribution Systems Speakers: designated members from each breakout group and moderators.	10:45 – 11:15
		Panel 2: From planning to implementation. Moderated by Irina Oleinikova, Norwegian University of Science and Technology and ISGAN WG6 on Power Transmission & Distribution Systems - Kjetil Obstfelder Uhlen, Special Adviser, Statnett - Javier Toro Cabrera, Head of Electrical Markets Unit, Chile's National Energy Commission - Pierre Bivas, Founder and CEO, Voltalis - Joni Rossi, Researcher, Research Institutes of Sweden (RISE) and Operating Agent of ISGAN WG6 on Power Transmission & Distribution Systems Q&A session.	11:15 – 12:30
		Final remarks, next steps and closing. Luciano Martini, Executive Committee Chair, ISGAN Vida Rozite, 3DEN Project Manager, Energy Efficiency Division, IEA	12:20 – 12:45
		End of workshop	12:45

