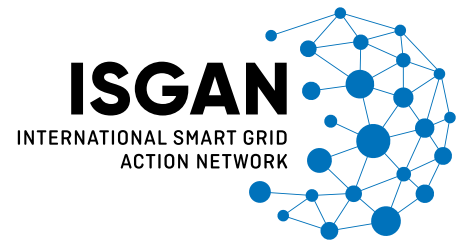


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International Energy Agency (IEA) Technology Collaboration Programme (TCP)

International Smart Grid Action Network (ISGAN)

# 2025-2026 Annual Report

for the period from 1 March 2025 to 28 February 2026



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Technology Collaboration Programme  
by **iea**

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# 1. Letter from the Chair

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As the global energy transition continues to accelerate, electricity grids are becoming increasingly central for reliable, **affordable, and secure energy systems**. The rapid growth of electrification, the massive **integration of renewable energy sources**, and the **need for greater system flexibility and resilience** are reinforcing the importance of smarter grids. In this context, international cooperation remains essential, and ISGAN continues to provide a **government-level platform to exchange experiences and best practices**, bridging policy and technical implementation to support policymakers at the national, regional and international levels.

During the reporting period from 1 March 2025 to 28 February 2026, ISGAN further strengthened its role as a catalyst for **collaboration on smart grid development and deployment**. This period was marked by active participation in major international fora, strong engagement across all Working

Groups, and excellent progress on the Lighthouse Project, among many other achievements. These efforts helped reinforce ISGAN's leadership in advancing smarter, more flexible, and more resilient electricity systems worldwide.

A key highlight of the year was the continued development of ISGAN's **Lighthouse Project on Long-Term Planning and Implementation of Smart Distribution Grids**, which is an important cross-cutting initiative that brings together all WGs and external stakeholders – including industry, policymakers, system operators, and other experts – in a shared process of knowledge development and co-creation.

In 2025, the **ISGAN Executive Committee (ExCo)** convened for its annual meetings: ExCo29, held in March at the International Energy Agency (IEA) headquarters in Paris, and ExCo30, kindly hosted by

the Sustainable Energy Authority of Ireland (SEAI) in Dublin in October. These meetings provided important opportunities to review progress, strengthen collaboration across Working Groups, advance ISGAN's strategic priorities, and once again, demonstrated the value of international dialogue and cooperation in addressing the challenges and opportunities of grid modernisation.

ISGAN also remained actively engaged in the broader Clean Energy Ministerial (CEM) community throughout the year. The **CEM Senior Officials' Meeting** in Seoul in April 2025 prepared the ground for the year's ministerial meeting and for planned collaboration activities. ISGAN strengthened its visibility at CEM16/MI-10 ministerial through its leading role and in particular it successfully organised the **11th ISGAN Awards of Excellence and the ISGAN-KEPCO event on distribution grid modernisation and DC solutions**. Moreover, it contributed to the **India Smart Grid Forum (ISGF)** and renewed its Memorandum of Understanding with the **Global Smart Energy Federation (GSEF)**. These engagements strengthened ISGAN's position as a global platform for cooperation on smart grids, digitalisation, and system resilience.

Another important milestone was ISGAN's participation in **COP30** activities. ISGAN reinforced its engagement by actively contributing to side events at different pavilions and endorsed, alongside more than 130 global initiatives, the *Plan to Accelerate Solutions: Expansion and Resilience of Grids – Innovative solutions for power system long-term planning*, which was included in the COP30 Action Agenda. This further highlighted the growing recognition about the role of modern, flexible and resilient grid infrastructures to achieving climate and clean energy goals.

ISGAN also strengthened its global outreach by continuing collaboration with key international initiatives and organisations, including the Mission

Innovation **Green Powered Future Mission (GPFM)**, the **Global Smart Energy Federation (GSEF)**, **ETIP SNET**, selected **IEA Technology Collaboration Programmes**, and other relevant organizations. Through joint activities and workshops to promote knowledge exchange and strategic dialogue, these partnerships supported the dissemination of best practices and the advancement of smart grid and power system transformation efforts worldwide.

The achievements of this reporting period also reflect the continued commitment of ISGAN's **Working Group members**, whose contributions support knowledge sharing and innovation across the **key themes of flexibility, digitalisation, interoperability and resilience**. These efforts remain essential to be able to support policymakers as energy systems become more complex and interconnected.

On behalf of the Presidium, sincere appreciation goes to all Executive Committee members, Working Group managers and experts, the Secretariat and Operating Agent, and the Co-Secretariat for their dedication and continued support. Their contributions enable ISGAN to remain a **trusted platform for cooperation and action** at a time of profound transformation in the global energy sector.

As we look ahead, ISGAN will continue building on this momentum by **strengthening collaboration, advancing the Lighthouse Project, and supporting the development of more flexible, digitalised, interoperable and resilient electricity systems**. I believe that in an increasingly electrified world, ISGAN's role in fostering dialogue, sharing experience, and promoting practical solutions remains more important than ever.

Yours sincerely,

**Luciano Martini**

Chair of the International  
Smart Grid Action Network (ISGAN)



## 2. International Smart Grid Action Network

### 2.1. Overview

As the global energy landscape transitions toward sustainability, smart electricity grids have emerged as a cornerstone of modern energy systems. Smart grids integrate advanced technologies, such as sensors, automation, and communication networks, to enhance the efficiency, reliability, and flexibility of electricity generation, distribution, and consumption. However, developing and implementing these systems requires

an international, collaborative approach. The International Smart Grid Action Network (ISGAN) plays a pivotal role in fostering this global cooperation.

Smart grids are complex systems that integrate multiple disciplines, technologies and stakeholders. The transition to these advanced systems presents challenges that transcend national borders, including:

### 2.2. The need for international collaboration

Smart grids are complex systems that integrate multiple disciplines, technologies and stakeholders. The transition to these advanced systems presents challenges that transcend national borders, including:

- 1. Standardisation:** Ensuring interoperability between technologies developed in different countries.
- 2. Knowledge sharing:** Accelerating innovation by sharing research findings, best practices, and lessons learned.

**3. Economic efficiency:** Reducing duplication of efforts and leveraging resources across nations.

**4. Global challenges:** Addressing universal issues such as climate change, cybersecurity threats, and energy equity.

No single country has all the necessary expertise, resources, or solutions needed to comprehensively address these challenges. International collaboration provides a platform to pool resources, align strategies, and establish a shared vision for the future of energy systems.

### 2.3. ISGAN: A catalyst for cooperation

The International Smart Grid Action Network (ISGAN) is a multilateral initiative that operates within the framework of the Clean Energy Ministerial (CEM) and the International Energy Agency (IEA). Since its estab-

lishment in 2010, ISGAN has worked to accelerate the development and deployment of smart grids worldwide by promoting international collaboration.

## 2.4. Key contributions

- 1. Policy and regulatory frameworks:** ISGAN provides a platform for governments to share insights on policies, regulatory approaches, and strategies that encourage the adoption of smart grids. By harmonising these frameworks, ISGAN helps reduce barriers and enables innovation and deployment.
- 2. Knowledge sharing and capacity building:** ISGAN organises workshops, webinars, and expert meetings to disseminate cutting-edge knowledge. These activities provide stakeholders with the necessary tools and understanding to effectively implement smart grid solutions.
- 3. Innovation and research collaboration:** Through its various Working Groups, ISGAN promotes joint research projects, pilot programs, and innovation exchanges. This allows countries to work together to address technical and systemic challenges.
- 4. Global benchmarks and metrics:** ISGAN develops performance metrics and benchmarks that allow countries to evaluate their progress and identify areas for improvement in their smart grid initiatives.
- 5. Outreach and engagement:** ISGAN fosters dialogue among diverse stakeholders, including policymakers, academia, and non-governmental organisations to ensure a wide range of perspectives informs global smart grid strategies.

## 2.5. Structure

Although ISGAN reports to both the CEM and the IEA, it operates formally within the IEA framework. Unlike traditional CEM workstreams, ISGAN operates under a legally binding Implementing Agreement that defines its participants' obligations. Participating countries are referred to as "Contracting Parties" and serve as signatories to the agreement. Together, they form the

**Executive Committee (ExCo), ISGAN's decision-making body.** Each Contracting Party appoints a **delegate** and an **alternate**. The ExCo meets in person twice a year to discuss new developments, identify knowledge gaps and implementation barriers, and shape ISGAN's Programme of Work accordingly.



Figure 1. ISGAN's 27 Contracting Parties

The ExCo is led by a **Chair and three Vice-Chairs**, who together form the Presidium. Each member of the Presidium is elected to a two-year term with the possibility of re-election. For ISGAN, it is important to have Chairs and Vice-Chairs from different continents

because this incorporates the specific interests and priorities of different regions into the Presidium's discussions. At the 30th ExCo meeting in October 2025, John Ward was re-elected Vice Chair.



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Figure 2. ISGAN Presidium

|  |   |  |   |
|--|---|--|---|
| <p><b>John K. Ward</b><br/>Vice-Chair</p> <p>Commonwealth Scientific and Industrial Research Organisation (CSIRO)</p> <p>Australia</p> | <p><b>Wickie Lassen Agdal</b><br/>Vice-Chair</p> <p>Danish Energy Agency</p> <p>Denmark</p> | <p><b>Luciano Martini</b><br/>Chair</p> <p>Ricerca sul Sistema Energetico (RSE)</p> <p>Italy</p> | <p><b>Atul K. Bali</b><br/>Vice-Chair</p> <p>Power Grid Corporation of India, National Smart Grid Mission (NSGM)</p> <p>India</p> |
|--|---|--|---|

The Presidium is supported by the **Budget Review Group**, which prepares budget proposals for meetings and executes budget decisions made during ExCo meetings. ISGAN is supported by a **Secretariat and Operating Agent**. The Secretariat and Operating Agent

is responsible for managing ISGAN’s communication activities and the Common Fund, supporting the Presidium and Working Groups, and reporting to the IEA. In 2025, ISGAN successfully transitioned to a new Operating Agent and Secretariat, **Zabala Innovation**.



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Figure 3. ISGAN Secretariat and Operating Agent

**Edoardo Genova**  
Secretariat Leader

**Marta Rodríguez**  
Communication Leader

**Alessandro Provaggi**  
Operating Agent

The **Co-Secretariat**, held jointly by the **Korea Smart Grid Institute (KSGI)** and **Korea Power Exchange (KPX)**, is responsible for supporting CEM communications and

events, organising the ISGAN Awards of Excellence, and coordinating activities in Asia.



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Figure 4. ISGAN Co-Secretariat

**JaeWan Seong**  
KPX

**SungJi (Chloe) Yoon**  
KSGI

**AhRam An**  
KSGI

## 2.6. Partner organisations

ISGAN actively collaborates with various organisations to promote innovation, knowledge exchange, and strategic alignment in the global energy transition. It has

signed memorandums of understanding (MoUs) and/or organised joint activities, such as webinars, with them. The figure below illustrates ISGAN's key partnerships:



- ISGAN works closely with the **International Energy Agency (IEA)** and other Technology Collaboration Platforms (TCPs) on power system-related research. It is part of the Working Party on Renewable Energy Technologies (REWEP).
- As a **Clean Energy Ministerial (CEM)** initiative, ISGAN provides policy support and briefings at various CEM events and meetings. Other collaborative efforts include coordination with other CEM initiatives and external communication.
- The **21st Century Power Partnership (21CPP)** is a multilateral CEM initiative that aims to accelerate the global transformation of power systems. It serves as a platform for public-private collaboration to advance integrated policy, regulatory, financial, and technical solutions for the large-scale deployment of renewable energy, alongside deep energy efficiency and smart grid solutions. The initiative aims to add value to ongoing power system transformation efforts by expanding the network of expertise, accelerating learning and knowledge sharing, and raising the profile of national efforts.
- The **Clean Energy Solutions Centre** empowers governments, advisers, and analysts to develop effective policies and programmes that encourage the adoption of advanced energy technologies and promote access to affordable, reliable, and secure energy. As a comprehensive knowledge portal, it provides access to a wide range of online energy resources, including policy best practices, data, and analysis tools.
- The **Clean Energy Transition Partnership (CETPartnership)** is a multilateral and strategic partnership of national and regional research, development and innovation (RDI) programmes in European Member States and Associated Countries, aiming to boost and accelerate the energy transition and to support the implementation of the European Strategic Energy Technology Plan (SET Plan).
- European Technology and Innovation Platforms (ETIPs) were created by the European Commission as part of the new Integrated Roadmap Strategic Energy Technology Plan (SET Plan), bringing together experts from a variety of energy sector stakeholders.

The role of the **ETIP Smart Networks for Energy Transition (SNET)** is to guide research, development and Innovation to support Europe's energy transition.

- The **Global Power System Transformation Consortium (G-PST)** is a public-private collaboration connecting power system operators, industry, and leading research institutions to address the key technical challenges involved in operating the secure, affordable and advanced power systems. Participants work to accelerate the development of technical solutions that will enable the greatest possible progress in power system modernisation worldwide. The G-PST also coordinates peer learning networks and the delivery of technical assistance at country level efforts for Africa, Asia, and Latin America and the Caribbean through regional partner organisations.
- The **Green Powered Future Mission (GPFM)** is one of the seven missions under the global Mission Innovation (MI) initiative. Its goal is to demonstrate that by 2030 power systems in different geographical regions and climates will be capable of effectively integrating up to 100% of variable renewable energy into their generation mix while maintaining cost-efficient, secure, and resilient systems. The GPFM Action Plan includes the flagship projects "5 Demos in Five Continents" and the "Multilateral Research Programme", whose results will populate a toolbox of innovative grid solutions to help countries build a renewable-powered future and realise an affordable clean energy transition.
- The **Global Smart Energy Federation (GSEF)** is not-for-profit corporation established in 2010. It is an association of major smart grid stakeholder associations and initiatives, committed to sharing smart grid best practices and providing countries seeking to deploy smart grids with easy access to clean technology, policy, and project insights to countries. This will enable them to enhance security, increase flexibility, reduce emissions, and improve affordability, reliability and accessibility in the most cost-effective manner.
- The **High Temperature Superconductivity (HTS) TCP** evaluates the current status of HTS and its potential future applications in the electric power sector and aims to share these findings with decision-makers in government, industry, and the research and community.
- The **Hydrogen TCP** was established under the auspices of the IEA in 1977 to promote collaborative research and development of hydrogen technologies, as well as the exchange of information, among its member countries. It envisions a future in which on a clean, sustainable hydrogen plays a key role in all sectors of the global economy.
- The **Industrial Energy-Related Technologies and Systems (IETS) TCP** focuses on energy use in a broad range of industry sectors, uniting IEA activities in this area. The work included in IETS ranges from the development of specific process or energy technologies to the consideration of overall system aspects, with energy efficiency playing an important role in practically all industrial sectors.
- The **Photovoltaic Power Systems (PVPS) TCP** is one of the collaborative R&D agreements established within the IEA. Since its establishment in 1993, participants have conducted a variety of joint projects applying photovoltaic technology to convert solar energy into electricity.
- The mission of the **User-Centred Energy Systems (Users) TCP** is to provide policy-relevant evidence on the factors that influence energy use and technology acceptance, and their impact on society. It provides an international platform for social researchers, economists, political scientists, and policymakers to collaborate on compiling and sharing the best practice policy-relevant research on the energy transition.



## 3. ISGAN's vision for a sustainable future

### 3.1. The role of smart grids in the energy transition

Smart grids are the foundation of a modern electricity system capable of supporting the clean energy transition. **As electricity demand grows and power systems become increasingly decentralised, digitalised, and interconnected, smart grids enable renewable energy sources, distributed energy resources (DERs), energy storage, electric vehicles (EVs), and other emerging technologies to be integrated easily.**

Unlike traditional electricity networks, which were designed around centralised generation and one-way power flows, smart grids facilitate **two-way exchanges of both electricity and information. Advanced sensors, smart meters, and automated control systems** give grid planners, system operators, consumers, and other stakeholders greater control and flexibility in managing increasingly complex power systems.

Smart grids are not just about technology. They combine **physical infrastructure, digital solutions, market mechanisms, regulatory frameworks, and**

**stakeholder participation** to ensure that electricity systems remain secure, affordable, and efficient while supporting decarbonisation objectives. By facilitating better coordination between transmission and distribution network operators, utility providers, and consumers, smart grids help to **optimise the use of existing infrastructure and reduce the need for costly network reinforcements.**

The **growing electrification of transport, heating and cooling, industry, and emerging sectors** such as hydrogen production is putting new demands on electricity networks. At the same time, the rapid deployment of variable renewable energy sources requires greater **system flexibility, interoperability, and resilience** in the face of challenges such as power outages, cyber threats, and natural disasters. Smart grids can address these issues by supporting **real-time system management, facilitating the integration of distributed resources, improving situational awareness, and enabling more informed planning and operational decisions.**

### 3.2. Trends shaping the future of smart grids

#### 3.2.1. Technological innovations

The world is entering the **Age of Electricity**, with demand for electricity is growing much faster than the overall energy use. This, coupled with the expansion of variable renewable energy sources, is putting pressure on grid operators to make better use of existing infrastructure and deploy new solutions more quickly.

The **growing demand for electricity** is driven by new electrified end uses and digital infrastructure, including EV adoption, data centre and 5G expansion, and the electricity-intensive manufacturing of clean energy technologies.

At the same time, **renewable energy deployment** continues to increase, requiring electricity networks to manage a greater number of variable and distrib-

uted sources of generation. This shift is leading to the adoption of advanced grid technologies, such as grid-enhancing technologies, distributed energy resource management systems, digital substations, advanced forecasting tools, and **grid-forming technologies** capable of supporting system stability in an increasingly inverter-based power system.<sup>1</sup>

**Artificial intelligence (AI) and digitalisation** are becoming central to modern grid operation and planning. AI-based tools are being used more and more to improve forecasting, congestion management, predictive maintenance, asset management, flexibility optimisation, and system planning. Digital twins are also becoming more prominent as tools for simulating network behaviour, testing future scenarios, and supporting investment decisions in uncertain conditions.

As electricity systems become more complex and interconnected, **digital technologies** are enabling system operators to transition from a reactive to a predictive and increasingly autonomous approach. However, this growing digitalisation also increases exposure to cyber security risks and raises important questions about data governance, transparency, and the responsible use of AI.

Another notable trend is the continued growth of **distributed energy resources and local energy systems**. Energy communities<sup>2</sup>, local flexibility initiatives, and consumer participation mechanisms are becoming important elements in the operation of power system operation, demonstrating how local coordination and distributed resources can contribute to the integration of renewable energy, flexibility, and system resilience.

### 3.2.2. Regulatory and policy developments

Policies are being shaped by **energy security** concerns and the need to accelerate the deployment of clean energy. In 2025, over 80 new energy innovation policies and 60 new initiatives were introduced.<sup>3</sup> Policymakers are focusing on enabling flexibility, accelerating grid connections, improving planning processes, and creating market structures capable of supporting large-scale renewable integration.

A significant policy development is the growing acknowledgement that **electricity network planning** can no longer rely solely on historical demand patterns and deterministic forecasts. Instead, regulators and system operators are adopting approaches that account for uncertainty, multiple future scenarios, and the interaction between different sectors of the economy.

This shift reflects the **growing complexity of electricity systems**. Decisions regarding charging infrastructure, renewable energy deployment, hydrogen production, energy communities, industrial electrification, and flexibility resources often involve stakeholders from outside the traditional electricity sector. As a result, planning processes are becoming more collaborative and increasingly require the participation of local authorities, regulators, infrastructure developers, communities, technology providers, and consumers.

This evolution is closely aligned with ISGAN's approach to long-term grid planning, which emphasises **broad stakeholder dialogue and coordination** across different groups of actors. Through the **Light-house Project**, ISGAN emphasises the importance of actor collaboration, governance frameworks, and information sharing as essential conditions for the effective long-term planning and implementation of smart distribution grids.

1 International Energy Agency (IEA). (2026). The State of Energy Innovation 2026. <https://www.iea.org/reports/the-state-of-energy-innovation-2026>

2 Ilo, A. (Ed.). (2024). Energy Communities' impact on grids. ETIP SNET and ISGAN. <https://op.europa.eu/s/Ain8>

3 IEA. (2026). The State of Energy Innovation 2026, p. 8.

At the same time, countries are **reforming connection procedures and network access arrangements** to manage growing connection queues and demand for grid capacity more effectively. There is a gradual shift away from purely first-come, first-served approaches towards more strategic planning models that prioritise system value, project maturity, and long-term network efficiency.

### 3.2.3. Investment and planning for future grids

Investment in electricity networks remains a critical priority worldwide. Significant capital is being invested in **expanding transmission and distribution infrastructure** to accommodate growing electricity demand and renewable energy deployment. However, there is also growing awareness that achieving the energy transition will require substantial investment in modernising and refurbishing existing assets, not only building new infrastructure.

Consequently, utilities and policymakers are placing greater emphasis on extracting more value from existing networks through digitalisation, flexibility, advanced operational practices, and grid-enhancing technologies. The focus is gradually shifting from building more grid infrastructure to making **better use of existing infrastructure**.

Investment priorities reflect the need to manage **uncertainty**. Challenges include long asset lifetimes, rapidly evolving technologies, changing customer behaviour and the pace of electrification. Consequently, planning methodologies that incorporate flexibility, scenario analysis, stakeholder engagement, and adaptive decision-making are becoming more important.

### 3.2.4. Smart grid deployment

Although progress varies across regions and technologies, the deployment of smart grids continues to accelerate. Smart meter rollouts, advanced distribution management systems, flexibility markets, digital platforms, energy communities, and grid-enhancing technologies are becoming more widespread.

A defining feature of current deployment efforts is the growing **integration of flexibility into system operation and planning**. Rather than relying solely on network reinforcement, system operators are increasingly using flexible resources such as demand response, energy storage, distributed generation, and active network management to address constraints and optimise network utilisation.

Another important trend is the growing **social dimension of the energy transition**. Consumers, communities, local authorities, and other non-traditional stakeholders are playing a more active role in electricity systems through energy communities, distributed generation, flexibility services, and local energy initiatives. Smart grids are therefore becoming not only a technological transformation, but also an institutional and societal one.

For ISGAN, these developments emphasise the need to address smart grids from **technical, economic, regulatory, and socio-technical perspectives** simultaneously. As electricity systems become more interconnected and complex, successful grid modernisation will depend not only on technological innovation, but also on collaboration, governance, stakeholder engagement, and the ability to plan under uncertainty.

### 3.3. ISGAN's operational priorities and focus areas

ISGAN is dedicated to advancing the global understanding of smart grid development, deployment, and operation while addressing critical knowledge gaps and fostering innovation. Its initiatives aim to identify and promote emerging solutions, facilitate technical collaboration, and recognise exemplary projects to encourage their replication on a large scale. By emphasising the integration of smart grid concepts into government policies and regulatory frameworks, ISGAN plays a vital role in shaping the energy sector's evolution.

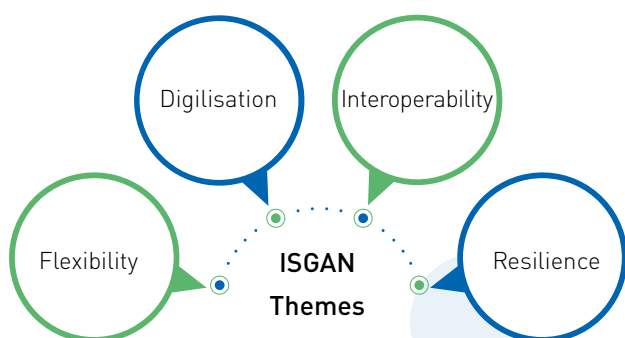
To achieve these objectives, ISGAN has **six Working Groups** designed to enhance global knowledge and collaboration. These efforts include identifying innovative tools and practices, enabling peer-to-peer

**knowledge sharing**, and fostering **international co-operation** within the smart grid community. ISGAN supports these goals through various activities, such as case books, discussion papers, workshops, webinars, fact sheets, and policy briefs, which provide actionable insights and technical guidance.

Moreover, ISGAN acknowledges exceptional projects and initiatives through its **awards program**, promoting their replication and broader adoption. This recognition highlights best practices and reinforces the importance of innovation in advancing smart grid technologies. By focusing on these strategic areas, ISGAN not only bridges knowledge gaps but also strengthens global efforts to create resilient, efficient, and sustainable energy systems.

### 3.4. ISGAN themes

At the core of ISGAN's efforts are four key strategic themes: **flexibility**, **digitalisation**, **interoperability**, and **resilience**. These pillars are vital not only to the modernisation of electricity grids, but also to achieving a sustainable, reliable, and future-ready energy ecosystem.



#### 3.4.1. Flexibility

Flexibility in the energy grid ensures that **supply and demand can adapt dynamically to fluctuations**

caused by changing consumer patterns or the integration of renewable energy sources, such as solar and wind power. This adaptability enables grids to manage peak loads, mitigate outages, and improve overall efficiency by allowing both physical infrastructure and operational strategies to effectively respond to changing conditions.

#### 3.4.2. Digitalisation

Digitalisation is transforming the way energy systems operate. By integrating advanced digital technologies such as sensors, data analytics, and artificial intelligence, grids can **monitor performance in real time, predict maintenance needs, and optimise resource allocation**. By integrating advanced digital technologies such as sensors, data analytics, and artificial intelligence, grids can **monitor performance in real time, predict maintenance needs, and optimise resource allocation** using digital tools to make grids smarter and more responsive to user needs.

### 3.4.3. Interoperability

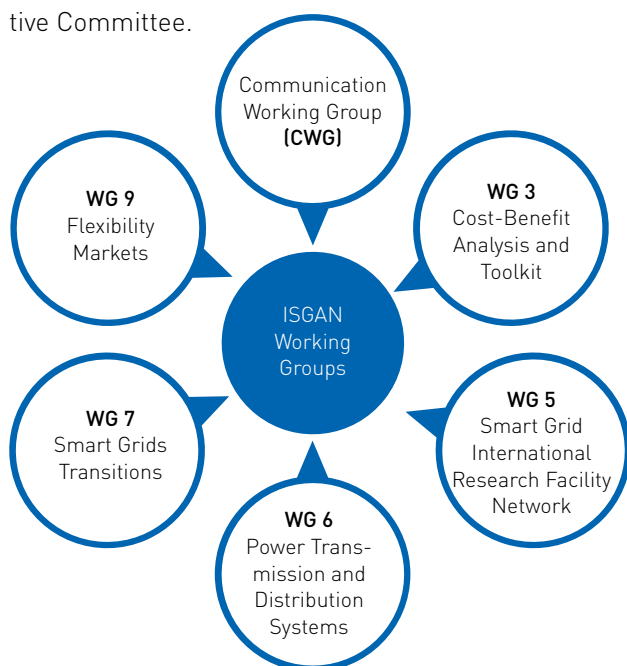
Interoperability ensures that various components of the energy system, including devices, networks, and software platforms, can **communicate and function together** seamlessly. Standardisation and collaboration across industries and borders are key to achieving this.

### 3.4.4. Resilience

Resilience involves creating energy systems that can **withstand and recover from disruptions**, whether caused by natural disasters, cyberattacks, or equipment failures. The resilience of the energy grid emphasises strategies and technologies that strengthen the grid's ability to absorb shocks, minimise downtime, and ensure the reliable delivery of energy, even in challenging circumstances.

## 3.5. ISGAN Working Groups

ISGAN organises its activities through standing Working Groups. Each Working Group operates under the direction of a manager and comprises national experts appointed by the member countries. The Working Groups' activities are planned annually and presented as the individual Programs of Work by the Working Group Manager and approved by the Executive Committee.



These themes encapsulate the essential dimensions of future energy systems and address the evolving demands and challenges faced by utilities, grid operators, end users, technology developers, policymakers, and other key stakeholders, along with their interplay.

These four themes encapsulate the key dimensions of future energy systems and address the changing needs and challenges faced by utilities, grid operators, end users, technology developers, policymakers, and other stakeholders, as well as the links between them. Together, they form the basis for ISGAN's priorities and provide a framework for navigating the rapidly evolving smart grid landscape. By promoting **international collaboration, knowledge sharing, and innovation**, ISGAN supports the development of smarter, more resilient, efficient, and sustainable energy systems.

Currently, ISGAN has six Working Groups:

- **Communication Working Group**
- **WG 3:** Cost-Benefit Analysis and Toolkit
- **WG 5:** Smart Grid International Research Facility Network
- **WG 6:** Power Transmission and Distribution Systems
- **WG 7:** Smart Grid Transitions
- **WG 9:** Flexibility Markets – Development and Implementation



Figure 5. Working Group managers



## 4. Highlights in 2025



### 4.1. ISGAN Lighthouse Project

#### 4.1.1. Summary of the Lighthouse Project

The Lighthouse Project aims to increase ISGAN's impact by promoting a **deeper understanding of and dynamic international dialogue about smart distribution grids**. This initiative aligns with the goals of the global energy transition, particularly the COP28 pledge to increase renewable energy capacity and improve energy efficiency. The first Lighthouse prototype required extensive inter-Working Group collaboration and stakeholder engagement to develop policy recommendations and tools for long-term grid planning and implementation.

The Lighthouse Project's vision is to unify ISGAN's focus on one overarching theme—smart distribution grids—to increase impact, promote knowledge sharing, and effectively engage stakeholders.

Key objectives include improving collaboration across Working Groups and producing impactful communications, including a policy brief and knowledge hub. Furthermore, the project engages diverse stakeholders in discussions about smart grid challenges.

#### 4.1.2. Activities and outcomes

Current activities include a webinar series on the Lighthouse Framework, explained in the [Knowledge Hub](#), and a **Knowledge Sharing Process (KSP)** focused on collaboration between key actors.

The KSP is an integral part of the Lighthouse Project, focusing on understanding how collaboration between key groups of actors enables (or obstructs) effective long-term planning and implementation of smart distribution.

Through a series of **workshops**, it invites external stakeholders to contribute their experience and knowledge to the process. Together, they co-develop knowledge with and for practitioners in dedicated workshops. Four such workshops took place between June and September.

#### 4.1.3. Key deliverables

- The ISGAN **Casebook on Long-Term Planning and Implementation of Smart Distribution Grids** will describe new methods and tools for planning and developing smart distribution grids and highlight pioneering approaches and cases of implemented innovations from around the world.

- A **policy brief** with key policy messages and recommendations on long-term planning and implementation of smart distribution grids will be released at CEM17. This document is intended to provide a concise and policy-oriented contribution, helping decision-makers identify practical priorities for more resilient and future-ready electricity systems.

#### 4.1.4. Webinars and workshops

The five-part **webinar series**, which disseminates knowledge and explores interesting aspects of the Lighthouse framework, began in 2025. Three Lighthouse Project webinars were held between September and October.

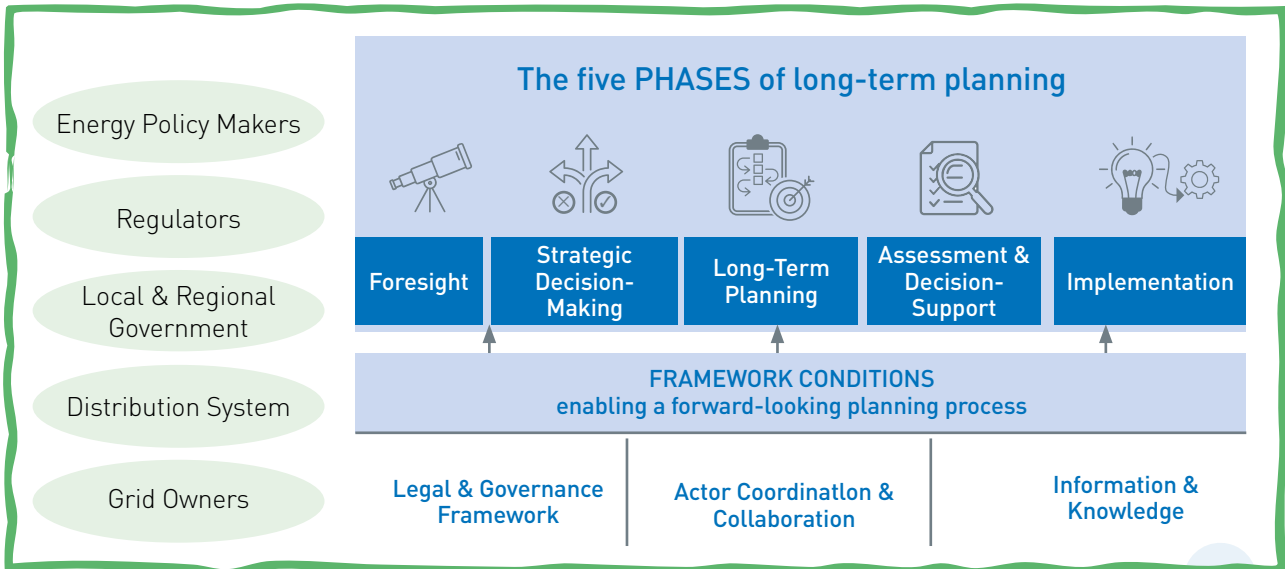


Figure 6. Phases of long-term planning (© Helena Lindquist)

The first two webinars covered the **foresight phase**, which plays a crucial role, together with strategic intelligence, in the long-term strategic planning of future resilient distribution grids, particularly in uncertain and complex environments like those related to the energy transition and climate change mitigation and adaptation. This phase ensures that

strategic decisions and plans are based on robust, actionable information, even when accurate predictions of future grid requirements are impossible. The first webinar examined the **challenges of incorporating foresight and strategic intelligence into grid planning**, which is vital for the energy transition and climate resilience.



Figure 7. Foresight and strategic decision making webinar

The **second webinar** focused on solutions and practical methods for incorporating foresight

and strategic intelligence into distribution grid planning.

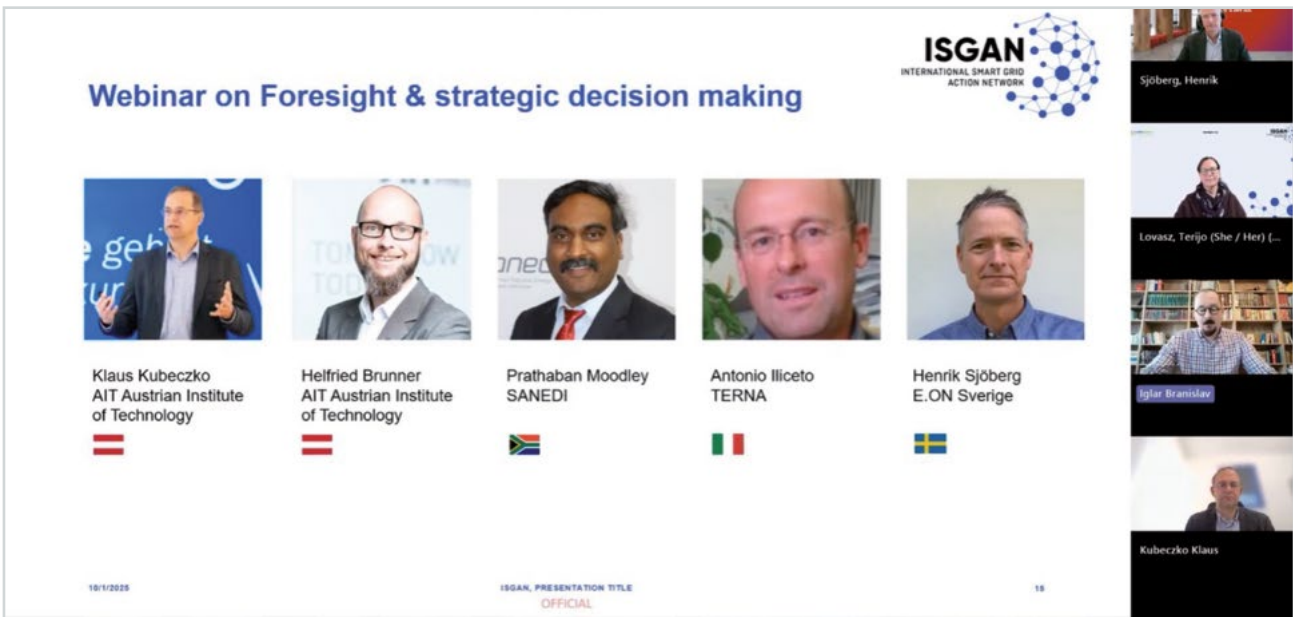


Figure 8. Webinar on solutions and practical methods for foresight and strategic decision making

The third Lighthouse webinar centred on **key considerations in long-term grid planning**, including technical integrity, system reliability, compliance with

standards and regulations, and financial impacts, to ensure resilience and interoperability.

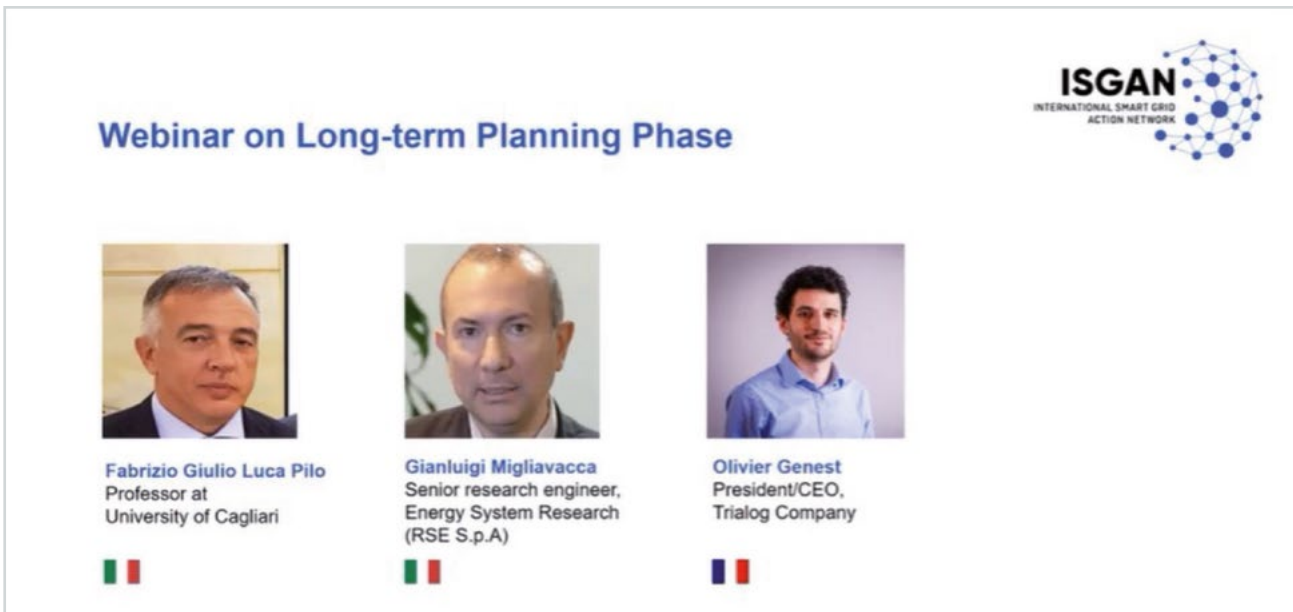
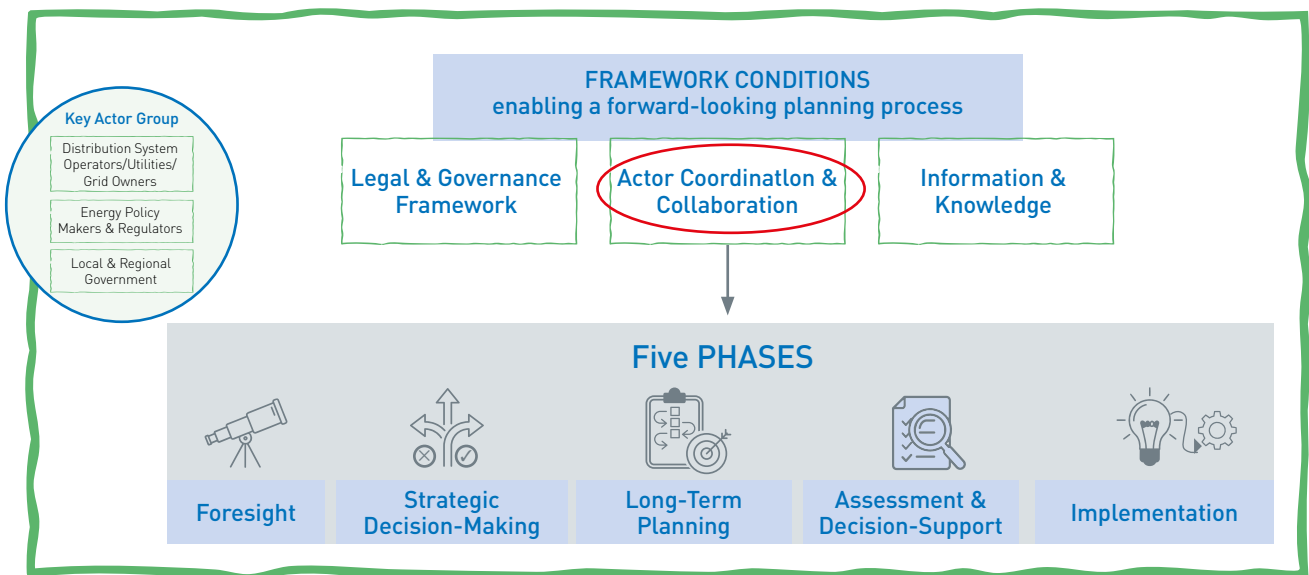


Figure 9. Webinar on key considerations in long-term grid planning

Furthermore, five **KSP workshops on actor coordination and collaboration** for the forward-looking planning of smart distribution grids were held in 2025. These workshops delved deeper into accelerat-

ing smart grid adoption by strengthening coordination and collaboration across the ecosystems of actors involved in the long-term planning and implementation of the smart distribution grids for the future.



The workshops bring together a core group of ISGAN national experts and invite external stakeholders to contribute their experience and knowledge to the

process, co-developing knowledge for and with practitioners.

## 4.2. 16th Clean Energy Ministerial

ISGAN had a strong presence at the 16th Clean Energy Ministerial (CEM16), held in Busan, South Korea, from 25 to 27 August 2025, where it organised the 11th ISGAN Awards of Excellence ceremony and a successful side event co-hosted with KEPCO on the role of distribution grids and DC technologies for power system modernisation.

ISGAN was also represented in high-level international discussions, including a roundtable organized by ISGF/GSEF on grid resilience, battery solutions,

and vehicle-to-grid (V2G) integration, contributing to the exchange of knowledge and best practices among stakeholders.

The joint CEM16/MI-10 ministerial meeting brought together high-level representatives from governments, industry, international organisations, and research institutions from around the world to discuss key challenges and opportunities related to innovation for the clean energy transition and international cooperation.



### 4.2.1. 11th ISGAN Awards

The **11th ISGAN Awards of Excellence** ceremony, held on 25 August 2025, was jointly organised with the Hydrogen TCP Awards of Excellence, highlighting the organisations' shared commitment to accelerating the energy transition through innovation and international collaboration. By recognising replicable projects from around the world, the annual awards facilitate peer learning and foster collaboration among policymakers, industry leaders, and experts. Under this year's theme, "**Solutions for Enhanced Grid Operations**", the awards showcased scalable innovations and connected policymakers and industry leaders to advance smarter, more flexible, and resilient power systems through international collaboration.

A wide range of smart grid nominations were received, representing projects from ten countries worldwide. The winning projects were selected by an independent international jury of smart grid experts, led by Reji Pillai Kumar, Chair of the Global Smart Energy Federation (GSEF). The jury chose the winning projects based on the following five criteria: potential impact, economic rationale, **potential for replication and adaptation, innovation, and other benefits.**

The award recipients were announced during the ceremony, with Mr Kyoungsoo Lee, Director of the Energy Policy Division at the Ministry of Trade, Industry and Energy (MOTIE) of the Republic of Korea, and Mr Damitha Adikaari, Director for Science and Innovation, Climate and Energy at the Department for Energy Security and Net Zero (DESNZ) of the United Kingdom, joining as presenters.



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### 4.2.2. ISGAN-KEPCO event

On 26 August, ISGAN and the **Korea Electric Power Corporation (KEPCO)**, Korea's national utility, hosted a side event titled "**The Role of Distribution Grids and**

**DC Solutions for Modernisation**". The event explored the growing importance of distribution grids, the need for their continued evolution, and the role of DC technology in accelerating clean energy deployment and transforming the power sector.



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- Opening remarks by Il-Joo Moon, Chief Technology Officer at KEPCO; Yeonwoo Choi, Director-General at the Ministry of Trade, Industry and Energy, and Luciano Martini, Chair of ISGAN
- Introduction to DC distribution in Korea by Wookyu Chae, Principal Researcher at the KEPCO Research Institute
- Panel discussion, moderated by Luciano Martini, with the following participants:
  - o Ali Izadi-Najafabadi, Head of Asia-Pacific at BloombergNEF
  - o Harry Stokman, CEO at DC Expert BV
  - o Reji Kumar Pillai, Chair of the Global Smart Energy Federation (GSEF)
  - o Julio Braslavsky, Senior Principal Scientist at CSIRO Energy
  - o Sungjin Oh, Energy Analyst at the International Energy Agency (IEA)
  - o Seulki Kim, Distinguished Researcher at the Korea Electrotechnology Research Institute (KERI)



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### 4.2.3. ISGF roundtable on grid resilience and V2G integration

As part of the CEM16/MI-10 programme, Luciano Martini contributed to the international roundtable “Driving Grid Resilience – Battery Solutions and V2G Integration in the Era of Electric Mobility”, organised by the India Smart Grid Forum (ISGF). The session explored the role of battery storage and

Vehicle-to-Grid (V2G) technologies in enhancing the flexibility, resilience, and reliability of power systems amid the growing electrification of transport.

During the discussion, he shared ISGAN’s experience and activities, highlighting the importance of international cooperation, knowledge exchange, innovative technological solutions and emerging approaches to integrating electric mobility and grid operations.



# 5. Insights from ISGAN Working Groups

This section showcases the invaluable insights and progress made by ISGAN’s Working Groups in the past year. These collaborative efforts have been instrumental in advancing ISGAN’s understanding of smart grid technologies and their integration into operational frameworks. Through knowledge and expertise sharing, the Working Groups have leveraged these

insights to enhance the efficiency, sustainability, and resilience of power system networks. ISGAN Working Groups examine the topic of smart grids from various perspectives and use different methodologies. In doing so, they complement one another through their distinct viewpoints and the various approaches they use to generate knowledge.

## 5.1. Communication Working Group

The ISGAN Communication Working Group (CWG) is a central hub for knowledge management and outreach within ISGAN. Its core mission is to **collect, summarise, and disseminate information about ISGAN’s activities**. As a cross-cutting entity, the CWG collaborates closely with all the other ISGAN Working Groups to support their communication needs and amplify their findings.

The CWG’s work revolves around six tasks:

1. **Synthesising findings** into accessible formats for various stakeholders.
2. Identifying and promoting **national priorities and best practices** through casebooks and workshops.
3. Facilitating **structured knowledge exchange initiatives**, such as the Lighthouse Project.
4. Organising virtual learning opportunities, like **webinars**.
5. Executing **outreach and liaison** functions with other organisations.
6. Creating **public media** content.

Dissemination and outreach are key functions of the CWG. Recognising that implementing smart grids, technologies, and systems requires engagement from diverse stakeholders, including policymakers,

governing bodies, transmission system operators (TSOs), distribution system operators (DSOs), and non-governmental organisations (NGOs), the CWG produces and shares resources, such as publications, webinars, and workshops. These activities promote knowledge exchange, highlight emerging trends, and anticipate future developments. Although the materials primarily focus on policy, they are designed to engage a variety of audiences and advance national, regional, and global clean energy objectives.



Create and curate knowledge that relates and reinforces the vital role of smart grids in the energy transition and ISGAN activities.



Maximize the impact of ISGAN’s various activities by engaging with diverse stakeholders, both internally and externally.



Maintain current members and increase the audience for ISGAN activities.

### 5.1.1. Achievements in 2025

**Phase 2 of the Lighthouse Project** began in 2025 with multiple CWG-led activities aimed at developing new knowledge products to be released at CEM17. A total of seven workshops were organised, including a **five-part webinar series on the new framework**. Analysis and planning meetings took place between each workshop.

Upcoming knowledge products resulting from these activities include a **Global Casebook** containing thir-

teen cases from ten countries and conclusions from the co-creation process on actor collaboration and the dissemination of Phase 1 outcomes, a **policy brief on multilevel governance for effective distribution grid planning**, new materials for the **updated Knowledge Hub**, and the final **Lighthouse report**.

In addition to the Lighthouse Project webinars, a **Virtual Learning webinar on managing collective self-consumption and local flexibility** was organised.

## 5.2. WG 3: Cost-Benefit Analysis and Toolkits

In order to reach the targets set for 2030 and 2050, an effective plan for the power system must be developed using modern planning and decision-making methodologies capable of addressing future challenges.

Working Group 3 develops **tools that help electrical system stakeholders identify investment requirements and priorities for smart grid systems and regulatory advancements**. These tools enable the creation of tailored business cases by factoring in existing regulatory and market frameworks, the system's current state, available resources, generation assets, and demand profiles. Additionally, WG 3 aims to establish a global framework and analytical methods to standardise the identification, definition,

and quantification of the benefits derived from the demonstration and deployment of smart grid technologies. Knowledge and experience sharing from participating countries serves as a solid foundation for this work.

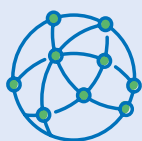
Working Group 3's flagship product is the **Smart Grid Evaluation Toolkit** (SmartGridEval), a web-based software offering a novel decision support tool for strategic smart distribution system planning. It integrates Multi-Criteria Analysis (MCA) and Cost-Benefit Analysis (CBA) to guide decision-making. Currently, the tool is being enhanced to expand its scope to include projects emphasising flexibility in system development and sector coupling, as well as to incorporate uncertainty management into its framework.



Development of tools to help analysts, regulators, utilities and other electricity system stakeholders to define and decide on system needs and priorities for smart grid system investment and regulatory changes.



Creation of a global framework and related analyses that can identify, define, and quantify in a standardized way the benefits that can be realized from the demonstration and deployment of smart grids technologies and practices in an electricity system.



Leverage existing knowledge and experience gained in different participating Countries as well as current international efforts underway and cooperation among major smart grids stakeholders globally.

## 5.2.1. Achievements in 2025

In 2025, WG 3 made progress in three areas: **methodological development for flexibility assessment**, renewal and promotion of the SmartGridEval platform, and systematic analysis of **hosting capacity evaluation and regulatory planning alignment**.

- Two complementary documents that address flexibility from implementation and methodological perspectives were finalised: the [Survey on Flexibility Market Implementation and Development](#) (May 2025) and the discussion paper **Methodologies for Assessing the Needed Flexibility** (November 2025). Together, these deliverables consolidate how flexibility is being defined, quantified, and organised across systems and countries and clarify the elements required for consistent comparisons of solution options in network planning.
- In parallel, WG 3 worked on renewing and **promoting the SmartGridEval web platform**,

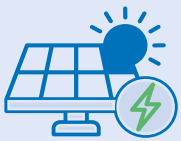
which is the digital interface that supports CBA and MCA-based evaluation. This included launching an online CBA calculation module to enable users to perform evaluations and producing updated communication materials, such as a redesigned flyer and graphic assets for training and dissemination, supported by the CWG and the Operating Agent.

- WG 3 also advanced its analytical work on **hosting capacity**, focusing on the capability of distribution networks to integrate distributed energy resources (DERs) without compromising service quality or reliability. The forthcoming report, “State of the Art Analysis on Techniques for the Estimation of Hosting Capacity for Distribution Networks” (under review and scheduled for publication in Q1 of 2026), provides a systematic review of deterministic, probabilistic, and AI-based methodologies for quantifying hosting capacity.
- A **joint activity with WG 7** under the Lighthouse Project framework was developed on participatory processes for determining investments in DERs.

## 5.3. WG 5: Smart Grid International Research Facility Network

The Smart Grid International Research Facility Network (SIRFN) is a network of smart grid research and testbed facilities located in ISGAN-participating countries. Participants in Working Group 5 coordinate joint activities related to testing relevant modern, “smart” electricity grids.

WG 5’s collaborative testing and evaluation capabilities are intended to enable the international community to improve the design, implementation, and testing of smart grids and their functionalities, including the reliable integration of clean energy technologies.



Research and testing facilities, test beds, testing projects: identification of collaboration opportunities among test facilities, state-of-the-art testing practices, identification of testing protocols needing attention.



Strong and active community of researchers engaging in applied research and impactful work on Smart Grids testing: DER, power systems, microgrids, protocols for advanced inverter functions for PV and storage integration etc.



Smart Grid Modelling: Server and interfaces to use these systems and topologies. SunSpec Alliance System Validation Platform, to reduce barriers to testing in emerging / developing economies.



Open source software tools, test cases and procedures to be used by DER vendors, universities, research institutions, certification laboratories, standards organisations, etc.

### 5.3.1. Achievements in 2025

In 2025, SIRFN held monthly coordination meetings and regular JRA meetings, participated in several workshops, organised two guest lectures, contributed to a book, and collaborated with the European Committee for Electrotechnical Standardisation (CENELEC) TC8X WG03 on the topic of “Recommended Testing Sequence of Grid Forming Inverter Grid Integration” and with the RISEnergy project on research infrastructure services and transnational lab access. WG 5 members participated in the following events:

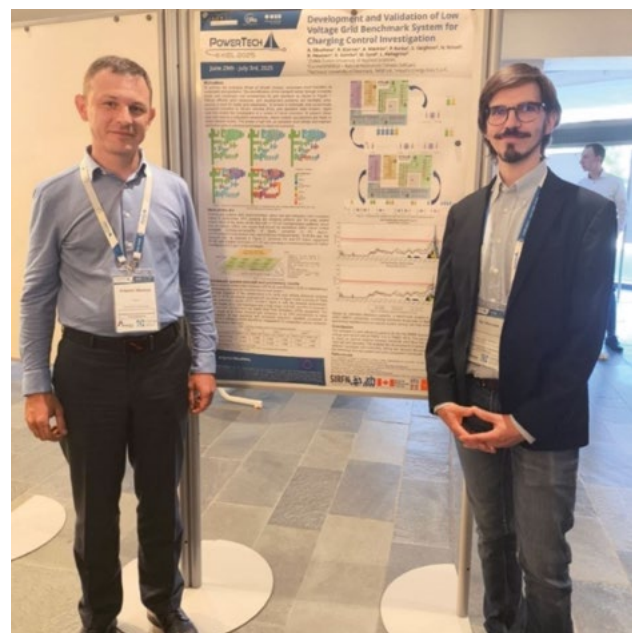


Figure 10. Poster presentation at IEEE PowerTech 2025

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| Event  | WG 5 Contribution   | Organisation  | Date and Location |
|--|---|---|-------------------|
| <b>Guest lecture on P/HiL testing infrastructures and praxis-relevant applications</b> | Presentation about ISGAN and WG 5; panel session on research infrastructures and laboratories | European Distributed Energy Resources Laboratories (DERlab), Fraunhofer, Technical University of Dortmund (TU Dortmund) | January, Germany  |
| <b>IEEE PowerTech 2025</b>   | Participation in a panel discussion and poster presentations                                  | Zurich University of Applied Sciences (ZHAW)  | June, Switzerland |
| <b>IREDonline 2025</b>   | Participation   | DERlab  | June, online      |
| <b>Workshop on Advancing Interoperability in a Fragmented Energy System</b>            | Organisation, moderation, and participation in a side event at ExCo30                         | Sustainable Energy Authority of Ireland (SEAI), University College Dublin (UCD)   | October, Ireland  |

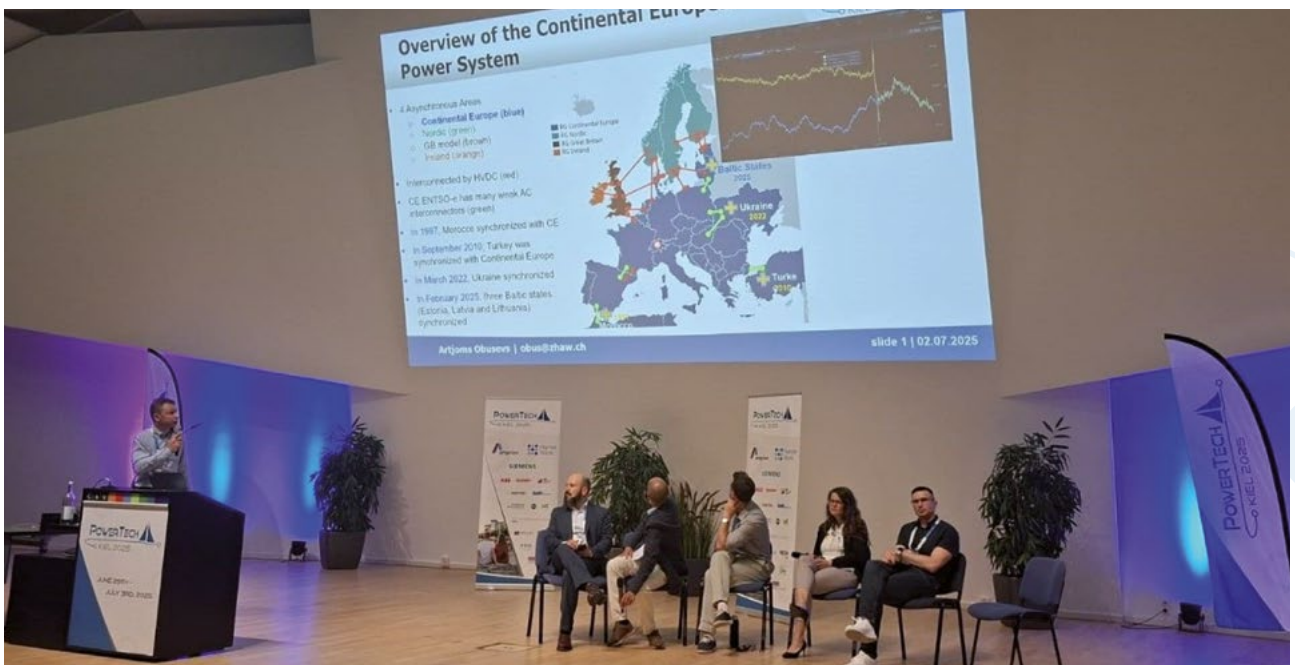


Figure 11. Panel discussion at IEEE PowerTech 2025

## 5.4. WG 6: Power Transmission and Distribution Systems

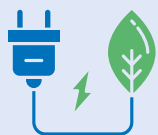
The focus of Working Group 6 is on **potential system-related challenges in the development of future smart grids**. Through knowledge sharing, the Working Group facilitates the application of advanced technologies needed for power grids to contribute to clean energy, climate, and sustainable energy access goals.

The Working Group promotes solutions that enable power grids to maintain and improve the security, reliability, and quality of the electric power supply while facing challenges, such as the expansion of electrification of the energy system to unserved areas, the integration of large-scale renewable energy sources

and distributed generation, the electrification of industries, heat and transport, increased customer participation, the replacement of aging infrastructure, and the integration of emerging, real-time information technology systems.

The main objective of WG 6 is to establish a **long-term vision for developing sustainable future power systems**. The Working Group will improve the understanding of smart grid technologies that are applicable to or influence power system performance and efficiency, accelerate their development and deployment and promote the adoption of related enabling policies.

By focusing on power system-related challenges and solutions, WG 6 provides ISGAN with a foundation for scientific discussions on the technological, market, and regulatory aspects of transmission and distribution systems. This work involves collecting, integrating, synthesising, and distributing information on smart grid technologies, practices, policies, and systems through discussion papers, webinars, papers, and presentations at relevant seminars, conferences, and workshops. It is important to process this information and deliver significant conclusions about the entire system. Knowledge sharing is essential within WG 6, and experts from the majority of ISGAN member countries are present, including system operators, policymakers, academics, and researchers.



Facilitate the application of advanced technologies needed for power grids to contribute in the best way to the attainment of clean energy, climate goals and sustainable energy access to all.



Solutions that enable power grids to maintain and improve the security, reliability and quality of electric power supply while facing challenges related to significant trends in the electricity sector.



Condense to conclusions and recommendations for policy makers: case books, discussion papers, workshops and collaboration with other initiatives.

### 5.4.1. Achievements in 2025

In 2025, one activity from 2024 continued, and five new activities and two pre-activities started. Two activities were in the finalisation phase. **Monthly coordination calls** were held to discuss ongoing Working Group activities, including presentations from national experts and other relevant parties, such as the IEA.

WG 6 published two new **discussion papers**:

- Active System Management by DSOs
- Exploring the Interaction Between Power System Stakeholders: Insights from Pilot Projects

Barbara Herndler presented the results of the survey on grid impact from grid forming units at the **Advancing Interoperability in a Fragmented Energy System workshop** held in Dublin, Ireland, in October.

Two papers based on WG 6 activities have been approved for **CIGRE 2026**: “Enabling System Flexibility through enhanced TSO-DSO Coordination: Insights from Pilot Projects” and “Hydrogen sector impact on the power sector: power system development, grid planning and operation”. Additionally, several papers from the *Deploying flexibility for resilience - best practice* sharing activity were published in the IEEE Power and Energy Magazine. Throughout the year, WG 6 made progress in the following ongoing activities:

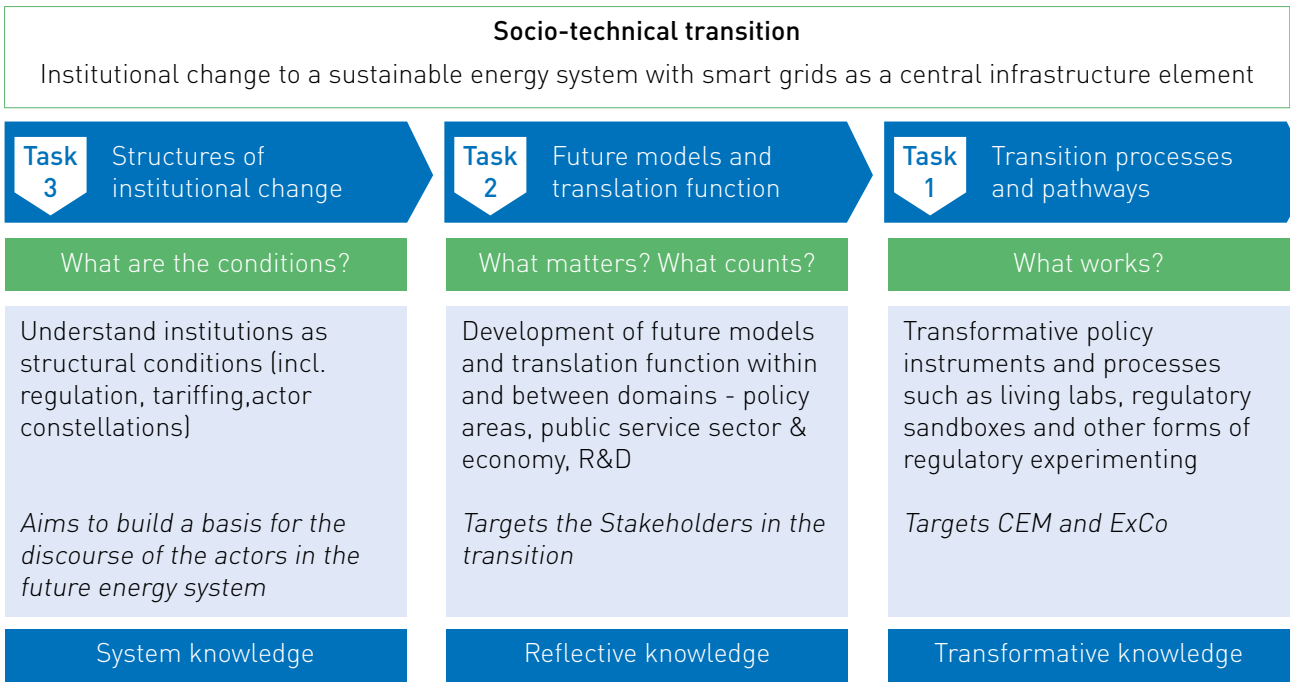
- **Activity 2023.02. Deploying flexibility for resilience – best practice sharing** (Lead: Norway)
- **Activity 2024.01. Hydrogen sector impact on power grid: production/storage/transport**
- **Activity 2025.01. The role of grid forming units and their impact on power systems and stakeholder interaction:** A survey was conducted and evaluated, with 35 responses received from around 20 countries. Respondents included representatives from academia, DSOs, TSOs, equipment manufacturers, and government/regulators. Literature and other materials were also reviewed. Work on the final report is ongoing. A webinar is planned for spring 2026.
- **Activity 2025.02. Long-term planning of residential distribution grids to facilitate electrification of space heating and transportation:** Scope definition is ongoing.
- **Activity 2025.03b. Lighthouse core activity:** WGs 5 and 6 are planning to lead the Lighthouse vertical public workshop/webinar on implementation.
- **Activity 2025.04. Lighthouse WG 6 contribution:** Several WG 6 national experts are involved in the Lighthouse project, moderating breakout sessions, contributing to integrated activities, and providing input for the upcoming casebook.
- **Activity 2025.05. Pre-activity cybersecurity studies for smart grid resilience:** A template to gather potential contributions has been distributed.
- **Activity 2025.06. Pre-activity on the potential of a multi-carrier approach to support electric grid development:** The intended scope has been identified, and a kick-off meeting has been organised.

## 5.5. WG 7: Smart Grid Transitions and Institutional Change

Working Group 7 aims to support policymakers in the field of electricity grids by addressing **issues related to the transition from the established institutional structures and governance processes to smart grids within the context of the energy system transition.**

It complements the work of other ISGAN Working Groups by focusing on the nontechnical aspects and framework conditions conducive to smart grid deployment. Its focus is on institutional change, including the governance of the electricity system, policies and stakeholder processes, regulatory aspects, and human behaviour. These topics are addressed by social science and humanities (SSH) disciplines, as well as transdisciplinary researchers who link SSH and engineering expertise.

WG 7's overall approach is to investigate the **socio-technical transition and governance issues associated with smart grid deployment using two related frameworks: sustainability transitions and reflexive governance.** Future development is understood to be a socio-technical transition process. The scope is determined by institutional change processes with electricity grids as the central infrastructure element. The work is divided into three thematic areas tailored to the needs of the target groups, which span the range from understanding the underlying conditions (systemic knowledge) over questioning the current models or relationships (reflective knowledge) to developing processes and possible pathways (transformative knowledge).



Future models and translation function: between domains role and implantation of the public sector in security of supply and operation of critical infrastructures.

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Structures in institutional change: regulation, tariff setting and incentives in smart grids.

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Transition processes: Policy instruments and governance processes including regulatory experimentation as a policy instrument of regulatory learning.

### 5.5.1. Achievements in 2025

In 2025, WG 7 presented at two **workshops of the International Sandbox Community of Practice** on innovative practices in legislation around emerging technologies and experiences with regulatory sandboxes in Spain, as well as at the EUSAiR co-creation workshop on AI regulatory sandboxes and the

International Sustainability Transitions Conference. WG 7 experts moderated and participated in two **KSP webinars on foresight and strategic decision-making**, contributing to shaping methodological approaches, stakeholder engagement processes, and governance insights. The first workshop focused on challenges, and the second on solutions.



The development of the **ISGAN Smart Grid Transitions Wiki** centred on content quality and website integration. The structure and content of the main pages were updated for greater clarity and readability, and the initial set of topics was revised further. Work will continue on integrating the core set of topics into the Wiki website and developing the next batch of topics.

Following an initial alignment with the BRIDGE initiative, ISGAN's activities were presented by WG 7

expert Klaus Kubeczko at the **BRIDGE Consumer and Citizen Engagement Plenary**.

At the ExCo30 workshop **“Changing Structural Conditions – Activating flexibilities through Price Signals”**, WG 7 presented recommendations for further developing tariff structures, to support energy system flexibility and the energy transition. This work has been submitted for publication as a scientific paper and is currently undergoing peer review.

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WG 7 engaged in three cross-cutting activities:

- WGs 3 and 7 work together on investigating the **role of participatory processes in making informed decisions about renewable energy infrastructure**.
- WGs 7 and 9 collaborate on **grid planning for consumer flexibility**, connected to WG 7's subtask 3.1 on grid tariffs and WG 9's task 2 on pricing for flexibility.

WG 7 worked on three publications and one conference presentation:

- Bauknecht, D.; Bolwig, S.; Kubeczko, K.; Rohrer, H.; Wiczorek, A. J. 2025. *Lock-Ins in Sustainable*

*Energy Transitions: A Forward-Looking Perspective*.

- Weber, K.M., Kubeczko, K. 2025. Transformative Innovation, Industrial and Infrastructure Policy for Energy Transition. In Bauknecht, D. (Ed.), *Energy Transitions: A Multidisciplinary Approach*. Elsevier.
- Corinaldesi, C; Kirchler, B. 2025. *Designing Fair and Flexible Electricity Grid Tariffs in Europe*.
- Kubeczko, K., Soloviy, V., Weber, K.M. 2025. Electrification as the multi-system transformation of the socio-technical infrastructure system & industrial production-consumption systems. Presented at the 16th International Sustainability Transitions (IST) Conference 2025, Lisbon, Portugal.

## 5.6. WG 9: Flexibility Markets – Development and Implementation

Working Group 9 focuses on the critical role of flexibility in smart grid development and operation. Its objectives are pursued across four key tasks:

- **Task 1: Flexibility-aware long-term system planning** aims to improve the understanding and application of flexible resources in distribution network planning. This involves reviewing emerging local flexibility market concepts, evaluating these markets alongside traditional network reinforcement solutions, and assessing the role of capacity market mechanisms in ensuring supply security amidst increasing renewable energy penetration.
- **Task 2: Price signals and tariffs for consumer flexibility** explores the evolving landscape of tariffs and price signals designed to incentivise consumer participation in grid flexibility. This includes analysing existing tariffs, their impact on consumption, identifying best practices, and understanding the underlying market drivers.
- **Task 3: Mechanisms for DSO remuneration with consideration of flexibility solutions** centres on gathering international insights into electricity distribution remuneration schemes to pinpoint and address regulatory barriers hindering the growth of local flexibility markets and to propose effective incentives.
- **Task 4: Flexibility market definition** aims to establish a shared understanding and definition of flexibility markets within the Working Group by examining various national implementations and characteristics and documenting them on the ISGAN Wiki.

Flexibility-aware distribution network planning integrates flexible resources such as demand response and energy storage into grid planning to manage constraints more efficiently. It reduces the need for costly infrastructure upgrades and supports the integration of renewables.

Price signals and tariffs for flexibility can encourage consumers and providers to adjust their energy use based on grid needs. These financial incentives help unlock and direct flexibility where it's most valuable.

Coordination and interplay of different flexibility markets ensures efficient use of resources and avoids conflicting signals. Aligning these markets supports overall grid reliability and economic performance.

### 5.6.1. Achievements in 2025

In 2025, WG 9 produced three **factsheets** covering the integration of flexible resources into distribution network planning and concepts of flexibility provision by local resources and capacity mechanisms, including a [brochure](#) containing insights from stakeholder engagements with representatives from seven countries regarding the effective incorporation of flexible

resources, such as demand response, battery storage, and advanced grid management strategies.

In partnership with WG 7, WG 9 organised and contributed to a **workshop on activating flexibility through price signals** at ExCo30. It is currently producing a **discussion paper** on mechanisms for DSO remuneration that consider flexibility solutions, in collaboration with BRIDGE.



## 6. ISGAN Awards

Since 2014, ISGAN has partnered with the **Global Smart Energy Federation (GSEF)**, to recognise and showcase leadership and innovation through the annual ISGAN Awards of Excellence.

An **international jury panel** acknowledges excellence

in the innovation, integration, and transformation of smart grid systems by selecting winning projects based on their potential impact, economic rationale, potential for replication or adaptation, innovation and other benefits.

The winning projects in 2025 were the following:

**Name:** Energy Networks Association's Open Networks Programme

**Period:** 2017-20251

**Location:** London, United Kingdom

**Lead Organisation:** Energy Networks Association (ENA)

**Description:** The initiative aims to drive Britain's **transition to distribution system operation (DSO)** through collective progress toward net zero by enabling **local network operators to manage supply, demand, and constraints more effectively.**



**Name:** Energy Valley Micro Grid Project

**Period:** 2023-20271

**Location:** Naju, South Korea

**Lead Organisation:** Korea Electric Power Corporation (KEPCO)

**Description:** The project aims to solve grid instability by **stably integrating distributed resources, enhancing power quality, resilience, and efficiency** while reducing infrastructure costs and enabling flexible, reliable grid operation.



**Name:** Plug & pLay eneRgy ManagEment for hybrLD Energy Storage (PARMENIDES)

**Period:** 2013-20251

**Location:** Vienna, Austria

**Lead Organisation:** Austrian Institute of Technology (AIT)

**Description:** The project develops an **interoperable and ontology-based energy management system** for hybrid energy storage systems within local energy communities, addressing the challenge of **integrating distributed renewables and electrified demand.**



**Name:** greEN Energy hUBs for local integRated energy communities optimization (eNeuron)

**Period:** 2020-2025

**Location:** Italy, Poland, Portugal, and Norway

**Lead Organisation:** Eindhoven University of Technology

**Description:** The project transforms local energy communities into **integrated local energy communities**, introducing a **cloud-native, privacy-preserving toolbox** that co-optimizes electricity, heating, cooling, and gas across planning, day-ahead scheduling, and real-time 15-minute operations.



| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|--------|---------|-----------|----------|--------|----------|--------|
|        |         | 1         | 2        | 3      | 4        | 5      |
| 6      | 7       | 8         | 9        | 10     | 11       | 12     |
| 13     | 14      | 15        | 16       | 17     | 18       | 19     |
| 20     | 21      | 22        | 23       | 24     | 25       | 26     |
| 27     | 28      | 29        | 30       | 31     |          |        |

TimeLine total Use : 30 day

## 7. ISGAN events and webinars

The ISGAN communication strategy distinguishes between internal and external stakeholders and between experts and non-experts. In line with this strategy, ISGAN publishes its results in various communication products in order to make the information available at different levels of detail:

- Policy briefs for policymakers
- Discussion papers for researchers
- Videos for the general public
- Webinars for researchers and application experts

Information about these publications is shared via channels such as LinkedIn and the website and is also promoted at events with stakeholders.

Dissemination at the national level takes place in many different ways. In some cases, national mirror groups or national IEA TCP days provide opportunities to present results.

Dissemination channels and their impact:

**Website:** The ISGAN website is the main primary hub for publications and event information. In 2025, it underwent a complete overhaul, introducing a modern structure, improved navigation and full compliance with current accessibility and legal requirements. The redesigned platform strengthens the visibility of ISGAN's activities and provides clearer access to publications and Working Group outputs. It also experienced a significant increase in visits, reaching 610,000 unique visitors.

**Newsletter:** Biannual newsletters featuring updates on recent publications and upcoming events are distributed to subscribers. The newsletter has an open rate of 56%.

**Social media:** LinkedIn posts generated 50,716 impressions, 1,459 reactions, 34 comments, and 69 reposts.

## 7.1. ISGAN ExCo meetings

### 7.1.1. ISGAN ExCo 29 in Paris, France

From March 11 to 13, representatives from 17 countries and the European Commission met in Paris, France, for the **29th Meeting of the Executive Committee**, where they discussed the accelerated development and deployment of smarter, cleaner electricity grids.

The meeting at the headquarters of the IEA proved both productive and strategically significant. The program featured keynote addresses by Prasoon

Agarwal, Deputy Head of the CEM Secretariat, SeongBo Hyun, Deputy Director at the South Korean Ministry of Climate, Energy and Environment (MCEE), and Jacques Warichet, Power System Transformation Analyst at the IEA.

Among the key outcomes, participants approved the **next phase of the Lighthouse project**. This phase establishes a structured mechanism to advance long-term planning and implementation of smart distribution grids through coordinated collaboration among ISGAN Working Groups and international partners, under the leadership of Helena Lindquist.



© Austrian Institute of Technology (AIT)

Figure 12. ExCo 29



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Figure 13. ExCo 30

### 7.1.2. ISGAN ExCo 30 in Dublin, Ireland

Between 13 and 17 October 2025, the **30th ISGAN Executive Committee meeting** was held in Dublin, Ireland, hosted by the Sustainable Energy Authority of Ireland (SEAI). Representatives from 18 countries and the European Commission came together to share knowledge and coordinate ISGAN efforts to make smart grids more flexible, sustainable and resilient.

The three-day meeting included engaging discussions and strategic planning, including **keynote speeches** from William Walsh, Chief Executive Officer at SEAI; Declan Meally, Director of Business, Public Sector and Transport at SEAI; Pat Eccles, Senior Manager at ESB Networks, and Ruth Buggie, Head of Mobility and Smart Networks at SEAI.

Vincenzo Franza, the CEM Partnership Manager, provided a video update on CEM activities. IEA Energy Analyst Brendan Reidenbach presented the organisation’s latest updates, including the Secretariat’s 2025 priorities and reports such as the Electricity Mid-Year Update 2025 and Renewables 2025, regional reports. He also provided details of past and upcoming high-level events, such as the Summit on the Future of Energy Security and COP30.

Other highlights from the first day included Zabala’s presentation as the **new Operating Agent and Secretariat**. KSGI reported on the outcomes of ISGAN’s engagement at CEM16, including the KEPCO co-hosted side event on distribution grids and DC solutions for modernisation and the 11th annual ISGAN Awards of Excellence, held jointly with the Hydrogen TCP. ExCo members shared feedback on their participation in CEM16.

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Figure 14. Irish representatives



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Figure 15. Secretariat and Operating Agent

The second day was largely dedicated to Working Group updates, presented by the Working Group Managers. The day concluded with a **synergy session**, during which the ExCo delegates rotated around the various tables to learn more about each Working Group and provide feedback in small groups. Each table focused on a different action area of smart grid development to encourage discussion, the sharing of experiences, and the exploration of potential collaborations to further advance smart grid initiatives.

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Figure 16. WG Synergy Session

Day 3 was dedicated to communication activities, including presenting the Communication Work Plan and the **redesigned website**. The new version of the website focuses on modern design, user-friendliness, responsiveness to different devices, optimised navigation and access to information, and compliance with legal obligations.

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Figure 17. Visit to the ESB Renewables Centre

In the afternoon, the delegates visited the **ESB Renewables Operations Control Centre**, which monitors, coordinates, and controls the day-to-day operations, maintenance, and technical performance of renewable energy sites across Ireland.

Two **side workshops** were held at the premises of the Department of Climate, Energy and the Environment: “Advancing Interoperability in a Fragmented Energy System” (WG 5) and “Changing Structural Conditions – Activating Flexibilities through Price Signals” (WG 7 and WG 9).

Over 100 people in total attended the workshops, which brought together national and international experts, policymakers, researchers, and industry representatives.

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Figure 18. Welcome remarks by John Ward, ISGAN Vice Chair, at the first workshop

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Figure 19. Attendees



Figure 20. Presentation by Julio Braslavsky, Australian Alternate



Figure 21. Panel discussion



Figure 22. Panel discussion at the second workshop



Figure 23. Panel discussion moderated by Branislav Iglár, WG 7 manager



Figure 24. Panel discussion with Nicole Kerkhof-Damen, the Dutch Alternate

## 7.2. Other events involving ISGAN representatives

### 7.2.1. 30th United Nations Conference of the Parties (COP30)

As previous COP events, COP30 represented an important momentum for international dialogue on climate action to achieve global decarbonisation goals. ISGAN contributed to several high-level events with key stakeholders, sharing its expertise on smart grids, system flexibility, and renewable energy integration and underlining the importance of power systems transformation, and the critical role of innovation and international cooperation in enabling a sustainable energy transition.

On November 15, Luciano Martini participated in the **COP30 side event “Powering the 3X Renewables Goal. Advancing the CEM Agenda for Action on Power System Solutions”**, which was hosted by the CEM Secretariat at the Australia Pavilion.

The session brought together government representatives and international organisations to discuss how the **CEM Agenda for Action** is accelerating the transformation of global power systems to support the tripling of renewable energy capacity. The discussions emphasised the strategic importance of developing regions in advancing clean energy solutions and strengthening international cooperation.

Following opening remarks by David Higgins of the Australian Department of Climate Change, Energy, the Environment and Water, Jean-François Gagné, Head of the CEM Secretariat, outlined CEM’s role in power system transformation. He emphasised its

contribution to the 3X Renewables Global Pledge and other COP commitments.

The event featured a high-level panel discussion with representatives from the CEM Secretariat, the Australian Department of Climate Change, Energy, the Environment and Water, the World Economic Forum, the Utilities for Net Zero Alliance, and the International Renewable Energy Agency. The discussion was moderated by Jean-François Gagné.

During his intervention, Luciano Martini highlighted ISGAN’s contributions to the Agenda for Action on Power System Solutions. In collaboration with the 21st Century Power Partnership and other CEM initiatives, ISGAN has supported the identification of enabling conditions for large-scale renewable integration, with particular focus on grid modernisation, system flexibility, and smart planning.

ISGAN also contributed to the event **“Connecting continents, empowering transition: the promise of OSOWOG as a new blueprint for a net-zero world”**, held at the Solar Hub in the International Solar Alliance (ISA) pavilion and organised in collaboration with the Energy Transitions Commission.

In his capacity as ISGAN Chair, Luciano Martini emphasised the importance of modern, digital, and interconnected power grids as an essential prerequisite for the safe integration of large shares of renewable energy to support the energy transition.

By participating in COP30, ISGAN has reaffirmed its commitment to promoting research, innovation, and international cooperation for a sustainable energy future.

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Figure 25. Panel discussion at the COP30 side event



Figure 26. Panel discussion at the COP30 side event

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## 7.3. Virtual Learning webinars

ISGAN Virtual Learning aims to provide the energy community, including the energy industry, decision-makers, students, and the general public, with an efficient and effective way to continuously enhance and update their technical skills in the field of smart grids.

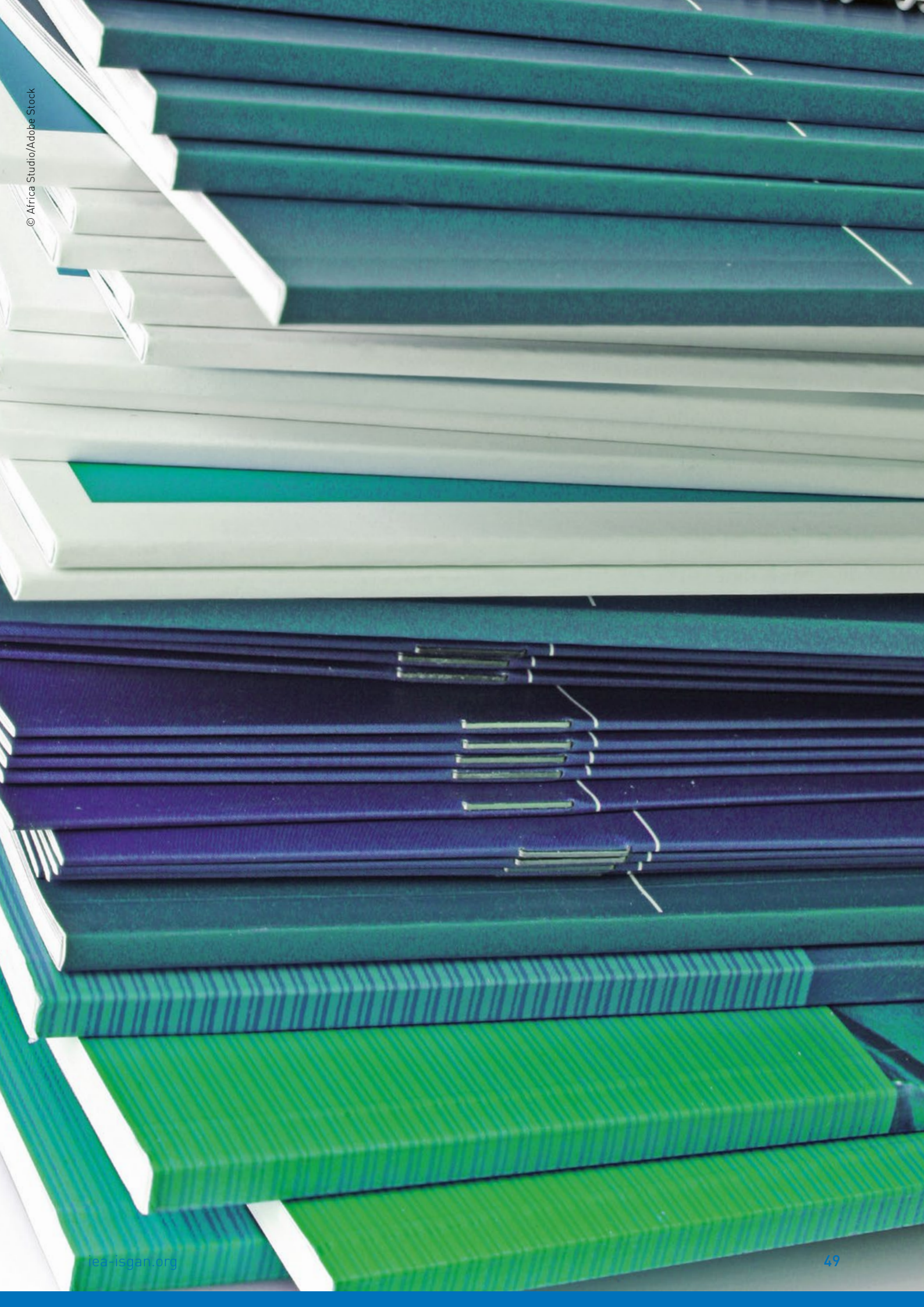
The webinar series offers the latest **information on emerging topics and challenges, recent advancements, best practices, and innovative methodologies** related to smart grids, as well as their theory, applications, and deployment. It also highlights events connected to ISGAN activities. Through the webinars, experts in smart grids from over 150 countries worldwide have been reached. Recordings of past webinars are available on the [ISGAN Virtual Learning YouTube channel](#).

In 2025, a webinar was held on **managing collective self-consumption and local flexibility using the RECreation platform**. The RECreation platform began as the Portuguese national project DigitalCER and was enhanced with flexibility market support in the BeFlexible project. It is also being integrated into the GDBN, a digital platform that supports the energy-centric flexibility value chain, and into SAP store and ecosystems.

The webinar delved into essential topics like self-consumption, sharing mechanisms, and allocation coefficients, as well as the structure and operation of Renewable Energy Communities (RECs). Topics included local energy markets, pricing mechanisms, transaction management, and settlement processes. Speakers discussed how RECreation can support REC participation in flexibility markets. A live demonstration of the platform highlighted its key functionalities and practical applications.



Figure 27. ISGAN Virtual Learning Webinar



## 8. ISGAN publications

### 8.1. Active System Management by DSOs

January 2025

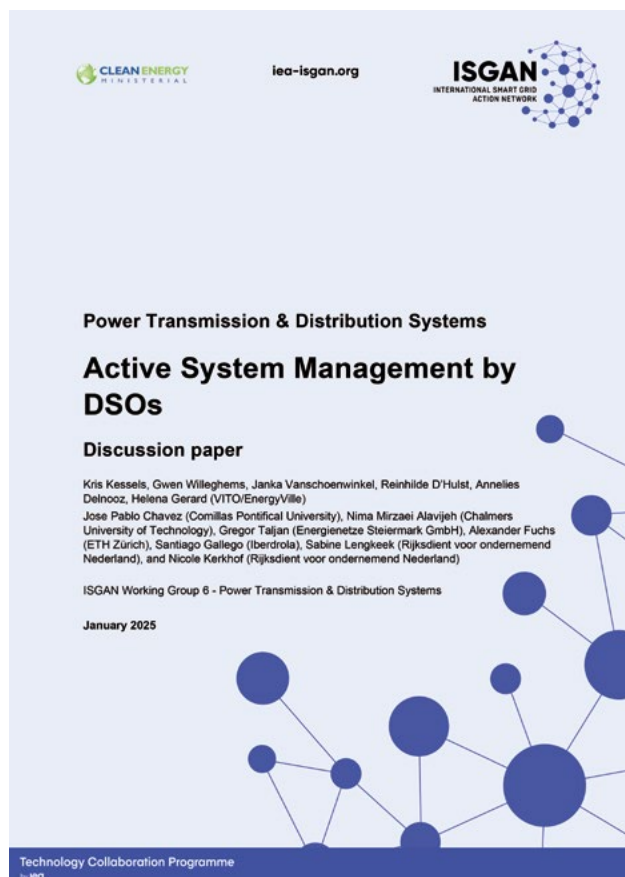


Figure 28. [Active System Management by DSOs](#)

This paper aims to provide insights into how DSOs can leverage active system management to cost-efficiently and securely manage their grids. These insights stem from a series of interactive workshops, complemented by case studies from literature, research projects findings, and real-world experiences shared by ISGAN members.

The paper discusses three key topics in detail:

**1. Market-based flexibility procurement by DSOs:** The design of flexibility procurement faces several challenges, particularly for low-voltage flexibility. One of these challenges is the lack of adequate prequal-

ification processes. Further analysis is needed to evaluate the implications of ex-post versus ex-ante product prequalification. Additionally, new flexibility services and products and new types of flexibility service providers (FSPs) and flexible resources require innovative baseline methodologies. Finally, aggregation models should be developed that are tailored to market frameworks, the types of products and services offered, and the types of FSPs and flexible resources involved.

- 2. Supporting grid tools for active system management:** Solutions for medium- and high-voltage grids cannot be directly applied to low-voltage (LV) grids, which often require simpler and more scalable approaches. To improve LV grid management, DSOs need increased visibility of LV grid needs and improved monitoring capabilities, including digital meters for all LV flexibility users. Enhanced modelling and estimation of flexibility impacts, improved congestion forecasting capabilities, and more detailed data on the specifications of connected flexibility sources are essential.
- 3. Applicability of flexibility mechanisms and their trade-off with investments:** Although substantial grid investments are needed, effectively using flexibility mechanisms can significantly reduce these requirements. DSOs must select the most suitable flexibility mechanisms based on economic and operational efficiency. There is no “one size fits all” solution; multiple complementary mechanisms will be necessary to address the diverse needs of DSOs and facilitate the energy transition.

In conclusion, integrating flexibility in the DSO domain is a multifaceted challenge that will require ongoing effort to ensure an effective and sustainable energy transition

## 8.2. 2024 Annual Report

June 2025



Figure 29. [2024 ISGAN Annual Report](#)

The 2024 Annual Report highlights ISGAN's ongoing commitment to accelerating the global energy transition by promoting smarter, more flexible, and more resilient electricity systems. It highlights the network's role in fostering knowledge exchange,

supporting policy frameworks, and promoting best practices among its diverse members.

A central focus of the 2024 report is the continued development of ISGAN's flagship initiative, the **Lighthouse Project**. Now entering its second phase, the project centres on the long-term planning and implementation of smart distribution grids under uncertainty. Key outputs include a widely recognised policy brief, the launch of the ISGAN Knowledge Hub, and a global series of workshops engaging stakeholders from 20 countries.

The report also documents major events, such as the **ExCo 27** meeting in Copenhagen, Denmark, the **ExCo 28** meeting in Incheon, Republic of Korea, and the **ISGAN Awards**, as well as the network's active participation in the 15th Clean Energy Ministerial (CEM15) and 9th Mission Innovation (MI-9) meetings. These gatherings provided opportunities to showcase ISGAN's contributions to the global "Agenda for Action on Power Systems Solutions".

In addition, the report features updates from ISGAN's six Working Groups, each of which contributes to key themes such as flexibility, digitalisation, interoperability, and resilience. It also includes a summary of the Virtual Learning webinars and a comprehensive list of publications released throughout the year.

## 8.3. Survey on Flexibility Market Implementation and Development

September 2025



Figure 30. [Survey on Flexibility Market Implementation and Development](#)

The growing use of renewable energy sources and increasing policy support for decarbonisation and decentralised energy systems, has sparked interest

in local flexibility markets across Europe. Within the framework of the EU's Clean Energy Package, DSOs are encouraged to explore flexible solutions at the local level to efficiently manage their networks and maintain grid stability.

In this context, **local flexibility markets** are structured mechanisms through which DSOs can procure variations in electricity consumption or generation from distributed energy resources, such as demand response, distributed generation, storage systems, and aggregators. These resources are activated to relieve local grid constraints, optimise asset utilisation, and defer network reinforcements, while ensuring the secure and reliable operation of the distribution grid.

The present report offers a descriptive analysis of the **questionnaire results**, primarily focusing on local flexibility markets. However, due to the diversity of responses and the varying stages of market development in different countries, the analysis also includes TSO-related mechanisms where relevant. Through the lens of these survey findings, the report aims to provide insights into current practices, perceived challenges, and opportunities for advancing flexibility market implementation.

## 8.4. Integrating Flexible Resources into Distribution Network Planning

October 2025

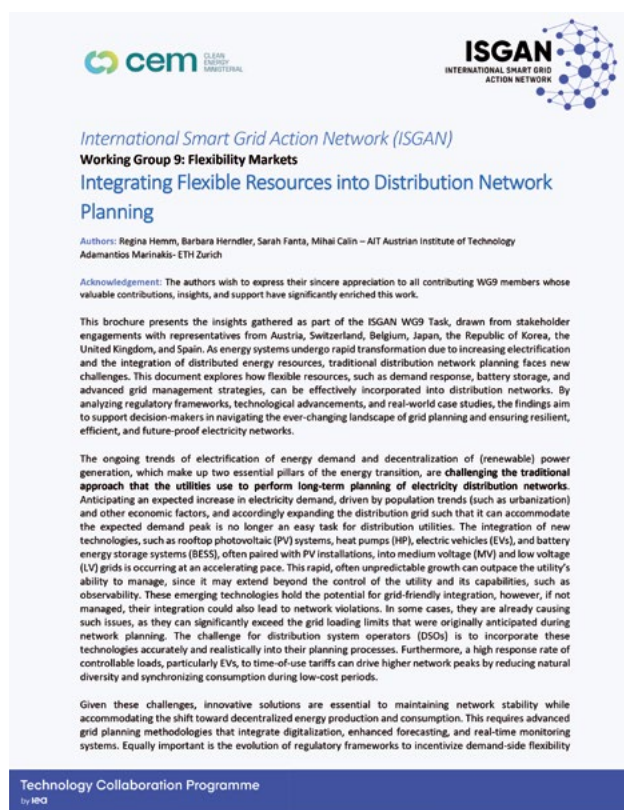


Figure 31. Integrating Flexible Resources into Distribution Network Planning

This brochure presents the insights gathered from **stakeholder engagements** with representatives from Austria, Belgium, Japan, South Korea, Switzerland, the United Kingdom, and Spain.

As energy systems undergo rapid transformation due to increasing electrification and the integration of distributed energy resources, traditional distribution network planning faces new challenges. This document explores how flexible resources, such as demand response, battery storage, and advanced grid management strategies, can be effectively incorporated into distribution networks.

By analysing regulatory frameworks, technological advancements, and real-world case studies, the findings aim to support decision-makers in navigating the ever-changing landscape of grid planning and ensuring resilient, efficient, and future-proof electricity networks.



## 8. Outlook

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In 2026, ISGAN will continue to build on the strong momentum generated in 2025, with a particular focus on scaling impact, strengthening Cross-Working Group integration, and delivering concrete outputs aligned with its four strategic themes: flexibility, digitalisation, interoperability, and resilience.

The Lighthouse Project will remain the central integrative initiative across ISGAN's activities. Following the extensive Knowledge Sharing Process and webinar series in 2025, Phase 2 will concentrate on finalising and disseminating the Casebook and the Knowledge Hub, to be launched at CEM17.

The **Communication Working Group** will continue refining ISGAN's outreach strategy, building on the redesigned website, expanded social media presence, and high newsletter engagement rate achieved in 2025. In 2026, communication efforts will prioritise targeted policy messaging, structured virtual learning formats, and clearer articulation of ISGAN's value proposition to different stakeholder groups.

**Working Group 3** will further enhance the Smart-GridEval platform by expanding its flexibility and uncertainty modules and strengthening its role as a decision-support tool for distribution system planning. The upcoming publication on hosting capacity methodologies will provide additional analytical grounding for integrating distributed energy resources into grid planning.

**Working Group 5** will continue advancing international research collaboration, including testing methodologies for grid-forming inverters and interoperability frameworks. Engagement with

standardisation bodies and research infrastructures will remain a priority to support scalable implementation of emerging technologies.

**Working Group 6** will deepen its focus on system-level challenges, including hydrogen-power interactions, grid-forming units, cybersecurity for smart grid resilience, and multi-carrier approaches. Working Group 7 will continue exploring institutional change, tariff reform, regulatory experimentation, and participatory processes, with an emphasis on integrating socio-technical perspectives into grid modernisation. Cross-Working Group collaboration on flexibility pricing and participatory investment decision-making will remain a core focus area.

**Working Group 9** will further develop its work on flexibility-aware system planning, DSO remuneration mechanisms, and consumer-oriented price signals. The ongoing discussion paper on DSO remuneration and the documentation of flexibility market definitions will contribute to greater clarity and international comparability.

As the current ISGAN term approaches its conclusion in February 2027, a comprehensive **strategic process** will be undertaken to define ISGAN's next phase. This process will aim to strengthen ISGAN's impact on knowledge sharing, policy advice, and international coordination, ensuring that the network remains at the forefront of global smart grid development.

Through sustained collaboration, focused thematic work, and targeted communication, ISGAN will continue to serve as a catalyst for advancing smarter, more flexible, and more resilient electricity systems worldwide.



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