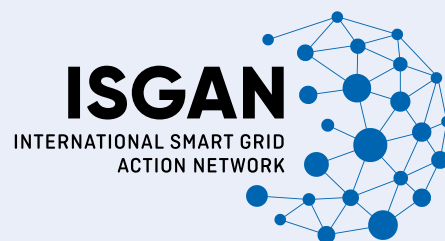


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International Energy Agency

Technology Collaboration Programme (IEA TCP)

**International Smart Grid Action Network (ISGAN)**

# Annual Report 2019

for the period from 1 March 2019 - 29 February 2020



# Disclaimer

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August 2020

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# Message from the Chair

It is my pleasure to present to you the ninth annual report of ISGAN. As both a Clean Energy Ministerial (CEM) initiative and an International Energy Agency (IEA) Technology Collaboration Programme (TCP), ISGAN continues to be a renowned strategic platform that brings together governments and support them in defining their strategy and related actions to develop and deploy smart electricity grids around the world.

ISGAN's 26 Contracting Parties span the globe and include most major developed and emerging economies from the five continents. ISGAN is a powerful and collaborative global platform to efficiently tackle with power system modernization challenges and the quality of its work is attracting more countries, mainly from Asia and South America, that have expressed a strong interest in joining ISGAN.



Since October 2019, I am honoured to serve as ISGAN Chair and I would like to thank all Executive Committee (ExCo) members for their trust in me to continue the excellent work of my predecessors. In this respect, I would like to express my gratitude to Karin Widegren and Michele de Nigris for their strong leadership and for the effort and time they devoted to the construction, consolidation and promotion of ISGAN.

The value of ISGAN lies in its activities and achievements in the area of smart grids deployment, and also in its strong community of ExCo Delegates, Annex Operating Agents and technical Leads, the Co-Secretariats, and National Experts who share a common vision and believe that effective collaboration at international level is both possible and strongly needed. The backbone of ISGAN is constituted by its Annexes that act as standing working groups to continuously develop and share knowledge and tools, highlight emerging solutions, identify trends and opportunities for policy innovation.

ISGAN is always prone to foster collaboration and also this year succeeded in establishing fruitful cooperation with key international initiatives. In particular, I am very pleased with the ISGAN and Mission Innovation (MI) collaboration on Innovation Challenge #1 on smart grids (IC1). The collaboration was formalised in Rome in November 2018 and then consolidated in the present year. ISGAN and IC1 held the successful joint workshop “1st CEM ISGAN/MI IC1 Forum to Facilitate Cooperation to Accelerate the Market Uptake of Smart Grids” on the margins of CEM10/MI-4 Ministerial in May 2019 in Vancouver. Two joint factsheets, on Power System Flexibility and on Energy Storage Integration, as products of the ongoing ISGAN-IC1 collaboration were released during this event that also presented the opportunity to award the best industry-led research and innovation projects on system flexibility. Another prominent example is the ongoing collaboration with the Global Smart Grid Federation and the highly recognized international workshops organized back-to-back to ExCo meetings, such as the public workshop “The future of electricity markets in a low carbon economy” at ExCo17 in Stockholm.

During the year ISGAN devoted its attention also to non-technical barriers to smart grid deployment such as regulatory aspects and market design. In this respect, ISGAN organized several successful activities to highlight opportunities and needs to accelerate smart grid deployment through innovative market design and organized a full-day workshop on Experimental Sandboxes.

This report provides an overview of ISGAN's ongoing research activities and main achievements towards smart grid development and deployment to ensure a reliable, economically competitive and environmentally sustainable electricity system as the cornerstone of a modern society. In this regard, it is a unique pool for international insight and I hope that reading it will stimulate your interest for becoming involved with our work and with the ISGAN community.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'Luciano Martini', with a stylized flourish at the end.

**Luciano Martini**

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# 1. ISGAN overview

## 1.1. What is ISGAN?

ISGAN, the International Smart Grid Action Network, is a Technology Collaboration Programme (TCP) of the International Energy Agency (IEA). The co-operative programme was formally established in 2011 and is also an initiative of the Clean Energy Ministerial (CEM).

The Clean Energy Ministerial is a high-level, global forum striving to promote policies and programmes that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Initiatives are based on areas of common interest among participating governments and other stakeholders.

ISGAN is an IEA Technology Collaboration Programme, and as such seeks to support governments and industry with insight and recommendations to high-level decision-makers. In addition, ISGAN closely co-operates with Mission Innovation, a global initiative that promotes the acceleration of the clean energy transition.

Operating as both an IEA TCP and a CEM Initiative, ISGAN is an international platform for the development and exchange of knowledge and expertise on smarter, cleaner, and more flexible electricity grids ("Smart Grids"). ISGAN provides an important channel for the communication of experience, trends, lessons learned, and visions in support of global, national and regional clean energy objectives as well as new flexible and resilient solutions for Smart Grids.



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▲ Schematic view of a modern electricity grid: Smart Grid

ISGAN seeks to improve global understanding of the benefits and opportunities of Smart Grids, to accelerate their development and deployment through furthering knowledge, frameworks, and tools. ISGAN's Contracting Parties can then apply these within their own national, sub-national, or regional contexts. The network's impact relies on the development of publications that will enable smarter investment and better policy but is also heavily dependent on the implementation by authorities in sovereign nations.

ISGAN creates a strategic platform to support high-level government attention and action for the accelerated development and deployment of smarter, cleaner electricity grids around the world.

ISGAN emphasizes knowledge-sharing by design and seeks to identify and implement effective communication mechanisms to ensure that results are useful for decision-makers.

ISGAN recognizes that robust, resilient, and smart electric grids play a key role in enabling greenhouse gas (GHG) emission reductions. This is achieved through:

- Management of electricity demand
- Integration of growing supply from both utility-scale and distributed small-scale renewable energy systems
- Accommodation of an increasing number of electric and plug-in hybrid electric vehicles
- Improvement of operational grid efficiency
- Application of energy-efficient technologies at their full potential

Smart Grids also enable better utilization of existing electricity generation assets. In coordination with the IEA and CEM, ISGAN strives to improve the potential of Smart Grid technologies at global, national and regional level. Another important motivation for Smart Grids is to ensure a resilient and secure energy system.

Investment in Smart Grid technologies and approaches, including Smart Meter deployment, has grown rapidly in recent years around the world. Smart Grids are playing an increasingly critical role towards the affordable and reliable integration of clean energy technologies. To ensure that Smart Grids can continue to meet current and future power system challenges, there is an increasing need for more adaptive regulatory frameworks and market designs that enable the development of innovative business models and accelerate market uptake. Challenges that Smart Grids are expected to manage in parallel include:

- Integration and interaction among an increasingly complex and diverse set of clean energy technologies, including sector coupling across electricity, space heating/cooling, transport, etc.
- Accommodation and coordination of all available sources of flexibility with the ability to improve system efficiency, maintain system reliability and resiliency, and cost management
- Increased use of local energy systems and microgrids including storage, where appropriate
- Engagement of a growing variety of power systems stakeholders and roles in an increasingly connected society, taking advantage of new digital tools and business models focused on delivery of data-driven energy services

To highlight some of the core objectives and means for achieving smarter, cleaner electricity systems, ISGAN in 2016 appointed its primary theme as (power system) flexibility and a secondary theme, digitalization. In 2017, ISGAN added another secondary theme, namely, resiliency. In 2019, interoperability was added as second side-theme to emphasize its importance in ISGAN's work.

## 1.2. Vision

ISGAN's vision is to accelerate progress on key aspects of Smart Grid policy, technology, and investment through voluntary participation of governments and their designees in specific projects and programmes. Its activities centre foremost on those aspects of Smart Grids where governments have regulatory authority, expertise, convening power, or other leverage, focusing on five principal areas:

- Policy standards and regulation
- Finance and business models
- Technology system development
- Workforce skills and knowledge
- User and consumer engagement

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



## 1.3. ISGAN's strengths

### Broad International Expert Network

ISGAN leverages expertise from governments, national laboratories and research institutions, transmission and distribution system operators, public utilities and others from 26 countries from five continents.

### Partnerships with Thought Leaders

ISGAN engages leading private sector Smart Grid initiatives, the IEA Energy Technology Network, and other Clean Energy Ministerial initiatives to advance systems perspectives on power grids and grid integration.

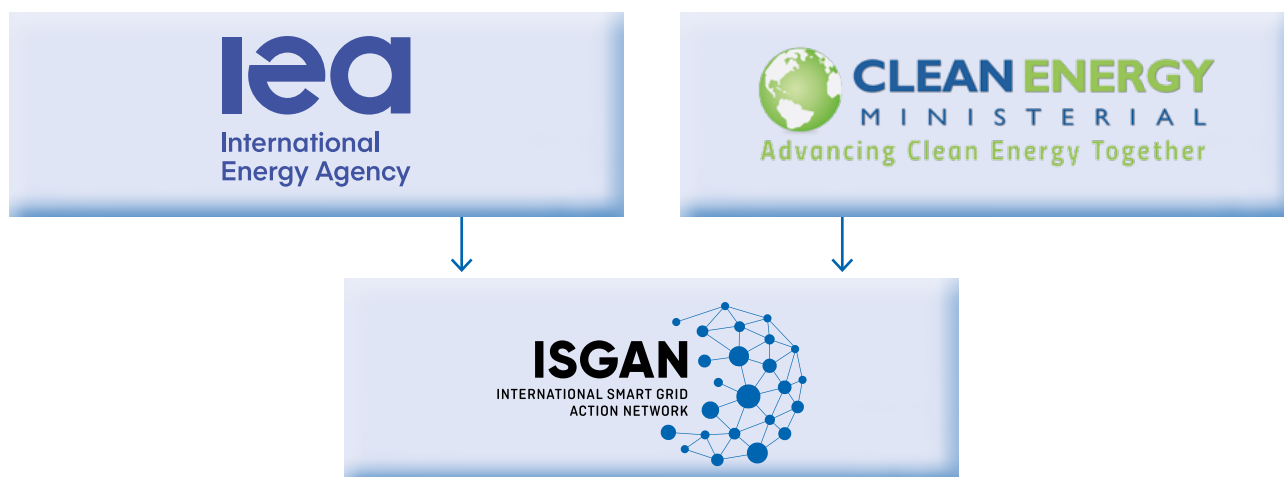
### Diverse Portfolio

ISGAN implements a range of activities to support a better global understanding of Smart Grids and the value they offer, address gaps in knowledge and tools, enhance peer-to-peer exchange, and otherwise improve international coordination.



## 1.4. History

ISGAN was launched in Washington, D.C., USA, in July 2010, at the first Clean Energy Ministerial meeting (CEM1), a forum for energy and environment ministers and stakeholders from 23 countries and the European Union. ISGAN was formally established at their second meeting, CEM2 in Abu Dhabi, in April 2011, as an Implementing Agreement for a Co-operative Programme on Smart Grids, operating under the IEA Framework for International Energy Technology Cooperation.



After the end of its first five-year period, an extension for ISGAN was requested and approved by the IEA in February 2017. The extension was granted for the period of 1 March 2017 until 28 February 2022.

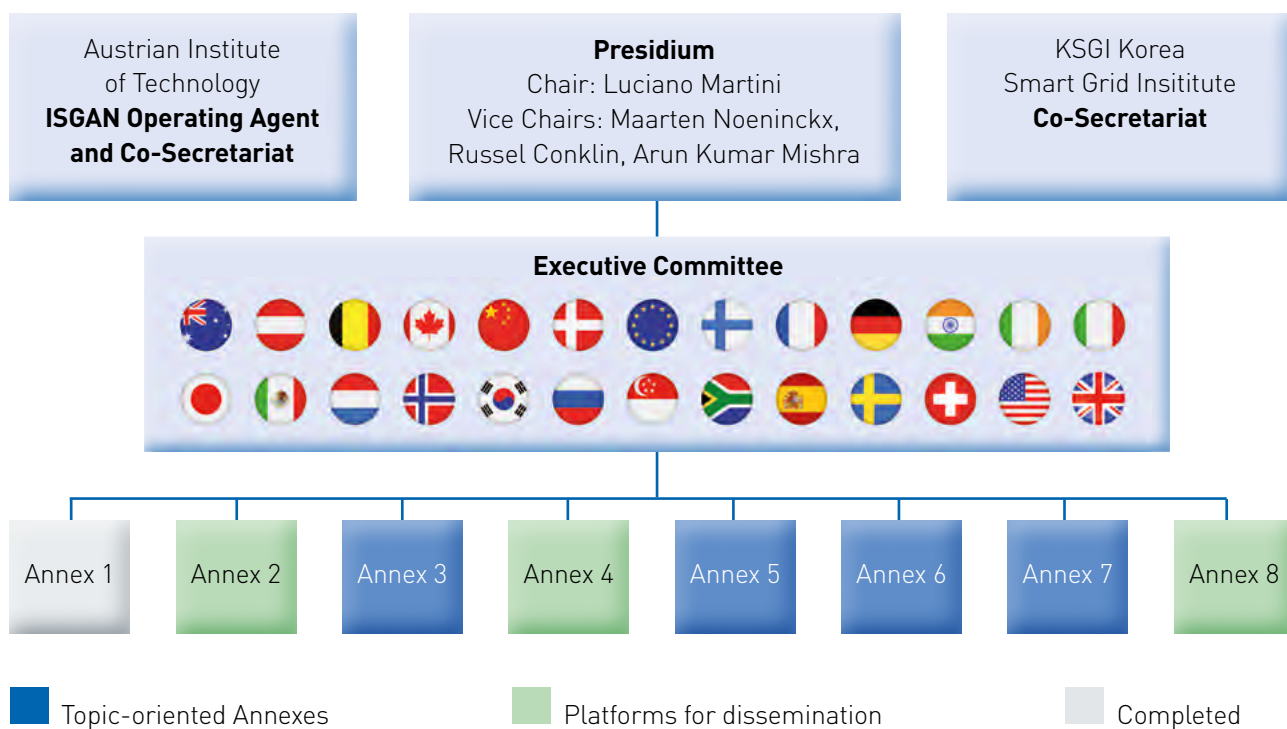
At ExCo18 in October 2019, the Executive Committee of ISGAN agreed to file a Request for Extension for the next five year-period of ISGAN, starting on 1 March 2022. A dedicated strategy process and a working group to prepare the relevant documents has been set up for this purpose.

## 1.5. ISGAN's organizational structure

ISGAN is a technology collaboration programme (TCP) with currently 26 Contracting Parties. Their nominated representatives form the Executive Committee which is headed by the Presidium and assisted by the Co-Secretariats and the Operating Agent of ISGAN. The activities of ISGAN are organized in eight Annexes, which are standing working groups, defining new tasks each year. Each Annex consists of national experts from Contracting Parties and is led by the Annex' Operating Agent and supported by a technical Lead. Annex 1 has already been completed, with some of its remaining tasks moved to Annex 2.

Four of the Annexes are topic-oriented (Annex 3: Cost-Benefit Analyses and Toolkits; Annex 5 Smart Grid International Research Facility Network (SIRFN); Annex 6: Power Transmission and Distribution Systems Annex 7: Smart Grid Transitions and Institutional Change), while three Annexes constitute platforms for dissemination and deployment of Smart Grid practices focused on specific products and methodologies (Annex 2 and Annex 4 comprise Knowledge Transfer Projects (KTP), Casebooks, and policy insight; Annex 8: Webinar-based virtual training and strategic communication to decision-makers).





### 1.5.1. The Executive Committee (ExCo)

Each Contracting Party appoints a delegate and an alternate to the Executive Committee. This is the decision-making body of ISGAN and convenes twice a year. Its main aims are to discuss new developments, identify knowledge gaps and implementation barriers, and shape ISGAN's Programme of Work accordingly. ExCo meetings are well attended; on average, 90% of the Contracting Parties and of Annex Operating Agents/Leads participate in ExCo meetings.



▲ ISGAN Executive Committee

## 1.5.2. The Presidium

The ExCo is led by the Chair and one or more Vice Chairs, together they form the Presidium. Each member of the Presidium is elected for a period of two years, with possible re-election. The first Presidium was elected at the inaugural meeting in Seoul, Korea, in June 2011. Owing to the complexity ISGAN's activities, having three Vice-Chairs was deemed appropriate.

The current Presidium consists of:

### Arun Kumar Mishra

ISGAN Vice Chair  
Director NSGM-PMU, India  
akmishra@powergridindia.com

### Russell Conklin

ISGAN Vice Chair  
U.S. Department of Energy  
Russell.Conklin@hq.doe.gov

### Luciano Martini

Chair of ISGAN  
Ricerca sul Sistema  
Energetico S.p.A, Italy  
Luciano.Martini@rse-web.it

### Maarten Noeninckx

ISGAN Vice Chair  
Directorate-General Energy FOD economie  
Maarten.Noeninckx@economie.fgov.be

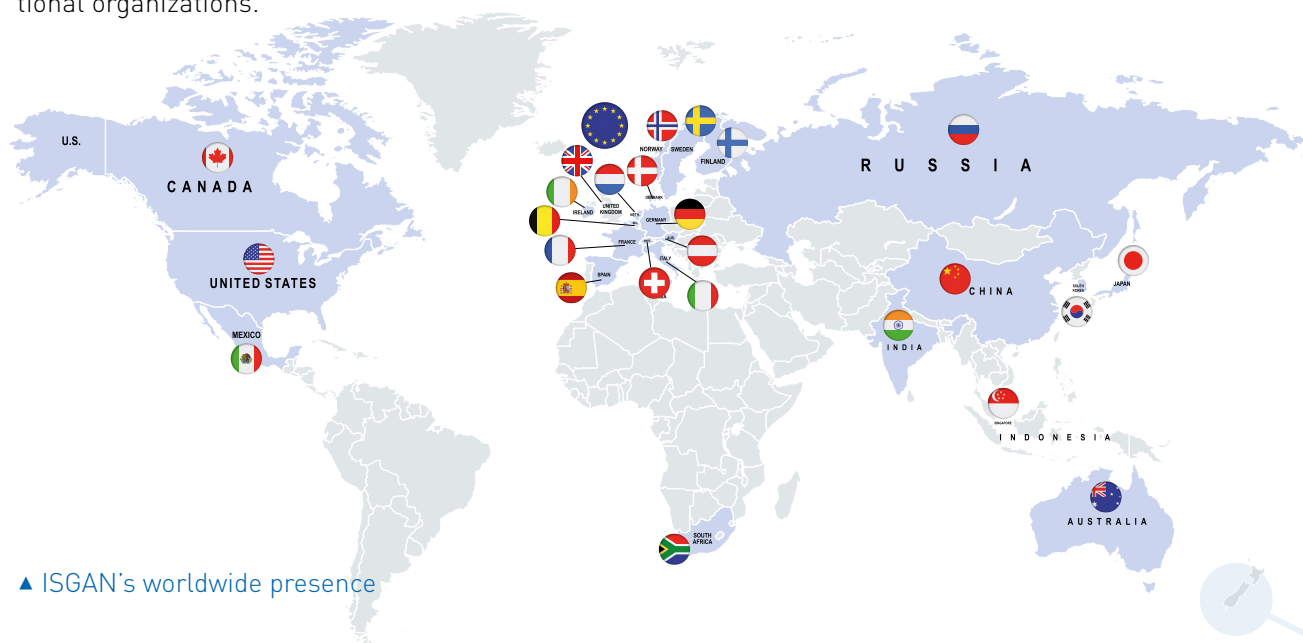


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▲ ISGAN Presidium

### 1.5.3. Contracting Parties

Under the IEA Framework for International Energy Technology Co-Operation, ISGAN is open to all governments, yet only upon invitation from the ISGAN Executive Committee. Although ISGAN is primarily focused on government-to-government cooperation, it is also open to entities designated by the participating governments, including academic institutions, select private sector and industry associations as well as international organizations.



#### List of ISGAN Contracting Parties (as of February 2020):

1.  Austria	14.  Japan
2.  Australia	15.  Korea
3.  Belgium	16.  Mexico
4.  Canada	17.  The Netherlands
5.  China	18.  Norway
6.  Denmark	19.  Russian Federation
7.  The European Commission	20.  Singapore
8.  Finland	21.  South Africa
9.  France	22.  Spain
10.  Germany	23.  Sweden
11.  India	24.  Switzerland
12.  Ireland	25.  The United States of America
13.  Italy	26.  United Kingdom

ISGAN has been constantly seeking to widen its group of Contracting Parties and will continue to do so in the upcoming term of the programme. Countries that ISGAN has been in contact with include Morocco, Brazil, Czech Republic, Indonesia, Malaysia and Thailand.

At ExCo16 (2018) in Vienna, Austria, Brazil was present as observer. The ExCo decided by unanimous vote to invite Brazil to become a Contracting Party to ISGAN. The accession process is currently underway.

In Asian countries there is currently great interest in joining ISGAN and a dedicated workshop for these countries was organized.

#### 1.5.4. Secretariat and Operating Agent

As per the Implementing Agreement, an Operating Agent (OA) must be appointed as a legal representative of ISGAN. AIT Austrian Institute of Technology has been holding the position of ISGAN OA since June 2017. During ExCo16, Werner Friedl assumed the position of the ISGAN Operating Agent. In spring 2020, Mihai Calin followed Werner Friedl as ISGAN's Operating Agent.

- **Werner Friedl**, Operating Agent of ISGAN until Q2/2020, [Werner.Friedl@ait.ac.at](mailto:Werner.Friedl@ait.ac.at)
- **Since Q2 / 2020: Mihai Calin** Operating Agent of ISGAN, [Mihai.Calin@ait.ac.at](mailto:Mihai.Calin@ait.ac.at)

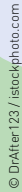
ISGAN is supported by two Co-Secretariats, as per the decision taken at ExCo13: AIT Austrian Institute of Technology and the Korea Smart Grid Institute (KSGI).

The Co-Secretariat at AIT is responsible for the management of ISGAN, communication matters as well as the administration of the common fund and reporting to the IEA:

- **Susanne Windischberger**, [Susanne.Windischberger@ait.ac.at](mailto:Susanne.Windischberger@ait.ac.at)
- **Sean Philipp**, [ISGAN@ait.ac.at](mailto:ISGAN@ait.ac.at)

The Co-Secretariat at KSGI is responsible for the support of ISGAN deliverables to the Clean Energy Ministerial, the ISGAN Award of Excellence and coordination and contact activities within Asia:

- **Aram AN**, [realaram@smartgrid.or.kr](mailto:realaram@smartgrid.or.kr)
- **Chloe Yoon**, [ysj@smartgrid.or.kr](mailto:ysj@smartgrid.or.kr)





## 1.6. Key Achievements and Highlights in 2019

ISGAN proudly looks back at numerous highlights and achievements in 2019. Of particular importance were events and workshops which attracted a very high level of interest both within ISGAN and externally.

- **Activities during CEM 10**

- ISGAN and Mission Innovation (MI) Innovation Challenge 1 on Smart Grids (IC1) co-organized the first joint CEM/ISGAN/MI IC1 forum on *Cooperation to Accelerate Smart Grid Market Uptake*, a full-day CEM10/MI-4 side event on 29 May 2019 at the Vancouver convention centre. There, ministers from over 25 countries gathered to accelerate progress toward a clean energy future.
- Award ceremony announcing the winning project of the 2019 ISGAN Award of Excellence.

- **Highly recognized public workshops back-to-back with ExCo meetings**

- Stockholm: Public Workshop in cooperation with the Swedish Energy Agency and the Swedish Smart Grid Forum on *The future of electricity markets in a low carbon economy*, 2 April 2019.
- Stockholm: Interdisciplinary workshop with IEA DHC TS3 and ISGAN
- Montreux: Public Workshop on *Needs, challenges and opportunities of TSO-DSO coordination*
- Montreux: Open workshop on *EERA Smart Grid/SIRFN workshop*
- Annex 6: Open workshop on *Micro vs MEGA grids – trends influencing the development of the power system*

- **Thematic knowledge exchange events (KTP)**

- *Experimental Sandboxes for Smart Grids*, Stockholm, 2019, in cooperation with the Swedish Smart Grids Forum and ICER International Confederation of Energy Regulators. This event was cooperatively organized by ISGAN Annexes 2, 4, 7 and 8.

- **Public Support to Smart Grid RD&I**

- *Focus on upscaling*, Montreux, 2019. This project was the third in the series of KTP workshops concerning public funding. It was organized by Annex 2 and 4.

- **Development of a communication strategy and action plan**

- **Development of a web-based tool using a combination of CBA and multi-criteria analysis**

## 1.6.1. Highlight: Projects on Regulatory Sandboxes

In conjunction with the 17<sup>th</sup> meeting of the Executive Committee of ISGAN, a full-day Deep-dive interactive knowledge exchange (KTP) workshop on Regulatory Sandboxes took place on 1 April, 2019.

Experimental (Regulatory) Sandboxes for Smart Grid transitions have been in focus for a major ISGAN inter-Annex knowledge exchange initiative in partnership with the International Confederation of Energy Regulators (ICER). Its purpose was to identify lessons learned and examples of good practice in regard to the design and implementation of such innovative policy instruments. The project was led by an international team of ISGAN experts and involved about 45 participants from more than 20 countries.

The project was part of a broad array of activities ISGAN has been undertaking with partner organizations to advance international dialogue around best practices and new approaches for innovative market and power system design which are needed to catalyse Smart Grid investments.

### What is a Regulatory (Experimental) Sandbox?

**Regulatory (Experimental) Sandboxes** for smart grids transitions are new, innovative policy instruments, under which innovations can be tested under experimental and real-life conditions. These activities may otherwise be hampered by institutional barriers such as energy legislation, regulation of monopolistic grid operators, market structures, infrastructure investment mechanisms etc.

Sandboxes provide an **experimental environment** to stimulate and foster innovation, replication and business model development. This can be achieved by granting stable framework conditions for a limited time (and often restricted to a specific area), e.g. by opening up, derogating or waiving relevant rules and regulations. Thereby, new products can be developed in a real-world environment without being limited by the usual rules and regulations.



▲ KTP-Workshop on Regulatory Sandboxes



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Thirteen of the participating countries have put sandbox programmes in place or were making preparations for designing and planning sandboxes at the time.

With feedback and insight from this workshop the participating Annexes published a casebook entitled “Innovative Regulatory Approaches with Focus on Experimental Sandboxes”. The casebook includes a total of seven case studies from Australia, Austria, Germany, Italy, the Netherlands, UK and US. Key insights from this knowledge transfer process were summarized and communicated during the Clean Energy Ministerial meeting (CEM10, Vancouver, May 2019).

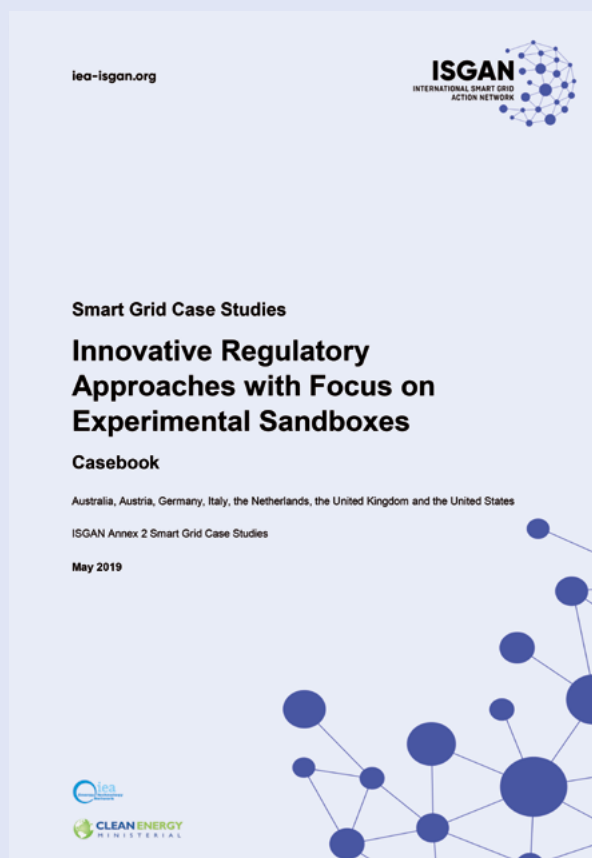
In addition, an ISGAN Casebook “Innovative Regulatory Approaches with Focus on Experimental Sandboxes”, illustrating examples from seven countries, was published. It will be updated in 2020 when new cases are established.

The ISGAN Sandbox initiative included a number of mutually supporting activities, all designed to support capacity building, share international experiences and co-create ideas in regard to this relatively new but important topic for the future energy systems and the Smart Grid community.

An ISGAN Academy Webinar was arranged to share and discuss the results of the project further.

Furthermore, an ISGAN Policy Message on Sandboxes to the Clean Energy Ministerial was published.

A LinkedIn discussion group was established enabling informal stakeholder interaction on this topic.





## 1.6.1. Highlight: Public Workshop Stockholm: The future of electricity markets in a low-carbon economy

On 2 April 2019, an ISGAN public workshop titled *The Future of Electricity Markets in a Low-Carbon Economy* took place. The event attracted high interest from experts within and outside of ISGAN. The event focused on international experiences and lessons learned, with emphasis on the importance of market design in relation to the following key aspects of power systems transformation and smart grid development.

The public workshop was opened by Karin Widegren, then Chair of ISGAN, and by Maria Sandqvist, Forum for Swedish Smart Grid. A keynote speech was held by Anders Ygeman, Swedish Minister for Energy and Digital Development.

The first session focused on new market opportunities enabled by digitalization of the power sector. The topic of the second session was *Flexibility and power system interaction and optimization leveraged by smart grid solutions*, followed by a session on innovative regulatory approaches to advance smart grids deployment with focus on experimental sandboxes.

In the afternoon the plenum was divided into three parallel interactive breakout sessions.

### New market opportunities enabled by digitalization

**Moderator:** Russell Conklin, Senior International Relations Specialist DOE Office of International Affairs USA

- Presentations of cases: Reimagining the energy market, an open-source scalable blockchain demonstration platform by Energy Web Foundation/ Grid Singularity, Ewald Hesse and Ana Trbovich
- Case studies from India addressing the opportunities of AI and blockchain by Global Smart Grid Federation
- Presentation of the EU project Flexiciency and CoordiNet by Vattenfall, Fredrik Carlsson and Yvonne Ruwaida
- Case study on AI and IoT for monetizing energy assets by Power2U, Arshad Saleem

### Flexibility and power system interaction

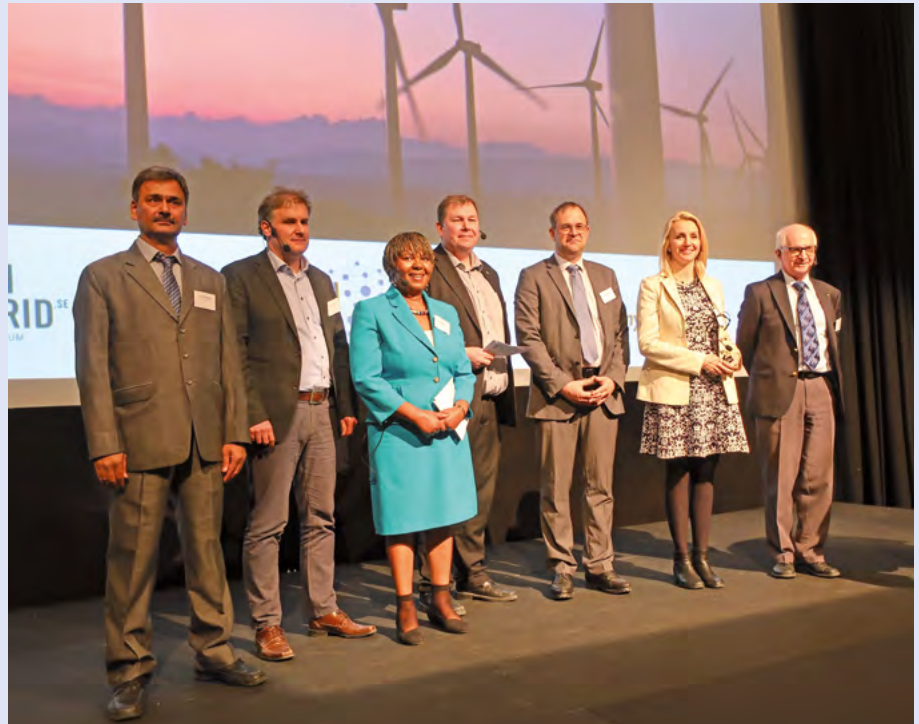
**Moderator:** Bo Normark, Thematic Leader Smartgrid and Storage InnoEnergy

- Focus on current and future solutions to the flexibility challenges regarding power and transfer capacity
- Presentations of cases addressing technology, market and policy. What technologies are needed? How do the markets need to develop? What policies need to be put in place?
- As a participant you can expect to get to meet colleagues from various countries and discuss with them how the power system can become more flexible

### Innovative regulatory approaches on Experimental Sandboxes

**Moderator:** Klaus Kubeczko, AIT Austrian Institute of Technology and Dierk Bauknecht, Energie & Klimaschutz, Geschäftsstelle Freiburg

- Introductory keynotes to discuss the options for experimental instruments for transformative innovation and energy policy.
- Summary of the interactive workshop on 1 April 2019
- Casebook on Regulatory Sandboxes
- A panel from various actors in the energy sector discussed how Regulatory Sandboxes are best applied to stimulate Smart Grid innovation.



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▲ Public Workshop “The Future of Electricity Markets in a Low Carbon Economy”

### 1.6.1. Highlight: CEM 10/MI4

ISGAN and Mission Innovation (MI) Innovation Challenge 1 on smart grids (IC1) co-organized the joint 1<sup>st</sup> CEM/ISGAN/MI IC1 forum on Cooperation to Accelerate Smart Grid Market Uptake. The event was the only full-day CEM10/MI-4 side event and took place on 29 May 2019 at the Vancouver convention centre, where Ministers from over 25 countries gathered to accelerate progress toward a clean energy future.



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#### ▲ ISGAN and Mission Innovation IC1 Side Event to CEM10/MI4

143 registered participants from 18 member countries and the European Commission attended the meeting. Several government representatives and ministers participated in the side event.

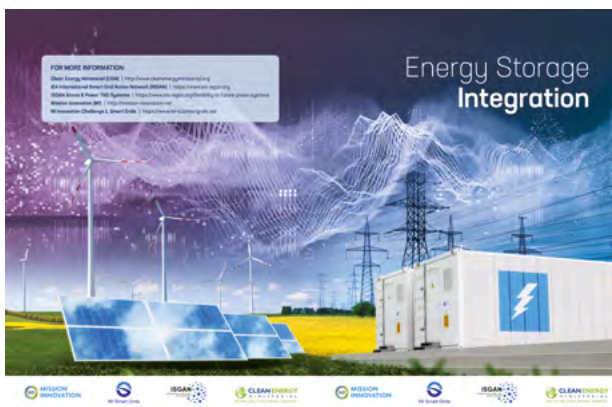
Highlights of the event included a presentation by Karin Widegren, former chair of ISGAN, on recent achievements of ISGAN, the release of a joint fact-sheet on Flexibility and Storage and a round table discussion on 'Regulatory and market innovations for advancing smart grids', chaired by Senja Nordström.

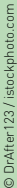
ISGAN booklets for CEM10 were published including several ISGAN deliverables to increase visibility of its activities to external stakeholders around the world.

This represents an initial tangible outcome of the increased cooperation between the two initiatives as per the Letter of Intent signed on November 2018 in Rome, as well as the joint fact sheets on energy storage and flexibility options to be released at this event.









## 2. ISGAN Annexes

The activities of ISGAN are organized in Annexes. In contrast to other IEA TCPs, these Annexes are standing working groups that continuously work on Smart Grids-related topics and regularly update their plans and objectives for the upcoming year at the spring meetings of the Executive Committee. To date, Annex 1 “Smart Grid Inventories”, delivering a general picture of on-going Smart Grid project deployment, has been completed. Any remaining activities or necessary updates are included in Annex 2.

Operating Agents lead the Annexes and are supported – depending on the Annex – also by technical Leads.

With the goal of maintaining the relevance and topicality of its work, during ExCo18 ISGAN’s Executive Committee directed its Annexes to complete a self-assessment in preparation for the 19th ExCo meeting. In doing so, ISGAN strives to enhance its impact on Smart Grid development and international deployment of the technology.

The Annex Self-Assessment (ASA) provides ISGAN’s Annexes an opportunity to take a fresh look at their work programmes, participation, and opportunities. The ASA process invites Annexes to take into account the current state of Smart Grids worldwide and ISGAN’s evolving programme and objectives. The ASA documents were discussed further in dedicated workshops and will contribute to the development of the ISGAN Strategy for the upcoming period of the TCP.

Furthermore, an Incubator team was established under the lead of UK with the aim to identify the gaps in ISGAN’s work and whether there was a need for a new Annex. A first focus was put on the possible creation of a new Annex on Creating Flexibility Markets, focusing on how digitalisation can enable this transition. Discussions included areas of focus for the Annex, its structure, work packages, and international collaborators. In a first step a review of existing initiatives and literature was carried out.

At present seven Annexes are active. Their Operating Agents are:

Annex	Title	Operating Agent	Country
<b>Annex 2</b>	Smart Grid Case Studies	Korea Smart Grid Institute – KSGI	Korea
<b>Annex 3</b>	Cost-Benefit Analyses	University of Cagliari	Italy
<b>Annex 4</b>	Synthesis of Insights for Decision Makers	Korea Smart Grid Institute – KSGI	Korea
<b>Annex 5</b>	Smart Grid International Research Facility Network (SIRFN)	DERLab	Germany
<b>Annex 6</b>	Transmission and Distribution Power Systems	Research Institutes of Sweden, RISE	Sweden
<b>Annex 7</b>	Smart Grids transitions	AIT Austrian Institute of Technology	Austria
<b>Annex 8</b>	ISGAN Academy on Smart Grids	Institute for Research in Technology IIT, Universidad Pontificia Comillas	Spain

# ISGAN Annex Participation (as of February 2020)

	Annex 2	Annex 3	Annex 4	Annex 5	Annex 6	Annex 7	Annex 8
Australia				+			
Austria	+	+	+	+	+	+ (OA/Lead)	
Belgium			+		+	+	
Canada	+		+	+	+		
China	+		+				
Denmark			+	+		+	
European Commission		+					
Finland				+			
France	+	+	+	+	+	+	+
Germany	+			+ (OA)	+	+	
India	+	+	+	+	+	+	+
Ireland	+			+	+		
Italy	+	+ (OA/Lead)	+	+	+	+	+
Japan				+			+
Korea	+ (OA/Lead)	+	+ (OA/Lead)	+			
Mexico		+			+		
The Netherlands	+		+	+	+	+	+
Norway					+		
Russian Federation		+		+			+
Singapore	+						
South Africa		+			+		+
Spain	+		+	+			+ (OA/Lead)
Sweden	+	+	+		+ (OA/Lead)	+	
Switzerland		+			+		+
United Kingdom		+	+	+	+	+	+
United States	+	+	+	+ (Lead)	+	+	

## 2.1. Annex 2: Smart Grid Case Studies



The objective of Annex 2 is to develop and validate a common template and methodological framework for case studies and to assess outstanding examples of current best practices. These are documented in ISGAN's common framework for case studies, the so-called Casebooks. Casebooks allow for comparison and contrast of policies and technologies adopted in different regulatory, legislative, network (grid), and natural environments. The overarching aim is to collect information from case studies around the world to extract lessons learned and best practices as well as foster future collaboration among participating countries. ISGAN participants contributing to this Annex actively shape the analyses of, and methodological framework for, Smart Grid-related case studies, as well as the selection of topics and projects for new case studies. Participants have first-hand access to the insights identified through analyses of existing and new case studies with focus on Smart Grid development in specific countries.

To date, ISGAN Annex 2 has published four Casebooks: Advanced Metering Infrastructure (AMI), Demand Side Management (DSM) and Consumer Engagement & Empowerment (CE&E). In 2018 a new Case Book on Energy Storage Systems (ESS) has been published and updated in FY2019.

The Casebooks are available for download on ISGAN's website <http://www.iea-isgan.org/our-work/annex-2/>.

Since 2016, Annex 2, supported by Annex 4, has drawn special attention to its **Knowledge Transfer Projects (KTP)** led by task leader Magnus Olofsson and knowledge transfer expert Helena Lindquist.

More information on KTP workshops can be found on the ISGAN website:

<http://www.iea-isgan.org/wp-content/uploads/2018/05/2.-KTP-FactSheet.pdf>

KTPs aim to capture, collect, and share knowledge about Smart Grid technologies among countries and their key stakeholders. Building on ISGAN's experience in delivering deep-dive workshops, KTPs foster meaningful international dialogue on Smart Grids with a focus on developing competence and building capacity.

The workshop format requires significant preparation. It promotes individual learning and emphasises active participation in the co-creation of concrete results. This is achieved through collaboration among interdisciplinary participants with complementary competencies.



## 2.1.1. Knowledge Transfer Project

A highly recognized **KTP workshop on Experimental Sandboxes for Smart Grids** took place in Stockholm in cooperation with the Swedish Smart Grids Forum and the International Confederation of Energy Regulators (ICER). This event was cooperatively organized by ISGAN Annexes 2, 4, 7 and 8. Please refer to Chapter 1.6.1. for more details.

In addition, a **KTP workshop on Public Support to Upscaling of Smart Grid Solutions** was held in Montreux, Switzerland in October 2019. It was a follow-up workshop that built on the results of the previous KTP workshop on Public Support to Smart Grid RD&I in 2018, gathering a diverse group of stakeholders from public funding agencies, ministries, research institutes and academia. The workshop focused on upscaling of Smart Grid/energy system solutions and involved representatives from nine countries (i.e. Austria, Belgium, Germany, India, Korea, the Netherlands, Russia, Spain and Sweden). During the workshop, the participating experts identified key barriers to upscaling of Smart Grid solutions in society and suggested several approaches on how to overcome them. A policy message on Upscaling of Smart Grid Research and Innovation was published.

### Further activities of Annex 2 were:

In 2018, a new Case Book on Energy Storage Systems (ESS) was published and updated in 2019. The Case-books are available for download on ISGAN's website <http://www.iea-isgan.org/our-work/annex-2/>.

The survey on Smart Grid Motivating Drivers and Technologies was started in FY2019 and will be analysed in FY2020.

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### Participating countries:



Austria



Canada



China



France



Germany



India



Ireland



Italy



Korea



Netherlands



Singapore



Spain



Sweden



United States



Korea (Lead)



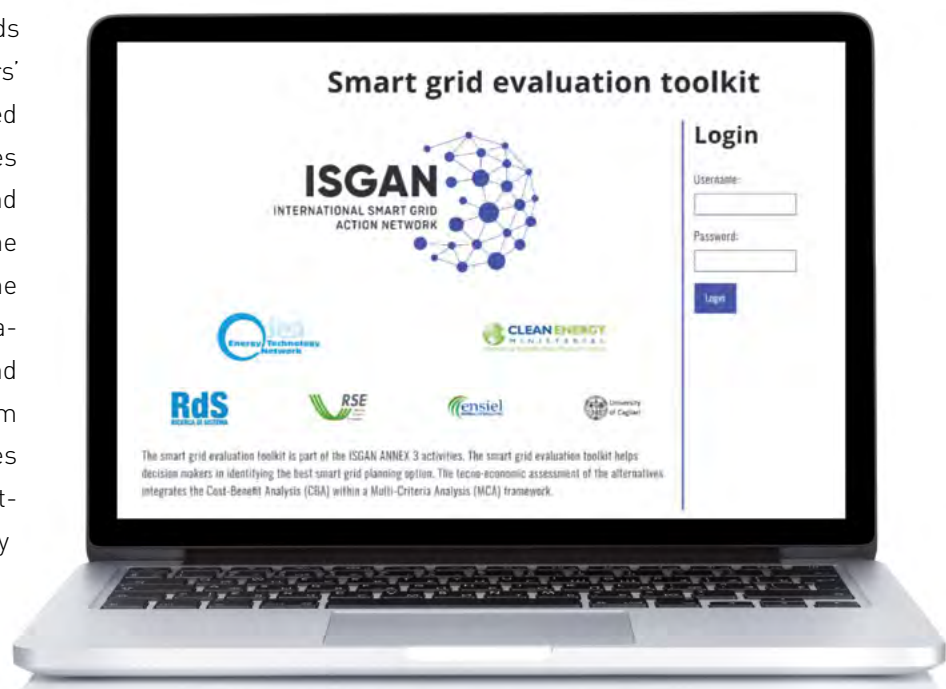
Korea (Operating Agent)

## 2.2. Annex 3:

### Cost-Benefit Analyses and Toolkits



Annex 3 deals with methods aimed at guiding stakeholders' investment decisions related to Smart Grid technologies by considering economic and social welfare aspects. The scope of this Annex spans the development of tools for analysts, regulators, utilities and other actors to define system needs and decide on priorities for Smart Grid system investments along with necessary regulatory changes. Annex 3 develops a global framework and related toolkits, which provide a way of identifying the benefits of demonstrating and deploying Smart Grids technologies in a standardized way. Annex 3 also puts the achieved benefits in relation to their costs.



## 2.2.1. Main accomplishments in 2019

Recent activities focused on evaluating existing approaches and developing new approaches to analysing the costs and benefits and comparing a range of scenarios at system level and at regional level. In particular, the experts from Annex 3 investigated socio-economic impacts of Smart Grids and the related regulatory implications. Three recently published reports identify existing gaps and shortcomings in current Cost-Benefit Analyses (CBA) when applied to Smart Grid projects, include new metrics for the assessment of benefits that may not be uniformly distributed among the stakeholders and, finally, propose new tools that can further improve Cost-Benefit Analyses. To become more specific, a CBA can be enhanced with a Multi-Criteria Analysis (MCA) that fills some of the gaps of traditional CBAs and is better suited for the evaluation of non-monetary and asymmetrical benefits.

### Web-based platform for multi-criteria decision-making and Cost-Benefit Analysis

The software platform can be accessed at <http://smartgrideval.infora.it/admin/>. New Multi-Criteria Methods (MCM) were proposed and improved for the application in the Smart Grid field. These methods were subsequently implemented on a publicly accessible web platform that can be used by everyone after registration.

**Several scientific papers were published, and webinars organized. There is very high interest in the platform e.g. for microgrid evaluation. Thus, webinars are also planned for FY2020.**

### Participating countries:



Austria



European Commission



France



India



Italy



Korea



Mexico



Russian Federation



South Africa



Sweden



Switzerland



United Kingdom



United States



Italy (Lead)



Italy (Operating Agent)

## 2.3. Annex 4:

### Synthesis of Insights for Decision-Makers



The core objectives of Annex 4 are to organize knowledge, identify key issues and important themes, and provide insightful analysis for decision-makers. Another responsibility of Annex 4 consists of consolidating and disseminating the efforts of other ISGAN Annexes, as well as, when appropriate, Smart Grid efforts beyond ISGAN in support of greater outreach and impact.

Annex 4 ultimately provides communication tools, products, and platforms that foster international understanding of Smart Grids, while recognizing the diversity of drivers and approaches among related technologies, policies, practices, and systems.

#### 2.3.1. Main accomplishments in 2019

Annex 4 supported several inter-Annex activities in 2019. In close cooperation with Annex 2, Annex 4 supported the KTP workshop on Upscaling of Smart Grid Solutions in Montreux, Switzerland, in conjunction with ExCo18. Furthermore, the policy message on Innovative Regulatory Approaches with Focus on Experimental Sandboxes to Enable Smart Grid Deployment at CEM was supported.

Concerning strategic communications, the ISGAN YouTube channel was re-activated. All ISGAN-related video clips from other websites (e.g. Leonardo Energy) were gathered under this channel.

A dedicated knowledge sharing seminar on Smart Grid policies and technologies at Gwang-Ju, Korea, was hosted in November 2019. Governmental and industrial speakers from Indonesia, Thailand, Malaysia, Viet Nam, Japan, and China were invited. Several of these countries are considering joining ISGAN.

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**Participating countries:**



Austria



Belgium



Canada



China



Denmark



France



India



Italy



Korea



Netherlands



Spain



Sweden



United Kingdom



United States

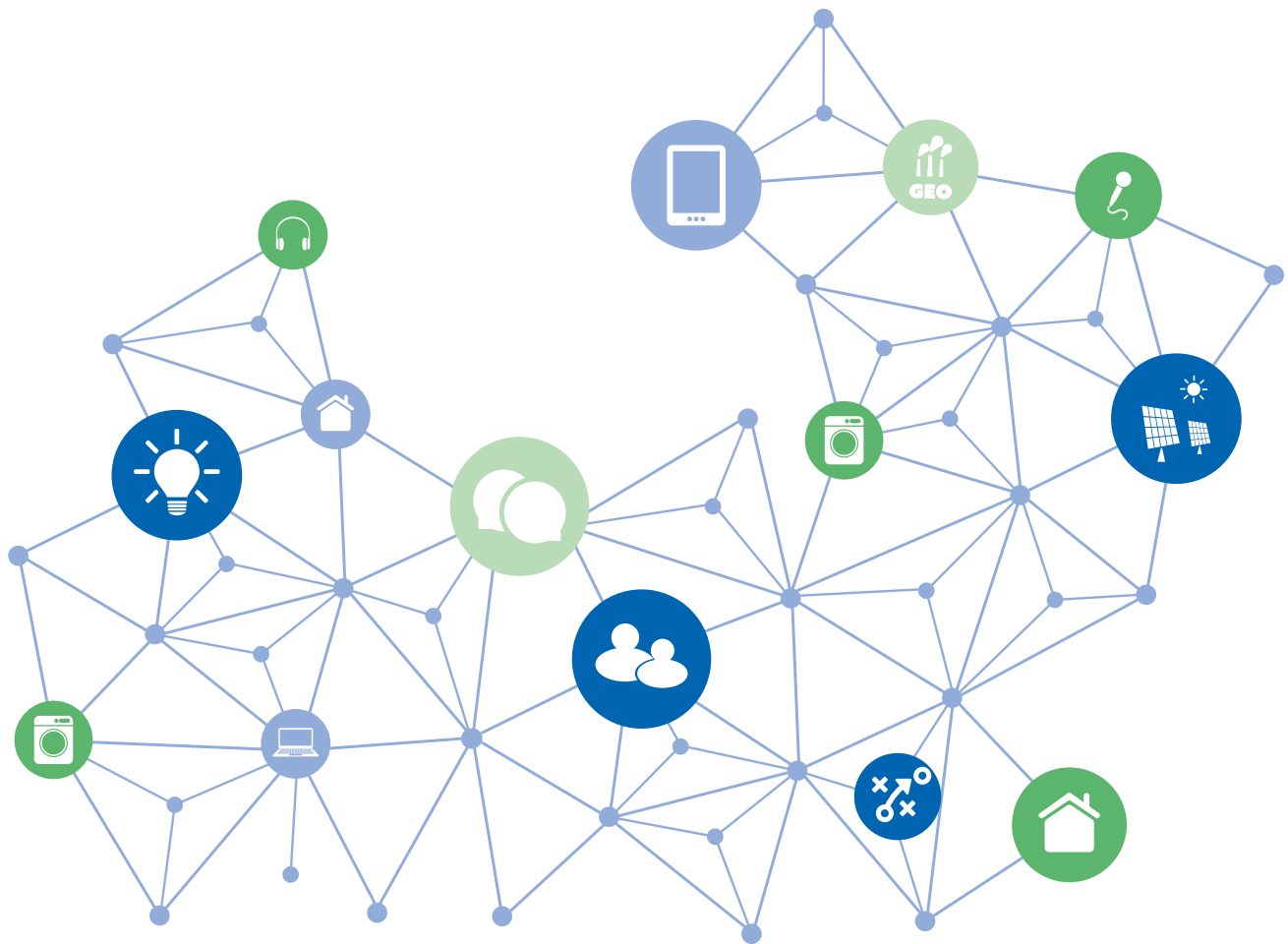


**Korea (Lead)**



**Korea (Operating Agent)**

## 2.4. Annex 5: Smart Grid International Research Facility Network (SIRFN)



SIRFN enables participating countries to evaluate pre-competitive technologies and systems in a wide range of Smart Grid use cases and geographies using common testing procedures. Research testbeds were selected based on their complementary capabilities to conduct specialized, controlled laboratory evaluations of integrated Smart Grid technologies. These include cyber security, plug-in hybrid integration, load management, automated metering infrastructure, protection, network sensing, energy management, renewable energy integration and similar applications. In this way, researchers in each individual participating country can benefit from the unique capabilities and environments of the other partner nations. Research data will be made available to all SIRFN participants to accelerate the development of Smart Grid technologies and systems and enable appropriate supporting policies.

The Annex consists of a strong, active community of researchers engaging in applied research and impactful work on Smart Grids testing including smart inverters, BESS, DER, ALTM, power systems, microgrids, etc. Open source software tools, test cases and procedures to be used by DER vendors, universities, research institutions, certification laboratories, standards organizations, etc. are developed. Input to national and international standards development has major impact on the capabilities of Smart Grid and DER equipment for electrical performance and communications capabilities.

**The work in this Annex is divided into the following technical projects:**

#### **Test Protocols for Advanced Inverter Functions**

- Test Protocols for Advanced Inverter Functions
- Goal: Develop and demonstrate consensus-based interoperability test protocols for advanced distributed energy resources (DERs)
- Evaluation of DER devices and test protocols
- Inform/accelerate adoption of certification protocols by national and international standards organizations

#### **Microgrids**

- Evaluate microgrid requirements for on-grid and off-grid operation
- Define microgrid functionalities for on-grid operation
- Define testing procedures for the functionalities

#### **Advanced Laboratory Testing Methods**

- Enhanced lab testing & testing methods (HIL, Co-Sim)
- Creation of a work basis for future contributions to
  - Support holistic testing and accelerated manufacturing
  - Create standardized testing procedures and toolboxes
  - Establish novel research areas for real-time/HIL applications

#### **Power System Testing**

- Numerous interdependencies in power system control
- Testing components only may miss such interactions/interdependencies
- Seeks to define requirements for real systems testing, applying state-of-the-art advanced lab testing methods

### **2.4.1. Main accomplishments in 2019**

#### **General Progress**

In order to disseminate the results of this Annex and to share information with relevant stakeholders, a **SIRFN Dissemination Strategy Plan** was developed. Consequently, the SIRFN website was migrated to the ISGAN website.

In the spirit of cooperation with other organizations, the following two workshops were held:

- SIRFN/DERlab **Joint Workshop** on **Research Task Collaboration**
- ISGAN/EERA JP SG/MI/DERlab **Joint Workshop** on **Digitalization, Research & Testing of Energy Systems for Energy Market Decision Support**

## Achievements in FY2019

The following achievements were accomplished in 2019

- **Webinar** on SunSpec Validation Platform – SNL
- **Public Workshop and Lab Tour** of Advanced Laboratory Testing at AIT
- **Conference Paper** of “Open-Source IEEE 1547.1 Test Scripts for Improved Solar Integration”, EU PV-Sec, Marseille France, 2019

With regard to the individual tasks, the following progress was made in 2019:

- Task 1a: SIRFN members facility inventory cluster was updated
- DERlab RI database: <https://infrastructure.der-lab.net/>
- Task 2: Test Protocol of DER Function
- Development of new testing protocol according IEEE1547.1
- Waveform capturing and test report generation
- Task 4: Power System Testing
- Sub-Task/Cluster creation with 11 test cases
- Task 5: Advanced Laboratory Testing Methods
- Global DER function classification
- Grid Code comparison template

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## Participating countries:



Australia



Austria



Canada



Denmark



Finland



France



Germany



India



Ireland



Italy



Japan



Korea



The Netherlands



Russian Federation



Spain



United Kingdom



United States



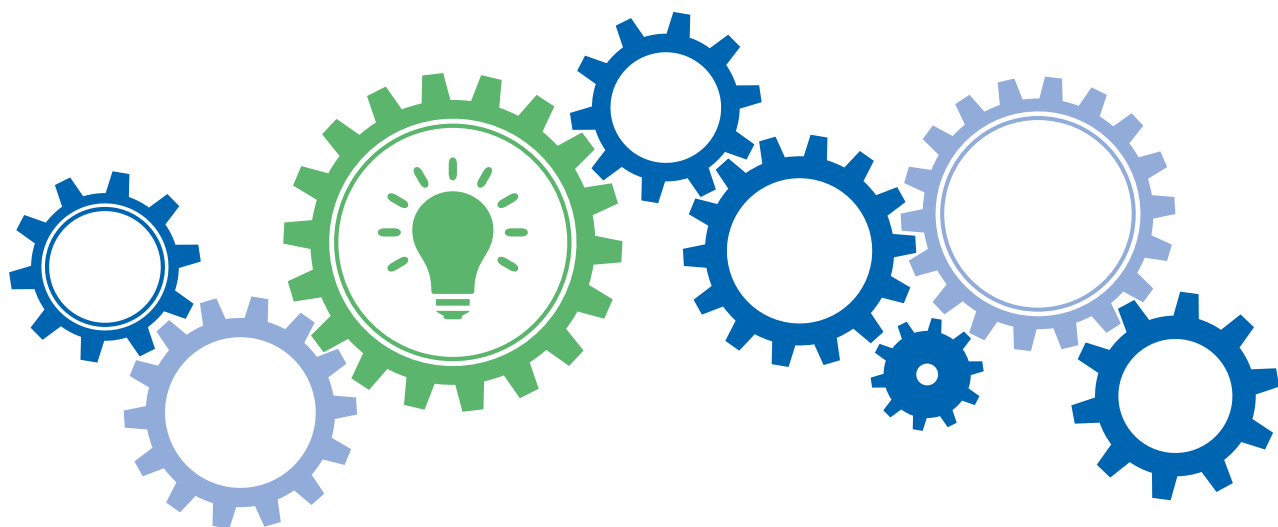
**United States (Lead)**



**Germany (Operating Agent)**



## 2.5. Annex 6: Power Transmission and Distribution Systems



Annex 6 focuses on potential system-related challenges in the development of future Smart Grids. The Annex' main goal is to facilitate the application of advanced technologies needed for power grids to contribute in the best way possible to the achievement of clean energy and climate goals as well as sustainable energy access to all. The Annex promotes solutions that enable power grids to maintain and improve the security, reliability and quality of electric power supply.

The Annex' work is based on collecting, integrating, synthesizing, and distributing information on Smart Grid technologies, practices, policies, and systems through discussion papers, webinars, reports and presentations at relevant seminars, conferences and workshops. The objective is not to repeat what has already been done, but to draw valuable insights and lessons. Different countries around the world face different challenges, apply different solutions to those challenges, and have reached different maturity levels in the implementation of those solutions. By learning from each other, both when it comes to best practices and success stories, we can reach proven solutions quicker and avoid repeating mistakes.

Annex 6's participation gives access to an international network of experts in the area of building future grids. The possibility of gaining and sharing knowledge within the Annexes brings us closer to the goal envisaged by ISGAN: Achieving global, national and regional clean energy and climate goals with the help of Smart Grids.

### 2.5.1. Main accomplishments in 2019

In FY2019, Annex 6 has performed the following work:

**TSO-DSO interaction schemes and real-time market architectures to allow distribution-grid resources to provide ancillary services to the system: A view on the SmartNet research project**

On 16 May 2019 the final workshop of the SmartNet project was held in Arona, Italy. The event, which gathered participants from a large number of stakeholders, included presentations of the final project results and a debate among the attendants. Emil Hillberg participated at the event as an ISGAN Annex 6 representative. The final discussion paper including results from the questionnaire among Annex 6 members was published in December 2019.

## Hybrid energy networks

A workshop together with *Hybrid Energy Networks (IEA DHC Annex TS3)* took place in Stockholm in April 2019, attracting 24 participants. The workshop was a starting point for deeper understanding of key integration aspects on different levels, which will result in a discussion paper in 2020.

## Flexibility requirements in future power systems

The final discussion paper was published in March 2019, with active contributions from 15 experts in eight different organizations and countries, i.e. Austria, Canada, France, Germany, Italy, Norway, Sweden, and Switzerland. A discussion paper was published on ResearchGate and was accessed 1,100 times.

Please refer to Chapter 6.2. for further publications by Annex 6.

## Annex 6's work was published at the following conferences and workshops:

- Conferences
  - Dynpower, IRED, CIGRE, WINDSWEDEN
- Workshops and other presentations:
  - IEA EUWP workshop on Flexibility for a sustainable energy system, Rome, March 2019
  - IEA Wind Task 25, Madrid, April 2019
  - SWEGRIDS, Stockholm, April 2019
  - ISGAN workshop: The future of electricity markets in a low carbon economy, Stockholm, April 2019
  - IEA Experts' Group on R&D Priority Setting and Evaluation (EGRD) workshop System Resiliency and Flexibility, Vienna, May 2019
  - ISGAN workshop: Steering our energy future - Making our power system fit for renewables, Brussels, May 2019
  - WINDSWEDEN, Stockholm, October 2019
  - ISGAN Annex 8 webinar, November 2019

## Interoperability of digital (ICT) systems in energy sector

This activity started in 2019. Since then, there have been several presentations of the activity during coordination calls and the preparation of a workshop: *Smart Grid Digitalization and Need for Improved Interoperability*.

## Lessons learned from international projects on TSO-DSO interaction

This activity started in 2019 and reached out to projects to provide lessons learned for a video. The first list of interviews resulted in a draft video which was presented at ExCo18 in Montreux.

Also, a presentation of all the previous experiences and deliverables from Annex 6 on TSO-DSO interaction was given at the public workshop of the Montreux meeting.

## micro vs. MEGA grids

As part of building up interest for this activity, the work has been presented at the ISGAN workshop in Brussels in May and at the DynPower conference in Winterthur in September 2019. A workshop and a closed meeting were arranged in Montreux which reached a participation of 30 experts from 20 organizations in 13 countries. The development of the discussion paper is an ongoing work and has received contributions from 22 experts in 12 different organizations in 11 countries, i.e. Brazil, Canada, Finland, France, Germany, India, Italy, Norway, Sweden, Switzerland, and UK.

## System and flexibility services – the CoordiNet view

This activity started in 2019, and Annex 6 members have participated at workshops arranged by the project: Swedish forum in March and December, and an Advisory Board meeting in September. Furthermore, the Annex' work was presented at the ISGAN/CoordiNet workshop in Rome in January 2020. During the coordination calls, there have been discussions on how to develop intermediate ISGAN deliverables during the project.

## Workshop: Steering our energy future – Making our power system fit for renewables

Together with FPS Economy and CORESO, an open workshop was arranged as a side event of the InnoGrid2020+ conference in Brussels, gathering 34 participants with presentations from FPS Economy, RISE, IEA, IRENA, European Commission, CORESO, AIT, Enedis, NTNU, CIGRE, ENTSO-E, Eirgrid, Flux50, KU Leuven, and Alliander. The minutes are available. This workshop was a good opportunity to strengthen the cooperation between ISGAN members, speakers, the ENTSO-E and E.DSO participants and moderators. The event also offered a great opportunity to disseminate the results of ISGAN's work to the Belgian smart grid community, get their feedback on the results and to learn from their experiences. At the workshop, the kick-off for the Annex' activities on micro vs. MEGA grids was held, too.

### Furthermore, in FY2019 Annex 6 has been involved in the following additional activities:

- Support of ENTSO-E and EDSO in the preparation of the InnoGrid2020+ conference held in Brussels, May 2019. This increased the cooperation with ENTSO-E, EDSO as well as the visibility of ISGAN at the event (key-note speaker: Arun K. Verma).
- Support of the preparation and participation in the ISGAN open workshop on *The future of electricity markets in a low carbon economy in Stockholm*, in April 2019. Activities included the presentation of the results of *Flexibility needs in the future power system*, chairing a session on Flexibility, participating in a panel and providing final remarks of the workshop.
- Participating at the Flexplan project kick-off meeting in October 2019 and presentation of Annex 6. Interaction with this project will be part of a new proposed activity which has been discussed during a coordination call.
- Cooperation with Mission Innovation through presentation of Annex 6's scope and activities at the 6th Mission Innovation IC1 workshop in Paris and scoping for common activities.
- Cooperation with ETIP-SNET: Presentation of ETIP-SNET's programme and activities during an Annex 6 coordination call in January 2020. Currently scoping for common activities.
- Joining the Knowledge Transfer Project on *Upscaling of Smart Grid Research and Innovation* in Montreux, 2019.

All public material from Annex 6 is available at the ISGAN website.

### Participating countries:



Austria



Belgium



Canada



France



Germany



India



Ireland



Italy



Mexico



The Netherlands



Norway



South Africa



Sweden



Switzerland



United Kingdom



United States



Sweden (Lead)



Sweden (Operating Agent)

## 2.6. Annex 7:

### Smart Grid Transitions and Institutional Change



The ongoing transition of energy systems describes the process of replacing a comparatively simple regime of just-in-time electricity production characterized by unidirectional trickle-down distribution, with complex, responsive, multidirectional systems. As a result, the electricity sector is undergoing a transformation toward an industry providing energy logistics services to match demand with volatile energy supply. Smart Grids will become the backbone of smart energy logistics. First of all, this requires new institutional structures and governance processes, as well as shared views on socio-technical transition pathways. How this institutional change shall be orchestrated, is the key topic of Annex 7 and a key policy issue for the IEA and the Clean Energy Ministerial.

The scope of this Annex is to co-ordinate applied social sciences and socio-technical change processes related to this transition towards a sustainable electricity system as well as to collect results and inform policymakers. The Annex' experts further seek to analyse shared cognitive frameworks (e.g. shared visions, norms and concepts) and informal modes of social organization (e.g. human psychology, culture, habits and customs). Thus, their work clearly complements other ISGAN approaches like technology development, technological system integration and techno-economic analyses. Hence, the Annex contributes analysis and policy advice regarding the framework conditions of the system transition from the current fossil-based to a more sustainable, decarbonized energy regime.

The Annex aims at establishing a network of researchers and practitioners sparking off an international, coordinated, interdisciplinary research activity in the social sciences supporting and complementing technology-oriented Smart Grid activities. In short, Annex 7 accumulates information and knowledge from innovation studies, political sciences, institutional economics, sociology and energy law, and makes this information palpable for policy makers and other stakeholders at multiple administrative levels. This includes supporting policy development in the field of Smart Grid-related research, technology development and innovation (RTI).

## 2.6.1. Main accomplishments in 2019

### Activities on Regulatory Innovation Zones (Regulatory Experimenting / Sandboxes)

Building upon its strategy regarding Regulatory Innovation Zones (Regulatory Experimenting and Sandboxes, Experimental Sandboxes, Innovation Sandboxes etc.) and the engagement with the European SET Plan Action, which explicitly calls for Annex 7's involvement and evaluation of ongoing Regulatory Innovation Zones projects and programmes (Innovation Activity, A4-IA0-4), Annex 7 pursued several related activities. First of all, a repository of international examples and publications was set up, which contributed to the Inter-Annex Regulatory Sandboxes Collaboration project.

[https://setis.ec.europa.eu/system/files/set\\_plan\\_esystem\\_implementation\\_plan.pdf](https://setis.ec.europa.eu/system/files/set_plan_esystem_implementation_plan.pdf)

### Inter-Annex Regulatory Sandboxes Collaboration project

Annex 7 joined the Inter-Annex Regulatory Sandboxes Collaboration project. In August 2018, the inter-Annex collaboration project was convened during ExCo16 in Vienna. The organizing committee consists of Annex Operating Agents and experts from Annex 2, 4, 7, and 8. Continuing the work in 2019, Annex 7 played a central role in the thematic priority-setting of the ISGAN casebook finalization, the facilitation of the KTP workshop in Stockholm (April 2019), and the drafting of policy messages for CEM 10. Please refer to Chapter 1.6.1. for details.

### Furthermore, the following dissemination activities were performed:

- Keynote presentation entitled *Regulatory Experimenting – Sandboxes and beyond* by Klaus Kubeczko and Dierk Bauknecht, at the ISGAN Public Workshop *The future of electricity markets in a low-carbon economy* in April 2019, in Stockholm.
- Breakout session on *Innovative regulatory approaches on Experimental Sandboxes* at the ISGAN Public Workshop *The future of electricity markets in a low-carbon economy* in April 2019, in Stockholm.
- Keynote at the Plenary Session *Recap on Regulatory and Experimental Sandboxes* of the ETIP-SNET National Stakeholders Coordination Group (NSGC) Meeting *SET-Plan, National and Regional Initiatives on Energy Communities, PV Community Self Consumption, Flexible and Energy Positive Districts*, Brussels, June 2019.
- Annex 7 webinar *How to replicate solutions for the flexibility challenge*, in February 2019.

### LinkedIn Discussion Group on Smart Grid Transition

The work on the LinkedIn Discussion Group on Smart Grid Transition was continued in 2019. Its purpose is to establish and maintain a network of researchers and practitioners dealing with Smart Grid deployment in the wider context of a long-term, socio-technical transition towards a low-carbon economy. The group covers current issues related to the socio-technical transition of energy systems based on Smart Grid solutions, policies, institutions, law, regulation, strategy, models, research, reflexive governance and orchestration processes. It is open to the wider ISGAN community as well as Smart Grid policy leaders, decision-makers, researchers, economists, analysts, students and journalists.

In 2019, the size of the group grew from 80 to over 120 members and was used for further exchange and discussion, dissemination of results and knowledge. The discussion group has been a key resource for Annex 7's work on the Inter-Annex collaboration on Experimental Sandboxes, where a repository to collect information on governance activities, policy instruments and implementation, as well as scientific contributions, was created. The LinkedIn group can be accessed (after invitation) under the following link:

<https://www.linkedin.com/groups/7489503/>

**10<sup>th</sup> International Sustainability Transitions Conference, IST 2019 in Ottawa, Canada**

National Experts from Austria and Denmark contributed to several IST 2019 sessions on the topics of energy transition and Smart Grids. Annex OA Klaus Kubeczko participated in the session on the governance of sustainability transitions and presented a paper on Experimental Sandboxes as tools for transformative innovation policy for the energy transition.

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**Participating countries:**

						
Austria	Belgium	Denmark	France	Germany	India	Italy
						
The Netherlands	Sweden	United Kingdom	United States	<b>Austria (Lead)</b>	<b>Austria (Operating Agent)</b>	

## 2.7. Annex 8: ISGAN Academy on Smart Grids



The ISGAN Academy offers the ISGAN community a possibility to share knowledge and engage with experts in the field of Smart Grids through an e-learning platform. The platform offers webinars on topics ranging from power system fundamentals to more specialized seminars on breakthrough Smart Grids solutions. The information includes recent developments, best practices, interesting methodologies, Smart Grids theory, applications and deployment. The ISGAN Academy is set up of as a number of e-learning modules that cover various different Smart Grids aspects. Fundamentals and further reading material are provided as complementary appendices to the critical learning path.

By attending the webinars developed by Annex 8, stakeholders obtain a means to stay updated on recent developments, pilot projects, demonstrations, software tools and case studies. By nominating a representative to the Academic Committee, supporters of the Annex can contribute to the evaluation of the quality of the content and the relevance of the selected topics.

### 2.7.1. Main accomplishments in 2019

The ISGAN Academy webinars are divided in five different areas as listed below. The webinars marked in blue were held in 2019. In line with the increasing international attention for the topic of flexibility in power systems, most of the webinars centred around this topic.

### **Novel Smart Grids tools**

- [Cost-Benefit Analysis for Smart Grids](#)
- [Rural Electrification Model for Universal Access to Electricity](#)
- [Distribution Planning for Smart Grids](#)
- [Augmented reality for Smart Grids](#)
- [GARPUR Project: TSO Reliability Management: A probabilistic approach for better balance between reliability & costs](#)
- [GARPUR Project: Generally Accepted Reliability Principle with Uncertainty modelling and through probabilistic Risk assessment](#)
- [Reference Network Models](#)

### **ISGAN Award of Excellence**

- [ISGAN Award 2019: Excellence of the Local Integrated Energy Systems \(Microgrids\)](#)
- [ISGAN Award 2018: International Smart Grid Action Network](#)

### **Flexibility in Power Systems**

- [CoordiNet- Large scale demonstrations for TSO-DSO Cooperation](#)
- [Flexibility needs in the future power system](#)
- [Dynamic Line Rating Principles-Applications-Benefits](#)
- [Vehicle to Everything \(V2X\) Energy Services](#)
- [How to replicate solutions for the flexibility challenge?](#)

### **ISGAN Knowledge Transfer Projects**

- [Regulatory Sandboxes to enable smart grids deployment – Outcomes of the ISGAN KTP](#)
- [Perspectives on ISGAN Knowledge Transfer Projects \(KTP\) in Mexico, Belgium and India](#)

### **New Challenges in Smart Grids**

- [The need to model coupled energy networks to transition to a decarbonized future](#)
- [Cybersecurity for Smart Grids: Vulnerabilities and Strategies to Provide Cybersecurity](#)
- [Cybersecurity for Smart Grids: Technical Approaches to Improve Cybersecurity](#)



In the following table the webinars held in 2019 are described in more detail.

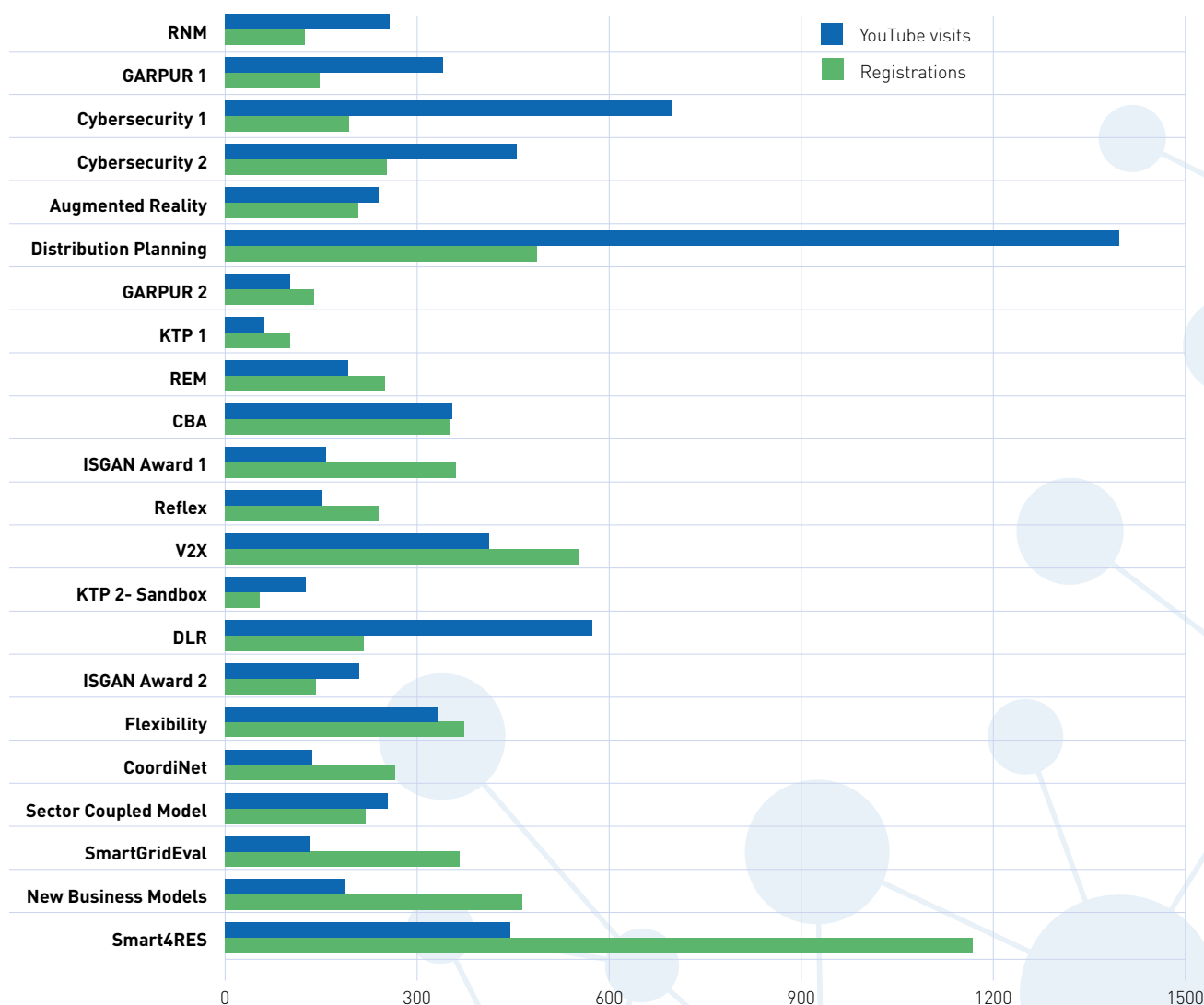
Presenters	Topic and Abstract
<p>Klaus Kubeczko Enrique Kremers, Xiubei Ge</p>	<p><b>How to replicate solutions for the challenge of flexibility?</b></p> <p>The webinar highlighted insights from the ReFlex Replicability Guidebook. It drew on learning experiences from ReFlex partners, which operate eight demo sites in four countries (i.e. AT, CH, DE and SE). The project follows a comprehensive socio-technical replicability concept, that includes levels of technical functionality, market institutions and regulation, social and political practices, social networks and micro- and macroeconomics. The webinar provided a checklist and information on tools to support demo regions and the wider group of in co-creating and advancing their Smart Grid initiatives and replication projects.</p>
<p>Andrew Thompson</p>	<p><b>Vehicle to Everything (V2X) Energy Services</b></p> <p>Along with rapid electric vehicle (EV) uptake will come a significant increase in electricity demand and electric power impact on the grid as public, private, and fast-charging infrastructure is developed. The ability to control and plan for the coming EV revolution will be crucial to ensure the security of supply of global electric grids while weaning the transportation sector away from fossil fuels.</p> <p>The topic of this webinar was on the coming Vehicle-to-Everything (V2X) paradigm and its impact on Smart Grids. While PHEVs and hydrogen fuel cell electric vehicles will also play an important role, the focus of this webinar was on fully battery-electric vehicles due to the energy and power capacity requirements of V2X. Three main areas of interest were covered: the grid impacts of EV integration, an explanation of the V2X paradigm, and a review of regulatory issues associated with V2X.</p>
<p>Klaus Kubeczko Helena Lindquist Magnus Olofsson</p>	<p><b>Outcomes of the ISGAN KTP on Regulatory Sandboxes to enable Smart Grids deployment</b></p> <p>The international Knowledge Transfer Projects (KTP) are strategic platforms to support high-level government attention and action for the accelerated development and deployment of smarter, cleaner electricity grids. Experimental Sandboxes for Smart Grid transitions have been in focus for a major ISGAN Inter-Annex knowledge exchange initiative in partnership with the International Confederation of Energy Regulators (ICER). The purpose of the initiative is to identify lessons learned and examples of good practice in regard to the design and implementation of such innovative policy instruments. The outcomes of this project were presented in this webinar.</p>

Presenters	Topic and Abstract
<p>Jean-Louis Repetto Rena Kuwahata</p>	<p><b>Dynamic Line Rating: Principles, Applications, Benefits:</b></p> <p>The webinar introduced the physics of Dynamic Line Rating (DLR), and calculation methods based on CIGRE and IEEE standards. Various approaches were discussed: direct measurement technologies (sensors) as well as (weather) model-based simulations. Already implemented applications by grid operators were described. These illustrated how DLR data have been integrated into grid operators' tools and processes, and in particular how forecasts are used. Furthermore, analyses were shared that demonstrate the benefits of DLR for reducing OPEX and CAPEX. These included examples on how to increase cross-border trading, reduce investment on new line infrastructure and reduce congestion, which aids decisions on reinforcement and investment.</p>
<p>Hyungsu Kim Bartłomiej Arendarski</p>	<p><b>ISGAN Award 2019: Excellence of Local Integrated Energy Systems (Microgrids)</b></p> <p>The webinar introduced electricity grid concepts in two projects:</p> <p><b>Open Micro Grid Project of the Korea Electric Power Corporation</b></p> <p>A microgrid is an eco-friendly local energy grid with control capabilities, which means it can be connected to external grids, or operated autonomously. KEPCO has successfully completed a microgrid demonstration project on Gasa Island and the Sinan district in southern Korea that harnesses renewable energy resources in convergence with ESS.</p> <p><b>RIGRID – Rural Intelligent Grid</b></p> <p>The planning of net zero energy system (NZES) requires a holistic view. All energy forms need to be considered simultaneously. A new planning tool for NZES is based on the multi-energy system (MES) concept. It considers three main criteria: energetic, economic and social.</p>
<p>Emil Hillberg</p>	<p><b><u>Flexibility needs in the future power system</u></b></p> <p>Power system flexibility relates to the ability of the power system to manage changes. Solutions providing advances in flexibility are of utmost importance for the future power system. Development and deployment of innovative technologies, communication and monitoring possibilities, as well as increased interaction and information exchange are enablers to provide holistic flexibility solutions.</p> <p>Furthermore, development of new methods for market design and analysis, as well as methods and procedures related to system planning and operation, will be required to utilize available flexibility to provide most value to society. In this webinar multiple perspectives were considered and discussed: stability, frequency, voltage, power quality and balance at different time scales (from seconds to hours and seasonal adequacy).</p>

Presenters	Topic and Abstract
Kriss Kessels Gonca Gürses-Tran Marco Baron	<p><b><u>CoordiNet project: Coordination schemes and Business Use Cases for TSO-DSO cooperation</u></b></p> <p>In this webinar, the CoordiNet project was presented. Through the implementation at three large-scale demonstrations the project demonstrated how Distribution System Operators (DSO) and Transmission System Operators (TSO) can act in a coordinated manner to procure and activate grid services in the most reliable and efficient way. In total, eight demo activities are carried out in three different countries, i.e. Greece, Spain, and Sweden.</p>

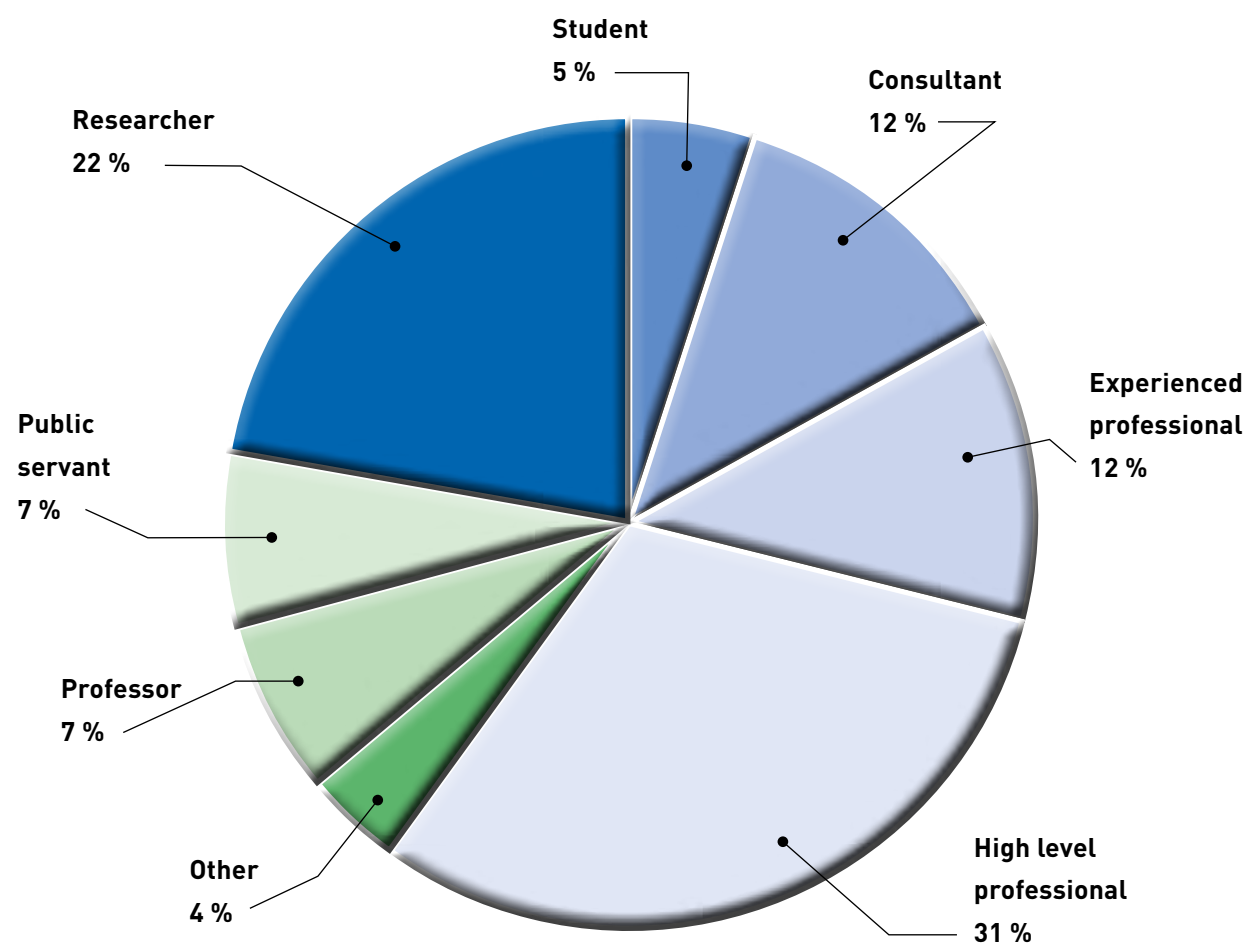
All past webinars can be accessed under:

<http://www.leonardo-energy.org/resources/1070/isgan-academy-58ec8d2e7b9b0>



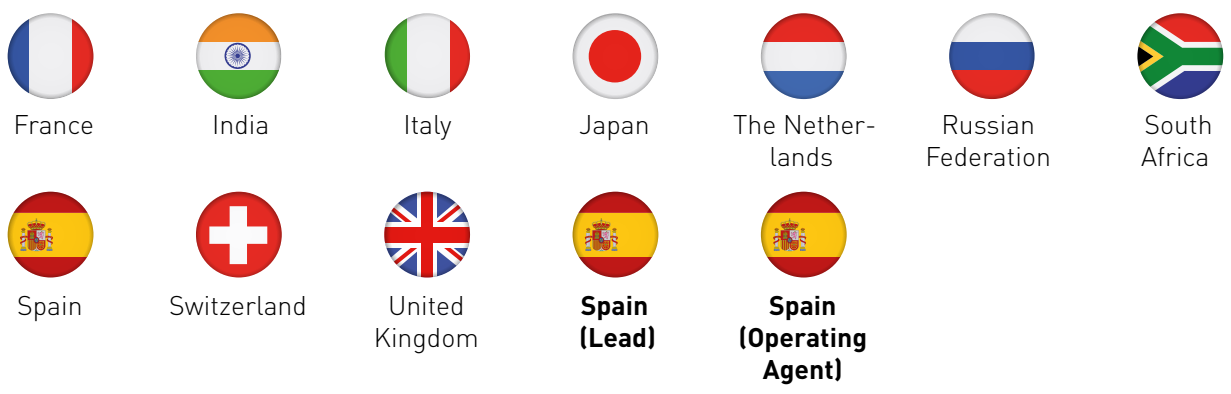
▲ The webinars recorded 4,675 registrations and 5,057 YouTube visits as per 27 February 2020

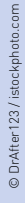
The ISGAN Academy webinars gained high attention and between 2017 and February 2020, registrations from over 150 countries were recorded. A typical profile of the professional background of the audience can be seen in the following graph.



▲ Professional background of the audience

**Participating countries:**





### 3. ISGAN Award of Excellence

The ISGAN Award of Excellence and the Global Smart Grid Federation (GSGF) Best Smart Grids Project Award showcase leadership and innovation in Smart Grid projects around the world. The awards highlight the tremendous value of smarter, more flexible electric grids.

For its 2019 Award of Excellence competition, ISGAN chose the theme *Smart Grids for Local Integrated Energy Systems (Smart Microgrids)*, to highlight the important role that Smart Grid technologies and approaches play in sustaining reliable, resilient, and affordable electricity distribution systems capable of integrating a variety of energy sources and demands. A total of 16 nominations from ten different countries were received. An expert jury organized by ISGAN's private sector partner, the Global Smart Grid Federation (GSGF), selected eight nominated projects for recognition:

- Winner of the ISGAN Award of Excellence, *Open Microgrid project of Korea Electric Power Cooperation*, Korea
- Second place was awarded to *RIGRID – Rural Intelligent Grid*, Poland
- Six projects received an honourable mention and were officially announced at the CEM/ISGAN/MI IC1 forum on 29 May 2019 in Vancouver. ISGAN shared the lessons learned from these projects via case studies, webinars, workshop presentations, and similar means.



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▲ The winners of the 5<sup>th</sup> Award of Excellence were honoured during CEM10 in Vancouver, Canada.



The 6<sup>th</sup> ISGAN Award of Excellence (Open from August until November 2019) focussed on *Digitalisation Enabling Consumer Empowerment*. A total of ten nominations was received from nine different countries. The winning projects were selected by an independent, international jury of smart grid experts, led by Mr. Reji Pillai Kumar, Executive Director of the Global Smart Grid Federation (GSGF). The jury selected the winning projects based on the following five criteria: potential impact, innovation, consumer benefits & empowerments, economic rationale, potential for replication and adaptation.

#### **Following projects were selected as this year's winning projects.**

- Smart Grids and Smart Communities Demonstration Project  
New Energy and Industrial Technology Development Organization (Japan)  
Partner Organizations: ELES, d.o.o., Hitachi, Ltd.,
- Future Flow, ELES, d.o.o. (Slovenia)  
Partner Organizations: 3E SA, Austrian Power Grid, C.N.T.E.E.
- Digitizing the Customer Experience with Real-Time Control  
London Hydro (Canada)

#### **Members of the Jury**

Our grateful thanks to the members of the 2020 ISGAN Award of Excellence jury for contributing their time and expertise to the evaluation process!

- Reji Kumar Pillai (India), Jury Chair, Chairman, Global Smart Grid Federation (GSGF), President, India Smart Grid Forum
- Kentaro Akiyama (Japan), Professor, Seijoh University, Advisor, Japan Smart Community Alliance
- Cheong Kam Hoong (Malaysia), Industry Advisor of University Tunku Abdul Rahman, GSGF Ambassador
- Marc Boillot (France), Founder and CEO of Algorus Consulting, GSGF Ambassador (Europe & Africa)
- Maria Sandqvist (Sweden), Executive Director of the Swedish Smart Grid Forum, Member of the Energy Development Board at the Swedish Energy Agency
- Ravi Sweethapathy (Canada), Executive Chairman, Biosirus Inc., GSGF Ambassador (Americas)
- Robert George Stephen (South Africa), Technology Master Specialist, ESKOM, President, CIGRE

## 4. Collaboration and Co-operation

One of ISGAN's key activities revolves round reaching out to and cooperating with outside stakeholders, clean energy initiatives and similar target groups. In 2019, ISGAN's main cooperation partners and activities were as follows:

- Engagement with **Mission Innovation, IC1** on Smart Grids:
  - 1<sup>st</sup> joint CEM/ISGAN/MI IC1 Forum on *Cooperation to Accelerate Smart Grid Market Uptake*  
At the 10<sup>th</sup> Clean Energy Ministerial (CEM10) an official side event of ISGAN and MI IC1 took place. The Forum to Facilitate Cooperation to Accelerate the Market Uptake of Smart Grids is described in detail in Chapter 1.6.3.
  - On 30-31 May 2019 the 5<sup>th</sup> Mission Innovation, Innovation Challenge 1 Deep Dive Workshop took place. This closed-door event was held at the National Research Council in Vancouver, Canada, where IC1 members, technical experts, funding agencies, governmental and research institutions gathered to discuss the recent achievements and future goals of MI IC1.
  - A special focus was put on the six research priorities (R&D Tasks) jointly identified in IC1.. A guideline for R&D tasks leaders was defined and IC1 commitment to fully engage the private sector and business investors to accelerate the adoption of innovative smart grid technical solutions was confirmed. The Smart Grids Innovation Accelerator (SGIA) Platform's future development was discussed.
  - One session was dedicated to Energy Storage, with important contributions of representatives from the National Research Council Canada (NRC) and NSERC Energy Storage Technology Network (NEST-Net). Present and future Mission innovation goals and MI Secretariat priorities for 2018-2019 were presented, including the launch of the SGIA Platform and the MI IC1/ISGAN collaboration as very significant examples of impactful initiatives.
- The long-lasting partnership between ISGAN and the **Global Smart Grid Federation (GSGF)** was deepened in 2019 through Meetings at ExCo17 in April 2019 and ExCo18, in October 2019. Furthermore, a joint round table during the European Utility Week on the topics *Challenges of the Network Digitalization*, and *Which business model for smart grids, and for sustainable energy projects?* were organized.
- Together with ENTSO-E and EDSO a side event during INNOGRID2020+ on 13-14 May 2019 in Brussels was organized. ISGAN was represented by Arun Kumar Mishra, Vice Chair of ISGAN.
- ISGAN became an Associated Partner of **ERA-Net Smart Energy Systems** in March 2019. ISGAN will support ERA-Net SES projects and the initiative by:
  - Leveraging expertise from governments, national laboratories and research institutes, transmission and distribution system operators, power generators, and other stakeholders from 25 countries.
  - Engaging with leading private sector Smart Grid initiatives, the IEA Energy Technology Network, and other Clean Energy Ministerial initiatives to advance systems perspectives on power grids and grid integration.
  - Implementing a range of activities to support a better global understanding of Smart Grids and the value they offer, addressing gaps in knowledge and tools, enhancing peer-to-peer exchange, and otherwise improving international coordination.

## 5. ISGAN Executive Committee Meetings

The Executive Committee meetings in FY2019 took place in Stockholm and Älvkarleby, Sweden in April 2019 and in Montreux, Switzerland in October 2019.

Both meetings were supported by high-level public workshops and very well attended Annex meetings and KTP Workshops. Also, technical tours were organized by the hosts of the ExCo meetings.

### 5.1. 17<sup>th</sup> Executive Committee Meeting of the International Smart Grid Action Network – Stockholm, Sweden

The Swedish Energy Agency hosted the 17<sup>th</sup> ExCo meeting in Stockholm and Älvkarleby, Sweden, held on 1-5 April 2019. In conjunction with the Executive Committee meeting, the Swedish Energy Agency and the Swedish Smartgrid Forum organized an international public workshop titled *The future of electricity markets in a low-carbon economy* on 2 April 2019. The workshop focused on international experiences and lessons learned in relation to several key aspects of power systems transformation, market design and smart grid development. The public workshop attracted an audience of over 100 participants.



▲ Public Workshop in Stockholm

On 1 April, a full-day Knowledge Transfer Project (KTP) on Experimental Sandboxes to enable Smart Grid deployment as well as a preparatory workshop for the Mission Innovation IC1 and ISGAN event at CEM10 took place. Please find more details on the KTP workshop in Chapter 1.6.

### **Älvkarleby hydro power plant and research facilities**

The technical tour of ExCo17 took place at the Älvkarleby hydro power plant, one of Sweden's larger utilities. Vattenfall's research centre is located at the site and a tour of the hydro power plant and Vattenfall's laboratories was arranged. The main challenges Vattenfall is facing are:

- Rising water levels in rivers
- Fish migration
- Problem-solving for nuclear power plants
- Simulations for wind power



▲ KTP Workshop in Montreux

Rising water levels are not a result of climate change, but are caused by the regulation of rivers, which cannot flood the surrounding landscape anymore. To face this challenge the dams need to be changed.

There are different strategies to ensure fish migration across the dams. Vattenfall built a new fish lab, where a small river can be simulated and also how the flow influences fish behaviour.

Research of nuclear power has been discontinued at the lab, and research capacities have been shifted to hydro simulations. Wind power research is also conducted, simulations aim at optimising the design of windmills and to improve their lifetime.



## 5.2. 18<sup>th</sup> Executive Committee Meeting of the International Smart Grid Action Network – Montreux, Switzerland

A highly successful meeting of the Executive Committee of ISGAN took place from 30 September through 4 October 2019 in Montreux, Switzerland. During the ExCo meeting, side events of various Annexes took place, which did not only attract great attention within ISGAN but also from external experts.

At this 18<sup>th</sup> meeting of the Executive Committee of ISGAN, Chairwoman Karin Widegren stepped down from her position and Luciano Martini, former Vice Chair, was elected as her successor.

The ISGAN community thanked Karin for her tremendous efforts and acknowledged her sage counsel and dedicated leadership, tireless commitment inspiration to colleagues and young professionals, and overall cheer in fulfilling her duties. Karin was presented with the ISGAN Achievement Award by the ISGAN Executive Committee.

At the meeting, ExCo members pointed out that ISGAN's work and impact could benefit from being closer to recent trends around flexibility markets, new business models, and the opportunities presented by digitalization. An Incubator team was founded under the lead of UK.

In order to identify the possible focus area of a new Annex (e.g. "Creating Flexibility Markets"), a scoping exercise was agreed on. This exercise will also explore the opportunities of creating of a new Annex specifically targeted at digitalization and data.



▲ Recognition of Karin Widegren

The 18<sup>th</sup> ExCo meeting also focused on strategy issues that ranged from re-organizing the Annex structure, boosting ISGAN's activities in digitalization and interoperability as well as enhancing ISGAN's task-sharing efforts:

- Reorganization of Annexes
- Development of a proposal for the adaptation/reorganization of the Annex structure
- Increased task-sharing efforts
- Self-assessment of ISGAN Annexes until ExCo20
- Increase relevance of output for policy makers: Definition of an action plan to deepen and widen participation in ISGAN's activities
- ISGAN's goal of becoming an organization based on task-sharing
  - How to re-engage inactive members in Annex work?
  - Regular self-assessment of Annexes
- Establishment of the Incubator team
- Focus on new developments regarding digitalization and interoperability
- Preparation of a knowledge base for decision-making
  - Should new topics be included in the work of ISGAN? And if so, how?
- Session on market definitions
  - Clarification of market definitions in relation to ISGAN's work
  - Aim: Review and clarify the numerous definitions for the term "market" in context of grid modernization, digitalization, and Smart Grids

### **5.2.1. Annex 6 Public Workshop: Needs, challenges and opportunities of TSO-DSO coordination**

The Swiss Federal Office of Energy SFOE and Research Center for Energy Networks – ETH Zürich in cooperation with ISGAN Annex 6 hosted a public workshop on needs, challenges and opportunities of TSO-DSO coordination on 3 October 2019.

The workshop attracted various stakeholders from both research and industry. It offered presentations and discussions centred around the current and anticipated future TSO/DSO interaction.

The introduction to the workshop described the paradigm shift in electrical energy supply, from traditional, centralised generation with fixed loads, and a unidirectional power flow towards decentralised systems with bidirectional power flow.

This shift toward distributed and renewable energy poses as a challenge to both the TSO and DSO. Thus, there has been an increasing awareness relating to the needs, challenges and opportunities associated with the implementation of the necessary solutions. Successful TSO/DSO coordination requires the consideration of various perspectives of the technical, market and regulatory aspects in order to maximize the potential benefits provided by DER. This includes congestion relief, reactive power and voltage control and frequency reserves.

An overview of international activities on TSO/DSO interaction between 2014 to 2019 was provided. Since the results of various projects are starting to become available, work on the Lessons learned from international



projects on TSO-DSO interaction which will consolidate the outcomes of these projects and will be available in 2020. The deliverable will take the form of an interview-styled video, to which various stakeholders are invited to participate. A preview of the video was shown at the workshop and received a very positive response from the audience.

Further highlights of the workshop included a summary of a TSO/DSO report which focused on the interaction in congestion management and balancing. The need for increased interaction was also emphasized in countries such as Ireland, where a target of 75% of power generation from non-synchronous machines is to be achieved. This raises the question of responsibility of providing the necessary reactive power to achieve this goal.

The development of business cases that enable TSO/DSO coordination was also discussed. It was pointed out that to ensure the optimal condition of the power system often requires a systematic behavioural change. In this regard, it has become evident that demand-side management plays an important role in market-related aspects and that sufficient incentives for optimization should be introduced when it comes to DER flexibility.

The panel discussion incorporated a Q&A session received a constructive response. The presenters from the previous discussion were available for further questions and discussion.

**Panellists:** Antony Zegers, AIT Austrian Institute of Technology GmbH, Austria; Tony Hearne, ESB Networks, Ireland; Gonca Gürses, RWTH Aachen, Germany; Andreas Beer, Repower AG, Switzerland; Markus Imhof, Swissgrid AG, Switzerland; Alexander Fuchs, ETH Zürich, Switzerland,

**Moderator:** Turhan Demiray, ETH Zürich, Switzerland



© AIT/Philipp

▲ Public Workshop: Needs, challenges and opportunities of TSO-DSO coordination

## 6. Deliverables



### 6.1. ISGAN Workshops and Other Events

Several workshops and events organized by ISGAN Annexes and ExCo members took place in 2019. Some of them were organized back-to-back with ExCo meetings, while others were stand-alone events.

#### 6.1.1. INNOGRID2020+

13 May 2019

The conference focused on the connection between physics and digitalisation. ICT is transforming the energy system into a cyber-physical system, combining IT networks and physical grids. The main questions are: How to ensure that digitalisation delivers all of its potential value to European citizens? And how can it support optimal TSO/DSO interaction?



ISGAN Annex 6 organized a side-event to this conference, see 6.1.2 below.

#### 6.1.2. Steering our energy future

The side event to INNOGRID2020+ focused on recent developments and innovations undertaken by network planners and regulatory bodies to increase coordination and control of interconnected systems and markets on a global scale. See also: <http://www.iea-isgan.org/innogrid2020/>

The large influx of fluctuating power is a challenge for the entire power system, especially in a context where large storage capacities still remain economically unviable. Securing network stability becomes increasingly difficult because of increased volatility and growing numbers of unscheduled flows. The electrification of society adds to the socio-economic impact and the political sensitivity of a disruption of power supply. Policy makers and network operators are therefore looking at global grid solutions and to better forecast and steer power flows:

- Technological options to increase their knowledge about the real-time status of their network (e.g. WAMS) and to manage power flows (e.g. FACTS, PSTs & HVDC)
- Increased coordination with other network operators, both at TSO and DSO level
- Improved modelling and forecasting tools for all relevant time horizons
- Discussion of alternative safety standards in order to improve system control and network planning
- Improved market design to attract the necessary system flexibility

Annex 6 focused on the application of advanced technologies needed for power grids to contribute in the best way to the attainment of clean energy and climate goals. In the interactive workshop conclusions of existing ISGAN activities on these topics were presented.

### 6.1.3. The future of electricity markets in a low carbon economy

2 April 2019

The event focused on international experience and lessons learned, with emphasis on the importance of market design in relation to the following key aspects of power systems transformation and Smart Grid development.

- New market opportunities enabled by digitalization of the power sector
- Flexibility and power system interaction and optimization leveraged by Smart Grid solutions
- Innovative regulatory approaches to advance Smart Grids deployment with focus on Experimental Sandboxes

### 6.1.4. ISGAN Knowledge Exchange Project on Experimental Sandboxes

1 April 2019

Experimental (Regulatory) Sandboxes for Smart Grid transitions have been in focus of a major ISGAN inter-Annex knowledge exchange initiative in partnership with the International Confederation of Energy Regulators (ICER). The purpose of which lies in identifying lessons learned and examples of good practice in regard to the design and implementation of such innovative policy instruments. The project was led by an international team of ISGAN experts and involved about 45 participants from over 20 countries.

The project was part of a broader scope of activities that ISGAN is undertaking with partner organizations to advance international dialogue around good practices and new approaches for innovative market and power system design needed to catalyse Smart Grid investments.

The ISGAN Sandbox initiative included a number of mutually supporting activities designed to support capacity building, share international experiences and co-create ideas in regard to this relatively new but important topic for the future energy systems and Smart Grid community. The initiative built on the successful [ISGAN Knowledge Transfer Project](#) approach and involved an interactive knowledge sharing workshop, held during the Stockholm Smart Grid week, in conjunction with the [17<sup>th</sup> ISGAN Executive Committee Meeting](#).

Key project results include (see downloads below):

- ISGAN Policy Messages on Sandboxes to the [Clean Energy Ministerial](#)
- ISGAN Casebook including examples from seven countries: *Innovative Regulatory Approaches with Focus on Experimental Sandboxes*
- [ISGAN Academy Webinar](#)

### 6.1.5. Smart Grids & District Heating and Cooling: Key Integration Aspects

1 April 2019

Representatives of Annex 6 and IEA DHC Annex TS3 *Hybrid energy networks* met for an interactive cooperation event during the Stockholm Smart Grid week. Integrating the different energy domains and thus creating hybrid energy networks is considered to be one of the key aspects of future energy systems. The interdisciplinary co-operation between international experts from ISGAN and DHC Annex TS3 is a unique opportunity for developing innovative solutions and successful business models towards a sustainable and flexible energy infrastructure. Aim of the event was to create awareness on both sides on system gains from increased flexibility and resilience by coupling energy vectors, which was discussed by means of real case studies.

### 6.1.6. ISGAN and Mission Innovation (MI) Innovation Challenge 1 on smart grids (IC1)

29 May 2019

ISGAN and MI IC1 co-organized the joint 1<sup>st</sup> CEM/ISGAN/MI IC1 forum on **Cooperation to Accelerate Smart Grid Market Uptake**. The event was the only full-day CEM10/MI-4 side event and took at the Vancouver convention centre. Ministers from over 25 countries gathered to accelerate progress toward a clean energy future.

### 6.1.7. Needs, challenges and opportunities of TSO-DSO coordination

3 October 2019

The public workshop explored the needs, challenges and opportunities of TSO-DSO coordination from a broader perspective accounting for technical, market and regulatory aspects and different views from national and international TSOs, DSOs, and Smart Grids projects.

The transition from a system comprised primarily of dispatchable generators to a system increasingly reliant on intermittent power sources increases the variability, uncertainty and thus also the need for flexibility. DERs and active customers can provide more flexibility and thus more services to both DSOs and TSOs. This shift toward distributed and renewable electricity supply poses challenges to both the TSO and DSO; however, it also encourages exploitation of underutilised synergies to achieve mutual benefits.

The coordination between TSOs and DSOs is of utmost importance for the grid to obtain the full value from services potentially provided by DERs such as, congestion relief, reactive power, voltage control and frequency reserves.

### 6.1.8. Knowledge Transfer Project on Upscaling of Smart Grid Research and Innovation

30 September 2019

Removing barriers to upscaling of Smart Grid and energy system innovations was the focus of the international transdisciplinary workshop in Montreux, Switzerland.

In conjunction with the ISGAN ExCo, nine member countries (i.e. Austria, Belgium, Germany, India, Korea, Netherlands, Russia, Spain and Sweden) participated in an interactive knowledge sharing workshop on the topic of *Upscaling of Smart Grid Research and Innovation*.

The workshop was an integral part of a longer knowledge transfer process and was preceded by considerable preparation by the participants, including an in-depth questionnaire and a preparatory webinar providing important background context about upscaling barriers and initiatives in different countries. The interactive knowledge-sharing and co-creation dialogue focused on how key barriers (economic, legal, technological, social, etc.) can be overcome and the role of government actors, such as public funding agencies.

The insights from the project have been summarised in the [ISGAN Policy Messages on Upscaling of Smart Grid Research and Innovation](#).

This knowledge transfer project on upscaling was the third under the umbrella initiative *Public Support to Smart Grid Research and Innovation* (2017-2019), in which countries have come together to share knowledge and experiences on aspects related to public funding and other support mechanisms relevant to smart grid development.



## 6.2. ISGAN Publications

One of ISGAN's most important outputs are publications for its target audience of policy makers and other stakeholders. They intend to support decision-making through the experience and insights from the Annexes' National Experts and a continuous international knowledge exchange.

### 6.2.1. Ancillary services from distributed energy sources

Ancillary services from distributed energy sources for a secure and affordable European system: Main results from the SmartNet project.

In Europe, there is a sharp increase in reserve needs to cope with the variability induced by a steadily rising share of RES in power generation. The major challenge is to extend the possibility of providing Ancillary Services (AS), e.g. frequency and voltage control, congestion management, etc., to entities connected to the distribution network.

All these issues have been addressed by the European research project SmartNet (<http://smartnetproject.eu/>, 2016-2019), which aimed at comparing different TSO/DSO interaction schemes and different real-time market architectures with the goal of finding out the best compromise between costs and benefits for the system. The objective of this project was to develop an ad-hoc simulation platform which models all three layers (physical network, market and ICT) for three national cases (Italy, Denmark, Spain).

In addition to providing information on the main results obtained by the project, this report includes some information on the status quo of the procurement of ancillary services in selected countries. A questionnaire was created and distributed among the members of ISGAN Annex 6. The questionnaire contained the following questions:

- Which system services are provided in your country (voltage regulation, frequency regulation, inertia, support to power quality...)
- Who is providing them (generators and/or loads?)
- Modalities to collect ancillary services: via markets, contracts, compulsory non-paid services... (Please describe in detail)
- Are generators and/or loads located in distribution admitted to provide system services? If yes, how is TSO/DSO interaction carried out
- Are there plans from the national regulator to activate demand side management or to collect inputs from generators connected to distribution for the future? Which timeframe? Are pilot projects already active?

[ISGAN\\_DiscussionPaper\\_SmartNet\\_2019.pdf](#)

### 6.2.2. Policy Messages on Upscaling of Smart Grid Research and Innovation

As part of the umbrella initiative *Public Support to Smart Grid Research and Innovation* (2017-2019), an interdisciplinary group of stakeholders from nine countries has jointly explored and shared knowledge on barriers to upscaling of Smart Grid research and innovation. The project, developed within the ISGAN Knowledge Transfer Platform, focused on the role of public sector institutions, in particular funding agencies, and on identifying solutions to overcome identified challenges.



The results of the project have been summarized as *Policy Messages on Upscaling of Smart Grid* solutions for decision-makers developing policy and strategies related to public funding of Smart Grid research and innovation. These policy messages are the result of an interactive workshop during ExCo18.

### 6.2.3. micro vs. MEGA grids

In this work by Annex 6 two distinct trends, herein referred to as the micro and the MEGA grid trends, are discussed. The micro grid perspective focuses on local solutions whereas the MEGA grid perspective focus on system-wide or even intra-system solutions.

The objective of this work is to present a critical assessment based on the questions:

- Does one trend outcompete the other?
- Does increased micro grid investment increase the need for MEGA grid investments, and vice versa?
- To what extent can micro grids benefit from MEGA grid solutions, and vice versa?

The intention of this work is not to prefer one solution over another, but rather to provide insight into the both perspectives and the decision-making process for a sustainable development of power grids. The work involves participations from Norway, Sweden, Germany, Belgium, Spain, Italy, France, Canada, South Africa, and India

#### Results:

- Support future collaboration in the ISGAN Annex 6 activity on micro vs MEGA grids
- Prepare messages for the report
- Understanding of the next steps of the report development



▲ Workshop on micro vs MEGA grids, Montreux, 2019

### 6.2.4. Annual Report 2018

ISGAN proudly looks back at numerous highlights and achievements in 2018. Its activities led to valuable interactions with high-ranking officials, fruitful discussions with professional experts and public dissemination activities.

Highlights of 2018 include:

- ISGAN's activities during the Nordic Clean Energy Week and the Clean Energy Ministerial (CEM9)
- Workshop and high-level panel discussion on the Acceleration of Smart Grid deployment through innovative market design
- Side event concerning Perspectives on Smart Energy Storage Systems



- Highly recognized public workshops in connection with ExCo meetings
  - Public workshop on Smart Energy for Smart Cities, Newcastle, Australia, as part of the Newcastle Smart City Strategy (ExCo15, Newcastle)
  - 8<sup>th</sup> International Conference on Integration of Renewable and Distributed Energy Resources IRED2018 (ExCo16, Vienna)
  - Thematic knowledge exchange projects (KTP): During ExCo16 in Vienna, a KTP workshop on KPIs in Public Support took place. A Summary of the event was published.
- Awards of Excellence:
  - 4<sup>th</sup> ISGAN Award of Excellence (FY2018) focusing on Flexibility: Award ceremony took place during CEM9
  - 5<sup>th</sup> ISGAN Award of Excellence (FY2019) focusing on Local Integrated Energy Systems (Smart Microgrids) was launched at CEM9
- Bimonthly webinars organized by the ISGAN Academy and co-hosted by the Clean Energy Solutions Center
- Publication of several discussion papers, event summaries and policy briefs.
- Collaboration and co-operation with other IEA networks and CEM initiatives.

Downloads: [ISGAN-Annual-Report\\_2018\\_Web.pdf](#)

### 6.2.5. Casebook: Spotlight on Energy Storage Systems

This casebook reflects how ISGAN gathers experts and stakeholders to increase awareness for energy storage systems in the field of Smart Grid. At this stage, the casebook includes fourteen cases from seven different countries, i.e. Austria, Canada, France, India, Korea, Netherlands, and Sweden. It specifically places its focus on actual operation of ESS rather than looking at test pilots in order to demonstrate feasibility and usability in real sites.

Downloads: [Energy-Storage-Systems-ESS\\_Casebook\\_Final-1.pdf](#)

### 6.2.6. Policy message on Innovative Regulatory Approaches with Focus on Experimental Sandboxes to Enable Smart Grid Deployment

The urgency of a transition of the energy system requires speeding up the innovation processes that will shape its future technological, economic and regulatory components.

As regulatory changes often lag behind what are identified as preferable pathways, such changes could be accelerated through Regulatory Sandboxes, which are used to verify effects of new regulatory instruments before actual implementation.

All energy systems, whether vertically integrated or deregulated, have some sort of regulatory or market oversight. Some of these regulations have been long established and originate from structures created around the turn of the 20<sup>th</sup> century. However, as the electricity grid transitions towards a more decentralized structure, with deepened engagement of end-users (including consumers) and involvement of a wider variety of other stakeholders and service providers, there is a need to enable testing of new regulatory structures that can better support integration of advanced smart grid technologies and business models.

Downloads: [ISGAN\\_Policy-Message-on-Regulatory-Sandbox-A2-1.pdf](#)

### 6.2.7. Casebook on Innovative Regulatory Approaches with Focus on Experimental Sandboxes

The casebook on Experimental (Regulatory) Sandboxes is a result of the workshop *Intelligent Market Design – Boosting Global Smart Grid Deployment*, May 2018, and the following Annex and inter-Annex meetings. In these discussions, market regulation was repeatedly identified as a key topic for further collaboration in research and innovation.

The casebook provides detailed information on planned or implemented Sandbox Programmes for Australia, Austria, Germany, Italy and The Netherlands. An overview of the previously well documented program in the UK is provided as well.

The US federal state of Hawaii is included as an example of another form of regulatory experimentation. The state experiments with a performance-based method for tariffs which, if successful, can be rolled out as a regulatory innovation to other federal states or other countries. The main focus of the casebook however lies on experimenting to achieve the aforementioned innovation goals by means of Sandbox projects.

Downloads: [ISGAN\\_Casebook-on-Regulatory-Sandbox-A2-1.pdf](#)

### 6.2.8. The Smart Grid Discourse Arena: A global social network analysis

For shaping and adapting policy agendas and institutional change towards Smart Grids, it is of utmost importance to understand how discourse develops in the fast-changing reality of energy transition. This policy brief provides evidence about the Smart Grid related topics, which create most attention by actor groups and the public. The analysis is based on systematically observed global communication on the social media platform Twitter with a dataset of over 70,000 messages between December 2015 and April 2018, which include the hash-tag #smartgrid and/or #smartgrids.

Downloads: [CEM9-ISGAN-Annex-7\\_b\\_Policy-Communication.pdf](#)

### 6.2.9. Flexibility in Future Power Systems

Power system flexibility: The ability to manage change

Solutions providing advances in flexibility are paramount for future power systems. However, flexibility is not a unified term and is lacking a commonly accepted definition. The term flexibility is used as an umbrella covering various needs and aspects in the power system which complicates the discussion on flexibility and craves for differentiation to enhance clarity.

ISGAN Annex 6 has dedicated an activity to flexibility with the intention to support an increased understanding of the flexibility concept, proposing categorisation of flexibility needs in the power system.

This activity resulted in several publications with contributions from Sweden, Austria, Canada, France, Germany, Italy, Norway, and Switzerland.

- The final results and conclusions of this activity were presented at a dedicated [ISGAN Webinar](#), November 2019.
- In the [Fact Sheet: Grid Evolved – Power System Flexibility](#), the condensed knowledge from this activity, with collaboration with Mission Innovation, was published for the [10<sup>th</sup> Clean Energy Ministerial in Vancouver, Canada](#), May 2019.
- In the [Discussion Paper \(DOI: 10.13140/RG.2.2.22580.71047\)](#), the full report is provided from this activity, including description of the flexibility categories: Flexibility for Power, Flexibility for Energy, Flexibility for Transfer Capacity, and Flexibility for Voltage.
- The [Leaflet: Power system flexibility – the ability to manage change](#) presents an executive summary of the discussion paper, giving a good insight into the work. This leaflet was published for the ISGAN Conference [The future of electricity markets in a low carbon economy](#) in Stockholm, Sweden in April 2019.
- The [Scientific paper: Flexibility to support the future power systems](#), based on the discussion paper, was published for the [CIGRE Symposium](#) in Aalborg, Denmark, June 2019.

Downloads:

[ISGAN\\_Factsheet\\_Flexibility-ExCo.pdf](#)

[ISGAN\\_DiscussionPaper\\_Flexibility\\_Needs\\_In\\_Future\\_Power\\_Systems\\_2019.pdf](#)

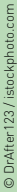
[ISGAN\\_Leaflet\\_Summary\\_Flexibility\\_Needs\\_In\\_Future\\_Power\\_Systems\\_2019.pdf](#)



## 6.3. ISGAN Webinars

As part of the deliverables of Annex 8, ISGAN Academy on Smart Grids, several webinars took place. See chapter 2.7.1 for details.

Date	Presenter	Webinar Topic
February, 2019	Klaus Kubeczko Enrique Kremers, Xiubei Ge	How to replicate solutions for the flexibility challenge?
April, 2019	Andrew Thompson	Vehicle to Everything (V2X) Energy Services
June, 2019	Klaus Kubeczko Helena Lindquist Magnus Olofsson	Outcomes of the ISGAN KTP on Regulatory Sandboxes to enable smart grids deployment
July, 2019	Jean-Louis Repetto Rena Kuwahata	Dynamic Line Rating Principles-Applications- Benefits
September, 2019	Hyungsu Kim Bartłomiej Arendarski	ISGAN Award 2019: Excellence of the Local Integrated Energy Systems (Microgrids)
November 2019	Emil Hillberg	Flexibility needs in the future power system
December, 2019	Kriss Kessels Gonca Gürses-Tran Marco Baron	CoordiNet project: Coordination schemes and Business Use Cases for TSO-DSO cooperation



## 7.1. ISGAN Financial Report

Status of Finance for FY2019, from 1 March 2019 through 29 February 2020

ISGAN Common Fund – End of the year status	
<b>Receipts</b>	
<b>Contributions from Contracting Parties</b>	€ 218,927.95
<b>Interest (minus fees)</b>	€ -117.30
<b>Grand Total Receipts</b>	€ 218,810.65
<b>Expenditures</b>	
<b>Secretariat Staff</b>	€ 251,300.00
	€ 16,920.00
<b>Executive Committee Reporting and Representation</b>	€ 3,307.88
	€ 10,000.00
<b>Strategic Outreach Projects</b>	€ 35,442.79
<b>Contingencies</b>	€ 171.89
<b>Representational and Invitational Travel</b>	€ 5,822.65
<b>Workshop (Invitational Travel, etc.)</b>	€ 3,884.73
<b>Grand Total Expenditures</b>	€ <b>326,849.94</b>





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