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ISGAN
INTERNATIONAL SMART GRID
ACTION NETWORK

International Energy Agency (IEA)
Technology Cooperation Programme (TCP)
International Smart Grid Action Network (ISGAN)

Annual Report 2021

for the period from 1 March 2021 - 28 February 2022

CLEAN ENERGY
MINISTERIAL

Technology Collaboration Programme
by iea

Disclaimer

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August 2022

Message from the Chair

It is my great pleasure to personally introduce you to the eleventh annual report of ISGAN, the International Smart Grid Action Network. Acting as both a Clean Energy Ministerial (CEM) initiative and an International Energy Agency (IEA) Technology Collaboration Programme (TCP), ISGAN is a unique and powerful global platform that aims to bring together governments and support them towards the definition of a clean energy strategy and the deployment of smarter electricity grids around the world.

The value of ISGAN lies in its highly collaborative and valuable work in the area of smart grids development and deployment, which attracts every year new relevant countries: in 2021 ISGAN warmly welcomed Israel as new member! ISGAN members span the entire globe, including developed as well as emerging economies from five continents working closely together in a highly cooperative environment.

Beside countries, ISGAN is able to engage relevant grid stakeholders and national experts in the area of smart electricity grids, thus being able to inform its members on new strategies, innovative approaches and available tools and technologies to reach their national and regional goals - towards the clean energy transition and in particular, power system modernization and decarbonization.

ISGAN is a dynamic initiative seeking continuous exchange of knowledge and experience among its members, but also relying on fruitful collaboration with key partners such as the GSEF and Mission Innovation, thus further enhancing its international visibility and impact.

Unfortunately, also in the year 2021 due to the Covid-19 pandemic we were still forced to organize virtual meetings only and this has somewhat limited our interactions. Nevertheless, I believe that in 2021 by working in close collaboration and harmony with the ISGAN Presidium, ExCo members, the Operating Agent and co-Secretariats, Technical Leads and national experts, we have made very good progress.

I am very glad to recall that we organized two very well attended ExCo meetings as well as several international workshops and webinars, some of which together with our strategic partners. Moreover, we jointly developed the needed documentation, including the ISGAN strategic work plan, that has been submitted to the IEA EUWP and CERT to successfully pass through the request for extension for a third period. I am very proud to underline that ISGAN was granted an extension for a five-year new term!

To accomplish this task, we passed through an internal self-assessment and dedicated meetings and workshops that allowed us to evaluate the present ISGAN structure and impact. Resulting from this process an internal restructuring of ISGAN was proposed with as an example a stronger focus on communication and dissemination to be combined into one new Communication Working Group. Several workshops have been organized to clearly define the tasks of this new working group with the aim to make ISGAN results more visible and impactful.

I strongly believe that even though the international landscape became increasingly crowded due to ongoing and new global initiatives on power and energy system transformation, ISGAN still keep its added value providing a global platform enabling effective coordination and collaboration at international level thus to advance faster towards smart grids development and deployment worldwide.

I would like to conclude expressing my great hope that by reading this eleventh ISGAN Annual Report you will find the right motivations to either continue your engagement or to become a new active member of the ISGAN community. Thank you.

Yours sincerely,

Luciano Martini

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1. ISGAN overview

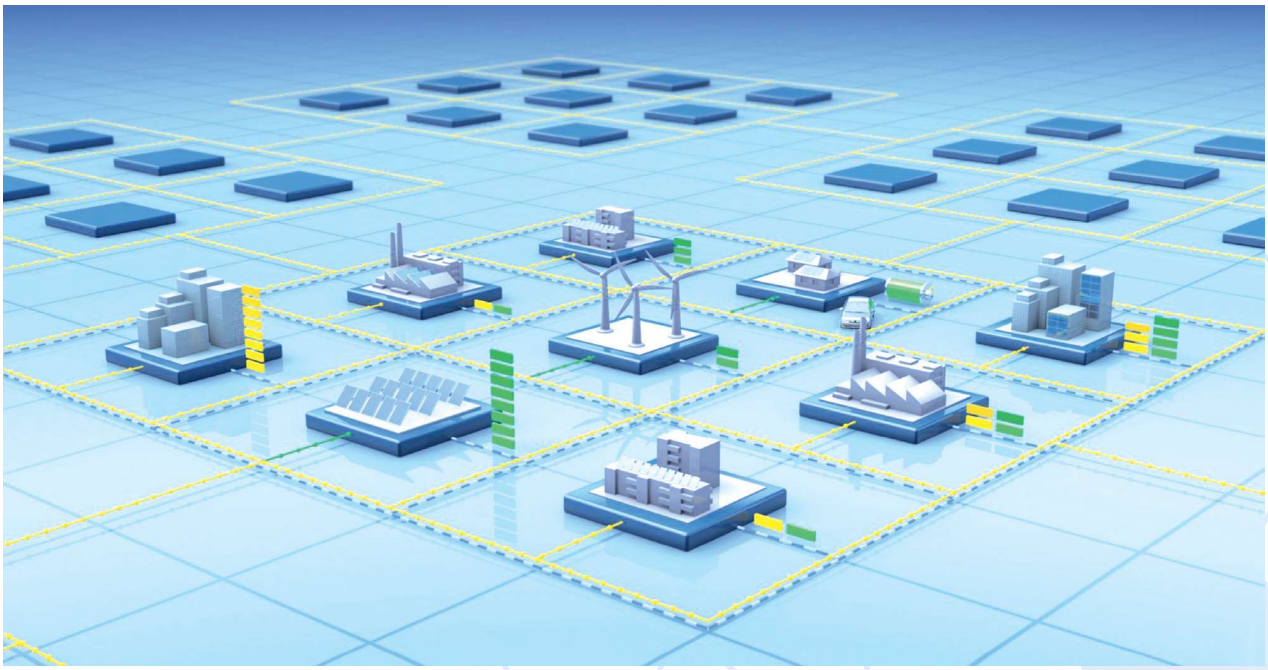
1.1. What is ISGAN?

The **International Smart Grid Action Network (ISGAN),** is a Technology Collaboration Programme of the International Energy Agency. The co-operative programme was formally established in 2011 and is also an initiative of the Clean Energy Ministerial. ISGAN creates a strategic platform to support high-level government focus areas that require increased attention and action for the accelerated development and deployment of smarter, cleaner electricity grids around the world.

The **International Energy Agency (IEA)** is an intergovernmental organization that works to shape a secure and sustainable future for all, through its focus on all fuels and technologies, and the analysis and policy advice to governments and industries around the world.

The **Technology Collaboration Programme (TCP)** is a multilateral mechanism established by the IEA with a belief that the future of energy security and sustainability starts with global collaboration. The programme is made up of thousands of experts across government, academia, and industry located within 55 countries who are dedicated to advancing common research and the application of specific energy technologies.

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



▲ Schematic view of a modern electricity grid: Smart Grid

ISGAN provides an **international platform and community of experts dedicated to the development and exchange of expertise and competencies on smarter, cleaner, and more flexible electricity networks.** Besides that it acts as an information exchange channel for communication of smart energy-related knowledge, trends, lessons learned, and future plans in support of regional, national, and global climate and clean energy objectives.

ISGAN differs from many other TCPs because, rather than address a single energy source or use, ISGAN focuses on electricity networks (grids), which are complex "system of systems" that dynamically balance supply and demand and therefore function as a key facilitator for clean energy integration and use. The **planning and operation of electricity networks must be integrated and optimized in conjunction with the array of surrounding energy systems to support the reliable, secure, efficient, and sustainable operation of the entire energy ecosystem.** ISGAN's aim is the wider acceptance, demonstration, and deployment of smart grids as a preferred intervention for the modernization and transition of electricity systems, including the integration of distributed energy resources, empowerment of energy users, connection with other energy vectors (such as hydrogen), smart buildings and smart transport.

ISGAN's **expert participant base extends across most major advanced and emerging economies** from five continents. It has become an established, trusted partner amongst various stakeholders and is well represented within several smart grid-related activities and events. Through its dual role within TCP and CEM, alongside its diverse participant base, portfolio of activities, and strategic collaborations, ISGAN provides support to facilitate the uptake of high-quality technical, market, and policy information by domain experts, thought leaders, and decision-makers alike, in alignment with IEA mission areas such as *Energy Security, Economic Development, Environmental Awareness,* and *Engagement Worldwide*.

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 improved utilization of existing electricity generation assets. In coordination with the IEA and CEM, ISGAN strives to improve the potential of Smart Grid technologies at a global, national and regional level while ensuring a resilient and secure energy system.

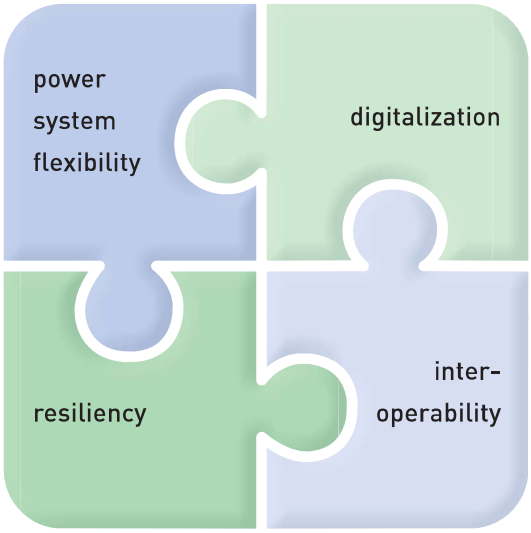
Investment in Smart Grid technologies and approaches, including Smart Meter deployment, has grown rapidly in recent years around the world. Smart Grids are playing an increasingly critical role in the affordable and reliable integration of clean energy technologies. To ensure that Smart Grids can continue to overcome 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 the delivery of data-driven energy services

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

Thus ISGAN's themes are:



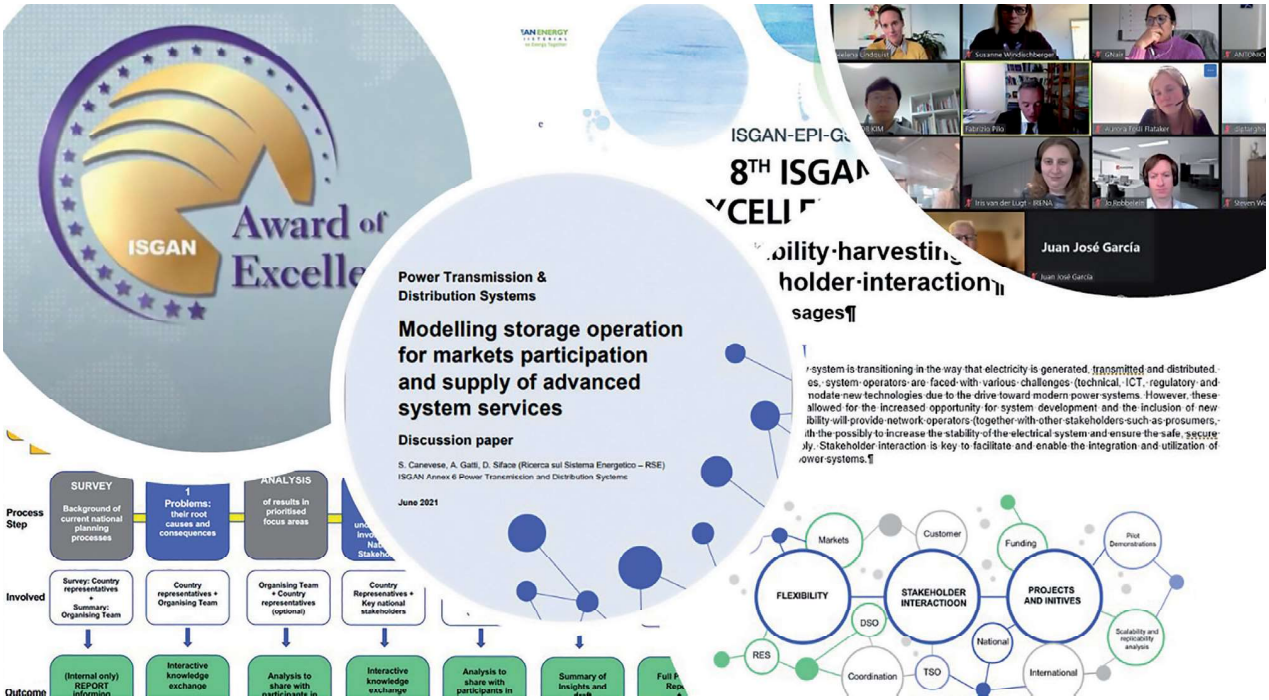
1.2. Vision

ISGAN's vision is to achieve national, regional, and global clean energy and climate change goals by integrating a variety of smart grid technologies, applications, and strategies. To this end, ISGAN serves as a platform for the development and exchange of expertise and competence related to smarter, greener power systems, and as an important channel for the communication of related knowledge.

1.3. Activities and Deliverables

The main purpose of ISGAN is knowledge sharing. Both, newly developed as well as well established methods and platforms are used to disseminate and distribute knowledge. The ISGAN national experts produce a variety of deliverables each year which can be categorized as follows:

- Casebooks
- Webinars
- Discussion papers
- Workshops
- Policy and technical briefs
- Technical papers
- Conference contributions



▲ Examples of ISGAN's activities and deliverables

1.4. 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 across 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.

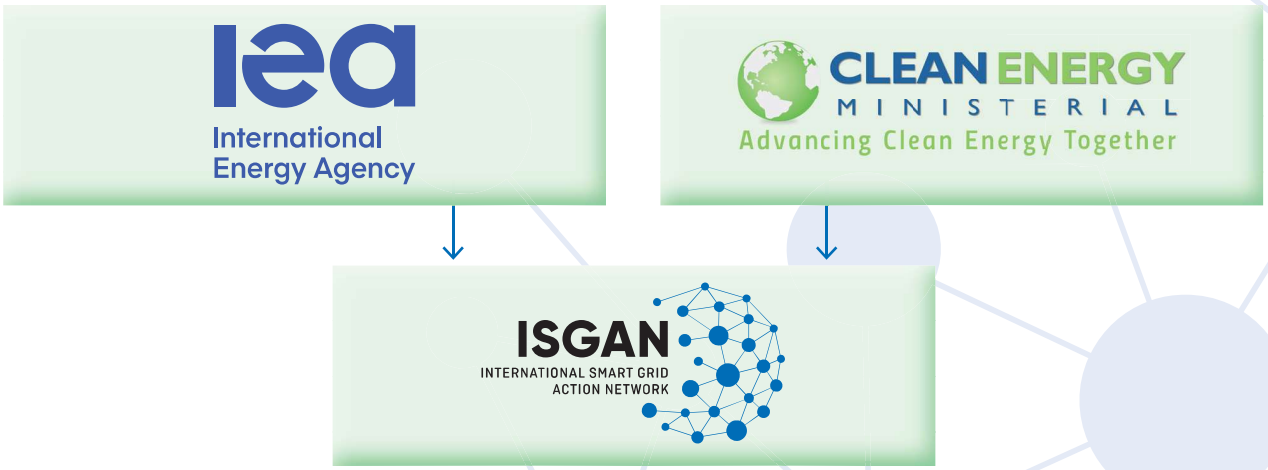
1.5. History

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 the ExCo 18, in October 2019, the Executive Committee of ISGAN agreed to file a Request for Extension for the next five year-period of ISGAN, to commence from 1 March 2022. The Request for Extension was granted on 5 November 2021 (i.e. 1 March 2022-28 February 2027).

In the years 2020 and 2021 the work of ISGAN was – as the whole world – overshadowed by the COVID pandemic. Some work was delayed, and some countries faced severe impact to their daily work. However, ISGAN managed also in these difficult times to hold meaningful meetings, produce very valuable deliverables and kept in contact.



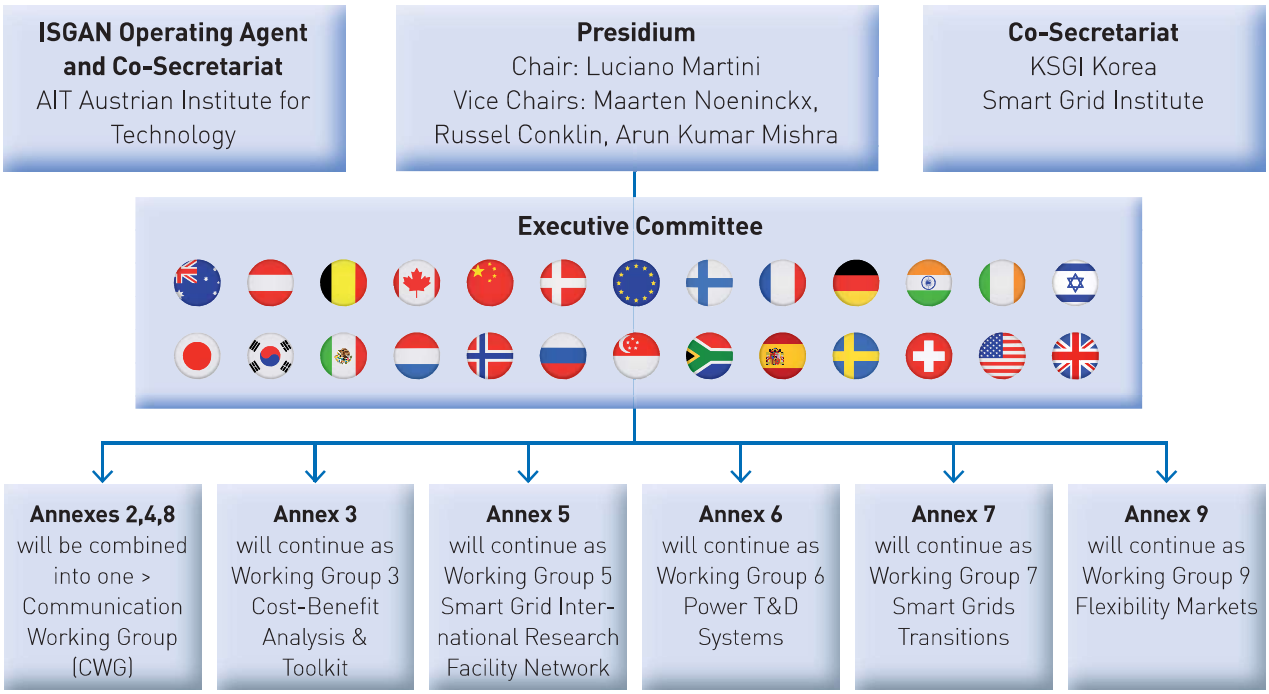
1.6. Organizational structure

ISGAN is a Technology Cooperation Programme (TCP), currently consisting of 27 Contracting Parties. Their nominated representatives form the Executive Committee which is led by the Presidium and assisted by the Co-Secretariats and the Operating Agent of ISGAN. The activities of ISGAN are organized into nine Annexes, which are standing working groups, which execute several topic-related 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. These Annexes form the basis for continuous work to be conducted for the duration of the working period. However, Annex 1: Global Smart Grid Inventory has already been completed, with some of its remaining tasks moved to Annex 2: Smart Grid Case Studies.

Furthermore, five of the Annexes are topic-oriented (Annex 3: Cost-Benefit Analyses; Annex 5: Smart Grids testing; Annex 6: Future T&D system needs; Annex 7: Smart Grids Transitions on Institutional Change, Annex 9: Flexibility Markets development and implementation), 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 of Knowledge Transfer Projects (KTP), Casebooks, and policy insight; Annex 8: Webinar-based virtual training and strategic communication to decision-makers).

In the year 2021, a strategy process and a renewal of the Implementing Agreement of ISGAN (the legal document an IEA TCP is based on) took place. Starting with the new Fiscal Year 2022 (i.e. 1 March 2022) the Annexes are referred to as Working Groups and are led by Working Group Managers. Furthermore, ISGAN undertook a strategy process to improve its impact and make the most out of its limited resources. During this process, it was decided to combine all tasks of the three platforms for dissemination into one Communication Working Group (CWG). However, since this report considered the achievements in 2021, the document is developed in order to be aligned with the previous structure based on the nine Annexes.

The following chart shows the new structure that was elaborated in FY 2021 and came into force by 1 March 2022:



▲ ISGAN's new organizational structure from 2022

1.6.1. The Executive Committee (ExCo)

The Executive Committee is the decision-making body of ISGAN which convenes twice a year. The ExCo's main aims are to discuss new developments, identify knowledge gaps and implementation barriers, and shape ISGAN's Programme of Work accordingly. Each Contracting Party appoints a delegate and an alternate to the ExCo.

▲ ISGAN Executive Committee

1.6.2. The Presidium

The ExCo is led by the Chair and three Vice-Chairs and 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 of ISGAN's activities, having three Vice-Chairs was deemed appropriate.

In 2021 the Presidium consisted of:

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

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

▲ 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.

▲ ISGAN's worldwide presence

List of ISGAN Contracting Parties (as of February 2021):

1.	Australia	15.	Japan
2.	Austria	16.	Korea
3.	Belgium	17.	Mexico
4.	Canada	18.	Netherlands
5.	China	19.	Norway
6.	Denmark	20.	Russian Federation
7.	European Commission	21.	Singapore
8.	Finland	22.	South Africa
9.	France	23.	Spain
10.	Germany	24.	Sweden
11.	India	25.	Switzerland
12.	Ireland	26.	The United States of America
13.	Israel	27.	United Kingdom
14.	Italy		

ISGAN has been constantly seeking to extend the participation list 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, Czech Republic, Indonesia, Israel, Brazil, Malaysia, Hungary, UAE and Thailand.
Israel joined ISGAN in May 2021. On the 21st (October 2021) and 22nd ExCo meeting (March 2022) a representative from Hungary was present. The ExCo voted for the admission of Hungary and the first steps towards their admission were already taken.

1.6.4. Operating Agent and Secretariat

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. Mihai Calin is the current Operating Agent of ISGAN.
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 management of the common fund, and reporting to the IEA:

Head of the Secretariat: Susanne Windischberger
Susanne.Windischberger@ait.ac.at; 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:

- Chloe SungJi Yoon, ysj@smartgrid.or.kr

- Sky JongCheon Son, jcson@smartgrid.or.kr

1.7. Key Achievements and Highlights in 2021

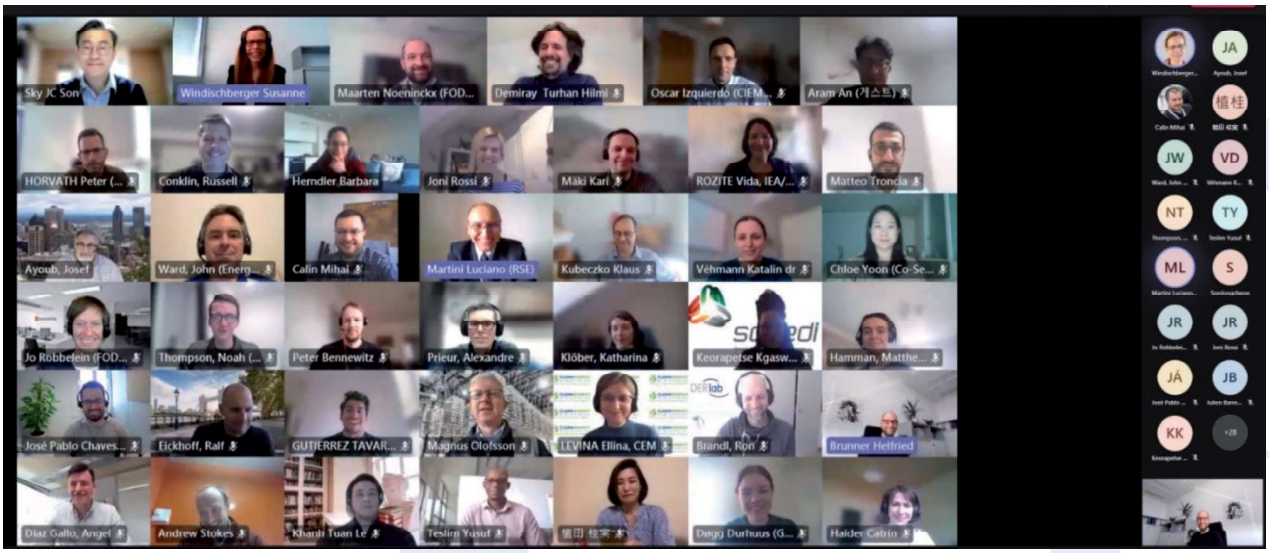
A particular challenge encountered during 2021 was to ensure that ISGAN continued to work successfully together as a network, despite the COVID-19 pandemic. ISGAN managed to successfully operate despite these challenges and reflects on the overall successes during the year 2021.

1.7.1. Virtual ExCo meetings and side events

ISGAN held two virtual ExCo Meetings in March (ExCo 21) and October 2021 (ExCo 22). Due to the online nature of the events, the attendance of contracting parties and Annex Operating Agents and leads was very high.

In conjunction with ExCo 22, Annex 6 and Annex 9 jointly organized a side-event on the topic *Flexibility and its impact on stakeholder interaction* that attracted high visibility within and outside of ISGAN. The workshop was held in order to present and discuss the results of a survey that was distributed and completed by several different stakeholders from various sectors around the world.

This survey formed part of the work conducted for the Task *Flexibility harvesting from renewable energy sources and its impact on TSO-DSO interaction* and the results were published as a discussion paper.



▲ ISGAN ExCo Meeting

© Helfried Brunner, AIT

1.7.2. Request for Extension and Strategy process

ISGAN submitted the request for extension for its third period and was granted an extension for five years. This process was also used to assess the current ISGAN structure and impact. Resulting from this process an internal restructuring of ISGAN was proposed.
As a first step, all communication-related Annexes (former Annexes 2, 4 and 8) are combined into one new Communication Working Group. Several workshops have been organized to clearly define the tasks of this working group with the aim to make ISGAN results more visible and impactful.

1.7.3. Cooperation with other organizations, TCPs, and initiatives

ISGAN is one of a growing number of forums pursuing international collaboration on power system transformation issues. ISGAN will continue to build collaborative ties with other relevant forums, aligning and differentiating activities as appropriate, in a mutual effort to attain the real outcomes needed in energy systems. ISGAN will also support any efforts by the IEA Secretariat, IEA Committee on Energy Research and Technology, its Working Parties, or other appropriate bodies to map this growing number of international, power system-related collaborative efforts.

1.7.4. Publication highlights from the Annexes

- ISGAN published a report analyzing a survey on Smart Grid motivating drivers and technologies. 18 countries took part in the survey and included responses from ISGAN participants other countries. This survey will help to understand recent national priorities for Smart Grid development around the World.

- To make the Annex 5 Smart Grid International Research Facility Network (SIRFN) more accessible, a brochure explaining how SIRFN works and how one can participate was published. This will make it easier for laboratories around the world to become a part of SIRFN.

- In 2020 and 2021 a knowledge transfer project on regulatory sandboxes was conducted, which resulted in several publications.

1.7.5.Highlight: ISGAN´s contributions to the 12th Clean Energy Ministerial

The 12th Clean Energy Ministerial (CEM12) was hosted by the Republic of Chile and chaired by the honourable Juan Carlos Jobet, Chile's Minister of Energy. Although in virtual format and carried out under extraordinary circumstances, CEM12 convened 150 000 people from more than 100 countries engaging in an amazing week of CEM12/MI-6 events that took place from 31st of May to 6th of June 2021. ISGAN contributed events as well as publications to this high-level event which are described in more detail in the following chapters.

CEM12/MI·6
CHILE 2021

1.7.5.1. Side Event: Policy Messages From The ISGAN Regulatory Sandbox 2.0 Project

This event shared the key findings from an international deep-dive knowledge exchange on the topic of Regulatory Experimenting, such as Regulatory Sandboxes, which can be used as levers to accelerate the energy transition. The Policy Messages presented were the result of an inclusive and transparent co-creation process, building on the experiences and lessons learned by policy makers, regulatory bodies and research actors in 15 countries.

1.7.5.2. Side Event: The 7th ISGAN Award of Excellence Ceremony

Each year ISGAN presents its Award of Excellence (AoE) to recognize excellence in smart grid projects, policies, and programs around the world. In 2021 the Award Ceremony took place as a side event at CEM12 which was live streamed and recorded for a global audience. The event actively engaged key speakers such as the Energy Undersecretary of Chile, the Director General from Natural Resources of Canada and present Chair of the IEA CERT. Details on the winning projects can be found in Chapter 3.

ISGAN Awards 2021 (iea-isgan.org)

2. ISGAN Annexes

ISGAN's Annexes are standing Working Groups that continuously work on Smart Grids-related topics and update their plans and objectives (Programme of Work) on a yearly basis. The new Programmes of Work are decided on at . To date, Annex 1 "Smart Grid Inventories", delivering a general overview of ongoing Smart Grid project deployment, has been completed.

Annex Managers lead the Annexes and are supported – depending on the Annex – by technical Leads and task leads.

During its Request for Extension, which was granted by the End Use Working Party (EUWP) of the IEA in September 2021, ISGAN conducted a strategy process review and, as a result, all tasks related to communication and dissemination of ISGAN results are combined onto one **Communication Annex.**

Annex	Title	Operating Agent	Country
Annex 2	Smart Grid Case Studies	Korea Smart Grid Institute – KSGI	Korea
Annex 3	Cost-Benefit Analysis	University of Cagliari	Italy
Annex 4	Synthesis of Insights for Decision Makers	Korea Smart Grid Institute - KSGI	Korea
Annex 5	Smart Grid International Research Facility Network (SIRFN)	DERLab	Germany
Annex 6	Transmission and Distribution Power Systems	Research Institutes of Sweden, RISE	Sweden
Annex 7	Smart Grids Transitions	AIT Austrian Institute of Technology	Austria
Annex 8	ISGAN Academy on Smart Grids	Institute for Research in Technology IIT, Universidad Pontificia Comillas	Spain
Annex 9	Flexibility Markets-Development and Implementation	Department for Business, Energy & Industrial Strategy	UK

ISGAN Annex Participation (as of February 2022)

	Annex 2	Annex 3	Annex 4	Annex 5	Annex 6	Annex 7	Annex 8	Annex 9
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 (inactive)		+			+			
Netherlands	+		+	+	+	+	+	
Norway					+			
Russian Federation		+		+			+	
Singapore	+							
South Africa		+			+		+	
Spain	+		+	+			+ (OA/Lead)	
Sweden	+	+	+		+ (OA/Lead)	+		+
Switzerland		+			+		+	
United Kingdom		+	+		+	+	+	+ (OA/Lead)
United States	+	+	+	+ (Lead)	+	+		

2.1. Annex 2:
Smart Grid Case Studies

The objective of Annex 2 is to assess outstanding examples of current case studies, develop and validate a common case study template and provide a methodological framework to develop in-depth case studies. The common framework, a so-called Case Book, enables the comparison of policies and technologies adopted in different regulatory frameworks, legislations, networks (grid), and natural environments. The overarching aim is to collect sufficient information from case studies around the world to extract lessons learned and best practices as well as to foster future collaboration among the participating countries.
ISGAN participants contributing to this Annex shape the analyses of, and methodological frameworks for Smart Grid-related case studies, as well as the selection of topics or projects for new case studies. The participants have first-hand access to the insights identified through analyses of new and existing case studies dealing with Smart Grid developments in specific countries.

To date, ISGAN Annex 2 has published five Case Books which are available for download on ISGAN's website www.iea-isgan.org.

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

The KTP aims to capture, collect, and share knowledge on Smart Grid technologies among countries and their key stakeholders. Building on ISGAN's experience in delivering in depth workshops, the KTP fosters meaningful international dialogue on Smart Grids with a focus on developing competence and building capacity.
The KTP workshop format, which requires significant preparation, promotes individual learning while emphasizing active participation in the co-creation of concrete results. This is achieved through collaboration among interdisciplinary participants with complementary competencies.

2.1.1. Main accomplishments in 2021

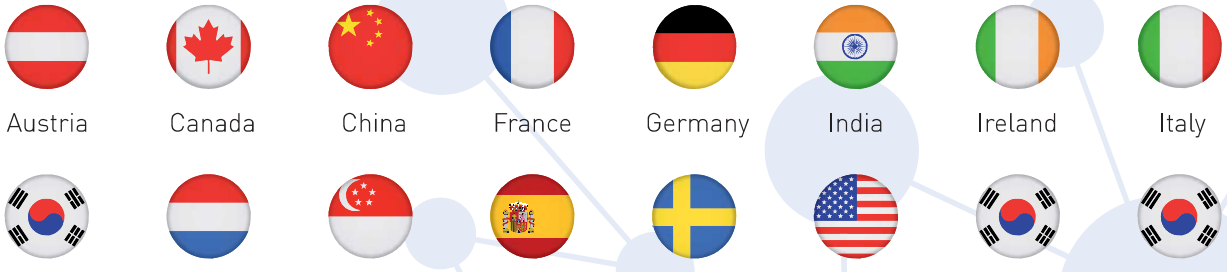
Casebook on Regulatory Sandboxes 2.0 released

In October 2021, Annex 2 released a Casebook titled "Innovative Regulatory Approaches with Focus on Experimental Sandboxes 2.0". Building on the first initiative on Experimental Sandboxes (2019), ISGAN has organized a follow-up project (2021) with a series of interactive knowledge transfer workshops and accompanying activities on maximizing policy-learning from Regulatory Experimenting programs or initiatives. As this is a new kind of mixed policy intervention with complex governance issues between public, semi-public, and private actors, efforts have to be made and resources provided to develop an adequate mix of innovation-oriented legislative or regulatory measures, as well as project-related support mechanisms and funding instruments. In addition to the first edition of the Regulatory Sandbox casebook, this second edition provides more detailed information on planned or implemented regulatory experimenting sandbox programs as well as providing examples from within the power sector in countries including Austria, Belgium, Canada, Denmark, France, Israel, Italy, Norway, Sweden and the United Kingdom. Additionally, the ISGAN Sandbox KTP Team formulated four policy messages which were successfully presented to a variety of stakeholders in the power sector around the world at the twelfth Clean Energy Ministerial (CEM12).

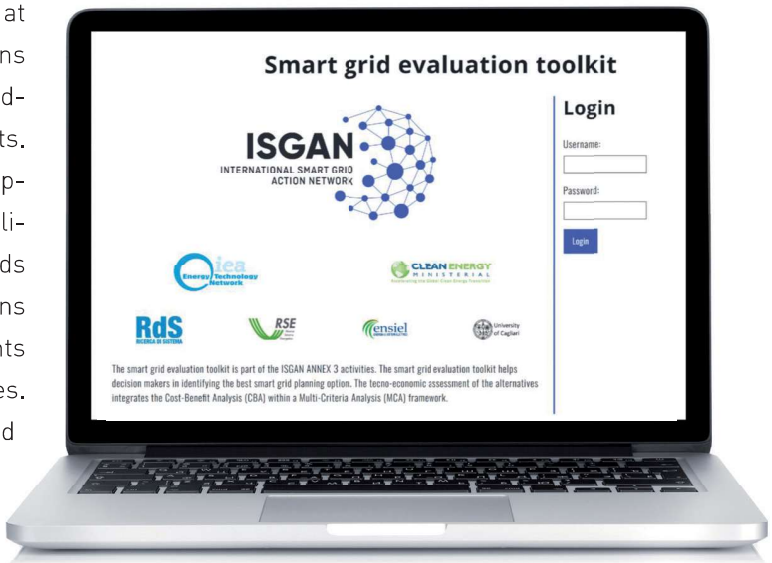
New casebook on Microgrids

Annex 2 completed a literature review on existing Microgrids and distributed a casebook template to all Annex participants to collect information on existing Microgrids. The template is focused on the economic aspects of a sharing economy. In order to support Annex 4, additional policy questions were added to the template. The casebook is expected to be released in 2022.

Participating countries:



2.2. Annex 3:
Cost-Benefit Analysis and Toolkits



Annex 3 incorporates the 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 facilitates the prioritization of decisions required for Smart Grid system investments along with necessary regulatory changes. Annex 3 develops a global framework and related toolkits, which provide a method to identify the benefits of demonstrating and deploying Smart Grids technologies in a standardized way. Annex 3 also provides an analysis of the achieved benefits of Smart grid technologies in relation to the cost of implementation. The use of an approach that combines the Cost-Benefit Analysis (CBA) for the monetary impacts and the Multi-Criteria Analysis (MCA) for non-monetary impacts is promising to increase the accuracy of the assessment of smart grid initiatives. As a part of ISGAN's activities, the *smartgrideval* software is developed and proposed as a decision making support tool in the context of smart grid assessment.

2.2.1. Main accomplishments in 2021

ISGAN Platform for MCA updated

In 2021, *smartgrideval* software platform was updated with an improved optimization engine and improved Human Machine Interfaces. The updated version was promoted via an online Video tutorial and webinar and is based on an example test case.

Additionally, a literature survey on flexibility services and products and techniques for calculating the benefit of flexibility in the electrical system has been completed.

On the topic of cost benefits for distribution planning with flexibility, Annex 3 continued its monthly calls with delegates from the UK, France, Spain and Italy. The first draft of a policy brief, along with suggestions for unique planning methodologies for DSOs (at least at national level) is in development.

At the virtually hosted 26th International Conference & Exhibition on Electricity Distribution (CIRED 2021), Annex 3 – together with Annex 6 and Annex 9, organized a Roundtable **"RT20 – The worth of flexibility in distribution planning and operation" that took place on the 23rd September 2022.**

Participating countries:


European Commission


France


India


Italy


Korea


Mexico


Russian Federation


South Africa


Sweden


Switzerland


United Kingdom


United States


Italy (Lead)


Italy (Annex Manager)

2.3. Annex 4:
Synthesis of Insights for Decision Makers

The core objectives of Annex 4 are to organize knowledge, identify key issues, distill important themes, and provide insightful analysis for decision-makers. Another important task 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 the development of the increased understanding of Smart Grids internationally, while recognizing a diversity of drivers and approaches among related technologies, policies, practices, and systems.

2.3.1. Main accomplishments in 2021

Annex 4 supported several inter-Annex activities in 2021:

Annex 4 Survey Report

In September 2021, the Comprehensive Trend Report on Digital Transformation of Utilities' was published on the ISGAN Website. This publication examines the various cases of digital transformation within utilities and identifies its implications on the transition toward clean energy. Moreover, Annex 4 aimed to convey key messages, such as what the digital transformation means in terms of transition into smarter energy, its potentiality, and the most pressing challenges, to policymakers and related industries.

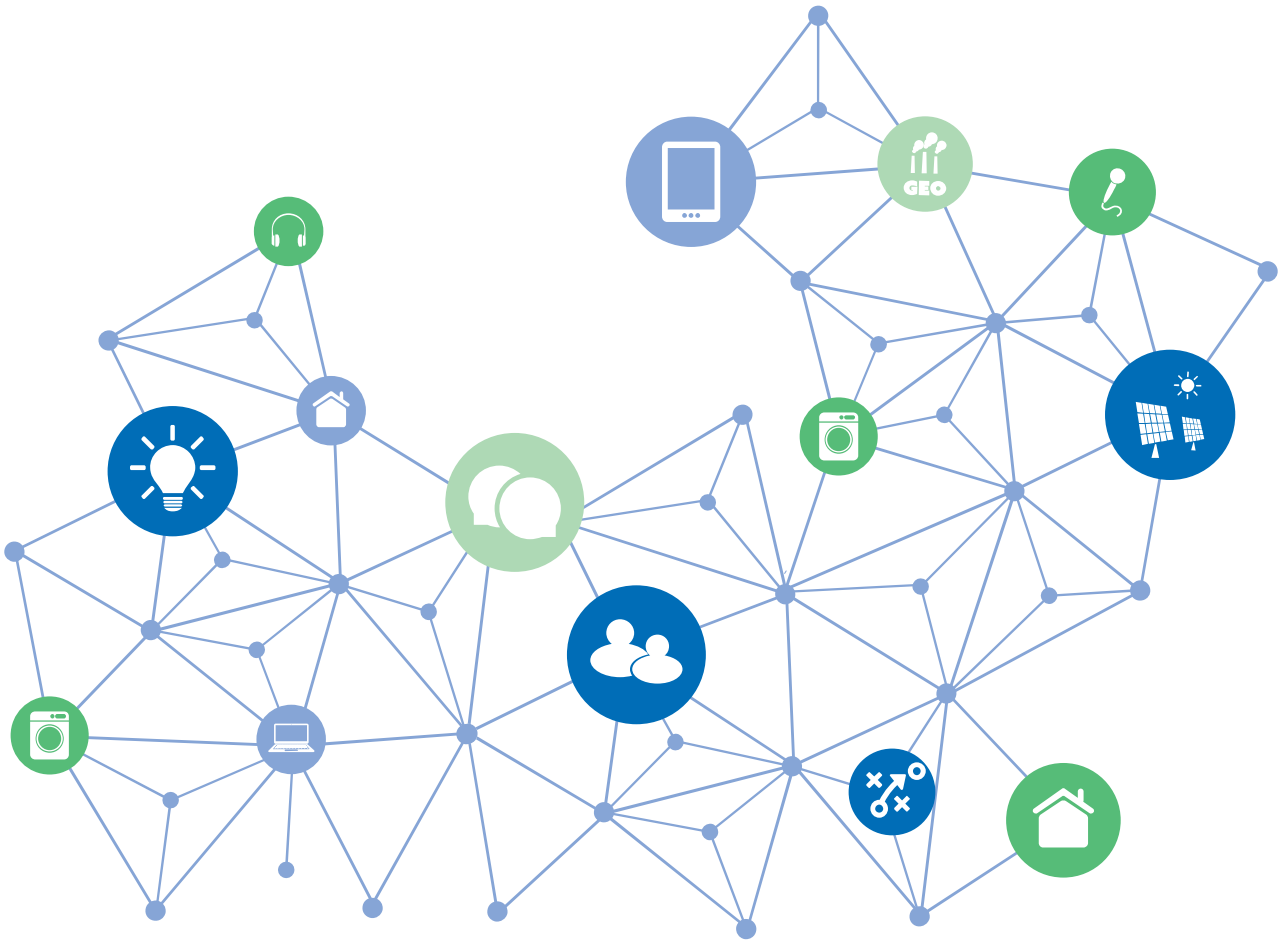
Smart Grid Academy: Essentials for Government Leaders

"The Smart Grid Essentials for Government Leaders" is the working title for a series of briefing materials on the basics of smart grids specifically developed for Government Leaders. In FY2021, Annex 4 completed a concept note on this project idea covering the basic questions such as "Why shall we develop such materials? What shall be covered? Who can do it and how shall we do it?" Nevertheless, it became obvious that this is a mid to long-term project that must be designed in cooperation and synergy with Annexes 2, 4 and 8, respectively by the new Communication working group that has been established in 2022. One main aim of that project is to better communicate beyond ISGAN and the Smart Grids research community.

Participating countries:

Austria, Canada, China, France, Germany, India, Ireland, Italy, Korea, Netherlands, Singapore, Spain, Sweden, United States, **Korea (Lead)**, **Korea (Annex Manager)**

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



SIRFN enables participating countries to evaluate pre-competitive technologies and system approaches 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 cybersecurity, plug-in hybrid integration, load management, automated metering infrastructure, protection, network sensing, energy management, renewable energy integration and similar applications. In this way, research within the 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 high-impact work on Smart Grids testing including smart inverters, Battery Energy Storage Systems (BESS), Distributed Energy Resources (DER), Advanced Laboratory Testing Methods (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 a 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

- Goal: Develop and demonstrate consensus-based interoperability test protocols for advanced distributed energy resources (DERs)
- Evaluation of DER devices and test protocols
- Inform/accelerate the 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
  - Supporting holistic testing and accelerated manufacturing
  - Creating standardized testing procedures and toolboxes
  - Establishing novel research areas for real-time/HIL applications

Power System Testing

- Numerous interdependencies in power system control
- Testing components only may results in an oversight of 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 2021

For Annex 5, the highlights in FY 2021 have been the following:

Soft Launch of Task "Advanced Lab-Based Testing Methods"

Laboratory testing methods for electric power systems are being enhanced by novel simulation techniques such as Power Hardware-in-the-Loop, Controller Hardware-in-the-Loop and Co-simulation, but practical experience with their use is limited and not yet widespread. Under the leadership of the University of Strathclyde – Glasgow, SIRFN participants are tapping into their world-class research infrastructure to share expertise and jointly evaluate these emerging techniques with the objective to inform the development of future testing procedures within international standards and make recommendations for optimum use of these techniques in laboratory environments. A series of use cases have been selected for evaluation of the new techniques (individually and in combination) verified against more conventional testing methods.

Increased international visibility through features in the IEA´s initiative "Today in the Lab – Tomorrow in Energy"

Today in the Lab – Tomorrow in Energy is an initiative designed to shine a spotlight on research projects under development in the Technology Collaboration Programmes (TCPs). To participate in this initiative, the 38 collaborations in the TCP network were invited to submit a brief summary of current research projects – with SIRFN being one of the selected showcases. This resulted in two articles plus two related videos:

Article 1: Published on 17th November 2020: "Accelerating research in smart electricity grids"
Video: https://www.youtube.com/watch?time_continue=9&v=yKgrCOsonrE&feature=emb_logo

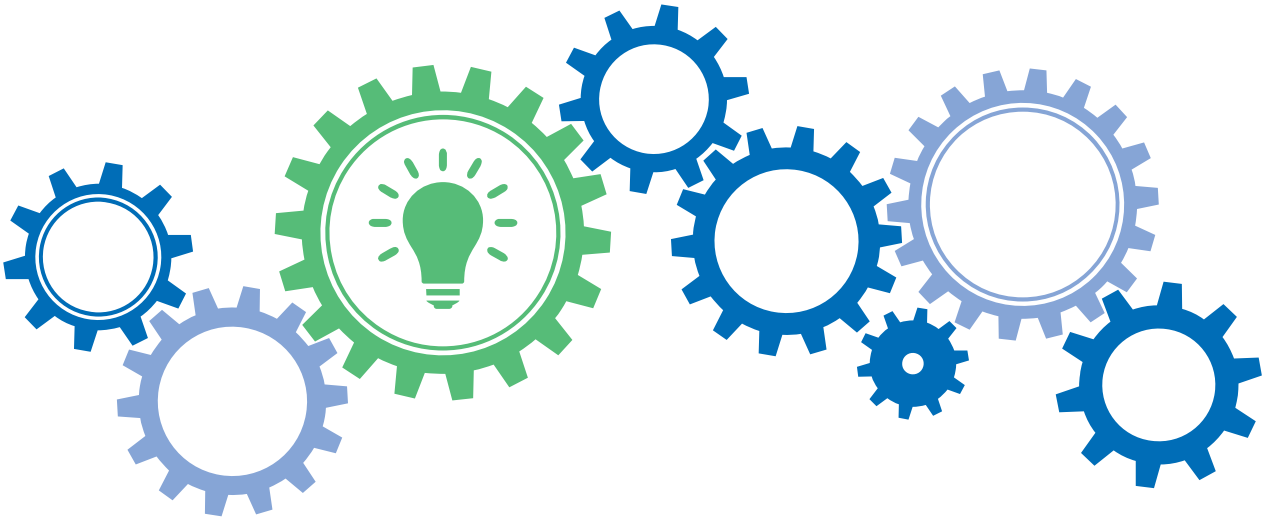
Article 2: Published on 27th January 2021: "Managing large amounts of distributed energy resources on electricity grids"
Video: Versatile automated testing of new distributed energy technologies - YouTube

Besides those highlights, the Annex published two journal papers on IEEE 1547, one Ride-through and interoperability tests, two papers for CIRED 2021 and held five knowledge exchange sessions.

Participating countries:

Australia, Austria, Canada, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, Korea, Netherlands, Russian Federation, Spain, United Kingdom, United States, **United States (Lead)**, **Germany (Annex Manager)**

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's main goal is to facilitate the application of advanced technologies needed for power grids to contribute towards achieving various clean energy and climate goals as well as ensuring 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's 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 idea is not to repeat what has already been done but rather to draw valuable insights and lessons learned from various stakeholders in the energy community. Different countries around the world face different challenges, apply different solutions to resolve those challenges and have reached different maturity levels in the implementation of those solutions. Through continuous collaboration and interaction, the best practices and success stories obtained from knowledge exchanges between various stakeholders can be used to resolve and/or avoid known problems in an optimal manner.

2.5.1. Main accomplishments in 2021

Annex 6 finalized the following activities in the FY 2021:

- Modelling of storage operation for markets participation and supply of advanced system services
- Interoperability of digital (ICT) systems in the energy sector
- A Canadian Workshop on Power System Flexibility from Local Energy Grids

Other accomplishments in FY 2021 are as follows:

Flexibility and Storage

Annex 6 finalised the report *Modelling storage operation for markets participation and supply of advanced system services*. The main focus questions centered around the analysis of how profitable battery storage systems can be for ancillary service provision for a balancing service provider, and what the optimal sizing would be for multiple service provision. The report also includes the international perspective based on a survey from Annex 6 members, which provided some suggestions for the removal of (regulatory) barriers.

Interoperability

The work on Interoperability of digital (ICT) systems in energy sector was finalised. The discussion paper motivates the need for interoperability improvements in the energy sector and considers aspects of how to improve interoperability by discussing various approaches for designing the system-of-systems and enabling and verifying the ICT-interoperability in Smart Grids. This is achieved by considering existing approaches commonly used to improve the interoperability of digital systems both with the energy sector as well as in other domains, and to learn lessons from them. It concludes with an overview of best practices on the level of management, documentation, testing and integration.

Decentralisation, digitalisation & end users

A new activity on Aggregator Roles in Digitalized Energy Systems started, which will consider tools and solutions to enhance and support the aggregator implementation in the digitalized energy market for improved management of intermittent renewable energy and raising awareness of consumer behavior change in energy consumption.

Transmission and distribution system interaction

A questionnaire, a workshop (as a side event of ExCo22, see Chapter 1.7.1 for details) and report on Flexibility and its impact on stakeholder interaction were prepared as a shared effort between Annex 6 and Annex 9. A separate task force is gathering input for the final discussion paper and video. Several (EU) projects are involved in the task force.

Participating countries:

Austria, Belgium, Canada, France, Germany, India, Ireland, Italy, Mexico, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, **Sweden (Lead)**, **Sweden (Annex Manager)**

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, towards 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 also a key policy issue for the IEA and the Clean Energy Ministerial.

The scope of this Annex is to co-ordinate applied social science 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 analyze 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 complements other ISGAN approaches such as technology development, technological system integration and technoeconomic analyses. Hence, the Annex contributes to the 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 igniting 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 it 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 2021

In the FY2021 the following highlights took place:

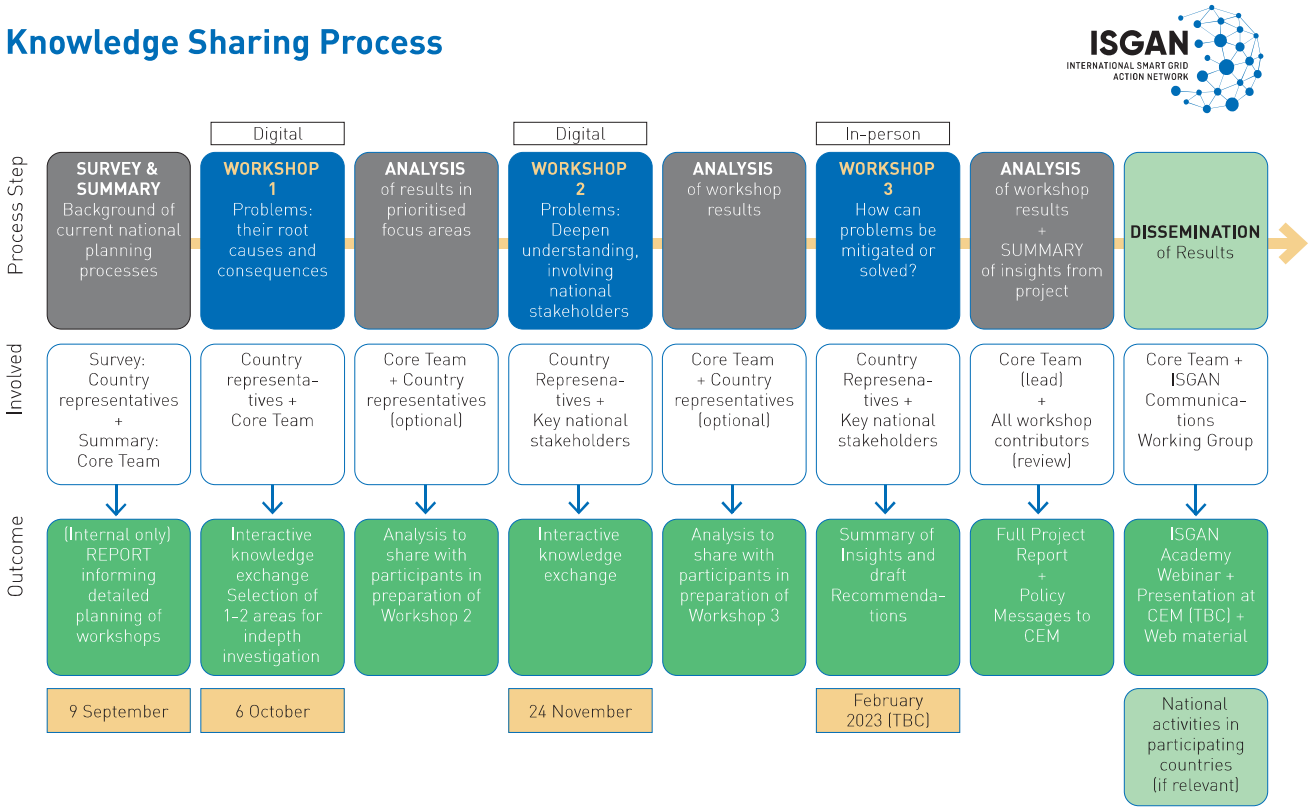
Policy Messages from the ISGAN Regulatory Sandbox 2.0 Project

ISGAN is leading an international collaboration project to capture recent developments and support countries in their development of regulatory experimentation such as sandboxes, which are key to enable up-scaling and deployment of smart grid and wider energy system innovation. Building upon the successes of the first ISGAN initiative on the topic in 2019, the project has resulted in four key Policy Messages to the Clean Energy Ministerial and the wider international energy community. The project was selected to share these results as an official On Demand Side Event of CEM12 (for details please refer to Chapter 1.7.5.1). The Policy Messages have been co-created by experts and practitioners from ministries, regulatory bodies, and research institutions in 15 countries on 3 continents through a unique knowledge-sharing process combining international knowledge exchange workshops with stakeholder dialogue at the national level. The focus questions that guided the international dialogue included:

- How sandbox programmes can be integrated into longer-term energy transition strategies;
- What are the legal preconditions and exemption laws required to enable sandbox programmes;
- How to coordinate between different stakeholders in programme implementation, and
- How to design evaluation processes for policy learning.

KTP Workshops

3 KTP workshops with participants from ministries, funding agencies, regulatory authorities, academia and research from 15 countries were organized.



▲ KTP Process

Updated ISGAN Casebook on regulatory sandboxes

Annex 7 published an updated casebook including regulatory sandbox programmes from 10 countries (details to be found in the Annex 4 main achievements section).

Scientific Publication in Utilities Policy

Argjenta Veseli, Simon Moser, Klaus Kubeczko, Verena Madner, Anna Wang, Klaus Wolfsgruber, **Practical necessity and legal options for introducing energy regulatory sandboxes in Austria,** Utilities Policy, Volume 73, 2021,101296, ISSN 0957-1787, https://doi.org/10.1016/j.jup.2021.101296

Decentralization pathways

On the topic of decentralized pathways, a paper was submitted and a dialogue session was organized at International Sustainability Transitions Conference 2022.

Participating countries:

Austria, Belgium, Denmark, France, Germany, India, Italy, Netherlands, Sweden, United Kingdom, United States, **Austria (Lead)**, **Austria (Operating Agent)**

2.7. Annex 8:
ISGAN Academy on Smart Grids

The ISGAN Academy offers the ISGAN community the 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 through several e-learning modules dealing with different Smart Grids aspects. Fundamentals and further reading material are provided as complementary appendices to the critical learning path.

With the help of webinars developed by Annex 8, stakeholders obtain a means to stay updated on recent developments, pilot projects, demonstrations, software tools and case studies. Supporters of the Annex can contribute by judging the quality of the contents and the relevance of the selected topics by nominating representatives to the Academic Committee.

2.7.1. Main accomplishments in 2021

The ISGAN Academy webinars are divided into five different areas:

1. Novel Smart Grids' tools
2. ISGAN Award of Excellence
3. Flexibility in the Power Systems
4. ISGAN Knowledge Transfer Projects
5. New Challenges in Smart Grids

The webinars that were held in FY2021 are listed in the table below and can be accessed under the provided links.

Nº	Webinar Title	Date	Authors
1	FARCROSS project - Innovative solutions for increased regional cross-border coop-eration	01/03/2021	Anastasis Tzoumpas, Katerina Drivakou, Thanasis Bachoumis
2	Advanced weather forecasting for renew-able energy applications - Smart4RES	23/03/2021	Matthias Lange, Quentin Libois, Remco Verzijlbergh
3	Advanced weather forecasting for RES applications Webinar (Smart4RES - Episode 2)	29/03/2021	Bijan Nouri, Annette Hammer
4	IEC61850 standard: definition, benefits, challenges. How is the Osmose project contributing?	03/05/2021	Yves Marie Bourien, Thomas Sterckx, Christoph Brunner, Camille Bloch
5	Electricity market designs for flexibility: zonal and nodal architectures, simulations	27/05/2021	Maxime Laasri, Sandrine Bortolotti, Florian Boehnke, Christoph WEBER
6	Optimizing participation of renewables generation in multiple electricity markets: Smart4RES	09/06/2021	Matthias Lange, Simon Camal, Pierre Pinson
7	Regulatory Sandboxes for Smart Energy Systems	10/06/2021	Magnus Olofsson, Helena Lindquist, Klaus Kubeczko, Dierk Bauknecht, Nicole Kerkhof - Damen, Rachele Levin, Urban Peyker
8	Powering System flexibility in the Future through Renewable Energy Sources: the role of virtual power plants (POSYTYF H2020 project)	18/11/2021	Bogdan Marinescu, Oriol Gomis Bellmunt, Carlos Collados Rodriguez
9	Optimizing the value of storage in power systems and electricity markets (Smart4RES H2020 project)	08/12/2021	Maria Ines Marques, Dimitrios Lagos, Simon Camal
10	Osmose project contribution to the enhancement of the IEC61850 standard	28/01/2022	Christoph Brunner, Jörg Reuter, Thomas Sterckx, Camille Bloch, João Saragoça

Participating countries:


France


India


Italy


Japan


Netherlands


Russian Federation


South Africa


Spain

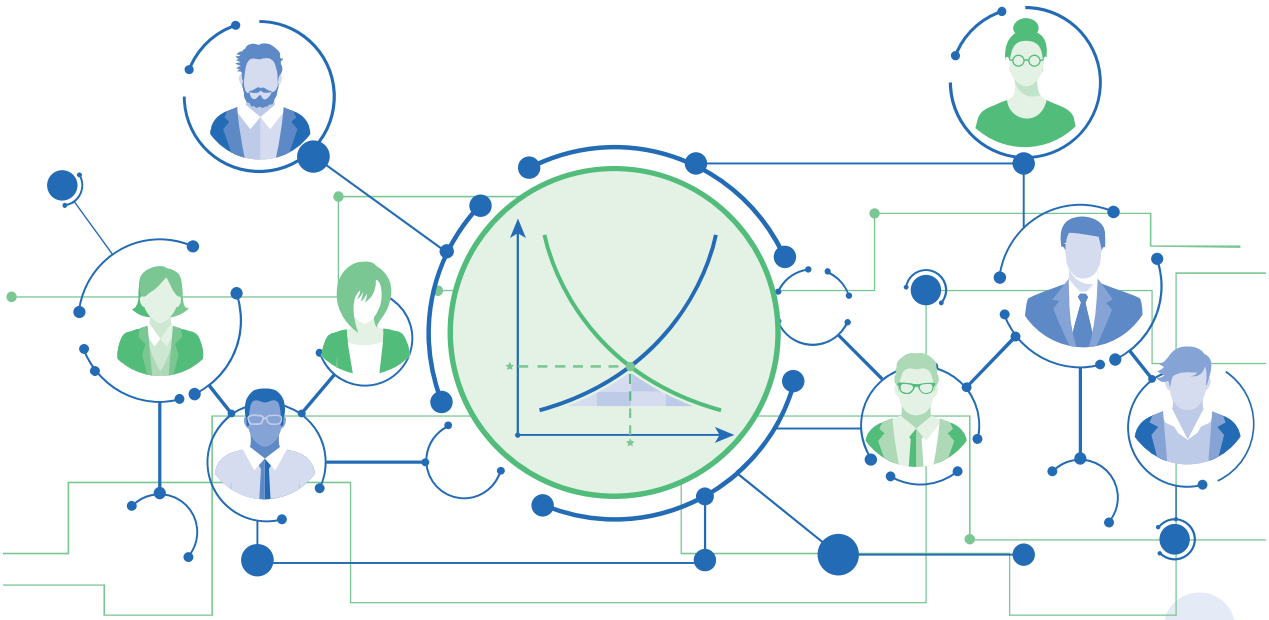

Switzerland


United Kingdom


Spain (Lead)


Spain (Operating Agent)

2.8. Annex 9:
Flexibility Markets - development and implementation



The scope of this Annex encapsulates all aspects of market design for power system flexibility. This includes the whole range of market timescales, from long-term investment signals to second-to-second balancing and response; the whole physical system from large centralized generation to behind the meter sources of flexibility within domestic settings and interfaces with other vectors; all sources of value that flexibility conceivably could capture, going beyond MWh to include characteristics like voltage control, repeatability, inertia, locational constraint alleviation; and aspects of the market that go beyond the trading rules such as consumer support, or how obligations (such as with respect to grid stability) are understood and checked. The initial work is guided by the six gaps as the overarching framework for how activities are related to each other and the overall objective, but each activity will have significant freedom to explore any topic the participants are interested in as long as it remains related to any of the dimensions listed above.

The objective of the combined impact of the Annex's activities are:

1. To enrich and disseminate participant's understanding of flexibility market design
2. To create and curate an evidence base all can draw upon to support decision making in the flexibility market space
3. To further facilitate and enhance the debate on best practice in market design

2.8.1. Main accomplishments in 2021

The main accomplishments of Annex 9 are summarized in the following bulleted list:

Flexibility Characteristics

- List of flexibility indicators with definitions created
- Working on a taxonomy for the indicators before sharing with Annex 9 members for comments
- Expected Outcome: A comprehensive list of indicators that would allow for flexibility potential to be evaluated theoretically and practically considering technical, economic and operational factors

Consumer focused flexibility

- Factsheet "Metering" – final version delivered
- Factsheet "Consumer interaction on energy markets" – final version delivered
- Factsheet "Incentives" – final version delivered
- A Workshop was held on 9th February

Interoperable Markets

- Based on Workshops and sector expert interviews a factsheet/brief report was drafted on TSO-DSO coordination
- Factsheet drafted on data standards, protocols and future development after engagement with sector experts
- Collaboration with Annex 6 on "Flexibility and Stakeholder Interaction Survey" and delivering "Flexibility Harvesting and its Impact on Stakeholder Interaction" report

Dissemination of insights from the initial scoping exercise

- Updated version of incubator team report prepared with insights from joint survey with Annex 6

Encouraging collaboration

- Spreadsheet format developed to capture initiatives, organisations and funding opportunities in the smart grid space
- Initial population completed

Participating countries:


Belgium


Canada


India


Japan


Korea


Sweden


United Kingdom (Lead)


United Kingdom (Operating Agent)

3. ISGAN Award of Excellence

The Award of Excellence is presented to outstanding power grid research projects from all over the world to emphasize the importance of intelligent, flexible power grids. The 7th ISGAN Award of Excellence (FY2021) focused on 'Smart Grids for Future-Proofing the Grid Operation via Advanced Digitalisation & IoT'. A wide range of smart grid project nominations was received, representing projects from ten different countries, and two projects were selected as the winning projects. An international expert jury selects the winning projects based on the criteria of impact potential, economic findings, transferability, innovation, and other benefits.

In 2021 the Award Ceremony took place as a side event at CEM12 at which two research projects were awarded:

- **Winner: Smart Energy Project of a Canadian utility Saint John Energy (Canada)**
  The winner was the Smart Energy Project of the Canadian utility Saint John Energy on the East Coast of North America. In this project, experts used artificial intelligence to develop an intelligent power grid and optimize the local energy system. The objectives of the Project are to reduce peak demands on the grid, lower purchased power costs, and reduce environmental emissions. The Smart Energy Project deployed a suite of embedded energy devices coupled with secure digital communications systems, advanced control technologies, and developed algorithms to predict and manage the peak loads on the grid. This reduced costs and made the grid more resilient and reliable.
- **Runner-up: Eu-SysFlex German Demonstration Project, MITNEZ STROM (Germany)**
  The German demonstrator of the European project SysFlex from the distribution net-work operator Mitnetz Strom near Halle an der Saale is the runner-up. Since January 2021, the demonstrator has been controlling more than one hundred wind and photo-voltaic plants with a combined installed capacity of 5 GW. In this way, the experts want to demonstrate that flexibilities from decentralized energy generation can be provided from the high-voltage grid to the transmission grid operator without negatively affecting the distribution grid. Particular attention is given to congestion management, voltage regulation and data exchange.The goal is to make grid operation secure in an energy system with a high share of electricity from renewable sources. The SysFlex projected was finalized in October 2021 and was funded under the EU's Horizon 2020 program and with a consortium respresenting 15 European countries.

Members of the Jury

Our thanks to the members of the 2021 ISGAN Award of Excellence jury for contributing their time and expertise to the evaluation process.

- **Reji Kumar Pillai (India):** Jury Chair, Chairman of the Global Smart Grid Federa-tion (GSGF)
- **Cheong Kam Hoong (Malaysia):** Industry Advisor of University Tunku Abdul Rahman, GSGF Ambassador (Asia)
- **Kentaro Akiyama (Japan):** Professor of Seijoh University
- **Valerie-Anne Lencznar (France):** Vice-chair of GSEF, Managing Director of Think SmartGrid
- **Ravi Seethapathy (Canada):** GSEF Ambassador (Americas)
- **Robert George Stephen (South Africa):** Technology Master Specialist, ESKOM, Former president of CIGRE
- **Steve Hauser:** Secretary-Treasurer of GSEF
- **Mark F. McGranaghan:** Fellow of Electric Power Research Institute (EPRI)

Outlook

As a novelty in 2022, the 8th ISGAN Award of Excellence, is divided into two parts, of which one focuses on 'EV Integration in Smart Grid' in cooperation with the Global Smart Energy Federation and the other on 'Smart Grid Workforce Development for an Inclusive Energy Transition' in cooperation with the CEM Empowering People Initiative. The recipients of the awards will be officially announced at the ISGAN Award ceremony at CEM13.

4. Collaboration and Co-operation

One of ISGAN's key activities is centered around reaching out to and cooperating with outside stakeholders, clean energy initiatives and similar target groups to align aims, avoid overlaps and share knowledge. During ExCo21 a dedicated breakout session took place discussing ISGAN's cooperation with other organizations. As part of the workshop, a key highlight of the many discussions included topics such as the main advantages of cooperation with other organizations and initiatives. Thereafter, a brainstorming session to collect concrete ideas for cooperation and outcomes which are fruitful for both partners (added value) took place. To improve the cooperation with other organizations, liaison persons from ISGAN were nominated and communicated to the other organisations.

In the following section, some examples of collaborations with results in 2021 are mentioned.

4.1. Collaboration with other TCPs, initiatives, and organizations

- The User's TCP joined the 22nd meeting of the Executive Committee on 12th October 2022. The presentation of their Chair, David Shipworth, highlighted several possibilities for cooperation. As a next step, experts from the ISGAN Annex 7 were invited to contribute to the USERS TCP Day "Solutions for an inclusive energy transition" in Vienna.
- ETIP-SNET and ISGAN Annex 6 collaborated on the topic of Flexibility for resilience and published a white paper: "Flexibility for Resilience - How can flexibility support power grid resilience?"
- During CEM12/MI-6, ISGAN co-organized together with the Power System Flexibility Campaign (PSF Campaign) the joint workshop "What's next for power system flexibility?" with opening remarks from the IEA Director for Energy Markets and Security, and a two panel discussions involving key experts from ISGAN and PSF.
- IEA Digital Demand-Driven Electricity Networks Initiative: the IEA has launched a four-year cross-agency initiative, Digital Demand-Driven Electricity Networks (3DEN). 3DEN is working to accelerate progress on power system modernization and effective utilization of distributed energy resources through policy, regulation, technology, and investment guidance. The project was developed in the context of the 2019 Climate Action Summit and aims to step up global action for clean energy to fight climate change. 3DEN will engage with relevant organizations, bringing together diverse stakeholders to foster dialogue and share experiences, including ISGAN.

4.2. Collaboration with IEA and CEM secretariat

Both IEA and CEM Secretariat are highly active in participating in ISGAN Exco meetings.

- At the 23rd ExCo meeting, Vida Rozite, ISGAN's desk officer from the International Energy Agency (IEA) presented an overview of recent publications by IEA including reports, commentaries, and articles. Then she provided an outlook on all upcoming IEA publications. In 2021 two Handbooks on Expanding the global reach of the TCPs and Enhancing multilateral collaboration were published. They are based on interviews with several TCPs and contain best practice tips including examples from ISGAN. Furthermore, the Online Handbook on New guidance for TCPs on developing collaborative projects was updated.
- Ellina Levina of the Clean Energy Ministerial (CEM)-Secretariat presented at the 23rd ExCo meeting focusing on CEM´s 3.0 phase. Thereby, that all members have agreed to increase all activities and initiatives to achieve ambitious outcomes. The Global Assembly meeting of CEM (former CEM-Prep) which took place 6-8 April 2022 in India was introduced by Ellina who presented the agenda and dedicated timeslots for Side-events. Plans for ISGAN´s contributions were made and it was agreed that ISGAN's Vice-Chair Arun K. Mishra will attend the Meeting and represent ISGAN at various side events.

5. ISGAN Executive Committee Meetings

In light of the COVID-19 pandemic, ISGAN changed its twice-yearly physical ExCo meetings to online meetings. The well-established procedures at ISGAN ExCo meetings ensured the success of various meetings throughout in these difficult circumstances.

5.1. 21st ExCo Meeting (16 – 18 March 2021)

At the 21st ISGAN ExCo Meeting, the future strategy of ISGAN on its way into its third period was a centerpiece of the discussions. In addition, the possible restructuring of annexes and the new legal framework for TCP´s was addressed. Following presentations from representatives of the Global Smart Energy Federation (GSEF), the Clean Energy Ministerial (CEM) and the World Bank, a dedicated session on next steps for enhanced cooperations with these organizations took place.

Dr. Katalin Véhmann, from the Hungarian Energy and Public Utility Regulatory Authority provided a presentation on the remote metering roll-out in Hungary, showing the progress by distribution system operator (DSO) companies. She also stated that Hungary is interested in joining ISGAN.
The ExCo was also used to present the Programmes of Work for the FY2021 of all eight active ISGAN Annexes. And lastly, the outcomes of the tendering process for a new Secretariat were presented and the corresponding selection of a bidder was made.

5.2. 22nd ExCo Meeting (12 – 14 October 2021)

Between 12th and 14th of October, the ISGAN community marked its 22nd Executive Committee Meeting.
At this online meeting it was reported that Israel joined ISGAN as a new Contracting Party in July 2021. The ExCo warmly welcomed Israel representatives Dr. Gideon Friedmann, Acting Chief Scientist and Dr. Yael Harman, Head of Technology and Renewable Energy, from Israel's Ministry of Energy.
At the time of the meeting, it was already foreseeable that ISGAN´s Request for Extension would have been approved. The green light for ISGAN´s third period was therefore celebrated and all necessary next steps were presented and discussed with the ExCo.

To further ISGAN's international cooperation, the following representatives were invited to the ExCo: Vida Rozite, ISGAN´s IEA desk officer, Ellina Levina from the CEM Secretariat, Irmgard Herold from the Mission Innovation Secretariat, Reji Kumar Pillai from the Global Smart Energy Federation and David Shipworth, the Chair of IEAs Users TCP.

6. Deliverables

6.1. ISGAN Workshops and Events

- Webinar – Optimizing the value of storage in power systems and electricity markets – the Smart4RES project

  9 December 2021 - 12:00 CET - ISGAN Academy Webinars invites you to discover how to optimize the value of storage in power systems and electricity markets - the Smart4RES project.

- Webinar – Dynamic Virtual Power Plant to combine flexibilities of dis-patchable and non-dispatchable RES – the POSYTYF project

  18 November 2021 – The ISGAN Academy invited you to discover the Dynamic Virtual Power Plant (DVPP) concept under development by the POSYTYF project.

- ISGAN-GSEF Joint Webinar – System Challenges and Opportunities in Electric Vehicle Integration with the Grid

  27 October 2021 - The webinar discussed the Vehicle to Grid (V2G) technology evolution and its present status across the globe in the global perspective. It also debated the challenges in rollout of V2G functionality and incentives for the EV owners to participate. Furthermore, the advantages and challenges of V2G as ancillary services for grid support were discussed.
  Also the topics of EV charging load at off-peak hours with Renewable Energy Integration (REI) and Battery Energy Storage (BES) were discussed.

- 22nd ISGAN ExCo Meeting

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  12-14 October, 2021, virtual meeting

- Webinar – Optimising participation of renewables generation in multiple electricity markets: Smart4RES vision, opportunities and role of fore-casting
  9 June 2021 - In electricity markets, errors associated to RES production forecasting lead to imbalance penalties when actual delivered production deviates from bids. Optimization strategies, requiring multiple predictions, have been proposed to minimize these penalties. However, having so many predictions represents a cost for operators and can be source of inefficiency by cumulating forecasting errors. In this context, Smart4RES proposes optimisation methods for trading tools, considering multiple market opportunities, high resolution forecast and prescriptive analytics.

- Webinar – Regulatory Sandboxes for Smart Energy Systems – What innovators and researchers should know about it?
  10 June 2021 - The webinar provided information about what Smart Energy Systems innovators and researchers should know about Regulatory Sandboxes and other Regulatory Experimenting as measures for accelerating the transition to a global clean energy economy.

- What's Next for Power System Flexibility
  31 May - 6 June 2021. This event was the second ISGAN-PSF joint workshop at CEM12. During this event the activities of the PSF and ISGAN were wrapped up. The ISGAN and PSF looked at flexible resources through three pillars, market design, digitalization, and sector-coupling. The event focused on solutions that have been deployed and the gaps that need to be filled. Further, areas of critical importance to improve power system flexibility were discussed, stressing the link between research projects and policymaking.
  ISGAN - What's Next for Power System Flexibility (iea-isgan.org)

- (CEM12) The 7th ISGAN Awards Ceremony
  2 June 2021 at CEM12

- Webinar - Electricity market designs for flexibility: from zonal to nodal architectures, findings from first market simulations
  27 May 2021 - Which are the most suitable market designs to capture the value of flexibility in power systems? The European project OSMOSE has developed different models from nodal to zonal market architectures to assess the economic value of different flexibility mixes (load, generation and power flows) in future power system scenarios. The webinar introduced the zonal and nodal market designs modelled in OSMOSE, presented the first simulation results, and discussed the preliminary findings of this ongoing work.

- Webinar – IEC61850 standard: what for, which benefits, what pending challenges? How is the Osmose project contributing?

  3 May 2021 - This webinar introduced the IEC61850 standard on communication protocols for intelligent electronic devices at electrical sub-stations, and its benefits. The interoperability needs and issues were presented, as well as the IEC61850 scope and structure, its applications fields, and complementarity with other standards. It concluded on the ongoing developments within the OSMOSE project for the stand-ard's implementation (subject of a second webinar).

- Webinar – Advanced weather forecasting for RES applications: multi-source observations to improve solar forecasting within the Smart4RES project

  29 April 2021 - ISGAN and Smart4RES organized the 2nd part of its webinar series on Advanced Weather Forecasting. This webinar presented solar irradiance forecasting methods based on a network of ground-based sky cameras, radiometers and ceilometers as well as satellite data. Furthermore, new designs to data assimilation were presented that combines the best of the observations with the best of numerical weather prediction models to produce optimized weather fore-cast for RES applications.

- Webinar- Advanced weather forecasting for RES applications: Smart4RES developments towards high-resolution and Numerical Weather Prediction solutions to improve RES forecasting models

  23 March 2021-This 3rd Smart4RES webinar addressed technological and market challenges in RES prediction and introduced the Smart4RES strategy to improve weather forecasting models with high resolution. Through wind and solar applications, Innovative Numerical Weather Prediction and Large-Eddy Simulation approaches were presented.

- The 21st ISGAN ExCo Meeting

  16 -18 March 2021

- Webinar- Innovative solutions for increased regional cross-border co-operation in the transmission grid: the FARCROSS project

  1 March 2021 - The webinar provided insight into the FARCROSS Horizon 2020 EU research project. Driven by recent development in EU internal market for electricity regulation, increased cooperation is key element for improving the interconnectors' utilization and market harmonization. FARCROSS project looks into these challenges and promotes integrated hardware and software solutions in five pilot demonstrators across eight European countries.

6.2. ISGAN Publications

- [(Casebook) Innovative Regulatory Approaches with Focus on Experimental Sandboxes 2.0]

The casebook provides some of the best practices of regulatory sandbox program and smart grid projects under that framework from 10 countries as well as four key policy messages that were formulated by the ISGAN Sandbox KTP Project Team and the transdisciplinary group of participants in the workshops, with the intention to bring it to the attention of the Clean Energy Ministerial. Four policy messages were successfully presented to a variety of stakeholders in the power sector around the world at the twelfth Clean Energy Ministerial (CEM12).

- [Trends of Digital Transformation of Utilities]

An important aspect of the energy transition is to expand the use of renewable energy and reduce energy consumption through energy efficiency. As such, energy transition can be more efficient through digital transformation, which combines technology and ICT in the field of electrical energy. Therefore, this publication examines the various cases of the digital transformation of utilities and identifies the implications of digital transformation in the transition to clean energy. Moreover, ISGAN Annex 4 aims to convey some messages, such as what the digital transformation means in terms of transition into smarter energy, its potentiality, and the most pressing challenges, to policymakers and related industries.

- [Smart Grid Drivers and Technologies by Country, Economies, and Continent]

This paper documents the Annex 2 unified framework for assessment, prioritized assessment results by each Participant, purpose and methodology for multinational (or clustering) analysis, analysis results of common motivating drivers and driver-technology pairs of high priority at the national level as well as across all nations and to nations clustered by economies or by continent, and comparison of multinational prioritized assessment results between the 2014 and 2020 studies.

- [IEA ISGAN Annual Report 2020 released]

The ISGAN Annual Report for 2020 was published in September 2021. A particular challenge encountered during this year was to ensure that ISGAN continued to work successfully together as a community, despite the many challenges encountered during the COVID-19 pandemic. Amongst many issues, this made the familiar ways of working simply impossible and new approaches had to be found. The overall success of ISGAN activities in 2020 reflects the network's ability to manage and operate despite these great challenges, testifying the strengths and cohesion of this TCP.

- How to Improve the Interoperability of Digital (ICT) Systems in the Energy Sector

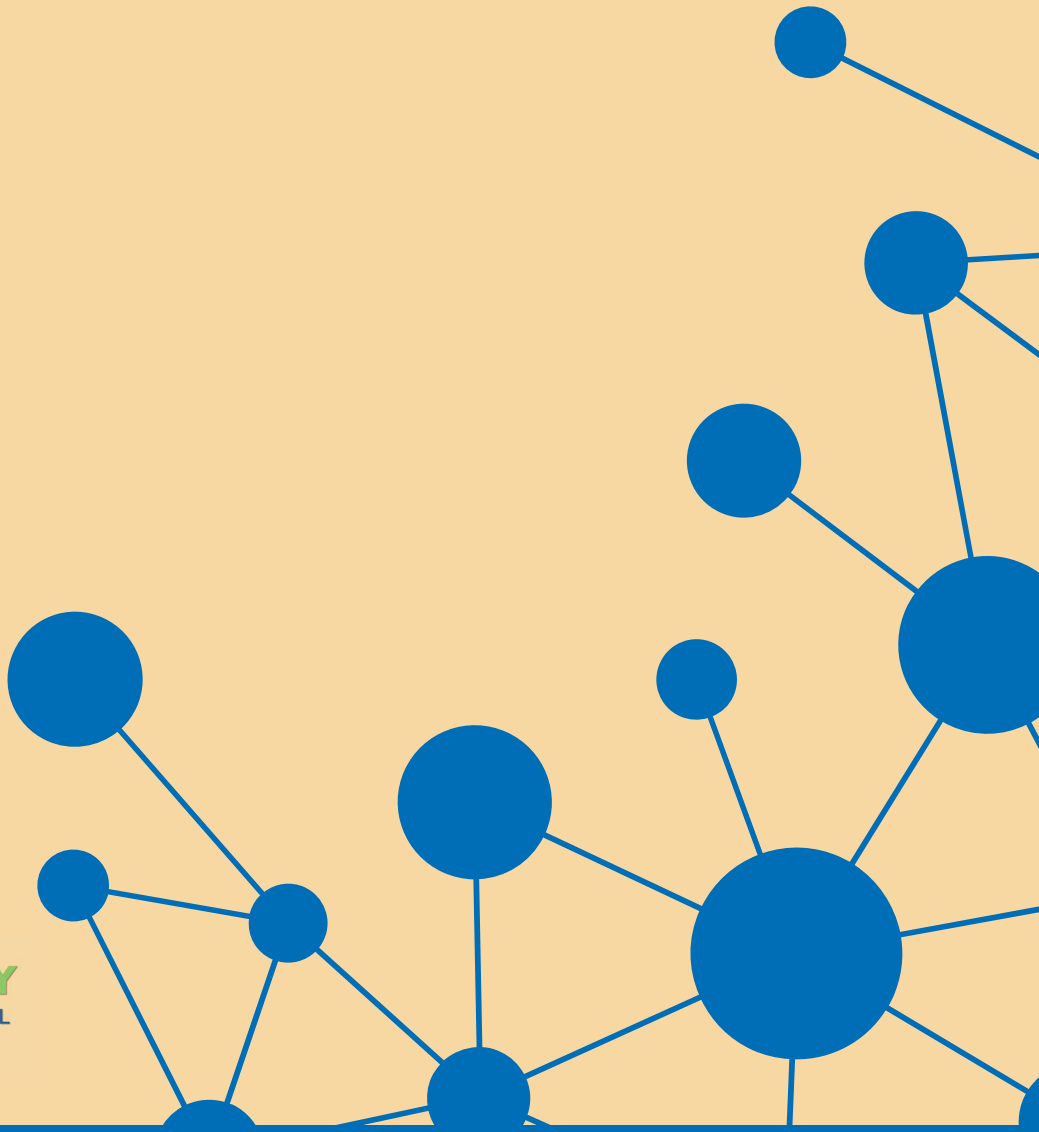
  This report has been prepared within the framework of ISGAN Annex 6 and focuses on the question "How to improve the interoperability of digital (ICT) systems in the (electric) energy sector?". The paper presents and discusses various approaches for designing the system-of-systems, different approaches for enabling and verifying the ICT-interoperability in Smart Grids and motivates the need for interoperability improvements in the energy sector. It does so by looking at existing approaches commonly used to improve the interoperability of digital systems both with the energy sector as in other domains, and to learn lessons from them.

- Policy Messages from the ISGAN Regulatory Sandbox 2.0 Project

  The focus questions that guided the international dialogue included: how sandbox programmes can be integrated into longer-term energy transition strategies; the legal preconditions and exemption laws to enable sandbox programmes; how to coordinate between different stakeholders in programme implementation, and how to design evaluation processes for policy learning.

iea-isgan.org

ISGAN
INTERNATIONAL SMART GRID
ACTION NETWORK



CLEAN ENERGY
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