The International Smart Grid Action Network

September 18, 2012

David Elzinga, International Energy Agency
Desk Officer, ISGAN Executive Committee

Outline

- **Who is ISGAN?**
- **What are our main initiatives?**
- **Points of view on Renewable integration and DG**

What and Why is ISGAN?

A mechanism for bringing high-level government attention and action to accelerate the development and deployment of smarter electricity grids around the world.

ISGAN…

- Sponsors activities that build a **global understanding** of smart grids, **address gaps** in knowledge and tools, and **accelerate Smart Grid deployment**
- Builds on the momentum of and knowledge created by the **substantial global investments** being made in smart grids
- Is organized as a task-shared **IEA Implementing Agreement** (2011)
- Was launched as an initiative of the **Clean Energy Ministerial** (2010)
- Fulfills a key recommendation in the **Smart Grids Technology Action Plan** (released by Major Economies Forum Global Partnership, 2009)
- **Leverages cooperation** with other initiatives and Implementing Agreements

ISGAN's Formal Structure

- **ISGAN continues its relationship with the CEM.**
- **ISGAN is formally organized as the IEA Implementing Agreement for a Co-operative Programme on Smart Grids (ISGAN)**
- **ISGAN is managed by its Executive Committee (ExCo)**
  - Consists of representatives from all Participants
  - Meets semi-annually. Next meeting: France, September 25-28, 2012
- **ISGAN is supported by a Secretariat at the Korea Smart Grid Institute**
  - Email address: isgan@smartgrid.or.kr
- **The ISGAN community includes representatives of governments, transmission and distribution system operators, national laboratories and research institutions, power generators, and more.**
- **Projects are largely task-shared through Participants' in-kind contributions. However, ISGAN has a common fund for certain joint expenses at its Secretariat.**

ISGAN Website: http://iea-isgan.org

Current ISGAN Participants*

Australia	Ireland	Sweden
Austria	Italy	Switzerland
Belgium	Japan	U.K.
Canada	Korea	U.S.
China	Mexico	
Finland	The Netherlands	
France	Norway	
Germany	Russia	
India	Spain	

** i.e. Signatories to the Implementing Agreement*

Future members and collaboration

In Process of Joining the Implementing Agreement
European Commission

Invited to Join the Implementing Agreement
Brazil
Denmark
South Africa
Turkey

GSGF
Global Smart Grid Federation

www.globalsmartgridfederation.org

- GSGF is an international initiative among national and regional smart grid stakeholder associations
- Launched with ISGAN at first CEM in July 2010
- Strong interests in inventories, case studies and tools

Current ISGAN Work Portfolio

Foundational Projects

Annex* 1: Global Smart Grid Inventory
Led by U.S. – DOE/E2RG

Annex 2: Smart Grid Case Studies
Led by Korea - KERI

Annex 3: Benefit-Cost Analyses and Toolkits
Led by Italy – RSE SpA

Annex 4: Synthesis of Insights for Decision Makers
Led by U.S. & Korea – DOE/NREL & KSGI

New Projects**

Annex 5: Smart Grid International Research Facility Network (SIRFN)
Led by U.S. – DOE/Sandia NL

Annex 6: Power T&D Systems
Led by Sweden & Norway – STRI AB

* "Annex" = Major Project

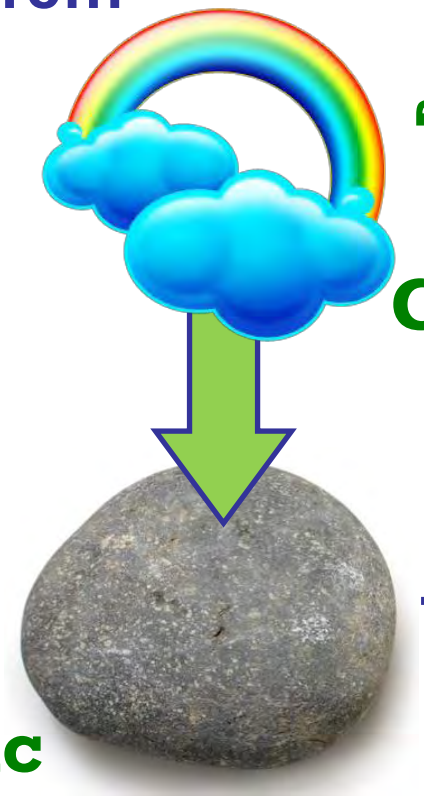
**Approved March 2012

Central Question Driving the Foundational Annexes

Annex* 1: **Global Smart Grid Inventory**	Annex 2: **Smart Grid Case Studies**
Annex 3: **Benefit-Cost Analyses and Toolkits**	Annex 4: **Synthesis of Insights for Decision Makers**

* "Annex" = Major Project

How do we move *international* collaboration on smarter grids from here…



Broad "Smart Grid" Concept

…to here?

Specific Applications & Policies

Annex 1: Smart Grids Motivating Drivers

24 Smart Grid Motivating Drivers in 7 Categories

+ 1 User-specified Driver in Each Category (shown as "Other")

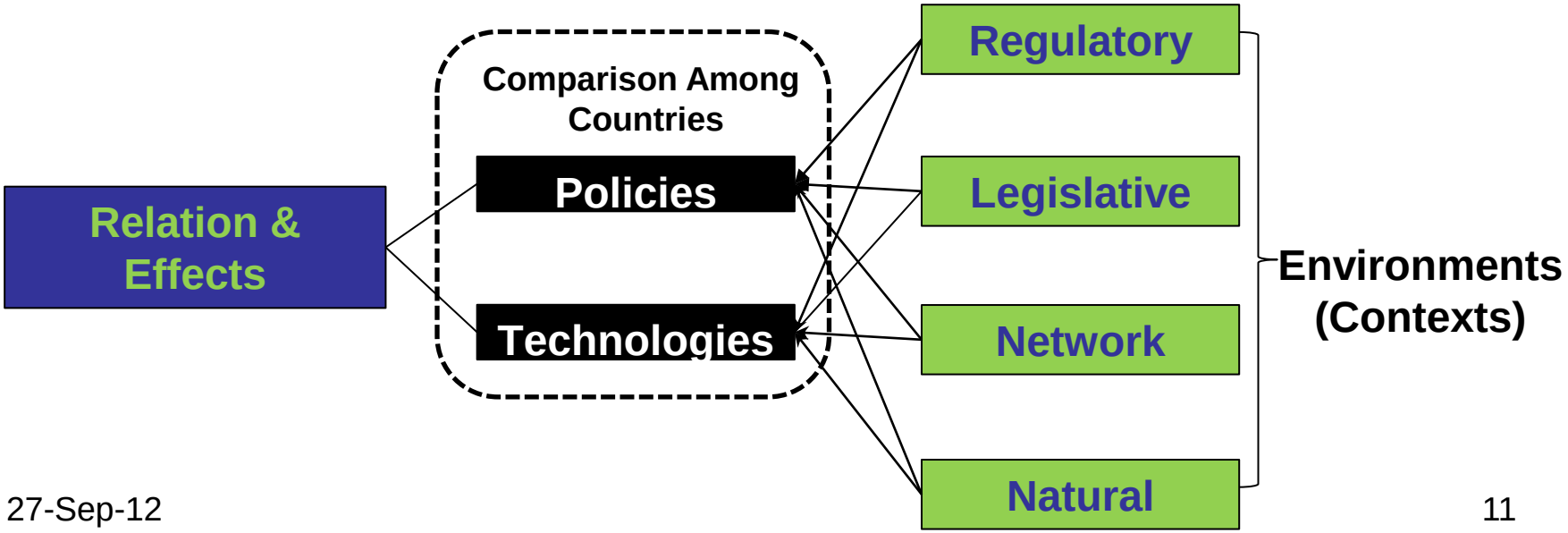
Drivers drawn from the IEA Smart Grids Technology Roadmap, the EPRI Electric Sector Framework for the Future, the Galvin Electricity Initiative reports, and the ESTA International, LLC report for the DOE on "International Smart Grid Strategic Opportunity Assessment," with incorporation of ISGAN member feedback.

Annex 1: Mapping Drivers to Technologies

Driver*	Ranking
Reliability	
Reliability improvements	
Power quality improvements	
Power restoration improvements	
Transmission adequac	
Generation adequacy	
Efficiency	
System efficiency imp	
Optimizing asset utiliz	
Energy efficiency impr	
Enabling new product	
Enabling customer ch	
Economic	
Economic advantages	
Government incentive	
Revenue collection an	
Reducing operating an	
Environmental	
Renewable energy sta	
Environmental advant	
Regulatory compliance	
Security	
National security conc	
Enhanced power syste	
Safety	
Safety improvements	
Crosscutting	
Aging workforce conc	
Aging infrastructure co	
Rural electrification	
Job creation	

Annex 2: Smart Grid Case Studies Objectives and Approach

- Assess best practice examples of case studies — IN PROCESS
- Develop and refine a common case study template and methodological framework — IN PROCESS
- Apply template to selected projects (*qualitative assessment*)



Annex 3: Benefit-Cost Analyses and Toolkits: Objectives and Approach

- **Assess, modify, and apply methodologies to measure the present level of maturity of networks (i.e., the "smartness")**
  — DEVELOPED METHODOLOGY BEING PILOTED/COMPARED
- **Assess, modify, and apply existing benefit-cost methodologies and tools — IN PROCESS**
- **Develop new methodologies, as needed**
- **From these analyses, develop appropriate toolkits (including definition of metrics/KPIs)**
  - Range of levels targeted: From high-level, broad-based methodologies to more detailed system-level approaches to project- or technology-level approaches
  - Builds on metrics and data identified by Annexes 1 & 2, and other sources

Annex 4: Synthesis of Insights for Decision Makers: Objectives and Approach

In short: Knowledge management and info sharing by design

- **Develop a platform that compiles smart grid concepts from high-quality sources and makes them accessible to policymakers (e.g., online glossary) — IN PROCESS; Beta version available at http://en.openei.org/wiki/ISGAN_Smart_Grid_Glossary**
- **Produce brief, timely analytical reports that clarify important issues or raise key questions in smart grid policy and deployment — ONGOING**
- **Establish platforms (or augment existing ones) for knowledge management and collaboration among ISGAN participants**
- **Develop and implement other tools for collaboration and information sharing — ONGOING; webinar series in development**

- Examples of products can be found in backup slides -

New ISGAN Annexes 5 & 6

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

- SIRFN will be a **coordinated network of Smart Grid research and test-bed facilities** in countries participating in ISGAN.
- The central driving question is how can ISGAN structure this network to better **evaluate Smart Grid concepts and technologies** in that all-important niche between R&D and commercialization.

Annex 6: Power T&D Systems

- Entails **assessment of technical and policy needs** for T&D systems as well as the **interfaces** between the two, with a focus on **renewables integration**.
- From electrical generators to end consumers, the sources and uses of electric power are becoming much more varied and complex. There is an urgent need to **make T&D systems smarter** to ensure unchanged or improved security, reliability and quality of supply.

Motivation Annex 6 Power T&D Systems

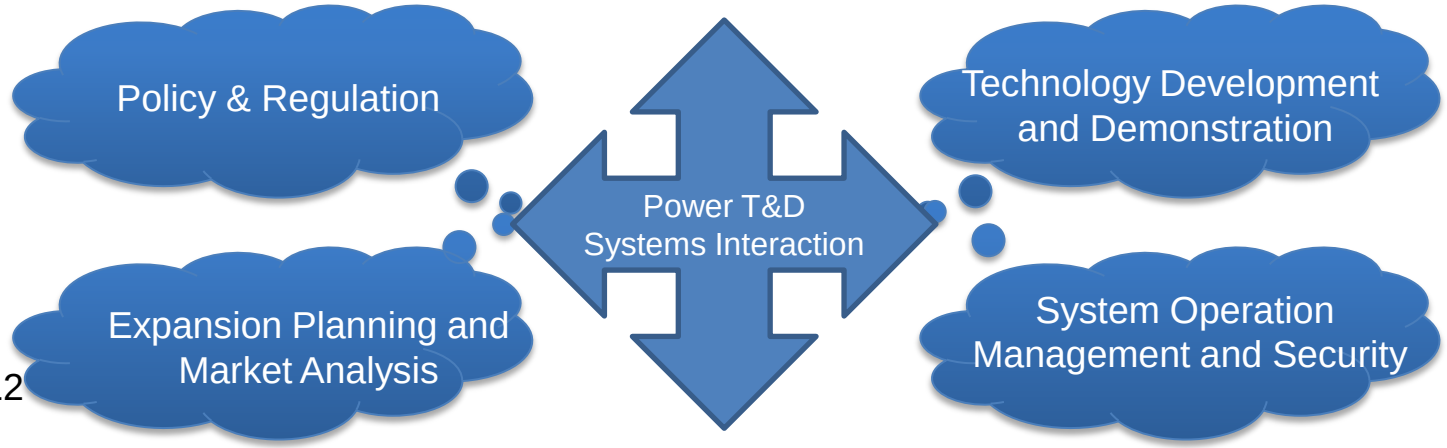
RENEWABLE ENERGY ALONE WILL NOT KEEP THE LIGHTS ON Massive introduction of RES requires more resilient and intelligent electrical grids and systems to ensure unchanged or improved security, reliability and quality of supply.

New requirements on Power Transmission and Distribution Systems both with respect to new and increased transmission capacity as well as improved visibility and controllability for balancing of intermittent power production and demand response.

There is a need to put more focus on the complete power system behaviour and how new, smarter technologies, combined with smarter governmental and regulatory policies can facilitate the necessary transition to a clean energy system

Annex 6: Power T&D Systems

- **Establish a long term vision for the development of "smarter" Power T&D systems – and support implementation processes**
  - Start with transmission systems
  - Expand to include interactions with distribution networks.
- **Improve understanding of specific Smart Grid technologies applicable to or influencing system performance, transmission capacities, operation practices.**
- **Promote adoption of enabling regulatory and government policies.**
- **Use a systems-level approach wherever possible.**



Annex 6: Key Questions

IMPACT: What are the emerging issues influencing the policy & regulation for the Power T&D system and why are they important to resolve?

INTEGRATION: What market mechanisms and tools are needed to plan the expansion of T&D systems with a large intermittent RES and who is involved to make this happen?

INNOVATION: Which are the most interesting and promising technology developments for the smarter T&D System and how can we introduce them in a reliable and efficient way?

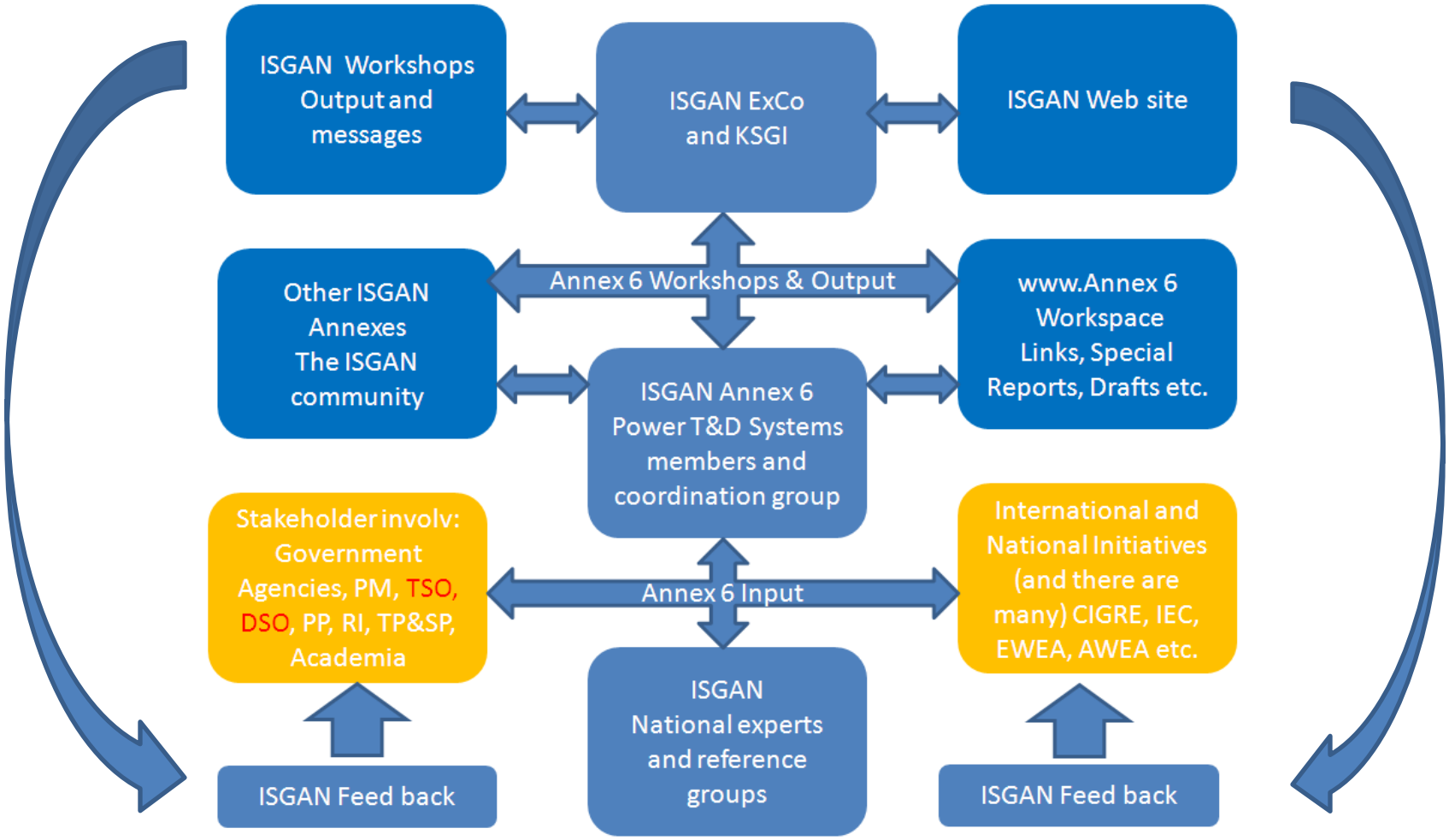
INTERACTION: Which parts of the T&D system are interdependent and require coordinated System Operation Management? When is it needed to initiate this process.

IMPLEMENTATION: What solutions can be deployed to make the T&D system more intelligent and flexible. - Where does this give the largest improvement / investment ratio?

Annex 6: Some initial conclusions

- **Three big challenges with the electricity system:**
  - Renewables integration
  - Peak Demand/Demand
  - Ageing infrastructure
- **System *flexibility* will be required to a degree not needed in the past**
- **Current regulatory systems were fit for old power systems, revolutionary approach needed – i.e. remuneration approach**
- **More co-ordination is needed between TSO's and DSO's**
- **Technology will enable better sharing of data between TSO's and DSO's**
- **Storage ownership/operation ability by SO's unknown**
- **VPP's could play a significant role and included storage**
- **Storage will play a role in not just balancing – but also ancillary services**
- **More quantification of flexibility due to RES integration is needed**

Planned work process for Annex 6



ISGAN Resources

- **ISGAN Website (New!): http://iea-isgan.org**
  - *Three new white papers, released in April 2012, available.*
- **ISGAN Secretariat Email: isgan@smartgrid.or.kr**
- **ISGAN Smart Grid Glossary "Beta": http://en.openei.org/wiki/ISGAN_Smart_Grid_Glossary**
  - *Needs addition of content from around the world.*
  - *Wiki platform – easy to edit and augment.*
- **CEM Website: http://cleaneenergyministerial.org**
- **IEA page on Implementing Agreements: http://www.iea.org/techno/index.asp**

Thank you!

Please don't hesitate to contact me if you have questions!

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THANK YOU!

ADDITIONAL INFORMATION

ISGAN is One of 13 Initiatives under the Clean Energy Ministerial (CEM)

- International Smart Grid Action Network
- Super-Efficient Equipment and Appliance Deployment Initiative
- Electric Vehicles Initiative
- Bioenergy Working Group
- Carbon Capture Use and Storage Action Group
- Clean Energy Education and Empowerment Women's Initiative
- Clean Energy Solutions Centers
- Global Superior Energy Performance Partnership
- Multilateral Solar and Wind Working Group
- Solar and LED Energy Access Program
- Sustainable Development of Hydropower Initiative
- 21st Century Power Partnership (new in 2012)
- Global Sustainable Cities Network (new in 2012)

ISGAN's Relationship with the Former ENARD Implementing Agreement

- **Recognizing alignment in program and interests, and with agreement of both Executive Committees (Oct. '11), ISGAN and ENARD merged (completed Feb. '12)**
- **ISGAN adopted Annex 6: Power T&D Systems (Mar. '12)**
  - Purpose is to extend ENARD's excellent work in its Annexes II & IV
  - Initial Annex 6 work program covers transmission (ENARD Annex IV)
- **Now, ISGAN developing path forward to extend ENARD's distribution networks work (Fmr. ENARD Annex II)**
  - Work to complement program in other IEA IAs (e.g. PVPS IA)
- **ALSO – Former ENARD Chair & Vice Chair serve in emeritus positions on ISGAN Executive Committee**

Annex 4 Product: Message to CEM3

Synthesis of Insights for CEM3:

Renewable Energy Alone Will Not Keep the Lights On!

The massive introduction of renewables requires more resilient and intelligent electrical grids and systems to ensure security of supply and power quality.

Smart Grids are a Key Enabling Infrastructure for Renewable Energy.

Ongoing, transformational changes in the resource base of power production, consumer demands and energy-use behaviors require new, integrated approaches. Power producers, utilities, users, decision makers and society at large will all be forced to rethink and adapt to these new paradigms.

The transition to clean and secure energy technologies is achievable if...

- The technical and policy needs for smarter system support of renewable energy are well-known and met.
- Investments in electricity networks are timely since delay will increase system risks and the ultimate costs to society.
- New, available technologies are deployed to increase network capacity within existing corridors and supply new on- and offshore interconnections.
- Smarter grid technologies are deployed to improve overall power system efficiency and to balance supply, demand, and storage in real time.
- Guiding principles for the development of smarter grids are shared and based on holistic system approaches, a regulatory shift of focus to longer terms, the recognized need for new innovation and workforce competencies, and international cooperation.

Source: Key messages identified during ISGAN's recent merger with the IEA Implementing Agreement for Electricity Networks Analysis, Research and Development (ENARD).

Smart Grid is a concept and vision that captures a range of advanced information, sensing, communications, control, and energy technologies. Taken together, these result in an electric power system that can intelligently integrate the actions of all connected users – from power generators to electricity consumers to those that both produce and consume electricity ("prosumers") – to efficiently deliver sustainable, economic and secure electricity supplies.

Source: Definition adapted from the European Technology Platform Smart Grid (ETPSG).
Note that ISGAN uses the singular form, "Smart Grid," to refer to the overarching concept and the plural form, "smart grids," to refer to the physical implementations of these intelligent networks. Photo Credits: U.S. National Renewable Energy Laboratory

Why Smart Grids?

From electrical generators to end consumers, the sources and uses of electric power are becoming much more varied and complex. To address this trend, the power sector has already begun integrating Smart Grid technologies and concepts into their networks, a process that will ultimately take decades.

Whether building new grids or improving existing structure, **Smart Grid** is a key platform for 21st century competitiveness.

***Effectively implemented*, smart grids are MORE:**

Reliable. Smart grids can maintain or improve reliability and decrease the frequency and duration of outages.

Secure. Smart grids can provide resiliency in the case of disturbances, natural or otherwise.

Economical. Smart grids can cut relative utility and consumer costs.

Efficient. Smart grids can increase operating efficiencies and use of existing infrastructure and reduce network losses.

Environmentally Friendly. Smart grids can enable integration of high shares of renewable energy, electric vehicles and electric heat, as well as improved energy efficiency and load management.

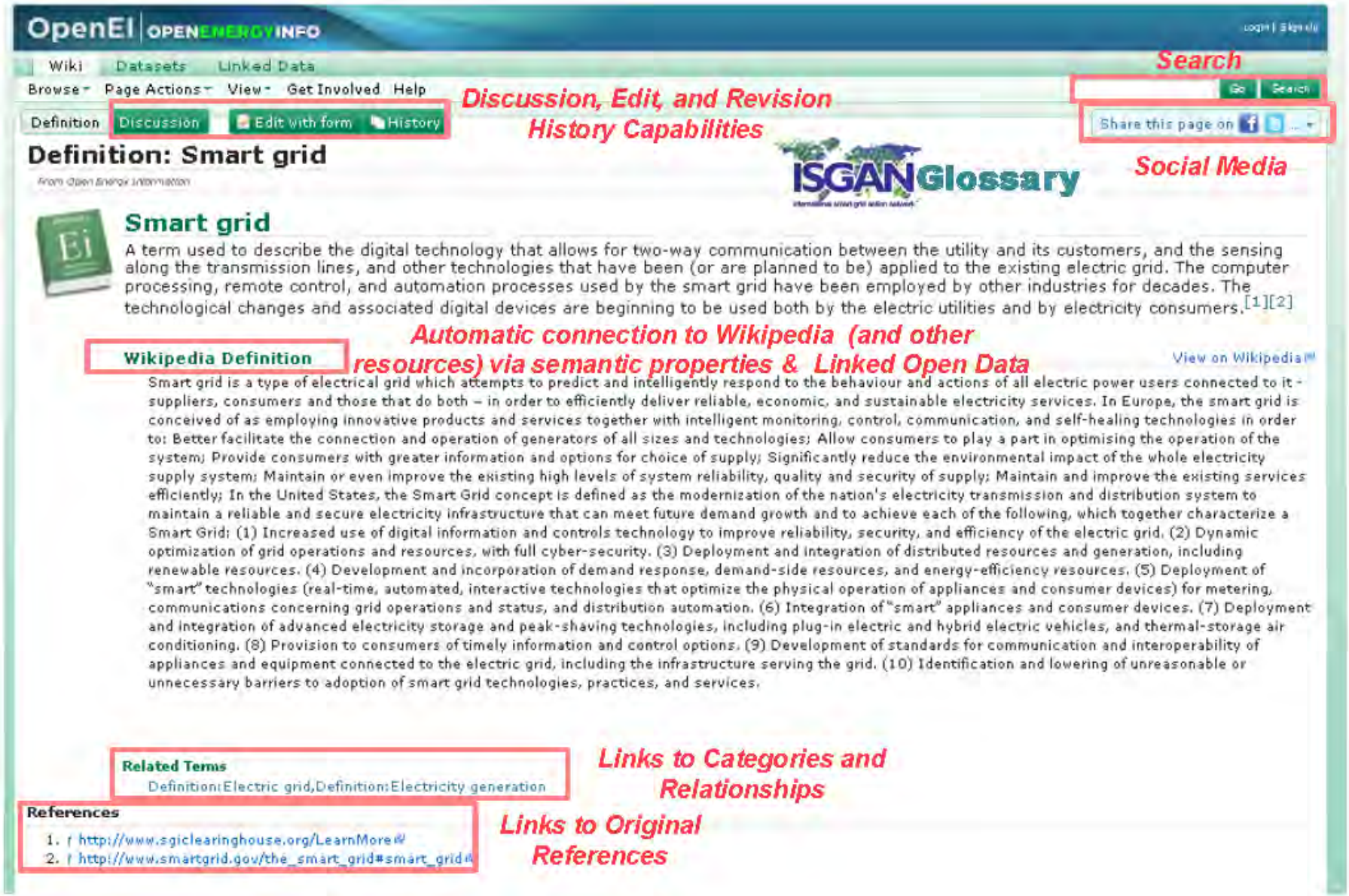
Safe. Smart grids can increase public and worker safety.

2GtCO$_2$/ yr

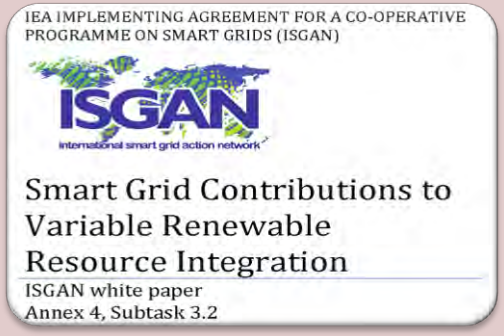
Smart grids have the potential to help reduce global CO_2 emissions by over 2 gigatonnes per year by 2050. (IEA 2010)

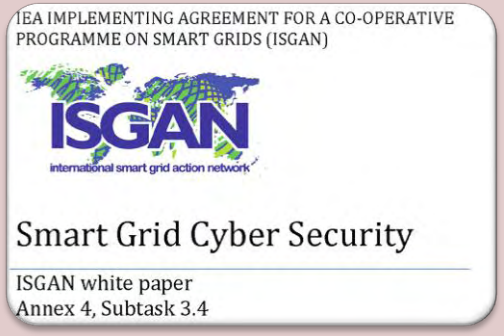
ISGAN, also known as the IEA Implementing Agreement for a Co-operative Programme on Smart Grids (ISGAN), functions within a framework created by the International Energy Agency (IEA). The views, findings and publications of ISGAN do not necessarily represent the views or policies of the IEA Secretariat, all of its individual member countries or all of ISGAN's Participants.

Annex 4 Product: Smart Grid Glossary Beta



Annex 4 Products: White Papers





INTEGRATION OF V.R.R.

- ACTIVATE DEMAND-SIDE INTELLIGENCE
- ACTIVATE DELIVERY-SIDE INTELLIGENCE
- ACTIVATE MARKETS
- ENABLE DG AND MICROGRIDS
- IMPROVE TSO-DSO COORDINATION
- IMPROVE TSO CONTROL ROOMS
- ENSURE ALIGNMENT OF SG ROADMAP WITH VRR
- EVALUATE VRR INTEGRATION IN CONTEXT OF ALL INTEGRATION SOLUTIONS

CONSUMER BENFITS AND COSTS

- DESCRIPTION OF CONSUMER BENEFITS FROM SMART GRIDS
- CONSUMER COST ALLOCATION IN DIFFERENT ELECTRICAL SYSTEM ORGANISTAION CONTEXT
- RECOMMENDATIONS FOR CALCULATING COST AND BENEFITS
- BEST PRACTICES FOR CONSUMER ENGAGEMENT

CYBERSECURITY

- PRIORITIZE EFFORTS TO ADVANCE REGULATORY AND INDUSTRY BEST PRACTICES IN CYBER SECURITY ECONOMICS IN THE SMART GRID CONTEXT
- ESTABLISH A FORUM TO SHARE BEST PRACTICES IN CULTIVATING ORGANIZATIONAL CHANGE AND COST-EFFECTIVE TECHNICAL INNOVATIONS IN SUPPORT OF CYBER SECURITY IN THE SMART GRID CONTEXT
- ESTABLISH A FORUM TO SHARE BEST PRACTICES IN POLICY DEVELOPMENT IN THE AREA OF CUSTOMER DATA PRIVACY IN THE SMART GRID CONTEXT

ISGAN Recent & Upcoming Schedule

- ***Week of 26 March 2012 ● Mexico City, Mexico***
  Joint IEA/ISGAN Workshop : "Smart Grids in Distribution Networks: How2Guide drafting workshop" and 3rd ISGAN ExCo Meeting
- ***25-26 April 2012 ● London, UK***
  Third Clean Energy Ministerial meeting
- ***21 May 2012 ● Bregenz, Austria***
- ***18-19 June 2012 ● Milan, Italy***
- ***10-11 July 2012 ● Milan, Italy***

  ISGAN Workshops (Annexes 3 & 6)
- ***Week of 24 September 2012 ● Nice, France***

24 September	Annex meetings
25-26 September	Workshop: "Why Smarter Grids? Regional Drivers for Smart Grid Deployment and Lessons Learned from Current Projects"
26-28 September	4th ISGAN ExCo Meeting

- ***3 December 2012 ● Berlin, Germany***
  Annex 5, SIRFN Workshop (as part of 5th Int'l Conference on Integration of Renewables and Distributed Energy Resources)