



Spotlight on Smart and Strong Electric Power Infrastructure

International Smart Grid Action Network ISGAN

WEBINAR MAY 5, 2015

BO NORMARK, CHAIRMAN ISGAN ANN 6 POWER T&D SYSTEMS

Clean Energy Ministerial started as a new initiative after COP-15 in Copenhagen



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The Clean Energy Ministerial is a global forum to share best practices and promote policies and programs that encourage and facilitate the transition to a global clean energy economy.

CEM initiatives help reduce emissions, improve energy security, provide energy access, and sustain economic growth.

CEM Initiatives

ISGAN is one of thirteen CEM Initiatives



Energy Efficiency	Clean Energy	Integration	Human Capacity
 <p>Super-Efficient Equipment and Appliance Deployment (SEAD) Initiative</p>	 <p>Bioenergy Working Group</p>	 <p>21st Century Power Partnership</p>	 <p>Clean Energy Solutions Center</p>
 <p>Global Superior Energy Performance Partnership</p>	 <p>Sustainable Development of Hydropower Initiative</p>	 <p>International Smart Grid Action Network (ISGAN)</p>	 <p>Global Lightning Energy Access Partnership (Global LEAP)</p>
	 <p>Carbon Capture</p>	 <p>Electric Vehicles Initiative (EVI)</p>	 <p>Clean Energy Education & Empowerment (C3E) women's Initiative</p>
	 <p>Solar and Wind</p>	 <p>Sustainable Cities</p>	

ISGAN in summary

Activities in ISGAN build a global understanding of smart grids, address gaps in knowledge and tools, improve peer-to-peer exchange, recognize excellence

□ ISGAN's strength includes:

① Broad Expert Network

ISGAN leverages expertise from governments, national laboratories and research institutions, transmission and distribution system operators, power generators, and others from 25 countries from five continents

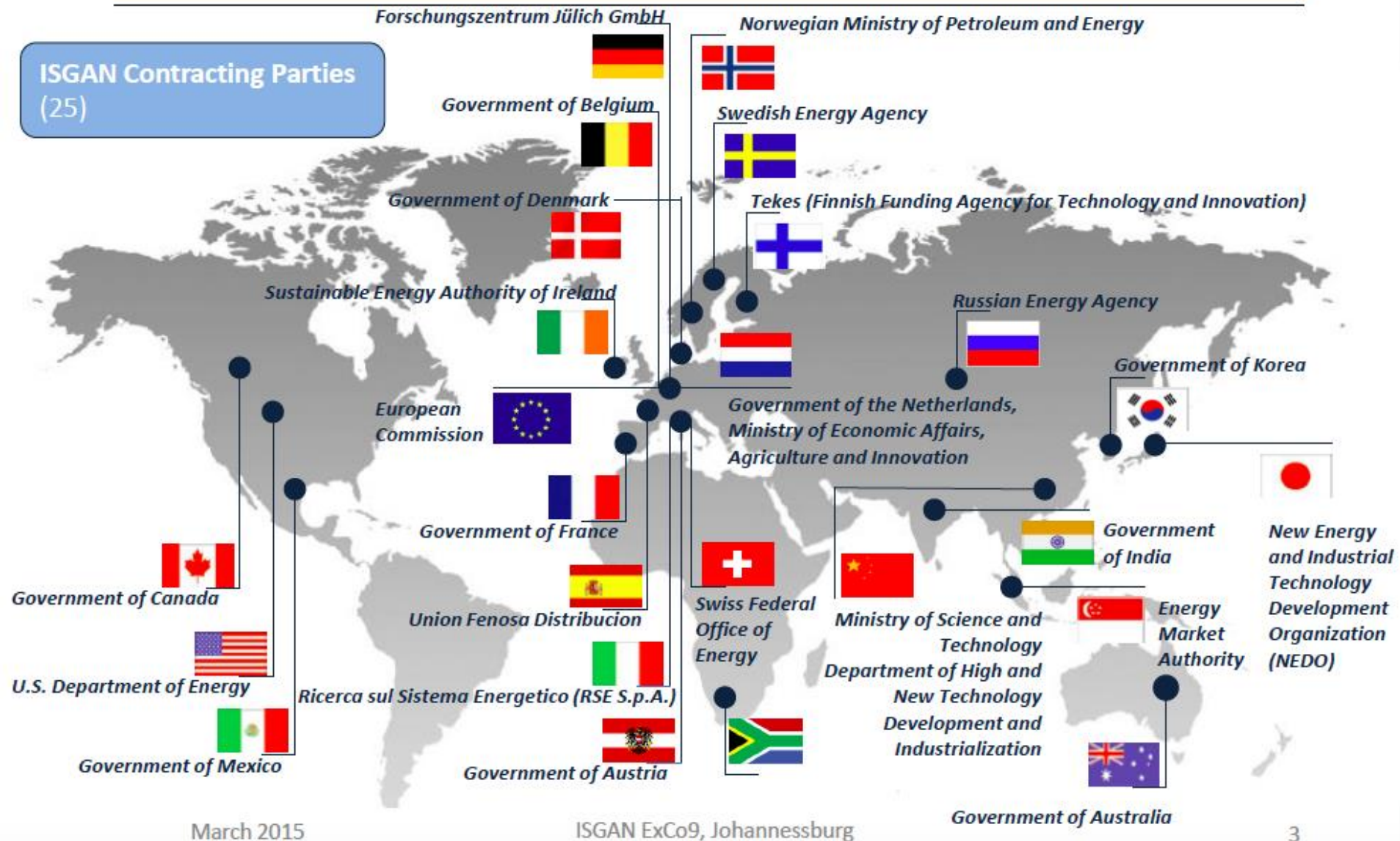
② Partnerships with Thought Leaders

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

③ Diverse Portfolio

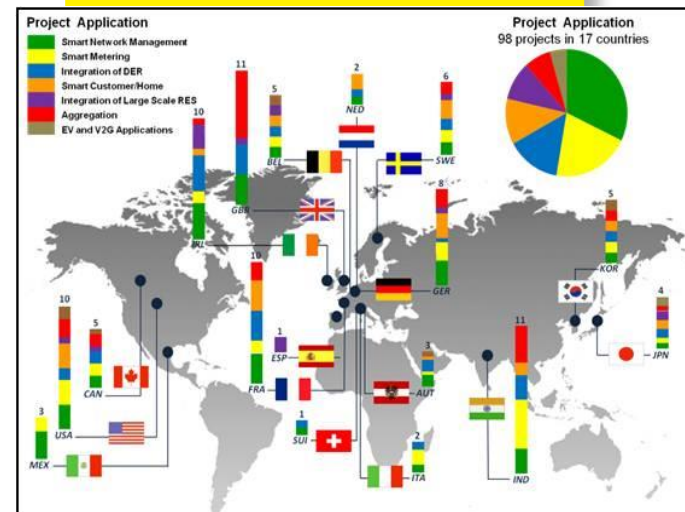
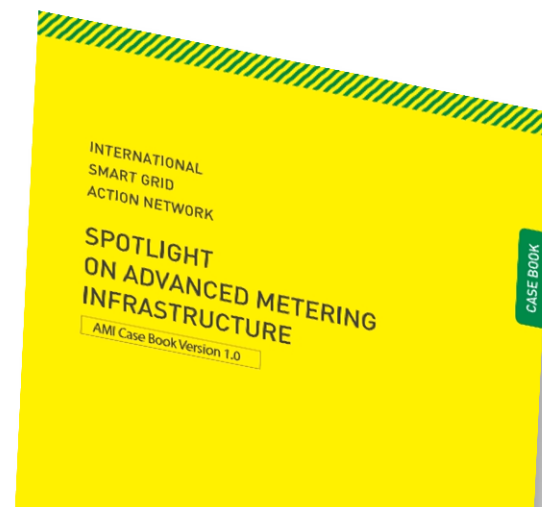
ISGAN implements a range of activities to support a better global understanding of smart grids and the value they offer, address gaps in knowledge and tools, enhance peer-to-peer exchange, and otherwise improve international coordination

ISGAN Contracting Parties
(25)



ISGAN collects and shares best practices and lessons learned, informing peer-to-peer exchange and contributing to the wider application of smart grid solutions.

- International casebooks on **Advanced Metering Infrastructure (AMI)** and **Demand Side Management (DSM)** identify emerging **best practices**
- **Online database catalogues smart grid activities** underway around the world mapped to motivating drivers.
98 projects, 17 countries... so far
- Frequent **webinars** highlight **lessons learned** in specific projects.



ISGAN Annex 6 Power T&D Systems Case Book
















Spread of geography and applications



- Integrate renewables (R)
- Improve markets (M)
- Engage customers (C)
- Increase security supply (S)



ISGAN Annex 6 Power T&D Systems Case Book

Country:	Case:	Level:	Reason:		
Ireland	East-West HVDC Interconnector	TSO			
Sweden	Embedded HVDC link	TSO			
United States	Wide Area Reliability	TSO			
Italy	WAMS experience in Italy	TSO			
South Africa	Demand Response	TSO			
France	Smart Substation	TSO + DSO			
Austria	Active Distribution Network	DSO			
Italy	Customers' response under time-dependent electricity prices	DSO			

Author:

South – West Interconnector Sweden

CASE HIGHLIGHTS

Optimal choice of transmission technologies

- Combination of overhead AC and DC; underground DC.
- No new right-of-way required.
- Increased transmission capacity for the overhead line within existing right-of-way.
- 200 km, 1200 MW underground line for virgin land.
- HVDC-VSC technology suited for future expansion to HVDC grid.

Ancillary service

- Increased transmission capacity and voltage collapse avoidance in existing grid by reactive power control.

Smart Substation, France

CASE HIGHLIGHTS

The smart substation solutions will provide the following benefits:

- Reduced environmental impact
- Improved integration of renewable energy
- Increased transmission capacities
- Optimised use of the existing asset

The smart substation solutions will achieve those benefits through the following mechanisms:

- Full digitalization of all links between the high-voltage equipment and the intelligent electronic devices
 - Development of an open architecture (IEC 61850) that allows high-level system functions like local state estimation, local analysis and diagnosis of incidents, and auto-adaptive protection schemes
 - Implementation of sensors and monitoring to optimize system operation and maintenance (e.g., dynamic line rating and preventive maintenance)
-

Grid Situation Awareness, South Africa

CASE HIGHLIGHTS

Investigate the feasibility, requirements, and development of a *Visualisation Server stack* to improve the *grid situational awareness*

The system will *provide real-time support for intelligent decision making* and *improve the efficiency of the following tasks:*

- Maintenance scheduling
- Preventative maintenance
- Fault-finding

Additional benefits include:

- Reduced downtime
- Immediate feedback based on data, including warnings of impending danger

Customers' response under time-dependent electricity prices , Italy

CASE HIGHLIGHTS

Time-of-Use (ToU) tariffs reduce the complexity of the metering infrastructure and extend the time slots, leading to incentives for customer to adjust their consumption during peak hours. At the same time, ToU tariffs protect those who are not able to modulate their demand.

Benefits of ToU tariffs include the following:

- ***Improve the efficiency*** of the whole Italian T&D system
- ***Illustrate for customers their role*** in shaping their energy consumption

WAMS experience, Italy

CASE HIGHLIGHTS

The development of Wide Area Measurement System (WAMS) technology, combined with phasor measurement unit (PMU) devices, offers *new, valuable solutions for power system analysis, monitoring, and control.*

System dynamics are tracked in real time with high accuracy, which provides valuable benefits:

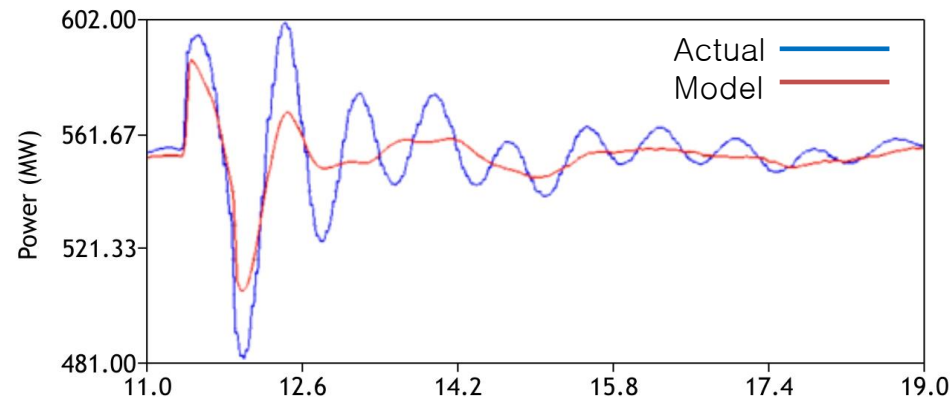
- Improves system-wide awareness and understanding
- Supports decision making and performance control

The availability of synchronized phasor measurements could *mitigate or even prevent large disturbance scenarios.*

- In 2013, BPA completed installation of a \$30M synchrophasor project, funded in part by the DOE's Smart Grid Investment Grant Program.
- BPA installed 126 phasor measurement units at 50 substations and large wind generators to take wide-area synchronized measurements of real-time grid conditions
- Measurements are delivered for analysis and possible action over a highly reliable, secure, control-grade operational system moving high volumes of real-time data.
- BPA now has the largest, most sophisticated synchrophasor network of any utility in North America.



- BPA engineers developed a suite of real-time analytical applications. The application engine processes about 18,000 PMU measurements every second.
- BPA’s synchrophasor-based controls will use wide-area synchronized measurements to determine voltage stability risks and will initiate corrective actions within < 1 second.
- BPA pioneered a new approach for validating power plant dynamic models using data of system disturbances.



Power plant model validation methods using PMU data have the potential to reduce outages, increase reliability, and save money

- *Optimized capital investment*
 - BPA expects to defer the need for \$40M in dynamic voltage control equipment over the next 10 years
- *Large-scale outage avoidance*
 - Based on historical data, BPA could avoid at least one large-scale outage in 40 years, at a conservative estimated value of \$1.2B to \$3.5B
- *Compliance with regulatory standards*
 - BPA spends about \$325,000 per year to comply with power plant model validation regulations; using a new application and data from a PMU at the generator terminals, costs could be reduced by at least \$100,000 per year

Thank you!
