

Smarter Grids ... and More of Them

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Making electricity grids smarter and bringing smarter grids into more widespread operation was the focus of a recent IEA workshop on the Swedish island of Gotland. Smart Grids are the essential key to reliable electricity networks that can integrate a broader portfolio of responses to sustainability criteria and take account of evolving energy approaches among both power producers and power consumers. Under the banner "Communications & Control", the 5-6 May gathering, organised by the IEA programme on Electricity Networks Analysis, Research and Development (ENARD), brought together nearly 30 participants from some 12 countries to review developments and brainstorm on addressing the challenges.



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Input of more electricity from intermittent renewable sources can change the load flows on the power grid. Power that depends on weather and winds is difficult to submit to power system supply/demand load balancing and regulation regimes. Moreover, changes in electricity consumers' energy-use patterns can also make a big difference to load patterns on the grid. The effect of plug-in electric vehicles, for example, or the customer's obligation to use electricity in a smarter way, will have a major impact on how the electricity grids are to be dimensioned and run. Generating and using electricity in a more sustainable way affects the performance of both transmission and distribution within the electrical power grids.

¹ The IEA [OPEN Energy Technology Bulletin](#) is a free, web-based periodical newsletter published by the International Energy Agency (IEA). Views expressed in *OPEN Bulletin* interviews do not necessarily reflect the views of the IEA.

² ENARD is an IEA international [energy technology collaboration](#).

Smart Grids respond to these difficulties by using a range of digital devices, communication tools, systems and applications to bring electricity from suppliers to consumers in an energy-efficient, less costly and more reliable fashion.

ENARD's workshop in Gotland's mediaeval town of Visby focused on ways in which the electricity network can adapt, and so contribute to de-carbonising the world's power systems. Speakers came from Australia, Europe and the United States. Their presentations and the ensuing in-depth discussions focused on both the systemic and the technological aspects, including different wireless and mobile options, public networks, satellite and other options. An opening speech struck a futuristic note with its vision of a "European Supergrid".

Solid foundations for Smart Grids

It is difficult to create better systems if little is known about the performance of existing systems. Improved communication and unambiguous protocols for processing information are the point of departure for the advances towards Smart Grids that we are witnessing in today's electricity networks.

Some basic questions emerged from the workshop's discussions.

- Is the resilience of these systems fully up to historical standards?
- Are investment drivers - cost, planning - conspiring to create potential problems for the future?
- Are these factors sufficiently recognised and acknowledged by high-level decision takers and policy makers?
- Ultimately, should these issues be addressed by changing regulatory frameworks, or incorporating cost into rate bases and tariff structures?

Workshop participants were reminded of the devastating hurricanes "Gudrun" and "Per" that caused extensive damage to Swedish electricity distribution in January 2005 and January 2007. Other presentations highlighted experience from other disruptions and underlined the crucial need for enhanced information on what in fact happened in the grids. Case histories recounted flooding in the United Kingdom and the major black-out in Italy in September 2003. Participants described ongoing efforts to secure information on events in the Australian and North American grids.

Getting smarter

A number of key challenges were identified during the workshop. One concerned the need to address convergence of information and communication technology (ICT) with power systems infrastructures, including inter-operability between power systems, meters and other devices, especially when power passes across national borders. Standards like those set by the International Electrotechnical Commission or the European Committee for Electrotechnical Standardization will play a crucial role. Operators will be keenly monitoring results from the rigorous testbeds to which the technology is subjected.

Practical application

At customer level, Smart Grids imply installation and ongoing management of smart meters. Participants noted that the right choice has to be made between either less costly, faster installation or high-performance features offering enhanced functionality and benefits. The challenges are essentially common challenges, but the way they are addressed varies greatly.

In unbundled markets where power generation, transmission and distribution are separated from competitive, commercial operations, broken value chains and different apportionment of benefits can create conflicting interests; hence the importance of identifying the right business drivers and making a well reasoned business case for investment decisions that ensure customer satisfaction.

Fully functional ICT-enabled Smart Grids facilitate provision of further added-value services and responses to adoption of new technology like plug-in electric vehicles. Smart Grids enable end-users to contribute to balancing of power demand within the system, thus reducing overload at peak-demand times. A key goal for transmission system operators will be to stimulate competition among providers of supply/demand balancing services. Technical solutions do not provide all the answers and, here again, a solid business case must underpin decisions.

Workshop participants heard about an interesting project in Danish Jutland where utilities are optimising intelligent processing of information and active operation of the network by applying island-operation mode in a specific local area. The project uses local wind-power and small-scale combined-heat-and-power (CHP) systems and the load is well controlled.

While conditions and issues may vary from network to network, many of the challenges are universal. Shared experience is therefore primordial for bringing Smart Grids into the mainstream. Our IEA programme on Electricity Networks Analysis, Research and Development ([ENARD](#)) provides an important platform for circulating information and stimulating awareness.

Launched in July 2006, ENARD brings together 13 countries (May 2009). It associates a further group of observers who follow its work. While it is true that efforts on the ground to improve the world's electricity networks are in the hands of companies and related organisations whose benchmarks draw on their own sources of information, ENARD provides an essential clearing house for widely sourced information and experience on the important issues for the electricity grids of tomorrow. Drawing on its findings, the ENARD Executive Committee is well placed to formulate policy messages and recommendations that the IEA and OECD can channel to national leaders and policy makers, for instance through work for the G8 heads of state. For more information, visit the [ENARD website](#) - www.iea-enard.org.