



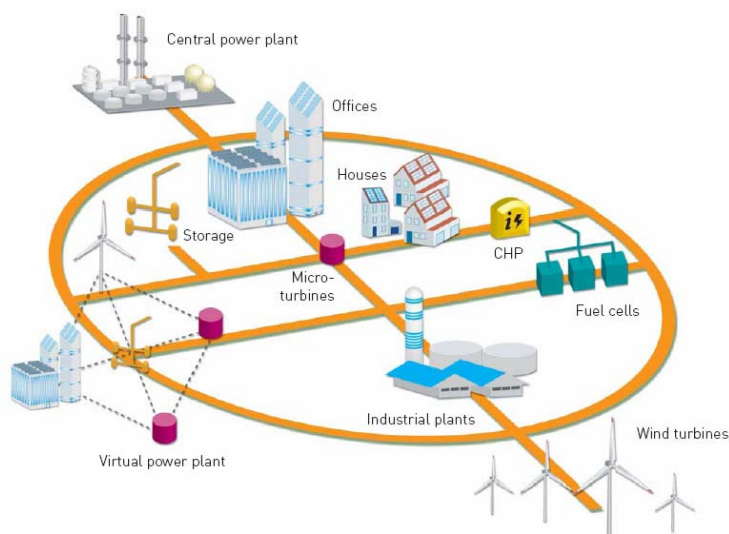
**IEA Implementing Agreement on
Electricity Networks Analysis, Research and Development (ENARD)**

Annex I Workshop Profile

“Intelligent Distribution Networks, micro-Grids & Active Network Management”

Annex I: Information Collation and Dissemination

**Annex I Workshop held EA Technology, Capenhurst, United Kingdom,
14th - 15th April 2008**



[*European SmartGrids Platform – Vision and Strategy for Europe’s Networks of the Future*
from the presentation given by David Openshaw, EDF Energy Networks]

Summary:

The workshop drew the support of 41 participants from 14 countries and comprised a series of expert presentations, an introductory presentation in relation to Annex II and a series of national overview presentations, all complemented by open discussion and dialogue.

The presentations, discussion and dialogue succeeded in providing a wealth of information and data, both to feed into Annex II, in the short term, and also for consideration by the ExCo in relation to the medium/longer term development of the Implementing Agreement itself.

This workshop forms one of a series of ENARD Annex I workshops organised and delivered by EA Technology in its capacity as ENARD Annex I Operating Agent



Workshop profile

1 Introduction

The workshop was convened as the sixth in the series of topical experts' meetings and workshops of the International Energy Agency (IEA) Implementing Agreement on Electricity Networks Analysis, Research and Development (ENARD). ENARD covers a wide range of issues associated with electricity transmission and distribution (T&D) systems. Annex I is the central information collation and dissemination Annex and also contributes to the definition of future priorities for the Implementing Agreement as a whole.

Annex I is essentially led by a series of topical experts' meetings and workshops, each addressing particular areas of interest that act as the foundation for the development of future collaborative research and development (R&D) Annexes. Further details may be found on the ENARD web-site at www.iea-enard.org.

2 Workshop Aim and Objectives

The workshop was convened with a view to addressing a range of issues in relation to active network management, intelligent distribution networks and micro-grids. It is anticipated that the workshop outputs will be beneficial to the development of ENARD Annex II, "DG System Integration" and also in relation to the medium/longer-term development of the Implementing Agreement itself.

3 Workshop Structure and Programme

The workshop was structured to comprise a series of expert presentations with ample opportunity for discussion and dialogue on day one. Day two then consisted of an introduction to ENARD Annex II, followed by a series of short national overview presentations, from both participating and non-participating countries. The workshop concluded with an optional technical visit to Dinorwig pumped-hydro storage scheme, in North Wales.

The workshop was opened by Robert Davis, Managing Director of EA Technology, UK, who were hosting the workshop, with Philip Baker (UK delegate to the ENARD ExCo and recent retiree from the UK Department for Business, Enterprise and Regulatory Reform) responding by commenting on the timeliness of the workshop given the growing emphasis on renewables integration and how this might require greater connection of generation to the distribution network. Stig Goethe (Chair, ENARD Implementing Agreement) concluded the opening addresses by noting that he believed that society is presently at the dawn of a new electrical revolution, with electrical networks likely to become even more significant.

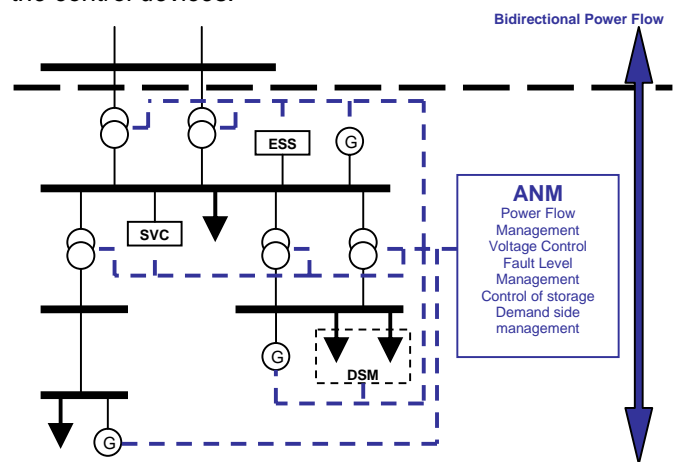
4 Expert Presentations

Responding to the Government's Targets for Renewable Generation – a UK DNO Perspective (David Openshaw, EDF Energy Networks, UK)

Mr. Openshaw described the structural framework within which the Distribution Network Operator (DNOs) work within the UK, where they are responsible for the power distribution network from 132kV and below. He noted the much quoted EU "three 20s" target; namely for a 20% reduction in greenhouse gas emissions, a 20% increase in energy efficiency and 20% of primary energy supplies to be from renewables, all by year 2020. Mr Openshaw then commented, that for the UK to meet its share of this target, the electricity sector would be required to take a proportionally larger share, probably in the region of 38% of electricity produced from renewables by 2020. He developed his presentation along the lines of what could be achieved within the UK and then went on to consider their implications for the UK power system infrastructure, particularly in terms of active networks and the role for bulk energy storage in Scotland. He commented that he could foresee the transition of today's Distribution Network Operators to Distribution System Operators, responsible for at least some of the balancing on their own networks.

Active Network Management – a Review of Worldwide Developments (Graham Ault, University of Strathclyde, UK)

Dr Ault began by defining Active Network Management (ANM) as "a network where real-time management of voltage, power flows and even fault levels is achieved through a control system either on site or through a communication system between the network operator and the control devices."



[from the presentation given by G Ault, University of Strathclyde, UK]

He described two recent reviews of ANM developments which have adopted a structured breakdown of technical areas. These have been identified as:-

- planning
- communications & control
- DSM
- fault level management
- future technologies
- power quality
- modelling & analysis
- power flow management
- protection system
- storage
- voltage control

Dr Ault highlighted the progress between the two reviews and noted a number of ANM which were at the demonstration stage including those associated with voltage control; power flow management; and communications and control. He concluded by describing some of the barriers to ANM that remain and noting the ongoing requirement for high profile and integrated demonstration projects.

SmartGrid Implementation in the United States

(Eric Lightner, Office of Electricity Delivery & Energy Reliability (OE), United States Dept. of Energy (DOE))

Mr Lightner opened by outlining the Energy Independence and Security Act 2007 and Title XIII on SmartGrids in particular. Under this Title, the OE has been tasked with a number of research projects to evaluate and demonstrate possibilities for SmartGrids. In its 2007 Strategic Plan "Transforming Electricity Delivery", the OE's R&D division identified SmartGrids and Climate Change as the two key unifying themes for its strategic opportunity areas. Mr Lightner outlined some of the OE's current activities in relation to SmartGrids including the Olympic Peninsula Grid Wise Demonstration (where customers actively participate in real-time market dynamics) and PNNL's Plug-Hybrid Impact Analysis (which noted that unused capacity on the US Grid could supply 73% of the energy needs of the current car population if charged off-peak).

The Smart Grids European Technology Platform

(Duncan Botting, ABB, UK)

Mr Botting contrasted the different policy drivers for SmartGrids between the European Union (mandatory renewables targets resulting from policy decisions) and the US (functionally driven to address network problems). He noted the very considerable challenges to be addressed in the implementation of SmartGrids, with the whole replacement, renewal and transformation of the power system functionality to be achieved "live" and with minimal impact on the customer. The forthcoming publication of the Strategic Deployment Document (SDD), mid-2008 is to address a whole series of essential deployment issues. Throughout his presentation, Mr Botting emphasized that the key challenge was that in relation to the adoption of technologies, with the present process of network renewal essentially being based on products and technologies some 40 years old and with a 40 year life.

Presentation of the Institution of Engineering & Technology (IET)'s "Big Picture"

(Duncan Botting, ABB, UK, & Chris Pearse, The Clarity Partnership, UK)

Messrs. Botting and Pearse introduced the IET's "Big Picture" poster display, setting out in pictorial form, scenarios for the development of the UK electricity supply industry from the present day, through year 2020 to year 2050. Discussion followed, facilitated by Messrs.

Botting and Pearse, with the comment and inputs received to be included in Mr. Pearse's wider ranging show-casing of the "Big Picture".

Technological Advances for Smart Distribution Networks – a Manufacturer's Perspective

(Carsten Boese, Siemens AG, Germany)

Dr. Boese noted that electrical processes can often be more efficient than those based upon the direct utilization of other energy sources; the complementary essential role of electricity networks in allowing for the integration of a wider range of renewable energy sources; and the requirement for holistic approaches to achieve overall optimal solutions. He noted the direct consequences of all the above in terms of the utilization of electrical energy likely to increase at a much faster rate than overall energy consumption. He envisaged a SmartGrids based approach creating a "toolbox" of proven technical solutions to enable existing power networks to accept power inputs from all types of generation plants. Dr. Boese further noted the development of active distribution networks, with the Distribution System Operator of the future being responsible for the provision of a full range of system services including balancing, frequency regulation, reactive power, and voltage control and the key role that communication technologies in relation to these concepts.

The FENIX Project --- a Step Towards the Future of Electricity Networks

(Martin Braun, ISET eV, Germany)

Dr. Braun introduced FENIX (Flexible Electricity Networks to Integrate the eXpected "Energy Evolution") as a 4 year European Union (EU) Collaborative Project, running from October 2005 to September 2009 and involving the participation of 21 partner organisations, with Iberdrola (Spain) as the overall project co-ordinator. Dr. Braun explained that the rationale for FENIX was the concept of fully integrated DG, via the concept of aggregating DG, both technically, to form a Technical Virtual Power Plant (TVPP) and also commercially, to form a Commercial Virtual Power Plant (CVPP). The Virtual Power Plant (VPP) is seen as essentially an aggregation of the capacity and characteristics of a variety of distributed generation resource. The VPP can be portrayed with a single operating profile which can be used for the provision of technical support services onto the network (as a TVPP) or can participate in commercial energy trading and supply arrangements (as a CVPP).

Towards a Market & Regulatory Framework to Facilitate SmartGrids

(Charlotte Ramsay, Imperial College, UK)

Dr. Ramsay described the transitional status of power systems at the present time, outlining their move from the traditional and well established operating structure of generation, transmission, distribution and supply to the new operational framework of SmartGrids. She highlighted how the traditional functional boundaries are now somewhat historic and how the various component

parts of the electricity supply chain now closely interact with and impact on each other. One fundamental challenge is that no individual market participant can see the overall network “big picture. Dr. Ramsay commented that today’s regulatory frameworks mitigate against truly cost effective DG system integration, before proposing a longer term, market based solution for SmartGrids (the Open Energy Market Place), with the various market participants being brought together as end-users on a real time basis, providing system operators with access to cost effective solutions for system management, as well as appropriate signals for long term investment decisions.

5 Annex II “DG System Integration”

Dr Helfried Brunner (Arsenal Research, Austria) introduced Annex II which focuses on distribution system issues. He outlined the objectives of Annex II and the principal tasks envisaged in the delivery of the first phase of the work programme, running from May 2008 to April 2010. Eight countries, to date, have expressed their intent to participate in Annex II, with its inaugural Experts’ Meeting being convened in Vienna, 13th – 14th May 2008. More information can be found about the work of Annex II on the ENARD website (at <http://www.iea-enard.org/content/Annexes.aspx>).

6 National Overview Presentations

Short overviews of the national distribution systems were presented by representatives of both participating and non-participating countries. The presentations given covered:

Austria	Norway
Belgium	Spain
Denmark	Sweden
Finland	Switzerland
France	United Kingdom
Germany	United States.
Japan	

Key outstanding issues highlighted included:

- managing an ageing infrastructure;
- increased levels of DG and intermittent generation being connected to networks;
- need for further investment in infrastructure and in development of new technologies;
- further development of regulatory standards.

7 Workshop Outputs

Key messages to emerge from the workshop were noted to include:-

- The overall magnitude of the challenge, in managing the transition to a distributed power system, based on low carbon generation sources;
- The difference in market drivers, evident between Europe and the US;
- The key role for smart metering in the context of customer buy-in;
- The various levels of activity and funding required in managing the transition from RD&D, to trials and to applications demonstrations;
- The challenges associated with prevalent market frameworks and their progressive transition over the past one to two decades towards regulatory unbundling and the breaking of value chains;
- The blurring of the traditional boundaries between generation and distribution;
- The application and implementation of technologies;
- The crucial role of communications and standards;
- Anticipated trends in favour of intelligent electrification;
- The differentiation between commercial virtual power plant and technical virtual power plant;
- The anticipated transition of Distribution Network Operators to Distribution System Operators;
- The sharing of network capacities and constraints and the application and uptake of non-network solutions (NNS);
- The extraction of full value by and from DG (eg via locational/time-of-use reward mechanisms).

Annex II “DG System Integration”

Key messages for consideration in the context of Annex II were noted to include:

- The essential need to define the business case for ANM/SmartGrids, from a DNO perspective;
- The development of authoritative justifications to assist DNOs in changing from present “fit & forget” policies; and
- The crucial importance associated with the development of a guidelines document, to facilitate the transition from today’s passive networks to the active networks of the future.

ENARD, the IEA Implementing Agreement on Electricity Networks Analysis, Research and Development, functions within a framework created by the International Energy Agency (IEA). The views, findings and publications of ENARD do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.

**ENARD Participating Countries:
Austria Belgium Denmark Finland Italy Netherlands Norway Spain Sweden Switzerland UK USA**