

Maximising the value of the SET Plan Integrated Roadmap

Rationale and Objectives

It has been recognised by a number of observers that the current EU Commission initiative to elaborate a SET Plan Integrated Roadmap has been set up in such a way that the manufacturers and developers of equipment and monitoring, protection and control systems for electricity networks, who are the main technology developers and providers in this vital component of the Energy system of Europe, have only a small, indirect representation in the Steering Committee and Working Groups of the process.

This document is intended partially to mitigate this omission by outlining some essential actions and technical topics pertaining to the European electricity system, which need to be included in the SET Plan Integrated Roadmap, and the Horizon 2020 programme of funding, that should be in tune with it.

Summary & Conclusions

Taking the example of the electricity network, a substantial body of work has already gone into defining the future developmental requirements. It is clearly recognised that these requirements seen from a grid perspective must be integrated and made compatible with those of the wider industrial complex and with society as a whole. However, it is necessary to emphasise that the R&D requirements defined for shorter- and longer-term horizons by the experts in electricity transmission and distribution are still seen as the most relevant targets and are generally compatible with the wider societal targets. Therefore:

1. It should not be necessary to consume further effort and time in the re-invention of work agendas that have already been developed. This would only delay development and implementation. Effort should be concentrated on areas where the requirements of different industries overlap or where gaps between them have been recognised. Topics identified as priorities for electricity networks by a wide spectrum of experts under the aegis of the ETP SmartGrids are summarised in Appendix 1.
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2. The manufacturers and developers of equipment and monitoring, protection and control systems for the electricity networks are the main technology providers to the networks and also the providers of the most up-to-date technologies. However, to date they have only been involved in the SET Plan Integrated Road Map at a level of intensity too low to provide adequate input to the proceedings. In this scenario, there is a danger that the existing technologies and the future potential or barriers will not be properly represented in the formulation of the Integrated Road Map.

It is therefore recommended that these Manufacturers be more intensively involved in the remaining stages of the development of the SET Plan Integrated Road Map, especially the

critical review stages. This involvement should be through at least the ETP SmartGrids, plus preferably the relevant Industrial Associations of that industry, such as T&D Europe and Digital Europe.

SRA 2035 and GRID+

The Strategic Research Agenda 2035 (SRA 2035) describes the research topics and priorities seen as necessary by the ETP SmartGrids, based on the work of some 200 experts in the field, for the advancement of electricity networks and intelligent electric systems with a time horizon of 2035.

The research activities and goals for the years leading up to 2020 had been discussed in the previous SmartGrids SRA of 2007. In 2010 the European Electricity Grid Initiative (EEGI) laid down the SmartGrids RD&D needs to achieve the European objectives by 2020. This has now been updated as part of the GRID+ project.

The SRA 2035 focusses on Research and Development for technologies that will be necessary for the further development of the electricity system from 2020 to 2035 and beyond. SmartGrids research for 2035 has to discover solutions that will go beyond the EU 2020 goals: 80% cutting of emissions has been envisioned by 2050 for which Europe's energy production will have to be substantially carbon-free. SmartGrids research up to the year 2035 must consider the increased impact of renewable-energy-based electricity generation, which is expected to be approximately 34% of the total energy consumption by the year 2020, and will go well beyond that level by 2035.

SmartGrids research by 2035 must also consider the increased stress of maintaining the high quality of the electricity supply and the security of the system due to an increased participation of distributed electricity generation by:

- creating a more controllable and intelligent overall system
- having an efficient electricity consumption
- making integrated energy storage available to consumers

The costs of such a system, as well as the associated market prices of products and services will change. This will lead to economic pressures on all parts of the electricity value chain beyond 2020. New actors and stakeholders will emerge, each with their own tasks related to new business models.

As its name proclaims, the SRA 2035 documents a "Strategic Research Agenda" with emphasis on research, whereas GRID+ addresses rather the needs of today and out to 2020, for the types of real-world demonstration projects that are needed.

As a concrete example of this differentiation, the SRA 2035 effectively assumes that it is the task of those dealing with projects targeted at 2020, such as those described in GRID+, to implement the first rounds of the technical integration of renewables. This task would continue but with emphasis gradually shifting towards greater penetration (and operation) of these technologies.

Arising out of the SRA 2035 there is also a priority setting document, which highlights those areas of research for the problems beyond 2020 which are seen today as the most important. Topics identified as priorities by a wide spectrum of experts in the field are summarised in Appendix 1. These do not overlap with the priorities of GRID+ (primarily driven by the operators of Transmission and Distribution systems), which concentrate on demonstration and (applied) research to achieve excellent demonstrations of emerging solutions, ie. technologies that have been shown to work but here they are being demonstrated as solutions in a real operational setting and on a realistic operational scale.

GRID+ objectives and actions have been derived by a coherent combination of European transmission operators (represented by the European Network of Transmission System Operators for Electricity (ENTSO-E)) and the distribution operators (represented by EDSO for Smart Grids (EDSO)). In 2012, ENTSO-E released a set of R&D deliverables consisting of three documents: R&D Roadmap 2013-2022, Implementation Plan 2014-2016 and R&D Activities and Indicative Timetable as a part of the ENTSO-E Annual work programme.

Priorities identified by ENTSO-E have been converted into specific topics to be performed starting in 2014. Their preference is that these topics should be funded under the framework of EC Calls. The suggested topics for 2014-2016 are focused on three main objectives:

1. to demonstrate technologies to foster network flexibility and enhance the observability and control of the pan-European network
2. topics that contribute to the construction of the Internal Electricity Market through the development of new tools and research on alternative market designs
3. research and development of new resources for operation delivered not only by the relation with DSOs but also the resources coming from the demand side.

For the distribution side, GRID+ is an update of the EEGI Implementation Plan 2010-12, originally prepared by EDSO and ENTSO-E in close collaboration with the European Commission, the European Regulators' Group for Electricity and Gas (ERGEG) and other relevant stakeholders. The original plan was formally endorsed at the SET-PLAN conference in Madrid in June 2010. This DSO implementation plan outlines activities to be developed in the 2014-2016 time frame whilst their R&D Roadmap focuses on the strategy and R&D activities for the 2013-2022 time frame, required to meet the 20-20-20 distribution system targets. The DSO Implementation Plan defines the R&D priorities for the first three years of this period and covers short-term R&D activities, serving as background for developing upcoming Calls for Proposals through the European Energy Research and Innovation programme.

The SET Plan Integrated Road Map and Horizon 2020

The SET Plan Integrated Roadmap is being developed to:

- consolidate the (up dated) technology roadmaps of the SET Plan
- cover the entire research and innovation chain from basic research to demonstration and support for market roll-out;

- identify clear roles and tasks for the various stakeholders such as the EERA, the EIs, the EIT, relevant European PPPs and other stakeholders such as universities, investors and financiers while promoting synergies and interactions between them.

The time horizon for these tasks is intended to cover the period “to 2020 and beyond”.

Horizon 2020 is intended to act as the EU Commission’s instrument for funding of Research and Innovation and will be the successor programme to FP7.

Ensuring a credible Road Map

In order to ensure that the Integrated Roadmap has the most solid possible basis for its projections, and indeed to ensure that it is genuinely integrated, it needs to include inputs from all the major experts in relevant technologies for future systems. Taking the example of the electricity grid, these include:

- Academics - who mainly develop science that will feed in to the development of technologies for equipment and solutions that will be used in the Grid

and

- Operators - who are essential to the demonstration and implementation of new technologies.

However, a further essential input is that of the **manufacturers and developers of equipment**, together with the accompanying monitoring, protection and control systems. These Companies are the main developers and providers of the real-world technologies for the operation of the electricity grid.

The obvious representation route for these manufacturers in the process for the Integrated Roadmap would have been through the ETP SmartGrids, but this body has, to date, been explicitly excluded from the process. The EEGI has been included but the main representation here has been through the transmission and distribution system operators. Manufacturers have had one representative, but this has been only for a Working Group, not on the Steering Group.

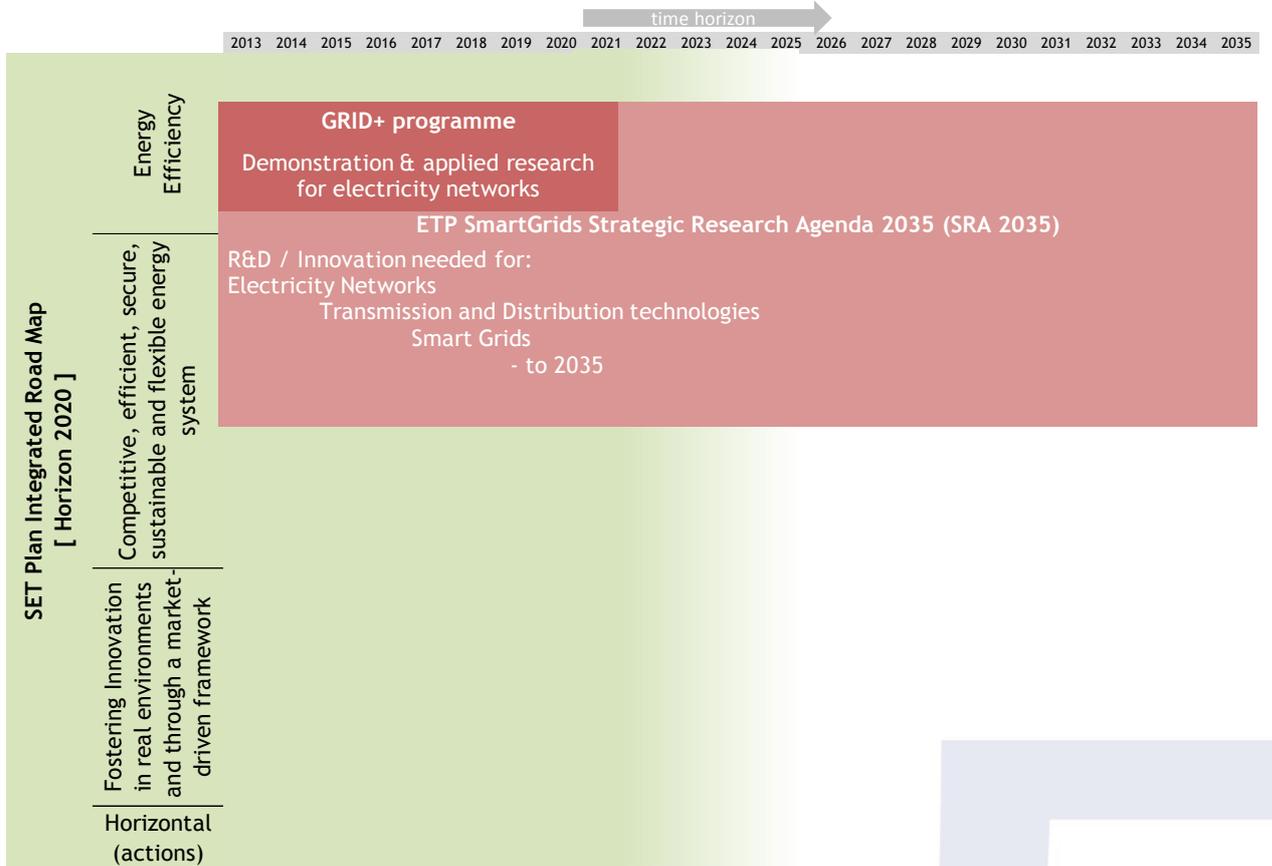
The electricity grid is a central element in the energy system of Europe and, therefore, in the road map for the SET Plan. It is a concern that the body of Experts with the most intimate knowledge of the approaching technologies in this field, as well as the longer-term future potential developments and the potential blockages, has not been engaged to a greater extent.

It may not be too late to bring this latent expertise into play, providing the ETP SmartGrids and Industrial associations for the relevant industries can be involved in the critical, review stages of the process in the development of the Integrated Road Map.

Considering the role of the manufacturers as developers, they also need to be present as far as possible in the discussions leading to the Integrated Road Map. Such first-hand experience of the process would help to inform their understanding of how best to develop the innovations called for by the Road Map.

Below in Figure 1 is a graphical representation of the relative scopes and timescales of the initiatives discussed above.





Research Area	Priority	Topic	
Smart Transmission Systems	T	1	Monitoring and control technologies for the Pan-European network
	T	1	Power Technologies to increase network flexibility – inc. Integration of new technologies
	T	2	Market mechanisms •eg. ancillary services & balancing
	T	2	Pan-European market tools •for system adequacy, efficiency, large-scale RES
	T	3	Long-term asset management
Smart Distribution Systems	D	1	Modelling Power Systems and ICT together •eg. volatility & response time
	D	1	Observability at Distribution Level: •cost effective techniques
	D	2	Power Electronics Technologies; •for Smart distribution
	D	3	EVI (Electric Vehicle Integration)
	D	4	Cyber Security
	D	4	Microgrids
	D	4	Risk based operation
	D	5	DC distribution grids & DC distribution integrated into AC grids
Research common for both Research Areas D and T	TD	1	The integration of demand-side management 2035 at DSO level into TSO operations
	TD	2	Ancillary services provided through DSOs; •new ancillary services; not just load tripping
Smart Retail and Consumer systems	RC	1	Distributed self-organisation vs. central control
	RC	2	Energy Cloud; •“big data” associated with the electrical network
	RC	3	The NEW Infrastructure integrating both Energy/Electricity and ICT
Integrated sustainable, secure and economic electrical systems	IS	1	Observability and Control •including ICT for Control, WAMS, etc •detection of anomalies/patterns as precursors to faults
	IS	2	Self-healing: •and interaction with protection & control
	IS	2	Widespread Storage within the Grid •different types: bulk, off-shore, local •synergies between them
	IS	3	Advanced components
	IS	3	VPP (Virtual power plants) and market
	IS	4	Operator Issues, Training and Education
Socio-Economical and Ecosystem SmartGrids barriers and opportunities	SE	1	Consumer Maturity •no single customer type •adaptation times vary •non-engaged customers?
	SE	2	Legislation/Regulation: New energy-markets designs •Balance: market creativity vs economic stability + security of supply, etc.