WG4: DIGITALISATION OF THE ELECTRICITY SYSTEM AND CUSTOMER PARTICIPATION

TERMS OF REFERENCE

Chairs: Maher Chebbo (SAP), Co-Chairs: Miguel Sanchez-Fornié (IBERDROLA), Esther Hardi (ALLIANDER) - Advisor: Carlo Tornelli (RSE)

Working Group established 09/12/2016

Background for all Working Groups

In September 2015, the European Commission issued the SET-Plan Communication[1], addressing innovation in the context of the strategy of the Energy Union. Among the priorities highlighted, of particular interest for the energy networks community is the priority "**Number 4 – Increase the resilience, security, smartness of the energy system**"[2].

The European Technology and Innovation Platform for Smart Networks for the Energy Transition (ETIP SNET) was set-up to reflect the increasing need to consider the smart grids as an integral part of the energy system. The mission of the Platform is to guide research and innovation activities to support Europe's energy transition. The ETIP SNET will elaborate a vision and a Roadmap for R&I activities (and the associated Implementation Plans) for smart networks, storage and other sources of flexibility, and integrated energy systems, engaging all stakeholders. It will also look at customer participation and the impact of digitisation. It will identify innovation barriers, notably related to market design, regulation and financing.

A number of permanent Working Groups and a Member States/Regulators Group were set up in the ETIP SNET to ensure the involvement and contribution of all the stakeholders of the energy system as a whole, providing vision, inputs, guidance and continuous feedback for the development of the integrated R&I Roadmap. The Working Groups are set up to ensure the most adequate balance between the effectiveness of their work on the planned deliverables and the openness towards new subjects and new issues which may appear. The following Working Groups are established:

- ❖ WG1: Reliable, economic and efficient smart grid system
- ❖ WG2: Storage technologies and sector interfaces
- ❖ WG3: Flexible Generation
- ❖ WG4: Digitalisation of the electricity system and Customer participation
- ❖ WG5: Innovation implementation in the business environment
- ❖ WG6: National Stakeholders Coordination Group

WG1 to WG4 are dedicated to the different aspects of development of the energy system along its different main development paths, while WG5 is more focussed on technology transfer, application and market uptake. The WG6 National Stakeholders Coordination Group, involves Governments and Regulators to ensure that the all ETIP outcomes optimally complement national conditions and innovation directions, and to facilitate the uptake of ETIP outcomes into local/national policy. The following figure illustrates the main fields of activities of WG1 to WG4:

Domain	Working groups			
System	**WG1: Reliable, economic and efficient smart grid system**			
Technology		**WG2: Storage technologies and sector interfaces**	**WG3: Flexible Generation**	**WG4: Digitalisation of the electricity system and Customer participation**
Market				
Society				

---

[1] Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation" (C(2015)6317).

[2] Other priorities, such as priorities one and three for instance, will also impact the energy system transformation.

Mission of the ETIP Working Groups WG1 to WG4

Experts acting in the Working Groups ("WG Members") will aim at providing strategic guidance about RD&I priorities and activities, ensuring the interaction and involvement of the entire expertise needs raised by the integration issues of the electricity system into the wider European energy system.

The Working Groups (WG) will also exchange with the other ETIPs (roadmap and implementation plans) and the other European or International R&I coordination activities (e.g. ERA-Net SG+, GSGF, CEM initiatives, Mission Innovation, IEA TCPs such as ISGAN, DSM, HTS, 4E etc.).

The Working Groups will act in close coordination with the European CSA assisting the ETIP SNET in the development of the RD&I Roadmap and implementation plans (for the period Oct. 2016-Sept. 2020 the CSA is INTENSYS4EU).

The Working Groups are set-up on the principle of avoiding overlaps among their goals and activities carried out. WG1 focuses on both technological and market solutions for the European electricity networks as well as on the integration of generation, consumption, storage, and interfaces to other energy networks. This integration should make the power system sustainable, reliable, secure and affordable. The WGs 2, 3 and 4 focus on providing the main different technological and market solutions to ensure the flexibility of the power system. Through this focus on system integration and flexibility to meet system needs, they support the system approach in WG 1 and of the entire ETIP SNET.

The mapping between the potential scope of each Working Group (WG1 to WG4) and the Functional Objectives of the (existing) Roadmap is presented Annex 1. Additional Functional Objectives provided by other stakeholders than those involved in the development of the present Roadmap will be mapped by the respective Working Groups.

The Working Groups (WG1 to WG4) should focus on:
- Delivering a vision (overarching goals and constraints) for the European energy system and respectively of the contribution of various technologies to this system by 2030, 2040 and beyond, guiding the preparation and update of the RD&I Roadmap in the direction of the specific priorities of the European Energy Union addressed;
- Reviewing the monitoring reports of the implementation of RD&I activities at European, national/regional and industrial levels, produced by on-going research and demonstration activities with the goal to establish the state of the art (e.g.: analysis of recent success stories / innovation actions in the area of expertise of the working group, analysis of the results from the outstanding project's demonstrators, analysis of the potential of scaling up and replication, analysis of the coverage of each functional objective within the scope of the WG by past and ongoing R&I project achievements);
- Reviewing the relevant BRIDGE reports that identify the economic, social, technical, legal, etc. barriers which may slow down business model deployment (impacting scaling, replication, deployment);
- Creating inputs to and reviewing output of the knowledge sharing activities at pan-European level organised by a) INTENSYS4EU through inputs to regional workshops or the production/review of contents for the Knowledge Sharing Platform (KSP) and b) by ERA-NET SG PLUS by its Knowledge Community.
- Preparing a consolidated stakeholder views about the Research and Innovation activities to meet both European and National/Regional Energy Policy orientations, also contributing to the process of development, review and validation of a common RD&I roadmap;
- Contributing to validate, integrate and prioritize the Research and Innovation activities in the updated RD&I roadmap and the related yearly implementation plans;

- Identifying the long term challenges, disruptive technologies , solutions to be addressed by the future R&I activities and the innovation barriers to be removed to favor the deployment of new knowledge in their area of expertise;
- Estimating the financial resources need to carry out the proposed RD&I activities and potential financing mechanisms to be used (EU, National / Regional Funding, financial contributions by project participants).
- Contribute or lead discussion / analysis on specific themes in their area of expertise that are of wider interest and call for the support of stakeholders in identifying steps forward.

Organisation of the ETIP Working Groups WG1 to WG4

The WGs gather experts representing the widest community of stakeholders related to their area of expertise. The WG is coordinated by a Chair assisted by one or more vice-chairs. The ETIP SNET Chairs will present to the Governing Board a short list of candidates of WG chairs and vice-chairs taking into account a balanced view of representativeness of different stakeholders in the ETIP Executive Committee. The ETIP Governing board approves the chair and membership of each WG based on their expertise and representativity.

 The WG Secretariat function is assured by the INTENSYS4EU project and provides a permanent logistical support to organise meetings, taking minutes and interacting with the Chairs on a permanent basis as well as following-up the execution of decisions taken. WG members are recruited through a call for experts addressed to the entire stakeholder community. Experts contribute to the WG on a voluntary basis and no reimbursement of expenses is foreseen. Decisions in the WG are normally taken by consensus (or through majority vote in cases consensus are not reached) and outcomes from the WG are reported to the ETIP SNET governing board by the Chairs.

Specific Objectives – WG 4: Digitalisation of the Electricity System and Customer Participation

WG4 (Digitalisation of the Electricity System and Customer Participation) addresses the use and impact of the Information and Communication technologies as a pervasive tool along the entire value chain of the power generation, transportation and use.

The communication layer is one of the pillars of the smart energy system, enabling system observability, monitoring, control and protection and specifically enabling a radical change in the relation between the final user and the energy system: advanced meters and modern appliances trigger the potential of active demand-response and enable new services for the energy user of the future. Customer participation in all stages of the development and expansion of the energy system is also favoured by digital tools ranging from Participative geographical systems to web portals or social networks. Internet of Things (IoT) and the related data analysis and computation tools (data mining, big data etc.) applied to the energy system can be disruptive for the development and management of the energy system, thus changing its planning and operation and transforming the energy market. The widespread use of digital technologies however needs to be accompanied by suitable measures for data and information protection from malicious intrusions and attacks (cybersecurity) and from uncontrolled use of customers data (data privacy)

In particular, WG4 follows on

- The full digitalization of both the transmission and the distribution networks with new ICT infrastructures with their associated software layers.
- Cybersecurity issues Use of big data, IoT and High Performances Computing to manage the entire value chain along the energy system;

- ICT infrastructures and technologies that will allow the involvement of the end customers and the retail market players providing new energy services, defining the interactions (market and regulations) between the different market players and the network and flexibility operators;
- The retail electricity markets empowering customers (favourable environment to choose electricity suppliers and to better control consumptions through new services provided by new market players).
- The Improvement of public awareness of long-term energy challenges and the need to build and protect transmission infrastructure to increase the social benefit of energy use
- Roadmap points, as described in Annex 2.

Key targets and performances Indicators

- *TBD with the WG chair*

Year 1 activities

- *TBD with the WG chair*

Annex 1: Mapping of the Roadmap Functional objectives with the potential scope of each Working Groups WG1 to WG4

The starting point of WG1 to WG4 should be, amongst the Functional Objectives of the R&I roadmap 2016-2025 adopted by the ETIP SNET end of 2016, those relevant to the topic of the working group.

The areas of expertise of the working groups WG1 to WG4 are illustrated by the table below as a function of the functional objectives of the R&I roadmap 2016-2025.

Clusters and functional objectives		WG1	WG2	WG3	WG4
Distribution Cluster C1 -Integration of smart customers and buildings					
D1	Active demand response				X
D2	Energy efficiency from integration with smart homes and buildings				X
Distribution Cluster C2 - Integration of DER and EV, storage, other networks					
D3	DSO integration of small DER	X			
D4	System integration of medium DER	X			
D5	Integration of storage in network management		X		
D6	Infrastructure to host EV/PHEV – Electrification of transport	X			
D7	Integration with other energy networks		X	X	
Distribution Cluster C3 - Network operations					
D8	Monitoring and control of LV network	X			
D9	Automation and control of MV network	X			
D10	Smart metering data processing and other big data applications	X			X
D11	Cyber security (system approach)	X			X
Distribution Cluster C4 -Planning and asset management					
D12	New planning approaches and tools	X	X	X	X
D13	Asset management	X			
Transmission Cluster C1 – Modernization of the network					
T1	Optimal grid design	X	X		
T2	Smart asset management	X			
T3	New materials and technologies	X	X		X
T4	Environmental challenges and stakeholders	X			
Transmission Cluster C2 –Security and system stability					
T5	Grid observability: PMU, WAM, Sensors, DSO information	X			
T6	Grid controllability: frequency and voltage stability, power quality, synthetic inertia	X	X	X	
T7	Expert systems and tools: expert systems, decision-making support tools and advanced automatic control	X			X
T8	Reliability and resilience: defense and restoration plans, probabilistic approach, risk assessment, self-healing	X			

T9	Enhanced ancillary services for network operation	X	X	X	X
Transmission Cluster C3 – Flexibility of power system					
T10	Storage integration, use of storage services		X		
T11	Demand response, tools for using DSR, load profile, EV impact	X			X
T12	Improved RES forecasting and optimal capacity operation	X			
T13	Flexible grid use: dynamic rating equipment, power electronic devices, use of interconnectors	X			
T14	Interaction with non-electrical energy networks		X	X	
Transmission Cluster C4 – Economy and efficiency of power system					
T15	Market/grid operation integration	X	X	X	X
T16	Business models	X	X	X	X
T17	Flexible market design	X	X	X	X
Transmission Cluster C5 – ICT and digitalization of power system					
T18	Big data management				X
T19	Standardization, protocols for communication, and data				X
T20	New technologies, Internet of Things				X
T21	Cybersecurity				X

Annex 2: Mapping of the Roadmap Functional objectives with the potential scope of Working Group 4 (for the start)

The following subjects can be considered for starting the work of WG4

- Full digitalisation in both transmission and distribution networks:
    - Development of tools for the monitoring, automation and control, cybersecurity issues Use of big data, IoT and HPC to manage the network
    - Address the use of IoT and data mining techniques (big data) to develop smart asset management strategies, manage the network, closer to its physical limits;
    - Coordinate and participate in standardization activities for communication and data exchanges between the different stakeholders of the electricity value chain.
    - Develop scalable solutions to address large-scale data management (customers, equipment, network, market) issues in the power system.
    - Ensure the physical and cyber-security of the digital substations.

- Cybersecurity issues:
    - Identify and define the cyber security issues (confidentiality, integrity, vulnerability and availability of information flow) by considering the different layers of the SGAM (Smart Grid Architecture Model);
    - Identify the existing security standards and the possible gaps so as to provide potential improvement for the specific case of the smart grids;
    - Explore possible cyber security R&D issues that should be addressed for the specific case of smart distribution grids (on top of the existing activities in other sectors such as the banking sector);

- Leverage knowledge of consumer data:
    - Efficient data mining algorithms for various applications ranging from generation/load forecast to consumer behaviour but also failure/ageing models for network components.
    - Efficient data mining algorithms for market players (prosumers, retailers, aggregators, ESCOs, traders, etc.) to boost retail electricity markets and create new business opportunities, in connection with the DSOs.
    - Address data privacy concerns, while ensuring a transparent and non-discriminatory access to the data for all market players.
    - Develop standard systems for editing smart meter data with different customer interfaces (e.g. PC, TV, custom displays, etc.) and connected to smart appliances

- Consumer involvement in the development and operation of the energy system:
    - Improve public awareness of long-term energy challenges and the need to build and protect energy infrastructure to increase the social benefit of energy use. Assessment of new environmental challenges and improvement of the energy infrastructure land use and environmental integration.
    - Exploit new channels for the public consultation processes.

Annex 3: Key input documents

- Strategic Energy Technology Plan - Towards an Integrated Roadmap: Research and Innovation challenges and needs of the EU energy system [https://setis.ec.europa.eu/system/files/Towards%20an%20Integrated%20Roadmap_0.pdf]
- Communications of the EC COM(2015) 80 final: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy [http://www.eea.europa.eu/policy-documents/com-2015-80-final]
- Communications of the EC C(2015) 6317 final: Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation [https://setis.ec.europa.eu/system/files/Communication_SET-Plan_15_Sept_2015.pdf]
- SET Plan – Declaration on Strategic Targets in the context of an Initiative on Energy Systems [draft]