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GRID+

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EXECUTIVE SUMMARY

The present document describes the Draft Implementation Plan for the period 2016-2018 of the Research and Innovation Roadmap prepared by the European Grid Initiative (EEGI). It involves a brief review of the R&D work performed before issuing the actual document, and the priorities that have been proposed for next period of years 2016-2018.

This draft concatenates results from previous initiatives:

- The available drafts of the SET Plan Integrated Roadmap
- On-going and previous TSOs and DSOs initiatives at EU level and monitored by the JRC
- The R&I implementation plan 2014-2016 and 2015-2017, both approved by the EEGI
- The Calls for 2014 and 2015 appeared in December 2013 related to Smart Grids

Priorities of present Implementation Plan are oriented to achieve a more flexible grid by increasing active user involvement, the share of micro-generation and renewable generation within the local grid and integrating storage systems in the grid. Relevant topics like cyber-security and ICT for Smart Grids have been addressed and aligned with results of the call 2014 of HORIZON 2020.

They include:

- Demonstrating active demand response in real world environments.
- Improving Network Reliability through medium and low voltage monitoring and control
- The technical study to deliver innovative ICT-based services and tools for high performance solutions

The joint TSO/DSO R&D project aims at improving the observability of the distribution systems for transmission network management and demonstration the power load control mechanisms.

R&D concepts not addressed in this Implementation Plan neither on previous ones are listed and dated for next years. These topics are oriented to manage the large amount of smart metering data flowing within the distribution network as well as to facilitate the integration of DER in a harmonized way. Regulation measures and technical solutions via large demonstration projects are needed in the field Medium DER integration. Future topics are linked to the final results of call 2014, not published yet.

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1 INTRODUCTION

The EEGI Implementation Plan is issued every year: it outlines the research and innovation (R&I) activities for the next three years in line with the 2013-2022 EEGI R&I Roadmap. The EEGI R&I Roadmap focuses on the R&I strategy driving a ten years R&I programme required to meet twenty-years transmission and distribution system targets; the Implementation Plan defines shorter term R&I priorities.

The present document describes the Draft Implementation Plan for the period 2016-2018 of the Roadmap prepared by the European Electricity Grid Initiative (EEGI). This new Implementation Plan results from parallel analyses of:

- The available drafts of the SET Plan Integrated Roadmap.
- On-going TSOs and DSOs projects at EU level,
- The R&I implementation plan 2014-2016 and 2015-2017 approved by the EEGI
- The Calls for 2014 and 2015 appeared in December 2013 related to Smart Grids

This document details the priorities that should be addressed during year 2016, as well as the draft plans for 2017 and 2018.

2 RATIONALE FOR DEFINING THE EEGI PRIORITIES FROM 2016 TO 2018

2.1 Background: the EEGI roadmap 2013-2022

At the end of 2012, a new R&I Roadmap 2013-2022¹ was developed and accepted by the EEGI for the period of 2013-2022. This roadmap took into account the inputs, suggestions and comments received from the stakeholders who took part to a public consultation based on a draft version of the roadmap.

In September 2013 the SET-Plan Team launched a series of meetings of Working Group and Coordination Group to design a new “Integrated Roadmap” where all Energy Research Subjects should be included.

EEGI took an active role in the design and discussions of these groups to implement the “Integrated Roadmap”, leading the Grid Challenge in Part II: *Competitive, Efficient, Secure, Sustainable and Flexible Energy System*; Heading 2: *Ensuring Energy System Integration* and the Heading 2: *Developing Integrated Infrastructures and Processes* of Part III: *Fostering Innovation in Real Environments and Through a Market-Driven Framework* and contributing to the Challenges of Storage and Active Demand in Part II and to the Heading of Electrification of Transport in Part III.

In September 2014 SET-Plan Organization Team is discussing with State Members the documents composing the “Integrating Roadmap” to take the final decisions before its official publication.

Call 2014 from HORIZON 2020 covers a two years period: 2014 and 2015. The submission dates for some of the topics of the call are already closed but the acceptance of the projects has not been published yet. This fact and some other pending variables that will be closed in the mid-time may affect the priorities for the following period 2016-2018.

¹ EEGI R&I Roadmap 2013-2022: http://www.gridplus.eu/Documents/Deliverables/GRID+_D6.1_r0.pdf

3 OBJECTIVES OF DSO’S IMPLEMENTATION PLAN 2016-2018

About 200 DSO-led projects have been launched in Europe, on top of the EEGI R&I activities which started in 2009. Moreover, 38 TSO R&I projects have been monitored since 2010. All these projects were funded with EU or Member State, support, or directly by system operators. JRC has identified 459 Smart Grid Projects, launched from 2002 until now. The total amount of investments rises to €3.15 billion.

Overall, a great R&D effort has been carried out during previous years on the Smart Grid functionalities to make them a reality within the European Grid. Otherwise, as it was reflected in the last version of the Gap Analysis, there is still a lot of work to be done at some other EEGI Functional Objectives needing to be addressed in future calls.

The following chapters try to prioritize and explain the Functional Objectives proposed for future years, having considered what it is mentioned above and the experienced gained from previous projects.

3.1 DSO’S REMINDER: R&I PRIORITIES OF THE EEGI IN 2015

The addressed R&I topics for 2015 were focused around the concept of grid flexibility and reliability, giving more weight to the DER integration concepts pursuing the following objectives:

- To facilitate a planned integration of DER at medium and high voltage levels, increasing the flexibility, reliability and the hosting capacity of the grid and reducing generation intermittency issues.
- The decentralization of the energy system, requiring a modernized European LV-grid with a more exhaustive and accurate control and monitoring systems at LV level.
- To pave the way for the future integration of electric vehicle and storage systems.

2015	
Topic titles	Functional objectives
DSO	
DSO integration of small DER	D3
System integration of medium DER	D4
Monitoring and control of LV network	D7
TSO/DSO	
Demonstration of power load control mechanisms at TSO and DSO levels	TD2, T6, TD5
Increased observability of the distribution systems for transmission network management	TD1

3.2 DSOs' topics included in Call 14 of HORIZON 2020

The priorities of the call 2014 of HORIZON 2020 are oriented to achieve a more flexible grid by increasing active user involvement, the share of micro-generation and renewable generation within the local grid and integrating storage systems in the grid. Relevant topics like cyber-security and ICT for Smart Grids have been addressed.

In fact, the LCE-7 Competitive Low-Carbon Energy Call is focused on demonstrating active demand response in real world environments in commercial operation with active involvement of consumers, aggregators, ESCOs, etc. and proposing new business models to make it possible.

The same Call is addressing the need to improve network reliability through enhancements at medium and low voltage network monitoring and control (intelligent active control, active/reactive power flows, fault and outage management, automatic control concepts, network synchronisation using active loads and eventually distributed storage integration) in a secure and economic way.

The next generation ICT infrastructure for Smart Grids requires a deep economic analysis, including operational costs, business models and benefits of the different options available. The technical study to deliver innovative ICT-based services and tools for high performance solutions is also included.

Find below a summary of the main EEGI Functional Objectives covered by Call 2014:

HORIZON 2020 – CALL 2014					
Call	Topic	Year	EEGI Functional Objective	Title	Implementation Plan
LCE-7	Distribution Grid and Retail Market	2014	D7	Monitoring and control of LV network	IP 15-17 (2015)
			D1	Active Demand Response	IP 15-17 (2017)
			D3	DSO integration of small DER	IP 15-17 (2015)
			D4	System integration of medium DER	IP 15-17 (2015)
			D13	New Approaches for Market Design	IP 15-17 (2016)
Transversal Objectives: ICT					
LCE-8	Local/Small-Scale Storage	2014	D5	Integration of storage and network management	IP 14-16 (2014)
DRS-12	Critical Infrastructure "smart grid" protection and resilience	2015		Transversal Objectives: Cyber-security	

	under “smart meters” threats				
GV-8	Electric vehicles’ enhanced performance and integration into the transport system and the grid	2015	D6	Infrastructure to host EV/PHEV	IP 15-17 (2016)

LCE 7 is addressing the following Functional Objectives:

- Monitoring and control of LV Network (D7) which was proposed in Implementation Plan 2015-2017 for year 2015. It is a main topic in the Call and proposals have been submitted, covering this critical issue.
- Active Demand Response (D1) which was proposed in Implementation Plan 2015-2017 for year 2017. It is clearly the principal objective in the Call and Large Demonstration Projects involving consumers have been presented to leverage the experience obtained from previous R&D Projects to progress towards real Demonstration.
- DSO integration of Small DER (D3) which was proposed in Implementation Plan 2015-2017 for year 2015. It is included as secondary aspect in the Call promoting the increase of Microgrids, Prosumers and Local Renewable Generation.
- System integration of medium DER (D4) which was proposed in Implementation Plan 2015-2017 for year 2015. It is included collaterally.
- New Approaches for Market Design (D13) which was proposed in Implementation Plan 2015-2017 for year 2016. This aspect is partially considered in the Coordination and Support Action, referred to the necessary ICT Infrastructure, where business models and cost benefit analysis are required.

LCE-8 and LCE-9 are dealing with Storage at Small and Large Scale respectively. LCE-8 is dealing with Local Small Scale Storage connected to Distribution Grids and corresponds to the Functional Objective D5: Integration of Storage and Network Management which was proposed in Implementation Plan 2014-2016 for the year 2014.

The Call Critical Infrastructure Protection **DRS-12-2015** is proposing to cover in 2015 a transversal EEGI Objective which is Critical Infrastructure “smart grid” protection and resilience under “smart meters” threats.

GV.8-2015. The topic Electric vehicles’ enhanced performance and integration into the transport system and the grid” is focused on increasing efficiency and making a major contribution towards the transition to fully electric vehicles. It is aligned with Functional Objective D6, “Infrastructure to host EV/PHEV”, which was proposed in the previous Implementation Plan for the year 2016. The topic will be addressed one year before the initial expectations and that will allow hopefully accelerating the transport electrification.

3.3 DSOs' Functional Objectives for 2016-2018

The topics proposed in the previous Implementation Plan (2015-2017) and not yet covered by EC Calls are:

- Smart Metering Data Processing (D10)
- Ancillary Services Provided through DSOs and Aggregator Agents (TD3)
- Network Management Tools (D9)
- Medium DER Integration (D4)
- Asset Management (D12)
- Improved Defence and Restoration Plans (TD4)

They have been included in the list of proposed objectives for the new Implementation Plan 2016-2018 together with new topics for these three years. The following table summarizes the proposal:

2016		2017		2018	
Objective	Title	Objective	Title	Objective	Title
D10	Smart Metering Data Processing	D9	Network Management Tools	D1	Active Demand
TD3	Ancillary services provided through DSOs and Aggregator Agents	D4	Medium DER Integration	D7	Monitoring and control of LV network
		D12	Asset Management	D13	New Approaches for Market Design
		TD4	Improved defence and restoration plans	D6	Infrastructure to host EV/PHEV

The priorities of 2016 address the Functional Objective D10: Smart Metering Data Processing. The Smart Metering mass deployment has started in several European countries and the data currently flowing is becoming a crucial topic, requiring ICT solutions to manage and properly exploit the huge amount of information collected. This R&I priority will pave the way for a harmonized integration of DER.

The large increase of small DER in the last years requires regulation measures and technical solutions to allow an organized deployment within the European Grid. This topic has been partially addressed by the Call 2014 and will need additional research efforts. Medium DER also needs improvements and large demonstrations of innovative solutions taking advantage of the experience collected from previous projects. Those functional objectives could be part of a new Call for year 2017.

Consequently and depending on the topics addressed by the projects finally funded by Call 2014, the functional objectives probably addressed in 2015 (D1: Active Demand and D7: Monitoring and



control of LV network) will be addressed again in future Calls, building over the experience achieved in previous years.

4 OBJECTIVES OF TSO'S IMPLEMENTATION PLAN 2016-2018

Similarly to its yearly predecessor, the Implementation Plan 2016-2018 revises the R&D projects portfolio on an annual basis, looking at the achievements to date, at the evolution of the technological and business context and shaping the priorities going forward. Implementation Plan 2016–2018 describes in great details the R&D projects planned for 2016 whilst outlining suggested topics and concepts in R&D areas for 2017 and 2018.

The priorities are set-up taking into account the needs for European interconnected transmission systems: the emerging integrated European energy market; the rapid paradigm shift towards diffused and/or renewable generation plants, mostly non dispatchable; the increasing role of demand side management as well as storage priorities. Several large-scale European projects have been initiated based on the Implementation Plan such as GARPUR and BEST PATHS.

4.1 TSO'S REMINDER: R&I PRIORITIES OF THE EEGI IN 2015

Topics 2015	
Inertia, control and protection of large power systems with large amount of inverter-based components	T6, T9, T4 , T5
Methods and tools to optimise asset management	T16, T17

The TSOs priorities for 2015 are focused on the managing the transmission systems with high penetration rate of renewables.

Both topics could be covered by the Horizon 2020 call for proposal LCE6.

4.2 TSOS' TOPICS INCLUDED IN CALL 14 -2015 OF HORIZON 2020

Horizon2020 calls →	LCE5 Innovation and technologies for the deployment of meshed offshore grids	LCE6 Transmission grid and wholesale market	LCE7 Distribution grid and retail market	B.2.16 Support to R&D strategy for SET Plan	B.2.7 Energy Storage Mapping and Planning	B2.6 Reliable and stable energy supply systems integrating RES and storage
List from previous IP 2015-2017						
Smart stations (Topic1 -2014)		Under development				
Cross border balancing (Topic 2-2014)		Postponed to 2016				
Inertia in large inverter- based systems (Topic 1-2015)		Under development (InCoPro)				
Methods & tools for asset management (Topic 2-2015)		Under development				

Load control TSO-DSO (Topic 3-2015)			Developed under project iDist Rejected			
UHV lines (Concept 1-2016)				Postponed to 2018		
Ancillary services (Concept 2-2016)			Developed under Project iDist Rejected			

4.3 TSOS' FUNCTIONAL OBJECTIVES FOR 2016-2018

Focusing on 2016, which is the year where the proposals are most concrete, R&D topics are focused on increased integration into the system of storage and demand side and on balancing and ancillary services.

Topics 2016 & 2017		
Topic 1-2016	Fast storage technologies needed by TSOs	T3, T7
Topic 2-2016	Control System of the future: real time tools for control centres	T6, T8
Topic 3 - 2016	Monitoring & observation tools for power network infrastructures	T6, T16
Topic 4-2016	Novel cross border balancing market mechanisms and tools for ensuring system reliability	<i>T10, T11, T9 to be checked with Market department</i>
Topic 5-2016	Demand Side Response: load control mechanisms and ancillary services at TSO and DSO levels	TD2, TD3, T10
Concept 1-2017	Advance tools for new market models	T12
Concept 2-2017	Improved defence and restoration plan	TD4, TD5
Concept 3-2017	Market modelling and system adequacy assessment for long-term planning	T2, T12

In particular:

- **Topic 1-2016**, concerning fast storage, is new and stemming from the quick technological advancements characterizing the power sector; indeed it is very important that TSOs follow strictly such technology upgrades, in close contact with the relevant manufacturers, in order to maximize their application possibilities, in terms of both performances and of time-to-market development.
- **Topic 2-2016** on innovative control systems aims at the development of more advanced control center tools, which will enhance European power system security allowing operating the system closer to its limits with an identical risk level.

- **Topic 3-2016** on Monitoring tools targets an improved knowledge of the individual component life status, in order to have a decisive impact on network performance, in terms of quality of electricity and security of supply and consequently on the electricity market.
 - **Topic 4-2016** is the shift of a topic previously foreseen in 2014 (topic 2-2014 in previous edition of IP), due to availability of resources of the involved TSOs.
 - **Topic 5-2016** on demand-side-response is the combination and updating of two previous topic (topics 3-2015 and concept 2-2016 in previous edition of IP), stemming from market inputs and from increased collaboration between TSOs and DSOs.
- Due to its rolling nature (3 years horizon revised each year), concepts for following years 2017 and 2018, are a preliminary indication, to be confirmed or updated in the next versions of IP.

The recent (and partially still under way) change of the framework and mechanisms of EU financing schemes (from FP7 to Horizon2020) and guidelines (Integrated Roadmap), which are the main reference for carrying out the R&D projects, requires an effort of alignment with the timing and procedures of the new schemes; therefore the concepts for 2017 and 2018 are simply a reshuffling, both as contents and as sequence, of previous concepts, having considered the updating of priorities of the interested TSOs.

This is also consistent with the future revision of ENTSO-E Roadmap, which shall be issued during the year 2016.

For the year 2018, the proposed concepts result from the postponement of the topics from the previous years.

Concepts 2018		
Concept 1-2018	Data & information management for system operation and asset management	<i>T15,</i>
Concept 2-2018	Realisation of ultra-high-voltage lines with partial underground cabling	T4, T14

5 CONCLUSIONS

The present implementation plan of the EEGI roadmap for 2016-2018 proposes a set of priorities for R&I project to be launched in 2016, 2017 and 2018. This set of priorities is the result of the Gap Analysis task; an analysis of the actual situation of the European Grid. Different stakeholders involved in the network operation were participating in the discussion, providing their feedback and their opinion of the European Grid requirements for the next period.

The integration of renewable energies, increasing the flexibility of the system and reducing the fossil fuels dependency is a crucial topic. At TSO level it is necessary to afford it preserving the reliability of the grid, consequently topics regarding control and monitoring of the system need to be addressed during next period.

At DSO level, Smart Metering Data Processing (D10) and Ancillary services provided through DSOs and Aggregator Agents (TD3) are two clear priorities for 2016, due to the high amount of flowing data in the distribution networks. Both topics will be addressed with some other Functional Objectives, which will be determined depending on the results of the Call 14-15.

The present document introduces a set of Functional Objectives for future years, however it is important to consider that due to its publication date, the submission dates for some of the topics of the call are still opened, which may affect the priorities presented above.