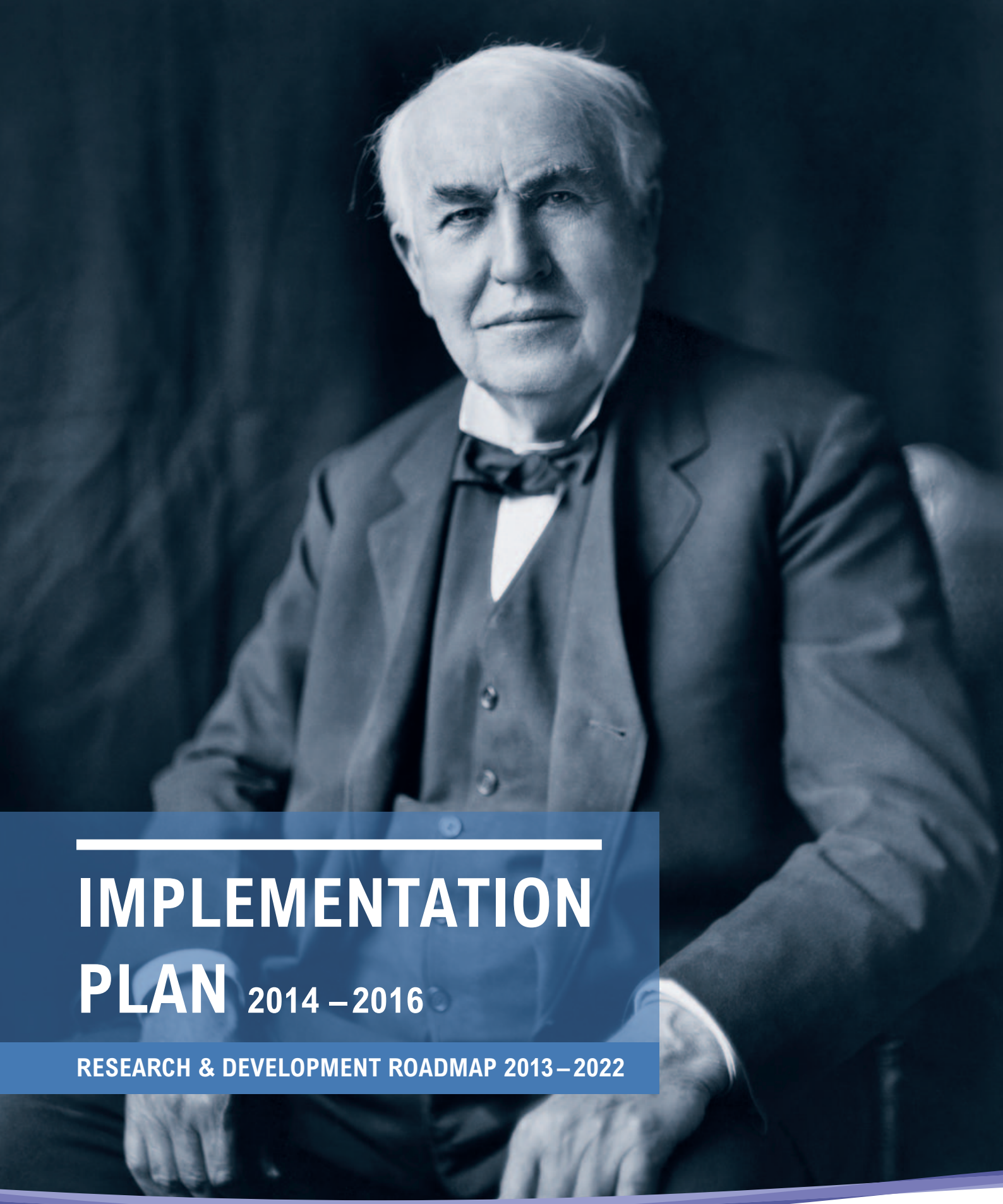


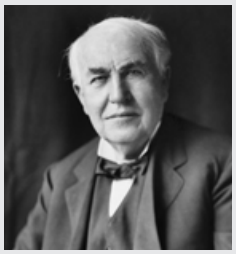
IMPLEMENTATION PLAN 2014 – 2016

RESEARCH & DEVELOPMENT ROADMAP 2013 – 2022

European Network of
Transmission System Operators
for Electricity

entsoe

"I never did anything by accident, nor did any of my inventions come by accident; they came by work."



THOMAS EDISON
(February 11, 1847 – October 18, 1931) was an American inventor and businessman. He developed many devices that greatly influenced life around the world, including the phonograph, the motion picture camera, and a long-lasting, practical electric light bulb. Edison is the fourth most prolific inventor in history, holding 1,093 US patents in his name, as well as many patents in the United Kingdom, France, and Germany.

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INTRODUCTION

The Implementation Plan is issued every year and outlines research and development (R&D) activities for the next three years as stipulated by the ENTSO-E R&D Roadmap 2013–2022, which is an upgrade of the ENTSO-E R&D Plan update 2011 [1].

While the R&D Roadmap focuses on the R&D strategy that details ten years of R&D activities required to meet twenty-year transmission system targets, the Implementation Plan defines R&D priorities. Since the Implementation Plan covers short-term R&D activities, it serves as a background to develop upcoming Calls for Proposals through the European Energy Research and Innovation program.

1) The 1st R&D Plan was published in 2010.

In 2012, ENTSO-E releases 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 program.

The Implementation Plan 2014 – 2016 summarizes the priorities which projects launched in the period 2014 – 2016 should focus on. Therefore, ENTSO-E suggests priorities in this document as initial input to European Commission (EC), European Electricity Grid Initiative (EEGI), technology providers and other stakeholders.

The TSO work in the Implementation Plan 2014 – 2016 is constraint by the limited available resources. Further work is necessary within ENTSO-E and its members to determine specific topics achievable by these resources. Based on this additional work the Implementation Plan will be updated in the beginning of 2013.

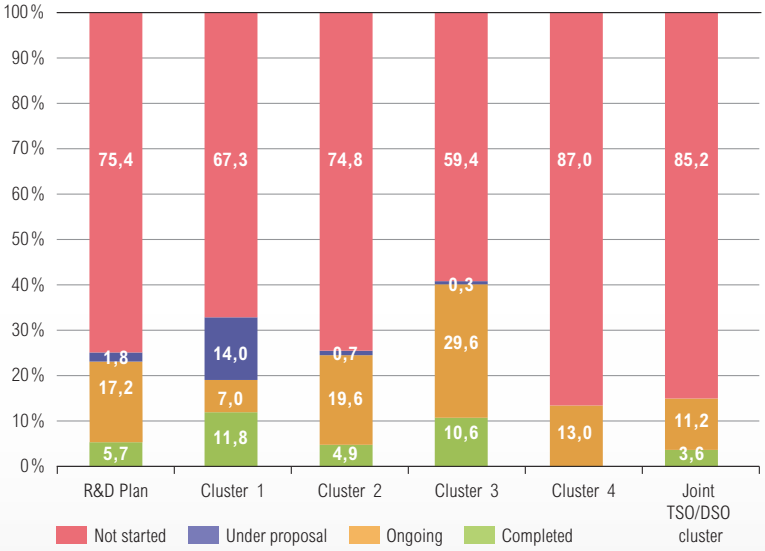
APG's Power Grid Control – the heart of Austria's electricity supply (commissioned in southeast Vienna in 2009)

MONITORING OF R&D ACHIEVEMENT

Based on the ENTSO-E R&D Plan update 2011, a survey has been addressed to project coordinators in February 2012 to monitor the progress and success of the R&D Plan. It measures how ongoing R&D projects contribute to the defined objectives of the R&D Plan. The results are available through a Monitoring Report made available in June 2012[2)].

The analysis provides quantitative information on what percentage of the R&D Plan has been completed, identifying which activities are ongoing or which ones have not yet been addressed. The results are used as an input to prioritize actions aimed to achieve the clusters and functional objectives defined in the R&D Plan.

Figure 1: Achievement per Cluster of the R&D Plan update 2011, results of survey launched in February 2012



The results show that around 75 % of activities defined in the ENTSO-E R&D Plan update 2011 have not started, ca. 19 % of the work is ongoing and about 6 % of the R&D Plan is achieved. Cluster 1, related to pan-European grid architecture, is well advanced (approximately 12 %) as is Cluster 3, Network operation (around 11 %). Cluster 2 (Power technology), Cluster 4 (Market rules) and Cluster 5 (Joint TSO / DSO R&D activities) are below the average of the whole R&D Plan in terms of work completed. Overall, this study shows that the R&D Plan is on target since it covers the period 2010 – 2018 and there is a reasonable amount of time left to achieve the remaining objectives.

2) Monitoring Report, 7 June 2012
https://www.entsoe.eu/rd/monitoring-of-the-rd-achievement/

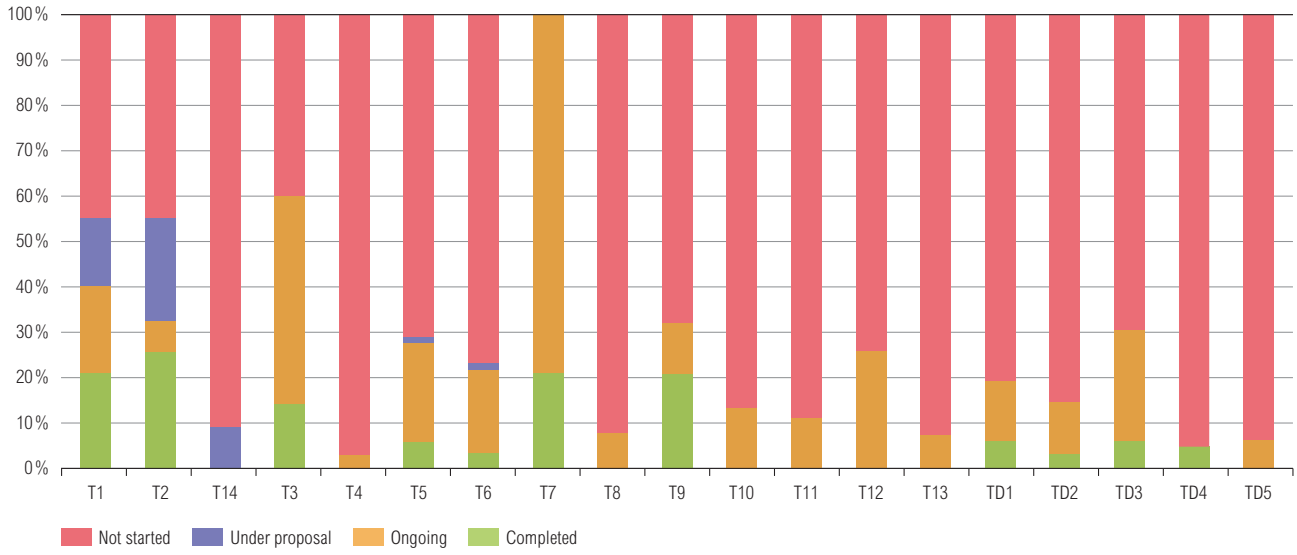


Figure 2: Achievement per Functional Objective of the R&D Plan update 2011, results of survey launched in February 2012

TRACKING THE R&D ROADMAP

In 2012, ENTSO-E upgraded the R&D Plan update 2011 to the R&D Roadmap 2013 – 2022. The structure of main chapters of the R&D Roadmap is different but the arrangement of clusters and functional objectives are very similar compared to the R&D Plan update 2011. T13 is merged into T10. T1 and T2 are swapped. A new cluster on Asset Management (three functional objectives T15, T16, T17) is added. The R&D budget for the Roadmap is 1005 M€. An increase of € 215 Million is added compared to the R&D Plan update 2011 (€ 790 Million). An overview of changes is given in the Appendix 2.

Thus far, EC has funded 14 projects related to the TSO R&D activities in the framework of FP7 with a total budget of € 166 Million (Appendix 1), and € 120 Million is expected to be arranged on calls 2013.

The Table 1 below summarizes the total investments launched by the TSOs and the € 719 Million in new resources needed for the R&D Roadmap.

	Budget (€ Million)
Budget of the R&D Plan update 2011	790
Cancelled resources for the 2010 roadmap	0
Added budget	+215
Total budget roadmap 2013	**1005**
Resources already funded (committed)	-166
Resources to be arranged on call 2013	-120
New resources needed for the R&D Roadmap	**719**

Table 1: New resources needed for the R&D Roadmap 2013 – 2022

SHORT-TERM R&D RESOURCES

In order to define a good implementation plan, available resources must be well estimated. ENTSO-E has launched an internal survey with its TSO members to get an accurate estimate of their contribution in man-year and other expenses in € Million for new R&D projects during 2014 – 2016.

It is noted that TSOs will lead the consortiums and other partners (stakeholders) will contribute their part to the R&D projects as well. Therefore, TSOs share a portion of the total budget of R&D projects.

Figure 3: Estimated personnel resources of TSOs arranged for R&D activities

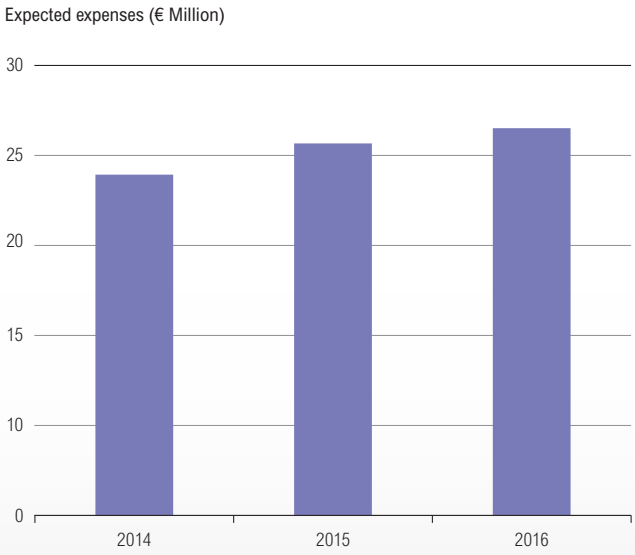


Figure 4: Estimated expenses of TSOs arranged for R&D activities

R&D PRIORITIES FOR 2014–2016

TOPICS ADDRESSED IN FP7-ENERGY-2013

Following the recommendations by the EEGI and Member States, the FP7-ENERGY-2013 program addresses topics that are part of the ENTSO-E R&D Plan update 2011. The mapping between calls addressed in FP7 and the functional objectives defined by ENTSO-E is presented in the table 2.

FP7-ENERGY-2013 Call	ENTSO-E R&D Plan update 2011
7.2.1. Advanced concepts for reliability assessment of the pan-European transmission network	T9: Tools for pan-European network reliability assessment
7.2.2. Advanced tools and mechanisms for capacity calculation and congestion management	T11: Advanced tools for congestion management
7.2.3. Large-scale demonstration of innovative transmission system integration and operation solutions for (inter)connecting renewable electricity production	T4: Demonstrations of power technologies for new architectures T5: Demonstrations of renewable integration
7.2.4. Ensuring stakeholder support for future grid infrastructures	T14: Innovative approaches to improve public acceptance of overhead lines

Table 2: Mapping FP7 calls vs. functional objectives

RATIONALE FOR DEFINING PRIORITY

The R&D priorities for 2014 – 2016 have been set based on objectives established in the ENTSO-E R&D Roadmap 2013 – 2022, the monitoring analysis of the R&D Plan update 2011, the FP7 calls launched by the European Commission and taking into account the TSOs' resources available for this Implementation Plan,.

Resources are already allocated for ongoing R&D projects. Difficulties to expand R&D activities due to lack of appropriate regulatory mechanisms for TSO R&D help explain the amount of available resources. It is believed that TSOs' resources would not allow for more than two oriented calls to be answered by TSO driven consortia.

There are key projects to be finalized in 2012 – 2013 and some others to be triggered on the basis of FP7 calls announced in 2012. The results of these projects are important to shape follow up activities in specific R&D areas.

By addressing the priorities proposed within the ENTSO-E Implementation Plan 2014 – 2016, TSOs will be able to maintain electricity grid reliability while helping to achieve European climate and energy goals. It should be pointed out that it is necessary to follow the right timing of call for proposal announcements in order to fulfil the functional objectives of the R&D Roadmap. Therefore, the task of defining priorities lies in an analysis of the results from monitoring the R&D achievements of the last years and the expected needs for the coming years. The procedures for granting projects as well as the duration of projects are among the important issues taken into account when defining priorities. The goal is to perform the right R&D at the right time to ensure efficiency and reach the R&D objectives.

SUGGESTED TOPICS 2014–2016

Priorities identified by ENTSO-E have been converted into specific topics that should be performed starting in 2014. Preferably, the topics should be funded under the framework of EC Calls (which are normally launched at least one year in advance).

The suggested sets of topics for 2014 – 2016 are focused on three main objectives: The first set is suggested to demonstrate technologies to foster network flexibility and enhance the observability and control of the pan-European network. The second set deals with topics that contribute to the construction of the Internal Electricity Market through the development of new tools and research on alternative market designs. The third set covers the research and development of new resources for

Year	Topics for the Implementation Plan 2014–2016
2014	• T3: Demonstration of power technology to increase network flexibility and operation means • T6: Innovative tools and methods to observe and control the pan-European network
2015	• T6: Innovative tools and methods to observe and control the pan-European network • T10: Advanced pan-European market tools for ancillary services and balancing, including active demand management • T12: Tools and market mechanisms for ensuring system adequacy and efficiency in electric systems integrating very large amounts of RES generation • T16: Development and validation of tools which optimize asset maintenance at the system level, based on quantitative cost/benefit analysis • T17: Demonstrations of potential at EU level for new approaches to asset management
2016	R&D activities related to defense plan and restoration plan including active distribution system. • TD2: The integration of demand side management at DSO level into TSO operations • TD3: Ancillary services provided through DSOs

Table 3: Topics for the Implementation Plan 2014–2016

operation delivered not only by the relation with DSOs but also the resources coming from the demand side.

In the Implementation Plan 2014 – 2016 the topics refer to functional objectives defined by the ENTSO-E R&D Roadmap 2013 – 2022. The R&D activities for 2014 will be specified in detail in close cooperation with EEGI at the beginning of 2013. The priorities and R&D activities for 2015 – 2016 can only be given on the basis of functional objectives because either the necessary R&D is not well identified or the results from ongoing projects are needed to outline the R&D activities required. When this is accomplished, the priorities can be packaged in a concrete proposal. The next Implementation Plan 2015 – 2017 issued in 2013 will provide additional details.

Table 3 summarizes the topics that should be addressed in the period 2014 – 2016.

CONCLUSIONS

Identifying priorities and available resources are necessary steps to structure the R&D activities for the following years. The Implementation Plan defines the right R&D at the right time to ensure efficiency and reach the R&D objectives.

The current available R&D resources at TSO side are insufficient to reach the R&D objectives in a reasonable time. TSO and regulatory commitment must be arranged to provide timely cost-effective and innovative solutions for future grids.

In 2013, ENTSO-E will follow the results of the ongoing projects and estimate the completion of the R&D Roadmap. Based on this monitoring activity and analysis of R&D gaps and need the next Implementation plan issued in 2013 will define priorities for the period 2015–2017.

Detailed R&D topics will be proposed in the beginning of 2013 as inputs to EEGI and EC to be considered for the Horizon 2020.

APPENDIX

APPENDIX 1:

The table below summarizes past and ongoing R&D activities with the budget and EC grant (status February 2012).

No	Project	Budget (€ Million)	EC funding (€ Million)	Start date	End date
1	iCoeur	4.79	1.92	January 2009	May 2012
2	Pegase	13.59	8.62	July 2008	June 2012
3	Twenties	56.81	31.77	April 2010	March 2013
4	Realisegrid	4.21	2.72	September 2008	February 2011
5	Susplan	4.79	3.42	September 2008	August 2011
6	Optimate	4.26	2.62	October 2009	September 2012
7	After	5.05	3.47	September 2011	August 2014
8	Safewind	5.62	3.99	May 2008	April 2012
9	EWIS	4.04	4.04	June 2007	October 2009
10	iTesla	19.43	13.23	January 2012	December 2015
11	Umbrella	5.25	3.86	January 2012	December 2015
12	eHighway2050	13.05	8.99	September 2012	January 2016
13	Grid+	3.96	2.99	October 2011	September 2014
14	Ecogrid.eu	20.68	10.33	March 2011	February 2015
	Total	**166**	**102**		

APPENDIX 2:

Comparison of the R&D Roadmap 2013 – 2022 to the R&D Plan update 2011

€ Million	R&D Plan update 2011		Clusters		R&D Roadmap 2013 – 2022	€ Million
19	A toolbox for new network architecture assessment	T1	C1 Grid Architecture	T1	Definition of scenarios for pan-European network expansion	20
21	Tools to analyze the pan-European network expansion options	T2		T2	Planning methodology for future pan-European transmission system	20
50	Environmental impact and social acceptance of transmission facilities	T14		T14	Towards increasing public acceptance of transmission infrastructure	30
80	Demonstrations of power technologies for more network flexibility	T3	C2 Power Technologies	T3	Demonstration of power technology to increase network flexibility and operation means	100
120	Demonstrations of power technologies for new architectures	T4		T4	Demonstration of novel network architectures	120
130	Demonstrations of renewable integration	T5		T5	Interfaces for large-scale demonstration of renewable integration	130
12	Innovative tools for pan-European network observability	T6	C3 Network Operation	T6	Innovative tools and methods to observe and control the pan-European network	50
24	Innovative tools for coordinated operations with stability margin evaluation	T7		T7	Innovative tools and methods for coordinated operation with stability margin evaluation	30
25	Improved training tools to ensure better coordination at the regional & pan-European levels	T8		T8	Improved training tools and methods to ensure better coordination at the regional and pan-European levels	25
14	Innovative tools and approaches f or pan-European network reliability assessment	T9		T9	Innovative tools and approaches for pan-European network reliability assessment	20

€ Million	R&D Plan update 2011		Clusters		R&D Roadmap 2013–2022	€ Million
18	Advance tools for pan-European balancing markets	T10	C4 Market Designs	T10	Advanced pan-European market tools for ancillary services and balancing, including active demand management	30
21	Advanced tools for capacity allocation congestion management	T11		T11	Advanced tools for capacity allocation and congestion management	25
14	Tools for renewable market integration	T12		T12	Tools and market mechanisms for ensuring system adequacy and efficiency in electric systems integrating very large amounts of RES generation	20
12	Tools for the integration of active demand into electrical system operations	T13				
			C5 Asset Management	T15	Developing approaches to determine and to maximize the lifetime of critical power components for existing and future networks	30
				T16	Development and validation of tools which optimize asset maintenance at the system level, based on quantitative cost/benefit analysis	30
				T17	Demonstrations of new asset management approaches at EU level	75
45	Increased observability of the electrical system for network management and control	TD1	C6 Joint TSO/DSO R&D activities	TD1	Increased observability of the distribution system for transmission network management and control	45
70	The integration of demand side management into TSO operations	TD2		TD2	The integration of demand side management at DSO level into TSO operations	70
50	Ancillary services provided by DSOs	TD3		TD3	Ancillary services provided through DSOs	50
45	Improved defense and restoration plans	TD4		TD4	Improved defense and restoration plan	45
20	Joint taskforce on IT system protocols and standards	TD5		TD5	Methodologies for scaling-up and replicating	40
790	**Total**				**Total**	**1005**

NOTE

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This is the first Implementation Plan in a series of five issues.

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