

European Electricity Grid Initiative

Implementation Plan

2015-2017

EUROPEAN ELECTRICITY GRID INITIATIVE

March 2014

EXECUTIVE SUMMARY

The present document describes the Implementation Plan for the period 2015-2017 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 next covers the priorities which have led to propose R&D topics for the years 2015-2017.

This draft R&D roadmap:

- Combines the previous Implementation Plan 2014-2016 (approved by the EEGI in February 2013) as well as the R&D projects selected for EC funding during the past year which may already address the future objectives for the period 2015-2017
- Is developed in parallel with the upcoming European Commissions' *Integrated Roadmap* for Energy Technologies and Innovation[1]. At the time of writing, the topics proposed within this document, for the years 2015 and beyond are aligned with the programs that are being shaped to meet the issues listed in this *Integrated Roadmap*.

Assuming that the 2014 topics are focused on the system reliability and flexibility (with the demonstrations of future smart HV substations and the integration of Storage and Metering Data Systems for network management), the priorities for 2015 cover the objectives of network monitoring, control, flexibility and security. They include:

- The development of control and protection for large power systems with a large amount of inverter-based components.
- The development of methods and tools to optimize asset management
- The integration of small and medium DER at distribution network level
- The monitoring and control of Low Voltage distribution networks

The joint TSO/DSO R&D project aims at improving the observability of the distribution systems for transmission network management.

R&D concepts to be included in future implementation plans (years 2016 and 2017) are also briefly described. These are consistent with the topics foreseen to be included in the next revision of the EEGI roadmap (2015) and in the integrated roadmap that is currently being developed under the coordination of the European Commission. They address network monitoring and management, already

[1] http://ec.europa.eu/energy/technology/strategy/strategy_en.htm

introduced in the previous implementation plans, together with new market approaches, giving a more active participation of electricity consumers to the electricity system functioning.

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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 year R&I programme required to meet twenty-year transmission and distribution system targets; the Implementation Plan defines shorter term R&I priorities.

The present document describes the Implementation Plan for the period 2015-2017 of the Roadmap prepared by the European Electricity Grid Initiative (EEGI). This new Implementation Plan results from parallel analyses of:

- Follow the societal challenge pillars of HORIZON 2020 and the ongoing work of the SET Plan Integrated Roadmap.
- On-going R&I activities performed at EU level by TSOs and DSOs (the work already completed or on-gong in line with the priorities set within the EEGI R&I roadmap approved in early 2013),
- The R&I implementation plan 2014-2016 which was approved by the EEGI in February 2013
- Upgraded priorities which have emerged for network operators as of late 2013, in order to remain compliant with the EU policies and the corresponding orientations (including the 2050 decarbonization targets of the European electricity system)

This document details the priorities that should be addressed during year 2015, as well as the draft plans for 2016 and 2017 in support of the next R&I steps, the means to monitor the progress made in the supported functional objectives and the investments related to such efforts.

1. RATIONALE FOR DEFINING THE EEGI PRIORITIES FROM 2015 TO 2017

1.1 Background: the EEGI roadmap

At the end of 2012, a new R&I Roadmap 2013-2022 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.

The R&I topics were classified in clusters made of functional objectives addressing the key issues faced by energy grid operators in the years ahead:

- Integrate increasing amount of variable, renewable electricity production in combination with appropriate deployment of demand side management, EV/PHEV, storage solutions, flexible back-up generation and virtual power plants;
- Address grid interplay issues (electric and gas, electric and heating and cooling) through appropriate architecture developments and innovative planning methods and tools;
- Develop systemic market design and rules to increase the overall competitiveness of the electricity market, efficiently integrating available technologies, using new services emerging from a more efficient integration between DSO and TSO grids, and providing business cases for any market players (generator, consumer, aggregator, storage operator);
- Support development and integration of novel technologies into the electricity grid (ICT, power electronics, new conductors, superconductivity, etc) and reinforce supply chains to speed up their deployment in cooperation with technology manufacturers;
- Optimize electricity network capacity and flexibility (e.g. expansion, refurbishment, asset life management, maintenance, operation);
- Develop novel decision-making processes and tools to increase and take advantage of the intelligence in the grid

The resulting collection of R&I activities are geared to support EU policies in relation with the construction of the single electricity market, for which significant improvements in market integration of a rising share of renewables, energy efficiency measures and smarter energy grids are expected.

These R&I activities are organized through an ordered, step-by-step and scheduled work program: it addresses the most urgent and relevant activities which are supposed to bridge the main existing knowledge gaps, thanks to and thus the related functional objectives with appropriate solutions that meet the functional objectives by mixing technology and market- based approaches.

1.2 Monitoring of the R&I achievements

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.

Figure 1 below shows the overall rate of completion for each of the cluster of the EEGI roadmap, and for the R&I Roadmap as a whole. The completion rates are grouped according to two categories. The first one includes completed projects and on-going proposals under evaluation; the second category covers the objectives which have not yet been addressed. The TSO results come from the ENTSO-E Monitoring Report 2013 , based on the responses of the R&I project coordinators linked with the R&I Roadmap. The DSO part is the result of a study on publicly available information about the projects listed in the JRC data base .

Figure 2 below shows the number of DSO projects which by now address each of the functional objectives of the EEGI road map. It highlights that projects dealing with Active Demand; Distributed Energy; Electric vehicle and Grid Operation are the most covered. The areas dealing with Market Design, Asset Management and Smart Homes need to be more deeply addressed in the future.

A full mapping of these projects is given in appendix 1 and 2.

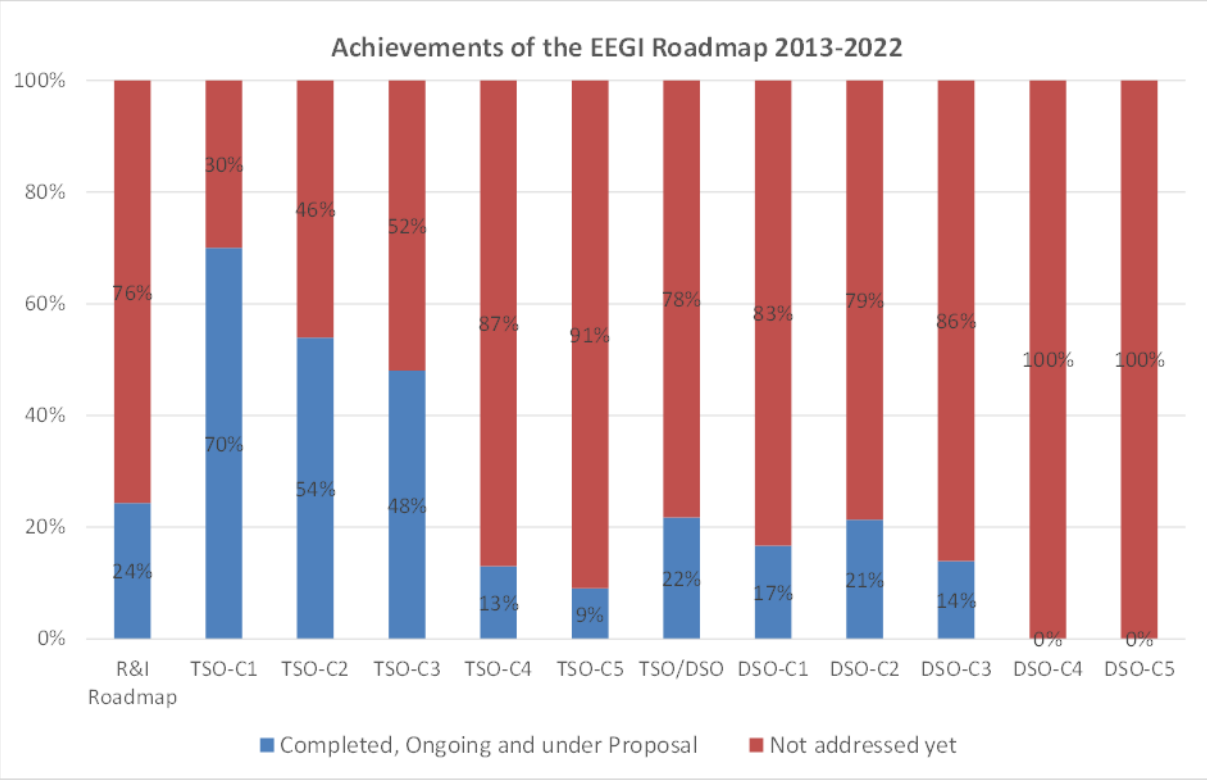

FIGURE 1 Achievement per cluster of the EEGI R&I roadmap 2013-2022

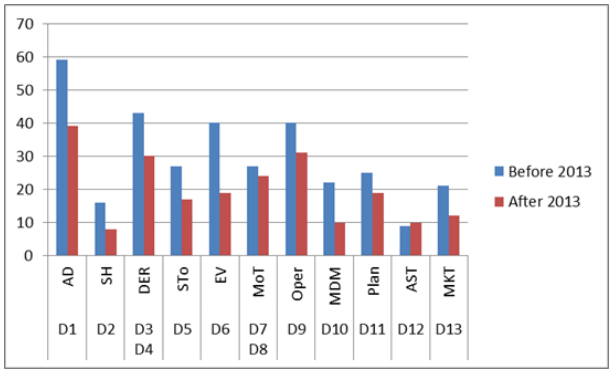

FIGURE 2: Total amount of projects completed until 2013

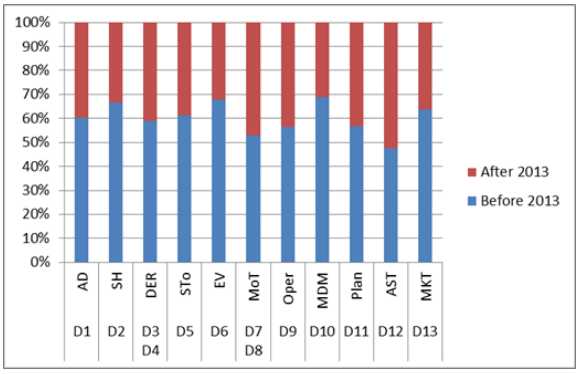

FIGURE 3: Percentage of projects finished until 2013 considering the functional topics

The above result monitoring and project mapping allow drawing the following conclusions for future work ahead.

High level of DER integration and Active Demand in distribution networks

A large number of projects have focused on smart metering and active demand: they are now in the deployment phase as shown on Figure 2: they help paving the way for system adequacy since increasing the network hosting capacity for renewable distributed generation. Asset Management and Smart Data Management have already been presented within the 2014 implementation plan: they should help providing ways and means to handle the information flow coming from the grid in order to increase its smartness level. Integration of medium and small DER (Distributed Energy Resources) are therefore the two key functional objectives that ought to be addressed by the 2015 implementation plan. They are the next steps for the further integration of renewables and DER into the electricity system.

Grid operations and Electric Vehicles

Grid operations and EVs (Electric Vehicles) have been the other two main R&I topics up to 2013. Grid operations address mainly the integration of DER. In the case of EVs, the flexibility and versatility of the proposed technology should enable its use in view of further active demand and grid operations. Both topics are envisaged within the 2016 implementation plan, since a large number of projects are currently on going on the very same topics: it seems reasonable to get more experience and knowledge from the on-going projects before moving forward.

Storage and market design

Storage and new market models are two functional objectives with only a few on-going projects. Storage is a technology for which more experience is to be gained from on-going R&I projects before implementing it in demonstrative business cases. Market designs are dealt with by a few projects, since it is it is difficult to find commonalities in several European member states to search for novel recommendations before deployment. This is why the functional objectives related to Storage and Market Designs should be positioned in the future 2016 and 2017 implementation plans..

1.3 Reminder: R&I priorities of the EEGI in 2014

The proposed R&I topics for 2014 focus on four main objectives:

- To demonstrate technologies which foster network flexibility and enhance the observability and control of the pan-European network
- To contribute to the construction of the Internal Electricity Market through research and development of new tools on alternative market designs at TSO level

- To improve operations and reliability of the system at DSO level
- To develop generic tools and methodologies in order to support scaling up and replication studies which need to be used when preparing recommendations towards regulators for the deployment of innovative solutions by network operators and other stakeholders of the electricity market

2014	
Topic titles	***Functional objectives***
TSO	
Demonstration of future smart HV substations	**T3**[2], T6
Novel cross border balancing market mechanisms and tools for ensuring system reliability	**T10,** T11, T9
DSO	
Integration of storage in network management	D5[3]
Smart metering data processing	D10
Asset management	D12
Methodologies for scaling up and replication	TD5
TSO/DSO	
Integration of demand side management at DSO level into TSO operation.	TD2

[2] *Main functional objectives are in bold; other functional objectives are supported ones*
[3] Only one functional objective is mentioned for DSO, but other functional objectives are included when defining the proposal

2. OBJECTIVES OF IMPLEMENTATION PLAN 2015-2017

2.1 R&I priorities in 2015

At the time of designing the present implementation plan, the topics of the first call 2014 of HORIZON 2020 cover some of the topics addressed by the 2014 EEGI implementation plan. The 2015 R&I priority is defined to achieve one of the main EEGI overarching goal: decarbonisation of the electricity sector through integration of renewable sources. This can be solved by ensuring the electricity system flexibility and reliability, while increasing the network hosting capacity to integrate more renewable generation.

The table below lists the functional objectives which have been selected for year 2015.

Table 1 LIST OF R&I TOPICS 2015

No	2015	
	Topic titles	Functional objectives
	TSO	
1	Inertia, control and protection of large power systems with a large amount of inverter-based components	**T6,** TD1 , T5
2	Methods and tools to optimise asset management	**T15,** T16, T17
	DSO	
3	Integration of DER at Low Voltage	D3
4	Integration of DER at Medium voltage/High Voltage	D4
5	Monitoring and control of LV network	D7
	TSO/DSO	
6	Demonstration of power load control mechanisms at TSO and DSO levels	**TD2,** T6, TD5
7	Increased observability of the distribution systems for transmission network management	TD1

The underlying reasons to prioritize such topics are explained below.

Integration of RES at high voltage and DER at medium and low voltage levels:

The increase of RES/DER is a reality in most of the main European networks. DER and RES penetration is requiring additional network hosting capacity, as well as electric system flexibility and reliability to cope with the problems coming from generation intermittency.

Novel technology-based issues must be considered like the impacts of inverter-based components onto the control and protection of grids at transmission level: this

requires an increased observability of the distribution system to ease the transmission network management and control, Solving this complex issue will contribute to the reliability of the whole system, thanks to an increased cooperation between distribution and transmission networks, which in turn increases the electric system performances and gives rise to new system services.

Monitoring and control of low voltage networks

It is another technology related issue that needs to be addressed to facilitate the integration of DER in low voltage grids. This will also have a positive contribution onto the electricity system reliability and hosting capacity. The decentralization of the energy system and the integration of DER at medium and low voltage require a modernised European low-voltage grid, paving also the way for the future integration of EVs and storage systems.

Asset management

This issue is already addressed in the 2014 implementation plan from the DSO side. It now needs to be addressed at TSO level. Both transmission and distribution operators see therefore seeing asset management as a critical component of overall network management strategy to face the growing uncertainties of component life time brought by renewable in-feeds. Current maintenance practices by grid operators involve periodic preventive actions, based on the average values of reliability performances for homogeneous families of components. This does not take into account:

- the real solicitations on the concerned equipment which are more and more impacted by variable in-feeds coming from renewable generation,
- the impact of an equipment failure which depends upon its geographical location

Accounting for such parameters is another way to improve the overall grid flexibility. Moreover, operation and network planners manage risk using a statistical approach of a full line. New tools are therefore needed to perform economic arbitrages between the three time horizons typical of any network operator. This in turn requires, amongst others, a single framework to model ageing laws of power components, predictive maintenance approaches and a formal link between reliability levels of each component and the reliability level of a full line.

The integration of demand side management at DSO level to provide extra system services for TSO operation will be the starting point of a chain of joint R&I activities

needed to make both networks cooperate more, in order to shape the coming new active role of electricity customers.

2.2 R&I concepts in 2016 and 2017

The two tables below list the R&I concepts under scrutiny by transmission and distribution network operators.

An active participation of the consumer in the energy system is EU energy policy orientation. It is not addressed specifically in the 2015 implementation plan, because of important R&I activities in on-going European projects dealing with consumer behaviour, tariffs, regulation and market design. It seems prudent to wait for the outputs out of these initiatives while preparing the massive incorporation of DER at all voltage levels before launching new R&I activities on active demand and demand side management in 2017. This allows capitalizing better on the new knowledge acquired.

The electrification of transport is also an important driver to meet EU energy policy objectives; incorporating EV/PHEV into cities requires developing the recharging infrastructure and adapting the networks to movable loads while taking into account all the impacts that it will have onto distribution grids. The topics related to EV integration into electrical grids need also to be developed and anticipated, since DER penetration into the grids is a more stringent reality than EV penetration as of now. For this reason this topic has been scheduled for 2016.

Provided that the expected results reach the desired maturity level, new tools for network management will be needed to deal with Active demand, EV, DER, storage, etc., as well as new approaches to market design to be able to go from demonstration level to full deployment. This new context will also require new services from DSOs to TSOs that will need joint R&I activities to design new economic incentives and technical solutions.

Table 2 LIST OF R&I CONCEPTS 2016

No	2016	
	Topic titles	Functional objectives
	TSO	
1	Realisation of ultra-high-voltage lines with partial underground cabling	**T3, T4, T14**
	DSO	
2	Infrastructure to host EV/PHEV	D6
3	Automation and control of the MV Network	D8
4	Network management tools	D9
5	New approaches for market design	D13
	TSO/DSO	
6	Ancillary services provided through DSOs and Aggregator Agents	**TD3,** *T10, T12, TD2*

Table 3 LIST OF R&I CONCEPTS 2017

No	2017	
	Topic titles	**Functional objectives**
	TSO	
1	Data & information management for system operation and asset management	**T6**, *T15,T16, T7, T9*
2	Advance tools for new market models	**T11**, T8, T10
3	Market modelling and system adequacy assessment for long-term planning	**T2**, T12
	DSO	
4	Active Demand Response	D1
5	Integration of storage and network management	D5
6	Monitoring and control of the low voltage network	D7
	TSO/DSO	
7	Improved defence and restoration plans	TD4, TD5

3. CONCLUSIONS

The present implementation plan of the EEGI roadmap for 2015-2017 proposes a set of priorities for R&I project to be launched in 2015 , together with R&I concepts for 2016 and 2017. The main underlying principles are to further address system flexibility in order to integrate more renewables into the electricity system, while leaning on network monitoring, control and security.

The Implementation plan is strongly linked with the societal challenge pillars of HORIZON 2020 and in line with the ongoing activities of defining the SET Plan Integrated Roadmap. To ensure secure, clean and efficient energy, the R&I topics and concepts emphasizes the development of a single, smart European electricity grid as an enabler of: low-cost, low-carbon electricity supply; smart and sustainable energy usage; market uptake of energy innovation, by empowering markets and consumers; and the use of new knowledge and technologies involved in the electricity sector

Furthermore, expected outputs will have thus direct impacts on climate action and resource efficiency. The proposed R&D activities will also directly benefit from the outputs of the Industrial leadership pillar of HORIZON 2020, since taking advantage of the next generation computing techniques, the new infrastructures, technologies and services coming from the Internet and content technologies and information management.

Annexes

ANNEX 1. THE PROPOSED EEGI TOPICS IN 2015 (FURTHER ADDRESS SYSTEM FLEXIBILITY TO INTEGRATE MORE RENEWABLES INTO THE ELECTRICITY SYSTEM)

1.1 Topic 1- 2015: Inertia, Control and Protection and Inertia of Large Power Systems with Large Amount of Inverter-Based Components (TSO)

The integration of large amounts of renewable generation with power electronic interfaces and addition of HVDC links into the power system will necessitate a review of the operation and control of transmission networks.

Scope

The goal of this topic is to investigate how power systems will behave when the transmission network is fed by large amounts of inverter-based generation, and identify what must be done to allow this equipment to be integrated into the system safely.

More and more components in the European power system are based on power electronics. This equipment feeds harmonic current into the system and in some cases could lead to unstable behaviour and impair the reliability of the power system. Entire areas might potentially be fed only by inverter-based generation, such as from HVDC offshore energy.

Therefore, fault detection, power system stability and control, de-rating of transformers due to higher harmonics and harmonic distortion must all be studied. Appropriate tools and methods for building models must be identified for this purpose.

Current control and protection schemes must be reviewed and may need to be redefined to allow stable, reliable and economic operation of the network.

Deliverables

- New control/projection schemes
- Definition of new grid connection rules

Key Performance Indicators

- A.1. Increased network capacity at affordable cost
- A.2. Increased system flexibility at affordable cost
- B.1. Increased RES and DER hosting Capacity
- B.2. Reduced energy curtailment of RES and DER

Cost: 6–9 million€

Duration: 3 years

1.2 Topic 2- 2015: Methods and tools to optimise asset management (TSO)

The necessity for new theoretical research and development of innovative practical methods of refurbishing and rehabilitating the European power grid and optimising asset lifetimes while taking into account network development

Scope

Asset management has a decisive impact on network performance in terms of quality and security of supply and consequently on the electricity market.

Innovative methodologies developed in this project will allow costs and benefits to be assessed accordingly to different management strategies and propose a risk-based approach for estimations at the system level. By implementing smart maintenance, higher levels of flexibility will be possible.

One challenge is to develop a standardised approach for life duration modelling so that the behavioural database can be expanded.

One of the main goals will be to discover the most beneficial asset management strategy per euro paid out.

Deliverables

- Efficient solution for optimising asset maintenance costs during operation, while increasing the performance of existing assets;
- Data requirements and software architectures needed for new asset management tools.

Key Performance Indicators

- A.1. Increased network capacity at affordable cost
- B.1. Increased RES and DER hosting Capacity
- B.2 Extended asset life time

Cost: 10–20 million €

Duration: 3 years

1.3 Topic 3- 2015: Integration of DER at Low Voltage (DSO)

Achieving the European 2020 objectives will require a large share of electricity produced by renewable energy sources connected to the distribution network at both the MV and LV levels. This will require novel cost-effective solutions that will increase the hosting capacity of DER (Distributed Energy Resources) on the existing LV and MV networks.

The purpose of this functional objective is Increase the Capacity of LV Network to host Distributed Generation. To achieve this objective, the steps are:

- Active Control of DER
- Increased economic efficiency and improved service level
- More active network monitoring, control and operation
- Solution of LV independent of MV; being the replicability easy to implement.

Scope

- Address technical issues such as volatility of generation, monitoring, forecasting and managing a large number of small generation units,

sudden unplanned loss of generation, electromagnetic transients and reverse power flows, oscillations and other electromagnetic related perturbations in the low voltage networks

- Develop improved network monitoring functionalities. These will include monitoring of the voltage levels, power (active/reactive) exchanges and the quality of the power exchanged within the grid
- Develop improved network control functionalities. These will include control of the voltage levels, active and reactive power flows and islanding, fault and outage management.
- Incentives to include provision of ancillary services (e.g. voltage regulation participation)
- Standardization in data exchange protocol between the network devices
- Development of bi-directional communication infrastructure supporting small scale DER integration in low voltage networks.
- Definition of required data for fast and efficient network operation between distribution network operator and generation/loads connected to LV network.

Key Performance Indicators

- A.1. Increased network capacity at affordable cost
- A.2. Increased system flexibility at affordable cost
- B.1. Increased RES and DER hosting Capacity
- B.2. Reduced energy curtailment of RES and DER

Cost: Approximately 50M€

1.4 Topic 4- 2015: Integration of DER at Medium Voltage/High Voltage (DSO)

With the substantial rise of distributed generation, the EU is facing the challenge of finding new ways of integrating more distributed resources in the MV/HV networks. This will require an increase in the network hosting capacity and the ability to cope with several different DER units (PV, wind, biomass, small hydro, mini-cogeneration, storage, CHP, VPP) and different network topologies (rural vs urban, radial vs meshed, different voltage levels).

The aim of this functional objective is to increase the secure penetration of medium DER in the MV networks by Active Control, helping the distribution network to become more flexible with the implementation of advanced Network Operation

and Energy Management capabilities and achieving economies relative to the conventional ways of increasing the DG hosting capacity of networks.

Scope

- Define metrics for operation flexibility and system adequacy involving the identification of day-ahead security margins and their impacts on the definition of new ancillary service markets
- Identify the impacts of flexibility and the adoption of advanced market solutions on distribution / transmission planning.
- Develop a new ancillary services market (like reserves, congestion management) to deal with the variability and grid location of the renewable sources: which involves extending the time horizon of these markets and the adoption of regional markets to deal with local problems.

Key Performance Indicators

- A.1. Increased Network Capacity at affordable cost
- B.1. Increased RES and DER hosting Capacity
- B.2. Reduced energy curtailment of RES and DER
- B.3.Power Quality and Quality Supply

Cost: Approximately 40M€

1.5 Topic 5- 2015: Monitoring and Control of LV Networks (DSO)

The need for better observability of the LV part of the grid has arisen as a reaction to the wider introduction of intermittent non-dispatchable resources which to a large extent have changed usual patterns of grid operation. For this reason, wider awareness of the LV network has grown in importance. The EU regulatory environment will provide additional needs for enhancing the monitoring of the LV grid.

The functional goal is to demonstrate under real operating conditions new cost-effective solutions to improve LV network monitoring and control. The important steps to focus to achieve the final objective are:

- Demonstrations
- New Cost-efficient Solutions

- New Market Models
- Operation schemes

Scope

- AMM involvement in the LV operation
- Participation of the aggregated demand facilities in the DSR concept
- Semi-automated LV network and its comparison to full automated grid approaches
- Schemes for selectivity of protection in the automated LV networks
- "Smart" inventions and their role in the DSR scheme or prosumer storage
- Load and generation control within island mode of operation
- Reliable wireless communication in LV automation schemes
- Data protection and cyber security methodologies
- Integrated communication solutions
- Information model aggregation
- Reliability of the available wireless connection between automated LV street cabinet (substation) and SCADA in terms of protection functions preventing jamming or interferences
- Grid Modelling.

Key Performance Indicators

- A.2. Increased system flexibility at affordable cost
- B.2. Reduced energy curtailment of RES and DER
- B.3. Power Quality and quality of supply
- B.5. Increased flexibility from energy players

Costs: Approximately 50M€

1.6 Topic 6- 2015: Demonstration of power-load control mechanisms at TSO and DSO levels (TSO/DSO)

Integration of high volumes of intermittent generation will impact in the way energy is managed and necessitate implementation of new technologies to add value to demand response and raise awareness about consumption flexibility and foster active customer participation in the energy market.

Enhanced coordination between system operators is becoming increasingly necessary to ensure that DSO can offer new services (i.e. frequency services) to TSO, ensuring system integrity and stability. Flexibility services related to load control is one option available that must be studied further.

Scope

The main objective is to develop processes, profiles, platforms and standards for commercial actors to generate localised offers that can be activated by the relevant DSO, TSO or market operators. To this purpose, the goals to be achieved by Demand Response (DR) and eventually distributed energy storage must be defined, and joint planning tools and models must be developed. A range of demonstrations must then be performed, with broad coverage, for different loads and different countries, to show the impact of integrating DR on a pan-European level. The impact on system stability and market efficiency can be studied, and the requirements for implementing such programs can be determined.

The potential benefits of flexible grids and products are energy savings, lower costs and increased network security through improved cooperations and communications between the participating parties (TSOs, DSOs end customers, etc.).

- Specific tasks include: Analysis and categorization of DSM functionalities available and operated by DSOs. Filtering and definition of those specific functionalities of particular interest to TSOs
- Definition of data required by TSOs and DSOs for efficient and fast operation, respecting privacy and cyber-security
- Definition of requirements on the demand side for services (i.e. frequency regulation) requested by TSOs to the TSOs
- Demonstration of the effective collaboration mechanisms for relevant TSOs, DSOs and/or market operators to activate demand side management services.

- Modeling of the customer/load behavior and segmentation, quantifying the potential degree of flexibility that could be provided by the DSO
- Joint demonstration between TSOs and DSOs dealing with small/medium residential and industrial customers. System-wide communication infrastructures and information integration capabilities must be addressed

Demonstrations in various countries where TSO-DSO cooperation is already taking place (Italy, UK, Denmark, etc.), in order to demonstrate the replicability of the developed methods.

Deliverables

Load control provided by distributed resources, which allows TSOs and DSOs to plan and operate the network efficiently and economically, and also to reduce grid congestion.

An increased level of flexibility in planning and operation of the network, which will help for enhancement of RES integration at pan-European level while maintaining security of supply.

Key Performance Indicators

- A.1. Increased Network capacity at affordable cost
- A.2. Increased system flexibility at affordable cost
- B.2. Reduced energy curtailment of RES and DER
- B.3. Power Quality and Quality Supply
- B.5. Increased Flexibility from energy players
- B.6. Improved competitiveness of the electricity market

Cost: 60 million € (several projects)

Duration: 4 years

1.7 Topic 7- 2015: Increased observability of the distribution systems for transmission network management (TSO/DSO)

Forecasting engines are needed to manage reserves in a timely and secure manner. Furthermore, the presence of PV, wind or CHP units at the distribution level will require TSOs to foresee the real-time requirements of the distribution system to maintain operational security. The delivery of new network codes will aim, among others, at integrating more DER into the networks with some degree of control over DER. This may end up with DER control centers to monitor, forecast and operate DER according to the needs of DSOs and TSOs. This should also allow for power flow control, load management, autonomous operations and control at the cell level.

Scope

DER is integrated in power control (active and reactive power control capability, technical aggregation, observability of DER for TSO and DSO) thanks to the above

- To improve short-term (15', 1h, 3h) and long-term (5-day) forecast engines for PV, wind, CHP and loads.
- To develop new modeling methods and tools for steady-state (static parameters) and dynamic analyses (capacities up to 1 MW)
- To deliver methods and tools for planning new DER connections at the TSO/DSO boundary (response to new connection requirements)
- To develop new methodologies for data processing at various system levels (DSO, TSO)
- To design new architecture, control systems and communications (including GIS assistance) that allow multiple new generators to be connected and share information with TSOs.
- To propose new integrated functions (scaling-up techniques) and solutions for technical aggregation of DER data acquisition capabilities for improved DER production observability

Deliverables

- More accurate production and load analysis for each network operator thus minimizing the impact of DER on the network and increasing the level of observability.
- Deployment of DER control centers, responding both to TSO and DSO constraints

- Improved load forecasts that deliver improved network security margins (i.e., more reliable determination of reserve requirements in a timely and secure manner) and make network operations more efficient

Key Performance Indicators

- A.2. Increased system flexibility at affordable cost
- B.1. Increased RES and DER hosting Capacity
- B.2. Reduced energy curtailment of RES and DER

Cost: 45 million €

Duration: 5 years

ANNEX 2. R&I PERSPECTIVES FOR 2016 AND 2017

2016	
Concept 1	*Realisation of ultra-high-voltage lines with partial underground cabling*
Leading	**TSO**
Relevant FO	**T3, T4, T14**, T2, T5
Motivation	The Ten-Year Network Development Plan (TYNDP) indicates the urgent necessity of expanding the current pan-EU transmission grid in order to meet the European energy policy goals. The main driver of grid expansion is the huge increase in production from RES. Since RES inputs are often situated far away from consumers, this results in large power flows through transmission networks. Furthermore, public acceptance of infrastructure projects is another issue for Member States. This induces public expectance to minimise the visibility of infrastructure. Cable links for EHV/UHV do not yet ensure adequate capacity at a reasonable cost. For the reasons stated above, TSOs require new transmission technologies that: ▪ Can provide greater capacities ▪ Can be easily integrated into existing grids, especially in existing corridors ▪ Can be utilised in densely populated areas
Comments	Following of e-Highways regarding new infrastructures and architectures
Concept 2	*Infrastructure to host EV/PHEV*
Leading	**DSO**
Relevant FO	D6
Motivation	The Concept is related to the mass roll out of the EV which will produce the need to address the impact of different types of charging options on the distribution grids (and generally in the electric system), triggering a change in the electrical scenario that have forced to study new operation methods.
Comments	
Concept 3	*Automation and Control of the MV Networks*
Leading	**DSO**
Relevant FO	D8
Motivation	It is a necessity to have better real time information of what is happening in the grid and good forecasting of the tendency of grid behaviour. The distribution networks, thanks to smart-metering national roll-outs, are becoming increasingly instrumented, and this deployment offers an opportunity to improve the efficiency in operation and maintenance for the rest of elements.
Comments	The basis of these improvements will be a higher monitoring and automation of MV network. Mathematical models of the network, optimisation algorithms, efficient communications, new ICT solutions are topics that should be addressed.
Concept 4	*Network Management Tools*
Leading	**DSO**
Relevant FO	D9
Motivation	This concept is related to the development of novel tools for network management by the introduction of technologies that give better observability and therefore improved control. The intermittency of the increased number of DER connected to DSO network lead to a variable generation and consumption loads on the MV and LV levels. The network management tools should then take into consideration the multiple network constraints that will occur in one hand and new opportunities for controllable load that will be possible in the other hand.

2016	
Comments	The development of new market schemes and new approaches should address and solve new challenges stemming from changing environment of the grid operation and management.
Concept 5	*New Approaches For Market Design*
Leading	**DSO**
Relevant FO	D13
Motivation	DSO should guarantee the quality of electricity supply within the stability boundaries while increasing the hosting capacity of the MV and LV network for RES and new usages and considering the new players such as aggregators and new market rules.
Comments	Better involvement of consumers is crucial while better awareness of his behavior will enable to take appropriate means to react to radical changes in the field of energy sector.
Concept 6	*Ancillary services provided through DSOs and Aggregator Agents*
Leading	**TSO/DSO**
Relevant FO	**TD3,** T10, T12, TD2
Motivation	The objective is to create new market design and new incentive mechanisms and address technical aspects so that TSOs receive new ancillary services from DSOs, based on DER, RES and load control.
Comments	

2017	
Concept 1	*Data and information management for system operation and asset management*
Leading	**TSO**
Relevant FO	**T6,** T15,T16, T7, T9
Motivation	Necessity for a new approach of managing enormous volume of information and data generated throughout the electricity system
Comments	Follow up of iTesla, UMBRELLA, Garpur projects
Concept 2	*Advance tools for new market models*
Leading	**TSO**
Relevant FO	T11
Motivation	Pan-European power flows within a free energy market plus massive integration of variable RES resulting in local and regional bottlenecks, necessitating a fair charging mechanism for capacity use.
Comments	Follow up of OPTIMATE for market modeling at long term horizons
Concept 3	*Market modelling and system adequacy assessment for long-term planning*
Leading	**DSO**
Relevant FO	**T2**, T1, T12
Motivation	Need for a better approach to address the uncertainties in the future energy mix and market mechanisms for long-term planning purposes
Comments	
Concept 4	*Active Demand Response*
Leading	**DSO**
Relevant FO	D1
Motivation	The increasing of DRES and unpredictable load makes neccesary increase the grid observability and a more active participation of the consumer, allowing a more flexible a optimized use of the network. This is possible through the previous smart metering deployment already done in previous projects. Getting from them the knowledge and the experience required for a positive implementation of this concept.
Comments	
Concept 5	*Integration of Storage and Network Management*
Leading	**DSO**
Relevant FO	D5

	2017
Motivation	This concept deals with storage systems, considering it as an important tool for network management and a way to absorb renewable generation overproduction. This concept will be deployed in parallel with the active demand response due to the wide range of possibilities that this technology offers.
Comments	Demonstration taking into account the results of projects launched in 2015
Concept 6	***Monitoring and Control of The Low Voltage Network***
Leading	**DSO**
Relevant FO	D7
Motivation	The basis of these improvements will be a higher monitoring and automation of LV network.
Comments	Demonstration taking into account the results of projects launched in 2015
Concept 7	***Improved defence and restoration plan***
Leading	**TSO/DSO**
Relevant FO	**TD4**, T9, T7, T6
Motivation	Need for different types of generation and demand technologies to participate actively in defence and restoration plans, not only centralised generation, but also DER and demand response.
Comments	

ANNEX 3. MAPPING OF THE EEGI R&I ROADMAP

3.1 TSO activities

MAP OF THE PROJECT CONTRIBUTION TO ENTSO-E R&I PLAN				
Cluster 1: Pan-European grid architecture	***T1: A toolbox for new network architecture assessment*** ▪ EWIS ▪ Development of early warnings systems (PMU/WAMS) ▪ TWENTIES ▪ eHIGHWAY 2050 ▪ REAL-SMART ▪ PoStaWind ▪ KÄVA2 ▪ REALISEGRID	***T2: Tools to analyze pan-European network expansion options*** ▪ EWIS ▪ Kriegers Flak ▪ ALMACENA ▪ eHIGHWAY 2050 ▪ REAL-SMART ▪ SAMREL ▪ REALISEGRID	***T14: Innovative approaches to improve the public acceptance of overhead lines*** ▪ eHIGHWAY 2050	
Cluster 2: Power technology	***T3: Demonstration of power technologies for increased network flexibility*** ▪ EWIS ▪ Kriegers Flak ▪ Cell controller pilot project ▪ TWENTIES ▪ 220 kV SSSC device for power flow control ▪ SUMO	***T4: Demonstration of power technologies for novel architecture*** ▪ Kriegers Flak ▪ TWENTIES	***T5: Demonstration of renewable integration*** ▪ EWIS ▪ Cell controller pilot project ▪ Development of early warnings systems (PMU/WAMS) ▪ TWENTIES ▪ WAMPAC ▪ ANEMOS Plus ▪ REAL-SMART	
Cluster 3: Network management and control	***T6: Tools for pan-European network observability*** ▪ PEGASE ▪ Cell controller pilot project ▪ Development of early warnings systems (PMU/WAMS) ▪ TWENTIES ▪ A complete and normalized 61850 substation ▪ SAFEWIND ▪ WAMPAC ▪ ANEMOS Plus ▪ REAL-SMART	***T7: Tools for coordinated operations with stability margin evaluation*** ▪ EWIS ▪ PEGASE ▪ UMBRELLA ▪ Development of early warnings systems (PMU/WAMS) ▪ iTESLA ▪ AFTER ▪ ANEMOS Plus	***T8: Improved training tools for improved coordination*** ▪ PEGASE	***T9: Tools for pan-European network reliability assessment*** ▪ EWIS ▪ UMBRELLA ▪ Development of early warnings systems (PMU/WAMS) ▪ AFTER ▪ REAL-SMART ▪ SAMREL ▪ GARPUR
Cluster 4: Market rules	***T10: Advanced tools for pan-European balancing markets*** ▪ OPTIMATE ▪ PoStaWind	***T11: Advanced tools for capacity allocation and congestion management*** ▪ EcoGRID EU ▪ OPTIMATE	***T12: Tools for renewable market integration*** ▪ Belgium East Loop network ▪ EcoGRID EU ▪ Kriegers Flak ▪ OPTIMATE ▪ REAL-SMART	***T13: Tools for the integration of active demand in electrical system operations*** ▪ EcoGRID EU

3.2 DSO activities

The projects in bold are EEGI labelled projects or candidates.

MAP OF THE PROJECT CONTRIBUTION TO the EDSO4SG R&I PLAN			
Cluster 1: Integration of Smart Customers	**D1: Active Demand**	Before 2012	**DG DemoNet Smart LV Grid**; **Building to grid - Smart Grids Model Region Salzburg**; Belgium east loop active network Management; Plug n' play-koncept for intelligent indeklimastyring; Pilot Project Home Energy Management System; REFLEXE; GRIDTEAMS; **MeRegio (Minimum Emission Regions)**; **Smart Watts**; Grid Surfer; Yello Sparzähler online; ADDRESS; Energy Home; Smart Info; 2.1.Meter Data Management system implementation sub project; 2.2. Energy efficiency pilotproject; 2.3. Pilotproject for testing of technologies for Smart homes; 2.4. Posibilities to use shared metering infrastructure for additional services; Smart Metering NTA Roll Out; Fieldtrail Mobile Smart Grid; Jouw Energie Moment (Easy Street & Meulenspie); PowerMatching City II; Intelligent E-Transport Management; The Metering data processing and central repository concept; Introduction of emergency Demand Side Response (DSR) programmes; CC SURE; GAD; EDRP; Orkney Smart Grid; Decentralised customer - level under frequency load shed-ding in Switzerland; **COTEVOS; SuSTAINABLE; INCREASE**.
		After 2012	LINEAR; Electricity demand as frequency controlled reserves; Automation systems for Demand Response; Demand Response medium sized industry consumers; Heat Pumps as an active tool in the energy supply system; Price elastic (Demand Response) power consumption and power production in the industry; The demand side as reserve power in the greenhouse sector; Interactive meters, activating price flexible power consumption; Information and education of the future power consumer; Energy Forecast; Experiments with heat pumps on spot agreement; INCAP; TotalFlex; Enr-Pool; Smart Metering; Green Island - Agios Efstratios; Jouw Energie Moment (Muziekwijk Zwolle); SSMART; Smart Grid Hyllie; Customer led Network Revolution; Hydro Active Network Management; New Thames Valley Vision;.
	D2: Energy Efficiency from Integration With Smart Homes	Before 2012	Consumer to Grid; Project 'Intelligent Home'; Sustainable Urban Living; LINKY; ECOFFICES; ewz - Studie Smart Metering; GAVE; Dynamic Tariffs; Charge Stands; Project 'Intelligent Home'; Sustainable Urban Living; HEAT 07; PREMIO; CC SURE; **COTEVOS.**
		After 2012	Smart Metering proof of concept (1); Smart Metering proof of concept (2); GRID4EU; eFLEX; Information and education of the future power consumer;
Cluster 2: Integration of DER and new uses	**D3: DSO Integration of Small DER**	Before 2012	Isolves PSSA-M; Houses as Interactive Smart Grid Participants; ProaktivNetz; Marina Power Dist. Hub with smart-grid functionality; PREMIO; MILLENER; GREENLYS; **MeRegio**; **eTelligence**; **RegModHarz**; Mini E-Berlin; NET-ELAn; OiDG; InovGrid; Decentralised customer - level under frequency load shed-ding in Switzerland; **COTEVOS; GridBox; IGrenGrid; INCREASE; SuSTAINABLE; More Microgrids; PlanGridEV.**

MAP OF THE PROJECT CONTRIBUTION TO the EDSO4SG R&I PLAN			
		After 2012	Network design and management in a Smart City with large deployment of DER; Generic virtual power plant (VPP) for optimised micro CHP operation and integration; Self-organising distributed control of a distributed energy system with a high penetration of renewable energy; Systems with High Level Integration of Renewable Generation Units; Power Hub; EDGE; Smart Grid In Agriculture - Demonstration Samso; NICEGRID (FR contribution to GRID4EU); Enr-Pool; IRENE; Electricity Mobility Pilot Region of Berlin-Postdam; Smart Nord: Smart Grids for Northern Germany; **PRICE-GDE**; **COTEVOS; GridBox**.
	D4: System Integration of Medium DER	Before 2012	More PV2Grid; ProaktivNetz; EDISON; IPOWER; NextGen; Dynamic Tariffs; The Cell Controller Pilot Project; Regulated Power. OUH; Marina Power Dist. Hub with smart-grid functionality; Development of a Secure, Economic and Evironmentally friendly Modern Power System; System Services from Small-scale distributed energy resources; PREMIO; MILLENER; SMART ZAE; **eTelligence**; **RegModHarz**; Harz.EE-mobility; Mini E-Berlin; Netze der Stromversorgun g der Zukunft; Virtual Power Plant; NET-ELAn; Smart Grids in Greece; ACEA DISTRIBUZIONE CP "raffineria"; ASSM San Severino Marche Tolentino; DEVAL S.p:A. CP VILLENEUVE; ESTER; LATENERGI; Ecogrid.EU; PRODINT; NSGRID; DISCON; OiDG; SMARTGEN; InovGrid; Supermen; SMARTCITY; DER-IREC22@Microgrid; **Swiss2G**.
		After 2012	Meer HEB door DSM; Network design and management in a Smart City with large deployment of DER; META-PV; Generic virtual power plant (VPP) for optimised micro CHP operation and integration; Application of smart grid in photovoltaic power systems; Power Hub; EcoGrid Denmark; Self-organising distributed control of a distributed energy system with a high penetration of renewable energy; Systems with High Level Integration of Renewable Generation Units; Power Hub; Opportunities to use Compressed Air Energy Storage (CAES) for storage of electricity in the electricity system of the future; SAFEWIND; SECOND1; Agent based control of power systems; EDGE; Smart Grid In Agriculture - Demonstration Samso; NICEGRID (FR contribution to GRID4EU); GRID4EU; Enr-Pool; OMERE; IRENE; Smart Nord: Smart Grids for Northern Germany; **Isernia**; INGRID; ENERGOS; **PRICE-GDE**; FENIX; SMART ENERGY; Low Carbon Hub; **COTEVOS; GridBox; IGrenGrid; INCREASE; SuSTAINABLE; More Microgrids; PlanGridEV.**.
	D5: Integration of Storage in Network Management	Before 2012	From wind power to heat pumps; Electricity Storage for short term power system control through dynamic power price; Charge Stands; Smart neighbouring heat supply based on ground heat pumps; Development of a Secure, Economic and Evironmentally friendly Modern Power System; PREMIO; MYRTE; **MeRegioMobil**; Grid Surfer; ADELE; NET-ELAn; E-mobility; Scientific Group Supporting Latvian Activities of the European Strategic Energy Technology Plan; SMARTCITY; STORE; **Swiss2G**.
		After 2012	LINEAR; CED; Meer HEB door DSM; Electrical vehicles impacts on the grids; Electricity demand as frequency controlled reserves; Energy Membrane; CanDan 1.5; Information and education of the future power consumer; IPOWER; ALP-CAES; Opportunities to use Compressed Air Energy Storage (CAES) for storage of electricity in the

MAP OF THE PROJECT CONTRIBUTION TO the EDSO4SG R&I PLAN			
			electricity system of the future; ENERGY MEMBRANE; Characterisation of vanadium-flow battery; Plug n' play-koncept for intelligent indeklimastyring; SmartGrid Ready Battery Energy Storage System; Consumer Acceptance of Intelligent Charging; MILLENER; NICEGRID; SMART ZAE; OMERE; Definition and development of an industry standard for Commercial & Industrial customer meter; Electricity Mobility Pilot Region of Berlin-Postdam; DESI; Green Island - Agios Efstratios; **Isernia**; REDES2025; BRISTOL; New Thames Valley Vision; **COTEVOS; GridBox; IGrenGrid; INCREASE; SuSTAINABLE; More Microgrids; PlanGridEV; SINGULAR.**
	D6: Infrastructure to host EV/PHEV	Before 2012	Isolves PSSA-M; EMPORA; **Smart Synergy Potentials - Smart Grids model region Salzburg**; Vehicle to Grid – Interfaces; Vehicle to Grid – Strategies; E-mobility; EDISON; EVCOM; Smart Grid Task Project; The Cell Controller Pilot Project; Charge Stands; Development of a Secure, Economic and Evironmentally friendly Modern Power System; MPC; **MeRegioMobil**; eE-Tour Allgäu; Grid Surfer; e-mobility; Future Fleet; Mini E-Berlin; NET-ELAn; E-mobility; ESB Distributed Connected Windfarms; ESB EV Network Integration Project; e-Mobility Italy; Use of Electrical Energy in Electrical Vehicles; Demonstration project Smart Charging; Fieldtrail Mobile Smart Grid; REIVE; SMARTCITY; DER-IREC 22@Microgrid; Charging Infrastructure for Electric Vehicles.
		After 2012	HiT; SPARC; CED; Electrical vehicles impacts on the grids; Volt-Air: Where energy meets mobility; ChoosCOM; eFlex; CanDan 1.5; Electricity for road transport, flexible power systems and wind power; IPOWER; Charge Spot; Remote Services for CHP; DREAM; Testcenter; Smart Wheels; Definition and development of an industry standard for Commercial & Industrial customer meter; IRENE; Electricity Mobility Pilot Region of Berlin-Postdam; Green Island - Agios Efstratios; **Isernia**; PRIME; PowerMatching City II; SSMART; **PRICE-GDE**; VERDE; Plug In Places; Low Carbon London; **COTEVOS; GridBox**; **PlanGridEV; SINGULAR; SuSTAINABLE**.
Cluster 3: Network Operations	**D7: Monitoring and Control of LV Network**	Before 2012	Automation and Security of Supply; HEAT 07; DG Demonetz Validierung; Smart Region; Cell Controlle Pilot Project; **eTelligence**; InovGrid; STAR;
		After 2012	Demand Response medium sized industry consumers; Open Node; KACTS SMART GRID; Low Voltage Network Templates for a Low Carbon Future; Ashton Hayes Smart Villages; **DG DemoNet Smart LV Grid**; Houses as Interactive Smart Grid Participants; ProaktivNetz; The Smart Peninsula - Pilot project Of Smart grid deployment at Energa-Operator SA; WAMPAC; **PRICE-GDE**; **GridBox**; **PlanGridEV; evolvDSO; IGreenGrid; INCREASE; SuSTAINABLE.**
	D8: Monitoring and Control of MV network	Before 2012	Smart Region; Cell Controlle Pilot Project; Development of Early Warning Systems; Automatic Receipt of short circuiting indicators; SGEM; MYRTE; **eTelligence**; ETM; ESB Smart Green Circuits; DISCON; InovGrid; REIVE; KIBERnet; Supermen; DCN4TSO; DENISE; STAR; CRISALIDA; TUDOSIS; RTTR; Orkney Smart Grid.
		After 2012	ProaktivNetz; 0.4 kV remote control; SOSPO; A2A CP Lambrate; A2A CP Gavardo; ACEA DISTRIBUZIONE CP "raffineria"; ASM Terni; ASSEM; DEVAL S.p:A. CP VILLENEUVE;

MAP OF THE PROJECT CONTRIBUTION TO the EDSO4SG R&I PLAN			
			SCHEMA; 1. DSO Automation Pilot Project; The Smart Peninsula - Pilot project Of Smart grid deployment at Energa-Operator SA; WAMPAC; **PRICE-GDE**; BIZKAIA; Open Node; Stockholm Royal Seaport; SMART ENERGY; KACTS SMART GRID; Low Voltage Network Templates for a Low Carbon Future; Flexible Networks for a Low Carbon Future; New Thames Valley Vision; **GridBox; IGrenGrid; SuSTAINABLE; More Microgrids; SINGULAR.**.
	D9:Network Management Tools	Before 2012	DG Demonetz Validierung; ADDRESS; More PV2Grid; **Smart Heat Networks - Smart Grids Region Salzburg**; Belgium east loop active network Management; Cell Controlle Pilot Project; Regulated Power. OUH; Service Optimization of the distribution network; Proactive participation of wind in electricity markets; Concept For Management of The Future Electricity System; Zone Concept and Smart Protection Pilot; SGEM; HOMES; MYRTE; SMART ZAE; GRIDTEAMS; **MoMa**; Harz.EE-mobility; Future Fleet; Netze der Stromversorgun g der Zukunft; Grid Integration of Offshore Windparks; ESB Distributed Connected Windfarms; ESB Smart Green Circuits; ADDRESS; STAmi; LATENERGI; ITM; IntDS; Supermen; DENISE; Orkney Smart Grid; **Swiss2G**.
		After 2012	ProaktivNetz; META-PV; Integration and management of wind power in the Danish electricity system; Power Pit; SAFEWIND; ENERGY MEMBRANE; Agent based control of power systems; Control and regulation of modern distribution system; SACSe; SOSPO; EDGE; ESWA; VENTEEA; GREENLYS; NICEGRID; GRID4EU; **evolvDSO;** Enr-Pool; OMERE; Electricity Mobility Pilot Region of Berlin-Postdam; DESI; Smart Nord: Smart Grids for Northern Germany; Smart Grids in 5 Greek islands; Smart Grids in Greece; INGRID; SmartGen; 1. DSO Automation Pilot Projec; SSMART; PAVEWAY; SUMO; ENERGOS; **PRICE-GDE**; Open Node; Low Carbon Hub; Clyde Gateway; Ashton Hayes Smart Villages; Flexible Networks for a Low Carbon Future; Capacity to Customers; FALCON; New Thames Valley Vision; FlexLast; **GridBox; IGrenGrid; INCREASE; SuSTAINABLE; More Microgrids; SuSTAINABLE; SINGULAR.**.
	D10: Smart Metering Data Processing	Before 2012	Building to grid - Smart Grids Model Region Salzburg; Consumer to Grid; Smart Synergy Potentials - Smart Grids model region Salzburg; ZUQDE; AMM; EVCOM; Information from the electricity grid - remote reading; MPC; STAmi; 1. DSO Automation Pilot Project; SMARTGAIN; PROSMART; PQRM; The Metering data processing and central repository concept; DCN4TSO; GAD; Orkney Smart Grid; Decentralised customer - level under frequency load shed-ding in Switzerland.
		After 2012	Smart Web Grid; Isolves PSSA-M; Volt-Air: Where energy meets mobility; Smart Grid Prague; Real-time demonstration test and evaluation of Bornholm electricity network with high wind power penetration; ACEA DISTRIBUZIONE CP "raffineria"; **COTEVOS; GridBox; SINGULAR; SuSTAINABLE;** 2.1.Meter Data Management system implementation sub project; Tertiary Reserve Power With zero CO2 emission; ENERGOS; Customer led Network Revolution; Low Carbon London; Ashton Hayes Smart Villages; Hydro Active Network Managemen; FPP.
Cluster 4: Network	**D11: New Planning**	Before 2012	More PV2Grid; EDISON; The Cell Controller Pilot Project; Concept For Management of The Future Electricity System;

MAP OF THE PROJECT CONTRIBUTION TO the EDSO4SG R&I PLAN			
Planning and Asset Management	**Approaches**		**E-DeMa**; ETM; e-Mobility Italy; POI; ESTER; Scientific Group Supporting Latvian Activities of the European Strategic Energy Technology Plan; Electricity Supply System based on Hydrogen and Wind Energy; LATENERGI; CONREN; NSGRID; OiDG; PQRM; REIVE; DER-IREC 22@Microgrid; SRS; Customer Value Proposition Smart Grid; RTTR; Orkney Smart Grid.
		After 2012	Electrical vehicles impacts on the grids; Smart Grid Prague; EcoGrid Denmark; Integration and management of wind power in the Danish electricity system; 0.4 kV remote control; PRIME; INGRID; Quality & Safety; e-harbours; SSMART; PAVEWAY; SUMO; Tertiary Reserve Power With zero CO2 emission; SGG; SMART ENERGY; PRO-NET; Low Carbon Hub; Clyde Gateway; Ashton Hayes Smart Village; FPP; Capacity to Customers; FALCON; **INSPIRE**; **INCREASE; SuSTAINABLE; More Microgrids; PlanGridEV; SINGULAR**.
	D12: Asset Management	Before 2012	Belgium east loop active network Management; Activation of 200 MW refuse-generated CHP upward regulation effect; SGEM; HOMES; **MeRegioMobil**; **E-DeMa**; ESTER; STAR.
		After 2012	**DG DemoNet Smart LV Grid**; SmartE; Smart Grid Prague; EcoGrid Denmark; ENERGY MEMBRANE; NICEGRID; ASM Terni; ASSEM; DEVAL S.p:A. CP VILLENEUVE; Use of Electrical Energy in Electrical Vehicles; 1. DSO Automation Pilot Project; **GridBox; evolvDSO; SuSTAINABLE**.
Cluster 5: Market Design	**D13: New Approaches for Market Design**	Before 2012	Vehicle to Grid – Strategies; EDISON; Flex Power - Indirect Power System Control through dynamic power price; Service Optimization of the distribution network; Smart Grid Task Force Project; MPC; **RegModHarz**; E-mobility; Scientific Group Supporting Latvian Activities of the European Strategic Energy Technology Plan; Demonstration project Smart Charging; BALVAL; IMPROSUME; PRODINT; NSGRID; The Metering data processing and central repository concept; Charging Infrastructure for Electric Vehicles.
		After 2012	EMPORA; SmartE; The demand side as reserve power in the greenhouse sector; IPOWER; Control and regulation of modern distribution system; System Services from Small-scale distributed energy resources; TotalFlex; Electricity Mobility Pilot Region of Berlin-Postdam; Green eMotion; PowerMatching City II; Ecogrid.EU; VERDE; SRS; Customer led Network Revolution; Low Carbon London; FALCON; New Thames Valley Vision; **COTEVOS; evolvDSO; IGrenGrid; INCREASE; SuSTAINABLE; More Microgrids; PlanGridEV; SINGULAR**.

3.3 Joint TSO/DSO activities

Cluster 5: Enhanced link between transmission and distribution	*TD1: Increased observability of the distribution system for transmission network management and control*	*TD2: The integration of demand-side management into TSO operations*	*TD3: Ancillary services provided through DSOs*	*TD4: Improved defense and restoration plans*	*TD5: Methodologies for Scaling-up and Replicating*
	▪ Belgium East Loop network ▪ Concept of management of the future electricity system ▪ SAFEWIND ▪ ANEMOS Plus	▪ EcoGRID EU ▪ EVCOM ▪ From wind power to heat pumps ▪ Concept of management of the future electricity system	▪ EcoGRID EU ▪ Cell controller pilot project ▪ From wind power to heat pumps- Concept of management of the future electricity system ▪ REAL-SMART	▪ Concept of management of the future electricity system	▪ From wind power to heat pumps ▪ EVCOM ▪ Concept of management of the future electricity system

ANNEX 4. SUMMARY OF EC SUPPORT FOR R&I AT EUROPEAN LEVEL (2005-2013)

Table 4: The tables below summarise past and on-going R&I activities of DSO (budget & EC grant).

Projects (before and incl. 2010)	Budget	EC funding	Start	Duration
DER LAB	4,1	3,1	nov-05	76
ADDRESS	16,0	9,5	jun-08	48-60
OPEN METER	4,1	2,4	jan-09	30
OPEN NODE	5,3	2,8	dic-09	33
MERGE	4,4	3,0	jan-10	24
W2E	4,7	2,9	jan-10	36
MIRABEL	4,5	3,1	jan-10	36
DLC-VIT4IP	5,1	3,5	jan-10	36
HYPER DNO	6,5	4,4	feb-10	36
INTEGRIS	5,6	3,4	feb-10	30
G4V	3,7	2,5	mar-10	18
Smart Watts	25,0	0	Jan-08	48
RegModHarz	16,3	0	Jan-08	48
Smart Watts	1,3	0	Jan-08	48
MeRegio	30,0	0	Oct-08	36
eTelligence	1,3	0	Jan-09	48
e-DeMa	25,0	0	Jan-09	48
SGMS	33,0	0	Jan-10	24
	195,9	**40,6**		

Projects (since 2011)	Budget	EC funding	Start	Duration
GREEN eMotion	42,0	24,2	apr-11	48
GRID4EU	54,0	27,0	nov-11	48
METER - ON	1,8	1,6	jul-12	24
ADVANCED	4,1	2,7	nov-12	24
DISCERN	7,9	4,8	dec-12	36
IGREENGRID	6,7	4,3	jan-13	36
SINGULAR (budget figure is an estimate)	5,0	2,5	dec-12	
Isernia	6,8	0	Jan-12	36
INOVGRID (*)	11,0	5,5		
COTEVOS	5,7	4,35	Set-13	30
PlanGridEV	7,5	4,8	Jun-13	32
PRICE	34,3	0	Jan-13	42
SuSTAINABLE	5,8	3,9	Jan-13	36
evolvDSO	7,9	5,3	Sep-13	40
	206,2	**94,9**		

(*) If we consider the development of the concept the figures will be different (budget: 7, funding: 3,6). This project refers only to Development the concept, excluding Automated Metering infrastructure installation in Évora and in the next phase of deployment in other locations.

Table 5: TSO projects

No	Project	Budget (M€)	EC funding (M€)	Start date	End date
1	EWIS	4,0	4,0	June 2007	October 2009
2	Pegase	13,6	8,6	July 2008	June 2012
3	Safewind	5,6	4,0	May 2008	April 2012
4	Realisegrid	4,2	2,7	September 2008	February 2011
5	Susplan	4,8	3,4	September 2008	August 2011
6	iCoeur	4,8	1,9	January 2009	May 2012
7	Optimate	4,3	2,6	October 2009	September 2012
8	Twenties	56,8	31,8	April 2010	March 2013
9	Ecogrid.eu	20,7	10,3	March 2011	February 2015
10	After	5,1	3,5	September 2011	August 2014
11	Grid+	4,0	3,0	October 2011	September 2014
12	iTesla	19,4	13,2	January 2012	December 2015
13	Umbrella	5,2	3,9	January 2012	December 2015
14	eHighway2050	13,1	9,0	September 2012	January 2016
15	GARPUR	10,9	7,8	September 2013	September 2017
16	InspireGrid	3,6	2,0	October 2013	December 2016
17	Best Paths	66,0	35,5	December 2013	December 2017
	Total	**246,1**	**147,2**	**-**	**-**

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