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ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

WG3 Flexible Generation

ETIP SNET Northern Regional Workshop, Riga
December 7- 8th, 2017

Eric Peirano on behalf of the WG3 chair

ETIP-SNET WG 3 - Organisation

Chair: Michael Ladwig (General Electric, CH)

Co-Chairs:
Jesus Garcia Martin (Iberdrola, ES)
Pascal Fontaine (CMI Energy, BE)

Advisor: Vincenzo Casamassima (RSE, IT)

February 14, 2016 30 WG3 members appointed

March 30, 2017 1st WG3 Workshop in Milano

May 31, 2017 2nd WG3 Workshop in Brussels

WG's Scope

WG1
Reliable, Economic and Efficient Smart Grid System

System aspects and new transmission and distribution technology

- *advanced power electronics technologies*
- *advanced measurement & network sensors*
- *various novel control & protection schemes*
- interfaces to be set-up with storage, demand response, flexible generation and the use of synergies with other energy networks, i.e. how to couple the electricity networks with the gas and heat networks.

WG2
Storage Technologies and Sector Interfaces

All energy storage solution, including

- power-to-X
- hydro and marine storage
- compressed air energy storage
- Heat storage
- Battery storage
- Sector interfaces
- Excl. storage integrated in flexible generation solutions

WG3
Flexible generation

All flexible generation technologies which can provide dispatchable energy to stabilize a vRES-based grid, including

- thermal power plants (incl embedded storage solutions)
- hybrid plants combining RES and thermal plants
- flexible generation solutions based on dispatchable renewable energies (hydro, solar thermal, biomass etc.), if not covered by ETIP Wind and ETIP PV

WG4
Digitalization of Electricity System & Customer Particip.

Use and impact of the Information and communication technologies

- digitalization of networks
- Cybersecurity issues
- Use of big data
- Internet of Things
- High Performances Computing
- ICT infrastructures and technologies
- Virtual power plants

WG5
Innovation implementation in the business environment

Helicopter view of activities carried out in the projects

- To build homogeneity in the analysis of projects, work done and lessons
- To create a common platform for analyzing developments in technologies
- To build a methodology to judge system
- To create a platform for identifying
- To review the relevant BRIDGE
- To search for innovative solutions

Specific Objectives (1/2)

Specific Objectives – WG3: Flexible Generation

WG3 (Flexible generation) addresses the business and technology trends considering

- **the contribution of generation flexibility from thermal power plants (centralized and distributed)**
- **other innovative technologies and solutions in thermal-based high efficiency generation systems (e.g. micro-CHP, industrial co-generation), heat distribution (e.g. district heating)**
- **embedded storage**
- **other dispatchable generation sources (eg hydropower)**

to address the needs for flexibility in the framework of an integrated energy system.

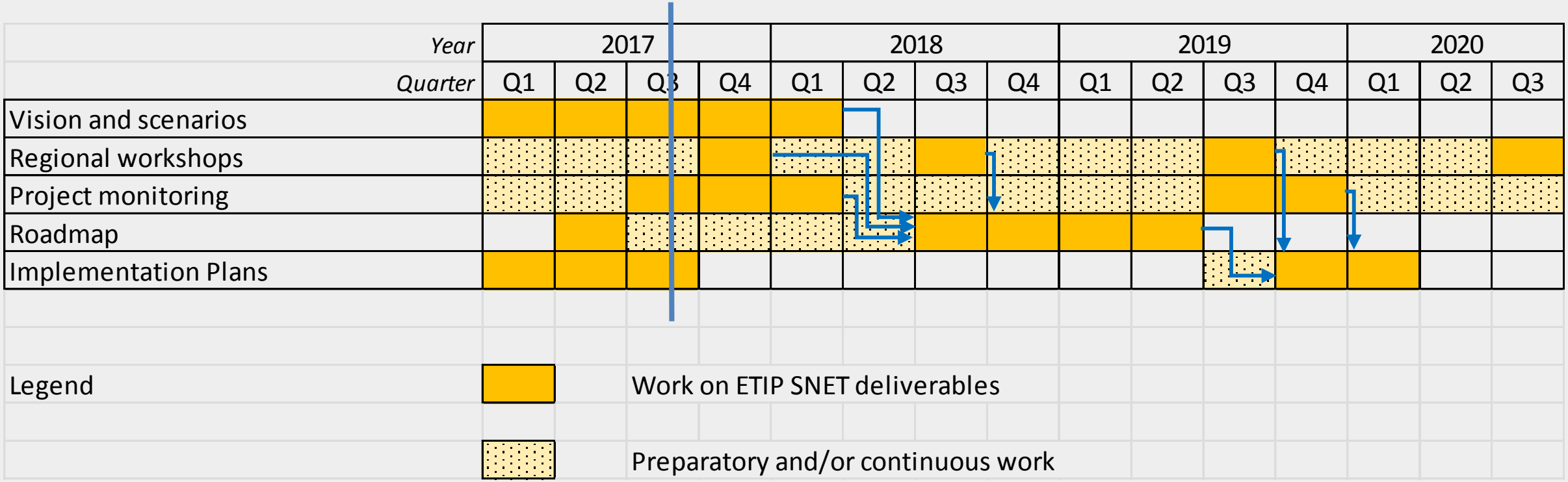
Specific Objectives (2/2)

Specific Objectives – WG3: Flexible Generation – ctd.

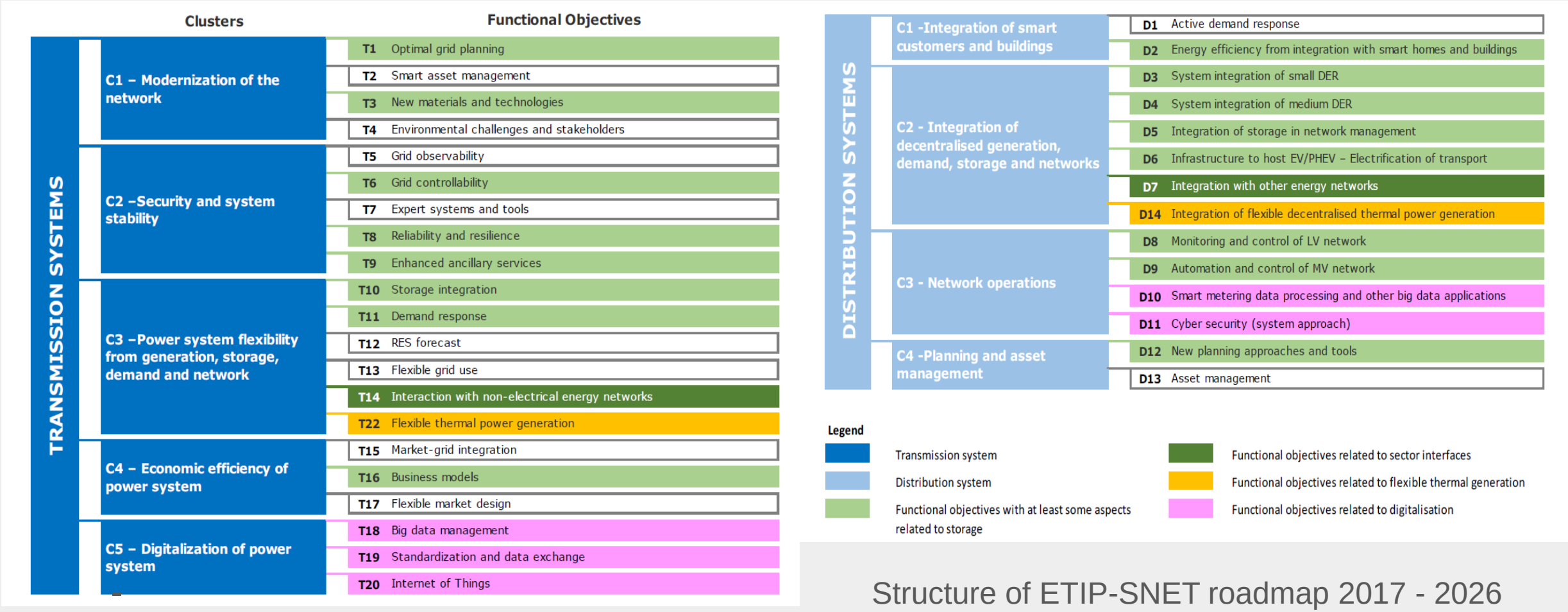
WG3 to address technologies and solutions of

- **the flexible generation (including thermal power plants, embedded storage and hybrid plants) from a technological, environmental, economic, regulatory and acceptance points of view**
- **integrated solutions based on variable renewable energies (solar PV, wind energy and hydro)**
- **energy storage devices**
- **smart technologies focused on the large integration of renewable energies in the network (both, transmission and distribution grids)**

ETIP-SNET Timeline 2017 – 2020



WG 3 to review and extend structure of initial roadmap:



Structure of ETIP-SNET roadmap 2017 - 2026

WG3 Topics in IP (1/7)

Coupling between flexible generation and storage:

Topic #	Topic description	Main FOs	Year	Target TRL
18	Integration of storage in existing thermal generation for increased flexibility	T22, D14	2018	4-7

Research challenges:

- *Thermal energy storage prototype and implementation in overall plant configuration*
- *CO2-cycling for synthetic fuel generation*
- *Integration of power-to-fuel technologies into power plant (generation and storage of renewable fuels*
- *Establish process chain using compressed air, batteries etc. to increase thermal plant flexibility*
- *Interlink fuel generation to other sectors*

Target TRL: ***4-7***

Estimated budget: ***40 – 60 Million EUR (one big demo or multiple pilots)***

WG3 Topics in IP (2/7)

Thermal generation:

Topic #	Topic description	Main FOs	Year	Target TRL
33	Developing the next generation of flexible thermal power plants	T22, D14	2018	3-7
34	Adaptation and improvement of technologies to novel Power-to-Gas and Power-to-Liquid concepts	T22, D14	2018	3-6

Research challenges:

- *Component improvements*
- *Improved operational flexibility*
- *Overall performance improvements (efficiency and emissions) at part load*
- *Enhanced thermal power plant robustness (reduce maintenance and repair costs)*
- *Enable multi fuel operation*
- *Novel monitoring and control*
- *Digitization*

Target TRL: ***3-7***

Estimated budget: ***65 Million EUR***

WG3 Topics in IP (3/7)

Thermal generation:

Topic #	Topic description	Main FOs	Year	Target TRL
33	Developing the next generation of flexible thermal power plants	T22, D14	2018	3-7
34	Adaptation and improvement of technologies to novel Power-to-Gas and Power-to-Liquid concepts	T22, D14	2018	3-6

Research challenges:

- *Combustion systems for stable combustion of gas mixtures with hydrogen up to 100%*
- *Extension of low emission load range*
- *Improving flexible load operation*
- *Improved design of combustor liner to reduce surface exposure to hot gas and radiation*
- *Development of safe hydrogen starting methodology*

Target TRL: ***3-6***

Estimated budget: ***10 Million EUR***

WG3 Topics in IP (4/7)

Variable RES:

Topic #	Topic description	Main FOs	Year	Target TRL
35	Improved flexibility and service capabilities of RES to provide the necessary ancillary services in scenarios with very large penetration of renewables	T6, T13	2018	3-6
36	Enhanced smart RES flexible solutions and control strategies for Power Electronic Converter (PEC) dominated grids	T6	2018	7

Research challenges:

- *Improvement of renewables generators for better adaptation for provision of ancillary services*
- *New control strategies with support services like storage and manageable RES*
- *Instability mitigation of RES, new strategies to define stability criteria in future scenarios*
- *Investigate different energy mix configurations to ensure electrical system stability*
- *Communication protocols with storage systems with PEC*

Target TRL: ***3-6***

Estimated budget: ***25 - 30 Million EUR***

WG3 Topics in IP (5/7)

Variable RES:

Topic #	Topic description	Main FOs	Year	Target TRL
35	Improved flexibility and service capabilities of RES to provide the necessary ancillary services in scenarios with very large penetration of renewables	T6, T13	2018	3-6
36	Enhanced smart RES flexible solutions and control strategies for Power Electronic Converter (PEC) dominated grids	T6	2018	7

Research challenges:

- *Identify qualification and interaction of smart converters*
- *Identify and develop concept of RFM including components*
- *Adaptation of current RFM's and explore additional functions of the future RFMs*
- *Integrate additional protection functions at RFM level*
- *Investigate role of storage systems and different energy mix configurations*

Target TRL: ***up to 7***

Estimated budget: ***40 - 45 Million EUR (4 – 6 projects)***

WG3 Topics in IP (6/7)

Hydropower:

Topic #	Topic description	Main FOs	Year	Target TRL
37	Refurbishment and upgrade of existing hydropower with the purpose of increased flexibility and expanded storage capacity	T9	2018	5-7
38	Environmental impact assessment of hydropower projects	T4	2018	5-7

Research challenges:

- *Medium and large-scale demonstration projects to focus on more flexible hydropower plants*
- *Medium and large-scale demonstrators incorporating technical improvements and planning tools*
- *Smarter compatibility with environmental restrictions*
- *Better utilization of hydro power in sensitive areas*

Target TRL: ***5 - 7***

Estimated budget: ***20 - 25 Million EUR (Topic 37), 2-3 Million EUR (Topic 38)***

WG3 Topics in IP (7/7)

Cross cutting issues:

Topic #	Topic description	Main FOs	Year	Target TRL
39	Digitalisation of flexible, dispatchable generation technologies	T7	2018	5-7

Research challenges:

- *Simulation of plant components and electromechanical system at development and design phase*
- *Predictive maintenance methods*
- *Plant operation optimization based on data analytics*
- *New operative process base on new algorithms and methods (big data; artificial intelligence)*

Target TRL: ***5 - 7***

Estimated budget: ***25 Million EUR (3-5 projects)***

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Any Question, Comment or Feedback?