



**ETIP SNET**

EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM  
SMART NETWORKS FOR ENERGY TRANSITION

**PLAN.  
INNOVATE.  
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# **WG3 Flexible Generation**

**ETIP SNET South Eastern Regional Workshop, Cyprus  
November 23-24, 2017**

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RSE - Italy**

# 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



## Specific Objectives – WG3: Flexible Generation

WG3 to address technologies and solutions of

- **Shifting the management of thermal conventional power plants from base-load (limited flexible capability) to flexible back-up power generation**
- **In future European energy scenario with very high shares of renewables (up to 100%) in the energy mix, system support functions need to be provided by renewable generation or procured from third parties.**
- **RES should significantly contribute to a more stable operation of the future energy system, allowing growing percentage of renewable sources to substitute traditional dispatchable generation.**

**WG3 will address the different technologies and solutions of the flexible generation (including conventional power plants, embedded storage and fuel cells) and RES optimisation from a technological, environmental, economic, regulatory and acceptance points of view.**

## WG 3 to review and extend structure of initial roadmap:

Clusters		Functional Objectives
TRANSMISSION SYSTEMS	C1 – Modernization of the network	T1 Optimal grid planning
		T2 Smart asset management
		T3 New materials and technologies
		T4 Environmental challenges and stakeholders
	C2 – Security and system stability	T5 Grid observability
		T6 Grid controllability
		T7 Expert systems and tools
		T8 Reliability and resilience
	C3 – Power system flexibility from generation, storage, demand and network	T9 Enhanced ancillary services
		T10 Storage integration
		T11 Demand response
		T12 RES forecast
		T13 Flexible grid use
		T14 Interaction with non-electrical energy networks
	C4 – Economic efficiency of power system	T22 Flexible thermal power generation
		T15 Market-grid integration
		T16 Business models
	C5 – Digitalization of power system	T17 Flexible market design
		T18 Big data management
		T19 Standardization and data exchange
T20 Internet of Things		

DISTRIBUTION SYSTEMS	C1 -Integration of smart customers and buildings	D1 Active demand response
		D2 Energy efficiency from integration with smart homes and buildings
	C2 - Integration of decentralised generation, demand, storage and networks	D3 System integration of small DER
		D4 System integration of medium DER
		D5 Integration of storage in network management
		D6 Infrastructure to host EV/PHEV – Electrification of transport
		D7 Integration with other energy networks
	C3 - Network operations	D14 Integration of flexible decentralised thermal power generation
		D8 Monitoring and control of LV network
		D9 Automation and control of MV network
		D10 Smart metering data processing and other big data applications
	C4 -Planning and asset management	D11 Cyber security (system approach)
		D12 New planning approaches and tools
D13 Asset management		

### Legend

	Transmission system		Functional objectives related to sector interfaces
	Distribution system		Functional objectives related to flexible thermal generation
	Functional objectives with at least some aspects related to storage		Functional objectives related to digitalisation

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
19	Towards fully dispatchable RES: Variable RES with Storage	T10, D5	2019	4-7
20*	<i>PV, CSP and storage (title might be reformulated)</i>	<i>tbc</i>	<i>tbc</i>	<i>tbc</i>

*\* Topic 20 is not available yet.*

## ***Research challenges:***

- *Hybrid solutions for optimal combination of RES with storage and manage RES uncertainty*
- *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:***

***Topic 18: 40 – 60 Million EUR (one big demo or multiple pilots)***

***Topic 19: 30 Million EUR***

# 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 Renewable Elexible Modules (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?**

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