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WG3 Flexible Generation

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

Michele de Nigris INTENSYS4EU Project – ETIP SNET Support Team 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)



March 30, 2017

1st WG3 Workshop in Milano



May 31, 2017

2nd WG3 Workshop in Brussels

February 14, 2016

30 WG3 members appointed



Specific Objectives – WG3: Flexible Generation

WG3 to address technologies and solutions of

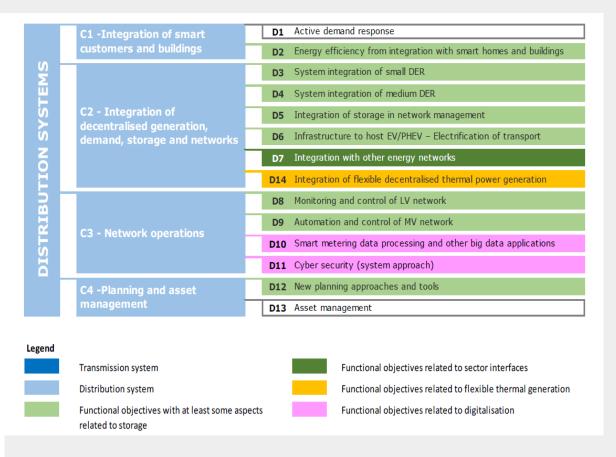
- Shifting the management of thermal conventional power plants from base-load (limited flexible capability) to flexible back-up power generation
- In future European energy scenario with very high shares of renewables (up to 100%) in the energy mix, system support functions need to be provided by renewable 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
		T1	Optimal grid planning
	C1 – Modernization of the network	T2	Smart asset management
		Т3	New materials and technologies
		T4	Environmental challenges and stakeholders
		T5	Grid observability
ก		Т6	Grid controllability
<u>г</u>	C2 –Security and system stability	T7	Expert systems and tools
S	······	Т8	Reliability and resilience
5		Т9	Enhanced ancillary services
I KANSMISSION SYSTEMS		T10	Storage integration
O T O	C3 –Power system flexibility from generation, storage, demand and network	T11	Demand response
<i>N</i>		T12	RES forecast
Σ		T13	Flexible grid use
2 Z		T14	Interaction with non-electrical energy networks
\$		Т22	Flexible thermal power generation
		T15	Market-grid integration
	C4 – Economic efficiency of power system	T16	Business models
		T17	Flexible market design
		T18	Big data management
	C5 – Digitalization of power system	T19	Standardization and data exchange
		Т20	Internet of Things



Structure of ETIP-SNET roadmap 2017 - 2026



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*	PV, CSP and storage (title might be reformulated)	tbc	tbc	tbc				
* Topic 20	* Topic 20 is not available yet.							

- 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



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



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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:3-6Estimated budget:10 Million EUR



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	Т6	2018	7

- 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



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	36	Enhanced smart RES flexible solutions and control strategies for Power Electronic Converter (PEC) dominated grids	T6	2018	7

- Identify qualification and interaction of smart converters
- Identify and develop concept of <u>Renewable Flexible Modules (RFM) including components</u>
- 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)



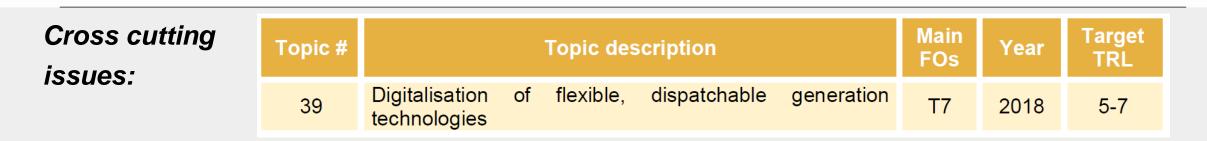
Hydropower:	Topic #	Topic description	Main FOs	Year	Target TRL
	37	Refurbishment and upgrade of existing hydropower with the purpose of increased flexibility and expanded storage capacity	Т9	2018	5-7
	38	Environmental impact assessment of hydropower projects	Τ4	2018	5-7

- 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: Estimated budget: 5 - 7

20 - 25 Million EUR (Topic 37), 2-3 Million EUR (Topic 38)





- 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 - 7Estimated budget:25 Million EUR (3-5 projects)

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Any Question, Comment or Feedback?

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