ETIP SNET

EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM

SMART NETWORKS FOR ENERGY TRANSITION

D3.3 Minutes of the regional workshops 2019

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1. INTRODUCTION

1.1 OBJECTIVES OF THE REGIONAL WORKSHOPS

The Regional Workshops aim at:

- Presenting national and regional RD&I projects of significant added value addressing energy system integration issues, in line with the thematic priorities of the ETIP SNET Working Groups;
- Identifying unsolved RD&I topics and monitoring the implementation of RD&I activities at national and regional levels in Europe;
- Ensuring consistency between national and European views;
- Stimulating knowledge-sharing between stakeholders and among Member States and associated countries, to foster the efficient implementation of RD&I projects all over Europe.

1.2 ORGANISATION OF THE REGIONAL WORKSHOPS

1.2.1 REGIONAL APPROACH

Based on the experience gained during the Grid+Storage workshops organised in 2016, and on the will to stimulate exchanges between stakeholders within different countries, it was proposed to adjust the scope of the different regions and to divide Europe into four parts, as illustrated below.

- Region 1: PT, ES, FR, UK, EI
- Region 2: DK, SE, FI, NO, LT, LV, EE
- Region 3: IT, SL, KR, MT, HU, RO, BG, GR, CY
- Region 4: BE, NL, LU, DE, PL, CH, AT, CZ, SK

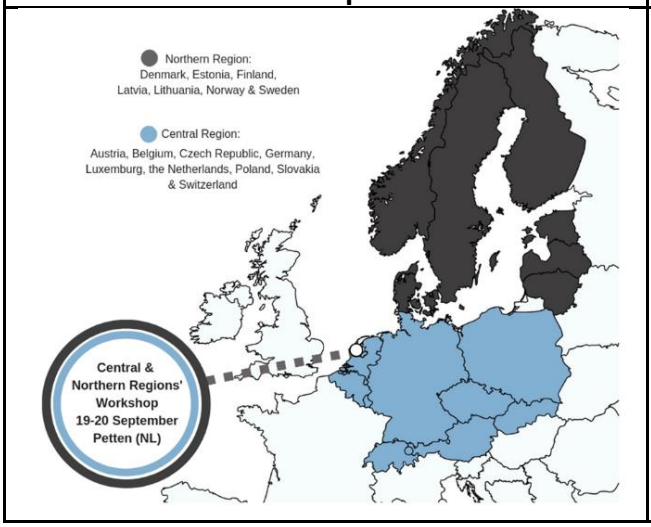
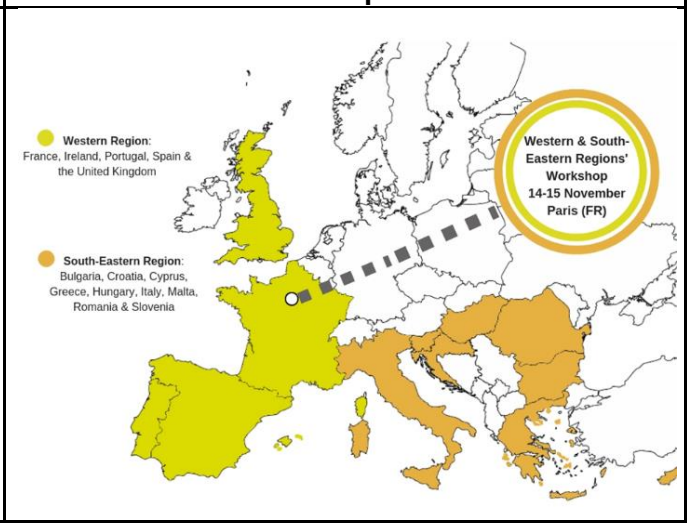
In 2017 and 2018, 4 workshops per year were organised (please see https://www.etip-snet.eu/regional-workshops/).

Based on the feedback from the 2018 regional workshops, the four regions were combined to foster knowledge sharing between regions of similar contexts.

In 2019, two workshops were set between September and December 2019:

- one workshop mixing projects from the central and northern regions and
- one workshop with projects from the western and eastern regions.

Table 1 – Planning for the 2 regional knowledge sharing workshops

Workshop nr. 1	Workshop nr. 2
	

1.2.2 PROGRAMME OF THE KNOWLEDGE SHARING WORKSHOPS

The 2 workshops are held over 1.5 days for the one in Petten and over 2 half days for the one in Paris, according to the agenda below (adjusted depending on logistical constraints and number of projects presented):

DAY 1		
30 min.	*Registration and Welcome Coffee*	
Introduction Plenary session		
10 min.	Host	Welcoming words
10 min.	European Commission	Horizon Europe Presentation
10 min.	ETIP SNET Vice-Chair	ETIP SNET: for an innovative and successful European energy transition
15 min.	ETIP SNET WG5 representatives	Presentation of the scope and activities of WG5. Projects' support during the workshop
Parallel sessions 1 on Projects' results		
	Reliable, economic and efficient smart grid system	Storage technologies and sector interfaces
10 min.	WG1 representative: scope of WG1 + expectations from projects to feed WG work	WG2 representative: scope of WG2 + expectations from projects to feed WG work
20 min.	Project (country), speaker (company) + Q&A (5 min)	Project (country), speaker (company) + Q&A (5 min)
20 min.	Project (country), speaker (company) + Q&A (5 min)	Project (country), speaker (company) + Q&A (5 min)
20 min.	Project (country), speaker (company) + Q&A (5 min)	Project (country), speaker (company) + Q&A (5 min)
30 min.	ETIP SNET support team Roundtable Confrontation of national opinions, collection and prioritization of R&I topics	ETIP SNET support team Roundtable Confrontation of national opinions, collection and prioritization of R&I topics
20 min.	*Break*	
Plenary session: Conclusions from parallel sessions 1, pathways to innovation and ETIP SNET roadmap/IP		
30 min.	ETIP SNET support team	Identification of main recommendations from projects' presentations and roundtables' discussions
30 min.	ETIP SNET WG5	Recommendations from WG5 in terms of "Innovation implementation in the business environment" for the projects presented during the parallel sessions 1
30 min.	ETIP SNET Support Team: ETIP SNET Roadmap / IP	Interactive discussions with the projects on ETIP SNET Roadmap/ IP

DAY 2		
30 min.	*Welcome and Registration*	
Parallel sessions 2 on Projects' results		
	Flexible generation	Digitisation of the electricity system and Customer participation
10 min.	WG3 representative: scope of WG3 + expectations from projects to feed WG work	WG4 representative: scope of WG4 + expectations from projects to feed WG work
20 min.	Project (country), speaker (company) + Q&A (5 min)	Project (country), speaker (company) + Q&A (5 min)
20 min.	Project (country), speaker (company) + Q&A (5 min)	Project (country), speaker (company) + Q&A (5 min)
20 min.	Project (country), speaker (company) + Q&A (5 min)	Project (country), speaker (company) + Q&A (5 min)
30 min.	ETIP SNET support team Roundtable Confrontation of national opinions, collection and prioritization of R&I topics	ETIP SNET support team Roundtable Confrontation of national opinions, collection and prioritization of R&I topics
30 min.	*Break*	

Plenary session: Conclusions from parallel sessions 2, pathways to innovation and ETIP SNET roadmap IP		
30 min.	ETIP SNET support team	Identification of main recommendations from projects' presentations and roundtables' discussions
30 min.	ETIP SNET WG5	Recommendations from WG5 in terms of "Innovation implementation in the business environment" for the projects presented during the parallel sessions 1
30 min.	ETIP SNET Support Team: ETIP SNET Roadmap / IP	Interactive discussions with the projects on ETIP SNET Roadmap/ IP
Conclusion		
15 min.	ETIP SNET Support Team	Main conclusions from the workshop
10 min.	Host	Closing words

1.3 STRUCTURE OF THIS REPORT

For each of the regional workshops, this report gathers the following information:

- List of projects presented, including the link to the slides displayed at the workshop;
- Participants in the different roundtables and statistical analysis of the attendees per country and organisation of origin;
- Main questions raised during the projects' Q&A sessions;
- Summary of the main recommendations from the projects and conclusions from the roundtables;
- Recommendations for innovation implementation in the business environment;
- The results of the interactive discussions with the projects on the next ETIP SNET Roadmap / IP.

2. REGIONAL WORKSHOP IN PETTEN (NORTHERN AND CENTRAL REGION)

The first workshop of the year 2019 was held in Petten, The Netherlands, the 19-20th of September 2019 in the TNO Premises.

2.1 PROJECTS AND PARTICIPANTS IN THE WORKSHOP

2.1.1 R&I PROJECTS PRESENTED

16 R&I projects were presented during the first workshop, as displayed in the table below:

Table 2 – Projects presented at the workshop in Petten

Project	Country	Purpose	Speaker	Link to presentation
Introduction Plenary session				
Dynamic Modeling Energy Pathways project	The Netherlands	The project aims at modelling the system transition, trying to quantify the impact of the solutions w.r.t sustainability ambitions, being able to monitor and manage the transition itself. It is about data acquisition, system description languages, simulation tools and communication about the results in such a way decision maker can base their decisions on it. The modelling approach was applied to the Island case of Ameland.	Richard Westerga	Link
Session on Reliable, economic and efficient smart grid system				
VINPOWER	Finland	The main objective of the VINPOWER project is the development of the expertise based Smart Grid Innovation environment at the University of Vaasa (Living Labs) and a platform focusing on the development of a physical research environment related to smart-grids system. The project provides new knowledge and concepts to the industry and promotes the utilization of new technology in power distribution like improved solutions to the protection and fault location of long MV cable feeder. Relevant use cases were developed for the Sundom Smart Grid Living lab (SSG).	Katja Sirviö	Link
FutureGas	Denmark	The project analyses the gas chain from supply to regulation in order to foresee the future of the gas in an energy transition context: efficient production and use of green gases including potential conditioning to natural gas quality, flexible use of gas also for transport, district heating, system integration, as well as application of measures to ensure an economically efficient use of gas. As a key part of the project, Danish energy system models are improved by including the comprehensive gas system, integration of green gas technologies, storage and smart use of gas, national and international transmission links, as well as improved	Rasmus Bramstoft	Link

		mathematical modelling. Energy system integration is key in this project as well as markets and regulation analyses to provide recommendations. Data are open source and available/applicable for other countries. Results are today used by the Danish Energy Authorities.		
ETIP SNET WG1 "White paper on sector coupling"		Among other activities, ETIP SNET WG1 is elaborating a white paper about "Sector coupling concepts and frameworks". This white Paper intends to be both Tutorial and Position Paper. It will cover and map technologies and processes with technical details including Role of storage for sector coupling, power to heating and cooling, power to mobility and power to carbon-neutral gas/fuels.	Antonio Iliceto	Link
PRIBAS: Pricing balances services in the future Nordic power market	Norway	The objective of the PRIBAS project is the design, development and verification of a multi-market model concept able to compute marginal prices for all physical electricity products in the Nordic power market, including different types of reserve capacity and balancing energy, flexible consumption and local storages. It is a Knowledge building project as basis for future market model development and initial analysis for future short-term market design in the Nordics.	Stefan Jaehnert	Link
Session on Storage technologies and sector interfaces				
Large-Scale Energy Storage in Salt Caverns and Depleted Gas Fields	The Netherlands	The projects aims to provide a technical assessment of the various options for the underground energy storage in the Netherlands. The technologies investigated are the ones that can support the large-scale increase of renewables, secure energy supply, and can be implemented in the subsurface (more efficient way!) and deployed within the next 10-30 years. The choice of the right storage can guarantee flexibility both for short-term (day) and long-term (monthly, seasonal) . Among the different options (P_tG, CAES, Hydrogen…) a technical, economic and spatial analysis is performed also in order to identify possible knowledge gaps. The analysis also includes an evaluation on how much these technologies will contribute to flexibily and security of supply on a regional level. Public acceptance issues and lack of incentives and industry investments are the main barriers to be challenged.	Serge van Gessel	Link
Energy Lab 2.0 & Kopernikus Project "P2X"	Germany	Two projects were presented: Energy Lab 2.0 and Kopernikus. Energy Lab 2.0 is a large-scale research infrastructure for the research on the interaction of components for future (2050) energy systems and the testing of new approaches to stabilise energy grids (with demonstrations until 2030). In order to understand and control such interactions, new methods for simulation and analysis are being developed and tested at the "Smart Energy System Simulation and Control Center" (SEnSSiCC). The SEnSSiCC serves as a central platform for the investigation and development of smart interlinked energy systems in the Energy Lab 2.0 (EL2.0). The focus is on sector coupling. EL2.0 demonstrates the successful integration of RES in the power grid, by a dynamic process to follow the fluctuations.	Michael Klumpp	Link

		The Kopernikus project (integrated inside the EL2.0) aims at exploration, validation and implementation of “Power to X” concepts (from electricity and air to liquid hydrocarbons and synthesised fuel). These technologies have the potential for sector coupling and CO_2 reduction.		
StoreITup-IF	Austria	Developing thermal energy storage is the main objective of StoreITup project (short term).The goal is to create solutions that are scalable (from kW to MW), and to create a flexible charging/discharging system, through heat storage and using phase changing polymers (PCM, Phase Change Material). The main advantage is that the polymers can be compounded, resized (thanks to modular design in order to influence capacity and power), recycled, created and reused by fully sustainable (circular) processes. The goal is to obtain certified polymers, following industrial standards, to be able to enter into the market. The next step is the creation of a demonstration project.	Christoph Zauner	Link
INVADE	Norway	This project delivers a cloud-based flexibility management platform where electric vehicles and battery storages at mobile, distributed and centralised levels are integrated. The platform is tested and verified in 5 pilots in Bulgaria, The Netherlands, Germany, Spain and Norway. New business models were developed related to flexibility management at distributed storage facilities and smart EV charging facilities. The Flexibility Operator (FO) is one of them. Recommendations were provided for regulations and standards for flexibility management using batteries and smart EV charging. The innovative approach in the INVADE project is the exploitation phase which was started from the very beginning (instead of at the end of the project). The key idea was the successful idea of “learning by doing”.	Dieter Hirdes	Link
Session on Flexibility at the level of the network and for conventional generation technologies				
LEAFS	Austria	The aims of the project are the development, field testing and analysis of advanced flexibility schemes for LV networks, based on the integration of loads and electric storage systems. The schemes shall allow the grid friendly activation of flexibility for market services and increase the possible penetration of distributed generation in LV grids. The project is demonstrated by 4 main concepts in fields trials: the first concept implements a separate remote control for grid control and market services to activate flexibility (PV-BESS); the second also uses PV-BESS, but the DSO controls the system as single entity for grid control and provision of market services (not as a market participation but as a platform operator). The third concept is a community storage. The forth is with monetary bonus for end customers.	Johannes Kathan	Link
Flexturbine	Czech Republic	FLEXTURBINE aims to strongly advance state-of-the-art fossil fuel power plant engine technology, enhancing the turbomachinery performances and service life under flexible operation conditions. The project focused on improved flutter-resistant turbine blade design, improved seal and bearing design and improved life	Alexander Wiedermann	Link

		cycle management. The project provides the technology basis for the next generation of flexible turbomachinery essential to enable transition to low carbon-emission power generation.		
FLEXITES	Germany	The project aims at supporting grid integration of RE (Renewable Energy) through a more flexible operation of remaining conventional power generation, thanks to thermal energy storage (TES) systems. Different plant configurations, with different storage schemes, have been studied, to improve load gradients, reduce minimal loads to avoid cold starts, increase the capability to participate in reserve, intraday, day-ahead markets. The project concluded that, despite the proved effectiveness of TES integration, revenues are currently too low to make this solution possible today.	Stefan Zunft	Link
SOFlex'hy	France	The project is about Solar-Wind-Hydro Virtual Power Plant (HPP) and the aim is to give proof of concept of a VPP with existing generation hydro power plants with nearby renewables in a same network area. It is important to create the day-ahead forecasting of the renewables to send it to the HPP in order to fulfil the gap between forecast and real-time states in the right moment. These new services can be provided at a low cost. Cyber-security issues has been analysed and tested for the different stakeholders.	Jean-Francois Balmitgere	Link
Session on Digitisation of the electricity system and Customer participation				
ITCity	Latvia	The ITCity project aimed at developing an Intelligent ICT framework to support EU and LAC (Latin American and Caribbean) cities in their transformation into Smart Cities with key focus on intelligent use of energy and digital services implementation, achieving social, economic and environment sustainable solutions. A functional architecture and structure of a game platform was elaborated, to collect energy consumption data from residences in developing countries. The main goal of the platform is to collect data on energy appliances that make possible the prediction of energy consumption in residences. The platform with gamification principles was created based on the Tamagotchi game principles, with the use of visual elements - an aquarium, where a small fish will evolve or not during the game, depending on successful challenges solving by users by quick answering the questions about energy consumption at home. The implementation in a very large diversity of district and cities allowed the evaluation of the knowledge and increased awareness of citizen about smart cities and specify patterns behaviour.	Ivars Zikmanis	Link
Connected Buildings	Belgium	Beyond the 'Connected Buildings' study, the project aims at accelerating the transition of the energy sector by delivering easy-to-use energy services for consumers and small companies. 'Connected Buildings' was during a period of 6 months involved in the Flux50 Innovator Zone Energy Cloud Platforms. A total package of innovative energy measurements and service models leads to greater	Miha Sajko	Link

		comfort and energy cost savings at home. By using real-time energy data obtained by low-cost sensors and other internet of things data sources, different services for residential users can be provided for home renovation. The 3 key steps are a) the digitization of the energy audit, installing the device and advising the customer on the energy solution and appropriate suppliers, then b) monitor the installation and finally c) validate that it is working to provide a quality assurance.		
WIVE (Wireless for Verticals)	Finland	The WIVE project designed and implemented a communication platform to support a cost-effective development and testing of 4G/5G and IoT technology components for smart grid monitoring, control, and protection in realistic environments. The platform enables more integrated development of new products and services from both energy and communications sides. The platform offers several core, cloud core, and radio access network alternatives and data connections to other test sites across Finland to test wide area services. A wide geographic area was tested: 3 cities separated by hundreds of km, different type of services and infrastructures and 6 pilots connected to each other.	Seppo Horsmanheimo	Link
Cyber-phySicAl security for the Low-VoltAGE grids - "SALVAGE"	*Poland*	The purpose of the SALVAGE project is to develop better support for managing and designing a secure future smart grid. This approach includes cyber security technologies dedicated to power grid operation as well as support for the migration to the future smart grid solutions, including the legacy of ICT that necessarily will be part of it. The objective is further to develop cyber security technology and methodology optimized with the particular needs and context of the power industry. Today, this is to a large extent lacking in general cyber security best practices and technologies. The focus of the project is on smart grid with many small distributed energy resources, in particular LV substation automation systems and LV distribution system.	*Project briefly presented by ETIP SNET Support team based on the initial presentation prepared by Robert Czechowski*	Link

2.1.2 ROUNDTABLES

Four roundtables were held during the workshop, moderated by members of the INTENSYS4EU support team (BACHER, DOWEL, RSE, EASE). The four were devoted to questions and different exchanges between the speakers of the projects presented and the respective representatives of the different ETIP SNET Working Groups. The table below shows the participants in each roundtable.

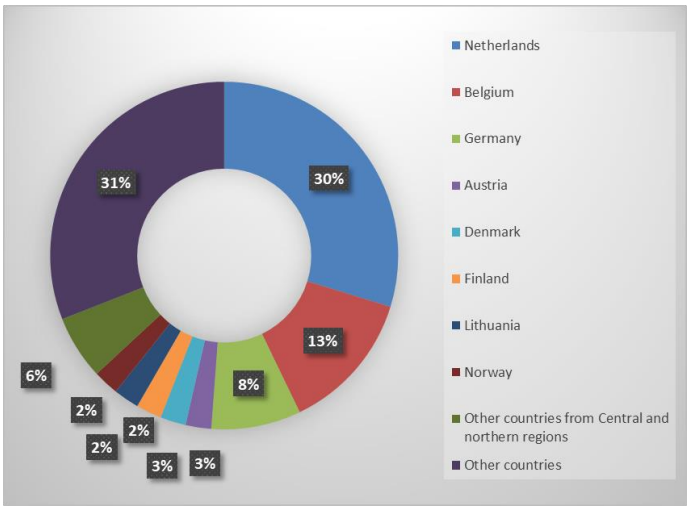
Table 3 – Participants in roundtables at the workshop in Petten

Roundtables	Participants
Reliable, economic and efficient smart grid system	• Gareth Bissell (ETIP SNET WG1 representative) • Antonio Negri (ETIP SNET support team) • Katja Sirviö (University of Vaasa) • Rasmus Bramstoft (DTU) • Stefan Jaehnert (SINTEF Energy Research) • Michael Laubenheimer (ETIP SNET WG5 representative)
Storage technologies and sector interfaces	• Davide Grazioli (ETIP SNET WG2 representative) • Brittney Elzarei (ETIP SNET support team) • Serge van Gessel (TNO) • Michael Klumpp (KIT) • Christoph Zauner (AIT) • Dieter Hirdes (Smart Innovation Norway AS)
Flexibility at the level of the network and for conventional generation technologies	• Alexander Wiedermann (ETIP SNET WG3 representative) • Coralie Badajoz (ETIP SNET support team) • Johannes Kathan (AIT) • Stefan Zunft (DLR) • Jean-Francois Balmitgere (EDF)
Digitisation of the electricity system and Customer participation	• Mark Mcgranaghan (ETIP SNET WG4 representative) • Rainer Bacher (ETIP SNET support team) • Ivars Zikmanis (IPE) • Miha Sajko (June energy) • Seppo Horsmanheimo (VTT) • Esther Hardi (ETIP SNET WG4 representative)

2.1.3 LIST OF ATTENDEES

Around 85 participants were registered for the workshop. The distribution of participants by country is provided in the figure below:

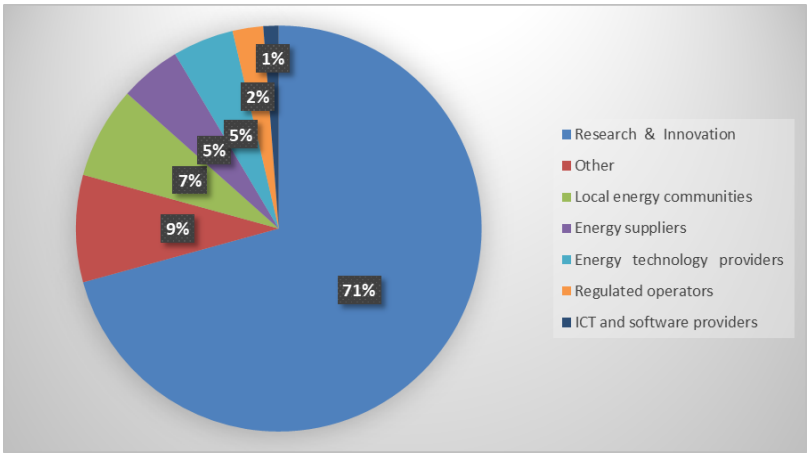
Figure 1 – Distribution of participants by country



The three main countries represented are Netherlands (30%), Belgium (13%) and Germany (8%). 31% of the participants were coming from other countries located outside of the central and northern regions: France and Italy are the most represented.

Moreover, the following figure gives an indication of the distribution of participants by their type of organization[1]:

Figure 2 – Distribution of participants by organization



It can be pointed out that 71% of the audience comes from Research and Innovation Centres 9% from “Other category” (European Commission, ETIP SNET support team) and 7% from local energy communities.

[1] **Regulated operators** are TSOs and DSOs as defined by the Electricity and Gas Directives; **Energy technology providers** gather manufacturers for energy transmission, distribution, generation, conversion and storage; **ICT and software providers** , include software and telecommunication vendors; **Energy suppliers** include energy retailers, energy generators, energy service companies (ESCOs) or aggregators acting in energy markets; **Research & Innovation** stakeholders include research centres, universities, think-tanks, consultants and other stakeholders providing R&I-based services. **Local energy communities** are defined as associations, non-profit organizations, cooperatives, partnerships

2.2 MAIN QUESTIONS FROM THE PROJECTS' Q&A SESSIONS

Each project presentation has been followed by a session of questions and discussions (5 minutes for each session). The main questions and comments are collected in the table below:

Table 4 – Main questions and comments (Petten)

Project	Country	Main Questions & comments
Introduction Plenary session		
Dynamic Modeling Energy Pathways	The Netherlands	▪ *Regulation is leading to involve the technologies. Are sand boxes needed?* This question was asked to the governmental representatives: It appears that sand boxes will not be enough. Sand boxes regulation in NL is clear but not their application.
Session on Reliable, economic and efficient smart grid system		
VINPOWER	Finland	▪ *What is the Sundom Smart Grid living lab?* It is a digital version of the Vaasa region. It regroups Vaasa energy cluster, VEBIC's Smart Grid Laboratory, DSO, manufacturers and 2 000 consumers. Two years-data are collected and could be utilized by R&D of protection relays, verification of relay algorithms, sales purposes, education (universities), customer training (companies) and AI for proactive fault detection. ▪ *Does the Database with the disturbance library have models available or is it just time series DB? Is it possible to develop intelligent applications with them?* Yes. It is extremely important to have new concepts tested. VINPOWER stressed the collaboration between academia and industry but it is usually difficult: it's a technology transfer from Academia to industry. ▪ In *the other way is it really possible to transfer the results in other projects that need to be funded?* In Vaasa, with the living labs, they are trying to pool it.
FutureGas	Denmark	▪ *PtG depends on price of electricity and availability of the price of biomass. Did you analyse different scenarios?* Electricity mix basically set the process and the internal variables in the model (i.e. they can be computed inside the model itself). Availability of biomass is used as an external variable (i.e. input for the model) and depending on the international and national trades. ▪ Another question that may arise is how to use the biofuels for the aviation, sailing and other transport system.
ETIP SNET WG 1 white paper on Sector Coupling		▪ *In the case where TSOs are not subject to cap global costs (CAPEX and OPEX) and the realization of new infrastructures is being remunerated at a very good WACC, how can we talk about optimization in economic terms and not just implement infrastructures*? A cap in global costs is advisable, see the case of TERNA, the Italian TSO. The suitable regulatory framework has to be established, in order to incentivize the best possible use of the economic resources.
PRIBAS: Pricing balances services in the future Nordic power market	Norway	▪ *Have you included the methodology where it is more beneficial to allocate the transmission capacity to the market?* For the exchange between Northern Europe countries, 5% reservation is actually beneficial. More cases have to be run on that. ▪ *Difficult market modelling – how to forecast the market behaviour?* Both social and economic aspects have been considered in the optimization.
Session on Storage technologies and sector interfaces		
Large-Scale Energy Storage in Salt Caverns and	The Netherlands	▪ *Are Biogas storage and ammonia storage considered in the Project?* Biogas storage is considered and has shown to be a really proven technology. Ammonia storage is not considered due to the poisoning issue.

Depleted Gas Fields		▪ *Timing of storage (seasonal or daily) with respect to the economic price for storage?* The parameters involved have been considered. The economic price (also for H_2) is not critical for the storage in itself but the issue is about the production cost. ▪ *What about site mapping?* Subsurface storage and site location/s: all the storage sites available have been investigated and mapped, then based on the characteristics of the site, one of them will be chosen for a real (pilot) project. The Ministry is interested; however, currently the key question for the government is if the Netherlands really need a LSES or not. The technical aspects are now not an issue
Energy Lab 2.0	Germany	▪ *What is meant by "Democratization of energy"?* It means to involve masses of buildings (heat pumps or capture CO_2) and involvement of consumers in the energy system. The energy will not be depending only on the big companies, but people can produce their own energy. ▪ *What about low efficiency of several subsequent conversion processes?* There is always a loss of energy during conversion process. But if the fossil sources have to step out, then the only alternative is a non-fossil - although non fully efficient - process. Of course the pricing is not yet competitive today.
StoreITup-IF	Austria	▪ *How can this solution (PCM) be enhanced?* The need to develop a lot of technology is the main barrier, but customers want to see examples already done and don't want to invest in new solutions. So they are looking for partners and possible applications. An idea to enhance can be to publish some solutions, but of course they have also to be competitive and they cannot publish really everything. ▪ *What happens to polymer at the end of life?* Most parts of the polymer materials are recyclable (see next question) *How long is the polymer lifetime?* Since it is a new technology, it is not possible to know for sure how long it lasts. Nobody has used this kind of storage for 10 years yet. This is still research.
INVADE	Norway	▪ *About open source algorithms*: the algorithms are made by university, but the implementation is not open. This is the challenge: Europe uses to publish the results and to promote the open source, but this does not match with the business issue. There is a need to focus more on this challenge. ▪ *Time of recharge?* In a common garage 20 cars can be parked. Using a smart charging algorithm, the time depends on how many cars are connected at the same time. The charging time will change to avoid to have one car charged and not the others.
Session on Flexibility at the level of the network and for conventional generation technologies		
LEAFS	Austria	▪ *What is the monetary bonuses for customers?* The monetary bonus is given to customers by the DSO for shifting electricity consumption to times of high local PV generation. Customers receive 10ct/kWh for every additional kWh consumed during times of high local PV generation. Customers are informed about the availability of the bonus via a smartphone app.
Flexturbine	Czech Republic	▪ *Is it possible to see a turbine?* there is a demonstration. The TRL was between 5 and 6, most of these developments have been tested in representative situations. In another project called "Turboreflex" we are working much closer to field installation. ▪ *What about flexibility when CCS technology will be connected to the system?* It is a business opportunity. Many parts of industry rely on the carbon (see also the CORETECH project). In many countries coal is phased out but still for a long time it will play a very important role in Europe
FLEXITES	Germany	▪ *Thermal efficiency values are quite low. Why?* The reported values (40-70%) do not refer to storage itself, but are calculated on the basis of the so-called "round-trip" efficiency. ▪ *Participation on ancillary market? Since it's legally decided that fossil fuel will step out, why are fossil-based solutions still studied?* There is a transition time and it is necessary to take action to make it as smooth as possible. Research funding allocated for this project is still necessary because traditional power plants will still be needed and not be shut down immediately. This technology can also be exported.

SOFlex'hy	France	▪ *Is it possible to pump water back?* Yes it's possible if necessary but not implemented in the Proof of Concept. ▪ *Policy makers involvement?* There was some interaction through presentations in congresses. ▪ *This solution has been made available to a set of private plants. If in future it will be made available to all plants, then flexibility will be higher and the profitability should increase. Is this correct?* In principle yes. The application has been done at the level of local network, with the aim of maximizing storage utilization. The diffusion of such VPP will help to avoid or solve congestions.
Session on Digitisation of the electricity system and Customer participation		
ITCity	Latvia	▪ *Is there enough collaboration between social and technical research?* Surveys were performed in this project to understand the consumptions use, the awareness of the citizen in order to understand the key to involve them. ▪ *Was the transcontinental collaboration, easy or perhaps even too complicated (overhead)?* There were of course some issues and it was sometimes difficult to work overseas with the language barrier but there was a real determination to communicate the results, the experience and share the different point of view based on the life habits and infrastructures specific to each cities and districts. This multi-country experience exchange allowed the achievement of quality results. The different behaviour patterns appeared to be quite different with a lot of leverage. It was possible to specify the costumer role. The next step will be to define what is the most convenient ICT tools for municipalities.
Connected Buildings	Belgium	▪ *What's in it for the consumer? How will they see the impact? As an individual what could be done?* One incentive could be to follow the contribution of the customer at a national level. "If we promise you to reduce your bill and that you don't save money higher than you pay us, we give you money back." Today, there is a need to go further and study the links between behaviour and economics.
WIVE (Wireless for Verticals)	Finland	▪ *What is the business model and what are the IP issues?* It will expand as the cities will be more and more connected. There should be a larger collaboration with other EU countries. Anyone should be able to join the service test. Standardization and regulatory from the telecommunication sides define the IoT timeframe: 0.5 minutes are needed to have the required resolution (for smart grid functionality).

2.3 RECOMMENDATIONS FROM THE PROJECTS AND CONCLUSIONS FROM THE ROUNDTABLES

These recommendations and conclusions have been discussed and agreed upon during the specific plenary sessions on Day 1 and Day 2 "Identification of main recommendations from projects' presentations and roundtables' discussions".

2.3.1 SESSION ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 1 "RELIABLE, ECONOMIC AND EFFICIENT SMART GRID SYSTEM"

- Projects should result in sustainable business models (in many cases subsidies are necessary).
- There are alternatives for massive undergrounding of medium voltage network in rural areas. Those alternatives shall be supported by the regulatory framework.
- The Role of PtX in the energy system integration depends on the definition of climate targets, the available biomass that is characterized as being sustainable, a well-functioning market, future electricity prices and a proper and coherent regulatory framework.
- Data availability and domain knowledge are crucial to replicate the power system operation realistically.
- There is a strong need to quantify the real "value" of flexibility.
- Demonstration and Planning: the development of the grid shall be optimized in coordinated manner with development of many other independent actors and sectors: not only generation and load, but also new services and new interfaces.
- System optimization depends strongly on the regulation.
- National funded project could be the basis to launch EU funded project involving other countries and other stakeholders.
- Pilot and/or sandboxes are needed to accelerate the energy transition and should not be related only on technological aspects but also on social/community issues.

2.3.2 SESSION ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 2 "STORAGE TECHNOLOGIES AND SECTOR INTERFACES"

- A lowest marginal-generation cost market approach undervalues storage-based flexibility technologies (Requirements: Time, regionality, quantity) to balance supply and demand.
- Regulatory framework (double taxes, grid fees, ownership, stacking of services) for storage needs to be updated.
- Consider long lead-times for certain technologies: 10 years for P2X (invest now to use it after 2030).
- Utilize only renewable, green electricity (grey in the transition) for carbon-neutral gases and liquids.
- Capture CO2 from ambient air in order to guarantee a closed carbon cycle.
- Scaling up carbon-neutral liquids and gases needs to have reduced CAPEX. But: OPEX = electricity costs + Carbon-pricing.
- "Democratisation" may have value to citizens (own carbon-neutral oil/fuels/gases).
- Polymer PCM heat storages work well (can be compounded; recyclable polymers): Keep them at different hours at different temperatures, thus provide different levels of storage; Store heat as heat; only modularisation allows scaling up (50 … 1000 kWh/m3; 30 EUR/kWh … 200 EUR/kWh).

- Energy efficiency in industry requires a holistic approach (energy efficiency rethought; adapt processes!); consider in particular efficient waste-heat concepts.
- Fossil energy today is still too cheap: CO2-price/tax needed.
- Regulations and standards are needed for business models related to flexibility management (Flexibility operator as aggregator), realized by platforms.
- In flexibility business, focus on the end-user first (for a viable and economic flexibility regime; incentives); Optimize their capacity (kW) or Time-Of-Use (ToU) tariffs; Bundle flexibility with "something": e.g. combine company car renting (during day) with private or tourist renting (after work).
- For flexibility business, put activities of DSO + BRP (Balance Responsible Party) second; First achieve critical mass of end-users; then negotiate with them (no battery ownership of DSO).
- Openness of project results (making data and programs public) is hard to realise due to non-European competition (China).
- It is better to store wind / renewable energy in other forms than loose/curtail it (even accepting the losses due to conversion).
- We need incentives so that politicians are driven by motivated consumers, and not only by DSO: DSO are rather conservative; but consumers want "new things".
- Regulation must be unified among countries (example: pay 5000 EUR/EV; higher CO2-taxes everywhere).

2.3.3 SESSION ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 3 "FLEXIBLE GENERATION"

- Advanced flexibility schemes at Low-voltage level proved to be very effective; however, there are significant barriers for a real-world implementation (regulatory, economic and technical). Moreover, there is a limited willingness of consumers to participate (integration efforts must be low).
- Interoperability, interfaces standardization and efficient monitoring are needed for integration. Community-scale ESS (Energy Storage Services) proved to be quite effective, while PV-BESS (Battery ESS) single consumer-scale are not economically viable.
- There's still a need of fossil-fired power generation, in the transition to low-carbon economy. The main character of the new and/or refurbished generation plants shall be the flexibility (in terms of fuel, load, efficiency, lifetime).
- In particular, advanced gas turbine powered plants are the backbone of future low-carbon power system, thanks to their ability to use "green" fuels and their flexible operation.
- Thermal energy storage (TES) could help improving the generation plants flexibility, in particular as a cost-effective retrofit tool. However, TES application still lack profitability, due to high volatility electricity prices and regulation issues (i.e. flexibility "value").
- VPP (Virtual Power Plant) could be a powerful and very cost-effective tool to locally optimize RES operation with benefit to the grid, taking into account community needs and constraints. An effective VPP type is obtained by combining variable RES (solar, wind) with hydro power plant.
- New regulations are needed, to give appropriate value to congestion avoidance, load shifting etc., thus allowing the definition of suitable and effective business models.
- Carbon emission reduction and, in general, circular economy initiatives will need ASAP a carbon price (at least at EU level), to assess the cost impact in all the involved sectors.

- Blue" vs "Green" Hydrogen: If hydrogen should be the fuel after 2050, we need a lot of RES generation sufficient to produce the (green) H_2. It is still very unclear how we want to realise a fully sustainable cycle for CO2 before 2050.
- To ensure the transition towards a low carbon economy there's a need of new infrastructures. The technical community shall therefore engage the public (citizen, opinion groups etc.) to share such a need and to agree together on the solutions (both at local and central level).

2.3.4 SESSION 4 ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 4 "DIGITISATION OF THE ELECTRICITY SYSTEM AND CUSTOMER PARTICIPATION"

- Lack of customer awareness is major barrier to roll-out of smart solutions. The level of awareness and engagement varies significantly across locations: this needs further study & pilot programmes.
- Customers' motivation still needs to be understood better: this will allow for more effective strategies to 'nudge' customers to implement changes.
- Information sharing between different stakeholders (e.g. energy, ICT, psychology/behavioural economics) is a big challenge. RD&I projects need to bring these different perspectives together.
- End-to-end architecture & integrated decision-making needs buy-in from range of stakeholders (customers, regulators, utilities, etc). This is key to make these solutions work.
- Cybersecurity and data protection issues are important across all applications.
- Information sharing is very difficult in the digitalisation space; the challenge of competition prevents closer collaboration between stakeholders.
- Today there is a huge number of projects with many players involved, different requirements for data exchange/security, different range of different architectures: It is difficult to align and integrate into energy system at scale. But much more efforts need to be undertaken in creating a common End-to-end architecture.

2.4 RECOMMENDATIONS FROM WG5 IN TERMS OF "INNOVATION IMPLEMENTATION IN THE BUSINESS ENVIRONMENT" FOR THE PROJECTS PRESENTED DURING THE PARALLEL SESSIONS

Following the approach of the previous workshops, the active participation of participant projects was fostered both in the definition of main recommendations and in the positioning of the projects in their path to exploitation.

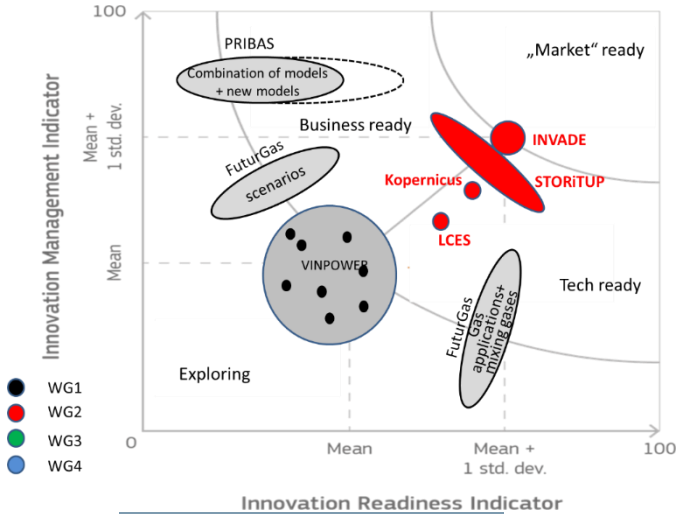
2.4.1 STATUS OF PROJECTS RESULTS' EXPLOITATION

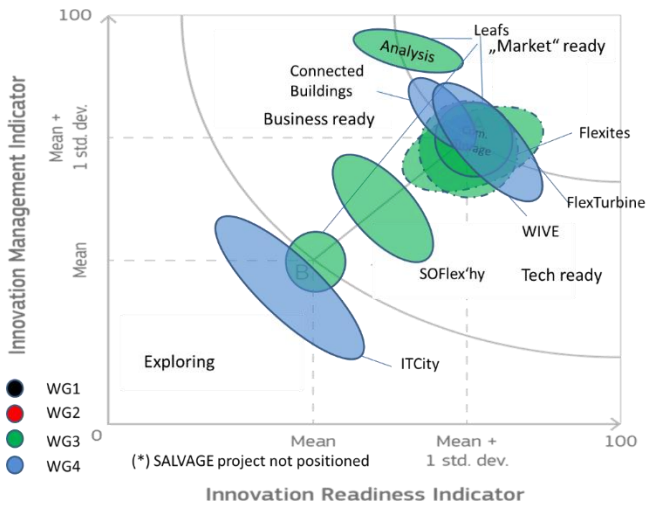
The JRC Innovation Radar methodology and diagram[2] can support consortia in assessing the innovation potential of their outcomes and of their beneficiaries. The full application of the methodology is a quite complex process and requires the calculation of several indicators.

The Innovation radar diagram, that is mapping Innovation management with respect to Innovation Readiness was used as a reference to map the different projects' position.

The final aim was supporting the projects in the understanding of their position with respect to the roadmap to be followed to get their results to the market, to the real economy. During the workshop, the different projects presenters agreed with the WG5 representatives their path to exploitation on the Innovation Radar diagram. The outputs of the work collected from the different projects is illustrated in the figures below. For the sake of clarity, results from the different session topics are reported on different diagrams:

- **Session related to ETIP SNET WG1 topic** "Reliable, economic and efficient smart grid system" in black
- **Session related to ETIP SNET WG2 topic** "Storage technologies and sector interfaces"
- **Session related to ETIP SNET WG3 topic** "Flexible generation"
- **Session related to ETIP SNET WG4 topic**" Digitisation of the electricity system and Customer participation"





[2] De Prato, G., Nepelski, D. and Piroli, G. (2015). Innovation Radar: Identifying Innovations and Innovators with High Potential in ICT FP7, CIP & H2020 Projects. JRC Scientific and Policy Reports – EUR 27314 EN. Seville: JRC-IPTS

2.4.2 CHALLENGES ADDRESSED: HOW CAN WE INFLUENCE; HOW CAN WE RAISE IMPACT?

Taking into account what emerged from the project presentations in Petten, from the roundtables, and from the project positioning on the previous diagrams, the following points can be addressed, and some recommendation can be formulated.

As a whole:

- Consortia reacted positively in the challenge to be innovative sensitive, knowledge building and knowledge sharing.
- Communicating the need for innovation readiness has proved beneficial and consortia are receptive.
- Value proposition and knowledge building of projects to raise impact is critical in R&I. Consortia have shown readiness to respond in enhancing the process. We need to formalise it and provide the means to support.
- Key exploitable results are more in focus with respect to previous ETIP SNET workshops. This work shall be maintained by consortia.
- Market study for the KERs Exploitation is still very limited: it is recommended that projects think beyond the project timeline.
- The project deliverables are still more in the focus of consortia and reviewers: it is recommended to focus more on outcomes and solutions.

2.5 INTERACTIVE DISCUSSIONS WITH THE PROJECTS TO CHECK THEIR COMPATIBILITY WITH THE NEW ETIP SNET ROADMAP

During this regional workshop, ETIP SNET has been undertaking a check of the currently (August 2019) proposed structures (7 Research areas, 14 Functionalities 2030) by the project participants being present at the Regional Workshop.

Some (non-conclusive) points related to the discussions and questions raised during the workshop:

- The presently 14 functionalities are derived from the building blocks defined in the ETIP SNET Vision 2050. In addition, the 36 Functional objectives of the ETIP SNET Roadmap 2017-2026 were reduced to seven research areas simplifying complexity without losing detail.
- Should there be - in the future – new requirements on projects at the proposal stage e.g. to say: “to which of the 14 functionalities will you contribute and how?”; success and failure stories on this could then be collected during project execution.
- “Contributions of projects to functionalities” could be scaled, in order to see how much the functionality has been fulfilled by an individual project. This would allow stakeholders to better see the depth of functionality completion.
- It is currently planned that "Integration Enablers” will be addressed in the Actions specified in the upcoming ETIP SNET Implementation Plan (IP). But first, the roadmap needs to converge on Functionalities 2030 and the Research areas and associated tasks, needed to achieve these functionalities. The approach is a connected approach. Putting functionalities in front of research area is a way to understand where we are going and how to do it.

3. REGIONAL WORKSHOP 2 PARIS (SOUTH-EASTERN AND WESTERN REGION)

The second workshop was held in Paris, France, the 14-15th of November 2020 at the UIC-P, International Union of Railways.

3.1 PROJECTS AND PARTICIPANTS IN THE WORKSHOP

3.1.1 R&I PROJECTS PRESENTED

12 R&I projects were presented during the second workshop, as displayed in the table below:

Table 5 – Projects presented at the workshop 2

Project	Country	Purpose	Speaker	Link to presentation
Session 1: Projects addressing topics within the scope of ETIP SNET's Working Group 1 (WG1): "Reliable, economic and efficient smart grid system")				
InforPv	Cyprus	Innovative Forecasting PV Energy Yield Solution for Sustainable Large-Scale Deployment. The largescale introduction of PV causes stability problems to grid operation, namely because forecasting is difficult. The project proposes an advanced solution to accurate point day-ahead and hour-ahead PV power production forecasting (lower than a 5.5.% state of the art accuracy). InforPv can enable large scale deployment of PV, increase the competitiveness of the technology (both technical and economical) and safeguard the investment. With a 5% absolute forecast accuracy improvement, the loss of revenue can be reduced.	George Makrides	Link
StoreNet	Ireland	The StoreNet VPP demonstration is located in the Dingle peninsula in the southwest of Ireland and controlled by the aggregator in Cork. It involves 20 homes with lithium-ion battery, smart meters with day/night tariffs, 7 of the houses have installed rooftop PV. The point is to design and demonstrate the viability of a VPP as an aggregation platform of distributed energy storages to mitigate the peak demand and provide grid services. The project serves to proof the concept for delivery of grid services from residential assets to facilitate the development of smart energy communities.	Shafi Khadem	**Link**

CATALYST	Italy	Converting data centres in Energy Flexibility ecosystems. Demonstrate that data centres (DC) can and should offer flexibility services to the grid to enhance the reliability of the grid and are suitable hubs coupling the grid with heat network. The project aims to develop a set of tools for DC management system to quantify how much flexibility or heat can be exploited from the data centre and the best strategies for configuration to match the data centre's own consumption.	Giuseppe Laudicina	Link
Session 2: Projects addressing topics within the scope of ETIP SNET's Working Group 2 (WG2): "Storage technologies and sector interfaces"				
SENSIBLE	Portugal	SENSIBLE aims to understand the economic benefits that energy storage can bring to households, communities, and commercial buildings and to explore how best to use energy storage in distributions systems. For example, is it better to work with other households as an "energy community", rather than to operate alone? The community approach can spread and possibly lower the initial investment (by having a single large battery rather than lots of small battery systems), reduce the average energy storage size required per household, and give the end users more "buying power" when negotiating with the distribution system operator (the DSO). The project brings together a team from many areas of the electricity trading sector – equipment designers and manufacturers, system operators, energy market traders, and research organisations, as well as the most important members – electricity users themselves. In SENSIBLE, the electricity users are represented by communities in Nottingham and Évora.	Alexandre Neto	Link
STORY	Finland	The main objective is to show the added value of small-scale storage for a flexible, secure and sustainable energy system and study the impact of large number of storage devices in the energy system and investigate viable business models. 5 demonstrations sites in four countries have been developed in the project, in residential and industrial environments. The demonstrators in the STORY project provide an excellent opportunity to develop methods that can estimate the state of charge of thermal storage units. These methods rely on a combination of temperature measurements and (physical) models.	Andreas Tuerk	Link
MefCO_2	Spain	The MefCO_2 project brings together 9 partners for one mission: to demonstrate the economic feasibility of valorising captured CO_2 by turning it into a versatile platform chemical and renewable fuel such as methanol using hydrogen produced from renewable energy surplus. MefCO_2 aims to produce green methanol as energy vector from captured CO_2 and hydrogen produced using surplus renewable energy. The technology is being designed in a modular intermediate scale, with the aim of being able to adapt it to varying plant sizes and gas composition.	Emeric Sarron	Link
Session 3: Projects addressing topics within the scope of ETIP SNET's Working Group 3 (WG3): "Flexible generation				
sCO_2flex	France	The Supercritical CO2 Cycle for Flexible & Sustainable Support to the Electricity System (sCO2-Flex) aims to adapt fossil-fuel power plants to the future energy system requirements. Conventional plants could foster the integration of renewable energy sources (such as wind and solar) by off-setting their intermittent nature providing fluctuating back-up power and helping stabilize the grid. However, these plants are not currently fit to undergo huge	Albannie Cagnac	Link

		power output fluctuations, as requested in future scenarios with increasingly higher shares of renewables. The sCO2-Flex consortium addresses such challenge by developing and validating a scalable/modular design of a 25MWe Brayton cycle using supercritical CO2 that will enable an increase in the operational flexibility (fast load changes, fast start-ups and shut-downs) and in the efficiency of existing and future coal and lignite power plants, thus reducing their environmental impacts, in line with EU targets.		
PUMHEAT	Italy	To enhance Combined Cycle (CC) power flexibility, the PUMP-HEAT (Performance Untapped Modulation for Power and Heat via Energy Accumulation Technologies) project proposes an innovative concept based on the coupling of a fast-cycling highly efficient Heat Pump (HP) with CCs. The integrated system features Thermal Storage and predictive control for smart scheduling. The CC integration with a HP and a cold/hot thermal storage brings to a reduction of the Minimum Environmental Load (MEL) and to an increase in power ramp rates, while enabling power augmentation at full load and increasing electrical grid resilience and flexibility.	Francesco Roncallo	Link
BestRES	Cyprus	The BestRES (Best practices and implementation of innovative business models for renewable energy aggregators) project aimed to identify the best business models for integration of renewable energy sources in Europe and improve them, taking into account new opportunities and synergies resulting from the evolution of market design, in line with the EU target model. Business models for aggregation of various RES such as wind, PV, biogas, biomass, hydro, Combined Heat and Power (CHP) were addressed and combining this with demand side management and energy storage. The improved business models ready for the market have been implemented / monitored under real-life conditions. The replicability of business models has been verified through European practitioners inside & outside the BestRES Consortium.	Venizelos Efthymiou	Link
Session 4: Projects addressing topics within the scope of ETIP SNET's Working Group 4 (WG4): "Digitisation of the electricity system and Customer participation"				
SIM	UK	The SIM project continuously measured and monitored grid stability – or system inertia – across an entire energy network. Until now, there was no known way to take a continuous direct measurement of grid stability (inertia), so it has always been estimated since more and more generation enters on distribution level. Grid operators use these estimates, which have an unknown error margin in them, for trading renewable and fossil fuel energy, setting multi-year budgets for energy reserve services and long-term investments in grid infrastructure. This technology development is expected to have a considerable impact on the way grid operators around the world manage their systems, potentially reducing costs for both of them and for end customers and reducing carbon emissions.	Jan Ernst	Link
FutureFlow	Slovenia	FutureFlow aimed at designing and piloting models for access of advanced consumers and distributed generators to a regional platform for balancing and re-dispatching services. The project has developed three ICT platforms that connect the field devices with the top level of system operation. These platforms enable real-time participation of the field devices in the most complex TSOs balancing services such as aFRR and were tested in a cross-border	Friedrich Georg Schwarzlaender	Link

		environment. One of those, the aggregation platform, won the joint ENTSO-E and EDSO-E reward for the best Innovation in 2019.		
APC 2020	France	The APC 2020 project (Citizen Photovoltaic Self Consumption by 2020) has studied the keys to develop self-consumption photovoltaics among the inhabitants of the Hauts-de-France Region. This project is part of the "Citizen Researchers" program which brings together citizens and research laboratories. The laboratory has developed a twofold application including a physical model representing self-consumption in a house and a modelling tools adapted to each type of household divided in several “profiles” (according to the type of their houses, their socio-economics background, etc.):. A user-friendly graphical interface makes it possible to model very quickly any user profile encountered in the Hauts-de-France. It makes it possible to obtain the real rate of annual photovoltaic self-consumption of a profile with an accuracy of one minute.	Thomas Roillet and Daniel Marin	Link

During this workshop, there were 12 presentations of projects from France, Italy, Cyprus, Slovenia, United-Kingdom, Ireland, Italy, Portugal, Spain, and Finland.

3.1.2 ROUNDTABLES

Four roundtables were held during the workshop, moderated by members of the INTENSYS4EU support team (BACHER, DOWEL, RSE, EASE). The four were devoted to questions and different exchanges between the speakers of the projects presented and the respective representatives of the different ETIP SNET Working Groups. The table below shows the participants in each roundtable.

Table 6 – Participants in roundtables at the second regional workshop

Roundtable nr.	Participants
1	• Natalie Samovich (ETIP SNET WG1 representative) • Antonio Negri (ETIP SNET support team) • George Makrides (University of Cyprus) • Shafi Khadem (International Energy Research Centre) • Giuseppe Laudicina (Enel X) • Marcel Antal (Technical University of Cluj-Napoca)
2	• Anastasiya Shapochkina (ETIP SNET WG2 representative) • Thomas Otuszewski (ETIP SNET support team) • Alexandre Neto (EDP) • Andreas Tuerk (Joanneum Research) • Emeric Sarron (Carbon recycling international)
3	• Martin Pogoreutz (ETIP SNET WG3 Representative) • Antonio Negri (ETIP SNET support team) • Albannie Cagnac (EDF) • Francesco Roncallo (University of Genova) • Venizelos Efthymiou (University of Cyprus)
4	• Maher Chebbo (ETIP SNET WG4 chair) • Stephanie Petit (ETIP SNET support team) • Jan Ernst (reactive technologies) • Friedrich Georg Schwarzlaender (SAP) • Thomas Roillet (Arts et Métiers Institut of Technology) • Daniel Marin (Arts et Métiers Institut of Technology)

3.1.3 LIST OF ATTENDEES

Around 90 participants were registered for the workshop. The distribution of participants by country is provided in the figure below:

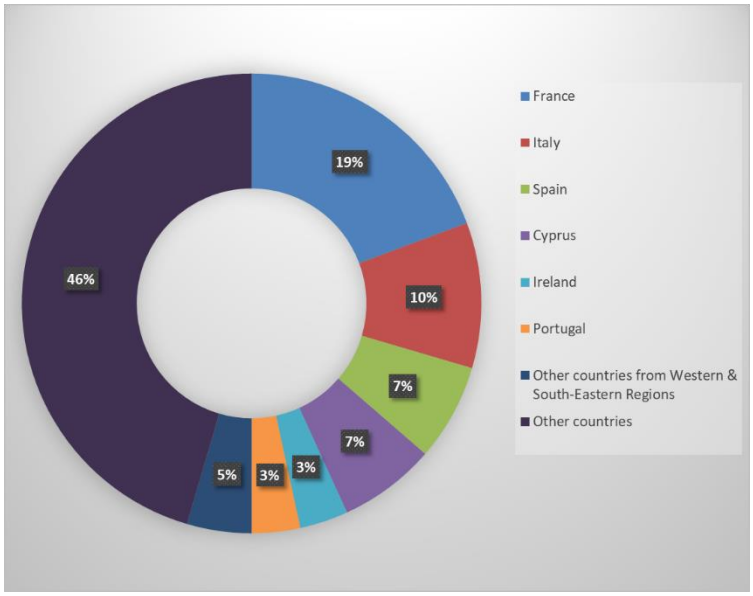


Figure 3 – Distribution of participants by country

It can be noticed that the four main countries represented from the Western & South-Eastern region are France (19%), Italy (10%), Spain (7%) and Cyprus (7%). 46% of the participants are coming from other countries located outside of the western and south-eastern region: Belgium, The Netherlands, Austria and Germany are the most represented.

Moreover, the following figure gives an indication of the distribution of participants by their type of organization:

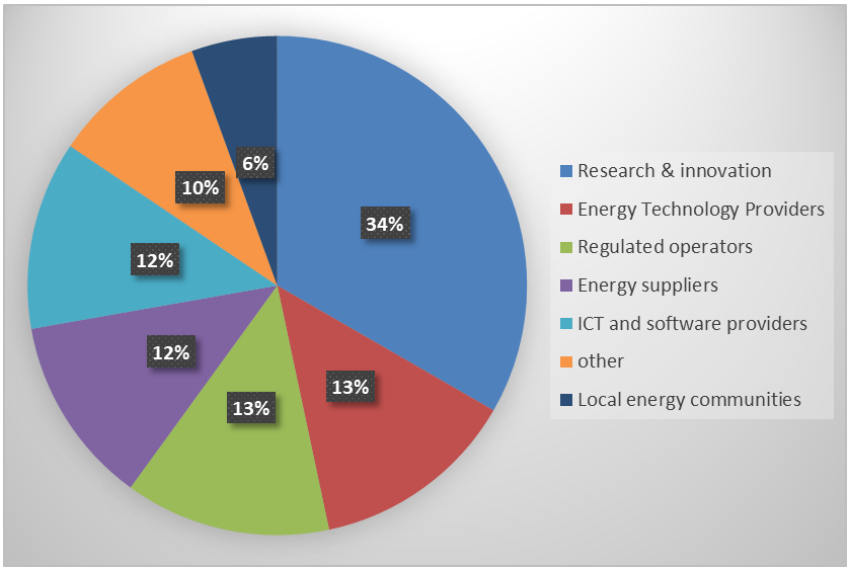


Figure 4 – Distribution of participants by organization

It can be pointed out that 34% of the audience comes from Research and Innovation Centres, 13% from technology providers and 13% from regulated operators.

3.2 MAIN QUESTIONS FROM THE PROJECTS' Q&A SESSIONS

Each project presentation has been followed by a session of questions and discussions (5 minutes for each session). The main questions and comments are collected in the table below:

Table 7 – Main questions and comments by project (Paris)

Project	Country	Main Questions & comments
Session 1: Projects addressing topics within the scope of ETIP SNET's Working Group 1 (WG1): "Reliable, economic and efficient smart grid system")		
InforPv	Cyprus	▪ *Would the 5.5% accuracy apply also to Northern Europe?* The model is trained to operate with more overcast data, more cloud days and less clear sky and 5 to 6% accuracy have been obtained. The test showed the model is quite robust but more data are needed. ▪ *From a market perspective, how much added value is there to gain for the 5.5%?* In the latest studies, including 12 companies in different locations, only a few attended 5%. Please refer to slide # 5 that shows the economic advantage for the utility plant owner. ▪ *How agile is the system, could it do the same for CPV?* There should probably be some adaptions, it has not been tested. ▪ *Which degradation factor do you use?* Important regarding the DSO tool, the year of installation multiplied by a degradation rate factor of 0.7% per year in order to calculate the ageing reduction of the nominal installed PV capacity for each site.
StoreNet	Ireland	▪ *Where do the presented (quite significant) savings come from?* Based on real data being analysed currently in the project on a monthly basis. It builds on the Irish tariff condition. Will have a clearer picture in one year when the full analysis is done. ▪ *Planning to use blockchain tech for peer to peer trading?* It is not being implemented in this project at this stage. The project rather looks at going to the wholesale market. ▪ *Regarding the challenge of consumer engagement, can you share the knowledge?* It is planned to write a white paper addressing the challenges in this context.
CATALYST	Italy	▪ *Regarding the prediction engine, how much time and engineering is required to adapt it to a different size?* The TRL is still quite low (from TRL4 to TRL7), but the goal is to deliver a tool that can interact with different systems not only data centres.
Session 2: Projects addressing topics within the scope of ETIP SNET's Working Group 2 (WG2): "Storage technologies and sector interfaces"		
SENSIBLE	Portugal	▪ *What do you expect from regulation? Can we state that Regulation is not yet here?* The storage ownership issue is to be clarified in terms of use of flexibility from consumer side. The use of flexibility on the consumer side is still not regulated in Portugal. ▪ *Technology part: you performed some control of loads and equipment with the users? What about acceptance from people?* PV inverter were controlled, some clients had batteries, smart plugs, the control was made for robust system. Water heater was controlled when the lower temperature was reached to absorb the energy by the PVs (if surplus). ▪ *What about the acceptance by user side?* Several engagement sessions were set to explain the limit, the goals to users. The acceptance was quite good. The involvement of media (televisions or newspapers…) was there and people participated.

		This project demonstrates change in people behaviour: they understood the benefits for them, and they decided to spontaneously cooperate, and the acceptability was great. The increase of the self-consumption was based on this change. ▪ *Why are the batteries not cost effective for the DSO?* It is not cost-efficient only for Portugal, due to the current regulation and limitation to own batteries.
STORY	Finland	▪ *Issues raised regarding developing of a demonstration and integration aspects. Need to go back to research because the demonstration-maturity is not yet ready? Do we have to wait for more mature research? Or do we have to better design the projects?* For CAES (e.g.) the academic papers tell us it's ready but in the real life it is not that easy. For some demos we should consider different set of actors for designing them. We need more research on interoperability: if a technology didn't work we shall be able to put another one. ▪ *When the things don't work, we often say that maybe regulation is not there. Should we focus on regulation with clear rules?* The point is the long term predictability of regulation. Every government changes regulation and this makes the situation difficult: long term stability is needed for these projects. ▪ *Do you think we are lacking the technicians? Is it an issue to be tackle here?* It's not a problem of lack of expertise but of lack of resources.
MefCO_2	Spain	▪ *Is the methanol used in this way cost-effective compared to other systems (SMR or conventional way to produce it)?* The aim is not to compete with traditional methanol production, due to the fact that CO_2 capture has to be done. The full chain cannot be as competitive as conventional methanol. i.e. the driver for this is the regulatory framework. The competition with the traditional methanol is not the purpose: the aim is instead to occupy a niche that is driven by the regulatory framework. ▪ *What do you mean when you talk about flexibility and load following: what is it referred to? Is it referring to the production of renewable energy for driving the electrolyser, to the production of CO2, to produce the methanol? Then it is not clear if the systems are coupled or decoupled?* The vision of the project is having the possibility to store electricity in a liquid form. The electricity can go up and down in terms of consumption and if we have an excess of production, the electricity that is not used, can be used then to produce methanol. ▪ *About CAPEX of the methanol production: is it per kW or KW/h? N/A Is it the same as for batteries (Price / kWh predominant) or as for PV (Price / kW installed capacity): is subsidisation needed for the methanol production?* There is a trade-off in electrolysis between the efficiency of the electrolyser and the size in capex of the electrolysers. If you want an efficient electrolyser you have to build them very large to decrease the current density and to lower the production costs. In term of electrolysers, the size of capex depends on the size of electrolyser. CAPEX is dominating.
Session 3: Projects addressing topics within the scope of ETIP SNET's Working Group 3 (WG3): "Flexible Generation"		
sCO_2flex	France	▪ *What are the costs compared to different way of generating electricity?* Same costs as the current coal power plant: use of less materials because less footprint, less heat pipes and simpler cycle. The projection shows that it is the same as current plant. Operating cost are the same as well: less combustible, less fuel, less failure, less cost of reliability of the cycle. For the operators' side, there will be not much change, but the market will be modified. ▪ *What about the efficiency and flexibility of ranking cycling?* For efficiency we chose to work on oxide combustion with more than 45% of efficiency and hoping to reach more 58% of efficiency. For now, at 20% of load, more than 30% of efficiency are reached.

		▪ *Up to now, the cycle has been designed as a primary cycle and not a bottom one. Could it substitute some fuel for power plant? Could it be used as combination with steam turbine or heat recovery?* The efficiency of the cycle needs to be between 400°C and 500°C, for the combined cycle, this is a very good design with gas plant. With very hot combustion turbine, to improve the efficiency, it could be tested.
PUMPHEAT	Italy	▪ *In terms of barriers, what is recommended for further future projects?* Trying to better investigate for alternative solutions for next years. The Winter period was a barrier and we encountered some problem with the starting point of the project. The phase change material usage is not well known in Italy. ▪ *With regard to the winter period, what type of temperature are you expecting, knowing that you use the heat pump outputs for district heating?* The DHN that was used for the design of the system was the Turin one, which provides heat at a temperature of 120°C, a second generation DHN. The lower temperature source of the system are the flue gases of the Combined Cycle, that are available at 90°C and exploited at 50 °C, with a minor effect of the seasonal ambient temperature change. This allow to maintain high coefficient of performance all year-round condition, even producing heat at 120°C. The performance in a third generation DHN (T<100°C) will be higher.
BestRES	Cyprus	▪ *Who are the owners of aggregators?* Aggregators mainly work with end-users. ▪ *Who could be subject to be an aggregator, do you think it should be mentioned by the law?* Aggregators do not have a clear relationship with their customers. Aggregators are professionals that can be suppliers. ▪ *Problem of hosting capacities is on DSOs side. Why are you talking about TSOs?* Currently the distribution operators do not have capabilities of balancing, so right now the aggregators are doing the balancing with the TSOs.
Session 4: Projects addressing topics within the scope of ETIP SNET's Working Group 4 (WG4): "Digitisation of the electricity system and Customer participation"		
SIM	United-Kingdom	▪ *About the accuracy: how do you estimate it in other cases (different from the pilots) where you don't have the baseline? How do you compare the accuracy?* The confirmation on accuracy can be given when power problems occur in the grid (e.g. substations burning down): the ratio "power change / known power" allow the system operators to determine – on that event – what inertia was in the system, and hence it is possible to compare the results: the accuracy is very close. ▪ *The question is about the sensitivity to the location: where is the best place to locate the station system?* When you inject the power, the sensitivity of the signal that is distributed to the grid has a very long range and our internal data processing allows to detect the signal that we injected. Anyhow, to be more conservative, the best location is to put the measure in central and stronger location of the grid. ▪ *About the business metrics?* It may still be too early to really identify the full business matrix behind it. Since it is a new technology, the system operators are not experienced yet and they still need time to collect and analyse the benefit of this metric, they can quickly come to the conclusion on how much money can be saved, spent or invest to secure the grid. Putting the project in the metrics is quite difficult. The assumption is that, based on the money spent today for being more conservative, the deviation between the money spent for program and the money potentially saved is quite high. ▪ *What should the grid operators do when this threshold is getting too low? Can your technology detect it? What about complementing inertia of rotating machines by voltage stiffness of batteries? Did you plan to do something in this area and when do you think this would be needed?* Within the national management of the system, some initiatives are running on the national (UK) grid stability, (f.e. Stability Pathfinder and VSM group) and they are looking on how to change the grid code

		regulation and to identify technologies to provide this kind of services. The Inertia measurement technology can enable these activities with the data provided (to better figure what is required on the grid). The measurement technology in the future requires huge energy storages (super capacitors) to inject the power changes. The team is working on developing/simulating the rotating machine that can be utilized from the Supercapacitor device simultaneously to providing the measurement service. There is still a long way to go to improve non-synchronous machines to contribute to the inertia (because of physical conditions issues). There is a commercial nationwide programme with National Grid (next year to go live) about installing a huge amount of energy storage into the grid to stimulate the power change pulse.
FutureFlow		▪ *In the project presentation, 16 companies and 4 countries have been mentioned: How are the 16 companies spread across the 4 countries?* most of them came from Slovenia and Austria, Hungary also. For more information see the deliverables of the project. ▪ *About using the blockchain: is there consensus among the partners in using this technology?* Some discussions are ongoing on the approach and on how to improve security. ▪ *Again about security aspects, how to avoid double counting of flexibility?* You have to automatize the monitoring and checking the procedure by some market operators or regulators (or DSOs). Blockchain could help in this monitoring action. Keep it transparent is also important.
APC2020		▪ *How did you define the customer profile?* 4 profiles have been defined thanks to a survey with 20-30 questions addressed to 1 thousand of contacts (contacts gathered by the association – about 15% of them answered). Based on the answers (surface of the house, consumptions, number of people living there, eco gestures etc,.), it was possible to define if households were ready to have PV in the house. ▪ *Not everyone is ready to use this kind of tools and systems. What could be the leverage to spread this solution?* During the project, we discovered with the associations that many things can be done manually and very easily: it is the first step to engage the customer and have an energy-efficient home. From the customer point of view, the payment/budget to have this kind of system is a barrier. In this project, the customer were the owners and they were already able to pay for PV, batteries or EV systems. It is assumed that in 2 to 10 years, they will be able to buy heavier systems. ▪ *The project now focuses on single buildings, but the next step is to deploy the solution at the city level. In between there is the grid. Does the presented approach is also looking into the grid to optimize the self-consumption?* For the purpose of this presentation, only the interface has been shown but it is also possible to see all the details about peaks, energy exchanges, time, etc. The next step is to know where the distribution grid is and to adapt the approach to it. Another project (with Enedis) is under discussion to have data from the DSO's point of view and to adapt it to new buildings. In addition, the solution can be upgraded and apply to a larger scale (→ the scale of cities), not only for small home. A work is on-going with the city of Lille. The scale of the smart city will allow to improve other aspects, e.g., for a bigger demo of EV charger (DC charger). ▪ *Who should use this simulator?* Simulations can be done in 1-2 minutes and have been proposed to Associations, even if they prefer to have data with excel diagrams, because the tool is not so complicated to use. In many cases, it makes it possible to answer to all citizens of Northern France and advise them on the equipment that can be used and to what extent. For the moment the model is used in the lab and we are working with the Associations, using excel graphs, to demonstrate/orient citizens & politics (during dedicated meeting) on how it works and to answer about their consumption etc.

3.3 RECOMMENDATIONS FROM THE PROJECTS AND CONCLUSIONS FROM THE ROUNDTABLES

These recommendations and conclusions have been discussed and agreed upon during the final wrap-up session of the workshop.

3.3.1 SESSION 1: ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 1 "RELIABLE, ECONOMIC AND EFFICIENT SMART GRID SYSTEM"

R&I needs:

- Field data: to have an accurate forecast.
- Forecasting standards: to respond to interoperability problems.
- Developing innovative business case: for the benefits/value proposition of all involved stakeholders (Aggregator, DSO, Utility supplier, Consumer).
- Identification of efficient ways to motivate consumer to become energy active consumers/prosumers (Introducing local ambassador, developing easy to use platforms and make evident the economic benefits).

Regulation needs:

- Harmonization between EU28 countries.
- Developing a homogeneous framework for the participation of the demand side.
- Developing new markets (heat) and allow the participation.
- Focusing on services more than products and think services based on value chain creation (*vs* grid operation architecture). To do this we need to bring enabling technologies on ICT and IoT level.
- Integrating in the design stages of plant and installations provision to participate to the demand side management (energy and heat).

3.3.2 SESSION 2: ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 2 "STORAGE TECHNOLOGIES AND SECTOR INTERFACES"

R&I conclusive facts:

- Losses in MV- and LV-grids can be reduced significantly with the right MV- and LV-storage design and operation.
- Self-consumption can be increased up to 67% (of which 26% by storage) and by that: savings of 25€/month (but no payments for PV capacity by prosumers demo).
- Batteries can be used (Up to 1 hour long proven) for islanding operation of LV and MV.
- The communication signals for Inverter and DSO operation may be conflicting (frequency of signals).
- Costs for control and communication is too high (for mass use). Masses of use cannot afford such high costs; costs must be reduced.
- Valorisation of storage must be clarified for everybody involved.
- Storage efficiency is low with losses increasing : additional energy may be needed for cooling & heating which may increase GHG/CO_2- emissions.
- The country specific starting point may be very different and case-dependent.
- More Demonstrations are needed for CAES (TRL must be increased; is still too low).

- Commercial business case for CO_2-neutral, liquid methanol is already given. But big equipment is not any more fundable (too high capex, goes up exponentially for larger equipment).
- GHG accounting in the context of CO_2-neutral Methanol production must be clarified.
- Thermal storage technology challenges: Time lags of thermal parts must be considered in the right way.
- Aggregation and aggregators are not yet widely understood by the consumer and market.

Fundamental issues regarding the legal basis for the demos:

- Ownership of ESS still unclear.
- There are no incentives yet for implementation of ESS based emergency solutions by DSO.
- For some countries there is no legal basis for Energy Community given; DSO cannot own or operate batteries; this must be clarified.
- The demos must be done with the right Research beforehand.
- Systems perspective is key: who invests must have the right incentives from a regulatory point of view.
- Control of system should adapt to legislation.

3.3.3 SESSION 3: ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 3 "FLEXIBLE GENERATION"

- Supercritical CO_2 cycle could beneficiate several markets, i.e., Heat recovery (due to the small size of the cycle), Decentralized small/medium power generation (10 – 500Mwe), Concentrated solar powerplant, Thermal powerplant (coal and gas), Biomass powerplant, thermal power plant.
- Combined cycle plant (for example a fast cycle heat pump and thermal energy storage) can increase part-load efficiency, reduce the minimum environmental load and increase power ramp rates, enhancing the flexibility of the system.
- A robust legal framework that ensures fair market access for aggregators is crucial. Aggregators shall be among the parties that are able to access the data of final customers.
- Aggregators are important market players when it comes to the market participation of consumers and energy communities and to facilitate the flexibility of the market.
- Local energy communities have to be entitled to share electricity from generation assets within the community based on market principles using ICT services.
- The public acceptance will arrive with the good education starting from school. More meetings with locals are needed to push for better acceptance of new infrastructures.
- New technologies shall be supported by significant funding that need enlarged partnerships.
- Hydrogen could be a vector for the future transition: blue hydrogen can be used within existing infrastructure or could stimulate adaptation of technologies to use hydrogen.

3.3.4 SESSION 4: ADDRESSING TOPICS WITHIN THE SCOPE OF ETIP SNET'S WORKING GROUP 4 "DIGITISATION OF THE ELECTRICITY SYSTEM AND CUSTOMER PARTICIPATION"

- **System Stability: Inertia can be directly measured**
  - This enables grid operators, and countries, to operate the system in a secure way while deliver on their decarbonization targets (by more RES).
  - Use Load banks to inject a power signal to the grid to stimulate minimal power changes lead to frequency changes (modulated frequency approach) which can be measured to determine the Inertia in real-world systems.
- **Pan-European wholesale market: By aggregated DR&DG units, the project achieved (mostly in simulation mode)**
  - Fast, reliable, technically and economically competitive aFRR (automatic Frequency Restoration Reserve) service for the energy market (energy and cost savings 30% of demand).
  - ACE (Area control error) quality performance indicator can be improved by regional cooperation.
  - Regional market gets increased market liquidity compared to several fragmented local markets. They can increase price convergence even between the different countries (25% price reduction).
  - Cross-border balancing market setup is not always the best solution and shall not be done on total available capacity. For some cases: late Flow-based capacity recalculation for the needs of balancing (PTDF) can be better but it is case-dependent (CZ).
  - Investment cost of 75'000 EU/MW is low compared to a Tesla battery 100 MW: 660'000 EUR/MW.
- **System stability – Local markets**
  - 50% Self-Consumption (SC) is possible by management with 1 Minute time interval modelling.
  - 70% SC can be reached by the right stationary battery and hot water tank Storage + Electric vehicle charging.
  - Right SC can decrease Electricity Bill (excludes investments) by 20% and leads to 20% less CO2 emissions/year (but depends on CO2-emissions beforehand).

3.4 RECOMMENDATIONS FROM WG5 IN TERMS OF "INNOVATION IMPLEMENTATION IN THE BUSINESS ENVIRONMENT" FOR THE PROJECTS PRESENTED DURING THE PARALLEL SESSIONS

Following the approach of the previous workshops, the active participation of participant projects was fostered both in the definition of main recommendations and in the positioning of the projects in their path to exploitation.

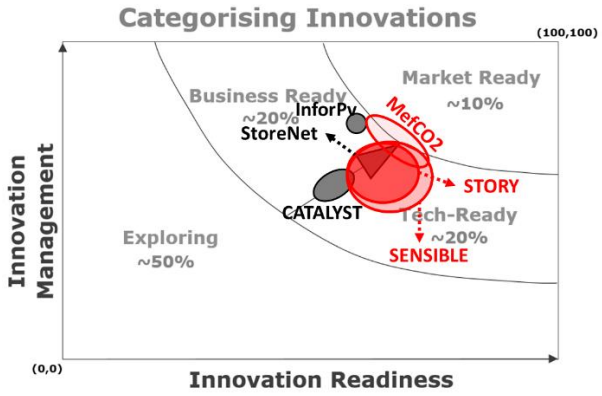
3.4.1 STATUS OF PROJECTS RESULTS' EXPLOITATION

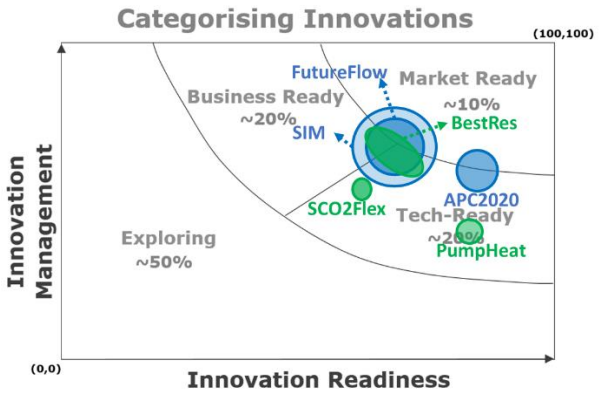
The JRC Innovation Radar methodology and diagram[3] can support consortia in assessing the innovation potential of their outcomes and of their beneficiaries. The full application of the methodology is a quite complex process and requires the calculation of several indicators.

The Innovation radar diagram, that is mapping Innovation management with respect to Innovation Readiness was used as a reference to map the different projects' position.

The final aim was supporting the projects in the understanding of their position with respect to the roadmap to be followed to get their results to the market, to the real economy. During the workshop, the different projects presenters agreed with the WG5 representatives their path to exploitation on the Innovation Radar diagram. The outputs of the work collected from the different projects is illustrated in the figures below. For the sake of clarity, results from the different session topics are reported on different diagrams:

- **Session related to ETIP SNET WG1 topic** "Reliable, economic and efficient smart grid system" in black
- **Session related to ETIP SNET WG2 topic** "Storage technologies and sector interfaces"
- **Session related to ETIP SNET WG3 topic** "Flexible generation"
- **Session related to ETIP SNET WG4 topic** "Digitisation of the electricity system and Customer participation"





[3] De Prato, G., Nepelski, D. and Piroli, G. (2015). Innovation Radar: Identifying Innovations and Innovators with High Potential in ICT FP7, CIP & H2020 Projects. JRC Scientific and Policy Reports – EUR 27314 EN. Seville: JRC-IPTS

3.4.2 CHALLENGES ADDRESSED: HOW CAN WE INFLUENCE; HOW CAN WE RAISE IMPACT?

When taking into account what emerged from the project presentations in Paris, from the roundtables, and from the project positioning on the previous diagrams, the following points can be addressed, and some recommendation can be formulated:

As a whole:

- Consortia are well prepared and aware to innovation readiness approach and responded positively
- Template for projects presentation have proven to be highly beneficial for lessons learned and key exploitable results to be outreached.
- Discussions with consortia were productive, constructive and to the wright direction (scalability, replicability and next steps)
- Benefits of this discussion proves to be beneficial for all
- TRL and Energy market readiness are non-directly connected

Moreover, recommendations were provided on how projects can be more proactive in support of their communication of results achieved to foster their targeted endeavours for ultimate evolution of their work to the level of utilization / implementation in the business environment and the real economy :

General recommendations towards projects willing to communicate about their results to push for their exploitations

- Prepare a presentation "solution oriented":
  - Focus on main results of the project
  - Identify the Unique Value proposition or the Key Performance Indicator
  - Regarding the challenge to be addressed by the project: specify what is the actual difficulty, who faces it?, describe the solution developed/tested (is there a market for the solution?) and its Unique Value Proposition (why is it different, why is it better, why is it worth 'buying') and concentrate on the essentials (less is more)
  - Focus on the exploitation paths by looking beyond the end of the project in two directions: for low TRL projects to identify research horizon ahead and for high TRL projects identify the road to utilization / exploitation in the business environment or wider economy
  - Indicate SMART Objectives: Specific, Measurable, Achievable, Realistic/relevant, Time-bound

- Prepare a presentation "communication oriented":
  - Adapt project reporting/presentation to the audience, use their language
  - Involve "commercial" persons, involve customers and users
  - Consider the whole value chain (the different business models, where the materials come from, who will produce)
  - Proposal to follow the "lean canvas model" to develop a "business" model

Regarding the next steps for the ETIP SNET WG5, a commitment to continue to build a closer relation to the projects was formulated as the WG5 is:

- trying on improving the availability of data and projects results through dedicated platform;
- creating working teams to provide analytical and exploitable knowledge through the platform.

3.5 INTERACTIVE DISCUSSIONS WITH THE PROJECTS TO CHECK THEIR COMPATIBILITY WITH THE NEW ETIP SNET ROADMAP

During this regional workshop, the path from "ETIP SNET Vision 2050" towards "ETIP SNET Implementation Plan 20-23" has been presented in the introduction session, with a highlight on the draft status on the 'ETIP SNET Roadmap 2020-2030' as of November 12th. At the end of parallel sessions, interactive discussions with projects and session moderators allowed to identify to what 'Functionalities in the energy system by 2030' each project contributes and what are the Research areas contributing to these functionalities.

RDI-level and Functionalities for each project have been gathered as showed in the figure below (R for research, D for demonstration and I for innovation).

WG	Project does Research, Demonstration or Innovation/ Deployment	1 CONSUMER & PROSUMER FOCUS	2 SYSTEM ECONOMICS	3 DIGITAL APPLICATIONS	4 PLANNING - HOLISTIC ARCHITECTURES	5 SYSTEM FLEXIBILITY	6 SYSTEM OPERATION	7 ASSETS AND MATERIALS
		_RA1	_RA2	_RA3	_RA4	_RA5	_RA6	_RA7
1	INFORPV (Cyprus)	i	d	r	R	d	d	d
1	StoreNet (Ireland)	D	I	D	D	R	I	
1	CATALYST (Italy)	R	D	D	D	D	D	
2	SENSIBLE (Portugal)	D	D			D		
2	STORY (Finland)	D	R	D	R	D	D	
2	MefCO2 (Spain)		I			D	I	I

Figure 5 Research areas and RDI-level reached by projects presented during sessions 1 & 2

Project contributes to Functionalities (High,Medium, Low; H-M-L	F1 **Cooperation** between system operators	F2 **Cross-sector** integration	F3 Integrating the subsidiarity principle - **The customer at the center**	F4 Pan-European **wholesale markets**	F5 Integrating **local markets** enabling citizen involvement	F6 Integrating **digitalisation services** (including data privacy, cybersecurity)	F7 **Upgraded electricity networks**, integrated components **and systems**	F8 Energy System **Business** (incl. models, regulatory)	F9 **Simulation tools** for electricity and energy systems (SW)	F10 Integrating **flexibility** in generation, demand, conversion and storage technologies	F11 Integrating efficient **heating and cooling** for buildings and industries	F12 Integrating efficient carbon-neutral **fuels & electricity for transport**
SCO2Flex (France)	M	L	H		M	L			H	M		
PUMPHEAT (Italy)		L								H		
BestRes (Cyprus)			H		H	L		H				
SIM (UK)	M	L	L	L	L	H	H	M	H	H		
FutureFlow (Slovenia)	H	H	M	H	H	H	H	H	H	H	M	M
APC2020 (France)		L	H	L	H	M	M	H	H	L	H	H

Figure 6 Level of contribution of projects to functionalities (sessions 3 & 4) (H: High impact; M: Medium Impact; L: Low impact; Empty: No impact)

The discussions at the regional workshop in Paris will be considered by the ETIP SNET Core Team in the preparations towards the upcoming ETIP SNET Roadmap 2020-2030 and the ETIP SNET Implementation Plan 2020-2023.

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