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EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

Storage technologies and sector interfaces

STORY project

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A vision of our future energy system

General project information

The main objective is to show the added value storage can bring for a flexible, secure and sustainable energy system.

- Duration: 5/2015 to 4/2020; Budget: 15,8 million Euro
- 18 partners from 8 countries,
- Six demos in four countries
- Diversity of technologies and actors
  - TRL 5 to 7
  - Interoperability and ICT (e.g. LORA)
- Understand economic, environmental and social impact
- Investigate viable business cases and the needed framework

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646426

Project demonstrations

Aggregation of residential flexibilities using LORA/Local energy community (BE)

PV, PVT, hatpumps, EVs, fuel cell, thermal storage, neighbourhood battery

Storage in a factory (ES)

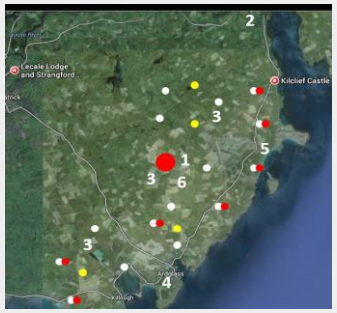
PV, 50 kW Li-Ion battery

Boiler/ORC/thermal storage in wood processing company (BE)

Use of waste wood for electricity and heat

Smale scale CAES/residential setting (UK)

Reduction of wind or PV curtailment



Community battery in a residential village (SI) im plemented by the DSO

Li-Ion, 220kW
Avoidance of grid reinforcement
Services to the grid

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Key exploitable results addressing energy system integration include

Result 1 Model based state of charge determination for storage tanks for domestic hot water (VITO)

- reduction of number of sensors, investment and maintenance costs
- Relevant for load shifting e.g. to be used by aggregators

Result 2: Significant improvement of ORC technology (expander, inverter). **(VITO, Beneens)**

- ORC now brought on the market
- higher efficiency than CHP for small scale applications and low temperature (<150%) e.g. in waste heat in industry

Result 3: Statistical framework for aggregating residential flexibilities (ACTILITY)

- Alternative to MPC, probabilistic distribution for the availability of a group of flexibility units
- number of units needed to have same availabilty as industrial unit.

Technological issues and barriers

No plug-and-play solutions for storage system

- Storage/software needs to be tailored to the grid/technologies available/user needs
- Many factors and technologies apart from storage system impact operation and reliability (communication issues, power electronics)
- Interoperability and communication issues (Heat pumps, Thermostats, meters...LORA devices not market ready)

Remote control of residential flexibilities still in development phase

- High cost of control and communication, narrow comfort zone of residents reduces profitability

Need for integrators

- E.g. different suppliers of boiler and ORC, unclear responsibilities, interoperability issues
- Software development in case of a range of technologies and tailored to the site

Non-technological barriers

Social aspects affecting the roll-out

- Proactive stakeholder engagement prerequisite to introduce the technology and manage use of storage.
- In residential buildings, involvement of children and other vulnerable persons cause stricter requirements to e.g. safety and user-friendliness (compared to industrial applications).

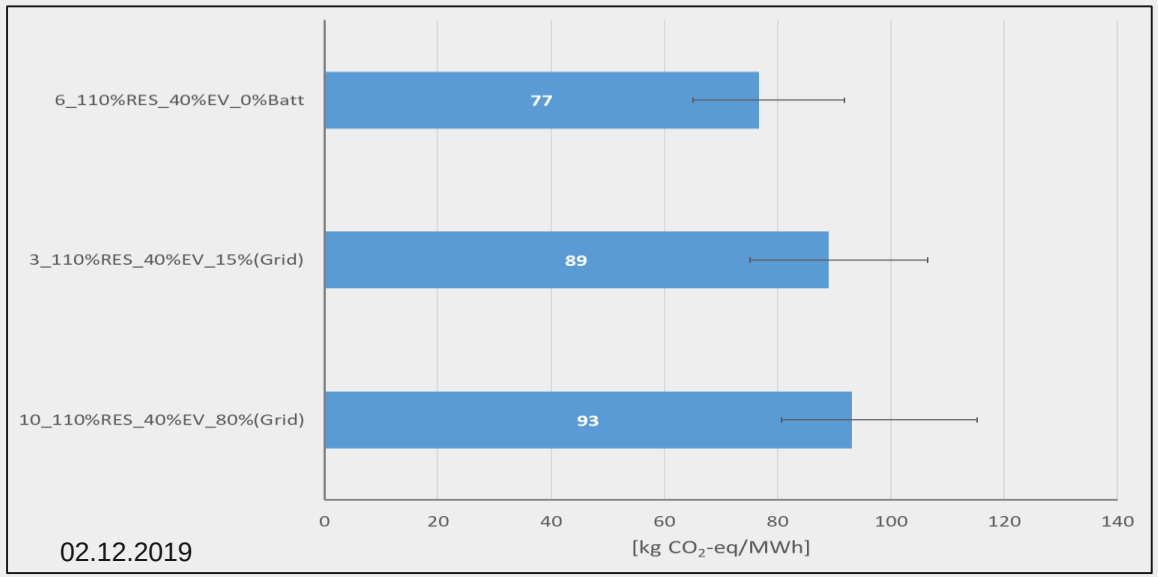
Market and regulatory barriers affecting the roll-out

- Information gaps (permitters)
- Storage is not well taken into account in current regulations, valorisation is not fully possible
- Lack of market liquidity, long response times, market not yet ready

Does storage reduce GHG emissions?

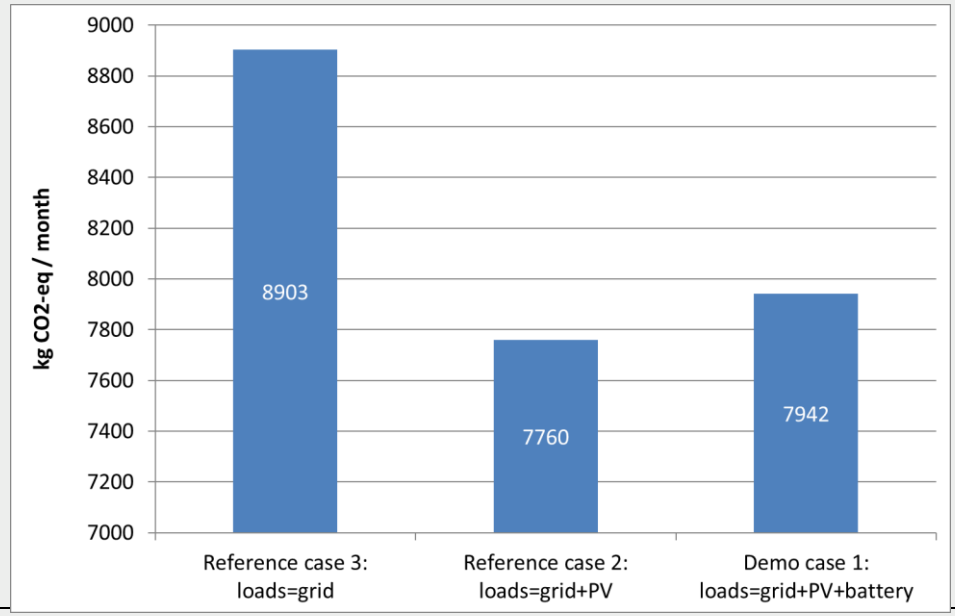
- **Based on an LCA,STORY demos provide no clear environmental benefit**
  - As efficiency is low, losses high, additional energy needed for cooling + heating

Scenarios for a **community size BESS in Slovenia** connected at the 30 MVA MV/LV transformer station supplying a LV network



Factory with 113 kWp PV plant + 50kW/200 kWh **Li-Ion battery in Spain**

intermediate results



Source: Joanneum Research, 2019

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Deployment prospects of the most promising solutions

Solution 1 (short term and mid term) **Larger batteries in industrial/commercial (also agricultural) settings**

- Predictability of loads, limited set of actors

Solution2 (short and mid-term) **ORC in smaller industrial applications** with waste heat

Solution 3 (mid- to long-term): **storage in residential settings**

- Mid-term: residential solutions with limited technology portfolio,
- Long-term: Energy Communities integrating a range of technologies with storage solutions

In STORY specific IPRs are protected, but we believe that the range of insight gained, will accelerate market deployment, once shared with a large range of stakeholders, market actors and policymakers (national, European)

Needs for future R&I activities coming out of the project

Hardware and storage systems

- Higher efficiency of BESS solutions from system perspective
- Integrated solutions (storage & control): a selection of plug-and-play BESS for different purposes (in analogy to cars)
- CAES too low TRL: efficiency of heat exchanger needs further R+I
- Safety issues in residential buildings (in progress in BE)

Control and valorisation

- Development of storage as service
- Adaptability of storage control to new services & regulatory developments
- Tailored customer engagement