EPC4SES Newsletter

May 2021

Digital Building Twins for Smart Energy Systems

Dear reader,

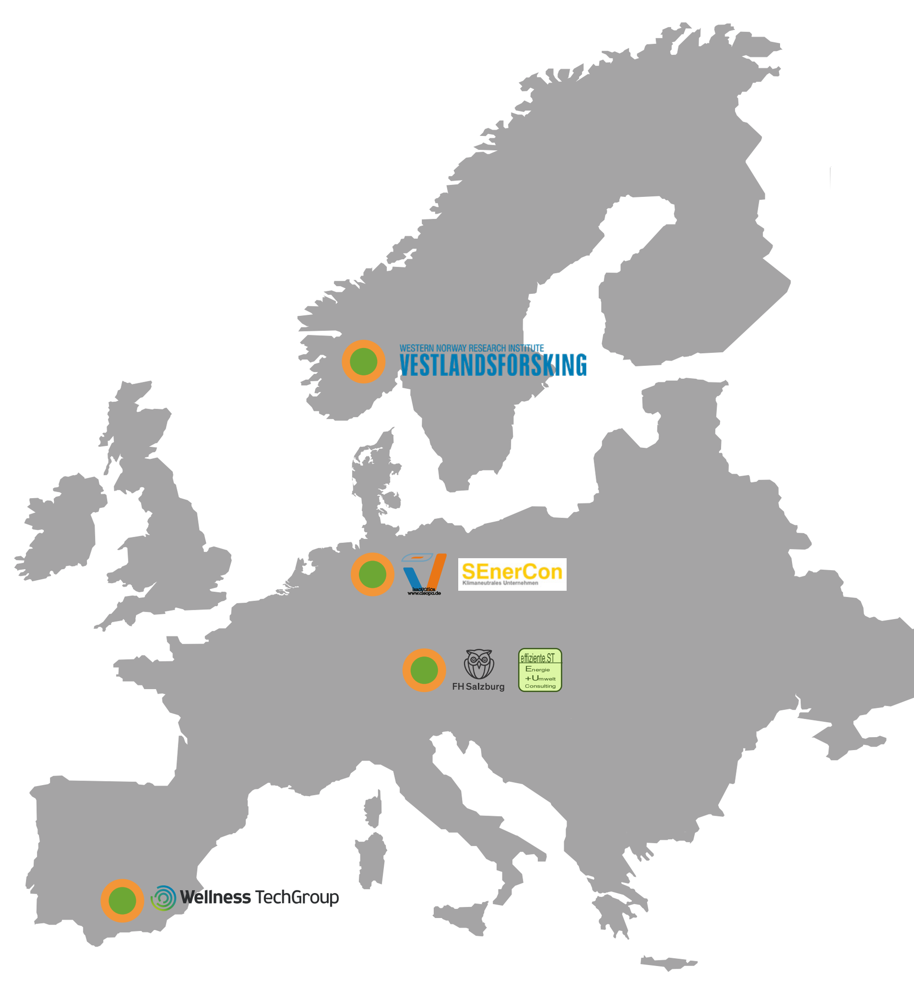
The **ERANet-RegSys project EPC4SES - EPC based Digital Building Twins for Smart Energy Systems** - aims at decarbonizing Heating & Cooling energy demand connecting bits and pieces in the underlaying process of domestic energy demand, adding sector spanning potential to smart grids. **Demand response (DR)** defines demand side management actions adjusting the energy demand to match the supply or to achieve a lower carbon energy mix.

Data acquired as input for calculating energy performance of buildings in the mandatory **Energy Performance Certificate EPC-schemes according to 2010/31/EU Energy Performance of Buildings Directive** is a valuable source - both for model-based annd regional energy planning of future SES and for model predictive grid/network control. EPC4SES is exploiting output data from software used to calculate **Energy Performance.** Those data streams are used to set up applications for optimal planning and operational control of smart energy systems.

Regional decarbonization plans - as part of good governance - profit from a better data basis from EPC registers, allowing also to include load shifting when setting up innovative systems. The **digital twin** is a virtual representation that serves as the real-time digital counterpart of the load shifting of an energy system. The main benefits of the digital twins are improved possibilities for demand control and allow flexibility in terms of usage of different renewable heat or power sources.

Partners

The project partners come from four different countries and unite experts in **buildings' modelling, EPC services, energy consulting, evaluation and IT.**



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Pilots

Berlin - *Germany*

The Berlin demonstrator - attached to SEnerCon - is covering 50+ similar buildings, connected to district heating via a larger subnetwork. The target is to manage loads such, that the district heating operator may feed in energy with a lower CO_2-footprint.
The model predictive control will be tested with the digital building twin and building's heating controller, utilising thermal building data from the transfer XML-file, which feeds the German EPC printing application.

Salzburg - *Austria*

A case study will be conducted with the use of a physical building model. With the application of model predictive control, the heat demand of the building model will be predicted by considering weather forecast and thermal properties of building envelopes.
The future heat supply to the model will therefore be optimized. The impact on district heating and the potential to integrate solar energy into the grid will be evaluated.

Vienna - *Austria*

Model predictive control will be demonstrated in a single family house equipped with a solar thermal system. Considering weather forecasts, thermal mass of the building and electricity prices, together with a virtual heat pump, an optimized control strategy to reduce CO_2 emission will be calculated. Coupled with hardware-in-the-loop approach, the control strategy will be tested and validated.

Rota - *Spain*

The research activities will be carried out in a retrofitted office building. The main focus will be on the application of a predictive model that will consider temperature, weather forecast, solar irradiance and the real time energy consumption of the building in order to, according to the energy demand, make recommendations for improving the energy efficiency of the building.

Tasks carried out

WP1	WP2	WP3	WP4	WP5
60%	100%	30%	10%	50%
Project management	Specification System Architecture Verification	Implementation of Research Prototypes	Evaluation & Exploitation	Knowledge Community

Expected impacts

The Energy Performance of Building Directive (EPBD) from 2002 initiated the spread of EPC throughout Europe. The project is also positioned within the European attempt to reduce the energy demand for cooling and heating of buildings framed in Directive (EU) 2018/844.

SOCIAL impacts

- Harmonize data model for EPC register databases, varying in scope and type across Europe.
- Add value to EPC register and additional value for the EU regulation, by bringing EPC at the highest level in Europe.

- Improvement of the EPC process.
- Low quality EPC input detected easily and feedback to regional quality assuring entities.
- Additional value for the EU regulation in the region.
- Contribution to a transnational knowledge.
- Electromobility development.
- Reduction of energy cost.
- Enhancement of innovation and city planning capacity.

ENVIRONMENTAL impacts

- Widening the potential for sharing vehicles at the end of the network and connecting more buildings to heating and/or cooling networks.

- CO_2, greenhouse emissions and fossil fuels usage reduction.
- Facilitation of decarbonization targets.
- Improvement of air quality.

FINANCIAL impacts

- Virtualization of energy transactions.
- Comparison of implementing technologies to have a stable, scalable and performing solution.

- Cost- effectiveness of transactional energy performance.
- Investment opportunities.
- Economies of scale.
- Energy cost reduction.

ENERGY impacts

- Digital twins for controlling virtual storage for heat pumps and district heating.
- Decoupling demand from supply.
- Power-to-heat and cool district heating both contribute to a sector overarching coupling.
- Demonstrate usage of demand prognosis.
- Peak shaving/load shifting.

- Improvement of possibilities for demand control.
- Use of fluctuating renewable or waste energy in local/regional thermal net - works and power grids.
- Higher percentages of renewable energy are achieved.
- Energy losses and curtailment reduction.
- Grid's stability.
- Energy demand reduction.
- Energy safety and reliability.
- Support of new models focusing on sector coupling.
- District planning capacity enhanced.

Future activities

1. **Implementation of smart embedded systems**, where energy monitoring will be enhanced by smart system services and data collection.

2. After **interoperability modelling of sector** coupling and **testing MPC-algorithms** in the pilots' projects (especially functionality and practicality), the **exploitation phase** will take place. It will disseminate ideas for a smarter grid and district heating networks, opening them to business models employing demand control and creating **Virtual Power Plants** (VPP) or other innovative energy aggregation business model.

3. Starting with research pilots, the solution shall **scale up** to district, or even regional experimentation after the end of the project. Roll out will be secured through **legal privacy assessments** and GDPR compliant provisions.
Further uptake will profit from authority support, harmonising regional data models for EPC and insisting on open interoperable IT in district heating networks.

4. Based on the IES methodology one application will be tested with regards to the interoperability.

5. The exploitation plan includes conceiving a **sandbox** experimental step to propose innovative grid support services that could be possibly scaled up in the near future.

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