



Impact Objective

- With the REnnovates concept we can make energy neutral neighborhood without increasing the costs for tenants, owners and the energy infrastructure by applying deep renovation and smart control

Novel concept fosters smart energy-based communities

The holistic REnnovates project aims to bring a holistic deep renovation concept to Europe's building industry through the inclusion of smart control and district integration

In order to reach a sustainable, smart and healthy society and economy the reduction of emissions and inclusion of people is important. For reduction of demand, the contribution of the existing stock of domestic houses is key. After World War II, the focus was on quantitative housing, energy efficiency and comfort were not considered an issue. An innovative EU project co-funded through the Horizon 2020 programme is seeking to ensure that the current housing stock is capable of meeting the future challenges in terms of sustainability, comfort and costs. The REnnovates project was commenced in 2015 and brings together nine partners from six EU countries (Finland, Poland, Netherlands, Spain, Belgium and Germany).

REnnovates Project Coordinator Dennis van Goch, from the Dutch construction company Royal BAM, says that while much of the EU housing was not built with energy conservation as the primary design thought, it is an excellent basis for modernising in an effort to reduce energy usage. REnnovates is an extension of the Dutch building renovation programme 'de Stroomversnelling'. It adopts a holistic approach that embraces the essential elements of smart control and district integration to develop a sustainable and flexible solution that brings value to all stakeholders.

RESIDENTIAL PILOT AREAS

REnnovates has a surprisingly simple brief for such a major undertaking: to explore the concept of increasing energy efficiency through a combination of insulation improvement, smart energy management and the use of renewable energy sources such as and solar panels to reduce a home's burden on energy consumption. However, the team is convinced that the insulation and energy gathering is only half of the answer, and investment in smart control systems is where the real value lies and that will become a natural addition to the housing market.

The work has been broken down into nine Work Packages (WPs). These include packages focused on a systemic holistic deep retrofit approach, holistic design and district impact management through smart ICT control. Three others are demonstrating the value of the REnnovates' concept through three residential pilot areas in the Netherlands, Spain and Poland. The pilot in Spanish demo (Mondragon) is examining the replication concepts in the Spanish market and climate while the Polish demo (Mostostal) pilot will consider the combination with district heating networks. The Dutch pilot is looking at large-scale implementation (200 houses) and district energy management, ultimately to avoid reinforcement of the local electric grid. This pilot has already seen success, with the

deep renovation of 149 houses on two sites in the Netherlands (Heerhugowaard and Soesterberg) with a third demonstration upcoming. This has resulted in net zero emission family homes. The team has also seen success in the deployment of standards such as the Universal Smart Energy Framework (USEF), which Goch says has been used to 'deploy flexibility in order to avoid grid issues on a district level' and EEBUS, which is used to enable interoperable connectivity for all energy relevant devices.

SUPPORTING A SMARTER FUTURE FOR HOMES

While the viability of the concepts at the three pilot sites is being proven, the team is already looking at opportunities to roll out the principles to more sites throughout Europe and raise project awareness. The REnnovates team believes that their approach and technological advances could be incorporated as standard into renovation and new-build housing, and contribute to the EU's energy sustainability targets. 'European housing has suffered from the worldwide economic crisis and a lack of funding, while having to try to meet European sustainability targets,' Goch points out. 'REnnovates supports a multi-pronged approach to energy systems to make European housing developments compliant today but also sustainable for many years into the future.'

The growth of net zero energy houses

REnnovates consortium members Dennis van Goch, Chris Caerts, Marc Eulen and Stefan Lodeweyckx discuss their work using a combination of innovative business cases, smart construction, interoperable connectivity and smart neighbourhood control to update Europe's housing to net zero energy standard



Dennis van Goch, BAM



Chris Caerts, VITO



Marc Eulen,
KEO GmbH



Stefan Lodeweyckx,
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What impact do you anticipate the REnnovates project will have?

DvG: A large amount of energy is consumed in the built environment, while most of the buildings society needs are already built. There is also a large push for sustainability from politicians and the public. REnnovates provides a holistic concept to address these. It is an innovative business model and industrialised approach designed to refurbish entire neighbourhoods to become net zero energy. We have an integral view on the investment and savings, long-term commitment and the role of the buildings in the energy infrastructure, and the ecosystem of partners required to transform neighbourhoods. The lack of a holistic approach is one of the reasons this transformation has not yet occurred. This work should bring comfort, health and sustainability to people and also create value for stakeholders without increasing the cost of living.

SL: With mass-scale rollout of REnnovates deep renovations, the mid-voltage operators

will be able to reduce significant stress on their networks by applying these advanced control strategies on an aggregated level. The building companies will additionally benefit from these types of control strategies through the energy shifting algorithms designed to reduce solar energy costs. Add to that increased awareness on the tenant and social housing company level, and various stakeholders will benefit significantly from REnnovates' results. This will ultimately avoid the EU investing hundreds of millions of euros into mid-voltage networks and still enabling terawatt hours of green energy and the related CO₂ savings.

How have you overcome the main challenges or obstacles presented by the project so far?

DvG: There are many challenges for realising smart, energy-neutral neighbourhoods throughout Europe. Two key challenges are the approach to the business model where savings are used to make investment possible, combined with long-term commitment and energy legislation, technology (interaction) and inclusion of the right stakeholders. In REnnovates we aim to prove the viability of this holistic approach and viability of the subsequent business cases throughout Europe.

ME: While BAM addresses the challenges from the construction point of view, KEO with its EEBUS-based connectivity framework enables the project to overcome the hurdles of non-standardised communication and missing device interoperability within the buildings. For most residential buildings today, the missing interoperability of the energy-relevant devices makes it impossible for smart energy management to be implemented on a bigger scale. The use of EEBUS as the unifying language for energy project provides

the needed interoperability to overcome this common obstacle.

CC: The creation of building flexibility models that balance accuracy with calculation complexity has been a challenge. Detailed models were created based on specific design information and the parameters of the buildings and relevant infrastructure. These models are continuously calibrated using machine learning techniques to tune them to the specific context and usage of/for each building. There is a need for machine-learning techniques so that local energy use can be optimised while user comfort is guaranteed at all times. For example, store energy when there is peak solar production using hot water and/or battery storage' or 'shift demand when needed using hot water and battery storage in order to support the energy infrastructure.

Can you talk a little about the smart software REnnovates will employ?

SL: We aim to use as much as possible existing software languages and well-established hardware sensors and actuators to maximise the viability of real cost-effective mass commercialisation. The Smartpower Suite is a software platform built by Enervalis to enable mass-market energy services to solve mismatches of supply and demand, and therefore support maximal green energy in a cost-effective manner. It encompasses three key layers – capturing data, analysing data and controlling assets – in a distributed manner with Big Data and machine learning techniques as key cornerstones.

ME: KEO provides the EEBUS integrations for all energy-related infrastructure like the heat pump, photovoltaic inverter and building-level battery to make them part of the smart

Project Insights

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BIO

Dennis van Goch (BAM) has a Master's in Sustainable Energy Technologies and completed his Professional Doctorate in Engineering at the Stan Ackermans Institute in the Netherlands in 2014. He is currently working on smart energy projects at BAM with the mission of creating neighbourhoods that contribute to a healthy, comfortable and sustainable society.

Chris Caerts (VITO) obtained his MSc in Electronics from the University of Leuven. He is currently responsible for the building flexibility valorization roadmap at VITO, and has an active role as Coordinator, Technical Coordinator or Work Package Leader in multiple European projects. Besides, he is leading the subprogramme on Interoperable Control and ICT in the European Energy Research Alliance Joint Programme on Smart Grids.

Marc Eulen (KEO) is Executive Manager & Partner at KEO GmbH and holds degree in General Management. After several years of management experience in the tech sector, he joined KEO in 2014 to become part of the executive management at the global leader in EEBUS integrations. With KEO he is as well involved in several German research projects in the fields of smart energy, where KEO is enabling the energy potential and interoperability with its EEBUS-based software solutions.

Stefan Lodeweyckx (Enervalis) holds a MSc and MBA and is an internationally experienced all-round leader/entrepreneur in the high tech sector. He has more than 10 years of hands-on leadership and managerial knowledge ranging from startups up to multinationals. He is passionate about innovation, inspiration and new opportunities.

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building and maximise energy savings. Without the provided interoperability for the differing device types of different sectors and various brands, it would be impossible to integrate all relevant devices efficiently into one smart energy management. This interoperability based on to the EEBUS standard essential to make the energy-savings potential of the devices feasible and contributes greatly to reaching the net zero energy status.

How do you support collaboration across the different organisations?

DvG: The partners all share the vision and mission of REnnovates, which is of primary importance for the ecosystem to work. There are four technology partners (Enervalis, VITO, KEO, MCT) involved in the project, three building partners (BAM, Mondragon, Mostostal) and one grid operator partner (STEDIN). This work is complemented by a financial partner (Belfius) to help prepare exploitation and replication. Each partner has a clear incentive to join and create a viable business model while the sum of the parts creates the additional value we need. Collaboration is supported by challenging partners to seek replication potential of project parts, which sparks interaction among partners.

Now the project is entering its second half, what does the future hold?

CC: For the second half of the project, the focus will be on incorporating feedback and learnings from the Dutch demonstrator into our machine-learning and control strategies. Next to this, these will be tested and validated with the Energy Module variants for the Spanish case (shared Energy Module for multiple flats) and

the Polish case (connection to district heating network and uCHP). Furthermore, we will increase the sophistication of our flexibility aggregation and decision disaggregation methodologies to improve their scalability and ability to deal with higher degrees of diversity. This will be key to facilitate replication to neighborhoods that lack the uniformity of the current Dutch 'stroomversnelling' case.

ME: After the implementation of the demonstrator sites in the Netherlands, REnnovates will start implementation of the concept in Spain with the deployment of a centralised Energy Module. The integration of more interoperable devices from more European markets is important to widen the scope and reach of this already successful project. The REnnovates team will explore a holistic multi-stakeholder business model to achieve maximum rollout across the EU, while ensuring the affordability of the approach.

DvG: A key will be to focus on replication business models in various countries. This means validation of the concept and seeking the value of flexibility in various scenarios. This also requires active market development in order to get houses integrated into the energy infrastructure and realise value, which is essential for the complete approach. Finally, it all starts with the realisation that a holistic approach is needed in which not only renovation takes place, but also a strong ecosystem is created. Through this collaboration we hope to improve the lives of people, increase sustainability, reduce social costs and provide viable business models based on long-term commitment and going beyond an individual home.