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CORDIS Results Pack on Deep Renovation

A thematic collection of EU-funded research and innovation results

November 2018

New approaches to transform the renovation market

Research and Innovation

Contents

Editorial

About 40 % of Europe's energy demand is generated by the need to heat, light and cool buildings. As nearly half of all European residential buildings were constructed before 1970, retrofitting existing homes to increase energy efficiency is just as important as building new zero-energy homes. Several EU projects are testing new ways to make renovations faster, better, cheaper and more energy efficient.

The Energy Efficiency Directive (EED) (Directive 2012/27/EU) and the revised Energy Performance Building Directive (EPBD) (Directive 2018/844) both contain provisions for increasing Europe's renovation rate.

The greatest challenge to reducing energy use in buildings lies in increasing the rate, quality and effectiveness of building renovation, since the current rate is merely 1.2 % per year. Effective renovation approaches need to be widely demonstrated and then replicated to ensure that the renovation rate rises to between 2 % and 3 % each year.

Research conducted at all levels

This CORDIS Results Pack focuses on seven EU-funded projects working with public and private actors. One initiative, **EmBuild**, collaborated with public authorities to establish effective long-term strategies that mobilise investment in energy efficiency renovations of their building stock.

The **HERON** project has developed a decision support tool that quantifies behavioural barriers to help policymakers improve model scenarios for future energy demand and increase the adoption rate of energy efficiency measures.

Meanwhile, **NewTREND** created an integrated approach to reduce disparities between the estimated and actual energy performance of building renovations, while exploiting the potential synergies of working at neighbourhood level. The **REFURB** project worked at the regional level to remove the obstacles currently preventing householders from progressing with energy refurbishments to create a zero-energy home.

Thanks to **RentalCal**, investors and building owners have a tool to support them in deciding whether to invest in energy efficient refurbishments in the private rental market. The **TRANSITION ZERO** project sought to establish the correct market conditions to enable net-zero-energy whole-house refurbishments on an industrial scale in France and the UK, building on the Energiesprong approach pioneered in the Netherlands.

Finally, under **URBAN LEARNING**, eight European cities worked together to improve their governance structures and integrate energy aspects into their urban design and planning processes.

Municipal strategies to mobilise investment and stimulate renovations

An EU-funded project has supported public authorities in south-eastern Europe to prepare their municipal renovation strategies and identify the buildings best suited for deep renovation.

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Local authorities face a significant challenge in identifying the most suitable buildings and in securing the necessary funds to carry out deep energy renovations. However, when successful, they can reap significant benefits that go beyond energy and monetary savings.

Public authorities in countries in south-eastern Europe will benefit from the long-term strategies prepared by the EmBuild project. These strategies mobilise investment in the energy-efficient renovation of the building stock at local and regional levels.

The goals of national strategies for renovation of the building stock and their suggested measures often do not seem to extend to the administrative levels where most public buildings are located. This was the challenge addressed by EmBuild. According to Project Coordinator Renate Schindlbeck: "Our approach was to mirror the national level strategy to foster renovation in the building sector through a local or regional approach."

Three-step approach for national renovation strategies on the ground

EmBuild supported municipalities in developing local renovation strategies that follow a simple three-step approach: plan, invest and benefit. These local strategies are important building blocks for the national renovation strategies required under EU law.

The EmBuild approach involved creating a stakeholder network of parties involved in the formulation, implementation and/or monitoring of building renovations. The municipalities also analysed the energy consumption of their public building stock and its renovation needs; they then reviewed potential measures and their profitability in order to set renovation priorities.

EmBuild worked with local authorities to analyse existing market and governance barriers and propose actions on how to overcome these. They identified measures to attract investment and improve the investment climate. Finally, the project quantified current and future energy savings and the wider benefits.

Consortium members also assessed the wider benefits of energy-related building renovation. Not only does this type of renovation generate jobs, but it also provides social benefits such as improvements in the quality of life and well-being of the buildings' users through modern lighting, the correct year-round ambient temperature and better indoor air quality. These additional benefits can be a powerful driver for building renovation programmes.

Our approach was to mirror the national level strategy to foster renovation in the building sector through a local or regional approach.

Project partners supported 95 municipalities in Bulgaria, Croatia, Germany, Romania, Serbia and Slovenia in developing local refurbishment strategies. A further 20 municipalities are expected to be added by the end of 2018. Over 850 public officers were involved in the project, through national, regional and local conferences, workshops, roundtables, direct consultation and communication, meetings and field visits.

Information toolkit to inspire and empower public authorities

Thanks to EmBuild, local authorities now have a wealth of reference materials to choose from. These include a set of documents and a training guide on how to analyse local building stock, a template to draft a public-sector buildings renovation strategy, a report on how to improve the investment climate at local level and a guide on raising awareness at municipal level.

In addition, the project also produced a study evaluating and specifying the wider benefits of deep renovation measures, a factsheet and webinar on wider benefits, and a technical guide on methodologies to assess and quantify the wider benefits and energy savings of deep building renovation.

Through EmBuild, local authorities now have a frame of reference for determining the benefits of renovation measures across different target groups that provide extra incentives for building renovation programmes. Schindlbeck points out: "It illustrates that renovation is not only a matter of reducing energy consumption."

PROJECT
EmBuild – Empower public authorities to establish a long-term strategy for mobilizing investment in the energy efficient renovation of the building stock

COORDINATED BY
German Corporation for International Cooperation GmbH, Germany

FUNDED UNDER
H2020-EU.3.3.7.

PROJECT WEBSITE
embuild.eu/

Quantification of energy efficiency barriers improves policymaking

EU researchers have identified which factors prevent individuals from embracing energy efficiency. A new tool integrates these barriers into model scenarios of future energy demand, enabling policymakers to optimise their policies so as to overcome this challenge.

Europe is leading efforts to design policies that encourage energy efficiency in the buildings sector, but many obstacles — such as lack of funds or concerns about certain technologies — still compromise the adoption of these policies.

The EU-funded HERON project identified the main social, cultural, educational, economic and institutional barriers to adopting energy efficiency, both in the building and the transport sectors. The team then developed effective energy efficiency policies to overcome these barriers. "HERON conducted case studies on energy efficiency in seven different European countries to help policymakers develop and monitor energy efficiency strategies," says Project Coordinator Prof. Dimitrios Mavrakis.

New software tool to aid energy efficiency policymaking

Researchers devised several energy scenarios for Bulgaria, Estonia, France, Germany, Greece, Ireland, Italy, Serbia, Spain and the United Kingdom. These included business-as-usual

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scenarios, scenarios that do not take account of behavioural barriers, others that include the effects of the barriers, and a best scenario based on policies adapted in response to the identified behavioural barriers.

More specifically, "the HERON Decision Support Tool (DST) calculates the impact of behavioural barriers on input drivers — i.e. technologies and policies — along with the desired energy efficiency scenarios," explains Prof. Mavrakis. The tool, which was developed by the Energy Policy and Development Centre of the National and Kapodistrian University of Athens, was assessed by two independent groups of EU evaluators who deemed it an innovative and successful solution for identifying and addressing barriers to energy efficiency.

HERON conducted case studies on energy efficiency in seven different European countries to help policymakers develop and monitor energy efficiency policies.

The result of the research carried out by HERON is a new integrated methodology based on the HERON DST. The methodology reveals what stops end-users from adopting energy efficiency policies. According to Prof. Mavrakis: "This allows policymakers to update and fine-tune the policies, and ultimately create the best policy recommendations."

Principal barriers to energy efficiency

Interestingly, four key barriers emerged from the seven case studies. "The two cultural barriers were, on the one hand, people's hard-to-change habits concerning energy efficiency, and on the other, mistrust of technologies and contractors," reveals Prof. Mavrakis.

He also highlighted the chief social barrier, which is the disadvantaged socioeconomic status of building users. The key educational barrier was identified as "the lack of awareness, knowledge on savings potential, and/or information regarding relevant technologies."

Support at local, regional and national levels

Thanks to the HERON DST, policymakers at all government levels — local, regional and national — can identify the optimal policy mix. "The Decision Support Tool helps transform behavioural barriers of end users into factors that impact energy efficiency drivers and targets," notes Prof. Mavrakis. "This provides a pathway for relevant policymakers in all EU countries to adopt the most effective combination of policies for overcoming behavioural barriers," he concludes.

The project team is now exploring how to apply the project outcomes in other areas, like the oil and natural sectors, and is considering scenarios developed with the aid of other energy models. Thus, the positive impact on Europe's environment and its citizens' well-being, as well as on cost savings, could be considerable.

PROJECT
HERON - Forward-looking socio-economic research on Energy Efficiency in EU countries

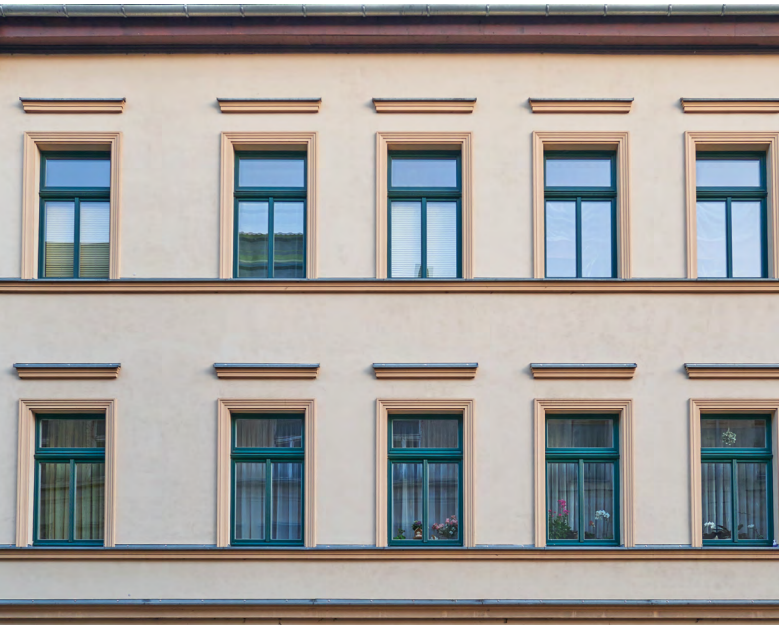
COORDINATED BY
National and Kapodistrian University of Athens, Greece

FUNDED UNDER
H2020-EU.3.3.6.

PROJECT WEBSITE
heron2017.wordpress.com/

Collaboration tools for effective and efficient retrofitting of buildings and neighbourhoods

An EU initiative has fostered collaboration in the building value chain by finding the most effective solutions in neighbourhood retrofitting projects, in terms of energy, cost efficiency and overall sustainability.



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Renovation activities are hampered by a range of factors: the unsatisfactory level of interoperability of construction project software tools, the fragmentation of the life cycle of the building, and discontinuities in the flow of information. In addition, users often observe disparities between the estimated and actual energy performance of a building, while renovations rarely exploit the potential synergies of working at the neighbourhood level.

The EU-funded NewTREND project addressed these issues by developing "a collaborative design methodology for the energy efficiency upgrade of individual buildings and districts," says Project Coordinator Nick Purshouse. "The NewTREND toolkit was created to support all phases, from concept design to implementation and operation, fostering collaboration among stakeholders, involving inhabitants and building users, and having energy efficiency and final performance as key drivers."

Technology as an enabler

NewTREND scientists developed an advanced suite of software and web tools. They comprise an interactive web-based data manager, a Collaborative Design Platform, a Technology (and business model) Library, a District Information Model Server, as well as a Simulation and Design Hub.

These tools tackle such diverse requirements as data collection, communication among all stakeholders, project and integrated design methodology management, sharing of information models, simulations of buildings' current state, potential retrofit scenarios, and simulation and result analyses.

Multiple expected impacts

End users have a great deal to gain from NewTREND's tools. One of its main impacts is the more effective refurbishment

NewTREND promotes cooperation among all key actors in the value chain, engaging occupants and building users, and supporting all phases of the renovation.

of buildings and districts. Enabling actors to make validated choices during refurbishment processes based on quantified performance objectives is another key benefit. A further advantage is the optimised design of energy-efficient buildings that takes energy, comfort, acoustics, air-quality and other important variables into account. The tools will also advance compliance with regulations and user-oriented comfort expectations and constraints.

NewTREND's tools facilitate near-real-time decision-making. This saves time and money during the construction phase, where all related decisions have been virtually pre-validated. As a result, system clashes are reduced, improving the control of both the schedule and the project budget.

Project partners successfully tested and demonstrated the methodology and tools at three demo sites in Finland, Hungary and Spain. According to Purshouse, in late 2018 they will finalise plans to take the products to market. "NewTREND promotes cooperation among all key actors in the value chain, engaging occupants and building users, and supporting all phases of the renovation," concludes Purshouse. "In this way, the project will improve the energy efficiency of the existing European building stock and improve the current renovation rate."

PROJECT
NewTREND - New integrated methodology and Tools for Retrofit design towards a next generation of ENergy efficient and sustainable buildings and Districts

COORDINATED BY
Integrated Environmental Solutions, United Kingdom

FUNDED UNDER
H2020-EU.2.1.5.2

PROJECT WEBSITE
newtrend-project.eu/

Accompanying home owners on their renovation journey

Building experts have identified how to best support homeowners during the zero-energy renovation of their property. Thanks to a new personalised service, more homeowners can now opt for a deep energy retrofit.

Building on the 'one-stop shop' concept, the EU-funded REFURB project has worked to create the right conditions for convincing homeowners to decide in favour of deep energy retrofits and to remain committed during the entire process. Key features included bespoke home renovation packages for specific markets and personal 'renovation coaches' to assist house owners during the process.

"The process of investing in deep energy refurbishment is called the 'customer journey'. Giving up on this journey is common,

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as house owners run into many barriers," says Virginia Gómez Oñate, Project Manager of VITO NV in Belgium. These barriers usually relate to unclear financial and environmental benefits. If house owners do not have access to all the necessary information, they can get lost along the way towards a future-proof dream home and lose interest in investing in house renovation.

The customer journey concept is pivotal in understanding how house owners act when involved in a renovation process," adds Gómez Oñate. REFURB addressed the complex interplay between the house owners on the demand side and the businesses on the supply side of zero-energy renovation.

Promoting a one-stop shop

There is a real need for additional tools to support and provide guidance to home owners during the whole renovation process. REFURB aimed to bridge this gap with a one-stop shop solution that could be replicated across Europe. "Our ambition was to remove the burden for house owners from having to turn to a whole raft of contracting parties and public bodies," explains Gómez Oñate.

The single point of contact seeks to build a high level of trust with the customer throughout the entire customer journey towards a near-zero energy home renovation. In this context, a renovation coach can play an important role: having an understanding of the technical side of the available solutions, while possessing the necessary soft skills to build a trusting relationship with homeowners.

"Understanding the key drivers and barriers in each country is pivotal in encouraging house owners to invest in deep energy refurbishment," comments Gómez Oñate. Project partners developed and tested 10 customisable renovation packages for 6 European countries, to ensure that they meet local demands and can be accommodated by local suppliers.

Understanding the key drivers and barriers in each country is pivotal in activating house owners towards investing in deep energy refurbishment.

Speaking the same language

Using non-technical language, these different compelling renovation offers determined the success of the one-stop shops in each country. The design of each country-specific offer was based on a match between the house owners' concerns and the available technologies tailored to the type and state of the dwelling. Selected customer segments included young families, post-war suburbs with detached houses, terraced houses with a high energy bill, convinced energy savers and owners of multi-apartment dwellings.

"The My Energy Compass online tool is designed to empower house owners to start their customer journey and nudge them to also follow the other essential steps for the successful completion of their house renovation," explains Gómez Oñate. Although the tool is tailor-made for Belgium, its design and concept can inspire similar attempts in other European regions.

The goal of REFURB was to provide house owners with a compelling offer — a renovation package offered by a one-stop shop that will make energy renovation easy for them. "We need to understand the house owner: People do not start a renovation just because they want a certain cost reduction on their energy bill, but because they want more comfort," concludes Dominiek Vandewiele from Intercommunale Leiedal, a project partner based in Belgium.

PROJECT
REFURB - REgional process innovations FOR Building renovation packages opening markets to zero energy renovations

COORDINATED BY
Flemish Institute for Technological Research, Belgium

FUNDED UNDER
H2020-EU.3.3.7.

PROJECT WEBSITE
go-refurb.eu/

Profitability of energy efficiency refurbishments in the private rental market

Researchers funded by the EU have developed a tool that provides information to help guide the decision-making process before investing in an energy retrofit.

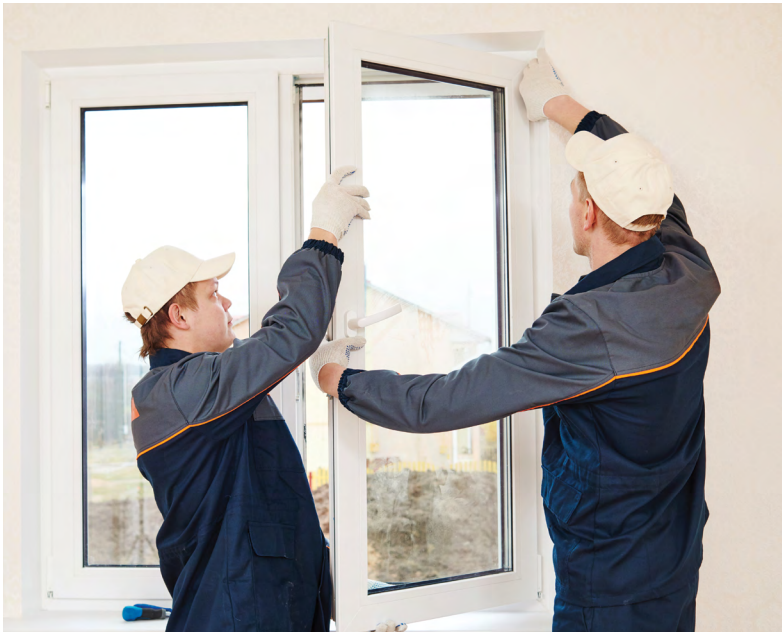
The EU Council has been mobilising Member States to put in place energy efficiency measures in the residential sector that will cut emissions by 30 % by 2030. Yet investors need certainty that energy efficiency improvements in the private rental sector are profitable. Without this information, the real estate sector is unlikely to take the necessary investment decisions and contribute to the EU's 2030 carbon reduction targets.

The RentalCal project worked to incentivise investment into energy efficiency in rented dwellings. "Our aim was to provide transparent information that will help guide investment decisions on energy-efficient retrofit of buildings. We took care to ensure that comparisons are possible across countries. To this end, a key focus was to develop methods and calculation standards that can meet the respective national laws in each country," says Project Leader Ms Iris Behr.

Facilitating retrofit investment decisions

With a consortium comprising practitioners and research institutions from eight European countries, RentalCal developed an advanced Profitability Calculation software, which enables owners and investors in the private rental sector to calculate the financial implications of any investment in energy efficiency. The tool takes into account all financial considerations, including architectural costs, government grants and tax benefits. It provides a clear picture of the costs and benefits, by country and by type of rental property.

"The RentalCal tool applies a dynamic model that enables property owners to assess the profitability of any mandatory or discretionary investment in modernisation that enhances the energy performance of the rental property," notes Behr. She explains further: "The newly developed tool calculates important profitability metrics such as the return on equity. In addition, it shows how the retrofit investment impacts on the net rent and the gross rent." Yet the tool is not limited to calculating certain key performance indicators; it also calculates the true 'green value' of the retrofit investment — that is the energy use.



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Our aim is to provide transparent information that will help guide investment decisions on energy-efficient retrofits of buildings.

The RentalCal tool can strengthen dialogue amongst all actors in the housing industry and financial sector who are primarily concerned with planning, financing and regulating green retrofits of buildings. The tool is available in two versions (targeting professionals and tentative investors) and seven European languages.

Providing incentives for green retrofits

The RentalCal software provides the required transparency for investors who are uncertain about the measurable financial benefits of energy efficiency retrofits in their rental property. It enables investors to conduct a detailed and realistic viability analysis of potential retrofit measures. The tool also reduces split incentive barriers by translating the positive effects of energy-efficient and sustainable renovations into real-value and financially feasible investments for the real-estate industry.

PROJECT
RentalCal – Incentives through Transparency: European Rental Housing Framework for Profitability Calculation of Energetic Retrofitting Investments

COORDINATED BY
Institute for Housing and Environment GmbH, Germany

FUNDED UNDER
H2020-EU.3.3.7.

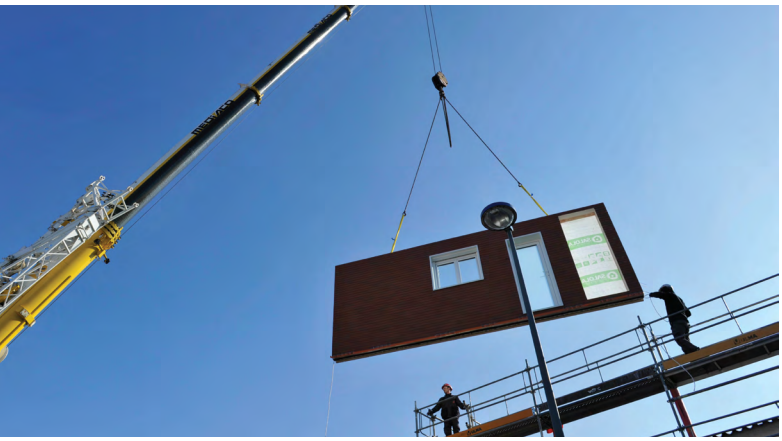
PROJECT WEBSITE
rentalcal.eu

Fast, affordable and trouble-free mass retrofit towards net-zero energy for social housing

An EU-funded project is enabling the roll-out of an efficient and economically viable approach to delivering attractive net-zero energy whole-house upgrades with an energy performance guarantee.

Net-zero energy homes can help ensure a sustainable future that is less reliant on fossil fuels. Such homes are well insulated and energy efficient, generating sufficient renewable energy to heat the house, provide hot water and power household appliances.

The aim of the TRANSITION ZERO project was to establish the right market conditions for the wide-scale introduction of net-zero energy homes across Europe. The project built on the Energiesprong approach pioneered in the Netherlands,



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adapting this successful methodology to retrofits in France and the UK, first and foremost in the social housing sector.

Current approaches to implementing energy efficiency measures for major renovations across the EU are not set to meet the ambitious 2020 targets. "Energy efficiency can't be optimised through piecemeal insulation measures and incremental steps. It has to be a whole-house retrofit approach to deal with the fundamental problems associated with hard to heat houses," notes Ron Van Erck, Transition Zero Programme Manager Europe.

Energiesprong, meaning 'energy leap', aims to shift thinking in the housing refurbishment sector and deliver net-zero energy housing on an industrial scale. "An Energiesprong retrofit is about delivering affordable year-round comfort. It's a collaborative process involving three agents of change: contractors, housing providers and residents," Van Erck observes. In the Netherlands, the involvement of residents' committees in design and procurement discussions helped residents reap the full benefits of refurbishment.

Warm, comfortable and affordable homes for life

The first retrofit pilot projects in the UK and France involved 37 hard-to-heat homes built between 1950 and 1980. "Superb energy performance isn't just expected — it's monitored and guaranteed. For each pilot, the solution provider offers measures that will generate sufficient annual energy to heat the house, supply hot water and power basic household appliances," says Van Erck.

But as the Dutch experience showed, economies of scale come with mass roll-out and volume prefabrication. Hence, the insulated wall panels used in the refurbishment are manufactured offsite and craned into position. "Typically, solution providers are wrapping the homes in a second skin made up of insulated panels constructed offsite. The heating and hot water systems are integrated into an energy module along with monitoring equipment, installed on the exterior, so access for maintenance is easy," explains Van Erck.

The aim was to complete the non-intrusive retrofit within one or two weeks, without the resident having to move out, with the result being a warm, comfortable and affordable home that is modern and attractive. The Energiesprong approach uses an energy performance contract to guarantee the performance of the improvements over a period of 25 to 40 years.

Making a deal

In 2017, 36 organisations — 9 social housing providers, 20 solution providers and 7 facilitating organisations — signed a charter including a collective agreement to renovate 3 600 homes in France. There are also plans to roll out retrofit to 225 homes in the UK. According to Van Erck: "When we scale this up, the whole-life income and cost savings can fund the work. Once the retrofit costs are comparable to 'business as usual', more housing providers will come on board."

The retrofit is non-intrusive, and the aim is to complete it within one or two weeks. The result is a warm, comfortable and affordable home that is modern and attractive.

The entire retrofit costs per home started at around EUR 75 000 in France, but a target of EUR 45 000 is needed to deliver mass adoption. "Efficiencies of scale, through off-site assembly and automation, will cut down costs. The second-generation energy module will cost 35 % less thanks to increasing orders and a more compact design," concludes Van Erck.

PROJECT
TRANSITION ZERO - Make Net Zero Energy refurbishments for houses a mass market reality

COORDINATED BY
The National Energy Foundation, United Kingdom

FUNDED UNDER
H2020-3.3.7.

PROJECT WEBSITE
transition-zero.eu/

European cities join forces to plan their urban and energy future together

Large urban areas throughout Europe are trying to strike a balance between their rapid growth and the need to significantly reduce fossil energy consumption and CO_2 emissions. Cities need efficient and effective planning practices to cope.

The EU-funded URBAN LEARNING project "started from the need for Vienna and other big cities to decarbonise their building stock and heat supply, while facing considerable population growth," says Coordinator Waltraud Schmid. "The second starting point was the observation that energy aspects aren't well integrated in urban planning processes — too little, too late, with suboptimal results."

"On the other hand, many more cities have lighthouse projects showcasing a low-carbon or climate-neutral city quarter, though often planned and built with a lot of resources behind them," she adds. The aim was to look at the urban planning processes. Schmid continues: "We identified what is required to achieve a low-carbon city quarter out of standard city planning: who is needed, what is needed and when."

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Solutions for upgrading integrative urban energy planning

URBAN LEARNING set out to mainstream and institutionalise integrative energy planning within the administrations of eight European cities. For nearly 3 years, local working groups within the administrations of Amsterdam, Berlin, Paris, Stockholm, Vienna, Warsaw, Zaanstad and Zagreb analysed their planning processes, identified essential framework conditions and key elements of the processes, and developed proposals for upgrading them. Most groups remain active beyond the project's lifetime.

"As the topic of integrative energy planning was new to the cities, it's a major achievement to have successfully and substantially increased awareness in all eight," stresses Schmid. This went hand in hand with an increased understanding for the need to better collaborate between departments, particularly those responsible for energy planning and urban planning.

Administrations are reaping the benefits

According to Schmid, some of the cities began seeing improvements even before the project ended. The Viennese administration established a working group with members from different departments and the grid operator to discuss the future energy supply of large urban development projects at their very early stages. Stockholm started revising its internal management handbook for urban planners to integrate energy planning aspects.

As URBAN LEARNING progressed, it became clear that a supportive legal framework was essential, and to some extent, even a prerequisite for enabling and enforcing integrative energy planning. The project therefore drew up proposals to upgrade legal framework conditions. Lastly, the cities developed concrete implementation plans. These plans outline priority actions and the next steps to be taken by each city as it moves towards integrative energy planning.

Vienna, for example, is working on introducing legal provisions that firmly establish energy efficiency and climate change as urban planning objectives in its building codes, and offer the possibility of establishing energy zones in the zoning plan. Meanwhile, Berlin recently published its first version of an energy atlas; a heat atlas is in preparation in Paris and Vienna. Finally, Amsterdam is developing approaches to phase out natural gas for heating.

URBAN LEARNING emphasised that energy planning is a public responsibility, not only the task of energy grid operators, and that cities need clear competences, instruments and tools to effectively deal with this responsibility.

Project partners expect the project to have significant energy impacts on over 3 million people, as well as on the homes and workplaces to be built and refurbished over the next 20 years in participating cities. Better governance of integrative urban energy planning could result in energy savings of at least 620 GWh per year and increased renewable energy production exceeding 1 500 GWh per year. "URBAN LEARNING highlighted that energy planning is a public responsibility, not only the task of energy grid operators, and that cities need clear competences, instruments and tools to effectively deal with this responsibility," concludes Schmid.

PROJECT
URBAN LEARNING - Integrative energy planning of urban areas: collective learning for improved governance

COORDINATED BY
UIV Urban Innovation Vienna GmbH, Austria

FUNDED UNDER
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PROJECT WEBSITE
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RESEARCH*EU MAGAZINE ISSUE 77: Charged up and ready to roll! Electric vehicles take to the road

In our latest issue of Research*eu magazine, we take a closer look at the drive towards better, faster and more efficient electric-powered vehicles. In particular, we focus on seven EU-funded projects that are contributing to making them a truly viable alternative to diesel and petrol, thus contributing to the fight against climate change and helping to ensure a sustainable future.

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