european energyinnovation
SUMMER 2018
Connecting Europe's Stakeholders in Energy and Transport

EUSEW – SUSTAINABLE ENERGY WEEK

ENERGY TRANSITION

AIR TRANSPORT DECARBONISATION

SWEDEN ENERGY

Includes editorial contributions from:

Dominique Ristori
Director-General for Energy
European Commission

Antonella Battaglini
CEO of the Renewables Grid Initiative

Ibrahim Baylan
Minister for Policy Coordination and Energy in the Swedish Government

www.europeanenergyinnovation.eu

European Utility Week

6-8 November 2018 | Vienna, Austria

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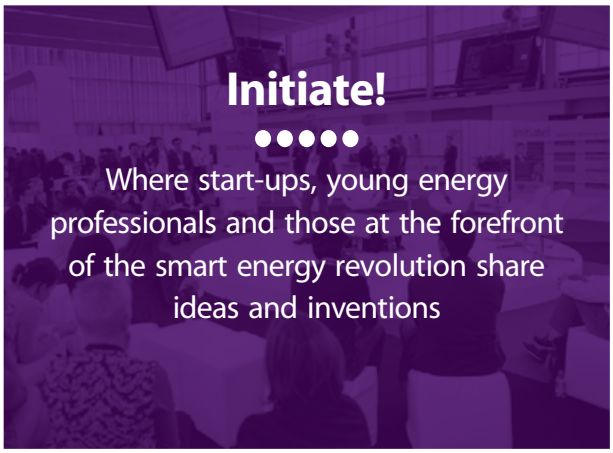

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Foreword

Welcome to the Summer 2018 issue, which marks this year's instalment of Europe's Sustainable Energy Week. Despite is name, EUSEW is in fact "a month-long series of activities to build a secure energy future for Europe." The concept, inaugurated in 2006, is designed to bring together energy stakeholders – public and private bodies and consumers, in order to promote energy saving and accelerate the transition towards renewable energy. And, once again, EEI is very proud to be a media partner for the week. If you are reading this, you are sure to be interested in the debate about new policy initiatives, or what constitutes best practice, or where to find networking events: visit eusew.eu, or facebook.com/euenergyweek, or follow #EUSEW18 for more information about this year's events.

Energy efficiency is a particular theme this year, so we are particularly pleased to feature an article by Director General Dominique Ristori, who argues that it is a priority with a positive impact upon all Europeans. Some measures have already reduced energy consumption and helped consumers save money, but he anticipates an increased focus on the building sector, reminding us of its energy, GHG and economic significance. Such initiatives, he believes, will encourage all the traditional stakeholders. Meanwhile "Energy efficiency first is not advertising slogan", he says, "but a fundamental principle". M. Ristori does not mince his words. Neither does he lack belief in its importance.

Patrizia Toia MEP argues that the fourth industrial revolution is already changing how we work and live; and that it is both the cause and the consequence of a revolution in energy production that makes energy efficiency more and more important. Meanwhile, Pirita Lindholm offers us a new Research and Innovation Policy Regional perspective. Beginning with a portentous "We live in interesting times", she reviews priorities for ERRIN's membership – which include Energy Efficiency and Smart Cities – before discussing its role in this year's EUSEW.

Tiit Jürimäe recounts with justifiable pride the story of CleanSky's BLADE project. Laminar airflow over aircraft wings can reduce wing drag by 50% and CO_2 emissions by up to 5%, and a heavily-modified Airbus A340 has now successfully demonstrated that it can be reliably and consistently achieved under normal operational conditions. In March, he tells us, the project was recognised with Aviation Week's prestigious Technology prize.

We are also pleased to feature an article by Ibrahim Baylan, Minister for Policy Coordination and Energy, in this issue's profile on Sweden. Energy, he says, accounts for two thirds of our greenhouse gas emissions. Pointing out the absolute necessity to change this habit, he suggests that addressing climate change cannot be separated from solving energy issues. He goes on to outline his country's ambitious policies: a 100 per cent renewable energy system by 2040 and net zero greenhouse gas emissions five years later. Perhaps it is no coincidence that Sweden has just unveiled eRoadArlanda, an electrified road claimed to reduce emissions by 80 to 90 percent.

Minister Baylan is convinced that we are in the midst of an historic shift, and Sweden, he says has all the right conditions to take a leading role. His optimism seems well founded – and with bailout in Greece and much larger debt problems in Italy, death in Gaza, nuclear uncertainty in Iran and doubt on the Korean peninsula, we look forward to a little bit of that optimism spreading right through EUSEW.

And there is more for you to read inside...

Michael Edmund
Editor

Energy Efficiency First is a concrete priority with positive impacts for all Europeans

By Dominique Ristori, Director-General for Energy, European Commission

Climate change is one of the biggest challenges of our time and to address it, the EU has decided to lead the worldwide clean energy transition. In the wake of the Paris Agreement, the European Commission tabled the Clean Energy for All Europeans package in November 2016 in order to set the most advanced regulatory framework that will facilitate the necessary public and private investment towards a modern and low-carbon economy.

Comprising eight different pieces of legislation, this package makes it clear that, alongside renewable energy sources, energy efficiency should be one of the major drivers towards a sustainable society. Let's not forget – the cheapest, cleanest, and most secure form of energy is the one we do not use.

Over the last 10 years, the EU had already established a number of measures to improve energy efficiency in all sectors – notably through the Energy Efficiency Directive and the Energy Performance of Buildings Directive, as well as important rules on Ecodesign and Energy labelling. These measures contributed considerably to a reduction in EU energy consumption and helped consumers save energy and money. But the new proposals go far beyond.

Building on the progress achieved, the EU is now pushing for a more ambitious approach to energy efficiency in order to successfully drive the clean energy transition. This will send the right signal to European investors, companies, national authorities and citizens.

It is worth being ambitious as energy efficiency is not only one of the most cost effective ways to support the transition to a low-carbon economy; it is also an effective way to create investment, growth and employment opportunities. It also increases the competitiveness of industries especially the energy intensive ones, and contributes to reducing the energy bills of consumers and improve their living conditions. Besides, it reinforces Europe's energy security. For every additional 1% increase in the 2030 energy savings target, combined with the 2030 targets for renewables and greenhouse gas emission reduction, the EU can reduce its gas imports by more than 3%.

I am very pleased that moves to accelerate the rate, quality and effectiveness of building renovation in the coming decades have now been agreed in the revised European Performance of Buildings Directive. This is the first part of the Clean Energy Package to be finalised by the European Parliament and the Council showing that energy efficiency is dealt with as a key priority.

It was important to start with the building sector where a considerable cost effective energy saving potential exists. It is the largest energy consumer in Europe, accounting for 40% of final energy consumption and 36% of greenhouse gas emissions in Europe and even more if we take into account heating and cooling. Yet, about three quarters of our building stock is energy inefficient and the current level of renovation is low. Besides, the building sector is an important segment of the EU economy. The construction industry provides already 18 million direct jobs in Europe and accounts for 9% of our GDP.

Based on the Commission's original proposal, the revised Directive, supported by various financing sources available at EU level, will boost investor certainty and help us to significantly increase renovation rates. The changes to buildings' energy performance rules will also encourage investors to take advantage of all technologies and progress available such as ICT and the uptake of digital technologies for buildings, in particular smart metering technologies and smart home appliances. These technologies will facilitate the penetration of renewable energy and encourage the active participation of consumers. Similarly, new rules for pre-cabling will facilitate progress on charging points for electric vehicles – one of the obvious bottlenecks in the

take-up of this new technology, thus supporting a more sustainable transport system. It is now over to Member States to show their level of ambition by transposing these measures into national law by early 2020.

At the same time, raising the energy performance and intelligence of buildings will strengthen Europe's competitiveness, reduce the level of greenhouse gas emissions, decrease energy dependence and will foster innovation and the creation of local jobs. In that context, the energy renovation of buildings could become a real European source of growth and jobs.

In addition, reductions of expenditure on energy will help the most vulnerable of our society by alleviating energy poverty, while contributing to better and more comfortable living conditions in households. The EU has made it clear that no citizen should be left behind in the energy transition. This will be one of the many concrete benefits felt by everyone in the transition to a decarbonised the society.

Energy efficiency first is not an advertising slogan but a fundamental principle. It is a concrete and productive priority with positive impacts for all Europeans. It is worth being ambitious as this will underpin the clean energy transition in Europe for 2030 and beyond. This is also highly relevant in the context of the future Long Term Decarbonisation Strategy under the Paris Agreement that the March European Council asked the Commission to present. Public consultation on this long term strategy will be launched in the coming weeks as engagement from all parts of society is key to reap the benefits of the energy transition. This is why I am looking forward to the many great energy projects and ideas presented at the EUSEW 2018.

ENEDIS
L'ELECTRICITE EN RESEAU

Electricity distribution networks: vectors of solidarity in the Energy Union

Michel Derdevet, Secretary General of Enedis*

While the current European Clean Energy package negotiations aim to extend the Union's ambition in terms of energy transition, with more important objectives than those of the energy and climate package of December 2008 and its famous "3×20" (20% renewables in the energy mix, 20% reduction in CO_2 emissions and 20% improvement in energy efficiency by 2020), they also intend to reshape the entire energy market, taking into account climate issues, the current digital energy revolution, and societal changes in respect to energy.

Under this new market architecture emerging within the Energy Union, one of the political priorities of the current Juncker Commission, the role of one energy sector player has been particularly emphasized.

With the widespread expansion of renewable, diffuse and decentralised energies, the debate on infrastructures has moved, in less than ten years, from upstream (namely, the major electricity transmission networks, security of supply guarantors, and essential architects of the opening up of transnational markets) to downstream (electricity distribution networks). The Clean Energy Package specifically focuses on Distribution System Operators (DSOs), in recognition of their central role as neutral system operators thus facilitating the functioning of European exchanges.

With the proliferation of new, diffuse and decentralised sources of production, the development of storage, energy efficiency, erasure and electric vehicles, as well as local considerations and the expectations of local authorities regarding more autonomous and renewable models, the distribution networks are clearly in a phase of transition or even revolution.

The distribution networks (i.e. all local low- and medium-voltage networks), which until now served citizens vertically from the very high-voltage network (THT), have in recent years become formidable collection networks, where the main part of wind or photovoltaic energy is connected (*95% of renewables are connected to them*), produced locally accross hundreds of thousand of sites. At the same time, they allow for greater demand side integration, support consumers in their quest for greater efficiency and energy savings and provide them with more and more intelligent and intelligible data.

With the arrival of smart metering devices, such as Linky in France, the distribution networks will more and more manage a considerable volume of data. This data will be relayed back to consumers and all local or regional decision-makers, who are keen to become actors in the energy transition. Increasingly "smarter", they are also the digital interface needed to support new uses by European citizens (electric vehicles, connected homes, etc.) within "smarter" local areas.

Electricity networks though, are not just technical or economic entities. They are also part of a broader vision of society. The Energy Union cannot be the mere addition of self-contained "local energy clusters" with a self-sufficient vision aimed at protecting themselves from their neighbours. Both historically and in the future, electricity networks were and will remain formidable vectors of solidarity: between Member States, European regions and territories, in all their diversity.

At a time when the Union is seeking to strengthen its proximity to European citizens, on the eve of the European elections, a European policy on energy infrastructure is possible. Let us take it forward with determination and ambition!

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* Enedis manages the public electricity distribution network for 95% of continental France.

The business case for digitalised district heating

By Steen Schelle Jensen, Head of Product Management, Kamstrup

The decarbonisation of heating systems is no longer a question of 'if' but rather 'how soon'. With increasing focus from all industry levels on the potential in district heating as the vehicle to make it happen, it is crucial to use current positive developments as stepping stones to making the digitalisation of district heating a reality.

One of the key measures supporting decarbonisation is the ongoing negotiations on the Clean Energy Package in which specifically the Renewable Energy Directive (RED) aims to increase the share of renewable and surplus energy in district heating. Smart grids are a fundamental enabler of this integration.

In this respect, another very important – and closely linked – directive is the Energy Efficiency Directive (EED), which focuses on providing end users with the knowledge and transparency they need to enable more energy efficient behaviour. One direct output of this is the updated Article 9 stating that district heating utilities must supply their customers with information about their actual energy consumption 12 times a year.

A precondition for utilities to be able to meet this obligation is the installation of remotely read heat meters to supply the necessary data. However, greater insight and feedback for end users is only the beginning. Once intelligent meters have been installed in the network, they will open up to a whole new world of digitalisation possibilities for the entire energy system.

FROM POTENTIAL TO REAL VALUE

Using the installation of intelligent heat meters to pave the way for going even further and getting meter data perhaps every hour rather than once a month holds enormous potential for the utilities as well.

Together with the Danish District Heating Association, Kamstrup set out to uncover the actual value of that potential. As a result, analysis company Ennova recently conducted a study based on in-depth interviews with 10 Danish utilities about their experiences with remote reading of meters.

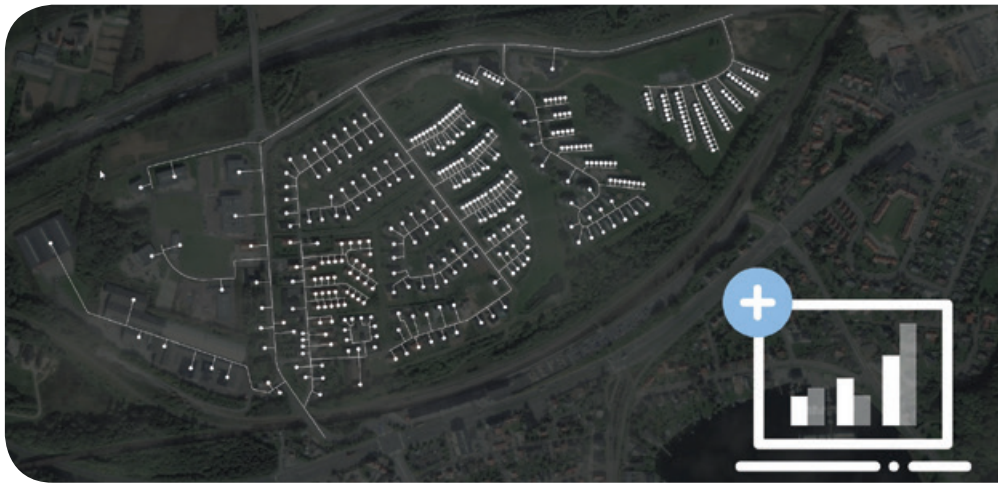
The study showed potential savings within the areas of infrastructure investments, administration, customer service, operational efficiency as well as energy consumption. In total, they amounted to an efficiency potential of 30 times the cost of investing in making the reading of meters more intelligent and frequent, which has been estimated at EUR 8 per year per connected customer. Thus, the business case was clearly established.

TALK IS CHEAP. INNOVATION IS NOT.

As a long-time advocate for the undeniable value of data, Kamstrup has a strong and strategic focus on innovation. As a result, 25% of our workforce work in product development including 20 employees dedicated to working exclusively on data analytics.

This is because in order for utilities to unlock that value they need the right tools to turn their meter data into knowledge on which to base both their everyday decisions as well as long-term investments. The possibilities in digitalised district heating are endless, but now is the time to take the next step of delivering real results.

kamstrup.com



Why we need more champions for a renewables-based future

By Antonella Battaglini, CEO of the Renewables Grid Initiative

AND THE WINNER IS...

If there was a prize for new records in the renewables sector, 2018 would have seen many winners already. Let's start with the category "costs". Under the amazed eyes of citizens and experts, prices for solar and offshore wind projects continue to fall around the globe. Moreover, project developers combine renewable generation with storage capabilities more and more often, thus increasing their flexibility and role in balancing the system. Secondly, it is worth to take a look at the growing abilities grid operators are showing in managing the grid with higher shares of renewables. At the beginning of January, Germany was running on almost 100% renewables for hours for the first time ever. In April, the British grid ran without any power from coal plants for three whole days. California received half its energy demand from solar energy in March this year, to name a few. Who would have thought that this could be possible?

However, do these records actually help us in progressing with the energy transition? I think they do. Grid operators are on a fast learning journey. They demonstrate regularly that they can safely operate a system with very high shares of variable renewables. Since grid operators are tasked with maintaining security of supply, their experience with integrating renewables gives confidence to policymakers across the globe to aim for more ambitious targets.

NEW CHAMPIONS WANTED

While, in general, the transformation of our power system is on a good path, there is still a long way to go. In this next phase, we will need new champions that have the courage to branch out. I personally would like to see some more of the following kind:

- **The most courageous activist:** Civil society plays a fundamental role in building bridges between politics and citizens as well as our societal needs and the need for sustainability. Grids are often contested and many believe that a decentralised energy generation can remove the need for transmission power lines. While we may discover new solutions for renewables integration sometime in the future, today grids are needed to sustain the growth of renewables. The next ten years are critical if we want to limit climate change. This requires courage to explain and defend choices for necessary new grid infrastructure. The most courageous activist would push for freedom and flexibility - knowing that, if one day in 30-50 years from now we have found out that there are new options for grid integration, we can always recycle the grid we have built today.

- **The most innovative regulator**: Regulators shape the framework in which transformation happens. One of their tasks is to keep costs as low as possible for consumers; this is important to maintain support for the energy transformation. However, to manage ongoing changes and uncertainties, the energy sector needs the flexibility to experiment and learn while doing. I hope

that regulators will find the right balance between these two aspects and encourage innovation also within the regulated business.

- **A new record in embracing Europe**: Anti-European movements are emerging everywhere across Europe. However, Europe is not the end of our national identities, but rather a vehicle to be more than a vulnerable little country in the middle of a global system. I would like to see a European Union which is stronger and fairer for the benefit of all European citizens and not just a few. The application of the solidarity principle and European energy security decisions will make the energy transition easier and more affordable, which will largely contribute to fighting climate change - which we all know does not stop at national borders.

- **The best dialogue convener:** The transformation of the energy sector will involve almost everyone. Whether you become a prosumer by complementing your solar panels with battery storage, your electric car and smart devices, or you see changes in the landscape with more wind farms and power lines instead of big coal and nuclear power plants, the impact on society is manifold. Therefore, we need to facilitate discussions, debate alternative options, explore the value of different views and together find solutions that are understood by all parties involved.

- **The best failure**: Imagine you are packing for a long trekking journey. You are well prepared, but uncertainties remain high. To mitigate potential surprises you need to add flexibility by packing some extra stuff, but not too much because you have to carry it anyway. Similarly, the energy transition requires new ideas and innovations. We do not know today which ones will succeed. Nevertheless, it is essential that we build a culture which allows experimenting and does not demonise failure. Failure is one of the greatest learning opportunities.

HONOURING THOSE WHO DARE TO TRY SOMETHING NEW

The Renewables Grid Initiative supports frontrunners by creating opportunities for knowledge sharing and the identification and dissemination of best practices. The 'Good Practice of the Year' award honours those who try out new approaches when developing a grid that is fit for the future. Three winners have been awarded just in May, more information about their practices are on our website. Moreover, we contribute to planning for the future by co-creating together with environmental NGOs and ENTSO-E a scenario for their Ten-Year Network Development Plan, which is compliant with the goals of the Paris Agreement.

The Renewables Grid Initiative is a unique collaboration of environmental NGOs and transmission system operators from across Europe which promotes transparent, environmentally sensitive grid development to enable the further steady growth of renewable energy and the energy transition.

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BAMB
BUILDINGS AS MATERIAL BANKS
Co-funded by the Horizon 2020 Framework Programme of the European Union

Buildings as material banks: Steps forwards

The EU funded H2020 BAMB project, Buildings As Material Banks, brings 16 partners from 7 European countries together for one mission – enabling a systemic shift in the building sector by creating circular solutions (see previous presentations of the project in EEI of Summer 2016 and 2017).

Considering Buildings as "Material Banks" is seeing them as repositories or stockpiles of valuable, high quality materials that can easily be taken apart and recovered. By harvesting materials and parts during the deconstruction and renovation of buildings, these materials can be reused in the construction, operation or refurbishment of other buildings, thus reducing waste and primary resource use. Moreover, the term 'Buildings as Material Banks' refers to a materialised investment. It is more than investing money in property funds. In this vision, the building itself is considered as a materialised savings account for material resources, through which building materials, products and components are temporarily 'deposited' into a functional element or part of the building. When socio-economic conditions are favourable, (a part of) the materials, products and components may be retrieved for another investment: another building or another high quality application. Seeing material resources as a temporary way of materialising investments opens the door to a wide range of circular business models, in which economic and environmental value is conserved and created through the reuse of materials, products, components and buildings, while (performance based) services are provided to support the daily life of (end) users. More information about the BAMB vision is available on www.bamb2020.eu/topics/blueprint/vision/.

MATERIALS PASSPORTS PLATFORM PROTOTYPE AND THE REMS EXHIBITION

A powerful new tool for materials banking across Europe has been launched at the end of 2017 and made accessible through http://passports.bamb2020.eu This new BAMB Materials Passports Platform will fill a gap in the marketplace by providing a 'one-stop-shop' to describe circular economy value across the building cycle, especially for using and re-using components and materials, and reducing the generation of waste.

A central aim is to support the transition of the building industry from a linear economy to a circular one by letting users identify value potential throughout the building cycle, from planning and construction through occupancy, repairs, renovations, repurposing and decommissioning, and by making it possible to continuously track component and materials quality & modifications. The Materials Passports Platform, currently a prototype forming the core of a materials passport system, is ready for testing by industry partners and it can be experienced by visiting the Reversible Experience Modules (REMs) exhibition.

The REMs exhibition is the largest travelling exhibition of circularity in the built environment. It consists of more than 70 building materials and products, all optimized for healthy use and reuse. Together, they form exhibition space that resembles parts of actual buildings, with a hallway, an office area, a home area and an outside area. In the REMs exhibition, all showcased products and materials will be represented in the


©E.Durmisevic, 4D architects.


REMs exhibition, Brussels, January 2018

BAMB Materials Passports Platform. Visitors are invited to access the platform and use the Materials Passports to dismantle and rebuild parts of the exhibition themselves.

The REMs exhibition launched its European tour in Brussels in January 2018. For more information on the Materials Passports Platform, contact materialspassports@bamb2020.eu. The REMs travelling schedule is available on www.epea.nl/rems.

REVERSIBLE BUILDING DESIGN

Important steps have been taken to further develop BAMB's reversible building design tools, which assess buildings' reuse potential and transformation capacity. The methodologies, protocols and tools in development have been tested in BAMB pilot projects including the Green Transformable Building Lab and the Green Design Centre. Based on the tools' assessments, a low score for reuse potential is associated with irreversible structures that make it difficult to recover materials, resulting in downcycling and recycling as the dominant reuse options on a material level. A high score for reuse potential is associated with a reversible, or circular, structure that allows for the ease of recovery of materials without damage, and consequently the direct reuse of materials and maintaining their value.

The testing of the Reuse Potential Tool and Transformation Capacity Tool in the GTB-Lab and GDC pilots has also helped to demonstrate a clear connection between the reversibility of building structures and their environmental and economic impacts. For example, prototypes developed for use in these pilots indicate that a high score for reuse potential is associated with significant waste reduction (as much as 93%), as well as a cost reduction over time (60% over the course of four transformation sequences). The abovementioned tools and Design Protocol for Dynamic and Circular Building will be finalized in early 2019. Updates and more information are available at www.bamb2020.eu/topics/reversible-building-design/

CIRCULAR BUILDING ASSESSMENT (CBA)

Later this year, BAMB will test an integrated assessment web-based Circular Building Assessment tool on building projects in the Brussels region and beyond. The objective of this tool is to help decision makers, such as architects and their clients, understand the benefits that could be derived when modelling circular building scenarios versus the linear, or 'business as usual', equivalents. The assessment encompasses environmental and economic aspects, alongside social and health related indicators where data provision makes this possible. For the economic and environmental aspects, the impact of various scenarios at a building or system level can be considered.

The underpinning methodology has been tested manually at both building and system level using existing buildings in Brussels and the UK, and a new concept building demonstrating high reuse potential and transformation capacity in the Netherlands. These examples have shown there to be quantifiable carbon benefits from the adoption of circular building scenarios when compared to the usual situation. More examples, across a wider set of building types and countries, will be available by the end of the year as the second stage of testing is completed. This second testing phase will use the CBA prototype tool and there may still be opportunities for readers of this article to get involved and volunteer a project for assessment.

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More information

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The BAMB consortium consists of: Brussels Environment (LEAD PARTNER) - Environmental Protection Encouragement Agency - Vrije Universiteit Brussels - Vlaamse Instelling voor Technologisch Onderzoek - Building Research Establishment - Zuyd Hogeschool - IBM Netherlands - Sunda Hus i Linköping AB - Ronneby Municipality - Technische Universiteit München - Universiteit Twente - Universidade do Minho - Sarajevo Green Design Foundation - Drees & Sommer - BAM Construct UK.

Energy Efficiency and Innovation

By Patrizia Toia, MEP

Energy efficiency means investing in innovation. By now, most people understand that the industrial sector is radically changing the way we produce - and hence how we work and live: this is the fourth industrial revolution, or Industry 4.0. But what may not be completely apparent is that the energy sector is also going through a revolution, one that is based on digitalization.

Energy has been a key factor in all previous industrial revolutions: steam powered the mechanisation of manufacturing that triggered the first industrial revolution in 1784. A century later, electrification drove the second industrial revolution by allowing the development of the production line, based on the division of labour. The third industrial revolution, around 1970, was based on the use of electronics and IT to control energy through the microchip. Today, the fourth industrial revolution is based on the digitalization of production, products and consumption: innovations such as the Internet of Things, 3D printing and modular production are crossing and blurring the borders between manufacturing and services, between hardware and software and between producers and consumers.

How is this is going to affect the energy sector? Before looking at the big picture let's consider a couple of everyday examples that show how the fourth energy revolution is already happening. Home automation, or domotics, is the residential extension of building automation and involves the control and automation of lighting, heating ventilation, air conditioning, and security and home appliances. Today, you can have lights that save energy by switching off automatically when nobody is in a room; or you can programme your washing machine to wash during the night, when energy prices are lower. Many already know this as the concept of the Smart Home.

Elsewhere, hybrid cars, are becoming more and more common on our roads. Their batteries can recover the kinetic energy that would otherwise be lost during braking, in order to reuse it later through an electric motor. A computer uses software to manage these flows of energy, deciding between recovery and reuse. This is energy 4.0: systems composed of physical entities and controlled or monitored by computer-based algorithms. And it is at the same time both the cause and the consequence of a revolution in energy production. Nuclear plants and fossil fuels are being phased out, giving way to intermittent renewables, making energy efficiency more and more fundamental.

According to the International Energy Agency (IEA), if EU countries were to exploit fully the potential of energy efficiency, overall GDP would grow by up to 1.1% per year. The European Commission has estimated additional GDP growth of up to 4.45% by 2030 if 40% energy savings could be achieved. Construction, for example, is a strong engine of the European economy, contributing nearly 10% to EU GDP and accounting

for 18 million jobs. Investment in the energy efficiency of buildings robustly supports this sector, which is why in April the EU Parliament approved the Energy Performance of Buildings Directive (EPBD). The first of 8 legislative proposals, it forms part of the Clean Energy for All Europeans package brought forward by the European Commission on 30 November 2016. The new legislation requires member states to develop national long-term strategies to support cost-saving renovation of public and private buildings, with a view to reducing emissions in the EU by 80-85% compared to 1990 levels.

Investing in energy efficiency will boost industrial competitiveness. High dependency on international energy markets exposes companies to price shocks, which reduce the predictability of returns on investment. Sudden price increases cannot always be passed on to the market and can therefore undermine profitability. Rising worldwide demand and the introduction of energy taxes are likely to drive energy price rises over the next decade, and energy efficiency measures can help decouple energy prices from energy costs for companies. Furthermore, the European Commission's scenario modelling also sees a direct link between energy consumption in Europe and international energy prices.

According to the models, achieving energy efficiency gains of 40% by 2030 could lower gas prices by 8% and oil prices by 3% , compared to business-as-usual scenarios.

Meanwhile, energy-efficient operation of industrial plants in the EU already makes them more competitive: Energy Efficiency Services Companies (ESCOs) deliver overall management of energy demand to energy end-users, providing operational, design maintenance and management of equipment services and leading to optimisation of energy consumption.

Energy efficiency is a driving factor for innovation in the manufacturing and services sectors. However, innovation centres will only stay within the EU if legislation is able to provide an ambitious long-term framework that demonstrates the political will to realise energy saving potential. The creation of local skilled jobs is an absolute imperative for the EU and it is widely recognised that ambitious energy efficiency measures lead to significant net job creation: the European Commission states that the number of jobs could be increased by up to 3% by 2030 if a 40% energy savings target were implemented. In other words, more ambitious targets on energy efficiency will boost our economy and the competitiveness of our industries, but will also have direct beneficial consequences for European citizens. About 10% of them are considered fuel poor, while many governments spend more money on fuel subsidies than on reducing energy bills sustainably through energy efficiency measures.

Energy efficiency is one of the smartest investments we can make, and is a win-win move for industries and citizens. All we need is a daring and forward looking approach.

A Call for Action in FP9 on Advanced Materials for Clean Energy & Clean Mobility

Despite ...

1. The role Advanced Materials play in enabling (driving costs down, increasing performance, increasing lifetime) clean energy & clean mobility technologies for the Energy Union and EU citizens' comfort & health

2. The share of Advanced Materials in the cost structure of clean energy & clean mobility technologies (beyond 50% today and trends will bring that share to 80+% making Advanced Materials a competitive factor for manufacturers of these crucial technologies)

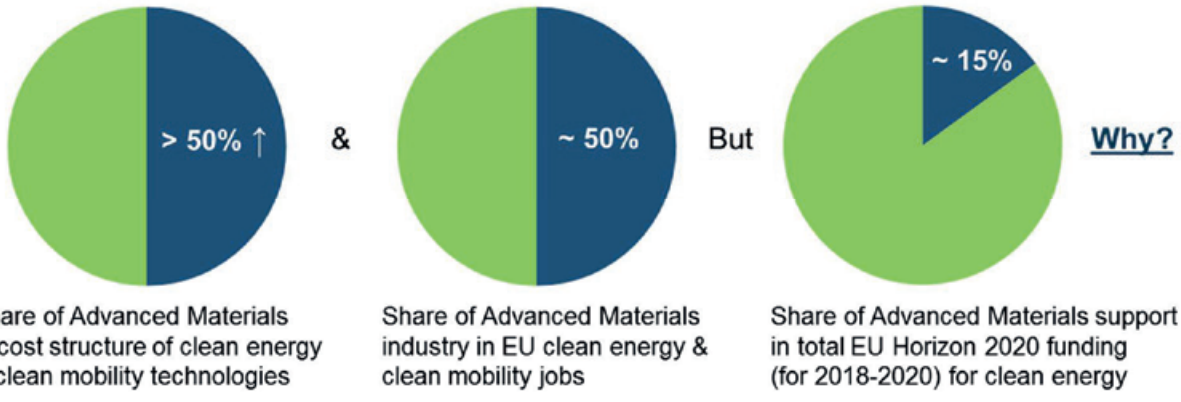
3. The need for risk-sharing policies & instruments at EU level to support the long, risky (market & technology) and capital-intensive development cycle of Advanced Materials

4. The contribution of EU-based industry of Advanced Materials to our economy (more than 30 billion euro, 500.000 jobs, 3 billion euro annual investment in R&D and facilities)

5. The share of Advanced Materials industry in EU clean energy & clean mobility jobs (at least 50%) and the importance for SMEs and start-ups to rely on a strong industry & research ecosystem to collaborate and co-innovate with

6. The excellent collaboration between EMIRI and EU DG R&I in Horizon 2020 (based on EMIRI strategic innovation roadmap called EMERIT) which led to increased EU support to Advanced Materials for clean energy & clean mobility

The share of support to Advanced Materials in total EU Horizon 2020 funding for clean energy is at a low 15% (in work programme 2018-2020) partly due to Horizon 2020 architecture & budget allocation.



Moreover, potential developments regarding EU Commission's forthcoming FP9 could affect negatively the EU support to Advanced Materials and other Key Enabling Technologies. This would result in an impact on European industrial leadership … Europe is not in a position to afford such a development.

IN FIELD OF CLEAN ENERGY & CLEAN MOBILITY TECHNOLOGIES, ANY DETERIORATION IN EU SUPPORT FOR INDUSTRIAL LEADERSHIP IN KEY ENABLING TECHNOLOGIES SUCH AS ADVANCED MATERIALS WILL LEAD UNDOUBTEDLY TO EU NOT DELIVERING ON ITS ENERGY UNION PROMISES:

1. **Europe not generating the much-needed economic growth & jobs for citizens who strongly supported European transition to clean energy & clean mobility technologies**

   EU is losing leadership in clean energy & clean mobility techs leading to deindustrialization and job destruction (net loss of 100.000 jobs in 2013-2016) while China & USA are thriving. Moreover, without presence in EU of a globally exporting Advanced Materials industry, the job loss would have been worse (EU-based Advanced Materials industry created 40-50.000 jobs over 2013-2016 while the downstream part of clean energy value chains lost 140-150.000 jobs). Our industry is actually slowing down EU loss of leadership in clean energy & clean mobility techs and is undoubtedly the foundation on which EU can regain global market share in the field.

2. **Europe weakening its innovation ecosystem in technologies critical to climate change mitigation**

   With China spending more than 2.5 billion euro annually on clean energy & clean mobility technologies, EU is now challenged. The situation is worsened by fragmentation, unclarity and instability of European R&I support to its ecosystem. In China, Advanced Materials are among the 10 priorities of "China Manufacturing 2025" … This is not the case in Europe.

3. **Europe replacing dependence on fossil fuels from outside EU by dependence on imported clean energy & clean mobility technologies**

   Today more than 50% of industrial players in top 10 of manufacturers of wind turbines, solar modules, batteries, … are Asian (in most cases Chinese)… Leading to EU representing today less than 15% of jobs in the field in 2016 (1.16 million jobs) while China is already at 44% (3.65 million jobs). Without EU action, EU will pass below 1.000.000 jobs in clean energy by 2020 (10% of global jobs in the field) and market opportunities of fighting climate change will not benefit EU citizens.

WE CALL ON EU COMMISSION, EUROPEAN PARLIAMENT AND MEMBER STATES TO FURTHER SUPPORT ADVANCED MATERIALS AND OTHER KETS AND SHOW AMBITION IN FP9 TO PRESERVE EUROPEAN TECHNOLOGY DEVELOPMENT LEADERSHIP, RE-INDUSTRIALIZE EU IN CLEAN ENERGY & CLEAN MOBILITY TECHNOLOGIES, DELIVER ON THE ENERGY UNION PROMISES AND PROVIDE ECONOMIC OPPORTUNITIES TO CITIZENS.

EMIRI (the Energy Materials Industrial Research Initiative) represents more than 60 organizations (industry, research, associations) active in Advanced Materials for clean energy & clean mobility technologies. The association contributes to industrial leadership of developers, producers and key users of Advanced Materials by shaping an appropriate European innovation, energy and industrial policy framework. For more information, contact Dr Fabrice STASSIN at fabrice.stassin@emiri.eu, visit www.emiri.eu

The Solar Smart Specialisation Platform

Promoting solar electricity exports from southern to central and northern European countries

By Dr. Díaz-Vázquez, A.R. (Joint Research Centre), Dr. Caldés-Gómez, N., (Ciemat)

In the light of the Paris Agreement and the EU Climate and Energy framework, Europe must find ways to decarbonize its economy in a cost-effective manner while improving its energy security, social and economic development. It must endure its leadership in the Renewable industry and moving towards an integrated and well-functioning Energy Union. In this context, generating and exporting solar electricity from Southern to Central/Northern European countries can contribute to achieve many of these goals.

1. Regional cooperation can help decarbonize the European power system in a cost-effective manner by generating renewable electricity where the resource is most abundant and/or system costs are lower.

2. Regional cooperation is a step forward towards a more integrated, well-functioning and cohesive Energy Union and ultimately to the 2020 and 2030 European strategy.

3. Since the best solar resource potential is found in the many of the least developed regions in Europe, the deployment of such projects could create remarkable social and economic impacts in such regions, contributing to reduce regional disparities within Europe.

SMART SPECIALISATION PLATFORM ON ENERGY (S3PENERGY)

The S3PEnergy is a joint initiative of the Directorates-General for Regional and Urban Policy, Energy, and the Joint Research Centre. The S3PEnergy is planned to become an enabling tool for regions to coordinate, rationalize and plan their respective energy strategies, develop a shared vision on knowledge-based energy policy development and set up a strategic agenda of collaborative work. The Smart Specialization (S3) is aligned with the Energy Union R&D and competitiveness priorities and promote the energy related Thematic Objective (TO) TO1, Research and innovation, TO4, Low carbon economy and TO7, sustainable transport, together with the commitment to the Strategic Energy Technology Plan (SET plan) 10 key actions

THE FIRST OF A KIND (FOAK) SOLAR GENERATION PLANT

Within this context, Solar Energy has been identified by various regions as one of their key S3 priorities. As a result, a Smart Specialisation Solar European partnership has been created as a way to support solar electricity generation and distribution in Europe and maintain the European concentrated solar power industry leadership worldwide. http://s3platform.jrc.ec.europa.eu/s3-energy-partnerships-solar-energy.

A cross-border solar electricity project, to export electricity from Southern to Central and Northern

“The project, a first of a kind generation plant, could bring multiple benefits for Europe as well as for the involved countries and regions, addressing the main goals of the Energy Union and CLIMA priorities”

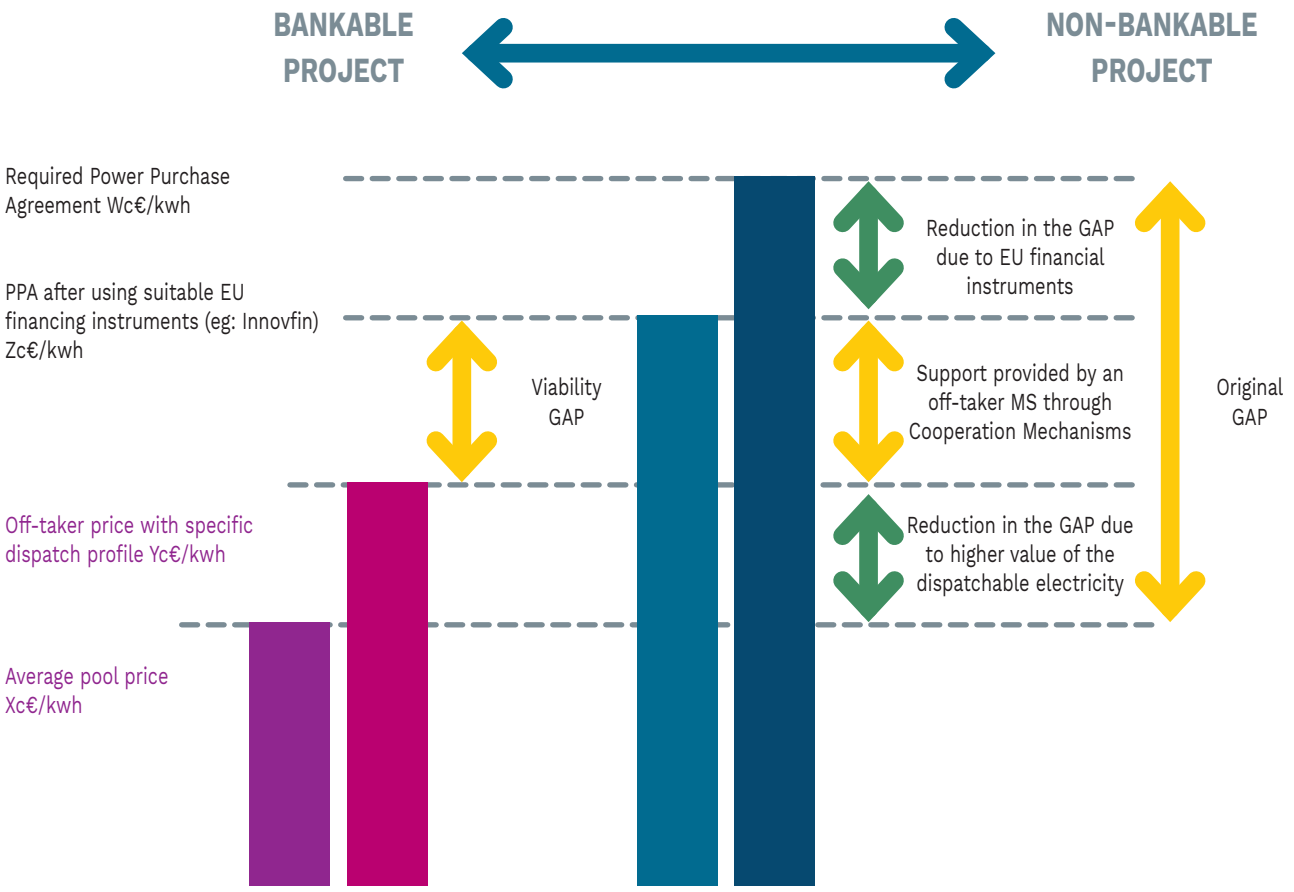


Figure 1: Example; how to reduce the financial gap between PPA and pool price. Source: Adapted from ESTELA (2017)

European countries, is under development as a result of the collaboration within the solar smart specialisation partnership. The project, a first of a kind (FOAK) generation plant, could bring multiple benefits for Europe as well as for the involved countries and regions, addressing the main goals of the Energy Union and CLIMA priorities:

1. The decarbonisation of the European economy, through the progressive replacement of the high intensive carbon generation power plants in Europe. The design and development of a combined cycle generation concentrated solar plant, hybridised with photovoltaic plant and gas or biomasse, is the only possibility to provide renewable baseload power for the European energy market.

2. Increasing of the limited interconnection capacities; the contribution to a fully-integrated internal energy market, to better exploit the renewable energy export-import potential across Europe.

3. The use of the Cooperation mechanism.

4. Maintaining the European industrial and research leadership in concentrated solar technologies and contribute to improve its techno-economic performance.

As for the possibility to use the Cooperation Mechanisms, the Renewable Energy Directive 28/2009/EC – also known as RED - provides the regulatory framework to allow for cross-border electricity trade while providing the possibility to grant financial support to solar FOAK projects for exports in Southern Europe. Back in 2009, the RED set national binding renewable target and allowed member state (MS) to cooperate to partially achieve their target jointly by making use of the Cooperation Mechanisms defined in Articles 6, 7, 9 and 11 of such Directive. The use of such cooperation mechanisms was intended to help MS by providing them with more flexibility in reaching their renewable targets as well as to achieve their 2020 renewable target in a more cost-effective. Alongside this, the proposal for Governance for the Energy Union aims at facilitating

COOPERATION MECHANISMS OF THE RES DIRECTIVE (2009/28/EC)

Article 6: Statistical transfers
In this case, renewable energy (electricity, heat or transport energy) which has been produced in one MS is virtually transferred to the RES statistics of another MS, counting towards the national RES target of that MS.

Article 7: Joint Projects between EU MS
Allows EU MS to finance a RES project jointly thus sharing the costs and benefits of the project and developed under framework conditions jointly set by two or more MS (i.e. a specific new plant is identified and the output of the plant is shared (statistically) between to cooperating MS). The involved MS define which share of the energy production counts towards which MS target.

Article 9: Joint Projects with third countries
Joint projects can also be implemented between MS and third countries (i.e.: countries outside the EU). A precondition is that an amount of electricity that equals the electricity amount generated from RES and subject to this joint project is physically imported in o the EU (For more information on this option, see www.better-project.net).

Article 11: Joint Support Schemes
Under this scheme, MS merge or coordinate (parts of) their RES support schemes and jointly define how the renewable energy produced is allocated to their national targets.

Source: RES Directive (2009/28/EC)

the coordination of National energy policies fostering regional cooperation between MS.

However, despite the expected benefits, some obstacles currently prevent the materialization of these types of projects.

1. As for the possibility to make use of the cooperation mechanisms, past experience indicates that it may take a some time to get the interest and the support from both host and off-taker countries This is due to the existence of several barriers of heterogeneous nature (eg: uncertainty about the post 2020 framework, social acceptability, first mover risk, limited interconnection capacity, etc). In any case, after identifying potential interested cooperating countries, there is a need to carefully assess and find the right framework conditions and the design elements of the cooperation agreement that lead to win-win outcomes for all involved actors.

2. As for ways to make this project economically feasible exists various options to reduce the financial "gap", understood as the difference between the required power purchasing agreement (PPA) and the average electricity pool price.

In this case, when considering a solar FOAK project, the interest of the off-taker country should go beyond purely costs savings and include, for example, industrial and technology interest, the need for dispatchable renewable electricity or/and research interests.

The fact that Extremadura (ES) is leading the Solar S3 partnership will help Extremadura collaborate and join forces with other interested regions/member states and their National Governments. Finally, lessons learned from the Extremadura case study will help other regions with similar circumstances better exploit their renewable energy export potential across Europe. This will facilitate the much-anticipated integrated renewable electricity market in Europe.

Ana Díaz Vázquez Profile

Dr. Ana Díaz Vázquez holds an industrial engineering degree from the University of Dresden, Germany and a PhD in energy engineering from the University of Pisa, Italy. Her thesis research was undertaken in collaboration with ENEL (Italian Energy Agency). She has also completed a Management Development Program (PDD) from IESE Business School.

She has conducted research activities at the University of Madison (Wisconsin, USA) and at the Institute for Energetic Economy Studies and Rational Use of Energies (IER, Stuttgart, Germany).

Dr. Diaz has co-authored the book "Opportunities and perspectives on innovation for the energy production systems", for the Ministry of Industry in Germany and is the author of several technical papers in international journal about energy production systems.

She has been the Chief technology officer at Abengoa and a member of the OMI-Polo Español-Portugal board. In august 2016, she began working at JRC Seville, carrying out research on Energy Policies and Technologies at the Economics of Climate Change Unit.

Structural Funds for de-risking energy investments in buildings

The use of financial instruments (FIs) supported by the European Structural Investment Funds (ESIF) is proving to be a more sustainable and efficient way to invest in growth and development than the classic non-returnable grant.

In the current 2014-2020 period, the Operational Programs (OPs) of the Member States (MS) plan to use 20 billion euros from ERDF and CF (about 8% of the total) for FIs, nearly double than the 11 billion euros of the previous period 2007-2013.

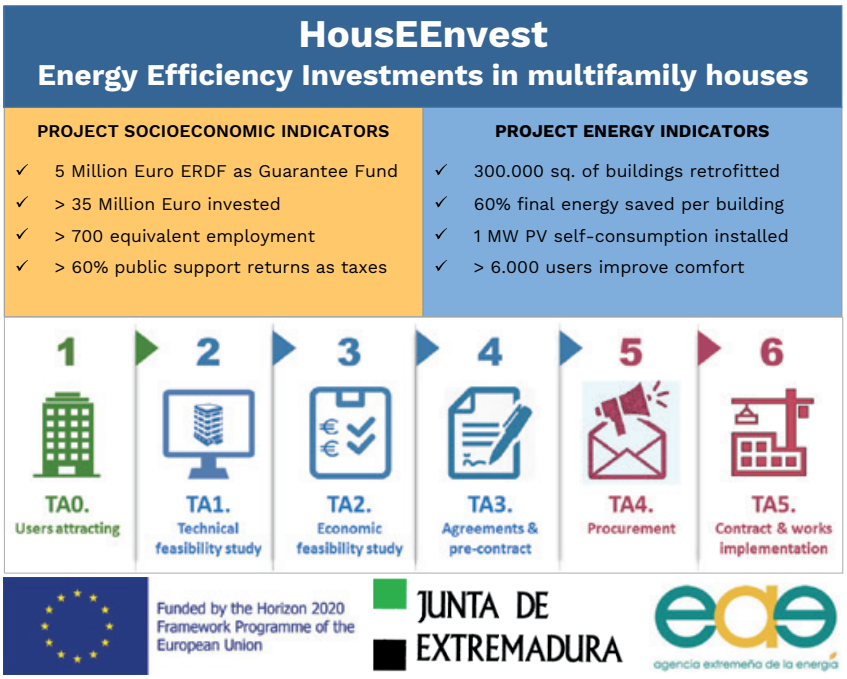
The financial products in larger use are currently loans and equity, or quasi-equity, with a lower introduction in the market of guarantees and multiproduct. This was also repeated in 2007-2013, mainly due to the intensification of FIs in the SME and RTD thematic objectives.

However, 2014-2020 presents a large number of FIs samples in the energy field, covering loans, guarantees and multiproduct. Extremadura Region is one of these samples.

Extremadura Region has designed a Guarantee Fund of 5 million euros ERDF from the ROP, which will cover the risk of the Commercial Banks when lending 35 million euros for energy retrofitting of condominiums.

Extremadura is going to combine 5 different fund sources in order to mobilize the final investments:

- The OP provides the guarantee to the commercial banks.
- Commercial banks leverage with private investment until 35 million.
- Finerpol project (Interreg Europe) funded the ex-ante assessment.



- Rehabilite project (Interreg SUDOE) funded the capacity building platform.
- HousEEnvest (H2020) will provide the technical assistance for the investment implementation through a one-stop-shop.

Some conclusions from Agenex (Extremadura Energy Agency) experience:

- Commercial banks are willing to increase their portfolio of clients through investing in new projects. However, due to the lack of references, the energy efficiency in buildings is still perceived as a risky investment when it includes full retrofitting and external insulation.
- The intervention of public sector is necessary in order to provide de-risking systems, which has to be offered through financial products such as Guarantees, and through integral market assistance such as one-stop-shops.
- EC initiatives were very valuable in the process of definition of Extremadura FI (Fi-Compass, Smart Finance for Smart Buildings Initiative, Sustainable Energy Investment Forums, EEFIG, DEEP or Managenergy), and their necessity will increase for the definition of the coming 2021-2027.
- Specific training is recommended for Managing Authorities all over Europe, to be able to manage FIs in OPs, and to analyse the results from ex-ante assessments. Managenergy initiative, together with National, Regional and Local Energy Agencies can play an important role in the analysis of the market gap to be covered by the FI.

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EU Energy Transition

Harnessing Technological and Systemic challenges, Addressing the Societal and Political ones.

By Adel El Gammal, Secretary General, EERA

The EU has historically been a driving force in fostering international climate action. After the shortcomings of the 15th Conference Of the Parties (COP 15) in 2009, EU was instrumental in forging a global agreement in 2015 at COP 21, also known as the "Paris Agreement"

This agreement, ratified to date by 176 of the 197 parties to the Convention, charts a new course in the global climate effort with the aim to keep a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

Under this Agreement the EU's "nationally determined contribution" is to achieve at least 40% domestic reduction in greenhouse gas emissions compared to 1990 levels by 2030.

The EU Strategic Energy Technology plan (EU SET Plan) was set up in 2007 as the core EC instrument to boost low carbon energy research, in the view of supporting the EU transition towards a low carbon economy. It is therefore also one of the key EU instrument to meet its international climate commitments.

THE SYSTEMIC AND CROSS-SECTORAL NATURE OF THE ENERGY TRANSITION

The structure of the EU SET Plan still reflects its original target, i.e. boost energy research to drive down the cost of low carbon technologies towards competitive levels.

Under EU's visionary impulse, most renewable energy technologies have achieved dramatic progress, many at scales never anticipated, even by the most optimistic experts. For instance, PV still considered 10 years ago as a highly expensive marginal technology reserved for niche applications, has seen its cost reduced since then by a factor 8, making it one of the cheapest energy sources in many countries of the world. And similar achievements were observed in most other technologies, notably on- and off-shore wind.

The resulting massive deployment and unexpected penetration of non-dispatchable low carbon technologies into our energy mix has restated the Energy Transition challenge in a way that efforts should now be mostly directed towards ensuring a security and stability of the energy system, under very high penetrations of various non-dispatchable and distributed generation sources.

As research pillar of the SET-Plan, EERA has over the past decade delivered on its objectives, achieving game-changing progress in the competitiveness of several low carbon technologies.

Its focus will now increasingly be on addressing the systemic nature of the energy system as a whole.

Allowing high penetration of intermittent and distributed renewables indeed requires a complete rethink on how to manage the energy system and calls for a complete departure from the systems design and management concepts that have prevailed up to now. It is now essential to understand how energy, in all its forms, is used, at which place and time, within and across the various activity sectors, and how energy can best be generated, converted to different forms, stored and transferred between sectors. Advances in many energy technologies (e.g. Hydrogen and "Power-to-gas" technologies, batteries, Carbon Capture and Storage ..) open up new approaches to the global generation, usage and management of energy within and across the various activity sectors and applications.

Capitalizing on the holistic energy expertise of its 17 Joint Research Programmes, this is in essence the challenge that EERA addresses today.

THE "PROSUMER", A CITIZEN BEFORE A MARKET AGENT

While significant strides were recently achieved in understanding smart intersectoral linkages between various forms of energy, very little progress seems to be achieved so far on how these new approaches to energy will eventually affect the end consumer.

Indeed, the so-called "societal dimension" of the transition is often understood as ensuring its acceptability by the "citizen-consumer", himself reduced to a simple market agent.

In fact the true societal challenge is about ensuring that the transition is driven along the values and aspirations of citizens. It is about designing a new framework that is not only acceptable, but also highly appealing and desirable to EU citizens of today and tomorrow.

As such, transitioning to a low carbon regime is about far more than switching to low carbon technologies. It is about a fundamental rethink of the relationship that we, as individuals, hold to energy generation, preservation and consumption. And policy makers need to fully

acknowledge that beyond technology, successfully transitioning towards a low carbon regime, is a wider challenge that entails redefining aspirations, preferences and lifestyle whereby citizens take stock of their entire energy footprint. It is about rethinking our societal values and eventually our education system.

EERA, capitalizing on its social science experts, is leading several initiatives to establish the conditions of a successful transition, by increasing awareness of Social Sciences and Humanities (SSH) concerns within the SET Plan policy making process.

EU SCIENCE & TECHNOLOGY IS DELIVERING, GOVERNMENTS NOW NEED THE POLITICAL VISION TO MAKE IT HAPPEN

While the size and structure of "Horizon Europe", the next EU Research and Innovation framework programme are still under discussion at the time of writing this article, it is essential to recall that the vast majority of public R&I funding still resides with Member States.

By the end of June, 14 thematic Implementation Plans covering the full SET Plan scope will have been endorsed by the SET Plan Steering Group – the governing body of the SET Plan – detailing the R&I actions that need to be implemented to achieve the overall SET Plan objectives.

Structuring a "bottom-up" institutional alignment has been the primary and original focus of EERA; it has resulted in the strong and unique convergence of efforts towards sharing research agendas across organizations within and across EU and associated countries.

However, at the outset of the critical execution phase of the SET Plan, increasing the convergence of SET Plan countries priorities – representing more than 90% of the mobilizable research funds - represents now the key challenge on which much of the SET Plan success will depend.

While research funding allocation fully remains within the political Member State's remit, EERA, with its extensive European coverage and through the intimate institutional connections its members hold with national stakeholders, will concentrate efforts to foster and facilitate higher convergence of SET-Plan countries research priorities towards the SET-Plan objectives.

At a moment where many of the EU Member States are struggling under populist and nationalist pressures, Member State governments are now confronted with a fundamental choice on their common future.

Either they demonstrate the political courage of implementing a strong and competitive Europe, united by shared fundamental values, striving to maintain and consolidate a common EU vision and leadership.

Either they give way to short term political motives and drive illusory nationalistic priorities that will irremediably weaken Europe's share of voice in the global geopolitical arena and eventually endanger the continuity of its very founding values.

EERA has been created along the fundamental belief in the virtues of collaboration. It stands more than ever firmly, with the entire EU Research Community, to support a better common EU future. ●

About EERA

The European Energy Research Alliance (EERA) is an alliance of European public research centres and universities. It constitutes the strategic research pillar of the European Strategic Energy Technology Plan (SET-Plan).

EERA brings together about 250 research centres and universities, representing about 50.000 energy experts across 30 countries. Actively working together on 17 joint research programmes, they build on national research initiatives. In a Joint Programme a research organization join institutions in other European countries to work on shared priorities and research projects. The EERA Joint Programmes are aligned with the priorities of the EU SET-Plan.

Visit: **www.eera-set.eu**

About Adel El Gammal

Adel El Gammal is a recognized expert and a senior EU Affairs professional in the fields of low carbon technologies, energy transition, and climate change.

Before joining EERA as Secretary General, Adel was active for the last 10 years in the EU climate energy debate, notably as Director of the Becquerel Institute, a consultancy providing advanced research and intelligence on the energy transition, and Secretary General of the EU PV Industry Association (EPIA, now SolarPower Europe), where he launched the SET-Plan Solar Europe Industry Initiative (SEII).

Adel is civil engineer from Ecole Polytechnique of Brussels, holds degrees in Business Administration from Solvay Business School (Belgium) and Insead (France) and later specialized in Environment Management (IGEAT, Belgium).

DEMOSOFC
FCH2-JU PROJECT

The first industrial-size biogas-fed CHP system based on fuel cells (high efficiency and zero emissions)

The DEMOSOFC project, funded by FCH-JU, has put into operation **the largest industrial size biogas-fed fuel cell plant in Europe**. The plant is a combined heat and power energy system, working by recovering the biogas obtained from the digestion of the sewage sludge in a wastewater treatment plant located near Torino (IT).

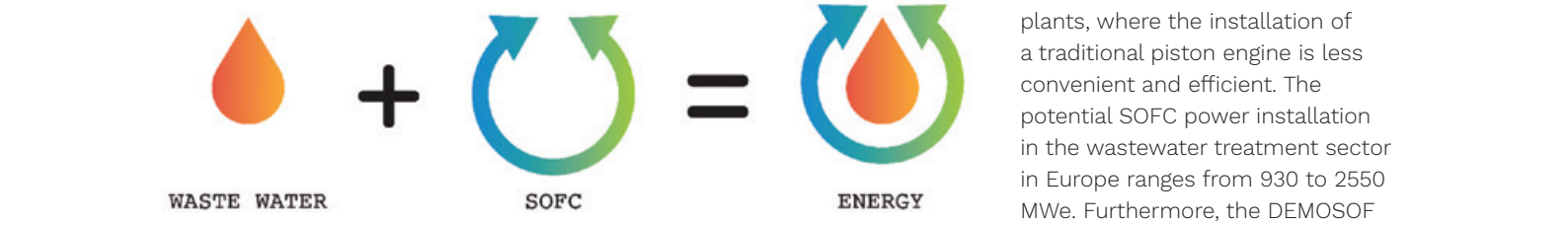
Thanks to the anaerobic digestion, sludge is turned into a useful fuel – biogas – made of methane and carbon dioxide. This 100% renewable fuel is fed to an innovative **Solid Oxide Fuel Cell (SOFC)**, able to produce **high efficiency electrical power, heat, and zero emissions to the atmosphere** (because the electrochemical process, which occurs inside the SOFC, is indeed generating no combustion products).

The DEMOSOFC plant is able to generate, from a by-product of the wastewater purification line, CHP energy for the plant. The installed 174 kW_e system (3 modules, 58 kWe each) will be able to **cover around 25-30% of the plant electrical load and around 50% of the thermal load** on a yearly basis.

The first of the three SOFC modules started its operation in the Collegno site (Torino, IT) on October 30, 2017 and has now reached **more than 2000 hours of operation**. Results confirmed the high efficiency of the SOFC module (always higher than 50%, with peaks at 55-56%) and the zero emissions to atmosphere. A dedicated onsite emissions analysis – carried out by the Finnish partner VTT in December 2017 – showed that all potential pollutants (NOx, SOx, particulates, VOC, etc) are below detection limits of the traditional instrumentation (e.g. < 20 mg/m^3 for NOx and < 8 mg/m^3 for SO_2).

Key advantages of the DEMOSOFC concept, compared to traditional internal combustion engines and micro-turbines, are the very **high electrical efficiency** (50-55% compared to 35-40% for traditional engines), **emissions and modularity**: the SOFC technology shows in fact stable performance despite the plant size (from kW to hundreds of kW to, in perspective, MW-size).

The **replication potential of this installation is significant**. The DEMOSOFC project estimated that, among the 23'423 wastewater treatment plants in Europe, more than 50% are small-medium size plants, where the installation of a traditional piston engine is less convenient and efficient. The potential SOFC power installation in the wastewater treatment sector in Europe ranges from 930 to 2550 MWe. Furthermore, the DEMOSOF



concept could be replicated in other biogas sectors like organic fraction of municipal solid waste treatment, agriculture, food industry and landfill.

Advanced solutions such as the one demonstrated in DEMOSOFC **can finally play a role in the transition to a Circular Economy**.

Politecnico di Torino (Project Coordinator: Prof. Massimo Santarelli), SMAT (Waste Water Treatment Plant Operator), Convion Oy (SOFC System Supplier) and VTT (Finnish Research Center), with the support and the business analysis of Imperial College of London, have developed the DEMOSOFC plant and concept.

The DEMOSOFC plant has generated a growing interest in industry, utilities and R&D experts: POLITO and SMAT, together with all the consortium, are available to organize meetings and visits to the demo plant, to analyse technical and economic benefits of the proposed solution. For more info, contact: demosofc@polito.it

"This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 671470. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research."

Contact information

DEMOSOFC website: www.demosofc.eu

DEMOSOFC Blog: https://demosofc.wordpress.com

Twitter: https://twitter.com/Steps_Polito

Facebook: https://www.facebook.com/StepsPolito/

Greener industry from algae network

Raúl Muñoz, Associate Professor, Department of Chemical Engineering and Environmental Technology, Universidad de Valladolid, Spain

A collaborative network bringing researchers and industry together is developing ways to use microalgae for the creation of high-value chemicals, ingredients and low-carbon biofuel.

High in antioxidants, pigments, polyunsaturated fatty acids and proteins, microalgae are seen as renewable ingredients. These tiny water-based organisms could also produce low-carbon biofuel and remove chemicals from waste gas or water.

To tap into this potential, EUALGAE – a COST-funded research and business network of over 180 members from 31 countries worldwide – is collaborating on processes and business models to commercialise algae through bio-based products.

Members are developing techniques to grow and harvest microalgae efficiently. They are also investigating how to extract and refine products for the market at a competitive price, with minimum waste and impact on the environment.

"Microalgae have lots of possibilities, but their potential has been studied poorly to date," says Dr Raúl Muñoz, the network's scientific dissemination

Picture caption here

Our big achievement is that all European researchers in microalgae have come together. We are establishing new collaborations between research and industry that will eventually lead to spin-offs.

manager and a researcher at the Universidad de Valladolid in Spain. "Our big achievement is that all European researchers in microalgae have come together. We are establishing new collaborations between research and industry that will eventually lead to spin-offs."

One early advance has improved technology to purify biogas, he adds.

"Here, microalgae remove carbon dioxide and hydrogen sulphide from biogas, producing pure methane to be injected into natural gas grids," he says. "Other breakthroughs will come later."

CIRCULAR ECONOMY INGREDIENTS

Dr Maria Hayes of Teagasc, Ireland's Agriculture and Food Development Authority, is leading cooperation on algae refining and applications within the network. "EUALGAE supports a move to more circular and bio-based economies," she says.

Microalgae compounds have uses in many industries, ranging from food and animal feed to pharmaceuticals and cosmetics, she explains. For example, members are investigating pigments such as astaxanthin, which can be used in fish products, and algal oils, which can replace less sustainable oils in cosmetics.

Algal proteins are particularly interesting, and can be used in infant formula. "There is a protein deficiency in Europe," says Hayes. "Companies could produce high-amino-acid flours that are very bio-available and lucrative."

Short-term research placements between members – over 30 so far – are opening up opportunities to develop new products. For example, EUALGAE provided funds for a Spanish researcher to go to Ireland to help scale up a process for extracting proteins that could benefit heart health or help prevent type 2 diabetes.

In addition, the network is helping the European Commission and national legislatures better understand the potential of algae-based industries. "We are preparing a white paper on microalgae, due by the end of 2018," she says. "It describes what strains are in Europe, current products, barriers to product development and costs and benefits."

PRODUCTIVE PARTNERSHIPS

These partnerships between researchers and industry are at the heart of EUALGAE, adds Dr John Dodd, a bio-business consultant and co-founder of the company AlgaeCytes Ltd, and who worked with the network.

"Researchers need SME partnerships to finance work, while commercial organisations have invaluable access to scientists' know-how and analytical equipment," he says.

He adds that the network's research placements and training are having a big impact on the industry: "EUALGAE gives a focus for work while the training increases the number of experienced specialists in this field, creating a stronger resource for Europe."

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Contact information

View the Action: http://www.cost.eu/COST_Actions/essem/ES1408

View the Network website: http://eualgae.eu

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CREATE project

Compact REtrofit Advanced Thermal Energy storage - An economically affordable, compact and loss-free heat battery for existing buildings.

The CREATE project is a research project funded by the European Commission under the Horizon 2020 programme. The consortium consists of eleven partners from eight different European countries and it is led by AEE – Institute for Sustainable Technologies. The project started in October 2015 and will last till September 2019.

The main aim is to develop and demonstrate a heat battery, i.e. an advanced thermal storage system based on Thermo-Chemical Materials (TCMs), that enables economically affordable, compact and loss-free storage of heat in existing buildings. In this manner, the CREATE system will be able to store surplus of heat from summer to winter.

DEVELOPMENT OF THE CREATE SYSTEM

A database of approximately 600 hydrate reactions of salt hydrates was created in order to select a the most suitable material for the Thermo-Chemical Material. Based on characteristics such as energy density, charging and discharging temperature, the salt potassium carbonate (K_2CO_3) was selected as the preferred TCM for the CREATE system. More than twenty different TCM composites of K_2CO_3 were manufactured on lab-scale and extensively characterized. The composite with the highest energy density in particle beds was selected for further upscaling. A production run of 100kg batches was successfully performed, proving that industrial production is within target range.

The entire system is based on seasonal storage of solar energy. The heat storage process is possible due to dehydration (discharging) and hydration (charging) of the salt in a closed system under vacuum. Heat from the solar collector is used to dehydrate salt while water vapour is released, condensed at evaporator/condenser (EC) unit and stored in the water reservoir. In winter, the water from the water reservoir is pumped to the EC and evaporated there. Then the vapour is flowing to the salt and the salt is hydrated.

PROJECT PROGRESS

The most challenging part of the project proved to be handling of the volume expansion/shrinking of the salt during the hydration and dehydration process and the provision of constant heating power.

So far, the main project's achievements revolved around (i) improvement of the salt performance such as power, stability and energy density; (ii) development and optimization of a prismatic shaped absorber vessel to improve stackability and space requirements; (iii) development and optimization of low-cost evaporator/condenser; and (iv) optimization of the full-scale system on basis of lab experiments and annual simulation.

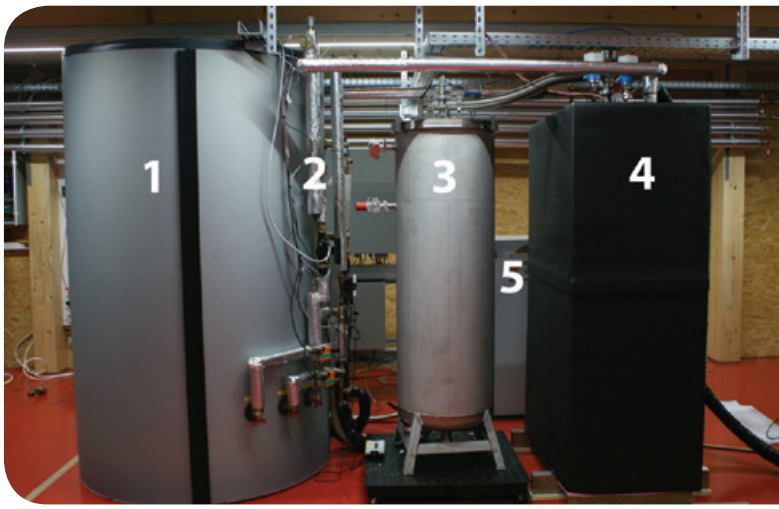

Figure: The test set-up for experiments with one CREATE storage module. 1. Buffer storage tank, 2. Heating rod, 3. Evaporator/Condenser (EC), 4. Storage module, 5. Heat pump

DEMONSTRATION

Implementation of the CREATE concept is foreseen in typical European dwellings. To demonstrate the applicability of the thermochemical storage solution and its operation in real-life conditions as well as to receive an early user feedback, the CREATE system will be installed in a full-scale into an orphanage in Warsaw, Poland. The climate at the location is characterized by cold winters and warm summers. The demonstration is planned to start in summer 2019.

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Value of Energy Storage in supporting cost effective decarbonisation

By Goran Strbac, Professor of Energy Systems, Dr Ioannis Konstantelos and Dr Danny Pudjianto, Imperial College London

The transition towards low-carbon electricity systems raises severe challenges with respect to increased balancing requirements and degradation in asset utilisation. Energy storage (ES) constitutes a flexible option that can offer numerous services and facilitate a cost-effective decarbonisation of our electricity systems. In the following sections we highlight and quantify the value of some key functions that ES could perform in the future.

WHOLE-SYSTEM BENEFITS OF ENERGY STORAGE

The WeSIM model, developed at Imperial College, was applied to quantify the benefit of installing 20GW of ES to the electricity system of Great Britain in future scenarios that feature a high penetration of variable renewables in the year 2030. Figure 1 shows the mix of cost and benefits across five scenarios; the first three and latter two achieving a carbon intensity target of 100 and 50g/KWh respectively. Sensitivity studies were also undertaken around the amount of photovoltaic and wind generation that could be installed at the time (denoted high PV and high wind). The annual net benefit of storage was found to be between 3.2 and 7.8 billion £/year. The model computed costs and benefits across several components:

(i) Investing in ES (S CAPEX) is the capital cost of deploying 20GW of ES across the country.

(ii) Investment in cross-border interconnection capacity (I CAPEX).

(iii) Investment in demand-side response capability (DR CAPEX).

(iv) System operating cost (OPEX) through energy arbitrage, balancing and frequency regulation.

(v) Distribution investment (D CAPEX) by supporting power management in distribution networks.

(vi) Transmission investment (T CAPEX) by managing north to south power transfers.

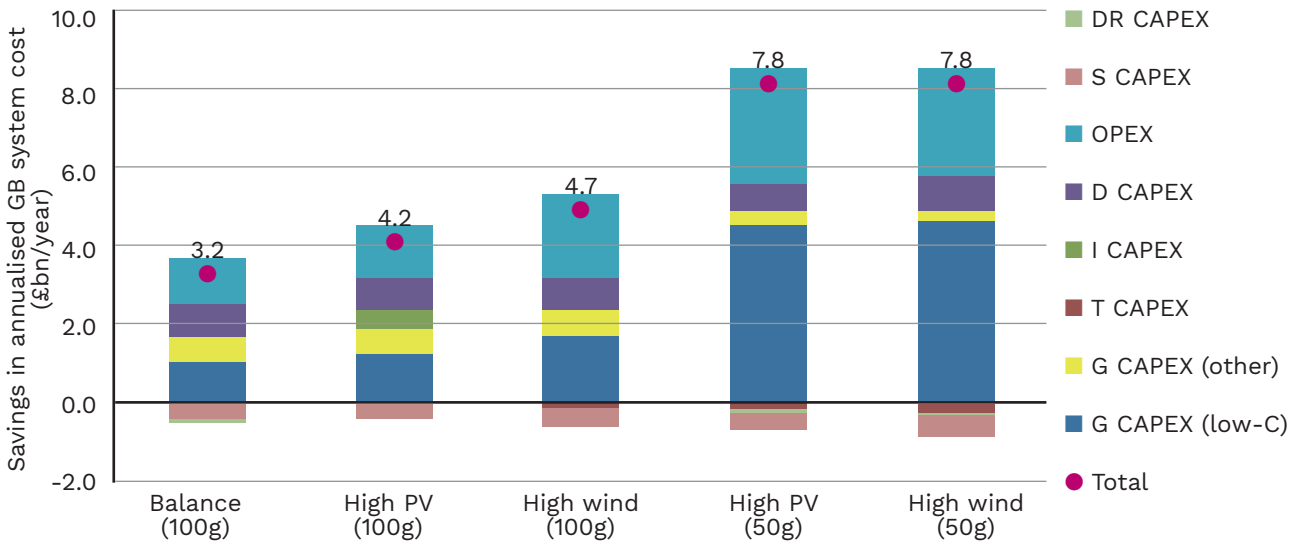

Figure 1: Annual cost savings resulting from the deployment of ES.

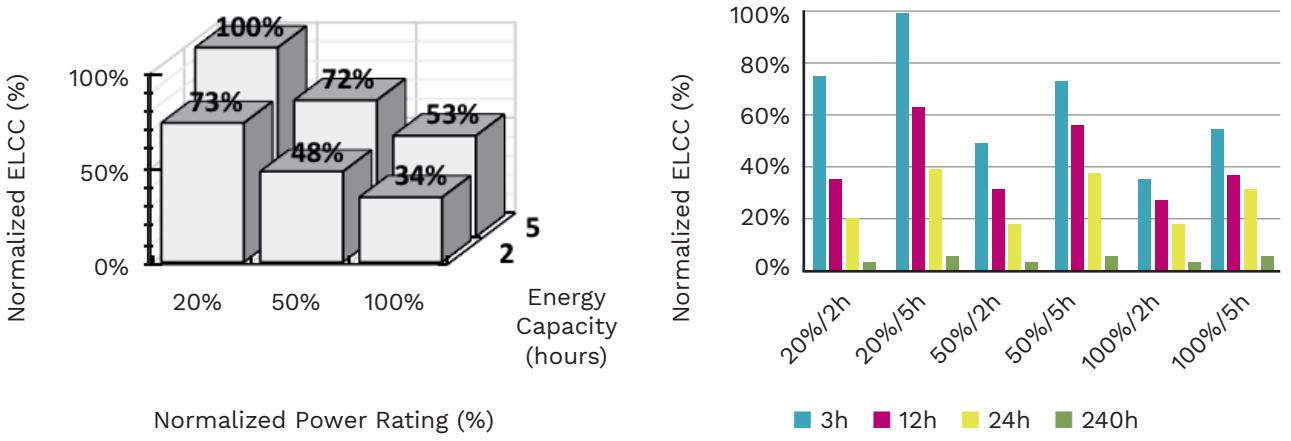

Figure 2: The contribution of storage to security (normalized ELCC) as a function of different ES power and energy capacity (left panel), and mean duration of an outage in hours (right panel).

(vii) Generation investment (G CAPEX) since ES reduces the need to invest in peaking capacity units (other) and low-carbon units (low-C).

In the scenario with carbon target of 50gCO_2/kWh, most of the benefits of ES are related to reducing the investment in low-carbon generation, while meeting the carbon reduction objective, through enhancing the ability of the system to integrate variable renewable generation. In this case, ES enables the system to meet the carbon emission target by building 10GW less nuclear generation or 17GW less wind generation.

SECURITY CONTRIBUTION OF ENERGY STORAGE

ES can also play a role in enhancing the security of electrical systems; they can provide peak shaving capability and maintain supply during network faults. Nevertheless, current design standards do not recognise that ES can be an attractive alternative to conventional network reinforcements and little work has been done to quantify the firm capacity that ES can provide. Note that ES is fundamentally different to other assets in two respects (i) ES faces energy constraints due to its limited capacity (ii) ES ability to charge is tied to the reliability of the network. In this context, extensive analysis undertaken by Imperial College has demonstrated that the Equivalent Load Carrying Capability (ELCC) of ES can be significant, but it largely depends on a number of factors such as ES power/energy capability, network reliability, demand shape and others.

In Figure 2 (left panel) we show the security contribution of ES as a function of power (expressed as a percentage of peak demand) and energy capacity (expressed in terms of hours); we show that energy capacity plays a key role since it is key in sustaining operation during fault conditions. In the right panel we show ELCC of six different ES plant sizes across four network reliability scenarios; the less reliable the network, the less the ES contribution. This analysis is the first step towards incorporating ES in existing design standards and enabling it to compete with other technologies.

OPTION VALUE OF STORAGE

ES's recognized ability to defer investment can have additional strategic value when facing long-term uncertainty. Nowadays planners often have to green-light projects ahead of need due to anticipation of rapid demand and/or generation growth and lengthy permitting and asset delivery procedures. ES entails lower stranding risks because even if the envisaged scenario that warranted its deployment does not materialize, it can still contribute to operation by providing other support services. Furthermore, fast-deployable solutions such as ES can 'buy time' until uncertainty is resolved:

CONCLUSIONS

It is clear that ES can offer a multitude of services which are bound to become increasingly important in the future decarbonization effort. ES can assist with system balancing, frequency regulation, defer investment in network and generation assets leading to cost-effective achievement of carbon reduction targets, provide network security as well as provide option value by aiding in the management of long-term uncertainty. Nevertheless, many of these benefits are not recognised by the current regulatory regimes and design standards worldwide. Levelling the playing field and allowing ES to compete with other technologies is imperative to ensure efficient levels of ES are deployed and that our future energy systems are flexible and future-proof.

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Powering people to fight climate change

By Marion Labatut, Director Policy Issues, Eurelectric

Early this year, the European electricity sector rolled up its sleeves to accelerate its contribution to the fight against climate change. Its plan is to deliver carbon neutral electricity to Europe well before 2050, and to develop clean electricity uses in transport, buildings and industrial applications.

Some have argued that this plan is too ambitious and that it can't be done, but let's pause for a moment here. The world is at a technological and climatic crossroad, and the power sector is on a mission. Beyond the deep overhaul of its production modes, it also contributes to a societal ambition. Electricity is much more than an electron travelling a cable to power your devices. It is a means to an end for a smarter, energy efficient and more sustainable society where people breathe clean air and commute in a seamless way.

So how do we get there? 2050 is a long way, but some of the key technologies are already here. The clean power sector will have a very high share of renewables, wind, solar, biomass, the often forgotten hydro (17% of the EU's 2017 power generation!) and probably new pilot technologies such floating turbines, waves' or tidal energy. It will also have nuclear in countries that choose it as a transition technology and perhaps Carbon Capture and Storage (CCS) for the remaining thermal plants.

Flexibility and different types of storage will be needed to make the best use of variable renewables (RES),

When electricity is set to be fully decarbonised, electrification is a no brainer. It makes it possible to power clean transport, improve air quality and bring solutions for buildings and industries.

from minutes to passing a season with low winds and high electricity demand. People and communities will invest in batteries to consume their own solar production as much as possible; But that takes us to minutes, maybe hours. Baseload solar would be a plus, but we won't get there with batteries. Bloomberg New Energy Finance (BNEF) says that the total volume of grid-connected batteries by 2030 will be sufficient to meet the world's power needs for just 7.5 minutes. Electric car batteries will be able to store electricity and to inject it back into the grid but they will not provide seasonal storage as hydro reservoirs do. That's where sector coupling comes in. Clean hydrogen could be a way to store power for a longer time, to help balance the system and to be used in industrial applications. We'll need more of these solutions in the years to come.

To achieve this clean power system, we'll need significant investments and that will come from different sources. Utilities, service providers, but also consumers will be betting on their own generation and storage, engaging in peer-to-peer exchanges and local energy communities. The same goes for grids. There is significant value embedded in power grids and they will be modernised and digitalised, underpinning high electrification levels and integrating decentralized resources. We will need a predictable regulatory framework and a sustainable investment environment. We will need to keep capital costs in check, with no retroactive changes and provide longer term investment signals through an upgraded market design. Power Purchase Agreements between large consumers and electricity producers have a promising future as well, with 1.1 GW contracted in the EMEA region in 2017. In future aggregation will help small consumers and producers make deals.

When electricity is set to be fully decarbonised, electrification is a no brainer. It makes it possible to power clean transport, improve air quality and bring solutions for buildings and industries.

In cities, we could deploy large scale electric public transport which would greatly improve traffic and air quality. China deployed over just a few years' time more than 150,000 electric buses. It will undoubtedly require significant political will, but Europe can nevertheless do it. Cars will not only be electric, but they will also be shared, autonomous and connected. With Tesla launching its E-truck and significant developments on costs and size of batteries, the future of road freight seems to be more open to technology competition, or to a range of solutions: electric and hydrogen or green gas trucks could well coexist. The most difficult bits will be maritime and aviation. But we see already small electric and hybrid electric planes popping up for shorter flights which offer promising prospects. The first one came in 2017 from Norwegian Avinor and announced that all short-haul flights will go 100% electric by 2040.

Electric solutions are also increasingly available and cost-efficient to cool and heat buildings, and to replace highly emitting industrial processes. As in transport, it is a matter of tackling a segment at a time with tailor made solutions. Electricity can play a very significant role, but alone it won't get us to a 100% decarbonised European economy. The Paris Agreement has set the ambition, it is now time to innovate and create solutions for all sectors of the economy. Paris forces us to deliver and to join forces between sectors, industries and citizens. Because it will take all we have to reach it.

EENSULATE project

"Development of innovative lightweight and highly insulating energy efficient components and associated enabling materials for cost-effective retrofitting and new construction of curtain wall facades."

The EENSULATE project is a research project funded by the European Commission under the Horizon 2020 programme. It gathers 14 partners from eight different European countries (AGC Glass Europe, SAES Getters, Focchi, Universita Politecnica Delle Marche, Selena, Bergamo Tecnologie, Gmina Miejska Dzierzoniow, University College London, University of Ulster, Evonik, Tvitec, UNStudio, and Fenix TNT). The consortium is led by RINA Consulting.

The main aim of the project is to develop an innovative lightweight (35 % weight reduction compared to the currently best performing modules), highly insulating energy efficient components. Simultaneously, it also develops associated enabling materials for cost-effective retrofitting and new construction of curtain wall façades. EENSULATE represents an ambitious project, which aims to introduce a novel unitized curtain wall system capable of meeting the market demand. It is expected to be an affordable (28 % reduction of total refurbishment costs), high performance prefabricated façade retrofitting solution with reduced weight and thickness. The objective of the project is to bring existing curtain wall buildings to "nearly zero energy" standards and reducing energy bills by at least 20 % while complying with the structural limits of the original building structure and national building codes.

EENSULATE PRODUCTS

The EENSULATE project develops a module that consists of two main parts. The first one is highly insulating environmentally friendly spray foam. It allows for the cost-effective automated manufacturing and insulation of the opaque components. The curtain walls also enable significant reduction of thermal bridges during the installation process. The second product is a lightweight and thin double pane vacuum glass used for the insulation of the transparent component of curtain walls; it is manufactured through an innovative low-temperature process.

A prototype vacuum glass samples have been fabricated using seal materials. These included a hot melt type polymer and an epoxy resin. Initial trials were conducted on small scale samples to determine appropriate application, techniques and processing criteria. Consortium is currently working on the foam to improve fire resistance and higher yield. The Single Burning Item (SBI) test for three types of foam will be performed and after the test, the foam sample with the appropriate fire resistance will be used for the preliminary industrial samples.

DEMONSTRATION

Four different demo sites will be used for validation of results in different climatic conditions: Public library in Pesaro (Italy), Focchi building in Rimini (Italy), and two buildings in Dzierzonow (Poland) – School building and City museum.

EENSULATE module's main components, foam and vacuum glass, are currently under the definition of the final specifications and, in the next months, the system design of the EENSULATE module will be realized. After the system design, the first full scale prototypes will be manufactured, and the performances tests will be conducted to validate the full system. The focus will be placed on thermos-acoustic behavior and indoor comfort.

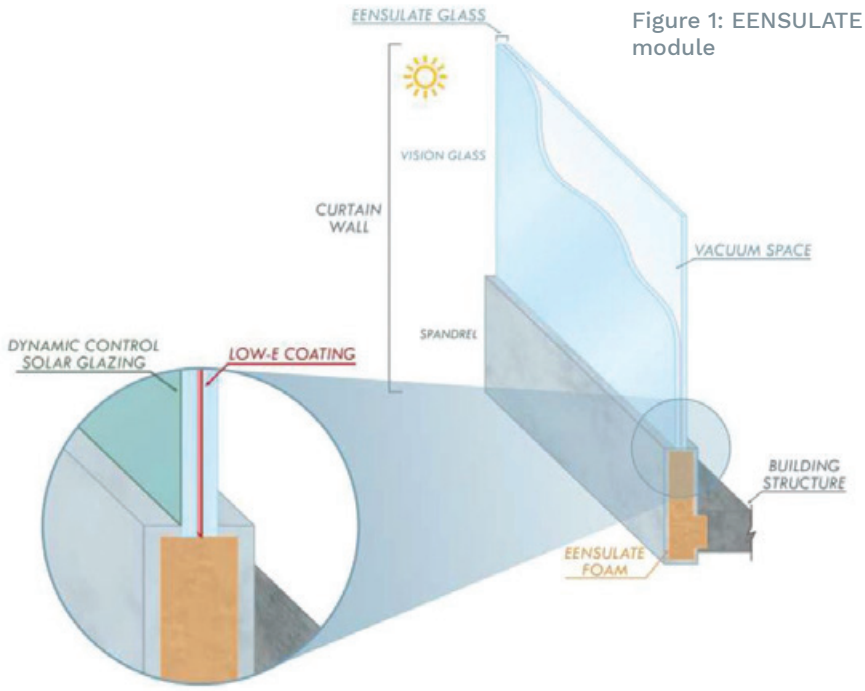

Figure 1: EENSULATE module

Contact information

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Towards a new Research and Innovation Policy
Regional perspective

By Pirita Lindholm, Director, ERRIN

We live in interesting times regarding Research and Innovation policy. The debate on the upcoming funding period (Multiannual Financial Framework post 2020) has raised skills as well as research and innovation as the main EU policy areas that should be strengthened. Commissioner Günther Oettinger has spoken strongly in favour of the future Framework Programme (Horizon Europe) and the ERASMUS + programme, both of which are key to Europe's future and economic development.

ERRIN, **European Regions Research and Innovation Network**, seeks to bring regional and local perspectives to Research and Innovation policy. By showcasing the impact, challenges and needs of regional innovation ecosystems, our objective is to create a dialogue with European Institutions and to open doors for financing opportunities that support and help strengthen these ecosystems further. Finding appropriate partners to cooperate with, is crucial in research and innovation. Therefore, match-making ideas and partners as well as supporting project development are ERRIN's core activities. The network also supports consortium-building through its various Working Groups, which cover a vast range of Research and Innovation areas. ERRIN works in a "bottom-up" way, which means that a few member regions – between three and five – lead the work of each working group, set priorities and prepare annual work plans with the support and input of the other members.

Helsinki Region Carbon Neutral 2035: Tuesday 24th April 2018, AALTO DESIGN FACTORY, Betonimiehenkuja 5 C, Espoo. (Photo: Tuula Palaste)

PRIORITIES FOR ERRIN MEMBERS IN THE FIELD OF ENERGY

The Energy and Climate Change Working Group, led by Scotland Europa (UK), Lombardy Region (IT), Oslo Region (NO), Extremadura Government (ES), Cities Northern Netherlands (NL) and West Finland (FI), aims to strengthen the overall work of ERRIN, by supporting regions to develop their regional energy systems, showcasing regional expertise to a wider European audience and developing successful projects at the EU level. This year, two main priorities have been identified by the group as key to ERRIN members: energy efficiency and the future of smart cities.

Energy efficiency: The Energy Efficiency Directive (art. 8) requires Member States to develop programmes encouraging SMEs to undergo energy audits and to implement the recommended energy-saving measures. Despite the relevant saving opportunities, SME contribution to energy efficiency is still limited across Europe due to lack of expertise, time and capital. To unlock this potential, many initiatives have been launched, with different results. For instance, Lombardy Region highlights the importance of engaging with regional authorities, industrial associations, chambers of commerce and energy agencies to draw up and implement regional energy efficiency plans targeting SMEs. Therefore, our work on energy efficiency this year will focus on creating strategic partnerships between the key stakeholders to mobilise resources, both public and private, at regional, national and European levels, to support energy efficiency projects within SMEs.

Future of smart cities within smart regions: The smart cities and communities programme has been well received by cities, as it helps to discover cross-sectoral innovative solutions. It is also based on a multi-actor approach, where city administrations work with research and private sector partners. Nevertheless, one of the bottlenecks of the programme has been scaling up the solutions developed by light house cities. A Smart Region perspective could provide some solutions to this. For example, Helsinki-Uusimaa has just adopted a carbon neutrality

target by 2035. The region has taken an important facilitation role in bringing together not only cities and municipalities but also the other actors of the quadruple-helix (private sector, research, civil society). There is an enormous potential for encouraging other regions to set their regional carbon targets and create further cooperation between the different actors. Ambitious targets and actions by cities and regions also send a strong message to the national, international and European government levels and can push forward more ambitious targets and increased actions at other levels..

OUR CONTRIBUTION TO THE EU SUSTAINABLE ENERGY WEEK

Clean energy transition requires further emphasis on sustainable energy storage solutions. Given the raise of electricity demand (electrification of the energy sector) in the coming years as well as the toxic properties of current battery technologies, we are facing resource dependency, environmental risks but also challenges such as battery fields like Elon Musk's Giga Factory in Australia. There are many environmental, social and economic reasons for a different type of battery technology. So far, this important dimension is hardly tackled in European energy storage discussions. What could be the vision for truly sustainable Energy Storage?

During the EU Sustainable Energy Week, ERRIN will co-organise a session on **smart grids, renewables and storage** as part of the official programme, as well as a side event on sustainable batteries. The latter will be an opportunity to showcase two innovative, sustainable, stationary energy storage technologies from two European Regions, Thuringia and Friesland; the progress of these technologies, but also what needs to be done to further improve stationary battery systems.

In addition, how these technologies meet the European Battery Alliance's sustainability criteria, their advantages in comparison to current battery solutions regarding social mining, reuse, recollection, recycling and Energy Return on Investment (EROI) will be discussed.. The objective will be to raise awareness on several existing valuable concepts and innovations different from mainstream developments. The examples of Thuringia and Friesland demonstrate that European regions can offer innovative solutions that could contribute to the clean energy transition the European Union is aiming at, if they are being integrated in ongoing and future initiatives and activities.

EVERYONE IS WAITING TO DISCOVER ENERGY PRIORITIES UNDER THE NEW FRAMEWORK PROGRAMME

The energy transition process requires scaling up existing innovative models, and both social and technological innovation. We hope to see that reflected in the upcoming research and innovation programme. There are some interesting new features in discussion, such as the "mission approach" that should be part of the societal challenges pillar in Horizon Europe. Such an approach will hopefully provide further opportunities to regional and local actors to actively propose their innovative solutions, and broaden the current call structure, which can be quite prescriptive. In addition, silos should be further broken by connecting sectors, such as climate, energy, and transport. One aspect on policy priorities is clear: we expect the draft Horizon Europe to place further emphasis on these three policy areas, as decarbonising our society requires research and innovation, and in particular accelerated actions – together.

ERRIN (**European Regions Research and Innovation Network**) is a Brussels-based platform that gathers together more than 130 regional organisations in 24 European countries. ERRIN aims to strengthen the regional and local dimension in the EU Research and Innovation policy and programmes. It promotes knowledge exchange between its members, focusing on joint actions and strategic partnerships to strengthen regional research and innovation capacities and thereby foster sustainable and inclusive growth in regions.

We are pleased to invite you to the ERRIN **EU Sustainable Energy Week (EUSEW)** side event "Energy Storage Vision 2025. Can Europe beat Elon Musk?", which will take place on 6th June from 14.00 at the Greater Birmingham and West Midlands Brussels Office (Avenue d'Auderghem 22-28 Oudergemselaan, Brussels)

SusPIRE Collaboration Leading to Technical Advancements and Value Creation in Heat Recovery

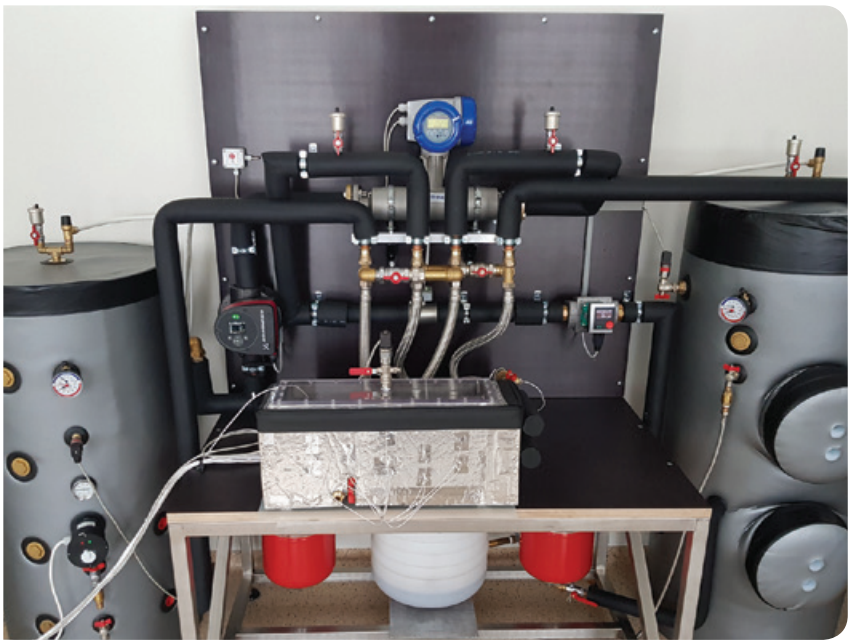
Energy in intensive industries is used to transform the chemical composition or the shape of raw materials or starting components. A very small quantity of this energy will remain integrated in the material itself. Supplied energy is lost in aspects such as radiation, intermediate or finished products remaining heat that are cooled to the open air or in residual heat streams. These energy losses are estimated at around 20 to 50% of the total consumption in one production plant. This project will focus on residual heat streams that can be classified by their physical condition: liquid, solid or gas and by the temperature range that they have. It has identified an investment casting manufacturing process with its corresponding residual heat streams as representative of a significant number of energy intensive industries such as steel, glass, cement and the food industry. The identified residual heat streams are:

- High temperature exhaust gases from combustion furnaces that are generated in a continuous way. Exhaust gases get out from the furnace at around 800ºC.
- Steam getting out of the boilerclave at around 100ºC and discontinuously generated.
- Cooling water from different equipments such as: Wax injection units, compressors, induction furnaces.

Different technical solutions have been identified in this project to accomplish the efficient energy recovery of these residual heat streams. The result, SUSPIRE's final goal, is a 20% reduction in the energy consumption of the plant.

On one side, the technical development will be carried out by way of achieving higher levels of energy recovery that include:

- Development of PCM (Phase Change Material) based heat exchanger for high temperature exhaust gases.
- Development of PCM based heat exchanger for steam released in boilerclave.
- High efficiency Heat Transfer Fluids (HTF) for high temperature efficient energy recovery.
- A high temperature energy buffer will be developed to distribute energy to a plant consumption point or to a Borehole Thermal Energy Storage System (BTES) that will accumulate low temperature energy and use the heat pump



to supply heating or cooling for buildings acclimatization.

- The energy recovery process will be controlled by a smart data management system that will achieve the best energy recovery yield for maintaining or improving the manufacturing and quality ratios.

These technical developments will be carried out by developing different activities among the partners in the project consortium.

Different milestones have been overcome by the project and they include:

- A low temperature heat exchanger design (LTHE) recovers energy form steam released in boilerclaves. This equipment has been proven in a test bench in terms of constructive materials, working routine and the use of an organic PCM. Results have shown adequate energy capture and release for the foreseen industrial cycle.

- A High temperature heat exchanger recovers energy form exhaust gases in the range of 800ºC. This equipment has gone over different simulation loops to achieve the best design and working routine. The final design achieves recovery rates of 30-40%, and incorporates a heat exchanger attached to the chimney aa well as a separate buffer for energy storage supported by an inorganic PCM. It is capable of generating steam for plant demand and the remaining heat, in condensed water form, is transfered to a low temperature circuit for plant heating demand.

- The construction of the Low temperature circuit has started, it is based on the BTES technology (Borehole Thermal Energy Storage) combined with a heat pump. It will balance heat and cooling needs of the plant by making use of the plant's residual heat water. The excess heat will be stored for use in winter and a new business model is being developedt to provide the excess energy to a sports center located next to the company.

- Two main objectives have been set in relation to the data management system: 1.- A specific data management system linked with the energy recovery to reduce temperature variability in shell room and wax room (Tmax and temperature variation range as main KPIs).2.-A Global smart data management system, incorporating critical process variables, including energy recovery a. (KPI: pores in visual and NDT inspection). This data management system has resulted in the analysis of how process variables such as day of the week, shift, season, external temperature and area of the room affects critical aspects for mold quality such as maximun temperature and temperature range in temperature controlled rooms. These KPIs are directly related to the energy recovery system. The first analysis carried out for the season of winter has detected for the shell room as critical variable some specific areas of the whole room.

- The general energy recovery balance after the final design has been completed and give promising results. The primary energy consumption of the plant is foreseen to be reduced by 20,9%. The total energy recovery rate of residual heat streams has been calculated as being 87%, representing advantageous values compared to other alternatives like energy conversion into electricity with much lower energy recovery rates.

- Is also remarkable that a specific business model is under discussion involving one of the companies of the project. This company will act as an energy distributor, investing in the connection and maintenance of the equipment and receiving income based on the energy use of a third party.

Participant No *	Participant organisation name	Country
1 (Coordinator)	PCB	Spain
2	MET	Lithuania
3	QPUNKT	Austria
4	TELUR	Spain
5	TECNODELTA	Italy
6	ZAE-BAYERN	Germany
7	DOW-CORNING	Belgium
8	IK4-AZTERLAN	Spain
9	IK4-TEKNIKER	Spain

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http://suspire-h2020.eu/

Ted Crowston, Dow Representative:
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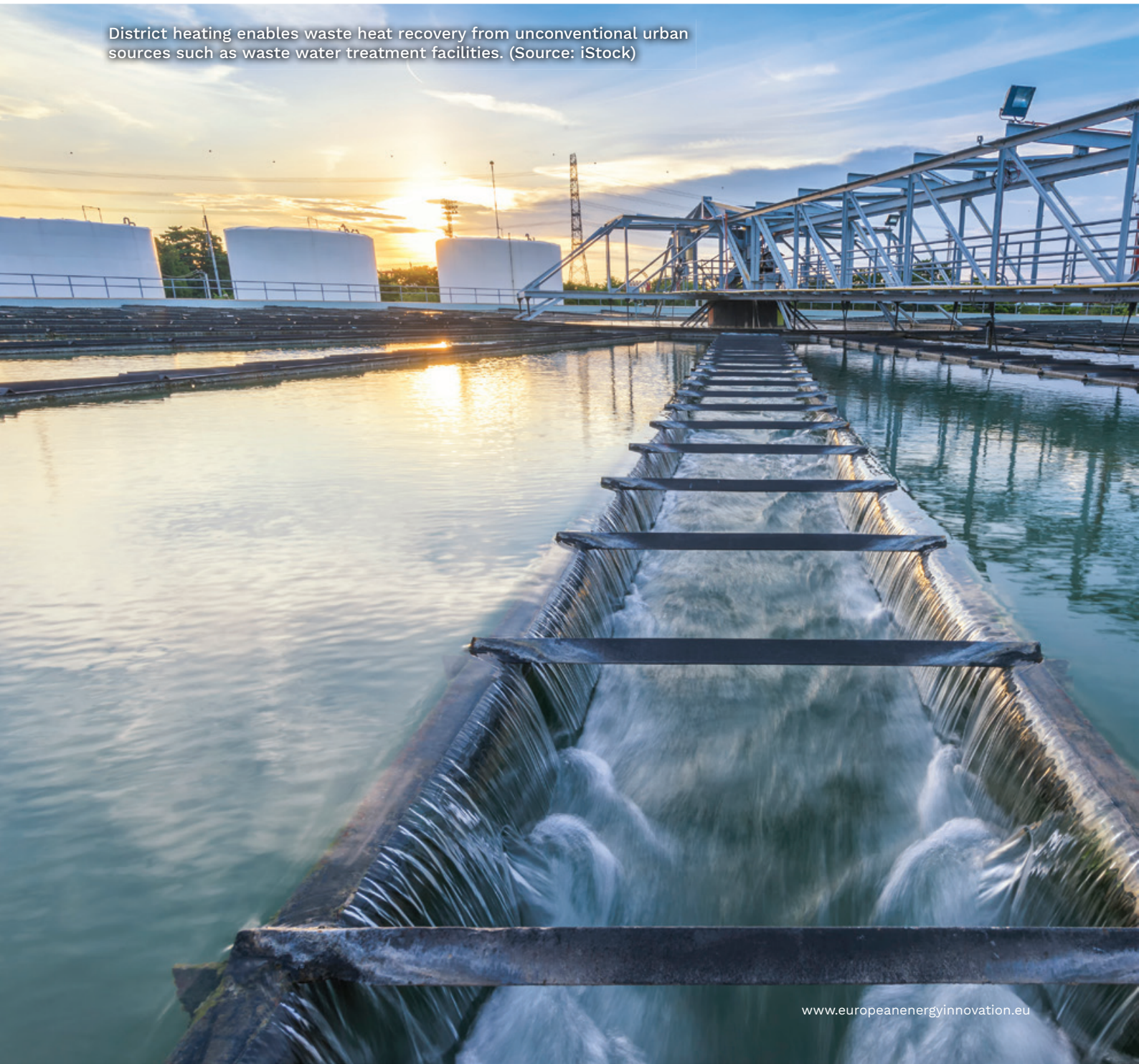
The consortia shows a good balance between industrial participants represented by multinationals like PCB, and DOW-CORNING, SMEs like MET, QPUNKT, TELUR, TECNODELTA and RTOs like ZAE-BAYERN. IK4-AZTERLAN and IK4-TEKNIKER. Each partners completes required skills for the ongoing of this project. Engineering and equipment construction skills are represented by TECNODELTA, TELUR and MET, modelling of heat transfer by QPUNKT, experience in energy and heat management by DOW CORNING and IK4-TEKNIKER, specialists in PCM and metallic materials by ZAE BAYERN and IK4-AZTERLAN and expert knowledge in final process by PCB and IK4-AZTERLAN. All that makes a complementary team that has been successfully developing the foreseen activities in the project.

Delivering EU's energy efficiency goals with district heating and cooling

By Dana Popp, External Relations & Communications Manager, Euroheat & Power



District heating enables waste heat recovery from unconventional urban sources such as waste water treatment facilities. (Source: iStock)

In order to deliver the best results for the energy transition, efficiency in the heating and cooling sector must be looked at from its two defining perspectives. One: the energy savings – reducing consumption by a balanced cocktail of measures for improving buildings' envelopes to making heating systems use less energy. And two: the heat supply – demand for heating and cooling will not miraculously disappear, the energy we still use must be based on the efficient use of available resources.

Saving energy in district heating and cooling has been driving innovation in the sector for many decades. Most notably, the positive impacts of digitalisation are already visible in many ways. At heat production level, advanced software solutions ensure fuel optimisation and enable the integration of different renewable energy sources.

At distribution level, networks use temperature optimisation software. Sensors and analytics platforms monitor grids and pipes in real-time. Detecting leakages can be done either with built-in smart solutions and predictive maintenance or via areal inspections with drones. At consumption level, the use of smart heat meters is rapidly expanding.

Energy efficiency is also about reducing heat losses in the transmission and distribution networks. Modern well insulated district heating pipe systems are one of the most cost efficient ways to save energy. Older networks are much more likely to suffer from higher heat losses, therefore replacing inefficient pipes and general network retrofit and optimisation can bring significant energy savings.

Another consideration becomes more and more relevant as we look at the overall energy system: maximising the synergies between the electricity, transport and heating and cooling sectors. The heating sector has the luxury of not depending exclusively on (renewable) electricity for its decarbonisation. Deploying highly-efficient district heating and cooling networks can save valuable electricity, much needed in other sectors such as transport. Moreover, with cooling demand expected to soar over the next decades, using district cooling systems instead of millions of individual cooling units


Dana Popp

can prevent electricity peaks or blackouts.

Let's not forget that in addition to energy savings, district heating brings about significant environmental benefits (reduction of CO_2 and other emissions) and it serves as a means to increase energy security by decreasing fossil fuels imports. That is why the supply sources we use for heating and cooling are equally important.

Obsolete coal, oil and natural gas boilers must be a thing of the past. Only the heat being wasted in Europe could cover 100% of our buildings' needs – it does not make any sense to let waste heat from industry or from more unconventional urban sources (data centres, underground systems, water treatment facilities) go up into thin air.

Reusing waste heat is a well-known and energy efficiency measure to increase the overall efficiency of a heat system inside an industrial plant. But it can be even more useful, when the waste heat is recovered and exported outside the plant to nearby commercial or residential heat users through district heating.

The world's largest solar heating plant is located in Silkeborg, Denmark. (Source: Arcon-Sunmark)

The same principle can be applied to waste heat sources in urban areas – a lot of heat produced in the middle of our cities that remains largely unused. In some cases, the potential is huge and will grow even further: data centres energy consumption is expected to double between 2007 and 2020, and so will the heat they produce. Channelling this heat via district heating networks is already a profitable business model.

If we add the unlimited renewable energy sources suitable for direct use for heating and cooling (geothermal, solar), the picture gets clearer.

Around the world, a switch towards renewable energy sources for district heating and cooling can help meet rising urban energy needs, improve efficiency, reduce emissions and provide cost-effective temperature control. In a few countries, such as Denmark and Switzerland, renewable energy already provides more than 40% of district heat supply (Source: IRENA).

Short term as well as seasonal heat storage (collecting heat from large scale solar thermal systems or industrial processes) is becoming more and more important, as it reduces demand for other energy sources and increases flexibility between seasons. Moreover, excess electricity generated when there is abundant sun or wind can be used by district heating companies to produce hot water through heat pumps. Therefore, district heating and cooling systems come to play a pivotal role in increasing the share of renewable heat as well as enabling variable renewable power integration.

With the new Clean Energy Package on its way for implementation over the next years, here is a number to remember: 12% of the new EU energy efficiency target can be covered by increasing the share of district heating and cooling from around 10% to 30% by 2030 (Source: Danfoss). We already know that it is possible and feasible to increase the district heating share to 30% by 2050 and 50% by 2050 (Source: Heat Roadmap Europe).

So, what do we need to achieve that? The right mindset and investments in the right infrastructure. Let's put (water) pipes in the ground, instead of (gas) pipelines!

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Autogas as the solution to improve air quality in Europe

The roads of Europe are busier than ever before. As governments across the continent search for solutions to help curb air pollution, one immediate option gains traction – LPG.

According to the World Health Organisation, 7 million people die prematurely each year because of illnesses caused by air pollution. In Europe the numbers are lower, but still unacceptable. Everyday European citizens walk into the streets knowing that they are surrounded by polluted air, in great part caused by the transport sector.

Autogas – LPG used in the transport sector – is a viable option that can make an immediate and impactful difference. Recognised in the Alternative Fuels Infrastructure Directive, Autogas is the most widely used alternative fuel in Europe with over 15 million vehicles on the road across the continent, served by over 46,000 refueling stations. The main benefit of Autogas lies in the savings it can offer consumers, a litre of Autogas is on average 50% cheaper than a litre of conventional fuels. In fact, among the alternative fuels available to consumers, Autogas is the one that allows any driver in Europe to travel freely without concerns about refueling, thanks to the widespread network of stations. But Autogas' benefits go far beyond the economic value it brings to its users.

The "Dieselgate" scandal led policy makers to seriously consider alternative options to reduce the levels of air pollution. The Autogas industry, confident in its own product, tested it not only in laboratories but on roads in Europe, where real people drive. The results made clear that Autogas can play an essential role in improving air quality, especially in urban areas, where NOx and particulate matter (PM) emissions affecting human health are generating socially and economically unacceptable costs. Recent research on real driving emissions measured through a portable system showed that Autogas cars emit on average 45% less CO, and 90% less small particles than their gasoline equivalents. It also confirmed that LPG brings a 98% reduction in NOx emissions compared with diesel.

Autogas vehicles bring benefits in terms of CO_2 emissions. Tests in real driving conditions confirmed that Autogas vehicles emits CO_2 at the tailpipe. What is more, according to the calculation method and reporting requirements in annex of the Fuel Quality Directive, based on the JRC JEC study, LPG vehicles emit 21% less CO_2 than petrol and 23% less CO_2 than diesel equivalent vehicles on a life cycle basis.

New technologies, such as hybridisation and battery range extenders, and direct injection enginesoffer great potential for reducing the environmental footprint of Autogas. Moreover, Bio-LPG recently introduced in the European market brings CHG emissions down by up to 90%, compared to conventional LPG.

The future of mobility is being written as we go. Many different options present themselves as the silver bullet that will solve all the challenges. In the meantime, Autogas represents the most immediate, practical and economic solution to improve air quality in European cities.

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Smart approaches to ending energy poverty

By Stefan Bouzarovski, Professor of Human Geography, University of Manchester, United Kingdom

Millions of people worldwide endure energy poverty, with their health and well-being suffering as a result. A new European network is helping researchers and policymakers to develop a common approach to improving energy access, and empowering at-risk consumers.

In Europe alone, more than 50 million households – nearly 11 % of the population – struggle to keep their homes warm, access hot water, pay their energy bills on time or live in damp-free homes. While many groups are working to address this problem, progress has been limited due to differences in how they approach the issues.

In response, the COST-funded network European Energy Poverty: Agenda Co-Creation and Knowledge Innovation (ENGAGER) brings together more than 60 organisations from over 30 countries to develop a shared understanding of energy poverty.

The network is also designing methods to identify and assist people at risk, along with training materials to help consumers influence decision-makers and access more affordable energy.

“Energy poverty is a hidden inequality but it impacts every country in the world. Measures to reduce this inequality improve lives,” says the network’s chair, Professor Stefan Bouzarovski of the University of Manchester.

Properly heated homes can help children perform better at school, and reduce winter deaths, he notes. Measures also save money – for individuals, utility companies and wider society – and improve energy efficiency, reducing society’s carbon footprint, he adds.

Launched in 2017 to run for four years, the network includes participants from research organisations, national and regional authorities, businesses and consumer advocacy groups.

“There is strong representation across constituents,” says Bouzarovski. “Our name reflects what we do. We engage!”

CONNECTED ACTION

Existing EU actions already address some energy poverty issues, such the Energy Performance in Buildings Directive under the Energy Union strategy. In January 2018, the European Commission also launched

the EU Energy Poverty Observatory, which catalogues and shares data on energy poverty.

"ENGAGER will reinforce this, adding in networking," says Bouzarovski, who also chairs the Observatory.

Conferences and workshops will be a big part of its work, as will funding for short-term research exchanges for young scientists. With members from diverse fields, such as energy studies, economics, sociology and consumer advocacy, the network's remit is wide.

"We will explore the issue beyond simple access to fuel, to areas such as climate or adapting policy to urban settings," he says.

Members will also investigate the impact on consumers of environmental, technological and regulatory developments, like smart systems that use pricing to regulate energy demand.

"Energy poverty is a hidden inequality but it impacts every country in the world. Measures to reduce this inequality improve lives."

"Energy is about how we organise our society. We want to investigate whether regulation includes all voices," says Bouzarovski. "The big challenge is 'hard to reach' people."

To reach a wider audience, ENGAGER will develop toolkits and manuals for training consumers to talk with decision-makers, get help and switch providers, if needed.

Network participants will also carry out targeted work. For example, a group of activists and researchers based in Barcelona focuses on disconnections.

Bouzarovski says: "This will make unheard voices louder."

He encourages more organisations to join the network: "We invite as much input as possible. We want to be the hub for bottom-up engagement on energy poverty."

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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View the Action: http://www.cost.eu/COST_Actions/ca/CA16232

View the Network website: http://www.engager-energy.net

European Energy Poverty Observatory: https://www.energypoverty.eu/

Advanced power electronics empowers the Baltic Sea region

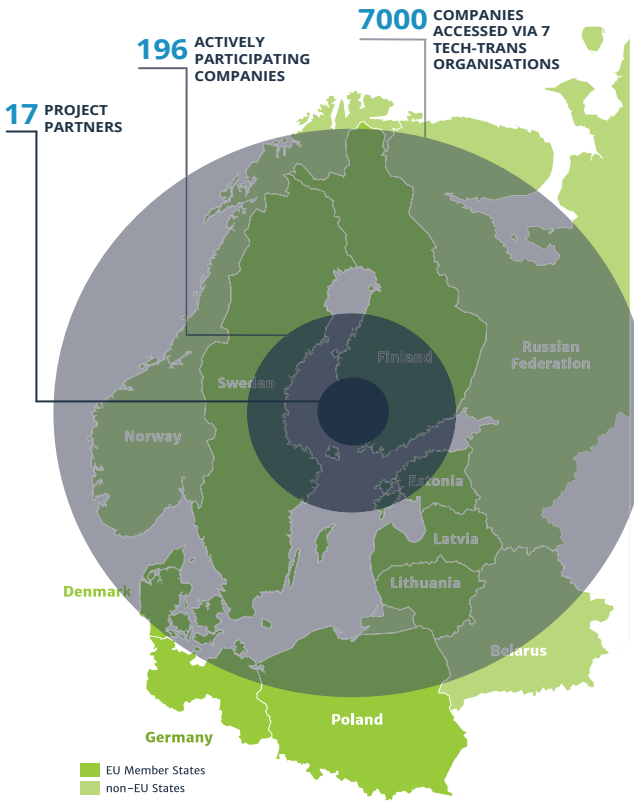
The novel technologies behind advanced power electronics allow for more than 50% in energy savings by reducing energy losses at all stages of the energy supply chain. Next generation large onshore and offshore windmills, large solar power plants as well as virtually all modern electrically driven cars require advanced power electronics to function reliably and efficiently; thus, advanced power electronics is one of the key drivers for the reduction of the CO_2 footprint in the Baltic Sea Region and worldwide.

Power Electronics for Green Energy Efficiency (Green PE) is a project that accelerates the market uptake of advanced power electronics by small and medium sized companies in the Baltic Sea Region for conversion, transmission and consumption of energy and thus supports a seamless transition towards a green society which uses clean, secure and efficient energy. The project is built on a cross-sector consortium consisting of seven research institutions, eighteen companies from the energy supply chain as well as seven partners from business development associations, technology transfer institutions and cluster organisations. It is led by the Mads Clausen Institute of the University of Southern Denmark.

As one major milestone in the project, a technology and product roadmap with regional specialisation has been developed and spread across the Baltic Sea Region via dedicated matchmaking measures. To proceed from road mapping to applications, the project carries out showcases in some of the most relevant energy sectors for the region, namely renewable energies, e-mobility and low-energy smart buildings. The showcases directly involve companies and research institutions. Within renewable energies, the utilisation of new sources for renewable energies (large scale photovoltaics, offshore wind and large-scale bioenergy) requires radical changes in the power electronics modules on the element (e.g., transistor) level. For the realisation of e-mobility as an alternative to conventional car technology, a radical new concept of car electronics, electrics and control is required, asking for power train-integrated advanced power electronics components. Finally, within the smart efficient building sector, new energy efficiency solutions require user participation, active feedback control and sophisticated (e.g., window- or wall-integrated) power modules.

The Green PE project has an intense focus on building strong relationships between industry and research institutions. This enables companies throughout the Baltic Sea Region to gain the latest knowledge and information within their field, while the research institutes get a chance to create long-lasting relationships and to commercialise their research. This win-win situation leads to a dynamic business and innovation eco system which, in turn, creates jobs and growth in the entire Baltic Sea Region. The strong collaboration with industry is witnessed through the nearly 200 companies that already have actively participated in the project. In addition, the project has activated seven technology transfer partners in the Baltic Sea countries with access to more than 7000 companies in the BSR in total.

Advanced power electronics



green power electronics

Interreg Baltic Sea Region

EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND

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New developments in thermal energy storage for buildings, European Project TESSe2b

The TESSe2b project is a European project, funded at €4.3 million under the Horizon 2020 program, which began in October 2015 and lasts 4 years (www.tesse2b.eu). The consortium consists of five higher education institutions, one research center and three SME and a non-profit organization, from from 8 countries, Portugal, Greece, Cyprus, Spain, Austria, Germany, Poland and the United Kingdom. The project is coordinated by the Polytechnic Institute of Setúbal (IPS, Prof. Luis Coelho).

The main objective of the project is to design, develop and demonstrate a modular and low cost system of thermal storage technology based on solar collectors and efficient heat pumps for heating, cooling and hot water production (DHW) contributing to the increase the share of renewables and to the flexibility of the electricity grid.

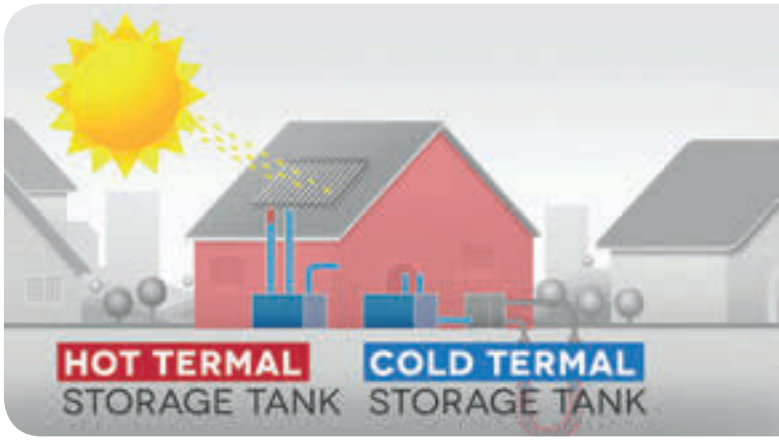
This project is expected to find a solution to reduce energy consumption in homes by up to 30% for heating, cooling and DHW production, with consequent reductions in energy billing for the final consumer, with a simple period of return of the initial investment in about 8 to 9 years.

The storage thermal energy will be carried out at three temperature levels for cooling, heating and DHW production.

Suitable Phase Change Materials (PCMs) were selected for each application, using two types of PCMs, organic (paraffins) and hydrated salts, comparing their performance in each application.

The tanks filled with PCMs have some particularities, namely the fact that they are modular, in order to allow them to be easily adapted in terms of capacity, climate conditions and easy assembled in existing buildings. Another peculiarity has to do with the development of heat exchangers (HEx) inside these tanks, immersed in PCM.

Some problems have been solved such as the incompatibility between paraffin-type PCMs and thermoplastic-based tank walls through a protective coating, the low thermal conductivity of the paraffins through the use of nanoparticles (nano-composite enhanced paraffin, NEPCM) or the use of an adequate geometry of HEx tubes and fins and a protection of the HEx metal parts from the corrosion of hydrated salts through a protective film.



Another innovation is the use of the paraffins in the boreholes heat exchangers (BHEx), mixed with the grout material, in an encapsulated form. The objective is to increase of the temperature stability of the BHEx, increasing the efficiency of the geothermal heat pump.

An intelligent control and self-learning system is also being developed in order to take full advantage of the potential of the proposed thermal system.

In the last year of the project, the TESSe2b system will be demonstrated and validated on a real scale in three houses, Austria, Cyprus and Spain, with the objective of covering three different climates.

The current phase of the project is finalizing the pre-prototype tests, the results achieved are promising, successfully reaching the proposed objectives.

After completing the project, the consortium intends to commercialize the system, through possible partnerships with companies outside the consortium.

This project has received funding from the European Union's Horizon 2020 research and innovation programme, grant agreement No 680555.

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Building Renovation Passport: the roadmap to a low-carbon building stock

By Jonathan Volt, Buildings Performance Institute Europe (BPIE)

The European Union's climate and energy goals entail a deep transformation of the building stock. A review of Energy Performance Certificate (EPC) data reveals that approximately 97% of all buildings in the EU must be upgraded by 2050 to become "future-proof". It would be hard to overestimate the importance of this task, as buildings accounts for more than one third of the region's total CO_2-emissions. The challenge is amplified by the composition of the housing stock, which is utterly diverse, in terms of age, building components and characteristics, design, heating system and source, etc. No silver bullet exists as no single plan can be applied to all buildings.

ENERGY RENOVATIONS IN THE EU: THE KNOWLEDGE BARRIER

Drastically reducing the energy need of a building is a complex process in which many things can go wrong, and often do. For instance, many homeowners seek advice from neighbours and friends rather than from professionals or existing energy advice tools (such as EPCs), often leading to

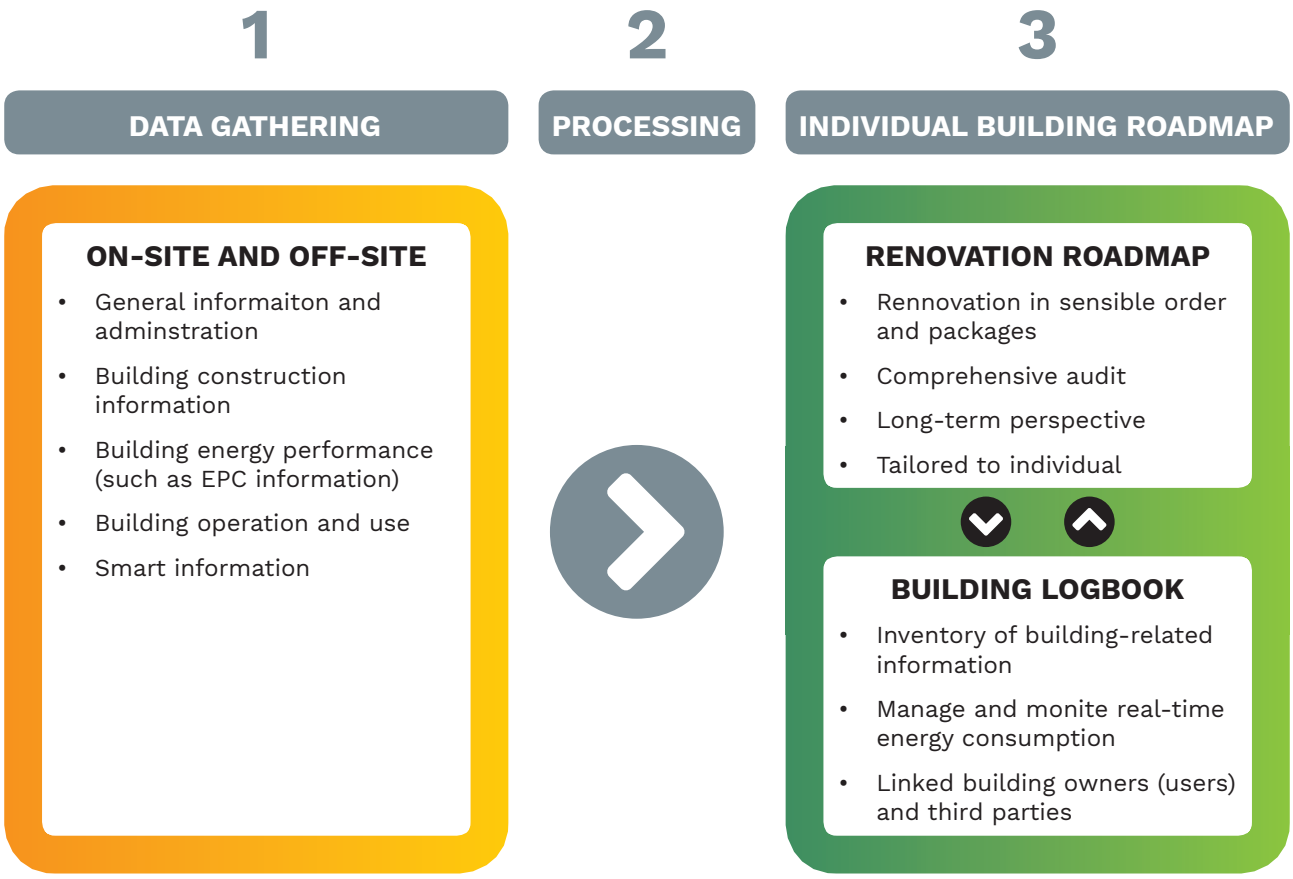


Figure 1: Building Renovation Passport - Overview of its components (Source: BPIE)

ill-advised investments. For the EU to increase not just the rate but also the quality of energy renovations, it is essential to overcome the lack of reliable knowledge about what to do, how to do it and in which order.

THE BUILDING RENOVATION PASSPORT AS A SOLUTION

One instrument that is gaining more attention is the Building Renovation Passport, which outlines a custom-made long-term (up to 10 or 20 years) step-by-step renovation roadmap for an individual house. In many ways, it is an evolution of the EPC, and builds on information from energy audits and dialogues with the occupants. Different variations of the idea have recently been implemented in Flanders (Belgium), Germany and France, and studied for replication in the Horizon 2020 project iBRoad, whose aim is to show how Building Renovation Passports can support deep renovation in the residential sector.

THE BUILDING RENOVATION PASSPORT: FEATURES

The Building Renovation Passport is designed to become a useful resource for the building owner, with features and information presented in an understandable manner. One example, which also works as trigger for investments, is the possibility for the owner to easily absorb the expected benefits of the renovation works.

The renovation roadmap can be combined with a digital repository of building-related information (a logbook) on aspects such as the energy consumption and production, executed maintenance and building plans. The logbook could also feature other sets of information related to each individual building, such as the financing options available in the area for renovation projects (e.g. green loans, incentives, tax credits) as well as energy bills, equipment maintenance recommendations and insurance and property obligations. Its main feature is to make the process easier for the occupant, but the logbook could potentially also be used to track renovation activities and send alerts to the users in case of unusual consumption patterns or suspicions of technical flaws.

THE BUILDING RENOVATION PASSPORT IN PRACTICE

The most innovative example of a logbook is the Woningpas in

Mein Sanierungs-Fahrplan

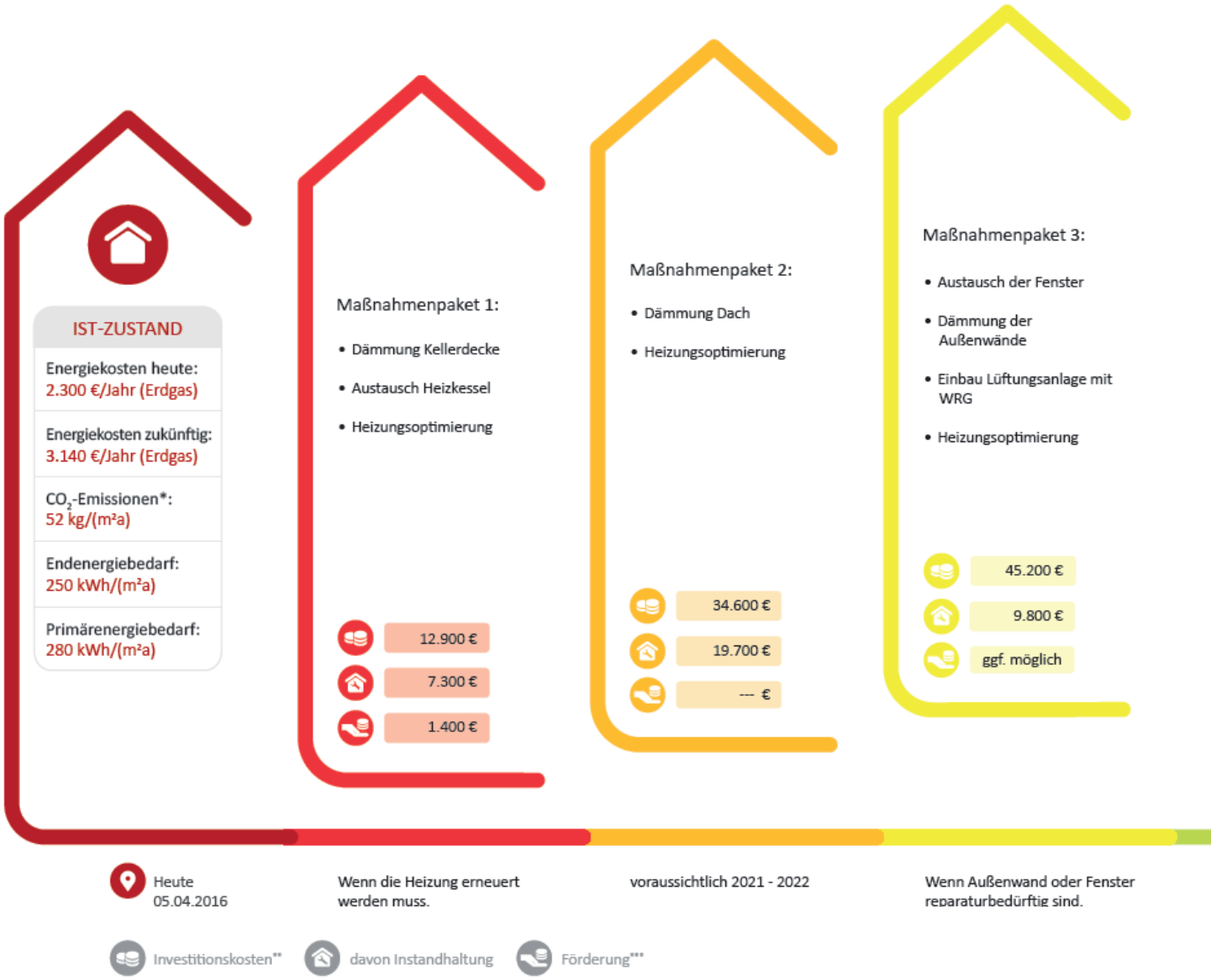


Figure 2: Overview of long-term transition in the German iSPF (Source: BMWi)

Flanders, which compiles a unique integral digital file of each individual building. The file can be retrieved by the building owner, but also by individuals who have been authorised access. The logbook features energy performance, renovation advice, the housing quality (such as stability, humidity, safety), data on the environment. In the future, other building aspects will be added, such as durability, water, installations and building permits.

The Woningpas will also make it possible for public authorities to track their progress towards a highly efficient housing stock by 2050. A first version of the Woningpas (Light) will be launched this year.

Another interesting example is the overview of the German renovation roadmap (Individueller Sanierungsfahrplan), which outlines the different renovation steps and associated benefits, such as lower heating bills, energy consumption and CO_2-emissions. The roadmap has been designed to be a user-friendly tool that includes both short and long-term measures and suggests ways to avoid lock-in effects. As about 85% of the energy renovation measures funded in Germany concern only one building component, the roadmap puts a strong focus on staged renovation and the interdependences between the stages.

* Quelle: Umweltbundesamt, Stand: 13.01.2016. Die CO_2-Emissionsfaktoren für die Energieträger finden Sie in der Umsetzungshilfe unter „Technische Dokumentation".
** Die angegebenen Investitionskosten beruhen auf einem Kostenüberschlag zum Zeitpunkt der Erstellung des Sanierungsfahrplans.
*** Förderbeträge zum Zeitpunkt der Erstellung des Sanierungsfahrplans; aktuelle Fördermöglichkeiten bitte zum Zeitpunkt der Umsetzung prüfen.

THE BUILDING RENOVATION PASSPORT IN THE EU LEGISLATION

The revised Energy Performance of Buildings Directive (EPBD) requires Member States to develop long term renovation strategies for their national building stocks, in which they should set 2030 and 2040 milestones and define measurable progress indicators (i.e. renovation rate or energy consumption). The Building Renovation Passport can support Member States in achieving this task, becoming the missing piece in the puzzle. As seen in Flanders, the Building Renovation Passport can enable public authorities to track renovation activities and, consequently, develop more effective support measures. As Robert Schuman once said, "Europe will not be made all at once, or according to a single plan" - the same is true for its building stock. A decarbonised building stock by 2050 requires a smarter approach for the years to come.

BPIE

Contact information

For more information on BPIE's work visit **www.bpie.eu**

For more information about Building Renovation Passports, visit **www.ibroad-project.eu**

Energy efficient buildings
Plan. Invest. Renovate!

Half of the EU´s energy consumption goes to heating our buildings. Most of them are old and inefficient. Renovating the EU´s building stock is a huge task that can only be done if action happens across all European cities and towns.

The Energy Efficiency Directive (EED), Article 4, requires all EU Member States to prepare a national renovation strategy for their building stock. The second version was due in 2017 (not all yet complied). Energy community countries need to submit their first strategy in 2018. But buildings aren't just in capital cities. They are in Europe's smaller cities, towns and communes. EmBuild, a H2020 funded project (www.embuild.eu) helps municipalities to formulate local renovation plans. Only with such local plans can we achieve national and EU goals.

EmBuild worked directly with public authorities in towns and regions in Romania, Bulgaria, Slovenia, Croatia, Serbia and Germany. The project generated new tools, better processes and built capacity in local governments to design ambitious but realistic renovation strategies. Renovating the building stock contributes to the achievement of multiple goals: lower energy bills, increased comfort, healthier living and working spaces, improved air quality and new local jobs. Turning the focus on these wider benefits gets attention. Energy efficiency on its own may not be a strong argument at local level, but higher comfort, insulated schools in which you can learn better, renovated hospitals that make you heal more quickly are strong arguments. EmBuild has prepared a tool for measuring these wider benefits.

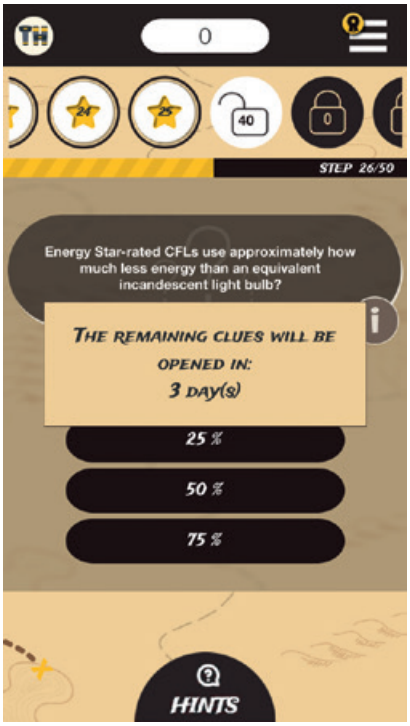
This tool and the experience of the EmBuild project will be presented and discussed at the EmBuild final conference in Belgrade, Serbia, on 7 June. The event is co-hosted by the Energy Community and is officially registered as an EUSEW energy day.

EmBuild has received funding from the European Union's Horizon2020 research and Innovation programme under grant agreement No 695169

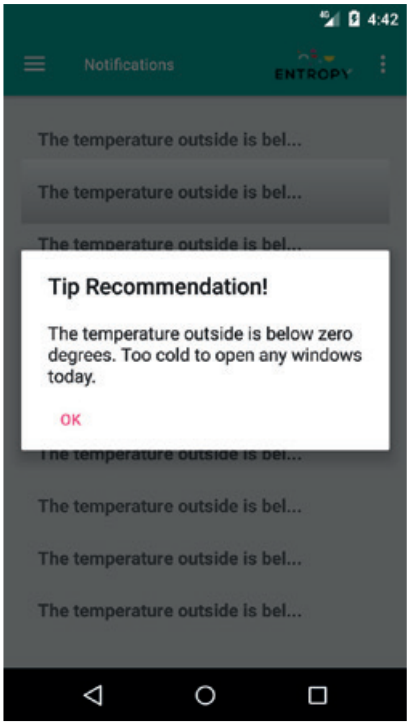
As stated in the Energy Efficiency Plan 2011, the greatest energy saving potential lies in buildings. The ENTROPY project addresses the challenge of energy efficiency in buildings via the design and development of novel solutions for accomplishing energy savings.

The ENTROPY project designs, deploys and assesses the ENTROPY ecosystem, an innovative energy-aware Internet-of-Things (IoT) platform for motivating end-users engagement and behavioral changes towards the adoption of energy efficient lifestyles. The ENTROPY ecosystem builds upon (a) IoT technologies for interconnecting numerous devices and collecting energy-related information from heterogeneous data sources, (b) advanced Data Modelling and Analysis techniques that support the realization of semantic models and knowledge extraction mechanisms and (c) recommendation and gamification mechanisms that stimulate users interest for energy efficient activities and educate them in adopting more energy efficient lifestyles.

Specifically, the ENTROPY ecosystem engages the end users by developing a set of serious games and personalized mobile applications that provide to the users energy-related information and recommendations for achieving energy savings in their daily activities. The users can monitor in real-time the energy data streams from the IoT-enabled buildings through the ENTROPY platform. Additionally, a digital-physical interactive game with VR capabilities provides to the users behavioral-based adaptive educational content and interaction with the sensors and IoT energy monitoring devices. Overall, the users have a unique, educational experience interacting with energy monitoring devices and gamified applications; and realizing how fruitful means can enable energy efficient behavior and lifestyle.



Entropy Serious Game – Energy related quiz



Entropy Personalized app – Energy saving Recommendation

Overall, the ENTROPY ecosystem introduces a number of innovative features. First of all, the ecosystem enables the easy and seamless integration of IoT devices and sensors installed in buildings, as well as plugin functionalities. Additionally, ENTROPY platform makes analytics easy, secure and comprehensible. The ecosystem ensures that every user, without any prior analytics knowledge, will be able to upload, build or execute energy analytics algorithms and explore the energy efficiency results via a user-friendly visualization module. The provided knowledge of energy consumption and efficiency can ultimately assist in decision making for the building energy managers. Further, the provided digital-physical interactive serious game and the mobile personalized app promote and enable change of energy consumption behavior through adaptive educational content. Finally, the ENTROPY platform has one more unique feature; it provides analytics of the users' behavior that interact with the serious game and the personalized app. In brief, the ENTROPY platform is also a means to see and evaluate the users/ consumers actual energy behavior in the building. Last, but not least, the ENTROPY system has implemented all the necessary EU prescriptions in order to protect the users' data privacy.

The ENTROPY ecosystem will be evaluated through its application to three public buildings: the Navacchio Technology Park (www.polotecnologico.it) close to Pisa in Italy, the Technological park and University campus in University of Murcia in Spain and the Technopole in Sierre in Switzerland.

The target audience and potential interested stakeholders range from Utilities / Smart Grids and Smart Cities stakeholders to individual end-users interested in home and/or office services that enable energy efficiency.

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Building an ocean energy industry a European success story

By Rémi Gruet, CEO, Ocean Energy Europe

Ocean energy is steadily marching towards industrialisation in Europe, with major milestones achieved in the last 12 months. Recognising the pan-European opportunity, the EU has championed the sector. Visibility on volumes and prices are now needed to set the industry on a cost reduction pathway, and ultimately compete with established renewables such as offshore wind.

STEADY MARCH TOWARDS INDUSTRIALISATION

Just off the northern tip of Scotland, four 24m-tall turbines sit on the seabed, quietly producing electricity from the predictable turning of the tides. To date, the Meygen tidal farm has generated over 6 gigawatt hours of electricity, including 1.4 gigawatt hours in March 2018. In April 2018, its owner, Atlantis Resources, announced that the turbines have been approved for production for the next 25 years.

Further north, the Shetland Tidal Array is replacing emission-heavy diesel generation and preparing for further build-out with the support of Horizon 2020. In France, Naval Energies will soon complete the world's first tidal turbine factory in Cherbourg, capable for delivering 25-50 turbines per year.

These major success stories are proof that ocean renewable energy continues its steady march towards industrialisation in Europe. We are building a new industry from the ground up.

EUROPE NEEDS OCEAN ENERGY

Ocean energy can be a mainstream provider of electricity. Our seas and coastlines boast some of the most powerful wave and tidal resource in the world - an untapped wealth of energy. And it will be needed to fully decarbonise the power sector, and meet the EU's commitments under the Paris Agreement.

The industry plans to build 100GW of production capacity in Europe by 2050: enough to meet 10% of Europe's electricity needs. That's as much as electricity as wind energy produced in the EU last year.

Europe will need new sources of clean energy in the coming decades to keep up with demand. This is driven by mega-trends like the roll-out of electric vehicles, electric heating, and the retirement of old power plants. The European Commission forecasts a 1% annual increase in electricity demand from 2020-2050 - the reality is likely to be much more dramatic. Like it's older brother wind, ocean energy can be ramped up fast and help meet this increase. It is thus key to the EU's future electricity mix.

But on the 21st century electricity grid, it's not just about how much electricity you can produce, it's also about when you can produce it. In this regard, ocean energy is a clear winner: Tides determined by the moon thousands of years in advance make it highly predictable. Waves follow the wind, and remain strong three hours after the wind has stopped blowing. Ocean thermal energy conversion (OTEC) and salinity gradient power generate energy 24/7.

Building ocean energy projects will greatly add to overall stability of the electricity grid.

A 2MW OpenHydro turbine on its way to deployment - Image courtesy of Naval Energies

THE EU CHAMPIONS OCEAN ENERGY

Recognising the significant industrial opportunity, the EU has emerged as a champion of ocean energy. Commissioner for Maritime Affairs, Karmenu Vella, has mustered strong political support through DG MARE's Blue Growth and Ocean Energy Forum initiatives.

Since 2014, the Commission has invested €150m in ocean energy through its Horizon 2020 programme. This support will keep Europe at the cutting edge of technology development, and accelerate ocean energy's journey along the cost-curve. It is vital that this support be at least maintained through 'Horizon Europe', so that the EU remains ahead of the competition. For example, China and the US are stepping up investments.

European Commission support has also brought the EIB into the sector for the first time through its InnovFin EDP (Energy Demonstration Projects) product. In 2016, Finnish wave energy outfit - AW Energy – became the EIB's first client under this mechanism. The loan will help finance a pre-commercial project in Portugal later this year.

PLOTTING THE PATH TO MARKET

To roll-out an industry on a commercial scale, visibility on volumes and prices is now needed. Revenue support mechanisms have been undeniably successfully at bringing first generation renewables such as wind and PV to market. Ocean energy will follow these technologies down the cost curve, but dedicated support is needed in the short term. A 10MW ocean energy farm cannot be asked to compete on price with a 1GW offshore wind farm.

The EU should support first-mover Member States giving ocean energy a path to market. The ETS' Innovation Fund, the successor to NER300 can provide additional help to get projects past the 'valley of death' of finance for demonstration.

A NEW INDUSTRY... BASED IN EUROPE?

Today, European companies are the clear global leaders in ocean renewable technology development. 66% of tidal energy patents and 44% of wave energy patents globally are held by European companies, according to the JRC.

In a pattern reminiscent of wind energy, Europe's technology dominance is translating into export market opportunities. Every single

Atlantis' AR1500 1.5MW tidal turbine, mobilising for deployment at Meygen, Scotland

project in the Bay of Fundy, Canada – home to the most powerful tidal resource in the world – is dominated by Europe's pioneering technology. European companies are also receiving orders and developing projects in areas such as South-East Asia and Japan.

The question therefore, is not 'when' but rather 'where' ocean energy will commercialise, and crucially who will reap the benefits? History shows that industrial first movers gain the learning and expertise to build an indigenous industry, before exporting that overseas.

Europe needs to act now and maintain its technology leadership by supporting pre-commercial ocean energy farms, and building a strong, domestic industry. Our competitors will not hesitate to seize the prize.

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Twitter: @Oceanenergyeu

Comsa is on the track for the next NZEBuildings

The innovation unit of **COMSA Corporación** is focused on developing NZEBs in the tertiary building sector based on R&D advances in Geothermal, Photovoltaic and Energy Management Systems. Some of the projects it is engaged in following this strategy are:

DRIVE

Current smart-grids lack low-cost, reliable solutions that engage the vast Demand Response potential of end users. DRIvE will develop and validate a fully-integrated ICT infrastructure consisting of interoperable DR-enabling Energy Management solutions for residential and tertiary buildings and a platform for effective and secure management of flexibility in the distribution grid, able to unlock and exploit the DR potential of the distribution grid. DRIvE builds on the work of previous EU projects and will align with and extend the Universal Smart Energy Framework (USEF), supporting all market phases (Plan & Validate and Operate).

GEOFIT

GEOFIT is aimed at the the technical development and deployment of cost effective enhanced geothermal systems (EGS) for energy efficient building retrofits and its components. Innovations include: low-invasive risk assessment technologies, site-inspection and worksite building monitoring techniques, control systems for cost-effective and optimized EGS in the operation phase and novel BIM-enabled dedicated tools for management of geothermal based retrofitting works. The project includes the application of tailored drilling techniques such as improved low-invasive vertical drilling and trenchless technologies.

GEOTECH

GEOT€CH aims to enhance greater utilization of **renewable heating and cooling** using shallow geothermal systems through **innovative drilling and ground heat exchanger technologies** that are significantly more **cost-effective**, affordable and efficient than current technology. For new large-size buildings, GEOT€CH removes the costs associated with drilling boreholes through the **thermo-activation of the foundation structures** such as piles, screen walls and basement slabs. GEOT€CH develops **optimized hybrid solutions** that integrates two different geothermal systems in small and large buildings market. The optimization of geothermal system operation is achieved through the Energy Management System and the development of a dual source heat pump (ground/air sources).

HYBUILD

HYBUILD will develop two innovative hybrid storage concepts that will be installed and monitored in three different demo sites in near-life operation: a Mediterranean system designed for optimal cooling, and a Continental system designed for heating and DHW production. The hybrid storage concepts include both renewable thermal and electrical components, balanced through seamlessly integrated compression and adsorption heat pumps, managed by an advanced building energy management systems (BEMS) that considers both building and district level needs. Energy savings of between 20% and 40% annually are acheivable for both designs.

LIFE BIPV

LIFE BIPV aims to foster the development and demonstration of organic photovoltaic (OPV) technology to be integrated in façades of new and refurbished buildings.

The main objectives of LIFE BIPV are the demonstration of a significant reduction in CO_2 emissions (-34%) and carbon footprint (-50%), and the validation of the economic feasibility of the BIPV system considering the Levelised Cost Of Electricity (LCOE) at the demonstration scale (0.30-0.36€/kWh). The project aims to improve awareness towards the sustainability of OPV systems in nZEBs and to reinforce its replicability for the construction sector and others (i.e. automotive, street installations).

All projects are partially funded by the European Commission.

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The World Sustainable Energy Days 2018

600 experts, 66 countries, 6 thematic conferences, 1 mission: driving the clean energy transition

Upper Austria is a European leader in the clean energy transition: already 75% of the electricity, 61% of all space heating and 32% of the primary energy in the region come from renewables. Moreover, through significant increases in energy efficiency and renewable energy, greenhouse gas emissions from buildings have been reduced by 43% in 10 years. Energy efficiency and renewable energy are key to boosting the economic competitiveness of the EU, its member states, regions and individual businesses. Resulting economic growth provides jobs and the ability to invest in the further progress of the clean energy transition to the benefit of all citizens.

Each spring, the sustainable energy community comes together at the World Sustainable Energy Days (WSED) in Wels/Austria to discuss these topics and work at driving the energy transition forward. The WSED, one of Europe's largest annual events in its field, offer several thematic conferences on key topics related to energy efficiency and biomass as well as technical site visits and a major tradeshow. Held from 28 February - 2 March 2018, the 2018 edition of the WSED was once again a great success with over 600 experts from 66 countries attending the events.

Energy efficiency first

In 2018, the **European Energy Efficiency Conference** comprised 5 conferences covering topics ranging from research to policy. Among these, the "Energy Efficiency Business Conference" addressed energy efficiency as a pivotal economic factor and focussed on how to make it into business. The "Technology Innovation Conference: Energy and Buildings" was dedicated to new research results on energy-efficient and sustainable buildings.

"Renewables second"

Pellets are a clean, CO_2 neutral and convenient fuel with growing market shares worldwide. The 2018 edition of the **European Pellet Conference**, the largest annual pellet event in the world, delivered the latest news about markets, technologies and policies. Upper Austria is an ideal location for this conference: more than 25% of all automatic biomass boilers sold in the EU are manufactured by Upper Austrian companies and pellet heating systems have become a standard solution in the region.

Welcoming the next generation

The WSED offer Young Energy Researchers an opportunity to present their work and achievements to an international audience. In the

context of a call for papers, young researchers from all over the world were invited to submit their work in the fields of biomass and energy efficiency. For 2018, nearly 100 papers were submitted from over 46 countries – a record high! The **Best Young Energy Researcher Awards** (Biomass and Energy Efficiency) were a highlight of the **Young Energy Researchers Conference**.

Full package deal – a leading tradeshow

The **Energiesparmesse**, a leading tradeshow on energy efficiency and renewable energy, takes place in parallel to the WSED. With nearly 100,000 visitors and 1,600 exhibitors each year, it presents product innovation in energy efficiency and renewables in buildings.

World Sustainable Energy Days 2019 – Call for Papers

The next edition of the WSED will be held from **27 February - 1 March 2019** in **Wels/Austria**. The deadline for the Call for Papers & Speakers (including for the Young Energy Researchers Conference) is **10 October 2018**.

OÖENERGIESPARVERBAND

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SWEDEN ENERGY

How to make everybody agree on a 100% renewables

Transition is necessary and Sweden can show the way

Sweden on the route to 100% renewables

Transition is necessary, and Sweden can show the way

By Ibrahim Baylan, Minister for Policy Coordination and Energy in the Swedish Government

The energy sector is undergoing change. And this change is absolutely necessary. The challenge of climate change cannot be addressed without solving energy issues; the energy sector accounts for two thirds of the Earth's total greenhouse gas emissions. The change that the energy sector is currently undergoing is of such a nature that I am convinced we are now writing history. For the first time in world history, we have the technology to provide our homes and businesses with energy in a way that does not destroy the climate and at the same time also creates new jobs and contributes to growth.

The Swedish Government has high ambitions for climate and energy policy. Our goal is for Sweden to have a 100 per cent renewable energy system by 2040 and to become one of the world's first fossil-free welfare societies. We have also decided that by 2045, Sweden will have achieved net zero greenhouse gas emissions. This demands a great deal of us politicians, as well as all actors in society. We need wise, forward-looking decisions, and we need to be prepared to invest in new and innovative solutions.

The Swedish energy sector has already embarked upon the transition to renewable energy. We began the transition in the 1980s, when economic reasons (the oil crisis) caused us to shift the heating sector from coal and oil to today's use of waste and bioenergy. Energy efficiency is another area in which we have begun to take action and where new technology is enabling us to make better use of waste heat from industry and buildings, and to lead it back into the energy system.

But it is not until now, in 2018, that we have reached the point at which the change is system-wide. I would say that the energy sector is in a disruptive phase. Previous truths and technologies are being re-examined and new solutions and services are emerging. And these novelties not only give us lower emissions, they also create new jobs and export opportunities. Sweden is an example of how lower carbon dioxide emissions can be combined with growth. Since the 1990s, Sweden's GDP has risen by 75 per cent, whereas our CO_2 equivalent emissions have dropped by 26 per cent.

As is already clear above, the heating sector has come a long way in the transition to renewable energy. We are now focusing on the electricity and transport sectors. The transport sector is also the area that appears to be the most difficult to solve. Not all solutions are in place here yet, but I am convinced that we are nearly there. Research and technological developments are taking place at both universities and companies, and energy-efficient transport, new fuels and electrification are gaining ground parallel to this.

However, the transition to fossil-free electricity is happening quickly. Much more quickly than we thought just a few years ago. If we look at the price of solar electricity or off-shore wind power, technological developments have given us ever lower costs, meaning that these new technologies are the most profitable ways to produce electricity in many places. Both technology and politics play an absolutely crucial role for the speed of the change. I want Sweden to continue to be a leading country in the development of new energy technology. Being at the forefront of energy research, development and commercialisation will create new jobs and growth, both in Sweden and around the world.

Sweden has all the right conditions to take on a leading role in this transition. We are one of the world's most innovative countries, we have fantastic natural resources in the form of forest, water and wind, and we have flourishing industry. We want to show that a comfortable and modern lifestyle can be combined with reduced emissions. We will show that it is possible to combine growth and job creation with sustainability.

I am convinced that we are in the midst of a historic shift. When we look back at this time in ten years, we should feel proud of the choices and investments that Sweden, Europe and the world made. It is happening now. And it is up to us.


Ibrahim Baylan

How to make everybody agree on a 100% renewables

By Jakop Dalunde, MEP

The idea that any advanced economy can be run solely with renewable energy has often – and Sweden is no exception here – been described as a fool's errand. Sweden in particular should be bad testing ground for an energy system that is renewable in its entirety. Half of the year the country is too cold for most sensible people, underscoring the need for a reliable energy system. According to popular opinion Sweden was also supposed to be too dark to be a suitable place for extensive solar energy programs.

Thus, when the Swedish Greens first proposed a 100% renewable energy system we were at best met with ill-concealed laughter. The proposal was according to most commentators and politicians supposed to be scientifically unviable and economically disastrous. Yet, seven years later, our proposal has become official government policy. A large bipartisan majority of the Swedish Parliament has agreed that Sweden should be 100 % renewable in 20 years and the industry is making big adjustments to reach it. How did we achieve this? I hope some lessons might be learned from our experience by other European politicians and popular movements, hoping to achieve similar things in their own countries.

First of all it was crucial that the majority of the parties in the Swedish parliament came to share the overarching understanding of the importance of 100% renewables. 2/3 of the global emissions derive from the energy sector. To reach the targets from the Paris Agreement the emissions from the energy sector must be addressed. Luckily, the momentum given by the Paris Agreement, made other parties and actors more susceptible for real climate action.

A determined but pragmatic green movement – willing to make allies of unexpected partners – is another key lesson for getting conservative parties and large sectors of the industry on board with the program. It is challenging to change an energy system quickly and business friendly politicians have traditionally been understandably reluctant to adopt high renewable energy targets.

By being pragmatic, we managed to show how demands for reduced climate impact are also an opportunity for Swedish companies, which are often the world's leading producers of environmentally friendly products and services. Presenting

In order to cope with the conversion of the energy system, a clear roadmap is required which specifies what policy measures are to be implemented in order to achieve the overall objective.

change as an opportunity, mostly benefitting early movers, has been a successful strategy. We are convinced that Sweden will benefit from the technological achievements that a 100% renewable target will bring. Right wing parties and the the Swedish industry came to share the view that we want to export new solutions to difficult problems, not emissions.

We also managed to drive home the point that a long term target will also benefit the industry by giving a clear signal on the direction in which we are moving. Many industrialists I have spoken to have not been worried by the 100% renewable target. On the contrary they usually see it as an incentive to innovate, given that government can provide sufficient support. What most of them want are just clearly defined rules and long-term guidelines, giving the industry sufficient security to invest in the solutions of the future. Especially so for energy companies and industry, which make investments that will last for 40 years or more; they need long-term conditions for their operations. This is another reason why bi-partisan agreements form such a crucial part for transition and innovation.

Sufficient government support is another a key factor in achieving any serious target for renewables. Public funding for renewable electricity has been strengthened and extended during our time in government. We have created long-term conditions for modern environmental requirements in hydropower, for long-term investments in power grids in Northern Europe and for a growing service sector in energy efficiency and small-scale electricity production. This has in no small way contributed to the achievability on the 100% target. The technique for renewables is there, but companies need public support to make the transition.

It cannot be stressed enough that any bipartisan effort to make a common target needs to be based on facts and knowledge – not on personal perception and ideological orientation. The Energy Commission leading the effort to reach a bipartisan agreement, held many meetings, study sessions and organized public seminars. Local, regional and national players participated in the conversation. This work dissolved some old ideological deadlocks. By putting science ahead of ideology everyone could in the end agree that investments in renewable energy and energy efficiency will be the answer to both questions about how we improve the environment and how we strengthen competitiveness.

However, nothing is won just by lofty targets. In order to cope with the conversion of the energy system, a clear roadmap is required which specifies what policy measures are to be implemented in order to achieve the overall objective. Reforms are still needed to provide better conditions for investments in renewable energy and energy efficiency. New technical solutions with energy storage, participating customers and smart grids are important components of the energy system of the future. Other important components for creating a robust electrical system are hydropower and a larger interconnection of the electricity grid in Sweden and neighboring countries. An important step in the roadmap is to review energy regulations and modify them to suit the power challenge. This includes questions relating to market design and product and demand side action.

Now the hard work begins in order to reach 100 % renewables in Sweden in 20 years time. Through determination, bipartisan cooperation and by giving businesses workable long term conditions I am convinced we can make this transition. And if Sweden with our unreasonable cold winter nights can make it, so can others.

Sweden on the route to 100 percent renewables

By Anne Vadasz Nilsson, Director General, The Swedish Energy Markets Inspectorate

After a broad political agreement, Sweden has set an ambitious target of 100 percent renewable electricity production by 2040. Sweden's tradition of combining good governance, regulation, well-functioning markets and innovation for fast-tracking progress in new or demanding areas will be vital for this undertaking. We are convinced that demand side flexibility and efficient and interconnected markets are key components for a successful transformation of the energy system.

Sweden is well endowed with hydro resources, with the bulk of hydro power plants installed in the first half of the 20th century. Today, most of the rivers and streams are dammed and controlled and there is a broad political agreement not to exploit the remaining rivers. Hence, only limited hydro resources remain to bolster the expansion of renewable electricity production and therefore most of the renewable expansion will come through solar and wind, sources that are inherently volatile in their electricity output. This is a notable change in the Swedish energy landscape that for decades has relied on hydro and nuclear power production. Some of the increased volatility can be managed with existing hydro resources, but more solar and wind will nonetheless create a more variable power supply. Contrary to controllable sources, this supply is not price sensitive as it produces electricity when the sun is shining or the wind is blowing, not when prices are high.


Photo: Robin Thunholm, Happify

In addition, the political push towards renewable electricity production and other global actions for a more sustainable energy future have contributed to reducing the profitability of nuclear, and in Sweden, this has resulted in the decommissioning or moth balling of reactors. Instead wind power has increased and especially large-scale wind has shown a substantial growth over the past years. This is mostly due to the green certificate system - a common Swedish and Norwegian support scheme - but also the result of shrinking variable costs for renewables. Sweden's good wind conditions and abundance of sparsely populated areas have also contributed to the development. Recently the Swedish Parliament has decided to increase and extend the certificate scheme with an extra 18 TWh until 2030. This will set Sweden even more on the route towards 2040 and the 100 percent target.

ENERGY-ONLY

Since 1996 Sweden has had a well-functioning wholesale market model for the pricing of electricity and prices reflect supply and demand. The energy-only model in combination with Sweden's four bidding zones have been of utmost importance in ensuring the right price signals for the efficient allocation of power production and transmission. Furthermore, we have a strong linkage between the wholesale prices and the retail market. Swedish customers are among the most active in Europe and tend to make informed choices based on market signals. The existing market model has served Sweden well and will be critically important for reaching the political goals. In addition, the green certificate support scheme has been implemented in a market based way, which has minimized the detrimental effects subsidies can have on market efficiency.

To reach the political targets in the best possible way it is important to maintain the focus on well-functioning markets and market efficiency while managing the challenges of more volatile power production. This can be done through creating frameworks that support and stimulate the use of smart technologies and customers' and other actors' active participation in the market.

Above all it is important to apply the right regulatory framework to make the transition possible while maintaining market efficiency. We are convinced that the current market model is flexible enough to incorporate the growing amount of wind and solar power if the market rules adapt to the new realities. Demand side flexibility and the utilization of existing and planned interconnectors are important parts of the solution.

Sweden has one of Europe's highest interconnection ratios with many over-head and under-sea cables to neighboring countries. In addition to transporting electricity, interconnectors can function as enablers of competition across national borders as they are moving power to where it is best needed. The European Internal Energy Market relies on optimal use of existing international interconnectors as well as new interconnectors being built in the right places.

Our simulations show that efficient utilization of existing and upcoming interconnectors between the Nordic countries and the continent is of vital importance for stimulating more renewable power production.

In 2016 the Swedish Energy Markets Inspectorate performed a study on the potential of demand side flexibility and important conclusions were reached. For example, the analysis showed that there was a substantial potential in household heating as a flexibility resource, due to the inherent inertia and heat holding-capacity in the material of the houses. To realize this potential, customers need hourly metering and hourly settlement, and this can be provided with smart metering and a proactive regulation. In the latter case, the Swedish Energy Markets Inspectorate as a regulator has a key role to play and has already made legislative suggestions to the government in this area.

There are additional challenges that need to be addressed before we can reach the target of 100 percent renewable electricity production by 2040, but we are convinced that Sweden can reach this goal while maintaining an effective market model where supply and demand determine the price. This is a market that brings benefits to customers and that is welfare enhancing for the society as a whole.

Contact information

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Sustainable Aviation: Having the means to realise our ambition

By Pavel Telička, Vice-President of the European Parliament Committee for Transport and Tourism Group of the Alliance of Liberals and Democrats for Europe

The end of the Parliamentary term coincides with the end of the 2014-2020 programming period and therefore the last legislative work of this Parliament will be the adoption of its first reading position on the new Multiannual Financial Framework for the period 2021-2027. The new generation of the Connecting Europe Facility - the dedicated fund for investment in Transport, Energy, Telecommunication and Digital infrastructure – the Horizon Europe programme and the InvestEU fund will be strategic tools for achieving the change we are aiming at in the aviation sector.

When it comes to this objective, my starting point is that reducing emissions from the aviation sector does not entail cutting on people's mobility and on regions' connectivity, but that an enormous potential lies beneath this shift, provided we adopt a coherent set of policies aiming at encouraging innovation and rationalising the airspace. In its report on an Aviation Strategy for Europe, the European Parliament underlines this potential and calls for a comprehensive transport policy linking all modes of transport in a long-term strategy. In a sector which is relying on heavy infrastructure investment, a long-term approach is the only way to ensure public and private investors have the necessary guarantee and incentive to finance research and infrastructure which aim at serving the transition towards a sustainable aviation sector.

In this current environment, expectations are high as regards the future Commission proposal. Although, to this date, the proposal for a CEF next generation remains unknown, the recently published Commission communication "A Modern Budget for a Union that Protects, Empowers and Defends – The Multiannual Financial Framework for 2021-2027" lays out the overall priorities and guiding principles of the next programming period.

CEF has been and will remain the corner stone of the transition towards a more environmentally-friendly transport sector. While its specific direct contribution to the aviation sector may seem limited compared to its amount for the other sectors, the implementation of the Single European Sky is its first horizontal priority and the role of the SESAR project in this respect is not to be questioned. The first figures communicated early May indicate that the Commission proposes a slight increase of the total budget for CEF compared to the previous period, for the benefit of the energy sector and regrettably at the expense of the transport sector.

In addition to CEF and equally – if not more – relevant for the aviation sector, the Commission emphasised that the new research programme Horizon Europe will benefit from an unprecedented amount of €97.6 billion. The programme is designed around three pillars directly supporting researchers and supporting the transition towards a clean mobility is one of its explicit objectives.

Lastly, InvestEU is taking over the Juncker Plan and will be the new integrated investment fund. It will integrate into one streamlined structure all the centrally managed financial instruments. The proposed contribution from the EU budget should reach €15.2 billion to trigger an expected €650 billion of additional investment across the EU. If so far in the current programming period, transport projects only accounted for 8% of the total investment approved by the EFSI, digital transformation and sustainable infrastructure are key objectives of the InvestEU, which opens opportunities awaiting to be grasped for innovation in the aviation sector.

With these figures in mind, and regardless of the appreciation we make of it, one should recall that neither multiplicity of the instruments, nor a promising amount allocated for each of them are per se guarantee of the success of the next MFF. The Commission promised a modern, simple and flexible budget and I should hope we deliver on this in the interinstitutional negotiations: the objectives and the budget should be clear for its beneficiaries, red tape must be cut and the tools at our disposal must be flexible – CEF in this regard has been quite well-performing in the last years and funds have been effectively reallocated from one call to another.

With respect to the specificities of the aviation sector, a particular attention will need to be paid in the next MFF to the complementarity of the CEF and the Horizon Europe programme, the nature of the financial instruments and the funding rates foreseen. I should also hope that a greater importance be given to the dialogue with and between the industry and the research centres. Policy makers will not themselves cut on the emissions in the aviation sector – and this should not even be our objective: researchers and the industry will do so. Our role, on the contrary, is to set the right guidelines and conditions for the sector to be in the capacity to deliver through innovation and the development of the appropriate technology.

Negotiations to achieve the right financial framework in the coming months will be crucial for the transformation of the transport sector, including for the aviation sector which is still often considered as being reluctantly dragged behind in the fight against climate change. The air sector understood that reducing emissions is no longer a choice but a key component for its competitiveness and in the context of intense worldwide competition that we know, the European aviation sector can certainly not afford that time and resources be lost and that opportunities be missed.

Clean Sky has taken off: The story of the BLADE project on laminar flow

By Tiit Jürimäe, Interim Executive Director, Clean Sky

1 March 2018: the National Building Museum, Washington, D.C. The reputable aviation magazine Aviation Week is holding its 61st Annual Laureate Awards ceremony recognising achievements in Business, Defense, Space, and Commercial Aviation.

In this final category, the Clean Sky flagship project BLADE (Breakthrough Laminar Aircraft Demonstrator in Europe) has won the much coveted Technology prize. This globally recognised award marks the achievements of excellent European research to reduce the environmental footprint of aviation, under the auspices of the European Union's Horizon 2020 research and innovation programme.

As part of the Clean Sky Programme's Smart Fixed Wing Aircraft (SFWA) efforts, the BLADE project aims to prove that natural laminar flow can be reliably and consistently achieved under normal operational conditions of aircraft in the air transport system, thereby reducing wing friction drag by 50% and aircraft CO_2 emissions by up to 5%.

The BLADE demonstrator aircraft, a heavily-modified Airbus A340, is the first test aircraft in the world to combine a transonic laminar wing profile with a representative, innovative structural design and manufacturing process.

Following a decade of dedicated research, the BLADE aircraft made its successful maiden flight on 26 September 2017. The aircraft flew for 3 hours and 38 minutes between Tarbes and Toulouse in France. The flight was a landmark achievement, and the BLADE project itself is a great example of pan-European cooperation in research to reduce CO_2. Under the leadership of Airbus, some 20 partners in eight European countries have worked together to bring together the technologies needed and integrate all innovative design, manufacturing and assembly concepts, as well as flight measurement systems.

On the outside the aircraft is fitted with two differently manufactured outer-wings, allowing the test flights not only to verify the laminar airflow, but to compare the two different manufacturing concepts selected for the test campaign. Inside the aircraft cabin, a novel and highly complex flight-test-instrumentation station was installed in order to acquire data from the array of sensors on the aircraft and measure the airflow and the aircraft's performance. The extensive modifications to the A340-300 test-bed aircraft took place during the course of a 16-month period in Tarbes, with the support of numerous partners across Europe.

On the wings, there are hundreds of points to measure the waviness of the surface to help Airbus' engineers ascertain its influence on the airflow

© AIRBUS 2017. Photo by S. Ramadier

and the extent of laminar, smooth flow – the first time that Airbus has used such a testing method on an aircraft. Other 'firsts' are the use of infrared cameras inside a pod attached to the fin to measure wing temperature and the acoustic generator which measures the influence of acoustics on laminar flow. There is also an innovative reflectometry system which measures overall deformation in real-time during flight.

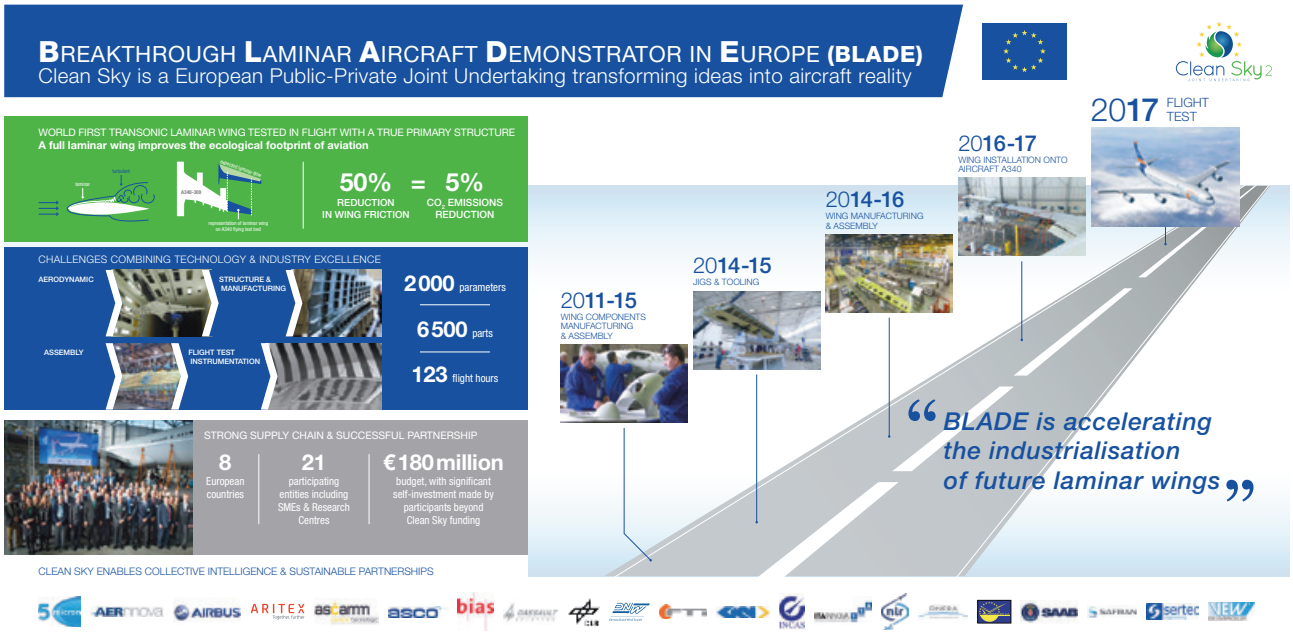
A key goal of BLADE is to be able to measure the tolerances and imperfections which can be present and yet still sustain the laminar airflow (and the so-called transition to turbulent boundary layer flow) needed to achieve the drag reduction targeted. To this end, Airbus will simulate every type of imperfection in a controlled manner, so that at the end of the campaign the tolerances for building a 'laminar wing' will be fully known. The BLADE demonstrator aircraft will perform around 150 flight hours in the coming months.

With sustained and reliable laminar airflow being shown to be achievable in the large commercial aircraft design space, one of aviation's 'Holy Grail' quests is being met, as aircraft designers and researchers have sought to make this possible through more than half a century of efforts. BLADE has now set the global benchmark in this quest. ●

Watch the BLADE first flight on Clean Sky's YouTube channel!

BLADE project full story

BLADE project first flight (short video)



What Europe can do to cut aviation emissions

By Andrew Murphey, Aviation Manager, Transport & Environment

Aviation has the unenviable distinction of being Europe's most challenging climate issue, with its emissions growing 23% since 2013 at time when other sectors are flat lining or even declining. There are no easy solutions but if we're to achieve a low carbon economy then all sectors must contribute and aviation cannot be an exception.

The growth in aviation emissions isn't inevitable and it's been considerably worsened as a result of the sector's special treatment by governments, and the fact that policy makers have spent so long pursuing false solutions.

The special exemptions are numerous, but let's start with some of the more egregious ones. Despite being the most carbon intensive means of transport, the sector pays zero fuel tax – whereas the road sector pays on average 48c a litre. The sector is also mostly exempt from sales tax, again unlike other transport modes and indeed most goods and services. As well as artificially inflating demand and disincentivising efficiencies, both these exemptions add up to loss for EU governments of about €40bn a year.

States have repeatedly failed to challenge these exemptions, continuing with a business-as-usual growth at any cost approach. This is in marked contrast with other sectors such as road transport and electricity where there is an acceptance that decarbonisation will require fundamental changes to how these sectors work.

The best example of conservatism is the current focus on development of an offsetting mechanism though the UN's aviation agency, the International Civil Aviation Organisation (ICAO).

In recent years EU efforts to cut aviation emissions have focused almost exclusively on measures adopted by ICAO. However ICAO isn't an agency suited to adopting ambitious environmental measures, and its flagship policy of offsetting is ultimately doomed to fail.

That's not to disparage ICAO, which has an impressive record on ensuring safety and security in the sector. It's to point out that there are some structural issues with how the agency operates. It lacks a legal enforcement mechanism, something essential if climate policies are to be applied fairly and its consensus-oriented decision-making severely diminishes its level of ambition. For example, last November ICAO's Council could not agree on sustainability criteria for alternative fuels and as result most of the criteria, which were developed over two years by a large group of experts, were dropped. Now ICAO

risks rewarding biofuels which have a devastating effect on land, water and worker rights.

The most worrying policy being pursued by ICAO is its global offsetting mechanism, known as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This scheme proposes that, from 2021 onwards, airlines flying certain routes will be required to purchase offsets for a portion of the emissions of that flight. Offsetting is the idea that instead of reducing your own emissions, you pay someone else to reduce theirs.

As neat as the idea may be in theory, it has failed to work in practice. It's simply too difficult to tell whether those emission reductions actually occurred, or whether they would have occurred without the payment. One study, looking at offsets purchased as part of the EU's climate goals, found that 85% of projects used could not be proven to have delivered emission reductions.

The Paris Agreement casts even more doubt on the future of offsetting. Unlike its predecessor the Kyoto Protocol, which asked only developed countries to cut emissions, the Paris Agreement demands that all countries set emission reduction targets, with the ultimate aim of decarbonising the global economy by the second half of this century. But if every state and sector is already required to cut its emissions, what role is there for offset payments?

And while CORSIA likely won't deliver any emission reductions in other sectors, it also won't deliver emission reductions in the aviation sector itself. That's because the global offsetting market is so flooded with bad credits that the price has collapsed to under €1 a tonne. One study, by the International Council on Clean Transportation, has found that by 2035 the cost of CORSIA may equal perhaps 2.5% of an airlines fuel costs - far too low to ever incentivise new aircraft or new fuels.

So what might work? ICAO talks about a basket-of-measures but its combination of weak CO_2 standards, damaging alternative fuels, ineffective CORSIA and no discussion of demand management won't do the job. Europe needs to recognise this and, in reviewing its long-term decarbonisation strategy, set out a far more ambitious and effective range of policies which complement the minimum effort coming out of ICAO.

The centrepiece of this must be retaining EU ETS. That system now has two important features: a rising price of credits and reforms adopted last year introduced a declining cap on aviation allowances. This means that the aviation sector will have to decarbonise by 2066 – close to what Paris requires, and a world first. Europe should be proud of this policy, and not allow an alliance of regressive states and industry to undermine it.

However, EU ETS alone won't be enough. What's need alongside this more effective pricing mechanism is the technologies which can decarbonise the sector. Radical new aircraft designs, including battery-electric, aren't a good bet. Even under the most optimistic scenario, they will take several decades to be developed and in the interim, Boeing and Airbus are producing 'traditional' jet engines which require liquid fuel. These aircraft will stay for decades in operation, and unless we find something other than kerosene to fuel them with, we will break the Paris goals.

A more promising avenue might be electro-fuels such as power-to-liquid. These can be produced using renewable electricity, and unlike alternative aircraft designs, they are technology ready. Barriers still exist – they require enormous amounts of renewable energy and there is an issue over where to source the CO2 required to manufacture it - but with the right safeguards, it is a technology worth pursuing for sectors which are difficult to decarbonise such as aviation.

Paris requires immediate and substantial emission reductions across all sector. The UN's cumbersome aviation agency is unlikely to deliver this for the aviation sector. That's why Europe, in establishing its new long-term decarbonisation strategy to reflect the Paris Agreement, must outline what role it will play in ensuring the aviation sector is put on a path to zero emissions.

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HORIZON2020 Project HERON

Forward-looking socio-economic research on Energy Efficiency in EU countries. *GA No. 649690*

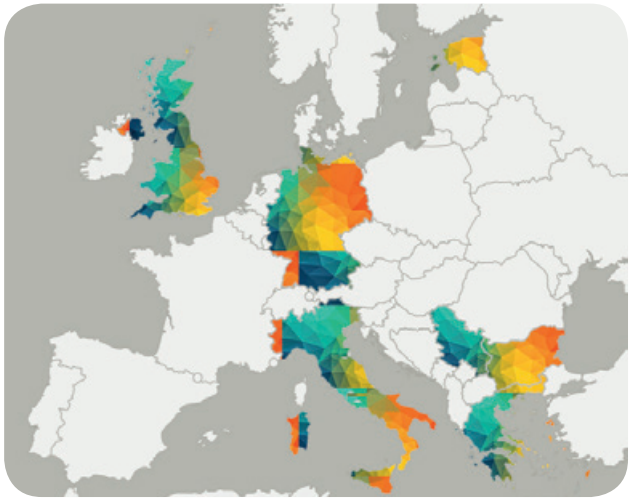
AIM

Taking into account that behavioral barriers demonstrated by end users create negative deviations in EE set targets between 5-20% in EU and 20-30% globally[1], the HERON project aims at facilitating policy makers to develop and monitor Energy Efficiency (EE) policies in building and transport sectors, through forward-looking socio-economic research in six EU and one candidate countries (Bulgaria, Germany, Greece, Estonia, the United Kingdom, Italy and Serbia). The research effort lasted for almost three years.

RESEARCH AND INNOVATION

The innovative core element is the incorporation of non-economic and non-market elements, such as social, educational and cultural, into energy modeling for reflecting the end-user behavior towards EE in the two aforementioned sectors.

Based on advanced research, surveys and questionnaire, an innovative tool is developed providing policy makers with the ability, for the first time, to quantify the qualitative characteristics associated with end-users' behavioral barriers. This user-friendly software, named as HERON Decision Support Tool (HERON – DST) allows the calculation of the impact of behavioral barriers on the input drivers (technologies and policies) and the assumed targets of EE scenarios. The tool is developed by the Energy Policy and Development Centre (KEPA) of the National and Kapodistrian University of Athens (NKUA) (Coordinator of the project) and is assessed as successful and innovative by two independent groups of EU evaluators.



HERON partners worked on deviations caused by barriers of end-users' behavior towards EE targets and studied ways of addressing these barriers and reducing these deviations, through effective policies. The developed pathway of the project facilitates its users to conclude with the preferred scenario, among a number of optimal developed ones with the use of the multi-criteria AMS[2].

This overall HERON process (pathway), as built through the project progress, follows these steps:

1. Develop EE scenarios;
2. Define the set of behavioral barriers (*in relation to input drivers*);
3. Collect and develop a reliable qualitative data base;
4. Calculate (through the HERON – DST) the impact and total impact factors of barriers;
5. Calculate the emerging deviations, due to behavioral barriers, on both the input drivers and EE targets, in scenarios' analysis;
6. Optimize the mixture of input drivers and final targets with HERON -DST;
7. Identify the optimum EE scenario against *Environmental performance, Political acceptability and Feasibility of implementation* using the multi-criteria AMS;
8. Conclude with a policy mixture leading to a more effective and preferable EE scenario.

IMPACT

HERON was selected by the European Commission as good practice project, incorporating social sciences and humanities in HORIZON 2020 projects, after a screening procedure with the participation of 500 project coordinators.

The importance of its outcomes is quoted in an EU Commission Staff Working Group Document (SWD/2016/0404 final - 2016/0376 (COD) (Document 4, Chapter 6.2, p. 95)).

HERON is disseminated among the twelve member states of the Black Sea Economic Cooperation organization while it is planned to be implemented in the process of promoting EE programmes through GCF procedures.

1. UNEP, 2016. The Emissions Gap Report 2016 – A UNEP synthesis Report. At: http://www.unep.org/emissionsgap/resources
2. Konidari P., D. Mavrakis, 2007. "A multi-criteria evaluation method for climate change mitigation policy instruments", Energy Policy 35, pages 6235-6257.

Media: www.heron2017.wordpress.com // www.heron-project.eu //
Social media: www.facebook.com/HERON-project-264688910595765// https://twitter.com/heron_project

HERON – Decision Support Tool

HERON – DST, developed by KEPA in cooperation with App-Art, is a user-friendly software, based on an innovative methodology, minimizing the negative impact of end-users' behavior in Energy Efficiency (EE) policy-making and leading to the optimum combination of EE technologies and practices.

PROBLEM

Overcome deviations in EE targets, created by behavioral barriers demonstrated by end users.

CONCEPT

Quantify qualitative data concerning end-user's behavior in forms capable to be incorporated into EE modeling input drivers.

METHODOLOGY AND SOFTWARE

The developed innovative methodology, based on Analytical Hierarchy Process (AHP), led to the HERON – DST (Mavrakis D., Konidari P., 2017)[1] which: i) allows the calculation of the negative impact of barriers (Impact factor), ii) incorporates these Impact factors in forward looking EE scenarios, iii) calculates the occurring deviation against targets due to these barriers and iv) provides combinations of technologies and practices, allowing the optimization of scenario's inputs.

Barriers are mapped, merged and grouped into three main categories: i) Social-Cultural-Educational, ii) Economic and iii) Institutional. Afterwards, barriers are compared pair-wised and the importance of one barrier over the other is assessed using a 1-9 scale. After the completion of all comparisons, the Impact factor for each one of the identified barriers is calculated.

The Impact factor is a numerical outcome, expressing the contribution of the concerned barrier in preventing the achievement of EE targets. The total impact of the assumed barriers on a certain input is expressed by the Total Impact Factor which is also calculated. Consequently, EE technologies and practices are linked with the relevant barriers through their Total Impact factors that are provided by HERON – DST. Occurring deviations are calculated. Options for reducing deviations through the optimum combination of EE technologies and practices and the minimization of the impact factors leads to optimized outcomes. Outcomes are available to be used as inputs to EE modelling.

The methodology has six steps:

Step 1: Mapping, categorization and merging of behavioral barriers;
Step 2: Development of the AHP tree and matrices;
Step 3: Calculation of weight coefficients;
Step 4: Definition and calculation of Impact Factors of barriers;
Step 5: Linkage of Impact factors with input drivers;
Step 6: Incorporation of the Total Impact factors in the forward-looking EE modelling.

MAIN CHARACTERISTICS

- Working fields: Buildings and transport sectors (Two sets of barriers);
- Options to: i) add or modify barriers and technologies; ii) add countries; iii) add sectors.
- Incorporation of end-user's behavioral barriers as inputs for EE modelling;
- Calculation and optimization of occurring deviations;
- Outcomes provided in Excel file.

Consortium members:

NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS – Energy Policy and Development Centre (KEPA), Hellas UNIVERSITA COMMERCIALE 'LUIGI BOCCONI' – Istituto di Economia e Politica dell'Energia e dell'Ambiente (IEFE), Italy SDRUZHENIE CHERNOMORSKI IZSLEDOVATELSKI ENERGIEN TSENTAR - Black Sea Energy Research Centre (BSREC), Bulgaria OXFORD BROOKES UNIVERSITY - Low Carbon Building Group (LCB), United Kingdom WUPPERTAL INSTITUTE FOR CLIMATE, ENVIRONMENT AND ENERGY - Energy, Transport and Climate Policy group (WI), Germany UNIVERSITY OF BELGRADE - Faculty of Mining and Geology (UB-FMG), Serbia ESTONIAN INSTITUTE FOR SUSTAINABLE DEVELOPMENT - STOCKHOLM ENVIRONMENT INSTITUTE TALLINN CENTRE (SEI-T), Estonia

1. Mavrakis Dimitrios, Konidari Popi, 2017. A methodology to insert end-users behavior in energy efficiency scenario modelling. Euro-Asian Journal of Sustainable Energy Development Policy, Volume 5, Number 2, pp. 59-83. At: http://www.promitheasnet.kepa.uoa.gr/images/journal_articles/Volume_5.2/July_December_2017_september_ONLINE_MAVRAKIS.pdf

Material:
Manual: https://heron2017.wordpress.com/manual/
Case studies: https://heron2017.wordpress.com/implementation/
Free disposal of HERON DST– ask here: https://heron2017.wordpress.com/heron-dst/

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