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Includes editorial contributions from:

Dominique Ristori
Director-General for Energy
European Commission

Bendt Bendtsen
Member of the European Parliament

Barbara Kappel
Member of the European Parliament

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Tel: +44 1923 286238
www.europeanenergyinnovation.eu

To obtain additional copies please email info@europeanenergyinnovation.eu

EDITOR
Michael Edmund
editor@europeanenergyinnovation.eu

BUSINESS DEVELOPMENT DIRECTOR
Philip Beausire
philip@europeanenergyinnovation.eu

HEAD OF BRUSSELS OFFICE
Sophia Silvert
Mob: +32 4 73 73 03 22
sophia@europeanenergyinnovation.eu

DESIGN & PRODUCTION
Ray Heath
rayheathdesign@icloud.com

WEBSITE DESIGN
pulseart.co.uk

PRINT
The Magazine Printing Company,
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Foreword

As 2017 draws to a close, the momentous Brexit negotiations have reached an important milestone. And when it comes to energy, the mood in Brussels might be also described as "determined". A somewhat upbeat third report on the Energy Union describes decarbonisation as the "new reality" and it may well have a point – as the costs of PV and Wind continue to fall, the share of RE in Europe's energy mix continues to rise (and is on track to reach the 20% target in 2020). Indeed, RE seems to have accounted for the highest proportion of new generating capacity for the eighth consecutive year. Nevertheless, the Commission began last year the task of revising the Renewable Energy Directive, partly as part of its broader 'Clean Energy for all Europeans' package, and partly to impart increased urgency to expansion of RE use: some have suggested that targets have been insufficiently ambitious. And, at the end of November, the Commission presented the recast Directive to Parliament, which is why we are delighted that Seán Kelly MEP takes a good look for us in his excellent article. Explaining that it is not "just about targets", he outlines how the Directive will help drive prices downward while broadening ownership and reform sustainable biofuels; and ultimately how the EU might assume global leadership in Renewable Energy.

On a related theme, Bendt Bendtsen MEP discusses the importance of energy efficiency; and the significance of the revised Energy Performance of Buildings Directive. Reminding us that a staggering 97.5 per cent of our buildings can be considered energy inefficient, he points out how attention to buildings can form an important means of fulfilling climate commitments, while delivering lower energy bills, better living and working conditions, improved health – all as well as creating jobs. Apart from boosting renovation, Bendtsen also explores how electromobility should incorporated into energy efficiency policy.

Frauke Thies charts the evolution of smart energy systems from the early model of large-scale centralised suppliers and largely passive consumers. In her fascinating article, she explores how technology and services have changed; and how regulation of this new environment must change, given the question she poses: is the top-down approach to the energy system now giving way to a bottom-up approach? Her answer is an an integrated perspective where the "digitally enabled interaction of millions of demand and supply of assets and solutions."

In our focus on Austria, we learn from Barbara Kappel MEP that around 80% of the electricity (and 30% of all the energy) in the "Land am Strome" is Green. She recalls how dependence of imported energy has influenced the country's energy policy and international stance: two pipelines pass though its territory to connect Russian energy with Western European consumers. Meanwhile, the country is a respected RE pioneer, and a leader in solar and wind energy, hydropower, biomass and geothermal energy.

To remind us why all this matters, a recent paper by Professor Zhang, an atmospheric scientist with UAF's International Arctic Research Centre, indicates that the apparent pause in the rise in global temperatures has really been as a result of under-reported data; and that "the rate of global warming had continued to rise at 0.112˚C per decade instead of slowing down to 0.05˚C per decade as previously thought"

Plenty to think about – and a lot more for you to read inside…

Michael Edmund
Editor

Clean energy for All Europeans – putting energy efficiency first

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

The EU energy system is undergoing profound and rapid transformations prompted by the global challenges of the decarbonisation, the decentralisation and digitalisation of our economy.

In the wake of its commitments under the Paris Agreement, Europe is leading the global shift to a modern low-carbon and clean energy system. The energy transition will be decisive for the decarbonisation of our economy since two thirds of greenhouse gas emissions in the EU is coming from the production and consumption of energy.

At the same time, with the growing share of renewable energies installed at distribution level, the energy system is becoming more flexible and decentralised. This calls for changes in the way we build and operate our energy systems as well as for innovative solutions such as digital technologies and ICT to make the electricity market fit.

Adopted by the Commission last year, the Clean Energy for All Europeans package intends to modernise the energy system in order to successfully achieve the energy transition. This package has three main goals: putting energy efficiency first; achieving global leadership in renewables and providing a fair deal for consumers. It is about adapting all part of the energy system to integrate and support energy efficiency, renewable energies, smart grids, home automation, smarter cities as well as to create major breakthroughs in cleaner and digital technologies.

The package makes it clear that energy efficiency should be the main driver towards a sustainable society. That is why the European Commission is promoting ambitious policies that will accelerate energy efficiency.

Because the cheapest, cleanest, and most secure energy is the one we do not use.

The EU has already adopted a number of measures to improve energy efficiency in all sectors and has set a comprehensive regulatory framework with the Energy Efficiency Directive, the Energy Performance of Buildings Directive and the Ecodesign and Energy labelling legislation. These measures have contributed considerably to a decrease in EU energy consumption and have already helped consumers save energy and money. New buildings now consume half of the energy they did in the 1980s.

However, we need to accelerate efforts if we want the EU to successfully drive the clean energy transition and meet its energy and climate targets. Therefore, as part of the Clean Energy for All Europeans package, the Commission launched new and ambitious energy efficiency measures. It proposed a binding energy efficiency target of 30% at EU-level for 2030 as well as measures to improve the energy performance of products and buildings. This will bring further savings to consumers and will foster the development of energy efficiency technologies.

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 in Europe.

This is particularly true in the buildings' sector, where a considerable cost effective energy saving potential exists. Just consider the facts: the construction industry provides already 18 million direct jobs in Europe and accounts for 9% of our GDP. Construction activities that include renovation work and energy retrofits add almost twice as much value as the construction of new buildings. And SMEs contribute with more than 70% of the value added in the EU building sector.

Today, the building sector is the largest energy consumer in Europe, accounting for 40% of final energy consumption and 36% of greenhouse gas emissions in Europe. Yet, about three quarters of our building stock is energy inefficient and the current level of renovation is low.

Accelerating the rate, quality and effectiveness of building renovation will be a great challenge for the coming decades and this is why the Commission has proposed an update to our Energy Performance in Buildings Directive to exploit this untapped potential. It is now being negotiated by the co-legislators, the European Parliament and the Council – with the support of the Commission in order to maintain a high level of ambition.

Indeed, the proposed measures will help us to increase renovation rates with changes to buildings' energy performance rules, while taking advantage of all technologies and progress available such as ICT, smart building technologies and e-mobility. In this context, the revised Energy Performance of Buildings Directive will stimulate 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, support a more sustainable transport system and encourage the active participation of consumers through demand response; thus contributing to the modernisation of the whole energy system.

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 provide tangible health and lifestyle improvements for our citizens. It will also foster innovation and the creation of jobs that are local, sustainable and not at risk of relocation. It is estimated that up to 700,000 jobs in the construction sector and 270,000 in the engineering sector will be created thanks to the measures put forward in the Clean Energy for All Europeans package. In that context, the energy renovation of buildings could become a real European source of growth and jobs.

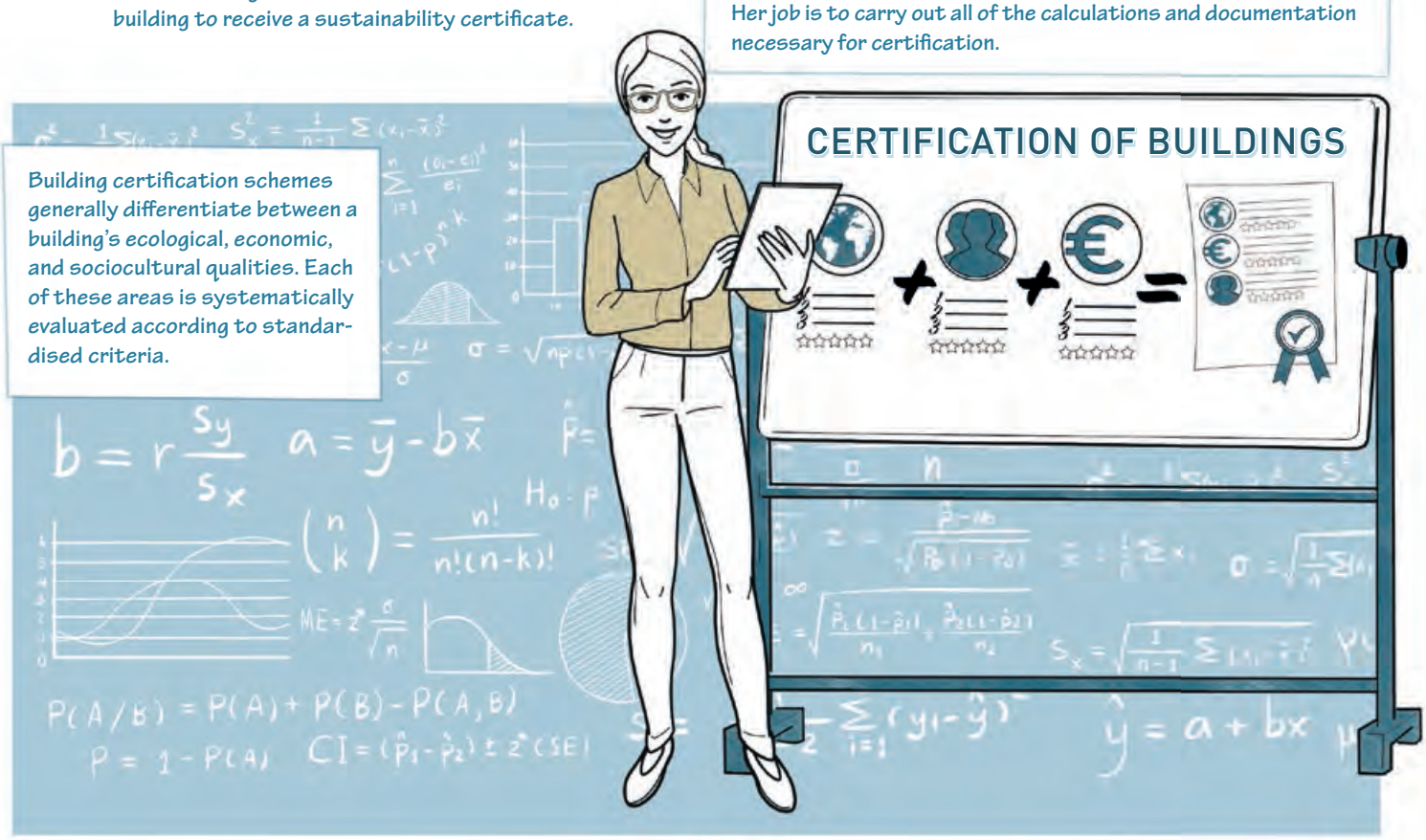
Beyond the regulatory framework, the role of local actors and in particular of cities will be decisive for the energy transition and the decarbonisation of buildings. Today, the transition to a smart, sustainable and secure energy system is no longer a choice. It is a responsibility towards all citizens. And cities are a motor of innovation and a driver of the EU economy, with three quarters of Europe's population living in them. But they are also responsible for an equal share of the EU's energy demand and greenhouse gas emissions. The Commission is therefore supporting cities to become smarter and engage with the use of digital and telecommunication technologies as they have the potential to accelerate the energy transition notably through better use of resources, smarter transport system and more efficient ways to light and heat buildings.

SUSTAINABLE CONSTRUCTION
How does it work?

Mr Schneider is an architect and he has designed an office building for Mrs Müller, who would like her building to receive a sustainability certificate.

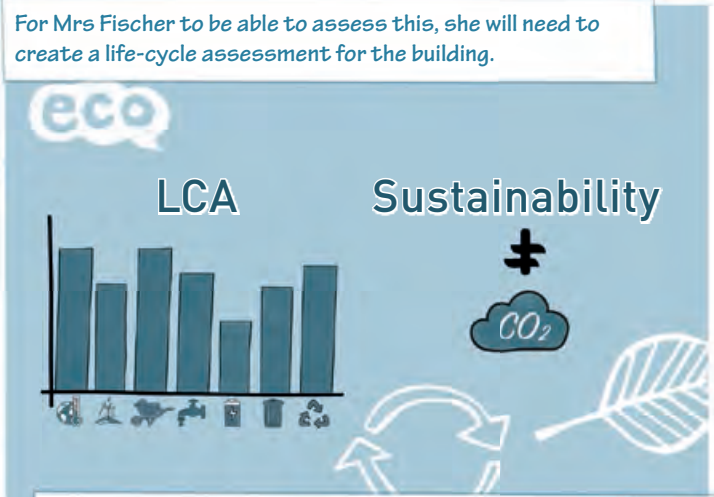
Mrs Fischer is an auditor for a building certification system. Her job is to carry out all of the calculations and documentation necessary for certification.

Building certification schemes generally differentiate between a building's ecological, economic, and sociocultural qualities. Each of these areas is systematically evaluated according to standardised criteria.



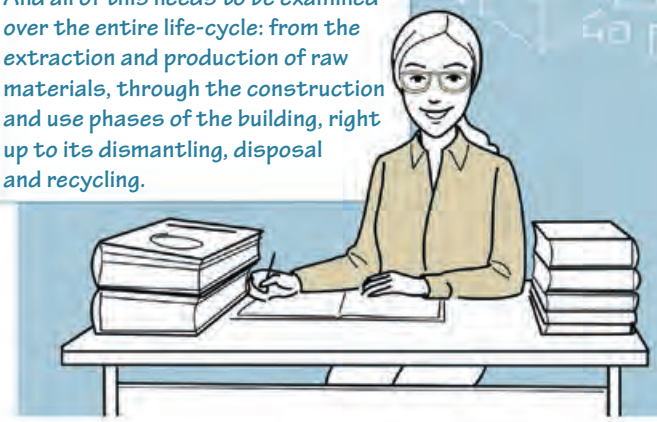
Let's look at an example: Environmental protection is very important to Mrs Müller. For her, the ecological quality of her building is the most important consideration.

For Mrs Fischer to be able to assess this, she will need to create a life-cycle assessment for the building.

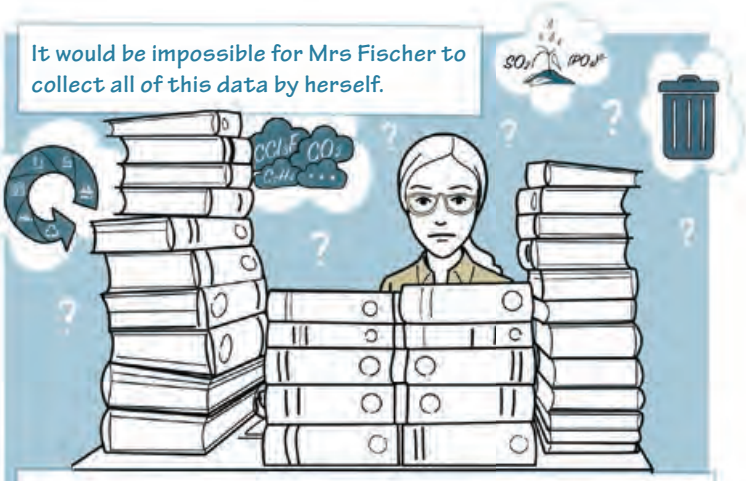


A life-cycle assessment is an internationally recognised, standardised method for analysing the potential environmental impact of processes, products, and even entire buildings – because sustainability cannot be broken down to just a single number, such as CO2 emissions.

To enable Mrs Fischer to create this life-cycle assessment, she will need detailed information about the building, and every individual product. And all of this needs to be examined over the entire life-cycle: from the extraction and production of raw materials, through the construction and use phases of the building, right up to its dismantling, disposal and recycling.



It would be impossible for Mrs Fischer to collect all of this data by herself.



So, how does Mrs Fischer get the life-cycle assessment data of the products, in order to calculate a building LCA with which to evaluate Mrs Mueller's office building?

The solution are EPDs –the Environmental Product Declaration. An EPD contains all relevant data from a product's life cycle assessment, assigned by the manufacturer to environmental impact categories and verified by independent experts.

Here I've got all the information I need for a sustainability certificate. Thanks to EPDs!

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One very important step towards energy efficiency

By Bendt Bendtsen, MEP

With the European Parliament's adopted position on the revision of the Directive for Energy Performance of Buildings (EPBD), we have paved the way for improving the energy efficiency of our buildings in Europe.

We spend roughly 90 per cent of our time indoors, however, according to a recent study[1], 97.5 per cent of our building stock in Europe can be considered energy inefficient. Keeping in mind that buildings consume 40 per cent of the total energy consumption in the EU, it does not take much attention to realise that buildings hold the key to delivering cost-efficiently on our international climate commitments.

And it comes with many added benefits such as lower energy bills, better living and working conditions, improved health, and jobs creation and growth in the building sector.

As rapporteur for the EPBD revision, I am thankful that my colleagues in Parliament share the ambitions to fulfil this potential. I am very satisfied that

we agree to focus on tools to boost renovations, supporting infrastructure for electrical vehicles, and improved monitoring of buildings' energy performance. Delivering on our promises to the European public and achieving a real boost in renovation is now in the hands of the Member States, as the result on the ongoing negotiations depends on the Member States' willingness to commit. From Parliament's side we are ready to make progress.

BOOSTING RENOVATIONS

Since new buildings are constructed at a rate of roughly one per cent a year, the revision of the EPBD mainly focuses on improvements to existing buildings. Member States simply must show that priority is given to addressing market failures that today hamper renovations.

The tool for this is the long-term renovation strategies, giving a clear political signal that we prioritise a better building stock, and it providing investor certainty. Security for investors is decisive, since public money cannot deliver solely on their own. Public money is a good tool to gear private financing for renovations and can take off part of the risk for investors. Energy efficiency is a sure investment, the interest rate is low and private investors are looking for long-term stable investments, so we must strike now to allow the available capital to reach the market.

ELECTRO-MOBILITY

Another cornerstone of the EPBD, is the proposal to use the directive to drive the roll out of infrastructure for electro-mobility. While one could - with good reason - question the relation between transport requirements and buildings, there are two reasons for linking electro-mobility with energy efficiency in buildings: Clearly, for cost-efficiency, it is profitable to incorporate expansion of infrastructure for electro-mobility when renovating buildings. Secondly, buildings must be seen as a part of urban planning and infrastructure in general. Citizens generally pay little attention to whether their parking spaces are considered buildings policy or transport policy.

From Parliament's side, we have focused on fine-tuning the Commission's proposal - with the aim at safeguarding the incentives to renovation by requiring mainly affordable basic such as pre-cabling and pre-tubing. Since electricity companies have a vested interest in rolling out recharging points, I trust the market to meet the expected demand in this regard - including by providing a future-proof approach to the technological development. I believe that we have found the right balance between costs, ambitions and incentives to renovate this way.

MONITORING ENERGY PERFORMANCE

Another way to improve our building stock is through improved monitoring and use of smart technologies. This is a low-hanging fruit in the energy efficiency efforts. Therefore, we in Parliament propose that Member States realise this potential by requiring building automation and control systems in larger non-residential buildings. This simple tool would enable significant savings, while holding short payback periods.

STATUS ON NEGOTIATIONS

The Parliament stands broadly united behind the position adopted by the committee in early October, and with the significant support expressed by stakeholders, it provides a clear signal for improving the energy efficiency in buildings. I truly hope that Member States are ready to show a similar level of commitment to provide healthier, safer homes, and lower energy bills for Europeans, while cutting CO_2 emissions and ensuring a sustainable and reliable energy supply for the future.

1 Carried out by BPIE: http://bpie.eu/publication/97-of-buildings-in-the-eu-need-to-be-upgraded/

How green can we make IT?

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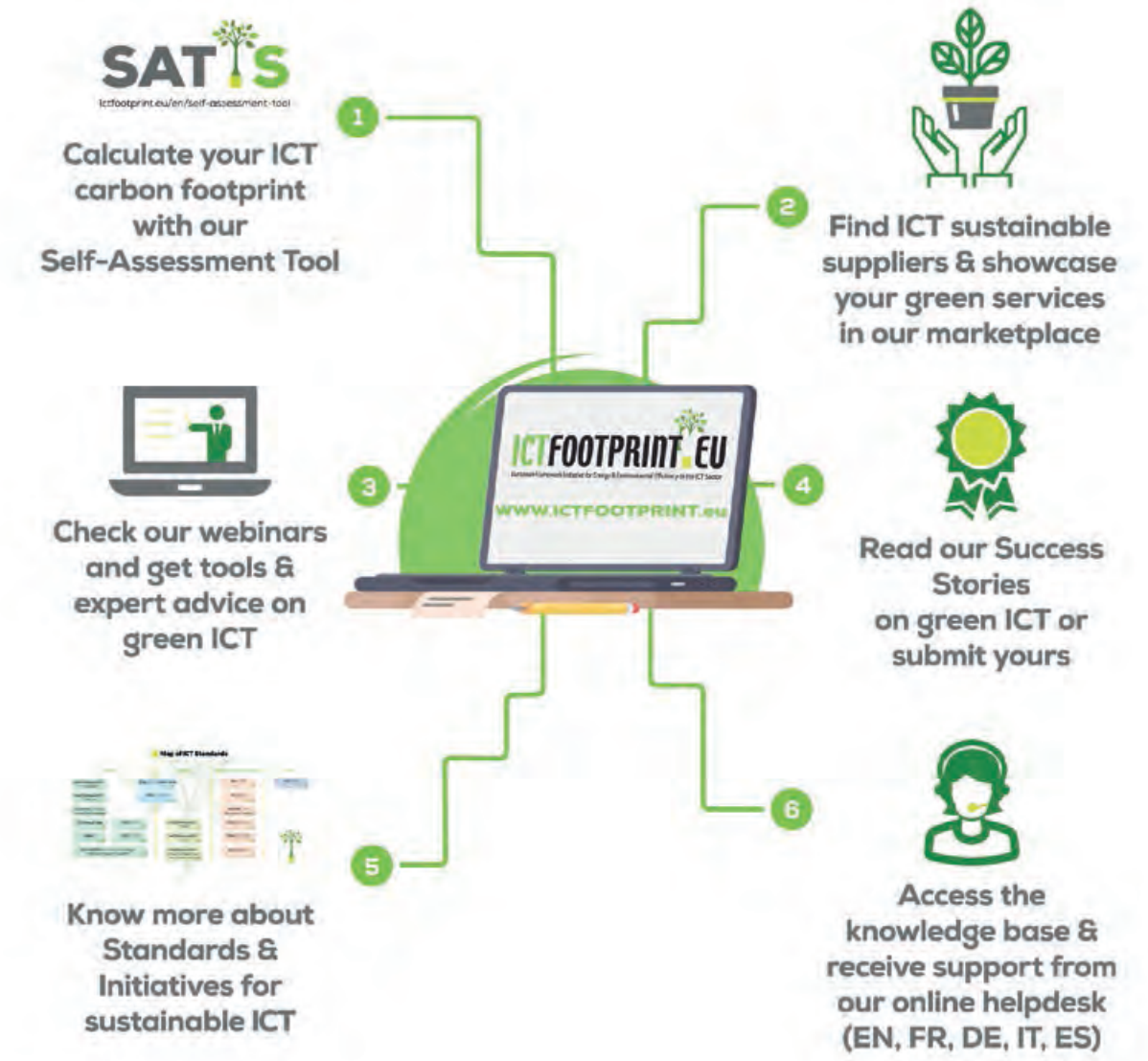
Information and Communications Technology (ICT) has become part of our daily life, with a massive influence on society, environment and its future. We are so used to living in our smart-hyper-connected world that we take for granted a number of digital-comforts unimaginable only a few years ago.

The good news is that ICT is one of the most powerful instruments for tackling today's environmental threats including climate change and exhaustion of resources: ICT-enabled solutions could cut the projected 2020 global greenhouse gas (GHG) emissions by 16.5%.[1] **The bad news** is that ICT is responsible for almost 10% of all energy used and 4% of carbon emissions, comparable to the aviation industry. With the Fourth Industrial Revolution in its infancy, **the demands of energy and resources for computing systems, data centres, networks and the supporting e-infrastructures are growing exponentially.**

Making ICT greener is no simple matter as it involves different disciplines and requires innovative solutions for improved energy efficiency. Following the AAA (Assess, Analyse, Act) paradigm, before reducing ICT's environmental impact, it must be measured. Performing an orthodox **Life Cycle Assessment** (LCA) is complex, costly and time consuming. It may require months and hundreds of



1. GeSI's SMARTer2020 report https://cda.iea-4e.org/document/10/gesi-smarter-2020-the-role-of-ict-in-driving-a-sustainable-future

thousands euros. The big ICT players include environmental friendliness in their core strategy and investment for ethical reasons and public image concerns.

For SMEs it's a whole different story. Most of them simply lack the basic knowledge or awareness to address the problem; they would not be able to afford an LCA and would have difficulty finding their way in the jungle of calculation methodologies and energy efficient solutions.

With over 10 million ICT intensive SMEs in Europe, this would be a missed opportunity for a healthier environment and for SMEs to improve their competitiveness, increase their energy efficiency & lower their bills. **Endless options are available to those who want to join the ICT energy efficiency quest: making them accessible is ICTFOOTPRINT.eu's mission.**

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Project Coordinator:

Silvana Muscella s.muscella@trust-itservices.com

Contact details:

Web: https://ictfootprint.eu/
Email: contact@ictfootprint.eu
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Renewables at the top of the Parliament's Agenda

By Seán Kelly MEP (pictured)

As readers of these pages will be well aware by now, since becoming an MEP in 2009, I have been a big supporter of Renewable Energy and the overall move to a low carbon energy system. For this reason, it is a great honour to have been appointed Shadow Rapporteur for the revision of the Renewable Energy Directive – or REDII – for the European People's Party (EPP) Group.

The REDII is in an important piece of legislation for a number of reasons. Firstly, it sets out the EU's ambition for the deployment of renewable energy to 2030, thus providing the needed signal to renewable energy investors. Secondly, it contributes to our overall aim of reducing harmful greenhouse gas emissions by 40% by 2030, which is the EU's collective pledge under the Paris Agreement. Thirdly, and perhaps most controversially, it sets out the sustainability requirements for biofuels and biomass.

As discussions progress on the file (and at the time of writing, we are deep in the ITRE committee negotiations), two things are evident: there are vastly diverging approaches between the different groups of the European Parliament, but, more positively, there is a common willingness to get a strong compromise that sends the right signal to the renewable energy industry. As President Juncker has reiterated on a number of occasions, our goal in Europe is to be the world leader in Renewable Energy. This means that not only should we have a higher share of renewables in our energy mix than the rest of the world, but also that we should manufacture more renewable energy technologies, that we should drive the R&D agenda to develop more innovative new technologies, and that renewable technologies are advanced to the stage at which they can compete with fossil fuels in the energy market. The Renewable Energy Directive is an important part of how we can do this.

The debate around the targets is well documented by now, and it is indeed an important one. It is increasingly clear that the final result will see the ambition levels raised from the October 2014 Council Conclusions agreement on 27%. There is a lot of debate still to be had in the coming months, especially as we move into trilogues. To me, if we land on a target of around 30%, I think it would be both positive and pragmatic. It is important that we give the signal to drive investments, but we must also consider the impact on energy prices that large increases in support for Renewables will bring. We should ensure, therefore, that the transition to renewables goes hand-in-hand with maintaining EU competitiveness. To me, finding the right balance between being ambitious on targets on the one hand, and keeping policy costs down as much as possible on the other is important to keep a positive public perception of renewable energy.

However, we should also remember that the costs of renewables are falling. Falling technology costs mean that it is much cheaper to meet the 27% target than it was assumed to be even when the numbers were crunched ahead of the Commission proposal. Using more updated assumptions for technology costs, achieving the 27% target could be up to €3 bn cheaper than we thought; we should ensure that the level of investment remains at least the same, and so a target of 30% or more should be very attainable.

It is easy, of course, to be caught in the trap of thinking the Renewable Energy Directive is just about targets – it isn't. The different parts of the Directive are equally important to increase deployment, and the text that Parliament is in the process of formulating will certainly help to boost renewables and possibly even lead us to overshoot the targets.

Take our text on support schemes, for example. Parliament lays out clearly that, aside from some exemptions, support to renewable energy installations should be granted through a competitive bidding process. Such competitive systems are proven to drive down the cost of renewables – take the recent extremely low strike prices for offshore wind observed in Denmark and Germany, for example. Additionally, our text will give help to incentivise renewable self-consumption and the development of Renewable Energy communities.

The best way to get more and more renewables in the system is to allow people to make money from it, and in my own country, we see strong opposition to onshore wind, for example. Making it easier for citizens to own a share of the installations and profit from them will help enormously with public acceptance. Additionally, Parliament will put forward a number of proposals aimed at shortening the approval processes for renewable energy projects. Such processes can be extremely slow and complicated in many Member States and it is our view that simplifying and streamlining can help reduce the perceived risk for investors in renewable energy projects.

A short final remark on sustainability. We must be careful not to legislate against the tools we need to achieve both our Renewable Energy targets, and indeed the 40% 2030 reduction target. Our overall aim must be to reduce emissions, and in the energy sector, this means cutting emissions from fossil fuels. The biofuels debate is one that highlights this problem well. The Parliament's Environment Committee recently voted to phase out conventional biofuels completely. This debate is an emotive one, but we cannot tar all conventional biofuels with the same brush.

Sustainable European biofuels made from crops grown by European farmers should not be considered in the same way as Palm oil from the Far East – biofuels can make a significant contribution to targets and greenhouse gas reductions, particularly in the short-term, by reducing the amount of fossil fuels we burn. Additionally, if we continue to impose such regulatory uncertainty on the biofuels sector, it is unlikely that the needed investments will be made in the development of advanced biofuels. I hope for a sensible solution on this topic as me move forward with the discussions.

In conclusion, it is important to note that Parliament is only half the battle on the Renewable Energy Directive. I look forward to working with my colleague José Blanco Lopez, the other shadow rapporteurs, and indeed the incoming Bulgarian Presidency, when we head to trilogues. We hope to finalise the process sometime in the third quarter of 2018 so that Europe can move forward with certainty and consistency and fulfil President Juncker's aim that the EU would be the global leader in Renewable Energy.

HORIZON2020 Project HERON

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

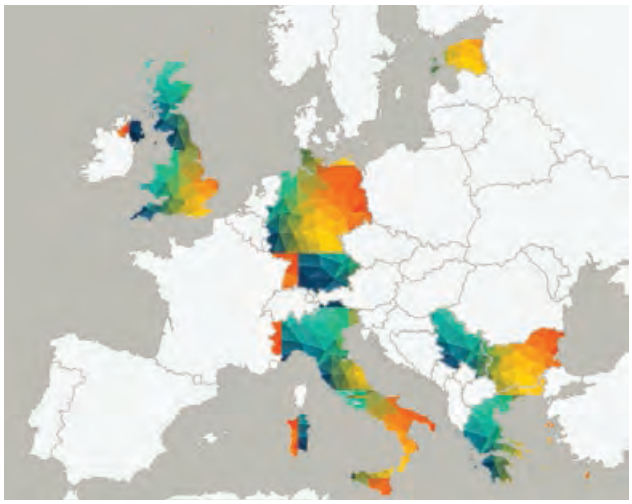
AIM

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/

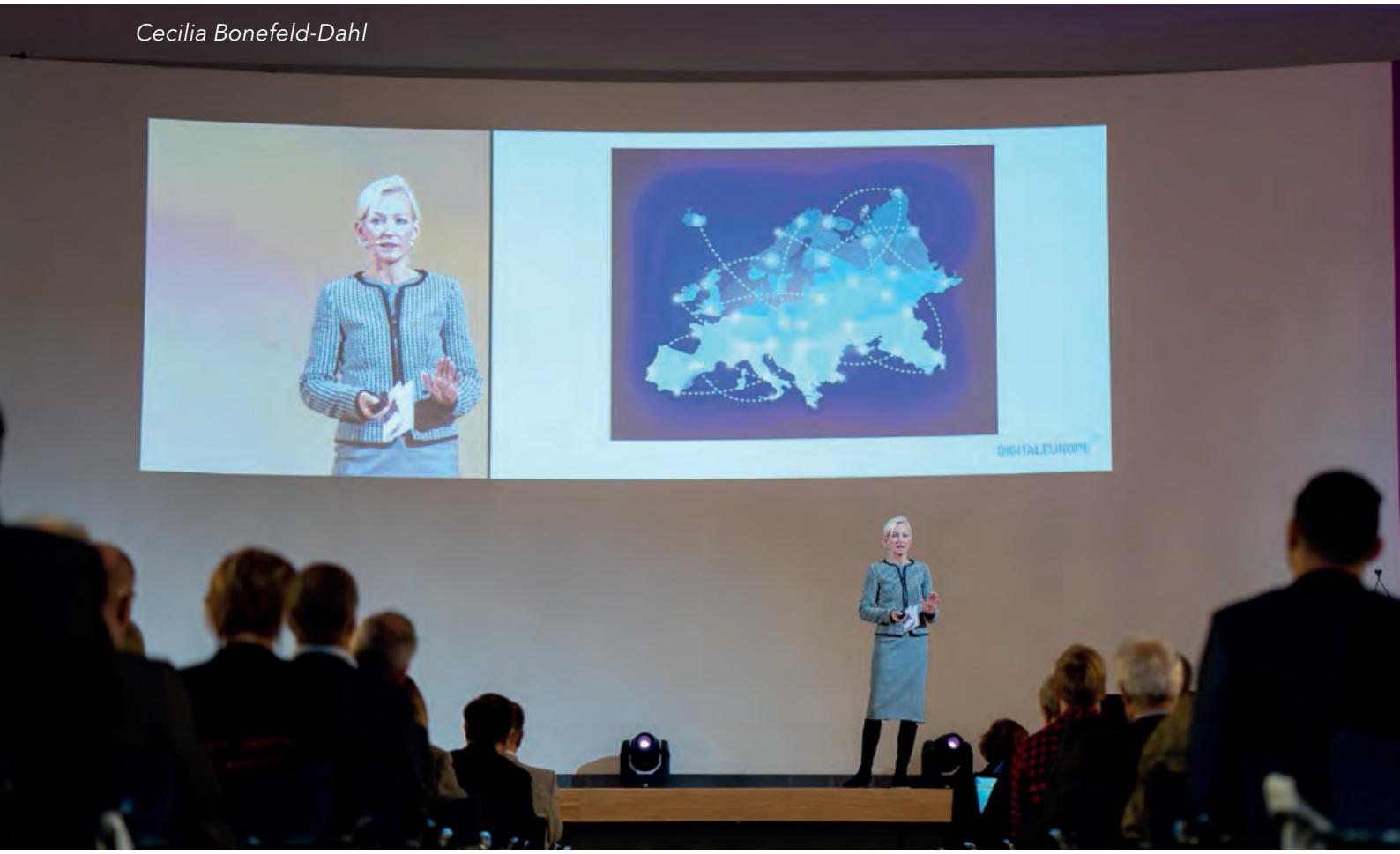
DIGITALEUROPE

Can TV monitors and display technology become even more energy efficient?

By Cecilia Bonefeld-Dahl, Director General DIGITALEUROPE

The energy efficiency limits laid out in the draft Energy Label Regulation for displays are so unrealistic that no product being currently manufactured could enter categories A, B and C. In the most optimistic scenario, less than 2% of today's televisions and monitor models would comply with category D. Even though display technology has achieved energy efficiency improvements of 41.3% since 2011, it is not reasonable to expect that such a decreasing trend can be permanent, nor to consider that an energy efficiency improvement of 7.5% per year is sustainable.

Yet, to address climate change and meet the Paris Agreement targets, continuous efforts to reduce energy consumption are required. DIGITALEUROPE's members are actively working hard to deliver on this common challenge by proactively minimising the carbon footprint of their products and operations worldwide. Studies assessing the energy consumption of the ICT sector in Sweden and Germany demonstrate



Cecilia Bonefeld-Dahl

Photo: © Freepik

that energy consumption will be decreasing by 15% at least until 2025.[1]

These efforts must be further supported by an adequate regulatory framework, and DIGITALEUROPE insists that any requirement for market access regulations must be realistic. In its current state, the draft Energy Label regulation is a missed opportunity.

The impact of the proposed measures would be disproportionate and even more dramatic for televisions and monitors with the most sophisticated and high-end features. Instead of targeting the least efficient models and making them redundant, it will prevent a large part of innovative and energy-efficient products from being sold in the EU and will, therefore, reduce the variety of products available to European consumers.

If the proposed measures go through, over 90% of displays, evaluated as being energy-efficient today, will be marked with the energy-efficiency labels F and G. The proposed standards would, therefore, mislead consumers and limit the effectiveness of the energy label as a purchase decision-making tool.

Photo: © manufuture2017.eu – Edmond Mäll

There is no evidence that recent technological improvement rates can be upheld in the future. In fact, it is unlikely judging from the currently available technology.

The proposed regulation is based on a false assumption: it presumes that energy performance of displays would improve annually by 7.5% on a linear basis. This incorrect analysis is most likely based on the improvement rates identified during the phase-out of cold-cathode fluorescent (CCFL) lamps, which led to massive energy efficiency gains for the whole sector. However, the phasing out of an old technology does not happen every year, and the technological improvements rate should not be considered constant, nor taken for granted.

In fact, further improvement of display LED backlighting is hardly possible, and new display technologies are yet to mature. It is hence difficult to foresee whether other upgrades could prolong the energy improvement trend.

In addition, the growing consumer demand for displays with high-performance features such as wider screen or connectivity functionalities must also be considered. As numerous high-performance models would not be able to comply with the proposed limits of the draft regulation, these would only be available for European consumers to a much lesser extent.

Facing reality: The way forward requires taking stock of the realistic improvement rates in energy consumption while remaining open towards technological innovations.

Indeed, had the developments within the last 6 years been linear, an average improvement rate of 6.9% would have been achieved. However, reality is far from being linear, and current energy efficiency standards for displays are very close to the technically achievable limit. Future potential savings are thus very hard to predict as they can only occur when new technologies become available and when the market is ready to adopt them.

It is essential for a regulatory framework to guarantee the freedom to innovate and to enable products to develop and mature as expected in a normal design and production cycle. Regulation must be considered only when these conditions are not met, or if there's been a significant market failure. To lessen the negative

1. Third study regarding the ICT-related energy consumption in Germany with forecasts for the years 2015, 2020 and 2025, Fraunhofer IZM and Borderstep Institut on behalf of the BMWi, 2016.

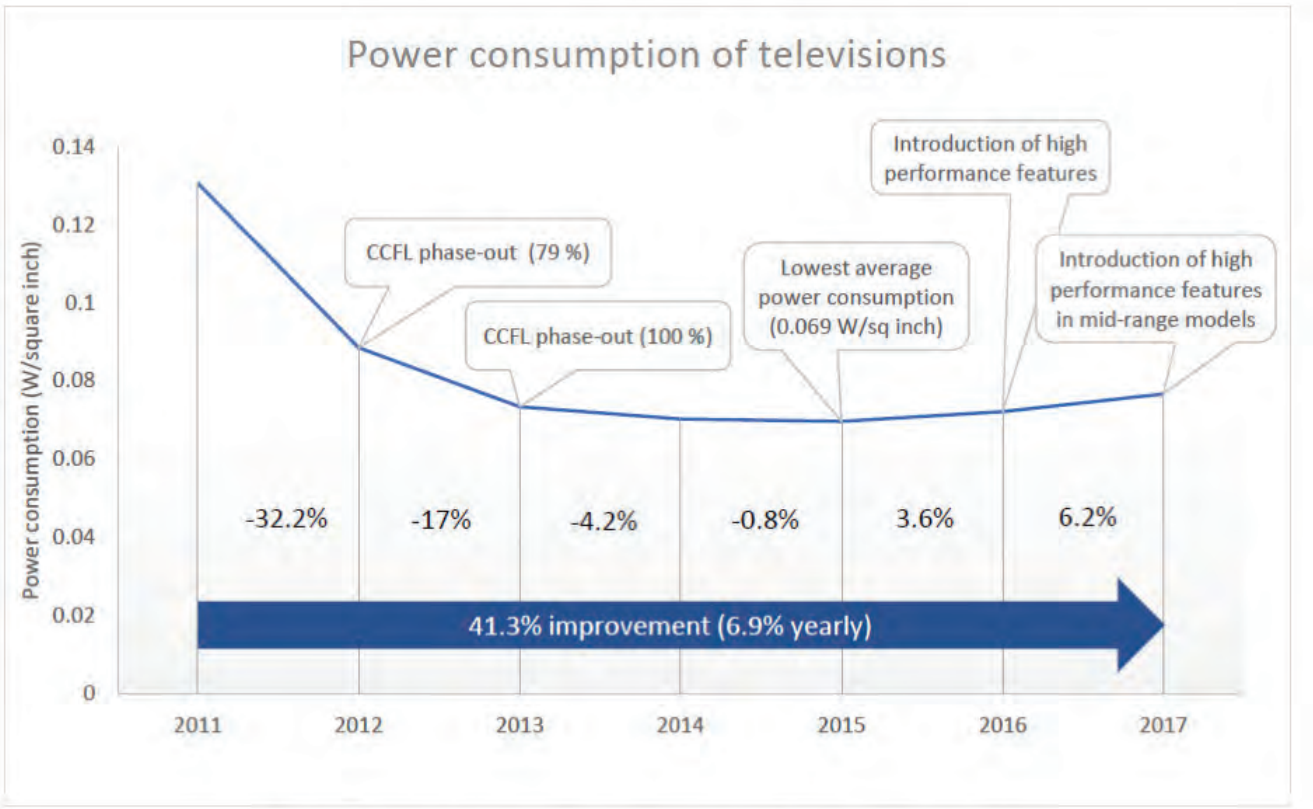


Figure 1: Power consumption of televisions between 2011 and 2017

impact of the proposed requirements on innovation and consumer choice, DIGITALEUROPE calls on policy-makers to be more reasonable in their assessment of their new energy-efficiency targets. In addition to a more appropriate energy labelling system, we believe that the energy consumption requirements under the eco-design regulation that would apply when a display is switched on should be eased by at least 10%-20% and a set of specific exemptions for products based on new, non-mature technologies should be provided.

Failing to give this flexibility to manufacturers will deprive European consumers of having a large choice of high-quality models, which in reality are already energy-efficient.

2. DIGITALEUROPE, Follow-up position on the proposed energy efficiency requirements in the display regulations (31 August 2017, Brussels)

The assumption of continuous annual improvement rates of 7,5% underlying the draft Energy Label Regulation for displays is unrealistic.

DIGITALEUROPE has analysed its members' television data from 2011 to 2017. **During this time, the total energy improvement of televisions amounted to 41,3%.** As it can be seen in the graph, a significant drop in power consumption took place between 2011 and 2012. This was principally the result of the industry's transition from cold-cathode fluorescent (CCFL) lamps to LED backlights. Consequently, the average power consumption decreased by 32%.

After a full phase-out of CCFL lamps in 2013, power consumption eventually stabilised around half of its original usage. This trend reversed after 2016, with display power consumption slightly increasing as a consequence of the uptake of Ultra-High-Definition technology, and other high-performance features for the benefit of the consumer.

DIGITALEUROPE's concrete proposal for the energy efficiency limits and classes can be found in our position paper dated 31st of August 2017.[2]

Filling in the blanks and saving Euros with smart meter data

By Steen Schelle Jensen, Head of Product Management, Kamstrup

Linking frequent smart heat meter data with facts about the pipes can fundamentally change the way district heating utilities plan, operate and maintain their distribution network. As a result, improving asset management and reducing heat losses in the network hold a huge savings potential.

As renewables integration in district heating increases so does the importance of an optimised infrastructure for moving renewable and surplus energy to where it is needed instead of primarily generating heat by burning off fossil fuel. Consequently, whereas utilities have previously focused on using data to improve the energy performance of individual buildings, tapping into the potential in an improved infrastructure requires them to look closer into the distribution network connecting the utility and the end users.

ZOOMING INTO THE NETWORK

The distribution network presents particularly two opportunities for significant cost savings: reducing heat loss and improving asset management. Both call for more than general calculations based on theory, assumptions or even airborne thermography, which delivers only a snapshot of the network and no insight into its actual condition and development. There is a need for more frequent fact-based knowledge.

Utilities already have a flow, temperature and, in some cases, a pressure sensor in each building connected to the district heating network: smart heat meters transmitting data by the hour 365 days a year. However, data alone – albeit accurate and frequent – is not enough either. Data only becomes really valuable when you use it properly.

Together with our customers, Kamstrup has created a tool connecting information from the meters with facts about the utility's pipe network. Its calculations are therefore highly specific and relevant as the basis for infrastructure optimisation, both in terms of reducing losses and prioritising investments in network maintenance and capacity.

ADVANCED MAPPING OF HEAT LOSS

Network losses are perhaps the biggest cost driver for district heating utilities so the potential in eliminating them is enormous. Combining temperature and flow measurements from energy meters with information about the length and size of the pipes allows them to calculate temperatures in all parts of the network and accurately map their heat loss.

If a building's forward temperature is lower than expected, this can indicate poor performing pipe insulation, a defect service pipe or incorrect meter installation causing lost revenue. If higher than expected, it can denote a leakage or perhaps an unknown or misadjusted bypass creating circulation that keeps the network temperature up. Whatever the reason, knowing the actual state of the network is the prerequisite for being able to act.

NETWORK LOAD MONITORING

As more and more buildings are connected to the district heating network, utilities must constantly consider its capacity. Because building and expanding infrastructure is economically heavy, logistically comprehensive and time-consuming, there is great value in maximising utilisation of the current capacity. This enables utilities to prioritise and postpone infrastructure investments. Also, knowing their exact capacity helps them minimise the risk of oversizing new pipes.

By linking energy meter flow measurements in a specific area with detailed pipe characteristics, utilities get a precise picture of the load throughout the network. This verifies whether there is a match between a utility's assumptions and reality plus it provides important knowledge for future expansion of its supply area – and facts are easier to convert into Euros than gut feelings.

kamstrup.com

A New Dawn for CCS in Europe

By Graeme Sweeney, Chairman of the European Zero Emission Technology and Innovation Platform (ZEP)

As 2017 draws to a close, it is worth reflecting on the CCS developments that have taken place over the past year. The latest COP meeting in Bonn closed on the 17th November – and it remains to be seen whether this meeting succeeds in delivering concrete actions to achieve the objective agreed in 2015 in Paris; to limit the global temperature increase to well below 2°C. Interestingly, CCS was the focus of a number of side events at the Bonn COP meeting – perhaps a reflection of the realisation that to deliver a 1.5°C goal will require unprecedented amounts of renewable energy and CCS.

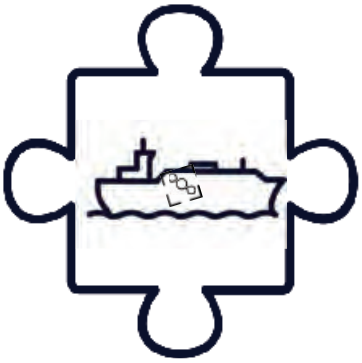
In Europe, a definite momentum for CCS has been steadily building over the last twelve months. Both Norway and the Port of Rotterdam are pursuing proposals to create the first European CCS clusters, able to capture and transport CO_2 from industrial facilities for permanent storage under the seabed. Norway is particularly interesting as their proposals include CCS applications at an ammonia facility, a cement plant and a waste-to-energy project. This could provide vital lessons to other countries on the importance of applying CCS to multiple sectors such as energy intensive industries, heating, power and transport.

Elsewhere, both the Netherlands and the UK have recently published decarbonisation plans which highlight the importance of CCS. The Dutch Coalition Agreement, published on the 10th October, includes a commitment to storing 20 million tonnes of CO_2 per year by 2030, whilst the UK's Clean Growth Strategy sets out the ambition to deploy CCUS (Carbon Capture, Utilisation and Storage) at scale during the 2030s.

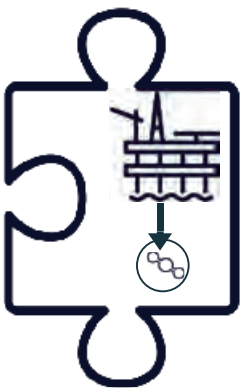
It is also extremely encouraging to note that all four cross-border CO_2 transport projects that were submitted as European Projects of Common Interest (PCI) have been adopted by the High-Level Decision Making Body. This includes a Statoil project which aims to connect emission sources in Teesside UK and Eemshaven in the Netherlands to a CO_2 storage site on the Norwegian Continental Shelf, The Rotterdam Nucleus project

Capture of CO_2 from power plants or carbon intensive industries.

Transportation of CO_2 via pipeline or ship to a selected storage site.



Injection of CO_2 into a suitable underground geological formation for permanent storage.



proposed by the Port of Rotterdam Authority, the Teesside CO_2 Hub in the UK in collaboration with the Nuon/Vattenfall Magnum Project in the Netherlands, and the Pale Blue Dot CO2 Sapling Transport Infrastructure Project which features partners from the UK, Norway and the Netherlands. All of these projects could potentially be funded under the Connecting Europe Facility fund and if all four went ahead, they would create important strategic CO_2 hubs which could drive the development of sustainable economic zones. Such zones represent the lowest-cost route to sustainable regional growth across Europe whilst safeguarding and boosting the global competitiveness of vital European industries through the creation of low-carbon products.

Looking forward, a conference is due to take place towards the end of this year on the European Strategic Energy Technology Plan (SET-Plan). This plan highlights the areas where the EU needs to strengthen cooperation to bring new, efficient and cost-competitive low-carbon technologies to the market faster. As part of the SET-Plan, a number of Member States are collaborating on a dedicated Implementation Plan for CCS and Carbon Capture and Utilisation (CCU), which sets out ten key targets for successful CCS deployment.

History has shown us that attempting to implement CCS on a country by country basis presents significant challenges. It is now time to shift the focus and concentrate on those countries that already posses the key characteristics necessary for CCS deployment – such as available CO_2 storage, good concentration of industrial emitters and a level of understanding of the CCS policies and incentive mechanisms that are required. But more importantly, successful CCS deployment will require increased levels of collaboration – both between countries and between Government and industry. Fortunately, there are already a number of areas that lend themselves well to such collaboration; in particular countries bordering the North Sea. In fact these countries are already cooperating to develop a joint offshore grid and there is a good chance that CCS will be included in these efforts in the future. The Baltic region also has great potential for collaboration regarding the development of CO_2 infrastructure.

Whilst CCS will undoubtedly need to play an important role in reducing emissions from energy intensive industries, heating and power, it is important to remember that CCS, in combination with bioenergy (bio-CCS or BECCS), also has the ability to deliver negative emissions. To meet the Paris Agreement, the IEA has estimated that CCS will need to deliver 32% of the extra effort to move from a 2°C scenario to well below 2°C and a substantial proportion of this effort will need to be met by BECCS. Negative emissions technologies are likely to become increasingly important towards the latter half of this century, particular to enable flexibility in sectors such as aviation, where emissions reductions will be challenging.

2017 has seen a number of positive steps for CCS in Europe, and there is a definite sense of excitement. It is now vital that the European Commission builds on this momentum and implements a policy framework that incentivises the capture and storage of CO_2, facilitating an environment in which follow-on projects and investments can develop. The key to delivering a successful European CCS industry lies in the development of CO_2 transport and storage infrastructure which can be shared by a large number of industries and a range of countries. We urgently need to put in place the investment and financing models to realise this infrastructure today and ensure the roll-out of CCS in Europe from 2025. The sustainable future of Europe's industries, regions and climate depends on it.

Dr. Graeme Sweeney, Chairman of the Advisory Council of the European

The European Zero Emissions Technology & Innovation Platform (ZEP)
Dr Graeme Sweeney is a leading authority on energy, fuels and climate change, drawing on extensive international experience across all aspects of the oil, gas and renewable industries.

Dr Sweeney is currently Chairman of the Advisory Council of the European Zero Emissions Technology & Innovation Platform (ZEP). ZEP's unique coalition of stakeholders (petroleum companies, equipment suppliers, scientists, academics and environmental NGOs) have been instrumental in the development of the EU Carbon Capture and Storage (CCS) Demonstration programme, providing expert advice to the European Commission on all technical, technology, policy, commercial and other related issues.

Dr Sweeney is also Chair of the energy efficiency start up The Chopping Company Ltd, a Chairman of the Board of the Climate Change Advisory Board of the Children's Investment Fund Foundation, Chair of The Scottish CCS Advisory Board, Chair of The UK Energy Research Centre Advisory Board, co-chair of the European Union's CCS Project Network Advisory Forum, a Member of the European Industrial Initiative on CCS under The EU Strategic Energy Technology Plan, and a founding member of the Global Carbon Capture and Storage Institute.

Dr Sweeney currently acts as advisor to the Scottish Government in his position as Chair of the Industrial Leadership Group on Thermal Power and CCS and Member of Scottish First Minister's Energy Advisory Board.

Until 2012, Dr Sweeney was the Executive Vice President CO_2 at Royal Dutch Shell and served on the University of California Davis Institute of Transportation Studies Advisory Board.

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)

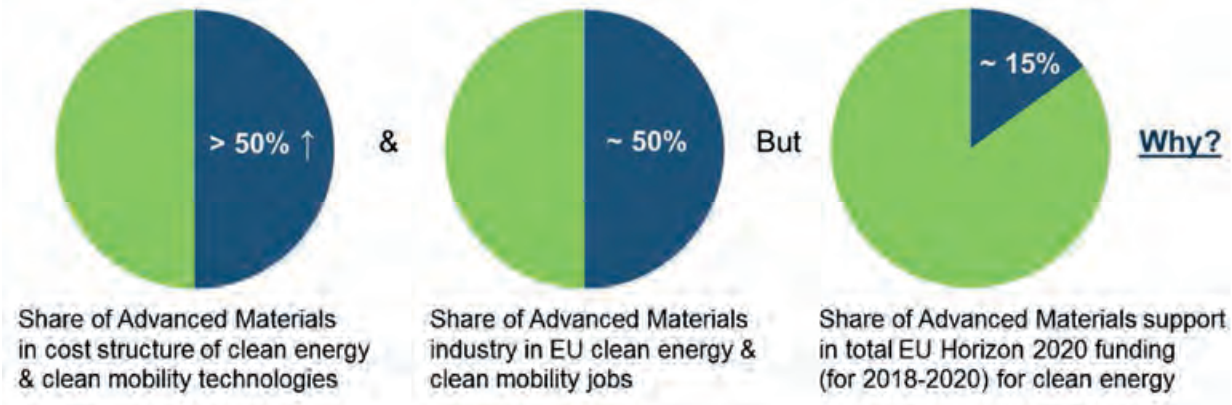
3. The need for risk-sharing policies & instruments at EU level to support the long, risky (market & technology) and capital-intensive development cycle of Advanced Materials

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

A strong partnership to support and Covenant of Mayors initiatives

By David Donnerer (pictured), Communication Officer, Covenant of Mayors for Climate & Energy

The EU has set itself a goal to reduce greenhouse gas emissions to more than 80% below 1990 levels by 2050. It is an ambitious goal that will require major changes to our energy and transport system. Therefore, Europe has to decarbonise its energy sector and shift to a more sustainable use of transport. This will only be possible when energy and transport are supported by advanced information and communication technologies.

Cities have a crucial role to play in this process. In today's Europe, about three quarters of the population live in or around urban areas. While consuming an approximately equal amount of energy and emitting about the same share of greenhouse gases, they create about 80% of the EU's GDP and are hence key to foster green growth and job creation.

The accelerating urbanisation by 2050 poses multiple challenges to Europe's cities, such as increasing traffic congestion and air pollution which, in extremis, can make cities dysfunctional, undermine competitiveness and seriously affect quality of life. Tackling these challenges effectively is therefore a top priority to ensure sustainable, resilient and liveable cities for EU citizens.

Many technologies which can potentially be used as part of smart solutions and which deliver intelligent and resource-efficient energy and transport management are already available. However, their scale-up in a fragmented market for energy, transport and ICT solutions is still risky. If these "smart tools" were widespread across Europe, cities could optimise their energy infrastructures and make their traffic management systems more efficient.

In order to boost the widespread uptake of smart solutions for energy and transport in cities, the European Commission launched in 2012 the European Innovation Partnership for Smart Cities and Communities. The partnership and its current community of more than 6,300 members seeks to engage stakeholders at various levels from cities, industry and research, in order to create a pipeline of projects worth at least €1 billion of investment and involve 300 cities by the end of 2019. This will build the nucleus of a real Smart City market, which is based on solid business models and bankability of the promoted solutions.

The bottom-up work of the EU Innovation Partnership is supplemented and actively supported by the so called "Smart City Lighthouse projects", funded with €300 million by the EU Horizon 2020 programme. Currently 12 Lighthouse projects are operational, building an innovative community of 36 so called Lighthouse Cities being in the lead and 42 Follower Cities tasked to replicate and further scale-up the solutions demonstrated in the Lighthouse Cities. And the collaboration between these cities goes well beyond their project scope, tackling common challenges such as business models, replication strategies, citizen involvement, communication and technical aspects.

local action: The EU Smart Cities

In addition to this, the Smart Cities Information System is pooling and structuring the results and best practices from these Lighthouse projects and previous EU Smart Cities (e.g. the Seventh Framework Programme) projects in a practical one-stop-shop website. The dissemination of the demonstrated solutions to local authorities, project developers, research institutions and universities thereby facilitates their further replication across Europe.

Moreover, the EU Strategic Energy Technology Plan supports the strategic roll-out of a cleaner and better integrated energy system for all Europeans. It also features a Smart Cities and Communities working group, which brings together EU Member States, regions, cities and industry and aims to implement Positive Energy Blocks and Districts in European cities, to support them in their transition to a sustainable and well-integrated energy infrastructure that makes optimal use of the urban built environment.

The Smart City market has been boosted by these integrated and interlinked EU Smart Cities initiatives and can provide much needed innovative, replicable and cost-effective solutions for the over 9 000 European cities committed to the Covenant of Mayors, as they can support them effectively in the implementation of their local action plans under the Covenant initiative. The Covenant of Mayors is the European urban initiative that harnesses strong local political engagement, bottom-up action and peer-to-peer learning and cooperation. Launched in 2008 by the EU Commission, its success quickly went beyond expectations and has mobilized and supported European cities in their local action and contributing to the achievement of European climate and energy targets.

The solutions brought forth by the EU Smart Cities initiatives and the strong local political commitment driven by the Covenant of Mayors act as ideal partnership to support a cost-effective and inclusive energy transition at local level. Thanks to the complementarity and coherence of these initiatives, European Covenant of Mayors cities will benefit from new products and services, new ideas and can draw from an ever-increasing number of good practices across Europe.

Increasing the market opportunities for new energy efficiency and renewable energy technologies and new transport solutions, enabled and supported by ICT, will drive down costs to the extent which will ultimately make mass production and use possible.

Local businesses, utilities, house owners, citizens associations, technology providers, financial or research institutions – all of them will be able to contribute developing and implementing innovative energy and transport solutions for EU Covenant cities. Their cooperation is key to facilitate the efficient and effective mass take-up of these solutions in these cities, thereby improving quality of life, the economic environment and urban infrastructure for European citizens.

Contact Details:

David Donnerer
Communication Officer
Tel: +32 2400 10 70
Email: david.donnerer@eumayors.eu
Web: www.eumayors.eu

Investor Confidence Project

Breaking down the barriers to energy efficiency investment in Europe

The European Commission chartered Energy Efficiency Financial Institutions Group (EEFIG) stated in its April 2015 report that energy efficiency investments have the clear potential to become a key driver of EU competitiveness, economic value, innovation and employment[1]. It emphasized that energy efficiency is of increasing strategic importance for Europe due to the need to increase energy security, offset rising energy prices, and the need to increase efforts to meet the EU's 2020 climate change commitments. However, this report also warned that if the investment into energy efficiency is not significantly increased, EU Member States are at risk of missing their 2020 and long-term efficiency and climate targets.

The importance of increasing investor confidence in energy efficiency and standardisation of the development process was stressed in the EEFIG report and the Investor Confidence Project, which was only operating in the United States at that time, was highlighted as "a relevant model initiative" and "an EU Investor Confidence Project" (ICP) was recommended. Dr. Steven Fawkes of EnergyPro Ltd formed a consortium, bringing together a range of expertise across five countries, and the team was awarded a €1.9 million grant from the European Commission's Horizon 2020 programme in 2015 to develop and roll-out ICP in Europe. The consortium has since achieved results far beyond those targeted in the grant agreement.

With the active involvement of many energy efficiency and finance experts, the ICP Europe team developed and published six Protocols, the basis of the ICP system, which set out best practice in project development and documentation; these were translated into Portuguese, Bulgarian and German.

In April 2016, ICP launched its Investor Network, which now boasts 19 major financial institutions – such as Royal Bank of Scotland, Joule Assets, Amber Infrastructure, SUMA Capital, SUSI Partners or Macquarie - with over €1 billion available for energy efficiency retrofit projects. Investors join the Network in order to find high-quality project pipelines and developers to work with, and because they recognize the value of standardised, investor-ready projects to increase deal flow and drive demand in the marketplace.

1 Energy Efficiency - the first fuel for the EU Economy - How to drive new finance for energy efficiency investments – Energy Efficiency Financial Institutions Group – commissioned by EC & UNEP

Shortly after, **ICP launched its Investor Ready Energy Efficiency™ (IREE™) Certification** for the European market to build investors' and owners trust in retrofits and savings. This announcement introduced the process of how to achieve IREE™ Certification: a project can be certified if it has been developed following the ICP Protocols by a credentialed Project Developer and verified by a credentialed Quality Assurance Provider. The first IREE™ project, a £13m hospital retrofit in the UK, was certified in the same month, and thirty projects and programmes have been certified or started using ICP in several countries in Europe since then.

ICP has been recognized as a best practice throughout Europe, notably in the European Commission's "Winter Package," a major energy policy update, where it cites ICP Europe as "best practice" to maximize investor interest in buildings requiring energy efficiency upgrades. Paul Hodson, Head of the European Commission's energy efficiency unit, said: "The potential of the Investor Confidence Project to de-risk energy efficiency investments has been recognised by the Commission. The ICP approach addresses the needs of investors looking for standardised projects that reduce the time, risk, and costs involved in funding energy efficiency building retrofits."

In 2017, ICP became part of Green Business Certification Inc. (GBCI), as one of their portfolio of green certifications which includes LEED and GRESB. This partnership will build upon the successes of its start-up phase, supported by Horizon 2020, and enable ICP to develop into a self-sustaining certification system. It will also open new geographical markets for ICP, streamline its Training and Credentials programme, and increase the number of ICP Project Developers and Quality Assurance providers working to deliver IREE™ projects across markets.

In early 2017 the European Commission further recognised the importance of ICP by awarding a new grant to extend ICP into industrial, street lighting and district energy projects.

Contact details:

Dr. Steven Fawkes, ICP Senior Advisor
steven.fawkes@eeperformance.org

Quitterie de Rivoyre, ICP Project Manager
quitterie.derivoyre@eeperformance.org

ESB Networks Smart Meter Programme

John Byrne, Smart Metering Project Manager, ESB Networks

Following the official Programme launch in late September 2017, the Irish electricity Distribution System Operator (DSO), ESB Networks, has embarked on the journey to deploy smart meters to all Irish electricity customers. A transformed energy retail market, a manual meter reading process which has existed for over 90 years and a desire to provide better information to customers are some of the drivers for this significant business and digital technology transformation.

The seeds were initially sown for this project between 2008 and 2011 when ESB Networks conducted customer behaviour and technology trials with 10,000 customers which looked at the behavioural impacts of smart metering on a sample of the population of Ireland. Following on from the completion of this work ESB Networks worked with the Commissioner for Regulation of Utilities (CRU) and the public to develop Time of Use (ToU) Tariff propositions and to understand the needs of the Pay As You Go community. All of this work was to develop a well rounded deliverable National Smart Metering Programme.

The main stakeholders of the National Smart Metering Programme (NSMP) including the CRU, ESB Networks, Gas Networks Ireland and the Energy Suppliers then embarked on a period of consultation to develop a series of policies to support the introduction of Smart Metering.

The programme itself is one of the largest transformation projects in the history of the Irish state as it aims to revolutionise the Irish energy market by installing smart meters which are capable of providing interval data directly to the market. The high level objectives of the NSMP include:

- Encourage energy efficiency
- Facilitate peak load management in the Irish energy sector
- Support renewables and micro-generation
- Enhance competition and improve customer experience in the Irish energy market
- Improve network services

The programme will be delivered by ESB Networks over three distinct phases of work, which will deliver the incremental addition of high-level functionality to the Irish Energy Market.

- Phase 1 (2017 – 2020) enables the installation of 250,000 meters and the delivery of the Market Schema changes by 2020 which will facilitate the flow of half hourly interval data to the market.
- Phase 2 (2021 – 2022) will support the installation of an additional 1 million smart electricity meters and the enablement of the remote and local service switch operation in smart electricity meters.
- Phase 3 (2023 – 2024) will see the installation of the remaining one million smart electricity meters, along with the activation of Gas Smart Metering services and In-Home Data services by 2024.

The Smart Metering programme will have multiple benefits for ESB Networks, Suppliers and most importantly customers. The programme will deliver a more competitive electricity retail market through better service offerings, ease of switching Supplier and changing address. The programme will provide Suppliers with improved opportunities in relation to ToU tariffs to enhance their relationship with customers. Finally, customers will see an end to estimated bills, be better informed of their energy usage patterns and will also be able to avail of more suitable, flexibility based tariffs from their Suppliers.

ESB Networks' ambition is to deliver a low carbon future for our 2.3 million customers powered by a smart electricity grid, with smart metering being core to that ambition.

Contact Details:
Web: www.esbnetworks.ie

Dublin City, Ireland

Breaking the silos: An integrated approach to smart energy

By Frauke Thies, Executive Director, smartEn – the European association for smart energy solutions (pictured)

When Europe established its 2020 objectives for the energy transition ten years ago, much of the debate was focussed on the shift of energy resources, away from polluting fossil fuels towards cleaner renewable alternatives. Only few would have expected the entire sector, and its prevalent business models, to change so fast with it. In fact, when the Smart Energy Demand Coalition, SEDC, set out to establish the demand-side as an interactive part of the energy value chain, the system was characterised by centralised supplies, delivered uni-directionally to largely passive consumers. Electricity, heating and transport were separate sectors with very little interaction. Today, it is commonly accepted that the new energy world is different.

On the **technology** side, we see decentralised generation go along not only with the rapid evolution of storage technologies, but also the automation of devices, allowing for demand response and technology interaction at various levels. The integration and increasing electrification of transport and heating, so called 'sector coupling', is advancing. Automotive manufacturers are cooperating or even integrating with heating and solar companies to promote interactive solutions. Smart appliances and building automation optimise consumers' energy use, offering both comfort and the ability to adjust to signals from the grid.

Services have moved beyond simple supply. Digitally-enabled business models have emerged from the need for facilitation, aggregation and market-placement of energy and services from distributed resources. For example, companies specialise in the identification of flexibility resources in large production sites, helping consumers make use of their potentials. Others provide residential energy users with solutions to optimise their local power production or the use of their heat pump. Many of the service providers themselves make use of digital service platforms enabling their business.

Coupled with this, the roles of the different **actors** can no longer be classified as they were. While network operation remains a contained role, the distinction between generators, suppliers and consumers has given way to new concepts and combinations. Consumers are becoming generators, asset owners may be individuals, communities or pension funds, and new service providers have entered the market. We are seeing traditional energy companies with previous portfolios of coal or gas generation, selling off their assets and investing in the management of decentralised solutions and services. New market entrants like independent aggregators are establishing themselves as important players, and traditional manufacturing, telecommunications and IT companies are entering the energy space.

With the changing realities of the energy system, **regulation** must also adapt. Decentralised solutions are a central part of the Clean Energy Package currently under negotiation in Brussels. An updated market design that enables the efficient uptake of demand response, storage and distributed generation is on the table, including proposals to open the markets for innovative products and service providers. For example, consumers should have the right to choose dynamic pricing offers or engage in self-generation, buildings should become smarter and be certified as such, aggregators should be given non-discriminatory conditions to provide their services to consumers, and distribution system operators are encouraged to source efficient flexibility services from the market.

NOW, WHAT DOES THIS MEAN FOR THE STRUCTURE OF THE ENERGY SYSTEM?

Is the top-down approach to the energy system now giving way to a bottom-up approach? Some current trends suggest so. Driven by existing market rules and incentive structures that are heavily determined by the blunting effects of rigid taxes, levies and charges, many prosumers using the new opportunities of self-generation and on-site flexibilities, choose to go off-grid or minimise interaction with the system, rather

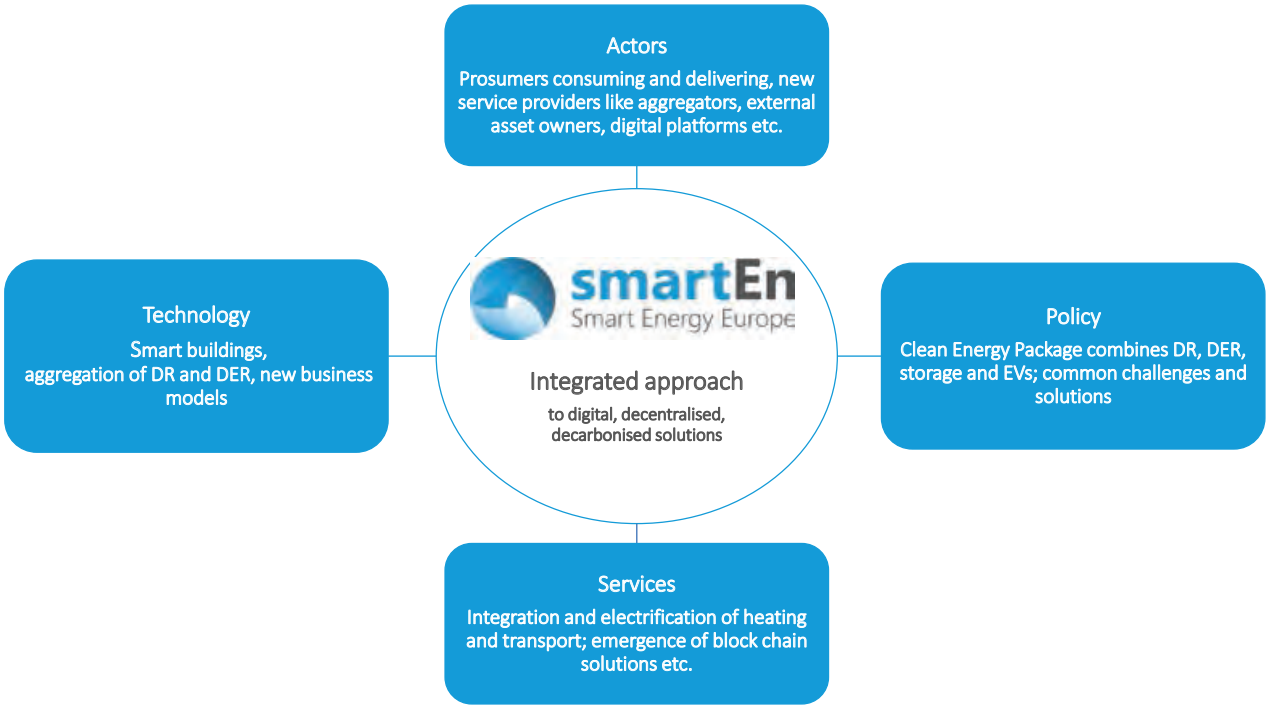
than participating proactively. But make no mistake! Decentralisation does not require fragmentation and autonomisation. A sustainable, decentralised energy system will build on an integrated perspective: Consumers, prosumers and asset owners should be able to use and sell their energy and flexibility resources wherever they are most valuable at any moment. This means moving beyond silos of demand or supply, local-level or system-level optimisation of resources. In such integrated markets, distributed energy and flexibility supplies and services could be used at every level and purchased by all different actors – Distribution System Operators, Transmission System Operators, and all market participants. For this to succeed, markets and products must be streamlined between the local and regional level, between the provision of services for system operation and energy for supplies.

The creation of a smart integrated system also means that taxes, levies and grid-charges must be revisited, encouraging smart interaction rather than pushing users away from the system. If, in many European countries, over two-thirds of a consumer's energy bill consists of flat taxes, levies and charges that are based on the kilowatt-hours consumed, grid defection is a natural reaction. Different options should be explored to overcome this effect. Levies could be linked to the point of fuel consumption, rather than final electricity; dynamic taxes linked with the electricity market price should be assessed; VAT, which has been linked with the volumes of electricity, could instead be based on purchasing price. Finally, if users can earn back part of their network charges or benefit by selling services to the system, monetising their energy and flexibility, they will tend to remain connected, contributing to a sustainable, cost-effective and increasingly decentralised energy system.

"A sustainable, decentralised energy system will build on an integrated perspective: Consumers, prosumers and asset owners should be able to use and sell their energy and flexibility resources wherever they are most valuable at any moment. "

In this context, digital solutions will not only support the provision of services to the system, but they are essential also for the operation of markets and platforms. The market integration and evolution of new and innovative products on the power exchanges and the trialling of new approaches to service acquisition by Transmission and Distribution System Operators gives reason to be optimistic for the next steps.

In an increasingly decentralised, decarbonised energy system, we need the digitally enabled interaction of millions of demand and supply assets and solutions. This requires an integrated perspective - and this why the Smart Energy Demand Coalition, SEDC has become Smart Energy Europe, smartEn.



Distributed flexibility and the value of TSO/DSO Cooperation

Fostering active customer participation to value their services on the market

By ENTSO-E, European Network of Transmission System Operators for Electricity

With the constant increase of distributed renewable generation and storage, and the expected rise of active customers, engaging in demand response, a key question must be addressed: how to integrate the flexibility services provided by these new assets and actors into the internal energy market? European TSOs' objective is not only to enhance system security for which they're responsible, but also to ensure that the value for end customers and distributed flexibility resources (DFR) providers is maximised.

INTEGRATION OF DISTRIBUTED FLEXIBILITY RESOURCES

DFR should be used – depending on time and location – where they provide the most value to the whole electricity system: whether it be in portfolio optimisation and trading for market parties at day-ahead and intra-day markets, in congestion management for solving transmission and distribution grid issues, or as balancing resources for TSOs to maintain power system security.

It is thus fundamental to develop a coherent and user friendly overarching market design, ensuring seamless coordination between different market processes (from day-ahead and intra-day markets to balancing and congestion management). This is key to delivering at all time frames an optimal use of resources, maximum value for consumers, and robust security of supply.

Furthermore, the market design should strive to minimise the number of different bidding processes and non-coordinated products and to achieve maximum liquidity, considering system requirements, technical capabilities

and commercial interest of the providers.

DSOs and TSOs need to coordinate closely and exchange the necessary information for operating their network securely and ensuring market efficiency. Such coordination will, among others, avoids double or counter activation of the same service at the same time.

Local and national pilot projects are good steps forward as they allow testing different strategies within a fast-evolving framework. Nevertheless, economic efficiency principles must be considered at an early stage. It must also be ensured that solutions are consistent with EU market design principles. DFR integration should not lead to market fragmentation nor competition distortion, but should ensure neutrality, confidentiality and transparency. In particular, effective DSOs unbundling is key to ensure neutral market facilitation and fair competition in procurement of flexibility services.

ENTSO-E highlights that the implementation and specific design questions of such a flexibility marketplace are up to national decisions. At the same time, ENTSO-E recommends defining and agreeing overarching market design principles at the EU level, ensuring a direct relation between any buyer and provider of a product, and avoiding a fragmentation of the market depending on voltage level.

In that sense, DFR providers should be able to interact both with DSOs and TSOs, depending to whom the service is sold. National implementations in which DFR providers can only beactivated through their local connecting DSO should be avoided (a scheme often referred to as "cascading principle"), as it would inevitably fragment liquidity and prevent system wide aggregation in the balancing process.

In the interest of both end consumers and operational needs, it is fundamental to ensure a coherent and integrated wholesale and retail market building on the IEM, and allow further cross-border opportunities.

KEY RECOMMENDATIONS

We further detail our key recommendations for the integration of DFR in the market as follows with a focus on TSO-DSO cooperation:

A SOUND DEFINITION OF PRODUCTS TO SUIT THE SYSTEM AND GRID NEEDS

- DSOs and TSOs need to assess the potential needs for DFR in their network for congestion management. Such needs should be compared with existing and foreseeable capacities of the potential flexibility providers and defined clearly to attract the interest of all relevant market parties.
- Suitable products should be defined jointly by DSOs and TSOs before NRA approval, in order to facilitate standardisation for efficiency purposes. A certain degree of flexibility may be needed to allow for more local specificities or certain technical parameters in implementation. The number of products needs however to be limited to minimise negative impacts on market liquidity.

COORDINATION OF PROCESSES AND INFORMATION EXCHANGE BY TSOS AND DSOS IS KEY TO GUARANTEEING OPTIMAL USE OF RESOURCES AND SYSTEM SECURITY

- Activation of DFR within the balancing or congestion management process shall not negatively impact the other processes. Therefore, TSOs and DSOs shall be able to set limitations or activate DFR to solve congestions considering the geographical location of the assets in a bid. Also, the availability of contracted balancing reserves to TSOs must not be endangered.
- Coordination between System Operators on activation of flexibility providers' bids and possible limitations is essential especially close to real time.

FLEXIBILITY SERVICES TO BE USED WHERE THEY GENERATE THE HIGHEST VALUE

- Flexibility providers should be able to offer their flexibility by placing their bids in such a way that they can be activated where they have the highest value to them.
- The market design should minimise the number of different bidding processes to answer the various needs of system operators. For instance, all congestion management needs for the TSO network and DSO network should preferably be fulfilled by a common bid submission process, which could possibly be merged with the bidding processes used for balancing.

A SINGLE MARKETPLACE IS A POSSIBLE SOLUTION TO ADDRESS THESE CHALLENGES

- A single marketplace at national level1) for collecting and activating distributed flexibilities may be a practical answer to different challenges: ensuring liquidity, building a level playing field for different service providers in a user-friendly way and allowing the coordination of different market processes such as balancing and congestion management.
- It allows TSOs and DSOs to access all bids and to mutually coordinate activations.
- It simplifies access to all markets for DFR and ensures that DFR providers can participate in all processes collecting the maximum value for their flexibility.

Based on these principles, ENTSO-E recommends assessing different options and benchmarking them against each other, as a basis for agreeing on a future market design for DFR. ENTSO-E is looking forward to closely cooperate on this with DSOs and stakeholders.

FutureFlow

Designing eTrading Solutions for Electricity Balancing and Redispatching in Europe

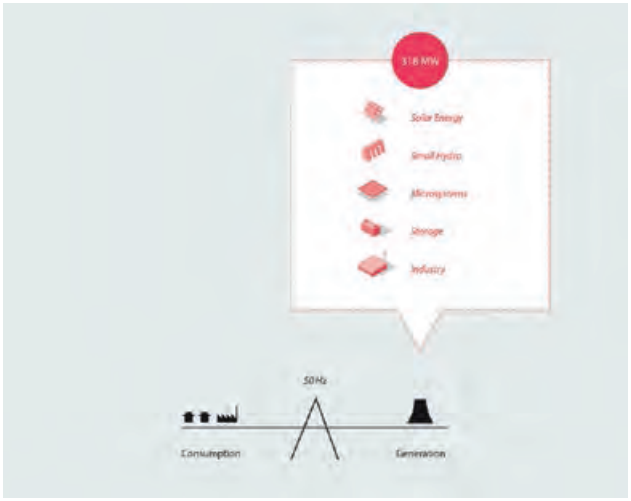
Our world is changing and so is the energy field. As we strive to the decarbonised world, we now have more and more electricity produced from renewable sources who have considerably reduced capabilities of conventional, fossil-fuel based power plants to ensure balancing activities and congestion relief through redispatching. And there are also industrial and household consumers, equipped with state-of-the-art devices, who are no longer just ordinary consumers, but can also produce electricity or regulate their consumption. Their potential is to become active players in power system security.

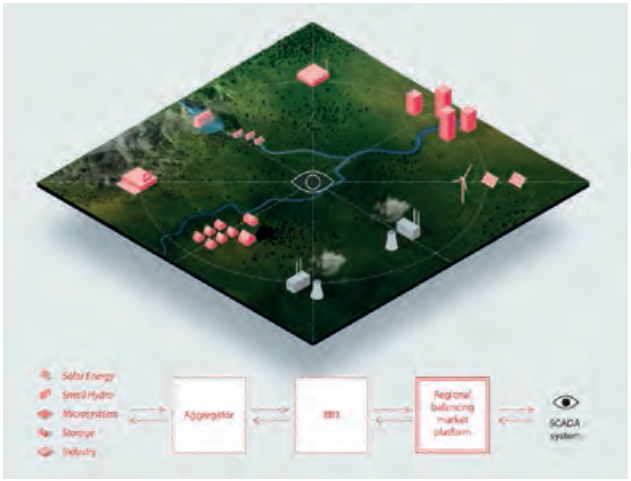
FutureFlow with its research and innovation activities aims to provide regional integration of balancing markets and to provide infrastructure for consumers and distributed generators to be able to provide flexible balancing and redispatching services. The aim is not just to provide prerequisites that enables participation of those sources but also to validate that they are actually capable of offering services on same quality level as conventional units within an attractive business environment.

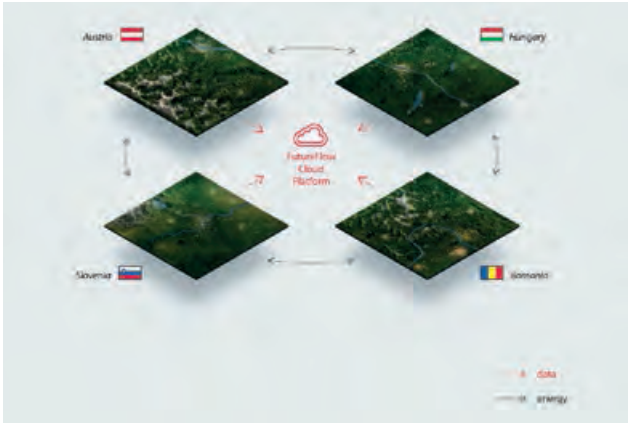
As a development project, FutureFlow will not remain solely on the level of scientific contributions. The results of its work will include prototype solutions which industry can apply in the real economy after the end of the project:

- Prototype platform for the aggregation of distributed generation and demand response;
- Prototype of the regional balancing and redispatching platform.

We believe that in the near future active consumers will become guardians of the power system, contributing to the most challenging of all TSOs' balancing services, consequently reducing their electricity prices and the dependence of countries on fossil fuels, as well as lowering CO_2 emissions.







PROJECT PROFILE

- Duration: 2016 – 2020
- Project value: EUR 13 million (Horizon 2020 programme)
- Consortium: 3E, APG, CYBERGRID, EIMV, EKC, ELEKTRO ENERGIJA, ELES, GEMALTO, GEN-I, MAVIR, SAP, TRANSELECTRICA
- Coordinator: ELES, d.o.o., Slovenia

More information:

Web Page: www.futureflow.eu
E-mail: future.flow@eles.si

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 691777

FHP

Dynamic Coalitions of distribution grid connected Power to Heat resources providing local and system level services

The *FHP – Flexible Heat and Power* project develops a **standards-based multi-stakeholder multi-agent platform** that enables the **trading of flexibility** provided by **Heat Pumps**. The focus is on heat pumps in buildings (residential, commercial, industrial), as well as heat pumps associated with a district level – seasonal – heat storage solution provided by **ECOVAT**. The prime selected business use cases relate to the mitigation of local and system level RES curtailment which is undesirable from societal and environmental point of view, and forms a barrier for increased RES investments. But the developed platform is capable of supporting other business use cases as well, both in the Day-Ahead /Intra-Day and the real-time time frame.

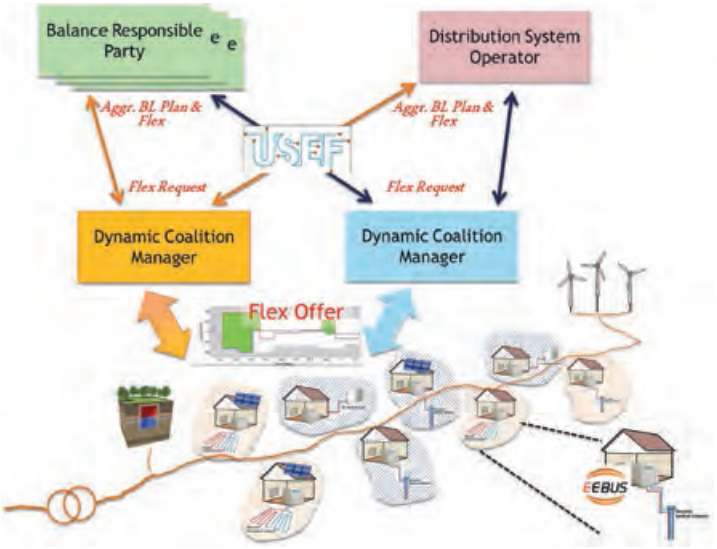
The work in the project is organized around four pillars.

Pillar 1: Dynamic Coalition Manager at the heart of a standard-based Multi-Agent System

The Dynamic Coalition Manager is a specialization of the aggregator role. It performs **location aware aggregation** of Power-to-Heat flexibility provided by buildings and the ECOVAT, and offers this to the DSO for local technical RES curtailment mitigation, or the BRP for economic RES curtailment mitigation. There is a **bi-directional information exchange** with the flex providers: the latter provide information on their optimal baseline consumption plan and available flex with expected activation cost, and the former communicates the activation decision which is a plan for the next *n* timesteps. The pool of resources that can be used by the DCM is dynamic, i.e. flex providers can decide freely when and to whom (if there are multiple DCMs) they offer their flex.

Pillar 2: Human expert-free multi-zone modelling of dynamic thermal behaviour

To determine the optimal baseline consumption pattern as well as the available flexibility, a combination of grey-box thermal modelling with machine-learning and optimization algorithms is used. Specifically, a methodology is developed that creates **high quality multi-zone models** that learn the amount of relevant zones, their adjacency and their relevant parameters in an automated data driven manner **without requiring human expert** intervention. This will provide a replicable solution that can be easily deployed.



Pillar 3: Optimal flex dispatch solution

Based on forecasts of load and (RES) generation, and a local grid model, the DSO performs an analysis on whether, where and when local grid problems can be expected. This results in a **flex request formulation** towards the Dynamic Coalition Manager. This flex request contains information on the minimal required flex activations (e.g. load shifting) that are needed to prevent the forecasted problem, as well as constraints for the acceptable load shifting solutions. The Dynamic Coalition Manager(s) determine an **optimal flex dispatching plan** for each of its available flex resources that adheres to the flex request, using information on the available flexibility and cost of activation of its current dynamic coalition.

Pillar 4: Grid Flexible Heatpump

Currently heatpumps are primarily designed for efficiency, not for offering flexibility services. Using them for flexibility services typically is done in an indirect manner, forcing them into a certain power consumption regime based on their heating curves and sensor overrides. In the FHP project we explore and prototype ways to control heatpumps in a **direct manner** in relation to the desired consumption profile. Besides, we will analyse how to **increase their flexible operation** without impacting their lifetime or safety.

Partners

vito · NODA · tecnalia · Honeywell · RISE · energi · ecovat · KU LEUVEN

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731231

Contact Details:

Web: www.fhp-h2020.eu
Email: chris.caerts@vito.be

Energy efficiency to fight climate change: the vital role of ICTs

By Malcolm Johnson, ITU Deputy Secretary General

The need for innovative energy solutions to reduce carbon emissions has never been more urgent. And with last month's Bonn Climate Change Conference fresh in their minds, world leaders now face the challenging task of finding ways to translate ambition into action.

Information and communication technologies (ICTs) can help us fast-track progress. Innovative ICTs are powering smarter electricity grids, greener cities, and more efficient agricultural practices. If we do it right, ICTs can enable a 20% reduction of global carbon emissions by 2030[1] and thus significantly contribute towards the Paris agreement targets.

ITU'S LEADING ROLE

At the International Telecommunication Union (ITU) – the United Nations' specialized agency for ICTs – we are working to provide innovative technological solutions and standards to help our government and private-sector members reduce their carbon emissions.

To minimize the carbon footprint of the digital ecosystem, ITU and its members committed to reducing greenhouse gas emissions per device by 30% by 2020. To meet this commitment, ITU has, for example, developed new international standards to reduce the greenhouse gas emissions of power feeding systems and data centres.

But this progress did not happen overnight.

When I first joined ITU almost 11 years ago, climate change did not really figure in ITU's work. I led the publication of ITU's first report on ICTs and climate change in December 2007, which highlighted that while ICTs are a contributor to greenhouse gas emissions, they are also an important element in mitigating and adapting to climate change, and reducing overall emissions of greenhouse gases.

Since then, ITU has been helping Member States understand how to use ICTs and satellite terminals for disaster warning, mitigation, response and recovery.

In addition to its focus on climate change adaptation and mitigation, ITU has been leading the work to capitalize on the potential of ICTs to secure an energy-efficient future.

EARLY PROGRESS

In many areas, we are seeing progress on energy efficiency – sometimes known as 'the fifth fuel' due to its great potential to save energy.

Many big Internet companies, for example, are taking steps to power their activities with renewable sources[2].

In addition, emissions avoided through the use of ICTs are nearly ten times greater than the emissions generated by deploying it[3].

ICT-enabled solutions such as machine learning, advanced data analytics and distribution management systems have the potential to manage electricity consumption and significantly improve the efficiency of electricity grids. ITU's Standardization Section has outlined how smart grids can help to mitigate climate change by building more controllable and efficient energy systems.

GREENER CITIES

Cities emit more than 70% of the world's total greenhouse gases, according to UN figures. ICT-enabled solutions such as sensors, smart meters, automated control systems, and the Internet of Things (IoT) offer an opportunity to reduce cities' energy costs and decrease their emissions by transforming urban infrastructure with intelligent buildings, smart street lights, more efficient transportation systems, and smart energy and water networks.

ITU is working on a number of initiatives to build smart, sustainable cities. In 2016, for example, ITU and the United Nations Economic Commission for Europe (UNECE) launched "United for Smart Sustainable Cities" (U4SSC) to respond to the Sustainable Development Goal 11. U4SSC is now supported by 16 United Nations bodies, and 50 cities have joined the pilot project.

These cities are implementing a set of key performance indicators developed by ITU and UNECE that fall under five

1 GeSI Smarter 2020: The Role of ICTs in Driving a Sustainable Future. The Global e-Sustainability Initiative. 2012
2 Clicking Clean: Who is Winning the Race to Build a Clean Internet? GreenPeace, 2017.
3 GeSI Smarter 2020: The Role of ICTs in Driving a Sustainable Future. The Global e-Sustainability Initiative. 2012

overarching categories, one of which is environmental sustainability. Under this indicator, the cities are measuring air quality, CO_2 emissions, energy use, and indoor pollution. Recently, ITU published a case study on Singapore's efforts to apply smart city innovations, providing a valuable reference point to other cities pursuing greater efficiency and sustainability.

ITU standards have an important role to play. Standards are essential for the interoperability of city systems, and to achieve consistent levels of performance and quality, as well as economies of scale. The ITU Study Group on IoT, smart cities and communities develops international standards to ensure this, and encourages the coordinated development of IoT technologies.

PARTNERSHIPS FOR SUCCESS

Since 2007, ITU has been committed to increasing awareness of the potential of ICTs, promoting innovation, and establishing standards to ensure that ICTs maximize energy efficiency.

New and innovative partnerships and initiatives, especially between the ICT sector and the energy sector, and between public and private entities, will be essential to enhance energy efficiency and make the Paris agreement targets a reality.

Only by collaborating together, pooling resources, avoiding duplication of effort, and concentrating on our core competencies will we harness the power of ICTs to reduce global CO_2 emissions, and thus help to minimize the negative impact of climate change for billions of people, leading to a better and more secure future for all.

IndustRE: Can the industrial sector enable the grid integration of renewables?

The IndustRE project aims to use the flexibility potential in energy-intensive industries to facilitate further grid integration of variable renewable energy sources

By Denzil Walton and Michael Papapetrou

For many years, the way European industries have consumed energy has been shaped by the traditional working day. This old, rigid model does not take into account when renewable energy is generated and how this affects the market prices. But if industry was to become more flexible about when it consumes electricity, it could adapt to wind and solar generation patterns and benefit from lower market prices.

With this in mind, the IndustRE project has been exploring how the flexibility potential of energy-intensive industries across Europe could help them save money, while supporting the efficient integration of more variable renewable energy into the European power system.

PROJECT SCOPE, ACTIVITIES AND TIMEFRAME

The project activities are relevant for all industries in Europe, especially the chemicals, non-ferrous metals, cold storage, steel, and water treatment sectors. These five sectors with 302 TWh/year represent about 10% of the electricity consumption in Europe.

The project work is applicable to all European countries, with particular attention being given to Belgium, France, Germany, Italy, Spain and the UK. These countries have traditionally had important industrial production and together they represent more than 65% of the EU population and almost 80% of all the installed wind and PV capacity. These figures allow a balance to be achieved between a manageable effort of working with six target countries and still having an important impact on a European level.

The project has two aims within two timeframes. The first is to offer practical tools for immediate impact, and the second is to quantify the longer term potential following the implementation of policy recommendations. Five case studies have also been analysed, covering five countries and four industry sectors.

NEW BUSINESS MODELS

Over the last three years, the IndustRE team has developed a range of new business models which:

- Create win-win situations for the involved parties
- Support the further deployment of variable renewable energy without dependence on support schemes
- Bring benefits for the power system and the environment
- Can be applied in the current market and regulatory framework of the target countries.

WHAT BENEFITS ARE POSSIBLE?

Energy intensive industries can make important savings by becoming more flexible in the way they use their electricity, leading to a 3% to 10% reduction in their electricity bill.

Advanced modelling shows that flexible industrial demand could deliver significant savings for the European power system. If 20% of industrial electricity demand was flexible, up to 2.5 billion euros per year could be saved in an EU power system with 60% renewables.

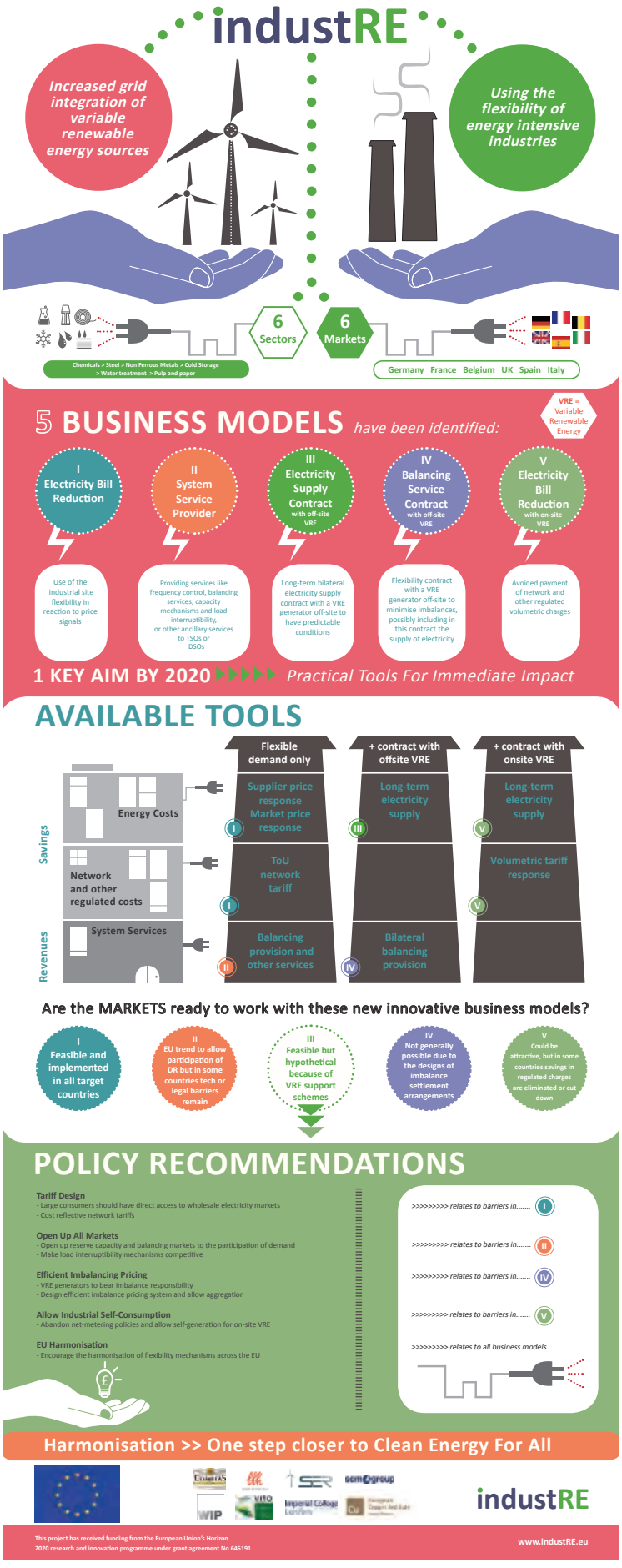
KEY POLICY RECOMMENDATIONS

Naturally, changes need to be made to the market design and policy framework to deliver all the benefits industrial flexibility has to offer. There is still a lot of work to do in every single country to bring all the benefits possible from flexible industrial demand, especially as current market and regulatory arrangements do not capture this complexity sufficiently. Key policy recommendations include:

- Giving large consumers access to wholesale electricity markets
- Opening up reserve capacity and balancing markets to demand
- Ensuring that variable renewable energy generators bear imbalance responsibility
- Harmonizing flexibility mechanisms across the EU
- Abandoning net-metering policies and allowing self-consumption on-site.

HOW CAN YOUR COMPANY BENEFIT?

Even in the current framework, industrial electricity users can save on their electricity bills by using the IndustRE methodology and results. A new tool has been developed – ProFlex – which can quantify how much flexibility they have does an industrial user have and what is that worth. All IndustRE results are available to download on the website www.industRE.eu, where you can also find out how the project can benefit your company.



Electricity Sector leaders commit to accelerating the clean energy transition

By Kristian Ruby, EURELECTRIC Secretary General

How should industry respond to the increasing urgency of climate change, air pollution and depletion of natural resources?

In December 2017, the European electricity sector announced a new long-term vision for the electricity industry in Europe.

National associations and Chief Executives from all major power companies in Europe have agreed a vision declaration that commits the sector to accelerate the clean energy transition, taking a leading role in Europe's efforts towards the Paris Agreement.

Sector leaders have all committed to take action to support the economy-wide shift to a climate-friendly society and achieve a carbon-neutral electricity mix in the EU well before mid-century.

ELECTRIFICATION AS A KEY DECARBONISATION TOOL

The new Vision statement is articulated around three major ideas: what electricity can bring to society, what the electricity industry commits to and what is needed from policymakers to deliver. Together, these three elements ensure that electricity continues to add value to the lives of citizens, communities and future generations.

With the new vision, the sector strengthens its commitment to invest in clean power generation and other transition-enabling solutions and, importantly, to help accelerate CO_2 emission reductions in other sectors through increased use of clean electricity.

Electricity as a product offers countless solutions. Its contribution to the development of society today has been extraordinary, and it will continue to grow. With the potential for electricity generation to become carbon-neutral, it will help decarbonise a number of other sectors of the economy, like transport and heating and cooling.

Press Conference on the new long-term vision for the electricity industry in Europe, from left to right: Kristian Ruby, Secretary General of EURELECTRIC, Magnus Hall, Vice-President of EURELECTRIC and CEO of Vattenfall, Francesco Starace, President of EURELECTRIC and CEO and General Manager of Enel Group, and Alistair Phillips-Davies, Vice-President of EURELECTRIC and Chief Executive of SSE

It can help reduce Europe's dependency on imported fuels, clean the air of cities and bring customers new comfort through digital energy services and zero-emission transport.

In order to reap the benefits of electricity's in a cost-efficient manner, policymakers need to recognise the key role of increasing clean and climate-friendly electricity in achieving Europe's climate and energy commitments under the Paris Agreement. They should actively support measures that accelerate the shift towards competitively priced electricity for European consumers.

They should also accelerate electrification through smart and better regulation, and promote the take-up of clean heating and cooling in residential and industrial buildings, clean electric mobility and more efficient industrial processes.

MAKING THE RIGHT INVESTMENTS AND PUTTING CUSTOMERS FIRST

The Vision statement also comes with a strong commitment to invest in innovation, to build new cross-sector business models, to make sure the electricity industry can keep creating value in the coming decades.

Digitalisation, distributed generation and technological progress are changing the fundamentals of the business and showing unanticipated interactions. To retain its pivotal role and maximise its value, the electricity industry needs to discover innovative ways to create value with a fresh approach.

Key to this will be to put the customer at the heart of the industry's activities and develop new offerings like aggregation, demand response, peer-to-peer energy transactions and new services. These new building blocks, connected by smart distribution networks, will provide Europe with a resilient, flexible and highly efficient electricity system.

The electricity sector commits to invest in finding sustainable solutions to transform societies into carbon-free ones, and to ensure building win-win initiatives that are inclusive and address the rights and duties of all stakeholders including investors, workers and local communities.

THE NEED FOR A FAIR TRANSITION

The ambition of this statement is significant, especially for regions which depend on high carbon value chains. This is why the electricity industry calls on policymakers to do their utmost to ensure a fair energy transition, both socially and geographically.

This must include the provision of the necessary support and funding to address socio-economic impacts. During this transition, policymakers must ensure fair effort sharing and guard data protection, privacy and freedom of choice for customers.

Following the adoption of this vision statement, the European electricity sector will engage with stakeholders and launch several projects in the coming years aimed at identifying the challenges and opportunities of an accelerated clean energy transition.

Harmonization of the ASCENT technologies to the worldwide Mission Innovation strategy

Mission Innovation is a worldwide initiative to accelerate the implementation of clean energy, announced during the COP21 in Paris on November 30, 2015. Several challenges were selected, one of those is the implementation of carbon capture, to enable near-zero CO_2 emissions from power plants and carbon intensive industries. A workshop has been held in Houston, Texas on September 25-29, 2017 which aims on early stage breakthrough CCUS technologies. The event was conceived as composed of a number of panels where experts have been invited to discuss the fundamentals of the worldwide research in the field of carbon capture, use and storage within the coming years.

One of the panel focused on sorbents and looping systems, and was attended by Paul Fennell, Tom Hills and Stefano Stendardo - members of the ASCENT consortium. In particular, Fennell gave a presentation showing the current state of the art of Calcium Looping (CaL), and included the processes which are being thoroughly investigated in the ASCENT project. The ASCENT project along with SCARLET project were presented as two EU initiatives on the CaL cycle at different scales, with the former more related to proof of concept scale and the latter on pilot scale. Different research actions have been prioritised during the discussion in the panel by the members of the ASCENT consortium with the other panelists: Hills have highlighted the importance of the implementation of CCUS technologies for the decarbonisation of industry whereas Stendardo has suggested to focus the future efforts in the development of new flexible CCUS processes for the production of decarbonised power.

ASCENT consortium is focusing on the experimental tests of novel processes at the proof of concept scale. The activities are complemented with modeling activities to give insight into the dynamics and performances of the lab-scale reactors. The experimental and modeling activities are related to the CaCu, CSHIFT and SER cycles. With regards to the CaCu cycle, the activities are related to the: (i) modification of the experimental set up to reduce heat losses and to improve the initial temperature profiles, (ii) study of the reduction/calcination stage with methane and mixtures of methane/hydrogen for the subsequent validation of the reactor model and (iii) proof of concept of the whole process.

The SER process has been tested in batch Fluidized Bed reactor for hydrogen production by sorption-enhanced reforming of methane at different fluidization velocities for the new sorbent materials developed. The materials performance was satisfactory for operation in fluidized bed environment and operating conditions have been validated. The experimental activities related to the SER process have been complemented with simulation carried out with a Lagrangian- Eulerian approach. A short movie of the simulated fluidized bed have been posted in the ASCENT website. Experimental long-term multi-cycle runs were performed in a micro-fixed bed reactor set-up to test the chemical stability of the materials. A satisfactory stability in relevant operating conditions has been achieved up to 200 cycles.

As for the CSHIFT, benchmarking of the process clearly showed that the process has a good potential when the process is run in an adiabatic manner with an efficient heat integration between the carbonator and calciner. New, alternative, process CSHIFT concept have been discussed and modeled.

The ASCENT consortium is proud to contribute with the other EU initiatives in paving the future of the worldwide research in the advanced CCUS processes and demonstrating the value of continued EU research, including the contribution of the UK. Assuming that all the Mission Innovation partners remain committed to the initial strategy agreed during the COP21, the contribution of the ASCENT representatives within Mission Innovation are expected to have significant and far-reaching consequences in the long term worldwide research on the decarbonisation of industry and power.

The research leading to these results has received funding from the European Union Seventh Framework Programme FP7 under grant agreement n° 608512

Contact Details:
Web: www.ascentproject.eu

Boosting more efficiency in the cloud through the usage of power states

By Matteo Repetto, CNIT – On behalf of the ARCADIA Consortium

Big cloud providers these days report power "overhead" (i.e., non-computing energy spent for cooling or power conversion) has dropped around 10%, hence the next step for further efficiency will consist in dynamically shaping power consumption according to actual load.

Unfortunately, this is not straightforward to achieve in practice. Consolidation can be used to keep only running the minimal number of servers to accommodate the sold capacity. However, it is worth pointing out that the above relationship should build on actual computation intensity (i.e., CPU usage) rather than the resource size (mainly, number of CPUs and amount of RAM), as someone might be tempted to do. It is undisputable that every interactive service (excluding therefore intensive computation on large bulks of data) is subject to large deviations of incoming requests, with typical hourly, daily, weekly, and even seasonal periodicity. The so eulogised cloud elasticity is only effective with the longer timescales, since the time to technically and, most of all, administratively provisioning and de-provisioning resources is in the order of days.

LET'S USE POWER STATES FOR VIRTUAL MACHINES!

Waiting for more concrete demonstration of the technical effectiveness and usability of emerging technologies like unikernels, real-time resource provisioning remains a chimera today. As a matter of fact, the deployment of additional (idle) resources is the only viable solution for critical business services that require high-availability/QoS both in case of failure and peaks of workload. That means cloud users are somehow forced to pay for something that might only be used occasionally, while the effectiveness of any energy-efficiency consolidation is partially undermined.

"Let's not put high-performance servers into a permanent idle state!" was the title of a recent article in this same magazine[1], which debated on the efficiency of low-power idle states for servers. We would like to continue the discussion with an additional challenging call: Let's use power states for virtual machine!

Putting VMs into suspended state (orange indicator) is an effective way to drive consolidation and aggressive power management into the underlying infrastructure.

But, what is the meaning of power state (e.g., active, suspend-to-ram, suspend-to-disk) for a virtual resource? Well, it cannot directly save energy as happens in real hardware, but it is an effective trigger for the management of the underlying physical infrastructure. Basically, it says that the resource will not be used before it gets resumed.

THE ARCADIA USE CASE FOR ENERGY EFFICIENCY

The ARCADIA project has developed an innovative framework for development, deployment, and management of highly-distributed cloud applications. Through policy-driven orchestration, the framework supports life-cycle operations: re-configuration, horizontal and vertical scaling, replication, etc. A specific Use Case has been implemented for energy efficiency, which chases more efficiency by changing the power state of virtual machines according to the evolving context. An energy-efficiency module extends OpenStack, by gathering active VMs together into the smallest number of servers, and putting all other servers into suspend-to-ram mode. The project will shortly carry out functional and performance evaluation for a video transcoding application.

Contact details:

Matteo Repetto, CNIT
Email: matteo.repetto@cnit.it
Project web: http://www.arcadia-framework.eu
Project twitter: @eu_arcadia

This project is funded by the EU's H2020 Programme under GA no. 645372.

1. Cecilia Bonefeld-Dahl, "Let's not put high-performance servers into a permanent idle state!," European Energy Innovation, Summer 2017, pp. 32-33.

Europe's energy future will be safe, clean and digital

For this, we must rebuild our entire energy system. But what is the right strategy to achieve this goal?

Austria could be a role model with its 76% renewables in the electricity system and a stability of more than 99.99%. Austria's pump storage accounts for more than 12% of Europe's installed capacity and therefore Austria can play a major role with its hydropower plants in the future European power system.

Oesterreichs Energie, representing the Austrian electricity industry, has worked out a strategy for the future of energy until 2030, called "Empowering Austria".

The direction is clear: The conversion of the energy system can only succeed if electricity takes a larger role in the transport and space heating sectors. The energy strategy of Oesterreichs Energie foresees an expansion of Austrian renewables in the energy system of at least 85% by 2030.

The share of electricity in the energy system in Austria needs to increase by 33% until 2030 with more flexibility and participation in the market system.

We need a climate and energy strategy throughout Europe which includes a binding strategy for electric mobility. What is required is an area-wide extension of charging infrastructure, standardisation at the European level, and

More electricity and efficiency within the energy system

More renewables an flexibility in the electricity system

More participation of all market players

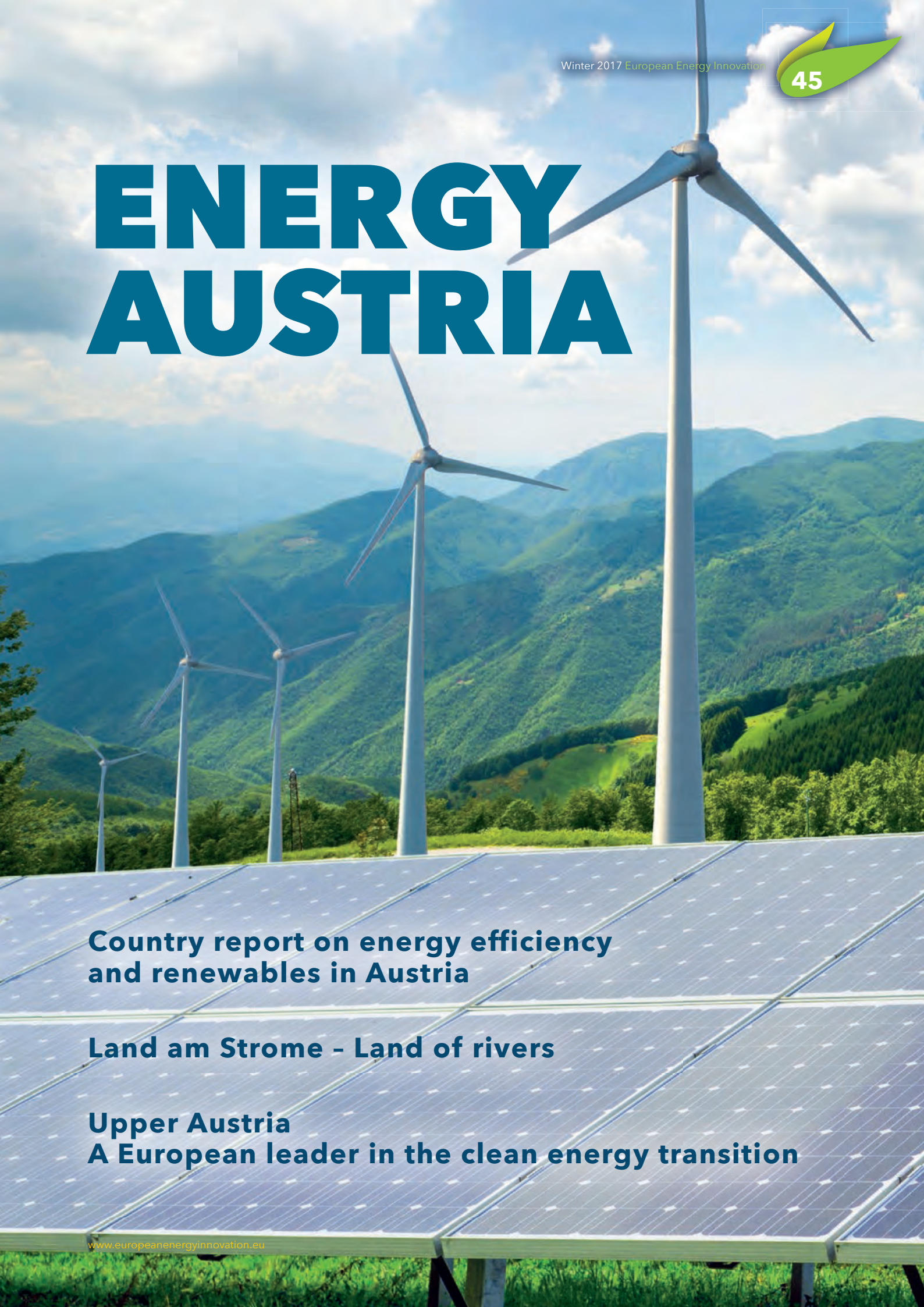
an understanding of mobility as a part of a smart energy system. We need large as well as scalable model regions from which to learn. This is part of the necessary research campaign which has to include innovative storage solutions. For this it is important to increase the energy research funding as well as to create coordinated research projects across all sectors. It would be constructive to bundle together existing projects and initiatives. As a motor for innovation, digitisation has become indispensable.

Austria's electricity companies work for a safe, clean and affordable energy future.

More information:

www.oesterreichsenergie.at

Photo: Christian Fischer / Oesterreichs Energie



ENERGY AUSTRIA

Country report on energy efficiency and renewables in Austria

Land am Strome – Land of rivers

Upper Austria
A European leader in the clean energy transition

Upper Austria
A European leader in the clean energy transition

By Christiane Egger – OÖ Energiesparverband, Conference Director of the World Sustainable Energy Days

Upper Austria, the most industrialised of Austria's 9 regions, is well on its way in the clean energy transition: 75% of the electricity, 61% of all space heating and 32% of the primary energy come from renewables, as does 38% of the region's industrial energy demand. Through significant increases in energy efficiency and renewable energy, greenhouse gas emissions from buildings have been reduced by 43% in 10 years.

Upper Austria has implemented stable policies since the mid-90s. Among others, this strategic and long-term vision has resulted in the growth of a vibrant industry that successfully exports worldwide.

"CARROT, STICKS AND TAMBOURINES" – AN EFFECTIVE COMBINATION OF POLICY MEASURES

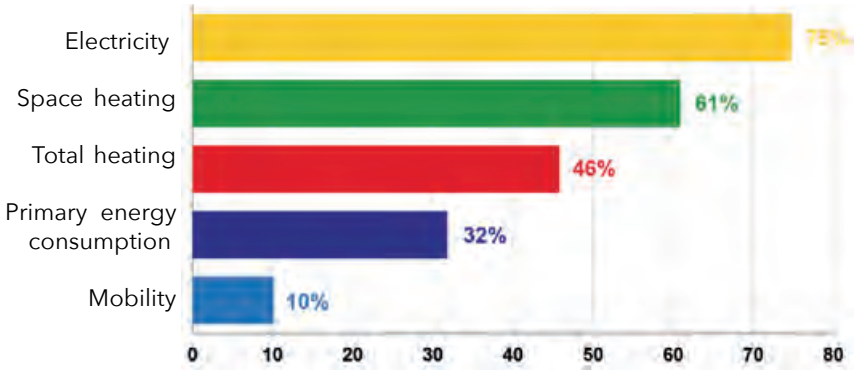
The region's progress in the energy transition is owed to its targeted energy policy approach. Coined "carrots, sticks and tambourines", it consists of a combination of financial incentives ("carrots"), regulatory measures ("sticks"), and information & training activities ("tambourines").

Financial support programmes specifically targeted at both mass-deployment and innovative technologies are available in the region. In addition to the financial incentives themselves, avoiding

Photo credit: iStock/bluejayphoto

stop-and-go through long-term programmes has shown to be important. The region also employs a range of regulatory measures, especially building policies (the implementation of the European Buildings Directive is under the responsibility of the regions in Austria). One approach used in Upper Austria has been to offer subsidies if certain levels of building performance are achieved. With time, regulatory building standards are tightened and the required performance level for subsidies is raised. Repeating this, step-by-step, over time permitted to gradually raise the overall energy efficiency of the building stock while driving innovation. Although "carrots" and "sticks" offer a good supporting basis for change, communication activities ("tambourines") really help to build up momentum.

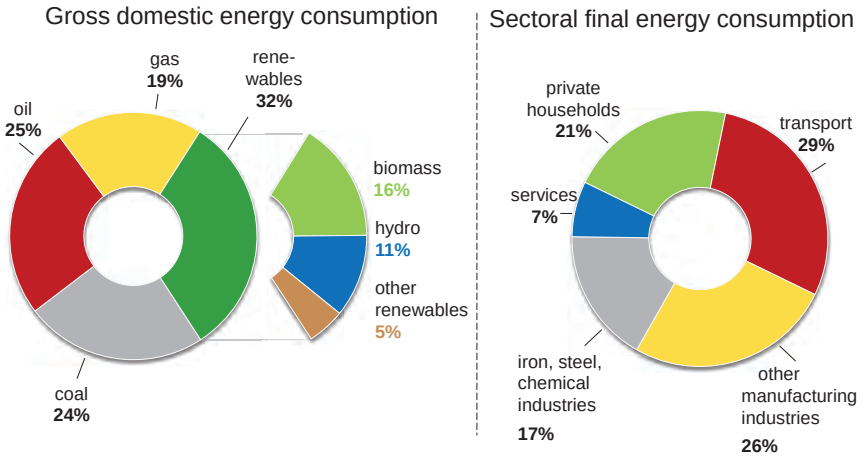
Share of renewable energy in different sectors in Upper Austria



Source: OÖ Energiesparverband

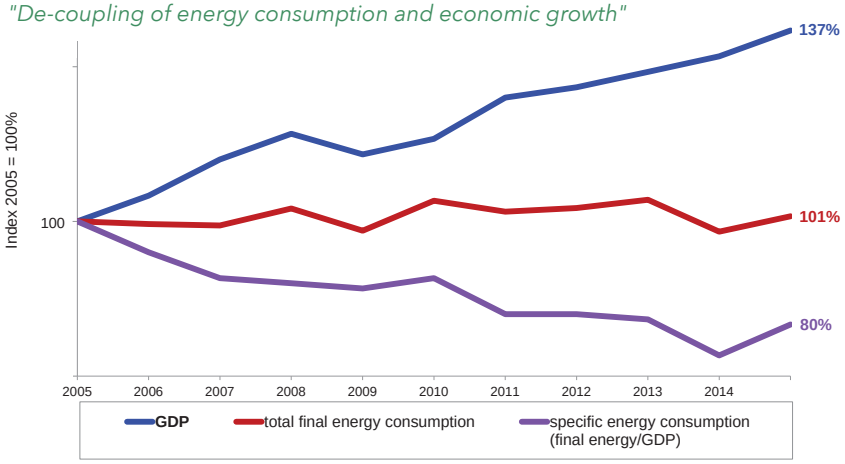
The OÖ Energiesparverband (ESV), the regional energy agency, is a central driver of the energy transition in Upper Austria. Among others, its key roles include developing and implementing regional policies and programmes and fostering the development of innovative technologies. Each year, the agency performs over 10,000 face-to-face advice sessions and trains more than 500 people in its Energy Academy. The ESV has also issued or checked over 150,000 energy performance certificates for buildings. Another main field of action is its support to energy companies in the frame of the Cleantech-Cluster – a business network that brings together 140 energy technology partners. As part of its activities at the international

Energy production and consumption in Upper Austria



Source: OÖ Energiesparverband

Development of energy consumption and GDP in Upper Austria
"De-coupling of energy consumption and economic growth"



Source: OÖ Energiesparverband

level, the OÖ Energiesparverband organises the conference World Sustainable Energy Days (WSED) which covers sustainable energy technologies, policies and markets. The event takes place annually in Wels/Austria and attracts over 700 experts from more than 50 countries.

THE CLEAN ENERGY TRANSITION – MORE THAN CLIMATE PROTECTION

The advantages of the clean energy transition are far-reaching and benefit economies and citizens as well as the environment. In the past decade, a game changing achievement in Upper Austria was the clear decoupling of energy consumption and economic growth, proving that energy efficiency and economic strength can go hand in hand.

Upper Austria has a thriving clean energy industry. For example, 25% of all modern biomass boilers installed in the EU are manufactured by Upper Austrian companies. Over 200 million Euro are invested each year in renewable energy systems. Increased energy efficiency and renewable energy share already result in more than 1.5 billion Euro per year in avoided imports of fossil fuels. Moreover, more than half of the 440 Upper Austrian municipalities have adopted energy actions plans, thus bringing the clean energy transition to the citizens of Upper Austria.

LOOKING FORWARD AND NO PLAN TO SLOW DOWN

In 2017, the energy policy targets were updated in the region's energy strategy "Energie-Leitregion OÖ". Through this strategy, the region set clear and ambitious goals. Among others, its quantitative targets include:

- reducing energy-related greenhouse gas emissions by at least 25% by 2030 and 70% by 2050
- increasing energy efficiency by at least 1.5% per year
- bringing up the share of renewables in electricity generation to as much as 97% by 2030

Sustainable energy, as key factor in global competitiveness, has been made a cornerstone of the region's economic and industrial policy. Having already experienced hands-on the manifold benefits of the clean energy transition, Upper Austria will continue on this path in the coming years.

To learn more about Upper Austria and exchange with energy experts from around the world, the OÖ Energiesparverband invites you to join the next edition of the World Sustainable Energy Days in Wels/Austria from 28 February – 2 March 2018.

OOENERGIESPARVERBAND

Contact details:
Christiane Egger,
OÖ Energiesparverband
Landstrasse 45, A-4020 Linz
+43 732 7720 14380
christiane.egger@esv.or.at

Flagship Region Energy – an Austrian initiative

Austria becomes the flagship region for energy innovations. With the development and testing of new energy and mobility technologies in the "Flagship Regions Energy", know-how is built and future-oriented jobs are created.

This initiative of the Austrian Climate and Energy Fund focuses on an efficient interaction of energy production, consumption, system management and storage. The best possible overall system for all market participants is characterised by temporary regional supply from up to 100 per cent renewable energies. Tomorrow's energy world should not only be innovative and safe, but also affordable, and secure Austria as an industrial location.

THE FLAGSHIP REGIONS AT A GLANCE

In the "Green Energy Lab", part of Austria becomes a test region for the future energy system with a significantly great share of renewable energies. The focus is placed on more flexibility and digitisation of the energy system to support energy supply security.

The purpose of "NEFI" (New Energy for Industry) is to show that 100% renewable energy supply of industrial sites is possible with energy technologies developed in Austria.

The aim of "WIVA" (hydrogen initiative) is to demonstrate the shift of the Austrian economy to an energy system which is largely based on hydrogen. The focus is on the production, storage, distribution and application of renewable hydrogen in the fields of energy supply, industry and mobility.

For more information:

www.klimafonds.gv.at
www.vorzeigeregion-energie.at

THE "FLAGSHIP REGION ENERGY" INITIATIVE

In the "Flagship Region Energy", model solutions for intelligent, secure and affordable energy and traffic systems of the future are developed and demonstrated.

With a total term until 2025 and a funding budget of 20 to 40 million Euros per flagship region, the Austrian Climate and Energy Fund is funding up to three flagship regions with different thematic issues, using funds coming from the Federal Ministry for Transport, Innovation and Technology (bmvit).

Land am Strome – Land of rivers

By Barbara Kappel, MEP (pictured)

The actual overall European electricity system does not sufficiently meet the requirements to facilitate the transformation into a low carbon economy. Therefore the European Commission has come up with a package of proposals to meet these challenges, the "Clean Energy for all Europeans Package", the most complex legislative package in the energy sector ever presented by the Commission. In particular, it stipulates a huge reduction of CO2 emissions, a higher share of renewable energy, fosters energy efficiency and creates a new electricity market model geared at the implementation of the climate and energy goals. As this is both an opportunity and a threat for our economy it is crucial that the European Parliament and the Member States are developing the right legal framework to tackle these challenges and ensure that energy will still be affordable for everyone. Otherwise, Europe will lose more and more of its energy-intensive industry to countries with weaker climate protection standards. In this concise article I would like to point out the competence and diversity provided by the Austrian industry and research centres in identifying meaningful and workable solutions.

AUSTRIA AND ITS STRONG TIES TO RENEWABLE ENERGY

Today 30% of the energy consumption in Austria is produced through renewable sources. Taking a closer look on the electricity generation we can see that Austria produces approximately 80% of its electricity out of renewable energy sources. Only Sweden, with 63,3%, comes close to this high amount of renewable electricity in the European Union.

Nature has not provided Austria with a huge number of different energy resources. There are virtually no hard coal resources, limited brown coal resources of poor quality and significant but declining hydrocarbon resources. Austrian energy policy therefore, depended vigorously on abundant hydropower resources and Biomass. Water power was promoted strongly after World War II and again after the oil crises of the 1970s. It grew steadily from about 5,000 GWh in 1950 to about 42,000 GWh in 1999. While construction of large hydro power plants almost stopped in the 1980s, small hydro power plants still see some growth. At present, more than 670 run-of-river power plants and some 1,800 small-scale hydropower stations are in operation and generate approximately 60% of Austria's electricity needs. Austria is number one in Europe when it comes to utilizing hydropower, and offers bundled know-how and a dynamic business environment to innovative companies. Nuclear energy is not an alternative source in Austria as on December 15, 1978 the Austrian Parliament voted for banning nuclear fusion. Consequently, Austria had to cope with a severe dependency on energy imports for the last decades. Austria´s energy policy, therefore, has always been sensitive to security on supply and oriented towards good international contacts. With its international contacts Austria deliberately developed transit facilities for gas and electricity through Austrian territory. This resulted in deliveries from Russia to Italy, France etc. via the "Trans Austria" and the "West Austria" pipelines. Further, Austria was also a founding member of the International Energy Agency.

Renewables play an important role to reduce the country's dependence on imported fossil fuels and to enable the reduction of greenhouse gas emissions. In 2012 the Green Electricity Act served as further incentive to expand the number of facilities producing green electricity. As a result, funding volume doubled to about EUR 50 million. An offensive designed to boost the share of electricity consumption generated by renewables to 85% by the year 2020, which is top performance when compared globally. Moreover, about 3,300 national experts focus on smart grids i.e. intelligent network management on the basis of modern information and communication

technologies. All Austrian households shall be equipped with intelligent meters, also known as smart meters, in the years ahead. Further, the city of Vienna ranks on the third place in the Smart Cities Index of the US-American climate strategist Boyd Cohen. The first plus-energy office building in Vienna with energy savings of up to 90 percent and sophisticated skyscraper faces ensuring perfect room temperature is one of several international acclaimed showcase projects.

These best practices testify the need for economic incentives and a long term legal framework to contribute to the energy transformation. Nonetheless, some parts of the Austrian economy will suffer financially. The environmental technology industry sector is more internationalised than the Austrian economy as a whole.

Due to its extremely high innovation potential, Austria is one of the leading countries in the field of environmental technologies. In 2011, Austrian green technologies were exported to 51 percent into third countries and 49 percent into the EU. In addition, Austria has a particularly high number of environmental patents and is, for example, successful in implementing ecological projects in the oil and gas industry. Austria is a respected pioneer in the field of renewable energies, a leader in solar and wind energy, hydropower, biomass and geothermal energy.

Around 80% of the electricity generated in Austria already covered by renewable energies. This puts Austria at the undisputed pole position among 28 Member States of the European Union.

Country report on energy efficiency and renewables in Austria

By DI Dr. Günter Simader, Mag. Gregor Thenius, and Christoph Ploiner, MSc., Austrian Energy Agency

OVERVIEW

In Austria, policies for energy efficiency and for renewable energy are mainly informed by the 20-20-20 targets of the climate and energy package. The 2008 Renewables Directive (RES – 2009/28/EG) and the 2012 Energy Efficiency Directive (EED – 2012/27/EU) establish a set of binding measures to help the EU reach its 20% renewables and energy efficiency targets by 2020.

The implementation of the RES directive in Austria means that the country has to increase its share of renewables to 34% of its gross final energy consumption by 2020. Increasing the share of renewables will be achieved by a set of measures including increasing the share of green electricity, bio fuels, and renewables in heating and cooling appliances both in residential and non-residential buildings.

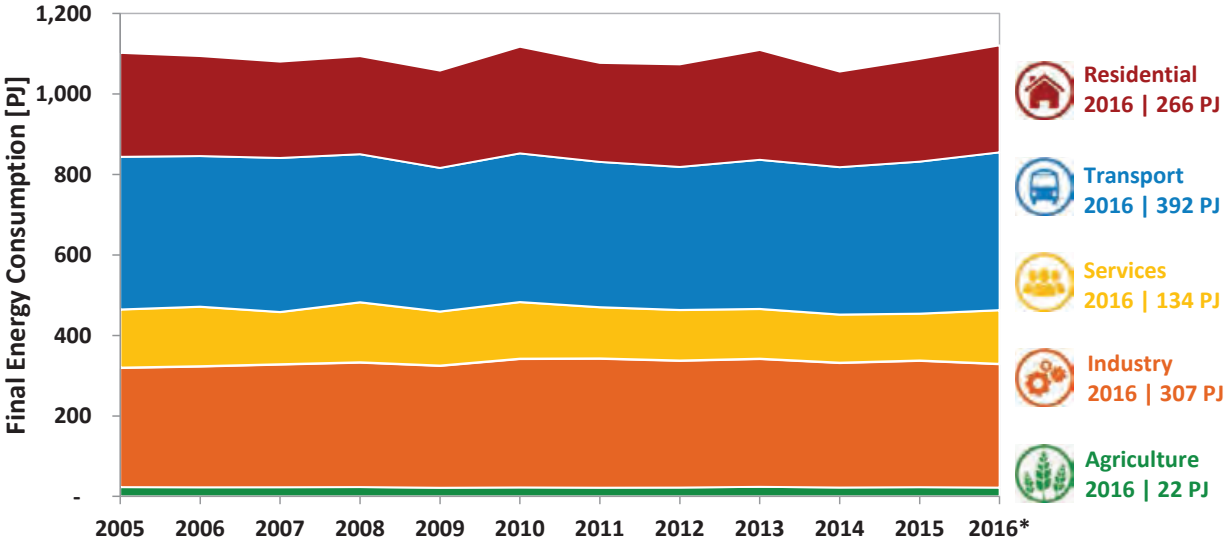
Increasing the share of renewables by different policy measures is only economically effective when the final energy consumption is decreased or at least stabilised in the medium term. These requirements have been incorporated into the Austrian energy policy (taking into account EU preconditions) by the Austrian Energy Efficiency Act that came into force in 2014. Within this act, Austria is increasing its efforts aiming to achieve a final energy consumption of 1,050 PJ by 2020. Furthermore, cumulative energy savings of 310 PJ have to be achieved till 2020.

These energy efficiency targets have to be accomplished, on the one hand, through an obligation scheme for energy distributors with a sales volume of more than 25 GWh to final energy consumers in Austria contributing with energy efficiency measures up to (cumulative) 159 PJ and, on the other hand, through so-called strategic measures by public authorities which have to account for up to (cumulative) 151 PJ till 2020. Strategic measures include energy taxes, corporate environmental protection subsidy schemes, refurbishment activities/ vouchers, housing and energy subsidies, etc.

AUSTRIA'S ACHIEVEMENTS IN INCREASING ENERGY EFFICIENCY AND RENEWABLES TILL 2017

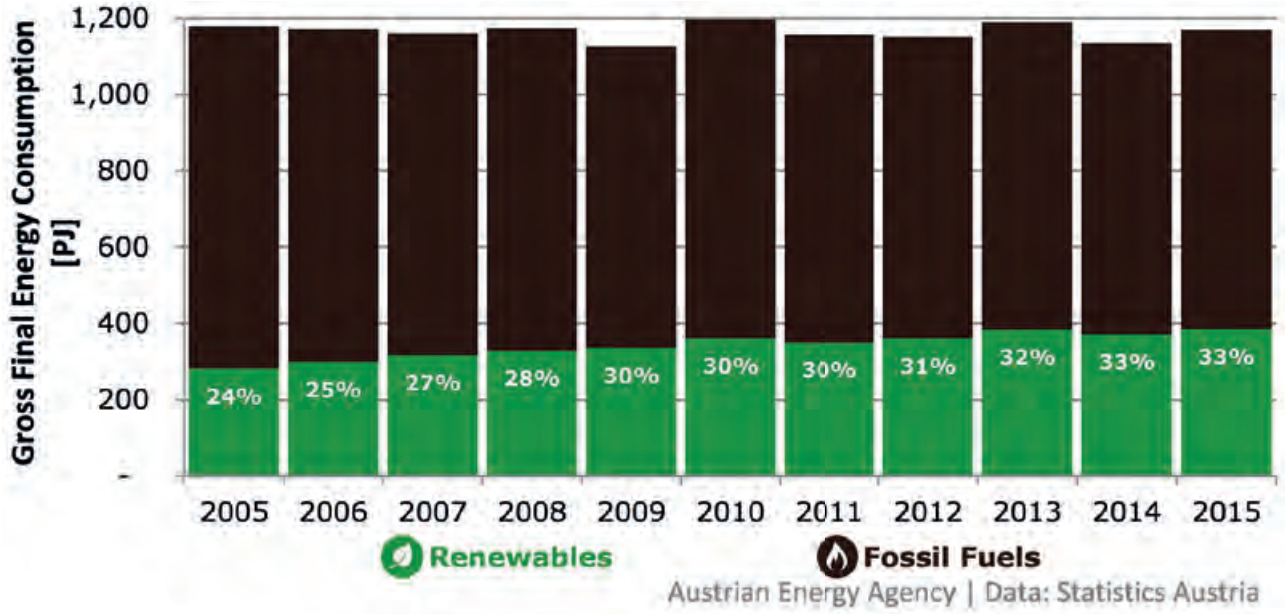
In 2015, the final energy consumption amounted to 1.087 PJ (see Figure 1), which obviously still exceeds the target

Figure 1: Development of the final energy consumption in Austrian sectors from 2005 to 2016 '2016' indicates preliminary numbers from the Statistical Office*



Austrian Energy Agency | Values for 2016 are preliminary| Data: Statistics Austria

Figure 2: Development of the gross final energy consumption and the share of renewable energy in the years from 2005 till 2015 (Source: Austrian Statistical Office, Austrian Energy Agency)



of 1,050 PJ that was set by the Energy Efficiency Act.

However, taking into account the final energy consumption of 1,087 PJ in the year 2015, the value of 1,050 PJ by 2020 seems to be achievable. Preliminary numbers reported by the Austrian Statistical Office indicate an increasing value up to 1,121 PJ in 2016 due to a cold winter in 2015/2016 and higher consumption rates in the transportation sector. Before the final confirmation of these numbers, further interpretations by the Statistical Office are not yet possible.

The measures increasing the share of renewables in Austria have been quite successful so far. From 2005 to 2015, the share of renewables could be increased from 23,9% in 2005 to 32,8% in 2015 (see Figure 2). Taking into account the present frame conditions, it is expected that the 34% target in 2020 will be achieved by Austria.

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Austrian Energy Agency
The Austrian Energy Agency provides answers for the future of energy. We provide scientifically founded advice for decision-makers in politics, business and administration. Our strategic focus is on achieving a fossil-free future, shifting the energy system towards smart energy, and supporting the resulting transformation of energy-related industries. Our focus lies on promoting energy efficiency and renewable energy sources between the poles of competitiveness, climate and environmental protection, and supply security.

The Austrian Energy Agency is active at the national and international levels. It develops strategies for sustainable and secure energy supply, provides advice and training, and is the networking platform for the energy industry.

Web: www.energyagency.at

Twitter: https://twitter.com/at_AEA

City Digital Profile – for integrated urban innovation

By Paul Copping, Chairman ETSI ISG "City Digital Profile" and Chief Innovation Officer, Digital Greenwich

Digital Greenwich (www.digitalgreenwich.com) is involved in a city test bed which operates on open standards and brings together around a dozen projects in mobility, energy, communications and social care. Many of these are supported by research funding from the H2020 programme and Innovate UK – and we also undertake private consultancy for cities and industrial partners through our subsidiary DG Cities Ltd.

Greenwich, the home of Greenwich Mean Time (GMT), is one of 32 London Boroughs and has a population of 275,000 people. Greenwich also has a long history of industrial innovation through its past history.

Digital Greenwich is active in international organisations, including ETSI. Recently I have helped establish a new Industry Specification Group at ETSI called "City Digital Profile" (CDP) which sets out to engage city leaders in developing an overall roadmap for smart city development. Our scope is the entire technology stack which supports a smart city. We were invited to set this up because ETSI was being asked to provide design guidelines at a higher level than are typically addressed in the telecoms industry.

ETSI CDP initiative differs from other city networks and related projects. To explain it with a metaphor CDP is to liken city leaders to householders who feel it is time for a new kitchen. When you want to buy a kitchen there is a choice of showrooms and modular products which can easily be configured because they use standard size cupboards and drawers, standard appliance apertures, power supplies, plumbing and so on.

By comparison, when you want to buy supplies for a smart city, your option is pretty much a custom build – the equivalent of selecting each component and sub system for your kitchen. It's rather like deciding you want an icemaker in the fridge/freezer – and then being asked what size water pipe you want and where you want it to be connected to the mains. Actually, you just saw the icemaker in a house down the road that you liked and you want that one but maybe you want to change out a halogen hob, add a waste disposal unit, choose different lighting… and so on.

If you are a city leader, out shopping for a smart city, what options appear in the energy section? You know your citizens and businesses will certainly want a standard resilient power grid with smart meters - so you want some sort of network interface to these meters which should ideally be used for other services too - and maybe you are aware that you will need a whole load of Electric Vehicle charging capacity on top. Maybe you also want to add some renewables, a Strategic Energy Management System, a district heat pump and some adjustable street lighting that works intelligently. Since you expect your "own use" city fleet will have more EVs than anyone else in town you would also be glad to use them for resilience - and maybe make money back - on a Vehicle To Grid (V2G) project.

As a city leader you also want the options of the Internet of Things and improved wireless connectivity therefore you are going to have a lot more data available to run all this. You are then thinking in terms of developing a city control centre, supported by a city insights team. You have heard that Digital Ledger Technology may help you to manage this information, keep it secure and reduce transaction costs so you have ticked that box too.

In Greenwich we are in the middle of a smart city build along these lines – and we are very fortunate to be members of a Horizon 2020 Smart Cities and Communities Lighthouse project called Sharing Cities. We represent London and we are working together

with leading cities Milan and Lisbon, and fellow cities such as Bordeaux, Warsaw and Burgas. Together we are developing an integrated response to the challenges we all face, including the European decarbonisation targets. We are exploring a wide range of energy related initiatives including shared electric vehicles and e-bikes, a district heat pump and smart lighting. By sharing our experiences we hope to make better decisions and reduce our entry costs.

Other smaller projects are also suitable for sharing. For example, with separate funding from Innovate UK, we are working with Magnetic Systems Technology Ltd (www.magtec.co.uk) retrofitting a 26 tonne Refuse Collection Vehicle with a fully electric drive train, bin hoists and compactor. This will have a 300 kWh battery and work for a 14 hour shift without recharging. We are proving the concept and seeking encouraging full commercial production in time for a renewal of our fleet of 36 vehicles in 2020. We are keen to share this experience with other cities.

Our work at the ETSI City Digital Profile ISG seeks to facilitate more of this sharing by providing easily replicable guidelines which are compatible with collaborative procurement frameworks. The key development we are experiencing here is that the domains of energy, mobility, communications, sustainability and so on are rapidly converging through use of shared management infrastructure. Increasingly we can set protocols to manage interactions based on real time data for building management, energy storage or air quality.

We are currently inviting more cities and places to join us alongside our founder members. We are well supported by industrial members but there will always be room for more, particularly energy industry participants, whether corporates or SMEs, so please join us and contact isgsupport@etsi.org.

Paul Copping is Chief Innovation Officer at Digital Greenwich, serving the Royal Borough of Greenwich, population 270,000. His role is to engage with industrial partners to deploy integrated technology solutions that will result in more innovative, agile and cheaper services for Greenwich citizens. Paul is currently working on connected and autonomous vehicles; 5G wireless; and a collaborative smart city procurement framework. Paul has an MBA in Marketing from Cass Business School and an MA in Spanish and French from the University of Cambridge. His earlier career background is in telecoms (Nortel, BT) and mobility (Transport Research Laboratory) with a focus on corporate development and innovation management. He is a Director of the City Protocol Society and the Chairman of "City Digital Profile" – a new Industry Specification Group at ETSI.

The Data Rush: towards an energy efficient Europe

By Roberta D'Angiolella and Cosmina Marian from the Buildings Performance Institute Europe

Having the right set of data when designing or renovating a building can be the decisive variable for the success of the project. Easy-to-access, transparent and trust-worthy data is indeed useful for a range of actors. For the building manager, to ensure that a building is operated in the most energy efficient way possible, respecting the original design. For the building designers, to understand the actual performance of buildings and their technologies once they are operational.

For the decision makers in the building sector, who require high-quality data in order to allocate resources to the most cost-efficient option. Last but not least, different other stakeholder groups, such as financial institutions, require information that can support informed decisions (i.e. green loans).

THE DATA GAPS

Despite the importance of having solid and transparent information, the building sector still has to fill many data gaps. For example, the many projects on energy efficient buildings financed every year by the European Union often include demo cases used to prove the effectiveness of new technology solutions or designs. However, the output data is not centrally collected. Most of the time, the information is lost

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once the project is closed, hindering dissemination of good practices or lessons learnt, preventing feedback into policy processes and leading to double efforts when a new project is launched.

When designing buildings, transitioning from theory to practice is more difficult than expected: the design is often based on simulations, and when the building is finally operational, there is very little feedback on the theoretical principles.

This leads to the application of techniques and approaches that, despite being theoretically sound, they are also repeatedly badly implemented, due to lack of constructive feedback.

Even the central source of information on the energy performance of the EU building stock, the Energy Performance Certificates (EPCs), are not always reliable, because some European countries still lack central databases, and where they have them, these are not necessarily publicly accessible. To add on that, citizens have justifiable privacy concerns. Data should be collected and stored while respecting EU data protection requirements.

FILLING THE GAPS...

When it comes to solutions, big steps ahead are being made by several initiatives. One is the Buildings Observatory, launched end of 2016 by the European Commission in an effort to mirror the state of the European building stock. Another interesting initiative is the ExcEED project, whose aim is to create a European database for measured and qualitative data on beyond the state-of-the-art buildings and districts.

... WITH A BUILDING PERFORMANCE MONITORING PLATFORM...

The EU Building Stock Observatory monitors the energy performance of buildings across Europe. It assesses improvements in the energy efficiency of buildings and impacts on the actual energy consumption of the building sector. The Observatory tracks many

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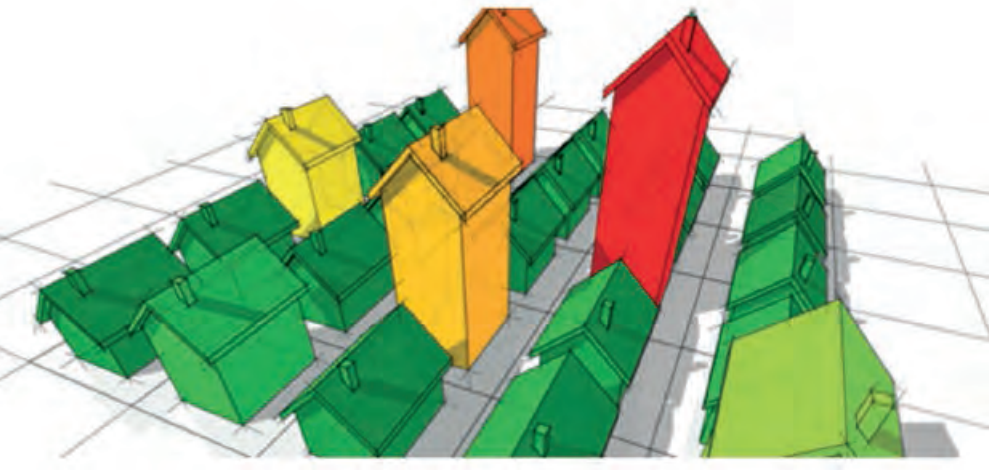
different aspects including energy efficiency levels in buildings at country and EU level, financing possibilities for renovation and energy poverty levels across the EU. The Buildings Observatory managed to gather data from various sources, like EU projects, national statistics, EPC databases, cities' sustainable energy action plans, and industry data. With the multiple sources implemented, the Building Stock Observatory allows for a neutral point of view on data gathering reducing the risk of biased data or false information.

...AND A EUROPEAN PROJECT WITH A KNOWLEDGE DATABASE

While the Buildings Observatory contains data on a wide range of buildings, the Exceed project focuses on a specific category: newly constructed buildings. The "European Energy Efficient building district Database" promises to establish a robust and durable return of knowledge mechanism collecting actual energy performance data. ExcEED provides information to different players, bringing added value in different fields. For example, designers can test their work with regards to a possible performance gap, energy managers can have a better overview on the overall building and its energy efficiency, while policy makers can better guide their work with geo-localised information.

The database will gather and categorise diverse data coming from different sources, including building monitoring systems, projects, building managers, public authorities, other European databases. The innovation lies in the fact that part of the information will be gathered from Indoor Environmental Quality (IEQ) surveys, developed by the projects itself to integrate the point of view of the occupants.

EU Building Stock Observatory



THE STEPS FORWARD

The initiatives named above show that the EU is taking steps in the right direction. At the same time, the gaps in the data collection process prevent a smoother and faster transition to more efficient buildings, because of biased, incomplete or unavailable data.

Other steps forward are therefore needed. Further technical progress in the field of ICT is extremely helpful. Publicly accessible central databases to collect information and redistribute statistical data should be made available. The aggregated data should also be anonymous, in order to comply with the EU data protection requirements.

To provide much needed data and help increase transparency on the use of public funding, these central databases should be also filled with information coming from Energy Performance Certificates and all publicly funded projects. To do so, EU legislation should require every Member State to establish a national database for registering EPCs.

With a smoother and easier process of data collection, coming from the establishment of central, public and reliable databases, the projects dedicated to making the building stock in the EU more efficient could accelerate and therefore proliferate. In particular, the creation of a publicly available EU database collating anonymised national data would help the European Union to better assess the situation of the building stock and take proper action to reach its local and global energy climate targets.

The SOTHERCO project: a step further towards autonomous solar buildings

By Marc Frère (University of Mons – Belgium), Gilbert Descy (BE-SOL – Belgium)

During the last decade, Solar Thermal Systems suffered from a lack a public support while such systems are mature for domestic hot water production and could be used for solar cooling. Could Solar Thermal Systems know a new golden age when applied to space heating ?

Such a question is challenging as in the major part of Europe, the efficient harvesting of solar energy and its conversion into heat takes place during summertime while heat demand for space heating occurs mainly in wintertime. There is thus a need for technologies able to store large quantities of thermal energy during summer (a few thousands of kWh per dwelling in Northern and Central Europe) in a reduced volume and without losses so that this energy could be efficiently recovered during winter.

The SOTHERCO[1] project consortium, granted by EU within the FP7 framework, worked on that question and is now delivering its results and conclusions[2 3 4] after more than 4 years of R&D activities. The consortium worked on the concept of thermochemical storage (heat storage using a reversible chemical reaction) and tried to bring technology solutions up to a TRL equal to 5-6 in order to lay the foundations of future demonstration projects. Solutions had to be brought (i) at the reactive solid level (cost effective, long-term stability, high energy density), (ii) at the reactor level (simple conception, compactness, enhanced heat and mass transfer to reduce the gap between the energy density at the reactive solid material and at the reactor levels and (iii) at the system configuration level (efficient connection of all the components). Six new reactive solid materials were synthesized, four reactor technologies were investigated and two system configurations were proposed. Best in kind solutions (one material, two reactor technologies and the two system configurations) were tested in relevant environment at a scale of a few hundreds of Watts (in between lab scale and real scale). Energy

SOTHERCO test bench for seasonal heat storage technologies

densities around 150 to 190 kWh/m^3 (an order of magnitude higher compared to seasonal heat storage in the ground) and specific thermal powers of around 100-150 W/kg of reactive solid material were reached. Considering the best combinations, it was found that the complete covering of the heat demand (space heating) of a building using solar energy is possible provided very low energy (passive) houses are concerned with a restriction for very cold climates. The question whether such a target (solar coverage corresponding to 100% of the heat demand) makes sense economically is still pending. However, technically, real demonstration case studies could be developed in the next years. Application to less performant buildings needs further developments and must be probably considered with a reduced solar coverage ratio of the need.

Contact details:
info@be-sol.eu
marc.frere@umons.ac.be
http://sotherco.eu/

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What Building Stock by 2050?

By Adrian Joyce (pictured), Secretary General, The European Alliance of Companies for Energy Eficiency in Buildings

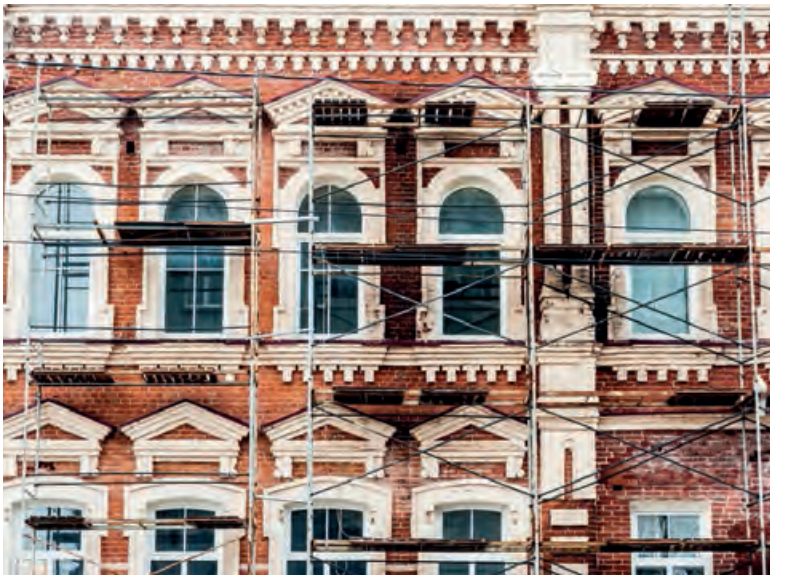
Futurists are concerned with projecting how our societies will be in the distant future, and 2050 is a favoured horizon for their writings. They describe scenarios of autonomous robots and flying cars. But how would we like our building stock to be in 2050? After all, it comprises our schools, our workplaces and our homes in which we spend around 90% of our time!

My vision for the future of our building stock will not feel futuristic to readers as it is based on knowledge of how static a sector the construction sector has been in the past. So before I set out that vision, I would like to remind readers of some basics in relation to the building stock in the EU.

There are around 210 million buildings in the EU with a heated and/or cooled area roughly equivalent to the size of Belgium. These buildings consume around 40% of all primary energy in the EU and emit over 36% (some studies now suggest 40%) of energy-related CO_2 emissions in the EU. The vast majority of these buildings were built before there were any energy-related building regulations in force across the continent and today's rates of construction activity are low. It is estimated that the rate of new building is less than 1% and that the rate of renovation is just about 1% across the EU as a whole. Finally, the demolition rate of buildings in the EU hovers around 0.15%.

Putting these statistics together we can see that if these rates of activity continue over the next 33 years (and they have not changed significantly in the last 33 years!), then more than 95% of the buildings standing and occupied today will still be standing and occupied in 2050, although they will then constitute about 75% of the total building stock. The new buildings to be built in the period to 2050 are required by EU law to be nearly zero energy buildings, but it is not clear that the Member States have prepared in time to meet the impending deadlines for the introduction of regulations that will require all substantially completed new buildings from 1st January 2021 to be nZEB.

Turning to a topical and important subject – the Paris Agreement on Climate Change – we can see that our political masters have woken up to the gravity of our collective impact on the Earth, the source of all the goods that we need for well-being, by the signing of a truly ambitious objective for 2050. That objective is to keep global warming to well below 2°C above pre-industrial levels. To achieve such an objective, we will have to reduce our greenhouse gas emissions to practically zero by 2050 and transition our societies to low-carbon societies.



A key sector to be addressed – due to its high energy consumption – is the buildings sector, and we must collectively agree on what to do with our buildings and how to go about it. For this, the setting of a vision for the building stock for 2050 is essential as it can act as a beacon for action, motivating the creating of coherent strategies and giving confidence to market actors who will be the main drivers of change in the intervening period.

The vision that I have for 2050 is a building stock that is firstly highly energy efficient, providing quality, healthy environments for occupants and that are resilient to the effects of climate change.

Putting energy efficiency first will lead to a dramatic reduction in the overall energy demand of the building stock. This means that supplying the remaining energy demand will be easier and more cost-effective. In fact, it will be beneficial for the renewable energy sector as a broader range of renewable technologies can be deployed to meet a reduced energy demand and the share of renewable sources in the overall energy mix will increase more rapidly as energy demand goes down.

But getting from where we are today to the achievement of the Vision 2050 outlined here is truly challenging. It will require a range of structural changes in policy, in the construction sector and in society at large and will not be achieved without significant innovation along the way.

To highlight a first, obvious, challenge: How can we accelerate the energy renovation rate of the building stock in the EU whilst ensuring that all renovations capture the full energy savings potential tied up in our buildings? In my view, this can be significantly assisted by the adoption and implementation of ambitious energy renovation strategies in the Member States. The preparation of such strategies is already a requirement under EU directives, but their implementation is not – a situation that may change in the coming months as the EU provisions are under review and the European Parliament has tabled proposals that significantly strengthen the requirements on renovation strategies.

A second challenge to be faced is how to increase the market uptake and quality of energy renovations at the same time. This challenge has been taken up in the market and one of the most successful and impressive examples can be found in the Netherlands, where the energiesprong approach (also known as nul op de

EuroACE
THE EUROPEAN ALLIANCE OF COMPANIES FOR ENERGY EFFICIENCY IN BUILDINGS

meter) has been developed and rolled out. It is an innovative approach where customised pre-fabrication of wall and roof elements with fully integrated heating and ventilation equipment, together with solar panels, can be installed on-site in just one day, meaning that disruption to occupants is fully minimised.

An advantage of the Dutch approach is that much of the work is carried out in factory conditions, increasing quality and making work in the construction sector more attractive to younger generations. It is an approach that relies heavily on advances in information and communication technologies and in automated fabrication, thus making it easier to reduce waste whilst increasing the efficiency of resource use.

In conclusion, if we don't set a 2050 Vision of a highly energy efficient building stock and simultaneously start to roll out new innovative approaches to achieving that vision on the ground, we will not achieve our collective 2050 climate goals and thus run the risk of degrading the quality of life in the EU for current and future generations.

Connecting the cities of the future

By Anna Lisa Boni (pictured), secretary general, EUROCITIES

The cities of the future will have a strong citizen focus. People will be empowered to make their city more efficient and inclusive. At EUROCITIES, our network of over 140 major European cities is connecting cities for a smarter future.

Smart cities use knowledge of local situations to tackle common urban challenges, while making efficient use of resources. Good governance is critical to success.

At EUROCITIES we work at different levels to ensure that smarter city developments are city-led and citizen focused. By linking together public and private sector partners at the local and international level, and working across different sectors, our members aim to add economic and social value to smart city projects. Through our role in the European Innovation Partnership action cluster on business models, financing and procurement, we try to ensure that cities' realities are kept front of mind when looking for smarter solutions.

We underpin this work through several EUROCITIES-led initiatives, including the Green Digital Charter, and EU funded projects, such as CityKeys and Sharing Cities.

TRANSFORMING URBAN HORIZONS

The strength of our Sharing Cities project is in working with citizens and sharing and replicating results between cities. In Sharing Cities, EUROCITIES is leading on replication efforts and ensuring a good quality exchange between cities. Three 'lighthouse' cities (London, Lisbon and Milan) have partnered three 'fellow' cities (Bordeaux, Burgas and Warsaw) to share ideas on how digital, energy management and e-mobility solutions can be integrated into complex urban environments. Through our replication efforts, cities can exchange and learn from each other in different formats such as peer learning, work shadowing and mentoring. This exchange happens at both political and technical level.

Lisbon recently hosted Bordeaux in a work shadowing visit. While technological solutions are most often touted as the key enablers of smart city success, our experience shows that it is a means rather than an end, and embedding new ways of thinking is just as important. Learning to collaborate across city departments, breaking down siloed work practices, and including citizens, is helping

Bordeaux to implement a more holistic vision for its future. Developing the political leadership, and willingness to change course is key to unlocking good governance.

Our CityKeys project, which focussed on measuring the performance of smart cities to support better decision making, offered a new way of working together with cities. In developing a common framework that allows cities to check whether their smart city project is reaching its goals, and compare it to other examples, we worked together with many cities, and citizens, to ensure that we offered something people truly wanted. Our indicators are now being used to benchmark the development of smarter urban solutions.

The Green Digital Charter, initiated by Manchester, shows that you can have growth that is smart and inclusive as well as sustainable. The charter commits 53 cities to work together to reduce their carbon footprint through the use of smarter technologies that improve people's lives. It matches the commitments of the Covenant of Mayors and reflects most Europe 2020 priorities.

LONGER TERM AMBITIONS

The cities of the future will rely on data, so opening up data is an important initiative that brings with it new challenges. How we use open data for better decision making, while protecting privacy, is one such challenge. Stockholm realised that even when collecting data on how people move around in an event area, the city may still have to take leadership to structure traffic flows and make sure the right audience is reached – such as giving direction to crowds of people at a concert. At the same time, people have to have better knowledge about how to manage their personal data online.

To share learning between cities and open up opportunities for businesses, we are working towards creating common standards and better interoperability between systems. Bordeaux, a member of EUROCITIES Knowledge Society Forum, leads our work in this area. This year we prepared a guide on standards and interoperability for Members of the European Parliament to explain why this is important. Because smart cities work on a holistic approach to urban planning, we need access to open and usable standards that will encourage city administrations and businesses to commit long term to creating the cities of the future.

Tackling the broader challenges goes beyond local competencies, and connecting the local with national and European level is key. An ongoing open dialogue between cities, member states and EU policy makers would help to scale up local smart city innovation projects to the national and European level. The urban agenda for the EU provides an important framework and the tools to facilitate this cooperation among the different levels of government. It emphasises the partnership approach and ensures cities are more involved in the development and implementation of EU policies with an urban dimension.

EUROCITIES has been working at the local and international level for many years to ensure that smarter city developments are city-led and citizen focused. By listening to our citizens and sharing the best practice of our members, we can connect the cities of the future.

EUROCITIES is the network of major European cities, with over 140 members, representing more than 130 million people.

Domestic appliances and energy efficiency

By Paolo Falcioni, Director-General of the European Committee of Domestic Equipment Manufacturers (CECED), the voice of the home appliance industry in Europe.

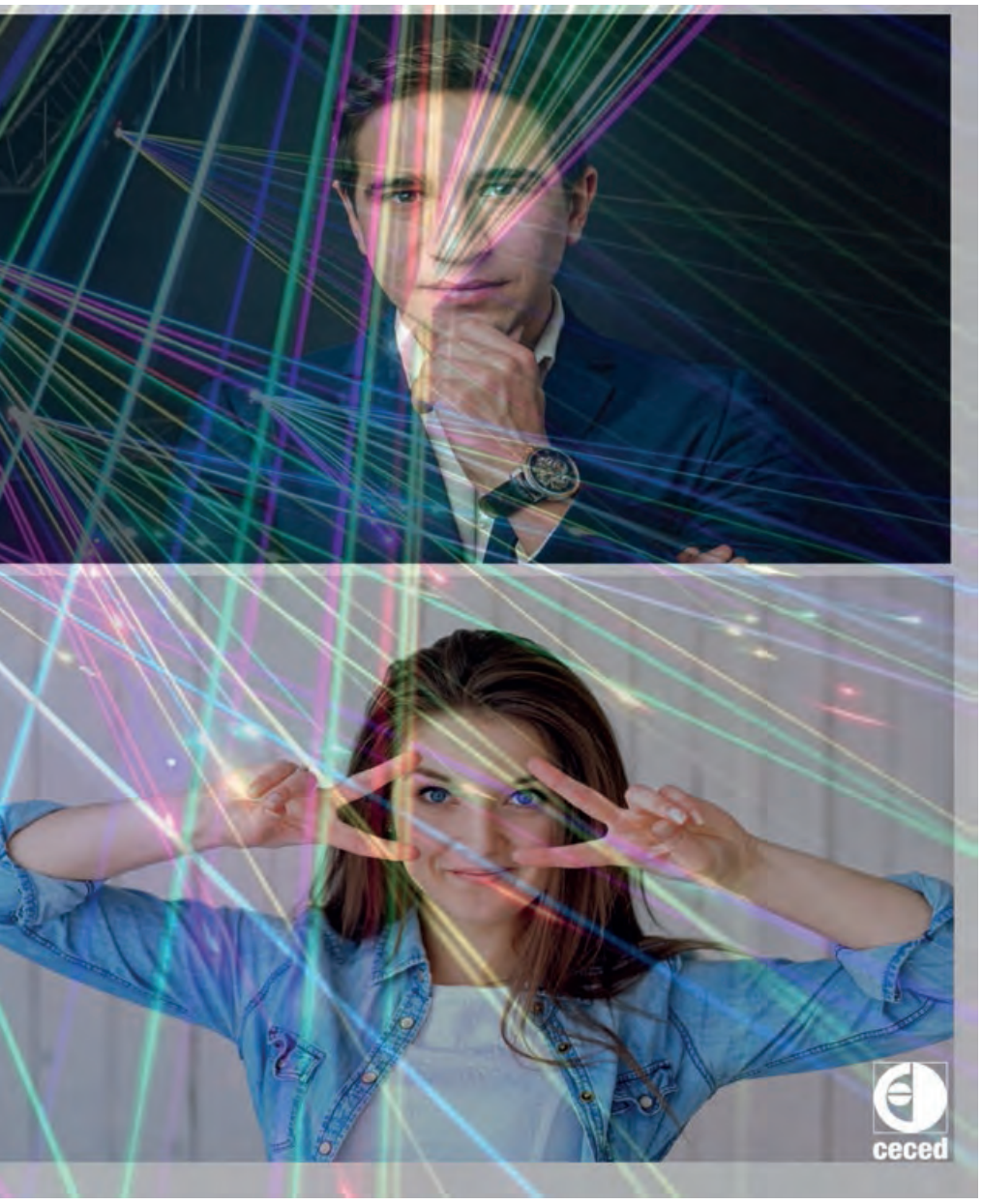
SUPPORT OUR GRASSROOTS (R)EVOLUTION

Sustainability starts at home. For several years now, CECED has been highlighting how the home appliance industry in Europe has been making its important contribution to the European Union's aim of decoupling growth from its environmental impact. On one hand, the industry supports Europeans and their desire to enjoy a comfortable life style as they go about their daily lives; while on the other, new innovative approaches to appliances drive down the impact of that lifestyle. Put simply, consumers use less energy to operate their appliances than they did just a couple of decades ago. A latest generation top-of-the-range refrigerator available on the European market consumes just a quarter of the energy of one placed on the market twenty years ago; the drive for energy efficient dishwashers means that in 2013, more than 75% of all dishwashers placed on the market were placed in the top classes of the energy label.

CECED's dishwasher campaign (#Dishwasher4All) shows how better Europeans would do in developing their sustainable lifestyles if all moved away from washing the dishes by hand and used a dishwasher. Some of the stats are staggering: a whopping 63.6% reduction in the energy consumption of a dishwasher has been secured thanks to the innovative efforts of engineers working in the home appliance sector.

CECED continues to stress that policy makers at European or national level need to do more to ensure the uptake of the latest innovative equipment in households. The technology needs better deployment. 500 million

consumers, 200 million European households all equipped with the latest energy and resource efficient technology is our positive vision.



The future is looking even brighter. With a focus not only on energy efficiency but, with the help of innovative smart technology, a move to appliances that help manage the demand and supply of energy and, when possible, tap into cleaner renewable energy when it is available.

Something of an innovative energy revolution is coming. Consumers, empowered through the new smart and innovative home appliance technology, are becoming energy actors, doing their bit to not only drive down energy consumption but helping to avoid blackouts at times of peak demand and using up cleaner, unstorable renewable energy as and when available.

Our industry is championing a future EU energy policy that is consumer driven and recognises the potential valuable contribution Europeans, as consumers, can make if they are connected.

It is often said that we need a citizen's Europe where people feel engaged. Our industry is offering a template for its deployment, on the ground. A smart template that channels our sector's contribution towards generating all the big things Europeans need: jobs, growth, wealth, sustainable development. A project supported by the grassroots. From within the home. I start as I finish, at home, completing the circle from my origins. Sustainability really does start at home.

Overview of CCS activities in Europe

By Francesco Corona

CCS STATE OF PLAY IN EUROPE

The status of Carbon Capture and Storage (CCS) in Europe has been significantly changing in the past two years. From a mainly power sector CO_2 emissions reduction technology, CCS has grown to be recognised as the only sensible and sustainable way of addressing emissions across Europe's diverse industrial sectors.

The global CCS fleet counts 17 large-scale facilities already operating and four coming on stream with an overall CO_2 capture capacity potential of 37 million tonnes per annum (Mtpa), which is equal to have 8 million cars removed from the road each year. In Europe the two operating CCS facilities, Sleipner and Snøhvit, located in the Norwegian part of the North Sea, have exceeded 23 million tonnes of CO_2 captured and stored in the 20 years up to 2017.

CCS has a great potential to contribute to the Paris Agreement targets, which would require having approximately 120 thousand Mtpa of CO_2 captured and stored at global level between now and 2050. As stated by the International Energy Agency (IEA), carbon capture and storage should contribute to reducing European CO_2 emissions by 21% in 2050.

Notwithstanding the crucial role CCS has as climate change mitigation technology, its large-scale deployment in Europe has been very slow, mainly due to a series of policy reversals and the failure of several large-scale facilities to reach a final investment decision.

If CCS has not yet enjoyed success in the power sector, a strong potential lies in tackling industrial emissions from steel, cement, chemicals and gas refining plants. Few CO_2 reduction alternatives are available to decarbonise such industrial sectors and CCS represents the best cost-effective option.

These initiatives together with additional technology improvements are explained in the following sections.

LARGE SCALE CCS FACILITIES

Five large-scale CCS facilities are in operation or development stage in Europe, all of which use (or intend to use) dedicated offshore geological storage. As mentioned above, Norway is home to the two operational large-scale CCS facilities in Europe both in natural gas processing, which combined have 30 years of operational experience.

The first full chain Industrial CCS facility is also being developed in Norway and is based on the feasibility studies completed by Gassnova (Norwegian state enterprise for CCS) for the Norwegian Ministry of Petroleum and Energy in 2016.

In April 2017, Gassnova awarded the three industrial emission sites that participated in the initial feasibility study – Norcem AS (cement plant), Yara Norge AS (ammonia plant) and Klemetsrudanlegget AS (waste-to-energy-recovery plant) – with financial support to further study carbon capture at their respective facilities.

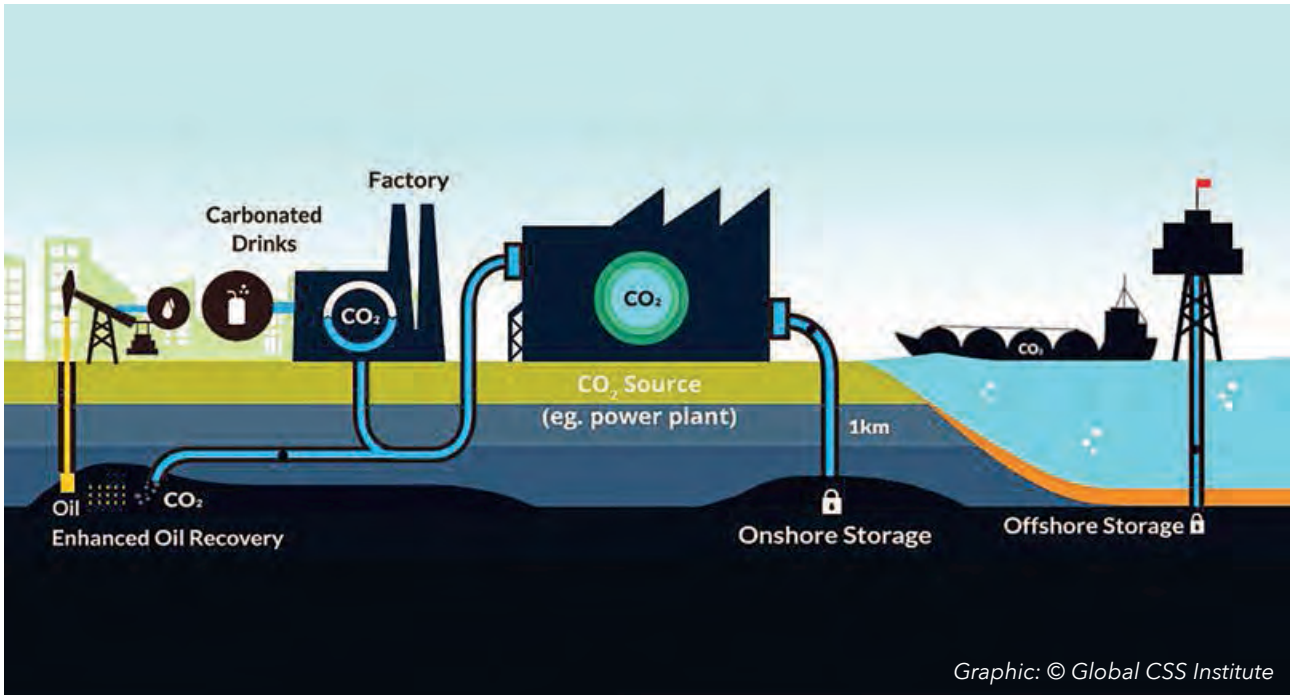
A total of 360 million NOK (€40 million) has been granted to continue the studies of full-scale demonstration

plants for CO_2 capture. The conceptual studies will optimize the technical solutions as well as reduce risk and establish more precise cost estimates for the projects. The aim of this work is to establish a basis for an investment decision in 2019. The potential CO_2 capture capacity of the three facilities would be approximately 1.3 Mtpa in full operation.

The United Kingdom hosts the two other proposed large-scale CCS plants, both in the initial stages of development. Located near Grangemouth, Central Scotland, the Caledonia Clean Energy project involves the construction of a new natural gas feed power plant with post-combustion CO_2 capture capacity of approximately 3 Mtpa.

The Teesside Collective is a cluster of leading energy-intensive companies

Photo: © Teesside Collective



Graphic: © Global CSS Institute

with the common goal of establishing the UK's first CCS equipped industrial zone in the Tees Valley, North East of England. This consortium of industries plans to develop a facility with an initial CO_2 capture capacity of approximately 0.8 Mtpa with a long-term target of 10 Mtpa.

SMALL-SCALE FACILITIES

CCS development benefits from several CCS small-scale facilities across Europe.

In addition to the two large-scale CCS facilities the UK will most likely host the Acorn project, which foresees the development of a minimum viable full chain industrial CCS plant. Located in North East Scotland the projects seek to initiate CCS in the UK by repurposing or rebuilding an existing CO_2 capture plant at the St Fergus gas processing facility.

In May 2017 the Acorn project was awarded Horizon2020 funding under the Accelerating CCS Technologies (ACT) Programme in addition to Scottish Government support. As most of the infrastructure already exists, the project developers plan to start CO_2 injection into the storage offshore site from as early as 2021/2022.

R&D activities are also making a significant contribution to CCS technologies understanding in industrial application and in cost reduction studies – e.g. the LEILAC and CEMCAP projects work on CO_2 removal improvements at cement plants.

Finally, while the formal cancellation of the ROAD project in Rotterdam has been a significant set-back for the city's climate ambitions, the Port of Rotterdam is developing a "backbone" infrastructure that would allow CO_2 to be transported from the port area to the storage site off the coast of the North Sea.

CCS & HYDROGEN TECHNOLOGY

Hydrogen as a potential emission free fuel for industry, transport and heating, is gaining momentum in the UK particularly. In the Netherlands, Statoil, Vattenfall and Gasunie are studying the possibility of converting Vattenfall's gas power plant Magnum into a hydrogen-powered plant, which would potentially reduce four million tons of CO_2 per year. The advantage application of CCS to hydrogen generated from coal and methane (natural gas) creates no CO_2 emissions.

CONCLUSIONS

After a period of stasis, the CCS sector has emerged again and can potentially provide the much-needed decarbonisation Europe has committed to achieve in the next decades, especially when applied to industrial clusters. For CCS technologies to make their contribution to the climate change fight, European countries should build "CO_2 transport and storage infrastructure, critical to unlocking large-scale CCS deployment". To do so, much more policy support is needed to back CCS, especially by the EU Member States. While the second round of Nationally Determined Contributions (NDCs) expected in 2025 will be a critical decision point for governments to review their commitments, action to foster CCS development must be taken now otherwise the deployment might at such a late stage would make it extremely expensive to reach the Paris climate goals.

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