AUTUMN 2021

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Connecting Europe's Stakeholders in Energy and Transport

EU SUSTAINABLE ENERGY WEEK

DELIVERING ON THE EUROPEAN GREEN DEAL

DRIVING THE ENERGY TRANSITION

ENERGY RENOVATION

Includes editorial contributions from:

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Kadri Simson
European Commissioner for Energy

Morten Helveg Petersen
MEP

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Foreword

Rossby waves, heat domes and a black summer.

Two major international events dominate our community this Autumn: COP 26 and EUSEW; and we are very proud once more to be chosen as a media partner of EUSEW. Both events have adapted to one existential threat, both confront another. The danger posed by the SARS-Cov-2 may be receding because of vaccination, but the threat posed by climate change most assuredly is not. COP 26 will assert that it is the greatest risk facing us all, while EUSEW is working towards reshaping the entire European Energy system by 2030.

With that in mind, we are delighted that Commissioner Simson writes in this issue – and that her theme is delivering the Green Deal. Commenting upon the new Climate Law and its climate-neutrality requirement, she tells us that the paradigm has changed from questioning if we should set a bold target emissions target to considering how it may be achieved. She also outlines greater ambition on carbon pricing and in renewable energy and energy efficiency targets. Underpinning all this is a strong commitment to vulnerable consumers.

These words are timely: Adel El Gammal sets out in stark and compelling detail the gravity and urgency of the situation we face. Fortunately, he also suggests potential escape routes: the fundamental reappraisal our energy and economic systems outlined in the IEA Net Zero Report and the transformation of our innovation capacity. "Our planet is burning and drowning" he says, "Science provided the technologies, experts a credible transformation roadmap. Now politicians should deliver. Immediately and fast. Very fast."

Prosperity through energy renovation: with this more encouraging title, Adrian Joyce discusses the significance of Europe's buildings on its energy budget. With the sobering statistic that 97% are energy-inefficient, he concludes that if the continent is to realise its ambition of being the first climate-neutral region in the world, its adoption of ambitious Climate Law must be backed up by addressing energy efficiency. This requires a modernised and ambitious approach to decarbonising buildings – and funding such as that opened up by the €672 billion RRF.

Commenting on the "Fit for 55" policy framework, aimed at a 55% reduction in emissions by 2030, Patrizia Toia MEP discusses batteries and transport electrification and the need for increasing investment, before welcoming a more holistic approach to legislation, because, as she observes, "We need more ambition".

Morten Helveg Petersen MEP makes a welcome return to these pages. Writing "As we look towards reshaping the European energy system, we best make room for offshore renewable energy", he sets out the case for maximising this resource. Noting that it's not just for the windswept waves of the North Sea, he observes that it is imperative to improve the development permitting process, and challenges an existing paradigm by suggesting that instant permits should be considered. He also suggests the rules regulating the energy markets need a tweak, though stressing the importance of the right balance between the interests of local actors and the overriding imperative to roll out RE.

Vincent Berrutto explores how three Ds – decentralisation, decarbonisation and digitalisation are reshaping European energy strategy towards an RE-based system based more on more electricity, efficiency and improved use of infrastructure. Key to this is digitalisation – and the pandemic has shown the way to greater reliance on telework, telestudy and teleschool – the three Ts. As ever, EUSEW is an excellent starting point!

A so-called Rossby wave in the atmosphere transformed rainfall over Japan into the lethal heat dome over North America; the Australian wildfires of the so-called Black Summer emitted nearly twice as much CO_2 in three months as that country's annual emissions from fossil fuel consumption, or about one year's global emissions from air travel. Meanwhile, the catastrophic floods in Europe had their counterpart in China when a year's worth of rain fell over Zhengzhou in three days. Climate records are being broken all over the globe, and the margins by which they are being broken are increasing.

Food for thought, indeed. Unpalatable though it may be, it must nevertheless be digested if it is to be acted upon.

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

Michael Edmund, Editor

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Delivering on the European Green Deal

By Kadri Simson, EU Commissioner for Energy

This year's EU Sustainable Energy Week (EUSEW) takes place at a moment of profound change. The European Commission under President Ursula von der Leyen made clear from the day we took office that the European Green Deal and the fight against climate change was the overarching political priority of our mandate. Our long-term ambition is to achieve climate-neutrality by 2050 and make Europe the first "net zero" continent. But in order to achieve that objective we have to shift gears and intensify our efforts as soon as possible.

Earlier this year, the new Climate Law was adopted and entered into force. It not only embeds our climate-neutral goal into EU law, but also fixes a clear step on that path – reducing net greenhouse gas emissions by 55% (compared to 1990 levels) by 2030. The paradigm has thus shifted: we no

longer question if we should set such a bold target, but consider how we can best achieve it.

To that end, on 14 July, the European Commission presented more than a dozen concrete legislative proposals to deliver on the European Green Deal and translate our climate goals into action. The main difference between this new approach and the climate policy of yesterday is not just the higher ambition, but its broader scope. We are not only focusing on the energy sector but on our economy as a whole – from transport to taxes, from buildings to forests. The package is as comprehensive as it is interconnected.

Getting to net zero is only feasible through a fundamental transformation of our entire society, so we must use all the tools at our disposal and make sure they complement and reinforce one another. We have put a price on carbon emissions and we propose to extend this proven system to new sectors that are lagging behind, such as aviation, shipping, road transport and buildings. We will set new and higher targets to push for change – be it in agriculture or industry. And we will make it easier to be green and less rewarding to use fossil fuels. There will also be a carbon border adjustment mechanism to avoid a situation where manufacturers in other parts of the world benefit from the fact that their climate standards are considerably lower than in the EU.

While this is a multi-faceted package of proposals covering many policy areas, energy remains at the heart of our climate ambition. Three-quarters of EU's GHG emissions come from producing and using energy, so without a green energy transition, there will be no 'net zero'. Two central elements of the package delivering on the European Green Deal are revisions to the Renewable Energy Directive and the Energy Efficiency Directive. Clearly, the combination of reducing our overall energy consumption by doing things in the most efficient way and ramping up our production and use of renewable energy will be crucial to achieving a 55% cut in emissions by the end of this decade. These proposals have now passed to the EU co-legislators – Member State ministers of energy in the Council and Members in the European Parliament – and will dominate our energy policy debates for the next couple of years.

Raising the renewables target to 40% by 2030

For the Renewable Energy Directive, the Commission proposal raises the ambition of the existing legislation and seeks to introduce new measures to complement the existing building blocks already established by the 2009 and 2018 directives, building on some of the concepts outlined in the energy system integration and hydrogen strategies, both published in 2020.

This headline change is to raise the overall renewables target for 2030 (from 32% to 40%), but with strengthened measures for transport or heating and cooling, where progress has been slower than expected. The Commission is also aiming at a more energy efficient and circular energy system. One that facilitates renewables-based electrification, and promotes the use of renewable and low-carbon fuels, including hydrogen, in sectors where electrification is not yet a feasible option, such as transport.

Energy Efficiency and the need for a just transition

In the energy efficiency proposal, the Commission is also looking to raise our ambition – going 9% further than Member States had previously pledged. (This is the equivalent of a 39% and 36% reduction in primary and final energy consumption relative to the baseline forecasts.) EU countries must also achieve new annual savings of 1.5% of final energy consumption from 2024 to 2030, up from the current level of 0.8%. This is an important instrument to drive energy savings in end-use sectors such as buildings, industry and transport.

The proposal also puts stronger focus on alleviating energy poverty and empowering consumers, through strengthened requirements on awareness raising and information provision. We are looking to introduce an obligation for EU countries to implement energy efficiency improvement measures as a priority among vulnerable consumers in order to alleviate energy poverty. This is all part of a consistent Commission drive to ensure that the clean energy transition leaves no-one behind – echoed by the additional EU spending dedicated to the Just Transition Fund. In this context, revenues from the EU Emissions Trading System (ETS) extension to buildings and transport will be used through the newly established Social Climate Fund to address possible negative distributional effects.

Our work here is far from over. A second wave of proposals will be tabled before the end of the year – looking to legislate on decarbonising the gas sector and establishing a hydrogen market, as well as revising the Energy Performance of Buildings Directive and setting new rules for reducing methane emissions.

In order for these policies to deliver the necessary results, we need all sides to buy in to the package – legislators, stakeholders, citizens. In this sense, this year's EUSEW provides an excellent opportunity to discuss, understand and embrace the policy aims we have proposed.

Red tape is in the way of Europe's green offshore energy transition

By Morten Helveg Petersen MEP (pictured)

As we look towards reshaping the European energy system, we best make room for offshore renewable energy. There has been a great deal of focus on the potential of offshore renewable energy, and we have good reasons for being excited about these technologies that can greatly contribute to our green transition. Given the vast amounts of renewable energy needed to cover our future energy needs, it is becoming abundantly clear that we need to make use of every available bit of space, both on land and especially at sea. As rapporteur for the European Strategy for Offshore Renewable Energy, I want to make sure offshore renewable energy gets the best possible conditions, and that it contributes to the EU´s green transition.

Offshore renewable energy will be the engine behind Europe´s move for climate neutrality, thanks to the huge amounts of cheap, clean energy it can provide. Some might think that offshore is a game for the North Sea, given the area´s leading role in developing and deploying offshore energy solutions, but offshore renewable energy is relevant across Europe's seas and can benefit the whole continent.

If we also ensure electricity can flow freely across borders, the winds blowing over The North Sea will power houses in Slovakia, while sunshine over The Mediterranean will power houses in Austria.

As the International Energy Agency (IEA) mentioned in its report earlier this year, we need to act now. The path to climate neutrality is getting narrower and narrower. With each year we are not reaching our full potential in terms of transitioning towards renewable energy, the scale of change needed becomes bigger and bigger.

There are many interests at sea, and it is clear that we need to balance these better than we are doing at the moment. The different stakeholders will play a role in how things will be done in the future, but at the political level we need to make sure the level of urgency is not forgotten.

Unabated climate change is pushing the development in the wrong direction. Failure to introduce more renewable energy into our energy mix will make the situation increasingly dire. All this could throw a wrench in the gears, as more dire weather conditions will lead to less space available. It is important to realise the benefits that come with offshore energy deployment, and prioritise offshore with a view to the enormous amount of energy needed to transition away from fossil fuels.

Offshore wind has been growing but there are still barriers that can hamper the necessary rollout

> *"While we need to make sure that further development is done in full compliance with all existing regulations and without infringing on the local actors, it is absolutely imperative to improve the current state of permitting processes."*

of projects. One of the more contentious topics is that of permitting. While we need to make sure that further development is done in full compliance with all existing regulations and without infringing on the local actors, it is absolutely imperative to improve the current state of permitting processes.

The gigantic task ahead of us, and the ambitious goals we have set for ourselves, will simply not be reachable if projects are stuck for years waiting for the right permits to be granted. Unnecessary red tape must be removed and application times must be reduced to a minimum.

We are reaching such a critical point that we might have to consider providing instant permits for offshore wind farms, and turn the burden of proof in its head in the permission processes. The urgency with which we need to deploy offshore renewable energy is so serious that we need to favour the deployment of projects. In order to ensure the necessary rollout of renewable energy, we also need to tweak the rules regulating the energy markets. Considering that the energy system of the future will look vastly different from our current one, it is important to align the market conditions to our ultimate goal: a carbon-neutral and sustainable energy system based on renewable energy.

Offshore renewable energy will play an important role in the energy system of the future, and market rules should account for that. Not having the proper incentives in place can keep investors away from green choices. While there is the political will to use public investments for greening the energy sector, we will need as much private investment as possible going into green projects. This will also require the removal of incentives that artificially keep non-renewable energy projects profitable.

One last barrier is the state of infrastructure. Our energy use is forecasted to increase and as we switch from fossil-fuel sources to renewable alternatives, the amount of electricity that will need to flow through our grids will soar. The very nature of offshore energy will add to the distance the electricity has to travel. We must remove any and all bottlenecks along the way. Every GW of renewable energy out at sea that is not able to flow into the grid is not only a waste of resources, but it most likely also represents a missed opportunity to replace a GW of fossil-fuel-based energy. The ability for offshore energy to contribute to our green transition will depend on our ability to build out the necessary infrastructure that will facilitate cross-border energy transfer. We will only succeed if we do it together.

The challenge seems daunting but IEA found it is still reachable. All we have to do is push forward and not delay this any further.

PLURAL

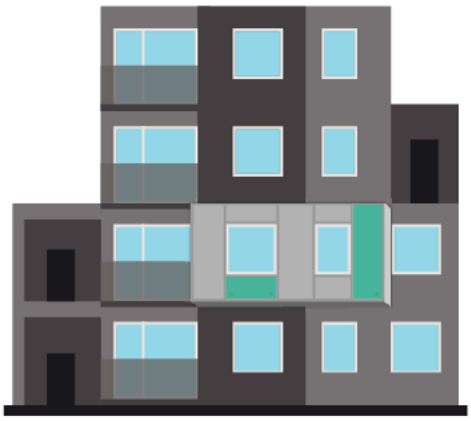
"PLUG-AND-USE RENOVATION WITH ADAPTABLE LIGHTWEIGHT SYSTEMS"

By Prof. Maria Founti, NTUA and Ing Zuzana Taťáková M.Sc., Fenix TNT

Insight

Reduction of energy consumption, emissions and carbon footprint of buildings is vital in meeting the EU's climate and energy targets for 2030. The Near Zero Energy Building (NZEB) concept requires a high level of energy efficiency, in combination with on-site renewable energy production and use. It is evident that improving the energy performance of existing buildings calls for retrofit/renovation actions that not only meet the energy and environmental targets, but also ensure minimum disturbance of the inhabitants and indoor comfort. The PLURAL project aims to tackle this challenge by developing "Plug-and-Use" kits for fast and energy efficient deep retrofitting of residential buildings.

"The previous experience of the consortium motivated the PLURAL concept, taking into consideration that current building renovation processes are time consuming, expensive and often unattractive to owners due to disturbance. The need for lowering renovation time and cost can be readily achieved via off-site prefabrication. Furthermore, since the envelope is the main interface between buildings' occupants and the outside, it is important to regulate energy gains and losses across it. Low cost, low weight, environmentally friendly insulation, compliant with local fire and structural regulations in the form of prefabricated panels can be used for fast and reliable renovation. PLURAL goes further and proposes prefabricated kits for residential buildings, that not only regulate energy gains and losses across the envelop but also actively interface with the building, integrating renewable energy production systems. The PLURAL all-in-one kits ensure NZEB status after renovation and take into account occupant comfort requirements; they are thus named "Plug-and-Use Kits" (PnU Kits), says Maria Founti, the Project Coordinator from the National Technical University of Athens (NTUA).



About PLURAL

PLURAL is a collaborative research project supported by the European Commission under the Horizon 2020 Programme for Research and Innovation (Call H2020-NMBP-ST-IND-2020), with a duration of 48 months.

The project consortium is made up of **18 partners** from **7 European countries**. Each partner develops activities in different areas and locations and together with the 6 demonstration sites (3 real and 3 virtual), this collaboration ensures that the developed solutions will be applicable in a large range of use cases.

Demonstration sites

The PLURAL PnU kits will be integrated at three different residential building sites, located in Greece, Spain and the Czech Republic, featuring different climate conditions and heating/cooling needs and user requirements, thus demonstrating the versatility and robustness of the overall concept.

Additionally, PLURAL includes three building demos for virtual replication in Switzerland, Germany and Sweden for simulating and validating the performance and operation of the solutions under further conditions. The real demonstrators will also be used for their assessment under conditions that differ from the actual ones. The results will be used for establishing best available techniques and guidelines regarding all implementation phases, including shipping, installation, maintenance, and decommissioning.

Concept

The key for the development and demonstration of the PLURAL PnU kits is to understand how to select and integrate various renewable energy technologies, incorporate them in prefabricated façade components and optimize their performance for different building types, climates and socio-economic conditions. Software tools to support digital design and decision making are developed. Additionally, PLURAL focuses on how to manufacture these kits while minimising energy use and material waste.

Objectives

The PLURAL project aims to design, validate and demonstrate a palette of versatile, adaptable, scalable, off-site prefabricated plug-and-play kits that account for user needs, named “Plug-and-Use” (PnU) kits”.

NEAR ZERO ENERGY CONSUMPTION

Heat losses through the envelope will be minimized through improved insulation of the façade components, (U values < 0.23 W/m²K; Building primary energy consumption < 60 kWh/m²).

COST-EFFECTIVITY

About 58% reduction in renovation costs will be achieved through offsite prefabrication, lean manufacturing and construction interactively supported by the BIM based platform and Decision Support Tool.

FAST RENOVATION

At least 50% reduction in the time required for deep renovation mainly by reducing the time to design, procurement, logistics, fabrication, and site preparation from avg. 5-7 months to 2-4 months.

ENVIRONMENTALLY – FRIENDLY

Deep renovation aiming at reduction of CO_2 emissions to reach 15% less than the current average 0.6 tCO_2eq/m^2 and additionally to achieve 70% material recyclability.

FLEXIBLE

System combinations will allow easy adaptation of the PnU kits to be developed and validated as part of the project to various residential building typologies in all EU climatic zones.

Project ID: 958218

Funding programme: H2020-EU.2.1.5.2.

Area: **Industrialisation of building envelope kits for the renovation market**

Website:
https://www.plural-renovation.eu/

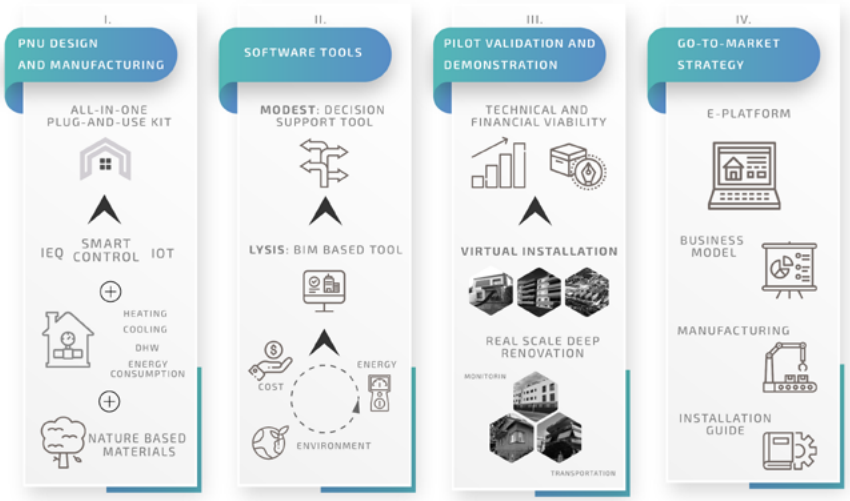
Start date: October 2020

Duration: 48 months

Project coordinator:
Maria Founti, NTUA

Contact email:
info@plural-renovation.eu

Fast and adaptable deep renovation towards NZEB



Project partners:

NATIONAL TECHNICAL UNIVERSITY OF ATHENS, Greece
PROIGMENES EREVNITIKES & DIAHIRISTIKES EFARMOGES, Greece
DIMOS VARIS - VOULAS - VOULIAGMENIS, Greece
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RD RYMAROV SRO, Czechia

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Clean energy and digitalisation: two pillars of the European Green Deal

By Vincent Berrutto, Head of Unit: Innovation, Research, Digitalisation, Competitiveness, Directorate-General for Energy – European Commission

We enter the digital world from the moment we wake up in the morning to the moment we go to bed at night. We check who has responded to us on social media, we write text messages to touch base with family and friends. At the same time, we tell our kids to put their cellphone away at the breakfast table! In the past 18 months, many of us have had to telework, telestudy or teleschool in a way that would not have been possible even five years ago.

As the pandemic has unfolded, most people have found themselves relying even more on the welcome distraction of streaming services. A huge selection of movies and podcasts have been ready-to-use on laptops, tablets and smartphones. We interact with complicated algorithms dressed up as virtual personal assistants to look for music or to check where we parked our car.

Would you change your behaviour when you see others using digital tools to become more environmentally-friendly? Can you imagine buying a car that is not just a means of transport, but also a means to sell power to the grid and to use more renewable energy? Are we really moving in the direction of radically new services targeted towards our specific needs and preferences?

Today's energy system is already radically changing. The European Commission's Energy System Integration Strategy pictures a renewable-based energy system that is more electrified, more efficient, more flexible and that uses infrastructure more wisely. The mega trends we are experiencing today are based on the three 'Ds': decentralisation, decarbonisation and digitalisation. Each of these has their own challenges, but they also provide opportunities as we shape up for Europe to become climate-neutral by 2050. This is the core focus of the European Green Deal and the European Commission's number one political priority.

Digitalisation has changed, is changing and will continue to change the way we supply, buy and use energy and the way we decarbonise the energy system.

Digital technologies have many benefits - from helping to improve the efficiency of wind turbines, to keeping us better informed on environmentally friendly practices. Do we fully grasp the transformative implications of digitalisation for energy, be it for companies, grids or consumers? To shed light on the questions and navigate through the challenges of digitalisation, we need to identify the key issues at stake and pinpoint exactly how to make the best use of digital technologies in energy for the benefit of society as a whole.

The European Commission is preparing an "Action Plan on the Digitalisation of the Energy System", which will outline ways to benefit from the full potential of digital technologies as we advance towards a green and digital future.

The green and digital transformation goes beyond just technological change. It is rather a combination of changes to infrastructure and changes in the way different market actors interact in the energy system. This applies, for instance, to network operators, building management systems, energy suppliers, aggregators, consumers, but also new digital service providers.

To develop a competitive and innovative European market for energy services we need easy access to data and interactive data exchange. The first aim of the action plan, therefore, is to develop a European data-sharing infrastructure, or a "Common European Energy Data Space".

The second aim is to address the challenge of developing a data-driven and citizen-centred energy market. This will focus on empowering consumers and looking at the ways digital solutions and future energy community models can perform well in energy markets, and ways to help them to consume less energy and more renewables. At the same time, the plan will address the challenges posed by the digital divide, energy poverty and the lack of digital skills and their consequences.

The third aim of the action plan is to present EU funding and other means of support, such as through Horizon Europe (for research and innovation), the Connecting Europe Facility and the Digital Europe Programme (on digital infrastructure and interconnections). As well as finding the most efficient combination between public and private investment, such programmes can help improve the use of IT in the energy sector. Digital solutions have a profound transformational potential. They create new business opportunities, new actors in the market, new business models.

Ever-evolving digitalisation makes the energy system smarter, but opens up new risks. Cyberattacks and cybersecurity breaches jeopardise the security of energy supply and data privacy. We do not need to look far to see the evidence: look at the cyberattack on a major oil pipeline in the US[2], or the large-scale attacks on critical energy infrastructure from the US SolarWinds platform. By attacking one company, hackers compromised thousands of others.

Related to this, the fourth aim of the action plan is to strengthen cybersecurity and data protection in the energy sector. Making sure that the privacy of our citizens is protected is a basic condition for any digital solution.

The fifth aim is about supporting the Information and Communication Technologies (ICT) sector in becoming a frontrunner in energy efficiency, in reusing waste heat, and using more renewable energy. The Commission is more than aware of the growing energy needs and increasing carbon footprint of the ICT sector and networking technologies.

More information on these five aims of the action plan are available in the roadmap presenting the initiative, published in July and inviting feedback. An Open Public Consultation will be launched in the coming months. Comments will feed into the action plan, which is scheduled to be adopted by the European Commission in the first half of 2022.

Another opportunity to provide feedback will be the European Sustainable Energy Week in October. This year's event is called "Towards 2030: Reshaping the European Energy System". On 27 October, we will hold a dedicated session on "Digitalisation of Energy: A step forward for the twin Green and Digital transition ". It will be a valuable opportunity for discussion and to look beyond the boundaries of the energy sector, learning from the experiences of other sectors on digitalisation.

Readers keen on shaping the discussion and gaining more insight on the topic, are invited to save the date and register to the event. We look forward to seeing you there!

[1] EU Strategy for Energy System Integration COM(2020) 299 final, July 2020)

[2] Remarks by Vice-President Schinas: Joint Cyber Unit (europa.eu)

Driving the clean energy transition: From vision to reality

By Adel El Gammal (pictured), Secretary General of the European Energy Research Alliance (EERA)

Our planet is burning and drowning. Science provided the technologies, experts a credible transformation roadmap. Now politicians should deliver. Immediately and fast. Very fast

After the stark conclusions of IEA's "Net Zero by 2050", last summer brought us a spate of ultimate wake up calls, providing undeniable scientific evidence of the unprecedented and irreversible biophysical transformation of our planet. It is burning, it is drowning, and plant and animal species are dying. Human life on earth is challenged.

On August 9, the Intergovernmental Panel on Climate Change (IPCC) released the first part of its Assessment Report 6 pertaining to the Physical Science of Climate Change. "Many of the changes observed in the climate are unprecedented in thousands, if not hundreds of thousands of years, and some of the changes already set in motion—such as continued sea-level rise—are irreversible over hundreds to thousands of years", the assessment claimed.

Under the most optimistic scenario, the earth is set to warm by at least 1.6°C in the coming decades. In addition, such warming is expected to have a much higher and severe impact than anticipated on all human activities and living conditions.

More recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) warned that about a third of all analysed plant and animal species are under severe stress, evoking the possibility of a sixth mass extinction: "We are eroding the very foundations of our economies, livelihoods, food security, health, and quality of life worldwide" reads the report.

Adding to the emergency, just a few days ago, an editorial published in 220 newspapers, including some 20 prestigious scientific journals such as The Lancet, and the British Medical Journal, alerted about the deterrent effect on human health of combined global warming and collapse of biodiversity. "Science is unequivocal; a global increase of 1.5°C above the pre-industrial average and the continued loss of biodiversity risk catastrophic harm to health that will be impossible to reverse", the editorial alleged.

Then, how can we still avoid complete chaos?

First, the IEA report was clear. To reach net-zero by 2050, half of abatements after 2030 will have to come from new or currently pre-competitive technologies. It warned that achieving such a historical surge in clean technologies development can only be envisaged by the massive and unprecedented growth of investments in research and innovation and the accelerated deployment of these technologies.

However, the parallel development of global crises and the increasing recognition of their strong interconnection starkly underlines the absolute necessity of addressing our planet's issues from a holistic and systemic perspective: climate, biodiversity, food, water, and other planet resources are intrinsically interlinked into a global system on which, let us read it carefully, human life on earth depends.

In this sense, only deploying faster than any time before both existing and future clean technologies will not be enough. Our society needs to be radically transformed. In fact, the "Clean Energy Transition" should be more accurately called "The Societal Sustainability Revolution".

This latest concept compels us to fundamentally redesign the siloed approach that has been "hard-coded" in the very foundations of society and therefore imprinted in individuals' mental structure. It also suggests that our current economic paradigm might not result from any "universal law". As such, it must be

The EERA White Paper on the Clean Energy Transition will be officially released at the occasion of the high-level policy conference "Clean Energy Transition: From Vision to Reality" that will take place on October 20 in a hybrid format, in Brussels and online. We invite interested stakeholders to join us at this occasion to learn and debate on EERA's recommended approach to driving the Clean Energy Transition.

CET: From Vision to Reality
EERA High Level conference
Register here

profoundly revised in a way that steers human action towards more desirable transformation pathways, dictated by the principles of a global, holistic, interdisciplinary, and fair science-based "benefit-cost" analysis.

Science has unequivocally and repeatedly alerted us of the eminent dangers humanity is facing. But besides these emergency warnings, it has also provided us with some light and hope. It tells us that containing global warming below 2°C might still be achievable if immediate, bold, and concerted action is taken globally.

For instance, the IEA Net Zero report provides a concrete roadmap to decarbonise our global economy in just three decades. But this roadmap is not an easy journey. It proposes to reshape our economy and energy system profoundly. Furthermore, it calls for a transformation of our society, including driving citizen's towards more responsible consumption patterns.

Echoing the need for a global transformation, the EERA White Paper on the Clean Energy Transition is a first and landmark attempt to break existing governance and policy silos by proposing a transition approach towards climate neutrality that is more consistent, integrated, and convergent. This publication constitutes the first step to challenging our common thought process towards a more systemic understanding of the daunting and pressing challenges human society faces today.

Moreover, this paper ambitions to fuel the debate on the need for an almost societal metamorphosis and seed the reflection to redesign human innovation capabilities. Its key recommendations to policymakers highlight the crucial importance of building collective adhesion to a new co-created societal model. It calls for developing a coherent, robust, and appealing storyline outlining transformation pathways towards a desirable common, sustainable, and climate neutral future. Such a narrative must provide a credible and tangible vision of resilient transition pathways enabling citizens and

society at large to envisage and endorse the transition process by connecting individual imaginaries into a converging collective sustainable future.

Ultimately, the path forward is outlined. It is narrow and fragile. Policymakers around the world have now a historic responsibility to act immediately, collaboratively, and decisively.

About EERA

The European Energy Research Alliance (EERA) is the association of European public research centres and universities active in low-carbon energy research. EERA pursues the mission of catalysing European energy research for a climate-neutral society by 2050. Bringing together more than 250 organisations from 30 countries, EERA is Europe's largest energy research community. EERA coordinates its research activities through 18 Joint Programmes and is a key stakeholder in the European Union's Strategic Energy Technology (SET) Plan. In line with its mission, EERA is committed to supporting Europe in achieving a successful energy transition in line with the EU's climate 2050 goals and Paris commitments.

For further information, see https://www.eera-set.eu

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Dynamic Thermal Rating: Slovenia took an innovative approach

By Andrej Souvent, CEO, Operato d.o.o.

With massive renewables integration and fostering the EU's internal energy market, transmission system operator's day-to-day business requires modern tools to assure transmission capacities and system stability. Nowadays, the key question for power system operators is how to operate the power system flexibly while keeping it secure and stable yet economically efficient. Also essential are – better utilization of the existing power system infrastructure, which is more environmentally friendly than building new power lines – and maintaining power system resilience.

The Slovenian national transmission system operator, Eles, has innovatively utilized Dynamic Thermal Rating (DTR) technologies to address the aforementioned challenges. DTR is a power system operation concept aiming to maximize utilization of the equipment, like power lines, transformers, when weather conditions allow it, without compromising the safety of operation.

The most know DTR technology is the Dynamic Line Rating (DLR) which focused on overhead power lines (OHL). Conductors of an OHL are heated by Joule losses caused by current and by solar heating, but on the other hand, they are also cooled – mostly by radiation and convection. As the temperature of a conductor increases, the sag also increases, and at some point, safety clearance may be violated. As this must be prevented, static ratings are used – these are current limits to prevent the conductor's temperature from reaching critical value. As these limits are set regarding the worst-case weather conditions, most of the time – e.g. when air temperatures are low, when the wind is blowing, the power lines can be utilized more as the static ratings allow.

It all started ten years ago when Eles joined forces with research institutions Elektroinstitut Milan Vidmar, Faculty of Electrical Engineering, University of Ljubljana, and Jožef Stefan Institute. A comprehensive modular concept of Dynamic Rating System (DRS) was developed, mainly focusing on power system operation, operational planning, and improving power system resilience – the latter with an innovative approach of reversing the DLR algorithm for the application for icing prevention.

The system – called SUMO – is an indirect dynamic thermal rating system (DRS) comprising of the Dynamic Line Rating (DLR), the Dynamic Power Transformer Rating (DPTR), and the Dynamic Line Anti-icing (DLAI) subsystems. It is a software-enabled and meteorological model's based system with the possibility to integrate also data from meteorological weather stations. DLR calculations are made for all power line spans, and the weakest line-span determines the rating for the whole line. The system supports real-time and short-term forecast operations, calculations of transmission capacities for up to two days ahead, and allows for mitigation of overloading operational situations, taking into account also contingency situations. It also features an inverse DLR algorithm for icing prevention and alarms for extreme weather conditions along the power lines. It is a modular IT system featuring an integration bus with programming APIs and templates for the integration of additional third-party modules.

As the system uses physical models to calculate results and as the main input data is weather assessment and forecasts, the main challenge has been dealing with uncertainties to operate the system with foreseeable risks. It should be mentioned that operating the system on static limits, as is the practice so far, is also not without risk. On a hot summer day with no or very low wind, the transmission capacity can also fall below the static limit! That means a reduction of transmission capacity to maintain safety clearances within permissible limits.

The weather assessment and forecast

are based on mezzo and microscale meteorological models. The results from the models can be further enhanced by integrating measurements from the weather stations.

Mesoscale weather model results represent an important source of uncertainties, which can be lowered by local weather measurements at the OHL's towers. On the other hand, weather models constantly improve over time, and weather data quality may improve significantly in the next years. But the most important is that the uncertainties can be evaluated and taken into account by the SUMO uncertainty module, which calculates the lower and upper limit of the dynamic thermal current related to the chosen confidence interval.

As of December 2013, the system had been trial running with four power lines. In December 2015 additional 17 power lines and one phase shift transformer were added. Since 2017 the system has been in full operational mode and in daily use at the National Control Centre. The dynamic thermal limits are currently calculated for 29 OHL on 400 kV, 220 kV, and 110 kV voltage levels, two phase-shift, and two power transformers. The system is fully functional and integrated into the daily operation. The main applications that support real-time operation and operation planning are mitigation, overloading operational situations, and calculations of transmission capacities for up to two days ahead.

On average, 92 – 96% of the time, the system offers a higher transmission capacity with a median increase of 15-20 % of the nominal capacity. Over 500 possible overloading events are mitigated annually.

In 2021, Eles decided to further promote the solution and has established a daughter company OPERATO, with a mission to share the knowledge and experiences with other national operators. Apart from ELES implementation, the system also runs at HOPS, the Croatian national transmission system operator. ●

"Nowadays, the key question for power system operators is how to operate the power system flexibly while keeping it secure and stable yet economically efficient."

Sustainable batteries for EU competitiveness

By Patrizia Toia MEP (pictured)

On 14 July the European Commission presented a package of proposals named “Fit for 55” to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Achieving these emission reductions in the next decade is crucial to Europe becoming the world's first climate-neutral continent by 2050 and making the European Green Deal a reality.

To achieve those goals batteries are a key technology because they allow the transition to climate neutrality, and to a more circular economy. They are essential for sustainable mobility and contribute to the zero pollution ambition. Batteries are also part of our daily life at home, in kitchen appliances, remote TV control or alarm clocks.

The demand for batteries will grow rapidly in the coming years, notably for electric vehicles using batteries for traction, making this market an increasingly strategic one at the global level. According to the European Commission's estimates demand for batteries is set to increase 14 fold by 2030 and such global exponential growth in demand for batteries will lead to an equivalent increase in demand for raw materials.

Europe is already investing a lot on batteries, to catch up with the asiatic leadership on the market. In 2020 alone, €25 billion was invested in the European battery industry – twice as much as in China. Europe is set to become the world's second biggest battery-cell producer.

But at stake there is not only the strategic leadership for such a key technology but also the impact that such a rapid change will have on our planet and our societies. Today, indeed, behind the boom for the battery industry there are violations of human rights for the extraction of raw materials in third countries, destabilising violations of the rule of law in fragile countries and unsustainable impact on the environment. Instead, with the right conditions in place, batteries could be a systemic enabler of a major shift to bring transportation and power to greenhouse gas neutrality by coupling both sectors for the first time in history and transforming renewable energy from an alternative source to

“Achieving these emission reductions in the next decade is crucial to Europe becoming the world's first climate-neutral continent by 2050.”

a reliable base. According to a World Economic Forum report, batteries could enable 30% of the required reductions in carbon emissions in the transport and power sectors, provide access to electricity to 600 million people who currently have no access, and create 10 million safe and sustainable jobs around the world.

That's why I welcomed the proposal presented by the European Commission on the 10th of December 2020 to introduce an “holistic european legislation” that establishes a comprehensive framework covering all types of batteries and addressing their whole life cycle from production process to design requirements as well as second life, recycling and incorporating recycled content into new batteries.

It is an overdue update of European tools to handle such a huge change in our economies, considering that up to now the only legislation in force is the Batteries Directive (2006/66/EC) dealing only with waste.

We need more ambition. Batteries placed on the EU market should become sustainable, high-performing and safe all along their entire life cycle. This means batteries that are produced with the lowest possible environmental impact, using materials obtained in full respect of human rights as well as social and ecological standards. Batteries have to be long-lasting and safe, and at the end of their life, they should be repurposed, remanufactured or recycled, feeding valuable materials back into the economy.

For that the Commission proposes mandatory requirements for all batteries (i.e. industrial, automotive, electric vehicle and portable) placed on the EU market. Requirements such as use of responsibly sourced materials with restricted use of hazardous substances, minimum content of recycled materials, carbon

> *We have to set our standard quickly or other standards, with different values, will be imposed at global level and then changing the practices will be very difficult if not impossible.*

footprint, performance and durability and labelling, as well as meeting collection and recycling targets, are essential for the development of a more sustainable and competitive battery industry across Europe and around the world.

According to the Commission's proposal, from 1 July 2024, only rechargeable industrial and electric vehicles batteries for which a carbon footprint declaration has been established, can be placed on the market.And to significantly improve the collection and recycling of portable batteries, the current figure of 45% collection rate should rise to 65% in 2025 and 70% in 2030 so that the materials of batteries we use at home are not lost for the economy. Other batteries – industrial, automotive or electric vehicle ones – have to be collected in full.

All collected batteries have to be recycled and high levels of recovery have to be achieved, in particular of valuable materials such as cobalt, lithium, nickel and lead.I am aware that change is never easy and entails costs, so I understand the worries expressed by some stakeholders and some governments, but I am firmly convinced the balance of costs and benefits change enormously if we are capable or looking to the long term results instead the focusing only on the short term costs.

As S&D Group we welcome this proposal because this legislation is particularly necessary now that the demand for electric vehicles and the electrification of transport is booming. We need to move to zero-emission mobility. Furthermore this proposal is important as it has huge environmental value as well as great industrial and strategic potential.
A sustainable and responsible European battery market could create up to five million jobs and be worth €250 billion by 2025. A new and comprehensive legislation on batteries could allow Europe, once again, to set a sustainable global standard in one of the fastest growing and most critical global markets for the future.

The battery regulation is going to set environmental as well as ethical standards, with EU-produced batteries saving up to 50% in CO_2 emissions compared to their Chinese equivalents.Is an opportunity that we cannot miss. As progressives, it will be crucial for us to develop a transparent and real due diligence process around the battery market so that the boom in the sector will no longer contribute to violations of human rights, the rule of law and the environment.

At the EU Council some EU environmental ministers expressed concern over the Commission's decision to choose the form of a EU Regulation for the battery legislation, instead of a EU Directive that would allow more flexibility in adapting the new rules to different national contexts. However I am convinced that in such a rapidly evolving market timing is key if we want to give to European companies legal certinities over the big investments required.

We have to set our standard quickly or other standards, with different values, will be imposed at global level and then changing the practices will be very difficult if not impossible.
The European legislative procedures are slow because they are deeply democratic and meticulous. That's also why they often become a global standard. But we have to be careful to not turn this advantage in disadvantage, making the legislation process too slow to have a real impact.

The European Commission presented last year a comprehensive battery legislation accompanied by an impact assessment. A public consultation on the new Eu battery legislation already took place from the 28th of May to the 9th of July. Now it is up to the Council and the European Parliament to finalize the process to adopt the new legislation in the form of a new Regulation, which is the only legal way to have the new rules in force by 2024.

Hydropower as a catalyst for a successful energy transition in Europe

Hydropower, as the still largest renewable energy resource, has a long tradition in Europe and contributed significantly during the last century to industrial development and welfare in most of the countries in Europe. Today, almost 600TWh of electricity are generated in an average hydrological year, which equates to about 60% of the economically feasible hydropower potential within Europe. The ambitious plan for an energy transition in Europe now seeks to achieve a low-carbon climate-resilient future in a safe and cost-effective way, serving as an example worldwide. The key role of electricity will be strongly reinforced in this energy transition. In many European countries, the phase out of nuclear and coal generation has started with a transition to new renewable sources comprising mainly of solar and wind for electricity generation. However, solar and wind are variable energy sources and difficult to align with demand. Hydropower already supports integration of wind and solar energy into the supply grid through flexibility in generation as well as through its potential for storage capacity. In the future, these services will be in much greater demand to achieve the energy transition in Europe, and worldwide. Hydropower has all the characteristics to serve as an excellent catalyst for a successful energy transition.

The HYDROPOWER-EUROPE Forum is built on the ambition to achieve a Research and Innovation Agenda (RIA) and a Strategic Industry Roadmap (SIR) roadmap for the hydropower sector, based on the synthesis of technical fora and transparent public debates through a forum that gathers all relevant stakeholders of the hydropower sector.

Through an extensive program of review and consultation addressing the whole hydropower sector and stakeholders (including construction, production, environmental and social issues), the Hydropower Europe Forum provides a focal point for reviewing and developing hydropower in Europe, and subsequently European hydropower in the wider world. Building from this extensive programme of consultation, the Hydropower Europe Forum has developed a strategic **Research and Innovation Agenda** (RIA) as well as a **Strategic Industry Roadmap** (SIR), towards implementation of the vision “Hydropower as a catalyst for the successful energy transition in Europe”.

A Consultation Platform was created to help manage the Hydropower Europe consultation process (https://hydropower-europe.eu) where more than 600 stakeholders and experts have registered and are involved in the consultation process, which may be considered a success. Besides organization of several consultation events and workshops, a successful workshop on environmental and social aspects was held in October 2020 and a round table with NGOs in January 2021; as well as a Partner Event at the EU Green Week in June 2021 under the theme of Zero Pollution; these are more recent examples of increased consultation with civil society.

The final versions of the RIA and SIR will be available online in Autumn 2021. Eighteen research themes comprising some 80 topics were identified (RIA) as well as 11 strategic directions including some 40 detailed actions (SIR) ranging from regulation framework to social acceptance and innovative environmental strategies. During several workshops with the Consultation Expert Panel (CEP), prioritization of these strategic actions, research themes and topics were established. For the latter, suggested programme time lines as well as indicative magnitude of funding and the expected TRL of the research outcomes were defined.

HYDROPOWER EUROPE

The HYDROPOWER EUROPE Forum is supported by a project that has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 826010. Project partners are: International Commission on Large Dams (ICOLD), European Association for Storage of Energy (EASE), European Renewable Energies Federation (EREF), Association of European Renewable Energy Research Centres (EUREC), International Hydro-power Association (IHA), Samui France SARL (SAMUI), VGB PowerTech e.V. (VGB) and ZABALA Brussels SPRL (ZABALA).

Prosperity through energy renovation

By Adrian Joyce (pictured)

Buildings are the cornerstones of our lives with most of us spending more than 90% of our time indoors. Our use of buildings leads to the consumption of 40% of all primary energy produced in the EU resulting in about 36% of energy-related CO_2 emissions. Addressing this wasteful energy use in our buildings has taken on a special significance in our efforts to address the negative effects of climate change.

It is estimated that the number of buildings standing in the EU is around 210 million. Together the heated and conditioned indoor floor area of these buildings is roughly equivalent to the size of Belgium. Around 75% of all these buildings are residential buildings – our homes – and around 80% of all buildings were built before there were any energy performance requirements in place.

Research by the Buildings Performance Institute Europe (BPIE) found that 97% of our existing buildings are inefficient as only 3% have reached an energy label "A" within the EU Energy Performance Certificate Framework that was established under the Energy Performance of Buildings Directive in 2002. The BPIE concludes that to address this poor performance and reach long-term targets, we must increase deep energy renovation urgently to reach an average of 3% of all buildings per year.

The EU has recently set itself the ambition to become the first climate-neutral region in the world and has adopted the most ambitious Climate Law of any developed economy. In deciding how best to address the challenge of decarbonising their economies, member states are now faced with difficult decisions about which sectors to prioritise and which measures to introduce in their policies and regulations. But without any doubt, including the buildings sector and applying the energy efficiency first principle will be an absolute must.

Most of the laws, regulations, and strategies that address climate and energy issues are currently (in 2021) undergoing reviews as the new level of climate ambition agreed by the Heads of State for 2050 cannot be reached without revising them upwards, injecting urgency and greater ambition in them all. Among the laws to be revised is the Energy Performance of Buildings Directive (EPBD), which provides the EU with the opportunity to equip itself with a modernised and ambitious approach to decarbonising our buildings.

At the same time, and in response to the negative economic and social consequences that have resulted from the COVID-19 pandemic, the Next Generation EU initiative, designed to assist the EU in its economic recovery, has been adopted. A key part of the initiative is the establishment of the Recovery and Resilience Facility (RRF), which will mobilise more than €672 billion in grants, subsidies, and preferential loans for disbursement to the member states.

A strict criterion of the RRF is that at least 37% of the funds must be spent on climate-related actions and at least 20% must be spent on digitalisation of the economy. This means that nearly

"The EU has recently set itself the ambition to become the first climate-neutral region in the world and has adopted the most ambitious Climate Law of any developed economy."

60% of the RRF could, in theory, be spent on buildings. To access this unprecedented facility, the member states must prepare national recovery and resilience plans (NRRP) that must be approved by the European Commission and the European Council before funds can be drawn down.

An early analysis, carried out for the Renovate Europe Campaign by E3G, of the first NRRP that have been submitted to the European Commission shows that allocations of funding to energy renovation of buildings vary from a low of just 3% to nearly 26%. At these levels, it is hard to see how the member states will succeed in achieving the increased levels of energy renovation that must be attained within the next five years, thus risking missing out on a golden opportunity to improve the quality and resilience of our buildings.

To assist the member states in planning, financing, and implementing their NRRP, the European Commission has introduced additional forms of technical assistance. There is a new department of the Commission, known as DG Reform, that administers the new technical support instrument (TSI), which specifically targets energy renovation amongst other flagship initiatives and differs from other available forms of technical assistance due to three unique features:

1. No co-financing by the member state is required.
2. The technical assistance covers the entire reform process from preparation and design through to implementation.
3. City and other local administrations can more easily benefit from the TSI by coordinating with their national contact points.

Whilst the matters I have laid out above generally refer to the building level, there is a growing realisation that there are great advantages to tackling the challenge of transforming our building stock at the city and/or neighbourhood level.

There is strong support for the adoption of such district or neighbourhood approaches within the European Parliament, as witnessed by the adoption, in early 2021, of an own-initiative Report on Maximising the Energy Efficiency Potential of the EU Building Stock. The rapporteur for the Report, Ciaran Cuffe (Ireland, Greens) sets out the concept of Integrated Renovation Programmes (IRPs) stating that they must be holistic, putting energy efficiency first, and must focus on the broader neighbourhood ecosystems, comprising high energy reduction targets for individual buildings.

Taking this neighbourhood or city-level, integrated approach brings valuable synergies that can more easily optimise the overall performance of the building stock within the geographical area covered by an IRP. Not least, the various energy demands, spread as they are across time and varying according to building type and use patterns, can be balanced by load sharing and supply sharing. At a neighbourhood level, shared access to renewable

energy sources makes the use of those resources more economical and bundling buildings together for energy renovation to take place at the same time brings economies of scale.

Looking ahead to the time when energy renovation activity in the EU will reach the levels that match our climate ambitions, we can expect that there will be more quality jobs of a more diverse nature in the construction sector. This will stimulate our economies, increase revenues for public finances and dramatically improve the quality of life of our citizens who will be living and working in more comfortable, healthier buildings.

There is no doubt in my mind that the challenge we are facing is great, but I am reassured by the fact that achieving our energy renovation ambitions will lead us to a prosperous future.

Turku seeks low-carbon life

Turku is moving toward its ambitious goal of carbon neutrality in 2029. Much has happened in the energy sector in a short time. Now the city is urging all residents and businesses to act on behalf of the climate in their day-to-day lives.

Risto Veivo, Climate Director for the City of Turku, Finland says that the city's greenhouse gas emissions have dropped to less than half of the 1990 level.

"In our energy production we will soon get completely rid of fossil energy. Emissions from transport, for example, have also declined significantly."

The city has also updated its forest plan. It is currently setting up a regional compensation system. Both are aimed at reinforcing carbon sinks and diversity in nature and increasing the recreational use of forests.

After 2029 Turku hopes to be climate-positive.

"Then our emissions will have fallen below our ability to bind carbon from the atmosphere and we will be able to produce renewable energy above our own needs."

Energy sector will soon be carbon-neutral

Timo Honkanen, the CEO of Turku Energia, says that 90% of electricity in Turku and 80% of its heat is produced in a carbon-neutral manner already now.

"A year from now we will be no longer be using any coal in the production of district heat", he observes.

The change has been great and fast. Still at the beginning of the new millennium, 100% was the number used with reference to the share of fossil energy in the production of heat.

Turku Energia trusts versatility in methods of production.

"We have not put all of our eggs in the same basket. We have adopted many kinds of green energy solutions and our investments have been spread over many years. At the same time, risks have also shrunk."

Making use of waste materials and waste heat

The Naantali combined heat and power (CHP) plant and the Kakola heat pumps are owned by Turun Seudun Energiantuotanto Oy (TSE).

Giving up coal has been made easier by the CHP plant in Naantali, which produces heat and electricity from wood chips, a by-product of the forest industry.

"This year we will also open a line for receiving wood and cardboard which is no longer suitable for recycling. Next year a heat pump will be introduced to produce heat out of steam from a process that had not previously been utilised."

In Turku, surplus heat is used at the Kakola wastewater treatment plant, where heat energy is recovered from wastewater. Heat pumps are used to turn it into district heating and district cooling. The Turku region already produces 30% of its district heating using methods that do not involve combustion.

Electricity is also procured from domestic and foreign hydropower plants, for example, and from Finnish wind power plants. In addition, solar panels have been placed on roofs in Turku at an increasing pace.

"Growth in wind power has been especially strong. Turku Energia is involved as an owner in many wind parks around the country"

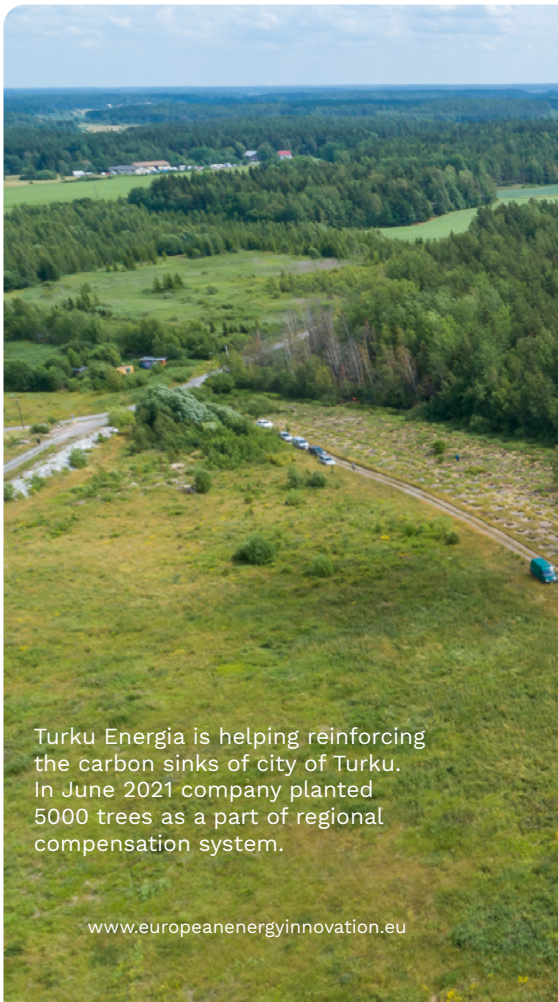
For the future Turku Energia's plans also include a geothermal plant which extracts heat from the earth's crust.

A good life with 1.5 degrees

However, Turku will not achieve its goals on emissions only by making changes in energy production, or through actions taken by the City Group. Businesses and residents will also be needed in the green transition.

Turku has launched its 1.5-degree life campaign, encouraging everyone to make climate-friendly choices.

Expert **Lotte Suveri** observes that



Turku Energia is helping reinforcing the carbon sinks of city of Turku. In June 2021 company planted 5000 trees as a part of regional compensation system.

a climate-friendly life is not a life of renunciation and misery; it also brings health and well-being into our lives, while creating new business activities in the best of cases.

“In Turku, day-to-day action on behalf of the climate can involve riding one of the new electric buses, for example. The number of electric buses in the city has multiplied this year. A third of the kilometres driven by public transport are powered by electricity”, Suveri says.

Food served at Turku schools has been modified to be more environmentally friendly by replacing beef with chicken and vegetable protein. People in the city are also encouraged to favour domestic fish, reduce food waste, and to recycle biowaste, for example.

Also taking part in the campaign are Turku’s libraries – circular economy veterans. In addition to traditional books, and the even more environmentally friendly e-materials, libraries also have all manner of other useful things, such as, 3D printers, for example, or sewing machines, and snow shovels. Consumption can be reduced by favouring borrowing.

If the goal of the Paris Agreement – stopping global warming at 1.5 degrees – is reached, it is likely that snow shovels will continue to be needed in Turku in the winter.

Toward a circular economy

A Circular Economy Roadmap has recently been completed in Turku – the first city-level plan in Finland for a transition to a circular economy.

“The circular economy is a way to achieve low-carbon consumption and to avoid wasting natural resources. At the same time, it creates completely new kinds of innovations, networks, work, and opportunities”, Risto Veivo says.

During the production of the roadmap, it emerged that the Turku area already has 300 different kinds of businesses operating in the circular economy field. They offer, for example, different kinds of rental or maintenance services, they utilise recycled materials, or seek ways to reduce food waste.

According to Veivo, the circular economy has great potential in industry, for example:

“An oil refinery in the Turku area is shutting down and it will be replaced by the Green Industry Park, with business activities focusing on a circular economy.” The chemistry departments of the universities of Turku are among the active developers in the field.”

The city, for its part, seeks to give visibility to the circular economy and the opportunities that it offers.

“The circular economy and sustainable development are also emphasised in the city’s own procurements”, Veivo observes.

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Unleashing the potential of hydrogen for Europe's ports

By Bart Biebuyck, Executive Director of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

With Europe showing the way, the global transition to hydrogen as an energy source is well on track, including in ports. Hydrogen is especially relevant for waterborne transport and associated logistics, which ultimately support the entire economy.

It is no secret – hydrogen has the potential to profoundly transform our logistics and transportation systems, providing a clean and efficient energy solution for machinery and vehicles. Is there a special role for ports in the hydrogen transformation?

We know that ports can be both drivers and beneficiaries of hydrogen technologies. Ports can act as hydrogen hubs, delivering hydrogen as a fuel for shipping and other industries, providing that we have the right infrastructure and a good supporting regulatory framework. Ports can also be users of hydrogen as they move to decarbonise their own operations.

This is all great news, but what is Europe doing to move the hydrogen transformation forward? In a recent initiative, the FCH JU has published a call for tenders for the development of a 'Study on Hydrogen in Ports and Industrial Coastal Areas'. For the European Union, this is a crucial next step in unleashing the hydrogen potential in ports.

Study launch

The study will be a comprehensive assessment of the hydrogen demand in ports and industrial coastal areas, enabling the creation of a 'European Hydrogen Ports Roadmap'. Next, the study will feature clear economic forecasts based on a variety of business models for the transition to renewable hydrogen in ports. It will

"One of FCH JU's important overarching goals is to accelerate the uptake of hydrogen-based energy solutions in ports and coastal areas."

also present newly generated case studies and project concepts.

One of FCH JU's important overarching goals is to accelerate the uptake of hydrogen-based energy solutions in ports and coastal areas. The forthcoming study will provide new directions for research and innovation, guidance for regulation, codes and standards, and proposals on policy and regulation.

It will also help create impetus for stakeholders to come together and take a long-term perspective on the hydrogen transition in ports. Finally, the study will be a centralised resource. It will form a Europe-wide hydrogen ports 'backbone' when combined with roadmaps and other materials created by individual ports.

The analysis will feed into the work of the Global Hydrogen Ports Coalition, launched recently at the Clean Energy Ministerial (CEM12). This important international initiative brings together ports from around the world to work together on hydrogen technologies.

Funding hydrogen for ports

Another exciting initiative is the FCH JU-funded H2PORTS project, which will demonstrate and validate real, concrete, hydrogen-based solutions at the Port of Valencia in Spain.

Project partners are testing a reach stacker at MSC Terminal Valencia, and a yard tractor at Valencia Terminal Europa. A new mobile hydrogen supply station has been specifically designed for use during the project. These are truly innovative solutions based on fuel cell technologies.

H2PORTS will run this equipment daily for two years in real operational situations. This milestone marks the first such trials to be carried out using hydrogen technologies in port-handling equipment in Europe.

Showing the way

Ports play an important role in Europe's transport and logistics chain. Indeed, it is no exaggeration to say that they serve as a mainstay for the whole economy. Initiatives such as the HEAVENN project, which has led to the 'North Netherlands hydrogen valley', have already pointed the way towards a fully linked hydrogen-based economy, including port systems.

HEAVENN, which also received funding from the FCH JU, is a great example of a demonstration project serving as a blueprint for further developments. We can now see concrete initiatives like the Zuid-Holland Hydrogen Valley that are building on the model established by this project.

Home to Europe's largest seaport, Zuid-Holland is in the race to become the EU's hydrogen hub, where the import, use and transport of clean hydrogen coalesce.

Hydrogen is an energy carrier with great potential. With its superior environmental performance, it can help to improve the quality of life for people everywhere, and can be a powerful key driver for job creation and economic welfare.

Clean and efficient ports, logistics platforms and inland waterways are essential to maintaining the EU's competitive position in the world transport arena. We want to see a wider and more rapid introduction of hydrogen as an alternative fuel at our ports, and we invite all interested stakeholders and citizens to join us in this venture.

About the FCH JU

A unique public-private partnership, the FCH JU contributes to the development of sustainable and globally competitive FCH technology in Europe. By bringing together a wide range of industrial and scientific partners, it supports EU approaches on sustainable energy and transport, climate change and industrial competitiveness.

More info:

The Fuel Cells and Hydrogen Joint Undertaking
https://www.fch.europa.eu/
H2PORTS
HEAVENN

We should not mess up with climate. It is safer to be bold, rational and start from energy efficiency

By Monica Frassoni (pictured), President of the European Alliance to Save Energy (EU-ASE)

Last summer's human and environmental tragedies, from the heavy floods in Belgium and Germany to the wildfires in Greece, Italy, and Turkey, were a strong alarm signal for Europe.

Such extreme events, due to climate change and the lack of proper mitigation policies and investments, will become more frequent if we do not respond quickly and decisively to the climate crisis. At the beginning of August, in the 6th report of the Intergovernmental Panel on Climate Change (IPCC), 234 scientists from 66 countries reiterated that without strong and urgent action to limit the increase in global temperature to 1.5°C the consequences for the health of the planet and humanity will be catastrophic.

Global energy demand has been growing steadily from 40.000 terawatt-hours (TWh) in 1965 to 160.000 TWh today. Unfortunately, installed renewable energy sources (RES) are not growing fast enough to cover this rising demand. Despite positive news about RES rise, we are still far from fully replacing fossil technologies. Back in the 1960s, 6% of global energy came from low-carbon sources, mainly nuclear. By 1994, this grew to 14%. In 2019 the growth stalled around 16%, of which wind and solar supplied less than 4%, with fossil fuels supplying 84% of the world total energy.

The transition to a net-zero energy system is impossible if we do not act to reduce and optimise energy consumption in our daily activities, as well as in buildings, industry and transport. This is essential for integrating and exploiting increasing production from renewable sources, replacing what is currently generated by fossil fuels.

All of that explains why energy efficiency is at the heart of the clean energy transition. Without reducing our energy demand by around 60% by 2050, it will not be possible to achieve the Paris agreement, or to stop our dependence on fossil fuels while maintaining our agricultural and industrial capacity as well as comfortable and healthy lifestyles.

Coming to the European Union, reducing energy demand and optimising energy consumption is the quickest and most cost-effective way to reduce emissions in line with the new energy and climate targets set by the EU, notably the -55% emission reduction by 2030 and climate neutrality by 2050.

The task is challenging, but it is doable. The technologies we need are already available. From insulation materials to smart and connected lighting, from highly efficient district heating to smart technical building system, from heat pumps to automation systems, Europe hosts global industrial champions and thousands of small and medium enterprises that produce energy efficiency technologies. These find application across buildings, transport, industry, water, agriculture and ICT.

Despite all this, several European and national decision makers do not seem to fully grasp the importance of energy efficiency to reduce emissions, to create local jobs and contribute to a sustainable economic recovery and growth. According to the International Energy Agency, no other energy sector has a higher ratio of job created for million dollar invested. Figures which are confirmed by recent projections on job created (average 18 per million of euro invested in energy efficient renovation of buildings).

So, what must be done? Policy and decision makers have a very clear path to follow. The first step is the full application of the Energy Efficiency First (EE1st) principle, i.e., priority must be given to energy efficiency investments whenever they are technically feasible and economically more convenient than investments in new energy infrastructure.

The principle must be a cornerstone of the bloc's energy and climate policy: it must be enshrined in all relevant legislation and accompanied by clear guidelines to operationalise it in all future energy and climate policy and investments. This will avoid locking precious resources in stranded assets that are not in line with the Green Deal goals.

Furthermore, we need a strong and ambitious EU policy framework. Many legislative files will be revised as part of the "Fit for 55" package. The key ones include the Energy Efficiency Directive (EED) and Energy Performance of Buildings Directive (EPBD). It is extremely important that the legislators look at these files with the goal to overcome current barriers and create an enabling framework which can deliver emissions reduction cost-effectively and in the short period.

If we take the EED as an example, the European Commission's proposal is comprehensive and promising, but it definitely needs improvements, such as higher European and binding national energy efficiency targets.

Last but not least, if we want to really deliver the benefits of energy efficiency to citizens, the business community and the environment, we need easier access to finance, technical assistance and capacity building in the Member States. In strategic sectors, like construction, strengthening technical assistance to increase the demand of quality energy efficiency projects and investing in the upskilling and reskilling of workers is paramount to turn the EU Renovation Wave strategy into a reality.

In the next three decades we are called to make an "energy revolution". The scale and the speed of the effort demanded to achieve a critical limit to global warming to 1.5 °C are formidable. To be able to make it, we need to be bold, take rational decisions and start from energy efficiency.

"The transition to a net-zero energy system is impossible if we do not act to reduce and optimise energy consumption in our daily activities, as well as in buildings, industry and transport."

The contribution of EU funded projects to support the clean energy transition of EU companies

Energy efficiency in industry has a key role to play in the EU meeting its 2030 and 2050 climate targets and fulfilling its objectives under the Paris Agreement. In 2018, industry and services made up about 40% of the total EU-27 final energy use. Furthermore, in order to reach the EU Green Deal objective of becoming a fully decarbonised economy by 2050, the EU industry will have to reduce its emissions to around 90-95% compared to 1990 levels.

The European Climate, Infrastructure and Environment Executive Agency (CINEA) recently published a study analysing the impacts and achievements of forty-one projects aiming to increase the market uptake of cost-effective energy efficiency measures within the industry and services sectors. Together these projects delivered more than 3,600 energy audits, trained more than 10,000 people and reached more than 4.5 million people with concrete information, guidelines, tools and benchmarks promoting the clean energy transition of EU companies across different sectors. This has led to 3,491 GWh/year primary energy savings, 1097 $ktCO_2$/year greenhouse gas reduction, €457m investment triggered; in average, 68.9 GWh/year of energy was saved for every million Euro of EU funding.

Projects worked closely with businesses operating in different sectors across the EU, particularly small and medium-sized enterprises (SMEs), to improve the overall energy performance of their activities and processes. Projects received funding from the EU's Intelligent Energy Europe and Horizon 2020 programmes, which were supporting among others the market uptake of energy efficiency measures within the industry and services sectors.

The detailed analysis of the projects' outcomes allowed CINEA to collect evidence on the role that the above-mentioned EU-funded projects have played in supporting the policy implementation (e.g. Art.8 of the Energy Efficiency Directive) as well as in facilitating the penetration of cost effective energy efficiency measures among European companies. Notably, the development of common European knowledge, sharing of best practices, increasing capacity and skills of market actors contribute to unlock the full potential of energy efficiency while improving the competitiveness of EU companies.

Analysis showed that on average an energy audit carried out in these projects enabled companies to identify up to 18% potential energy saving measures, and 25% of those measures were implemented and reported by the participating companies, which means an average reduction of energy consumption of 4.5%. A number of reasons explain the significant gap between potential and actual energy savings, and more generally the reasons why despite the availability of a wide range of cost-effective, energy-saving measures on the market, their actual roll out is still limited.

The barriers holding companies back from acting in this space are initially often a lack of information and knowledge. Available information on energy efficient technologies is frequently challenging for companies to interpret and to transpose to their own sector and company context. A lack of financing can then be a substantial barrier for companies, especially given the longer payback time for significant equipment upgrades. There is also a number of behavioural barriers hindering companies from investing in sustainability. Such barriers may be, for example, lack of commitment or resources from decision-makers at company level, lack of interest, reluctance to disrupt operational processes; essentially, energy efficiency is not perceived as strategic investment. SMEs in particular face significant challenges in implementing energy saving measures and the projects analysed often addressed the challenges of sectors dominated by SMEs, seeking to speed up the market uptake of low-carbon technologies and services.

Many of the analysed projects have highlighted the importance

Impacts and Achievements of relevant EU-funded projects supporting the market uptake of Energy Efficiency measures in Industry and Services

41 IEE II and H2020 Energy Efficiency Projects (2007-2020)

EU Contribution €57.7 million
27 Member States plus UK
and 7 neighbouring countries

3 491 GWh/year Primary energy savings

3 600 energy audits

10 000 people trained

4 500 000 people reached

Critical success factors for implementation

- ✔ Driver for change
- ✔ Company wide buy in
- ✔ Financial viability of measure
- ✔ Strategic value recognised
- ✔ Long term policy framework

How these projects addressed the barriers hampering the market up-take of energy efficiency measures

BARRIER 1: Lack of financing, long pay-back time for some energy saving measures along with the lack of government regulations on mandatory energy audits for SMEs

ACTION

Highlight potential savings
- Energy and € savings
- Non-energy savings

Highlight potential revenue growth
- Green unique selling point
- Sustainability and productivity
- Stronger value proposition
- Align with supply chain

IMPACT

- "Starting point" for energy efficiency in companies
- Strategic repositioning in industry
- Supply chain pressure
- Wider recognition and quantification of non-energy benefits, at least halving the pay back period

BARRIER 2: Lack of information, practical experience and time resource

ACTION

Stakeholders brought together

Different sectors, Different industries, Different size companies, Academia and industry, Various geographies, Policy makers and standards bodies

413 Project partners

IMPACT

Knowledge creation

- 598 articles
- 1 125 events
- 32 000 attendees
- 368 good practice guides, case studies and fact sheets
- 59 Roadmaps and strategies

BARRIER 3: The value of energy efficiency is poorly recognised and captured

ACTION

Utilising the knowledge created

- 3 600 energy audits
- 10 000 people trained, external experts and internal company advocates
- 51 tools and platforms
- Leveraged benchmark and best practice knowledge to unlock financing

IMPACT

- 3 491 GWh/year primary energy savings
- 1 097 $ktCO_2$/year GHG reduction
- €457 million Investment triggered
- 227 GWh/year Renewable energy triggered

18% Potential savings identified in audits

× **1/4** 25% implementation rate

= **4.5%** Actual savings achievable through an energy audit

≈ 30% of the 2030 energy reduction goal set for industry if all EU companies implemented this approach, at this rate

EUR 1 million EU funding

leveraged 39 GWh/year

triggered EUR 5 million company investment

The full report is available at **https://cinea.ec.europa.eu/publications/assessment-and-communication-relevant-eu-funded-projects-supporting-market-uptake_en** The sole responsibility for the content of this document lies with the author Ricardo. It does not necessarily reflect the opinion of the European Union. Neither the CINEA nor the European Commission are responsible for any use that may be made of the information contained therein. Data has been extracted from the review of the 41 energy efficiency projects. This is the impact of the 41 projects taking into account only reliable and acceptable data. If potential data would be included the impact would be much higher. Please see the final report for an assessment of reliability of all data.

European Climate, Infrastructure and Environment Executive Agency

Project number: 2021.1038. Title: Impacts and Achievements of relevant EU-funded projects supporting the market uptake of Energy Efficiency measures in Industry and Services. Print: ISBN: 978-92-9460-434-7

of recognising the "multiple benefits" or "non-energy related benefits" of energy efficiency investments in correlation with the decision making process at company level. EU-funded projects such as M-Benefits (www.mbenefits.eu) and STEAM-UP (https://steam-up.eu) have demonstrated how energy efficiency will deliver other co-benefits to the companies such as enhanced competitiveness, decreased maintenance costs, better working environment, and improved environmental performance. Furthermore, both projects have addressed the multiple benefits from a cost side perspective, identifying that the payback times associated with the investment of energy efficiency measures can be considerably reduced (between 0,5 to 2 time less).

The study presents several success stories stemming from EU-funded projects, like the three stories below.

Nestlé's Swiss Workplace Solutions department have adapted their activities following the participation in the M-BENEFITS project. The project enabled Nestlé to improve its value proposition by acknowledging the impacts that non-energy related benefits have on downgrading operational costs along with reducing business-associated risks. Having seen the value of the approach and the additional benefits associated with energy efficiency improvements, the company are currently using this method on two strategic projects focusing on the refurbishment of the factory/offices.

The STEEM-UP project helped Fahnen-Gärtner, a market leader SME in the production of promotional and national flags based in Austria, to reduce their energy consumption by 1 GWh/year through an energy audit that was carried out with the developed project methodology (focusing on multiple benefits). The company invested in several measures that were identified though the energy audit such as a new steam generation boiler, an exhaust gas heat exchanger with heat recovery and buffer storage. They also installed an Energy Monitoring System and a PV system to cover 20% of the total electricity needed to power the plant.

The ENERWATER project developed a standard methodology for assessing and improving the energy efficiency of wastewater treatment plants. The project methodology was translated into the CEN/TR 17614 standard, which was approved in January 2021 by the European Committee for Standardization (CEN), thus becoming the European standard for defining and measuring energy efficiency in wastewater treatment plants.

Alongside this work, an online survey was conducted to identify market stakeholder's views on the most pressing needs and priorities that are relevant to accelerate the energy transition of the industry and service sectors, with a particular focus on SMEs. More than 185 respondents completed the survey, which were used to feed into the preparation of the first batch of topic priorities that were published on the 13th of July 2021 under the Clean Energy Transition sub-programme of the LIFE programme, which is the follow up of the energy efficiency market uptake activities supported under the Horizon 2020 programme for the period 2014-2020.

Finally, various lessons learned and conclusions were identified following investigation of the achievements and impacts of the analysed EU projects, including interviews with project participants and relevant market stakeholders. Useful insights are available in the study on how the projects affected the market for energy efficiency audits and measures, how projects contributed to overcoming key barriers and what the key drivers were that encouraged companies to invest in energy efficiency measures. Notably, the primary driver for many companies was the desire to increase the operational efficiency of their processes by saving energy and the associated costs. Other drivers included the need to increase the sustainability of their business while improving their market position as well as responding to supply chain pressures or recognising the wider non-energy benefits. More in general, the analysed projects show that the clean energy transition of a company needs to be accompanied by a radical transformation of the energy corporate culture of the whole staff both at managerial and operational level.

In this regard, EU-funded programmes will continue to support capacity building of market stakeholders in the area of energy efficiency for industry and services in the EU. The market uptake of energy efficient solutions within SMEs evidently has a significant contribution to make towards the achievement of the EU Green Deal objectives. The first LIFE call for proposals targeting the clean energy transition of companies is now open with a deadline on 12 January 2022. In this regard, there are two specific topics supporting companies to climate-proof their activities, which target respectively energy audits for the energy transition of companies and sustainable value chains.

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POLYPHEM: The future of small-scale CSP plants

The POLYPHEM project aims at improving the flexibility and the performance of small-scale Concentrated Solar Power plants, thanks to a solar-driven micro gas-turbine technology. As a final result, the project is building a 60 kW prototype plant with a thermal storage unit and will validate this innovative power cycle in a relevant environment at the Themis solar tower in Targassone.

The challenge for small-scale CSP Plants

The decentralized generation of power on-demand in remote areas at competitive cost is a major challenge of CSP to which POLYPHEM is all about. This project of small-scale solar tower proposes robust technologies of engines forming the combined cycle (micro gas-turbine and ORC), easy-handling heat transfer fluid (thermal oil) and cheap material for heat storage (concrete). One expectation of this challenging project is to demonstrate the reliability of the technology and the flexibility of the power generation from solar energy.

POLYPHEM: Small-Scale Solar Thermal Combined Cycle

Funded under Horizon 2020 (Energy programme), POLYPHEM is coordinated by CNRS-PROMES and brings together 9 partners from 4 EU countries. The project runs from April 2018 to March 2022 with a 4.975 M€ EC grant over these 4 years.

The main objective of the POLYPHEM project is to improve:

- the performance of small-scale Concentrated Solar Power (CSP) plants
- and their flexibility to generate power on demand.

To this end, a new technology is proposed: a solar-driven combined cycle with integrated thermal energy storage.

The power block considered in POLYPHEM is a combined cycle intended to be used for decentralized small-scale power generation in the range 40 kW to 2000 kW in remote areas. The purpose is to meet the variable demand of energy of a mini-grid. The baseline technology consists of an air Brayton cycle as top cycle and an Organic Rankine Cycle (ORC) as bottom cycle.

POLYPHEM broadens this technology by driving the top cycle with solar energy through the development of an advanced technology of pressurized air solar receiver and by including an innovative thermal energy storage unit between both cycles. Besides electricity generation, other applications will be considered for future developments.

Expected impacts and results

The outcomes of POLYPHEM will allow in the short term to reinforce the competitiveness of this new low carbon energy technology, to favour its integration in the medium term in the European energy mix and to contribute to the mitigation of climate change.

The main expected impact of this project is to enhance the competitiveness of low-carbon energy production systems through the technology developed. The expected progress is a better fitting of electricity generation to variable local needs, an overall conversion efficiency of solar energy into electricity of 18% for an investment cost of less than 5 €/W and a low environmental impact.

By 2030, the cost of electricity production targeted by the POLYPHEM technology is 165 €/MWh for an annual direct normal irradiation of 2600 kWh/m²/year (North Africa and Middle East) and 209 €/MWh under 2050 kWh/m²/year (Southern Europe).

In addition to decentralized power generation, other applications are considered for the deployment of this technology used in poly-generation: solar heating and cooling of multi-family buildings, water desalination for small communities, industrial heat production, desalination of seawater or brackish water, etc.

https://www.polyphem-project.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 764048.

Europe is decarbonising like no other. Time to speed up!

By Kristian Ruby (pictured), Secretary General, Eurelectric

This past summer has been a showcase of what the world has in store if we leave carbon emissions unfettered: firestorms, floods, heat waves and torrential rains. If anybody were still in doubt, the updated report of the IPCC delivered an unequivocal message: It's 'code red' for mankind. Fix the climate issue or face the increasingly unbearable consequences.

In July, the European Commission presented its proposals for how to fast-track Europe's decarbonisation. The so-called 'Fit for 55' package wields an impressive number of plans and proposals. Let's be clear: delivering what's on the table will not be a walk in the park. It is a very ambitious package that will transform major parts of the European economy. But it is justified by the sinister backdrop of an escalating climatic crisis. From a legal perspective, the package represents significant progress in terms of aligning with the long-term net-zero objective and committing all economic sectors to contribute.

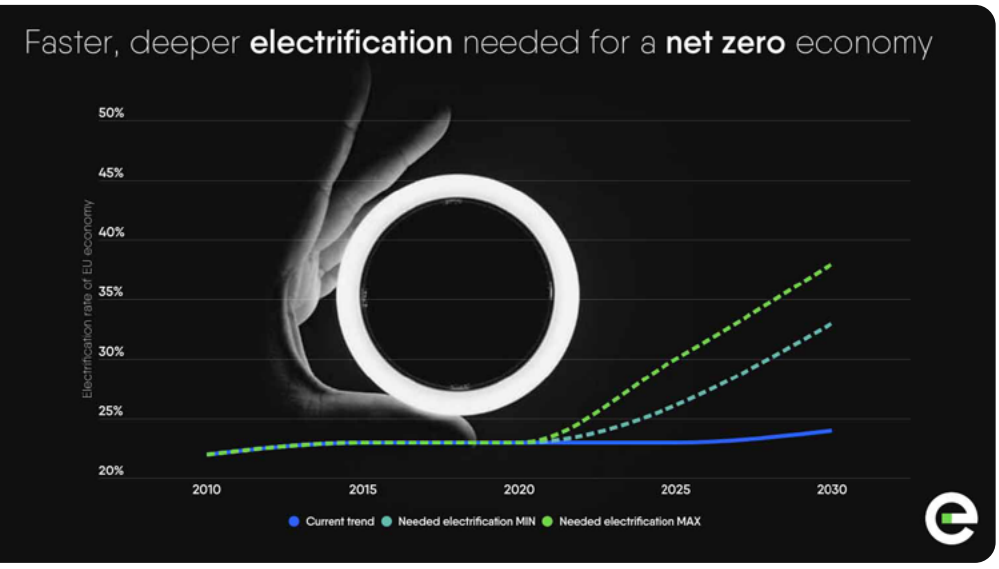
Fit for 55 assigns a critical role to electrification as a core avenue for decarbonisation, and for good reasons. The past years have seen the power sector speed up its own decarbonisation. In 2019, renewables reached 34% of the electricity mix while coal generation had fallen 24%. In 2020, for the first time ever, renewables represented a larger share of electricity generation than fossil fuels in Europe. 65% of the electricity was clean last year: a momentous achievement.

All tech on deck

The decarbonisation trend has continued this year in the power sector, but recently with more strain due a combination of lower wind resource and high commodity prices driven by strong policy and a rapidly recovering economy. As we march toward 2030 targets, the deployment of renewable energy will need to accelerate further. No less than 500 GW of renewables, mainly wind and solar, will need to be added to the system in the next nine years. But in generation it will be all hands on deck for clean technologies. We will need to rely on the full range of clean technologies to cover demand and thus ensure continued decarbonisation while keeping the system stable and reliable.

The "all hands on deck" approach will also apply beyond generation. Deep digitalisation will be needed to help expedite the more complex flows of a fully decarbonised power system. For instance, deployment of smart meters shows that there are multitudinous benefits to digitalisation. While customers are empowered with greater visibility and control of their electricity consumption, operators gain valuable information on how to manage the grid. Thus, they can integrate more renewable capacity and make a dent in both consumer and producer emissions.

The same goes for hydrogen and other power-to-X solutions which will also need to see rapid deployment to keep the pace with political ambition. Nevertheless, direct electrification remains the most important avenue for decarbonisation of end-use sectors. The key is getting there. We still need around 50 million heat pump installations and additional EVs in the same order of magnitude. Rolling out the necessary infrastructure to make for a smooth, seamless customer experience will be one of the key challenges in the next ten years.



What needs to be done?
A shift of this magnitude in the way we source and use our energy is extraordinary. It will indeed require all major parts of the European economy to change. With Fit for 55, the Commission takes serious steps to ensure that electrification takes centre stage. The rate of electrification has been far too slow in Europe.

To reach the Commission's new decarbonisation targets, electrification, especially in end-use sectors, needs to do much of the heavy lifting. Therefore the policy proposals to promote direct electrification, eliminate discriminating taxes on electricity, and provide the necessary infrastructure are most welcome and should be helped to a swift adoption.

Another positive element of the package is the reform of the ETS system, which should provide for clearer investment signals. Investors require long-term, stable and predictable signals to de-risk their investments. As a result, policymakers will do well to maintain robust emissions trading and carbon pricing systems.

At least two areas need further attention, however. Lengthy and opaque permitting procedures remains one the biggest barriers to progress. This must be streamlined.

If we want to double renewable capacity by 2030, we must reconcile the lack of synergy between processes at local, national, and EU levels. Improving on this front would also feed into investor confidence, complementing efforts in implementing market frameworks.

Another critical area is networks. Especially distribution grids need reinforcement and modernisation. We have to reverse the receding investment trend, since distribution grids are critical to manage the increasingly decentralised nature of the power system. Alongside the massive additions of renewable capacity, EVs and heat pumps are slated to be added to the grid in the tens of millions each.

To handle this, major investments are required, while network tariffs will have to be modernised to reflect an altogether different manner of grid utilisation. While planning and approval of distribution grid investments mainly happens at national level, addressing this with urgency will be mission critical.

As said, all this will certainly not be a walk in the park. But: we simply cannot afford any further delays. Getting this package agreed can help us eliminate some key roadblocks and take substantial strides forward. The power sector is already on the move. Now let's speed up!

"The "all hands on deck" approach will also apply beyond generation. Deep digitalisation will be needed to help expedite the more complex flows of a fully decarbonised power system."

Emergency CO_2 - Low temperature catalytic methane decomposition for COx-free hydrogen production

Methane decomposition (MD) reaction, also known as methane pyrolysis, allows the conversion of methane from natural gas or biomethane into **solid carbon** and **hydrogen** with high purity:

$CH_4 \rightarrow C\,(s) + 2H_2 \quad \Delta H^0 = 75.3\ kJ\ mol^{-1}$

This reaction has the unique feature of being **100% selective**. Apart from allowing the **swift decarbonization of the energy**, when biomethane is used, this reaction has the power to remove CO_2 from the atmosphere as it produces H_2 at very competitive costs. This technology enables **using the present storage and distribution infrastructure for natural gas** and produces H_2 to be used locally as a fuel for electricity/heat or as feedstock for chemical industries (steel production, ammonia synthesis, reversal petrochemistry, etc.).

Considering only the price of the raw materials, H_2 from the decomposition of natural gas costs 1.9 €/kg, while biomethane-derived H_2 costs 2.2 €/kg. At the present prices of CO_2 allowances, >60 €/ton, this process saves 0.54 €/kg of H_2. The MD of biomethane removes CO_2 from the atmosphere. Assuming a cost for the direct air capture of CO_2 of 150 €/ton and for its sequestration of 50/ton, per 1 kg of H_2 produced, 0.60 € are saved in capture and sequestration of CO_2.

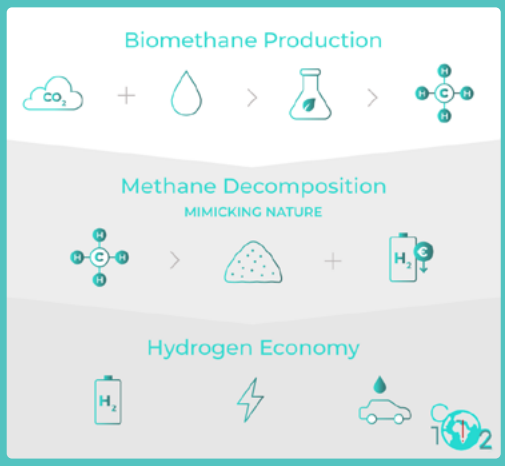
The industrialization of catalytic MD has been hindered so far by the extremely **fast catalyst deactivation**, which is caused by the inevitable coverage of catalytic sites by the formed solid carbon. Competing institutions/companies are developing high temperatures MD processes involving either metal liquid reactors or reactors using carbon catalyst particles; however, these approaches are energy-intensive, dangerous to operate and display low catalytic activity.

112CO2, a FET-Proactive project, aims at developing a **disruptive low temperature (ca. 550 °C) methane decomposition process, using abundant and cheap metallic catalysts**. Briefly, the designed reactor uses Ni-based catalysts, which are very active but need to be **cyclically regenerated**. It is expected to reach **>0.45 $g_{H2}\ g_{Cat}^{-1}\ h^{-1}$ and stable for at least 10 000 h.**

The project, which has started in September 2020, gathers some of the finest EU research laboratories and companies, including University of Porto, author of this new MD concept; Pixel Voltaic Lda., which is a spin-off company from UPorto, responsible for designing the process lab prototype; CSIC to synthetize the catalysts; DLR to develop proton conducting ceramics for efficient and cost-effective H_2 purification; EPFL responsible for the dissemination activities; Paul Wurth S.A. and Quantis for performing life cycle assessment and economic analysis.

As explained by Adélio Mendes, professor at the University of Porto and project coordinator: “preliminary results allowed to reach **a maximum catalytic activity of 3 $g_{H2}\ g_{Cat}^{-1}\ h^{-1}$ and proved that the cyclic regeneration allows keeping the catalyst at its maximum catalytic activity.** Initial experiments **demonstrated world-record stabilities**, using a compact reactor loaded with commercial and non-optimized catalysts.” 112CO2 also proposes an ambitious communication strategy, aiming to involve stakeholders, investors, researchers, youngsters, and students for this emergent technology.

Schematic overall objective of 112CO2.



Check the progress of 112CO2 on www.112CO2.eu and follow EmergencyCO2 EU on Facebook and LinkedIn.

112CO2 project has received funding from the European Union’s Horizon 2020 research and innovation Programme under the grant agreement No 952219.

European mayors take collective action for a fairer, climate-neutral Europe

By Floriane Cappelletti (pictured), Covenant of Mayors – Europe Office

2021 is a milestone for the European Covenant of Mayors, as signatory cities are stepping up their climate ambition to reach a common vision: "By 2050 we will all be living in decarbonised and resilient cities with access to affordable, secure and sustainable energy."

On 21 April, mayors and local leaders from the Covenant Political Board showed the way by endorsing this new vision during an online ceremony, and are now inviting all European local authorities to join the movement.

Building on a survey among local authorities and on the climate neutrality target of the European Union, these renewed ambitions reflect local leaders' commitment to a climate and energy transition that is fair, inclusive and respectful of us citizens of the world, and of our planet's resources. Beyond the objective of reaching climate neutrality by 2050, Covenant of Mayors signatories also commit to implementing adaptation to climate change measures and alleviate energy poverty through a just transition. They finally commit to engaging their citizens, businesses and local stakeholders in the transition, thus contributing to the European Green Deal.

In a video message in support to these new ambitions, Commissioner for Energy Kadri Simson highlighted that the collective moment of the Covenant of Mayors paved the way for the European Commission to do more. Now that the Green Deal has been adopted, she invites all local authorities to join forces with the Commission towards a climate-neutral Europe, resilient and fair, where cities are healthy places for citizens to live in, and for local businesses to thrive.

"The European Covenant of Mayors is a successful movement with more than 10,000 signatories that have been leading the way through voluntary commitments and effective local action for more than 10 years, incorporating experiences with a multi-level cooperation model and bringing together a wide diversity of territories", says Rafał Trzaskowski, Mayor of Warsaw, member of the Covenant of Mayors Political Board and rapporteur of the Committee of the Regions on the European Climate Pact. "It is an ideal platform for making the Green Deal become reality in all EU territories."

The Covenant of Mayors is a partner of the EU Sustainable Energy Week of which European Energy Innovation is a media partner. Registrations for the event are now open.

Additional information/links:

- www.eumayors.eu/join
- Mayors' call to action video
- Video message from EU Commissioner for Energy Kadri Simson

About the author
Floriane Cappelletti is in charge of communications for the Covenant of Mayors – Europe Office.
The Covenant of Mayors is the world's largest movement for local climate and energy actions. In Europe, over 10,000 cities and towns are joining forces to secure a better future for their citizens.

In Europe's race to climate neutrality big change has local energy beginnings

Implementing the energy transition from the bottom up

By Giorgia Rambelli, ICLEI Europe Coordinator for Climate Policy and Energy Governance

From devastating floods to catastrophic wildfires, the past few months have made it clear that the consequences of a changing climate across Europe, and the globe, are no longer a distant threat. In the race to climate neutrality, Europe is determined to come out on top. With milestone policy and legislative proposals like the Fit for 55 Package, which provided major revisions of existing energy policies like the Renewable Energy Directive (RED II), the EU is aligning its energy legislation with its climate objectives. Achieving climate neutrality by 2050, while transforming the EU into a competitive and resource-efficient economy through the European Green Deal, however, depends significantly on progress made at the local level.

Local governments are responsible for implementing over 70% of EU legislation and are the first responders when it comes to rebuilding after natural disasters and implementing sustainable energy solutions. Many European cities are already working diligently to transform their local energy supply and demand, a process that provides both a complex challenge, as well as a unique opportunity to rethink the way we build and live in our local communities, transforming the social fabric of their cities along the way.

In Valencia (Spain), rethinking the energy system involves viewing citizens viewing citizens 'as active stakeholders' rather than as passive consumers. In 2019, the city set up an Energy Office to provide citizens with information, training and personalised advice on energy-related topics. The Energy Office actively supports energy community set-up aiming to establish 100 energy communities by 2030. Furthermore, the city has made civic centre roofs available to energy communities for photovoltaic panel installation.

For many years now, communities and local governments have been advocating for the critical role that people must play for Europe to become the first climate neutral continent. With the introduction of Renewable Energy Communities and Citizen Energy Communities as legal entities in European legislation such as the revised Renewable Energy Directive (RED II) and the Internal Electricity Market Directive, energy communities have the potential to play an increasingly stronger role in the energy transition. Yet more needs to be done to channel the full potential of local commitment: while there is currently no requirement for national energy community targets, such targets, as well as roof-top PV capacity targets for EU Member States in relation to their maximum capacity, would help boost the role of citizens in the transition. Given the positive effect of energy communities on social acceptance of Renewable Energy Sources and the reducing of energy poverty, this holds relevance for national energy transitions as well as the COVID recovery.

While numerous initiatives can be found in towns and cities across Europe, every solution must still confront obstacles: limited access to funding, lack of stable regulatory frameworks, and limited capacity are still hindering the large-scale transition that Europe needs. Current energy networks were built to provide a one-way supply route. Thus, reverse energy and revenue channels require not only costly technical changes, but also demand new business models and operating processes from utility companies, network operators and building owners. Without suitable business and operating models, the uptake of such solutions will remain an exception rather than the standard.

To help develop new models and solutions, cities across Europe are engaging in programmes such as EU Horizon 2020, which has been helping to provide crucial support to municipal and local actors over the years. Horizon projects such as RUGGEDISED and EXCESS are working in and with cities like Graz (Austria) to develop smart solutions that enable buildings and entire neighborhoods to become modern,

interconnected, self-sufficient energy providers. EXCESS supports the transformation of a feed production silo into a plus energy student hostel in the former industrial "Tagger-Werk" area of Graz. The concept of plus energy buildings that produce more energy than they consume opens up the possibility of sharing surplus energy with neighboring buildings and other services, such as e-mobility. To make the energy transitions successful, it is imperative they take place in a local context that allows local stakeholders to define solutions that address their needs.

It is important to foster opportunities for local actors to take charge in the energy transition process. And while support from these types of initiatives – through access to EU funding frameworks that incentivise innovation, replication and integrated planning – is essential, national and international entities also rely heavily on local governments to foster cooperation and kick-start action.

This multidimensional relationship requires clear national legislation developed in close cooperation with their local counterparts. It also necessitates the availability and accessibility of direct and adequate funding. If this is achieved, the solutions and processes developed in these breakthrough projects will allow for considerable replication in local communities across Europe.

And there is no better time to highlight the myriad efforts to get cities on board for the energy transition towards climate neutrality, than the upcoming EU Sustainability Week (EUSEW), which overlaps with several global UN initiatives and campaigns, such as Urban October and Cities Race to Zero, and leads up to the UNFCCC Climate Conference (COP26).

For Europe's Sustainable Energy Transition to succeed, and international leaders to manifest a global trajectory toward a climate friendly economic system, there is only one way forward: empowering local governments and communities to embark on their own races to climate neutrality and energy innovation. This can be accomplished through close multi-level cooperation on regulations, capacity building and funding. For local governments and energy actors, the EUSEW conference will provide an opportunity to voice their needs, exchange solutions and define energy governance requirements and benchmarks for making local and global energy transitions a realistic scenario in the lead up to COP26. A streamlined approach to cross-sector collaboration and the horizontal integration of climate and energy policies is needed for Europe, and the world, as the global race to climate neutrality will ultimately be won through successful local energy transitions.

"While numerous initiatives can be found in towns and cities across Europe, every solution must still confront obstacles: limited access to funding, lack of stable regulatory frameworks, and limited capacity are still hindering the large-scale transition that Europe needs."

Pushing innovation measures into the EU's support for renewables

By Greg Arrowsmith (pictured), General Secretary, EUREC

Think of "Renewable Energy Directive". What comes to mind? Targets, obviously: the famous "20-20-20" triad and the new 2030 targets for renewable energy. Possibly also permitting and 'Guarantees of Origin'. Sustainability criteria... maybe. Innovation, however, would not be in most people's top ten. That should change. The RED should be equipped to offer direct support to innovation.

Responding to the climate emergency, the European Commission has proposed to double the share of energy coming from renewables within a decade, from 20% in 2020 to 40% by 2030. The new capacity to install is colossal. Between 2010 and 2018, 150 GW of wind and photovoltaic capacity were added in EU-27. 40% renewable energy by 2030 implies an increase of 550 GW in the period 2018-2030. Capacity would have to be added in 2018-2030 at about 2½ times the average amount it had been added 2010-2018. Huge expansion will be needed in renewable energy technologies for heating and cooling, too.

Subtarget for innovative renewables

We are entering a moment in the history of renewables in Europe

The SHIP2FAIR project has created a 'Replication tool' for solar heat systems for industry integrating a variety of datasets from a variety of sites.

where new equipment will be installed rapidly everywhere, and where a (probably growing) number of companies along the supply chain will turn over ever larger sums to satisfy demand. These are conditions under which an obligation could and should be put in place that requires some of those GW to concern advanced technology. Constant development of new technology is necessary to ensure that the EU remains competitive in high-value, knowledge-intensive segments of the supply chain.

The Renewable Energy Directive is a good vehicle to push innovation, because it creates demand for technology. As such, it complements the myriad "technology-push" instruments that stimulate supply, like competitive calls for proposals for R&D projects. **We call for a share of the Commission's proposed EU-wide target of 40% renewables by 2030 to be supplied by innovative technology.** The idea is not revolutionary. For biofuels, the Commission proposes that "advanced biofuels" account for 2% of all biofuels sold by 2030. Let's not stop there: set contributions from advanced electricity and heating and cooling technologies, too!

A technology could be considered "innovative" or "advanced" if it, for example, has much lower carbon footprint from manufacture than other similar renewable energy technologies; higher efficiency; longer-lifetime; less use of scarce or hazardous materials; better capability to monitor and optimise its performance with sensors and AI (see 'Data sharing' below). Member States would justify which technologies they select as "innovative", or their criteria for identifying them, in their National Energy and Climate Plans, due to be revised in 2023, which would also contain details on laws to facilitate their uptake. The Commission would scrutinise the plans and may demand revisions per the usual process.

Data-sharing

One of the ways to drive improvements in technology performance is to analyse data from machines operating in the field. That happens already (companies analyse data from their own devices or systems) but too often they keep that data to themselves. Collectively, Europe's renewable energy industries could advance fastest if they changed their culture and shared with trusted external researchers or even made datasets public. **The more high-quality data is made available to analytical tools, the better insights those tools can provide.**

Here are our policy ideas, which align what the Commission refers to as the "twin transitions towards climate neutrality and digital leadership":

- Member States in their National Energy and Climate Plans to set out a strategy for encouraging data sharing between companies (Member States must present draft updated plans to the EC in 2023). The sharing should be cross-border and linked to the Common European Energy Data Space and recommendations expected to come from 2022's Action Plan for the Digitalisation of the Energy System. Highly innovative projects could join the knowledge sharing arrangements already in place for ETS Innovation Fund. Public incentives may be needed to initiate data sharing. State Aid rules should allow this (as EUREC has recommended on 31 July in its input to the relevant public consultation);

- Plants built under the EU's Renewable Energy financing mechanism to share data, possibly publicly, if not then in a shared repository for EU researchers under reciprocal terms;

- National bodies responsible for administering renewable energy incentives (such as GSE in Italy)

to publish the instantaneous power delivered at the grid connection point by large plants. Meta data should be provided, too: plant location and a set of high-resolution copyright-free timestamped photos of the installation and installation subsystems;

- The Energy Efficiency Directive and likely EBPD to be amended. In the EED, the Commission proposes "an obligation for renovation of 3% of public building floor area" per year. There should be protocols in place to collect data on energy performance (including from any new renewable energy technology installed) before and after the renovation to monitor the success of the measures, with the data made available to researchers.

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GRIDABLE technology at the core of future HVDC cables

The installation of high voltage direct current (HVDC) technology in electrical power grids has been increasing due to the need to connect electrical power over large distances. In HVDC applications the electrical insulation faces specific challenges differing from those encountered in conventional AC power grid applications due to the stress buildup within the insulation material caused by the constant DC electric field stress. This phenomenon is referred to as space charge accumulation, one of the most critical phenomena compromising the HVDC insulation reliability and lifetime. In order to secure reliable availability of clean and inexpensive electricity, the EU funded GRIDABLE project started four years ago with the goal of improving the HVDC insulation performance.

The project was concluded on 30th of June 2021 and on 14th of June an online stakeholder meeting was held. Among the many technological and scientific advances of GRIDABLE, the most relevant has been the prototype of a next generation HVDC cable with outstanding insulation properties. In fact, the test results on the HVDC model cable demonstrator show the absence of breakdown in the cable length up to 480kV and the absence of thermal runaway. The results in terms of leakage current measured on the cable are also excellent. For Nexans, one of the industrial partners in the project, the production of such a promising prototype was important to demonstrate the extrusion feasibility on existing industrial lines.

Detail of the internal structure of HVDC cables; GRIDABLE material are used for the insulating layer.

We have interviewed Gabriele Perego and Christelle Mazel, respectively the Nexans' Scientific Director and the Products Team Leader at Nexans Research Center, who have been working on the project since its inception. We learned that GRIDABLE developed a nanocomposite formulation presenting an extremely low leakage current and no thermal runaway phenomenon. These are exceptional properties and constitute an important progress compared to the commercial reference. Moreover, the breakdown voltage obtained gives the possibility to decrease the thickness of the insulation layer and to obtain a lightweight and more reliable cable. Although the gain in thickness, of the order of a few millimeters, might seem negligible, when scaled up to the length of cables, it entails huge savings in manufacturing costs, making it a highly competitive product once on the market and even more combined with a lighter weight base formulation.

Christelle is very optimistic about future developments. With the initial objective of the project fully reached in terms of level of performance on the HVDC model cable demonstrator, she expects that the new GRIDABLE insulating material will be able to reach extra high voltage for power transmission at rated voltage up to 800kV. To understand why this will be an important breakthrough, consider that current insulation technologies for HVDC power cables based on extruded XLPE can reach a voltage rate of up to 525kV and present huge technical limits such as its maximum conductor temperature 70°C. Moreover, its recyclability is limited.

A remarkable feature of GRIDABLE cables lies in their low environmental burden thanks to the recyclability of the PP based materials. In a policy context characterized by the the green transition led by the EU (and the USA and China seem to be following), this means a larger economic and societal impact of this technology. In September 2020, Nexans disclosed its commitment to minimize the environmental impact of its activities and products and to develop cabling solutions that contribute to preservation of the environment and saving of energy. Therefore, limiting the environmental impact of power cables is a major achievement. Nexans intends to work on further developments of the GRIDABLE technology to meet a key challenge: the compounding of this material on large scale industrial facilities and with a full control of the cleanliness.

Co-founded by the Horizon 2020 Framework Programme of the European Union.

Green hydrogen for industrial use in the European Union

By Arnulf Jäger-Waldau, Georgia Kakoulaki and Nigel Taylor, Joint Research Centre, European Commission

In July 2021, the Intergovernmental Panel on Climate Change (IPCC) approved during its 54th Session the report "Climate Change 2021: The Physical Science Basis, the Working Group 1 contribution to the Sixth Assessment Report"[1]. The report concludes "Unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions, limiting warming to 1.5°C will be beyond reach".

In December 2020, the European Council approved the European Commission's (EC) European Green Deal, the main political initiative for reaching net-zero greenhouse gas (GHG) emissions by 2050[2]. The European Union's Hydrogen Strategy is one of the key elements to achieve carbon neutrality by 2050[3]. The Hydrogen Roadmap Europe report indicates that hydrogen could provide up to 24% of total energy demand corresponding to ~2251 TWh of energy in the EU + UK by 2050[4]. The two main aspects are the industrial hydrogen use in the European Union (EU) and the fact that hydrogen is considered a key component of the future energy system as a flexible energy carrier for industry and transport, helping to reduce GHG and particle emissions. The current use of hydrogen in the EU amounts to approximately 9.7 million tonnes (Mt) or 8% of the global hydrogen demand of 120 Mt[4,5]. Global hydrogen production is responsible for 830 $MtCO_2e$ emissions per year, 2.3% of total global CO_2 emissions[6] secure and affordable energy future. At the request of the government of Japan under its G20 presidency, the International Energy Agency (IEA. Worldwide, over 90% of hydrogen consumption is associated with two industries: oil refineries (ca. 52%) and ammonia production (ca 43%), whereas in Europe oil refineries have a lower share with approximately 30% and ammonia production is dominant with 50%[6,7]. To reach net-zero GHG emissions by 2050 hydrogen production has to be decarbonized. Therefore, it is of no surprise that industrial activities to decarbonize the ammonia production in Europe using renewable electricity is attracting attention[8].

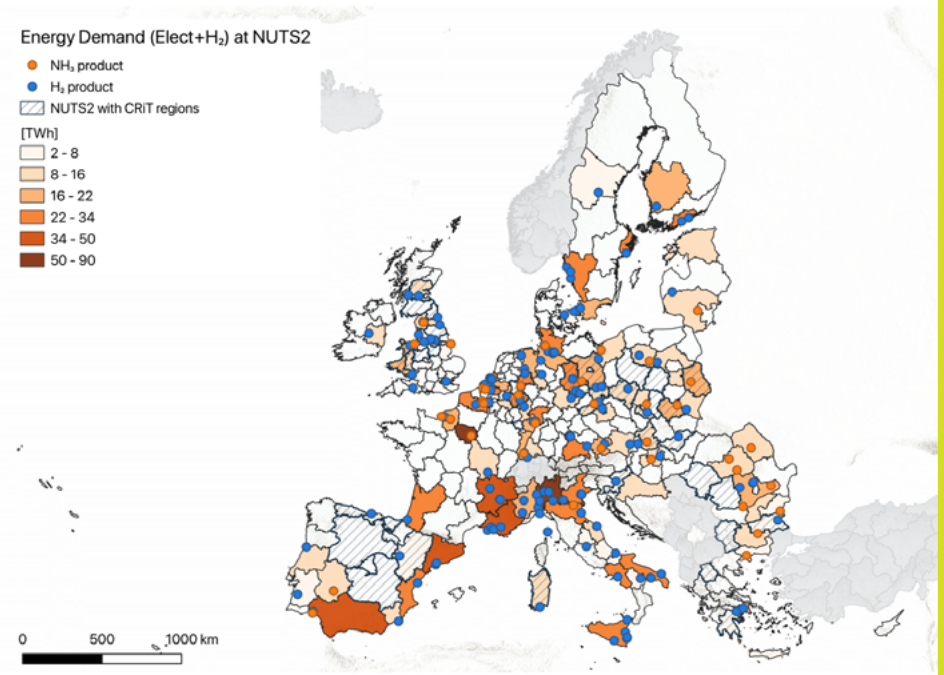


Figure 1. Distribution of main hydrogen production hubs in EU27 + UK. Blue and orange represent geolocated chemical industries with hydrogen and ammonia production respectively[11]. Shaded polygons show EU coal regions in transition (CRiT)[13]. Background colours represent total demand in TWh per year i.e. the sum of electricity consumption and the potential demand for electrolysis only in hydrogen-producing regions.

In a recent study the Joint Research Centre (JRC) analysed the regional potential of renewable energy sources (RES) to produce green hydrogen in the EU and the United Kingdom[9]. The study assessed the feasibility of producing green hydrogen from solar, wind and hydropower resources

assuming a maximum potential at both regional (NUTS2) and national (NUTS0) level following the 2016 Nomenclature of Territorial Units for Statistics (NUTS) classification[10]. Net zero carbon and climate mitigation strategies involve the use of RES at large scales to cover electricity demand. Efforts to produce green hydrogen using processes powered by renewable electricity should not affect the transition towards clean electricity generation systems. Therefore, the analysis compared the potential electricity demand for a transition to green hydrogen for industrial use in each country or region, with the renewable energy potentials (solar, wind, hydro) net of the need to cover existing total electricity consumption across all sectors.

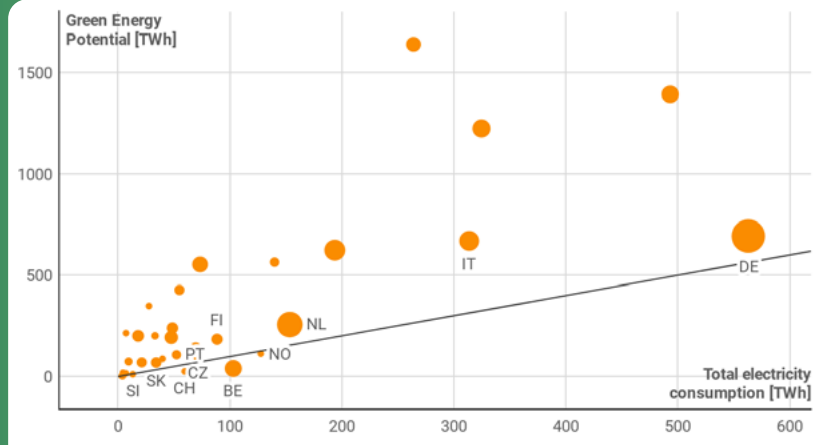
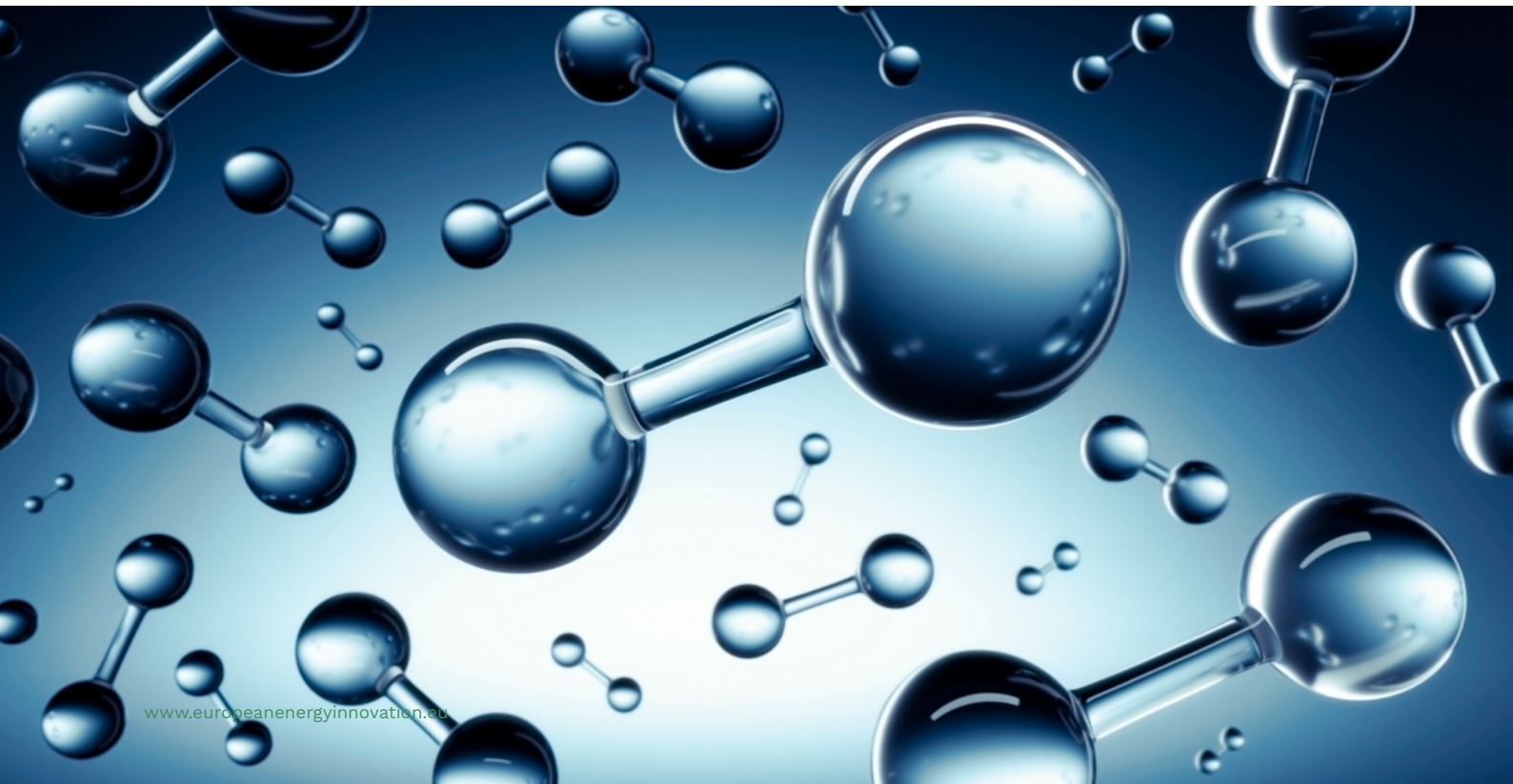


Figure 2. Total electricity demand (current consumption and proposed electricity for hydrogen electrolysis) in EU and some neighbouring countries compared to countries' green electricity potential. The size of the markers represents the calculated electricity for hydrogen electrolysis per country. The solid black line is the 1:1 line.

The calculated electricity demand for the year 2019 across all sectors at regional level, covering the current consumption and demand of hydrogen by using water electrolysis is shown in Figure 1. It considers the current know sites for production of pure hydrogen and ammonia production, covering about 70% of total production[11,12].

In 2019 electricity consumption in the EU and UK was 2939.6 TWh. If hydrogen in the EU and UK would be produced using electrolysis (including that for ammonia production) an additional electricity demand of approximately 290 TWh (the geo-located hydrogen production is 68% of the total estimated EU and UK annual production) would be needed. Therefore, the total electricity would amount to 3229.6 TWh. In comparison the combined technical potential for wind, solar PV and hydropower electricity considering the specific restrictions described in the JRC study[9], is over 10,000 TWh annually, of which only 819.9 TWh were actually produced in 2019[14]. This finding indicates that more than sufficient RES potential is available in the EU for a green hydrogen production.



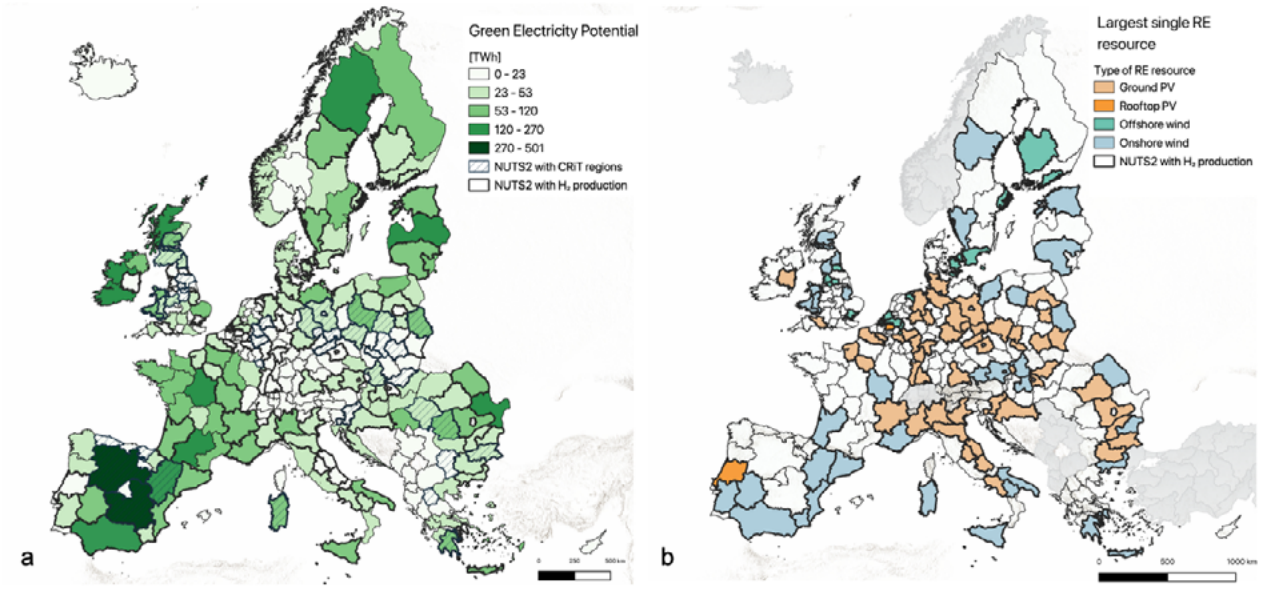


Figure 3. For the 109 NUTS2 regions with hydrogen production in the EU and UK, figure a shows the total technical potential for green electricity per region, while figure b shows the largest single resource in that region from the categories considered in this study: ground solar PV, rooftop solar PV, onshore and offshore wind, and hydropower.

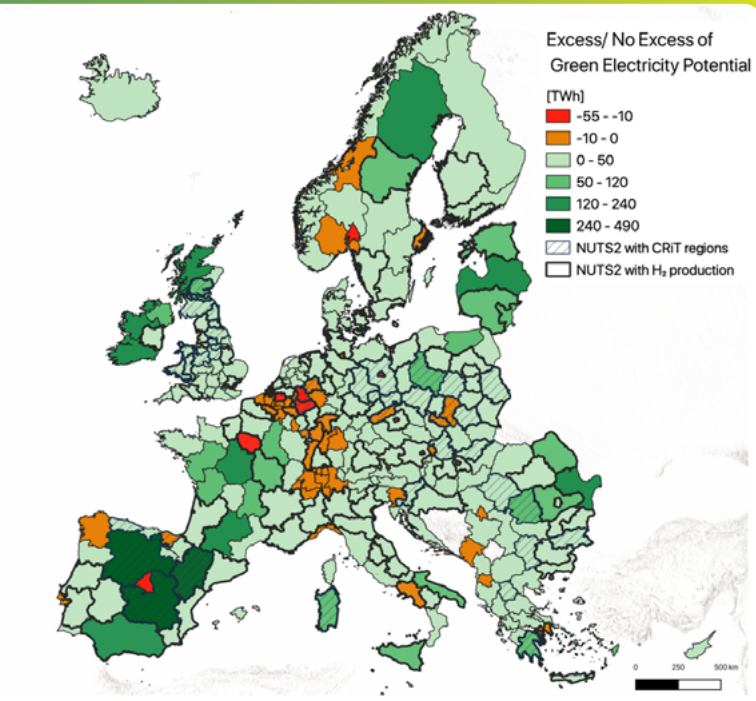


Figure 4. Regions with an excess or deficit of technical potential for green electricity after subtracting the current consumption for all sectors and that needed for moving from existing hydrogen production from grey to green. The shaded regions represent the CRiTs and the bold black outlined polygons the NUTS2 with current hydrogen production.

Figure 2 shows the supply and demand per country. The total green electricity potential exceeds the total electricity demand including that for hydrogen production in the majority of countries with the exceptions of Belgium (-62.7 TWh), Luxemburg (-2.2 TWh), Slovenia (-1.6 TWh) and Malta (-1.1 TWh). The countries with the highest amount of surplus green energy potential are Spain and France followed by Romania and Poland. Neighbouring non-EU countries with significant hydrogen production are the UK with a huge surplus renewable green electricity potential (+900 TWh), whereas Switzerland would have a net deficit of 34 TWh.

At regional level, 3a presents the technical potential for green electricity and 3b the renewable technology with the largest estimated technical potential in regions associated with hydrogen production.

109 regions in the EU and UK are associated with hydrogen production, which could be geo-located. Out of

the total 309 regions, 246 regions have excess of RES electricity potential after subtracting the current electricity demand (Figure 4). From the 109 regions with hydrogen production, only 13 have a deficit of RES potential for covering the current electricity consumption. The remaining 96 regions (88%) have excess green potential and 90 of those still have an excess even after subtracting the postulated electrolysis demand (indeed for 84 the remaining excess is over 50%). It is noted that 20 regions out of the 90 regions belong to the coal regions in transition group (CRiT)[13].

Of those six regions with a deficit of green energy after adding the demand for electrolysis, Ile de France (FR10) has the largest deficit with 46.3 TWh followed by Zeeland (NL34) with 12 TWh. The other four regions show deficit values below 6 TWh. Percentage wise, Zeeland (NL34) has the highest deficit (-12%) compared to demand. It is noticeable that the regions with lack of green potential electricity often include large metropolitan areas or lack wind power potential. However, from Figure 4 it is obvious that neighbouring regions could cover for the RES generation deficit by transmitting power from regions with surplus potential (marked in green) to those in deficit (flagged red/orange).

As shown, most of the examined European regions have sufficiently high technical potentials to be self-reliant using renewable energy. The presented findings also indicate to which extent each European NUTS2 region can take advantage of the decreasing costs of modern renewables in order to become energy self-sufficient. A recent study of the European Technology and Innovation Platform for Photovoltaics (ETIP PV) illustrates that hydrogen generated with solar photovoltaic electricity will be globally a less expensive fuel compared with hydrogen produced from natural gas with CCS already during this decade[15].

Furthermore, clean hydrogen offers new opportunities for re-designing Europe's energy partnerships with both neighbouring countries and regions and its international[3], regional and bilateral partners, advancing supply diversification and helping design stable and secure supply chains.

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"The scientific output expressed is based on the current information available to the authors, and does not imply a policy position of the European Commission."

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The strange case of the Bulgarian energy transformation

By Julian Popov (pictured)

Recently the logistics giant DHL Deutsche Post signed a partnership agreement with the Bulgarian startup Dronamics. The plan is for DHL to use 4,000 fixed wings drones each capable of carrying 350 kg and flying 2,500 km for its deliveries. The approach could revolutionise cargo transport as we know it. The drones will be built and operated by Dronamics, which also has the ambition to become carbon neutral by 2023.

The two largest renewable energy projects in the world are partly driven by the venture capital group PostScriptum and its Bulgarian Managing Director Dimitar Enchev. HEC – a Bulgarian family company- is building solar power plants all over the world. The Bulgarian PV solar construction company SolarPro recently opened an office in India after realising a number of projects in Egypt, the Netherlands, Germany, Saudi Arabia and other countries. Many other Bulgarian solar engineering companies are crawling successfully on all continents.

These are just a few examples of Bulgarian success stories in the broader carbon neutral energy sector. Clearly, Bulgaria offers a good entrepreneurial environment for the digital and renewables sectors. Both sectors are well represented through both branches of leading multinational companies and national start-ups. They might give the impression that Bulgaria is some kind of a new tech carbon neutral global leader, an emerging Denmark (the country that in the 80s developed the wind power industry that is taking over the world now). Well, it is not.

Bulgaria is better known for other things: its obstructive behaviour, low energy efficiency, dependency on coal and reluctance to engage even in a conversation on energy transformation.

While Bulgaria ranks high when it comes to businesses in the digital sector, it suffers from a growing and complex digital divide. Its scores for internet access, online learning, working from home, online shopping and other areas linked to digital equality is among the lowest in the EU.

Two very different stories coexist in two parallel realities and hardly interact with each other. One entrepreneurial and dynamic and one sluggish and obstructive. One is global, the other is very domestic. One is pragmatic and innovative;

> *"The large funds from the EU Recovery and Resilient Facility could also help in propelling forward the carbon neutral digital direction of the Bulgarian economy. With sustained pressure for reforms, we might soon see Bulgaria as a bright star of the new economy. Miracles happen."*

the other is highly political and conservative. The reasons for this duality are difficult to define. One could speculate that it is linked to three key factors: migration, education and economic history.

Since the collapse of Communism, Bulgaria's population has declined from nearly nine million to less than seven million. Bulgaria lost to migration 1/4 of its population, a share similar to the population decline in Syria during the war. Young, entrepreneurial and ambitious people are more likely to leave. Bulgaria has turned into a talent donor for the rest of the EU and other advanced economies.

Average standards of education are low. Top students often leave the country to continue their studies in leading western universities and to compete on the global job market.

Looking into economic history, we can recall that in Communist times, Bulgaria somehow received the Comecon blessing to be a digital hub. The country started producing computers, very much based on IBM and Apple components. A large production plant was built in Pravets, a Balkan village where the longest serving Bulgarian Communist dictator was born. Naturally, the computers were called Pravets. At the same time Bulgaria was one of the largest producers in the world of electric plant service cars. Both sectors collapsed together with the end of Comecon. Whether current digital and other technological successes of the new wave Bulgarian companies have anything to do with the pre 1989 industrial heritage, could be only a matter of speculation and curious guesses. The country however is powering ahead in the new sectors.

Recently some hesitant bright lights started coming from a Bulgarian government keen to support the entrepreneurial spirit in the country. The large funds from the EU Recovery and Resilient Facility could also help in propelling forward the carbon neutral digital direction of the Bulgarian economy. With sustained pressure for reforms, we might soon see Bulgaria as a bright star of the new economy. Miracles happen.

Julian Popov is a digital ambassador of the EU Sustainable Energy Week of which European Energy Innovation is a media partner. Registrations for the event are now open.

About the author

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Julian Popov is a Fellow of The European Climate Foundation, Chairman of the Buildings Performance Institute Europe, former Minister of Environment of Bulgaria and founding board member of the Institute for Sustainable Transition and Development.

Identifying air transport effects on regional development: COST Action ATARD

By COST and Dr Hans-Martin NIEMEIER, Chair of COST Action ATARD

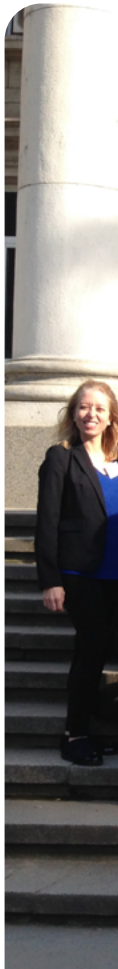
Changes in air transport can have important effects on regional development. Whilst traffic level's growth can create important congestion at major airports, remote regions can themselves suffer from the lack of service on thin routes. At times where the pandemic has affected even more the air transport sector, understanding the relationship between air transport and regional development is essential to better support economic competitiveness and social cohesion in Europe.

COST Action 'Air Transport and Regional Development' (ATARD) focused on this specific topic to help drive clearer policy recommendations on how air transport infrastructure and service improvements should be made. Running from 2015 to 2019, the Action gathered a wide variety of professions and backgrounds from 33 countries and looked at the constitution of a network of researchers dedicated to air transport and its economic, social, and environmental implications aligned with Europe 2020 strategy.

Launch of first publications on air transport and regional development

So far, there were no source publication covering this area in such a comprehensive manner. But the work performed by this network led to the publication in last December 2020 of three key inter-related books covering the most important themes explored during the Action. These books ('Air Transport and Regional Development Methodologies'; 'Air Transport and Regional Development Case Studies'; 'Air Transport and Regional Development Policies') were

Photo: © Getty Images



completed before the coronavirus pandemic, but the issues discussed remain very relevant.

The books draw from experienced researchers in the field, they complement each other and fill a much-needed gap. They present a multi-sector (airports, airlines, air navigation services, government organisations) and geographically Europe-wide coverage of both remote and core regions to fully explore all critical issues related to the linkages between air transport and regional development.

The three books focus on methodological approaches, case studies related to air transport and regional development, and policy implications.

In March 2020, the special issue "Air Transport Markets, Strategies and Policies" was published in "Research in Transportation Economics", Vol 792 covering eleven contributions discussed in the ATARD workshops.

Outcomes: from policy recommendations to solving the chicken and egg problem

One of the challenges in this area is to identify whether air transport is causing regional development or the opposite. Thanks to the networking enabled by this COST Action, a rigorous method was put together, addressing the chicken and egg problem.

COST Action ATARD also helped analysing best practices to develop air transport and tourism. Its work also focused at supporting policies' discussions to increase connectivity of remote and core regions.

Finally, the work performed under ATARD concludes that Cost Benefit Analysis and Computable General Equilibrium Models is recommended instead of Economic Impact Analysis to assess investments in air transport infrastructure.

COST Action ATARD workshop in Ruse (Bulgaria), April 19th – 20th 2018

Details of the books can be found from the following links:

Air Transport and Regional Development Methodologies

Air Transport and Regional Development Case Studies

Air Transport and Regional Development Policies

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BALANCING ENVIRONMENTAL CHALLENGES WITH ECONOMIC DEMANDS

Reclaiming energy and value from domestic used water

Domestic wastewater (WW) contains thermal energy in the form of organic matter (close to 4 kWh/kg Chemical Oxygen Demand (COD) for 500 mg COD/l – or about 2 kWh/m^3), but in conventional WW treatment plants (WWTP) the organic matter is oxidised with an electricity consumption of at least 0.5 kWh/m^3, and producing sludge. In larger WWTP with capacities above 50,000 population equivalent (PE), this biomass can be converted to biogas in anaerobic digestion, but on average only up to 50% of the energy can be recovered by co-generation.

Other valuable resources in WW are nutrients, essential ingredients for plant growth in agriculture, as each European produces yearly about 4.5 kg N, close to 1 kg P and 2 kg K. However, centralised WWTP can only recover a small fraction of diluted nutrients by precipitating up to 50% of the phosphorus in sidestreams, while two thirds of the nitrogen is converted to gas and lost to the atmosphere. In the production of artificial fertilizer, this nitrogen is gained back from the atmosphere with an energy input of 10 to 15 kWh/kg.

One approach to increase recovery rates and optimizing the energy balance is by treating concentrated streams in a decentralized concept, before the waste is diluted by the freshwater use of 150 l/PE/d. The project H2020 Run4Life (Recovery and Utilization of Nutrients 4 Low Impact Fertiliser) demonstrates the options of decentralized WWTP, based on the source-separated collection of greywater (from showers, basins...), blackwater, from toilets), and kitchen waste, with each flow receiving optimal treatment for resource recovery.

As part of Run4Life, blackwater from an office building in Nigran, near Vigo in Galicia, is treated with the AnMBR process, combining Anaerobic Digestion (AD) with membrane filtration to separate biosolids and clean water. As ultrafiltration with pore sizes between 0.04-0.1 µm retains solids, bacteria and even some viruses, permeate is suitable for reuse while providing nutrients for agriculture (fertigation). This in turn reduces CO_2 emissions by recovering organic matter and avoiding the need of mineral fertilizer.

Blackwater treatment at room temperature removes above 90% of the organic matter, while biogas with >75% of methane concentration is obtained and biosolids production is cut by half compared to conventional WWTP. The higher organic concentration of blackwater allows for direct AD treatment, and incorporating the organic kitchen waste increases biogas production and nutrient recovery, while avoiding biowaste collection and transport.

This concept will also be applied by Aqualia in the new Life Zero Waste Water project, in collaboration with the University of Valencia, to exploit their joint patent (EP3225596). AnMBR has been demonstrated at different WWTPs, achieving low power requirements (0.15 kWh per m^3 of treated water in Life Memory) whilst producing a nutrient-rich, pathogen-free permeate.

AnMBR has also been used to retrofit of an old septic tank of a small village (20 m^3/d WW), as OPEX was 20% less compared to conventional WWTP. A larger AnMBR to treat domestic WW from an industrial park (400 m^3/d), to generate bioenergy and reuse water in the factories and green spaces is under design as a sewer mining concept in H2020 Rewaise.

Above: AnMBR operated in Life Memory (Alcazar de San Juan, Spain). Below: AnMBR operated in H2020 Run4Life and equipment arriving to Nigran office building (Spain)

The Run4Life project receives funding from the EU Horizon 2020 Research and Innovation programme, GA no 730285. This article reflects only Aqualia's view. The European Commission is not responsible for any use that may be made of the information it contains.

Industrial heat pumps for greener European industry – From lab to reality

As part of the EU milestone to make leaps in energy efficiency savings and near zero emissions by 2050, a five-year Innovation Action project funded by Horizon2020, DryFiciency has advanced on research and demonstration of high temperature heat pumps (HTHP) that are able to supply process heat up to 160°C.

The Horizon2020 DryFiciency high-temperature project demonstrations are the first-ever tests in industrial settings of waste heat upgrade of up to 160°C using technology developed by a consortium led by AIT, the Austrian Institute of Technology.

Most people are familiar with heat pump technologies in residential buildings, but less so in industry. The uptake of this technology in industry is in its early phase of market diffusion, due to the technical complexities of using heat pumps to generate high-temperature heat for industrial use, as for example for drying of starch, bricks and bio sludge.

The challenge is to design and construct a heat pump that is capable to provide high temperatures."Compared to conventional gas boilers, heat pumps have the potential to increase energy efficiency by up to 80%, reduce CO_2 emissions by up to 80% and also cause up to 20% less productions costs," says Veronika Wilk, Senior Research Engineer at AIT and coordinator of the project.

"The technologies we have developed here can be used in many industrial sectors, from paper, food and beverages to textile and other chemical industries, and they can be integrated into existing plants or for greenfield applications," she added.

Specifically, the consortium of 13 partners is addressing the challenge of the Resource and Energy Intensive Industries sectors that produce significant amounts of waste heat currently being lost.

Recapturing lost energy, which normally would be expelled, for drying processes in industrial settings eventually could substitute or complement fossil fuels, such as gas.

Capturing this energy would not only afford a massive energy saving by re-using it as a substitute fuel for firing, but also would dramatically reduce climate damaging CO_2 emissions which are expelled in factory processing. Energy and fuels represent between 20% and 40% of the production costs in several of these industries and also produce large amounts of CO_2 emissions.

Within DryFiciency three demonstrations in industrial drying have been pioneered as the drying processes are very energy intensive and offer huge potential for energy efficiency.

DryFiciency Heat Pump Demonstration at Lindum waste management facility in Drammen, Norway

The first of two closed loop heat pumps under the coordination of the (AIT), with a heating capacity of up to 400 kW has been integrated at Wienerberger, the world's largest producer of bricks in Uttendorf, Austria.

In a continuous dryer clay bricks with a moisture content of around 30% are dried to 2 to 4%, the drying air is heated by a heat exchanger supplied with hot water from a heat recovery cycle located inside the tunnel.

The heat pump demonstrator replaces a natural gas burner shown to lead to energy savings of up to 80% and reductions in CO_2 emissions of about 80%. The heat pump provides hot water up to 160°C to heat the drying air. The hot air is fed into the outlet zone of the tunnel dryer, where the highest temperatures are required.

AGRANA, a global player in the three segments fruit, starch and sugar, specialized in processing and refining of top-quality agricultural raw materials is operating, the DryFiciency high-temperature closed loop heat pump demonstrator at the wheat starch plant in Pischelsdorf, Austria. With this innovative technology temperatures up to 160°C are possible, which are required to remove water in a wheat starch drying process. The DryFiciency Heat pump demonstrator has undergone some 5.000 operation hours with a maximum heat output ~350kW and a COP between 2-4 at varying source temperatures. While currently only contributing to a small part of the production process, internal calculation shows an annual CO_2 savings up to 500 tonnes/year with the demonstrator.

Chief Technology Officer and Member of the Board of AGRANA Group Norbert Harringer said that "the DryFiciency project is an important step for reaching our climate goals which means climate neutral production by 2040".

The DryFiciency closed loop heat pump demonstrators include novel screw compressors developed by Bitzer, and piston compressors developed by Viking Heat Engines. Both are engineered to operate at very high pressures and internal temperatures. They are compatible with all common refrigerants of the 3rd and 4th generations e.g. HFOs like OpteonMZ (HFO 1336mzz-Z) from Chemours as used in the demonstrator. For its lubrication, the novel lubricant is provided by FUCHS.

The third demonstration under the coordination of SINTEF is an open loop heat pump system also known as Mechanical Vapour Recompression (MVR) system using water as refrigerant in steam drying processes. "With the technology developed for the open loop heat pump we are able to use water as refrigerant. Water or steam are already widely utilized by industry as heat carriers and the industrial acceptance for such technology is high. Water is surely also the saftest most abundant refrigerant on the planet." says Michael Bantle, Senior Research Scientist at SINTEF Energy Research.

In this demonstration Scanship is drying biomass at the Lindum waste management facility in Drammen, Norway. With the help of EPCON, an expert in mechanical vapour recompression, a number of modifications towards energy efficient Super Heated Steam (SHS) drying, including turbo compressors from the automotive industry developed by ROTREX have been accomplished.

This demonstration has shown improvements in efficiency and capacity of the dryer of more than 75% while reducing energy consumption by 70%. Over 100 tonnes of biomass has been dried using the system so far, now additional operational hours will be used to optimize and validate the system.

DryFiciency Heat Pump Demonstration at Agrana Starch in Pischelsdorf, Austria

DryF

To learn more about the project, partners and results go to www.dry-f.eu.

Financing the European Energy Transition – Costs, benefits, markets

18 November 2021 • Online

Franco-German Office for the Energy Transition, in cooperation with the French Ministry of Ecological Transition (MTE), the German Federal Foreign Office and the German Federal Ministry for Economic Affairs and Energy (BMWi)

The recent years have brought about profound changes all around the world, especially in the energy sector. The curtailment of public life in the wake of the Covid-19 pandemic has resulted in a sharp decline in energy demand. While demand, especially for fossil fuels, plummeted in 2020, renewable energies, despite the lockdown and recession, continued their growth and, for example, met about half of the electricity demand in Germany. However, when looking at total energy consumption, renewables only account for just under 20% – the same is true for France.

Increased energy and climate policy ambitions were formulated at the European and national level to ensure that this share will increase rapidly. These higher targets, volatile markets, innovation and falling prices for green technologies, as well as constantly changing framework conditions at various political levels, are more than ever raising the question of how to finance the energy transition:

- How should the energy system of the future look like and how to design its transformation?
- How can the costs of the transformation be distributed fairly?
- Which factors are decisive for this process and which actors must interact now as well as in the future to promote change?
- How can synergies from free-market innovation and political planning security be generated and increased?

During a Franco-German lunch, young climate activists from France and Germany will discuss with Members of the European Parliament to what extent the raised European ambitions for climate protection are appropriate and which measures are necessary in relation to the energy transition to implement these goals in a socially acceptable manner.

The target audience of the Franco-German Energy Forum is all actors of the energy transition in Europe.

The Forum will be fully translated into German, French and English simultaneously, the participation is only possible online.

The participation in the Energy Forum is free of charge.

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Event link and registration: energie-fr-de.eu

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The hashtags of the conference:

#FrancoGermanEnergyForum
#EnergyTransition
#EnergySystem

4TH FRANCO-GERMAN ENERGY FORUM

Financing the European Energy Transition: Costs, benefits, markets

- Online, 18 November 2021
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