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HOMEGROWN ENERGY: RESILIENCE THROUGH RENEWABLES

A SCALABLE METHOD OF RECYCLING CEMENT

IS OUR AGEING GRID A NET ZERO BOTTLENECK?

DIGESTATE'S POTENTIAL IN REGENERATIVE FARMING

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Technical Director
European Biogas Association

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Contents

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Foreword

We misuse the language of conflict when we describe the climate emergency as a "fight". We are not "fighting" global warming, nor are we "combating" greenhouse gas emissions. There is certainly no "war" on oil and gas. All of these are lazy tropes, overused by journalists and politicians, who know that aggressive rhetoric sells newspapers and wins votes.

I am reminded of this on my Sunday morning litter-picking walks. If you listened to local news, you'd assume that trash strewn on the ground was solely caused by the "litter louts" and wrong-doers discarding their food wrappers on the pavement, who need to be caught and punished. Certainly, there are people who do this, and I'm sure the couple upstairs throw cigarette butts from their balcony. But you don't have to look far before you realise that elements of the problem are more prosaic than that – the waste bins in my community are too small, have no protection against the wind, and are easily accessed by hungry foxes.

But nobody would click on that story, nor would it win the heart of an undecided voter. Systemic issues are less alluring than problems which can be attributed to a tangible enemy. So instead of a meaningful discussion about improving the design of waste receptacles in my city, there are vacuous declarations of "a war on litter" and an "offensive" against people who discard their waste irresponsibly. It makes for punchy soundbites, but meanwhile, the trash piles up. We must avoid the language of violence when we can, and treat environmental issues as problems to be solved rather than enemies to be vanquished.

In this issue

Commissioner Kadri Simson has written an excellent article for European Energy Innovation this issue, in which she outlines the momentous response to the very real, non-metaphorical war being fought on Europe's border. The invasion of Ukraine, she says, exposed Europe's dependence on Russian oil and gas, and as such has fuelled a "rollout of renewable energy on an unprecedented scale". The Net Zero Industry Act is among the legislation forged in the wake of the war, while the Critical Raw Materials Act came into force just before *EEI* went to print, in anticipation of potential future conflicts.

The Commissioner also wrote about the importance of innovation, which is something you can find on every page of this issue. We spoke with Dr Cyrille Dunant about his team's work on recyclable cement, something you can find out about towards the back of the magazine – it's a nascent technology, but one with untold potential in the construction and refurbishment industries. The idea that concrete – the most-used material on the planet – could be partially recycled, or that energy-intensive cement could one day be produced with (theoretically) zero emissions, is remarkable.

EEI magazine is proud to continue its partnership with European Sustainable Energy Week this year. Come and find us at the Energy Fair – stand C-16, on the second floor of the Charlemagne Building.

We also have an interesting article by Eurelectric secretary general Kristian Ruby, whose insights into the challenges facing energy distribution in Europe offer both concerns and hope for a more resilient, efficient grid. Dirk Vansintjan, Stavroula Pappa and Felix Kriedemann have all weighed in on energy communities – a topic we'll return to in our Autumn issue – while Mieke Decorte and Lucile Sever of the European Biogas Association have shared an interesting article about the role digestate can play in regenerative agriculture.

2024 was never going to be an easy year, and as we cross the half-way mark there are many challenges to come. But thanks to the policymakers, scientists and leaders in the field of sustainability and energy – many of whom contribute to this magazine – there are plenty of reasons to be hopeful. ■

Ed Wiseman, *EEI magazine*
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Shutterstock photo: ©Jamie Hall

Renewables and innovation are key to decarbonising Europe with homegrown, green energy

By Kadri Simson, European Commissioner for Energy

It is over two years since Russia started its unjustified war against Ukraine. Yet Ukraine has proven to be courageous, resilient and determined in its response. Europe continues to stand by Ukraine and the Ukrainian people. At the same time, the war exposed Europe's dependency on Russian energy and the risk this meant for the security of our energy supply. Before the war around 45% of Europe's gas, almost half of its oil imports and nearly one-third of its coal came from Russia.

A steady supply of energy is vital for the well-being of any economy. Any disruption to that could have a devastating effect. Energy trade with Russia seemed strong and hard to unravel and it appeared unlikely that the status quo would change. There were long-term commitments, infrastructure that had taken years to build and seemingly few alternatives to cater for Europe's energy needs.

The EU proved the doubters wrong. With speed, unity and determination, the EU committed to cutting its energy dependency on Russia by diversifying energy supplies away from Russia while saving energy and accelerating Europe's clean energy transition. The initiatives build on the European Green Deal, the EU's pledge to reach climate-neutrality by 2050.

In the two years that has followed, the EU has achieved a paradigm shift. The EU dramatically reduced imports of Russian coal, oil and gas, while reaching record gas storage levels, using less energy and using it more efficiently.

Thus, Europe got through two successive winters, keeping our lights on and our homes warm, with no energy shortages, and we are already well-prepared ahead of next winter.

The EU's increased rollout of renewable energy on an unprecedented scale is testament to that. We accelerated pending legislation and introduced new rules to make it faster and easier to invest in renewables and easier for households to produce their own energy, such as through solar panels. We are already seeing its positive impact. In 2021, 39% of the EU's electricity came from renewables and 36% from fossil fuels. In 2023, 45% came from renewables and 28% from fossil fuels. This trend will undoubtedly continue in the years ahead.

Not only is wind and solar energy being installed at a record scale, Europe also has the largest pipeline of green hydrogen projects in the world, and the surge in biomethane production will bring new opportunities to decarbonise our industry.

For example, we are already seeing new cutting-edge technologies like floating offshore wind power, and a new alliance is gathering dozens of promising next generation projects on small modular nuclear reactors. Planning and construction to expand electricity grids is also underway to accommodate more renewables across Europe. European companies and citizens will thus enjoy the freedom to buy green energy when they want, where they want it and in the volumes required.

Indeed, the success of renewables in Europe depends on the innovation and resources underpinning it. The European Commission has provided steer and funding for European research and innovation for decades. Our funding contributed to breakthroughs in renewable energy as early as the 1990s. This resulted in the emergence of major new industrial sectors in Europe and globally.

The EU is committed to continue investing in its world-class clean tech sector and increase its competitive edge. Innovation has played a key role in order to decarbonise Europe's energy system and society as a whole. It will continue to do so in the years to come.

The EU has just adopted a Net Zero Industry Act with measures right across the supply chain to strengthen this valuable sector in the face of fierce international competition and high energy prices. By streamlining permitting processes and accelerating access to market for net-zero technologies; by fostering innovation with regulatory sandboxes to test new technologies.

In parallel, a new Critical Raw Materials Act should ensure secure supply of critical raw materials to power electrification, while ensuring sustainability and core rights of exporting countries are respected.

For a continent with limited fossil resources, clean energy is the road to energy autonomy and global competitiveness. Investment in clean tech innovation will help Europe reach our net-zero goal of the Green Deal and to mitigate the risks of new dependencies.

The EU has put the consumers in the centre of the transition with increased opportunities, rights and advantages. The revised energy market design enables consumers to conclude more than one electricity supply contract or energy sharing agreement, for the same connection point for their homes.

They can also share with friends, families, neighbours, the electricity they produce directly or collectively. This means, for example, that low-income families living in social housing could benefit from renewable energy from the solar panels on public buildings.

In addition, there is a steady increase in charging points and fuelling stations for electric or hydrogen-powered vehicles on major roads, in our homes and neighbourhoods.

During this political mandate, Europe has redrawn its energy map and re-powered its energy policy. At the same time, we have continued to support Ukraine, and will continue to do so, for as long as it is needed. By trying to choke us with our fossil fuel dependency, Russia inadvertently accelerated our green transition. Meanwhile, Europe has stabilised the energy market. Since 2022, we have decreased our energy import bill, and prices are back around pre-war levels. Europe will never again be vulnerable to energy blackmail by Russia, or any other State.

Together, the EU and its Member states turned a historic threat into an equally historic opportunity. These foundations are our legacy and the basis for our work ahead. ■

"For a continent with limited fossil resources, clean energy is the road to energy autonomy and global competitiveness."

Localising EU ambition: How to equip municipalities to deliver the EU Green Deal

By Mohamed Ridouani, Mayor of Leuven and President of the Energy Cities network, a partner organisation of EUSEW

"Almost every Directive or Regulation of the European Green Deal has elements that concern local authorities."

In the past five years, the European Union set up the legislative framework to become climate neutral by 2050 and deliver the EU Green Deal. 2024 marks the start of the implementation phase for EU's climate and energy policies, and municipalities will have a key role to play.

We municipalities can ensure the achievement of the EU's ambitious objectives, leaving no one behind. But we need staff and resources to take collective actions.

As Mayor of Leuven, I am proud to say we are among those municipalities who are leading the way towards the achievement of those objectives. Leuven 2030 has been uniting our community in the past 10 years under a shared purpose: climate neutrality. Our Climate City Contract, handed over to the European Commission at the end of 2023, is another step in that direction. Nevertheless, we should not underestimate the effort and resources needed to make the EU Green Deal a reality.

Municipalities' struggle for resources

Almost every Directive or Regulation part of the European Green Deal has elements that concern local authorities. A new publication by Energy Cities and Eurocities provides a detailed analysis, but, as an example, a lot of efforts are going to be needed at local level when it comes to mapping, planning, building management and renovation. A 2022 study shows that each municipality in the EU would need around 2.5 additional full-time positions only to decarbonize their built environment.

But the success of the Green Deal is also linked to social justice: how can we make sure it is not seen as a luxury, but as the number one social policy that will bring long term benefit for everyone? That is where municipalities can have a big impact, thanks to their proximity to the citizens and economic actors. They are best placed to coordinate the local ecosystem, bring everyone together as active participants in the transition, and provide support. This role has been widely recognized in


Flickr photo: ©Karl Bruninx

European legislation, but the issue of corresponding financial and human resources remains.

Structural changes needed at EU level

Some solutions have already been put on the table. The EU Social Climate Fund could be an opportunity for cities to finance their investments for a just and equitable transition. EU legislation, such as the Energy Performance of Building Directive suggests Member States provide training for local authorities. But at Energy Cities, we think that one-off measures are not enough. The upcoming discussions on the EU multiannual budget and the reform of the EU Cohesion Fund will make the perfect occasion to implement structural changes and equip local and regional authorities with the resources they need to make the EU Green Deal a reality. ■

About the author

Born in Leuven, Ridouani holds a master's degree in economics and a postgraduate in international relations. He started his career as a business consultant but left the business world once appointed Deputy Mayor of Leuven in 2007, to fully focus on his political duties. He's the inspirer of Leuven 2030, in which more than 300 companies, organizations and citizens are united to turn Leuven into a sustainable and CO_2-neutral city by the year 2050. Ridouani was elected Mayor in October 2018 and President of Energy Cities at the end of 2023. He stands for positive change and aims to turn Leuven into one of the most caring, green, and prosperous cities in Europe, in cooperation with the citizens.

For more information

1. Local Staff For Climate: The Study
2. Cities in the EU Green Deal – Opportunities & responsibilities
3. Tangible targets for cities – 33 concrete goals to advance the local ecological transition

Europe's 'grid challenge': pressure on ageing energy systems poses risk of a net zero bottleneck

By Kristian Ruby, Secretary General, Eurelectric

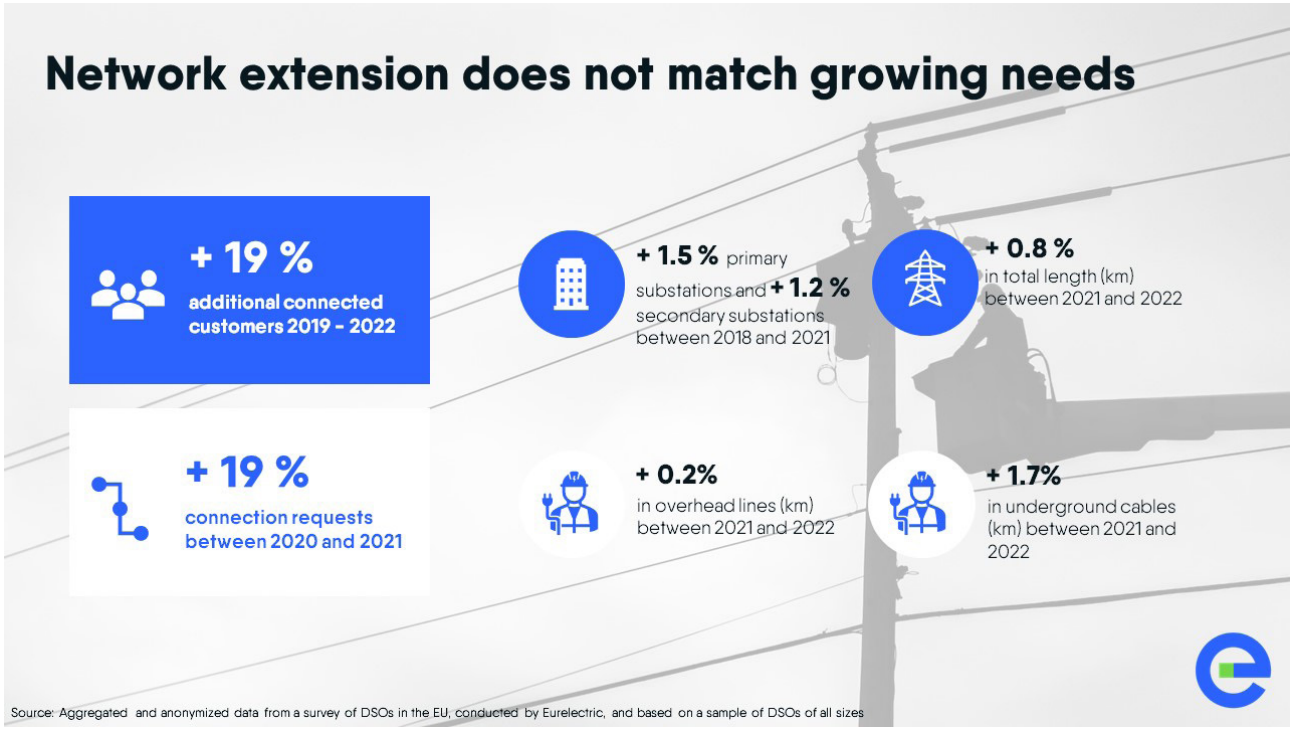
In the past five years the European Union set off towards ambitious decarbonisation goals, decided to phase out sale of new combustion engine cars by 2035, and raised the bar for renewables deployment to tackle mounting energy security pressures. The objective is to double our current renewable energy capacity within the span of just six years.

While this is good news for our climate and energy security, we must make sure the energy system is properly equipped to turn targets into reality. This is not yet the case when it comes to Europe's power infrastructure.

Europe's transmission and distribution grids were largely built at a time when the energy system was run by centralised power plants that consumed fossil fuels. Electricity flowed from the generation source to the final customer through power networks that in many cases are now more than forty years old.

In the past years, the deployment of renewables has accelerated significantly. So far, 49% of all electricity in the EU has been

"More frequent extreme weather events and cyber-attacks challenge the resilience of our networks"



generated with renewable technologies in 2024, with the lion's share coming from variable wind and solar. This shift necessitates a change in mindset as more grid planning and better forecasting is needed due to renewables' weather-dependent nature.

In addition, more and more smart, decentralised assets such as electric vehicles and heat pumps need grid connections and risk experiencing long delays in congested areas where there is simply not enough grid capacity to accommodate this increased demand. Last year's edition of the Eurelectric Power Barometer showed that grid buildout is not keeping up with the increase in customer connections. Flexibility management is also not advanced enough to cope with future needs.

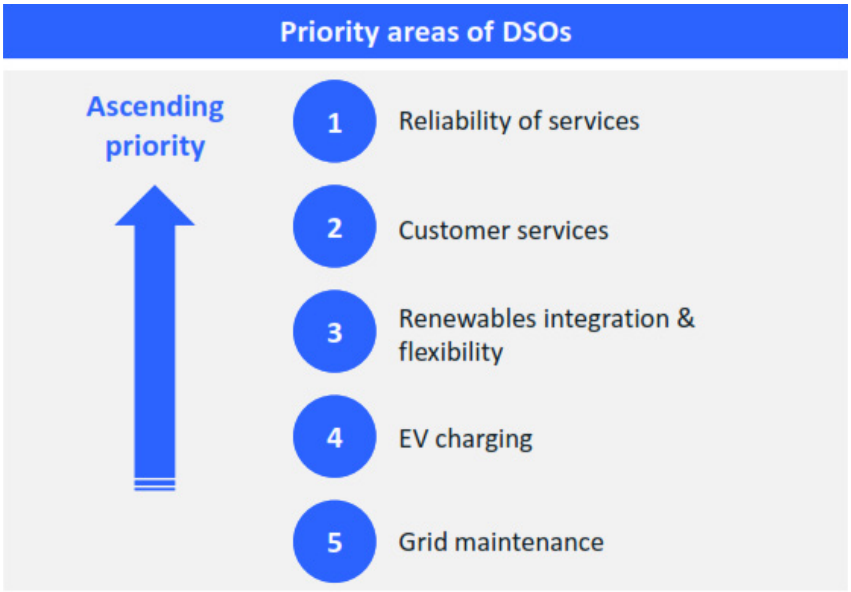
On top, more frequent extreme weather events and cyber-attacks challenge the resilience of our networks, even if the power outages and length of blackouts continue to decrease. The job of a grid operator is getting more complex.

Managing the power system of today and tomorrow needs a modernised grid. Building new cables will be essential to enable our energy transition. Yet, we should not forget there is also a low-hanging fruit that can help optimise current capacity and increase the efficiency of the cables we already operate today: digitalisation.

Grids must go digital

Eurelectric's latest Grids for Speed study shows that distribution grid investments will need to reach €67 billion per year from 2025 to 2050 to support the energy transition. While the bulk of this investment should go towards infrastructure build out, around €8 billion should also go towards the digitalisation and automation of our current grid infrastructure each year until 2050.

The true extent of digitalisation benefits in the energy system often goes unrecognised. A new piece of research from Eurelectric – the Wired for Tomorrow study – shows that digital technologies commercially available today can improve grid capacity and efficiency across the entire span of the core activities of distribution system operators (DSOs), from construction to operation and maintenance.

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DSOs today show a positive trend and indicate comprehensive ongoing efforts with regard to data-driven practices, reaching an advanced stage of digital maturity. Strong emphasis on cybersecurity measures has ensured a secure digital environment for operations. However, in terms of operational efficiency and maintenance, digitalisation holds lots of opportunities.

A survey conducted with more than 30 DSOs serving over 80 million customers across Europe reveals that digital tools are underutilised when expanding the grid, particularly in engineering and construction, compared to the operation and maintenance capability. As the expansion and enhancement of the grid heavily relies on the industry's digital readiness, addressing the digital gap is instrumental in unlocking the full potential of grid modernisation.

Although the digital maturity in grid operations is progressing, considerable room for improvement remains, particularly in flexibility management to meet future demands. The Eurelectric study also underscores the need for advanced technological solutions in maintenance decisions, especially when deciding whether to build new infrastructure or maintain existing models.

Overall, our findings suggest that, no matter the level of digitalisation, all DSOs acknowledge the need for more digital prowess and maturity, but several challenges hinder this potential today.

Challenges to digitalisation: regulations, skills, interoperability and flexibility

Sluggish regulatory processes are perhaps the most significant impediment for DSOs' digital journey. 56% of surveyed DSOs have pointed out regulatory constraints on capital expenditure investments as a significant issue when building and operating the grid. Moreover, 24% express frustration over the lack of clear guidelines regarding the future roles of DSOs, which hampers their ability to implement strategic initiatives effectively.

In simpler terms, the speed at which regulations are evolving is failing to keep up with the rapidly changing business needs of DSOs.

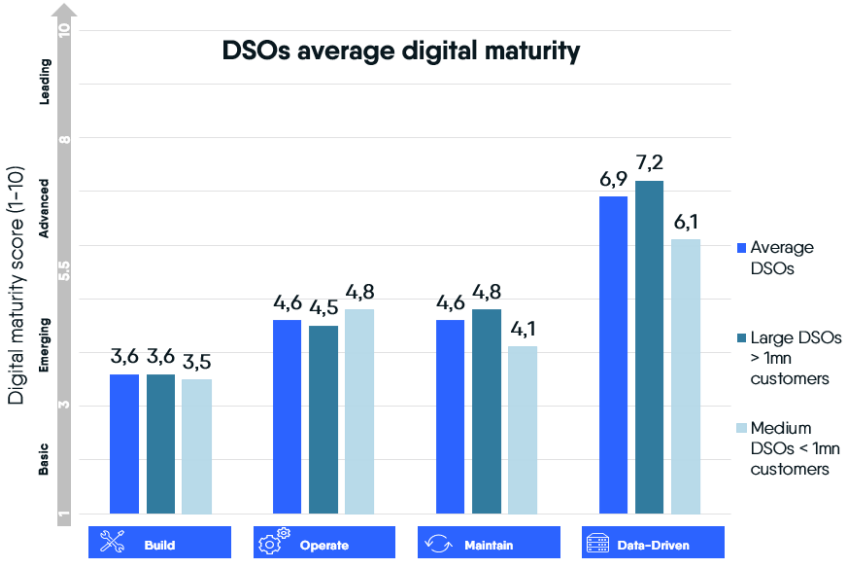
As a regulated monopoly, DSOs can only invest up to the point agreed with national regulatory authorities (NRAs). Today, the NRA only allows infrastructure build-out when a customer has formally requested a connection, even though the capacity was anticipated long before. This prolongs the connection queues and becomes more expensive in the long run.

Considering the massive expansion of electricity in the coming decades, NRAs now need to allow DSOs to be more proactive by investing in a more future-oriented manner.

Acting ahead is the best way to make sure our power infrastructure can keep up with the speed and scale of our energy transition. This change in mindset from national authorities is key to spur investments into grid digitalisation and modernisation.

Within the grid ecosystem, a critical challenge concerns the **scarcity of skilled professionals**. 56% of our survey respondents identified a lack of skilled talent as a significant constraint in advancing grid digitalisation efforts. The unique expertise required for operational technology (OT) and IT systems, coupled with historical organisational divides between IT and OT teams, exacerbates this challenge.

Clearly, substantial efforts are needed to facilitate a more seamless digital transition, particularly in addressing the shortage of highly specialised skills. Prioritising the cultivation of digital talent across all levels is essential. This involves instilling a digital vision, driving digital initiatives and fostering a digital mindset through comprehensive training programmes. By embracing these



strategies, DSOs can effectively navigate the digital landscape and drive sustainable growth.

Other challenges remain in the **integration of operational technology (OT) data within IT systems**. DSOs collect data – such as on frequency and voltage – from different parts of the grid like substations and smart meters. Yet, the programmes and software used to manage this data differs from the traditional IT systems. This means that a lot of data that could be used to learn and improve grid efficiency cannot be shared as the two systems are not speaking to each other. The technical challenge of integrating these two siloed data systems is further heightened by the need for ensuring cybersecurity.

A higher integration between IT and OT systems can have many benefits. It can unlock new digitally advanced solutions like fraud detection, predictive grid maintenance, virtual automation platforms, advanced metering and simplified cross-domain analytics, towards a highly digitalised self-healing electricity network. We should strive for more integration without jeopardising the systems' security.

Finally, to increase the needed grid capacity, **both build-out and flexibility are needed**. Achieving a balance between upping flexibility and long-term scalability is imperative for success. This entails harnessing digitalisation strategies such as dynamic grid management, collaborative planning platforms, and real-time distributed energy resource (DER) visibility and management. Let's address these challenges head-on.

A roadmap to digital success

It is mission-critical that our grid infrastructure is primed not just for present needs but for future demands as well. To achieve this, we propose a few key strategies.

Firstly, it is imperative that national regulatory authorities (NRAs) recognise the role of digitalisation measures by ensuring the appropriate compensation in national remuneration schemes. NRAs should recognise increasing costs for DSOs arising from complying with an increasing number of legislations.

Ensuring coherent implementation of regulations is also essential. The twin green and digital transitions have translated into an unprecedented amount of legislation – spanning from the Electricity Market Design, to the Renewable Energy Directive, the Data and AI Acts. It's crucial that EU countries coherently implement new legislation across sectors, avoiding overlaps, inconsistencies and contradictions.

Interoperability and cohesion are equally vital in the digitalisation journey of DSOs. We advocate for harmonising cybersecurity regulations, streamlining data management rules across the Data Act and sector-specific regulations and establishing an interoperable Common European Energy Data Space.

Lastly, innovation should be fostered for grid digitalisation, particularly in tandem with artificial intelligence (AI). To this end, the AI Act should support non-high-risk solutions to spur innovation. At the same time, measures to enhance grid observability through smart meters should be expedited given that a whopping 54% of surveyed DSOs still face obstacles in harnessing the potential of smart meter data.

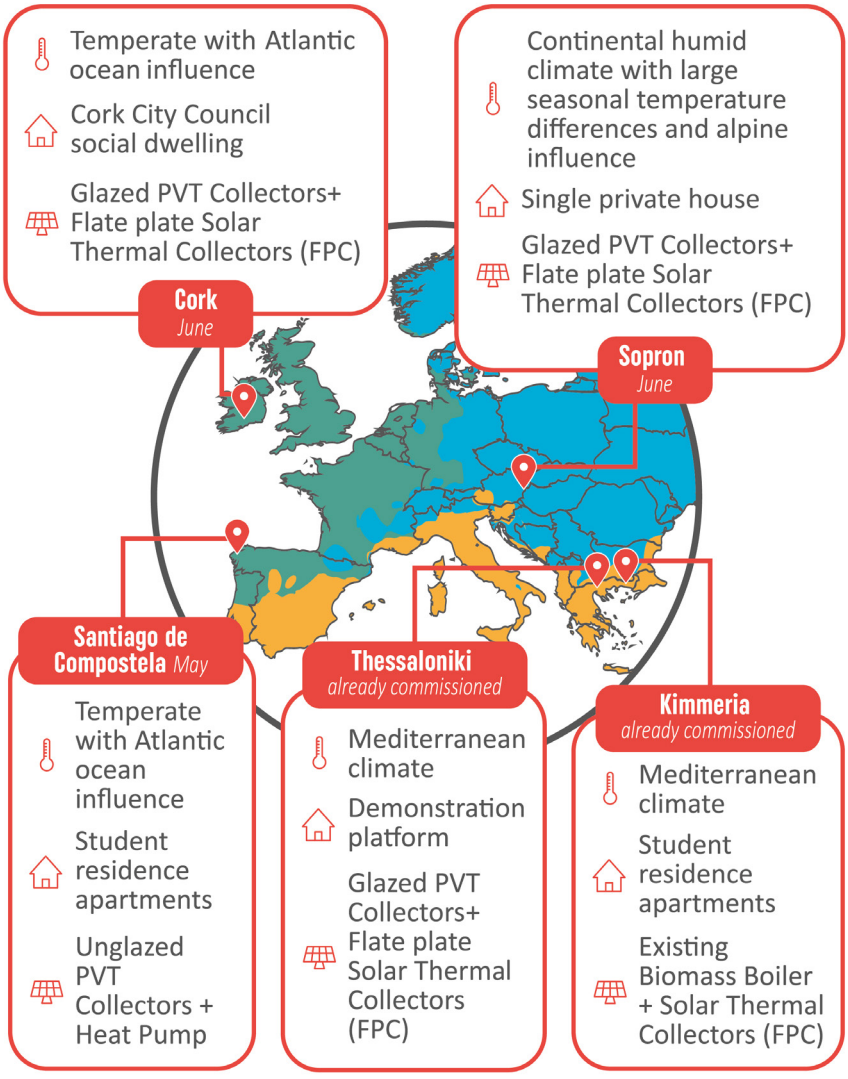
By embracing these policy-focused recommendations, we can pave the way for a resilient and future-ready grid infrastructure.

Digitalisation is a must and a no-regret. It's time to treat it as such. ■

MiniStor, the reliable thermal storage solution for all climates and households

Flexible, high-capacity heating and cooling technologies are ready to leverage the variability of renewable energy in the residential sector

MiniStor, a Horizon 2020 project, is testing its high-density thermal storage system in multiple climate conditions and home configurations, providing both heating and cooling in an integrated yet flexible unit. The consortium, gathering seventeen partners from the EU and Switzerland, and coordinated by IERC, has reached its final phase with the deployment of units across 5 demonstration sites. Operating year round, MiniStor aims to provide energy security across Europe's residential sector with a thermal storage density well over 10 times that of water, a practical solution for leveraging the variability of renewable energy sources.

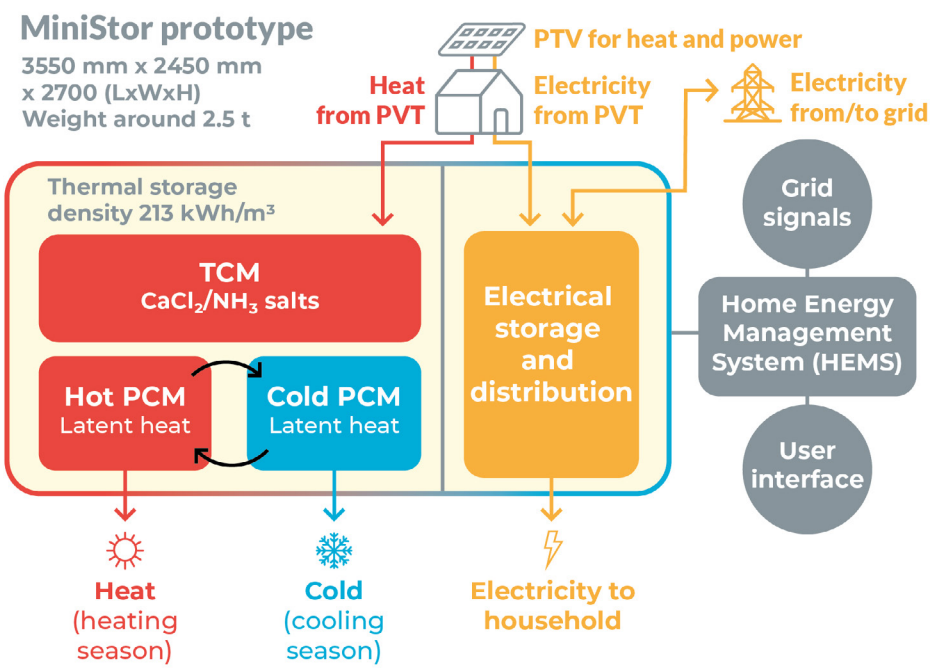


Concept

At its core, the system combines an efficient thermochemical storage and a phase-change material that stores latent heat. When paired, the multi-day energy storage reactor based on $CaCl_2/NH_3$ salts along with the PCM storages for cooling and heating reach a high density of 213 kWh/m^3, allowing a minimal size installation and scalability. This state-of-the-art thermal storage setting initially envisioned by CERTH/CPERI and CNRS-PROMES and manufactured by Sofrigam lies alongside the control room unit within a container, measuring 3.5 m long, 2.5 m width and 2.7 m height, and around two and a half tonnes.

At a suitable distance from the MiniStor container there are also unique solar hybrid photovoltaic thermal (PVT) collectors, which not only reach the required heat for activating the reactor, but also generate electricity for a battery system. ENDEF's newly design PVT panels include glazed collectors, with a laminate of 265Wp, to be combined with solar thermal flat plate collectors (FPC); and unglazed collectors, with a laminate of 390Wp.

Critically, the entire operation is handled via the Home Energy Management System (HEMS), a smart digital tool devised by CARTIF. Key to the technology fusion, it is now being developed into a second iteration to actively consider demand and generation predictions to help in comfort control and long-term decision-making. Alongside an Internet of Things (IoT) platform build by CERTH/ITI, it will help in the user-



centric approach and allow obtaining feedback from users. In conjunction, the MiniStor system leverages the variability of renewable energy sources, saving thermal and electrical energy until they are in short supply.

Demonstration

One of the prototypes was at a test environment from April to May, under evaluation for summer and winter operation modes at the ÉMI facilities. The analysis of said evaluations is nearly finished, but it already served SGS in the preparation of MiniStor's own Project Audit Program, covering the manufacturing process in Psyctotherm as well.

The main evaluations build on the Thesaloniki pre-pilot at CERTH premises, where MiniStor was first installed in December 2023. During the preliminary tests, commissioning and optimisation of the system control, performance and safety measures were accounted for and evaluated through certification of the TCM reactor and the enclosure by notified bodies in France and Greece.

In the last months, additional tests were performed in the SmartHome development platform of CERTH/ITI, including the Supervisory Control and Data Acquisition (SCADA) systems, controllers and hydraulics, start-up, charging and discharging stepwise process, and the PLC software upgrade. Although the pre-pilot at CERTH has verified that MiniStor operates smoothly and safely, further performance monitoring and assessment will follow during the next twelve months.

While the rest of the units were being assembled, shipped and commissioned, the DUTH demonstrator in Kimmeria was the second to receive the MiniStor unit. This site is slightly different from the rest, as the Ministor container will receive its energy from an existing solar field and biomass boilers, proving the complementarity of the system with different configurations and energy sources that have been servicing these dormitory buildings in recent years.

MiniStor is calling for the standardisation of its technologies, working for a value chain beyond industrial parameters, and supporting adequate certifications for maintenance, comfort and performance. Its relevance has only increased in recent years, for controllable and high-capacity thermal storage can increase the use of renewable energy based sources for the heating and cooling of homes across the European Union, moving it closer to the decarbonisation goals. Moreover, this practical solution is poised to be scaled up for various configurations due to its high density and design modularity. ■

MiniStor has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869821.

Partners

Exploring digestate's contribution to healthy soils

By Mieke Decorte, Technical Director and Lucile Sever, Policy Officer European Biogas Association (EBA)

The further expansion of biogas production in Europe will see the generation of increasing amounts of digestate. Leveraging its significant advantages will yield benefits for farmers, local communities, and producers alike. The European Biogas Association is launching a comprehensive white paper exploring the potential of digestate in fostering healthy soils and advancing sustainable agricultural practices across Europe. Further work is also carried out via the FER-PLAY project, assessing multiple types of alternative fertilsers.

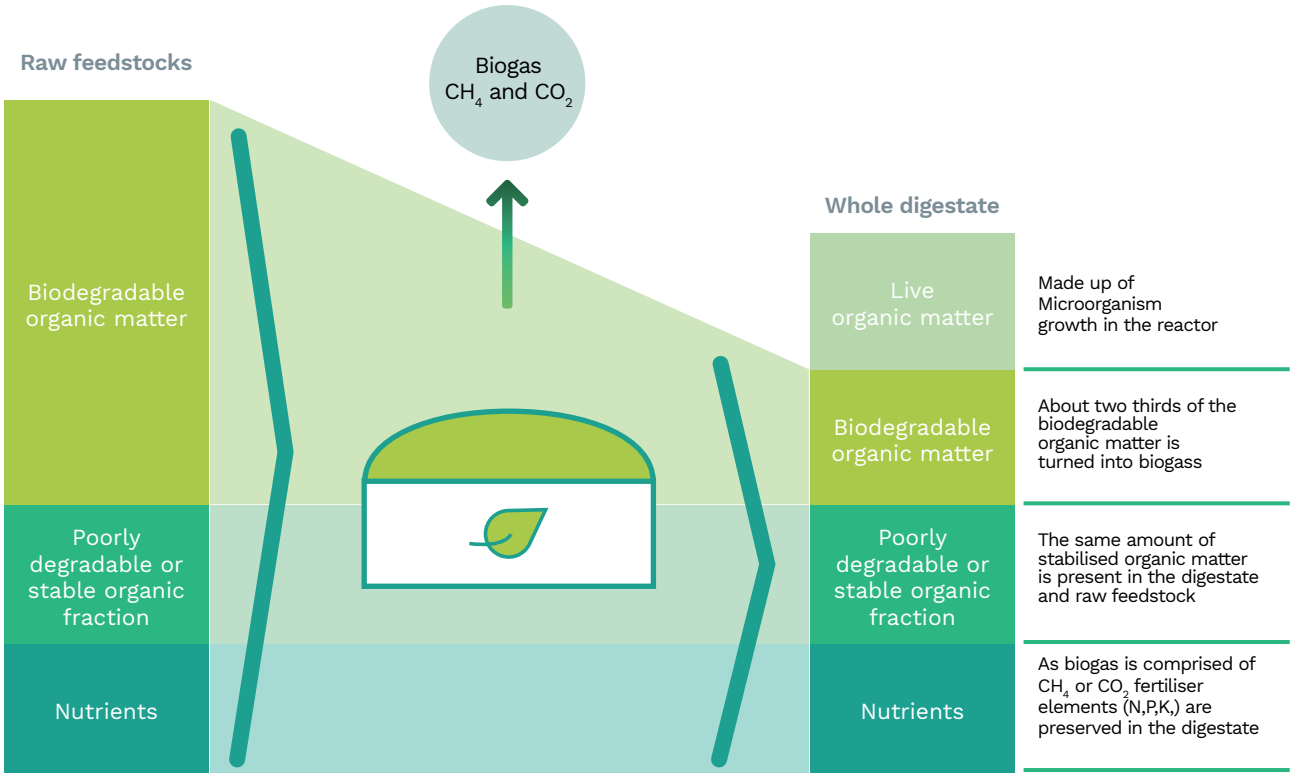
From reducing reliance on costly synthetic fertilisers to promoting effective soil management and restoration, digestate emerges as a key player in addressing mineral imbalances in soils and facilitating efficient carbon capture. Moreover, its utilisation aligns with ongoing developments in EU carbon farming policies, positioning it as a cornerstone in Europe's transition to a greener, more sustainable agricultural sector.

What is digestate?

During the anaerobic digestion process, biogas is produced alongside another valuable stream, called digestate. While a portion of the organics from the raw feedstock is converted to biogas during the process, the mineral fraction remains largely intact in the digestate. This makes it an appealing organic-mineral fertiliser.

Raw feedstocks for anaerobic digestion are largely composed of biodegradable organic matter, poorly degradable or stable organic fraction and nutrients. First, about two thirds of the biodegradable organic matter is turned into biogas, heavily reducing its share in the digestate. Second, for the stable organic fraction, the same amount is present in the digestate and raw feedstock. This stable organic fraction is particularly beneficial for soils as it serves as precursor for humus material, thus improving the clay-humus complex of soils. Thirdly, as biogas is composed of methane and carbon dioxide, fertiliser elements (N,P,K) are preserved in the digestate. Moreover, some of these elements are transformed in the AD reactor to the benefit of plant growth. For example, the organic nitrogen in the substrate is partly mineralised into ammonium, a readily available source of nitrogen for plants.

What happens in the digester



Source: Reworked from "l'utilisation des digestats en agriculture)

Regulatory framework

Several legislations regulate the production, application, and marketing of digestate in the European Union. These policies encompass various aspects of digestate management, including its production processes, quality standards, application rates and environmental considerations.

They often depend on the input used in the anaerobic digestion process. Policies governing digestate at EU level include the Waste Framework Directive, the Animal By-Products Regulation, the Fertilisers Regulation, and the Nitrates Directive and the Sewage Sludge Directive.

The framework for digestate at national level is complex and far from being harmonised across Member States. Individual member states may have their own specific regulations and guidelines pertaining to digestate management to ensure compliance with EU directives and to address local environmental and agricultural needs.

The crucial aspect regarding digestate on a national scale is to have clear legislation providing legal certainty for all types of products and requirements that can be easily operationalised, thus avoiding red-tape. Additionally, providing an end-of-waste criteria for digestate at national level will have a positive impact on the public perception of digestate. As long as digestate is classified as waste, its value is diminished, hindering its broader acceptance and utilisation.

Regulatory barriers persist, limiting the application of digestate. For example, under the Nitrates directive, digestate from manure can only be applied under 170 kg of nitrogen per hectare per year, whereas synthetic fertilisers can be used above this limit to reach the nitrogen requirement for each specific crop. The lack of fertiliser or product status for digestate in national law is another major barrier as it leads to a restricted use of digestate or at least a depreciation of its value.

Positive impact on environment, climate, and soil health

Digestate has the potential to drive Europe's agricultural sector towards regenerative practices and offers an attractive, sustainable alternative to commonly used synthetic fertilisers.

The incorporation of digestate or its derivatives in EU agronomic practices contributes to the achievement of the strategic objectives for resource efficiency, the circular economy, and overall environmental stewardship. Utilising digestate enables a reduction in synthetic fertiliser usage as stipulated by the Farm to Fork strategy, has a positive impact on soil management and restoration, addresses mineral imbalances, and tackles the deficiency of organic matter in soils as outlined by the EU Soil Strategy. Moreover, it facilitates efficient carbon capture, aligning with ongoing developments in EU carbon farming policies. ■

About the authors

Mieke Decorte – EBA Technical Director decorte@europeanbiogas.eu

Mieke Decorte is Technical Director at the European Biogas Association since 2021 while she joined the association in 2018. Mieke manages and coordinates the technical and project work within the EBA and supports EBA's policy and communication work with technical knowledge and data. Her main responsibilities include coordinating EBA's involvement in Horizon Europe and other programs and overseeing the EBA's technical publications such as the EBA Statistical Report and the European biomethane map. Mieke has earned technical and market knowledge on the biogas sector with her work at the Flanders biogas association. She graduated in 2016 as a bioengineer at UGhent with a specialization in environmental technology.

Lucile Sever – EBA Policy Officer sever@europeanbiogas.eu

Lucile Sever is the Policy Officer in charge of following the Circular Economy dossiers.
She is dealing with legislation related to agriculture and environment and coordinates the EBA Working Group Circular Economy.

Before joining the EBA in January 2023, Lucile worked for INRAE – the French Research Institute for Agriculture, Food and Environment – for three years implementing the advocacy strategy of the Institute and assisting researchers in the emergence of new EU projects. Previously, Lucile worked as a public and legal affairs officer in the Wine and Spirits sector.

Second-generation EU Energy Communities legislation: we've made progress, but there's more to do

By Dirk Vansintjan, President of REScoop.eu, EUSEW digital ambassador, and Stavroula Pappa and Felix Kriedemann, both Policy Advisors at REScoop.eu

The EU's Clean Energy for all Europeans Package (CEP, 2019) introduced for the first time provisions for renewable energy communities (RECs), and citizens energy communities (CECs), empowering citizens to take ownership of renewables instead of exclusively depending on corporations.

While energy communities have come a long way since 2019, several barriers still exist, including issues with accessing the grid, a lack of funding opportunities, and complex administrative and regulatory procedures.

As indicated by REScoop.eu's Transposition Tracker, several Member States have made considerable progress in transposing these provisions into national legislation.

Modern sustainable neighbourhood in Almere, The Netherlands. The city heating in the district is partially powered by a solar panel island.

"In Belgium, the energy community Beauvent raised €1 million from their members in 30 minutes"

However, most Member States have yet to develop an enabling framework allowing energy communities to participate in the market without discrimination compared to other market actors.

Since the Clean Energy Package, Europe has experienced a global pandemic, the biggest war at our door since WWII, and an energy and related cost-of-living crisis that exposed our dependency on much-too-expensive fossil fuels. Many European policymakers have worked very hard to soften the blow of these crises.

Among these solutions was the REPowerEU and the Fit for 55 Packages, and the revision of the Electricity Market Design. Crucially though, these laws reinforced the model of energy communities, further acknowledging that citizens no longer need to depend on corporate power for their renewable electricity, heating, or renovations. We can now collaborate and take part in the local energy transition.


Shutterstock photo: ©Pasko Maksim

What can energy communities do?

There is a common misconception that energy communities only develop renewable projects at the local level. Positively, the second-generation EU legislation for energy communities clarifies that citizen-led initiatives actively contribute to other activities as well, including renovations, the alleviation of energy poverty, energy efficiency, offshore wind, and heating and cooling.

Community Heating and Cooling (CH&C) initiatives, where citizens own their local renewable heating infrastructure, are emerging all over Europe. In Belgium, the energy community Beauvent raised €1 million from their members in 30 minutes, and as a result, now supplies citizen-owned renewable heat to the municipality, 500 citizens, 25 Small and Medium Enterprises, and 2 hospitals in Ostend. Similar projects are succeeding in Greece, Italy, Denmark, France and the Netherlands.

The role of energy communities in the development of larger projects is recognised by the revised Renewable Directive in order to improve public acceptance of the transition. To this end, Member States may include RECs in joint cooperation projects on offshore renewable energy.

Belgium stands out as an example. In 2019, the Royal Decree on new offshore zones included citizen participation as one of the tender criteria. By 2022, the government published a law that transposed provisions for RECs at the federal level, solidifying citizen involvement as a key selection criterion for offshore wind projects.

A minimum of 1% of the capital raised for the entire project should be opened to citizens. The tender criteria will allocate 10% of the points to citizen participation, and the RECs are entitled to contract 25% of the energy through a citizen purchase power agreement (PPA). This groundbreaking approach ensures that wind energy profits can directly benefit citizens, communities and small businesses.

The way forward: practice what you preach

Direct citizen ownership of renewable energy projects is an essential safeguard for ensuring social acceptance and accelerating the transition. The potential of community energy is enormous – by 2050, around 45% of renewable energy production in the EU could come from citizens.

Moving forward, the Commission needs to ensure full and effective transposition, implementation, and enforcement of EU rules to create robust regulatory and enabling

REScoop.eu represents over 2,250 energy cooperatives and 1,500,000 European citizens. It could be said that the collaborative societal model that we defend is an embodiment of the potential that Jean Monnet saw in our Union. We have been promoting citizen ownership of the green energy transition since 2013. REScoop.eu played a vital role in the introduction of two definitions for energy communities in the context of the Clean Energy Package. While some Member States are still dragging their feet when it comes to citizen empowerment, the EU has put in place a second generation of legislation recognising the role energy communities play in different activities.

frameworks that remove obstacles for citizens, and level the playing field for energy communities in the energy market. A next step could be the development of an EU-level strategy for how different EU and national actions can support the development of energy communities across the different areas of EU policy.

We must now live by the words of Jean Monnet, and make citizens work together to show them that beyond their differences and geographical boundaries, lies a common interest. ■

About the authors

Dirk Vansintjan is – for his Belgian cooperative Ecopower cv – the president of REScoopeu, the European federation of citizen energy cooperatives since its creation in 2013. He is also board member of Cooperatives Europe, the European branch of the International Cooperative Alliance. In REScoop.eu he actually is project manager in the Interreg NWE AquaCOM project on district heating with aquathermal energy from surface water by energy communities. Dirk is one of the EUSEW Digital Ambassadors.

Stavroula Pappa is an EU qualified lawyer working as a Policy Advisor at REScoop.eu. Her role entails the representation of the Federation in European projects that aim to design enabling frameworks for energy communities in different EU Member States and explore how citizens and energy communities can take up a more active role in the energy system. Stavroula is actively contributing to the Advocacy work of the Federation, following up on the progress of national legislation on energy communities and relevant EU files. She holds an LLM in Energy and Climate Law from the University of Groningen and her research focused on how energy communities could promote the energy transition of Non-Interconnected Islands.

Felix Kriedemann, born in Germany and raised in Spain and France, works as Policy Advisor on CLR and CH&C at REScoop.eu, the European federation of citizen energy cooperatives. His background is in EU Public Affairs and he has worked in trade associations (for transport, and renewable energy), as well as the European Parliament. He currently works on citizen-led renovations (CLR), and Community Heating and Cooling (CH&C) to democratise the EU's energy system

Useful links

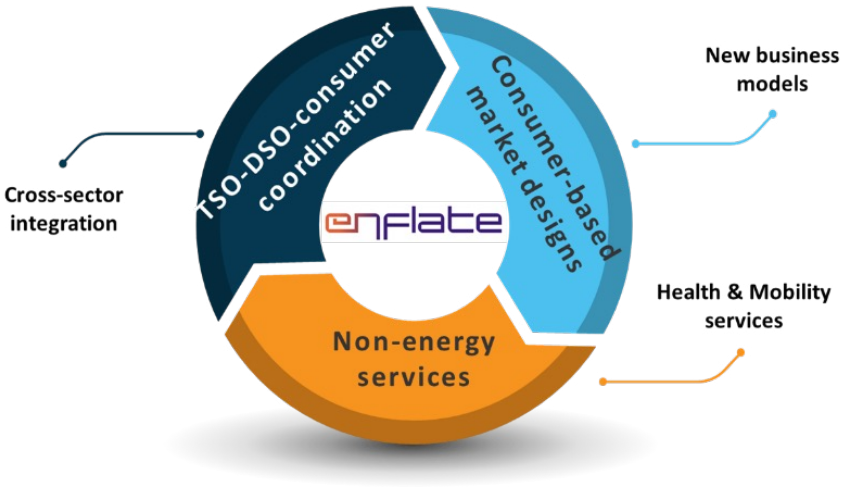
1. A roadmap to developing policy and legal frameworks for energy communities
2. REScoop.eu transposition guidance document
3. Energy sharing for energy communities – a reference guide
4. REScoop.eu success story on offshore wind
5. REScoop.eu Community Heating and Cooling (CH&C) Guidelines
6. REScoop.eu Briefing for Municipalities and Social Housing Providers on CH&C

The need for flexibility

The EU power system's shift towards decarbonisation and decentralisation poses serious challenges in managing the increasing variability of the generation mix while ensuring grid stability. Unleashing demand-side flexibility (DSF) plays a key role in this transition.

It is estimated that in a full-DSF activation scenario, which unleashes the flexibility from buildings, electric vehicles and industry, €4.6bn is saved due to lower costs of generating electricity, while €11.1–29.1bn would be saved in grid investment needs at EU 27 annually between 2023 and 2030[1].

To achieve this, smart and innovative solutions are required, that will enable citizens to access flexibility markets and allow distribution system operators to have a higher level of observability and controllability in their grids, while ensuring seamless coordination among all actors of the energy value chain. Moreover, utilizing the flexibility available in other energy carriers beyond electricity – such as heat and e-mobility – can be a game changer for increasing the grid flexibility.



The ENFLATE approach

The ENFLATE project develops a **collaborative platform of tools**, that builds upon existing solutions, enabling **consumer-driven business models** for energy services, valorising their multi-vector flexibility potential and integrating them with other **non-energy services**. This platform features consumer-centred flexibility markets, smart grid technologies and innovative applications creating an ecosystem in which owners of flexible assets, prosumers, aggregators, TSOs and DSOs exchange flexibility in a truly collaborative approach for a socially fair energy transformation.

The developed solutions will be demonstrated through 6 demonstration campaigns across 5 European countries, i.e. Bulgaria, Greece, Spain, Sweden and Switzerland, ensuring their replicability and scalability.

More specifically, an **integrated flexibility market** will be demonstrated in Switzerland, a **blockchain-based flexibility marketplace** for small-scale DER in Greece, **tools for flexibility prediction and management** and a health-assessment tool based on energy monitoring in Spain, **a real-time control system for coupling heat and electricity network** in Sweden, as well as **non-energy services for health and mobility** in Bulgaria and Switzerland respectively.

Energy networks digital twins will be developed for all demo sites and will be utilized to validate the feasibility of the ENFLATE proposed business models. The impact of the ENFLATE innovations at the pan-European level will be assessed leveraging the capabilities of the **Artelys Crystal Super Grid modelling platform**, which is also used by the European Commission to power the METIS model.

Engaging citizens in demand side flexibility schemes is a pivotal step towards achieving energy transition targets. It involves **educating and empowering consumers to participate in local flexibility markets and demand response programs.** In this context, ENFLATE tests new innovative business models and the provision of non-energy related services, while adopting robust consumer engagement strategies". ■

Learn more
enflate.eu

ENFLATE has received funding from the European's Union Horizon Europe Research and Innovation programme under the Grant Agreement No 101075783.

1 SMARTEN Report, Demand-side flexibility in the EU: Quantification of benefits in 2030, September 2022

Replicating energy efficiency: bringing EU innovation actions close to market

By Dusan Jakovljevic, co-founder and Policy and Communication Director at Energy Efficiency in Industrial Processes (EEIP), EUSEW digital ambassador

For over 10 years, Energy Efficiency in Industrial Processes (EEIP) has been working on the perspectives of improving European industrial energy efficiency, including through EU-funded Innovation Action initiatives.

Our main learning is that energy efficiency – although in some ways 'common sense', especially in a case of industrial and business energy users – does not happen spontaneously. It very often feels like a Sisyphean task of endlessly pushing the boulder of innovation up the hill of market feasibility.

The hill

This absence of a dynamic market for industrial energy efficiency stems from various interconnected challenges. Companies often face significant barriers to investing in energy efficiency measures due to the high upfront costs involved in upgrading equipment and implementing new technologies.

Furthermore, skills and work force shortage remains one of the key long-term barriers in decarbonisation of European manufacturing businesses. Additionally, the lack of clear metrics for assessing energy efficiency improvements (benchmarks) and the uncertainty surrounding long-term energy prices further discourage investments.

"Industrial energy efficiency is already all about collaboration. There are very few opportunities found only behind the factory gates."

The boulder

The first steps have been taken. A significant development has been made by the European Commission's Joint Research Centre, under Innovation Radar methodologies, with the creation of the Market Creation Potential Indicator (MCPI). This has the potential to become a valuable asset in navigating complex market landscapes, driving sustainable investments and growth, and fostering a more resilient and dynamic EU economy.

Our view is that any project must have a solid market awareness and orientation. This should be a foundation of replication methodologies in all EU-funded projects. Replication should not only be in a presentation of ideas and results; actions are not taken based on good ideas and inspiring information.

Competition for research funding between many actors, often comprising 'commercial' competitors (many of which are non-profit), can be balanced with collaboration through a range of means and incentives.

One approach is to further emphasise shared goals or mutual benefits already in programme calls and in application processes, such as addressing common challenges, or leveraging complementary expertise, or insisting on references to existing recent work in similar areas.

Additionally, incentives like access to broader markets, cost-sharing opportunities, or enhanced reputation through joint replication efforts can motivate collaboration. CINEA's thematic workshop that focused on replication in the clean energy transition of the business sectors (20-21 April 2023), which included more than 10 different projects and where EEIP supported facilitation and moderation, is an exceptional example of collaboration across project consortia.

Ultimately, by emphasising the synergies and long-term benefits of energy efficiency, different project consortia can mitigate the adversarial aspects of competition for future projects.

Innovation becomes a success only when market opportunities are effectively created and mobilised. Enforcing this perspective of market orientation of energy efficiency developments would undoubtedly add value to the project investments and outcomes.

Connecting the dots

An energy efficiency market can be created and stimulated only by actors working together. This would include all, from research centres and sectoral associations to companies and investors. Regulatory and EU funding programmes should create an effective framework for this collaboration to flourish.

Industrial energy efficiency is already all about collaboration. There are very few opportunities found only behind the factory gates. Connecting to other energy users, in order to optimise energy use, is often the best way forward.

Industrial Symbiosis is a good example. As energy efficiency makes common sense within a company, industrial symbiosis does the same in energy and resource-connected circular economy.

EU-funded projects like EENOVA, which analyses connections of value chains in optimising energy efficiency innovations in the food industry, or CORALIS, which connects decarbonisation for resource and energy intensive sectors, are examples where replication builds on pre-existing interaction of multiple sectors and energy users. Working together and learning from each other, between research, factories and business enablers, is that much-needed springboard for energising future energy efficiency markets. ■

About the author

Dusan is an expert in European energy transition, manufacturing industries and sustainability related financing. He has been involved in EU regulatory and technical advocacy on sustainable heat policy, energy management systems, electrification, critical infrastructure, industrial digitalisation and financing energy efficiency.

For more information

1. DG CONNECT 'Innovation Radar, the European Commission's repository of innovations with market potential, hits the 10,000 milestone'
2. JRC Technical Report 'Market Creating Innovations in the EU Framework Programme'
3. EENOVA project
4. CORALIS project

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POWER PLANT 2.0

A guidebook to electrify in harmony with nature

13 June 2024, Brussels

The power sector is committed to tackle climate change and biodiversity loss in synchrony. With a show-don't tell mindset, our sector has developed integrated renewable projects, adopted nature-friendly practices, involved local communities and learned by doing.

Our decarbonisation efforts can lower risks to biodiversity by up to 75% and contribute to save more than €5 trillion of global economic losses caused by climate change. And we can do even more...

On 13 June in Brussels, Eurelectric will present their new Power Plant study developed by WSP: A Guidebook to electrify in harmony with nature.

Discover with us **the 12 principles for biodiversity integration.**

Learn how **renewable developers** can retain natural habitats, protect endangered species, and even create new possibilities for wildlife to flourish.

Join **policy makers, industry representatives and NGOS** to discuss key enabling factors for scaling up nature-inclusive design.

Will you join us in our mission?

Registration now open:

eurelectric wsp

POWER PLANT

BioSFerA
Biofuel for biotravels

A successful project implementation towards the deployment of Biomass-to-Liquid (BtL) technologies

BioSFerA is a Horizon 2020 research and innovation project that introduces an alternative Biomass-to-Liquid (BtL) concept for the production of sustainable aviation and marine biofuels based on the gasification of biogenic residues/wastes. In particular, a fuel synthesis scheme based on the double-stage fermentation of the produced syngas (syngas → acetic acid → microbial oil) is assessed instead of the conventional Fischer-Tropsch (FT) or Alcohol-to-Jet (AtJ) synthesis.

The BioSFerA project, funded by the European Union's Horizon 2020 (Grant Agreement number 884208), started in 2020 and finished last March this year. The project not only performed the development and validation of the technology at pilot level (TRL5) but also evaluated the scale-up potential of the concept in financial, environmental, and social terms based on reasonable upscaling considerations and models validated at pilot scale. The valuable legacy of the project could be condensed into the following points:

Experimental/pilot achievements:

- Six different types of feedstock (forest residues, olive/vineyard prunings, wheat straw, sunflower husk, biogenic waste fraction) were successfully gasified, ensuring the feedstock flexibility of the concept.
- Integration of pilot gasification unit with mobile syngas fermentation unit for acetic acid production from real, biomass derived syngas and successful continuous operation for several days under various gas purities. Optimization in terms of costs reduction of the gas cleaning chain.
- Metabolic engineering of acetogenic bacteria and oleaginous yeasts for the enhancement of the acetic acid and triglycerides (TAGs) productivities towards the optimization of the novel double-stage fermentation process.
- A scalable DSP (downstream processing) train was defined for the efficient TAGs recovery from the fermentation broth. Innovative techniques, such as steam explosion and membrane separation, were tested.
- Hydrotreatment tests verified that the produced BioSFerA microbial oil (TAGs) is an appropriate feedstock for upgrade into drop-in advanced biofuels, compatible with the existing refining infrastructure. Around 300 liters of advanced biofuels for aviation and maritime use were produced.

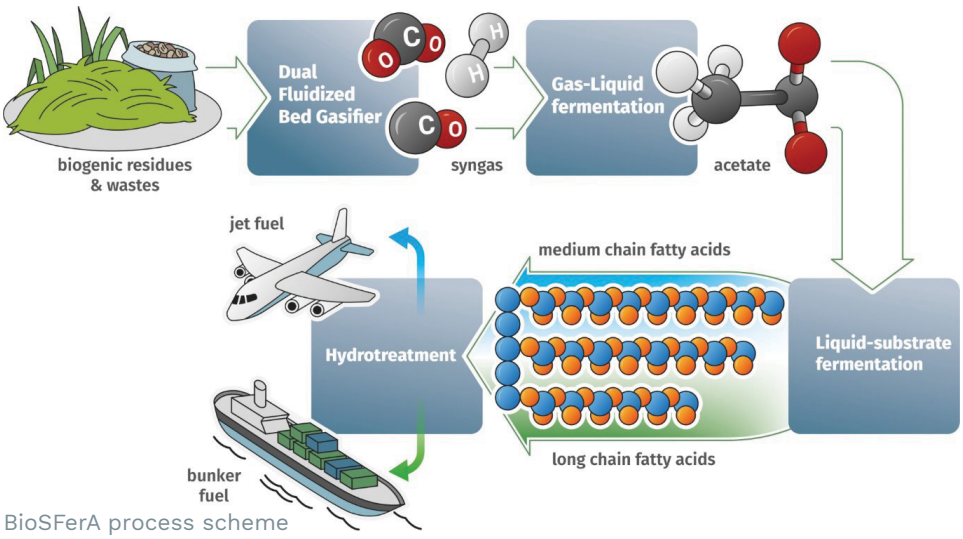
Impact assessment towards commercialization:

- The environmental assessment of the BioSFerA value chain through LCA (Life Cycle Assessment) modeling revealed 50-86% GHG emission savings compared to conventional (petroleum) fuel routes.
- 15-40% operational costs reduction compared to the conventional BtL technologies (FT & AtJ).

Bio Base Mobile Pilot Plant arrival at the Bioruukki VTT's site of installation

- Estimated baseline minimum selling prices of 1.83 €/L for jet fuel and 1.71 €/L for diesel (marine fuel) can be considered in the competitive price range for advanced biofuels.
- Similar to other BtL technologies that target advanced feedstock, capital investment and feedstock costs are the main cost-drivers of the BioSFerA process. Design optimization expressed in reduced capital costs or favorable financial terms expressed in low feedstock prices can upgrade the financial competitiveness of the concept.
- The direct exploitation of the BioSFerA microbial oil from the existing refining infrastructure as sustainable feedstock could be an attractive business case delivering economic benefits to the industry and beyond ■

For more information:
https://biosfera-project.eu/



BioSFerA process scheme

Advancing towards carbon-neutral energy and high-value chemical production

SunCoChem Project: Carbon-Neutral production for the European Chemical Industry through innovative Photoelectrocatalytic Reactor Technology.

www.suncochem.eu

Reducing greenhouse gas emissions stands as one of Europe's major challenges in addressing global warming and climate change. Over the years, the European chemical industry has pursued this goal, striving to achieve carbon neutrality by 2030.

As the fourth largest manufacturing industry in Europe, the chemical sector produces around 120 million tons of CO_2 annually and heavily relies on carbon feedstock imports for energy and chemical processes, mainly from fossil fuels. Although the industry has been transitioning towards the use of more renewable energies since 1990, there is still a long way to go to reach carbon neutrality.

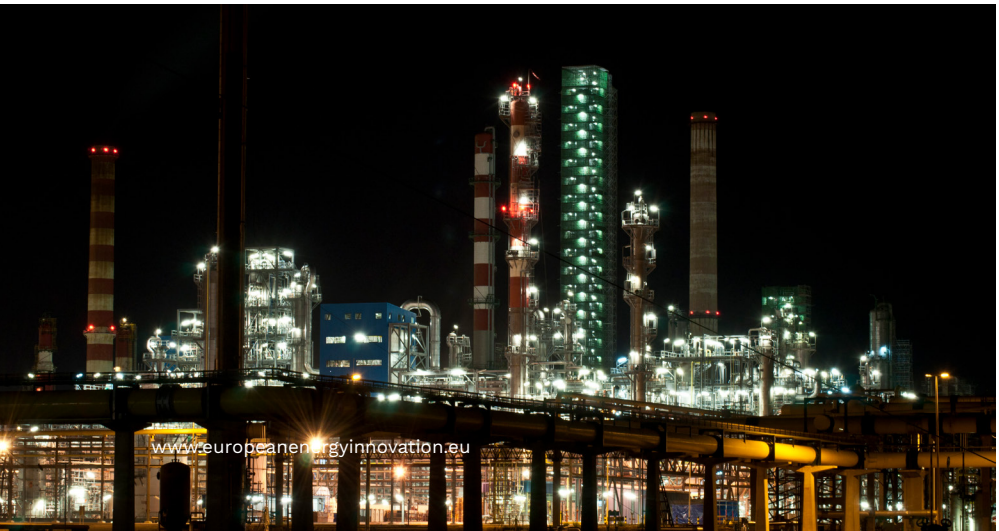
The achievement of a carbon-neutral chemical industry requires a fundamental shift in production methods, while maintaining global competitiveness. Embracing sustainable chemistry and leveraging renewable resources for chemical production presents an opportunity for an efficient use of resources and environmental preservation. This is pivotal for transitioning to a new energy and chemical production paradigm.

A key element of this transition is the solar-driven chemistry which refers to a future chemicals production based on the substitution of fossil feedstock as energy source and raw materials and the utilization of renewable energy sources. This intensification in the transformation from solar to chemical energy is crucial for sustainability.

In this sense, the Horizon 2020 SunCoChem project has been working to offer a sustainable and carbon-neutral alternative for the production of chemicals, utilizing CO_2 captured from the chemical industry itself combined with solar energy.

SunCoChem, coordinated by Eurecat Technology Center, is developing a photoelectrocatalytic reactor to synthesize valuable chemical oxo-products, chemicals manufactured from oxo-chemistry processes, from CO_2, H_2O, and solar energy. Oxo-chemistry involves the hydroformylation of olefins by using syngas (H_2/CO) to produce essential compounds such as limoxal, valeraldehyde and glycolic acid commonly used in cosmetics and food manufacturing.

What sets SunCoChem's innovation apart is the utilization of a self-biased photo-reactor, ensuring carbon neutrality while pushing the boundaries of sustainable chemical synthesis.



SunCoChem's photoelectrocatalytic device for solar-driven CO_2 conversion into green chemicals

The SunCoChem's novel reactor architecture integrates CO_2 capture and conversion units, creating a self-sustaining device poised to significantly reduce CO_2 emissions. At the same time, it enhances solar energy conversion efficiency for chemical production, avoiding the use of fossil fuels. This reactor has undergone rigorous testing to develop value-added chemicals for diverse applications, including cosmetics and food.

Chemicals are present in nearly every aspect of modern manufacturing, with applications in a countless number of sectors. SunCoChem's innovation mitigates costs and CO_2 emissions, reducing the European chemical industry's dependence on carbon-based raw materials while contributing towards a solar-driven carbon-neutral industry aligned with the commitments agreed at the 2015 United National Climate Change Conference (COP21).

SunCoChem is made up of a consortium of 14 partners from eight European countries, including five technology and research centres; four small and medium-sized enterprises developing advanced materials and technologies; one engineering firm; two chemical corporations and two operational support partners. ■

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 862192.

Copper: A strategic raw material for the energy transition

By Quentin de Hults (pictured), Director General, International Copper Association Europe

Copper is indispensable in the journey toward electrification, energy efficiency, and the adoption of renewable energy technologies. Copper plays a crucial role with its high electrical and thermal conductivity, corrosion resistance and ductility, in addition to being fully recyclable.

In the EU, copper demand is projected to grow by 35% by 2050, driven by its necessity in achieving climate neutrality. The copper industry is committed to enhancing mining, refining, and recycling capabilities while reducing greenhouse gas emissions to contribute to a resilient and climate-neutral EU economy.

Copper: the 'Big Picture'

The copper value chain has a robust presence in the EU, backed by a diversified import strategy that aligns with the Critical Raw Materials Act (CRMA) benchmarks. Through extensive mining, refining, and recycling operations within the EU, the industry ensures a stable supply of copper, which is crucial for strategic net-zero value chains.

Strong trade agreements and strategic partnerships also help diversify import sources and mitigate supply risks. These efforts collectively enhance the EU's resilience and competitiveness in the global market while upholding high environmental and community development standards.

Copper Sector is Ready to do More

ICA members are advancing projects to expand mining, processing, and recycling capacities both within the EU and abroad. These initiatives aim to strengthen the EU's supply chain resilience and support climate goals.

By increasing mining and refining operations and boosting recycling efforts, ICA members contribute to securing essential raw materials while adhering to stringent environmental and community standards. Their commitment to sustainability includes the goal of achieving net-zero Scope 1 and 2 greenhouse gas emissions by 2050, further strengthening the EU's strategic raw material value chains.

ICA members also adhere to internationally recognised responsible operating practices and sustainable development standards, particularly The Copper Mark, providing a comprehensive social and environmental assurance program for copper production.

coppermark.org

The Next Steps

The EU must create the right conditions to materialise new copper production projects, including a stable, coherent, and inviting regulatory environment promoting investments in strategic raw material value chains in the EU and partner countries. This involves streamlining permitting processes for mining, refining, and recycling, ensuring access to competitively priced, fossil-free energy, developing stronger strategic partnerships with third countries, and providing financial incentives like grants, subsidies, tax credits, and low-interest loans. A predictable market outlook and clear transition trajectories for electrification, energy efficiency, and renewables are also essential. ■

ICA Europe's policy priorities for 2024-2029 include:

1. Making the resilience and competitiveness of strategic net zero value chains a political priority.
2. Establishing a stable regulatory framework to attract investments in strategic raw material value chains.
3. Streamlining permitting processes within the EU and building stronger partnerships outside the EU.
4. Ensuring access to competitively priced, fossil-free energy.
5. Promoting effective policies for electrification, energy efficiency, and renewable energy, particularly in buildings and transport.

These priorities aim to support the EU's climate-neutral and resilient economy. Let's work together! ICA Europe is interested in your views. My email is quentin.dehults@internationalcopper.org

Wiring European industry for net zero through advanced manufacturing and electrification

By Malte Lohan, Director General, Orgalim, Europe's Technology Industries, EUSEW's partner organisation

"I believe the net zero goal remains valid and essential – but it's time to adjust the instruments to get there."

In the grand race to combat climate change, Europe stands tall, aspiring to lead the way towards a greener future. However, this ambition comes with a pressing question: How can Europe maintain its businesses' competitive edge on the global stage while championing environmental sustainability?

The answer lies in a powerful combination: advanced manufacturing, and electrification.

Advanced manufacturing harnesses innovative technologies such as automation, robotics, and digitally connected solutions to enhance products and processes, catapulting industries into the future. Electrification ties together multiple strands that are important to our industries, including decarbonisation of the energy system and the switch to renewables, a focus on energy and resource efficiency, sector coupling, new "advanced" manufacturing processes and the shift to smarter grids, smarter buildings and smarter transport.

This dynamic duo isn't just about reducing emissions, though – it's about revolutionising the way industries operate. By embracing advanced manufacturing techniques, businesses can streamline production processes and use fewer critical resources, while reducing energy consumption and waste along the way. Meanwhile, electrification can ensure that the energy used comes from carbon-neutral sources and unlock new efficiencies, further cutting down on harmful emissions.

What's more, Europe's technology industries are at the forefront of this revolution. They're not only world leaders in advanced manufacturing and electrification technologies but also pioneers in shaping the future of sustainable industry.

To maintain this competitive advantage while we lead the journey towards climate neutrality, a well-crafted policy framework is indispensable. While some may argue that Europe has overreached in this endeavour, suggesting that the costs are too high, I firmly believe that the net zero goal remains both valid and essential.

However, it is time to adjust the instruments to get there. The next five years will be pivotal in this regard. Hence, we advocate for a fresh political agenda, meticulously designed to establish the optimal conditions for unleashing the full power of Europe's high-tech manufacturing potential.

This includes policies that incentivise


Unsplash photo: ©Thomas Reaubourg

innovation, support clean energy infrastructure, and foster collaboration between industries and governments. As the driving force behind the technologies indispensable for achieving net-zero emissions, we have developed an agenda aimed at strengthening Europe's high-tech manufacturing base.

Europe's ambition to lead the net zero transformation needs to be squared with the pressing need to safeguard its competitiveness and secure its economic resilience. It won't falter due to competitors' policies. But it may falter if the right policy conditions are lacking at home. As Europe charts its course towards a greener future, it's clear that industrial innovation and electrification hold the keys to success. By embracing these technologies and creating an enabling environment for businesses to thrive, Europe can demonstrate that the fight against climate change can go hand in hand with a thriving economy.

Together, let's make it happen. ■

About the author

Malte Lohan is the Director General of Orgalim, Europe's Technology Industries, speaking for high tech manufacturing companies spanning the mechanical and electrical engineering, electronics, ICT and metal technology branches. Together they represent the EU's largest manufacturing sector, generating annual turnover of around €2,906 billion, manufacturing one-third of all European exports and providing 11.19 million direct jobs.

Appointed Orgalim Director General in 2018, Malte is responsible for setting Orgalim's strategy, acting as the senior representative of the European technology industries in Brussels and managing the operations of the association. He joined Orgalim from Anheuser-Busch InBev, the world's leading brewer, where he held multiple roles including most recently Head of Corporate Affairs for AB InBev's European region.

Malte has held numerous voluntary leadership positions, including President of the Society of European Affairs Professionals (SEAP), which represents the interests of the public affairs community in Brussels. Malte obtained his BA in philosophy and economics at the London School of Economics and went on to complete an MSc in political science at LSE. In 2016, he took part in a corporate MBA programme at AB InBev.

For more information

1. https://orgalim.eu/insights/technology-heart-delivering-net-zero-heart-europe
2. https://orgalim.eu/position-papers/green-transition-orgalim-position-and-recommendations-communication-2040-climate
3. https://orgalim.eu/insights/shaping-europes-climate-future-embracing-opportunities-and-addressing-challenges
4. https://orgalim.eu/position-papers/industrial-policy-delivering-net-zero-transformation

TAKE-OFF and the techno-economic and environmental assessment of jet fuels production from CO_2 and H_2

By Hadis Marami, Benyamin Khoshnevisan, Morten Birkved, Department of Chemical Engineering, Biotechnology and Environmental Technology, University of Southern Denmark

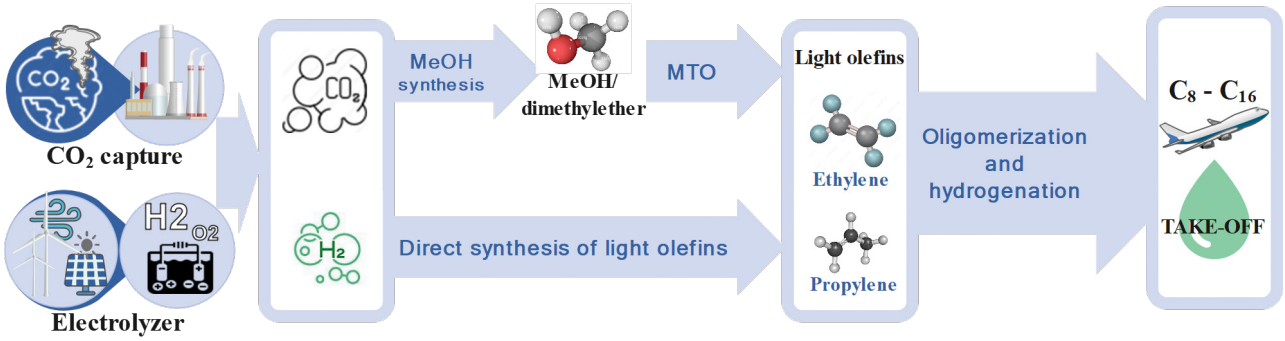
The TAKE-OFF project

In 2017, European aviation contributed 163 million tonnes of CO_2, about 3.6% of Europe's total, with a projected 21% increase to 198 Mt by 2040, making it crucial to reduce its CO_2 and other greenhouse gas emissions. Sustainable aviation fuel (SAF) from renewable sources can significantly lower the carbon footprint compared to fossil-based aviation fuels. Launched in 2021, the European-funded project TAKE-OFF–Production of Synthetic Renewable Aviation Fuel from CO_2 and H_2 — is developing next-generation technology to produce SAF from CO_2 and H_2. TAKE-OFF is an industrially driven project that will be a game-changer in the cost-effective production of SAF.

Conceptual models and benchmarking

Currently, Fischer-Tropsch (FT), a certified method for producing SAF, is considered a benchmark for TAKE-OFF. Both TAKE-OFF and FT are competitive pathways for large-scale SAF production using similar feedstocks. TAKE-OFF's technology involves two process lines (Figure 1):

Fig 1. Overview of direct and indirect pathways development in TAKE-OFF; MTO: Methanol to olefin; MeOH: Methanol.



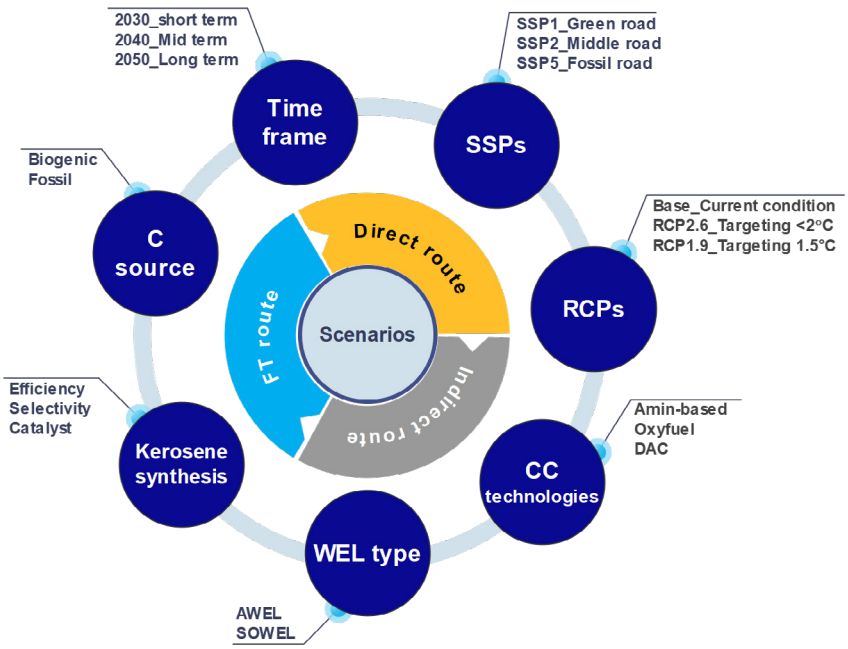


Fig 2. Developed scenarios under TAKE-OFF Direct, TAKE-OFF Indirect, and FT pathways; CC: Carbon capture; WEL: Water electrolyzer; AWEL: Alkaline water electrolyzer; SOWEL: Solid oxide water electrolyzer; DAC: Direct air capture; SSP: Shared socio-economic pathways; RCP: Representative concentration pathway.

- **Line 1:** Captured CO_2 and H_2 are first converted to Methanol (MeOH)/ dimethyl ether (DME), then to light olefins, reflecting the current state-of-the-art technology..

- **Line 2:** Directly converts H_2 and CO_2 to light olefins with process improvements from TAKE-OFF's research.

Both lines convert light olefins to jet fuel through oligomerization and hydrogenation. In the FT pathway, feedstocks are converted to syngas via reverse gas shift and then to syncrude, with final fuels influenced by catalysts, conditions, and refinery processes.

Techno-economic and environmental assessment of jet fuels

The TAKE-OFF pathways for producing SAF from CO_2 and H_2 are currently at a low technology readiness level (TRL~3-4) and are expected to reach TRL 5 by the project's end. To include sustainability aspects in the early stages of design and production, all three technology lines are assessed in terms of sustainability using Life Cycle Assessment (LCA) and Techno-economic Analysis (TEA). Multiple scenarios in terms of carbon capture, hydrogen production technology, energy sources, etc. are developed and system models for each scenario are created and simulated using experimental data (Fig 2).

LCA results explored in this project can be used for decision-making purposes, determining whether large-scale SAF production via olefin pathways (direct and/or indirect) should be prioritized over FT pathways in the medium to long term.

The sustainability assessment is enhanced by using IPCC's Shared Socio-economic Pathways (SSPs) to ensure sustainability goals will be reached regardless of future socioeconomic changes.

This approach considers future changes, policy implications, and socio-economic aspects. Additionally, our LCA assessment evaluates environmental impacts under three climate scenarios: the base scenario, RCP2.6, and RCP1.9. This comprehensive framework ensures a robust comparison of the sustainability of SAF production pathways.

TEA integrates technical evaluation and economic analysis to assess a technology's economic viability. It has two primary stages: process design and economic analysis. Process design evaluates plant components, efficiencies, chemical consumption, utilities, mass and energy flow, plant capacity, and products are assessed. Economic analysis investigates capital expenditure, fixed and variable operating expenses, loan interest, salvage value, selling price, payback period, return on investment, gross profit, and net present value.

Website

For more information, please visit the project website at www.takeoff-project.eu ■

The TAKE-OFF "Production of synthetic renewable aviation fuel from CO_2 and H_2" project, has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006799.

Biohydrogen's complementary role in the net-zero equation

By Mieke Decorte, Technical Director, European Biogas Association (EBA)

Biogases, including biohydrogen, are emerging as key players in the search for sustainable energy solutions. They can help decarbonise energy-intensive manufacturing processes, transportation and other sectors in need for defossilisation. An increasing number of innovators, researchers and industry experts is testing the solutions that biohydrogen can bring into the net-zero equation.

This form of green hydrogen is produced from biological feedstocks. The unique advantage of using biohydrogen technologies as renewable energy carriers is the achievement of negative emissions. This happens when more CO_2 is being taken out of the atmosphere than added into it. As biohydrogen technologies continue to evolve, their transformative potential becomes more and more apparent, paving the way for a more sustainable and resilient energy future.

Biohydrogen production in the European biogas industry

The European biogas sector has been exponentially growing, with over 20,000 plants generating 223 TWh of energy in 2022. The industry is at an important turning point, transitioning towards biomethane production. In fact, the future energy mix will be formed by a co-existence of renewable gases, where biogas, biomethane and hydrogen have complementary roles. Biohydrogen production from biogas can further increase the versatility and flexibility of biogas plants, by diversifying the energy products and thus potential off-takers of anaerobic digestion plants.

Biohydrogen refers to hydrogen obtained from biogenic sources. It can be produced from biogas, but also from a range of other production routes (Figure 1). The European Biogas Association (EBA) is involved in TITAN, a R&D project exploring an innovative biohydrogen production technology. TITAN involves the direct conversion of biogas, by simultaneous biogas cracking and carbon dioxide dry reforming, to obtain biohydrogen and solid carbon materials. The project addresses the unique needs of small, remote, or unsubsidized biogas plants, offering an alternative path to valorise biogas efficiently and in a cost-competitive way.

Technologies that directly convert biogas into biohydrogen, such as the TITAN technology, find relevance in market segments or areas where grid connections are costly, making it ideal for plants far from the gas network. As financial incentives for electricity-only biogas plants in some areas are being phased-out, these technologies step in as a viable option, ensuring a more efficient and diversified renewable gas production with biohydrogen. They also hold promise in areas with hydrogen and carbon-intensive industries, becoming a strategic choice for existing plants in need for decarbonisation in synergy within local markets.

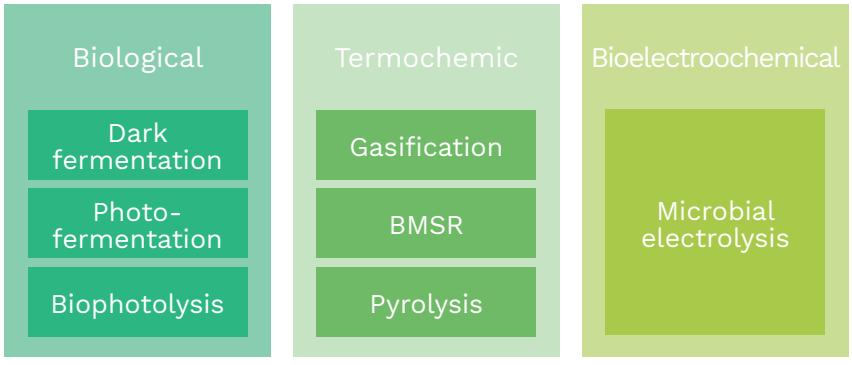
Biohydrogen particularly stands out in rural areas, as a locally sourced green energy solution, reducing costs and issues associated with hydrogen transport. Finally, in the context of broader energy mix scenarios, biohydrogen from biogas facilitates allows the simultaneous deployment of complementary energy solutions, aligning with the EU's decarbonisation goals.

Bio-hydrogen: a game changer for green industries

In 2020, Europe's hydrogen demand hit 8.7 Mt. Most of the hydrogen demand went to refineries and ammonia industries (49% and 31% respectively), while the chemical industry used 13% of the total hydrogen demand. From 2015 to 2050, the Clean Hydrogen Monitor estimates a sevenfold rise in hydrogen demand. By 2030, industrial projects plan a total consumption of 5.2 Mt hydrogen/year. These energy intensive sectors, however, are slowly shifting from fossil to green and biohydrogen utilisation, aligning with emission reduction goals. In this context, biohydrogen emerges as a game-changer energy source and carbon removal renewable gas.

The industry of iron and steel is a prime example of an industrial sector in urgent need for defossilisation. Renewable electricity alone is not sufficient to decarbonise the sector

Figure 1. Overview of biohydrogen production technologies



and the use of biohydrogen can effectively double the carbon credit of hydrogen-based steelmaking routes. Likewise, in the chemical industry, the use of biohydrogen as feedstock can stir up steam methane reforming (SMR)-based ammonia production.

The use of bio-hydrogen in that process can substantially reduce associated carbon emissions and facilitate the production of carbon-negative ammonia with carbon capture and storage (CCS) technologies. The ethylene synthesis process, reliant on hydrogen-based heat generation, sees a remarkable reduction of its carbon footprint using carbon-negative biohydrogen.

On top of the industrial applications, hydrogen-carrier molecules such as biomethane, biomethanol and bioammonia offer a solution to transport hydrogen cost effectively. Biomethane and hydrogen integration in Europe's energy mix show promising synergies in terms of seasonal storage and grid utilization. Bioammonia serves as a direct and biologically produced hydrogen carrier, offering versatility in energy applications. Similarly, biomethanol appears as an eco-friendly fuel for hard-to-decarbonize transport, presenting safety advantages and potential for diverse downstream products.

A promising solution for Europe's renewable energy landscape

Biohydrogen technologies provide promising solutions for Europe's renewable energy landscape. Especially biogas market segments facing challenges, such as large distance to gas network or the phasing out of incentives for electricity-only biogas plants, will benefit from these technologies. Biohydrogen not only facilitates industrial decarbonisation but also aligns with broader energy mix scenarios, contributing to the EU's decarbonisation goals. As biohydrogen continues to advance, the next frontier in renewable energy unfolds, promising a more resilient and eco-friendly future. ■

About the EBA

The EBA is the voice of renewable gas in Europe. Founded in February 2009, the association is committed to the active promotion of the deployment of sustainable biogas and biomethane production and use throughout the continent. The association counts today on a well-established network of over 250 national associations and other organisations representing the whole biogas and biomethane value chain.

About biogas and biomethane

Biogas is produced from the decomposition of organic materials. These residues are placed in a biogas digester in the absence of oxygen. With the help of a range of bacteria, organic matter breaks down, releasing a blend of gases: 45 – 85 vol% methane (CH4) and 25 – 50 vol% carbondioxide (CO_2). The output is a renewable gas which can be used for multiple applications.

Biomethane – purified biogas – is a renewable alternative to natural gas. Its multiple applications include heat and power supply for our buildings and industries, and renewable fuel production for the transport sector.

A new mission for the SET Plan: selec for Member States' auctions for renev

By Greg Arrowsmith, Secretary General of EUREC

Updated Renewable Energy Directive containing a target to deploy innovative renewable energy technology? ... tick

Net Zero Industry Act mandating the use of non-price criteria by Member States in their auctions for renewable energy support, these criteria supporting high performance technology?... tick

Awareness in the European Commission that these measures reinforce each other? ... tick.

ukasz Kolinski, Head of Unit C.1 in DG Energy said at a conference 22 May that together, they could "give a strong kick for innovative technology." The next question is how to make the magic happen for the remaining years up to 2030, and the answer is: **with the SET Plan's help**.

The SET Plan – what is it?

The Strategic Energy Technology Plan is the interface between EU policy for clean energy innovation and national policies. It's governed by the SET Plan Steering Group, a group of officials delegated by Member States and countries associated to Horizon Europe, and European Commission staff. Their job is to coordinate national energy technology policy with the EU's strategy.

They do this with the help of input from experts outside the European Commission or government offices who work daily with specific technologies. These experts are gathered in groups called ETIPs (European Technology and Innovation Platforms). There is an ETIP on wind energy, one on photovoltaics, another on renewable heating and cooling technologies and so forth, covering the full spectrum of energy technology research.

It's time to ask these ETIPs prepare a kind of recommendation for the SET Plan Steering Group unlike those they have made so far, and the SET Plan Steering Group members to use it in their countries to meet the "5% innovative renewables" target. I'll get to nature of that recommendation in a moment, but first some background...

What should qualify as 'innovative' technology under the Renewable Energy Directive and Net Zero Industry Act?

The target in the Renewable Energy Directive refers to the fact that "at least 5%" of the renewable energy capacity to be installed to 2030 should be "innovative".

If we estimate that total amount to be 1 TW, the Directive aims to deliver a minimum of 50 GW of capacity provided by such "innovative" technology across the EU. 50 GW is an amount beyond mere pilot-scale or "first commercial demonstration" examples. It is for companies that have proved that their technology works and that are trying to take market share from incumbents.

So the definition can't be too restrictive. Technologies that improve "in at least one way comparable state-of-the-art renewable energy technologies" would qualify under the Renewable Energy Directive, while under the similarly worded Net Zero Industry Act, they should "comprise genuine innovations that are not currently available on the Union market".

Some technologies improve on existing ones without any need of support, but NZIA anticipates that often the new technology will start by costing more. Article 26 allows Member States to abandon plans for an auction using non-price criteria if they "estimate based on objective and verifiable data" that the auction would attract bids at least 15% higher than if no NPC were applied.

With these guidelines in mind, each Member State will soon need to think about what, in its specific case, would qualify, aiming for things that are new, but not so new that the scale of deployment would be negligible compared to the approximately 50 GW capacity goal, and that don't cost much more than today's equivalent.

Missed opportunity in National Energy and Climate Plans

Member States failed to use the opportunity of their updates to their National Energy and Climate Plans to offer examples of the technologies they would use to reach the "5% innovative renewables" target.

In every single one of the country-by-country Recommendations it issued in Dec 2023, the European Commission urged Member States to "Include an indicative target for innovative renewable energy technologies by 2030 in line with Directive (EU) 2018/2001 as amended" in the second and final version of their NECP. This must happen by the end of June this year.

Our own work looking at 10 Member States identified some interest in helping new technology, but not at a GW scale (e.g. Spain with Measure 1.4 of its draft NECP or Italy, where 680 M EUR of National Recovery and Resilience Plan money would fund just 200 MW).

Given that the updating of NECPs happens only once every five years and that even when it does most

t non-price criteria vables support

countries allow little external input to the drafting, the EU needs another place where NZIA- and RED-qualifying innovative technology may be defined. Enter the SET Plan and its ETIPs.

New mission for ETIPs: advise on non-price criteria for NZIA auctions

ETIPs have traditionally produced documents called Strategic Research and Innovation Agendas every 2-3 years listing, fairly exhaustively, the research priorities for their sector. The SRIAs guide the European Commission in its choice of topics to fund with Horizon Europe or other programmes, and hope to influence Member States' spending, too.

With their transparency, public profile and balanced composition of members from industry and academia, ETIPs are qualified to look one step beyond the allocation of research grants to the kinds of advanced technology that are ready to receive a boost from auctions run under NZIA Article 26.

They should suggest which technologies or approaches should score highly for 'innovation', set thresholds, and determine the difficulty associated with particular performance goals. Every few years, when they are not busy with a SRIA revision, they should revisit their guidance and ratchet up the criteria to keep pace with technology development.

The final decision on the design of Article 26 auctions will of course lie with Member States, with one Member State considering 'innovative' a technology that its neighbour may not, but at least the ETIPs' work would serve as a baseline against which their decisions can be challenged. Our advice on the use of non-price criteria in Article 26 auctions is in the box below.

Sustainability a source of innovation

NZIA allows points to be earned not only for innovation but for sustainability, and often the two go hand-in-hand: a more innovative PV module, for example, may be one that converts sunlight with greater efficiency, increasing its productivity and therefore spreading any environmental harm associated with its manufacture over more kWh output.

As examples of the kinds of sustainability criteria that could apply to PV, the European Solar Industry Alliance has proposed values relating to carbon footprint, share of recycled content, recyclability, and inverter efficiency.

ETIP-PV could review these performance indicators and the thresholds attached to them, and ETIPs concerned with other technologies could draw up similar lists. ■

Checklist for successful application of non-price criteria in Art 26 NZIA auctions

- Use the SET Plan (beefed up in Oct 2023 and in March 2024 with NZIA) and its ETIPs to get sectors' views on appropriately challenging non-price criteria on innovation, feeding them into national policy making via the Steering Group.
- Build on the experience some Member States already have of using non-price criteria in auctions for renewable energy support, as detailed in the European Commission's Guidance to Member States on Auction Design (May 2024).
- Accept that auctions using non-price criteria necessarily have to be technology-specific.
- Be realistic about the capacity of NZIA to help made-in-EU PV in the short term. Because of widely suspected dumping by China, and the openness of the EU market to Chinese-made modules, EU module prices are so low that the ability under Article 26 auctions to ask for a price 15% higher than usual hardly even begins to close the price gap.
- As the Recommendation to Member States on auction design for renewable energy says, "Member States seeking to foster innovation through the use of non-price criteria should rather use them as award criteria" (Recommendation 14), i.e. innovation should mostly be scored so that the best technology can be distinguished from the good. However there are at least two possible exceptions where innovativeness should be laid down as a "prequalification criterion", i.e. assessed as pass/fail:

  Case 1: new technologies with so little market share that the entire class of the technology may be innovative without further qualification and any deployment should count towards a Member State's Article 26 obligations, e.g. ocean energy and airborne wind generation (for which Germany has recently offered support).

  Case 2: deployments of wind or PV where rich performance data from sensors on the operating plant will be collected and shared with defined groups, e.g. researchers in specific fields from specific categories of organisation. The data collected and conditions for sharing would have to be laid down very precisely ex ante, so here too, this innovation would need be applied in the 'pre-qualification' mode.

Always apply sustainability or innovation criteria alongside resilience criteria. As we've argued, resilience criteria protect Europe-based industry from external competition. To prevent that situation eroding the performance of European technology in the long term, sustainability criteria or innovation criteria are needed as compensatory pressure to boost performance.

Upcoming events 2024

1. **European Sustainable Energy Week (EUSEW)**
   June 11-13
   Brussels and online
2. **Large Scale Solar Southern Europe**
   July 2-3
   Athens, Greece
3. **34th ACI EUROPE Annual Congress and General Assembly**
   July 2-4
   Istanbul, Turkey
4. **European Transport Conference**
   September 18-20
   Antwerp, Belgium
5. **EUPVSEC, 41st European Photovoltaic Solar Energy Conference & Exhibition**
   September 23-27
   Vienna, Austria
6. **InnoTrans**
   September 24-26
   Berlin, Germany
7. **European Mobility Expo**
   October 1-3
   Strasbourg, France
8. **6th European Conference Biomass PowerON**
   October 9-10
   Copenhagen, Denmark
9. **Gas, LNG & The Future of Energy**
   October 22-23
   London, UK
10. **Greenport Congress**
    October 23-25
    Le Havre, France
11. **Tomorrow Mobility**
    November 5-7
    Barcelona, Spain
12. **Global Mobility Call**
    November 19-21
    Madrid, Spain
13. **Intermodal Europe 2024**
    November 12-14
    Rotterdam, Netherlands
14. **Energy Transition Europe 2024**
    November 13-14
    London, UK
15. **World Sustainable Energy Days**
    March 5-7, 2025
    Wels, Austria

1. EUSEW

June 11-13, 2024 | Brussels and online

CINEA

5. EU PVSEC 2024

23-27 September 2024 | Vienna, Austria

EU PVSEC

8. 6th European Biomass PowerON

October 9-10 | Copenhagen, Denmark

10. Greenport Congress

23-25 October | Le Havre, France

19TH GREENPORT Congress & Cruise
Le Havre 2024
Host port
HAROPA PORT

15. World Sustainable Energy Days

March 5-7, 2025 | Wels, Austria

International Conference

World Sustainable Energy Days 2025

5 - 7 March 2025
Wels/Austria

3

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Energy transition now – fast, smart, resilient!

There's no time like now for the energy transition! Over 650 experts from 60 countries took part in the World Sustainable Energy Days 2024 (WSED) from 5-8 March in Wels, Austria – a leading annual conference on the energy transition and climate neutrality that offers a comprehensive package for the entire energy transition community.

Price fluctuations, geopolitical instabilities and the climate crisis make the importance of the energy transition evident. New EU targets require a strong push for energy efficiency and renewable energy in all sectors. Under the motto "Energy transition now – fast, smart, resilient!", the WSED 2024 focussed on how to realise the high policy ambitions of the Green Deal and strengthen the clean energy markets.

The WSED are organised by OÖ Energiesparverband, the regional energy agency of Upper Austria. Upper Austria has established itself internationally as a pioneer region for sustainable energy as well as for the development and uptake of innovative energy technologies.

It is a perfect location for the event: Through significant increases in energy efficiency and renewable energy, greenhouse gas emissions from buildings in the region were reduced by 42% in the last 20 years. Renewables already supply 33% of all primary energy and 65% of all space heating.

Compact and comprehensive – a full package for the energy transition

The WSED offer a complete package of complementary events covering key topics for the global energy transition. In just 4 days, delegates can attend 6 dedicated conferences on policies, markets, financing, e-mobility, industrial decarbonisation and more. A leading tradeshow on renewables and energy efficiency and valuable networking events round up the programme. In 2024, the WSED attracted over 650 experts, including a wide range of business actors, the sustainable energy research community, and representatives from public bodies.

Energy efficiency policies in choppy waters

The Green Deal has resulted in an intense policy making process on European level with a range of new and challenging policy requirements for Member States. The Energy Efficiency Policy Conference presented the ambitious new European energy efficiency legislation and how it can be implemented. It highlighted different initiatives which empower energy consumers and support key policy areas on their shift to sustainable energy.

Pathways to net-zero industries

Decarbonising industry is one of the main challenges in the energy transition and climate neutrality. Transforming industry quickly is imperative for economic survival. The Industrial Energy Efficiency Conference featured the key topics of the industrial transformation from competitiveness to digitalisation and innovation. Delegates learned about innovations to accelerate and upscale energy efficient and sustainable transformation pathways as well as inspiring examples from Austria and beyond showing how decarbonising industrial sites can be successfully tackled.

Pellets – smart and sustainable

As a CO_2-neutral fuel, sustainable bioenergy is a key component in the energy transition. The European Pellet Conference showed how the acceptance of pellets as an important element in the clean

energy transition and the positive contribution of pellets to circular economy can be increased. The event presented latest trends in markets, policies, technologies and innovations, helping the participants stay on top of developments in the pellet and bioenergy world. With more than 400 participants each year, this is the largest annual pellet event worldwide.

E-Mobility – next level!

The major role of e-mobility in achieving climate targets is obvious. The Smart E-Mobility Conference offered an overview of policies and innovations that drive e-mobility to the next level. It also provided an update on the latest R&D developments and solutions around smart charging – from bi-directional to automated – and battery integration.

Cities and regions, drivers for climate neutrality

Over 90 people attended the workshop "Cities and regions, drivers for climate neutrality". This interactive event was tailored to regional and local energy agencies as well as representatives of cities and regions. It presented best practice examples of a wide range of energy transition investments with different financing solutions, and provided a platform for inspiration, networking, and exchange for this community.

The next generation of experts

The Young Energy Researchers Conference presents the work and achievements of young researchers in the fields of biomass and energy efficiency from all over the world. It supports budding professionals in developing their peer network. More than 110 papers from over 40 countries were submitted to the Call for Papers for the 2024 edition. These were reviewed and evaluated by a high-level international scientific committee, who select papers for oral and poster presentations. The Best Young Energy Researchers Awards were a highlight of the event. ■

World Sustainable Energy Days 2025 – Call for Papers & Speakers

The next edition of the WSED will be held from **5 – 7 March 2025** in **Wels, Austria**. The deadline for the Call for Papers & Speakers (including for the Young Energy Researchers Conference) is **10 October 2024.**

Contact details
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Christiane Egger (far left), Conference Director of the World Sustainable Energy Days, the Stadthalle Wels, WSED conference venue plus Young Energy Researchers and the WSED delegates.

The man making 'electric cement'

Could recycling end-of-life concrete in electric arc furnaces hold the key to zero-emission cement? *European Energy Innovation* speaks with Dr Cyrille Dunant from the University of Cambridge, where researchers may have cracked one of industry's hardest problems.

Cement is the cornerstone of our built environment. Worldwide, we consume around half a tonne of it per person per year – an astonishing figure that reflects its unique strengths, unparalleled versatility, and consequent ubiquity in virtually all construction projects.

Its production, however, remains a significant environmental challenge, accounting for some 7.5% of all anthropogenic CO_2 emissions. And while efforts have been made to mitigate this impact, through both tweaks to the manufacturing process and by carbon capture, it remains impossible to replace and incredibly difficult to decarbonise.

But researchers at the University of Cambridge might have found a solution. By recycling end-of-life concrete, reclaiming the cement and adding it to an electric arc furnace at the same time as recycling steel, his team found that the result was recycled but usable portland cement – a discovery that changes the way we think about concrete, the world's most-used material.

"We've found that cement is in fact a recyclable material," says Dr Cyrille Dunant from the University of Cambridge's Department of Engineering.

"It can be recycled at the same time, and in the same facility, as recycling steel. And because this process uses existing industrial equipment and infrastructure, it can be scaled rapidly as an alternative solution to the old way of making cement."

Put simply, Cyrille and his team have found that 'second-hand' cement reclaimed from old buildings is a good substitute for the lime used in the recycling of steel, and that the byproduct can be used to make more cement.

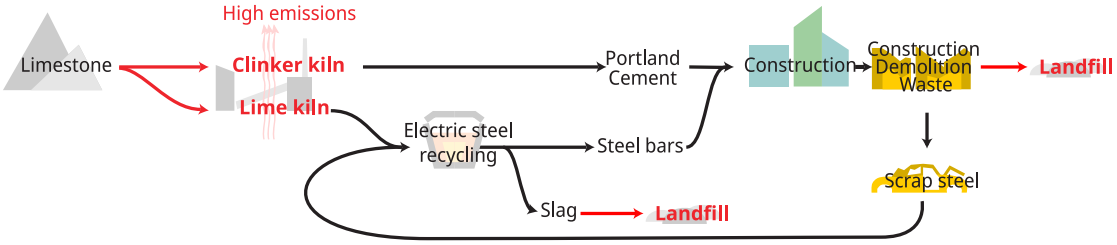
Normally, the lime is used as flux and effectively floats to the top of the molten steel, to be scooped off as slag and discarded. But if you put cement paste in there instead of the lime, the resultant slag contains clinker – the precursor to cement.

This has significant implications. Firstly, the idea that concrete is recyclable is pretty revolutionary, and comes at a time when end-of-life concrete structures are becoming abundant. But more importantly, the recycling of steel can take place in an electric arc furnace which – provided the furnace runs on renewable energy – implies that zero-emission recycled cement is a viable possibility.

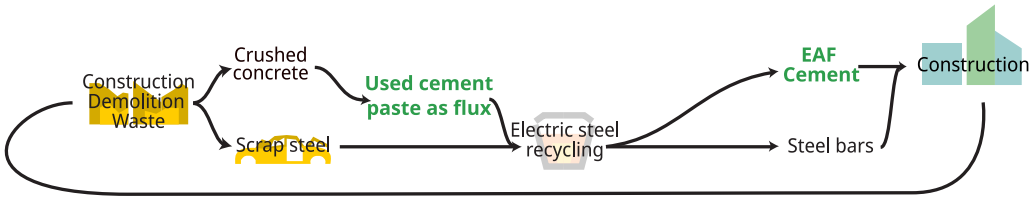
"We have opened the route to electrifying cement recycling", says Cyrille. "That's quite important, because normally there's no way of electrifying a high-temperature process for non-conductive material. With a conductor, you can zap it and

The first electric cement production in an electric arc furnace at the Materials Processing Institute in Teesside.

Today's construction with Portland cement: high emissions, landfill or downcycling



Cambridge Electric Cement. Closing the leaky loop



it'll heat up, but cement is a non-conductor. The trick is to zap the steel, and the steel then provides the heat to the cement."

It sounds relatively simple. So why hasn't it been done before? Cyrille says that the primary reason is economic, rather than technical.

"Concrete is very cheap," he says. "Recycling materials that are very cheap is a bit strange – unless you can make it even cheaper. The other reason is the energy required for the high temperatures. If you burn fossil fuels you make some savings, but not great savings. And if you don't make savings you're not going to make it economically viable."

Economic viability and scalability are next on the project's agenda. The researchers have worked with partners in industry, including Celsa, Tarmac, Atkins and Balfour Beatty, and have founded a spin-off company, Cambridge Electric Cement.

"We have a whole range of partners," explains Cyrille. "It's important to have a complete supply chain of partners to be able to understand how everything would need to be reorganised so we could make the recycling viable. It really is a team effort. We have the idea, but it'll only make an impact if we can make it work really well.

"And that involves a lot of people, who all do their job very well and in very optimised ways. And crucially they are not used to working together. The steel and cement industry – traditionally they're like oil and water, they don't work very well with each other. But here we're proposing a way for steel and cement producers to form a team, because they co-produce and co-recycle. So there cultural aspects to this as well."

It's interesting to note that the world's two dominant building materials have such different life cycles. Steel is the world's most recycled material, but recycling cement is virtually unheard of. Cyrille thinks that there's a significant untapped market for recycled, low-emission concrete, as well as other efficiencies to be made in cement-based construction.

"It's underappreciated, but there's a huge pool of consumers," he says. "If I'm developing homes, or building infrastructure, I am often ready and have a budget for lower-impact products and practices. And frequently the buyer is not so budget-constrained, it's that the products aren't there. Adding options is helpful at this stage."

"Concrete mixes are quite inefficient," adds Cyrille. "We could be making concrete just as strong as today with slightly better grading of aggregates. Typically today we use 350 kilos of cement per metre cubed of concrete, that's your typical ratio. It would require a change, but you could well do with 250kg and you could produce concrete just as strong. Design is another thing. Big savings are possible."

There are obvious hurdles to overcome, both technically and practically. But the breakthrough has been described as "miraculous", while Julian Allwood, Professor of Engineering and the Environment at the University of Cambridge, says it could be "one of the biggest material breakthroughs to come out of Cambridge in the past few decades". We ask Cyrille how long it will be before a building can be built using recycled cement.

"We've made quite a few samples," says Cyrille, holding up a battered block about the size of an apple. "We've produced the stuff and tested it. But the next big step is understanding the quality and how to reliably produce it.

"We're already doing trials at scale with our partners, trying it in a full-scale electric arc furnace that recycles something like a million tonnes of steel per year. We're fairly close, so this is not something for 20 years – perhaps more like four or five years. We're optimistic. But you know, famous last words." ■

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