EUROPEAN
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# Diversifying proteins

## The challenges and opportunities surrounding Europe's food chains

**Technology spotlight:** Sodium-ion batteries and what they could mean for Europe

How the ELOBIO project **converts biomass into sustainable hydrogen**

**Plus:** News, reviews and features from the forefront of Europe's energy transition

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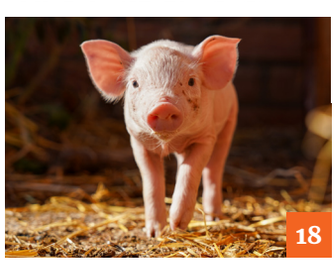








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# Foreword

By **Ed Wiseman**, EEI editor

As autumn stamps its muddy boots at Europe's door, and the sun sets on yet another record summer, I have found myself reminiscing about one of our most ancient shared celebrations – the 'harvest festival'.

It's still widely observed in Britain, with children invited to leave cans of non-perishable food at their local church or village hall as both a gesture of spiritual gratitude and a donation to local pensioners. I remember being confused at the time, but in hindsight I feel somewhat privileged to have taken part in such a timeless ceremony. It is still one of the first things I associate with this time of year, alongside the smell of conker husks and the sound of a robin whistling in the mist.

Similar rituals and feasts will take place across Europe, from *Erntedankfest* to *Trgatev* to *Miķeļdiena*, all ostensibly expressing thanks for a successful harvest, and many presumably featuring baffled six-year-olds clutching tins of baked beans. It is among the longest-running annual celebrations in human history and (perhaps remarkably) still has a place in today's secular, urbanised world.

This issue of *European Energy Innovation* is a seasonal nod to that shared reliance on food and agriculture. Our civilisation is as dependent on food as it was at any other point in the past few thousand years, though we face a mixture of ancient and modern-day challenges. In this issue, MEP Barry Cowen draws parallels between Europe's nutrition and energy systems – and the criticality of both – while MEP Anna Strolenberg talks about the importance of diversifying and decarbonising our protein sources. Alongside them is British food writer Tomé Morrissy-Swan discussing the opportunities and threats facing lab-grown meat.

## A pinch of salt

This issue's Technology Spotlight falls on sodium-ion battery research, which is an exciting – if not wholly sexy – frontier in both energy storage and mobility applications.

We have a new *EEI* contributor, Liam Critchley, writing in some depth about sodium-ion development and its current state of play, alongside longstanding analyst Xiaoying You providing context on China's prowess in this particular corner of the battery industry. Turn to page 24 for that.

As a transport enthusiast, I'm particularly excited by the impact this nascent technology might have on EVs, which remain a leading application for these batteries as well as a key driver of sodium-ion research in general. Incidentally, fellow mobility nerds are advised to pick up copies of *EEI*'s upcoming Winter and Spring editions, as both will feature transport issues.

Back in the autumn issue, *EEI* is proud to include a technical presentation from ELOBIO, an exciting research project joining the dots between biomass and sustainable hydrogen. And if you flick to the back of this magazine, you'll find our new Innovation Index, which showcases some more projects and initiatives breaking new ground in Europe's energy sector. The Innovation Index is a brand new feature, and one that we hope will provide a useful insight into the kinds of endeavours currently taking place across the EU and beyond.

And after a short break, the Events section returns to our back pages. *EEI* is proud to be a print-first publication, and many of our paper copies reach their readers at conferences, workshops, presentations and summits around Europe – if you would like to have print copies at your event, contact Caroline in the panel opposite. ■

# The daunting task of grid renewal

## Anticipatory investments, digital solutions, regulatory reform and fresh attitudes are needed to bring Europe's energy system into line with green objectives

By **Anna Stürgkh,** MEP

Electricity grids are the veins of our electricity system. Without them functioning properly our electricity system will collapse. 'Back in the day', our electricity system was marked by big power plants – mainly gas or coal – that transported electricity via transmission lines to substations, where it was then distributed to consumers via distribution grids. But this has changed.

Electricity is increasingly generated by renewable sources. Renewable electricity is cheaper than fossil-based electricity and makes Europe independent from imports and therefore more resilient and less prone to geopolitical threats. However, renewable electricity changes the way our grid is configured, because of the need to incorporate multiple, distributed sources.

Forecasts expect that by 2030, 70 percent of renewable energy will be injected directly into the increasingly decentralised distribution grid. On the other hand, the way we consume energy changes. Heat pumps, electric vehicles and industrial electrification will increase both electricity consumption and our reliance on it.

In addition, the sun doesn't always shine, and the wind doesn't always blow, so the generation of renewables won't necessarily happen when the electricity is needed, which makes additional flexibility and storage necessary. These massive changes require a rapid response by Europe's transmission and distribution grids. 2030 is around the corner, so we need to act now.

### Unfit for purpose

40 percent of the European distribution grid is over 40 years old and needs to be updated. The transmission capacity across borders must also be increased. The more integrated European electricity markets are, the cheaper the energy bill for consumers as the continent becomes able to pick and choose the most abundant or economical source. Hence, if the grid won't be updated and extended, it will be expensive for customers and renewable energy will be wasted – a lose-lose situation. In other words, urgent grid investments are essential to decarbonise the European power system and ensuring security of supply.

The European Parliament's own-initiative report "*Electricity grids: the backbone of the EU energy system*" picks up on these challenges and what is needed to modernise our electricity grid.

Firstly, the planning of the European cross-border electricity lines needs to be improved. The underlying legislative framework needs to be strengthened. There is still too much of a national focus rather than improving the cross-border angle. A stronger involvement of the European energy regulator, ACER, will bring the European focus to grid planning. Furthermore, distribution grids must play a bigger role in the relevant planning framework and shall also be able to achieve the so-called PCI status (Project of Common Interest).

**"Nationally managed EU funds like the Cohesion Fund or the Recovery and Resilience Facility are in theory also available for funding grid infrastructure. In practice, they are underutilised or used for other projects."**

### Who pays?

Secondly, there is the issue of financing. The European Commission estimates that by 2040, EUR 730 billion will need to be invested in distribution grids and EUR 472 billion in transmission grid infrastructure. This is why public EU funding such as through the Connecting Europe Facility for Energy (CEF) must be guaranteed and increased.

The recently published proposal on the EU's Multiannual Financial Framework (MFF) foresees almost a sextupled amount of funds compared to the current envelope. However, within

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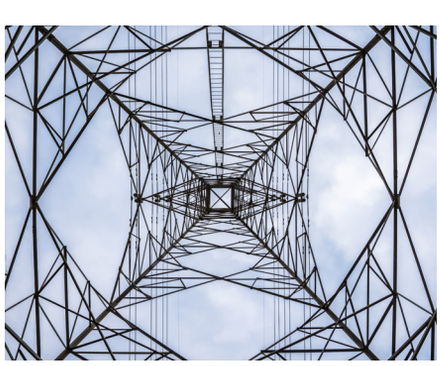
this new CEF-E, electricity grids will now unsurprisingly compete with a huge number of hydrogen projects or projects related to carbon capture and storage. In addition, the increased investment need for distribution infrastructure will need to be accounted for. While smart electricity projects may already be financed through CEF-E – as long as there is a cross-border dimension – financing needs go way beyond.

There are diverging opinions whether CEF-E is the right funding mechanism for distribution projects – both legally and with regards to the application procedure. After all, it doesn't matter if one applies for 1 million euro or 1 billion euro of funding, the procedures remain the same. Therefore, you might find it cumbersome to apply as a TSO or a big national DSO, but for smaller and medium sized DSOs it might simply seem overwhelming to deal with.

Nationally managed EU funds like the Cohesion Fund or the Recovery and Resilience Facility are in theory also available for funding grid infrastructure. In practice, they are underutilised or used for other projects. Therefore, it must be ensured that the Member States will make these funds available for grid modernisation, enhancement and build-out. So why not earmark a certain amount of these funds to be spent in infrastructure – say, for each Euro that funds a renewable generation project, a certain percentage of that amount should be spent in infrastructure. This way, easier access to funds could be granted at national level.

Another approach for a funding instrument could be the creation of a dedicated EU grid facility, which could be fed by a small percentage of Member States' ETS revenues and then made available to fund grid projects on distribution level. The merit in this idea would be that its structure and application procedure could by design be made less complex, less complicated and therefore more accessible to smaller and medium sized DSOs.



One might argue that distribution grids are rather a national business – why do we need to create a facility for decentralised grids at all rather than leaving it to the Member States? Well, firstly, the generation of renewable electricity is a common European goal, secondly it is mainly fed into the distribution grids and thirdly, as mentioned above, national EU funds already exist, but are underutilised. And apart from that, many policies that are in place to reach our climate and energy targets change how we consume electricity: charging of electric vehicles or the electrification of household heating, including heat pumps, just to mention a few.

However, when it comes to increasing CEF-E, guiding Member States to use more funds for grids, or even creating new instruments, the big question remains: How much opposition will we face from the Member States? The upcoming MFF negotiations will certainly tell us how serious the national governments take electrification and how much willingness there is to come one step closer to a true Energy Union.

What is not to be forgotten in the entire equation of financing is private investments, which consequently should also be increased, no doubt. Therefore both the EU and the Member States must set the right environment by providing market-oriented conditions and limiting the investment risks. Member States can encourage private investments by providing risk mitigation tools or Member States guarantees, the Commission and the European Investment Bank can provide for de-risking and initiatives and tools. And most importantly for investors but for every actor involved is ensuring reliable supply chains. If supply chains are not working properly, delays and uncertainties are inevitable – not a very attractive condition for investments.

A quick word on investments as such. Long awaited but eventually born is the Commission's guidance on anticipatory investments. Guidance that allows the system operators to make forward looking investments, giving them more certainty, that should be approved by the regulatory authorities. If well implemented, this could really help to make these investments happen in a more efficient manner.

## Digital innovation

Thirdly, digital and innovative technologies must always be considered as alternatives to grid expansion. The deployment of so-called grid enhancing and innovative technologies as well as the digitalisation of our grids should be incentivised. These technology options are often a cheaper and faster alternative to building new lines. Not to mention that upgrading an existing line might be done much faster as it could spare the hassle of going through lengthy permitting procedures and all the shenanigans that come with that.

**"The upcoming MFF negotiations will tell us how seriously the national governments take electrification, and how much willingness there is to come one step closer to a true Energy Union."**

There is even more exciting news. Making use of digital tools and data sharing can enable flexibility through local flexibility markets. Flexible connection agreements are the low hanging fruits. But wouldn't it be great if everyone could decide in real-time when to sell their flexibility? With all the digital excitement aside, it can certainly not replace grid expansion – however comparing costs and benefits of both options for each case would certainly be worth the effort.

In both cases, adding hardware or digital solutions, there have been many events in the recent past that have shown that there is another dimension to investments, cost benefits or efficiency: the issues of resilience and security have become a huge consideration when it comes to electricity grids and must not be neglected. Grid equipment must be secure; digital and physical grid equipment must be resilient against cyberattacks, sabotage or extreme weather events. The good news is that the EU already has updated its legislative frameworks, such as the cybersecurity and related network codes, and legislation, such as the NIS 2 Directive and the Cybersecurity Act. Implementation is now key, and so is cooperation between regional, national and EU levels.

A lot has been done, but a lot is still to be done. Eyes are now on the Commission and Member States. In this political climate, we are at the crossroads – will the Grids Package bring us one step closer to a true Energy Union or will we fall back into national nostalgia? ■

# Demand-side flexibility is a powerful tool that Europe must utilise

By **Michael Villa,**
Executive Director, smartEn

Europe's energy transition is a story of ambition, investment, and innovation. Over the past decade, we have poured resources into expanding renewable generation, strengthening electricity grids, and designing market reforms to speed up decarbonisation. Yet, despite this progress, there is a glaring gap in our strategy: we are not fully using one of the most powerful, immediately available tools at our disposal – Demand-Side Flexibility (DSF).

If Europe is serious about affordable energy, industrial competitiveness, and climate neutrality, DSF cannot remain a supporting act in the clean energy narrative. It must take centre stage – and it must be driven by a thriving Flexible Demand Management Industry.

## Ignoring a competitive advantage

Europe's industrial base is under pressure. Energy costs remain stubbornly higher than in North America and much of Asia. Our electricity demand is climbing as electrification accelerates, yet our grids face growing congestion. While billions are invested in new generation and grid reinforcement, the fastest, cleanest, and most cost-effective lever – flexible demand – is still underused.

DSF enables energy consumers – or "flexumers" – to shift or reduce electricity consumption in response to price signals or grid needs. This is not theory; it is a proven mechanism to balance the system, integrate higher shares of renewables, and reduce the need for expensive, carbon-intensive backup generation. It can lower emissions, cut energy bills, and boost industrial resilience.

**"We are not fully using one of the most powerful, immediately available tools at our disposal"**

The potential scale is striking. According to a joint study by smartEn and DNV, unlocking DSF across Europe by 2030 could deliver:

- €71 billion in annual consumer savings
- €11–€29 billion in avoided grid investments
- 61% less renewable curtailment
- Over 2.7 GW of avoided peak generation

These are not marginal improvements. They represent systemic efficiency gains that could make European industry cleaner, more competitive, and better protected from energy price shocks.

## Why demand-side flexibility stays stuck in pilot mode

Despite its benefits, DSF in Europe remains a niche activity. In most Member States, it is trapped in pilot projects, hindered by regulatory fragmentation, inconsistent market rules, and outdated infrastructure.

smartEn's latest Market Monitor, developed with LCP Delta, highlights the imbalance. Only a handful of countries (France, Belgium, Sweden, and the UK) have taken meaningful steps to enable DSF across wholesale and balancing markets. Elsewhere, implementation is incomplete, smart meter rollouts lag, and legacy rules still give priority to supply-side responses.

Even when DSF is technically allowed, market design flaws hold it back. Capacity mechanisms often favour fossil-fuelled backup plants. Industrial tariffs remain static and unresponsive to system needs.

And while the EU's recent Electricity Market Design reform sets the right

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**"Demand-side flexibility is ready, the economics make sense, and the benefits are measurable"**

direction, Member States are slow to apply it in practice.

This is more than a missed opportunity – it is a strategic mistake. In a world where Europe is competing for clean technology leadership, we cannot afford to keep one of our most effective competitiveness levers idle.

## From cost control to revenue stream

Across Europe, energy consumers of every kind—households, buildings, electric vehicles, and industry—have a largely untapped asset: the ability to flex when and how they use electricity. Demand-side flexibility makes it possible to shift or reduce consumption in response to price signals or grid needs. This not only helps stabilise the system and integrate more renewables, but also turns energy use into a source of savings and in many cases, a source of income.

These benefits are not hypothetical. In France, aggregated flexibility from buildings and industry alike is helping balance the system. In the UK, flexible demand from EV charging already earns revenue in capacity markets and provides essential ancillary services.

The business case becomes even stronger when DSF is combined with digitalisation, on-site storage, and renewable self-generation. Flexible plants can align production with hours of low-cost renewable supply, reduce peak charges, and enhance grid stability, all while reducing emissions.

At the European scale, unlocking DSF across sectors means a cleaner economy, reduced grid costs, and a stronger, more secure energy system for everyone — from households to heavy industry.

## Three moves to make demand-side flexibility mainstream

If DSF is such a clear win, why hasn't it taken off everywhere? The answer lies in policy inertia, inconsistent implementation, and a persistent bias towards supply-side thinking. The technology is ready, the economics make sense, and the benefits are measurable. What we need is decisive political and regulatory follow-through. Here's what the EU must do – now:

1. *Turn existing legislation into real-world results*
   The Electricity Market Design and Fit for 55 packages already contain more than 70 provisions enabling DSF. These rules require Member States to allow consumers to receive price signals, participate in markets, and be rewarded for providing flexibility.The technology is proven, the benefits are documented, and the economics are compelling. What's needed now is full and consistent implementation across all Member States, embedding DSF into market design, regulatory frameworks, and corporate strategies as a normal part of energy operations. Achieving this requires political leadership, regulatory certainty, and a shift in mindset; flexibility is not niche – it is central to an affordable, reliable, and competitive European energy system.

2. *Make energy data speak a common language*
   DSF begins with visibility. Without accurate, (near) real-time metering and accessible consumption data, flexumers cannot respond to signals or be compensated for doing so. The EU needs common rules for data access and interoperability, ensuring that market participants can seamlessly exchange information and unlock flexibility value across borders.

3. *Electrify smarter, not just faster*
   Electrification is essential for decarbonisation – but simply replacing fossil demand with electric demand will increase peak loads and grid stress if not managed smartly. As we raise Europe's electrification rate from 23% to 32% over the next five years, we must simultaneously scale the flexibility of both existing and new electricity demand. This means integrating DSF into every electrification strategy from day one.

## A call for political will and ambition

The EU has led the world on clean energy innovation before. We pioneered renewable integration, emissions trading, and cross-border power markets. However, leadership isn't a final destination – it's an ongoing commitment that must be renewed and strengthened over time. Today, DSF represents one of the largest untapped sources of system efficiency and industrial competitiveness.
The economics are compelling. The technology is mature. The environmental benefits are clear. The question is no longer whether DSF works. It is whether we are willing to act with the urgency and scale required. If Europe wants to maintain industrial strength in a decarbonised world, we cannot keep DSF on the bench. It must be part of the starting lineup. ■


### About the author

**Michael Villa** is the Executive Director of smartEn – the European association of the Flexible Demand Management Industry. With a background in energy sector advocacy, Michael previously served as Head of Policy at smartEn after six years as a Senior Consultant for clients in the EU and Middle East. Michael holds a Master's from the Institute for European Studies in Brussels and a bachelor's degree from the Catholic University of Milan.

# ELOBIO
# Electrolysis of Biomass-Based Feedstocks

## Combining green hydrogen and value-added chemical production for Europe's energy and resource transition

By **Philipp Röse,** Dissemination & Communication Manager of ELOBIO

Europe's energy landscape is undergoing a profound transformation, driven by the urgent need to decarbonise industry, reduce dependency on fossil imports, and transition to renewable energy. The chemical industry plays a key role in this shift: it is both energy-intensive and heavily reliant on fossil-based feedstocks and critical raw materials. To achieve a successful energy and raw material transition, innovative approaches are needed – not only in how energy is sourced, but also in re-thinking chemical production.

One of Europe's strategic responses is the expansion of a green hydrogen economy. Hydrogen produced via electrolysis using renewable electricity – known as green hydrogen – offers a clean energy carrier for hard-to-abate sectors, supports long-term energy storage, and opens up new opportunities for sustainable chemical production.

However, conventional water electrolysis remains energy-intensive and often economically unattractive unless coupled with low-cost renewable power.

In this context, the ELOBIO project explores a promising alternative: instead of producing hydrogen and chemicals in separate processes, they combine them in a single integrated process (*Figure 1*).

### Using biomass feedstocks

Today, most hydrogen is still produced from fossil fuels using carbon-intensive processes like steam methane reforming (SMR) or coal gasification – so-called grey hydrogen – which emit 11–19 kg CO2 per kilogram of H2.

Water electrolysis, the main route to green hydrogen, is only as clean as the electricity powering it. For instance, hydrogen produced using the EU's 2022 electricity mix results in 13.7 kg CO2/kg H2, more than conventional SMR.

Only when powered by renewable or low-carbon electricity does electrolysis qualify as green. To provide clarity, international bodies have begun to define thresholds for "clean hydrogen"; the EU's is ≤ 3.38 kg CO2/kg H2 (RED III), the USA's is ≤ 4.0 kg CO2/kg H2, and China's is: ≤ 4.9 kg CO2/kg H2.

Against this backdrop, ELOBIO's approach stands out: biomass-derived molecules – such as sugars like glucose and xylose, 5-hydroxymethylfurfural (HMF) – can be electrochemically oxidized at much lower voltages than water. This opens the door to more energy-efficient hydrogen production, while simultaneously generating valuable platform chemicals from renewable carbon sources.

### The ELOBIO concept

ELOBIO aims to develop and demonstrate electrochemical processes that convert biomass-based molecules into green hydrogen and value-added chemicals in a single step. This 200% electrolysis approach not only reduces the energy demand per unit of hydrogen but also significantly increases the overall economic and environmental value of the process.

The feedstock originates from non-edible biomass residues, such as lignocellulosic agricultural or forestry waste. These are abundantly produced at tens of billions of tons per year worldwide and do not compete with food production. Their molecular properties allow for oxidation at lower potentials than water splitting, enabling the simultaneous co-generation of green hydrogen and organic compounds such as organic acids, aldehydes, or furan derivatives, which are base chemicals in chemical industry.

In doing so, ELOBIO contributes to a circular bioeconomy and aligns with the EU's climate and energy targets for 2030 and beyond; by combining the goals of hydrogen production, biomass valorization, and electrification at once.

### From lab to demonstrator: Scientific and technical challenges

The technologies explored are currently at Technology Readiness Levels (TRL) 2-5. While the core scientific principles have been proven in the laboratory, several technical challenges remain before industrial implementation become feasible.

One of the main hurdles is the chemical complexity and variability of biomass-based molecules. Unlike water, these feedstocks vary in reactivity and often lead to competing reactions. This calls for tailored electrocatalysts that are highly selective, stable over time, and capable of operating efficiently under industrial conditions.

Another challenge is found at the system level. Electrolysis cells must be redesigned to accommodate organic electrolytes, prevent crossover of reactants and products, and allow for effective separation of hydrogen. Standard membrane and cell designs developed for water electrolysis are often unsuitable in this context.

Finally, the process must be viewed holistically – from biomass pretreatment and feedstock conditioning to product purification and system integration. A successful technology must not only work electrochemically but also be economically viable and environmentally sound across the full value chain.

### Key innovations from ELOBIO

To address these challenges, ELOBIO has delivered several important innovations:

- Low-overpotential electrocatalysts have been developed that enable the selective and efficient oxidation of glucose and HMF under milder

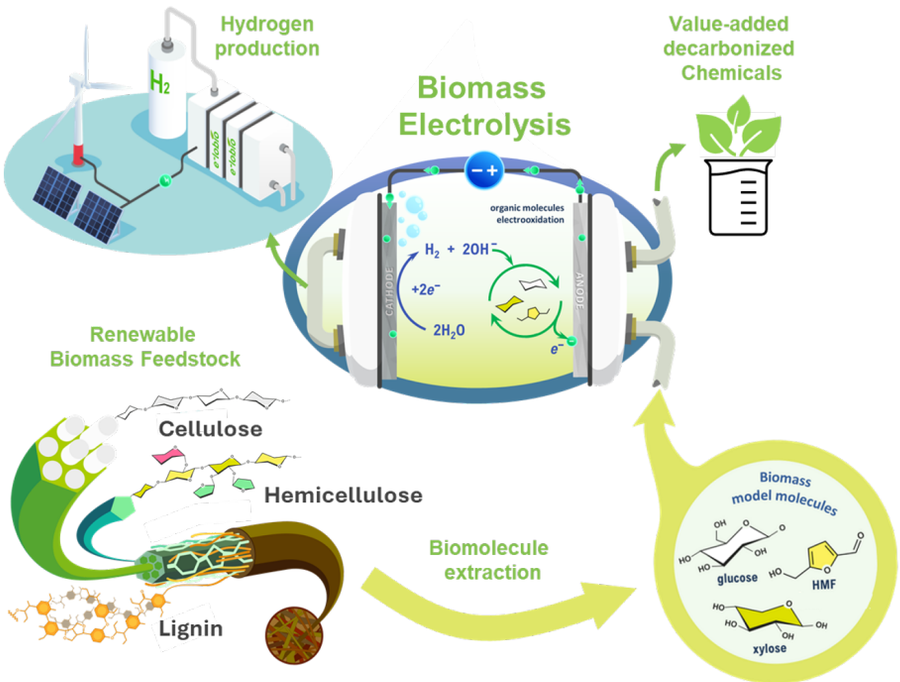


*Figure 1: Biomass electrolysis concept for the co-generation of hydrogen and value-added decarbonized chemicals from biomass feedstock © ELOBIO.*

conditions than those required for oxygen evolution. These catalysts increase energy efficiency and produce industrially relevant chemical intermediates.

- Modular flow electrolysis cells tailored to organic feedstocks have been designed and tested under realistic process conditions. These setups enable flexible operation, improve product separation, and are scalable towards industrial application.
- Integrated system models linking experimental electrochemical data with life-cycle assessments and techno-economic evaluations have been established. This provides a framework for benchmarking the environmental and economic impact of bio-based electrolysis technologies.

Together, these advances form the technological backbone for a new generation of biomass-based hydrogen production processes – designed to be efficient, scalable, and embedded in future biorefinery concepts.

## Outlook: A path toward integrated green chemistry

As Europe accelerates its transition toward climate neutrality and raw material sovereignty, the need for multifunctional and integrated technologies becomes increasingly clear. Bio-based electrolysis, such as developed in ELOBIO, offers an attractive path forward; it merges hydrogen production with renewable carbon valorization, supports decentralized and regional energy systems, and contributes to greater resilience across supply chains.

The path ahead will require continued technological development, scale-up efforts, and policy support to recognize hybrid processes that blur the lines between energy and chemistry. But the direction is set. With continued research and cross-sector collaboration, projects like ELOBIO can help shape a European hydrogen landscape that is not only cleaner – but also smarter, more efficient, and built on the foundations of circularity and innovation. ■


### About ELOBIO

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# News in Brief

Photo: RAF

## Red Arrows turn green

The Red Arrows – an official aerobatic display team operated by the British RAF – fuelled their Hawk T1 aircraft with SAF during the King's birthday celebrations in June, marking an historic first for 'The Reds'.

Having gradually introduced SAF blends to its operations since a regulatory changed was made to allow it in 2020, the Ministry of Defence now includes SAF in all its fuel acquisitions and says that the inclusion of SAF is now "routine". This is the first time the Red Arrows have performed in public using SAF, however.

In addition to a SAF fuel blend, The Red Arrows' trademark red, white and blue smoke trails were created using hydrotreated vegetable oil (HVO) rather than diesel.

The RAF's submarine hunting Poseidon aircraft, as well as the Typhoon fighter, already run on SAF blends. The Typhoon was involved in a landmark air-to-air SAF refuel in 2023, and made a SAF-fuelled public appearance in 2024.

Sqn Ldr Andy King said: "The beauty of these alternative fuels is how easily they can be used and with little additional work. The team will now look to explore further opportunities to use this innovation at other events."


Photo: qenergy.eu

## Floating solar milestone

Europe's largest floating photovoltaic (FPV) installation has come online in France and is expected to provide enough electricity for 37,000 people.

Q Energy and Velto Renewables inaugurated the 74.3MWp facility, situated alongside Route Nationale 4 near the Haute-Marne town of Saint-Dizier, in June. Its 135,000 modules float on 45.5 hectares of former gravel pits, and are complemented by 2MW of non-floating land-based PV.

Combined, the site is expected to save 18,000 tonnes of CO2 emissions per year. The plant has been named 'Les Ilots Blandin', a nod to the aggregates firm that previously ran the gravel pits.

Northern France has a large number of similar sites and other artificial lakes which, combined with its well-developed grid, make it well-suited to FPV development.

Les Ilots Blandin adds considerable capacity to Europe's existing FPV development (there was around 210MWp in place at the end of 2024) and a not-insignificant proportion of floating solar outside Asia. Albeit relatively tiny in terms of output, FPV has soared in popularity over the past decade and is expected to grow rapidly; China already operates several farms of 100MWp or more.

### In case you missed it...

Every issue of European Energy Innovation highlights a small selection of news from around the energy sector and those adjacent to it. To send us press releases, please contact news@pantograf.media – this inbox is monitored by the team.


Photo: Tomáš Malík

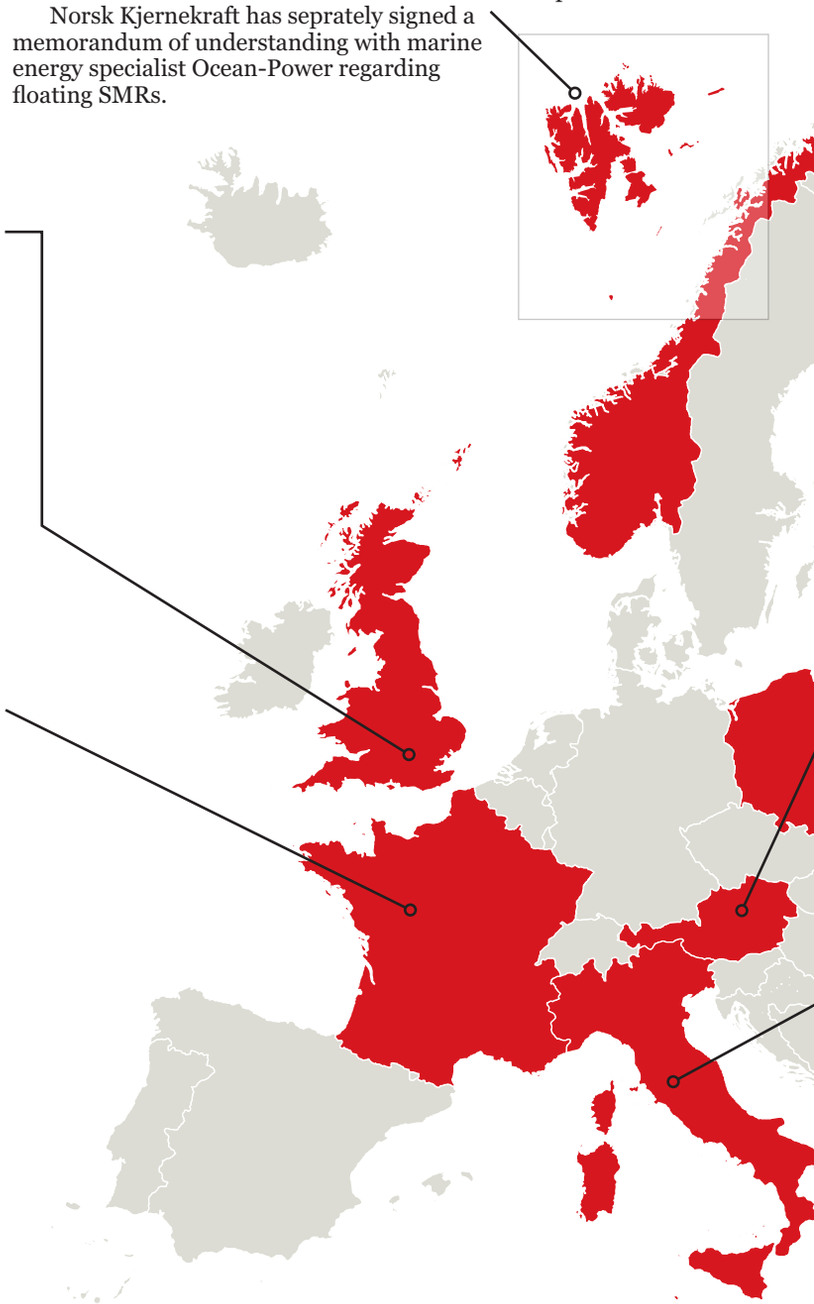
## High arctic SMR

Swedish lead-cooled SMR technology developer Blykalla and Norwegian power company Norsk Kjernekraft have submitted plans for a reactor to be built in Longyearbyen, Svalbard.

The town – the world's northernmost – has a population of around 2,200 people. Until 2023 it ran a coal-fired power station, but since then it has relied upon "temporary" diesel generators. Its modest grid and harsh climate make renewables difficult to implement.

The plan is to install a SEALER (Swedish Advanced Lead Reactor) on the island to connect with the town's existing electricity and district heating infrastructure. Detailed studies and environemntal assessments will need to be completed.

Norsk Kjernekraft has seprately signed a memorandum of understanding with marine energy specialist Ocean-Power regarding floating SMRs.

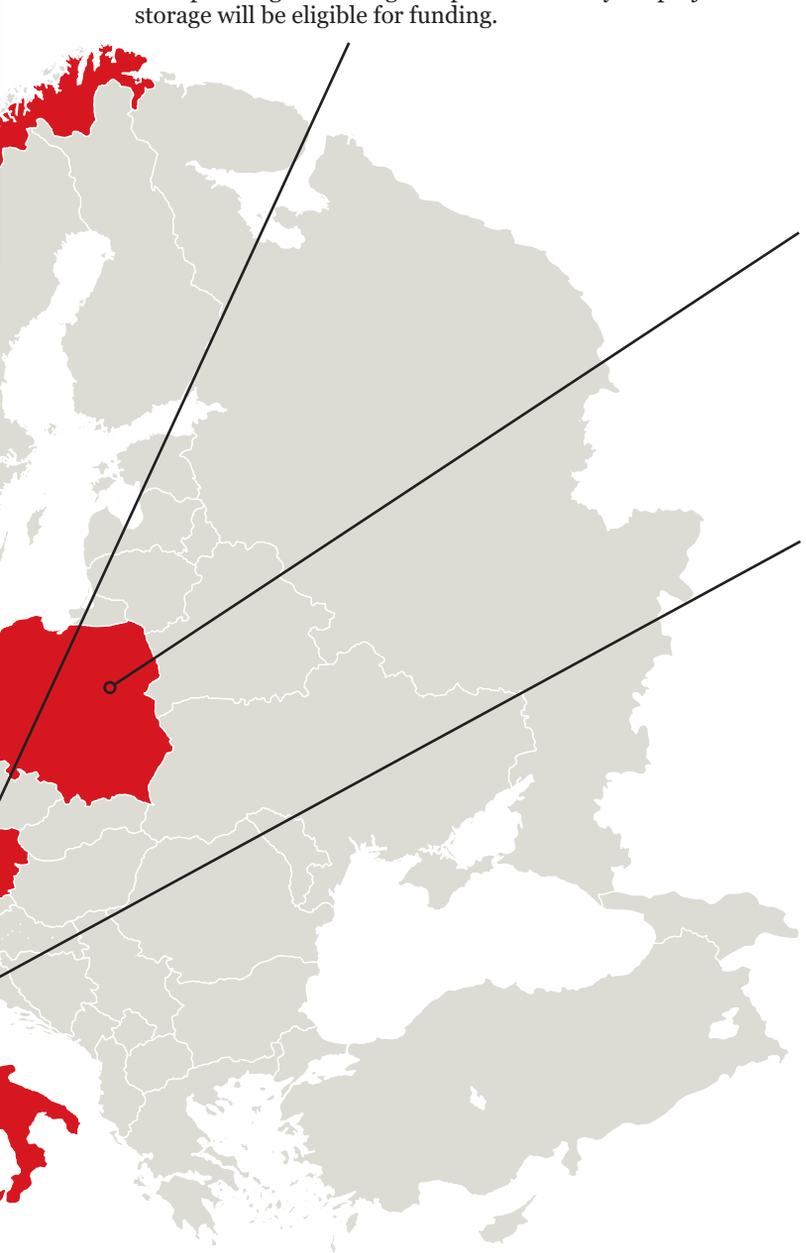



## Made in Europe bonus

Austria has launched an incentive scheme to encourage the installation of European-made photovoltaic components in small-scale projects. The government will provide additional funding of up to 20 percent, as well as the amounts already offered, providing certain criteria are met.

Currently, the subsidies are between 140 and 160 euros per kilowatt, depending on the size of the installation. A bonus of 10 percent is available on modules and inverters respectively. The Austrian government has specifically cited the need for stronger European manufacturing, in the context of competition from Asian manufacturers, as a reason for the new bonus. Austria has considerable expertise in photovoltaic components and inverters.

Upcoming rule changes stipulate that only PV projects with storage will be eligible for funding.



## Oil reserves discovered

A massive hydrocarbon deposit has been discovered in the Baltic Sea, approximately 6km from the Polish port town of Świnoujście, near the German border.

The reserves are thought to contain 22m barrels of crude oil and 5 billion cubic metres of natural gas, making this one of the largest finds in Europe for years. Announced by the relatively small Canadian-owned Central European Petroleum, the Wolin East 1 well could be Poland's largest ever discovery.

"The discovery of the Wolin East hydrocarbon deposit – although it still requires the preparation, submission, and approval of the deposit's geological documentation – may prove to be one of the breakthrough moments in the history of hydrocarbon exploration in Poland, especially with regard to areas that have so far remained insufficiently explored, such as Poland's Exclusive Economic Zone in the Baltic Sea," said Krzysztof Galos, Undersecretary of State and Poland's Chief National Geologist.

"The future development of this site may significantly contribute to strengthening Poland's energy security and reducing its dependence on external hydrocarbon suppliers, provided that all necessary formal requirements enabling its exploitation are met in advance."


## Rail link to Sicily

The Strait of Messina Bridge received final approval from the Italian government in August, bringing the long-anticipated infrastructure project – arguably dating back to Pliny the Elder – into the delivery phase.

The crossing represents a small but crucial part of the 2,200km Berlin-Palermo axis high-speed rail project, itself "project no. 1" of the TEN-R high-speed rail programme, which in turn falls under the vast TEN-T project.

A bridge across the Strait, which is characterised by strong currents, deep water and significant seismic activity, has been explored for millennia.

The proposed structure will carry rail lines and a wide roadway. It will be the longest suspension bridge in the world at 3.6km and will clear the sea by 72m in order to make room for shipping – though under full load of traffic and trains, this will dip to 70m. Two 400m-tall towers (roughly the height of the Empire State Building) will support it.

Rome hopes to account for the bridge as a military expense, so that its considerable cost counts towards NATO defence spending targets. The project is currently projected to cost 13.5bn euro.

Thousands of locals protested against the plans shortly after approval was given, with the loose "no ponte" movement citing various economic, social and environmental risks. The nature of the area makes it ecologically sensitive and, campaigners say, the bridge may pose a danger to migratory birds.

Fears that Italy's notorious organised crime groups could become involved with the lucrative construction project have long been part of the project's discussions.

# News in Brief


## Ammonia emissions

Data released by the Global Maritime Forum (GMF) suggests that ammonia fuel could reduce a ship's "tank-to-wake" emissions by up to 95 percent, exceeding previous predictions.

The report, titled "From pilots to practice: Methanol and ammonia as shipping fuels", highlights the relative readiness of both fuels while warning that both could fall short of industry adoption targets without additional investment.

Acknowledging that ammonia ships emit nitrous oxide in addition to ammonia slip, the report says that "results from full-scale engine tests suggest that operating on ammonia could reduce a ship's tank-to-wake emissions by between 90 and 95 percent" adding that this figure "exceeds the leading engine designers' own initial expectations and targets".

Contributors to the report emphasised that ammonia uptake will be gradual, and will be used up to half the time on the first ships as data and experience is gathered. Ammonia can only power ships during sea passage and is not currently expected to be used during low-speed operations such as in ports – the report says that "questions remain" as to whether this will ever happen. It also concedes that blue ammonia is expected to be "a common choice" until at least 2030. As a consequence, "ammonia-powered ships are unlikely to reach 90 to 95 percent emissions reductions overnight".

## LIFE after MFF

The LIFE programme, which is celebrating its 33rd year, has long been a cornerstone in advancing environmental and research innovation within the EU.

The programme, designed to support research and innovation that aligns with the EU's climate and environmental goals, has funded critical research across 6,000 projects, particularly in clean energy, biodiversity, and circular economy initiatives.

However there have been growing concerns about its future following release of the Multiannual Financial Framework (MFF). The MFF proposes absorbing the programme into a new European Competitiveness Fund.

With climate change and biodiversity loss growing more pressing by the day, researchers fear that the programme's uncertain future could jeopardise the EU's green transition. They say a reduction in long-term funding could stall crucial projects in sectors such as renewable energy and sustainable agriculture.

"The loss of LIFE as we know it in the new MFF is not simplification – it's sabotage," Patrick ten Brink, secretary general of the European Environmental Bureau, said in a statement.

"The LIFE Programme exists for a reason. It delivers targeted, cost-effective results for nature, climate and public health."


## CSDDD vs. LNG

The EU's Corporate Sustainability Due Diligence Directive (CSDDD) is designed t o ensure that large companies — both EU and non-EU — assume responsibility for human rights and environmental issues throughout their supply chains.

With a turnover threshold of €450mn, companies face penalties of up to 5% of revenue for non-compliance. The law's implementation will be gradual, with full compliance required by 2029.

One significant challenge to the directive is its impact on non-EU suppliers of critical energy sources. Qatar, which supplies approximately 12% of Europe's LNG according to S&P Global Commodity Insights, is particularly concerned.

In July, Qatar's Minister of State for Energy Affairs Saad al-Kaabi wrote to the European Commission, threatening to cut off LNG supplies unless the EU modifies the CSDDD.

In December, al-Kaabi said at a Doha conference that the directive is "ridiculous". US lawmakers have made similar complaints.

But it leaves European lawmakers in a bind: the continent is increasingly dependent on LNG from the US, Qatar and China as it works to phase out Russian gas by 2027. Regulatory tensions risk disrupting the continent's energy security.


## On the Horizon

The Commission released its initial proposal for FP10 in July as part of the 2028-2034 budget.

The European Parliament is calling for an increase, but member states have already said that the Commission wants too much.

In the plans, a doubling of Horizon Europe's budget to €175bn is the headline figure, though a significant proportion of that – €68bn – will be managed by the European Competitiveness Fund.

The Commission wants the budget for fundamental research to increase from €25bn in the current Horizon Europe to €44bn. Some researchers and MEPs are calling for more, but the final amount is likely to be reduced following negotiations, as it has been previously.

The Pillar 3 budget for innovation will almost triple from €13.6bn to €38.7bn and will mainly fund the European Innovation Council (EIC), which provides grant and equity funding to start-ups and researcher-led innovation projects.

No budget appears to be allocated to the European Institute of Innovation and Technology (EIT), or the five Horizon Europe Missions, which are set to only receive funding until 2030.


## Seeing RED III

In July, the European Commission began infringement proceedings against 26 of its 27 member states over their failure to implement the Renewable Energy Directive III (RED III) by the May deadline.

The legislation is key to achieving the EU's renewable energy targets, including a 42.5% share by 2030 and mandatory hydrogen integration in industry and transport.

RED III also establishes binding quotas for renewable fuels of non-biological origin in transport, and aims for a 60% hydrogen share in industry by 2035.

However, only one member state — Denmark — had fully transposed it by the deadline, while 10 had made "some progress". The legislation is "instrumental to accelerate the roll-out of homegrown clean energy, to further reduce GHG emissions in the energy sector … and to strengthen energy security", the Commission said in a statement.

The delay is particularly concerning given the urgency of accelerating renewable energy deployment to meet the EU's climate goals. The Commission has given the 26 countries two months to respond and implement the framework. If responses are not satisfactory, it "may decide to issue a reasoned opinion".


## Reactor shutdowns

The Gravelines nuclear power plant, between Calais and Dunkirk on France's northern coast, was forced to shut down due to a large number of jellyfish this summer.

Described by EDF as "massive and unpredictable", the swarm of the invertebrates – also known as a bloom – are thought to have slithered past the plant's main filters before blocking the much finer meshes of the drums deeper inside the cooling system. Four of the 5.4MW plant's six reactors shut down automatically; the other two were already closed for maintenance.

French nuclear power stations have been beset by climate-related problems this summer, with several being shut down or curtailed due to the high temperature of the rivers that cool their reactors. Warm readings from the Gironde Estuary and Rhône reduced output at Blayais and Bugey respectively, while Golfech shut amid fears that water in the Garonne could reach 28ºC – even without the plant's contributions. RTE said that France could still supply its domestic demands and export its excess.

Jellyfish breed in warm waters, with both rising temperatures and lengthening summers increasing their numbers in the North Sea. Additionally, non-native jellyfish species are thought to be "stowing away" in ships' ballast tanks, impacting ecosystems when they are ejected in waters elsewhere. Neither the species nor the political motivations of the jellyfish have been confirmed by EDF.

## EU consults on AI

The EU has launched a consultation on a new Strategic Roadmap for digitalisation and artificial intelligence in the energy sector. Part of the EU's broader digital strategy, the roadmap aims to harness AI's potential in optimising grid management, accelerating the energy transition, and improving storage technologies. The Commission expects it to accelerate the deployment of digital tools — particularly European AI solutions — in areas vital to decarbonisation.

The initiative, part of the Affordable Energy Action Plan, will also address the growing energy use of data centres and how to integrate them more sustainably into energy systems. Safeguards to manage risks associated with large-scale AI deployment are also under consideration.

The consultation also looks into the regulatory frameworks necessary to ensure the ethical use of AI while driving energy sector innovations. As energy systems become more complex, AI could be crucial to achieving EU climate goals. The consultation will conclude on November 5.

To read more about grid investments, turn to page 4 and read MEP Anna Stürgkh's call for enhanced digitisation and cooperation across Europe's energy networks.


## Grid bottlenecks

A study has revealed that up to 1,700GW of renewable energy capacity is being blocked by grid bottlenecks in Europe and beyond.

Outdated infrastructure, insufficient grid connectivity, and long waiting times for connections are all at fault, hampering the growth of renewable energy sources.

The report, published by a coalition of energy think-tanks, notes that this is not unique to the EU: similar capacity problems are emerging globally as countries bring higher shares of renewables into their energy mix.

In the UK, for example, the National Grid was forced to close its connection queue in January. The delays are causing massive backlogs for photovoltaic and wind projects, potentially delaying net zero goals and undermining energy security.

Experts have long argued that substantial investment in modernising grid infrastructure is needed to unlock clean energy's full potential.

"Europe's electricity grid is not modernising fast enough, and that must change," E3G research manager Vilislava Ivanova said in a statement.

"Only through political leadership, independent governance, and clear incentives can we ensure grids become enablers, not barriers, of Europe's clean and competitive energy future."

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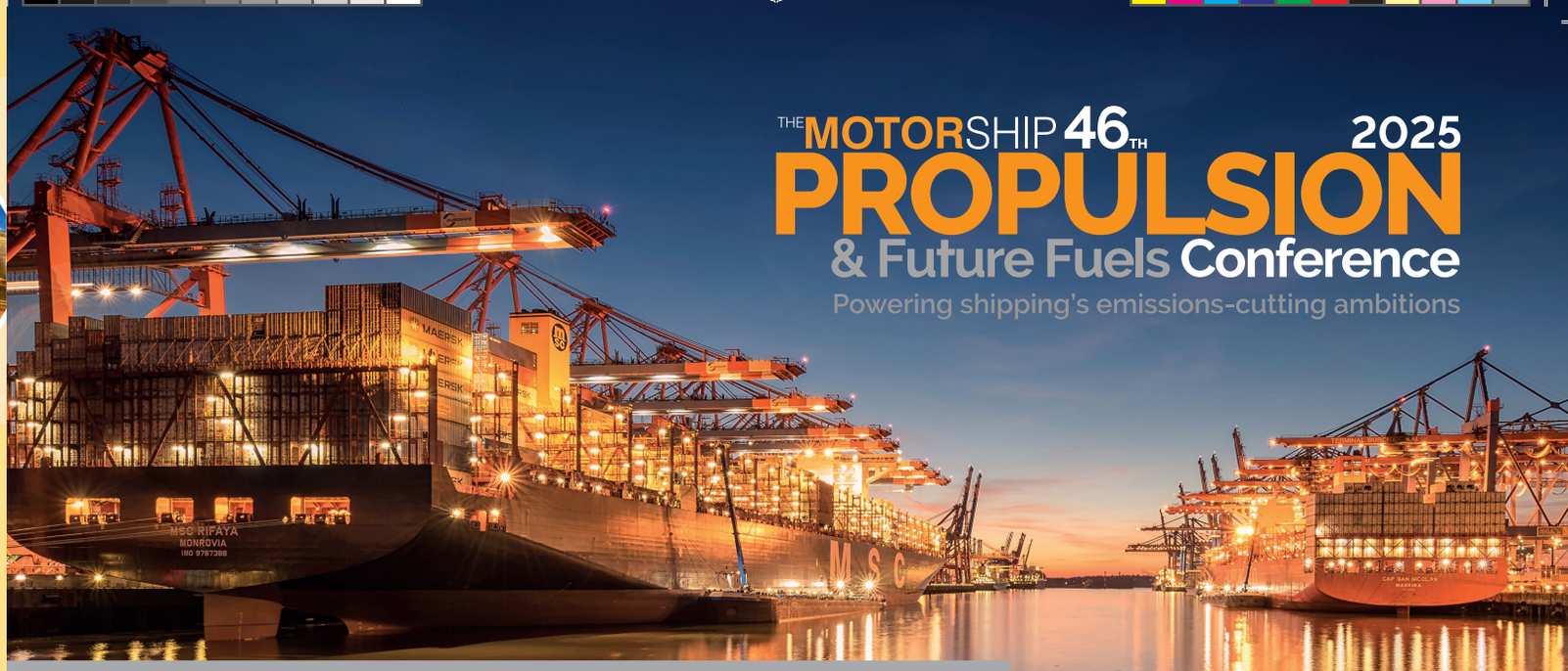

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# A meaty issue

## Diversifying proteins and decarbonising food are key to a climate-resilient, sustainable food system in Europe

By **Anna Strolenberg,** MEP

The climate crisis is no longer a looming threat, it is a daily reality. From parched soils in Southern Europe to floods in Central regions, agriculture and food systems are increasingly caught in the crosshairs of environmental change.

Yet, paradoxically, these very systems also contribute substantially to the crisis. Food production is responsible for roughly 30 percent of Europe's greenhouse gas emissions, with much of this footprint driven by livestock and the production of animal-based proteins.

To meet our climate goals, particularly under the EU Green Deal and the 2040 climate targets, we must rethink the fundamentals of our food system. At the heart of that transformation lies a straightforward but powerful strategy – protein diversification. Europe must move beyond the status quo of animal-dominated diets and support a broader portfolio of protein sources that are environmentally sustainable, nutritionally adequate, and economically viable.

This transition is not merely about changing what's on our plates. It is about reshaping a core pillar of Europe's economy, land use, and innovation ecosystem. Therefore, Volt created a vision for a sustainable food system in Europe. This places protein diversification at the centre of the transformation, built on science, powered by innovation, and implemented through coherent European policies.

In this article, I argue that unless we commit to diversifying protein sources, through both plant-based and novel proteins, we will fail to decarbonise our food system. And unless we fully mobilise innovation to make this transition competitive, fair, and scalable, we will miss both our climate and economic targets.

### The climate cost of protein imbalance

The environmental footprint of food varies widely depending on what we eat. Numerous studies confirm that animal products are associated with significantly higher greenhouse gas emissions, land use, and water demand than plant-based alternatives. One recent analysis estimates that shifting to more balanced consumption of animal- and plant-based proteins could reduce food-related emissions by up to 48 percent. This makes protein diversification the single most effective dietary lever to reduce emissions.

**"Over 80 percent of EU agricultural subsidies flow to animal-based production systems, locking farmers into high-emission pathways and limiting their ability to invest in alternatives."**

Yet, Europe's food policy continues to support an outdated model. Today, over 80 percent of EU agricultural subsidies flow to animal-based production systems. These subsidies effectively lock farmers into high-emission pathways, limiting their ability to invest in alternatives. Even more problematic is the heavily unbalanced public funding for research, where animal-based products receive 1,200 times more funding than novel protein technologies.

If Europe is serious about becoming the first climate-neutral continent, then our protein strategy must align with our climate goals. This requires more than

voluntary initiatives. It calls for a policy framework that puts innovation and transformation at the core of agriculture and food policy.

### Innovation as the driver of transition

The good news is that the science and technology to support protein diversification already exist or are rapidly emerging. From legume breeding and precision fermentation to plant-based meat alternatives and mycoproteins, innovation is driving a quiet revolution in how we produce protein. The challenge is not the absence of solutions, but the need for a supporting policy framework for market acceptance and upscaling.

Volt envisions Europe as a global leader in sustainable food innovation. This means deploying a full range of technological, nature-based, and social innovations to drive down emissions while restoring biodiversity, improving soil health, and building resilient food economies.

Our proposal for a €50 billion European Food-Innovation Moonshot Fund is emblematic of this ambition. It would support breakthroughs in alternative proteins, new crop varieties, biopesticides, and high-productivity agroecology. Importantly, it would also back innovations in consumer engagement, nudging, and education – the protein transition will not happen without people choosing differently.

Equally critical is regulatory innovation. Today, approval processes

**"The protein transition will not happen without people choosing differently."**

for novel foods, such as cultivated meat or precision-fermented dairy, are often slow, unclear, and fragmented across Member States. We need a reformed and empowered European Food Safety Authority (EFSA), with fast tracks for high-impact sustainable products, early-stage advisory services, and adequate staff to process applications. Innovation without access to the market is merely an idea on paper.

### Strategic Autonomy and Resilience

Protein diversification is also a matter of strategic autonomy. Europe imports over 70 percent of its protein-rich animal feed, such as soy. Our food system also relies heavily on importing fertilizers and energy, often from regions vulnerable to deforestation and geopolitical instability. This dependence leaves Europe's food system vulnerable to external shocks, as demonstrated during the war in Ukraine and ongoing disruptions to global trade.

Volt proposes a Strategic Autonomy Plan that rebalances Europe's protein economy by boosting local legume cultivation, supporting domestic supply chains for alternative proteins, and promoting circular systems that upcycle food waste into feed or human-edible protein. A circular food system strategy, also central to our vision, could free up 71 percent of agricultural land and reduce emissions by nearly 30 percent without sacrificing nutritional security.

Protein diversification thus enhances Europe's resilience while aligning with broader sustainability goals. It reduces deforestation pressures, lowers water use, and allows for more diversified and climate-adapted farming systems across regions.

### Equity and opportunity: A just protein transition

A major concern in any transition is fairness, especially for young farmers, SMEs, and workers across the food chain. Protein diversification, if done right, offers not a threat but an opportunity for European producers. Shifting to plant-based protein crops or innovative protein processing can open new markets, reduce exposure to input price volatility, and attract a new generation of farmers and food entrepreneurs.

But the transition must be supported. Volt proposes a reformed Common Agricultural Policy (CAP) that phases out hectare-based payments and redirects funding toward de-risking sustainable investments. This includes support for farmers growing protein crops, developing on-farm processing facilities, or participating in cooperatives focused on alternative protein value chains.

Training is also key. An EU-wide training and apprenticeship programme on sustainable food systems, organised by EIT Food, will ensure that farmers and food workers have access to the knowledge and skills they need to thrive in the new protein economy.

### Consumer empowerment and food culture

The shift in protein consumption must not only happen on the supply, but also on the demand side. Today, many Europeans still consume far more animal-based proteins than recommended by health guidelines.

**"While the Green Deal promotes sustainability, the CAP still channels billions into high-emission livestock systems."**

At the same time, alternative proteins often remain niche products. They are either too expensive, poorly marketed, or unfamiliar to the average consumer.

Volt calls for a European Healthy Diet Transition Programme that phases out subsidies for unhealthy foods, expands healthy public procurement in schools and hospitals, and uses fiscal tools and nudging to make sustainable proteins the easy choice. This must be paired with a robust EcoScore and NutriScore labelling system to increase transparency and consumer trust.

Importantly, the transition must respect Europe's diverse food cultures. Protein diversification is not about prescribing a single diet, but about ensuring that healthier and more sustainable choices are available, affordable, and aligned with local traditions.

### Policy coherence

Despite growing recognition of food's central role in climate and health, European policy remains fragmented. Agriculture, health, innovation, trade, and environment are governed in silos, often with conflicting objectives. For example, while the Green Deal promotes sustainability, the CAP still channels billions into high-emission livestock systems. This incoherence undermines both credibility and effectiveness.

A Common Food Policy should replace the outdated Common Agricultural Policy. It would integrate food with climate, health, innovation, and trade policy, overseen by a dedicated European Commissioner for Food. This governance reform would ensure long-term policy coherence and provide the legal certainty needed to drive transformation at scale.

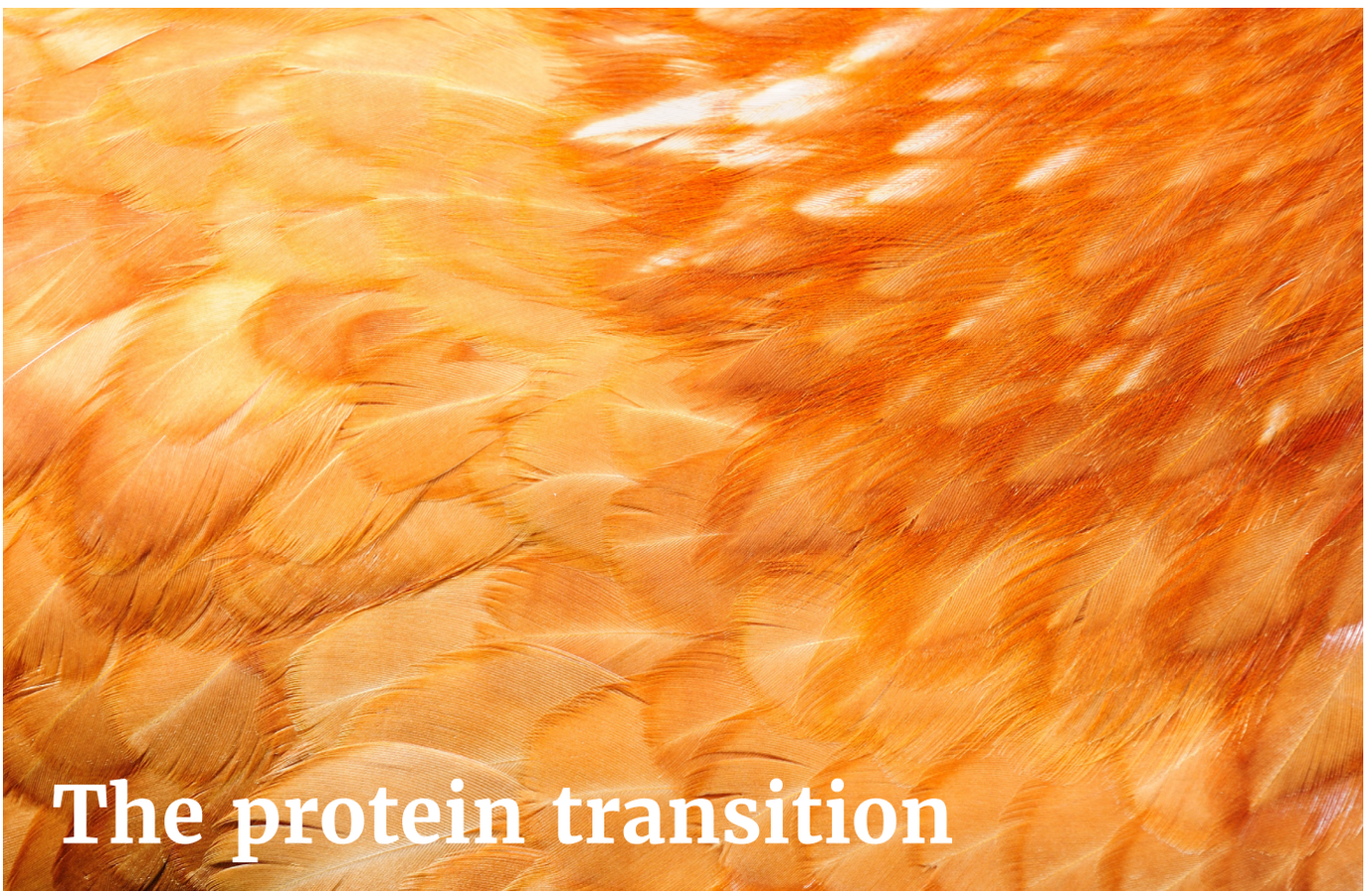
### A European Opportunity

The protein transition is often framed in terms of sacrifice. In reality, it is a once-in-a-generation opportunity. It allows Europe to lead the world in sustainable food innovation, create new economic sectors, regenerate ecosystems, and promote public health. It opens up new roles for rural regions as hubs of entrepreneurship and circular bioeconomy. And it brings us closer to a future where our food system aligns with our values: sustainability, health, equity, and resilience.

This opportunity will only materialise if we choose thorough reform over incrementalism. Tinkering at the edges will not deliver the emissions reductions or resilience we need. The transformation must be systemic, science-based, and inclusive. This can be done by strengthening the European board of agriculture and food with independent researchers to give context, unbiased information, and measure the impact of different potential scenarios. This way, we make sure the discussions go beyond defending economic positions and stimulate outside-the-box thinking with all food system stakeholders.

In Volt's vision, a decarbonised food system is not a distant dream, it is a deliberate choice. It is a political act. And it starts with changing the way we think about proteins. ■

**"The protein transition is often framed in terms of sacrifice. In reality, it is a once-in-a-generation opportunity."**



# The protein transition

By **Tomé Morrissy-Swan**

## Europe's diet has an environmental hoofprint, but complex challenges stymie large-scale behaviour change

Over the past decade there's been a revolution on the supermarket shelf. Once confined largely to health food shops, save for a few options in a hidden corner of the fridge or freezer, plant-based protein substitutes have experienced a spectacular rise. There now exists a dazzling array of options, from sausages to bacon, milks to cheese.

According to the Good Food Institute Europe (GFI Europe), sales of plant-based meat, seafood and dairy across 13 key European markets rose by 6% between 2021-22. Consumers cite several reasons for ditching animal products for them, from the environmental impact and ethics of meat and dairy farming, to health.

But there's no denying that momentum has stalled. Sales have declined since 2022, partly due to concerns over ultra-processed foods, and when New York City's three-Michelin-starred Eleven Madison Park went fully vegan in 2021, it felt momentous. Its decision last week to reintroduce meat was equally significant – if unsurprising. Yet proponents of a reduction in animal protein are undeterred.

According to a report by Wageningen University & Research (WUR) in the Netherlands, the ratio of consumption of animal protein to plant-based protein must be flipped from 60:40 to 40:60 by 2030.

That won't be easy. Though consumption of plant-based protein alternatives has increased dramatically in the past couple of decades, there are considerable barriers to further growth. Meat and dairy remain deeply culturally rooted.

According to Stacy Pyett, programme manager at Proteins for Life, "the most important thing is that we try and understand the gap between intention and behaviour. When we ask consumers if they want to change their diet and decrease their meat consumption, almost everyone says yes. We also see an increase in sales of meat-replacers. At the same time the meat consumption stays pretty consistent."

**"Novel ingredients or approaches, such as fermentation-made products, must pass through a rigorous approval process that can take more than 18 months."**

**"Supermarkets do not see it as their primary task to change consumer behaviour, set social trends, or set standards."**

Luke Byrne, innovation and sustainability director at This, a UK-based manufacturer of plant-based meats, agrees. "It's no longer enough to simply be a plant-based option; our products must be exciting, delicious, and accessible. People choose food for joy, and we have to deliver on that emotional connection and create a desire."

For Helen Breewood, senior market and consumer insights manager at GFI Europe, "taste, price and convenience are the main barriers preventing European consumers from eating more plant-based foods." She adds that meat alternatives are a small fraction of the overall meat and dairy markets because they "don't yet match conventional animal foods on these key metrics."

Certain animal-free products are clearly entering the mainstream. NIQ data show that 46% of households in Spain, 37% in Germany and 32% in the UK bought plant-based milk at least once last year. Plant-based milk has achieved the highest market share of animal protein substitutes, reaching 9.3% of total milk sales in Spain in 2024, for example. A third of households in Germany and the UK bought plant-based meats last year, and more than a third of respondents in both countries told a survey they wanted to eat more plant-based food. But some suspect a "halo effect" (where consumers reward themselves for positive choices by splashing out on something else, for example, taking a long flight after buying energy-saving lightbulbs). Perhaps they are substituting salad, rather than meat, with meat-free burgers?

A key theme for many in the field over recent years has been a focus on "protein transition", a hope to encourage the public to shift from animal products to plant-based alternatives. There are four key drivers in influencing people. The first, and most obvious, is sustainability and the need to produce food within our planetary boundaries. A 2024 review concluded that plant-based protein has a fraction of the impact of conventional meat, with up to 94% less greenhouse gas emissions and using around 90% less land and water. A further report found that switching from animal products could free up 21% of European farmland for domestic food production.

Other factors included climate resilience (increasing the range of crops eaten could help prepare against harvest failure), health (eating more plants is associated with reducing the risk of bowel cancer, improving gut health and maintaining a healthy weight among other benefits), and global equity. Currently, animal protein isn't distributed fairly – while the West indulges, those in many low-income countries eat too little.

So what is the discerning European consumer to do? Currently, there are three main categories of product, which experts argue we should eat more of while reducing those from animal sources. The first are analogues, those that copy meat and dairy – think veggie burgers or soy milk. Then come non-analogues, such as tofu, nuts and legumes (which many people don't even consider as "proper" protein). Finally, hybrids, which combine plants and animal-products, such as beef burgers replacing some of the meat with seaweed.

"Meat mimics, despite some of the commentary, are still the biggest segment of the market," says Byrne, who nevertheless admits they are "in a plateau moment within the category". For Byrne, the main plant-based area experiencing "real growth" over the past few years is tofu. "This is following the consumer demand for more familiar products that don't necessarily mimic meat, but instead provide a versatile and healthy protein source."

Habits won't change automatically – often, consumers need a push. This is where supermarkets come in. Around 70% of food consumed in the Netherlands is bought from them, so they will inevitably play a crucial role in the protein transition. But is there more they could do? After conducting several interviews with supermarket bosses, researchers at WUR concluded that "the power of the livestock, meat, and dairy sectors and the strength of established food cultures make the protein transition vulnerable. Moreover, supermarkets do not see it as their primary task to change consumer behaviour, set social trends, or set standards. Therefore, the success and acceleration of the protein transition require more than just the strength of supermarkets."

For Breewood, governments also hold the key. "Just like they've funded research and development for renewable energy, governments should fund open-access research into plant-based foods, to achieve their goals of boosting food security, reducing climate emissions and farming in harmony with nature."

Robust regulation is also vital for the future of meat and dairy alternatives. Consumers can be suspicious of new products, especially given the rise of concern over UPFs. Novel ingredients or approaches, such as fermentation-made products, must pass through a rigorous approval process that can take more than 18 months. For lab-grown meat, which is not yet approved for human consumption in the EU, there are further regulatory hurdles, not to mention taste, texture and cost barriers.

Byrne adds that another stumbling block was the potential ban on the naming of plant-based products with their animal counterparts – for example, using the terms 'sausages' or 'burgers' for meatless versions. "The plant-based industry has rallied well throughout Europe, and this is hopefully not going to come into regulation," says Byrne.

Ultimately, the proof is in the pudding. People will switch to vegan options, thus facilitating the protein transition, if it is easy and rewarding to do so. "Taste, familiarity and convenience are blocking large groups from choosing plant-based foods," says Breewood. "To enable people to act on their intentions, companies need to develop tastier products, communicate nutritional benefits more clearly, and help consumers overcome their lack of familiarity with simple recipe suggestions." ■

**"Meat and dairy remain deeply culturally rooted."**

# Dig for victory

## The European Commission cannot ignore that feeding Europe and powering Europe are vital pillars of defending Europe in the next MFF

By **Barry Cowen,** MEP

Across Europe, in recent years, we are rethinking what security means. In a climate shaped by war on the EU's eastern border, volatile trade flows, climate instability and disrupted supply chains, policymakers have rightly prioritised defence. But one critical area, in my view, continues to be under-prioritised: our ability to feed ourselves sustainably.

Without food security, strategic autonomy is a hollow phrase. Yet, even as the European Commission proposes joint borrowing of up to €150 billion for defence under its ReArm Europe plan – with Member States likely to spend more than €800 billion – agriculture faces a cut of over 20 percent in the next Common Agricultural Policy. As a member of both the Agriculture and International Trade Committees of the European Parliament, I cannot support this approach. It risks leaving our most essential sector underfunded at the very moment it is being asked to meet higher standards, adopt new technologies and respond to unprecedented environmental and geopolitical pressures.

Alongside the headline budget cut, the structural changes proposed under the Commission's Multiannual Financial Framework (MFF) for 2028–2034 would also weaken agriculture's strategic position. CAP funding – which underpins food production, rural development and environmental delivery – is set to be folded into a single "National and Regional Partnership Plan" alongside cohesion, fisheries and other funding streams.

This may sound like just a technical realignment, but its consequences are political and far-reaching. It would erode the budgetary ringfence that has allowed CAP to function as a reliable long-term policy tool and instead subject agriculture to competition with other priorities. The result would be greater uncertainty for farmers and a loss of strategic focus for Europe's food system.

We cannot treat agriculture as a secondary concern. It underpins everything else. It deserves not only a robust and protected budget, but also a policy framework that reflects the scale of the transition ahead. That is why, in my role as Renew Europe's lead negotiator on the European Parliament's report on the next CAP, I proposed evolving the current two-pillar structure into a three-pillar system.

**"If we expect farmers to deliver food, deliver biodiversity, deliver climate action and now deliver energy as well, then the least we can do is give them a coherent policy framework and a fair budget."**

This would establish a dedicated third pillar for voluntary environmental ambition – a coherent, results-based and incentive-driven pillar to replace today's fragmented eco-schemes. Such a pillar would reward farmers as stewards of land, water, biodiversity and soil health. But, most importantly, it would be underpinned by real investment to match farmers' ambition. If we are serious about building sustainable food systems, we need to make environmental schemes viable, not burdensome.

While it may not arrive in the form of a third pillar, the fight to better reward farmers adopting new practices, techniques and technologies continues. The idea that farmers adopting methane inhibitors, AI, precision technologies or genomics to reduce emissions should be actively supported is, in truth, commonplace at the Agriculture Committee. So too is the belief that smaller, high-nature value farms playing a role in biodiversity protection should also be supported, particularly through tailored schemes and access to nature and carbon credit markets.

As such, it is my view that public money should be directed toward active, productive farms of all sizes – farms that feed Europe and can remain viable

through this transition. In 2020, just 7 percent of farms produced over 75 percent of our food. Meanwhile, more than 60 percent were small, often semi-subsistence holdings. All have a place, but if we want to maintain food security, we must prioritise support for those whose livelihoods depend on farming, who take on financial risk and who are central to our food and environmental goals. These are the farmers expected to adapt, invest and future-proof the sector.

But the future workforce of European agriculture is uncertain. The average age of farmers is rising fast. Entry points for younger generations remain few and far between. Land prices are inflating, access to credit is limited and bureaucracy is becoming a deterrent in itself. The next CAP must be strengthened with enhanced support for young farmers, targeted tax incentives, succession schemes and flexible pathways into farming.

More support is also needed for women in agriculture, whose contribution remains under-recognised in both policy and practice. This is not only a budgetary challenge – it is a structural one. The transition to sustainable agriculture will stall without generational renewal.

The private sector must also be part of the solution. Retailers, processors and financial institutions need to see young farmers not just as grant recipients, but as strategic actors in the agri-food system. They can support innovation funds, offer preferential purchasing agreements for sustainable products and improve access to affordable finance. The necessary transition cannot be delivered on public investment alone. It must be underpinned by partnerships that reflect the shared responsibility of producers, processors and markets.

Food production, it should not be forgotten, is deeply connected to climate, energy and environmental policy. That concept will not be foreign to readers of this publication. Agriculture can – and must – play a central role in emissions reductions, biodiversity restoration and energy diversification. But farmers need a policy environment that enables them to contribute. That means removing barriers to diversification through renewables, bioeconomy solutions and carbon credit schemes. It also means reforming planning and permitting systems, unlocking grid access and supporting on-farm generation – from rooftop solar to biomethane. These can prove both essential income streams

**"Without food security, strategic autonomy is a hollow phrase"**

for farmers and also, more generally, building blocks of energy resilience. A coherent rural development strategy must place them at its core.

Recent developments make clear that energy and food security are not separate. The war in Ukraine exposed deep links between energy dependency, agricultural inputs and food price volatility. Europe's historic reliance on Russian gas revealed structural vulnerabilities in both the energy and agri-food sectors. The recent EU–US LNG agreement – which I supported as part of the International Trade Committee – will provide breathing space. But LNG must be treated as a transitional lever, not a permanent solution. Europe needs to accelerate investment in renewables – especially in countries like Ireland, where offshore wind capacity offers not just energy security, but new economic opportunities for coastal and rural regions. Linking this to a wider European energy grid is not just technically feasible – it is strategically urgent.

The environmental and economic case for a strong CAP is clear. But what is now often overlooked is the security argument. If we expect farmers to deliver food, deliver biodiversity, deliver climate action and now deliver energy as well, then the least we can do is give them a coherent policy framework and a fair budget. The transformation expected of European agriculture cannot be achieved with declining supports and increasing red tape. The next CAP must remain a distinct, properly resourced tool with the flexibility and focus required to meet this moment. Food, energy and defence cannot be treated in isolation. Farmers must be at the centre of any credible plan for Europe's future defence and energy security. Their role is growing, not shrinking, and will continue to do so. We must reflect that in how we fund and support them. ■

# Tech spotlight: sodium-ion


# Technology spotlight: sodium-ion batteries

Sodium-ion batteries could become a key energy frontier in Europe. In this issue's Technology Spotlight, EEI explores the fundamentals of sodium-ion, the real-world potential it has in storage and mobility applications – and what we can learn about that from China.

# A pinch of salt?

By **Liam Critchley**

Metal-ion batteries are one of the most important classes of battery architecture today. Lithium-ion (Li-ion) has dominated the market for many years due to having a good trade-off between scalability of manufacturing, safety and energy density. However, other options have been slowly creeping up behind Li-ion batteries for many years, and while not at the commercial readiness of Li-ion yet, there could be some disruption in the coming years as other metal-ion technology matures. Of all the metal-ion options beyond lithium, sodium-ion (Na-ion) batteries have the most commercial potential due to their safety, similar cost per kWh to Li-ion, and the ease and low cost of obtaining an abundance of raw materials.

## What are Sodium-ion Batteries?

In terms of battery architecture and setup, Na-ion batteries are not much different to Li-ion batteries. The anode releases electrons during operation, while the cathode receives them. In between the two electrodes are an electrolyte and separator and the ions shuttle between the two electrodes (via the electrolyte and through the separator) to charge and discharge energy. During charging, the ions move to the cathode to create a potential difference, and the electrons are transferred to the external circuit. During charging, the ions move to anode and receive electrons from the external circuit until an end-of-charge voltage threshold is reached.

The main difference is the ions that are released and shuttled between the two electrodes are sodium ions, not lithium, and therefore the cathode is a sodium-based material instead of a lithium material. Another slight difference is the anode material. While both use carbon-based materials, Li-ion anodes use well-established graphite materials that have been manufactured for decades. However, graphite is not suitable for Na-ion batteries, so other forms of carbon – such as hard carbon– are used as the anode material. There are also many other anode materials being trialled in academia, including manganese oxide, graphene aerogels, carbon nanofibres, and red phosphorus. Like Li-ion batteries, the electrolyte varies based on the specific type of Na-ion battery.

## Why There's Interest in Sodium-ion Batteries

Despite their similarities, there are some differences between the two technologies that relate to the wider battery ecosystem that make Na-ion batteries desirable. For example, lithium mining is mostly very destructive, and it is becoming more energy intensive and costly to extract the lithium out of the ground. Since 2021, lithium prices have increased 700% and may likely reach a point where it starts to become economically unfeasible for some electronics (without increasing the price significantly of consumer devices).

The demand for batteries is growing year on year and is likely to continue along this trend for many years to come. As technology advances further, the price and scarcity of lithium (and other rare metals such as cobalt) are likely to increase further. On the other hand, Na-ion batteries offer an alternative solution because sodium is much more widely available without extensive mining operations. So, not only is it potentially a more sustainable solution with a lower environmental impact—as sodium is the world's 6th most abundant element—it is much lower in cost and more readily available then lithium. So, it could mitigate the potential economic and scalability issues of lithium going forward.

Aside from the sustainability aspects, Na-ion batteries are inherently safer than Li-ion batteries as they are less likely to catch fire or explode. Perhaps one of the key technical benefits of Na-ion over Li-ion though is their wider operating temperature range. Where Li-ion batteries are typically only optimal between 0-50°C, Na-ion batteries can operate efficiently from -40°C to 70°C – making them better than Li-ion for harsh operating environments.

## Why Sodium-Ion Batteries Have had a Slower Adoption Compared to Lithium-ion

Even though both battery architectures have similar battery chemistry, it is differences at the atomic level that has made Li-ion batteries more commercially feasible than Na-ion. The difference? Three 10-billionths of a metre, or 0.3nm. The atomic radius of sodium is 0.3 Angstroms larger than lithium. While this is a tiny amount and may not seem like a big difference, at the atomic level it is a rather substantial increase that has a big impact. Practically speaking, it means that sodium's atomic weight and mass is over 3 times larger than lithium – 22.99 atomic mass units (amu) to lithium's 6.94 amu.

The movement of such heavier and larger ions between the electrodes creates more mechanical stress on the cell that causes it to deteriorate quickly. Because of this, Na-ion batteries have typically had much shorter cycle lives than Li-ion batteries. The issue is compounded by graphite not being suitable for Na-ion batteries because sodium intercalation into the anode is thermodynamically unfavourable due to their size. This makes it difficult for the ions to enter in and out of the anode, causing adverse and irreversible exfoliation reactions at the electrolyte-anode interface – causing it to break down after only a few cycles.

Given that the graphite supply chain is highly robust, and battery-grade graphite is produced in such large quantities for Li-ion batteries, it has been a big commercial challenge to find a scalable alternative. If graphite were suitable for Na-ion batteries, we may have seen a much quicker adoption

because there'd be a much better material supply chain than there is currently for Na-ion batteries – and it could have essentially 'piggybacked' off the Li-ion supply chain instead of having to create an entirely new one.

But there have also been more technical challenges as well. The reduction potential of sodium is lower than lithium, so Na-ion batteries supply a lower voltage than Li-ion—typically 2.3-2.5 V vs 3.2-3.7 V for Li-ion. Even though both ions carry the same charge, because of the increased weight of sodium a Na-ion battery can carry up to 40 percent less charge than Li-ion battery (assuming the same weight). Na-ion batteries also struggled to break beyond a cycle life of around 5000 cycles compared to 8,000-10,000 cycles for Li-ion, and an energy density of 140-160 Whkg-1 compared to 180-250 Whkg-1 for Li-ion. But the landscape is now changing, and Na-ion is getting closer to Li-ion in terms of capabilities.

In a world where people are looking for as much charge as possible in portable electronics, Na-ion batteries have struggled to break into these highly sought-after commercial markets. Despite these setbacks, there are many applications where the wide operating temperature range safety, and sustainability benefits of Na-ion batteries outweigh the negatives, which is why they are now starting to be commercialised. As with any new technology, technical barriers need time to be overcome, and this is the same for Na-ion batteries – they have just taken longer because lithium was favourable for a lot of consumer applications that have been driving the battery market.

## The Main Types of Sodium-ion Battery and Where they are Used

The maturity of the Li-ion industry has created many different battery Li-ion architectures, including lithium iron phosphate (LFP), lithium nickel manganese cobalt (NMC), lithium nickel cobalt aluminium oxide (NCA), lithium-ion manganese oxide (LMO), lithium-ion cobalt oxide, and lithium titanate oxide (LTO). While the Na-ion industry is not as mature, there are still different classes of Na-ion battery being developed based on their internal architecture.

### Thermal Na-ion Batteries with Solid Electrolytes

Batteries such as sodium-sulphur (Na-S) and sodium-nickel chloride (ZEBRA) use a solid aluminate electrolyte. These batteries can only be used under high operating temperatures (250-370 °C) because the sodium anode becomes a liquid during operation. These batteries have a typical energy density between 100-120 Whkg-1 and operating temperature range of -20°C to 60°C, and they can be safely discharged down to 0V.

The wide operational range and high internal temperature operating requirements means that they are more suited for stationary storage applications in extreme temperature environments – such as power grids, heavy industry applications, and as backup power for subways and other underground railway systems that have more extreme local temperatures.

### Aqueous Electrolyte Sodium-ion Batteries

Na-ion batteries can also contain aqueous electrolytes and are known as saltwater batteries. These are very safe because they mostly contain water, with both liquids and hydrogels being used as the electrolyte. The absence of any toxic or flammable materials makes them an attractive option from an environmental and recycling perspective too. However, aqueous electrolyte batteries currently have a lot lower energy density compared to other Na-ion batteries – between 10-25 Whkg-1 – because the batteries need to operate at a low voltage to prevent oxygen and hydrogen evolution reactions in the cell.

More work is being done to try and make these batteries more commercially feasible, and potential applications could include small-scale (home-scale) stationary storage applications and environmentally friendly batteries for disposable health monitoring devices and implantable medical devices.

### Organic Electrolyte Sodium-ion Batteries

Like Li-ion batteries, a lot of work has gone into Na-ion batteries with organic electrolytes, with energy densities reaching beyond 150 Whkg-1 (the lower end of Li-ion batteries). Academic laboratory results have also seen much higher energy densities too. Despite having lower energy densities and not being able to hold as much charge as Li-ion, the Na-ion batteries have high power densities, meaning that they charge quicker than Li-ion. These batteries have also shown very wide operating temperature capabilities, ranging from -40°C to 70°C. While Na-ion batteries are safer than Li-ion, organic electrolytes always carry a higher risk than aqueous electrolytes, but some of the big applications include stationary storage, and more recently, electric vehicles (EVs).

## China Leads the Sodium-ion Industry in 2025

The Na-ion industry is nowhere near the scale of Li-ion but there are global developments occurring that are pushing the industry in the right direction. Overall, Na-ion batteries are still more expensive than Li-ion batteries, but this is all due to economies of scale and the presence of a robust lithium supply chain. Na-ion batteries do have the potential to be cheaper in the long-run but will require GWh production capacities and a widespread adoption from end-users. One of the advantages that sodium does have over other battery architectures under development, is that the processes are very similar to lithium, so existing plants could be retrofitted to accommodate Na-ion production and scale up at much lower costs using similar economy of scale methodologies to lithium.

As is stands, the main market (like Li-ion) is China. This is where most of the Na-ion production is happening. CATL, the biggest producer of Na-ion batteries in the world, has recently released multiple lines aimed at stationary storage and EVs and have even developed hybrid battery packs that use both Na-ion and Li-ion technology.

CATL have now developed Na-ion batteries with 12C charging rates and temperature operating ranges of -40-70 °C—with 90% retention of usable power at -40 °C. The batteries developed by CATL are comparable to Li-ion with energy densities up to 175 WhKg-1, 500 km ranges, and lifetimes up to 10,000 cycles. They have also developed 24V start-stop batteries specifically for heavy duty trucks with expected service lives of 8 years—and the ability to start even after being idle for a year. It's been touted that the next generation of CATL Na-ion batteries will go above 200 Whkg-1, but this won't be until at least 2027.

Behind CATL are HiNA and BYD, two other big Chinese companies helping to spearhead Na-ion commercialisation. HiNa have developed batteries with an energy density of 165 Whkg-1 that can be charged in 20-25 minutes, used over -40-45°C temperature ranges, and have a cycle life of at least 8000 cycles.

BYD—best known for their EVs—have developed utility scale Na-ion batteries that have a storage capacity of 2.3 MWh (compared to 5 MWh for their

Li-ion counterparts) but are looking to exploit the low temperature tolerance and safety of Na-ion batteries. However, BYD are making more waves on the supply chain side, as they have started the construction of a 30GWh (annual capacity) sodium-ion battery plant in China which will be able to scale up the production capabilities of Na-ion batteries far beyond what we see today and will set the wider supply chain on the right path.

## How Does Europe Compare?

Europe and the rest of the world falls quite far behind China in terms of production volume, battery performance, and the potential for developing a robust supply chain. There have been promising companies in Europe, such as Faradion in the UK and Northvolt in Sweden that have already closed. Faradion were bought out by the Indian company Reliance New Energy, while Northvolt filed for bankruptcy in 2025 after delivering 160 Whkg-1 sample cells to customers in 2024.

Two companies—Stora Enso (Finland and Sweden) and Altris (Sweden)—have joined forces in Europe to build more sustainable batteries and try to build a local supply chain for hard carbon anode materials made from lignin. They have so far developed some prototype 3V 20 Ah cells, but it is still in early stages compared to what is going on in China. The company has stated that they hope the abundance of lignin in trees could help to develop a consistent raw material supply chain that is not reliant on material from outside Europe, with both companies stating that they hope to help better establish a European battery value chain for Na-ion batteries. But this could take a while, and will require more organisations to get involved.

## Concluding Remarks

As it stands, Na-ion batteries lack a robust supply chain compared to lithium, and it is currently almost non-existent in Europe and any locations outside of China. Like the Li-ion battery market—which China also controls with about 79% of all Li-ion batteries and 61-70% of global lithium refining capacity—the Na-ion market is likely to also revolve around the expansion of the Chinese market.

It could be that global companies—such as BYD—who are creating the gigafactory to build a supply chain, but also have operations in Europe, may end up making the first major moves into Europe and help to build a more robust supply chain. A lot of this is hypothetical at this stage, but given that Europe has already had some promising Na-ion manufacturers close down their operations already—in-part due to supply chain issues—it's not far-fetched to suggest that the supply chain in Europe may hinge on global Chinese companies (who are already well established and have the capital) to first establish a robust supply and demand, where more European companies can then follow and build from any potential success.

Only time will tell, but Na-ion batteries are undergoing a lot of development and commercial advancement and may become a more mature and commercially feasible alternative to Li-ion in the next 5-10 years for multiple applications. ■

# China's sodium-ion lead

## Chinese companies already produce them at scale and will likely dominate global production for a decade. Can Europe catch up?

By **Xiaoying You**

Sodium-ion batteries have gone into mass production, a milestone for a world that has been relying on lithium-ion cells for the energy transition.

Those novel cells use sodium, a globally abundant element that can be extracted from sea salt, instead of lithium, which is a critical mineral mined and processed in just a few countries. Their commercial rollout gives hope to countries that intend to enhance the resilience of their supply chains.

Chinese companies are leading the world in bringing sodium-ion batteries to the masses, riding on their manufacturing supremacy in lithium-ion cells. The new technology has already been used in energy storage plants and on small vehicles there. It may soon start powering heavy trucks.

To many, the development comes as no surprise. "The reality…is that China is still very much leading Europe in all of the battery and energy storage technologies, sodium-ion included," says Sarah Montgomery, chief executive of Infyos, a UK-based supply chain intelligence platform for renewable manufacturers.

Sodium's abundance is highly attractive to Europe as it seeks to reduce its dependence on China-controlled supply chains and spur homegrown manufacturing. Europe aims to make "almost 90 percent" of the batteries it will need locally by 2030. But it currently holds "very little" of the global battery supply chain, according to the International Energy Agency (IEA). In comparison, China dominates every stage of the downstream battery supply chain and is home to nearly 85 percent of global cell production capacity, the IEA said.

Europe's efforts to pursue the technology largely take place in the lab rather than on the factory floor, according to various sources interviewed for this article. But R&D is only a small step in the long journey towards mass-producing batteries, several of them warn.

"The hardest thing for any western company is to mimic is the 20 years of experience that Chinese companies now have," Aaron Wade, an electrochemical engineer, tells *EEI*. Wade visited more than 20 battery factories in China during the past two years. "They are so far ahead," he says.

But sodium-ion cells are facing an uncertain future due to the low prices of lithium driven by oversupply. This makes it hard for them to grab market and cut cost.

Regardless of sodium-ion's future, most sources spoken to by *EEI* agree that if Europe wants to have a home-grown battery industry of some sort, it must work with Chinese companies and learn from them.

### Sodium's uncertainty

The research of sodium-ion and lithium-ion batteries both began around 50 years ago. But lithium-ion cells' huge commercial success in the 1990s – spearheaded by Japanese firms – caused the study of the sodium-ion technology to be largely abandoned until a few years ago.

In the interim, only few companies in the world worked in the field. One of them was Faradion, which was founded in the UK in 2010. Another was HiNa Battery Technology, a Chinese startup established in 2017.

"It was essentially an academic topic," Philipp Adelhelm, a professor of physical chemistry at The Humboldt University of Berlin, tells *EEI*. Adelhelm has researched sodium-ion batteries for more than 15 years.

Sodium-ion cells have lower energy density than lithium-ion cells, meaning they can pack less energy into the same size. But their advantage is also clear: they can be much cheaper to produce at scale, perform better in sub-zero conditions, and charge rapidly. More importantly, sodium's high accessibility can potentially reduce manufacturers' reliance on heavy metals like cobalt and nickel that can be toxic to humans and free them from supply chain choking points.

Although safety has been described by many as an advantage of sodium-ion cells, Adelhelm says the claim that they are "intrinsically safer" than lithium-ion batteries is not true.

"This is not only because there are different varieties of lithium-ion and sodium-ion batteries, but also because safety is a very complex topic that can be discussed on different levels." But Adelhelm says there are "plenty of ways" to make batteries safer.

A defining moment for sodium-ion cells came in July 2021 when Chinese battery behemoth CATL launched its first battery made with the technology. The move kickstarted a new trend among battery makers, which had been looking for low-cost alternatives to lithium-ion cells due to the price hikes of raw materials, says Phate Zhang, founder of the Shanghai-based EV news outlet CnEVPost. The price of lithium jumped a staggering 400 percent in 2021 due to soaring demand for electric vehicles (EVs) and Covid-19 lockdowns. It continued to increase for much of the following year.

But sodium-ion's fate quickly ran into uncertainty when lithium saw a price collapse from late 2022 to most of 2023. Mining and refining companies across the world had ramped up production, while demand for EVs grew at a slower-than-expected rate. Sluggish prices have continued until today.

**"Europe's efforts to pursue the technology largely take place in the lab rather than on the factory floor."**

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*Opposite: Sodium-ion batteries in mass production by Huayang New Material Technology Group, Shanxi Province*

Some companies have had to close. US startup Bedrock Materials, which focused on developing sodium-ion cells, wound down its operation in June after two years.

"Our modelling pointed to a clear outcome: in a world where lithium remains abundant, today's sodium-ion batteries can't compete on cost – even at commercial scale," its co-founder Spencer Gore wrote on social media, explaining the decision.

The technology's commercialisation has slowed down, too. In 2021, the industry expected that to happen in a year or two, says Wade, who leads business development at Gaussion, a London-based startup that has developed a rapid-charging battery technology. Now he thinks it could take another three to five years for sodium-ion cells to be used on a large scale.

"The trend has swapped completely," he points out. Battery makers and buyers are now focusing on lithium iron phosphate (LFP) cells due to their low prices, he adds.

LFP is a type of lithium-ion batteries that do not use cobalt or nickel. It is cheaper, safer and more sustainable than nickel manganese cobalt (NMC) cells, which are widely used in the west. LFP cells have been the dominant lithium-ion cells in China for the past few years.

## Seeking niche markets

Nevertheless, there are firm believers in the technology's future.

"Sodium-ion batteries are a typical disruptive innovation," Tang Kun, co-founder of China's HiNa Battery Technology, tells *EEI*. "As technology continues to progress, their energy density can keep improving and their production costs can be lowered further, especially when manufacturing reaches a bigger scale."

HiNa is betting big on the technology. It opened China's first gigafactory for sodium-ion cells in late 2022 with its partners. A year later, it launched a sodium-powered car in partnership with automaker JAC Motors.

Last year, HiNa started mass manufacturing two commercial products using its self-developed and self-produced chemistry: one for storing renewable energy for the grid and the other for powering two-wheelers. A third product is due to hit the market in October: a fast-charging battery to power heavy trucks.

"Sodium-ion is one of the few existing technological options that can potentially beat lithium-ion cells in cost-effectiveness," Tang says.

Sodium-ion cells' main market is energy storage because the size of a battery matters less when they are fixed in a location. But like HiNa, many Chinese companies are actively exploring niche markets. The strategy could provide a future for the technology, Lü Yanlin, an analyst at market intelligence website Shanghai Metals Market, tells *EEI*.

In the heavy truck sector, for example, drivers cannot afford long pit stops, so sodium-ion's fast-charging feature could be valuable for them, according to HiNa. Their battery can fully charge in 20 minutes, the company says. And because trucks have more space than cars, they can just use more sodium-ion cells to make up for their lower energy density, Lü says.

Lü thinks that sodium-ion cells will likely complement rather than displace lithium-ion cells in the future, and that they will have a bigger chance bagging market shares from lead-acid batteries, which have even lower energy density and shorter lifespans.

The two and three-wheeler sector is a good example. Earlier this year, Yadea, a major Chinese two-wheeler manufacturer, put sodium-ion batteries into its Vespa-like scooters and developed a fast-charging ecosystem for them. The company hopes to use Asia's vast market for small vehicles to drive sodium-ion's commercialisation.

Another example is a vehicle's starter battery, which provides a burst of electric current to start the engine. More than 20 Chinese battery manufacturers including CATL have announced plans to make sodium-ion starter batteries, according to Starting Point Sodium-ion, a Chinese think tank.

"Both internal combustion engine and electric vehicles around the world need starter batteries. It will be a sizable market for sodium-ion," Lü says.

As for the much-prized EV market, luck is yet to come for sodium-ion. Chinese companies have launched three models, but only a couple of hundred of them were sold in total last year, according to Starting Point, a drop in the ocean in China's massive EV market.

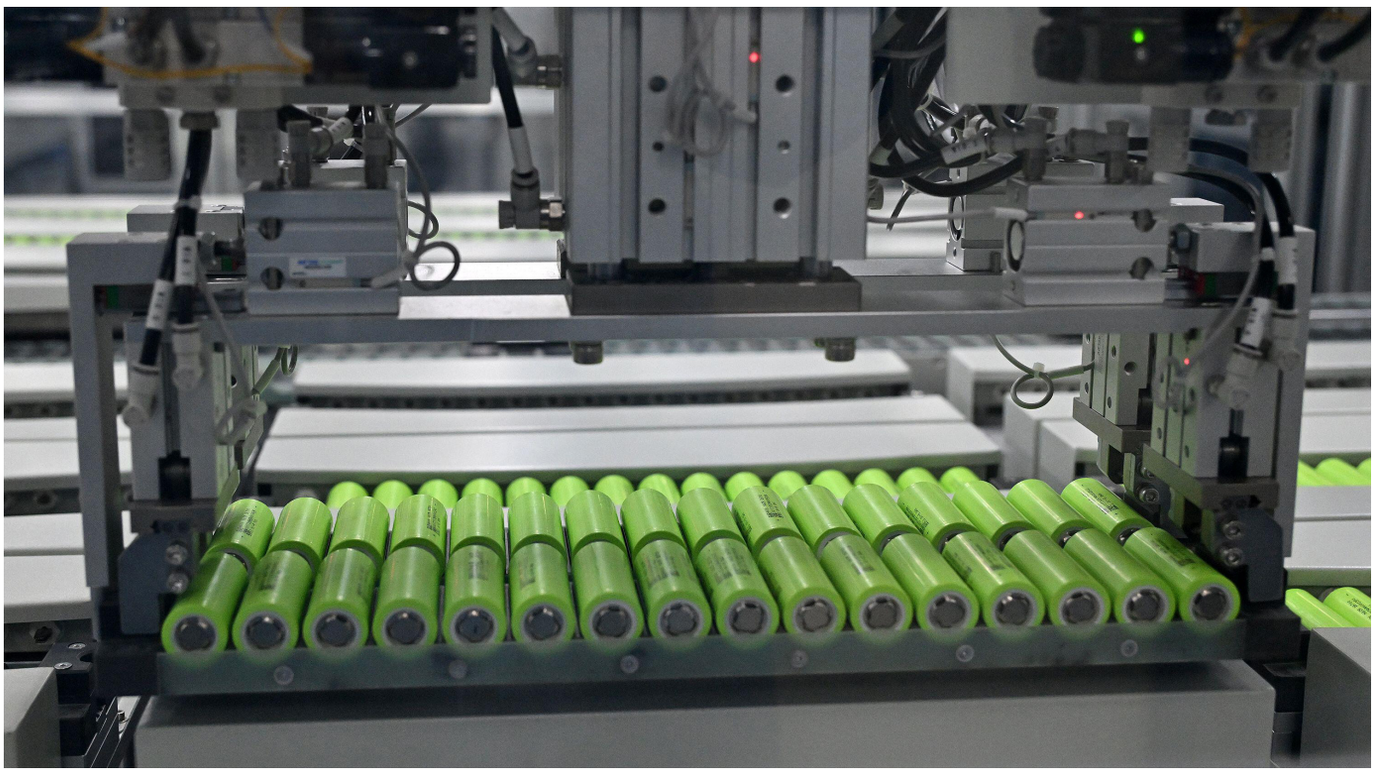
"In the short term, it will be difficult for sodium batteries to be used on a large scale in passenger cars," says Zhang of CnEVPost, because lithium-ion cells are cheap and can promise longer range.

In the long run, different battery technologies are expected to serve different types of EVs. "For instance, high-end sports vehicles typically necessitate high power density, best met by high-nickel lithium-ion batteries. In contrast, for entry level vehicles, battery cost is crucial, making LFPs and potentially sodium-ion batteries attractive options," Brigita Darminto, an analyst at Oslo-based research and intelligence company Rystad Energy, tells *EEI*.

## Europe's role

No European company is mass-producing sodium-ion cells right now. Nor are Japanese, Korean or US companies.

But some plans have been announced in Europe. For example, French startup Tiamat has partnered with Chinese manufacturer Wuxi Lead Intelligent Equipment to build a five gigawatt-hour (GWh) factory in northern



France, scheduled to be completed by 2030. Its first phase, which has an annual production capacity of 0.7GWh, is expected to start operation in 2026 following a delay, according to Darminto and a report.

Tiamat has been working with Chinese battery manufacturer Zenergy to produce sodium-ion cells in the latter's 25GWh factory in east China since 2023, and has tapped into the electric power tool market as a potential outlet for its cells.

In Sweden, a company called Altris has been using abundant elements, such as salt, wood, iron and air, to create the material for a cell's cathode, the electrode where electricity flows out. It has worked with Volvo Cars recently to develop battery energy storage systems.

California-based startup Lyten has acquired all remaining assets of Northvolt, once Europe's homegrown battery hopeful that collapsed into bankruptcy last November. But it remains unknown whether Northvolt will produce sodium-ion cells if it makes a comeback. There are also a series of government-funded consortia working on the R&D front. One of them is EPISODE, which has received over €6.5 million from the European Commission to develop sodium-ion technologies at mass-manufacturing scale. ENTISE and SIB:DE FORSCHUNG are two ongoing programmes funded by the German Federal Ministry of Education and Research. They received around €7.5 million and €14 million, respectively, and aim to speed up the industrialisation of sodium-ion cells.

**"No European company is mass-producing sodium-ion cells right now. Nor do Japanese, Korean or US companies."**

"One of Europe's big strengths is that it can carry out really high-quality research and development, and innovation. I think there is a lot of that going on in Europe at the moment [for sodium-ion]," says Ben Nelmes, executive director of New AutoMotive, a UK-based independent transport research organisation.

But some warn that R&D alone is not enough if Europe wants its own battery supply chain. "There is a very big difference between developing something in an R&D lab, and developing it on a pilot-production scale, and then developing it at large-scale production," says Montgomery at Infyos. "In order to do that, you need the technical expertise and know-how."

The lack of battery workforce is a challenge for Europe. "Let's say, a lab in Germany... has this great innovation. Who's going to manufacture it? The answer is either a German or Chinese company. And the Chinese company is going to do it better at this point because they have the talent," says Cory Combs, who researches critical minerals and supply chains at Beijing-based consultancy Trivium China.

Many, including Wade, see collaboration with China the way forward. Europe should "swallow its pride and understand that Chinese companies are the best...find ways to work with them to share their knowledge," Wade says. What European companies really need is to start making cells and use their revenue to do R&D rather than "changing all these battery chemistry and shooting for the moon", he adds.

China's lead is unlikely to shrink anytime soon. By 2034, the global manufacturing capacity for sodium-ion cells is projected to exceed 500 GWh, and China would account for over 90% of that, according to Zheng Jiayue, an analyst at Wood Mackenzie.

"China is expected to maintain a dominant position," she tells *EEI*. ■

**About the author**

**You Xiaoying** is a London-based freelance journalist focusing on climate change and energy transition.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# Embrace print

EEI EUROPEAN ENERGY INNOVATION

# Upcoming events 2025/2026

SEPTEMBER
9-12
**Gastech inc Gastech Hydrogen**
Milan

SEPTEMBER
22-26
**EUPVSEC**
Bilbao

SEPTEMBER
22-26
**Flexcon**
Brussels

SEPTEMBER/OCTOBER
29-3
**EU Hydrogen Week**
Brussels

OCTOBER
6-7
**E-Mobility Power Integration Symposium**
Berlin

OCTOBER
15-17
**Greenport Congress**
Malta

NOVEMBER
25-27
**Motorship Propulsion and Fuels**
Germany

DECEMBER
2-5
**World LNG Summit**
Istanbul

FEBRUARY
24-27
**World Sustainable Energy Days**
Austria

MAY
6-7
**Coastlink**
UK

SUMMER
2026
**DETAILS TBC**

| | | | |
|---|---|---|---|
| Ukraine Wind Energy Forum | 9-10 Sep | Lviv | https://uweaforum.com/en/ |
| Gastech | 9-12 Sep | Milan | www.gastechevent.com/ |
| European Research and Innovation Days | 16-17 Sep | Brussels | https://research-and-innovation.ec.europa.eu/ |
| Large Scale Solar Southern Europe | 16-17 Sep | Athens | https://lssse.solarenergyevents.com/ |
| EU PVSEC | 22-16 Sep | Bilbao | www.eupvsec.org/ |
| Solar & Energy Storage Live UK | 23-25 Sep | Birmingham | www.terrapinn.com/exhibition/solar-storage-live/ |
| Sustainability Expo Europe | 24-25 Sep | Amsterdam | https://sustainability-expo.com/europe/ |
| Flexcon 2025 | 24-25 Sep | Brussels | https://flexcon.energy/ |
| Biogas PowerON 2025 | 24-25 Sep | Hamburg | https://fortesmedia.com/ |
| CEM Emissions and Air Quality | 24-26 Sep | Ljubljana | https://www.ilmexhibitions.com/cem/ |
| Global Congress on Climate Change | 29-30 Sep | Berlin | https://global-climatechange.com/ |
| EU Hydrogen Week | 29 Sep - 3 Oct | Brussels | https://euhydrogenweek.eu/conference/ |
| Wind Finland | 30 Sep | Helsinki | https://www.windfinland.fi/ |
| London Climate Technology Show | 1-2 Oct | London | https://climatetechshow.com/ |
| Sustainability Week Europe | 6-7 Oct | Amsterdam | https://events.economist.com/sustainability-week-europe/ |
| 18th European Nuclear Energy Forum | 6-7 Oct | Bratislava | https://energy.ec.europa.eu/events |
| E-Mobility Power System Integration Symposium | 6-7 Oct | Berlin | https://mobilityintegrationsymposium.org/ |
| World Hydrogen Week | 6-10 Oct | Copenhagen | https://www.worldhydrogenweek.com |
| Wind and Solar Integration Workshop | 7-8 Oct | Berlin | https://windintegrationworkshop.org/ |
| ESG Days 2025 | 7-8 Oct | Utrecht | https://esgdays.com/ |
| Biomass PowerON 2025 | 8-9 Oct | Stockholm | https://fortesmedia.com/ |
| SDEWES | 5-10 Oct | Dubrovnik | https://www.dubrovnik2025.sdewes.org |
| Impact Day 2025 | 9-10 Oct | Tallinn | https://impactday.eu/ |
| GreenPort Congress | 15-17 Oct | Valetta | https://www.portstrategy.com/ |
| 10th Intl. Conf. Small and Medium Wind Energy | 20-21 Oct | Hurup | https://www.folkecenterevents.net |
| Climate Change Summit Week | 20-25 Oct | Bucharest | https://climatechange-summit.org/ |
| Future of Biofuels | 29-30 Oct | Gothenburg | https://fortesmedia.com/ |
| Green Energy Fair 2025 | 29-30 Oct | Zagreb | https://www.zg-gef.com |
| Li-ion Battery Europe | 3-4 Nov | Barcelona | https://li-ion-battery-europe.metal.com/ |
| European Power Investment Summit | 4 Nov | London | https://www.woodmac.com/events/euro-power-investment-summit/ |
| Smart City Expo World Congress | 4-6 Nov | Barcelona | https://www.smartcityexpo.com/ |
| ECOMONDO – The Green Technology Expo | 4-7 Nov | Rimini | https://en.ecomondo.com/ |
| Wood Mackenzie Hydrogen | 12-13 Nov | London | https://www.woodmac.com/events/hydrogen-conference/ |
| Enlit Europe | 18-20 Nov | Bilbao | https://www.enlit-europe.com/ |
| WaterXChange | 18-21 Nov | Freiburg | https://www.waterxchange.net/ |

# Upcoming events 2025/2026

| | | | |
|---|---|---|---|
| Business Post ESG Autumn 2025 Summit | 20 Nov | Dublin | http://www.esgsummit.ie/ |
| End-of-Life Issues and Strategies (EOLIS) | 20-21 Nov | Lisbon | https://windeurope.org/eolis2025/ |
| World Conference on Climate Change and Global Warming | 21-23 Nov | Copenhagen | https://www.ccgconf.org/ |
| ICREC 2025 | 21-23 Nov | Florence | https://icrec.org/ |
| Future Battery Forum | 25-26 Nov | Berlin | https://en.futurebattery.eu |
| Motorship Propulsion & Fuels | 25-27 Nov | Hamburg | https://www.motorship.com/propulsion-and-future-fuels-conference/ |
| Sustainable Plastics Live | 26-27 Nov | Dublin | https://plasticslive.ie/sustainable-plastics-live-conference/ |
| Industry CCUS 2025 | 26-27 Nov | Amsterdam | https://fortesmedia.com/ |
| World LNG Summit and Awards | 2-5 Dec | Istanbul | https://www.worldlngsummit.com/ |
| ICM Forum (previously CCUS Forum) | 8-9 Dec | Athens | https://energy.ec.europa.eu/events |
| Biogas Convention and Trade fair | 9-11 Dec | Nuremburg | https://www.biogas-convention.com/en/ |
| **2026** | | | |
| Energy Week Black Sea | 4-5 Feb | Romania (TBC) | https://bsenergyweek.com/ |
| International Energy Week | 10-12 Feb | London | https://www.ieweek.co.uk |
| World Sustainable Energy Days (WSED) | 24-27 Feb | Wels | https://www.wsed.at/ |
| The Distributed Energy Show | 11-12 Mar | Birmingham | https://distributedenergyshow.com/ |
| The Energy Storage Show | 11-12 Mar | Birmingham | https://energytechlive.com/energy-storage-show/ |
| Green Marine Transport | 18-19 Mar | Amsterdam | https://fortesmedia.com/ |
| Safe, Sustainable, Swift Reconstruction Ukraine | 19-20 Mar | Lviv | www.circular-concrete.in.ua/swift-reconstruction-conference |
| ISEC | 14-16 Apr | Graz | https://isec-conference.at/ |
| H2FC Hydrogen + Fuel Cells Europe | 20-24 Apr | Hanover | http://h2fc-fair.com/ |
| Wind Europe 2026 | 21-22 Apr | Madrid | https://windeurope.org/annual2026/ |
| Coastlink 2026 | 6-7 May | Humber | https://www.portstrategy.com/coastlink |
| All-Energy Exhibition and Conference | 13-14 May | Glasgow | https://www.all-energy.co.uk/ |
| EUBCE European Biogas Conference & Exhibition | 19-22 May | Amsterdam | https://www.eubce.com/ |
| CO2 Capture, Storage and Reuse 2026 | 20-21 May | Copenhagen | https://fortesmedia.com/ |
| Intersolar Europe 2026 | 22-25 Jun | Munich | http://intersolar.de/ |
| Battery Cells & Systems Expo | 8-9 Jul | Birmingham | https://www.batterysystemsexpo.com |
| Eurosun Conference | 14-18 Sep | Freiburg | https://www.ises.org/ |
| Renewable Energy Conference (GRCREN 2026) | 17-18 Sep | Rome | https://www.renewableenergyconference.org/ |
| Wind Energy Hamburg | 22-25 Sep | Hamburg | https://www.windenergyhamburg.com/ |

# Motorship Propulsion & Future Fuels Conference 2025

**The longest running technical maritime conference in the world, the 46th Motorship Propulsion & Future Fuels event, will take place in Hamburg, Germany, from 25-27 November 2025.**

The conference sessions at the three-day event are concerned with decarbonisation as the maritime world has moved from hard-to-abate to first mover in many respects including progress on carbon capture and the introduction of future, low emissions fuels. In fact, *The Motorship* magazine, first published 105 years ago, this year started a series of special reports looking at each fuel in turn, with expert commentary from the engineers involved. These representatives from top maritime innovators will be at the conference presenting papers and answering any questions readers of *EEI* may have.

The net-zero by 2050 target set by the International Maritime Organization (IMO) adds not just a looming deadline but a regulatory aspect to the event with a keynote panel discussing European Union policy updates among other issues.

The conference will be chaired by Lars Robert Pedersen, deputy secretary general of The Baltic and International Maritime Council, and Markus Munz, managing director of Verband Deutscher Maschinen-und Anlagenbau large engines. The conference will also offer attendees sessions moderated by Gavin Allwright, secretary of the International Windship Association, and Philipp Simmank, technical advisor for climate, marine research and digitalisation at VDR – German Shipowners' Association.

Sessions will focus on key debates in the decarbonisation sphere, for instance the price/availability of green ammonia and methanol, how ship design is evolving for new fuels and how far companies can refine LNG with advances in methane slip reduction and so on. A session on day one will explore the specific challenges with hydrogen and fuels cells, focusing on the restrictive costs of the technology and difficulties using it within a maritime context.

Over 200 attendees from 30 countries are due to attend the Motorship Propulsion & Future Fuels Conference during its 46th anniversary year.

***To find out more or to register to attend the event, visit the Propulsion & Future Fuels Conference website.***

20TH ANNIVERSARY

# GREENPORT Congress

## Valletta 2025

15 TO 17 OCT 2025 | Valletta Malta

Host port: TRANSPORT MALTA

In partnership with: SHORE TO SHIP TRANSPORT MALTA, EOPSA

## Book now - 20th Anniversary event!

### Congress speakers include:

**Isabelle Ryckbost**, *Secretary General, ESPO*

**Edvard Molitor**, *Head of Sustainability, Gothenburg Port Authority*

**Lamia Kerdjoudj-Belkaid**, *Secretary General FEPORT*

**Ignacio Benítez**, *PhD, Senior Project Manager - Innovation & Port Cluster Development, Fundacion Valenciaport*



### Gain insight from industry experts on:

- **Developing a Sustainable Port Community**
- **Harbouring the Future:** *Infrastructure for a Stronger Port Ecosystem*
- **Renewables, Reclamation & Responsible Economic Growth**
- **Ports of the Future:** *Innovation, energy transition and new roles for the port beyond 2050.*
- **How will ports contribute to decarbonization**
- **Managing Cyber Risk in Automating Processes**
- **Electrification of Ports**

Sponsors: Haskoning Enhancing Society Together, JENBACHER, KLÜBER LUBRICATION

Supported by: ESPO, ECOPORTS, IWSA International Windship Association, FEPORT, BPO BALTIC PORTS ORGANIZATION, CRUISE EUROPE, iaph international association of ports and harbors, CLECAT

Meet and network with over 200 attendees representing port authorities, terminal operators and shipping lines. For more information on attending, sponsoring or speaking, contact the events team:

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EU PVSEC
PV Academy
4th edition
21 September 2025
www.pv-academy.com
EU PVSEC 2025
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Photovoltaic Solar Energy
Conference and Exhibition
22 — 26
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STEP INTO THE FUTURE OF SOLAR AT THE EU PVSEC 2025 IN BILBAO!
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At the EU PVSEC 2025, leading scientists, industry experts and innovators will gather in vibrant Bilbao to explore the breakthroughs shaping solar energy — from cutting-edge research to real-world applications. Expect lively discussions, new partnerships and a shared commitment to accelerating the energy transition.
Whether you are deep in research, driving technology or shaping policy, this is where your work connects with global impact.
Be part of the movement. Be part of the EU PVSEC.
EUPVSEC.ORG

## PERSEUS

**Printed Perovskite Solar Cells for Large Area User Applications**
**www.perseus-project.eu**
**Contact: Thomas Kraft – VTT Technical Research Centre of Finland**

PERSEUS bridges the gap between lab-scale and large-scale applications of perovskite solar cells. It focuses on developing three module types - opaque, semi-transparent, and tandem, to suit applications such as floating, urban, and building-integrated photovoltaics. The project supports industrial scalability and aims to accelerate commercialization and mass production of these high-efficiency, low-cost solar technologies across Europe. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

**Project funded by:**

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## AM2PM

**Additive to Predictive Manufacturing for Multistorey Construction**
**https://www.am2pm-project.eu | Contact: Aaron Sprecher – TECHNION - Israel Institute of Technology**

AM2PM transforms multistorey construction using additive manufacturing, robotics, and AI. It aims to halve material use and embodied carbon, optimize structures via computational design, and utilize sustainable cementitious materials. Through digital twins and predictive models, it ensures real-time precision and efficiency, promoting a more sustainable and cost-effective construction sector. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

Funded by the European Union

## APOLLO

**A Proactive Approach to the Recovery and Recycling of PV Modules**
**www.apolloproject.eu | Contact: Roland Kunert – Fraunhofer Gesellschaft**

APOLLO enhances PV module recycling by recovering key materials like silicon, silver, and copper. Using advanced techniques like sonification, it processes PV waste into new components. The project increases material recovery efficiency, supports remanufacturing of high-grade modules, and introduces digital product passports and a marketplace for recycled materials. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

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## CARBON4MINERALS

**Transforming $CO_2$ into Added-Value Construction Products**
**www.carbon4minerals.eu | Contact: Liesbeth Horckmans – VITO**

CARBON4MINERALS turns $CO_2$ emissions from steel and cement industries into construction products. It combines industrial flue gases with waste to create low-carbon materials. With eight industrial pilots, the project aims to cut emissions by 10% and foster cross-sector innovation to enable sustainable, competitive European construction practices. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

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## FOREST

**Advanced Lightweight Materials for Energy-efficient Structures**
**www.forest-project.eu | Contact: Marta Estellés Luna – AIMPLAS**

FOREST reduces emissions in the transport sector by developing lightweight, carbon fiber-reinforced components and biocomposites. It uses recycled and bio-based materials to replace fossil-based inputs, while improving fire resistance and mechanical performance. The project promotes full recovery of carbon fiber waste for reuse in demanding transport applications. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

Funded by the European Union

## GREENEST

**NEST Ingrained Ecosystem for Zero Emission Buildings**
**www.greenest-ecosystem.eu | Contact: Maria Founti – National Technical University of Athens (NTUA)**

GREENEST integrates renewable energy and $CO_2$-neutral materials in construction to meet and exceed zero-emission building standards. It features SmartWall, a modular wall system with HVAC integration. Demonstrated across Europe, the project supports circular construction, indoor air quality, and significant reductions in emissions and construction time. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

**Project funded by:**

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## HERIT4AGES

**Retrofitting for Energy-efficient and Inclusive Cultural Heritage**
**www.herit4ages.eu**
**Contact: Carlos Ochoa – University College Cork**

Funded by the European Union

HERIT4AGES develops energy-efficient, user-friendly retrofitting solutions for heritage buildings. It focuses on maintaining architectural identity while improving comfort and sustainability. By addressing challenges like insulation and humidity, the project supports adaptive reuse of heritage sites and ensures their preservation through innovative, climate-resilient technologies. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

## REUSE

**Efficient Direct Recycling for Low-Value LFP Batteries**
**https://www.reuse-batteries.eu**
**Contact: Claudia Stauch – Fraunhofer Gesellschaft**

REUSE develops direct recycling technologies for LFP batteries, maximizing recovery and purity of key materials. It targets production scrap and end-of-life batteries, supporting a circular approach in the battery value chain. With automated sorting, disassembly, and life-cycle analysis, REUSE enhances the sustainability of the European battery sector. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

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## REVEAL

**Revolutionary Energy Storage with Carbon-free Aluminium**
**https://www.reveal-storage.eu | Contact: Páll Árnason – Taeknisetur ehf.**

REVEAL creates long-duration energy storage by converting aluminium oxide into carbon-free aluminium fuel. This metal fuel stores over 15 MWh/m³ and enables low-cost electricity and heat supply. The solution supports seasonal and off-grid applications, offering scalable, flexible, and transportable energy storage for a climate-neutral Europe. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

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## TEAPOTS

**Agriculture Waste Pyrolysis and Composting for Energy**
**https://www.teapots-project.eu | Contact: Raffaele Catoni – SMACT Consortile**

TEAPOTS harnesses agricultural waste for clean energy using pyrolysis and composting. It generates electricity, heat, and compost while improving soil quality. The project features modular, replicable systems and a digital platform to optimize biomass logistics. Pilots in Italy and Greece demonstrate scalability across diverse European regions. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

Funded by the European Union

## TREASURE

**Large Pit Thermal Energy Storage for Sustainable Heating**
**https://www.treasure-project.eu | Contact: Wim Van Helden – AEE INTEC**

TREASURE advances large pit thermal energy storage (PTES) to enable 100% renewable district heating. It establishes pilot sites across Europe, improves PTES design, and addresses regulatory and social barriers. By optimizing integration and performance, the project aims to support over 2,000 PTES installations and reduce heating-related emissions. This development addresses urgent needs in scalability, efficiency, and industrial adaptability, contributing to Europe's strategic energy goals. By providing a bridge between research and market application, the project ensures that innovative designs can be reliably transferred to large-scale production environments with measurable impact.

Funded by the European Union

# World Sustainable Energy Days 2026

**25 – 27 February 2026**
**Wels/Austria**

**CALL for PAPERS:**
**10 October**

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- European Pellet Conference
- Industrial Energy Transition Conference
- Smart E-Mobility Conference
- Energy Communities Workshop
- Young Energy Researchers Conference

**www.wsed.at**

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