EUROPEAN
ENERGY
INNOVATION

ISSN 3049-5431

Issue 58 | **Summer 2025**

Flying start

Fuel innovation gathers pace in aviation and shipping

MEP Thomas Pellerin-Carlin: EVs mustn't be the preserve of rich urbanites

Could Europe's race to rearm backfire – **and undermine environmental progress?**

Plus: heat pumps, urban cooling, hydrogen, industrial electrification, and much more

www.europeanenergyinnovation.eu

European Energy Innovation
is available online and in print.

To enquire about receiving physical copies, or about distributing EEI at your event, please contact print@europeanenergyinnovation.eu

EEI
EUROPEAN
ENERGY
INNOVATION

The in-house magazine
for Europe's energy leaders

Always free to read

www.europeanenergyinnovation.eu

EU PVSEC

PV Academy
4th edition
21 September 2025
www.pv-academy.com

EU PVSEC 2025

42nd European Photovoltaic Solar Energy Conference and Exhibition

22 — 26 September

BEC —
Bilbao Exhibition Center

Bilbao
— Spain

Be part of the solar PV revolution!

Exhibit, sponsor, make an impact!

JOIN THE EU PVSEC 2025 AND ELEVATE YOUR BRAND!

The **EU PVSEC** is the premier event in the field of Photovoltaics, bringing together a world-class **Conference** on research, technology, and applications with an innovative **Industry Exhibition**. This is where **companies, manufacturers, and research centres** from across the globe connect to shape the future of solar energy.

Why Participate?

- Showcase Your Innovations: Present your cutting-edge products and solutions to a global audience.
- Network with Industry Pioneers: Build connections with leading PV professionals, researchers, and decision-makers.
- Maximise Brand Visibility: Enhance your reach and recognition in the growing solar energy market.

Be part of the solar PV revolution!

Exhibit, sponsor, and make an impact at the EU PVSEC 2025!

EUPVSEC.ORG

In this issue:

The publishers of European Energy Innovation would like to offer their sincere thanks to all individuals and organisations who have contributed editorial images, photos and illustrations to the magazine. Whilst every effort has been made to ensure accuracy of the content, the publishers of European Energy Innovation accept no responsibility for errors or omissions.

European Energy Innovation is published by: Pantograf Media, 86-90 Paul Street, London, EC2A 4NE, United Kingdom

www.europeanenergyinnovation.eu

Editor
Ed Wiseman
ed.wiseman@europeanenergyinnovation.eu

EU Advertising Office
Silvert Media Srl, Brussels, Belgium
Sophia Silvert
Mob: +32 4737 30322
contact@silvertmedia.eu

Dissemination and UK sales
Charlotte Baseley
charlotte@europeanenergyinnovation.eu

Event partnership manager
Caroline Ferguson
caroline@europeanenergyinnovation.eu

Design & Production
Claire Newland, LC Creative

Website Design
pulseart.co.uk

Foreword

By **Ed Wiseman**, EEI editor

As analysts untangle the causes and effects of April's blackout in the Iberian Peninsula, fresh information – and misinformation – continues to emerge from all corners of the internet. There's a conspiracy theory to suit all tastes, enabling social media users to blame any given bogeyman for the ten-hour power cut that affected hundreds of thousands of Europeans about four weeks before EEI went to press. If you're worried about Russia, you'll gravitate to sources blaming Moscow; if you're staunchly pro-nuclear then you'll prefer the analyses lamenting Spain's lack of new reactors; if you believe in aliens you'll find some earnest YouTuber explaining why UFOs chose to sabotage Spain specifically. And if you're a climate sceptic, you can find a near-endless supply of journalists attributing the blackouts to renewables, green technology, and all that woke nonsense you get nowadays.

I was in the area the day after the outages, travelling to the Coastlink conference in Bilbao, and was slightly affected by the aftermath. Having arrived at the Spanish border from Paris by TGV I was soon confronted by patchy train services, which eventually petered out altogether in San Sebastián. From there I took a coach, before arriving at my destination about half a day late, to a town that was only partially switched-on. It sounds straightforward, but this relatively brief interruption to a region's energy supply was demonstrably destructive, and my short journey gave me an insightful preview of what can happen when the energy system wobbles for any reason.

Information on the ground that day was incredibly sparse. Electronic information boards at rail stations were variously offline, or incorrectly reporting business as usual. Nobody on the ground knew if or when services would be restored that day. At the coach station, some services ran, but the ticket machines weren't taking card payments. Crowds of confused backpackers and exhausted locals milled around the manned desks hoping to snag a seat on largely booked-up departures, which were presumably absorbing some of Renfe's rejectees. Upon eventual arrival in Bilbao, my booked hotel couldn't check me in as the computers were still affected, so I had to find an alternative at short notice, but then the original hotel charged me for my stay anyway, only refunding me after I'd sent some emails...

The hardship I experienced was draining but surmountable. Elsewhere in Spain and Portugal, the realities of large-scale power outages had been unfolding, with several deaths and many more injuries now attributed to the blackouts. Some victims had been reliant on mains electricity for their medical equipment, others mistakenly misused candles and fossil fuel generators. The cost to Spain's economy is estimated to be billions of euros (RBC is reported by Reuters to have put the figure at between 2.25 billion euros and 4.5 billion euros) and the multiple probes into what happened are likely to be complex and time-consuming.

Millions of people like me were directly impacted, to some extent, by the events themselves in late April. But the indirect effects of the Iberian Blackout will ripple through the rest of Europe for years to come. ■

Celebrating 15 years

After 15 years online, *EEI* launches its new website this month. In addition to the magazine itself – which will always be free-to-read as a digital download – the website will showcase features and reports written by our many contributors, including policymakers, researchers, and our own small team of journalists. And as part of *EEI*'s commitment to European technology, we will also be launching our social media presence on Mastodon and Pixelfed (alongside BlueSky and our existing LinkedIn page) later this year. *EEI* is still primarily a print publication, however, and will remain available in paper form at events and institutions across Europe; for more information on how to apply for physical copies, please turn to the back of the magazine.

THE MOTORSHIP 46TH 2025 PROPULSION & Future Fuels Conference

Powering shipping's emissions-cutting ambitions

Propulsion & Future Fuels is the longest-running technical conference in the ships & marine engineering sector providing senior executives with a meeting place to learn, discuss, and share knowledge of the latest developments in efficient propulsion technology and low flashpoint, low carbon fuels.

BOOK NOW

25 TO 27 NOV 2025 | Hamburg Germany

Media partner: THE MOTORSHIP MARINE TECHNOLOGY

Sponsors:

DNV · GTT Technology for a sustainable world · Gulf Marine · Sauer Compressors · TGE MARINE · LEWA Creating Fluid Solutions · LR · TECNOVERITAS Dedicated to innovation · WIN GD

Media supporters:

BUNKERSPOT · SAFETY4SEA · CARGO Connections · Cruise&Ferry · UFO FREIGHT · MARPRO MARITIME PROFESSIONALS · european energyinnovation · freightbook · WorldOils · DIGI FREIGHT GLOBAL NETWORK · PROJECT CARGO NETWORK

Visit: motorship.com/propulsion-and-future-fuels-conference
Contact: +44 1329 825335
Email: conferences@propulsionconference.com

#MotorshipPFF

mercatormedia magazines|events|online

Working class e-mobility

A European Social Leasing Scheme would ensure the Green Deal works for rural families

Thomas Pellerin-Carlin MEP

Photo: Unsplash

Electric vehicles (EVs) constitute the cleanest transport mode for hundreds of millions of Europeans who still need a car in their daily life. Yet, public perception around EVs remains divided, with many still seeing EVs as too expensive, too elitist or too urban.

To successfully transition to clean mobility, we need to shift the political narrative around EVs. We don't need a costly and heavy US-manufactured Tesla marketed for urban upper-class men, but an affordable, light, EU-manufactured car designed for working-class men and women living in our rural areas.[1]

Such a narrative shift is urgent, as rural working-class drivers are particularly exposed to the forthcoming increase in petrol prices, resulting from a recovery of the oil market, the next geopolitical crisis or the full implementation of the new EU carbon market for buildings and road transport (ETS 2), starting in 2027.

To mitigate the political risk associated with ETS2, we need to make EVs accessible to those who need it the most. This is why we need an EU Social Leasing Scheme. Building on the French January 2024 social leasing experiment, the EU Social Leasing Scheme could ensure that up to one million people per year can start accessing affordable EVs.

Starting next year and lasting for at least ten years, it could support 10 million European families, thus granting access to affordable EVs to around 35 million people.

What is the EU Social Leasing Scheme?

It's a leasing scheme; it allows people to access an electric car without paying any upfront cost (which might typically be around €30,000), but instead by paying a monthly rate that would range between €50 and €180 per month.

It's a social scheme; it focuses on people who are the most in need to access a light and affordable electric car. For instance, individuals earning less than the national median income and living 10 to 15 kilometres away from their workplace.

It's an EU scheme: it is co-funded with EU funds (e.g. Social Climate Fund, Recovery and Resilience Facility) and national revenues from EU policies (e.g. ETS1). Moreover, it should be politically spearheaded by the European Commission which already benefits from political support coming from both Council and Parliament, as covered in a Euronews column published last April by Polish Minister Bolesta and myself.

> **"To mitigate the political risk associated with ETS2, we need to make EVs accessible to those who need it the most"**

The car models eligible for the scheme will be selected at EU level to ensure those cars are manufactured in Europe in a way that respects environmental protection and social justice. Most importantly, pooling the demand for light and affordable electric car at EU level ensures the cost-efficiency of the scheme, allowing car manufacturers to opt for a pricing strategy that focuses more on volume than over unit margins.

To conclude, the European Social Leasing Scheme should become a priority public policy to show that the EU is a political project for the working class and the middle class. ■

1 https://www.euronews.com/next/2025/04/15/a-social-leasing-scheme-would-make-electric-cars-affordable-in-europe

Fuelling the future

Sustainable Aviation Fuel (SAF) mandates are catalysing energy innovation in one of Europe's most challenging sectors

By **Elizabeth Meager,** EEI journalist

In a critical year for climate regulation, two major developments have landed with potentially transformative implications for the decarbonisation of transport: the EU's sustainable aviation fuel (SAF) mandate and the International Maritime Organisation's (IMO) agreement on cleaner shipping fuels.

These moves will not only introduce compliance obligations for carriers and fuel suppliers, but they also signal an accelerated shift toward alternative fuels, prompting questions about the state of innovation, investment readiness, and market maturity.

Transport accounts for around 25 percent of global carbon dioxide emissions, but aviation and shipping have long remained stubbornly hard to decarbonise. They are, however, now being pulled into sharper regulatory focus.

Under the EU's climate target plan, SAF is recognised as a key lever to cut emissions. The European Commission's ReFuelEU Aviation initiative promotes increased use of SAF as "the single most powerful tool to decrease aviation CO2 emissions", and is a key tool for the bloc to meet its emissions reduction target of 55 percent by 2030.

ReFuelEU outlines a rising trajectory for SAF blending requirements: from 2 percent in 2025 to 6 percent by 2030, 20 percent by 2035, and a highly ambitious 70 percent by 2050. It also has a target of 35 percent synthetic aviation fuels in all EU airports by 2050.

The UK has finalised a parallel mandate, with a more aggressive 10 percent target by 2030 but a slower climb thereafter. Though aligned in spirit, the two regimes differ in scope, definitions and support mechanisms, adding a further layer of complexity for operators working across both jurisdictions.

How to get there

Meeting these targets will require a major scale-up of SAF transactions, says Andrew Williams, a finance partner at law firm Norton Rose Fulbright in London.

"We are speaking to an increasing number of developers and financiers that are already looking at SAF investment as a recognisable asset class, with its own challenges and complexities to navigate, before final investment decisions are made," Williams tells EEI. "Clearly, though, the overall volume still remains low compared to conventional fuel transactions and indeed other more established alternative fuel and energy markets."

Williams believes that mandates and targets alone are simply not enough to achieve sustained private sector interest and investment in the alternative fuels industry. He points to the UK's "revenue certainty mechanism", on which the government recently consulted the industry as a helpful policy instrument.

Funded by the industry, the mechanism would determine levies based on airlines' market share of fossil-based aviation fuel, and would reduce revenue uncertainty risks for emerging SAF producers.

In the US, policy interventions have been more focused on the carrot than the stick; the Inflation Reduction Act has provided a tax credit of $1.25 per gallon for SAF achieving at least a 50 percent lifecycle GHG emissions reduction compared to conventional jet fuel.

"Mandates without financial incentives lead to pretty costly regulations — for me it makes sense to blend these instruments together," says Andre de Fontaine, managing director at non-profit Center for Green Market Activation in Washington DC, which serves as secretariat for the Sustainable

Aviation Buyers Alliance (SABA). Finland's Neste is the biggest SAF producer globally, creating fuel from 100 percent renewable waste and residue including animal fats and cooking oil. A spokesperson for the company agrees that policy support can take a range of approaches, but tells EEI that the company would also like to see measures to protect the European biofuels industry from unfair competition. This would "help safeguard the industry's competitiveness" and ensure that Europe does not "become dependent on biofuels imports in the future".

Creating the market

Neste's spokesperson also points to airports like Amsterdam Schiphol and London Heathrow, which offer incentives for SAF use which "helps airlines mitigate the cost gap with fossil jet fuel".

"Above-and-beyond" policies, such as companies purchasing SAF from airlines or directly from fuel producers to reduce their own business travel emissions, are also helpful in accelerating SAF production and adoption, Neste says.

This is where SABA focuses its efforts. In April 2024 it announced a $200 million investment in SAF certificates from more than a dozen major corporations. The companies, which included AstraZeneca, JPMorgan Chase and Netflix, committed to buying certificates representing 50 million gallons of high-integrity SAF to reduce aviation-related carbon emissions.

As SABA said in a statement at the time, this allows corporate travellers to capture the environmental benefits SAF offers "even if the fuel does not flow directly into the planes they fly on".

In the UK, the Advanced Fuels Fund will provide £135 million of grant funding for early-stage SAF projects. But while this will play an initial de-risking role, Norton Rose Fulbright partners Rob Marsh and Alistair Black say that the revenue certainty mechanism is likely to "be more critical in unlocking long term funding".

Norton Rose's Williams says he is already speaking to developers and financiers that view SAF as a recognisable asset class, but "clearly the overall volume remains low compared to conventional fuel transactions".

Strong tailwinds

Compared to other decarbonisation tools, SAF has a lot going for it. It is a drop-in fuel, meaning it can be used in existing aircraft and related infrastructure. Its use can cut lifecycle emissions by up to 80 percent compared to conventional jet fuel, and it also helps reduce air pollutants like carbon monoxide, nitrogen oxides, and particulate matter.

However, cost remains a major drag: SAF tends to be 3 to 10 times more expensive than fossil kerosene. Bringing that cost down will depend heavily on producers' ability to scale up dramatically — but that is not as easy as it sounds.

REFuelEU is open-minded about the forms SAF can take, including synthetic fuels from renewable hydrogen and captured carbon, advanced biofuels from waste, oil and fats, and recycled carbon aviation fuels.

That is helpful because all of these options depend on finite resources, explains de Fontaine. He says there is a real risk that biofuels producers end up competing with agriculture for land.

"We really want to avoid a situation where producers are growing crops for fuel that could have been used for food, then land use conversions are happening elsewhere, and it all results in increased emissions," he says. And although used cooking oils and animal fats do not pose a land use risk, there is only so much of these resources available.

For this reason, SABA is highly focused on "next generation" e-fuels, which have greater scaling potential. The alliance also believes electrification over biofuels should be the priority for road transport, to preserve "the limited supply of bio-based feedstocks" to service the aviation sector.

In the meantime, though, Neste insists that there is enough SAF available globally to meet ReFuelEU's annual targets up to 2029, and enough bio-SAF for the 2030 mandate.

Shipping's major breakthrough

In April, the UN's International Maritime Organisation reached a long-awaited agreement that imposes emissions reduction requirements on commercial shipping for the first time.

Shipping accounts for roughly 3 percent of global greenhouse gas emissions, yet it has lagged behind other industries in technological transformation. Ninety percent of all global trade moves by sea, and the industry remains largely dependent on fossil diesel.

Starting in 2028, ship owners will be required to transition to cleaner fuels — or face a penalty of up to $380 per tonne of CO2, with proceeds directed into a global net zero fund.

The agreement marks the culmination of nearly a decade of negotiation and makes shipping the first industry with a globally mandated emissions reduction pathway. And it nearly did not happen: Saudi Arabia forced a last-minute vote, and the US — representing less than 1 percent of world shipping by tonnage — pulled out of negotiations.

"The issue is that there is no alternative to fossil fuels," says Norton Rose Fulbright partner Philip Roche. While blended biofuels are increasingly available, competition is high and certification is difficult — so these fuels are likely to "remain a niche in comparison with fossil fuel".

Liquefied natural gas is the other "immediate solution" for shipping, adds Roche. But, unlike SAF, LNG requires major design alterations or conversions.

New fuels like hydrogen, e-methanol and green ammonia show promise, but are three to four times more expensive to produce, and infrastructure is sparse. These are all "unlikely to be more than a niche alternative for some time to come", adds Roche.

Mandates as catalysts — not solutions

The new SAF and shipping mandates represent top-down pressure to accelerate innovation. But bottom-up momentum will hinge on whether investors, producers, and carriers see a viable business case.

The long term outcome will depend on how governments, industry, and finance respond to these early signals: whether hydrogen, synthetic fuels, and ammonia can attract the same level of investment seen in solar or EVs.

It will also depend on broader macroeconomic and geopolitical factors — including the price of oil. "How attractive investment in clean fuel innovation is at any given time will in part be determined by the overall energy market," says Norton Rose's Williams. ■

"New fuels like hydrogen, e-methanol and green ammonia show promise, but are three to four times more expensive to produce, and infrastructure is sparse."

The gas game

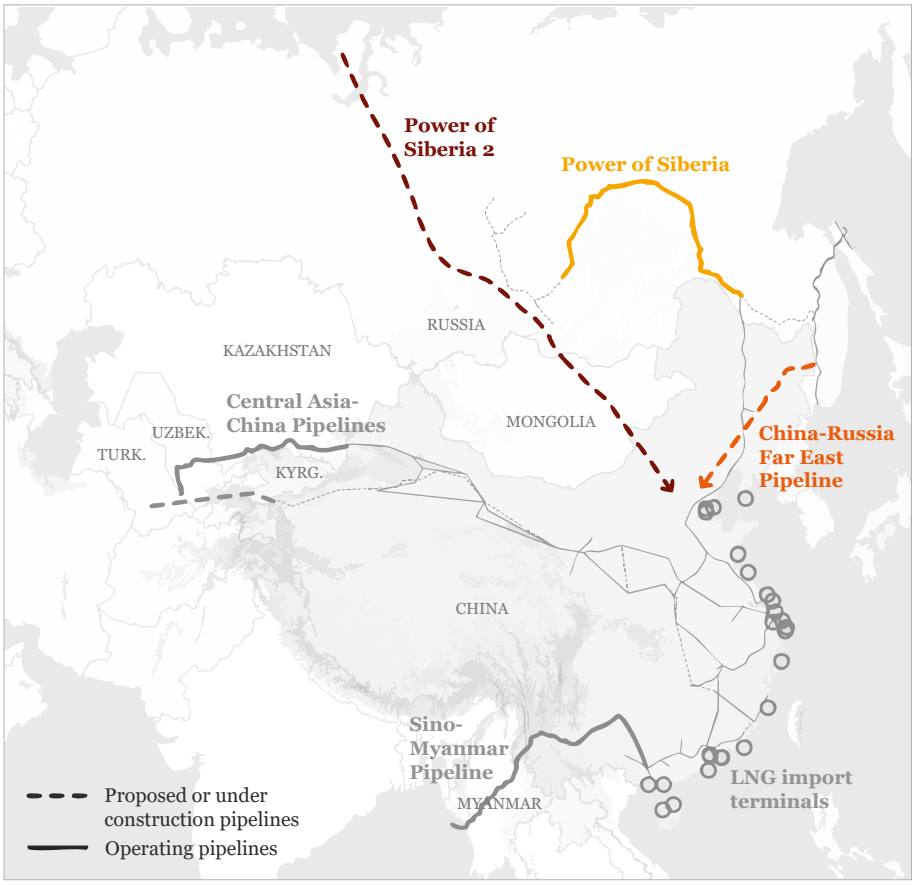
China celebrated the completion of its first gas link to Russia weeks before Ukraine stopped sending Moscow's gas to Europe

By You Xiaoying

The Versailles Declaration of March 2022 was a direct response to Russia's invasion of Ukraine and committed the EU to "phase out dependency" on Russia for energy. Since then, there have been 16 sanctions packages against Russia, and a concerted effort under the REPowerEU roadmap to reduce EU energy demand, particularly gas, and diversify supply.

The EU decided not to open the already-constructed NordStream 2 pipeline and closed the Yamal route to Poland and NordStream 1.

By the end of 2023 EU dependency on Russia's fuels was very substantially reduced, but rebounded by about 18% in 2024. In May 2025 the EU announced a renewed roadmap to totally end EU import of Russian gas, oil and nuclear fuel by end-2027, with the relevant legislative proposals due to be put forward in June. We explore the Russian "pivot" to China and Asia.



Credit: Global Energy Monitor

Following the end of a five-year gas transit agreement, the flow of Russian gas through Ukraine to the European Union stopped on January 1 this year. It was an end of an era that made global headlines; over the four years since 2021, the number of pipelines had been reduced from four to just one, Turkstream.

But less than a month earlier, another significant event had taken place in the Far East: the "east route" gas pipeline linking Russia and China was completed, opening a new page for Beijing's — as well as Moscow's — energy strategy.

The pipeline, which was in the making for three decades, means that Russia can send up to 38 billion cubic metres (bcm) of Russian gas from Eastern Siberia via the Power of Siberia pipeline straight to China's megacity Shanghai, according to the Chinese state broadcaster CCTV.

As Moscow reorients its foreign policy towards Asia, energy acts as the spearhead. Last year, more Russian pipeline gas was exported to China than to the EU — albeit at much lower prices — according to the Centre for Research on Energy and Clean Air (CREA), a think tank based in Helsinki.

Russia will be keen to increase exports to China because it is the "most likely and practical buyer", Isaac Levi, an analyst tracking Russian fossil fuel flows at CREA, told *EEI*.

But Moscow's plan makes Russia beholden to Beijing, which has other foreign pipeline gas suppliers and intends to boost domestic gas production to enhance energy security.

Looking towards the East

The capacity of the recently completed project is around 70% of the annual capacity of Nord Stream 1 (halted in mid-2022), which carried gas from Russia to Germany under the Baltic Sea.

The east route measures 5,111 kilometres within the Chinese border, linking Shanghai on the industrialised east coast with Heihe, a northeastern city bordering Russia, via a huge urban cluster around Beijing. From Heihe, it is connected to the "Power of Siberia" pipeline in Russia, which runs for around 3,000 kilometres to the Kovykta and Chayanda gas fields.

Although many now view China and Russia's energy partnership through the lens of their so-called "no-limit " friendship — a slogan first used by China in early 2021 — the two country's intention to build cross-border gas routes actually dates to the mid-1990s.

A long road to a long pipe

Following the collapse of the Soviet Union in 1989, the Kremlin hoped to revive its slumping economy by sending energy to China, which laid the ground for negotiations over two possible gas pipelines, one in eastern China and the other in western China, according to a 2016 paper Analysis of the Sino-Russian Relationship Model Behind Natural Gas Cooperation by researchers from Peking University. But the talks saw little progress in the initial two decades for various reasons, including a lack of mutual interest, geopolitical tensions and major disagreements over the routes and prices, the paper said.

A turning point appeared in 2014: Moscow was desperate to close the deal after being slapped with multiple sanctions by the EU and US over its annexation of Crimea.

"That was a decisive moment in the marathon negotiations," says Yu Aiqun, who researches China's energy policies at Global Energy Monitor, a US-based non-profit organisation. Meanwhile, China had also had to deal with rising energy demand at home and a need to cut air pollution, which drove it to look for gas suppliers, Yu tells *EEI*.

In May that year, the two sides signed an agreement on constructing the east route. The $400 billion contract enables Russia to export gas to China via the link for 30 years, starting in 2018. Half a year later, a preliminary agreement about the west route was reached, which allowed Russia to send an additional 30bcm of gas to China every year for three decades.

Putin, who already had been pushing for his "Pivot to Asia" strategy since 2012, had high hopes for the Chinese market. Following the signing of the east route, he said at an economics forum: "In the country ranking, China, along with Germany, is becoming a major consumer of Russia's natural gas. Once the western corridor project is realised, China will surely become our number one consumer."

However, the final contract of the west route, known as the "Power of Siberia 2" in Russia, has yet to be signed today.

Growing supply to China

China is building a separate "Far East" line, which is designed to send 10bcm of gas yearly from Russia's Sakhalin-III gas blocks to China's border city Hulin. From there, a Chinese domestic network is set to carry the resource through the rust belt provinces in the north east to Shijiazhuang, a city in China's Jing-Jin-Ji mega urban cluster that includes Beijing. It is scheduled to be completed in 2027. Its contract was sealed in February 2022 — days before Russia invaded Ukraine — during Putin's visit to Beijing.

As Russia increased its bet on the Far East following its full-scale invasion of Ukraine and the closure of NordStream and the Yamal-Poland transit route and Europe's decision not to open NordStream2, its energy exports to China have jumped rapidly, contrasting with the shrinking EU market. According to CREA, only 7% of Russia's pipeline gas exports went to China in 2021 while 71% flowed to the EU. But last year, China ascended to being Russia's largest foreign pipeline gas client.

"China made up 37% of all Russian pipeline gas exports in 2024 whilst the EU imported 31% of Russia's pipeline gas volumes," says Levi. Even so, Russia earned around €3 billion more from the EU than from China in revenue over the 12 months because the pipeline gas sold to China was significantly cheaper, he adds. China's unit price is nearly 50% lower than their European peers, according to Bloomberg.

"Chinese customs data indicates that Russian pipeline gas was China's cheapest source of pipeline gas and much cheaper than China's LNG (liquified natural gas) imports in 2021," Dr Erica Downs, a senior researcher at Columbia University's Center on Global Energy Policy, told *EEI*.

But China is determined to diversify its imports and won't rely on one foreign source, GEM's Yu stresses: "China has deliberately crafted four major import sources for gas from four different directions." Beijing calls them its four "strategic channels ".

The country receives gas from Turkmenistan, Uzbekistan and Kazakhstan via a system of pipelines in the northwest; from Myanmar via a link in the southwest; and from Russia via the east route in the northeast. Plus, it has constructed a series of LNG ports on its eastern coast to receive shipments from more than 20 countries, with Australia and Qatar being the top two suppliers in 2023.

Power of Siberia 2

Russia has made it no secret that it is eager to build the long-delayed Power of Siberia 2. It was this route — not the Power of Siberia — that Moscow had originally wanted to sell to Beijing because it could draw gas from the Yamal Peninsula, Russia's largest gas reserves and the origin of its EU-bound gas, Petras Katinas, another analyst at CREA, tells *EEI*.

The Kremlin hoped that the project would make up for the lost potential exports to the EU through the Nord Stream 2 pipeline, which was built but never went into operation. Russia now intends to shift 50bcm of gas a year — instead of the originally agreed 30bcm — to China through the potential project.

Last May, Putin visited Xi in Beijing in the hopes of closing the deal, only to return to Moscow empty-handed. The talks were stalled due to China's tough stance on pricing, the *Financial Times* reported.

Another sticking point is the project's route, which is meant to start from Yamal and enter China for its sparsely populated northwest through a third country — Russia only borders China very briefly on the west.

Mongolia was the original transit candidate, but Russia later proposed to reroute it via Kazakhstan. "Mongolia hopes to get investment from China and Russia, [but] Russia does not have the money and China is not in a rush to build the pipeline," Li Lifan, a researcher at the Shanghai Academy of Social Sciences, told South China Morning Post.

China has an even stronger hand in the Power of Siberia 2's negotiations compared to the other two projects. "Any additional gas supplies in the west are not a must for China," Yu says. The country is already receiving more than 50bcm of gas a year through the Central Asia–China gas pipelines, which are docked into the Chinese domestic gas networks in Xinjiang before being sent to the inland and the coast.

Even if Russia manages to supply gas to China at maximum volumes through all three links, their export volume and revenue will be "incomparable" to its EU sales, according to Katinas. Russia exported 141bcm of gas to the bloc in 2021, while the combined capacity of the three China-Russia links is due to be less than 70% of that.

But if the Power of Siberia 2 moves ahead, it will make Beijing too reliant on Moscow for gas, Yu argues: "It means one-third of China's total gas supply, including pipeline gas and LNG, will come from one single country. It simply breaks the balance and presents a geopolitical risk for China."

Implications for the EU

The China-Russia gas pipelines are unlikely to bring direct impacts on the EU's energy strategy, but they can send strong messages to Brussels and the world.

It "would be a geopolitical coup for Moscow" if it gets China to commit to the Power of Siberia 2 amid its war in Ukraine, Dr Downs and her colleagues wrote in an analysis. Russia would be able to demonstrate "to the West and the Global South that it is able to deepen its energy relationship with China despite the war," they said.

Chinese observers are clearly aware of this reality. Wen Shaoqing, a Chinese political columnist said. "In the eyes of the Russian president Putin, this pipeline will not only be a lifeline for Russia's energy exports, but also a representation of its global image."

The Power of Siberia 2 could have a bearing on Europe's LNG market, too, because it will influence demand by China, the world's largest LNG importer in 2023.

"The more pipeline gas China imports, the more LNG is likely to be available to European consumers," Dr Downs says. A team of UK-based researchers projected LNG prices to increase for Europe between now and 2030 if China builds no or limited new gas pipelines to Russia while also reducing its domestic gas production.

Beijing's ties with Brussels are also in play. Countries such as China, India and Turkey, which are still buying Russian energy products "are reducing the impact of Europe's sanctions by providing alternative markets" for Moscow, Levi says. He adds that EU policymakers "may be keen" to sanction European companies that support these collaborations or prohibit them from doing so.

With Donald Trump in the White House, the stakes have gone higher for China, Yu stresses.

"Cutting ties with Russia is the bottom line for being friends with Europe," she noted prophetically in February 2025. "While China seeks to foster closer relations with the EU at a time when US president Trump threatens to launch another trade war, importing more Russian gas won't do good for it."

US is the world's largest LNG exporter and, according to the US Energy Information Administration North America's LNG export capacity will double by 2028.

Thanks in part to renewable energy deployment and policies aimed at curbing gas consumption, Europe's gas demand declined by 20% between 2021 and 2024 and LNG imports sharply decreased (by 19% in 2024). At the same time, the continent's LNG import capacity has grown by 31%. According to the Institute for Energy Economics and Financial Analysis, this means that Europe could potentially replace the lost Russian gas pipeline supply and refill gas storage with LNG while still importing lower LNG volumes than in 2023. ■


EPAL
EPAL

Is rearmament costing the Earth?

By **Ellie Kinney**, Climate Advocacy Coordinator at the Conflict and Environment Observatory (CEOBS)

European military spending could exacerbate the climate crisis – and by extension, instability

The world has now marked a decade of rising military spending, with the global total now standing at a record breaking $2.7 trillion annually. Within this, spending in Europe rose by 17 percent, a dramatic increase of 83 percent from 2015.

As the rising tide of militarism continues to engulf Europe, interlinked with global instability and the very real need to defend citizens from authoritarian states, there is a risk that promised investment into EU militaries will only serve to expose us to a different threat: the climate crisis.

Militaries are already responsible for an estimated 5.5 percent of global greenhouse gas (GHG) emissions. They and their supply chains are fossil fuel intensive and every Euro of military spending will carry a carbon cost. And now, as EU leaders plan an €800 billion boost to defence spending, military climate action that can help measure and mitigate their impact is becoming more important than ever; but instead voices are calling for it to be deprioritised, or actively erased.

"Militaries are already responsible for an estimated 5.5 percent of global greenhouse gas (GHG) emissions"

The climate cost of 'security'

A recent paper published by the Conflict and Environment Observatory (CEOBS) found that the cost of the climate damage caused by NATO's increased military spending could amount to up to $264 billion per year. This figure factors in the announced investment in EU militaries as well as those announced by non-EU NATO members like the UK and Norway, and is based on research that suggests a 1 percent rise in military spending by share of GDP increases national GHG emissions by up to 2 percent. Are we truly investing in security if it contributes to the long-term insecurity caused by the climate crisis?

Ramping up military production to increase stockpiles is energy-intensive and, with limited progress towards military decarbonisation, the current procurement push means that militaries will be locked into fossil fuel-intensive equipment for decades. The European Defence Agency (EDA) recently noted the lack of standardised 'green' procurement across EU militaries, with fewer than 40 percent of respondents reporting a 'green' procurement policy in place – 'green' in this context does not equate to low carbon. This means that we are committing to equipment today that will hinder tomorrow's mitigation efforts.

In addition to directly increasing military emissions, rising military spending also risks diverting finance from climate action. Research finds that increasing military spending crowds-out green investment and innovation, disrupting the green transition. Governments like the UK are directly cutting aid and development funding to fuel defence spending, throwing uncertainty over the country's ability to meet climate finance commitments and support crucial climate projects overseas. As expected, charities have branded this decision as "disgraceful" and "short-sighted", and even a former Army chief of staff has called the move "a fundamental strategic error". Not only will rising military spending risk worsening the climate crisis, it will also limit our ability to respond to its impacts effectively.

Less transparency on military emissions means less climate action

The world's militaries'contribution of 5.5 percent of global emissions will increase as military spending rises and the rest of society decarbonises. However, this is only an estimate as countries don't currently have to include the emissions from their militaries in their national reporting to the UN Framework Convention on Climate Change. While some choose to publish their military emissions independently, what is

"Countries don't currently have to include the emissions from their militaries in their national reporting"

released is far from the full picture. This means that we don't have an accurate understanding of the impact that militaries are having on global emissions now, and nor can we accurately project how this will increase with the planned increases in military spending. As governments ramp up military spending, accurate data is becoming increasingly critical for efforts to understand how much of our rapidly dwindling carbon budget is being consumed by military investment.

We urgently need more transparency. Instead we can see the opposite happening. Since taking office in January, the Trump administration has deleted the climate portal from the Department of Defense (DoD) website, removing a back catalogue of US military emissions reporting. The US DoD is the single largest consumer of energy in the US, and the world's single largest institutional consumer of fossil fuels and, while this reporting was not a complete picture of the full scale of the US DoD's climate legacy, it represents a significant portion of global military emissions. The removal of this data is not just a headache for academics or activists working to spotlight the military's emissions, it also sets a dangerous precedent globally. While avoiding reporting military emissions is not a new phenomenon, the past few years have seen a slow but steady creep towards greater transparency of military emissions and the US closing the book altogether should be condemned by civil society, militaries and policymakers alike.

The actions of Trump's administration to hide the true scale of the DoD's contribution to the climate crisis, and to performatively denounce military climate action as 'woke' nonsense, is a warning sign of a more far-reaching risk. The EU faces its own rise of far right populism, which joins Trump in using military climate action as fuel for culture-war fires. Add to this spiralling defence budgets detached from consideration of their environmental impact, and you create the perfect conditions for less transparency in military emissions reporting, and stalled progress on defence decarbonisation.

Leadership in European military climate action to date

It would be highly regressive for the EU to turn its back on military climate action at this stage, regardless of pressure from the US or from the EU's political right. It's not just peace or climate activists who say so; in recent years it has largely been militaries themselves driving forward change. The EDA hosts the Consultation Forum for Sustainable Energy in the Defence and Security Sector (CF SEDSS), a network designed to help the European Union Ministries of Defence move towards greener, resilient, and more efficient energy models, and contribute to the EU's goal of net zero by 2050. EDA Deputy Chief Executive André Denk has noted that "The EU's goal to become climate neutral by 2050 cannot be achieved without the engagement of the defence sector." Through this network, European Ministries of Defence can share knowledge and promote best practice, while collaborating on research and innovation in sustainable energy.

But the moral imperative to support Europe's decarbonisation efforts doesn't even need to be the driving factor behind military climate action. There are numerous reasons why European militaries benefit from climate action; Denk has also pointed out that more energy sustainability in defence means "less costs, less reliance on fossil fuels, and increased resilience." EUROMIL, the European Organisation of Military Associations and Trade Unions, advocates the promotion of sustainable practices in the military sector, and has recognised that policies that reduce emissions can simultaneously increase operational effectiveness.

In addition, they note that initiatives like specialised training on the topic of climate change for military personnel can not only significantly contribute to reducing the military's impact on the climate but also support troops' ability to safely respond to climate impacts. Those at the coal face of military climate action, like EUROMIL and the CF SEDSS network, understand the clear military imperative for decarbonisation, as well as its societal urgency.

These military-driven initiatives are operationalising what has already been encouraged within the European Parliament. Ahead of COP28 in Dubai, parliamentarians voted to encourage the defence sector to contribute to the reduction of emissions through accelerating the development of decarbonisation technologies and strategies, as well as agreeing that military emissions reporting to the UNFCCC must improve. While the EU is yet to be a driving force encouraging the UNFCCC to implement mandatory military emissions reporting, a number of its member states are already taking the lead by improving the reporting of emissions from their Ministry of Defence - an example other countries must follow.

Fighting for our future

The foundations for effective military climate action have been slowly building over recent years. But pushing back on the threat that climate-blind rearmament poses to military decarbonisation requires far deeper engagement than we have seen to date from the climate movement, philanthropy, policymakers and militaries themselves. We also need leadership from those governments whose militaries have adopted climate targets and are already advancing decarbonisation policies — weaker sectoral action and backsliding on commitments will impact existing and planned work. We need a coalition of voices, be they military, academia, or civil society raising the alarm about the risks that abandoning military climate action poses to national and international climate targets, and ultimately to our collective security.

The last few years have seen considerable momentum build around military decarbonisation but the current rush to rearm for short-term defence threatens to undermine this progress, while exacerbating the longer term threat we face from the climate crisis. Military decarbonisation is a prerequisite for our future security but this future will not happen unless governments and the wider climate movement fight for it. ■

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!

The 20th GreenPort Congress will take place from 15–17 October 2025 in the historic city of Valletta, Malta. The 2025 conference will be hosted by Transport Malta, in partnership with EOPSA, and co-located with the highly anticipated Shore to Ship Conference.

Gain insight from industry experts on:

- New policy and legislative updates
- Port Infrastructure and development
- Alternative fuels
- Digitisation in ports
- Terminal development and sustainable operations at port
- Electrification of ports, terminals and equipment

Sponsors: Royal HaskoningDHV – Enhancing Society Together; KLÜBER LUBRICATION

Supported by: ESPO, ECOPORTS, IWSA, FEPORT, BPO BALTIC PORTS ORGANIZATION, CRUISE EUROPE, iaph, 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:

visit: **greenport.com/congress**
tel: **+44 1329 825 335**
email: **congress@greenport.com**

#GPCongress

mercatormedia magazines|events|online

Media Partners: PORTSTRATEGY INSIGHT FOR PORT EXECUTIVES; GREENPORT INSIGHT FOR PORT EXECUTIVES

From wind energy innovation to industrial competitiveness

Authoring: Nerea Rodriguez, Project Officer,
WindEurope - ETIPWind Secretariat

About ETIPWind

The European Technology and Innovation Platform on Wind energy (ETIPWind) connects industry, researchers, and policymakers to set Research & Innovation (R&I) priorities and guide EU innovation policy for wind energy. The platform is supported by the SETIPWind project, funded by Horizon Europe, the EU's funding programme for research & innovation. ETIPWind's latest report, '**From Innovation to Industrial Competitiveness**[1]', analyses public support for wind energy R&I and present recommendations to optimise EU funding and boost the competitiveness of the European wind energy sector.

The role of R&I in Europe's wind energy competitiveness

Wind energy is Europe's flagship clean tech industry – a homegrown success story that is now central to the EU's energy security and decarbonisation strategies. What was once an emerging sector is now an established industry with 231 GW of installed capacity delivering 20% of Europe's electricity and employing over 370,000 people. Wind energy's contribution to EU's Gross Domestic Product exceeds €54 billion[2], and investment is growing rapidly: over €11 billion is currently being channelled into new and expanded manufacturing facilities across the continent.

This is the result of decades of strategic policy and sustained public investment, most crucially in R&I. Public R&I funding has been one of the main engines behind the technological advances in European wind energy technology. Innovations that enabled the scale-up of turbines from 450kW machines in 1990 to 15MW machines in 2025. As well as driving down costs, boosting reliability and enhancing overall sustainability.

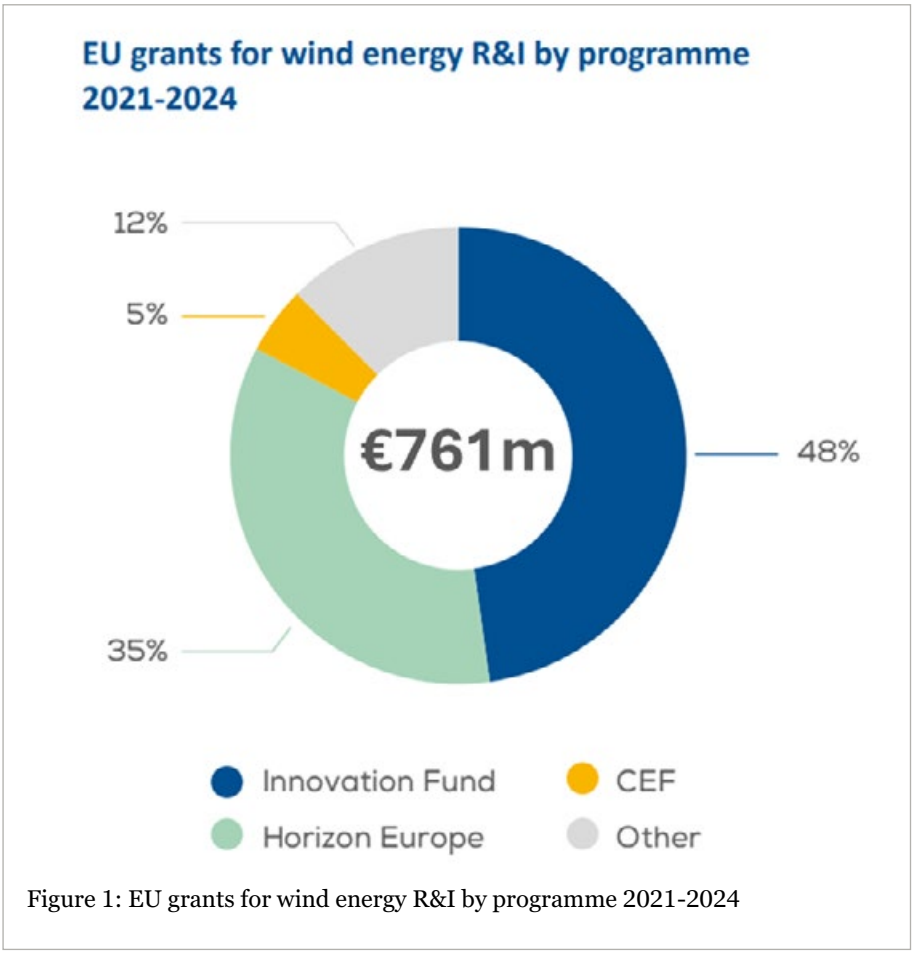


Figure 1: EU grants for wind energy R&I by programme 2021-2024

More than simply a source of clean electricity, wind energy now plays a key role in Europe's broader economic and geopolitical resilience. Indeed, over 99% of the wind turbines installed in Europe are made in Europe. Yet, the wind sector faces critical challenges as it looks to further scale-up to meet the rising societal demand for clean and affordable electricity.

Poor permitting, slow grid build-out, bad auction design, stagnating levels of electrification, and aggressive foreign competition put the European wind sector at a crossroads. The path to 2050 — where wind energy is expected to supply up to 50% of the EU's electricity, with total installed capacity rising to as much as 1,300 GW — demands a new approach to wind R&I. By 2050, wind farms will need to be larger, smarter, more sustainable, and better integrated into the broader energy system. That will require innovation to develop advanced materials, autonomous operation systems, circular designs, and digital tools that ensure better performance and resilience.

1 https://etipwind.eu/wp-content/uploads/files/publications/20250408-Etipwind-report.pdf
2 ETIPWind European wind energy competitiveness report 2025 – to be published

ETIP Wind
EUROPEAN TECHNOLOGY & INNOVATION PLATFORM ON WIND ENERGY

"The EU's current approach to wind energy R&I is insufficient, fragmented, and not sufficiently aligned with the needs and urgency that the sector faces"

Achieving these breakthroughs will require a coordinated, well-resourced, and long-term public R&I funding strategy. And this is where the EU must act decisively. As the recent ETIPWind report '**From Innovation to Industrial Competitiveness**' highlights, the EU's current approach to wind energy R&I is insufficient, fragmented, and not sufficiently aligned with the needs and urgency that the sector faces. Without a more coherent and robust support strategy Europe risks losing its competitive edge in the global wind energy race.

EU funding support for wind energy R&I

Between 2021 and 2024 R&I investment in the wind energy sector was approximately €6.9 billion — with nearly 75% of that coming from the private sector. The EU allocated €761 million in grants for wind energy R&I across 72 projects. The €761 million is only a small fraction — often less than 3% — of the total budgets available under major funding programmes such as Horizon Europe or the Innovation Fund.

Nearly half of the €761 million in EU grants for wind R&I came from the Innovation Fund, and went to just ten projects. Horizon Europe (including Cluster 4 and Cluster 5), accounted for most of the remainder (Figure 1). Other contributions came from six other programmes offering limited grants to a large number of projects.

The above shows the EU funding landscape is highly fragmented, with wind R&I grants spread across eight different funding programmes, each with its own set of rules, scopes, and application procedures. As a result, the wind energy sector struggles to navigate complex eligibility requirements and application procedures. The lack of a dedicated funding stream for wind innovation blocks long-term visibility, dilutes funding impact, leads to missed opportunities, and ultimately slows down the pace of technological development. This is particularly damaging as the sector has a clear and ambitious R&I strategy for wind in Europe.

Common European strategy for wind R&I funding

Through the Strategic Energy & Technology Plan (SET Plan)[3], the European wind R&I community (formed by ETIPWind representing the industry, EERA JP Wind representing the research community, and the IWG Wind representing the Member States) has defined a common R&I strategy set to deliver five core objectives by 2050: keeping the industry healthy and competitive, leveraging digitalisation and automation, making wind the backbone of a climate-neutral energy system, achieving circularity and environmental excellence, and reinforcing a skilled workforce and social support.

1. **Remaining healthy and globally competitive** will require Europe's wind energy sector to address urgent challenges. While Europe continues to lead in wind turbine manufacturing, meeting the EU's 2030 energy targets require a significant scale-up in production and installations. This calls for innovative manufacturing solutions, such as semi-automated processes and modular designs, alongside with new approaches in transport, installation, and component durability, essential for cost-efficient and rapid deployment.
2. **Digitalisation, automation, and AI** hold a critical role in optimising wind farm operations. The European wind sector has already made progress in reducing operations and maintenance (O&M) costs through these technologies. But continued R&I is essential to keep pace with rapid technological developments. Priority areas include smart materials, predictive maintenance strategies to extend the lifetime of turbine components. As well as autonomous tools or robots that limit the need for onsite operations, thus increasing workers' safety.
3. As wind energy becomes the backbone of Europe's increasingly **electrified energy system**, the ability to integrate this growing capacity smoothly into the grid becomes essential. Europe needs major upgrades and expansion of its grid. And significant R&I to improve system flexibility. Priority areas include large-scale demonstrations of grid-forming capabilities, multi-terminal high-voltage direct current systems or even hybrid wind farms and energy islands. Enhanced grid management and modelling tools and storage solutions will need to support and underpin these technologies.
4. Although wind energy is inherently sustainable, the industry aims to go further by becoming **fully circular and delivering net-positive environmental impacts** by 2050. This involves scaling up recycling technologies – especially for challenging components like blades and permanent magnets – while incorporating recyclable materials into turbine designs. In parallel, more research is needed to scale nature-positive solutions for biodiversity around wind farms, together with harmonised tools to assess cumulative environmental impacts.

3 Established in 2007, the SET Plan is the European Commission's instrument to boost the transition towards a climate-neutral energy system through the development of low-carbon technologies in a fast and cost-competitive way.

Figure 2: European Fund for Wind Research & Competitiveness

5. Finally, the long-term deployment of wind energy will depend on **public support and a skilled workforce**. By 2030, the industry will need 200,000 additional workers. This calls for coordinated education and training programmes, strong collaboration between academia and industry, and the establishment of lifelong learning culture. At the same time, building and maintaining public support for wind energy will require consistent efforts to engage communities, counter misinformation, and ensure the coexistence of wind farms with other land and marine activities.

The need for a European Fund for Wind Research & Competitiveness

Europe's wind energy sector has a clear strategy but lacks a supportive EU funding framework that matches the scale and urgency of the challenges. Increasing EU and national investments in wind energy R&I is essential. To correctly address the R&I priorities, public R&I investment must increase by at least 20%, reaching €1.8 billion between 2025 and 2027[4].

But more funding alone is not enough. How public funding instruments are structured and the money is delivered matters too. As highlighted in the Draghi report on European competitiveness[5], the EU lacks an integrated financing ecosystem to scale and commercialise innovation effectively.

Luckily the EU already has tools in place - early-stage research through the European Research Council, technology development via Horizon Europe, and scale-up support from the Innovation Fund. But these tools lack coordination which leads to gaps and overlaps in the EU funding offer. The Heitor report 'Align, act, accelerate'[6] also reinforces the case for a more streamlined, mission-oriented R&I framework.

In response, the SET Plan wind energy community proposes the creation of a **European Fund for Wind Research & Competitiveness** under the next EU Multiannual Financial Framework (2028–2034) (Figure 2). This Fund would act as a centralised, dedicated mechanism for wind energy R&I—pooling resources from EU institutions, national governments, and private actors. It would support the entire innovation cycle, from fundamental research to industrial deployment. It will have five key elements:

1. A technology-specific public budget for wind energy R&I.
2. Upfront and long-term visibility on that public budget.
3. Co-decision from the industry and research sector on what projects will get funded.
4. Leaner and simpler administrative procedures.
5. A one-stop shop for public funding for the entire innovation lifecycle, including for manufacturing.

The European Fund for Wind Research & Competitiveness will be the framework needed to turn Europe's excellence in wind energy R&I into industrial competitiveness and to deliver technology sovereignty. But it needs to come with a strong EU industrial policy for clean energy technologies, as well as a drastic simplification of the administrative requirements associated with public R&I funding. More details about these recommendations are available in the ETIPWind report 'From Innovation to Industrial competitiveness'.

As the **ETIPWind Chair, Adrian Timbus** (Vice-President Portfolio and Market strategy, Hitachi Energy), notes: "*This report shows wind energy can become the pillar of Europe's industrial competitiveness and energy security agenda. There is great consensus between the political will and the industry and research needs. We need to build on this momentum to ensure wind is a top priority in Europe's industrial strategy and that we invest massively in innovation and industrialisation of wind power solutions. We must strengthen and formalise the collaboration between the wind sector, the European Commission, and the Member States.*" ■

4 ETIPWind Strategic R&I Agenda 2025-2027 - https://etipwind.eu/files/file/agendas/231205-ETIPWind-SRIA.pdf
5 The future of European competitiveness - https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20_%20A%20competitiveness%20strategy%20for%20Europe.pdf
6 Align, Act, Accelerate: Research, technology and innovation to boost European competitiveness - https://op.europa.eu/en/publication-detail/-/publication/2f9fc221-86bb-11ef-a67d-01aa75ed71a1/language-en

Gastech

EXHIBITION & CONFERENCE | 9-12 SEPTEMBER 2025 | MILAN, ITALY

AI::Energy | Climatetech | Hydrogen

Co-Hosts

Chevron | ExxonMobil | Shell

Powering a sustainable energy future

Attend the world's largest exhibition and conference for natural gas, LNG, hydrogen, climate technologies, and AI in energy

50,000	1,000	1,000	7,000	150
Attendees	Exhibitors	Speakers	Delegates	Countries represented

BOOK A VISITOR PASS
gastechevent.com

Under the Patronage of | City Partner | Host Associations | Host Venue | Organised by

Ministero delle Imprese e del Made in Italy | YES MILANO | ASSOLOMBARDA | ASSORISORSE | FIERA MILANO | dmg::events

gastechevent.com @gastechevent #Gastech

News in Brief

Italian hydrail

The Sardinian government has approved plans for a hydrogen railway line connecting Alghero and the nearby "Riviera del Corallo Airport" at Fertilia.

Designed to cut travel time between the city and the airport, as well as emissions from road routes where many such journeys take place, the new line – which includes 6.7km of track, a 3.95MWp photovoltaic installation, a 1,500kg-per-day electrolysis plant, and a depot – will be serviced by hydrogen fuel cell multiple unit trains. These vehicles, built for a the 950mm narrow-gauge railway, are among the first of their kind, and will each accommodate over 150 people.

"Investing in hydrogen mobility means projecting Sardinia into the future of environmental innovation," said Rosanna Laconi, Sardinia's councilor for environmental protection,

The decision was met with some scepticism by local politicians and unions, given the relatively untested nature of the technology and the high-profile problems with Alstom iLint multiple units in Germany. However, the rollout of hydrail across Europe – including Germany – continues to gather pace, with analysts claiming the technology is more appropriate than electrification on regional, lightly-used lines.

Nuclear options

Proponents of nuclear power have been active in the wake of the blackouts on the Iberian Peninsula in April, with advocates highlighting the advantages of stability. The exact causes of the power cuts are not yet known.

Spain's nuclear lobby has called for a review of the country's phase-out plans, which would see all reactors decommissioned by 2035. The president of pro-nuclear group Foro Nuclear, Ignacio Araluc, said that it did not seem "logical" to continue with this plan, agreed in 2019, given how much has changed in Europe since then.

The country's environmental transition minister, chemical engineer Sara Aagesen, signalled last month that there could be some flexibility to the 2035 cut-off, according to Bloomberg, which suggested that the government was waiting for proposals from plant operators.

Spanish prime minister Pedro Sánchez confirmed his commitment to wind and solar power in parliament, stating that the country would not deviate "a single millimetre" from its plans to ramp up clean energy generation, and that renewables represented the only way to reindustrialise Spain. However, it's difficult to ignore the momentum behind nuclear energy as Europe faces multiple energy quandaries.

While there remains little suggestion that more nuclear power would have significantly changed the outcomes of April's catastrophe, pro-nuclear commentary emerged from around Europe in the wake of the blackouts. Estonian energy minister Andres Sutt called for more storage and nuclear capacity to be installed alongside the rollout of renewables, while Swedish energy minister Ebba Busch was even more emphatic.

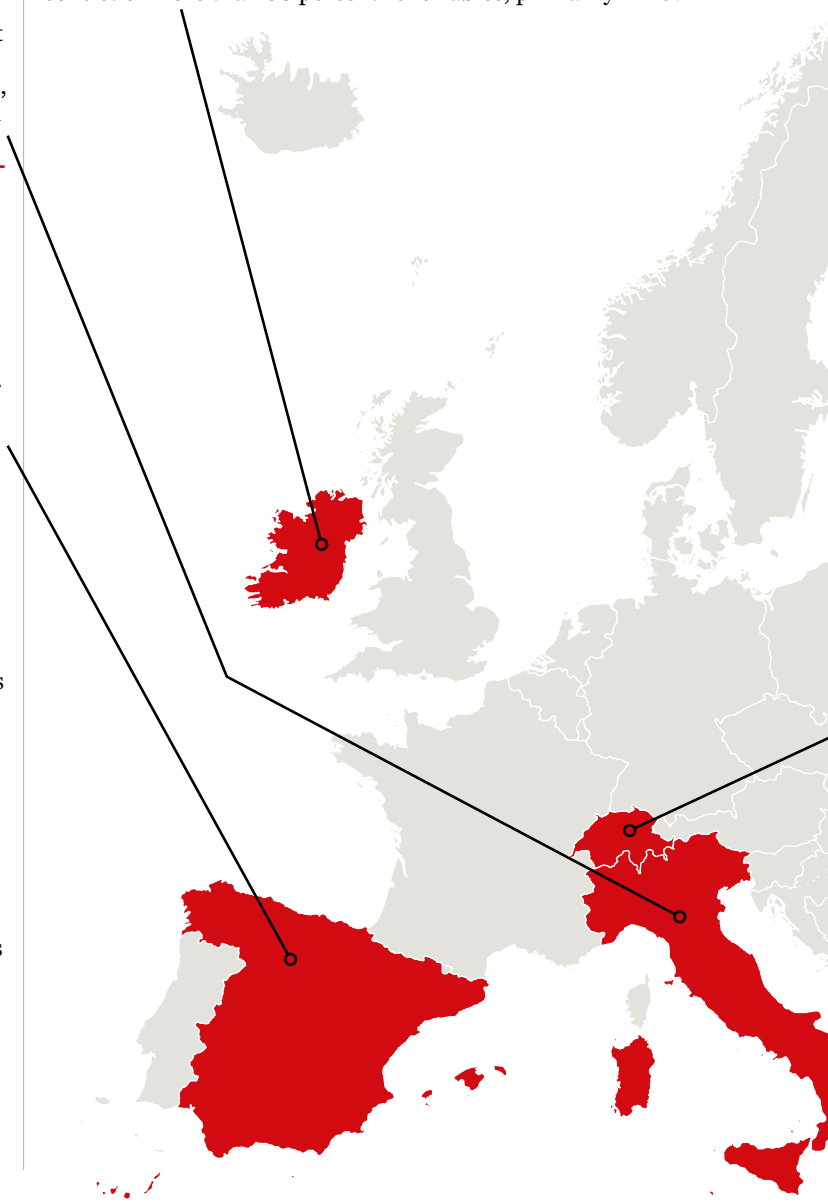
"If you want a lot of power and you want it to be fossil-free, then nuclear is your pick," she said. "Europe cannot be defended without a robust energy system."

Solar surges

Photovoltaic generation in Ireland reached a new high in March, with a peak of 750MW reported on the 25th. Solar accounted for about 2.8 percent of the country's energy mix across the whole month.

"While just under 3% of total electricity generation came from solar for the month, during particularly sunny periods this peaked at over 18% which augurs well for further records this summer," said Charlie McGee, system operational manager at Ireland's TSO, EirGrid.

This beat a record set in June 2024 and reflects the rollout of significant grid-scale solar facilities across the country Ireland's spring also saw new records set for wind generation (3,884 Megawatts on February 13) and BESS (300MW on March 14). In 2025, the country's energy mix is expected to consist of more than 50 percent renewables, primarily wind.



Coal shutdown

Finland shut down its last major coal-fired power station in April, bringing reducing the country's reliance on the fuel to below 1 percent significantly ahead of its 2029 cut-off date.

The closure of the 177MW Salmisaari energy and heat plant, near Helsinki, is a milestone in what has been a dramatic decrease in coal use since the turn of the century. Today, wind accounts for 25 percent of Finland's energy, that proportion having doubled in the past five years.

Finland retains some coal-burning capacity, including two mixed-fuel plants at Vaskiluoto 2 and Martinlaakso 2, which primarily run on biomass. Coal generation is now around 0.67 terrawatts. The country does not produce its own coal (though has some peat reserves) and has historically imported the majority of the fuel from Russia.

Closer ties

The European Commission and Switzerland's Federal Council have agreed further details of the country's participation in European Union scientific programmes, including Horizon.

Following a deal struck in Bern in December, Swiss officials have taken further steps towards association with Horizon, Euratom Research and Training, ITER/F4E and Digital Europe, along with Erasmus+ and EU4Health. Since the start of the year, Swiss researchers have been able to participate in Horizon calls, but ongoing access to funding will depend on full association. The same is true for Digital Europent and Euratom Research and Training. Once full Horizon association has been reached, Swiss researchers will be able to obtain funding and lead consortia as an EU member state would, rather than having the status of a non-associated third country as they have for four years.

Diplomatic tensions led to Switzerland being excluded from full Horizon membership in 2021.

"EU funding programmes are among the world's most prestigious programmes for education, research and innovation," read an official release from the Swiss government in April.

"Switzerland's participation in EU research and innovation programmes has a long tradition and for many decades the country has played an instrumental role in strengthening Europe's position in research and innovation."

In the previous Horizon programme that ran from 2014 to 2020, Switzerland coordinated 3.9 percent of all projects. Switzerland is also a founding member of the European Space Agency and co-hosts CERN. It was previously excluded from Horizon in 2014 for six months over a dispute with the EU primarily involving immigration limits.

Bigger BESS

A battery energy storage system described as the European Union's largest has come online in Bulgaria, as part of the country's ambitions to install 10 GWh of capacity over the next year.

Energy minister Zhecho Stankov inaugurated the 124MW, 496MWh site in Lovech, near Pleven, in May. It follows a smaller site (25MW/55MWh) that opened in the south-west of the country last year.

"The facility... will help Bulgaria's energy system remain the most stable in the region," he said. "We are the pillar in the Balkans and in Southeastern Europe that balances electricity systems and we have proven this with actions.

"It is the first step towards achieving the goal of having 10,000 MWh of operational batteries in Bulgaria within the next year," he added.

The site, which consists of some 111 battery containers, took six months to build thanks to rapid permission and approval from local authorities. It is located in the Balkan Industrial Park near a 106MW photovoltaic installation, and will charge up during periods of cheap electricity in order to discharge when prices rise.

Industrial Electrification – Europe's ultimate power play for boosting competitiveness

By **Cillian O'Donoghue**,
Policy Director at Eurelectric

Europe's industrial base is facing a dual crisis of competitiveness and carbon intensity. Indeed, the continent's over-reliance on imported fossil fuels has left industries vulnerable to high energy prices and price volatility, especially for energy-intensive sectors. At the same time, decarbonisation pressures are mounting, with the effects of climate change becoming ever more evident and much-needed EU climate targets pushing for transformation.

In this global context, electrification is rapidly emerging not just as a climate imperative, but as a strategic solution to Europe's industrial competitiveness woes. A brand new Eurelectric study, 'The new industrial age; Tailored electrification pathways for Europe's industrial competitiveness[1]', shows how for many sectors, the business case for switching to clean electricity is already quite compelling — and it will only strengthen as technologies mature and grids continue to decarbonise. Thus, seizing this growing momentum could redefine Europe's industrial future and restore its competitive edge in an increasingly decarbonising world.

Electrification, a competitiveness game changer

Our reliance on imported fossil fuels cost Europe €350 billion in 2024 (€451 billion in 2023), undermining competitiveness and exposing energy-intensive industries to volatile markets. Our study reveals that for processes below 500 °C — such as battery cell manufacturing — electric heat pumps and boilers are already beating fossil alternatives when it comes to the total cost of ownership, while even sectors like milk powder production are lowering energy consumption and costs through direct electrification.

Although high temperature processes await further technological advances, scaling electrification across low and medium temperature uses could already substantially shrink Europe's fossil fuel import bill, bolster trade balance savings and save industry. Seen in this light, electrification is not just a decarbonisation tool, but also a strategic game changer for European competitiveness and innovation leadership.

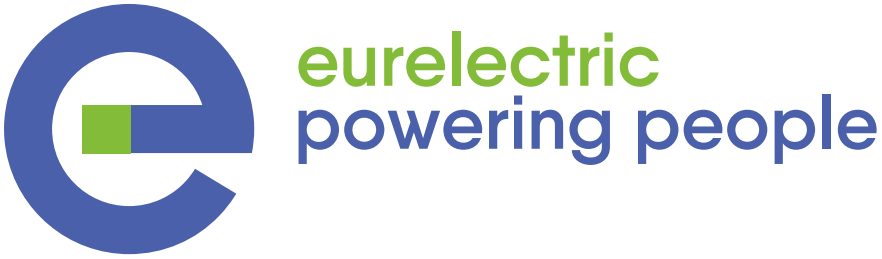
Clean tech already has a business case for electrification

This early "in-the-money" reality also extends to medium-intensity sectors, where direct electrification can cut both energy use and costs compared to oil and gas. These findings underscore that mature electric technologies are no longer niche pilots but are instead commercially viable solutions, turning decarbonisation investments into immediate competitiveness gains. As Europe accelerates grid decarbonisation, the business case will only strengthen, creating virtuous circles between cleaner power and industrial growth.

Medium & high heat processes need more time

While low-temperature applications are already cost-competitive, medium-heat processes (200–500°C) in many Member States will only reach profitability around 2030, as technology costs decline and learning-curve effects kick in. Variations in national energy mixes mean some countries will hit

1 https://powersummit2025.eurelectric.org/industrial-competitiveness/
2 https://energy-security.eurelectric.org/



this tipping point earlier than others, a reality that underscores the need for tailored timelines. High-temperature sectors — such as ethylene cracking and metallurgical furnaces — face steeper hurdles: today's electric solutions carry higher capital expenditures and require further R&D, pilot deployments and scaling support before they can outcompete fossil alternatives.

Policymakers must therefore combine innovation incentives, targeted funding and clear roadmaps to ensure these critical segments join the electrification journey in the decade ahead.

What is it going to take

Accelerating industrial electrification requires more than just the technology – it demands a robust enabling framework. First, industries need access to tailored financial instruments such as Carbon Contracts for Difference (CCfDs) and Power Purchase Agreements (PPAs) to de-risk investments and lock in predictable energy costs. Second, grid infrastructure must be rapidly upgraded at the low and medium voltage levels to handle new electric loads, improve connection times and unlock flexibility services. Finally, Member States must align incentives by phasing out fossil fuel subsidies, adjusting energy taxation to favour clean electricity, and implementing sector-specific electrification strategies. Without coordinated support across these fronts, the switch will remain out of reach for much of industry.

An ecosystem approach: industry can't do it alone

Indeed, electrifying Europe's industry isn't just a matter of swapping boilers – it is going to require a well-coordinated ecosystem of stakeholders. Energy producers must accelerate renewables deployment to drive down wholesale power costs, while grid operators need smart-grid upgrades and flexibility markets to manage increased loads and two-way flows. Regulators and policymakers must align incentives – phasing out fossil fuel subsidies, reforming taxes and embedding electrification targets in national strategies – to send clear investment signals. Industrial users, in turn, should engage in long-term offtake agreements to secure price stability and bankable business cases. Only through this "Team Europe" approach can we bridge technology, finance and infrastructure gaps — and ensure that no link in the value chain is left behind.

Europe must act, or fall behind

Although it has been repeated to the point of ad nauseam, it remains true that Europe is at a pivotal moment: clinging to fossil fuels exposes our industries to volatile prices and erodes competitiveness, whereas electrification will offer an already proven path to cost savings and resilience. Business as usual will only widen the innovation gap as global rivals deploy clean-power strategies. To seize the upcoming new Industrial Age, we must implement targeted policies – tailored sectoral roadmaps, PPAs and CCfDs, grid upgrades and R&D support – to scale low-temperature solutions and drive breakthroughs for high-heat processes. The time for incremental change has passed: Europe must mobilise its full ecosystem now or risk forfeiting its industrial leadership once and for all. ■

Scan for the digital version, which includes relevant links to third party websites, or visit europeanenergyinnovation.eu and subscribe for free

Sustainable cooling in a warming climate: an urgent social question for our cities

Rising temperatures and extreme heat waves deepen social inequalities across Europe. Stronger local government action is required to protect vulnerable groups and build just, climate-resilient cities.

By **Allison Le Corre**, communication manager for the EU Covenant of Mayors, EUSEW's partner organisation

Rising temperatures pose a serious threat to Europeans' health and quality of life, while also raising many social justice issues. Heat waves disproportionately affect particular groups of people based on factors such as where they live, socio-economic status, the conditions of their dwellings, and current health conditions, exacerbating existing social inequalities across Europe. On the frontline of facing climate risks, local governments play a key role in addressing heat-related threats.

With summer approaching, Europe braces once again for the prospect of extreme temperatures and increasingly frequent, prolonged heat waves. Every year, an average of 48,000 people in Europe lose their lives due to heat-related causes – a number expected to rise as Europe warms at roughly twice the global average, as outlined in the European Climate Risk Assessment.

Cities are particularly vulnerable to heat waves, where the heat-island effect can raise temperatures by 10 to 15 degrees compared to nearby rural areas, according to the JRC's latest report on EU cities and extreme heat. This means that, as cities work to reduce emissions and combat rising temperatures, they must also prepare for an already warmer climate, all the while keeping energy and housing affordable.

Sustainable cooling: a social justice issue

The heat-island effect is unevenly distributed across cities, with low-income neighbourhoods often suffering the most due to high density, lack of vegetation, poor housing conditions, and inadequate cooling systems. Rising electricity costs also threaten energy-poor households, with 19% of EU homes unable to stay cool in summer, according to Eurostat data. Local actions to address heat must balance technological solutions with social equity, recognising cooling as both a climate and social issue.

Some cities are proactively implementing these measures in housing. In Zaragoza, Spain, the EU-funded Renaissance project tackled energy inefficiencies in social housing by implementing bioclimatic design and renewable energy, focusing on optimal sun exposure, insulation, and solar protection. In one neighbourhood, measures like double orientation, upgraded facades, and improved insulation reduced the total energy consumption by half.

Similarly, Amsterdam's RESILIO project (2018-2022) developed a 10,000 m² network of blue-green rooftops on social housing. These roofs kept buildings cooler in summer and warmer in winter compared to those without them.

Some other cities, like Vienna, Austria, have created green oases to provide respite from heat and reduce the heat-island effect, prioritising the transformation of vulnerable neighbourhoods.

These strategies not only help households across all income levels stay cool but also prevent 'maladaptation' by reducing reliance on air conditioners, which release hydrofluorocarbon refrigerants that directly contribute to climate change and intensify the heat-island effect.

Beyond cooling: the strength of communities and social bonds

Developing strong community support systems for vulnerable populations is as important as implementing cooling solutions. Heat exacerbates pre-existing health conditions, representing a greater danger to the elderly, people suffering from chronic illness, pregnant women, and children.

The Swedish city of Kristianstad has developed a heat plan specifically focused on vulnerable groups, including checklists for education, healthcare, and social services institutions to ensure preparedness and response to heat waves, with a mapping of where vulnerable people live. This type of social infrastructure, when activated, can save many lives.

Comprehensive local heat strategies

Cities can only manage the complexity of sustainable cooling – balancing climate adaptation, energy poverty, mitigation, and social justice – through integrated policies and action plans. Major cities like Paris with its 'Paris Under 50 Degrees' plan, Athens with its Chief Heat Officer, and Barcelona with its network of climate shelters, have set examples of thorough heat action plans. Smaller municipalities, like Weiz in Austria and Rethymno in Greece, show that towns are also proactively addressing rising heat with plans and targeted measures.

The Covenant of Mayors' new #CitiesRefresh campaign highlights these local efforts, from cities of all sizes and geographical locations, encouraging them to exchange experiences and solutions to better cope with rising heat. Follow the campaign to find out more. ■

About the author

Allison Le Corre is the communication manager for the EU Covenant of Mayors initiative and a storyteller for cities' climate transitions. For the Covenant of Mayors, she runs campaigns aimed at connecting European policy and local action in the fields of energy and climate, such as energy saving, heat decarbonisation, climate adaptation, and more.
The EU Covenant of Mayors is the largest European movement of local authorities working to secure a better future for their citizens by committing to EU climate and energy objectives.

This opinion editorial is produced in co-operation with the European Sustainable Energy Week (EUSEW) 2025. See ec.europa.eu/eusew for more details.

Molécule du monde

A coherent strategy – and a reality check – will drive hydrogen innovation now that the hype has abated

By **Dr. Thomas Hillig**,
EUSEW digital ambassador

"Starting to develop hydrogen now ensures that applications are mature at the end of the energy transition when all potential for direct electrification has been leveraged"

Scan for the digital version, which includes relevant links to third party websites, or visit europeanenergyinnovation.eu and subscribe for free

In recent years, hydrogen has captivated the imagination of the energy sector, garnering significant attention from governments, corporations, and the media. The hype around hydrogen seemed to promise a transformative shift in the global energy landscape. Many ambitious projects were announced, with plans for massive hydrogen production in the gigawatt (GW) scale.

However, as with many technological promises, the initial momentum has somewhat waned. Today, the hydrogen narrative is less about large-scale ambitions and more about pragmatic realism.

Scaling down ambitions, but progressing forward

The focus has shifted to smaller projects, typically in the range of 2-20 MW, particularly in Europe. While these projects are crucial steps forward, their impact on large-scale decarbonisation, particularly in energy-intensive industrial sectors, remains limited.

In this early stage, hydrogen projects will not significantly contribute to achieving Europe's decarbonisation objectives. For short-term decarbonisation, direct electrification is more cost-efficient. However, starting to develop hydrogen now ensures that applications are mature at the end of the energy transition when all potential for direct electrification has been leveraged. Governments must support research and development (R&D) to drive down the cost of hydrogen production, improve electrolysis processes, and enhance hydrogen storage and transportation. Collaborations between governments, industries, and research institutions will be essential to unlock hydrogen's potential as a mainstream decarbonisation lever – from production to a broad variety of applications.

The secondary layer: hydrogen as a location factor

Despite the scaling back of some of the overly ambitious projects for massive hydrogen production, access to hydrogen, in particular, green hydrogen seems to be increasingly perceived as critical for site selection and business location decisions to build new or expand operations. This shift is driven by several factors, including the pressure to reduce carbon footprints, comply with tightening emissions regulations, and secure access to clean energy sources in the future.

For example, industries with high energy demands, such as steel, chemicals, and glass, are beginning to recognise that their long-term viability will depend on their ability to access affordable, green hydrogen. As companies work to reduce their carbon emissions, hydrogen can serve both as a fuel and a feedstock, offering a route to decarbonise chemical and industrial processes that are difficult to electrify.

The hydrogen reality starts now

This is where regional advantages come into play. Companies that are situated in regions with good access to green hydrogen will have a clear competitive edge, not only in terms of their environmental credentials but also in terms of cost. As hydrogen production increases and economies of scale are realised, the cost of green hydrogen is expected to decrease.

Regions that establish themselves as hubs for hydrogen production and infrastructure development will be in a prime position to attract businesses that rely on hydrogen as a key input. Conversely, regions that fail to invest in renewable energy and hydrogen infrastructure risk losing out on investment and innovation – potentially facing deindustrialisation and business delocalisation as a result. ■

About the author

Dr. Thomas Hillig is the founder and managing director of THEnergy, a boutique consultancy established in 2013 that focuses on innovation in the energy space, including hydrogen, microgrids, energy storage, energy management, and e-mobility. For industrial companies, THEnergy develops energy and sustainability concepts – combining experience from conventional and renewable energy with industry knowledge in consulting. THEnergy also advises investors and energy companies regarding cleantech opportunities in rapidly changing markets. Hillig has led several large-scale due diligence processes, helped scale up numerous start-ups, and assisted companies from overseas to enter key European markets.

This opinion editorial is produced in co-operation with the European Sustainable Energy Week (EUSEW) 2025. See ec.europa.eu/eusew for more details.

Clean Industrial Deal: time for an 'EU Implementation Fund'?

An EU Implementation Fund would ensure Horizon Europe and LIFE project results achieve real-world impact through better post-project support and coordination

By **Dusan Jakovljevic**, EUSEW's digital ambassador

The European Union has invested significant resources into research and innovation through Horizon Europe and environmental sustainability via the LIFE Programme. However, a persistent challenge remains: how to ensure the uptake and implementation of the innovative results of these projects.

Many cutting-edge technologies, business models, and environmental practices developed under these programmes fail to reach the market due to lack of post-project financing, or insufficient coordination between research and implementation stakeholders. To address this gap, the EU should establish an 'EU Implementation Fund', dedicated to ensuring that the outcomes of Horizon Europe and LIFE projects translate into tangible economic, social, and environmental benefits.

The fund would not need to focus solely on direct financial investments, but rather on creating structured and systemic mechanisms that maximise the replication and impact of EU-funded projects. By facilitating knowledge transfer, regulatory adaptation, industry partnerships, and capacity-building, the fund can ensure that research outcomes transition efficiently into market-ready solutions and widespread adoption. By focusing on the later stages of innovation, such an initiative could help de-risk promising technologies, support matchmaking initiatives, capacity-building programmes, facilitate pilot/follower projects, and support regulatory adaptation where necessary.

EU projects: engines for business

An 'EU Implementation Fund' would serve as a crucial mechanism to bridge the gap between research results and market deployment, addressing one of the biggest barriers to competitive sustainability: the 'valley of death' between innovation and commercialisation. Many breakthrough technologies and sustainability solutions

Scan for the digital version, which includes relevant links to third party websites, or visit europeanenergyinnovation.eu and subscribe for free

"The 'valley of death' between innovation and commercialisation is a barrier to competitive sustainability"

developed under Horizon Europe and LIFE projects struggle to reach market adoption due to high upfront costs, regulatory hurdles, or a lack of industry engagement. By providing targeted funding for scaling up, piloting, and adapting these innovations to market needs, the fund would ensure that research-driven advancements do not stagnate at the prototype or pilot stage but instead reach widespread commercial use across the EU.

Moreover, the fund could support businesses, particularly SMEs and startups, in adopting and implementing innovative solutions emerging from EU-funded research. By facilitating market uptake, the fund would help create demand-driven ecosystems where research outcomes are actively sought by industry, encouraging more companies to integrate sustainable practices and driving the EU towards a circular, low-carbon, and resource-efficient economy. Already, the European Innovation Council (EIC) Accelerator plays a positive role by providing funding and support to high-potential startups and small businesses developing groundbreaking innovations. EIC helps bridge the gap between research and market, accelerating the growth of deep-tech companies across Europe. More initiatives of this kind are needed.

Additionally, the EU Implementation Fund would enhance Europe's competitive advantage by ensuring that European innovations are the first to scale globally. Many promising sustainability solutions risk being commercialised elsewhere due to faster-moving regulatory frameworks or more aggressive investment strategies in other regions, such as the U.S. or China.

EU projects: engine for jobs

At EEIP, we are already pushing replication and implementation in the early stages of the projects we support. We aim to match innovation with its potential to generate employment across various sectors.

For example, the CAPTUS project focuses on demonstrating sustainable pathways to produce high-value renewable energy carriers by valorising industrial carbon emissions and integrating renewable electricity surplus. It involves developing and operating new technologies, which needs skilled workforce for research, development and operational phases, thereby creating local and regional jobs in engineering, manufacturing and plant operations.

Similarly, the eLITHE project aims to decarbonise the ceramic industry by electrifying high-temperature thermal processes. This transition from fossil-based systems to electric heating processes requires the development of innovative technologies and materials, leading to job creation in research and development, as well as in the manufacturing and maintenance of new equipment.

The EENOVA project addresses energy efficiency in regional food processing value chains, aiming to reduce the carbon footprint of the agri-food sector. The project's emphasis on collaboration among regional food hubs across Europe further fosters employment opportunities by stimulating local economies and supporting small and medium-sized enterprises in adopting energy-efficient practices.

This progress is already underway. The EU projects planning is already moving to simplified and more impact-orientated calls and proposals. Banu Altin (Istanbul Minerals and Metals Exporters Association) welcomes the increased focus. Support will be given to innovation enablers, such as ESCOs, technical support, chambers of commerce and others who understand technological innovation and can effectively communicate it to potential users, especially SMEs.

Innovation and market-oriented implementation can effectively complement and reinforce each other by creating a balanced ecosystem where research-driven advancements translate into competitive business models. By aligning public funding with industry needs, policies can de-risk early-stage innovations and stimulate private sector participation, ensuring policy-industry synergies to enable Europe to maintain its leadership in sustainability. ■

About the author

Dusan Jakovljevic is a co-founder and Policy and Communication Director at EEIP, a policy and business platform for industrial energy transition. He is the founder of #EuroBubble Twitter live monitoring free tool at vattel.com.

This opinion editorial is produced in co-operation with the European Sustainable Energy Week (EUSEW) 2025. See ec.europa.eu/eusew for more details.

Heat pumps and the circular energy economy

Heat pump technology is about much more than just the efficient warming and cooling of buildings.

By **Thomas Nowak**,
EUSEW digital ambassador

Scan for the digital version, which includes relevant links to third party websites, or visit europeanenergyinnovation.eu and subscribe for free

Efficient heating and cooling is essential, yet much thermal energy goes to waste. What if we could avoid this thermal pollution and instead establish a circular energy economy in urban areas by recovering and recycling waste heat?

Clean heating and cooling in cities is not happening

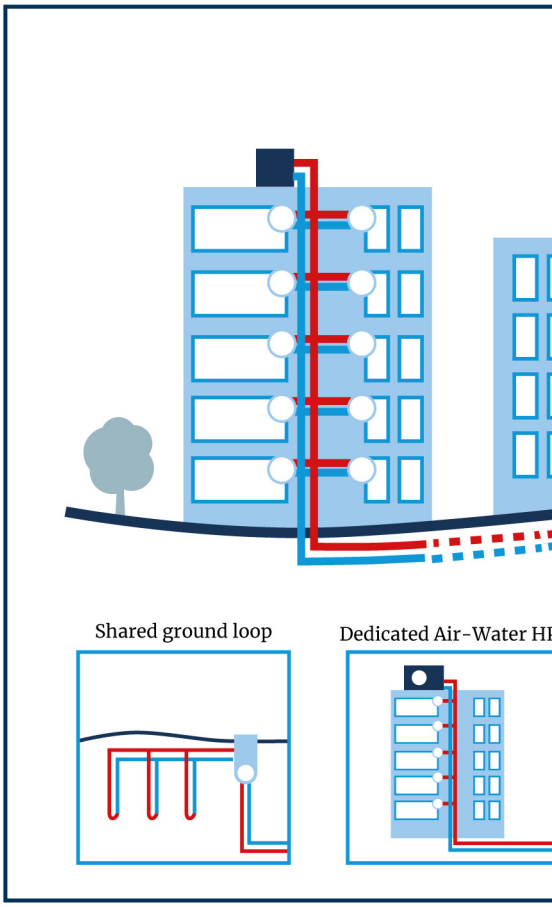
As the climate crisis worsens and urban populations grow, cities face increasing pressure to improve infrastructure and services. Cities need to be made more resilient against extreme weather incidents and heat waves. The use of fossil energy must be replaced by clean alternatives. This is not only a response to climate change, but also an obligation codified in EU law, notably the EU Energy performance of buildings and the Renewable Energy Directives.

The symbiosis of heat pumps, low temperature energy grids and the use of renewable electricity/heat provides a solution.

Low temperature thermal networks to unlock "the energy chest" of cities

Traditional district heating and cooling distributes high temperature thermal energy generated in central plants to its clients. Even using insulated pipes, some energy is lost in the distribution. Changing from central to decentralised networks and reducing operating temperature avoids this disadvantage.

Low temperature, multi-input-output networks connect all types of buildings requiring heating and cooling. They collect waste heat from many different sources (e.g. industrial processes, offices, data centres, or public infrastructure) and distribute it where it is needed. Heat pumps raise the temperature to the required level at the point of demand.



Heat pumps for clean thermal energy

Heat pumps extract heat from a source (air, water, ground or a thermal network), lifting it to a higher temperature level to provide heating. At the same time the source is slightly cooled. Heat pumps always provide useful heating and cooling and it depends on the system design which of these services can be used.

Connecting the many energy users and (waste) heat providers in a city through a thermal network and adding heat pumps of different types and capacities in apartments and buildings (see circles) enables the collection of waste heat and highest heating and cooling efficiency. One user's waste heat becomes another users heat source (see figure 1).

Multiple benefits for cities

The benefits for cities of transforming their heating and cooling infrastructure are plentiful.

- Replacing fossil fuels with clean energy reduces CO_2 emissions and air pollution, leading to better air quality.
- Collecting waste heat from cooling limits the heat island effect in cities.

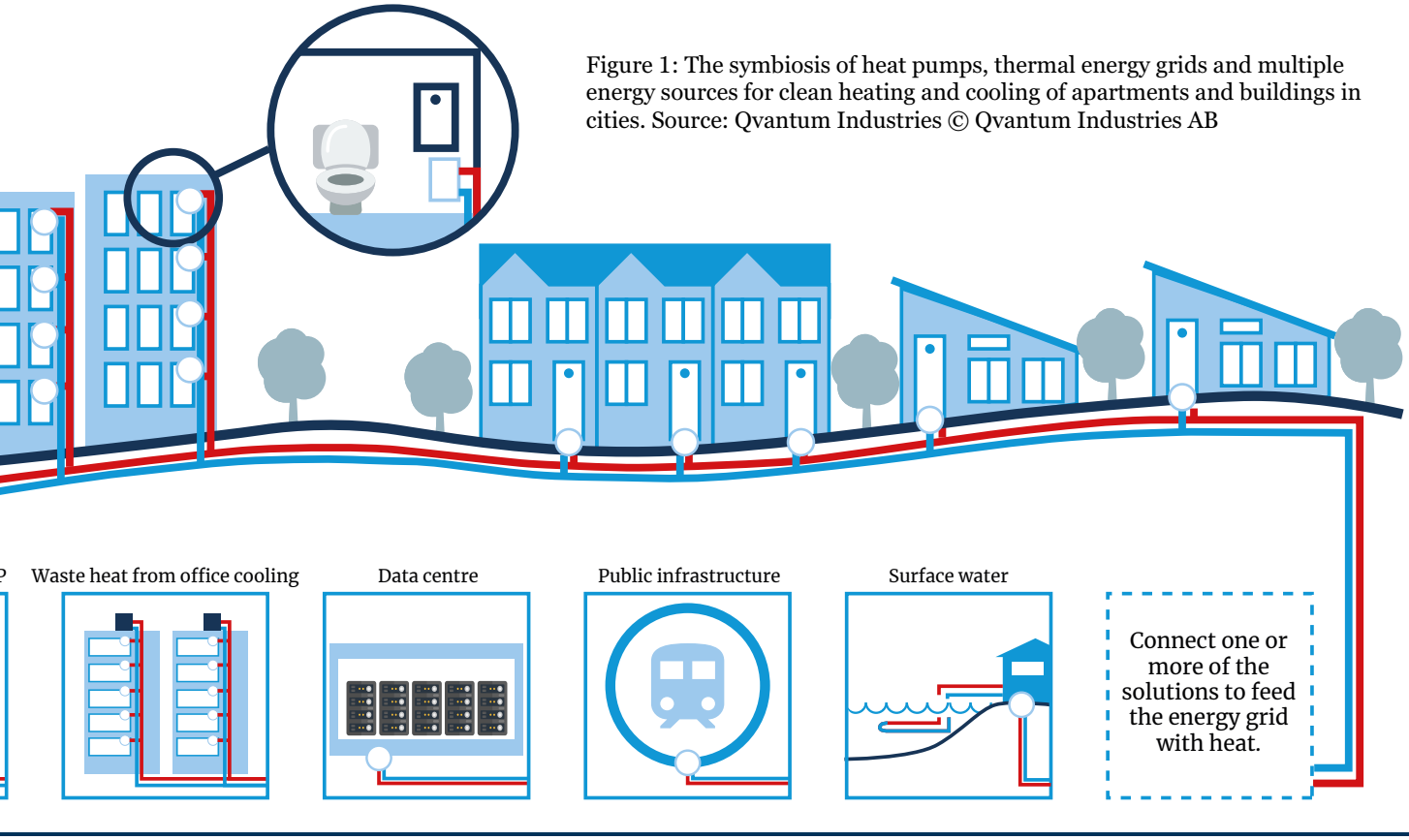


Figure 1: The symbiosis of heat pumps, thermal energy grids and multiple energy sources for clean heating and cooling of apartments and buildings in cities. Source: Qvantum Industries © Qvantum Industries AB

Buildings equipped with cooling help citizens withstand heat waves. Cities and citizens are more resilient to already observable climate change.

- Storage tanks and the energy grid itself operate as thermal battery, balancing the electric grid.
- Local energy sources, used by European technology solutions and designed and installed by a European workforce, help Europe become largely independent of fossil energy.

Breaking barriers to adoption

Implementing heat pump technology and thermal networks faces challenges. Upfront investment costs, regulatory hurdles, and limited public awareness can slow progress. Cities and policymakers should incentivise modern heat pump-based heating and cooling by making deployment easy and economically attractive. Cities should make thermal networks part of their public waste heat collection infrastructure.

Convincing humans is also key. Campaigns explaining policy, highlighting the benefits of clean heating and cooling and explaining how end users will be supported in their decision making will create trust and accelerate adoption by decision makers.

A path to sustainable cities

Urban heating can become decarbonised, efficient and sustainable while creating cleaner, more affordable, and more resilient communities. The technology exists, its potential is enormous. Let's make use of it. Clean heating and cooling is not just a choice – it is the cornerstone of Europe's energy and climate policy. ■

"Cities and policymakers should incentivise modern heat pump-based heating and cooling by making deployment easy and economically attractive"

About the author

Thomas Nowak is a long-term (renewable) energy aficionado. Apart from closely following the energy transition both in the electricity and heating sectors, he is the owner of a heat pump, a PV power plant and a building in which both peacefully cooperate. Currently, Thomas represents the Swedish scale-up Qvantum Industries as vice president government relations and public affairs aiming to position heat pumps as a viable solution for single and multi-family buildings. Before his current position Thomas was leading the European Heat Pump Association as Secretary General, and he is a member of its board today.

This opinion editorial is produced in co-operation with the European Sustainable Energy Week (EUSEW) 2025. See ec.europa.eu/eusew for more details.

Why education could seal the Green Deal

As the EU and its member states make significant investments in energy infrastructure, the success of the Green Deal depends on the ability of citizens to understand and adopt new technologies and practices.

By **Dr. Eng. Alexandru Muresan**, Technical University of Cluj-Napoca, CEO of Renergia, and EUSEW Young Energy Ambassador

Climate change can be regarded as a disruptive "black swan" event, compelling the allocation of substantial financial resources for investments in renewable energy sources, advanced energy infrastructure, energy storage solutions, hydrogen-based technologies, energy efficiency, and other sustainable innovations. However, I propose examining this situation from a different perspective — one that merges social, civic, and professional dimensions.

Many EU Member States have implemented support programmes to encourage the adoption of renewable energy systems in residential and commercial sectors, leading to a significant increase in the number of energy prosumers. However, even if they are not always aware of their lack of energy literacy, a considerable share of the consumers of this new renewable capacity (including some prosumers) do fully understand how their behaviour impacts the grid or the potential benefits of their choices to the energy system.

This phenomenon observed among the general population can be linked to the **Dunning-Kruger effect** — the tendency of non-experts to overestimate their understanding of complex matters such as the energy system. This is unsurprising, considering that energy infrastructure and market dynamics require advanced technical and economic knowledge, which is often inaccessible to individuals outside these fields. Based on the scientific foundation of this idea, another phenomenon with profound societal implications has emerged in public discourse: the artificial conversion of opinions into knowledge (pseudo-knowledge). This phenomenon underscores the importance of equipping citizens with the tools and resources needed to make informed decisions, particularly in areas like energy policy, where public opinion increasingly influences regulatory outcomes.

This calls for a deliberate effort to enhance individual capacity to engage with complex topics, including re-skilling initiatives and adapted educational programmes that enable citizens to grasp the intricacies of technological and economic systems altogether. Addressing the need for informed decision-making is not solely an intellectual endeavour but a fundamental step toward cultivating a knowledgeable and adaptable society equipped to navigate the complexities of a rapidly evolving energy sector, where all of us must play an active role.

The fundamental question arises: what is the gap between the pace of technological advancement and the average level of energy literacy within civil society?

To address these issues, I, as a EUSEW Young Energy Ambassador, recommend central and regional authorities to make education a cornerstone of the **European Green Deal**. This could be done by launching the program: **The Green Deal Education Initiative – Education First**. This initiative would support educational institutions — schools, high schools, universities, and parent associations — in adapting existing curricula and creating new educational subjects centred on the green

"The Clean Energy Transition will not happen without taking citizens on board"

Scan for the digital version, which includes relevant links to third party websites, or visit europeanenergyinnovation.eu and subscribe for free

transition. While I fully understand that the European Union has limited competences in the field of education and cannot directly change curricula or mandate new subjects, it can play a supporting role by collaborating with Member States and their Education Ministries. The EU's role should involve scaling up existing best practices, facilitating knowledge-sharing platforms, and **providing financial and technical support to Member States to adapt and enhance their educational frameworks.**

For younger generations, education is of paramount importance, as they will become the principal actors in achieving long-term climate goals, developing sustainable skills and competencies. For users of green technologies, whether it is residential, commercial use, or use by local public authorities, educational programmes are vital to maximising the efficiency of these technologies and facilitating their integration into daily practices.

Furthermore, technical education and vocational training for those working in the production, installation, and maintenance of these technologies are important to ensuring the optimal performance of green technologies across all sectors. In parallel with the investment programmes, the European Union must support Member States in implementing large-scale educational programmes by providing financial and logistical assistance to universities, research centres, and schools, thereby ensuring an efficient and sustainable transition for all stakeholders.

To unlock a large-scale adoption of green technologies, several practical measures and actions are required. First and foremost, the training of teaching staff is a priority, as educators play a key role in preparing future generations. This would require financial support and continuous professional development programmes will enable them to integrate sustainability-related topics into school curricula, equipping young people to face the challenges of the green transition.

Secondly, for the existing workforce, reskilling programmes such as "**Back to School**"[1] will facilitate the transition to roles within the green economy, providing the competencies required to meet new market demands.

Lastly, community involvement through local campaigns and parent associations is essential for reinforcing sustainability values and promoting lifelong learning, thereby fostering a culture of sustainability across society. These measures are fundamental to the success of the transition to a green and sustainable future.

The Clean Energy Transition will not happen without taking citizens on board and doing so, requires a historic educational effort. The Green Deal education initiative "**The Green Deal Education Initiative – Education First**" has the potential to mark a historic moment in transforming the European educational system, aligning it with the demands of a sustainable future. By prioritising education, we can cultivate a well-informed and skilled workforce capable of driving the ecological transition and supporting the European Union's ambitious sustainability goals. ■

About the author

Alexandru Muresan is a researcher, entrepreneur, and educator in the field of energy transition. A member of the Energy Transition Researcher Centre at the Technical University of Cluj-Napoca, he is also the CEO of *Renergia*, Romania's first sustainability app, which helps users lower energy bills and protect the planet.

This opinion editorial is produced in co-operation with the European Sustainable Energy Week (EUSEW) 2025. See ec.europa.eu/eusew for more details.

[1] *The "Back to School Re-skilling Program" could be implemented through partnerships with technical universities and high schools to train citizens whose jobs are impacted by the green transition. With financial support from the EU, these programs would offer practical courses to prepare individuals for opportunities in renewable energy, energy efficiency, and sustainable technologies.*

From tradition to transformation in the global energy sector

Innovations that were once distant prospects are having tangible impacts across Europe

By **Christopher Hudson**,
President at DMG events

While the global energy industry is always evolving, often reshaped by the shifting priorities of every country and region, it remains the very foundation upon which social and economic progress is built. Whether it's Europe's pursuit of stability and decarbonisation, the US drive for growth and stimulus, or the Global South's quest for development and economic empowerment, energy is essential for all, no matter the geography. The question therefore remains: how can the industry possibly address such a diverse array of demands? How can it balance the pressure for drastically reduced emissions with the unavoidable need to sustain growing populations and economies? The answer lies in the relentless pursuit of innovation, which has become the engine powering the transformation of the global energy landscape. For decades now, technological advancements have proven essential to industry growth and modernisation, often breathing new life into even the most established energy sectors. In oil and gas, the rise of next-generation extraction and transportation tools – including precision drilling, seismic imaging, and AI-powered pipelines – has helped to boost key outputs and reduce environmental impacts. Similarly, the emergence of Carbon Capture, Utilisation, and Sequestration (CCUS) is integral to the decarbonisation of heavy industry and power generation processes, turning what was once a waste stream into a source of value. Together, these cutting-edge projects are transforming traditional resources and value-chains into high-efficiency and low-carbon ecosystems.

But innovation has not simply improved existing resources and operations, it has also accelerated the development and expansion of nascent solutions that are shaping the future of energy. Renewable technologies offer a clear example: the average efficiency of commercial solar panels has increased by more than 30% over the past decade, and new wind turbine designs are making offshore wind more reliable than ever. Meanwhile, new low-carbon fuels such as hydrogen and bio-methane, which were once distant prospects, are now becoming commercially viable resources, thanks to innovative breakthroughs in electrolysis and pipeline infrastructure that facilitate production and transportation at scale.

These advancements, both in the sustainability of traditional fuels and the viability of new energy sources, are not being made in a vacuum. Instead, they respond to the priorities of our international system, and particularly the pressing need for a balanced, stable, and low-carbon energy mix that can meet the demands of our ever-growing modern economy. Nowhere is this more clear than in Europe, as the continent's commitment to energy innovation is deeply intertwined with its pursuit of long-term growth and sustainability. Across several landmark policies, the European Union has emphasized the role that innovation must play in

improving energy security and enhancing the bloc's domestic energy capabilities.

Take the Innovation Fund, an investment programme launched in 2020 to support innovative decarbonisation projects throughout the European Union. Backed by a substantial allocation of EUR 40 billion, the Fund has been integral to the development and deployment of more than 200 pioneering low-carbon technologies – including advanced CCUS solutions, energy storage tools, and sustainable shipping products – many of which are now transforming the bloc's energy landscape and improving its long-term resilience. Coupled with

repeated investments in local renewable energy capacity and modern gas and LNG infrastructure, these efforts are not only reducing emissions – they are laying the foundation for a secure and independent energy system that can fuel Europe's economic and digital ambitions.

Looking forward, further investment will be required to unlock the full potential of energy innovation as a driver of sustainable growth and progress. While the EU has made significant progress in mobilising capital for this very purpose, important gaps still remain, and many countries around the world still lack the funds needed to accelerate their own technological revolutions. In fact, while the size of the global climate technology market is expected to reach USD 149.27 billion by 2032, recent studies show that 80% of the money already allocated for climate tech research and development was spent in the UK, the United States and the European Union (EU). Moreover, most of this funding has been concentrated on renewables, and too often ignores the cutting-edge solutions that are transforming traditional resources into sustainable destination fuels.

Gastech 2025 – to be held in Milan under the theme of "Powering a Sustainable Energy Future" – offers a unique opportunity to bridge these important gaps, as top energy stakeholders from across the value chain will come together to align on the policies, projects, and investments that can accelerate energy innovation on a truly global scale. With a dedicated Climatetech Conference and Programme, and the participation of more than 1,000 industry-leading CEOs and international ministers, Gastech 2025 will serve as a catalyst for a sustainable, secure, and prosperous energy system, where the power of innovation is unleashed to redefine key sectors – including natural gas and LNG – and reshape the future of energy.

Perhaps most importantly, Gastech 2025 will also highlight the shared responsibility – and shared opportunity – of building a truly inclusive energy industry that responds to the needs of every country and geography. As the world's energy priorities evolve, so too must our approach to innovation and collaboration, as only by working together to elevate the most promising energy solutions can we continue to deliver growth and prosperity for all. Ultimately, energy will always be the foundation of social and economic advancement, but it is technology and innovation that will ensure this foundation remains strong for generations to come. ■

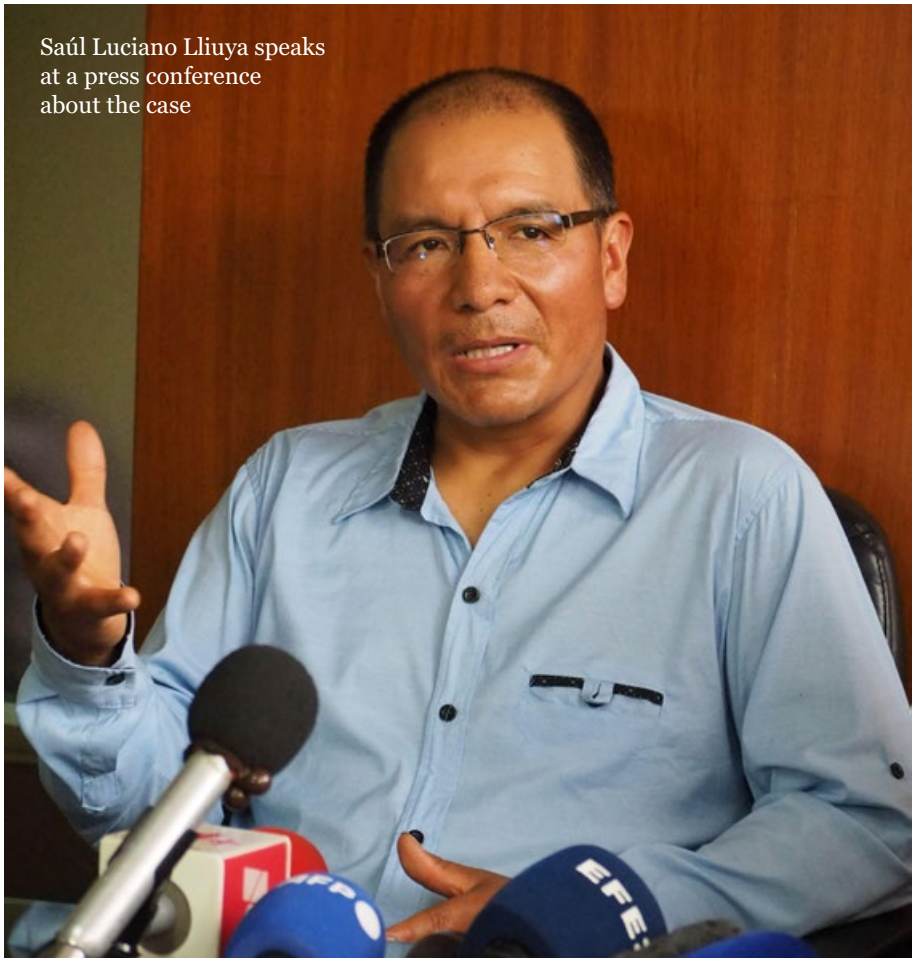
"Nowhere is this more clear than in Europe, as the continent's commitment to energy innovation is deeply intertwined with its pursuit of long-term growth and sustainability"

Gla

cial progress

A Peruvian farmer took on a German energy giant – and lost. But the ten-year legal case could be part of a much larger, slower movement.

By **Sam Meadows,**
EEI journalist


Saúl Luciano Lliuya speaks at a press conference about the case

As Saúl Luciano Lliuya worked high in the Peruvian Andes near his home in the city of Huaraz he started to notice the mountains changing. The glaciers were receding, swelling the size of the mountain lakes and, he began to fear, threatening a flood which could damage his home in the city below.

Blaming the changes on climate change, he sought legal redress from an unlikely source – an energy company based 6,500 miles away in Germany.

He first sued RWE, one of Europe's biggest firms, in 2015, claiming its role in contributing to historic emissions meant that it should contribute €17,000 to the cost of flood defences in Peru. On May 28, after 10 years of legal wrangling, his case was thrown out by a German court. But not before setting what campaigners argue is a significant legal precedent in the realm of climate litigation.

Although the Hamm regional court determined that the risk to Saúl's home was not high enough to justify his claim, for the first time in legal history it has opened the door to the idea that energy companies could be held liable for the cost caused by their emissions.

The risk of a flood

Back in 2015, Saúl's intention was just for his government and the international community to take the impact of emissions seriously. As a farmer and mountain guide he was acutely aware of the changes being caused by climate change. The Cordillera Blanca, the mountain range he lives in, has the highest concentration of tropical glacial lakes in the world. While glacial recession occurs naturally, scientists are clear that climate change has accelerated the process.

Glacial lakes sit below glaciers, in the areas hollowed out by their recession over millennia. Glacial lake outburst floods (GLOFs) occur when the level of a lake exceeds its banks. This can happen in two main ways. First, the glacier melts, increasing the water levels of the lake until the pressure causes it to burst its banks. Or, by a landslide or chunk of the glacier falling into the water, causing it to be displaced.

Saúl, more than most, has reason to be concerned by the possibility of a GLOF. His city Huaraz sits downstream of a glacial lake called Palcacocha. In 1941 it burst its banks, sending water surging through the valley and flooding the city below. Estimates as to the number killed vary, but as many as 5,000 people lost their lives.

According to Germanwatch, an NGO supporting him with the case, Palcacocha has grown more than fourfold since 2003, and 34 times since 1970. A minor flood occurred in 2003, and there have been numerous alerts in the years since. In January last year, an avalanche caused a 3-metre wave which was halted by an existing dam. Locals insist that a larger dam is required to permanently avert the risk to the population.

The case

Despite not operating in Peru, German energy giant RWE was targeted because of its role at the time as one of Europe's largest emitters. According to a 2014 report by the Carbon Majors Project, it contributed to roughly 0.5 per cent of global emissions. Saúl's claim, filed in Essen, Germany, on November 24, 2015, took this into account, requesting RWE made a proportional contribution towards the cost of the dam. This sum came to €17,000.

The court initially threw out the claim in 2016, saying that the link between RWE's emissions and the threat to Saúl's home was too indirect to establish liability. But a year later, a higher court in Hamm allowed an appeal.

After pandemic-related delays and a 2022 site visit to Huaraz, the case was finally heard in March this year. On May 28, the court revealed its decision. Saúl had lost. The direct risk to his home from glacial-related flooding in the next 30 years was only one per cent and not high enough to justify the claim, the court said.

But its longer findings didn't close the door entirely. In a press release published following the ruling, the court confirmed the grounds for the claim. "If there is a threat of adverse effects, the polluter of CO_2 emissions may be obligated to take preventive measures," it read. "If the polluter definitively refuses to do so, it could be determined, even before actual

"Despite the loss of this case, activists have hailed it as a victory, saying it sets a precedent and that polluters could one day be held liable for the costs of emissions."

costs are incurred, that the polluter must bear the costs in proportion to their share of the emissions."

It added: "The great distance between the defendant's power plants and the plaintiff's residence in Peru alone was not sufficient reason to declare the lawsuit unfounded."

The science

Saúl's case was underpinned by a growing field of study known as "climate attribution" science. It attempts to establish the extent to which human activities contribute to climate change. A study published in 2013 was one of the first high-profile examples of climate attribution science. It estimated that just 90 companies, many of which were fossil fuel firms, were responsible for two-thirds of emissions since the industrial revolution. But as the methods and data needed for attribution have become more precise, research has become more common. More than 500 studies have attributed extreme weather events to increased gas emissions, according to Zero Carbon Analytics.

There is a broad scientific consensus that global warming caused by climate change has accelerated glacier retreat in Peru and elsewhere. A study of glacial retreat between 2000 and 2023 published in Nature earlier this year found that the rate of ice loss increased by 36 per cent between the first and second periods observed, attributing this to human greenhouse gas emissions. Glacial retreat increases the size of glacial lakes and therefore the risk of GLOFs.

The calculation of the emissions attributable to RWE came from a 2014 study by the Carbon Majors Project, another example of climate attribution science.

Noah Walker-Crawford, a research fellow at the Grantham Institute, which is affiliated with LSE and Imperial College London, said climate attribution science is growing in importance and underpinning a greater number of legal efforts. "The science is giving us a much clearer idea of what the impacts [of climate change] are and who is contributing," he said. "That means a lot of cases are becoming possible that just weren't possible before."

A global precedent

Despite the loss of this case, activists have hailed it as a victory, saying it sets a precedent and that polluters could one day be held liable for the costs of emissions.

Murray Worthy, a senior researcher at Zero Carbon Analytics, said future plaintiffs could point to this decision to argue that their cases should be allowed to proceed. "This is a historic turning point in climate litigation and efforts to seek accountability for large polluters," he said. "By setting a precedent, it enables a new wave of cases to come through."

According to a study by Zero Carbon Analytics, there are currently 43 similar cases currently ongoing. Some 54 per cent of all cases seeking financial redress for the impacts of climate change have targeted the fossil fuel industry. Depending on the level of climate damages estimated, Zero Carbon Analytics estimates that the cost could exceed $38 trillion a year by 2049.

The number of cases seeking climate damages has already increased in the past decade. Some 70 per cent were filed since the Paris Agreement in 2015.

Walker-Crawford said: "The Higher Regional Court of Hamm established a powerful legal principle: corporate greenhouse gas emitters can be held liable for their contribution to climate change impacts."

Sébastien Duyck, senior attorney at the Center for International Environmental Law, said that the judgement "shatters the wall of impunity for major polluters".

"For the first time, a European court has affirmed that climate victims can pursue justice, and polluters can be held legally accountable," he added. The case would provide a "legal spark" to others in the field.

Several other climate litigation cases are currently progressing through the courts. Hugues Falys, a farmer from Belgium who claims his livelihood has been impacted by climate change, is suing TotalEnergies. A group from the Indonesian island of Pari have sued Swiss cement company Holcim for funding for flood defences to mitigate against climate risks. The attorney general of California has also taken action against Exxon Mobil in relation to plastic pollution in the state.

Despite the fact that this ruling was made in Germany, experts argue that the existence of similar legal systems and precedents, particularly in property law, mean that courts in other countries are likely to point to the ruling in future decision making.

Industry running defence

However, RWE did not accept the analysis of the activists, academics and legal experts. Responding to the judgement, a spokesman said that the attempt to use the case to create a precedent holding individual companies responsible "had failed". The spokesman warned that such a precedent would have "unforeseeable consequences" because "claims could be asserted against any German company for damage caused by climate change anywhere in the world".

When asked by *European Energy Innovation* to explain this reasoning the spokesman said that three other regional courts have taken a different legal view and the Hamm regional court "cannot overrule" these decisions. "The court did not examine and therefore did not rule on whether and to what extent RWE can actually be held legally responsible for the effects of climate change as a result of its emissions," he added.

Germanwatch says that the case failed on "evidentiary grounds", not those of admissibility. "Far from 'closing the door', this in fact leaves it wide open for better-evidenced future cases," it said.

Worthy said that there are probably "unavoidable" financial risks for energy firms. "If large polluters want to avoid these kinds of costs, having in place science-based plans for reducing their emissions in line with the temperature goals of the Paris Climate Agreement is likely to be something that courts would take very seriously," he added. "Those who don't have that really are exposing themselves."

The response from the rest of the industry has been muted so far. Energy UK, the trade body representing the UK's biggest energy firms, said it was aware of the case but had not had any involvement. Another UK trade body and a leading European industry body also declined to comment.

One person who has not been disheartened by the headline loss of the case is Saúl himself. "This case was never just about me," he said in a statement on the day of the ruling. "My case has shifted the global conversation about what justice means in an era of the climate crisis, and that makes me proud.

"Today the mountains have won." ■

Upcoming events 2025/2026

JUNE
10-12
EU Sustainable Energy Week
Brussels

PCIC energy EUROPE

JUNE
17-19
PCIC Energy Europe
Madrid

CONNECTING HYDROGEN EUROPE
18-19 June 2025 | IFEMA MADRID

JUNE
18-19
Connecting Hydrogen Europe
Madrid

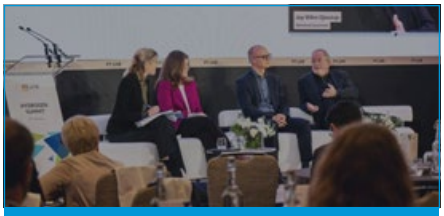
MOVE
MODELS • TECHNOLOGY • SUSTAINABILITY

JUNE
18-19
Mobility Reimagined - MOVE
London

JUNE
23-25
4th European BESS Conference
Berlin

RC RESET CONNECT LONDON
24 - 25 June 2025 | excel
The award-winning sustainability and net-zero event for business, investors and innovators

JUNE
24-25
Reset-Connect
London



JUNE
24
FT Live Hydrogen Summit
London

SOLAR & STORAGE LIVE España

JUNE
25-26
Solar & Storage Live
Valencia

Carbon 2025

JUNE/JULY
29-4
Carbon 2025
The World Conference on Carbon
Saint-Malo

EUROPEAN SCIENCE EDUCATION RESEARCH ASSOCIATION ESERA 2025 Copenhagen

AUGUST
25-29
ESERA Sustainable Conference
Copenhagen

cenex EXPO
NET ZERO - CONNECTED AUTOMATED MOBILITY

SEPTEMBER
3-4
CENEX Expo
UK

Gastech

SEPTEMBER
9-12
Gastech inc Gastech Hydrogen
Milan

SEPTEMBER
16-17
Large Scale Solar - Southern Europe
Athens

SEPTEMBER
16-17
European Research & Innovation Days 2025
Brussels

SEPTEMBER
22-26
EUPVSEC
Bilbao

OCTOBER
6-10
European Geothermal Congress
Zurich

OCTOBER
8-10
Biomass Power On 2025
Stockholm

OCTOBER
21-23
Carbon Capture Technology Expo
Hamburg

OCTOBER
29-30
Future of biofuels
Gothenburg

NOVEMBER
4-6
Smart City Expo/World Congress
Barcelona

NOVEMBER
12-13
Wood Mackenzie Hydrogen Conference
London

NOVEMBER
12-13
London EV Show
London

NOVEMBER
18-20
ENLIT Europe 2025
Bilbao

NOVEMBER
21-23
6th World Conference on Climate Change & Global Warming
Copenhagen

NOVEMBER
25-27
Motorship Propulsion & Fuels
Hamburg

DECEMBER
2-4
Politico Sustainable Future Week
Brussels

DECEMBER
9-11
BioGas Convention & Trade Fair
Nuremburg

FEBRUARY
24-25
Energy Storage Summit (Europe)
London

MARCH
24-25
Lisbon Energy Summit & Exhibition | Lisbon

APRIL
15-16
Energy Tech Summit Europe
Bilbao

World Sustainable Energy Days 2026

25 – 27 February 2026
Wels/Austria

CALL for PAPERS:
10 October

Conferences:

- European Energy Efficiency Conference
- European Pellet Conference
- Industrial Energy Transition Conference
- Smart E-Mobility Conference
- Young Energy Researchers Conference
- Innovation Workshops

www.wsed.at

OÖENERGIESPARVERBAND

upper austria

OÖ Energiesparverband, Linz/Austria, Tel. +43 732-7720-14386, office@esv.or.at, www.wsed.at