REVOLVE

QUARTERLY INSIGHTS INTO A CHANGING WORLD

N°60 | Summer 2026



AI x Solar

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Solar Flair

The Iberian energy blackout of April 2025 was met with by many in central Madrid a giddiness like that of a child on a snow day. Terraces across the city quickly filled up with people who, unable to work without Wi-Fi, were more than happy to swap conspiracy theories over a few beers.

For others, it was more serious. At the Atocha train station, anxious travellers queued around the block and into the night with no idea when they would be able to get home. The blackout, caused by a heady cocktail of interlinked factors rather than a cyber-attack, wiped as much as 1.6 billion euros off the Spanish economy, business lobby group CEOE claimed at the time.

The blackout shone a light on just how much we rely on power grid efficiency, stability, and resilience to external and internal disturbances. Geopolitical crises offer us these timely reminders, too. The wars in Ukraine and Iran continue to destabilise our energy markets, affecting the lives and habits of everyday people.

And so, as the EU's top brass scratches their heads about how to build energy independence at a time when demand is rising in part due to our growing affinity to using AI ('A Match Made in Heaven,' p.8) solar power emerges on the horizon as an increasingly attractive pathway to greater sustainability.

Indeed, solar installation deployment and its renewable energy production have been growing for years, but the next steps to scaling up have less to do with continued growth and more to do with operations and management, as we discover in our lead feature 'Why Solar's Next Leap Is Operational' (p.10).

Take a tour of renewable energy projects and building efficiency around Europe in our VIEWS ('Visualizing Energy', p.19) and then explore how we keep can cool data centres amid an AI boom in 'Data on the Water' (p. 36) as well as our towns and cities amid ever more ferocious heatwaves in 'Keeping Our Collective Cool' (p.44). Read on for much, much more.

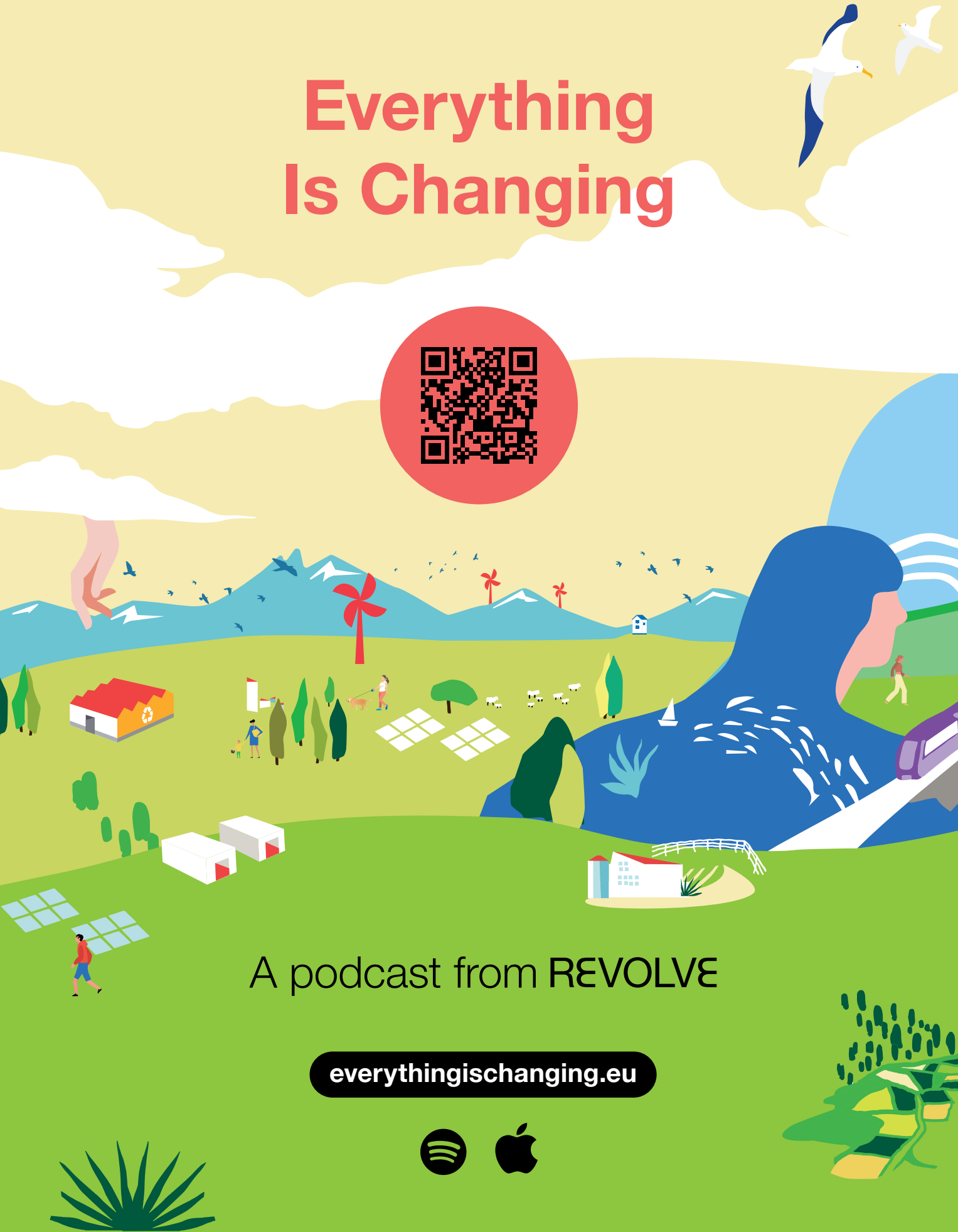
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Jake Threadgould

Editor-in-Chief

Everything Is Changing



A podcast from REVOLVE

everythingischanging.eu



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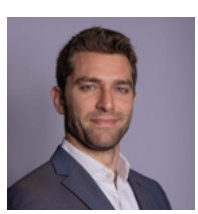
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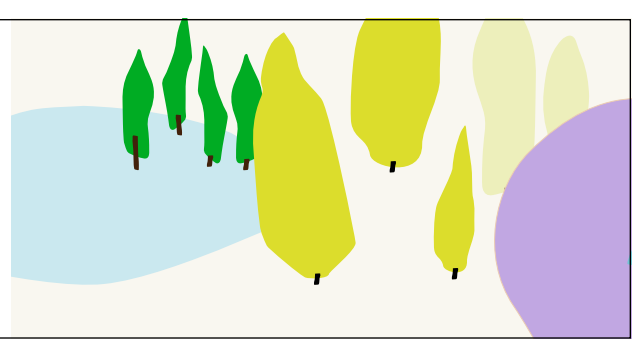
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REVOLVE x Sustainability

REVOLVE is committed to climate-conscious reforestation and tree-planting initiatives as part of our company's sustainability policy to mitigate the impact from our business and project travel activities.

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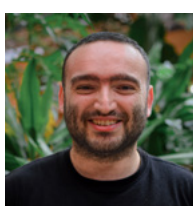
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Cover image:

The PVOP project consortium during a visit to a case study site in Zaragoza, Spain. Photo: Jake Threadgould / REVOLVE

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A Match Made in Heaven

WRITER: **TRIGYA SINGH,**
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AI and electrotech are perfect partners for modern economies.

Renewable energy, storage, and smart grids will play a vital role in supplying energy-hungry data centres. The fossil fuel industry is promoting a false narrative that data centres must rely on their energy products.

But the future is not one of burning fossil fuels with huge energy losses. Instead, it is smart energy networks that move energy efficiently back and forth between electrotech, including solar panels, wind turbines, batteries, electric vehicles, heat pumps, and data centres that can act as flexible system assets.

Fossil fuel lobbyists are terrified that their electrotech rivals have this huge potential to combine with digital technologies as a central motor of innovation and economic prosperity. AI is already being used to intelligently integrate renewable energy so it can be maximised via electricity grids.

Like King Canute trying to hold back the inevitable tide of scientific progress, the advocates of oil, gas, and coal know there are limitations to using their analog fossil fuel tech with advanced digital technologies. They hope that no one will notice the absurdity of running shiny new AI-enhanced digital technologies on 20th-century energy sources.

Looking beyond a fossil-fuelled AI narrative

The fossil fuel industry keeps spotlighting data centres' natural gas connections, but this obscures a bigger truth: AI data centres can and will run on cheap and reliable renewables.

The 2026 Ember Global Electricity Review shows that renewables reached 43% of global electricity generation in 2025, surpassing coal's 33% share for the first time in over a century. Meanwhile, in 2025 solar power met 75% of global electricity demand growth.



Illustration: Dariana Guevara/ REVOLVE

IRENA's new landmark report, '24/7 renewables: The economics of firm solar and wind,' shows that in prime solar and wind regions, hybrid systems combining solar, wind, and battery storage now deliver round-the-clock power at lower costs than fossil fuels, with firm costs as low as $54 (46 euros) per MWh compared to over $100 per MWh for new gas globally.

The direction of travel is clear, and Big Tech knows this. That's why in 2025, the tech sector signed around 40% of all corporate power purchase agreements for renewable energy.

There's more they can do, though. When they invest in data centres, instead of annual renewable energy certificates, which let a company claim green power while drawing fossil fuel electricity in real time, they should follow leading operators who are shifting to hourly, locationally matched procurement. When hyperscalers commit to hourly matching, they become anchor customers for renewable buildout that serves entire national grids.

ASEAN's data centre electricity demand is projected to nearly double by 2030. Latin America's data centre market is set to reach $14.3 billion by the same year. Sub-Saharan Africa is at the earliest stage of a buildout that will accelerate through the decade. These markets are making foundational choices right now, and they sit on top of the world's best renewable resources.

Like everyone else, Big Tech wants to protect its data centres from fossil fuel volatility. As oil and gas markets remain exposed to geopolitical shocks, including ongoing disruptions in the Strait of Hormuz, energy sovereignty through renewables has become a strategic imperative, not a value statement.



Why Solar's Next Leap Is Operational

WRITER: **AHMETCAN UZLAŞIK**



1

Solar is a shining example across Europe amid energy crises, but grid bottlenecks and price volatility demand smarter, more efficient operations.

The exposure of the EU's energy markets to external affairs is rendered clear during geopolitical crises. Russia's full-scale invasion of Ukraine in 2022 prompted a near pan-EU scramble to decouple from Russian gas. Four years later, the United States-led attack on Iran and the resulting blockade of the Strait of Hormuz – a maritime route for some 20% of the world's oil and liquified natural gas (LNG) supply stream – has rocked the bloc's energy security once again.

During times of crises, the question of whether domestic renewables could help to stabilise the EU market inevitably arises, often with some urgency. In 2025, the EU's clean energy investments totalled some 418 billion euros (around $491B), compared to 308 billion euros in 2021, just before the 2022 energy crisis.

Renewables accounted for nearly half the EU's energy supply in 2024 and 2025, with solar contributing 11% and 13%, respectively. In 2008, solar energy's impact on the European energy mix was modest at just 1%. Over the years, solar became the fastest growing renewable energy source, every year saturating more of the EU's renewable energy hunger.

A vulnerable continent

To put the EU's energy dependency into context, it helps to look at some numbers. Before its invasion of Ukraine, Russia provided around 40% of the EU's natural gas but that figure has since dropped to 12%, according to the EU. In 2025, 27% of total gas and LNG purchases came from the US, instead.

The EU's energy imports dependency rate was nearly 60% in 2024, underscoring the continent's high dependency on imported fossil fuels on its path to net zero by 2050.

This is what leaves EU member states so exposed to external goings-on. Disrupted energy flows create price volatility in energy markets, as inflation rises and electricity prices increase significantly. In the words of European Commission president Ursula von der Leyen, the attacks on Iran have cost the EU 500 million euros per day. She took the occasion to highlight Europe's need to reduce its dependence on fossil fuels and accelerate its clean energy transition.

Photovoltaics specialist Luis Narvarte, professor at the Polytechnic University of Madrid (UPM) and coordinator of the EU-funded PVOP project, told REVOLVE that the "real challenge" was not just producing electricity, but transforming how energy is consumed.



2



3

"Europe must electrify sectors like heating, transport, and industry, which still rely heavily on fossil fuels. Solar will provide a large share of this electricity, but it must be integrated into a broader system transformation," he said.

Solar has been a major component of this green transition strategy. Over the years it has become the cheapest source of power. However, despite its fast growth, solar photovoltaic (PV) technology needs to develop solutions for its operational bottlenecks.

Solar's flair

Our harnessing of solar energy has come a long way since the photovoltaic effect was first discovered by Edmond Becquerel in 1839. It took 115 years after that milestone to produce the first efficient solar cells, and then several decades more to deploy 3 GW of production capacity globally. But then it only took 13 years to scale from 3 GW to 300 GW by 2016. As of 2026, global solar photovoltaic (PV) capacity is approaching 3 terawatts (TW) worldwide.

The solar picture of the EU is one of the most ambitious globally. Solar power expanded rapidly in the late 2000s before slowing between 2013 and 2017, partly due to EU tariffs on inexpensive Chinese solar panels. After the tariffs were removed in 2018, growth accelerated again. The sector also proved resilient during the Covid-19 pandemic, with installations increasing by 15% in 2020.

In 2024 alone, a total of 65.1 GW of solar PV was installed across the EU. By 2025, the cumulative installed capacity of PV in the EU had reached 406 GW, with Germany leading the market with 121 GW, over half way to its 2030 goal of 220 GW.

One of the reasons for Germany's pre-eminence in the solar sector is its introduction of the feed-in tariff (FiT) law. Dating back to early 1990s, the policy guarantees renewable energy producers a fixed price for the electricity they supplied to the grid. Spain is another leading EU country in solar installation, adding 13.8 GW in 2025 alone and bringing its total solar capacity to around 48 GW. Many experts argued that this ambitious investment in clean energy was one of the reasons why Spain was relatively less affected by the latest crisis in the Middle East.

The production of solar energy is not a monolithic event. It can range from small-scale residential rooftop systems to large commercial and industrial installations, as well as utility-scale solar farms supplying electricity directly to national grids.

Solar development in the European Union has historically been driven by rooftop installations, a trend further accelerated by the energy crisis. In 2023, residential, commercial, and industrial rooftop solar segments collectively grew by 61% year-on-year, with the commercial and industrial sector recording the strongest gains.



4

The rapid expansion of solar PV across the European Union is not only accelerating the clean energy transition but also driving significant employment growth across the sector.

In 2024, the EU solar sector employed nearly 865,000 people, with the vast majority of jobs linked to deployment activities, which accounted for 85.9% of total employment. As solar installations continue to increase, employment in the sector is expected to rise sharply, potentially reaching 916,000 jobs by 2029 according to SolarPower Europe.

Cheap but problematic

Although its boom is well-acknowledged, solar energy is not immune to operational problems. The rapid expansion brought another reality check – building photovoltaic capacity is no longer enough.

As solar installation rises across the continent, operational complexity is increasing just as quickly. Grid congestion, curtailment risks, volatile electricity prices, and tightening profit margins are forcing operators to rethink how PV plants are managed.

"Growth is no longer the central issue," Luis Narvarte told REVOLVE. "The challenge today is managing what already exists. Operators are dealing with an unprecedented volume of data coming from their plants."

Modern PV installations continuously generate operational information ranging from irradiance – the amount of solar energy reaching a surface at a given moment – and temperature to inverter behaviour, tracker positions, alarms, weather inputs, and market signals. Yet much of this data gathers just dust. According to Narvarte, many supervision teams are overwhelmed by the scale of information flowing from increasingly complex solar portfolios.

As a result, even advanced solar plants often produce less energy than expected. Small issues like dirty panels, faulty connections, overheating equipment, or poorly aligned trackers can gradually lead to major energy and financial losses, especially across large solar farms.

Let's imagine a massive utility-scale solar farm producing 500 GWh of electricity annually, enough to power roughly 150,000 European households. A seemingly small 5% performance loss would mean around 25 GWh of lost electricity every year, a chunk that would translate to millions of euros in lost revenue over the project's lifetime.

Then what is the solution? This is where artificial intelligence and big data are beginning to reshape the sector.

How AI and big data are changing PV operations

In order to increase the efficiency of the PV operations, Europe can no longer rely on reactive maintenance. This new generation of digital tools is emerging to transform photovoltaic operations to secure a data-driven management.

Advanced sensorisation systems now monitor solar plants at string (a group of solar panels connected together as one unit), PV generator, sun trackers, power stations, and environmental dimensions. This helps improve visibility into real operating conditions and degradation trends. A good example is the digital twin models, which aim to create virtual replicas of PV plants continuously updated with live field data. This helps operators reduce forecasting uncertainty and better understand how installations behave over time.

Another example is the AI-based fault detection systems, which are changing the rules of the game by transforming how O&M is carried out. According to GreyB, a consulting firm, modern solar arrays typically lose between 0.5% and 2% of their energy output annually due to performance degradation. At the same time, studies show that around 45% of solar installations operate with at least one undetected fault, often reducing production for months before being identified.

Instead of waiting for failures to appear, machine learning models can identify abnormal patterns early, often before they affect production. According to Narvarte, this allows operators to move from reactive troubleshooting to predictive maintenance, reducing downtime and unnecessary inspection costs.

"Artificial intelligence becomes essential because the volume of operational data is simply too large to process manually," Narvarte explains. "AI allows us to detect anomalies, predict failures, and optimise plant performance much faster and more accurately."

The changing mindset in PV

One of the European initiatives attempting to apply these technologies at scale is the EU-funded PVOP project, which analyses operational PV data in more than 11 GW of PV plants while developing eight interconnected technical solutions focused on sensorisation, smart tracking, automated fault diagnosis, predictive asset management, electricity market forecasting, and AI-driven battery control.

"One of the biggest challenges today is the enormous amount of operational data generated by modern PV plants," says Laura Barrutia, researcher at the Solar Energy Institute of UPM. "As the sector enters the terawatt era, digitalisation, big data, and artificial intelligence become essential for improving plant performance."

Barrutia, who works on PVOP's sensorisation solution, explains that the project focuses on reducing uncertainty by improving how key operational variables are measured. "The quality of the data is fundamental," she says. "More reliable measurements allow us to build more accurate digital twins and better predict real plant behaviour."

Other PVOP solutions focus on scaling inspection and maintenance processes for increasingly large solar portfolios. According to Nuno Marques, CEO of Aeroprotechnik, traditional inspection methods are no longer sufficient for utility-scale PV systems. "Manual inspections are too slow and limited for the scale of modern solar plants," he says. "Issues can remain undetected for months or even years."

Marques explains that PVOP's AI-powered aerial inspection systems combine multispectral imaging, automation, and predictive analytics to monitor solar assets with minimal human intervention. "We are moving from reactive inspections to predictive, data-driven operations," he says. "That shift is essential for the terawatt era of solar energy."

PVOP doesn't approach solar farms as static electricity generators. Rather, the project sees them as dynamic and data intensive systems requiring ongoing optimisation.

With the rise of renewable penetration, electricity markets are becoming more volatile and less predictable. This is reflected in negative electricity prices, curtailment periods, and grid bottlenecks, curtailment periods, and grid bottlenecks, especially in highly solarised regions across Europe.

Recent market developments already show how rapidly this issue is escalating. According to a recent Euronews report, Spain recorded nearly 400 hours of negative electricity prices in the first months of 2026 alone, largely driven by excess solar and wind generation combined with insufficient grid flexibility and storage capacity.

Similar trends are also emerging in Germany, France, and other highly renewable-dependent markets across Europe, where operators are increasingly being forced to curtail production during peak generation hours.

To adapt, AI-based forecasting tools are helping solar operators predict electricity price swings by analysing weather, energy demand, and grid conditions. Combined with smart battery systems, they allow PV plants to store electricity when prices are low, sell it when prices rise, reduce wasted energy, and support grid stability.

According to Narvarte, this marks a broader shift in the role of solar infrastructure.

“The next challenge is not simply producing electricity,” he says. “It is producing, storing, managing, and trading that electricity in the most intelligent way possible.”

But these operational challenges are not unique to Europe. As utility-scale solar expands globally, similar issues around data management, grid integration, and profitability are emerging across major PV markets worldwide.

In that sense, Narvarte also emphasised that the solutions developed under PVOP are not limited to Europe alone. “The photovoltaic market is global,” he says. “European companies managing PV assets often operate across multiple continents, from South America to Asia and Australia.”

According to Narvarte, the challenges facing the sector are increasingly shared worldwide. “Issues such as data overload, performance optimisation, and system integration are not specific to Europe,” he explains. “They are becoming common across global PV markets.”

As a result, PVOP’s solutions are being designed with scalability in mind. “These technologies can be applied wherever large-scale PV systems exist,” Narvarte says, “making their impact potentially global.”

Europe’s latest energy crises have once again exposed how vulnerable the continent remains to geopolitical shocks, fossil fuel dependency, and unpredictable energy markets. While solar power has become one of the EU’s fastest-growing and cheapest energy sources, the next phase of the transition will depend not only on expanding capacity but on operating that capacity more efficiently.

In this increasingly unstable energy landscape, the future competitiveness of solar is not about who installs the most panels, but who can operate them with the greatest efficiency, flexibility, and resilience.

1. Solar panel installation, 2022, Germany. Photo: Markus Spiske / Unsplash
2. A battery testing site involved in the PVOP project. Photo: Jake Threadgould / REVOLVE
3. The PVOP project consortium during a visit to a case study site in Zaragoza, Spain. Photo: Jake Threadgould / REVOLVE
4. Solar farm, 2017, United States. Photo: American Public Power Association / Unsplash
5. Taipei Energy Hill solar park from above, 2020, Taiwan. Photo: Anders J / Unsplash



5

PVOP

SUN-POWERED PROGRESS

PVOP is transforming Europe's approach to solar energy by leveraging advanced artificial intelligence and big data. The project develops and validates eight technical solutions to address the sector's main challenges through the analysis of real operational data from over 11 GW of PV systems. By advancing solar technology, PVOP supports the EU's sustainable energy goals.

8 Technical Solutions

- Sensorization Toolkit
- Smart Tracking Control
- Digital Twins
- Electricity Market Prediction Tool
- PV Portfolio Management System
- Aerial Inspection AI System
- Fault Detection AI Systems
- Multi-Strategy Control of Batteries

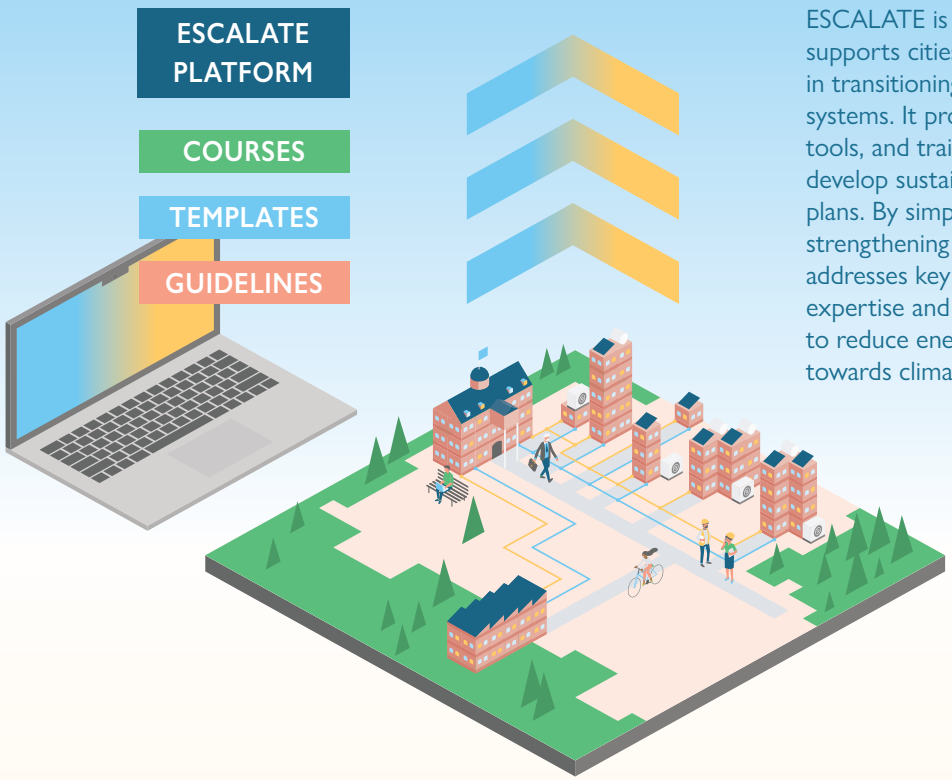
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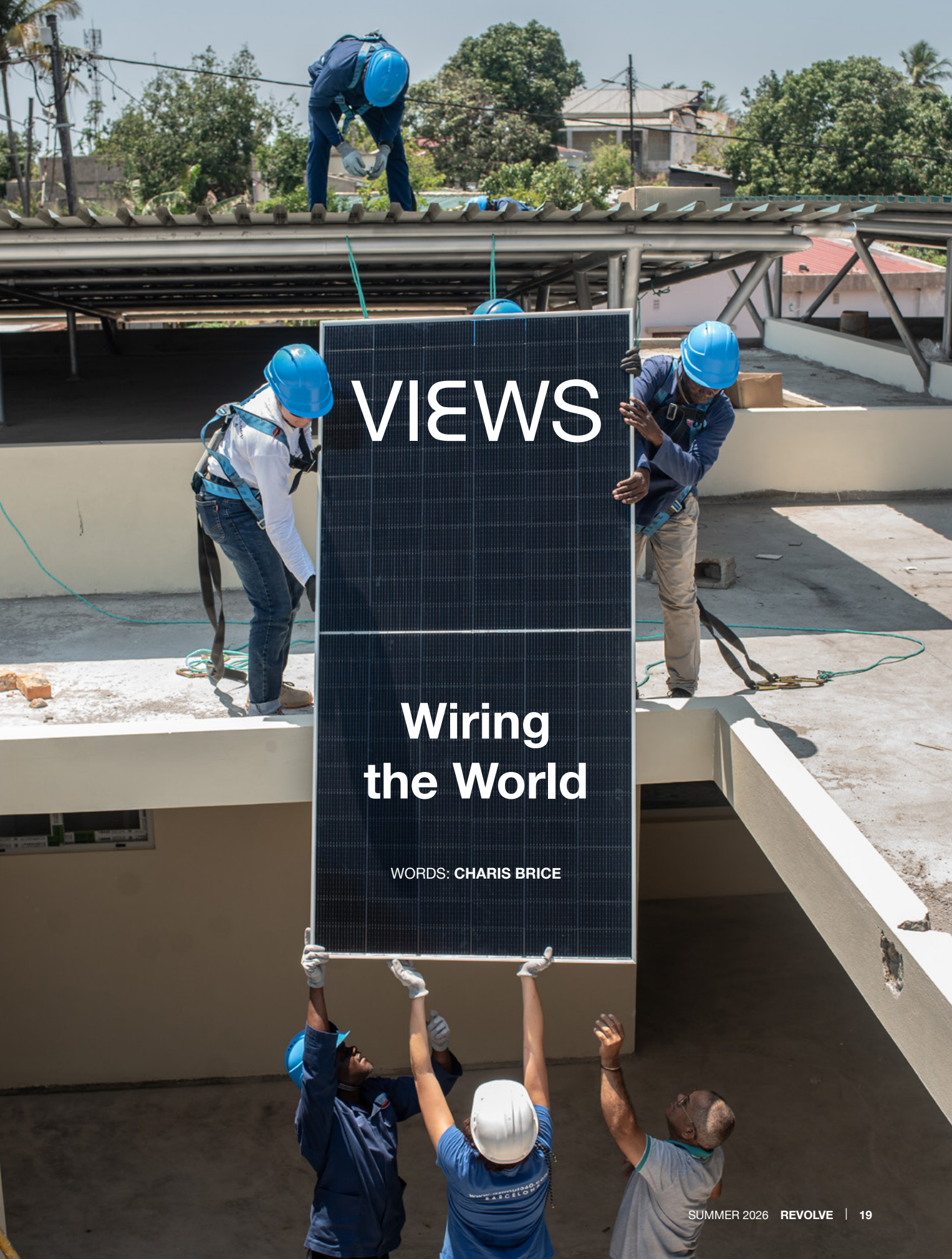
ESCALATE is an EU-funded project that supports cities with over 45,000 inhabitants in transitioning to clean and efficient energy systems. It provides practical methodologies, tools, and training to help local authorities develop sustainable heating and cooling plans. By simplifying complex processes and strengthening local capacity, ESCALATE addresses key barriers such as limited expertise and resources, enabling communities to reduce energy use, cut emissions, and move towards climate-neutral cities by 2050.

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VIEWS

Wiring the World

WORDS: **CHARIS BRICE**

The green transition is one of the great human projects of this century. It's not built by policy alone, but by the sweat and grit of those who make it happen.

Europe's building stock is aging and inefficient. Approximately 220 million of its buildings were constructed pre-2000; a time before energy ratings became mandatory, when double-glazed windows were an unnecessary luxury, and heating ran on fossil fuels without smart controls.

But in the next decades, policy aims to bring the oldest building stock in the world in line with the realities of climate change. That will be done by adding insulation, improving cooling and heating systems, and using renewables to run buildings. The Energy Performance of Buildings Directive from the European Commission aims to fully decarbonise Europe's buildings by 2050.

The urgent need for renewables is not just a European issue – it is a global one. The entire world must contend with the effects of a changing climate, and using renovation as a response to these changes requires a workforce that can quickly adapt to and learn new technologies and processes.

By necessity, electricians become energy specialists, builders take on retrofit coordination, and entire crews develop sustainability expertise previously unheard of in their field.

This VIEWS honours the thousands of humans who do the work to help our buildings become more sustainable and allow us to leave a gentler mark on our planet. ●

Photographs have been provided by Azimut 360, a non-profit renewable energy engineering cooperative based in Barcelona, Catalonia (Spain) working to promote a just and sustainable energy transition through the values of the Social and Solidarity Economy, and by Build Better Lives, a pan-European people-oriented campaign gathering nearly 100 social justice, housing, climate, and health civil society organisations, that aims to ensure decent, affordable, and energy efficient house for all.

Cover: Azimut 360, in collaboration with Fund Ulls del Mon, installs a solar energy system at the Provincial Hospital of Inhambane, Mozambique. Photo: Azimut 360



A 33 kWp solar agro-voltaic installation developed by Mbolo Association, brought to life in Tujereng, Gambia, by a group of activists. The panels power irrigation, milling, agricultural machinery, food refrigeration, and digital connectivity for the community, in partnership with the University of Gambia and family-owned agro company Afrifarm. Photos: Azimut 360







A worker installs solar panels in Barcelona, Catalonia, Spain, as part of a growing network of shared self-consumption projects, bringing community-owned renewable energy to residents across the city. Photo: Azimut 360

Above: Workers partnered with Azimut 360 in Malawi, Africa. Photo: Azimut 360
Below: Technicians install inverter-chargers and battery storage units as part of an off-grid energy system. Photo: Azimut 360



Azimut 360 and local partners document the façade works at Sant Joan de Déu Hospital. Photo: Azimut 360





Azimut 360 completed a solar installation at the Mediterranean Institute for Management ISMM in Tetouan, Morocco, delivering hands-on training for women of the cooperative Sunpower. The project was supported by the City Hall of Barcelona in collaboration with the City Hall of Tetouan.
Photo: Azimut 360

Above: Azimut 360 technicians navigate the heat and physical demands of urban solar installation, wiring Barcelona's residential communities into a shared clean energy future – one rooftop at a time. Photo: Azimut 360
Below: Barcelona has tripled its municipal solar power potential since 2023, putting 91 new installations into operation in just two years, reaching a total of 268 active facilities with 11,449 kWp of installed capacity, as per the local government. Photo: Azimut 360

Above: A technician installs solar panels on a rooftop in Spain. Photo: Azimut 360
Below: Solar panel installation in Tetuan, Morocco. Photo: Azimut 360

Above: The following photos from Build Better Lives tell the story of a former military site in Rome that is being transformed into affordable, energy-efficient homes for 54 families without consuming a single extra metre of land. Photo: Build Better Lives. **Below:** Residents of Porto Fluviale co-designed their new neighbourhood, which includes a public square, a local market, an anti-violence center, and a rooftop solar energy community. Photo: Build Better Lives

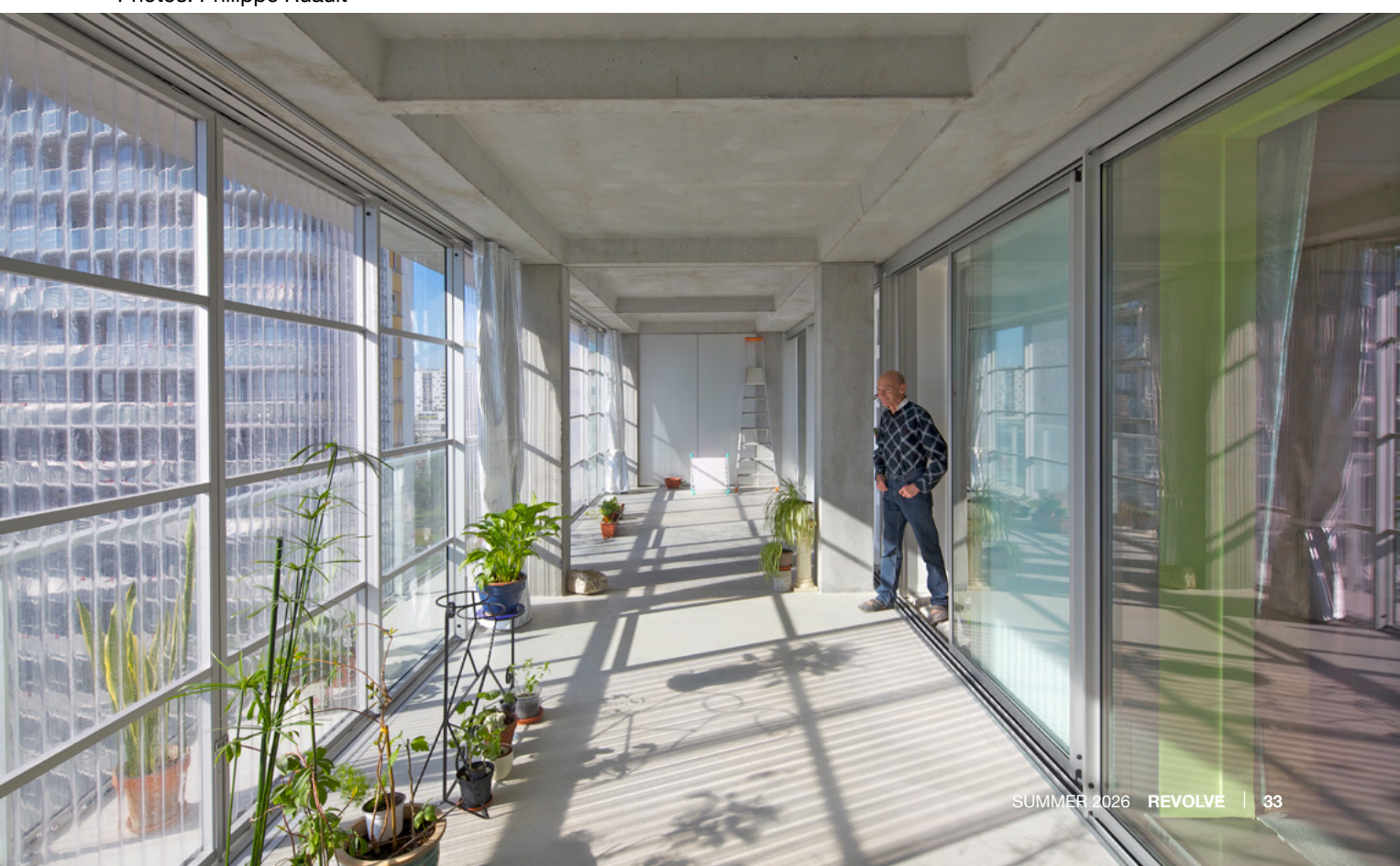
Above: By repurposing an abandoned yet historically significant structure, this initiative prioritises affordability, sustainability, and community cohesion. Photo: Build Better Lives
Below: Through a participatory co-design process, residents and stakeholders actively shaped the project, combining heritage preservation and forward-thinking housing solutions. Photo: Build Better Lives



These before **(above)**, during **(below)**, and after **(right page)** photos show another project from the Build Better Lives inspiring stories repository which was led by the Municipality of Bordeaux & Aquitanis in collaboration with Lacaton & Vassal architectes, Frédéric Druot Architecture and Christophe Hutin Architecture. They offer a glimpse of the renovation transformation which added an outdoor space to 530 social housing units in France.
Photos: Philippe Ruault



Five hundred and thirty housing units from the 1960s were completely renovated with residents staying in their homes throughout. Each flat gained a spacious winter garden and balcony, flooding interiors with natural light while acting as solar collectors. Rents were kept the same. Energy bills fell. Not a single family had to move out during construction, which took just 12 to 16 days per apartment, thanks to prefabricated modules and lightweight materials.
Photos: Philippe Ruault





Behind every carbon-conscious renovation is a crew making real-time decisions about what stays and what goes. Refurbishing an existing structure rather than demolishing it can cut lifecycle carbon emissions significantly.
Photo: Build Better Lives

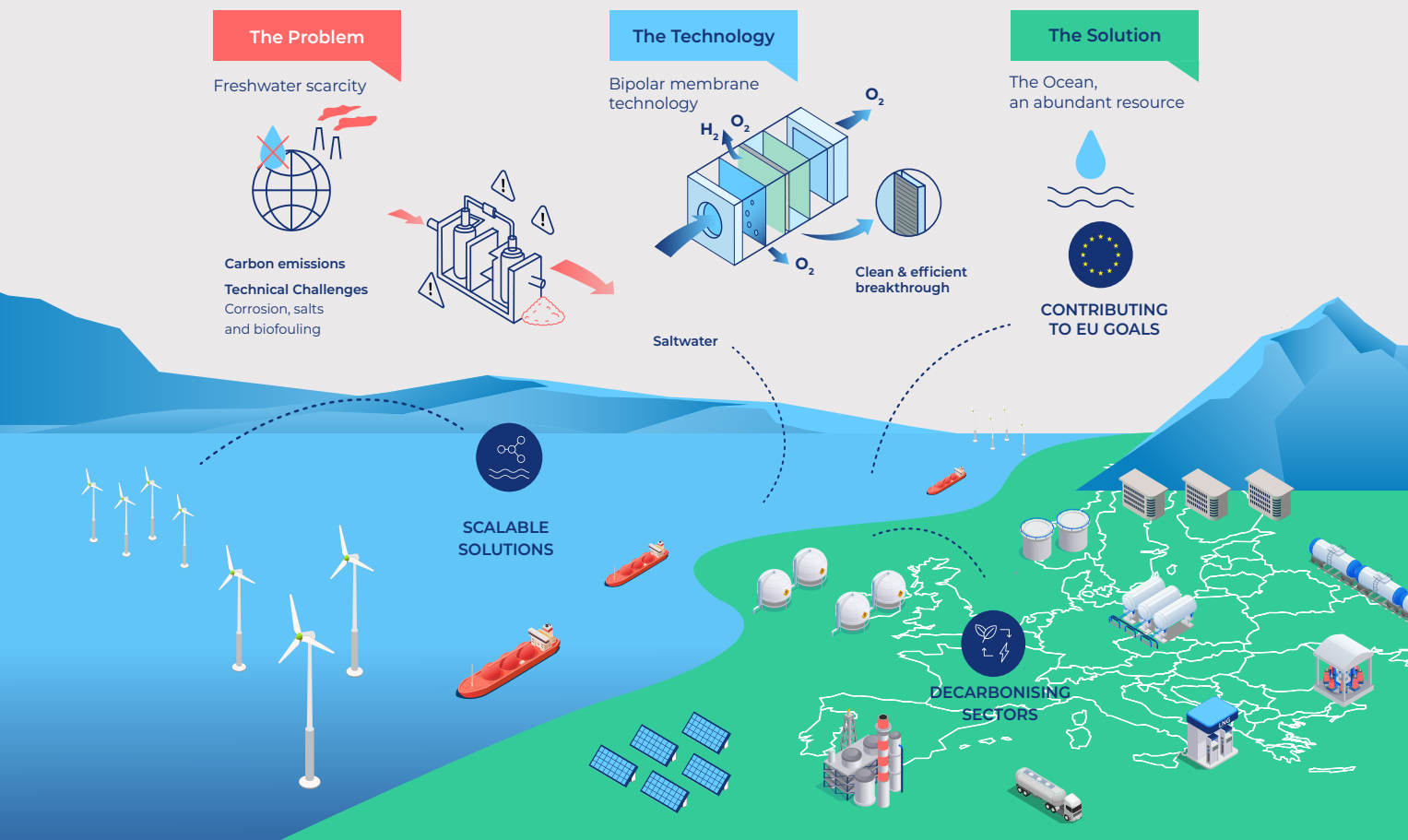
HYSEAS

Pioneering Green Hydrogen Production from Seawater

hyseas.eu

HySEAs is a three-year EU-funded project that brings together partners from 6 countries to develop a new, **sustainable method to produce green hydrogen directly from seawater**. Unlike traditional approaches that can damage equipment and harm marine ecosystems, HySEAs uses an **advanced Bipolar Membrane** to carefully control how ions move during electrolysis. This makes the **process cleaner, safer, and more efficient**.

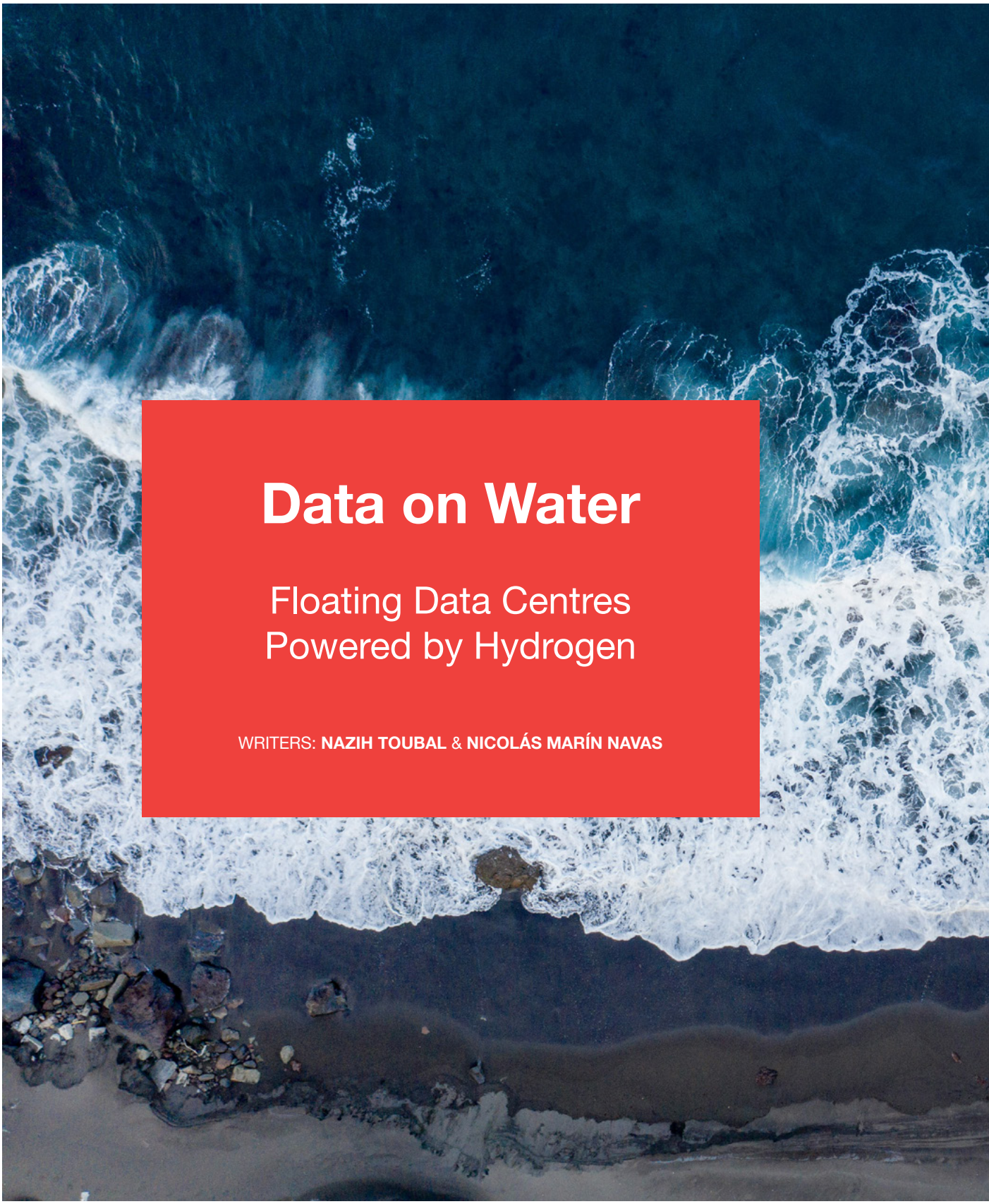
HySEAs aims to overcome the **efficiency and material challenges of seawater electrolysis**, offering a **durable and cost-effective solution for green hydrogen production**. The project objectives align with EU goals for **climate neutrality and green transition**.



Follow us! HySEAs hyseas_project

Co-funded by the European Union

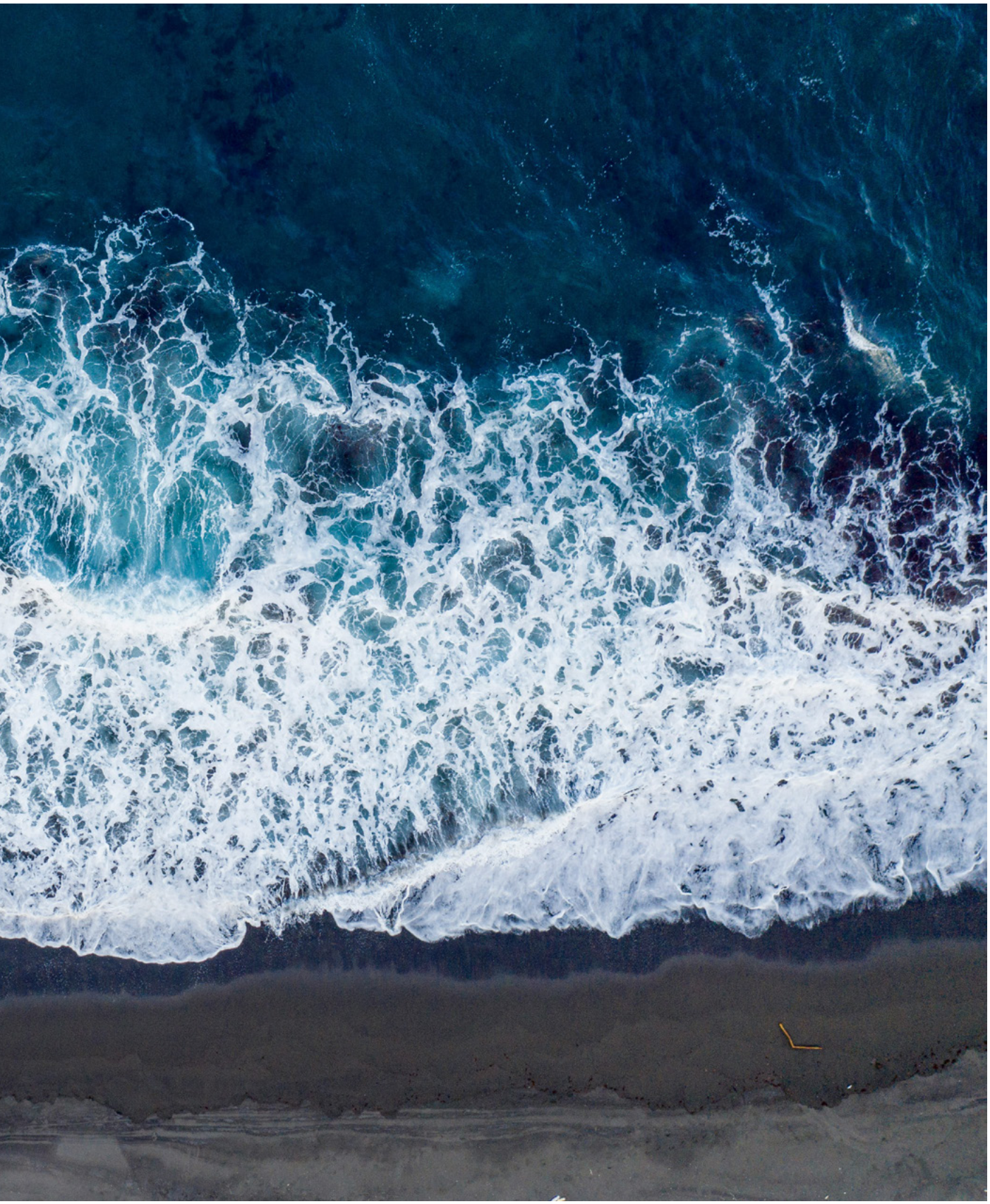
Clean Hydrogen Partnership



Data on Water

Floating Data Centres Powered by Hydrogen

WRITERS: **NAZIH TOUBAL** & **NICOLÁS MARÍN NAVAS**



1

Can floating, hydrogen-powered data centres offer Europe a way out of its digital infrastructure crisis?

Fourteen subsea cables run from the Grand Port Maritime de Marseille to Europe, Africa, the Middle East, and Asia. They carry the majority of data traffic between Europe and the rest of the world, and they have turned France's second city into one of the most strategically significant digital infrastructure hubs on the continent. Marseille is not usually mentioned in the same breath as Frankfurt or Amsterdam when European data centre markets are discussed. But by any measure of connectivity, it is the Mediterranean's undisputed digital gateway, and it's growing fast.

As of 2025, the city hosts 77 megawatts of operational data centre capacity, with a further 107 megawatts in various stages of planning and permitting, according to a January 2025 investigation by La Quadrature du Net. The bulk of those facilities sit within the port perimeter itself, drawing their power from the Saumaty source substation in the Saint-André district and, in some cases, discharging thermally altered cooling water back into the Mediterranean Sea. A public inquiry into that practice identified risks of eutrophication and raised concerns about ecological impacts that, in the investigators' own assessment, are not fully understood.

Residents of the 16th arrondissement, whose lives are shaped by the port's noise, air pollution, and industrial activity, have submitted formal objections calling for a halt to all further data centre construction in the city. Sébastien Barles, Marseille's deputy mayor responsible for ecology, summarised the community's position in Le Monde with a directness that left little room for interpretation: data centres, he said, currently produce only negative effects for the neighbours who live alongside them.

This is a tension that is playing out in different forms across almost every major digital infrastructure hub in Europe. In places like Frankfurt, connecting a new data centre to the electricity grid can take up to seven years, with some cases stretching to 13, according to Ember Energy, a consultancy. In Dublin, a de facto moratorium on new connections has been in place since 2023 and will not lift until 2028. In Spain, data centre developers are encountering community opposition over water and energy resources.

Europe says it wants to triple its data centre capacity within five to seven years, as set out in the EU's AI Continent Action Plan published in April 2025. The ambition is clear. What is less clear is where the power, the water, and the space for that tripling are supposed to come from.

Against this backdrop, a concept that has spent years on the fringes of infrastructure planning is attracting renewed attention: data centres built on water and powered by hydrogen. The idea is not new, but the conditions in which it is being reconsidered most certainly are.



2

The ambition is clear. What is less clear is where the power, the water, and the space for that tripling wouldcome from.

A solution looking for the right problem

The basic logic of a floating data centre is straightforward. Water has a thermal capacity roughly 3,500 times greater than air, making it a vastly more efficient medium for absorbing the heat that server racks generate continuously. A facility positioned on or near a body of cold water can use that water for cooling without the energy-intensive chillers and cooling towers that conventional onshore facilities depend on.

The result is a measurable reduction in what the industry calls Power Usage Effectiveness (PUE): a metric that expresses the ratio of total energy consumed by a facility to the energy used for actual computation. A perfect PUE score is 1.0, meaning that every watt of electricity powers computation with zero spent on cooling.

A conventional data centre in central Europe typically operates with a PUE of between 1.3 and 1.5. Facilities that use natural seawater or fjord water for cooling have recorded PUE values of between 1.07 and 1.15. In practical terms, a water-cooled facility can achieve the same computational output while consuming roughly 20 to 30% less total energy than its land-based equivalent. According to data published by Hydrogen Europe in September 2025, eliminating cooling towers and mechanical refrigeration alone reduces overall power consumption by around 23%.

Norway has quietly demonstrated what this looks like in practice for over a decade. Facilities built into fjord-side locations draw seawater at a stable temperature of around 8°C year-round, a natural heat sink that does not require mechanical cooling. The Nordic region more broadly achieves average PUE values of between 1.1 and 1.2 routinely, according to various studies. Cool ambient air, available for eight to ten months of the year across Scandinavia, combined with hydroelectric and wind-generated electricity, gives these facilities an environmental profile that urban data centres in Frankfurt or Amsterdam simply cannot match.

Building a floating data centre takes this logic one step further. Instead of constructing a facility near a body of water, a barge- or platform-based facility is positioned directly in a harbour, on a river estuary, or in sheltered coastal waters. No land acquisition is required. No urban planning queue. No long grid connection process. The facility can, in principle, be moored and operational in a fraction of the time it would take to site, permit, and connect a conventional facility in a congested European city.





Powering data centres with hydrogen

A proposition is underway to use hydrogen fuel cells to power data centres with the aim of bringing the PUE closer to a 1.0 score. When hydrogen is fed into a fuel cell, it reacts with oxygen to produce electricity, emitting only water vapour. Coupled with on-site storage, fuel cells can provide continuous, dispatchable power that does not depend on a grid connection nor on the intermittency of solar and wind generation. Hydrogen Europe's September 2025 briefing noted that if European data centres offered just 30 hours of grid flexibility annually, drawing instead on on-site generation and storage, the grid capacity available to the sector could more than double.

In South Korea, a 900 megawatt hydrogen fuel-cell facility at the Dangjin Green Energy Hub, due online at the end of 2027, will be among the first commercial-scale plants in the world built explicitly to feed data centres. In the United States, Plug Power has agreed to supply Amazon's AWS facilities with hydrogen back-up generation.

Across Europe the hydrogen experiments are smaller, but they are converging fast. In Dublin, where new grid connections have been effectively frozen since 2023, Microsoft and the Irish utility ESB are running a green-hydrogen fuel-cell trial that supplies 250 kilowatts of clean electricity to a Microsoft campus, designed to test whether hydrogen can stand in for the diesel generators that have long served as the industry's invisible insurance policy.

The engine manufacturer INNIO is deploying a 60 megawatt hydrogen-ready island-mode plant for another hyperscale operator. In the United Kingdom, the Nottingham-based firm GeoPura, backed by Siemens Energy, is shipping containerised hydrogen units of up to 50 megawatts directly to developers who cannot wait on grid reinforcements.

A floating data centre is a combination of two ideas: water cooling and hydrogen power. It is a data centre independent of both terrestrial grids and freshwater supplies, deployable in harbours along Europe's extensive coastline, and potentially powered by green hydrogen produced from the offshore wind capacity that the continent is building at scale.

From renderings to the dock

The clearest signal that floating, hydrogen-powered data centres are moving from slide deck to project pipeline arrived not from Europe but from Singapore. Singapore, like Marseille, has effectively run out of suitable land; unlike Marseille, it has chosen to push the energy plant onto the water first, in advance of the facility it will eventually power.

In March 2026, the developer Bridge Data Centres and the Chinese renewables firm Concord New Energy unveiled plans for the city-state's first barge-mounted hydrogen power plant for AI workloads, engineered with Nanyang Technological University. The plant is designed to float while hydrogen handling sits offshore, kept clear of the IT halls. Marseille seems to have taken note: among the development projects registered at the Grand Port Maritime is a floating data centre concept from the infrastructure developer Nautilus, to be moored in the port waters rather than built on land.

The required parts for floating data centres are converging on the Mediterranean. Marseille's own Fos-sur-Mer complex has positioned itself as a green-hydrogen and data-centre hub, with hyperscalers including Microsoft and Equinix expanding nearby. Barcelona's port authority is preparing hydrogen bunkering infrastructure under Spain's H2Med pipeline plans. Italy is pushing the SoutH2 Corridor, a hydrogen pipeline running from North Africa through Sicily and Tuscany up to Bavaria. On the southern shore, Algeria has signed memoranda to feed SoutH2; Egypt is courting investment in green-hydrogen complexes around the Suez Canal Zone.

The hidden costs of green hydrogen

Powering European data centres with hydrogen could end up absorbing between 8 and 27% of the bloc's projected clean-hydrogen supply by 2030, according to Hydrogen Europe's own scenarios – molecules that would then not be available to decarbonise "hard-to-abate" sectors like steel, fertiliser, or shipping.

Water does not disappear because the platform floats. In communities such as Talavera de la Reina, in Spain, where the *Tu nube seca mi río* movement has rallied alongside SEO Birdlife against hyperscale projects drawing on already-stressed rivers, the cloud's freshwater footprint is being contested in real time. Floating the facility offshore does not erase that cost. It shifts where it lands.



This could be tackled with a new frontier of hydrogen production under exploration: direct seawater electrolysis. This involves splitting seawater into hydrogen and oxygen without desalinating it first. Pilot rigs are now being tested at sea, with new catalysts able to resist chloride corrosion long enough to keep the cells running. If the technology matures at industrial scale, a floating data centre moored off Almería or Catania could one day produce part of its own fuel from the water it sits on.

Floating, hydrogen-powered data centres are not fiction anymore. They are being engineered, financed, and permitted, and the Mediterranean has the wind, the sun, the coastline, and the political momentum to host them at scale. What they will not do, by themselves, is absolve the choice. AI's appetite for energy is going to keep growing. Whether communities along the Mediterranean coast end up with a greener version of the cloud, or simply a new infrastructure that shifts the same costs abroad, will depend on whether this expansion is carried out transparently, agreed upon with local communities and subject to the necessary controls to minimise environmental impact.

Redefining Europe's coastline

The deeper implication of floating, hydrogen-powered data centres is that they are not simply proposing a new type of facility. They are proposing a different geography for the digital economy itself. For two decades, Europe's data infrastructure has concentrated around inland financial and connectivity corridors: Frankfurt, Amsterdam, Paris, Dublin, London. The logic was proximity to users, exchanges, and fibre optic routes. But the rise of AI is changing the scale equation. Training large language models and processing real-time AI workloads require levels of electricity and cooling capacity that many of Europe's traditional hubs can no longer provide without triggering political backlash, ecological stress, or outright grid saturation.

The coastline, once peripheral to the digital economy except for the landing points of subsea cables, is rapidly becoming strategic territory again. Ports are evolving into energy-and-data interfaces. Marseille is the clearest Mediterranean example, but it is far from alone. Across the basin, infrastructure planning is beginning to follow a new logic: place data where renewable energy can be generated and imported most efficiently, rather than where land happened to be historically available. Ports that once depended on fossil fuel logistics are repositioning themselves around hydrogen terminals, subsea cable landings, offshore renewables, and AI infrastructure. The port of the future may look less like a traditional shipping hub and more like a hybrid industrial ecosystem where cloud computing, energy conversion, and maritime logistics operate side by side.

The shift is particularly visible in Southern Europe, where the energy transition and digital transition are beginning to overlap geographically. Spain's eastern coast, southern Italy, and parts of Greece combine three strategic assets rarely found together at scale: abundant renewable energy potential, direct access to subsea connectivity routes, and proximity to emerging hydrogen corridors linking Europe to North Africa. This creates the possibility of entirely new industrial clusters. In the same way that cheap coal shaped the geography of nineteenth-century industry and oil



The deeper implication of floating, hydrogen-powered data centres is that they are not simply proposing a new type of facility.

terminals shaped twentieth-century trade, renewable electricity and hydrogen availability may increasingly determine where twenty-first century AI infrastructure is deployed.

That evolution could alter long-standing economic relationships across the Mediterranean. For decades, North African energy exports to Europe were defined by hydrocarbons moving northward through pipelines and Liquefied Natural Gas (LNG) terminals. The emerging hydrogen economy introduces a more diversified model, one where energy molecules, renewable electricity, industrial processing, and digital infrastructure become interconnected. If Europe succeeds in scaling green hydrogen imports from the southern Mediterranean, the region may evolve from being simply an energy supplier into a strategic partner in Europe's digital transition itself. Data infrastructure, in that sense, becomes part of a broader geopolitical architecture.

At the same time, this concentration of digital and energy infrastructure along coastlines raises difficult questions about resilience and security. Subsea cables already carry more than 95% of intercontinental internet traffic, making coastal infrastructure one of the least visible yet most critical components of the global economy. Integrating energy generation, hydrogen storage, and hyperscale computing into the same maritime zones may improve efficiency, but it also concentrates strategic assets in ways that governments are only beginning to evaluate. Cybersecurity, maritime security, environmental risk, and energy sovereignty are converging into the same infrastructure discussion.

Data centres are about more than energy

The implications extend beyond energy policy. Whoever hosts the infrastructure of artificial intelligence will shape the economic geography that comes with it: cloud services, advanced computing, research clusters, and industrial innovation. Europe has spent years debating digital sovereignty in terms of software regulation and semiconductor production. But sovereignty also depends on something more physical: where the servers are located, how they are powered, and who controls the infrastructure supporting them.

This may ultimately explain why the debate around floating data centres feels larger than the technology itself. Coastal regions that historically sat outside Europe's main technology corridors may suddenly find themselves central to the next wave of infrastructure investment. Mediterranean cities long associated with tourism, shipping, and energy transit are beginning to position themselves as future AI gateways.

Floating data centres sit at the crossroads of multiple transitions taking place simultaneously: decarbonisation, digitalisation, maritime industrial renewal, and geopolitical realignment. They are not a silver bullet, and they may never become the dominant model for hyperscale computing. Yet their emergence signals something important. The infrastructure underpinning the digital world is no longer invisible. It is becoming materially and politically impossible to ignore. ●

1. Waves. Photo: Ryo Yoshitake / Unsplash
2. View of Digital Realty's MRS2 MRS3 MSR4 data centers in Marseille. Photo: LaMèreVeille / Wikimedia
3. Sandia National Laboratories is testing the feasibility of using hydrogen-fuel-cell-powered generators as an alternative to diesel power, Port of Honolulu. Photo: Hydrogenics Corporation / Flickr
4. Researcher from Sandia National Laboratories presenting the hydrogen-fuel-cell-powered generator. Photo: David Murphey / Flickr
5. Marseille's Fos-sur-Mer industrial complex. Photo: Gortyna / Wikimedia
6. Port of Barcelona, Spain. Photo: Alexander Starcew / Unsplash



Keeping Our Collective Cool

WRITER: **ASYA AL MARHUBI**



1

Europe's cities are overheating. The solution to keeping cool must be collective, not individual.

Summer brings Brussels to life. For a city with a well-earned reputation for rain, once the mercury hits 18°C, jackets are tossed aside as Bruxellois pull shorts and sandals out of the closet to greet the early signs of summer. When the sun is shining, the city seems fuller, filled with sun-drunk urbanites nursing ice cold drinks, sapping up as much of those precious rays as they can before retiring home to rest and cool off.

In northern Europe, in general, we do indeed get to cool off. Even in July, the average temperature in Brussels ranges between 14°C-23°C, offering cool nights and a natural balm to the heat and sun. Until a heatwave hits, that is.

During a Europe-wide heatwave in July 2025, the city's emblematic Atomium shortened its opening hours due to "extreme heat and structural limitations" – its iconic steel spheres were too hot for visitors.

Extreme heat is deadly. A 2023 study published in Nature attributed over 62,000 deaths reported across Europe in the summer of 2022 – at the time the warmest on record – to excess heat. Research published by Imperial College London's Grantham Institute found that a climate change-fueled heatwave in late June and early July 2025 tripled heat-related deaths on the continent. Of the 2,300 estimated heat deaths in that timeframe, around 88% were people over 65.

Heatwaves will not only continue to scorch swathes of Europe each year, but they will do so with ever more ferocity. Temperatures exceeding 30°C are no longer confined to the Mediterranean south; they are becoming a continental challenge that demands collective adaptation. Such changes cannot simply be dealt with by switching on the AC. We need systemic solutions that address energy demand, urban design, and social equity simultaneously.

Conventional approaches to keeping cool

AC is our go-to approach for keeping cool when it gets hot. Europe is one of the fastest growing markets for air conditioning, with demand increasing by 60% between 2014 and 2021. The market is forecast to double in size by 2035, according to EuroDev, a consultancy.

Turning on the AC might cool us down, but it also creates a surge in electricity demand. During the July 2025 heatwave, total electricity demand in the EU was 7.5% higher than that same week the previous year. In Spain alone, energy demand was 16% higher compared to 2024.

Cooling Degree Days – a measure of how often and severely outdoor temperatures require a building to be actively cooled – have nearly quadrupled across the EU since 1979, according to EuroStat, the EU's statistics agency. If left unchecked, energy demand from air conditioners could more than triple



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by 2050, making cooling the leading energy use in buildings.

However, for those with tight budgets, AC might not be an option. Summer energy poverty is defined as the inability to "maintain adequate indoor thermal comfort due to insufficient or unaffordable access to cooling." It's a growing concern for Europeans, particularly in southern Europe, where cooling needs are higher for longer. According to a 2023 survey by the European Commission's Joint Research Centre, 26% of households were unable to keep their homes "comfortably cool" in 2022; 35% of those being among the lowest-income group.

The paradox of air conditioning

While we struggle to keep our individual homes cool, we're collectively making ourselves hotter. This is a simple matter of physics: the heat we're removing from our homes must go somewhere. In conventional AC technology, heat is removed from the air in our homes and expelled outside, along with the heat generated by the extraction process. A 2011 Applied Energy study found that AC usage in Paris could increase street-level heat by 2°C-4°C.

This adds to the Urban Heat Island (UHI) effect, where urban areas experience higher temperatures than surrounding suburban rural ones. It's a consequence of the de-naturalisation of our environment, exchanging green for gray, replacing vegetation with high-density urban sprawl. Tarmac and concrete absorb heat, releasing it back into the air, keeping cities hot and depriving residents of much needed cooler temperatures.

The UHI effect compounds summer energy poverty by layering physical heat onto existing social disadvantages. Lower income residents face overlapping challenges – poorly insulated homes that are expensive to cool, limited means to invest in more efficient alternatives, less access to green spaces. They also often live in areas with higher urban heat. Those with the fewest resources to escape the heat are often forced to endure the most extreme temperatures.

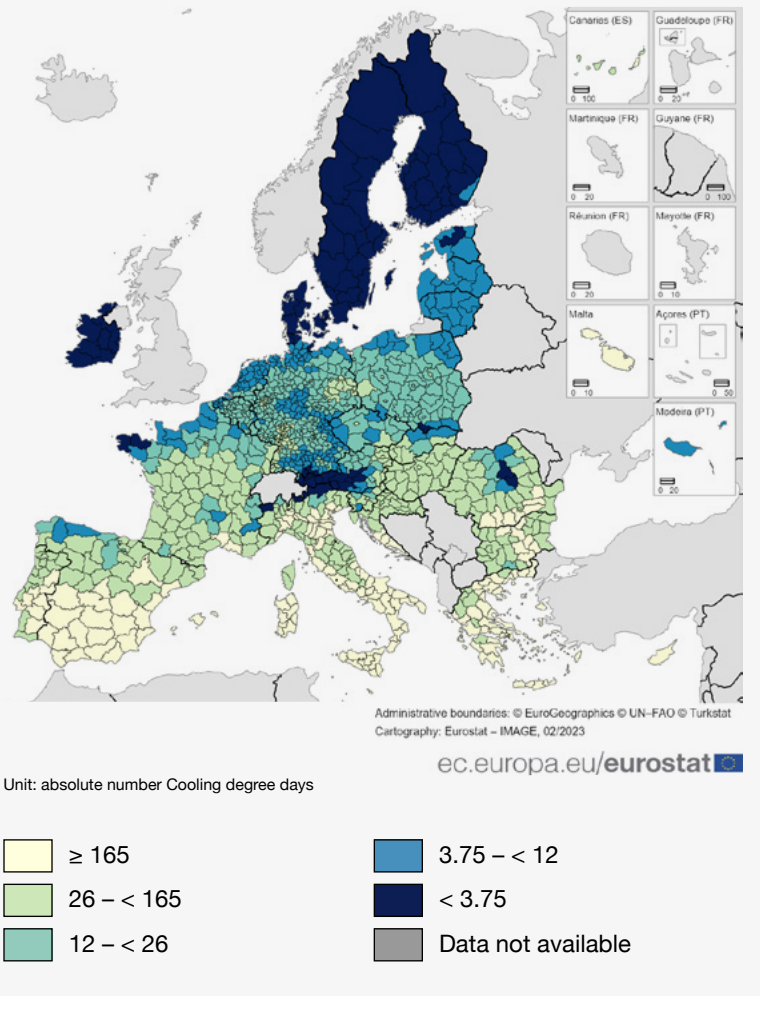
"It's harder to escape the heat than is it to escape the cold," René Schellekens, Senior Consultant on Energy Transition and Energy Poverty at the Netherlands Enterprise Agency (RVO), said in an interview with REVOLVE in 2023.

So, how can we make sure that turning on the AC won't lead to even more heat? How can we keep temperatures, costs, and emissions down all at the same time so everyone can stay comfortable and safe during extreme heat?

The solution lies in switching from individual to collective cooling approaches.

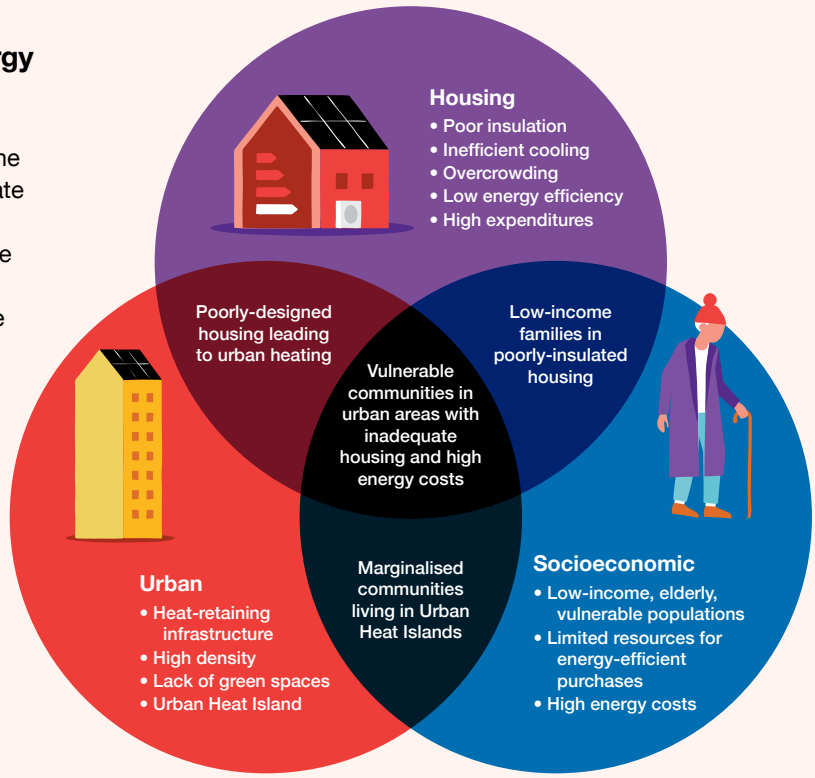
The number of Cooling Degree Days

This measure of how often and severely outdoor temperatures require a building to be actively cooled has nearly quadrupled across the EU since 1979. Source: Eurostat 2023.



What is Summer Energy Poverty?

Summer energy poverty is the inability to "maintain adequate indoor thermal comfort due to insufficient or unaffordable access to cooling", and it is rarely the product of a single factor



Adapted from "Framing Summer Energy Poverty: Insights and Recommendations for a resilient future". EC 2025"

From individual to collective approaches

District cooling is a collective approach for keeping temperatures down. Unlike conventional cooling approaches, which focus on the needs of a single dwelling or building, district cooling starts by zooming out to see how we can provide cooling on a much larger scale.

Instead of every building running its own AC unit, cooling is produced centrally and distributed through a network. The approach differs fundamentally by taking advantage of scale, avoiding the explosion of individual units that worsen heat in the streets. “District cooling is basically the collective version of air conditioning,” Nicolas Raimondi, policy and project manager at the European Association of Cities in Energy Transition (Energy Cities) said in an interview with REVOLVE in 2026.

How do we keep cool today?

- **Conventional split AC systems:** The dominant technology, which uses refrigerant technology to remove heat from the air and expel it back into the room.
- **District cooling:** Centralised cooling production distributed via networks, integrating renewables and leveraging economy of scale for high efficiency.
- **Passive cooling:** Passive measures include using shading, ventilation, and building design to reduce active cooling needs.

When planned effectively, it leverages scale and reduces emissions through renewables integration, as well as making use of waste heat and natural cooling from water bodies. In Stockholm, the combined District Heating and Cooling system uses free cooling from seawater. While not a mainstream option, similar examples exist across Europe, including Barcelona, Helsinki, Lisbon, and Paris.

But district cooling is not one-size-fits-all, nor does it work everywhere. It requires a certain urban density and a long-term planning vision. “You need a critical mass of buildings, a mix of uses, and coordination between urban planning, energy planning, and infrastructure investment,” Raimondi explained. “This is why local heating and cooling plans are so important.”

“In many cases, the best cooling solution is not a machine, but a well-designed public space.”

Nicolas Raimondi, Policy and Project Manager, European Association of Cities in Energy Transition (Energy Cities).

Since the 2023 Recast of the Energy Efficiency Directive, the obligation to produce local heating and cooling plans has been extended to all municipalities with over 45,000 residents, meaning up to 1,200 cities will need to develop plans. Those plans matter enormously: heating and cooling accounts for roughly 50% of the EU’s total energy consumption, the vast majority of which occurs in buildings.

“A lot of municipalities would like to decarbonise their energy systems, but they lack the human, financial, and technical resources to do so,” explained Giulia Conforto, senior researcher at e-think Energy Research and expert in sustainable energy transitions, on the Everything Is Changing podcast in 2025.

This often results in smaller cities outsourcing planning to larger ones with dedicated offices and resources. To bridge that gap, the EU-funded ESCALATE project is developing a training platform and materials explicitly aimed at small and medium-sized cities, giving regional energy agencies the knowledge and tools to become capable of helping municipalities develop plans that work for their communities.

“We also need to change how we think about building renovation,” explained Raimondi. Buildings renovated today should be “network-ready,” with low-temperature systems, space for



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“It’s harder to escape the heat than is it to escape the cold.”

René Schellekens, Senior Consultant on Energy Transition and Energy Poverty, Netherlands Enterprise Agency (RVO).

connections, and flexibility to plug into future district solutions. “The decisions taken today – on buildings, networks, urban form – will lock in energy use patterns for decades,” he added.

Keeping homes cool

Before residents can reap the full benefits of optimised local cooling systems, we need stable foundations. If cooling reaches an energy-inefficient and poorly insulated home, then precious cool air, no matter how cleanly supplied, is still being lost.

“Energy efficiency [in buildings] is based first and foremost on minimising the thermal demand of the building envelope, which must therefore be the priority,” said Claudio Del Pero, Associate Professor in the department of Architecture, Built Environment, and Construction Engineering at POLIMI (Politecnico di Milano) in an interview with REVOLVE in 2026.

Over 75% of the building stock in Europe is energy-inefficient, and despite urgent need for deep renovation to meet decarbonisation goals, renovation rate remains stuck at 1%.

Through the RE-SKIN project, researchers have developed a modular solution to increase building efficiency that is being tested in two pilot sites: at a public school in Burgas, Bulgaria, and a community housing centre in Milan, Italy. Beyond improved insulation, the project is developing practical non-invasive cooling delivery. As Fabrizio Leonforte, fellow Associate Professor at POLIMI explained: “smart fan coils developed in RE-SKIN replace traditional radiators, allowing cooling to be delivered to all rooms in a non-invasive manner,” offering more efficient cooling at lower cost.

How we design and use buildings matters just as much as what systems we install. Passive cooling prevents heat from entering a building through shading or removes it with in-built ventilation, while simple habits – like closing shutters before midday heat builds - have measurable impacts on indoor temperature.

According to Adrienn Gelesz, sustainability expert at ABUD – Advanced Building and Urban Design, analysis conducted by the EU-funded CoolLIFE project suggest passive cooling and behavioural measures together could reduce cooling demand by up to 97% in dwellings with fans, shading, and limited use of heat generating equipment indoors.

But, behavioural change is not easy. Studies conducted as part of the CoolLIFE project show that behavioural change programmes can deliver savings of up to 12% in residential buildings, but only when the right measures are in place, and people are motivated to act. Monetary incentives help, as do so “social comparison nudges – showing occupants how their energy use compares to efficient peers – can reduce cooling consumption by approximately 2% to 5%,” explained Gelesz.

Ultimately, the impact of these strategies needs to be felt: in the form of a cool room to walk into at the end of a hot day or a lower monthly energy bill.

Greener spaces for cooler cities

Sitting on a park bench in the shade is going to be cooler than resting in a concrete square. While it seems obvious, when city planners create tree-lined streets and green spaces, it lowers the urban heat island and offers a nature-based approach to cooling.

In Greece’s capital this idea is being put to the test with strong results. Thermal data from Argentinis Dimokratias Square in Athens showed that exposed paved surfaces reached 60°C, while areas shaded by trees were a comparatively cool 30°C. A 30°C difference within the same public square.

As part of the city’s guidelines for designing cooler public spaces, led by its Chief Heat Officer, a role established in 2021, parking lots have been transformed into micro forests, and cooling

gardens offer refuges to residents. And these spaces do more than cool air, they offer public spaces for people to connect. As Gelesz notes, they "can also restore opportunities for socialising with neighbours," drawing people away from the retreat into private, air-conditioned "islands of cold."

When public green spaces offer comfortable places to be on the hottest days, individual cooling demand falls and community life returns. The collective cool space becomes both an environmental and social infrastructure: somewhere to beat the heat, and somewhere to do it together.

The future we want: our collective cool

Summer is coming. At the time of writing, Brussels is expecting its first 30°C temperatures of the season – in May.

Summer energy poverty is real and growing. For many, keeping cool in summer heat is an unaffordable comfort. Climate change is not creating this new inequality, it is just showing us where the cracks already existed, and where they need to be addressed.

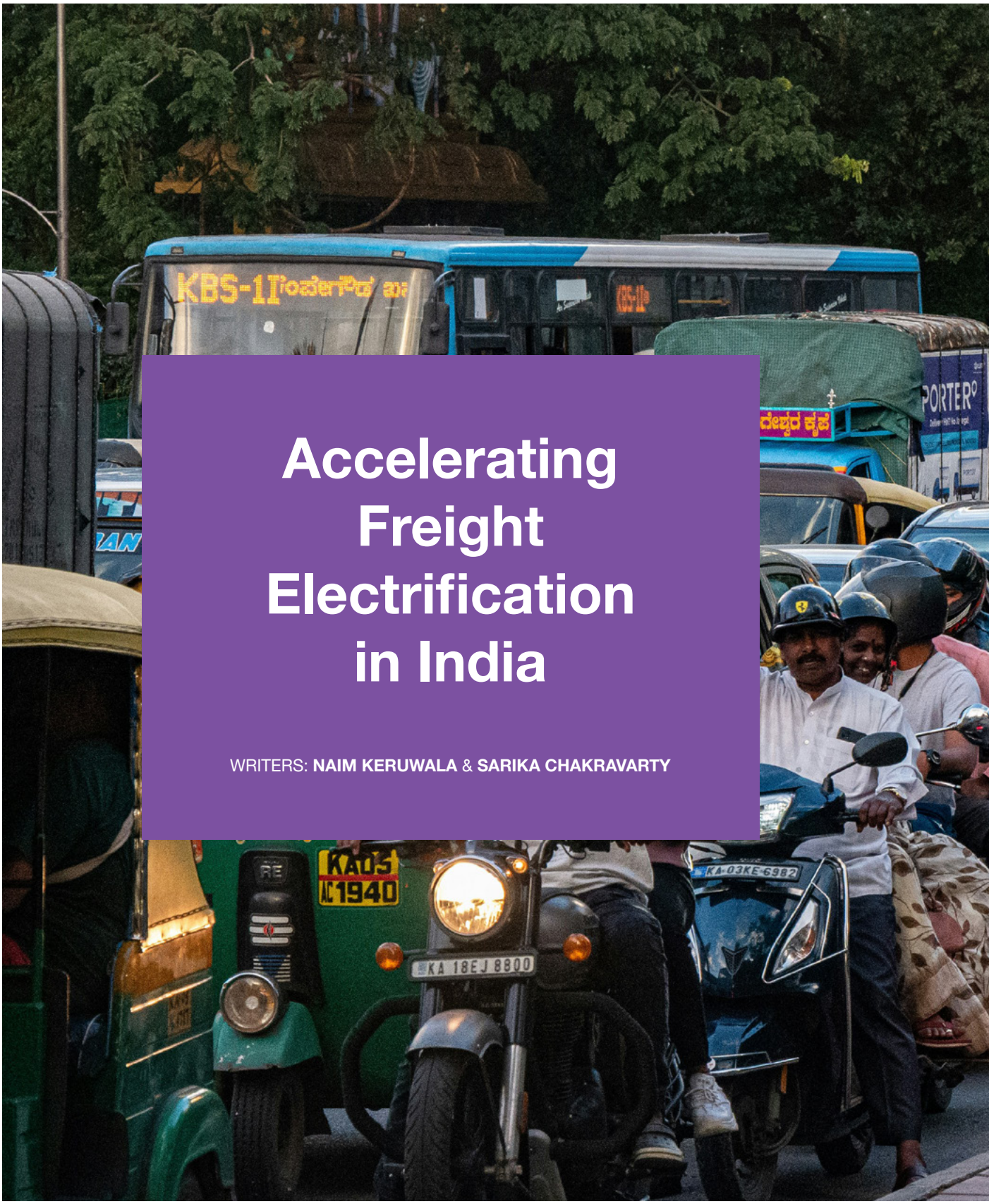
Cities of the future must be proactively planned for heat. That means developing cooling networks that lower building temperatures efficiently, designing structures through passive strategies like ventilation and insulation, and replacing heat-absorbing concrete with green oases where people can gather and find relief.

The crisis of keeping cool is forcing us to ask a valuable question: what future do we want? The answer must be where keeping cool is a universal right, not a privilege. And where people can choose between two oases: a cool home, and a public refuge designed for the community that surrounds it. ●

1. Sunset over Athens, Greece. Photo: Ana Tovar / REVOLVE
2. People walking under a cooling mist during a heatwave in Florence, Italy in 2025. Photo: Richard Vanlerberghe / Unsplash
3. People enjoying the shade of trees in the park. Photo: TBD Traveller / Pexels
4. Public fountains offer urban residents a fun way to cool off during heatwaves. Photo: Charis Brice / REVOLVE



4



Accelerating Freight Electrification in India

WRITERS: **NAIM KERUWALA** & **SARIKA CHAKRAVARTY**



1

E-trucks are decarbonising India's transport sector, with data driving efficiency, planning, and scale.

India is witnessing historic growth. Rapid urbanisation, a rising population, expanding e-commerce, and higher incomes are dramatically increasing the demand for goods and services. To keep pace, the road freight sector is projected to grow nearly fourfold by 2050, according to research published in 2022 by The National Institution for Transforming India (NITI Aayog), a government think tank.

However, if this surge continues to run on fossil fuels, it will worsen air pollution, deepen public health crises, inflate energy costs, and drive up emissions just as we race to reduce them. Meeting future freight demand with conventional diesel trucks would mean spending over $1 trillion on crude oil imports by 2050, according to NITI Aayog, an unsustainable economic and environmental burden.

Already responsible for 70% of goods movement and nearly 40% of fuel use, India's road freight sector stands at a pivotal moment. The transition to Zero-Emission Trucks (ZETs) offers a clear path to decarbonisation, cutting emissions while lowering operating costs and achieving India's net-zero goals. With battery costs falling and policy momentum accelerating, the missing link isn't technology but data. By leveraging e-freight data to accelerate adoption and debunk technology myths, India can unlock the economic, environmental, and health benefits of zero-emission trucking.

Road freight drives the Indian economy

India's freight network is the backbone of its economy and one of its biggest climate challenges. A working paper by the World Bank published in 2018 found that the country moves about 4.6 billion tonnes of freight each year, creating a transport demand of 2.2 trillion tonne-kilometres at a cost of nearly $115 billion. Trucks dominate this movement carrying over 70% of domestic freight while representing less than 5% of total vehicles.

However, freight trucks are responsible for a disproportionately large share of India's transport emissions. They account for nearly 40% of on-road fuel consumption and roughly half the particulate and NO_x pollution. Transport



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analysts estimate that under business-as-usual, the number of medium- and heavy-duty trucks on our roads will more than quadruple by 2050.

Transport already makes up 13% of India's total energy-related greenhouse gas emissions, according to India's fourth biennial update to the United Nations climate change treaty (UNFCCC). If current trends continue, India's truck fleet could quadruple by 2050, locking the country into higher emissions, fuel imports, and health costs.

Why electrify and why now?

The case for ZETs is no longer environmental idealism – it's economic pragmatism. According to NITI Aayog, wide-scale Zero-Emission Trucks adoption could help India avoid 3.8 gigatonnes of CO_2 and save about $140 billion in oil imports by 2050.

The public health case is even stronger. Studies from IIT Kanpur and the International Council on Clean Transportation (ICCT) estimate that accelerated EV adoption could prevent more than 70,000 premature deaths each year by 2040. Communities in freight corridors often already live with asthma, respiratory distress, and constrained daily lives because of dust, smoke, and pollution. Clean-air benefits would be immediate and meaningful.

And yet, electrified freight remains a rounding error in India's logistics sector. Of over 0.83 million trucks sold in 2024, just 6,200 were electric and 95% were small urban vehicles. Only 280 were heavy-duty electric trucks. This gap isn't for lack of will; it's for lack of data. Without reliable, shared information on routes, costs, usage, and demand, no business model can scale.

Building the policy momentum, India is already steering in the right direction with the government having announced $60.2 million in incentives for over 5,600 e-trucks and subsidies of up to $57 per kWh. The Bharat Zero Emission Trucking (ZET) policy advisory, led by the Office of the Principal Scientific Adviser, calls for tax breaks, low-interest loans, and charging infrastructure along key corridors. Guidelines released by the Union Government recommend fast chargers every 100km on national highways. And the National Logistics Policy and Unified Logistics Interface Platform are aligning multiple agencies behind a common digital backbone.

Meanwhile, NITI Aayog's e-FAST initiative has aggregated demand commitments for nearly 7,800 ZETs from 16 companies creating a pathway for scaled manufacturing and adoption. Policy frameworks are already aligning with the government identifying ten highway segments for zero-emission truck movement showcasing that the political will exists.



4

In India, 20 pilot e-trucks have run over 150,000km along the Bengaluru-Chennai corridor for e-commerce, pharmaceuticals, retail, and auto ancillary to evaluate the performance of the vehicles: from the preliminary analysis for the retail use case the travel time reduced from 11 to 9.5 hours matching diesel trucks - driven by route familiarity, driver experience, and effective use of en route opportunity charging.

These 20 e-trucks alone have the potential to save over 500,000 litres of fuel by the end of 2025 and around 3 million litres of fuel by 2030. They can also lead to 34% reduction in GHG emissions and 77% reduction of particulate matter emissions as compared to diesel trucks.

These efforts show strong intent. But turning pilot projects into national transformation depends on one missing ingredient: data-driven adoption of electric freight in India.

C40 Cities' Laneshift Programme has begun to show how data can bring this hope within reach. Along the 350-kilometre Bengaluru-Chennai highway, Laneshift is testing long-range electric freight trucks. Early operational data indicate that with sufficient infrastructure and planning, fuel cost savings and emission reductions are large enough to make electric trucks viable for real commercial freight, not just pilots.

Truck manufacturers, logistics firms, state governments, and EV infrastructure providers are now collaborating, learning where charging must be placed, understanding where trucks break down or idle, and where demand patterns make or break profitability. Businesses, cities and finance are coming together to accelerate the positive tipping point for zero-emission freight, making the technology more affordable, accessible, and attractive than conventional fossil fuel alternatives showcasing the use of data for building momentum in the industry.

Fleet, charging, route, energy, freight, and policy data are key to driving India's e-freight adoption and operational efficiency. Financing can be structured to favour operators with smaller fleets who today are excluded because the risk is uncertain. And communities living near major freight routes – often poorer or marginalised – can benefit first, because emissions reductions will happen where emissions are worst.

Cities can also play a role by utilising 'pull' policies to foster market momentum. For electric trucks, this includes leading by example by mandating the electrification of municipal vehicle fleets to generate early demand and build initial charging infrastructure. This

initial phase is crucial, as it builds public support before cities introduce 'push' policies. These regulatory measures, such as implementing Low Emission Zones (LEZs) or establishing mandates that limit fossil fuel vehicles, make conventional ICE trucks less convenient or unavailable, accelerating the market shift away from old technologies.

With freight electrification, there are broader gains beyond health. Reducing India's reliance on imported diesel strengthens energy security. Lower fuel and maintenance costs will bring down costs of goods, helping low-income communities. Green jobs in charging infrastructure, battery servicing, and EV manufacturing can revive regional economies. While cleaner streets and quieter nights are the improvements people will directly feel.

How can data drive e-truck adoption?

E-trucks are crucial for India's freight decarbonisation, with data playing a pivotal role in accelerating their adoption. Data, including telematics, operational, and charging information, is vital to speed up their adoption. This data helps to understand battery usage, energy efficiency, and route performance, which is essential for replacing diesel trucks. Charging data further guides the strategic placement of charging stations and maintenance hubs, plan for energy and grid infrastructure enabling efficient nationwide deployment.

Using data on freight movement to see where goods move, where demand centres are, and where routes overlap can help match the right type of electric truck to the right route and duty cycle. It also enables charging stations to be planned where they are actually needed.

Demonstrating these data-driven efficiency gains not only debunks technology myths but also encourages private sector participation and scales e-freight adoption beyond pilot projects. This evidence-based data driven approach to electric freight adoption in India contributes to policy making, enables targeted investments, maximises environmental benefits, and accelerates large-scale adoption of zero-emission freight.

When aggregated responsibly, these insights can also help policymakers and utilities anticipate charging demand, optimise grid planning, and



5

prioritise investments in high-impact corridors. The transition to electric freight is accelerating.

This is an opportune moment for the transition. Battery costs have dropped substantially. Grid technology is improving. Policy frameworks are aligning as the government shows commitment to a future of electric freight.

When data is leveraged it can power smarter decisions across the ecosystem. Policymakers can plan infrastructure where it's needed most. Financiers can price risk accurately, enabling credit access for small fleet operators, the main drivers of India's road freight. OEMs can optimise for real-world Indian routes, and cities can target emission reduction where the air is dirtiest.

We need to treat data not as an optional add-on but as an enabler for stakeholder decision-making in India's EV transition.

Data-driven e-truck adoption is key to achieving India's net-zero goals enabling a cleaner, smarter, and more efficient freight future in India.

1. EV shift can counter excessive emissions from urban Indian cities. Photo: Lukas Kienzler / Unsplash
2. Transport makes up to 13% of the energy related greenhouse emissions in India. Photo: Ravi Sharma / Unsplash
3. Road freight could grow 4x by 2050, increasing pollution and emissions if fossil fuels remain the norm. Photo: Shantum Singh / Pexels
4. Large-scale Zero-Emission Truck adoption could help India avoid 3.8 Gt of CO_2 and save US$140 billion in oil imports by 2050. Photo: Juice_World / Unsplash
5. Driver monitoring the charge of his electric vehicule through a smartphone app, India. Photo: Kazam Charging Station / Pexels
6. Roads act as a backbone of Indian economy. Photo: Atharva Tulsi / Unsplash



6

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Following Water Through a Mediterranean Landscape

WRITER: **PATRICIA CARBONELL**



1

Learning lessons in the footsteps of flooding in eastern Spain.

On 26 March 2026, a small group of researchers, and communicators moved slowly across the Sierra de Chiva, stopping at points that, at first glance, seemed unremarkable: a forested slope, a dry ravine, a patch of dense shrubland. Yet each of these places formed part of a system that, just months earlier, had carried destructive flows from the mountains to the plains of Valencia.

The watershed field visit, co-organised by Centre per a la Investigació i l'Experimentació Forestal (CIEF), and the European Forest Institute (EFI), as part of the Mediterranean Network Forum, was conceived less as a technical briefing than as lesson in how to read the territory. By following the path of water from the upper basin of the Rambla de Poyo down to the Albufera lagoon, the experience revealed how landscapes structure risk (and resilience) and how that structure is changing.

What emerges along this trajectory is not a single event, but a sequence of relationships: between vegetation and soil, land use and hydrology, upstream decisions and downstream consequences.

A system that regulates (until it doesn't)

The Sierra de Chiva forms part of a relatively inconspicuous hydrological system. Unlike the Turia or the Júcar, it is not defined by a permanent river, but by a network of ephemeral watercourses that activate during periods of intense rainfall. These channels, often dry for much of the year, connect the mountainous terrain to the densely populated areas of Horta Sud and, ultimately, to the Albufera.

This type of watershed depends heavily on the condition of the landscape through which water moves. Vegetation cover, soil structure, and land management practices all influence how rainfall is absorbed, retained, or released. When these elements are functioning in balance, they distribute water across time and space, reducing peak flows and limiting downstream impacts.

As Xavier García Martí, forest engineer at Plataforma para el Estudio y Conservación de la Sierra de Chiva, explained during the visit: "This watershed area and its regulation services are fundamental in mitigating major floods." The emphasis here is not on the exceptional nature of extreme events, but on the everyday capacity of the system to regulate them.

That capacity, however, is not fixed.



2

The 2024 DANA: A system under stress

In October 2024, approximately 600 millimetres of torrential rain fell in less than half a day across parts of this basin. The intensity of the event was exceptional, but its consequences were shaped by conditions that had been built over decades.

Water moved rapidly from the upper slopes, carrying sediment, vegetation, and debris through the network of ravines. By the time it reached the lower basin, the combined force of these flows overwhelmed urban areas that had expanded into historically flood-prone zones. The result was catastrophic: more than 200 fatalities, widespread damage, and a landscape visibly altered by the passage of water.

> “This watershed area and its regulation services are fundamental in mitigating major floods.”
>
> Xavier García Martí, forest engineer at Plataforma para el Estudio y Conservación de la Sierra de Chiva.

Standing in the upper basin months later, the physical traces of the DANA remain – widened channels, exposed soil, disrupted vegetation. Yet the event cannot be understood solely through these immediate impacts. As one participant noted during the visit, the flood “did not start with the storm; it started with the way the landscape has been transformed over time.”

This distinction is critical. The DANA was not only a climatic event; it was also the expression of a system under stress.

From managed landscape to fragmented territory

The Sierra de Chiva still carries evidence of a more integrated relationship between land use and ecological function. Terraces built to prevent erosion are visible along the slopes, remnants of agricultural systems that combined production with water management. Crops such as almonds, olives, vines, and carob once formed a mosaic landscape, supported by grazing practices that helped regulate vegetation density.

Over the past half-century, this system has gradually been dismantled. Rural abandonment, shifts in economic activity, and the decline of traditional practices have altered both the structure and function of the landscape. In many areas, dense pine regrowth following repeated fire events – including a significant fire in 2003 – has led to more homogeneous vegetation, increasing both fire risk and the speed at which water can move across the surface.

At the same time, the lower parts of the basin have experienced sustained urban and industrial expansion. Watercourses have been diverted or constrained, and development has taken place in areas historically shaped by periodic flooding. These changes have effectively reduced the space available for water to spread and dissipate energy.

The cumulative effect is a system where natural regulation is weakened, and exposure is increased.

Forests as functional infrastructure

One of the central insights of the field visit is the need to reconsider how landscapes are valued within risk management frameworks. Forests and shrublands are often discussed in terms of biodiversity or conservation, but their hydrological role is equally significant.

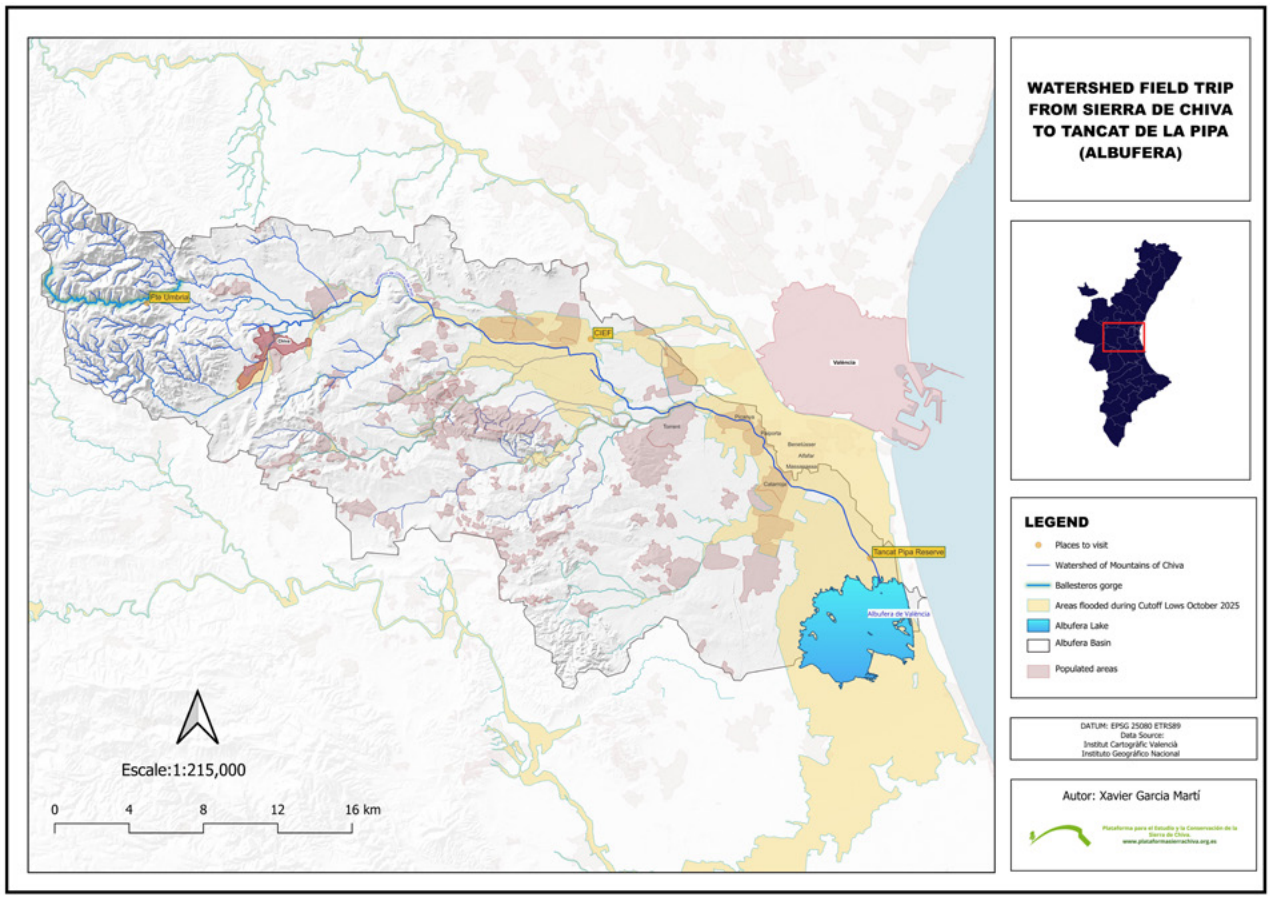
“The regulatory services provided by these forests and Mediterranean shrublands are of enormous importance to the densely populated areas of the Valencian plain,” García Martí explains. These services include reducing runoff, stabilising soil, and facilitating aquifer recharge — processes that are essential not only for ecosystem health, but also for agriculture and urban resilience.

From this perspective, public forests such as those in the Sierra de Chiva can be understood as part of a broader system of infrastructure. Unlike engineered solutions, their effectiveness depends on long-term management and ecological integrity. Yet their contribution to reducing risk is no less real.

As one of the CIEF representatives noted during the visit: “If we neglect these systems, we are effectively reducing our capacity to manage water before it reaches the city.”

Restoring function at the end of the basin

The downstream section of the visit, at Tancat de la Pipa, provides a counterpoint to the processes observed in the upper basin. Located at the edge of the Albufera, this site demonstrates how ecological restoration can reintroduce functions that have been lost elsewhere in the system.



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Once an intensive rice field, Tancat de la Pipa has been transformed into a wetland composed of lagoons and marshes. Managed through a model of custodia del territorio by Acció Ecologista-Agró and SEO/BirdLife, it serves multiple roles simultaneously.

Water entering the site is slowed, allowing sediments to settle and pollutants to be filtered through natural processes. The wetland also acts as a buffer during periods of high flow, reducing pressure on downstream areas. In parallel, it supports a wide range of species, contributing to biodiversity within the Albufera system.

What distinguishes this site is not only its ecological function, but the governance model that sustains it. The collaboration between civil society organisations and public authorities enables long-term stewardship, aligning conservation objectives with water management needs.

As one of the organisers from AGRÓ explained, “this is not about recreating nature as it was, but about restoring the functions that the system needs today.”

Connecting the system

Taken together, the Sierra de Chiva and Tancat de la Pipa illustrate the extent to which flood risk is distributed across space and time. The same water that accelerates in the upper basin is eventually absorbed and filtered in the lower reaches, provided that the necessary ecological conditions are in place.

From mountains to wetlands, this watershed reveals two distinct but interconnected trajectories: one in which degradation amplifies risk, and another in which restoration contributes to resilience.

The challenge lies in aligning these trajectories.

This requires moving beyond fragmented approaches that treat upstream and downstream areas separately, or that prioritise short-term solutions over long-term system functioning. It also requires integrating ecological knowledge into planning processes that have historically overlooked these dynamics.

Beyond event-based thinking

The field visit highlighted a broader issue in how environmental risks are framed. Extreme events tend to be analysed in isolation, with attention focused on immediate causes and impacts. Yet the conditions that shape these events – land use, vegetation patterns, governance decisions – evolve over much longer timescales.

Understanding this requires a shift in perspective.

Floods are not only the result of extreme rainfall. They are also the outcome of accumulated changes in how landscapes are managed and inhabited. Addressing them therefore involves not only responding to events, but rethinking the systems within which those events occur.

In the Sierra de Chiva watershed, that system remains visible – and, to a certain extent, still functional. Its future will depend on whether that functionality is recognised, maintained, and restored where necessary.

The implications extend well beyond this particular basin. Across the Mediterranean, similar dynamics are unfolding, linking ecological processes to social and economic outcomes in ways that are often poorly understood.

Making those connections visible is a first step. Acting on them is the next.

1. A grey heron flies over water near Valencia, Spain. Photo: María González Delgado / EFI
2. Banan Al Sheikh, from the Palestine Institute for Biodiversity and Sustainability (PIBS), poses for a photo during the field trip. Photo: EFI
3. Watershed from Sierra de Chiva to Tancat de la Pipa. Source: Xavier Garcia Martí
4. Field trip partipants listen to a talk. Photo: María González Delgado / EFI



4

A Remote Sentinel With Global Consequences

Antarctica matters more than ever.

Antarctica is the planet's climate sentinel, according to Eric Rignot, the Distinguished Professor of Earth System Science at the University of California, Irvine and senior NASA scientist. Rignot spoke with Ahmetcan Uzlaşık on the sidelines of the Antarctic Futures Symposium in late April 2026.

You describe Antarctica as remote but relevant. Why is Antarctica important?

Antarctica is essentially a sentinel of the planet. It shows very clearly how Earth is responding to greenhouse gas emissions, and these effects tend to be amplified in the polar regions.

Antarctica holds enough ice to raise global sea levels by around 60 metres. We are not worried about that happening tomorrow, but even a much smaller increase is critical. A rise of about one metre per century would already have massive global consequences impacting 250 million people.

Sea level rise affects economies, trade, safety, and even national borders. In some low-lying regions, particularly island nations, entire populations may be forced to relocate. This creates a new form of climate-driven migration. It is not just a local issue but a global one, requiring international cooperation and solutions.

There's a lot of excitement around the Andromeda Earth Observatory, how will it differ from existing research stations?

We view Andromeda as the Antarctic research station of the 22nd century. Many current Antarctic stations still rely heavily on fossil fuels for heating, transport, and logistics. We want to move away from that by using renewable energy, particularly wind, and storing it as electricity or hydrogen.

We also want to develop zero-emission mobility systems. In Antarctica, this is especially important because there is no infrastructure like fuel stations.

How is technology changing Antarctic research?

Technology is evolving very quickly. We no longer need to send as many people into the field as before. Drone technology – which can now carry advanced instruments such as radar sounders, gravimeters, and laser altimeters – means we're expanding our observational reach over hundreds of kilometres without relying on aircraft.

Satellite internet allows us to receive data from the Antarctica almost instantly, rather than collecting it manually once a year. We can install long-term observatories that continuously collect data and transmit it back to laboratories via the internet. In many ways, we are trying to build something similar to global weather station networks, which currently do not exist at scale in Antarctica.

These innovations are transforming how we conduct research and opening up entirely new possibilities for understanding the Antarctic system.

What is the current state of observation capacity in Antarctica?

It is still very limited and not sufficiently developed. The observation network is not mature and is often under threat due to funding constraints. There is also a lack of awareness among policymakers about how critical these observations are. If we want to understand and model how Antarctica interacts with global climate, we need consistent and long-term data.

We cannot model a system that we do not observe. That is why building a comprehensive observation system, both on land and in the surrounding ocean, is essential. ●

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VIEWS

Pamukkale on Thin Water

WORDS: **EMIN YIĞIT KOYUNCUOĞLU** & **AHMETCAN UZLAŞIK**
PHOTOGRAPHY: **EMIN YIĞIT KOYUNCUOĞLU**

Water, stone, and a wonder under pressure.

At Pamukkale in southwestern Türkiye, nature has built something that feels almost impossible, bright white terraces stepping down the hillside, filled with warm, clear pools. The formations run for nearly 3 kilometres, created as hot spring water – some of it close to 100°C – flows downhill and leaves behind thin layers of calcium that slowly harden into limestone.

Just above the terraces stands the ancient city of Hierapolis, founded over 2,000 years ago around these same thermal waters. Once a major spa town of the Roman world, it's now a spread of ruins, a grand theatre, stone streets, broken columns, all overlooking the bright pools below. The link between people and water here has lasted for centuries.

Today, Pamukkale is a UNESCO World Heritage Site and one of Türkiye's most visited places, drawing more than two million people each year. But the springs that built the terraces are weakening. In recent measurements, water flow in some areas has dropped from around 400 litres per second to nearly 100–150. Scientists link the decline mainly to a decade of ongoing drought, reduced snowfall, thinner snow cover in recharge areas, heavier short rainstorms that fail to feed groundwater properly, and increased underground water and geothermal extraction in the surrounding region.

These photos show Pamukkale as it is now – stunning, busy, and fragile – a landscape shaped by slow geology and fast modern pressure, where every stream of warm water matters.

Cover: Pamukkale travertines, Denizli, Türkiye. A UNESCO World Heritage Site known for its white limestone terraces formed by calcium-rich thermal waters.



A lone tree rising from the white travertine terraces of Pamukkale, Denizli, Türkiye.

Above: The Roman theatre of Hierapolis, Denizli, Türkiye, constructed in the second century A.D. and once seating thousands in this UNESCO-listed ancient city. **Below:** Hierapolis Ancient City, Denizli, a UNESCO World Heritage Site founded in the second century B.C., famed for its Roman theatre, necropolis, and proximity to the travertine terraces of Pamukkale.



Thermal waters on the travertine terraces of Pamukkale, Denizli, Türkiye.



Where turquoise meets white.





Mineral-rich pools atop travertine terraces.







Pamukkale, Denizli, Türkiye, is one of the country's most distinctive natural landscapes.



A wide angle view of Pamukkale's pools and terraces.



A landscape of contrasts.







View of the city beyond the travertines, Pamukkale, Denizli, Türkiye.

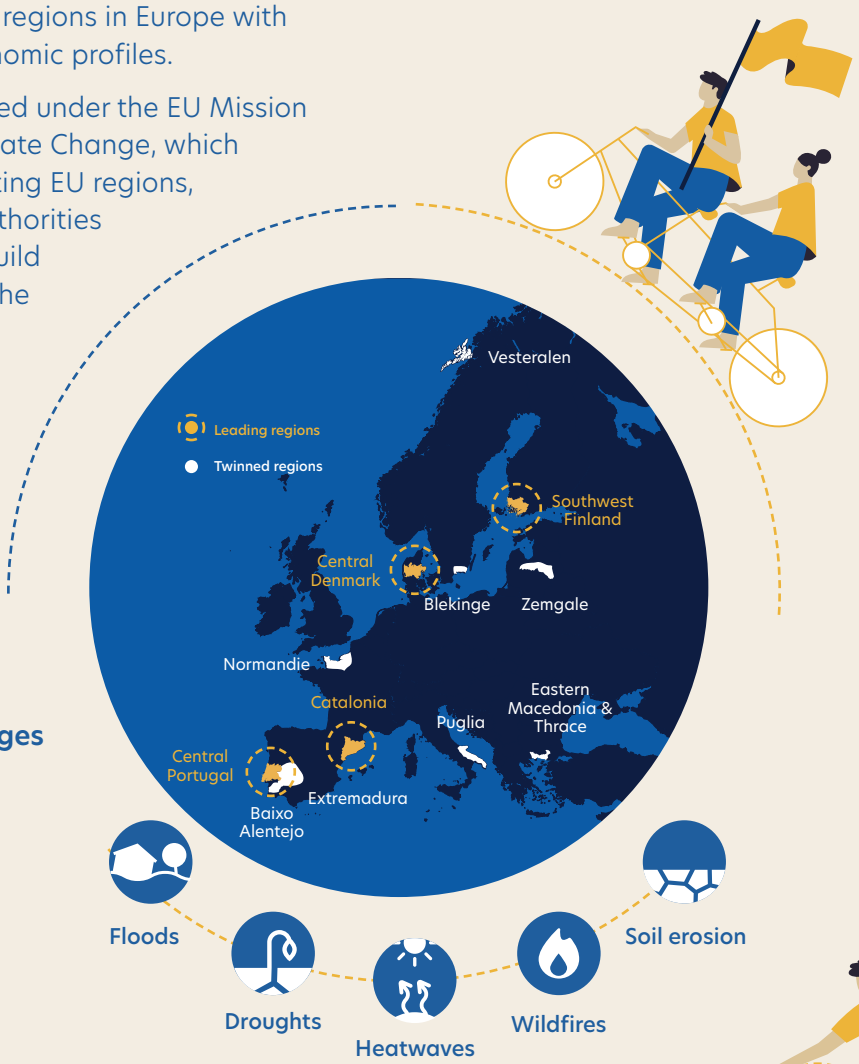
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Reviving Abandoned Forests Is Europe's Best Defence Against Wildfires

WRITER: **TOM LOVETT**



1

As rural abandonment fuels mega-fires, pioneers prove that managing forests reduces risk and offers revival.

"Every summer we fear it could happen again," says Guillermo de Rueda Úbeda, gazing across the valley at a hillside scarred by a wildfire 25 years ago. That blaze consumed thousands of hectares, stopping just one kilometre from his farm, Eco Finca Cortijo Los Gorros.

Since taking over the property permanently in 2018, de Rueda Úbeda has transformed the 100-hectare site – located within the Sierra de los Alamos, an hour inland from Murcia – into a hub of ecological plum production and rural tourism. The once burnt hillside is now a dense pine forest. But, de Rueda Úbeda explains, the expanding forest is the real threat.

Historically, the area thrived with families farming terraces and grazing livestock. When they needed extra cash, they'd sell timber in the nearby town of Moratalla. Today, those families have gone; the remaining houses stand empty or serve as fleeting holiday homes, leaving the land abandoned. This demographic collapse has created a tinderbox. Without regular grazing or management, firebreaks vanish and pines grow unchecked. "Fire watchers are vital," de Rueda Úbeda says, pointing to the closest lookout tower, "but we must stop the fire before it starts."

Wildfires in Europe are spreading. They arrive earlier, last longer, and burn with more intensity. It's a perfect storm: rising temperatures and prolonged droughts driven by climate change, combined with a dangerous build-up of dried vegetation – the direct result of land abandonment and inadequate forest management.

Stopping wildfires requires more than reactive firefighting; it demands clear, coherent, and decisive action to transform abandoned landscapes. The true solution lies in revitalising rural economies to transform neglected forests from high-risk zones into actively managed, productive, and biodiverse havens.

Wildfire season arrives earlier each year

The 2026 fire season arrived early in Murcia. A prolonged drought combined with strong winds created the conditions for a blaze to sweep across 400 hectares of the Sierra Espuña Natural Park in March – months before the traditional peak.

This premature start mirrors trends identified by the European Commission's Joint Research Centre (JRC) for the 2025



2

season: a record for fires in Europe, impacting 1,079,538 hectares. While fires also scorched parts of France, Germany, and the Netherlands, the fury was concentrated in Southern Europe, particularly on the Iberian Peninsula. A three-week heatwave in early August 2025 sparked 22 large-scale fires across Portugal and Spain, burning 460,585 hectares. This single event accounted for 43% of all land impacted by wildfires in the EU during that period.

Just 80 kilometres northeast of the Sierra Espuña at Los Gorros, de Rueda Úbeda illustrates the physical reality behind the statistics. Access to the forest has become increasingly difficult as pines have choked the landscape. In some areas, four or five trees compete for a single square metre of land.

These are not tall, healthy pines but scraggly trees with dried branches. "This is what I collect to start my fireplace at home," de Rueda says, snapping a nearby branch. "Imagine what can happen with thousands of hectares of this stuff," he adds.



3

Prevention is the best cure

Wildfires are a cross-cutting crisis that threatens the core of the European Green Deal, the EU Mission on Adaptation to Climate Change, the Biodiversity Strategy, and Rural Development policies. And yet, according to Fernando Pulido, Professor of Biology and Forest Conservation and Improvement at the University of Extremadura, existing EU policies only focus on suppression, not land management. They are therefore ineffective strategies for wildfires.

"There are wildfires because there is no local economy and there is land abandonment," Pulido tells REVOLVE. "There is a change in social dynamics as people leave here for the cities. This leaves us with a forest that is unmanaged, leading to overly large forest fires." In Spain, forest cover has surged from just 13% in the 1950s to 56% today, according to the Forestry Statistics Yearbook 2023. Similarly, forest ecosystems now cover 46% of Portugal, as reported by the Biodiversity Information System for Europe.

In an age of biodiversity loss – where the WWF reports a 73% decline in global wildlife populations over the last 50 years – criticising the "greening" of landscapes through forest expansion may seem counterintuitive.

From a satellite view, Los Gorros sits within a lush forest that is part of the Natura 2000 network and a Special Protection Area for birds. But in reality, these are not thriving, biodiverse ecosystems; they are frequently monocultures. When land is abandoned, pioneering species like conifers swamp the potential for diverse flora and fauna. The result is a uniform powder keg primed to ignite.

The scale of neglect is staggering. The 2023 data shows that only 23.6% of Spain's 28 million hectares of forest are covered by a formal management plan. This leaves roughly 21 million hectares without any strategy for thinning, harvesting, or fire prevention. Portugal faces a similar crisis, compounded by the fact that over 90% of its forest land is privately owned, with records missing for half the territory, according to research published by the European Forest Institute in 2015.

This is not limited to the Iberian Peninsula. Forests are an extensive ecosystem in Europe covering 35% of the continent. And yet, research by the JRC published in 2023 found that one third of Europe's forests are in decline.

"It's a structural problem," says de Rueda Úbeda, who has witnessed the forest expansion in his area over recent years. "The omission of management is a genuine danger. We see the evidence through thousands of hectares lost every summer to fires that spread in hours, days, or weeks."

Against this backdrop of abandonment, entrepreneurs like de Rueda Úbeda are proving that active management is the only viable defence. At Los Gorros, his work is not merely about stopping fires but rebuilding a rural economy. "We are trying to make this a holistic project," de Rueda notes, describing a space where visitors can learn about water management, renewable activities, and ecological infrastructure. "And we want to show that others can come here, take over abandoned farms and regenerate the forest."

Practically, this means de Rueda Úbeda selectively extracts pine trees and clears dried vegetation to foster a more resilient, biodiverse forest. Hidden among the pines are century-old holm oaks and gall oaks, as well as the offspring of these trees. He gives these oaks room to breathe by removing encroaching pines and clearing the undergrowth.



4

The long-term vision is a rich mosaic: holm oaks with their waxy, fire-resistant leaves; gall oaks with broad, sturdy canopies; aromatic rosemary growing on the forest floor; and ancient, long-living yew trees. Research published in the International Journal of Disaster Risk Reduction in 2023 confirms that diverse forests significantly slow the progression of wildfires, acting as natural firebreaks.

"We went from managing the forest to abandoning it. The only way forward is to regenerate it," de Rueda explains. "We cannot afford to walk away again."

To aid his work, de Rueda hopes to reintroduce a small herd of cows to graze the undergrowth naturally. However, this practical solution remains mired in complex bureaucracy and regulatory hurdles. Even clearing some of the larger pine trees requires a special permit that takes months of administrative work to receive.

"This is a challenge seen across Spain," says Fernando Pulido, "legislation is designed to respond to problems from more than 40 years ago." The foundational *Ley del Monte* was enacted in 1957 to protect forests at a time when they were shrinking due to over-exploitation.

While there have been adjustments since the 1950s, Pulido argues they are ill-suited to today's evolving reality: not a lack of trees, but an excess of unmanaged biomass due to rural abandonment.

Land laws not suited to the times

Pulido and his team work to develop forest legislation in Spain. Championed by the RESIST project – a five-year EU-funded programme that was launched to make regions more resilient to climate change – is the concept of a "productive firebreak" (PFB). Unlike conventional firebreaks, which are simply cleared strips of land where activity is prohibited, a PFB is an area where vegetation is actively managed through economic activity.

This includes livestock grazing, agroforestry, or biomass harvesting. The goal is to create a landscape that is both economically viable and naturally resistant to fire. "Traditional firebreaks carry high maintenance costs charged to the public budget," explains Pulido, "whereas PFBs cost nothing and they prevent fires while generating economic activity."



Pulido and his colleagues at the university have used fire simulation models to test the effectiveness of PFBs. In simulations of high-risk areas in Extremadura, strategically placed PFBs reduced fire size by 15%. However, their simulations reveal a crucial detail: when administrative and bureaucratic limitations are lifted to allow for more flexible management, that reduction jumps to 25%.

"In all major fires we observe that zones that are productive, meaning they have permanent livestock or crops, normally do not burn, or burn with much lower probability," Pulido notes.

Empirical evidence supports the models. During the July 2025 Caminomorisco fire in Cáceres, which consumed 2,660 hectares, a viral photo taken by environmental officer José Nuñez shows an olive grove standing untouched in a scorched landscape.

Recognising this potential, Extremadura became the first region in Spain to legally define PFBs, paving the way for their integration into regional prevention strategies. While administrative hurdles remain, Pulido views this legal recognition as a critical shift from mere suppression to proactive, economy-based prevention.

Wildfires are getting hotter

This adaptation is urgent. Rising temperatures and prolonged droughts are fuelling a new type of mega-fire, often termed "sixth-generation" wildfires. These blazes are so massive they generate their own weather systems, creating pyrocumulus clouds that can evolve into firestorms. Such fires are nearly impossible to control, capable of consuming thousands of hectares in a matter of hours.

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Europe's closest encounter with this phenomenon occurred in 2017 in Pedrógao Grande, central Portugal. Five separate wildfires merged into a single catastrophe that devastated 53,000 hectares – an area four times the size of Lisbon – killing 66 people and injuring 253. The triggers were lightning strikes and contact between an electrical line and dried vegetation.

It is in this same area of central Portugal that the RESIST project is developing participatory models together with communities to create fire-resilient landscapes while supporting the local economy.

In the Coimbra region, through Integrated Areas of Landscape Management (AIGP) they identify areas of risk and increase the scale of managed forests. A key tool in this effort is the "Village Condominium" model, which establishes 100-metre protective buffer zones around rural settlements by pooling land management efforts.

"Our primary goal is to create managed buffer zones at the village-forest interface to shield communities from external fires," says Jorge Cunha, Project Manager for Circular Economy and Value Chains at Colab Forest Wise, a private organisation bridging the gap between science and industry. "Whether by reducing fuel loads or planting resilient species, our methodology starts by engaging local authorities and landowners to tailor solutions to each village's specific reality."

Cunha explains that the core challenge is economic disconnection. "Landowners are not economically dependent on these forests. In most cases, they inherited the land from their parents and view the abandoned forests as a liability rather than an asset." The project addresses this by extracting value from abandoned forests through collecting the very fuel that creates wildfire risk and by establishing more resilient productive areas using native species.

This extracted material, which can also be used in nature-based solutions to prevent soil erosion or as shelter for animals, is already powering a diverse range of facilities, from industrial plants to public infrastructure. In one collaborating municipality, a woodchip-fuelled boiler heats the local swimming pool and sports complex. Looking ahead, the RESIST project is exploring advanced biorefinery applications, such as converting biomass into synthetic gas.

For Cunha, the immediate key to scalability remains keeping the logistics chain short, ensuring that the cost of collection and transport does not outweigh the energy value produced.



Abandoning forests is abandoning them to fire

What these pioneers demonstrate is that the only cure for Europe's worsening wildfire seasons is prevention. We can no longer afford to wait for the flames before acting; we must plan ahead. This means empowering rural entrepreneurs and communities to actively manage their landscapes – tending forests to reduce fire risks, creating buffer zones to shield villages and collaborating with experts like Pulido to use simulations for strategic planning. The goal should be to prevent catastrophe while stimulating the rural economy.

As wildfires become an enduring reality of the European summer, forest management requires a fundamental shift in perspective. Forests should not be viewed as untouched wilderness to be left alone, but as living systems requiring a relationship of management, care, and interaction. "This is never going to be an original forest," says de Rueda, underneath the shade of a holm oak. "It has been managed by people for centuries. We've made terraces, we've cultivated, we've changed the ecosystem."

The stark reality is clear: abandonment inevitably results in fire, whereas active forest management cultivates both economic vitality and resilience. "We cannot abandon the forest," de Rueda warns. "To abandon the forest now is to ultimately abandon it to fire." ●

1. Guillermo de Rueda Úbeda extracts young pine trees to give a holm oak space to grow. Photo: Tom Lovett
2. Dense pine trees choke the forest creating a severe fire risk. Photo: Tom Lovett
3. Guillermo de Rueda Úbeda cutting pines. Photo: Tom Lovett
4. Guillermo de Rueda Úbeda stands on once-farmed terraces at Eco Finca Cortijo Los Gorros. Photo: Tom Lovett
5. Jorge Cunha and community make a forest plan in Portugal. Photo: Colab Forest Wise
6. A viral photo shows an olive grove untouched during the Caminomorisco fire in Cáceres in July 2025. Photo: José Nuñez

"In all major fires we observe that zones that are productive, meaning they have permanent livestock or crops, normally do not burn, or burn with much lower probability."

Fernando Pulido - Professor of Biology and Forest Conservation and Improvement at the University of Extremadura.

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Scaling Sustainable Fuels in Europe Amid Geopolitical Volatility

INTERVIEW WITH **LEONIDAS KANONIS**, DIRECTOR FOR COMMUNICATIONS AND ANALYSIS AT EWABA



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Europe's ambitious climate targets require immediate deployment of sustainable fuels, but this depends on investor certainty and holistic policy implementation.

Driven by the geopolitical volatility of the Iran War and years of industrial scaling, fuel price fluctuations signal a turning point for the European energy market. For the first time in history, in April 2026, biofuels were priced below fossil fuel diesel, market specialists Argus Media reported.

Yet, despite this competitive advantage, the sector faces a paradox of investor hesitation, fragmented policies, and a reliance on imported feedstocks that threatens the EU's fuel sovereignty and ambitious 2030 and 2050 climate targets.

Ahead of the FUELPHORIA Policy Event at the European Biomass Conference & Exhibition (EUBCE), Leonidas Kanonis, Director for Communications and Analysis at the European Waste-based & Advanced Biofuels Association (EWABA), provided his analysis on the state of the renewable fuels sector in Europe.

He discussed the critical role of advanced biofuels and renewable fuels of non-biological origin (RFNBOs) in decarbonising hard-to-abate sectors, the challenges of the 2026 fuel crisis, and the urgent measures needed to transform Europe's waste resources into a robust, circular, and sovereign fuel-independent future.

Do the current EU laws (like ReFuelEU Aviation and FuelEU Maritime) set realistic targets for sustainable fuel use by 2030, or are the goals too ambitious given the current speed of industrial deployment?

The ReFuelEU regulation has been an ambitious regulation from the outset since it requires fuel suppliers to ensure that at least 2% of standard jet fuel is composed of Sustainable Aviation Fuel (SAF) as of 2025, rising to 6% SAF by 2030. The expected curve of adoption rises exponentially thereafter, creating a danger of putting too much pressure on already limited Hydroprocessed Esters and Fatty Acids feedstocks (HEFA) – the source of over 90% of SAFs. Alternative technologies have not been progressing as fast as they should be, and the EU has not promoted such technologies accordingly. Combined higher airline ticket prices due to SAFs and geopolitical instability from the Iran War means the outlook for airlines and their customers is increasingly precarious.

The FuelEU Maritime regulation sets relatively modest targets: a 2% Greenhouse Gas reduction for 2025 and 6% GHG intensity reduction in 2030. Crucially, unlike aviation's ReFuelEU mandate, these targets are not dictated by a fixed blending requirement. Therefore, shipping operators and owners implement a wide range of strategies – such as refuelling outside European waters or speed optimisation to reduce consumption – to comply with emissions reduction targets. Effective decarbonisation in maritime requires stricter mechanisms that incentivise actual renewable fuel adoption rather than allowing compliance through loopholes or operational tweaks.

Why are advanced biofuels and RFNBOs considered essential for the EU to reach its 2030 and 2050 climate goals, particularly for "hard-to-abate" sectors?

The only way for Europe to meet its climate goals is to immediately deploy renewable fuels in hard-to-abate sectors such as road transport, aviation, and maritime shipping. Although maritime and aviation emit just under 10% of global GHG emissions, this represents a significant challenge due to limited decarbonisation options.

As mentioned above, to fulfil its ReFuelEU mandate, aviation in Europe has become over-reliant on SAFs developed from HEFA. This dominance has come at the expense of promoting nascent, scalable technologies like e-fuels, Fischer-Tropsch, and alcohol-to-jet solutions. To achieve decarbonisation, the aviation sector must urgently diversify its fuel mix beyond HEFA-based SAFs.

Despite what global shipping container companies advertise, green methanol and ammonia – renewable fuels derived from green hydrogen – are not yet universally available in global ports. Waste-based and advanced biofuels are the only existing solution that can decarbonise vessels today without the need to modify the engine or the fuel infrastructure. RFNBOs are a promising option for the shipping sector and at FUELPHORIA we are exploring the potential of such fuels.

For road transport, advanced biofuels offer an immediate "drop-in" solution, lowering emissions from heavy-duty vehicles (HDVs) transporting essential EU goods without requiring infrastructure changes. RFNBOs can offer another solution in the medium term for reducing road transport GHG emissions.

How has the 2026 fuel crisis impacted the development of renewable fuels in Europe? Has it accelerated the push for energy independence, or has it forced companies to delay projects due to soaring energy and construction costs?

Unfortunately, we are seeing hesitation of companies to invest in projects because of the soaring energy and construction prices, which is creating uncertainty for investors. A major blow to the sector came in 2025 when BP and Shell cancelled their plans to invest in HVO (Hydrotreated Vegetable Oil) and SAF facilities in the Netherlands. The decision was due to low renewable fuel prices at the time, which would not have led to a profitable investment. Next to that, new HEFA-SAF projects are questionable due to resource conflict for feedstock with other transport sectors. The EU must act and support renewable fuels produced in Europe, strengthening regional supply chains, acknowledging our energy and fuel dependence on sources outside the continent, and securing a more robust investment environment.



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What are the main challenges in developing and expanding advanced biofuel and RFNBO production plants in Europe, and do existing policies adequately create an enabling environment?

The main challenge is investment certainty. Building advanced biofuel and RFNBO plants requires high upfront capital costs, long permitting procedures, access to renewable electricity and hydrogen, and long-term visibility on policy support. At the same time, investors face uncertainty regarding future feedstock availability, fluctuating energy prices, and constantly changing regulatory requirements.

Additionally, Europe lacks the necessary infrastructure and industrial integration to support these technologies at scale. RFNBO production, in particular, is held back by a shortage of renewable electricity and electrolyser capacity, while advanced biofuel projects struggle to secure sustainable feedstocks at stable prices.

Another critical challenge is policy. Current EU policies provide important market signals through regulations like ReFuelEU Aviation and FuelEU Maritime, but the overall framework remains too complex and fragmented. Europe needs a more stable and technology-neutral approach that supports innovation beyond already mature technologies and creates investor confidence that projects developed today will remain competitive and supported in the long term.

One of the major issues for the sector is feedstock supply. What are the most significant bottlenecks you've identified regarding the availability of sustainable biomass for advanced biofuels in Europe?

Feedstock is indeed scarce, forcing production to rely heavily on biomass imports from outside of Europe for feedstocks like Used Cooking Oil, with the deficit made up through imports from China, Indonesia, and Malaysia. This dependency creates significant fragility in an already volatile market.

A critical failure in European feedstock supply lies in the European Commission's lack of resources dedicated to analysing the EU market's

actual biomass collection potential. The lack of reliable data prevents the market from operating credibly. Investors cannot assess availability, risks or the viability of specific fuels without accurate information. Studies that are published on feedstock availability are not coherent with a specific framework or methodology. They present conflicting figures that distort the picture for actual availability and collectability.

How should policymakers address the competition for feedstocks between different sectors (for example, renewable energy demand, mobility sector competition, heavy industry) to ensure an efficient and fair distribution of resources?

An often-overlooked element of regulations is impact assessment. Impact assessments are evidence-based reports that the European Commission publishes before proposing new laws or regulations. These assessments are instrumental as they can allow an industry to flourish but, on the other hand, they can lead to signals that confuse investors and create unnecessary competition between sectors. Europe is already deficient in renewable fuel production. To ensure European policy is having the intended effect, we need these assessments to be thorough, grounded in accurate market data and developed with industry input.

What are the biggest barriers in getting everyone across the value chain – from waste collectors and fuel producers to end consumers – to work together effectively to create circular value chains?

The biggest barrier is policy. Since the advanced biofuel and RFNBO sectors exist primarily due to regulatory mandates, complex policies create uncertainty across the entire value chain. For example, biofuels are as of April 2026, for the first time ever, priced below diesel due to the conflict in Iran. In a free market, this price advantage should lead to an uptake in demand for biofuels. However, regulatory caps and restrictions prevent further scaling, blocking the uptake of this cleaner, cheaper fuel.

In addition, fragmentation within the European Commission – particularly between aviation and maritime units – forces these sectors to compete for the same limited feedstock pools to meet their targets. A holistic policy approach is needed to align objectives and allow the market to respond to price signals.

Drawing from the pilot demonstrations within FUELPHORIA, what are the most critical 'lessons learned' regarding the social, technical, or economic barriers to scaling up?

One key lesson is that scaling up renewable fuel technologies is not only a technical challenge but also an economic and societal one. We have demonstrated in FUELPHORIA that



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promising technologies for RFNBOs already work at pilot scale, but moving from demonstration to commercial deployment remains extremely difficult because financing conditions remain uncertain and operational costs remain high.

Another important lesson is that cooperation across the value chain is essential. Fuel producers, technology providers, ports, airports, industrial users, and policymakers all need to move in the same direction. If one part of the chain is not ready, deployment is significantly delayed.

From a societal perspective, communication and public understanding also matter. Citizens and stakeholders need to better understand why these fuels are necessary for hard-to-abate sectors where direct electrification is not feasible. Without broader public acceptance and clear policy communication, scaling up becomes even more difficult.

Beyond the challenges, what specific opportunities do you see for European industries to become global leaders in producing advanced biofuels and RFNBOs?

Europe already has strong industrial expertise, advanced research institutions, and ambitious climate legislation that can position it as a global leader in renewable fuels. European companies are among the pioneers in advanced conversion technologies, engineering solutions, and sustainability certification systems.

There is also a major opportunity to strengthen Europe's strategic autonomy by producing more renewable fuels domestically and reducing dependence on imported fossil fuels. Developing regional supply chains around waste-based feedstocks, renewable hydrogen and e-fuels could create thousands of industrial jobs and support economic growth across rural and industrial regions alike.

If Europe manages to scale up these technologies successfully, it can also export knowledge, standards and technologies globally. We have already seen this happen with Europe taking the lead in renewable electricity technology.

What is the single most impactful measure the European Commission could take in the next 12 months to accelerate the transition from pilot projects to full commercial deployment?

The most impactful measure would be to provide long-term regulatory and investment certainty. Industries are ready to invest billions into commercial plants but only if they know that the policy framework will remain stable and provide support over the next 10 to 15 years.

This means simplifying regulations, reducing administrative complexity, accelerating permitting procedures, and creating stronger financial support mechanisms for first-of-a-kind commercial facilities. Europe must move beyond targets alone and actively de-risk investments for innovative technologies that are still struggling to compete with fossil fuels or already mature renewable fuel pathways.

A clear and stable framework would immediately improve investor confidence and accelerate the transition from pilot demonstrations to industrial-scale deployment across Europe.

What does sustainable success look like for Europe fuels by 2030?

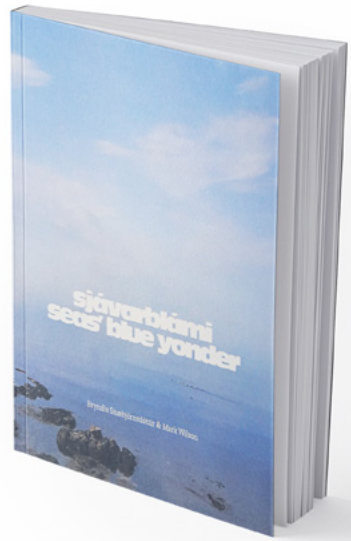
Energy and fuel independence should be a key priority for Europe moving forward. In a very unstable global environment, Europe needs to be a sovereign bloc of countries that can sustain itself, its ambition, its targets and which, in times of war or shock, can provide a safe and stable environment for its citizens.

Domestically produced fuels will be needed as much as ever and strengthening these supply chains within Europe is critical. While global trade remains important, Europe's lack of fossil fuel reserves and dependence on imported rare earths exposes it to significant risk.

Faced with this reality, Europe must strategically prioritise its existing resources, expertise, and competitive advantage. What better way to do that than with a robust, innovative, and circular domestic sustainable fuel industry? Europe can secure its energy independence while positioning itself as a global leader in green technology.

1. Airplane fueled on tarmac, Brazil.
   Photo: Vitor Paladini / Unsplash
2. Aviation fuel pump, Lelystad Airport, Netherlands.
   Photo: Haberdoedas / Unsplash
3. Airplane fueled on tarmac ahead of takeoff.
   Photo: Nik Oak / PEXELS

On Whaling in Iceland



REVIEWED BY **STUART REIGELUTH**

Sjávarblámi / Sea's Blue Yonder
Bryndís Snæbjörnsdóttir & Mark Wilson
National Gallery of Iceland, Reykjavik
25.01.2026 – 10.05.2026
Exhibition Book. Reykjavik: Husavik Whale Museum, 2025. 248 pages.

The little exhibition room in the modest National Gallery on the eastern side of the Tjörnin Pond does not do justice to the magnitude of the topic: whaling in Iceland… and beyond. The small space means that the curation crammed different pieces and formats together that created a confusing and unsatisfying experience. Arguably, the point was to provide different formats together to give the visitor a more comprehensive experience, but they came across as too many fragments.

The 'Apparition' installation piece on the ground is a replication of a whale's back surfacing for air, appearing out of the floor, and then disappearing in the photos that surround the replica; the disappearing spots on the photos are calm areas on the surface of the sea where the whale was a few moments before submerging again, after having appeared for breath, breaking the surface. The movement is there, but it is not understood at first without an explanation.

The explanation the visitor gets is of a young woman on a video describing what it was like to grow up with her father working in the whaling industry and how natural it all was and how beautiful the sea and environment always were, almost hiding – even ignoring the savagery of the whaling all around; and the other audio in the room is of a whale supposedly breathing under water, making gargling sub-sea sounds, bubbling, playing, just being underwater; it's hard to tell, you are not sure, maybe that is the point.

The highlight of the exhibition is the series of 21 Japanese black-ink paintings based on photos of stranded (*hvalreki*) whales. It is unclear why whales come onto beaches to die, and most of the causes of death are either unknown or clearly visible due to propeller cuts from a ship. The short descriptions under each painting reveal: 'no confirmed cause of death, but recent orca bite marks evident' and 'malnourishment – no sign of trauma' and 'malnourished – died after beaching' and 'suspected ship's propeller strike' and so on…

"Once land mammal themselves, over eons their nostrils have migrated from the front of their heads to the top […] whales were once land mammals." (p.139, 147) Does this explain why whales come to shore to die? Not all whales do, so why do some whales beach and not others? As underwhelming as this exhibition may be, it serves its purpose in raising questions for the inquisitive visitor that are answered in detail in a well-curated bilingual Icelandic-English book about this two-year project.

Traditional Icelandic farming culture welcomed the beaching of whales as an "occasion for celebration. Farmers would come together to collect its abundant flesh, blubber, and oil, providing sustenance for months. The Icelandic term *hvalreki* means good fortune." (p.51) Today, the beaching of whales is seen with sadness at the massive sea mammal's demise and also with frustration by the local authorities that have to dispose of the multi-ton carcass, often dragging it back into the ocean.

The transition from farming to whaling occurred in the mid-19th century in Iceland with the influx of foreign enterprises that considered whales to be the moving oil wells of the ocean. Whales

provided meat and blubber for human consumption as well as many auxiliary products such as whale oil for lamps (and streetlamps were proliferating exponentially in Europe and beyond) and whale bones for the manufacture of women's corsets (which were quite the fashion among Europeans during the era of industrialisation).

By 1935, Iceland begins to own its whaling industry and in 1948 establishes a whaling station in Hvalfjordur (Whale Fjord) in west Iceland by repurposing a US Navy station from World War II. The repurposed whaling station becomes a tourist attraction, for Icelanders and foreigners alike who are interested in seeing the "bloody spectacle of the flensing plant amid relics of military occupation." (p.61) 'Flensing' is the industry term for the bloody practice of stripping blubber, fat and skin from whales (and seals).

The savagery of whaling is hard to comprehend today. While the industry is significantly in decline, whaling in Iceland will continue disgracefully until 2029 at least, unless new legislation is passed. Japan and Norway are the only other two countries that continue whaling. As Iceland transitions into the 21st century, the island is exploiting more renewable natural resources such as geothermal energy from the earth and hydropower from rivers, unfortunately both of which are being used to grow another foreign-imposed industry: aluminum. ●

revolve.media/between

1. Japanese black-ink paintings based on photos of stranded (hvalreki) whales.



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Climate Frontline

An initiative by
European Journalism Centre
REVOLVE



Strengthening newsrooms and communities in Europe for resilient futures

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The aftermath of the DANA floods in Valencia, Spain. October, 2024. Photo: Danil Rudenko