REVOLVE

QUARTERLY INSIGHTS INTO A CHANGING WORLD

N°57 | Fall 2025



Connecting Europe

Bridging Mobility Gaps p.10

Port Puzzles p.36 Sunscreen Pollution p. 52 COP Controversies p. 60
DANA Reflections p. 68 EV Batteries p. 84 Circular India p.92



Reimagining Mobility

Let's do a quick experiment. Imagine you are told that in one month's time you have to take a trip from Paris to Barcelona, a quick check online reveals the cheapest train option comes in at around 69 euros, while the cheapest flight – with a travel time nearly 5 hours quicker, if you don't count waiting around in departures – is 50 euros. Which are you taking?

Rethinking the ways we travel is not easy, but it is vitally necessary not only for the European Union to achieve its ambitious carbon neutrality goals but for us humans to ensure a livable world for future generations. In the EU, transport accounts for over a quarter of all greenhouse gas emissions, much of it belching from private cars and planes.

Across Europe, regions and communities are working to address these challenges with research and initiatives that range from daunting infrastructure overhauls to local bike schemes.

This issue of REVOLVE opens with a Special Guest Editorial from Joost Vantomme, CEO of ERTICO-ITS Europe, who tells us about how Europe's regions are a perfect testing ground for citizen-centric mobility.

Then, Hollie Fisher takes a look at transport innovation around Europe, from the impressive Rail Baltica project to AI-empowered bike lanes in Barcelona. Our first VIEWS gives us a glimpse into alternative transport modes around the continent, both old and new.

From there, Asya Al Marhubi brings us up to cruising speed with the latest port innovations before Ana Maria Tovar gives us an insight into circular solutions in frigid northern Sweden.

The effect of sunscreen pollution on the Mediterranean Sea might surprise you in Cush Rodríguez Moz and Rocío Periago's deep dive on the issue before we head to Brazil for Ahmetcan Uzlasik's look at a controversial COP.

We reflect on the deadliest storm in Spain's modern history in our second VIEWS by Paula Rivas almost a year after the devastating DANA.

Then, Lauren Beauchamp gives us insights on the potential re-use of EV batteries before we hear about the role of women in India's circular economy in an interview with Chase Advisor's Suryaprabha Sadasivan. Daniela Deken reviews a sobering exhibition on factory farming in the latest Between the Lines.

Enjoy reading REVOLVE and send us your comments at: editors@revolve.media



Jake Threadgould

Editor-in-Chief



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10



36



44



52



60



76

Mobility

N°57 | Fall 2025

08 Guest Editorial
Towards accessible, scalable mobility

10 Connecting Europe
Regional transport initiatives take root

19 On the Move
Sustainable ways of getting from A-Z

36 Port Puzzles
Bringing shipping in line with carbon goals

44 Circular Solutions
A crop unlocks opportunities in northern Sweden

52 Contaminated Seas
The not-so-sunny side of sunscreen

60 Good COP?
UN climate talks throw host city's troubles into light

67 Bearing Scars
Spain reflects on deadly DANA one year on

84 EV Go Home
Extending the life of electric car batteries

92 Gender Equality
Broadening the circular economy for India's women

98 Eye Opener
Photojournalists reveal shocking reality of factory farms



Joost Vantomme

CEO, ERTICO - ITS EUROPE

p.8



Hollie Fisher

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p.10



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p.36



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p.44



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p.52



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p.52



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p.60



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Freelance Photographer

p.67



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p.84



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p.92



Suryaprabha Sadasivan

Senior Vice President, Chase Advisors

p.92



Daniela Deken

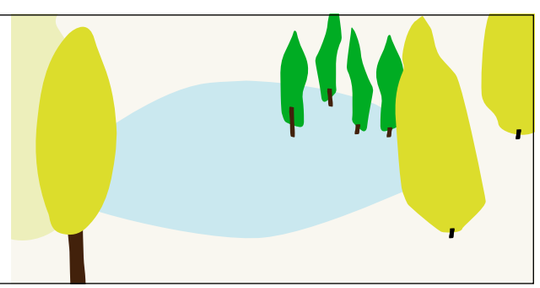
Communication Officer, REVOLVE

p.98

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.

revolve.media/sustainability



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Hamburg train station, Germany. Photo: Moritz Kindler

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Beyond Emissions

WRITER: **JOOST VANTOMME**
CEO OF ERTICO-ITS EUROPE



Illustration by Dariana Guevara / REVOLVE

Modern mobility must embrace inclusivity and empower communities.

Mobility is no longer just about moving people and goods, it's about enabling access, reducing emissions, and creating equitable resilient cities. Across Europe and beyond, cities and regions are taking the lead in transforming transport systems to be cleaner, smarter, and more inclusive. At ERTICO – ITS Europe, we believe that this transformation hinges on empowering regions with the tools, partnerships, and digital infrastructure they need to innovate effectively.

As we progress in an era where digital infrastructure is as essential as physical roads and rails, Intelligent Transport Systems (ITS) help make this possible by connecting vehicles, infrastructure, and users in real time. But this revolution is only meaningful if it is inclusive accessible and scalable across Europe's diverse regions.

Regions are the ideal testing grounds for next generation mobility. They allow for agile experimentation and real-world deployment of solutions that can later be scaled up. EU-funded projects such as IN2CCAM, which fosters inclusive automated mobility, and SINFONICA, which ensures vulnerable users have a voice in mobility planning, show how regional pilots can shape national and EU-wide mobility strategies.

Large-scale City Mission projects like the ERTICO-coordinated MetaCCAZE project are also contributing to the cross fertilisation of citizen-centric business models and innovations to create new sustainable travel options.

Another powerful example is the 3DxVERSE project in Hamburg, where digital twins that integrate real-time sensor data in combination with satellite imagery and AI planners are being used to optimise mobility flows and reduce emissions. When paired with immersive XR tools, the platform also fosters public engagement a critical factor in building trust in new technologies.

Data is another pillar of innovation and through platforms like Data for Road Safety and TM2.0, which enable local governments and private operators to share mobility data in real time, creating predictive traffic models that improve safety and reduce environmental impact.

Just as important as the technology is the collaboration that supports it. Regional authorities, universities, start-ups, and large mobility providers are crucial when it comes to building ecosystems of trust. By scaling these local successes Europe can build a truly integrated and accessible transport network while remaining globally competitive in smart mobility.

The emphasis on region-led innovation is also reflected in the main theme of the 2026 ITS European Congress in Istanbul "Bridging Innovation: Integrated Safe and Seamless Mobility." The event will highlight the ongoing collaboration between the EU and Türkiye through projects like SUMP Turkey, which ERTICO has supported to bolster new sustainable travel across the country.

The Congress will be held from 27-29 April 2026, offering over 100 expert sessions, more than 400 speakers, live demonstrations, and technical tours.

As of 2 September 2025, the Congress welcomes submissions of papers, sessions and demonstrations that will bring smart mobility closer to the people it serves.

Bridging Europe's Mobility Gaps

WRITER: **HOLLIE FISHER**

1

From the transnational to the hyper-local, Europe's transport initiatives must prioritise real sustainability.

Europe's transport landscape is a diverse patchwork quilt that morphs in design and character as you move around the map. It is a landscape that reflects the varied histories, geographies, economies, and cultures of a continent that endeavors to build deeper connections at a time when we must move beyond our reliance on fossil fuels.

It's easy to focus on the contrasts. The often-rickety Soviet rail networks of parts of central and eastern Europe feel eras away from the glitzy high-speed trains that pulse through Spain, France, Italy, and Germany. Countries like the Netherlands lead the charge when it comes to electric vehicle charging points, with 144,000, which equates to 23% of all charging points in the EU, according to the European Alternative Fuels Observatory. Less affluent nations lag far behind, with Latvia, for example, home to just 535 and Cyprus just 329.

Cyprus is implementing sustainable travel initiatives to connect rural mountain communities with the spoils of a growing sustainable tourism industry through the development of new bike paths, hiking routes, and electric vehicles. And in Barcelona, Artificial Intelligence is helping to make cycling routes safer.

These regional and municipal-level transport initiatives show that beneath the contrasts and comparisons, there is a unifying search for sustainable transport initiatives. It is one that receives billions of euros of backing from the European Union. Initiatives come in all shapes and sizes. Let's start with the big, bold, and risky.

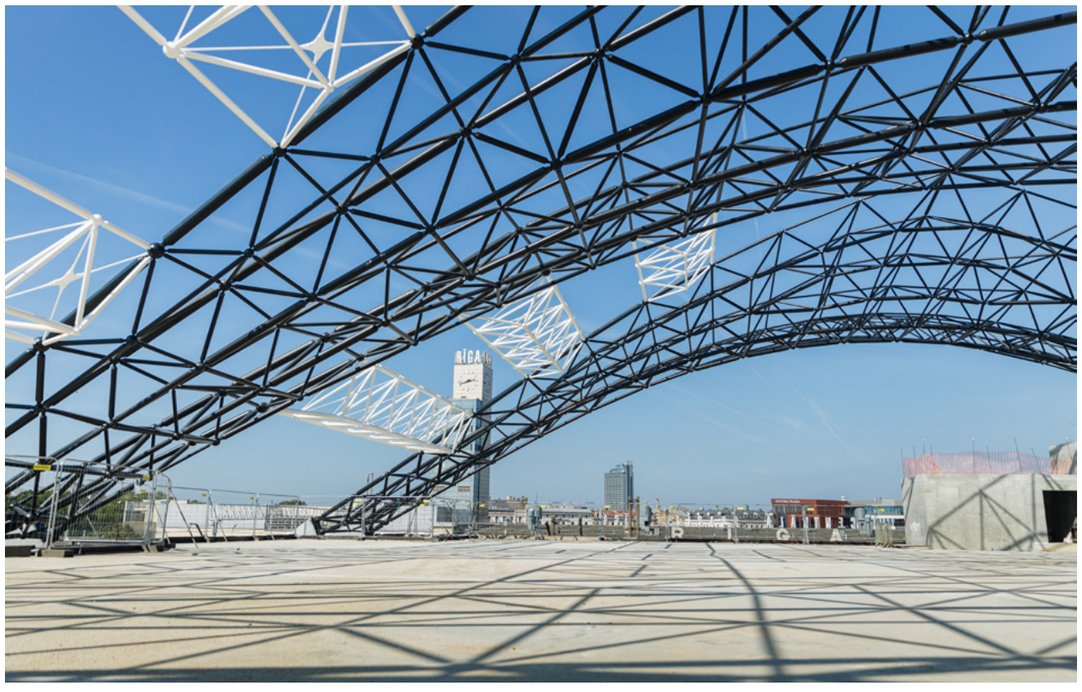
Engage the gauge

Estonia, Latvia, and Lithuania face a curious transport issue – their railways gauges are out of sync with the rest of the EU. While the majority of Europe uses the 'standard' or 'European' gauge, most rail lines in the Baltics still use the wider Russian gauge. This hangover from the Soviet era, when the region's infrastructure was geared toward freight movement with Russia rather than passenger travel with the west, makes it difficult to connect the Baltics seamlessly to Western and Central Europe via Poland. This presents a barrier to deeper economic integration, sustainable growth, and the kind of low-emission mobility Europe needs to meet its climate goals.

The Rail Baltica project seeks to bring about railway revolution with a vast electrified rail network connecting the Baltics with Poland and beyond. Spanning 870



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kilometres, it will combine high speed passenger lines and freight networks connecting Helsinki (by ferry), Tallinn, Pärnu, Riga, Panevėžys, Kaunas, Vilnius, and Warsaw. The plan has the potential to slash greenhouse gas emissions by hundreds of thousands of tonnes annually by reducing the need for road and air travel in the region, the project says.

Road transport accounts for just over 73% of transport emissions in the EU, which has a total fleet of around 250 million private vehicles, European Commission estimates suggested in 2022 — that's around 560 cars per 1,000 people. Flights make up nearly 14% of the EU's transport emissions, according to the bloc's own calculations and global emissions from international flights could triple by 2050, the International Civil Aviation Organisation has said.

In the 2024 report Connection Failed, Greenpeace Central and Eastern Europe analysed 990 routes between 45 European cities and found they were "still far better connected by air than by rail." The campaign group specifically identified "huge gaps in our rail network" due to "misguided mobility spending priorities."

Rail Baltica claims it could reduce annual carbon emissions by 150,000 tCO_2e (that's tonnes of carbon dioxide equivalent, used as a catch-all term for all greenhouse gases) by 2030 and 400,000 tCO_2e per year by 2050.

Bumpy ride

Such a massive cross-border undertaking is naturally susceptible to unforeseen twists and turns in the road. The gargantuan project, majority funded by the EU's Connecting Europe Facility with significant contributions from Estonia, Latvia, and Lithuania, comes at an estimated cost of over 23 billion euros over two phases, the supreme auditing bodies of the three Baltic nations said in a joint statement in 2024. This is four times what was initially tabled back in 2017. The first phase of the plan, which aims to connect Tallinn with the Polish border by 2030, is set to cost 15.3 billion euros – all going well.

In the same statement, the audit bodies warned that the Rail Baltica project faced a budget deficit of 10-19 billion euros and pointed out a potential EU funding gap between 2027 and 2028 due to financial framework norms. Rail Baltica responded in a statement acknowledging the rising costs, but attributing them to inflation, more accurate data, and increased scope, while adding that the economic benefits are due to eclipse outlay with an estimated 48 billion euros for the Baltic states, a figure that has nonetheless been questioned by local media.

In a statement to REVOLVE, the project's European Coordinator, Iveta Jēgere, said the project "brings completely new expertise to the region – knowledge on how to design and build a modern, resilient high-speed railway that will serve society for at least the next 100 years." She added: "For people and communities, Rail Baltica will bring better accessibility, new opportunities for business, tourism, and cultural exchange, and a renewed sense of belonging to Europe after decades of isolation."

European Coordinator Catherine Trautmann said of the plan: "Rail Baltica will make it easier for people and goods to travel between the Baltic States and to the rest of the EU. The EU will grow closer together, for leisure travel, economic development, and our common security. In the current geopolitical environment, building Rail Baltica is a necessity."

More than trains

While Rail Baltica is the headline act, the region is also making major strides in other areas of sustainable transport. In August 2024, the three Baltic nations launched the Baltic Mobility Collaborative (BMC), a forward-looking partnership that is making low-emission, smart mobility a reality across borders.

It brings together national transport and mobility associations to create systems that are more sustainable and efficient. This includes coordinated ticketing systems, shared bus services, and integrated logistics networks that streamline the movement of goods and people across the region.

Working closely on the project, Valts Murāns, Team Lead at ITS Latvia, said: "The Baltic Mobility Collaborative was created out of necessity. We can see

The Rail Baltica project seeks to bring about railway revolution with a vast electrified rail network connecting the Baltics with Poland and beyond.

all the ways that our nations and our regions are similar, but we must combine our strengths and increase the potential of our markets for innovation."

By working together to avoid duplication, the region can lower costs and accelerate the transition to sustainable mobility. Shared services mean fewer vehicles on the road, while smart delivery systems reduce congestion in cities. Importantly, the BMC is also supporting smaller towns and municipalities in their transition to green energy, ensuring that innovation doesn't stop at city limits.

As Edgars Starkis of the Latvian company Rift Traffic goes on to explain: "We're not just trying to move people. We want to move them in ways that reduce emissions, revitalise our cities, and build a greener economy."

Beyond the Baltics

The second quarter of 2025 saw a record number of new fully electric vehicle registrations in Western Europe, according to research analyst Matthias Schmidt. And while the rapid increase in EV registrations prompts certain questions (see: Lauren Beauchamp's 'Recharged for a Circular Future,' p.84) it also makes clear the need for modernised infrastructure that makes the electric vehicle experience easier and encourages their further uptake.

Research organisation ERTICO is involved in several projects working towards this endeavour, including ePowerMove and ZEV-UP, which address challenges of affordability and accessibility with regards to EV charging points and vehicles in urban settings, respectively.

Andrew Winder, Senior Project Manager at ERTICO, pointed out that European cities are especially ideal settings for scaling up small electric vehicle usage. "Our cities are older, more compact, and more congested compared to places like the United States. That creates an urgent need for smaller, cleaner vehicles that can navigate tight spaces and meet pollution targets," he told REVOLVE in an interview at the 16th Intelligent Transportation Systems (ITS) Congress in Seville, Spain, in May 2025.

Improved charging infrastructure and public awareness around electric vehicle systems are needed to boost the transition towards a larger EV fleet, he added. "Fleet incentives are key. When companies, delivery firms, bus operators, and logistics providers electrify, it creates demand and visibility. That's where public money and policy can have the biggest impact."



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8

I want to ride my bicycle

When it comes to cycling, there are some obvious countries at the head of the peloton. In the Dutch cities of Utrecht and Zwolle, the Sniffer Bike project turned bicycles into roaming air quality sensors. A country that reportedly has more bikes than people makes a perfect testing ground for initiatives that seek to convert these humble vehicles into intelligent transport nodes.

Meanwhile, in Barcelona, Spain, and Sarajevo, Bosnia and Herzegovina, the AI-powered project SCREEN sought to improve cycling safety and infrastructure through intelligent computer vision scanning of bike lanes.

Local authorities in the mountainous Troodos region of Cyprus are also using bike lanes — as well as new walkways — as part of an infrastructure plan that seeks to tap into the benefits of sustainable tourism for rural communities. Four villages are participating to foster their connections in collaboration with the EU-funded Regions4Climate project.

Connecting the dots

Representing nearly a third of the EU's emissions, addressing challenges in the transport sector is vital. It also presents opportunities. From flagship infrastructure projects like Rail Baltica to hyper-local cycling initiatives in rural Cyprus, efforts to decarbonise mobility are ongoing at every scale. This transition to more sustainable modes of transport goes hand in hand with political and cultural shifts as well.

The benefits of sustainable travel alternatives need to be made abundantly clear and shifts away from fossil fuels must be rewarded, subsidised, and made accessible to all. This patchwork of sustainable mobility movements demonstrates how a continent can move forward together.

1. A view of the Rail Baltica construction process. Photo: Rail Baltica
2. A view of the Rail Baltica construction process. Photo: Rail Baltica
3. A general view of RB Riga Central Station. Photo: Rail Baltica
4. Riga airport station under construction. Photo: Rail Baltica
5. Rail Baltica map Phase 1. Credit: Rail Baltica
6. An electric vehicle charging station. Photo: Wrs Tm Pl / Unsplash
7. A cyclist heads down the road. Photo: Franco Ruarte / Unsplash
8. Electric scooters by a tram stop in Strasbourg. Photo: Kseniia Penkova / Unsplash

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VIEWS

Moving Forward

Snapshots of sustainable travel around Europe.

Across Europe, the way people move is being rewritten. Transport accounts for around 29% of the EU's greenhouse gas emissions, so the push for cleaner, shared, and people-focused mobility isn't just a policy goal, it's a collective necessity. From Amsterdam's narrow canal-side streets and Berlin's wide modern boulevards to the plains of Spain, a shift is clearly underway.

The new mobility landscape is built on alternatives: scooters for the last mile, bikes and e-bikes for daily commutes, electric cars and charging hubs for city centers, and trams and autonomous shuttles reshaping public transit. What makes these changes powerful isn't only the technology itself, but the rethinking of what mobility means, less about owning a car, more about access, inclusion, and care for the environment.

This edition of VIEWS brings together snapshots of Europe's mobility transition: a mosaic of wheels, wires, and walkways pointing toward a future that's healthier, cleaner, and more connected.

Cover: Electric scooters are growing in popularity both as private vehicles and through app-based rental services. Photo: Gabriella Clare Marino / Unsplash



Above: A trusty steed since the 19th century, bicycles are still a popular and affordable way to move around, especially in urban areas like Amsterdam. Photo: Sabina Fratila / Unsplash
Below: These initiatives receive an extra boost when paired with well-developed and efficient cycle lanes, like this on in Copenhagen, Denmark. Photo: Antoine Schibler / Unsplash



In 2023, Paris became the first European capital to ban rental e-scooters from its streets following a referendum. Photo: Volodymyr Dobrovolskyy / Unsplash

Above: The rise of e-scooters was a good example of regulation falling behind a trend with controversies arising due to safety concerns. Photo: Pony / Unsplash
Below: The quiet whirring of electric vehicles is becoming an increasingly common feature of many European cities. Photo: Stepan Konev / Unsplash



Above: The advent of new technologies has ushered in a taste for autonomous vehicles like this electric shuttle being tested in Berlin. Photo: Falco / Pixabay
Below: An autonomous tourist shuttle. Photo: Bernd Dittrich / Unsplash



Bike sharing programs in urban centres around the world encourage citizens to opt for cycling as a sustainable way of getting around.
Photo: Nextbike / Unsplash



Above: Intercity travel options like highspeed facilitate more sustainable travel options over cars and planes. Photo: Joon Kwon / Unsplash

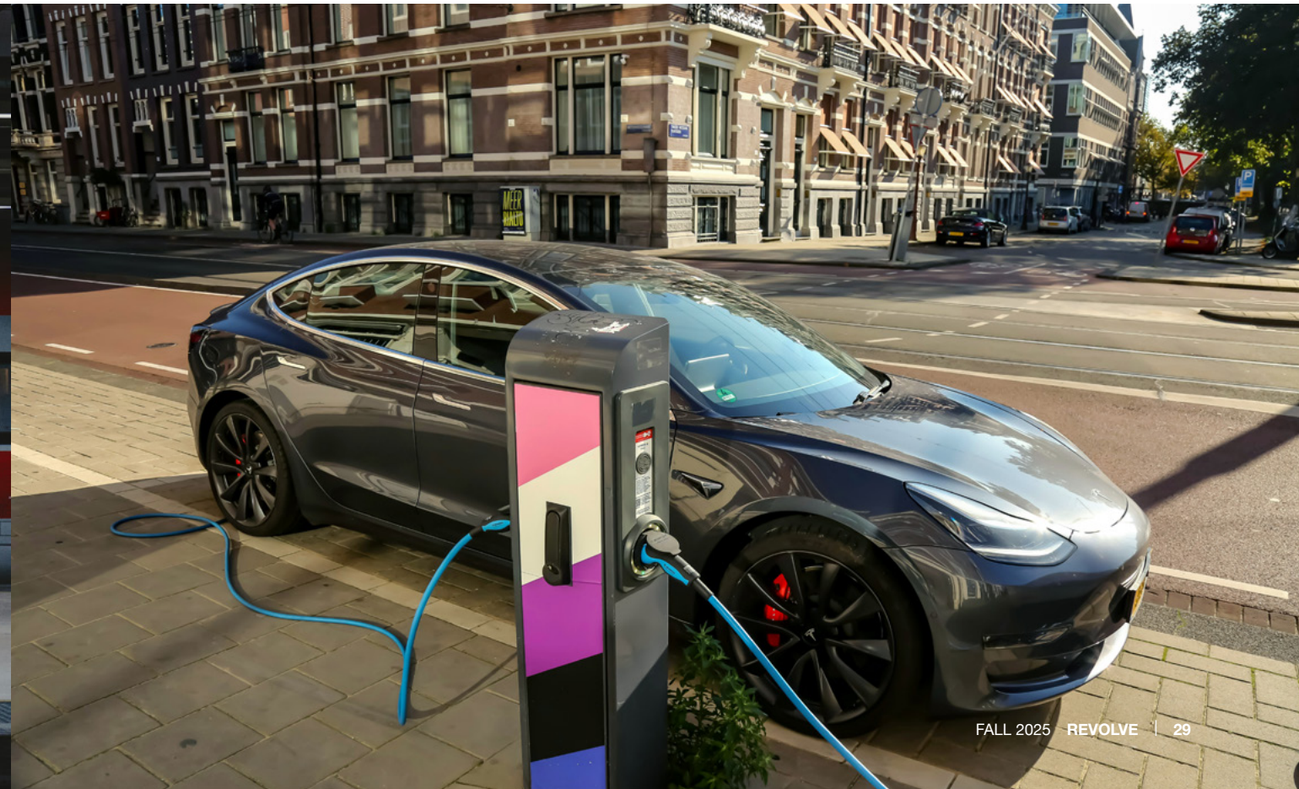
Below: In Spain, high speed trains turn a 6.5-hour car journey between Madrid and Barcelona into a 2.5 whizz through the countryside. Photo: Nico Ruge / Unsplash





Above: Car-sharing app based rental schemes like this CAR2GO vehicle offer comfortable trips through urban areas. Photo: JavyGo / Unsplash

Below: Growing EV demand has seen the rapid roll out of new infrastructure, such as this charging point in the Netherlands, which is home to more than any other European country. Photo: Rick Govic / Unsplash



It's not just electric cars nowadays either. This electric ferry runs routes in Norway.
Photo: Hyke

Sustainable transport options don’t have to be modern and shiny, something this classic Czech tram demonstrates. Photo: Stephen Tafra / Unsplash

Sustainable mobility can be fun for all the family.
Photo: Sven Brandsma

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Ports of the Future

WRITER: **ASYA AL MARHUBI**

1

As the link between land and sea, ports play a critical role in decarbonisation.

Ports have been centres of trade and cultural exchange for millennia, with the oldest known ports dating back over 4,500 years. Over their long history, ports have evolved to adapt to our changing use of the sea, playing a central role in our increasingly interconnected economy. Their influence extends far beyond their coastal locations. A glance at your (likely) nearby smart device, is reminder enough of the true scope of their influence: no matter the brand, it is made up of hundreds of parts from across the globe and brought to a retailer near you via various ports of call along the way.

Ports have grown substantially to meet the rising demand for global shipping. According to UN Travel and Development (UNCTAD), today ports enable the transport of over 80% of the goods traded worldwide. Shanghai, the world's largest and busiest shipping port, is over 3,600 square kilometres in size and processed a record breaking annual container throughput of 50 million TEU (Twenty-foot Equivalent Unit – the average size of a shipping container) in 2024, according to the Shanghai International Port Group.

With decarbonisation high on the maritime agenda for 2050, ports are evolving again, turning towards digitalisation, automation, and data-driven insights to optimise port processes, reducing inefficiencies and cutting down waiting times, with cascading benefits for both sides of the global supply chain.

Ports of the future, today

Industry 4.0 is transforming industries across the board. As of 2025, the "smartest" ports are taking full advantage of advances in the Internet of Things (IoT), AI, automation, and blockchain technologies to unlock opportunities that optimise port operations. With these tools, ports can provide more reliable schedules, faster turnaround times, and improved worker safety, making them more attractive ports of call for any route planner.



2

What is a fully automated port?

In a fully automated port, the stacking yard cranes and horizontal transport between the quay and the yard are all automated. Semi-automated ports rely on automation for yard cranes, and human-operated horizontal transfers around the port.

Since the Port of Rotterdam introduced the world's first fully automated port terminal in 1993, automation has had an increasingly relevant role. While the uptake of automation has been slower than in other sectors, as of 2024 there are over 70 automated container terminals, 22 of which are fully automated, according to Theo Notteboom, Athanasios Pallis, and Jean-Paul Rodrigue in their 2022 book "Port Economics, Management and Policy". And more ports of the future are on their way: the two busiest container ports in the world, Shanghai and Singapore, are heavily investing in automation. Singapore opened Tuas Port in 2022 – expected to be fully operational by 2040 – and it aims to be the world's biggest fully automated port, employing automated yard cranes as well as automated guided vehicles for horizontal transport. In May 2025, the Port of Shanghai announced the construction of its largest automated container terminal for 2033.

The sector is similarly taking advantage of digital twins – virtual representations of ports that use real-time data – which are being tested and used worldwide at some of the busiest ports. From a logistical point of view, the benefits of a digital twin are unparalleled. Real-time data from sensors about equipment, cargo, and port conditions combined with satellite imagery, traffic, and weather data, equip ports with all the information they need to ensure the best allocation of resources. This supports cargo tracking, faster cargo handling, and enables predictive maintenance, lowering the risk of worker injury and strengthening risk planning.

These trends, together with additional opportunities from integrating AI, blockchain technologies, and innovative data-sharing practices and technologies, such as those developed by the EU-funded MISSION project – which aims to minimise maritime shipping waiting time in ports – are providing actionable data-driven insights that enable the highest degree of optimisation in all port activities. And with it, the opportunity for port call optimisation.

Unlocking the full potential: Port Call Optimisation

In 2024, the Global Liner Performance Report from Sea Intelligence found average schedule reliability to be between 50 and 55%. Half of the time, ships experienced delays. Another study found that ships could spend an average of 15 to 22 days per year waiting for a berth or services, amounting to 4-6% of operational time per year. The potential emissions savings from addressing waiting time could be huge: 10% for container ships and bulkers; 16% for gas and oil tankers; and almost 25% for chemical tankers.

What is a port call and what is port call optimisation?

Port call refers to all the activities involved in the scheduled stop of a ship at port, from arrival to departure, including berth allocation, pilotage, cargo operations (loading and/or unloading), bunkering (refuelling), compliance inspections, crew changes, waste disposal, maintenance, and any other services agreed with the port or terminal.

Port Call Optimisation is the process of improving the planning and execution of a ship's port call so that its arrival is coordinated with the availability of nautical services (such as pilotage, towage, and berth access). Benefits include fuel and emissions savings, operational efficiency and cost savings, higher predictability and coordination, and improved safety and environmental quality.

The potential emissions savings from addressing waiting time could be huge: 10% for container ships and bulkers; 16% for gas and oil tankers; and almost 25% for chemical tankers.



3

Just-In-Time shipping is a shipping practice enabled by Port Call Optimisation, referring to a model in which a ship's arrival is coordinated with the availability of berth and services.

In practice, this means that any delays are communicated as early as possible, and ships can adjust their speed to arrive when a berth is available. This reduces congestion in and around the port and permits the ship to optimise the journey for fuel consumption.

Key terms to follow along:

Demurrage: A fee paid by the charterer, (the party responsible for loading and unloading the cargo) to the shipowner if cargo operations exceed the agreed laytime (the time allowed in the charter party for cargo operations). It compensates the shipowner for delays in making the ship available for its next employment.

Despatch: The inverse of demurrage, despatch is a payment made by the shipowner to the charterer when cargo operations are completed in less than the laytime specified in the charter party.

Notice of Readiness: A formal notification issued by the ship's master (or their agent) to the charterer, confirming that the vessel has arrived at the agreed location (port area, anchorage, or berth, depending on the charter terms), is in all respects fully ready to load or offload cargo, and has the required documentation in order. Tendering the NOR marks the start of laytime.

For this approach to work, each stakeholder group's respective sets of obligations and incentives need to be considered and realigned to allow for emissions reduction opportunities to be taken – a long-winded way of saying we need to make sure that there is something in it for everyone.

For ports, the argument is clear. As direct beneficiaries of Port Call Optimisation, this group stands to gain significantly. For charterers, optimised port processes can lead to tighter scheduling, reducing demurrage fees, and potentially earning dispatch payment instead.

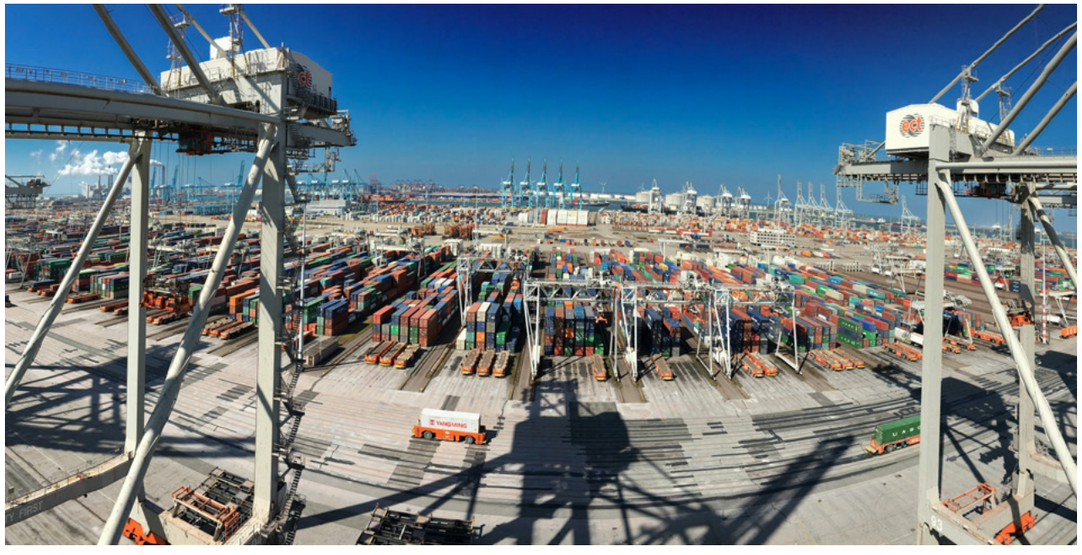
Over their long history, ports have evolved to adapt to our changing use of the sea, playing a central role in our increasingly interconnected economy.

For shipowners and shipmasters, it is not quite so straightforward. The industry standard practice at port has long gone by the principles of "first come, first served," encouraging ships to "sail fast then wait." Port Call Optimisation challenges this status quo, asking them to slow down and arrive at a more convenient time for the port. While this can reduce fuel consumption and waiting times, contractual terms such as demurrage complicate the incentives.

Demurrage, paid by the charterer to the shipowner when cargo operations exceed the agreed laytime, can influence the behaviour of shipowners and masters. Laytime usually starts when the Notice of Readiness is tendered, not at arrival, so any time waiting before NOR does not count as lost time for the shipowner. Once NOR has been tendered, laytime is considered to have started, so any subsequent port delays, such as congestion or berth unavailability, are typically borne by the cargo interests.

Depending on the charter party terms this could include shippers, receivers, charters, or insurers.

This nuance can reduce the incentive for shipmasters to adjust speed for port convenience. For shipmasters, the vessel's operation is their responsibility, but unless the contract includes specific incentives, such as performance bonuses or shared fuel savings, there is little reason to slow down for optimisation.



4

Enter virtual reality. Well, Virtual Arrival (VA). The Virtual Notice of Readiness (VNoR) was first introduced in 2011 and allows a vessel in transit to register its arrival as the time it would have arrived, had it sailed at full speed. A nifty fix, this contractual mechanism means that if a delay is communicated by the port with enough notice, the shipmaster can optimise the ship's speed for fuel efficiency and arrive at an updated agreed-upon time while still registering their "contractual arrival" as when they would have arrived travelling at "utmost despatch" – the nautical phrase for "as fast as you can."

By decoupling contractual arrival from actual sailing speed, VNoR allows the benefits of Port Call Optimisation without the need for a full overhaul of contracts or sector-wide collaboration, as it requires just two parties to agree to it: shipowners and charters. In doing so, VNoR better aligns shipowners' incentives with port efficiency goals, creating a clearer motivation to slow down when it benefits the overall supply chain. Compared to full-blown Just-In-Time shipping, which a joint article from International Taskforce Port Call Optimisation (ITPCO) and BIMCO (one of the largest associations representing shipowners) describes as "a multilateral agreement between all stakeholders involved in a port call," VA is somewhat easier to implement.

In pilot testing coordinated by the Global Maritime Forum conducted between 2022 and 2023, implementing VA offers fuel consumption savings. However, in a 2025 article, the Global Maritime Forum highlighted that a lack of coordination across the supply chain has hindered large-scale implementation. Regardless of how clever a solution it may be, its impact could remain minimal unless adoption rates increase.

Influencing the sector from the land out

Ports are central by design: their locations chosen precisely because they were the perfect place to connect land and sea, providing ability to connect people across vast distances. Today, they are central hubs that underpin the functioning of our global economy, connecting stakeholders from across the globe. In their brief on Port Call Optimisation, the Global Maritime Forum suggests that ports are also perfectly placed to assume a more proactive role: by requiring the use of VA in their contracts, ports can drive up adoption rates, helping to create the conditions they need for ships to engage in port call optimisation processes.

Ports continue to evolve, influenced by rising shipping demands, decarbonisation goals, and the opportunities offered by advanced digital technologies. But if the Global Maritime Forum is right, maybe this time ports have the chance to leverage their central position, literally and figuratively, to influence the parallel evolution of the maritime sector, and in doing so, unlock benefits for the sector and beyond.

Port Call Optimisation challenges this status quo, asking them to slow down and arrive at a more convenient time for the port.

1. Port of Barcelona, Spain.
   Photo: Olga Subach / Unsplash
2. Ships docked at the container terminal of the port of Hamburg, Germany.
   Photo: Dominik Lückmann / Unsplash
3. Stacked containers and cargo ships, Valparaíso, Chile.
   Photo: David Vives / Unsplash
4. Panoramic view of the port of Rotterdam, Netherlands.
   Photo: Bernd Dittrich / Unsplash

MISSION JUST IN TIME

Making maritime shipping more sustainable by optimising port call efficiency to reduce emissions and to enhance safety

3 MAIN BENEFITS

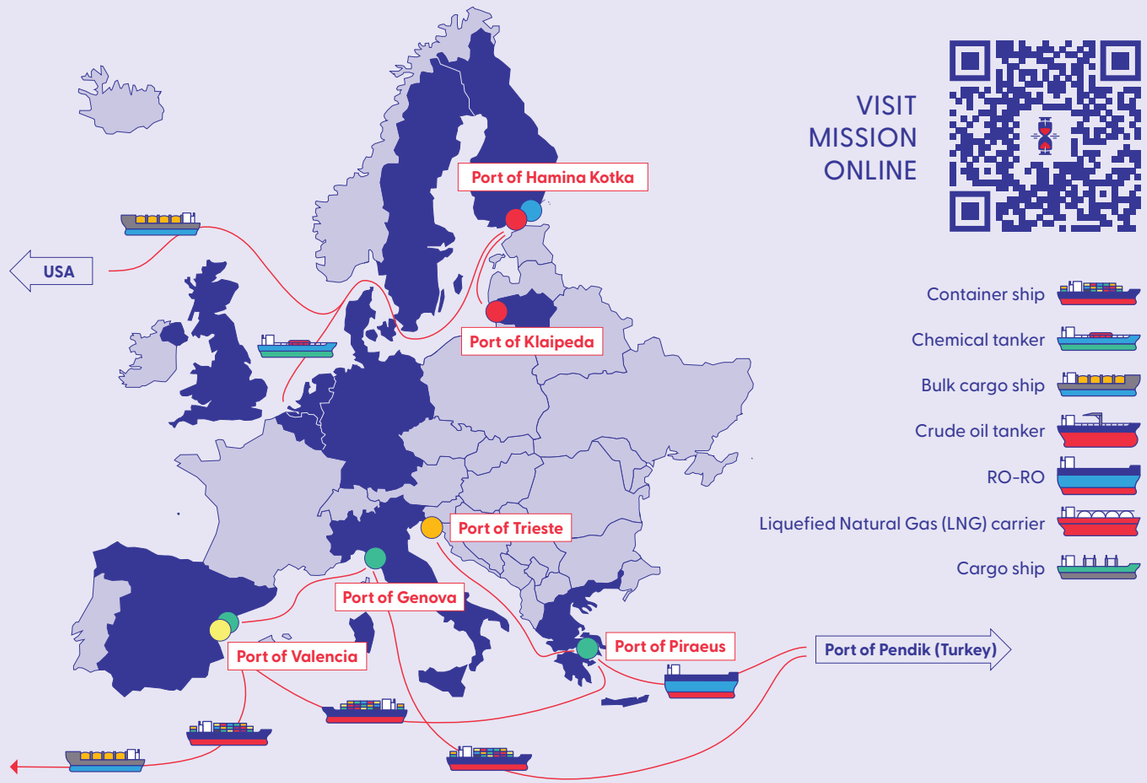
Reduction of:

- **(A)** Port congestion & anchorage traffic
- **(B)** Risks of accidents & collisions
- **(C)** Green house emissions and fuel consumption by 23% of the overall voyage

6 PORTS + 5 CASE STUDIES

- **Case #1:** Container shipping
- **Case #2:** Roll-on / Roll-off (RO-RO)
- **Case #3:** Roll-on / Roll-off (RO-RO)
- **Case #4:** Bulk Shipping
- **Case #5:** Bulk Shipping

Partner countries



VISIT MISSION ONLINE

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SDU

Transforming Agriculture in Northern Sweden

WRITER: **ANA MARÍA TOVAR**

1

How a crop could fuel a circular value chain in cold climes, producing everything from animal feed to renewable biodiesel.

In Upper Norrland, the northernmost region of Sweden, farming is a major challenge. Arable land is scarce, and climate conditions are harsh due to their long and intense cold seasons. Many of the lands in the north are classified as 'marginal' because of their low agricultural value: production costs outweigh potential revenue. Nevertheless, a group of researchers and agricultural experts has launched an innovative bid to make these lands productive by cultivating turnip rape and using it to produce biodiesel, animal feed, and glycerol for use in a biogas plant.

The ambitious project has taken root in the counties of Västerbotten and Norrbotten, where the percentage of arable land is tiny– only 1.2% and 0.3% respectively. The natural conditions in the area make it difficult to grow anything other than barley, grass or hay; as a result, agriculture focuses mainly on milk and meat production. The region also has the largest land surface and lowest population density in the country, which poses challenges for logistics and cooperation for farming and commercialisation. In addition, the local population is declining and ageing, reducing labour availability and straining rural services.

Facing this scenario, experts started to look for a crop suited to the region that could offer new opportunities for local agriculture and the economy. They landed on turnip rape, an oilseed plant typical of the region that performs well in short growing seasons. As an industrial crop suited to cold temperatures, it is more resilient than the more common rapeseed cultivated extensively in southern Sweden.

The crop has the potential to improve soil quality and productivity when employed in rotation with other cereals. Among its benefits, turnip rape can act as a "cleaner" in crop rotation, since it is not susceptible to cereal diseases. It can also reduce the need for tillage, according to various scientific studies. They also contribute to flowering resources for the benefit of pollinators. These qualities led experts to propose turnip rape as the central pillar of a circular value chain for bio-based production in the region.



2



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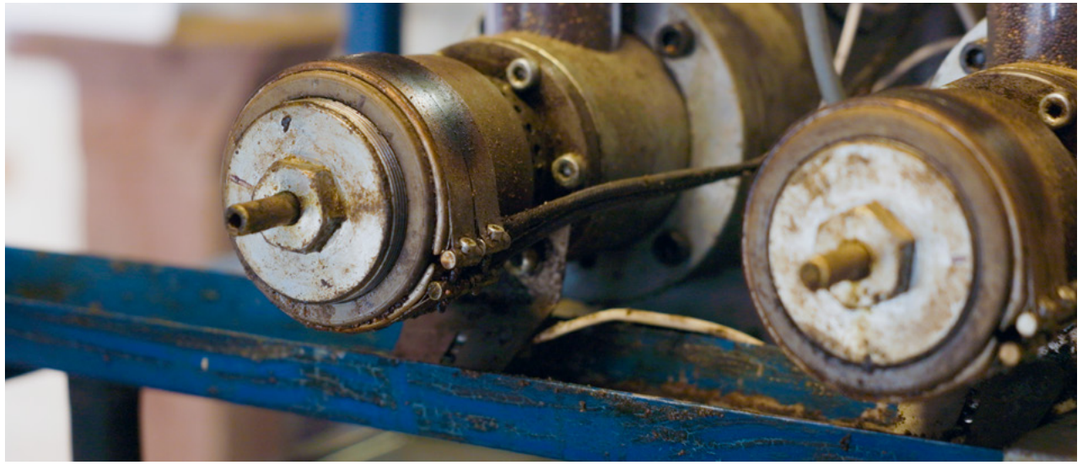
Fueling change

This initiative is part of the MarginUp! Project, an EU-funded project that is developing sustainable and circular value chains to produce bioproducts and biofuels from natural raw materials in seven international pilot cases. The Swedish case study is being spearheaded by RISE, a state-owned research and innovation institute that collaborates with industry, academia, and the public sector to enhance business competitiveness in the country.

The *Hushållningssällskapen Norrbotten-Västerbotten* (HS) agricultural association is also participating in the project. HS is responsible for cultivating the crop and managing the oil press and drying technologies at the farms. RISE Processum, a RISE subsidiary specialising in biorefinery development, is responsible for automating and optimising the biodiesel production unit. Another partner in the project is Ernsts Express, a major transport company in Sweden, which is responsible for providing the biodiesel plant and testing the biofuel produced in its trucks.

For Susanne Paulrud, senior RISE researcher and project manager, it is precisely the involvement of different actors from the value chain that makes this pilot case especially interesting. "We are working in many different stages of the value chain, from cultivation and technology development to building the relationship between stakeholders," she said. The initiative has brought together farming specialists, scientists, bioenergy experts and business leaders from across the country.

The crop has the potential to improve soil quality and productivity when employed in rotation with other cereals.



4

Reversing farming trends

Benjamin Bollhöner, a farming advisor from HS, emphasised the importance of the project in light of the current challenges facing Swedish farming. “For a long time, farming has focused particularly on dairy. Dairy farms are getting bigger while smaller ones are closing, leading to a sharp decline in the number of farms,” he explained. This has led to high dependency on the beef and milk markets, a situation that must be addressed by expanding agricultural alternatives. New crops could help reverse the trend of disappearing farms, which is crucial to strengthening the agriclutural sector in the region. “A critical number of farms is needed. If you are the only farm in a huge area, you cannot get help from neighbours and collaboration is impossible, for example, for exchanging machinery, which is essential,” Benjamin said. In this scenario, the pilot aims to demonstrate that turnip rape can be part of the solution.

The cultivation activities in the project are taking place at two sites: the Öjebyn Agro Park near the town of Piteå and a farm near the town of Skellefteå. Over the past few years, different farming techniques and seed varieties have been tested to identify best practices for cultivation.

Erik Häggbom, deputy researcher at HS, explained that during the first year a different sowing technique was implemented, which coincided with a dry season of approximately four weeks with no rain. As a result, they didn’t get any harvest at all in 2023. For the following cropping season, the sowing technique changed with the implementation of a sowing machine, an extra harrowing was done, and less fertiliser was used. This time, the harvest was successful: 1,150 litres of oil were produced, and the first biodiesel batches were completed in 2024.

To extract the oil, turnip rape oilseeds are cleaned and pressed. In the Öjebyn Agro Park, there are two presses that have the capacity to produce approximately 12 litres per hour, which is around 300 litres a day when they operate 24 hours. The extraction process leaves behind press cake, the solid material. In the project, this by-product is used as animal feed because of its excellent protein-rich properties.

Finding new crops could help to reverse the trend of farms disappearing, which is crucial to strengthening the farming sector in the region.



5

Once the oil has been extracted, it is transformed into biodiesel at the production unit installed in the Öjebyn Agro Park. The biodiesel plant, provided by Ernsts Express, is a lab inside a container that is fully equipped with all the tools and technologies needed to produce biofuel. Automation and optimisation were key challenges in the project. Nathalie Söderlind, research and development engineer in RISE Processum, described the process as a “3D Tetris or puzzle to get it all in the container” while looking for efficiency in the production system. For 2025, the project aims to produce 3,000 litres of biodiesel to be later tested in farm machinery and trucks.

This later stage of the biodiesel production process also produces glycerol, a second significant by-product that can be further processed and used in various applications. In the pilot case, glycerol is utilised in experiments to evaluate its potential for biogas production.

By-products to harness

By considering all the possible uses of the by-products, the pilot aims to establish a circular and sustainable value chain that produces a variety of products to be used for the self-sufficiency of farms and commercialisation. The production of biodiesel from the oil extracted from turnip rape serves as a renewable and environmentally friendly



6

> “We get so many products from this crop that it is not even necessary to produce biodiesel”
>
> – Susanne Paulrud, RISE researcher and pilot coordinator.

1. Aerial view of the farm. Photo: Johan Granstrand / Cinedox
2. Turnip rape is suited to cold temperatures and short growing seasons, making it adaptable to northern Sweden. Photo: Johan Granstrand / Cinedox
3. The biodiesel plant is a fully equipped container, provided by Ernsts Express. Photo: Johan Granstrand / Cinedox
4. Oil presses in the Öjebyn Agro Park. Photo: Johan Granstrand / Cinedox
5. Oil from turnip rape. Photo: Johan Granstrand / Cinedox
6. The press cake generated during oil production is used as animal feed. Photo: Johan Granstrand / Cinedox

alternative to traditional fossil fuels. It reduces dependency on imported fossil fuels, thereby contributing to energy security and reducing carbon emissions. Pressed cakes can be used locally as protein-rich animal feed and as an alternative to imported soy meal. This enhances resource efficiency, minimises reliance on external resources, and reduces emissions associated with transportation. As for crude glycerol, the by-product has the potential to be used in the production of another biofuel, among other uses.

Paulrud believes that the value chain has real potential to be replicated by local farmers, since the crop is flexible and offers many alternative products. “We get so many products from this crop that it is not even necessary to produce biodiesel. You can choose to produce either the seeds, the oil or the animal feed for your own use, or to sell them,” she explained.

Regarding the competitiveness of turnip rape biodiesel, the expert affirms that its price is similar to that of other biofuels and is competitive if a good yield of the crop is achieved. However, it is still not comparable to fossil fuels. For Söderlind, the project contributes to the transition from fossil fuels to renewables by discovering new alternatives. Moreover, it promotes a mindset that enhances innovation at the local level, proving that “good science does not need to be rocket science.”

Making circular fuel attractive

Project members are aware that local farmers can initially be more interested in incorporating the crop in their rotation systems without implementing biodiesel production. Operating a biodiesel plant requires financial, technical and knowledge resources that not all farmers have at first hand, despite experts’ efforts to make the production unit practical, efficient and accessible. Nevertheless, they believe that it will be possible to implement it locally in the near future. A possible solution, for example, could be the collective operation of the biodiesel plant between an association of farms. In the meantime, simply encouraging farmers to include the crop in their systems is seen as an important first step.

The solution also has replication potential in other cold regions of Europe and the world. Phillip Grundmann, coordinator of the MarginUp! project, highlighted that similar experiences are taking place in other Nordic countries in Europe, which shows there is a market for the value chain. Its decentralised structure makes it adaptable to smaller-scale operations where access to large processing facilities is limited. Moreover, the integration of fuel, feed, and other by-products into a single circular model offers a replicable pathway toward rural resilience and increased self-sufficiency in energy and agriculture.

In this way, turnip rape has the potential to change the agricultural landscape of northern Sweden and other cold regions, creating new economic alternatives and proving that farming is feasible in harsh, sparsely populated areas. It also positions these regions at the forefront of the sustainable transition.

MarginUp!

MarginUp! is developing sustainable and circular value chains to produce bioproducts and biofuels from natural raw materials grown on marginal lands.

margin-up.eu



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The Not-So-Sunny-Side of Sunscreen

WRITERS: **CUSH RODRÍGUEZ MOZ** AND **ROCÍO PERIAGO**

1

Sunscreen pollution is altering Mediterranean ecosystems. We may see impacts on human health in the future.

Catchy and repetitive, few things are more enduring than a summer hit song. But pop melodies are not the only trace of summer that remains along Mediterranean shores once the leaves have turned and the tourists have left: Just like a chorus we can't get out of our heads, sunscreen – in particular, the different mineral and chemical components it contains – lingers on well beyond the summer season.

Sunscreen is essential for protecting the skin from harmful UV rays and is considered an indispensable item for a day of beachgoing. However, over the last decade, different scientific studies have shown that sunscreen components can seriously affect marine biodiversity and may also pose a risk to human health. According to estimates, more than 20,000 tonnes of sunscreen end up in Mediterranean waters each year, interfering in the growth and reproduction of microalgae, mussels, sea urchins, crustaceans, corals, and even fish and sea turtles.

Every summer, the Mediterranean coasts fill with tourists who come to relax on their beaches. France and Spain alone receive around 150 million visitors annually. With an area of approximately 2.5 million km² and an average depth of 1,500 metres – but reaching up to 5,400 metres in some areas – the Mediterranean Sea not only influences the climate and lifestyle of 20 countries, but also boasts a vast marine diversity, with more than 10,000 aquatic species. And while it may not be apparent to the naked eye, the Mediterranean is also one of the areas most affected by pollution, exacerbated by the fact that it is nearly an enclosed body of water, linked with the Atlantic only through the narrow Strait of Gibraltar.

The sources of Mediterranean pollution are multiple: plastics and microplastics (now ubiquitous the world over), industrial discharge, fossil fuel waste, and general refuse, just to name a few. And while there is European Union legislation regarding the potential human health impacts caused by some of these pollutants, many others have yet to be regulated.

Sunscreen contamination stems primarily from the active chemical ingredients different sunscreens and sun creams contain, such as oxybenzone, octocrylene, octinoxate, and homosalate. These compounds are found in many



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cosmetic products as well; by absorbing UV rays, they prevent them from reaching the skin. While these compounds have grown ubiquitous since the mid-20th century, the environmental consequences of their ever-growing presence are just starting to be studied.

"Everything indicates that these are global contaminants," explains Antonio Tovar of the Institute of Marine Sciences of Andalusia in Cádiz, Spain. "We still don't know the scale of the effect that they may be having." Tovar and his colleague Araceli Rodríguez have been researching sunscreen pollution in marine ecosystems for over a decade and are among the leading experts in this field.

However, they are hesitant to generate public alarm over their findings. "We never want to give the message not to use sunscreen because we would be going against the medical advice of every dermatologist," Tovar clarifies. "We are not doctors, we are scientists, so we limit ourselves to simply saying that this is having an environmental impact."

Many sunscreen labels boast that their contents are "eco-friendly," "reef-safe" or "reef-friendly". However, such promises don't always turn out to be true. "Today, there are no regulations defining what an 'eco-friendly' sunscreen actually is," Rodríguez clarifies. "We can find products on the market with logos that claim they 'protect oceans' but they are based on each manufacturer's own criteria. Each sunscreen has its own formula."

At the Institute of Marine Sciences of Andalusia, Rodríguez leads a project focused on developing a battery of ecotoxicological tests to predict the impact of sunscreens on marine ecosystems. Her goal is to share the results with cosmetics companies so they can create sunscreens with the lowest possible environmental impacts. "We need to create a product that is as environmentally friendly as possible, but that also protects our skin."

> "Everything indicates that these are global contaminants. We still don't know the scale of the effect they may be having"
>
> – Antonio Tovar, Institute of Marine Sciences of Andalusia.

Working directly with cosmetic companies seems to be an effective way to try to unite the interests of the industry, consumers, and environmental stewardship. However, it is a slow and difficult task, largely because of a lack of environmental regulations concerning sunscreen, and also because no company wants to give up a successful business model.

The environmental impact of sunscreens in marine ecosystems is undeniable. In Hawaii as of 2021, the sale and use of sunscreens containing oxybenzone or octinoxate have been banned in response to their proven link to coral bleaching, a consequence of DNA damage that disrupts growth and reproduction. Additionally, Thailand and Palau have also taken measures to restrict or ban the use of sunscreens containing ingredients harmful to local marine ecosystems.

In Europe, however, similar regulations remain absent. In 2015, members of the European Parliament submitted a motion calling on Member States to ban oxybenzone, which is also known as benzophenone-3, but a definitive resolution was never reached. A 2021 opinion by the European Commission's Scientific Committee on Consumer Safety concluded that the use of a product containing oxybenzone in concentrations above 6% posed a risk, but this is yet to translate into any formal restrictions, leaving Mediterranean ecosystems exposed.

Components like oxybenzone and octocrylene are not the only active ingredients used in sunscreens; in addition to these chemical UV blockers, mineral components such as and zinc oxide (ZnO) and titanium dioxide (TiO_2), also offer effective sun protection by deflecting UV rays rather than absorbing them. While some look to mineral based sunscreens as more ecological alternatives, their "eco-friendliness" is far from being scientifically verified.

In 2024 Cintia Corinaldesi, a marine biologist and ecologist at the Polytechnical University of the Marches in Ancona, Italy and researcher for The National Biodiversity Future Center, conducted a study analysing the effects of four sunscreens labelled "eco-friendly", "reef-safe", and "sea-safe" on sea urchin embryos. Of the four, three caused growth delays in the embryos, producing adverse impacts in their early stages of development that correspond to endocrine disruptors. Despite being classified as "eco-friendly" or "reef-safe", sunscreens containing ZnO and TiO_2 were not shown to be more environmentally friendly than those containing chemical UV filters like oxybenzone and octocrylene.

"TiO_2 is the same mineral used in wastewater treatment plants," explains Antonio Tovar. "And it has a particular property: it produces hydrogen peroxide, which is reactive when in contact with sunlight. It's like when you put hydrogen peroxide on a wound and it bubbles: it degrades organic matter. A long time ago, we realised that TiO_2 could cause skin cancer, so the solution was to encapsulate it in silica and alumina in order to protect the skin from this reactivity. But what happens when this encapsulated TiO_2 reaches the sea? Its capsule dissolves immediately, unleashing harmful effects on the marine environment."

"Classified as 'eco-friendly'or 'reef-safe', sunscreens containing ZnO and TiO_2 were not shown to be more environmentally friendly than those containing chemical UV filters like oxybenzone and octocrylene."

– Antonio Tovar, Institute of Marine Sciences of Andalusia.



4

Sunscreen and tourism

The onset of negative effects of sunscreen components on marine species is largely a question of time and volume: the presence of ever-increasing numbers of beachgoing tourists – and more and more of the sunscreen they wear – year after year, sustained for decades.

The first records of topical protection against solar UV rays date back millennia. During ancient times, the Egyptians covered themselves with jasmine, rice bran, and lupine flowers to protect their skin, while the Greeks covered themselves with olive oil, which has a sun protection factor (SPF) of around eight.

According to the U.S. National Library of Medicine, the first modern sunscreen was created in Stuttgart, Germany, in 1891, made with quinine and lotion. During the first decades of the 20th century, various scientific investigations linking sun exposure with cutaneous melanoma led to the emergence of new sunscreen recipes. At the same time, in many European countries, a tanned skin – historically associated with agricultural labour and the peasantry who performed it – began to take on a new meaning: in industrialised societies, where a large portion of the working class spent long hours in toiling away under factory roofs, a sun-kissed complexion became a sign of leisure and privilege.

In the 1930s, Eugène Schueler, chemist and founder of the multinational cosmetics company L'Oréal, developed "Ambre Solaire", a tanning lotion based on benzyl salicylate that filtered UV rays. In the following decade, new formulas appeared under a variety of brand names, some of which – Coppertone, Piz Buin – are still marketed today. During the post-World War II boom in sun and beach tourism, the working classes began flocking to the Mediterranean coasts, and sunscreen became an essential product for long days by the sea.

Although the main way polluting sunscreen components reach seas and oceans is via beachgoers, it's not the only way. They also travel via urban wastewater systems.

"Sunscreen also reaches the sea directly through the shower drain," says Victor León, researcher at the Spanish Oceanographic Institute who works on the issue of marine pollution. "Although wastewater treatment plants eliminate a very high percentage, 99%, is eliminated, 1% still escapes. If the amount used is very large, that 1% can be a significant continuous mass. What we need to see is whether these compounds accumulate and in what concentrations they produce negative effects," he explains.

Today León participates in several EU-level projects focused on investigating the impact of various emerging pollutants, which include sunscreens. "If it becomes clear that there is a negative environmental impact, there will be steps backward," explains León. "We can reduce a chemical to a certain limit or even ban it if necessary. There is much more control and monitoring with agricultural pesticides because food products treated with pesticides are consumed directly."

León draws a comparison between sunscreen and dichloro-diphenyl-trichloroethane, more commonly known as DDT, a pesticide widely used throughout the first half of 20th century to combat malaria and yellow fever. First championed as landmark scientific development – its effectiveness afforded its inventor a Nobel Prize – over time the long-term health and environmental effects of DDT exposure slowly became apparent, among them neurological and reproductive alterations in warm-blooded species, including humans. The 1962 publication of Rachel Carson's Silent Spring, considered to be one of environmentalism's founding texts, presented extensive evidence demonstrating DDT's harmful effects. A decade later, what had once been considered a miracle chemical was banned by the United States Environmental Protection Agency, a move followed by the European Economic Community in 1988.

> "The scientific community has finally understood that human health, environmental health, and animal health are closely related."
>
> – Emma Martínez López, Professor of Toxicology at the Faculty of Veterinary Medicine at the University of Murcia.



5

Today research into the impact of so-called emerging pollutants is increasingly frequent, although the list of these compounds continues to grow. Recently, commonly used pharmaceuticals have been detected in Mediterranean cetaceans. Emma Martínez López, professor of toxicology at the Faculty of Veterinary Medicine at the University of Murcia explains that, "Often we find something because we decide to look for it." Marine mammals "are not only indicators of ocean health, but also indicators of human health, but you have to know how to interpret the data."

The discovery of components of ultraviolet filters in corals or bivalves, and traces of antibiotics or anti-inflammatory drugs in dolphins or whales, are just another example of how environmental pollution can affect different ecosystems and cannot be considered an isolated issue.

"Somehow, the scientific community has finally understood that human health, environmental health, and animal health are closely related. That we have a lot in common and that we can provide feedback. Even if we work in isolation, we all have a lot to contribute to each other," she says. ●

1. A beach scene at the Mar Menor in Spain. Photo: Gloria Nicolás
2. Beach-goers apply sunscreen in Sicily, Italy. Photo: Roberto Boccaccino
3. Beach reveller at the Mar Menor in Spain. Photo: Gloria Nicolás
4. Beach crowds in Sicily, Italy. Photo: Roberto Boccaccino.
5. People sit on the beach in Sicilly, Italy. Photo: Roberto Boccaccino.

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This article was developed with the support of Journalismfund Europe.

Good COP, Bad COP

WRITER: **AHMETCAN UZLAŞIK**

1

Amid criticism and controversy, COP30 could be make-or-break for the Amazon.

Located on the edge of the Amazon rainforest, the Brazilian city of Belém is symbolically powerful but structurally fragile. This contradiction is being thrown into light as the Brazilian city of 1.5 million people gears up to host the United Nations COP30 climate talks between 10-21 November 2025.

Belém, the capital of Brazil's Pará state, is marketed as a "Gateway to the Amazon" and a "Cultural Capital of the Amazon" but below the PR sheen lies serious socio-economic and environmental issues, from deforestation and illegal mining to social inequality.

As of 2024, Brazil's North Region, which includes most of the country's Amazon territories, had just 1.73 physicians per 1,000 inhabitants, the lowest rate in the country, according to the public news agency Agência Brasil. The national average in the South American nation stands at around 2.8 per 1,000. The World Health Organization recommends at least 2.3 to ensure adequate access to essential health services. In the North Region, similar trends can be seen for other indicators of human wellbeing – access to basic sanitation, infant mortality rates, GDP per capita, and average human development indicators are all far below the national average.

As leaders prepare to debate planetary futures, many locals worry the summit will overlook the daily realities of the region it's supposed to protect. The Amazon's ecological health is inextricable from its social and political conditions, and Belém, for better or worse, has become the focal point for both.

Rich in biodiversity, poor in quality of life

The Amazon is of global importance when it comes to nature. It is home to some 10% of the world's known biodiversity, according to the WWF – 9% of mammals; 14% of birds; 8% of amphibians; 13% of freshwater fish species; and 22% of vascular plant species, much of which is under threat from logging and overexploitation of natural resources.

But for many of its human residents, daily challenges are of an urban nature. Around three-quarters of Brazilian Amazonians live in cities, according to research by Amazonia 2030, a development initiative aimed at boosting sustainable development and human welfare in Brazil's Amazon regions. The state of infrastructure, healthcare, and education indicators also paint a stark picture of inequality.

Journalist Daniel Nardin pointed out at the 2025 International Journalism Festival that only 45% of Amazon households have access to basic sanitation. Infant mortality rate stands at 19.3 per 1,000 live births, far above the Brazilian average of 12.4, he added. Meanwhile, GDP per capita was 50% lower than the national mean, and the region's Human Development Index (HDI) averages just 0.66, compared to 0.76 in Brazil as a whole.

Education also lags behind, with school dropout rates as high as 20% in some areas and cities like Belém face chronic infrastructure problems, including waste management failures and deep-rooted social inequality.

This is the Amazonian paradox: a place vital to global ecological balance but plagued by local neglect. As the world looks to the Amazon for environmental leadership, the social conditions beneath its canopy demand equal attention. While rich in biodiversity, the region remains critically poor in access and opportunity.

> "Those most affected by the climate crisis, particularly in the Global South, can also be protagonists in shaping the narrative."
>
> — Ana Carolina Cazzeta, Coordinator, Rede Amazônidas pelo Clima (RAC).

The road to Belém

Brazil has long been recognised for its leadership on climate issues. In 1992, the Rio Earth Summit marked a historic milestone by launching three major UN conventions: the UNFCCC (on climate change), the UNCCD (on desertification), and the UNCBD (on biodiversity). Brazil's bid to host a future COP was officially accepted during COP28 in Dubai. It's clear why Brazil is well-positioned to lead a COP, but why Belém?

Belém carries powerful symbolism. As the first-ever COP held in an Amazon region, its location offers both strategic access to the forest and a rare opportunity to bring the region's importance onto the stage of international climate diplomacy. Belém could stand as a representation of the urgent needs of this natural marvel, an ecosystem that stores 120 billion tonnes of carbon in its soil and trees, according to a 2014 report by the magazine Scientific American.

Despite its symbolic importance, Belém's ability to host a truly inclusive COP30 is under logistical pressure. Delegates from African and Pacific nations have raised



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the alarm about "astronomical" accommodation costs, with some hotel prices running into the thousands of dollars during the summit week, jeopardising the participation of those most vulnerable to climate change. COP organisers face mounting criticism that the summit may become one of the most inaccessible in recent memory.

Ana Carolina Cazzeta, coordinator at the climate campaign group Rede Amazônidas pelo Clima (RAC) views COP30 as a pivotal opportunity to shift the summit's talking point. "I believe COP30 has the potential to be the COP of the Global South. Those most affected by the climate crisis, particularly in the Global South, can also be protagonists in shaping the narrative," she tells REVOLVE.

Cazzeta highlights how regional actors are already stepping up to broaden participation beyond official negotiations. "Countries from the region will likely be more active participants, especially in spaces beyond the official Blue Zone." For her, the power of COP30 lies not just in high-level declarations but in creating space for those who have long been on the frontlines, communities in the Global South, to lead the conversation on climate justice.

Ciro Brito, also a member of RAC, cautions against inflated expectations: "Although this has been called the 'Implementation COP', with such a challenging international scenario and all the difficulties that the COP30 Presidency is facing, it would be overly optimistic to imagine that this will be the COP of the COPs."

Brito adds: "On the other hand, with all the pressure for the COP to leave Belém, if this scenario is confirmed, it would not even be possible to call it the COP of the Amazon. If the negotiations and high-level meetings leave Belém, the Belém COP will become a World Social Forum."

COP Controversies

COP30, like the COPs before it, is not immune to criticism. New infrastructure projects launched to serve the summit have stirred backlash over environmental damage and political contradictions. One of the most contentious is Avenida Liberdade, a 13-kilometre road slicing through the last significant remnant of rainforest within city limits. Though state officials claim the road predates COP30 planning, critics argue its construction, through a protected area larger than Manhattan, undermines the very spirit of the summit. In a region where roadbuilding has historically fuelled deforestation, many fear this expressway could trigger illegal development and the slow unravelling of a fragile ecosystem. The installation of fake trees in the city of Belém has also not gone down well.

Meanwhile, Brazil's federal government is pushing for offshore oil exploration near the mouth of the Amazon River. President Lula, while positioning Brazil as a climate leader, has defended exploratory drilling as a means to finance green energy. Yet this dual agenda, expanding fossil fuel extraction just ahead of a climate summit, has also drawn global criticism.

> "We've entered a period where the concept of multilateralism is under debate, and the influence of international platforms is weakening. In such a moment, making meaningful progress is becoming increasingly difficult."
>
> — Özgür Gürbüz, Climate Journalist and Co-founder of Ekosfer.

Indigenous and Black Brazilian voices

Indigenous communities and Black Brazilian organisations are demanding meaningful inclusion in COP30, not just as symbolic participants but as decision-makers with real power. Brazil is home to around 305 Indigenous groups and has the highest number of uncontacted peoples in the world, according to Survival International.

Across Brazil, Indigenous and Black Brazilian groups are organising pre-COP gatherings, releasing joint declarations, and pushing their demands to the national level. These groups are calling for Brazil's climate commitments to include land demarcation, territorial rights, and direct access to climate finance.



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They are asking for formal recognition within climate frameworks. Their territories play a key role in storing carbon and protecting biodiversity yet remain largely invisible in policy. Indigenous groups insist that land rights are essential to protecting forests and ecosystems and are calling for full representation in national and international decision-making spaces.

What COP30 must deliver

As COP30 approaches, expectations bear down heavily, and trust is low. The outcomes of COP29 in Baku set a sobering stage: despite prolonged negotiations, developed nations pledged only $300 billion annually in climate finance by 2035, far below the $1.3 trillion demanded by developing countries. The gap between need and commitment, urgency and delivery, has rarely felt so stark.

Climate journalist and Ekosfer co-founder Özgür Gürbüz reflects the mood shared by many: "We've entered a period where the concept of multilateralism is under debate, and the influence of international platforms is weakening. In such a moment, when solving the climate crisis depends on contributions from every country, making meaningful progress is becoming increasingly difficult."

According to Gürbüz, the disappointment of COP29 will hang over Belém. The underwhelming finance package and geopolitical distractions, from war to economic instability, have diluted attention from climate action. "Many countries that once played active roles in climate talks are now less engaged," he tells REVOLVE.

Yet COP30 could mark a turning point, if ambition is restored. Gürbüz points to one critical opportunity: the revision of Nationally Determined Contributions (NDCs) under the Paris Agreement. "Seeing bold new pledges from countries like Türkiye, which has not yet updated its NDC, could help shift the tone of the negotiations," he notes.

As COP30 draws near, the world's eyes will turn to Belém, but what happens after the cameras leave will matter even more to inhabitants of the Amazon. The summit offers a historic platform to confront not only the climate crisis but also the social inequalities that undermine any real environmental progress. Belém symbolises the Amazon's paradox: a region vital to global survival, yet neglected in policy, investment, and justice.

If COP30 fails to deliver more than speeches, if it becomes another stage for greenwashing rather than real change, the consequences will be felt far beyond the rainforest. It risks deepening distrust in international climate diplomacy, especially among those who have long been excluded from its halls: Indigenous, Black Brazilian, and traditional communities who have protected the forest for generations.

1. A drone shot view of Belém, Brazil. Photo: Rafael Medelima / Cop30amazonia
2. Belem, 2025. Photo: Rafael Medelima / Cop30 Brasil Amazônia.
3. Women's Camp, 2025. Photo: Rafael Medelima / Cop30 Brasil Amazônia.
4. Combu, 2025. Photo: Rafael Medelima / Cop30 Brasil Amazônia.

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Spain's DANA Storm

WORDS AND PHOTOGRAPHY: **PAULA RIVAS**

Taking stock of the recovery and loss a year after the catastrophic flash flooding that shocked Spain in October 2024.

Many of the towns around Valencia still bear the scars of the DANA, which claimed over 230 lives in parts of eastern and southeastern Spain in late October and early November 2024. Water level marks on the walls offer a traumatic reminder of the volume of the torrents that swept through streets, homes, and fields – often well over head-height.

Piles of cars, wrecked fields, and building rubble provide an indication of the scale of material destruction, which is estimated to exceed 17 billion euros. Anger over the regional government's allegedly slow response to the flooding simmers on to this day.

Photographer Paula Rivas first visited the affected areas in November 2024 to document the aftermath of the storm and to help with recovery efforts. In April 2025, she returned on behalf of REVOLVE.

On both occasions she connected Juana Palomo and Lola Ramón, two residents of Catarroja, and discovered stories of trauma, resilience, and hope.

Definition of DANA: In Spain, DANA stands for "Depresión Aislada en Niveles Altos" or "Isolated Depression at High Altitudes" in English. It is a meteorological phenomenon characterized by a pocket of cold, isolated air at high altitudes that can cause intense rainfall, flash floods, and severe storms, often when it interacts with warm, moist air near the surface or in this case coming off the Mediterranean.

Cover: A person walks through the debris of the flood in Catarroja, Spain, November 2024.



Above: Signs of damage were still apparent in Chiva in April 2025.
Below: A car lies abandoned in a field in Algemesí in April 2025.



Above: Water marks were still visible on the walls of this building in Catarroja in April 2025.
Below: The immediate aftermath of the flooding in Paiporta, November 2024.



A marker shows the height of the flooding in Chiva, April 2025.

Juana Palomo leaned against the doorframe watching on as volunteers cleaned mud from her floor inside her house. It was 5 November 2024, just days after the deluge that swept through towns and villages around Valencia, including Juana's hometown, Catarroja. It was only when she noticed the camera, that she snapped out of her trance, grabbed a squeegee, and began to clean, all the while keeping her gaze fixed on the lens.

"You have to report on this," she said.

The water that had entered her house at the height of the flooding had reached eye-level. Juana pointed to where the water washed away a gas canister. Her clothes lay ruined in a sodden pile. The fact that she had an upstairs floor could very well have saved her life.

Five months later, in April 2025, Juana had made progress in her recovery. It was like meeting a completely different Juana. Not only had she cut and coloured her hair, but she seemed more present in the conversation – less distracted, less fearful. Juana was now living with her daughter and three granddaughters (they lost their house in the floods) on the upper floor of her home. The ground floor was superficially clean, Juana was still waiting for financial aid to renovate properly.

"I've been given some help, but it's expensive to recover. Also, they don't ask for budgets when they give you financial help, how am I supposed to know whether what I receive will cover the renovation?"

Financial help and resources are among the final hurdles this 70-year-old needs in order to continue in her recovery from the floods.



Above: Juana photographed at her house in April 2025.
Below: Juana in November 2024, in the immediate aftermath of the floods.



Signs of flood damage in the countryside in April 2025.

Juana cleans the front of her house in November 2024.



Above: Juana poses for a photograph in her house in November 2024.
Below: Juana in her kitchen in April 2025.



Elsewhere in Catarroja, Lola Ramón and her partner Miguel were trying to rebuild their lives on 21 November 2024. Without electricity for three weeks, Lola illuminated the damage in their home with a headtorch. Inside the house itself, the only light came from a lamp strung from a broken ceiling fan, plugged into a power outlet on the floor above.

Charismatic and energetic, Lola reacted to the shock of the floods by working hard. By April 2025, she had managed to clean up, paint, and craft her patio to a point where it was as good as before, if not better.

But now, without distractions, she seemed to get lost in her thoughts. While posing for a photo, the conversation drifted off, she began to think out loud. “Now we have to do everything all over again, buy everything again.”

She's still reeling, but her determination to dig herself out of the hole and leave the house spotless is much stronger. That mental image of her house “as it was before,” with things in their place and the space clean and tidy, promises a kinder future, a scenario that overcomes the fear and chaos of such a terrible experience. “We'll make it,” she said. “Because there's no other way, but also because we want to. There's still so much to do, and we're going to do it.”



Lola stands for a portrait outside her house in Catarroja, April 2025.

Lola stands for a portrait outside her house in Catarroja, November 2024.





Above: Lola shows a photograph, in April 2025.
Below: A furniture catalogue lays open on Lola's kitchen sink.



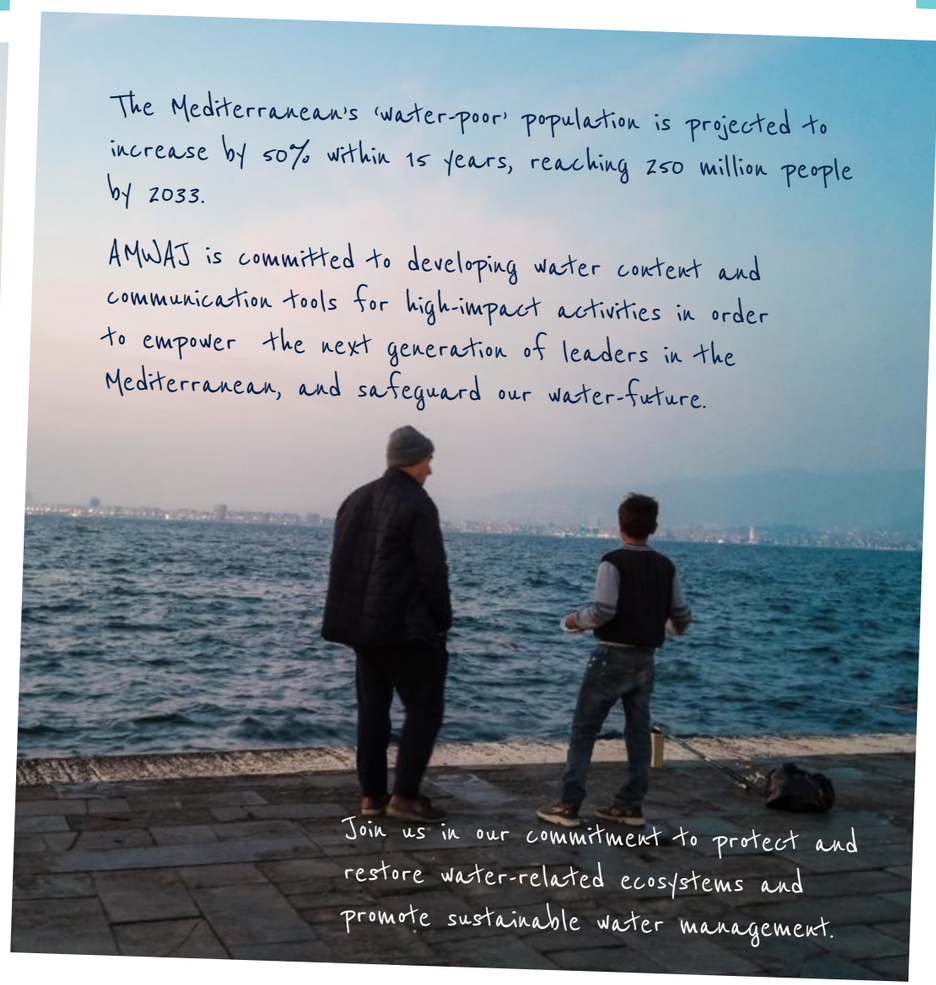
Wreckage from the flash flooding in Valencia.

AMWAJ أمـــواج

Valuing Mediterranean Ecosystems

The Mediterranean's 'water-poor' population is projected to increase by 50% within 15 years, reaching 250 million people by 2033.

AMWAJ is committed to developing water content and communication tools for high-impact activities in order to empower the next generation of leaders in the Mediterranean, and safeguard our water-future.



A view of the Aegean Sea in Izmir, Türkiye.

Photo: Emin Yigit Koyuncuoglu/ REVOLVE

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Recharged for a Circular Future

WRITER: **LAUREN BEAUCHAMP**



1

With the race for critical minerals intensifying, the question is no longer just how to build more batteries, but how to make the ones we already have go further.

The global shift to electric vehicles (EVs) is essential to decarbonising transport and forms a cornerstone of the European Union's plan to reach carbon neutrality by 2050. As EV sales continue to increase, having reached 17 million worldwide in 2024, interest and questions about battery disposal and reuse have been top of mind for consumers, policymakers, and the automotive industry.

The stakes are high: EV batteries can contain more than 200 kg of critical minerals, such as lithium, nickel, and cobalt. As mineral mining is both exploitative and environmentally unsustainable, recycling existing raw materials offers a crucial path forward – one that could meet more than half of the lithium and nickel demand for lithium-ion batteries by 2040, according to a May 2023 report in Science Direct. Yet the vision of a circular battery economy is still far from reality. As a November 2024 Deloitte report makes clear, we simply don't have enough end-of-life (EoL) batteries to feed the recycling market today. The first generation of mass-market EVs is only now nearing decommissioning, meaning recycling capacity will remain underutilised and mineral shortages will persist for years to come. In the meantime, how can these valuable resources be given a second life?

Three roads to an EV battery's second life

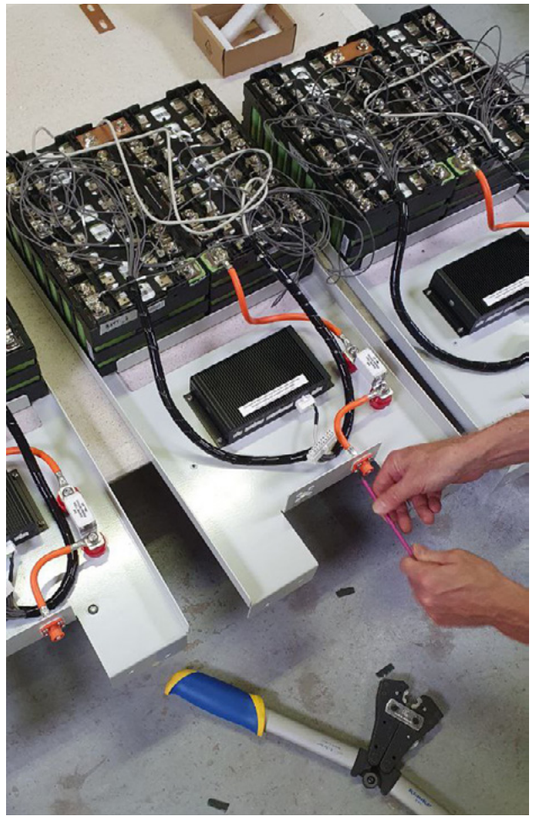
When an EV battery can no longer power a car at peak performance, it doesn't have to head straight for the scrapyard. There are three main roads to a second life: reusing it in another vehicle, repurposing it for a different application such as stationary energy storage, and recycling it to recover valuable minerals for new batteries. Each route has its trade-offs, but together they form the backbone of a circular battery economy.

Repurposing, in particular, is gaining momentum. After 10 to 15 years, EV battery capacity drops below the threshold required for road use – typically around 70-80% of their original capacity, but batteries can still be viable for less demanding applications. One promising example comes from SolarTechno Europe, a partner in the EU-funded Horizon Europe project RE-SKIN, which aims to integrate repurposed batteries into building energy systems. Working with cells recovered from Mitsubishi Outlander plug-in hybrid vehicles, SolarTechno Europe is creating battery energy storage systems (BESS) for photovoltaic-powered heating and cooling. These second life systems balance energy loads, reduce reliance on the grid, and help cut building emissions.

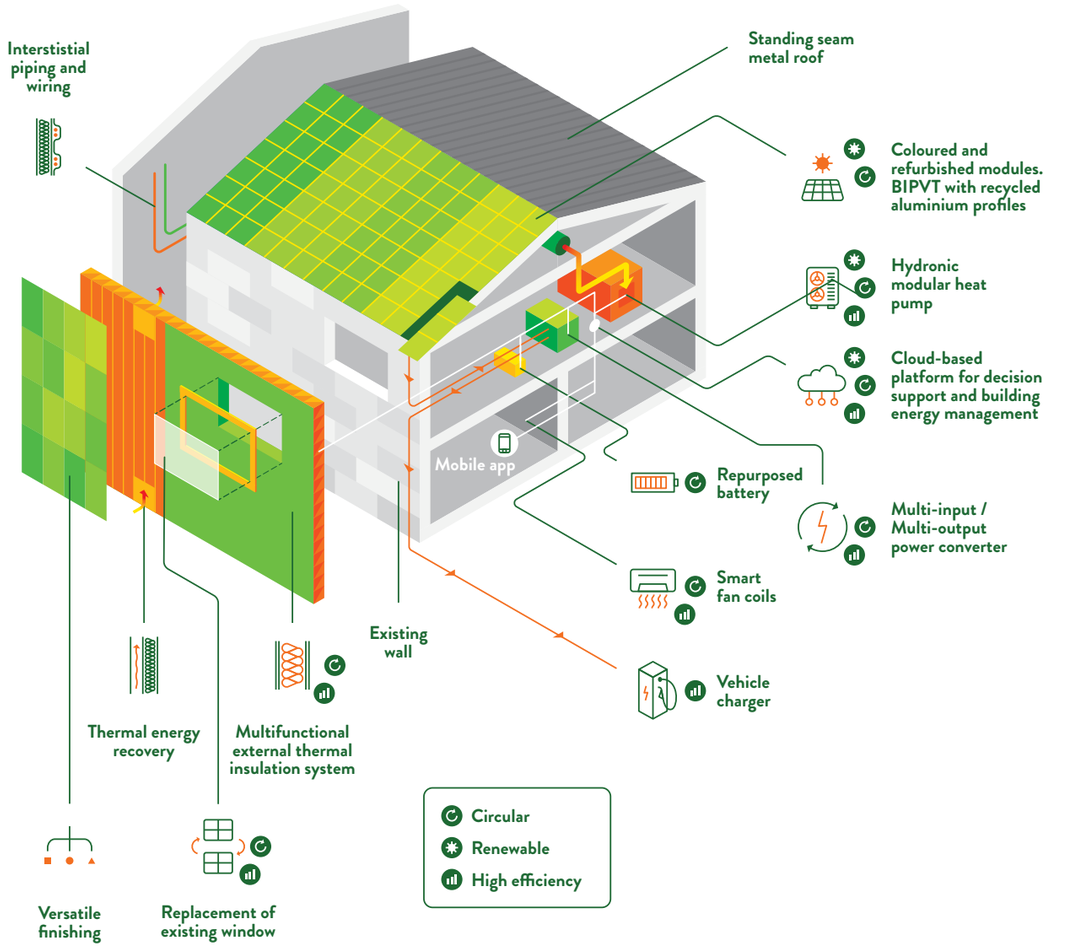
The repurposing process begins with safely removing the battery from a decommissioned vehicle, as even "spent" packs can hold significant energy. The pack is then tested to ensure it's safe and viable before being opened and separated into smaller modules. "Once we've selected the healthy modules, we reassemble them into a new 'second life' battery system," Aidan Heddes, Business Developer at SolarTechno Europe, tells REVOLVE. "We wire them together and integrate the necessary control electronics to ensure they perform reliably in their new application." The final step is installing the "brain" of the battery, which, as Heddes explains, "monitors performance, manages charging and discharging, and safeguards the pack against any potential hazards."



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After 10 to 15 years, EV battery capacity drops below the threshold required for road use – typically around 70-80% of their original capacity, but batteries can still be viable for less demanding applications.

What are BESS and what role do they play?

BESS are systems that store electrical energy using rechargeable batteries. These systems have the ability to release that energy when needed. They typically contain both hardware and software components and can perform several supportive functions to the electrical grid. This can include storing surplus electricity when supply exceeds demand and discharging stored energy when demand exceeds supply, helping balance the electrical grid by providing ancillary services that improve its reliability and efficiency.

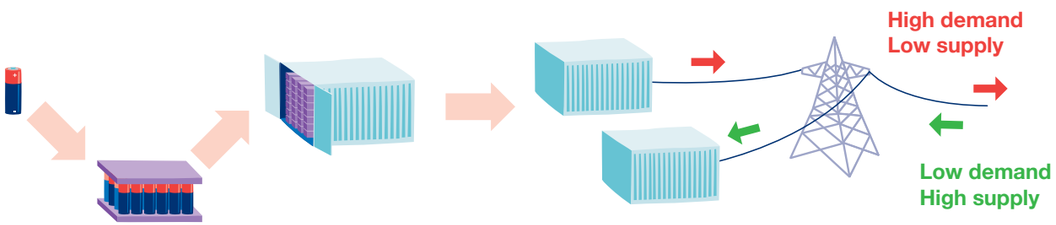
A life cycle assessment (LCA) conducted for the RE-SKIN project reveals that repurposing batteries delivers clear environmental benefits. Compared to new battery systems with the same effective capacity, repurposed systems reduce greenhouse gas emissions by 38% to 55% across most categories, including global warming potential, fossil resource use, and water consumption.

How does recycling stack up?

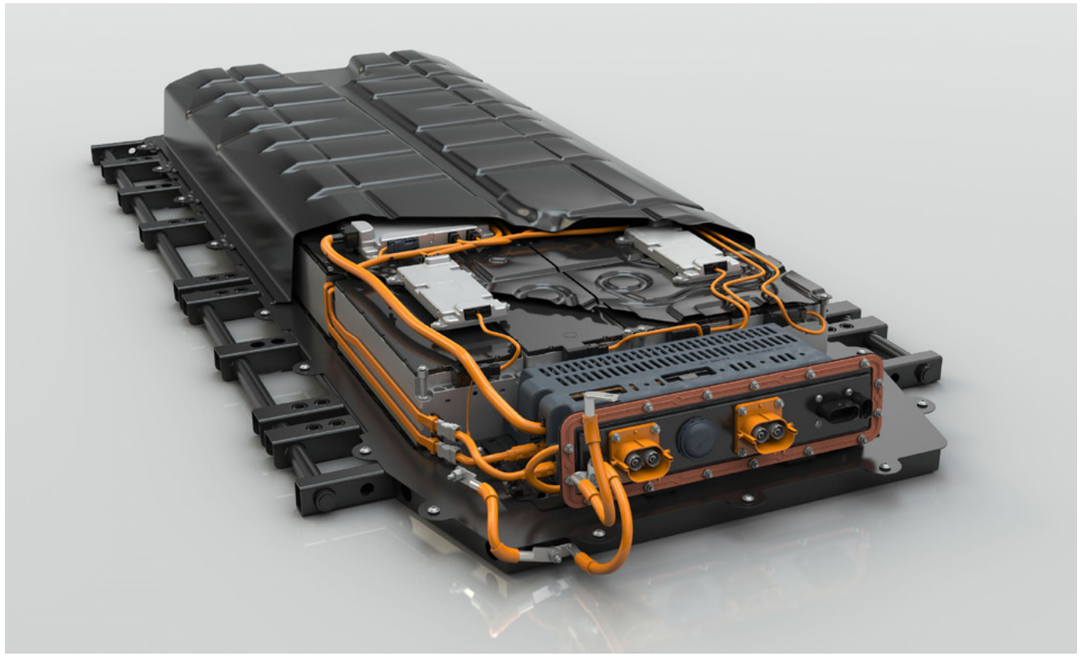
Recycling EV batteries is a complex and rapidly evolving process, with several competing techniques for extracting valuable raw materials. The three most common approaches: hydrometallurgical, pyrometallurgical, and direct recycling, differ in efficiency, cost, and environmental impact.

Hydrometallurgical recycling uses chemical leaching and solvent extraction to recover up to 99% of nickel, cobalt, and lithium, making it highly efficient and broadly applicable, particularly for high-value chemistries. Direct recycling, still in its early stages, aims to preserve and rejuvenate cathode materials without breaking them down into their elemental components. With the lowest environmental footprint of the three, it shows particular promise for lithium iron phosphate batteries and manufacturing scrap. Pyrometallurgical recycling, by contrast, relies on high-temperature smelting to recover nickel and cobalt but often loses lithium in the process. While it is well established, it is energy-intensive and carbon-heavy, hardly the blueprint for a future circular economy.

Yet even the most advanced recycling methods face significant hurdles. Pyrometallurgy, in particular, generates substantial emissions and often results in the permanent loss of lithium and manganese. Supply constraints add another layer of difficulty. With the first wave of mass-market EVs not reaching end-of-life until the 2030s, recycling facilities will struggle to run at full capacity before then. Infrastructure gaps, especially in collection systems and the uneven distribution of recycling plants, further limit what's possible.



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Safety is another constant concern. Damaged or degraded lithium-ion batteries can enter thermal runaway and catch fire during transport or dismantling. Without robust safety protocols, the process meant to enable a cleaner future risks carrying serious environmental and human costs. Overcoming these challenges will require more than technical breakthroughs — it will demand regulatory frameworks that set clear targets, standardised designs for recyclability, and the expansion of infrastructure needed to recover batteries at scale.

Setting the standard

Policy is beginning to reflect the urgency of building a more circular battery value chain. The EU's new Battery Regulation, which entered into force in August 2023, sets mandatory targets for recycled content: 6% lithium and nickel, and 16% cobalt in batteries by 2031, rising to 12%, 15%, and 26% respectively by 2036. On 4 July 2025, the European Commission introduced detailed, harmonised rules for calculating and verifying both recycling efficiency and material recovery rates.

Still, when it comes to repurposing, regulatory frameworks remain thin. "There's currently no specific regulation for repurposed EV batteries," Heddes points out. "That makes it very difficult to insure buildings with these systems, something we've seen first-hand at our French demo site." Without dedicated safety and technical standards, insurers remain wary, and developers face uncertainty over compliance.

Technical hurdles add to the challenge. Testing decommissioned battery cells, critical for ensuring safety, can be time-consuming and costly. "You don't want potentially dangerous cells in a repurposed battery pack," Heddes notes. Without standardised protocols for assessing and certifying second life cells, each project must navigate its own path, adding delays and costs.

Heddes believes the solution lies in separating regulatory treatment of new and repurposed batteries. "Clear safety and technical standards for repurposed cells would give insurers more confidence and make these projects far more viable," he says. Without them, the widespread adoption of repurposed systems risks stalling.

Repurposing, while not a substitute for recycling, is a valuable addition to the process, stretching battery lifespans, creating interim value in sectors like construction and renewable energy, and buying time to scale up Europe's recycling infrastructure. But to unlock its full potential, policy needs to evolve as quickly as the technology.

Without dedicated safety and technical standards, insurers remain wary, and developers face uncertainty over compliance.

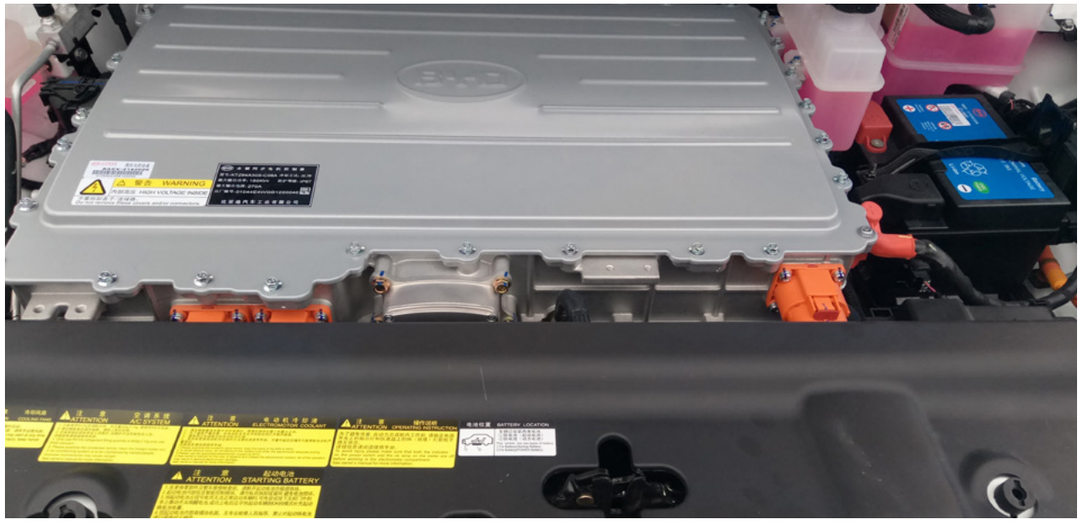
Circular goals require circular thinking

Europe's climate ambitions hinge on electrifying its mobility and energy systems while keeping their environmental footprint in check. That means more than switching fuels; it means rethinking how materials are sourced, used, and reused.

Recycling will be indispensable, but for now it cannot do the job alone. Repurposing provides a practical bridge – one that delays extraction, cuts emissions, and squeezes more value from resources already in circulation. As the RE-SKIN project and similar initiatives show, the technology is ready. What's needed now is systemic backing: targeted regulation, upfront investment, and product design that anticipates a second life from the outset.

In the race to close the loop, Europe must plan not just for the end of the road, but for the road after that – because in the circular economy, endings are only ever beginnings. ●

1. Location of the battery pack shown in a cutaway of the 2013 Nissan Leaf. Photo: Norsk Elbilforening
2. A cabinet with the battery pack in it. Photo: SolarTechno Europe
3. A Solartechno employee attaching connectors to a battery slab. On the slab, a battery pack and a BMS are visible. Photo: SolarTechno Europe
4. A diagram showing how RE-SKIN enhances building renovation and repurposes materials such as electric vehicle batteries to store solar energy and manage power peaks. Illustration: RE-SKIN
5. BESS collect energy from renewable energy sources and store the energy using battery storage technology. Illustration: REVOLVE
6. Render of a A high-voltage battery pack. Photo: Handtmann Systemtechnik GmbH
7. BYD e5 Electric Vehicle Battery. Photo: DKMcLaren



7

RE-SKIN
MULTIFUNCTIONAL RETROFIT SYSTEM



The RE-SKIN project is developing an advanced, integrated and multifunctional retrofit system targeting the renovation of the European building stock by combining energy efficiency, smart readiness, sustainability and circular economy.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor CINEA can be held responsible for them.

A Just Circular Economy

INTERVIEW WITH **SURYAPRABHA SADASIVAN**
BY **SHREYA JAIN**



1

Advancing climate resilience through circular economy models must prioritise women's leadership and equitable participation.

What are the key barriers preventing women, especially in climate-vulnerable regions, from participating in or benefiting from circular economy models?

Women are at the heart of India's circular economy, whether it's composting organic waste, conserving seeds, or collecting and sorting recyclables. Yet, they often find themselves in the lowest-value and least secure parts of the chain.

The first barrier is informality and lack of recognition. In many cities, women make up 40 to 70% of waste pickers but work without contracts, safety gear, or social protection. That keeps incomes low, often between ₹6,000 and ₹8,000 ($70-90) a month, and their contributions largely invisible in policy discussions.

The second is limited access to assets and markets. Access to credit for equipment like shredders or composters is limited, and finding steady markets for their products is a constant challenge. Public procurement could help, but circular products from women-led enterprises are rarely prioritised.

The third is the skills gap. Women are rarely trained for higher-value work like IT refurbishment, recycled product quality control, or plant operations.

In climate-vulnerable areas, these issues become more acute. Droughts, floods, and degraded resources disrupt livelihoods, making finance scarcer, mobility harder due to care responsibilities, and training opportunities fewer. Yet, when barriers are addressed, impact follows. In Pune, the SWaCH cooperative's 3,800 mostly women members work under municipal contracts with steady pay, safety standards, and formal recognition, proving that inclusive policy and institutional support can turn invisible work into dignified, climate-positive livelihoods.



2

What policy measures, financing mechanisms, or institutional arrangements could help scale gender-responsive circular initiatives in India?

India has a strong policy base for the circular economy, from the Draft National Resource Efficiency Policy to the Swachh Bharat Mission 2.0 and GeM's Womaniya programme, but their potential is limited without coordinated action across stakeholders.

The first opportunity is in policy and contracting. Municipalities can require that women's cooperatives and self-help groups be part of waste management contracts, Extended Producer Responsibility (EPR) systems, and material recovery facility operations.

The second is financing. Institutions like Small Industries Development Bank of India and National Bank for Agriculture and Rural Development can offer blended finance products for women-led circular Micro, Small and Medium Entreprises (MSMEs), combining low-interest loans for equipment with performance-linked grants tied to diversion targets, safety standards, and fair wages.

The third is institutional design. City-level Circular Economy Cells (living labs) can bring together government, industry, and women's collectives to map enterprises, match them to tenders, provide technical assistance, and resolve operational challenges.

These measures work best when accountability is built in. Third-party monitoring of contracts and participatory review platforms where women can directly share feedback with officials ensure that initiatives don't just launch, they scale and sustain impact.

> "Circular models can do more than reduce waste, they can directly strengthen women's capacity to adapt to climate shocks."
>
> — Suryaprabha Sadasivan, Senior Vice President – Public Policy & FIPRA India Lead, Chase Advisors.

In what ways can circular models enhance the adaptive capacity of women in drought-prone, flood-affected, or degraded-resource regions?

Circular models can do more than reduce waste, they can directly strengthen women's capacity to adapt to climate shocks.

In Gujarat, the Bhungroo system stores excess monsoon water underground, providing irrigation for up to eight months. Women's groups managing these systems have increased crop yields by 25–40% and collective incomes by ₹15,000–₹20,000 annually.

In Tamil Nadu's Kolli Hills, women-led seed banks conserve over 20 millet varieties, cutting post-disaster recovery time from months to days and reducing input costs by up to 30%.

In Assam, women's self-help groups have turned flood-damaged organic waste into compost, improving soil health for the next planting season and creating extra seasonal income of ₹5,000–₹7,000 per household.

Scaling these models will require structured action. Circular Economy Cells could map climate-vulnerable wards, prioritise women-led enterprises for resilience-focused contracts, and bundle funding from municipal budgets, CSR programmes, and climate adaptation schemes. Standardising resilience indicators, such as recovery time after shocks or income gains from restored resources and tracking them annually would ensure adaptation benefits are measured, valued, and used to shape future investments.

What skills and training are needed to prepare women for leadership in emerging circular economy sectors like e-waste, bioeconomy, or green construction?

High-value opportunities in the circular economy are expanding rapidly, and women should be at the forefront of this growth. In the e-waste sector, skills such as refurbishment, data wiping, and safe dismantling can generate three to four times more value than dismantling for scrap, yet training for women in these areas remains limited. In the bioeconomy, operating biogas

plants, ensuring bio-fertiliser quality, and processing biomass are becoming core competencies. In green construction, as more cities enforce construction and demolition waste recycling mandates, skilled operators will be needed to produce recycled aggregates and run recycling plants.

Training on its own isn't enough, it must be linked to market-ready opportunities. Certified women-led teams could be pre-qualified for municipal or EPR contracts, ensuring their skills translate into income and leadership roles. Circular Economy Cells could partner with the Skill Council for Green Jobs, the National Skill Development Corporation, and local institutes to deliver modular, on-site training followed by direct bidding support.

Models like the Skill Impact Bond have shown how public-private partnerships can deliver training that leads to measurable job outcomes. Embedding similar performance-linked models in the circular economy, with gender audits to track contract awards and revenue flows, would ensure women move from being participants in training to leaders in enterprises.

What indicators can help track gender equity in circular economy projects – beyond just participation numbers?

Counting women is only the first step. We also need to measure how their situation has changed. This means tracking median income growth, the share of contract revenue reaching women, and whether their earnings meet living income benchmarks. Leadership is another key metric, the proportion of women in supervisory roles, holding contracts, or influencing procurement decisions.

Safety and benefits must be part of the picture. Are women receiving PPE? Are they covered by social security and maternity benefits? Do they have access to regular health check-ups, safe transport, and childcare facilities? Time saved through closer facilities or reduced travel can also be a valuable measure.

Finally, resilience indicators help link circularity to climate adaptation. These include the speed of recovery after a climate shock, hectares under climate-resilient crops, and households benefiting from systems like Bhungroo or seed banks. Embedding these indicators into municipal surveys, enabling digital reporting on platforms like GeM, and verifying through third-party gender audits – combined with participatory platforms for direct feedback, would make institutions accountable while ensuring women's voices shape both policy and practice.



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1. A woman sells fish by the roadside. Photo: Karthick Gilsen / Unsplash
2. A woman sits by a stall selling goods. Photo: Pranshu Sharma / Unsplash
3. A woman carries produce through the street. Photo: Jannes Jacobs / Unsplash
4. Labourers at work on farmland. Photo: Deepak Kumar / Unsplash

> "Counting women is only the first step. We also need to measure how their situation has changed."
>
> — Suryaprabha Sadasivan, Senior Vice President – Public Policy & FIPRA India Lead, Chase Advisors.

The Hidden Costs of Factory Farming

REVIEWED BY **DANIELA DEKEN**

Factory Farming: Unveiling the Hidden Costs
We Animals
24-27 March 2025
Brussels

Exhibitions hold a special kind of power. As the saying goes, a picture is worth a thousand words – and a collection of them can speak volumes.

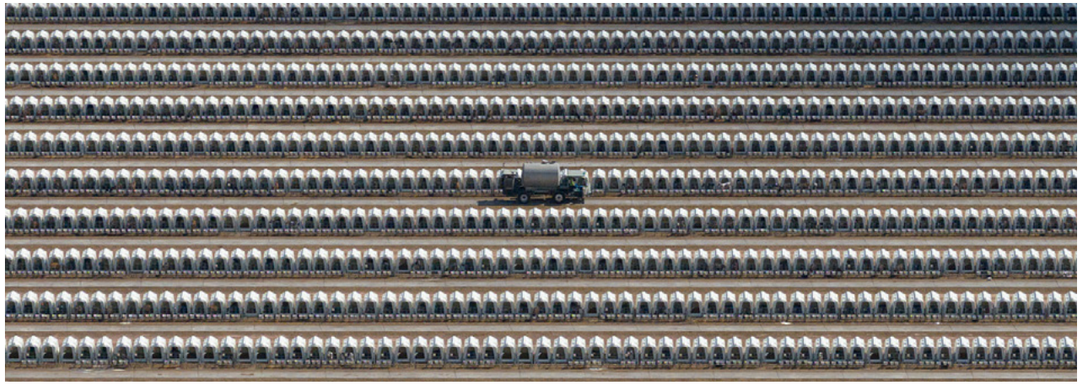
The images on display at the European Parliament building in March 2025 did more than that: they left you with a feeling you can't quite pin down – heavy, unsettled, impressed.

'Factory Farming: Unveiling the Hidden Costs' shed light on the effects of factory farming on animals, human health, and the environment within the EU. Captured by several photographers, each photo tells a unique story about the suffering caused by our intensive factory farming sector.

At the launch, Members of the European Parliament and photojournalists spoke briefly. Jo-Anne McArthur, an animal rights photojournalist and founder of the We Animals platform behind the exhibition, described her work documenting unjust cruelty and hidden exploitation. She recalled her first time inside an industrial pig farm in Europe: "It was at night. As we approached the farm, the smell hit me like a wall. My eyes were already watering before I'd even stepped inside." Inside, she found endless cages, no windows, and pigs caked in filth.



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"That smell is something that stays in your camera, in the rubber, for weeks and weeks after you spend even an hour on a farm," she said. "Pigs also have a much greater sense of smell than we do. And they have to live in this?"

The photos on display at the exhibition held nothing back, exposing the raw reality of factory farming. They showed ducklings bred for foie gras crammed into dark barns, sheep being milked while matted with dirt, rows of tiny rabbit cages, an isolated dairy calf crying out after separation from its mother, and piglets having their teeth clipped and tails cut – without anaesthetic.

One photo showed a five- to six-week-old broiler chicken from a farm in Italy. It was sitting on its stomach with its legs splayed out. The animal was unable to stand or walk due to its unnaturally rapid growth, which made it difficult to reach water – a common issue.

Beneath the photo, an infographic explained how chickens raised for meat undergo intensive selection to promote faster growth. As a result, modern commercial chickens gain weight nearly five times faster than they did in the 1950s. That leads to numerous health and welfare issues, making it nearly impossible for these chickens to experience a good quality of life. In 1957, a 56-day-old chicken weighed around 905 grams. By 1978, that had doubled to 1,808 grams. In 2005, it had more than doubled again to 4,202 grams – over four times their weight from seventy years ago.

The exhibition also spotlighted the environmental damage and public health consequences of factory farming. Aerial shots revealed endless rows of barns, while others showed pig manure spilling into nature, staining rivers and lakes.

Human stories were there too. A portrait of Jan, a Dutch resident living just metres from a massive pig farm, told of health impacts from the constant air pollution. A photo of Giorgio from Italy, displayed him wearing a mask to protect himself from the odours of nearby cow and chicken farms. He suffers from extreme nausea and a loss of consciousness because of the exposure. Another image showed a grieving couple holding a photograph of their late son, who had suffered from severe health conditions. Due to the toxic air from factory farms near their house, he was not able to receive treatment at home, meaning his mother had to travel daily to care for him up until his death.

In their closing remarks, MEP Krzysztof Śmiszek and MEP Tilly Metz spoke about both human and animal welfare. The impacts of factory farming are manifold – it's about the water we drink, the soil that grows our food, the air we breathe, and the people who live or work near these farms. We can no longer turn a blind eye to the environmental risks, the pollution, the smell, the consequences for the landscape, and the suffering of living beings.

This is the kind of exhibition that lingers. You leave more informed, yet with more questions than when you arrived. You feel hopeful for change, but heavy-hearted.

So why display them? And who should see them? The answer is: anyone who can help. Although photographs don't have the power to change these systems, they can inspire and empower others – you, me, us – to do so.

revolve.media/between

1. The interior of the transport truck is reflected in this cow's eye. Canada, 2018. Photo: Louise Jorgensen / HIDDEN / We Animals
2. A milk dispenser truck drives between some of the thousands of calf hutches in a massive dairy farm's yard. Turkey Creek Dairy, Pearce, Arizona, USA, 2023. Photo: Ram Daya / We Animals


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