Magazine of EU-China Energy Cooperation Platform

EU-China Energy Magazine

2023 September Issue

About ECECP

EU-China Energy Cooperation Platform was launched on 15 May 2019, to support the implementation of activities announced in the 'Joint Statement on the Implementation of EU-China Energy Cooperation'.

The Joint Statement was signed during the 8th EU-China Energy Dialogue that was held in Brussels on 9th April between Commissioner for Climate Action and Energy Miguel Arias Cañete and the Administrator of the National Energy Administration of China Mr ZHANG Jianhua, back-to-back with the 21st EU-China Leaders' Summit on 9 April 2019 and was witnessed by Jean-Claude Juncker, President of the European Commission; Donald Tusk, President of the Council of Europe and Dr Li Keqiang, Premier of China.

The start of the implementation of the EU-China Energy Cooperation Platform (ECECP) was included in the EU-China Leaders Summit Joint Communique.

The overall objective of ECECP is to

'enhance EU-China cooperation on energy. In line with the EU's Energy Union, the Clean Energy for All European initiative, the Paris Agreement on Climate Change and the EU's Global Strategy, this enhanced cooperation will help increase mutual trust and understanding between EU and China and contribute to a global transition towards clean energy on the basis of a common vision of a sustainable, reliable and secure energy system.'

Phase II of ECECP is implemented by a consortium led by ICF, and National Development and Reform Commission - Energy Research Institute.

EU-China Energy Magazine

2023

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Dear All,

Welcome back from the summer break! The summer of 2023 has been one of the longest and hottest on record, with freak weather events causing widespread damage and disruption around the world. This issue of the EU China Energy Magazine focuses on three key areas of our energy transition that are essential for building a more resilient and sustainable future: grid bottlenecks, local energy communities, and electric vehicle battery recycling.

Europe's grid bottlenecks are becoming a major challenge as the continent transitions to clean energy. The weather events over the summer have shown how pressing the need is for new grid infrastructure and reform of existing market rules. Therefore in this issue, we include an article by Eurelectric addressing this topic, with a special focus on distribution grids.

Local energy communities are playing an increasingly important role in the clean energy transition. These communities are owned and operated by their members, and they can provide a range of benefits, such as lower energy costs, increased energy security, and reduced carbon emissions. Repeated aberrations in weather patterns have highlighted the vulnerability of centralised energy systems, and we discuss here how local energy communities can offer a more resilient and sustainable alternative.

This issue puts the spotlight on electric vehicle battery recycling, which is essential for a sustainable future in transport. China faces a number of challenges in standardising its battery recycling industry and this issue looks at potential solutions. The world needs a circular economy for EV batteries, so that the valuable materials they contain can be recovered, and their environmental impact can be reduced. In a separate article, we delve into the different options to accelerate policy action for safe and green EV battery recycling drawing on current practices.

In addition, this month's issue includes an interesting article about the challenges of matching employers and employees in the burgeoning clean energy sector.

On 12 October 2023, ECECP will hold an in-person public event to disseminate the results of ECECP II's flagship project, 'Investment and Technology Planning for Net-Zero Carbon Infrastructure'. The public event will be followed by a networking cocktail dinner. More information is available on our website, where you can register either to attend in person or to join in one of the online forums.

I hope you enjoy reading this issue of the EU China Energy Magazine.

Dr. Flora Kan
ECECP Team Leader

Europe's grid bottlenecks are delaying its energy transition

No amount of record sales and deployment in Europe of heat pumps, EVs, solar farms, wind turbines and all the rest will guarantee the region meeting its electrification targets if the grids aren't ready to integrate them. As Eurelectric explains, supported by a suite of its studies, Europe's ageing distribution grids lack capacity, have cumbersome permitting, and need a multi-billion euro step change in investment. Meanwhile, existing grids can be better optimised, digitalised and made smarter and more flexible to manage and spread loads, thus maximising efficiency. And better information makes for better decisions and planning, so data-sharing between system operators, market players and national authorities is paramount.

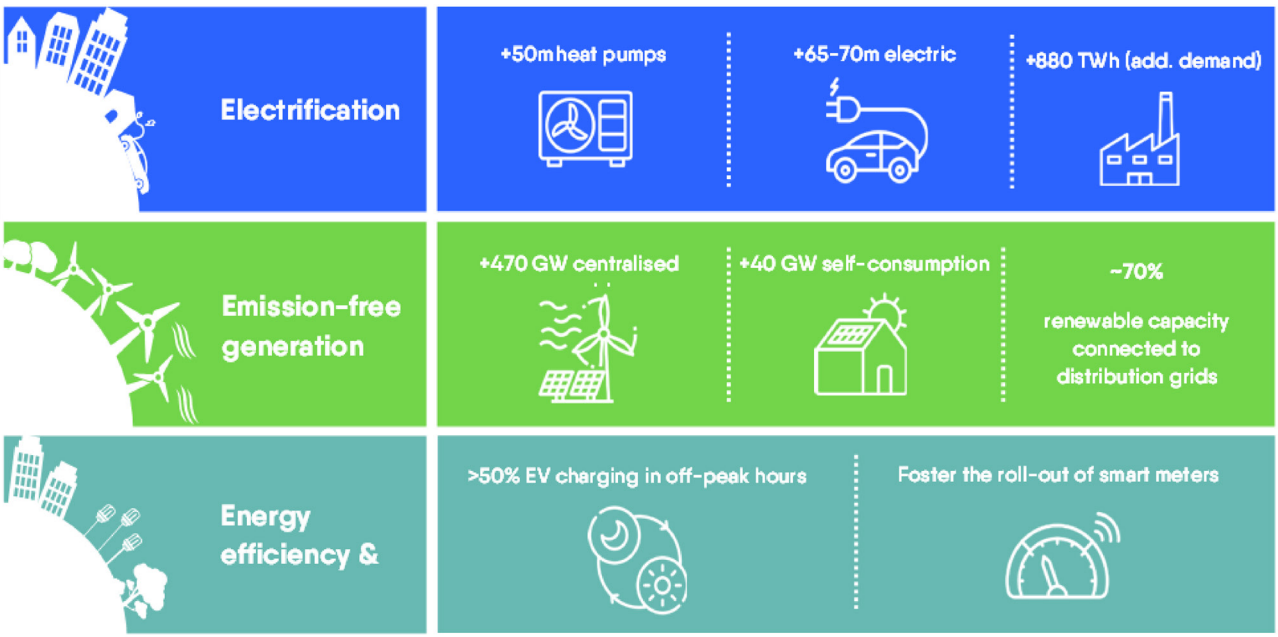
Europe's energy transition heavily relies on ageing electricity grids. Today, the capacity of our copper cables to integrate mass electrification and meet higher decarbonisation targets is limited. It is high time legislators embrace an anticipatory approach to future-proof electricity networks.

Eurelectric's new grid report shows how the current electricity market design reform can put this approach into action by incentivising anticipatory investments, longer-term grid planning, digitalisation, flexibility and more advanced data exchange.

Europe's ambitious 2030 targets

By 2030, Europe will see around 50 to 60 million heat pumps, 65 to 70 million electric vehicles (EVs) and over 600 gigawatts of additional renewable capacity as foreseen by REPowerEU. Around 70% of that capacity will be directly connected to distribution grids – those electric lines that travel across cities and villages and connect increasing windmills and solar installations. While becoming ever more critical to the continent's decarbonisation, Europe's distribution grids face scarce capacity, cumbersome permitting, and insufficient investments.

'Getting our electricity networks fit for net zero should be a top priority in the coming years, both at EU and national level' – says Kristian Ruby, Secretary General at Eurelectric – 'This requires a new mindset among regulators and legislators. One that anticipates Europe's capacity needs to integrate more renewable projects, and one that accommodates unprecedented electrification of transport, buildings and industry to match the speed and scale needed for Europe's energy transition.'



"EU27+UK energy transition levers by 2030" - updated, Connecting the Dots, Eurelectric

SOURCE: 'Power System of the Future – Keys to delivering capacity on the distribution grid' – Eurelectric (September 2023)

Congestion, delays, costs

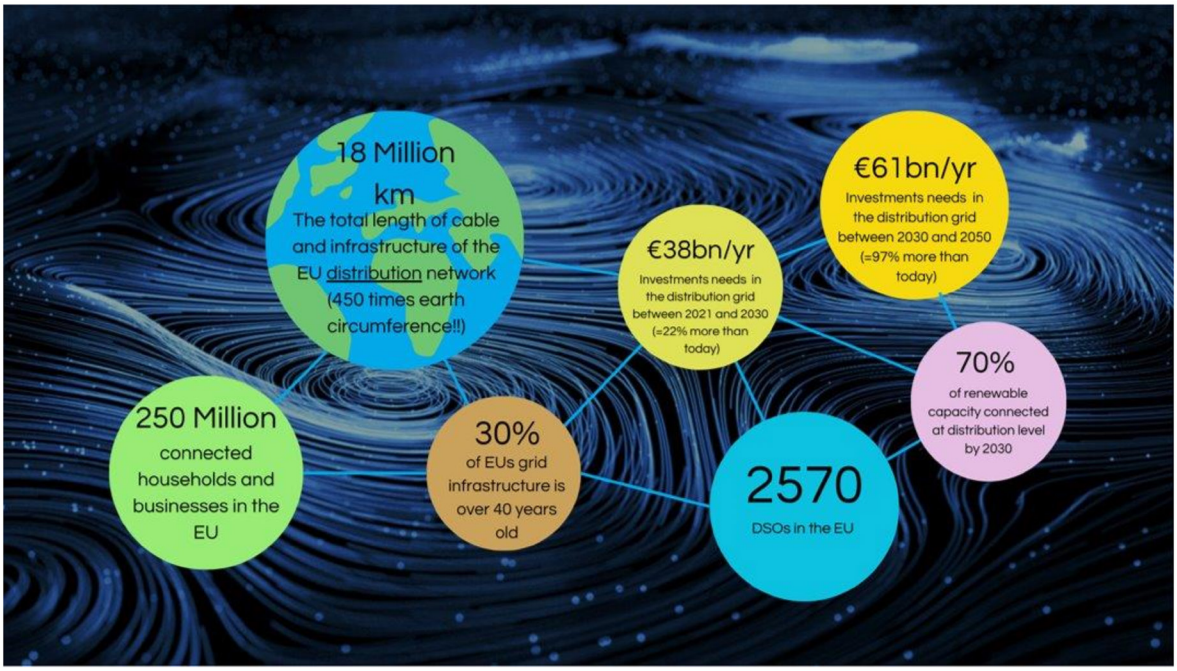
Scarce capacity translates into longer waits for grid connections, more congested areas, and higher costs for network users. To avoid this, Europe must reinforce and expand its grid infrastructure to add capacity while trying to make the most of the capacity that already exists. Anticipatory planning of grid extension is now key to meeting EU electrification needs by 2030 and ensuring reliable electricity across thousands of kilometres of power lines throughout Europe. The surest way to enable such an urgent build-out is to plan and invest ahead.

Multi-billion euro investment gap

Anticipatory investments should be structurally incorporated in the electricity market design reform to bridge the EU's EUR 7 billion annual investment gap in electricity infrastructure. As shown in Eurelectric's Decarbonisation Speedways study, the EU currently invests EUR 23 billion per year in grid infrastructure. This is way too low: investment in distribution grids should reach no less than EUR 38 billion per year until 2030 and up to EUR 100 billion per year until 2050, considering the anticipated additional demand to deliver on the EU decarbonisation's agenda.

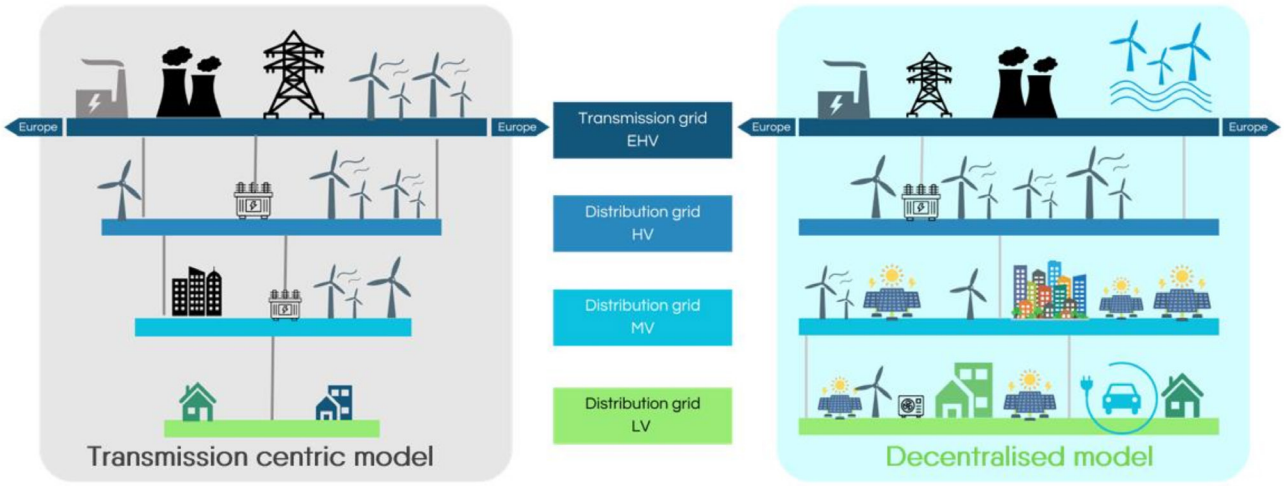
Accelerated permitting

Catalysing the necessary levels of investment also requires accelerated permitting. Today, lengthy grid permitting often delays renewable project deployment. This structural time lag increases the risk of congestion due to growing connection and capacity requests. A simplified permitting process must urgently be agreed upon by policymakers. Factoring grid updates into a generator's project under a unique permit can also ease this administrative burden.



Handbook on the grid®, "Unprecedented electrification objectives for the distribution grid as the energy system's backbone", by Eurelectric

SOURCE: 'Power System of the Future – Keys to delivering capacity on the distribution grid' – Eurelectric (September 2023)



Handbook on the grid®, "from a TSO centric to a DSO centric model", by Eurelectric

SOURCE: 'Power System of the Future – Keys to delivering capacity on the distribution grid' – Eurelectric (September 2023)

Optimising existing grids

Concurrently, while developing new infrastructure, existing grids should be optimised to the fullest. This calls for digitalisation and flexible connection agreements as a way to optimise the use of existing capacity in congested areas. By allowing faster grid connections for part of the needed capacity, these agreements can partially alleviate the urgency of additional capacity buildout. As these instruments enable the existing grid to be used more efficiently, they should be promoted to all network users under a clear legal framework.

Smarter, flexible grids

Electricity consumers can further help grid management and enhance the overall system stability by shifting or lowering their consumption to less congested hours through demand-side response schemes and local flexibility markets. Unleashing higher flexibility, however, requires a smarter grid. Regulators should incentivise system operators' investments in digitalisation as a critical component to delivering a more resilient power system and efficient service to network users.

Data sharing

Beyond just going digital, planning ahead necessitates accurate information. Boosting closer collaboration and transparent data exchange among system operators and market players, as well as national authorities, is paramount to have a more detailed grasp of the requested time of connection and capacity needs. Robust data-sharing mechanisms can enable system operators to perform more accurate forecasts on emerging generation patterns and capacity requests.

Providing data access, however, should not come at the expense of customers' privacy. Implementing clear data privacy and security measures is vital to protecting sensitive information and maintaining trust among all relevant actors.

By **Eurelectric**

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Empowering people – the role of local energy communities in clean energy transitions

Putting people at the centre of all clean energy transitions not only improves people's lives but is also key to successfully implementing energy and climate policies. Local energy communities, or community-based energy projects, are showing clear benefits across the globe in deploying renewable technologies, improving efficiency, supporting reliable power supply, reducing bills, and generating local jobs. At the same time, these initiatives are garnering increased attention as effective vehicles towards more inclusive, equitable and resilient energy systems.

Digital platforms and tools are making it easier to set-up cooperatives, engage stakeholders, make investments and exchange electricity. An increasing number of countries are allocating significant funds to support community-based clean projects. The Italian National Recovery and Resilience Plan has allocated EUR 2.2 billion 1 to support energy communities and self-consumption, while the USD 370 billion United States Inflation Reduction Act of 2022 offers additional financial incentives for community-based clean energy projects. The IEA recently organised discussions to explore and share experiences about the role that energy communities can play in supporting clean energy transitions.

Enhancing energy efficiency and community benefits through local generation and sharing

With ever growing pressure to accelerate decarbonisation and to mitigate impacts of the energy crisis on households and businesses, community-based energy communities can help address numerous challenges faced by power systems, including losses, grid congestion and the need to accommodate growing peak demand. Recently, the IEA estimated that one gigatonne of carbon dioxide emissions come from grid losses, equal to almost 3% of current global energy-related CO_2 emissions. Local community-based generating, sharing and consuming of electricity can significantly avoid these losses and enhance energy efficiency. For example, in northern Perth in Australia, a battery resource shared by 119 households resulted in collective savings of over AUD 81 0002 during a five-year period. The battery also helped ease the strain on the grid by enabling an 85% reduction in consumption of electricity from the grid at peak times for participating households. The energy community of Magliano Alpi in the Italian Alps developed tools to forecast energy generation and demand and share electricity, enabling the community to more effectively use their solar photovoltaic systems and cover 35% of their electricity needs. Increased reliance on their own generation resources during peak demand periods alleviated grid stress and helped defer expensive infrastructure upgrades.

Digital tools boost the potential of local energy communities

Providing customers with access to their energy production and consumption data is crucial to the success of energy communities, raising awareness about the impacts of individual behaviour and underscoring the economic benefits of being part of the community. Software based on machine-learning is also widely used to optimise energy efficiency and deliver financial savings. Recently, peer-to-peer digital trading on blockchain platforms have been tested to enable citizens to exchange energy within the community. Such initiatives foster collaboration and trust among prosumers and consumers. For example, in the Indian city of Lucknow, residents were able to sell their rooftop electricity production at 43% below the central market price through the use of digital tools, allowing other residents to benefit from local clean energy while also cutting their electricity bills.

Community initiatives are empowering citizens

Developed by people for people, local energy communities are an effective means of maximising socioeconomic empowerment. As they depend on trust, both within and outside the community, these systems involve and educate people who would otherwise be excluded or passive in clean energy transitions. More than this, they have become tools to help overcome historical societal inequalities in energy systems. For example, the RevoluSolar energy initiative was the first photovoltaic community founded in a Brazilian favela, enabling renewable energy access for 30 families. The community opted to re-invest the profits from the projects into charities and jobs training to tackle rising rates of local unemployment. This ability to determine where, how and to whom the revenues from the project are distributed, improved overall citizen welfare in the favela. Not only this, but it enabled the community to protect the citizens from rising energy prices.

Local value-chains gain

Energy communities also help develop local value-chains, jobs, and skills. The Lyndoch residential community microgrid project, which interconnected over 30 homes via a tiered grid system (from household to household, to the village, to the national grid) was the first smart embedded residential rooftop microgrid in South Africa. The pilot project is co-owned and maintained by the utility (Eskom), but members of the community were taught and certified by industry to assume roles in the development, installation, maintenance, operation, and ownership of the energy system. Such initiatives help ensure the sustainability and longevity of projects while also demonstrating the value of enhancing citizen engagement in localised clean energy transitions.

Citizen engagement is key to accelerating clean energy transitions

Energy community models can be effective mechanisms to deliver clean energy transitions. They not only illustrate the benefits of place-specific interventions, but also highlight the added value of inclusive people-centred approaches. Better access to financing and support, regulatory reforms, and sharing of experiences could give communities around the world greater access to local, clean and affordable energy. For instance, the European Parliament has recently provided funding for the creation of an advisory hub and support service to help collect and disseminate best practices and provide technical assistance for community initiatives across the European Union. Further mapping of initiatives and benefits is underway as part of the IEA People-Centred Clean Energy Transitions Programme and the Digital Demand-Driven Electricity Networks Initiative (3DEN).

This work forms part of the Digital Demand-Driven Electricity Networks Initiative, supported by the Clean Energy Transitions Programme, the IEA's flagship initiative to help energy systems worldwide move towards a secure and sustainable future for all.

By **Vida Rozite,** Energy Policy Analyst
Matthieu Prin, Programme Coordinator
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Josh Oxby, Former Energy Analyst
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Ideally, battery manufacturers, car companies and recycling firms would form their own closed recycling circles

(Image: Alamy)

How can China address its EV battery-recycling challenge?

Battery recycling needs standardising, say experts, who also call for loopholes to be closed and awareness raised among EV owners

Five years ago, Liu Gong bought an electric car for just over 100,000 yuan (USD 14,600) with the help of government subsidies. Its battery has now weakened to less than 70% of the original capacity. To continue driving, he has been told that he will have to pay around 60,000 yuan (USD 8,277) to replace the battery.

'For not too much more, I could just buy a new car,' he says. A dealer told him that the depreciation in the price of old batteries means any buyback from the dealership would mean practically giving the battery away for free. Staff, unable to give any concrete guidance, suggested he deal with it himself.

But how should he go about doing that? Liu Gong, who is among 13.1 million EV owners in China – or 4.1% of total car owners – isn't alone in his predicament.

EV batteries are typically usable for five to eight years. Once the battery deteriorates to 70-80% of its original capacity, there's no real way for it to satisfactorily power an EV.

Around 2016, the Chinese EV industry entered a period of rapid growth, and since 2021, there has been a notable increase in batteries falling into disuse. By 2022, the capacity of decommissioned batteries had reached a total of 34.5 gigawatt-hours (GWh) – or 277,000 tonnes. It is forecast to reach 116 GWh – around 780,000 tonnes – by 2025.

Power batteries contain substances that are harmful to the environment, such as heavy metals and electrolytes, as research by Energy Foundation China highlights. If sent to landfill, these could leak into the ground and upset the pH balance in the soil, threatening ecologies and human health.

Recycling batteries doesn't just help to reduce this kind of pollution. There is also a pressing need for it, as the EV industry's demand for batteries increases by the day. Battery production requires several crucial resources for which China has limited supplies, including nickel, cobalt and lithium. China is the world's largest consumer and importer of lithium, with 65% of demand relying on imports. Effective recycling would reduce this dependency on imports, guaranteeing supply, while also alleviating the negative effects of extracting raw materials at home and abroad.

The government has already recognised the importance of recycling batteries. As early as 2012, the State Council proposed drafting a means of managing battery recycling and reuse, and of establishing a management system for tiered reuse and recycling. However, China is yet to build a mature recycling system. Obstacles in the way of implementing relevant measures have created fertile ground for a black market industry of small workshops.

Recycling chaos in 'small workshops'

In recent years, several media reports have addressed the problem of trustworthy 'whitelist businesses' being unable to supersede small workshops in China's battery-recycling industry.

Whitelist recyclers are those listed as being compliant with the Industrial Regulatory Requirements for the Integrated Repurposing of Disused Power-storing Batteries. To get on the list, businesses must submit a self-assessment of their technology, industrial work, and energy consumption to the Ministry of Industry and Information Technology. By the end of December 2022, the ministry had published four lists of compliant companies, of which there were 88 in total. Among them were car and battery manufacturers, as well as independent recycling firms.

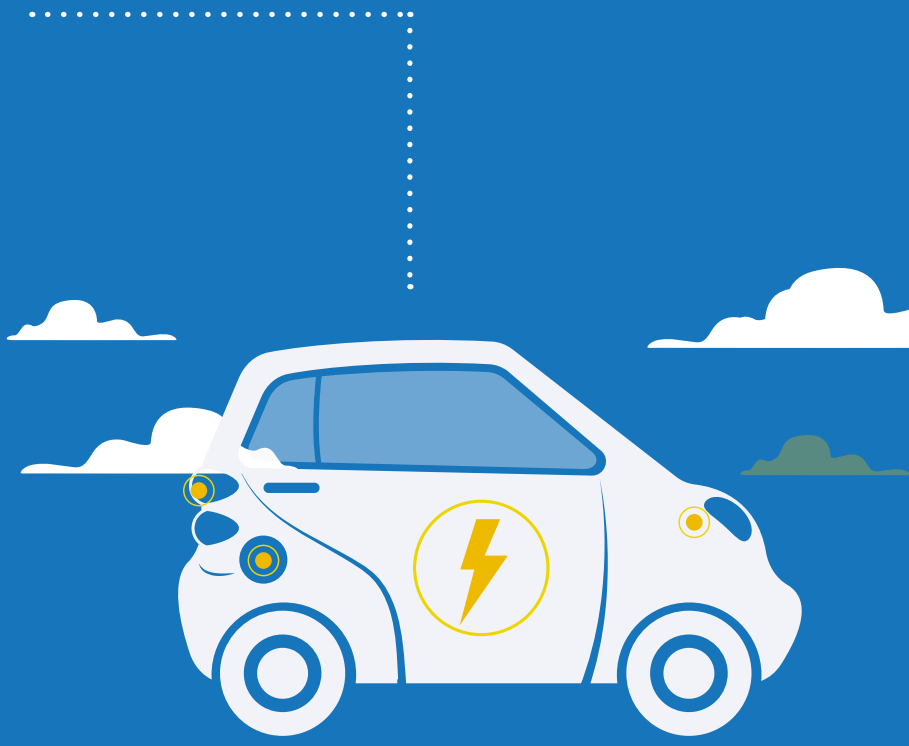
Compare that to the number of registered companies involved in the battery recycling industry as a whole: by 2018, there were over 1,000 such businesses, according to data from Qichacha, an online database of China-based companies. This reached 3,400 in 2020, and an explosion of registrations took the number to 24,500 by 2021.

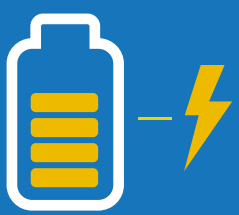
Less than one-quarter of decommissioned batteries go to whitelist businesses, leaving the remaining processing work to be acquired by small workshops, according to the Energy Storage Application branch of the China Industrial Association of Power Sources. Other data from market research company Gaogong Lithium Batteries shows that batteries recycled through approved channels only make up 20-30% of the total.

Zeng Yuqun, chairperson of CATL, a lithium-ion battery manufacturer, said: 'On the whole, approved recycling businesses struggle to get their hands on decommissioned batteries, meaning a large amount of high-quality recycling capacity is sitting idle.'

Li Xiangnan, executive director of Green Anhui, a grassroots environmental organisation, told China Dialogue that the competitive edge of small workshops lies mainly in price and convenience. They can often lure in car owners with a high buying price and home collection service.

A reporter from Latepost saw firsthand the disassembly process in a small workshop while carrying out investigative interviews. Not wearing any goggles, two male workers cut a crevice in the chassis of a car by hand, then used metal bars to wrench open a larger hole before removing the battery with their bare hands.





Li Xiangnan says that compared to approved businesses, some illegal workshops lower costs by hardly investing in environmental protection. Lots of car owners are not aware of the hidden environmental and safety risks that come with using small workshops. They simply want to sell for a good price, and don't consider whether the recycling point complies with regulations.

He also points out that while the industry ministry publishes its whitelist, the law does not provide businesses on the list with any compulsory protections – such as subsidies or crack downs on illegal businesses – and small workshops are well concealed and therefore very difficult to regulate. Civil society organisations can normally only monitor non-compliant businesses' release of pollutants, such as gas and wastewater.

Who is responsible for recycling?

In China, the Provisional Measures on the Recycling and Repurposing of EV Power Storage Batteries stipulates that EV manufacturers bear the primary responsibility for recycling old batteries and should establish a network of recycling service centres, based on their sales network, that can collect them. Stored batteries can then be transferred to recycling business with whom they have agreed partnerships.

It is clear that battery manufacturers, car companies and recycling firms would ideally form their own closed loops. Car companies could directly receive disused batteries from consumers across a comprehensive sales network before passing them onto third-party specialists for recycling. Recycling companies could then extract materials such as lithium, cobalt, and nickel to sell back to manufacturers for making new batteries.

An employee removes modules from a worn-out EV battery at the Volkswagen plant, Salzgitter, Germany

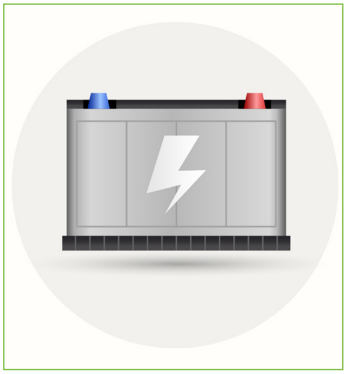
(Image: Alamy)

However, once a vehicle has been sold to a consumer, the battery becomes the consumer's property. How then are manufacturers to take on the responsibility of effectively recycling old batteries? Li Xiangnan says that to facilitate this, Green Anhui will be producing a series of videos to educate EV owners about the environmental impact of non-compliant recycling and encourage them to recycle through approved channels.

To achieve a breakthrough as soon as possible, some manufacturers are exploring commercial models. EV manufacturer Nio is launching a 'battery-lease' scheme that sees people rent batteries rather than own them. The car becomes the property of the consumer but the rights to the battery belong to a third party, thereby preventing the consumer from selling it on. In a 2021 article for China Dialogue, Yang Muyi, associate director of clean energy at the Asia Society Policy Institute, proposed measures such as deposit return schemes or subsidies to encourage consumers to turn over batteries to the approved channels, limiting the space for black-market operators.

In addition, the government should also take on supervisory responsibilities. As the world's largest producer of batteries and largest market for EVs, China has already launched a platform for tracing batteries. Every vehicle battery produced in, or imported into, China has a unique serial number, which can be used to help follow the battery and deal with it appropriately throughout its lifecycle.

Yang Muyi told China Dialogue that this tracing platform aims to build the foundations of a standardised battery-recycling system. Battery producers, car companies and retailers, and battery repurposing and recycling companies, are all expected to update information on the platform in a timely manner, ensuring that disused batteries are ultimately dealt with appropriately.



EU battery laws speed up reforms

China is not the only one implementing battery serial numbers. In July 2023, the European Union passed the new European Battery Regulation, which stipulates that by 2026, power batteries must have a passport to be sold in the European Economic Area. Battery passports keep records of manufacturing history, chemical components, technological specifications, and carbon footprint.

Moreover, the law makes demands regarding disused batteries, requiring that 45% of all batteries are recycled by the end of 2023 and 70% by 2030. More detailed stipulations exist for different metals, such as lithium, cobalt, nickel, and copper.

The EU is a major importer of lithium batteries from China. Data from the Chinese customs head office shows that in the first quarter of this year, the top five importers of Chinese lithium batteries were the US, Germany, South Korea, the Netherlands, and Vietnam, accounting for 62.6% of all exports. Batteries sent to Germany and the Netherlands were worth 27.3 billion yuan (USD 3.7 billion) in total, more than the 22.5 billion yuan (USD 3.1 billion) imported by the US.

Professor Xu Ming, of Tsinghua University's School of Materials Science and Engineering, believes the European Battery Regulation initiates a shift towards circularity in the global battery industry by stipulating efficient recycling and quotas for repurposed materials. In order to meet the EU's requirements, Chinese battery manufacturers, car manufacturers, and other parties should cooperate to build a recycling system for disused batteries, improving their own battery-recycling efficiency and increasing the amount of materials repurposed, he said.

Speaking at the 2023 Summer Davos Forum, around the time the law took effect, CATL chief production officer Ni Jun said the company was negotiating with an EU partner to set up several EV battery-recycling stations, while seeking a partner in North America for the same purpose.

Yang Muyi believes China's battery-recycling industry is still in its early stages, with the relevant laws and oversights still being refined. The new European Battery Regulation will hopefully press China to strengthen its laws and regulations and standardise industry development. As the market matures, leading exporters to the EU will likely formulate some industry norms. This should spur their development among other domestic companies and gradually drive out non-compliant workshops.

Can recycling reduce mineral extraction?

Yang Muyi thinks that with the transition to renewables, the demand for rare metals like lithium is bound to continue increasing and that in the long-term, recycling them will be an economic given. But recycling a proportion of metals is not just an economic consideration, he says. More importantly, it can play a role in stabilising supply chains and reduce Chinese dependence on imported metals.

However, it will be difficult to meet the growing demand for raw materials through battery recycling alone.

A report by the International Council on Clean Transportation, a Berlin-based thinktank, suggests that if battery technology were not to change, in the two decades from 2020 to 2040, the accumulated demand for raw materials would be 11-12 million tonnes of lithium, 48-55 million tonnes of nickel, and 3-4 million tonnes of cobalt. This corresponds to about half of the global reserves deemed economically recoverable in 2022, and about 13-18% of total estimated reserves.

The mining of metals crucial to battery production is a delicate issue in China. The recently published 2023 Evaluation of Global Mineral Reserves, from the National Energy Administration, assessed global and domestic reserves of 13 minerals. The report was clear that China's share of global reserves of nine minerals – including lithium, cobalt, and nickel – were relatively low and in short supply.

The 2021-25 National Security Strategy, reviewed by the Politburo in November 2021, elevated mineral security to a national strategic issue for the first time, positioning stable, strategic mineral supply chains as key work for the state.

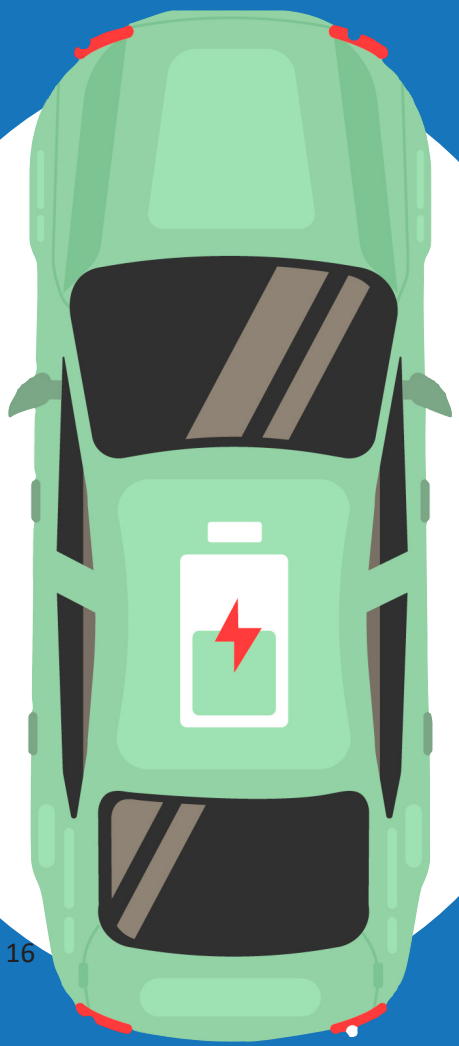
For now, the Chinese battery industry will probably choose to mine more. China's largest lithium compound producer, Ganfeng Lithium, recently announced that the likelihood of recycling replacing mining in the short term is small. 'As for the long-term value in recycling heavy-duty lithium batteries, it is projected to become a larger function of the business in the future,' it said.

Mining heavy metals needed for EVs has raised resource and environmental concerns in recent years. The extraction of lithium from salt lakes can consume a large amount of water and electricity, and lithium mine projects undertaken by Chinese companies in Chile and Argentina have caused local disputes. Domestically, lithium mining and processing have caused environmental pollution in Sichuan province and Yichun, Jiangxi province.

Controls on mineral demands are a complex issue. In order to stabilise supply chains in the future, considerations such as developing batteries that are less reliant on these materials, and policy guidance that cuts down demand for new cars, will be of utmost importance.

By **Niu Yuhan**

Accelerating policy action for safe and green electric vehicle battery recycling



Electric vehicle (EV) battery recycling poses a triple opportunity: 1) potentially cutting about 40% of a battery's lifetime carbon footprint, 2) creating jobs and, 3) reducing the reliance on virgin material inputs.

Yet specific challenges need to be overcome to scale EV battery recycling:

- Securing equitable access to sufficient and predictable battery quantities;
- Improving the economics of the recycling of lower-value cell chemistries;
- Further reducing the environmental and social impacts of recycling.

Policy-makers in China, the European Union (EU) and the US have realised the strategic importance of EV batteries and are aiming to scale their recycling through ambitious policy actions, such as the EU Battery Regulation and US Inflation Reduction Act.

Policy-makers need to collaborate to enable a safe and clean transboundary movement and management of end-of-life batteries by:

- Standardizing definitions and transaction triggers;
- Developing and harmonizing standards for black mass composition;
- Increasing information availability through traceability;
- Providing incentives for new recycling technologies that can treat LFP batteries economically;
- Supporting the development of safety measures.

Battery recycling works today but innovation will revolutionize the sector

Between 2020 and 2021, global electric vehicle (EV) sales increased by 50% to 6.6 million vehicles. By 2030, EVs could exceed 50% of total automotive sales,5 driven by technological advancements and internal combustion engine vehicle phaseout regulations. If options for second-life or echelon use are not viable, batteries must be collected, treated and recycled. In Europe alone, the scaling-up of EVs could result in the recycling of more than 1 million spent batteries by 2030. EV battery recycling poses a triple opportunity, potentially cutting about 40% of a battery's carbon footprint compared to virgin material used, creating jobs and reducing reliance on virgin material inputs. By 2050, recycling could provide 45% to 77% of Europe's supply of battery metals.

In the shorter term, the share will be significantly smaller due to a growing EV market and the longer lifetime of EV batteries.

The recycling of batteries aims to recover the raw materials and can be broken down into three steps:

- Preparation for recycling
- Pre-treatment
- Main processing.

The preparation focuses on discharging and dismantling, while pre-treatment separates battery ingredients so they can be fed into the further industrial processing steps. The product of this step is the so-called black mass, which consists of high amounts of battery metals that can then be extracted and recycled in further processing steps.

The final step comprises two approaches – pyrometallurgy and hydrometallurgy – that are typically combined in industrial battery recycling processes.

- Pyrometallurgy employs high temperatures to conductsmelting and refining operations to extract metals from the black mass.
- Hydrometallurgy dissolves battery materials into acids to recover materials. It involves the leaching of intermediate products followed by further extraction processes to extract the desired metals.

In addition, there are also promising new recycling methods, such as direct recycling, by which cathodes are chemically regenerated to be reused without further processing, or biorecycling, where specialized micro-organisms are used to extract resources. Both technologies promise to require much lower energy and processing needs but are still in the research or pilot phase and it is unclear if and when they may be commercialized.

The three main EV battery recycling challenges

For policy-makers and the automotive industry, the priority is to scale the safe and clean recycling of batteries globally. To do so, they will have to overcome three key challenges:

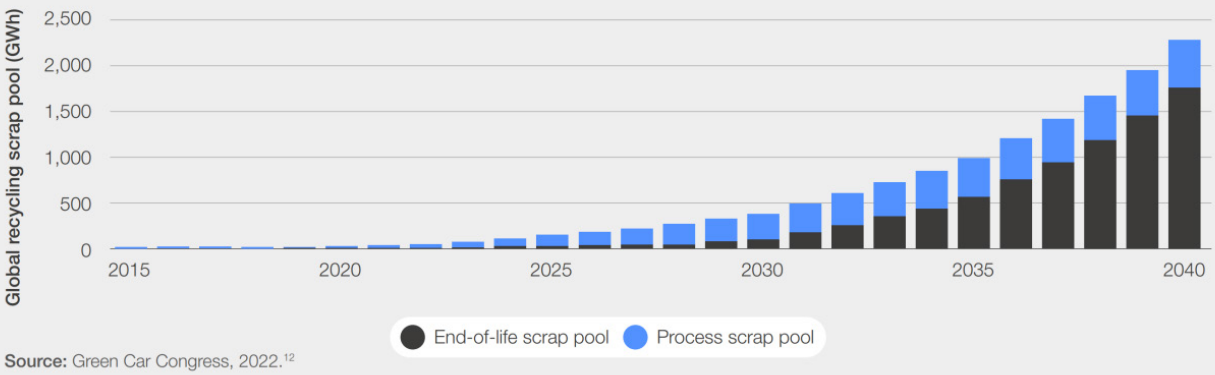
◆ Getting access to sufficient battery quantities

Recently, there has been a rush into battery recycling, with global recycling capacity expected to surge nearly ten times from 2021 to 2025. By 2025, there may be three times more recycling factory space than scrap to feed the plants. Due to batteries' long lifetimes, in 2025, 78% of the available supply is expected to come from manufacturing waste, while only 22% would come from end-of-life vehicles.

For battery recyclers, the biggest challenge will be to access enough scrap. Cell manufacturers and automakers are particularly well-poised for production scrap since they have direct access. Therefore, recyclers in the EU and the US, in particular, face this issue. For end-of-life scrap, a key challenge is re-collection and preventing leakage of spent batteries into the environment, particularly for smaller handheld batteries, for example from electric scooters.

China will likely capture a significant percentage of this market early since it has about 50% of the world's battery recycling capacity, putting investments into capacity recycling in Europe and the US at risk.

Figure 1: Process scraps dominate the global recycling pool until the 2030s



Source: Green Car Congress, 2022.[12]

◆ Improving the economics of the recycling of lower-value cell chemistries

The economic viability of recycling is heavily dependent on the recovery of high-value transition metals, specifically cobalt and nickel. However, as cobalt in cathodes is reduced and cheaper chemistries such as lithium iron phosphate (LFP) become more popular, current recycling methods will become less economically viable. By 2030, LFP chemistry is expected to account for around 45% of cell demand. One crucial issue will be preventing the irresponsible disposal of lower-value cell chemistries. There are three ways to help support recycling profitability:

- Reduce the costs of recycling processes –The diversity of batteries and the manual nature of the disassembly process challenge the economics of recycling processes. This can be improved by introducing automation and robotics in the disassembly process and battery passports that make information on the battery type, state of health and state of charge easily accessible, thereby increasing the throughput. Automakers can also ease recycling through increased standardization of battery design and design for disassembly, for example by reducing the use of glues to hold components in place. Finally, there is a need for well-developed reverse logistics and dismantling networks to minimize transportation costs, which are one of the biggest recycling cost drivers.

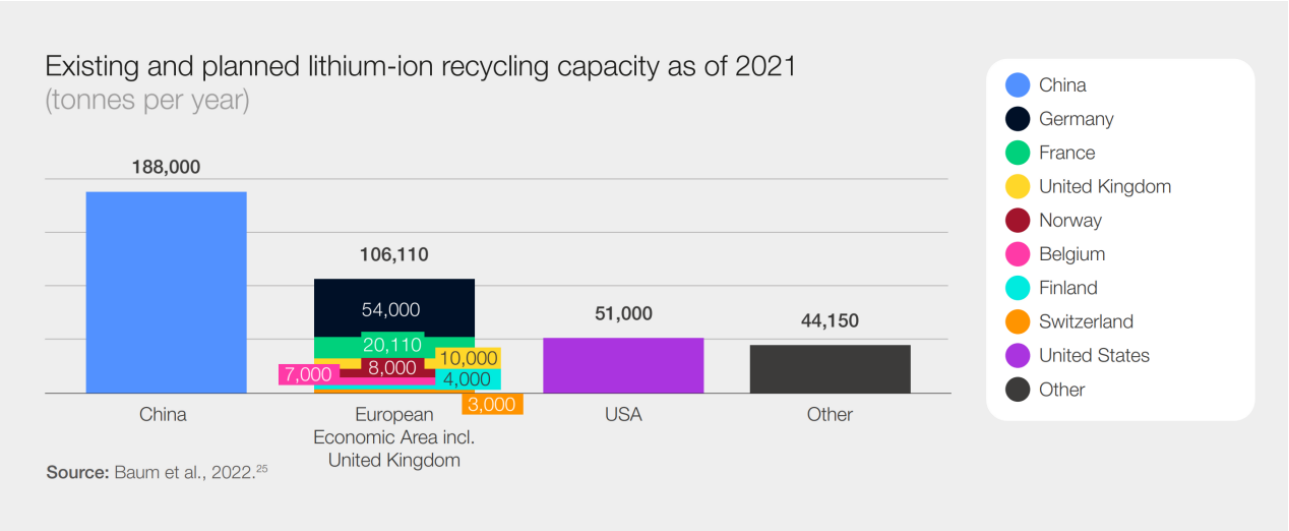
- Focusing recycling on countries with a lower cost base – The recycling of lower-value cell chemistries can also be enabled by focusing on countries with low labour and fixed costs (e.g. energy), such as China or northern Africa. While rising lithium prices have improved the economic attractiveness of LFP recycling, China would currently be best suited for recycling due to its cost structure.

- Scaling new recycling technologies – Unlike pyroand hydrometallurgy, direct recycling, by which cathodes are chemically regenerated for reuse without further processing, is currently the only recycling technology that can profitably recycle LFP chemistries, spanning almost all geographies. However, this recycling technology is currently not commercialized. It will likely also be limited to production scrap due to the higher homogeneity of this flow and a shorter lead time to market compared to current battery technologies. The commercialization of this technology could enable the recycling of lower-value cell chemistries.

◆ Further reducing the environmental and social impact of recycling

Environmental issues focus specifically on reducing the greenhouse gas (GHG) footprint of pyro- and hydrometallurgy and reducing the environmental risks of the chemicals used in hydrometallurgical routes. This can be achieved by decarbonizing equipment, inputs and industrial processes, minimizing the use of leachants and solvents and preventing leaching or other forms of environmental pollution. Reducing social impacts focuses on the safe tooling and handling of batteries during disassembly processes and minimizing health risks during hydrometallurgical processes.

Figure 2: Existing and planned lithium-ion battery recycling



Key regional actions for EV battery circularity underway

In recent years, China, the EU and the US have passed comprehensive policies to prevent irresponsible disposal, ensure access to critical raw materials and develop domestic recycling infrastructure. Table 1 provides a brief overview of the most relevant battery recycling policies in the three geographies.

Table 1: Synthesis of current EV battery recycling policies

Circular Cars Initiative (CCI) Policy Levers Framework	China	EU	USA
Create cross-cutting market enablers	Introduced a traceability system for the management of EV battery recycling	EU Battery Regulation introduced Battery Digital Product Passport	
Reshape economic incentives		EU Taxonomy Regulation guides investments into sustainable EV battery manufacturing & recycling	Provides subsidies & tax credits for near-shoring battery recycling; subsidies for recycling infrastructure development
Harmonize & strengthen existing measures	Makes automotive original equipment manufacturers (OEMs) responsible for battery recycling; defines guidelines for battery recycling	EU Battery Regulation introduced material-specific recycling & recycled content standards; producer responsibility for end-of-life batteries	

China

Since 2016, China has introduced a series of measures to develop a comprehensive policy framework for EV battery recycling. Between 2016 and 2018, Chinese policy-makers focused on laying the foundation before focusing on converging and fully implementing policy from 2019 onwards. These include:

- Interim Measures for the Management of Recycling and Utilization of New Energy Power Vehicle Battery – Makes automakers responsible for EV battery recycling.
- Interim Provisions on the Management of Traceability of Recycling and Utilization of New Energy Vehicles Power Battery – Mandates information on battery recycling at all stages from manufacturers, automakers and recyclers to determine recycling effectiveness.
- Guidelines on Construction and Operation of Power Battery Recycling Service Network for New Energy Vehicles –Narrows definitions for lithium-ion battery recycling facilities.
- Measures for the Administration of Echelon Utilization of Power Batteries in New Energy Vehicles – Standardizes and ensures the quality and recycling of second-life, repurposed and remanufactured batteries.

European Union

The European Union's comprehensive battery policy framework started with the 2006 EU Battery Directive. Given the EU's sustainability ambitions through the EU Green Deal and its Strategic Action Plan for batteries, it reformed its regulatory framework for batteries through the revised 2022 EU Battery Regulation and the EU Taxonomy.

- 2022 EU Battery Regulation: This regulation aims to facilitate dismantling processes by requiring manufacturers to ensure that batteries are readily removable and replaceable. It also introduces material-specific recycling targets and minimum requirements for recycled content in batteries. This incentivizes high-quality recycling and the recovery and recycling of more valuable materials. For lithium, for example, which is not recovered in large quantities today, the regulation requires recovery and recycling rates of 50% by 2027 and 80% by 2031 and recycled content targets of 6% by 2031 and 12% by 2036. Moreover, the EU Battery Regulation improves data availability throughout the value chain by introducing a digital product passport for EV batteries. Compliance will be a prerequisite for permission to sell into the EU market. This will include critical information on battery type, chemistry, state of health and state of charge. Thus, it will facilitate dismantling and recycling processes. Manufacturers will be responsible for the end-of-life management of all batteries.
- EU Taxonomy Regulation: Regulations classify recycling as a sustainable economic activity, thereby strengthening the design for recycling. The EU Taxonomy Regulation incentivizes manufacturers to design recyclable batteries and use recycled materials to attract investments. Recycled materials may cover both production and end-of-life scraps.

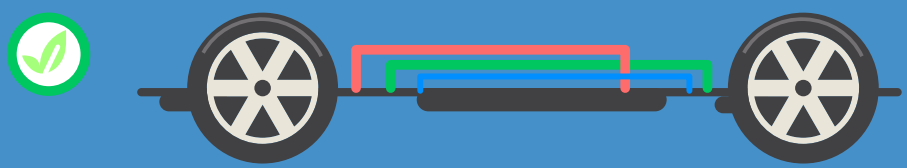
United States

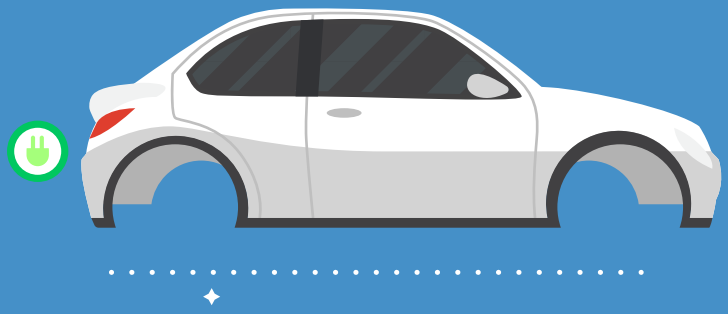
The US government is committed to bolstering domestic recycling to near-shore EV battery supply chains and ensuring material availability.

- Inflation Reduction Act: The passing of the Inflation Reduction Act means significant tax benefits and other subsidies for localizing supply chains and fuelling EV uptake. Buyers can qualify for a tax credit of up to $7,500 if certain thresholds for the extraction, processing or manufacturing of critical minerals and battery components in the US or in a country with which the US has a free trade agreement are met. For minerals, this threshold is 40% through 2023 and increases to 80% after 2026. For the value of battery components, it is 50% through 2023 and 100% after 2028.

- Federal Bipartisan Infrastructure Law: This law dedicated $3 billion to a battery material processing programme and $3 billion for domestic battery manufacturing and recycling.

The review shows that China, the EU and the US aim to improve sustainability performance and ensure the competitiveness of their EV battery value chains. This increasingly leads to competing interests between the three, with the EU and the US aiming to reduce dependencies on China. Even though increased resource regionalization may reduce overall trade in spent EV batteries and recycled materials, China is still expected to dominate EV battery manufacturing, accounting for 69% of global manufacturing capacity in 2027, down from 77% in 2022. As a result, global trade will remain critical to maximizing the deployment of recycled materials in new EV battery production.





Recommendations: Enabling the safe and green management of end-of-life batteries

The challenge for policy-makers in the EU, the US and China will be to develop the framework conditions to enable the safe, green and efficient recycling of EV batteries globally. They could leverage established initiatives such as the ZEV Transition Council to do so. Potential actions should cover the following:

- Standardizing definitions and transaction triggers –Align definitions of critical terms such as waste, recycling or recycled material across jurisdictions to ensure harmonized treatment and enable EV battery recycling. In addition, policy-makers can foster circular value creation by harmonizing regulatory frameworks to enable consistent, efficient and transparent product classification. For example, if a contract for recycling is in place, the 'product' trigger could be retained and the default 'waste' trigger avoided.

- Developing and harmonizing standards for black mass composition – As the composition of black mass is diverse and differs between battery chemistries and designs, develop standards that specify criteria for what metals are present and in what quantity and quality to facilitate trade. Legislators should prompt the industry to establish standards, with support from academia, to ensure scientific rigour.

- Increasing information availability through traceability – Strengthen and harmonize global traceability and transparency requirements to ensure sufficient information availability to enable effective, efficient and sustainable battery recycling. This could, for example, involve the harmonization of digital battery passport requirements to ease battery recycling and the use of recycled materials.

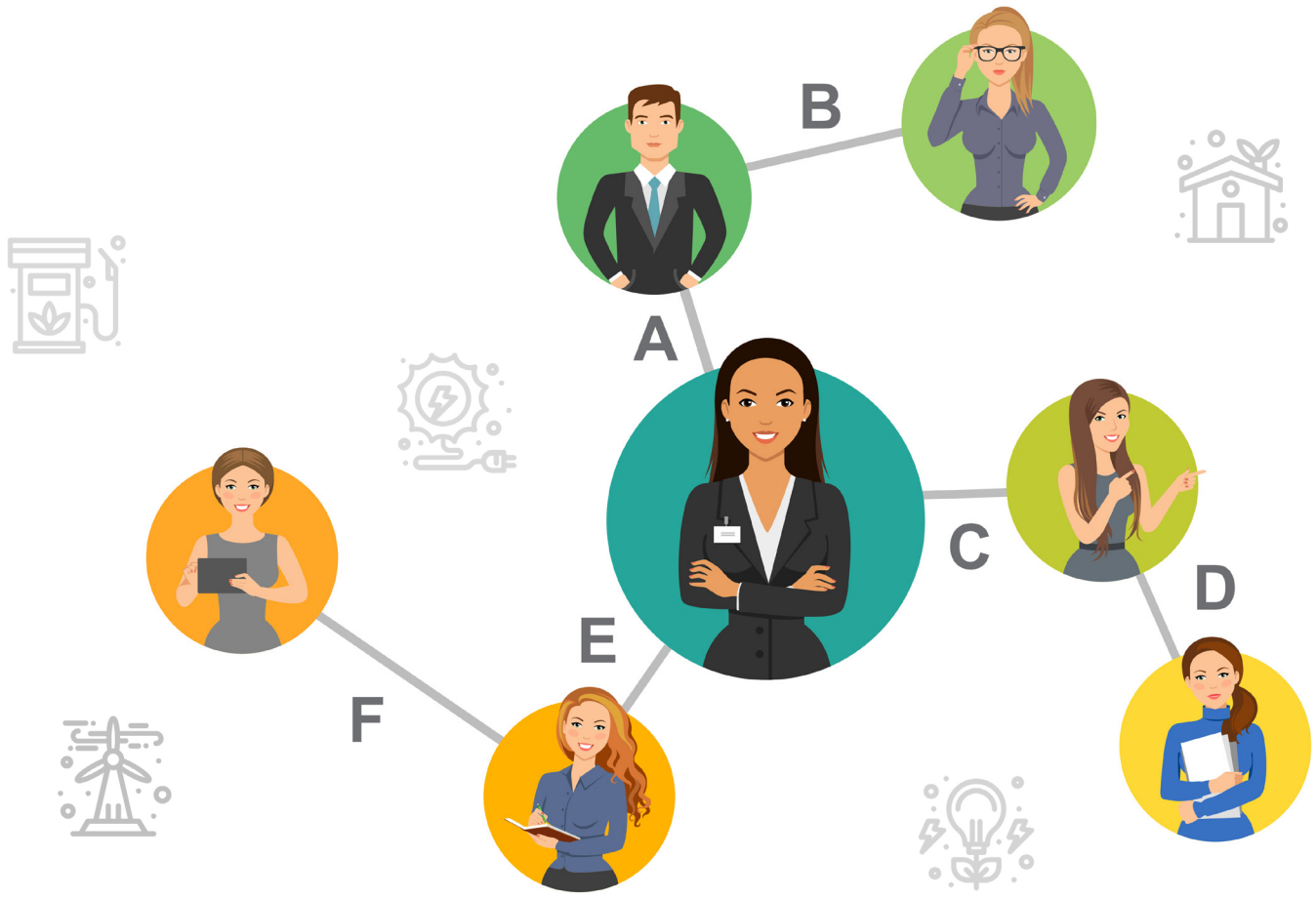
- Providing incentives for new recycling technologies that can economically treat LFP batteries – Support the commercialization of new technology, such as direct recycling, through research and development assistance or other public-private partnerships.

- Supporting the development of safety measures – Support the development of safe recycling practices globally, for example, by requiring internationally recognized standards in recycling operations.

This briefing paper was developed as an output of the Circular Cars Initiative's policy workstream in collaboration with Systemiq. It was funded and supported by the ClimateWorks Foundation, with inputs from the China Automotive Technology and Research Center (CATARC). Republished from World Economic Forum under CC BY-NC-SA 4.0 licence.

Green jobs surge in the energy transition

Half of the energy sector workforce is in clean energy – but matching employers and employees is no easy matter



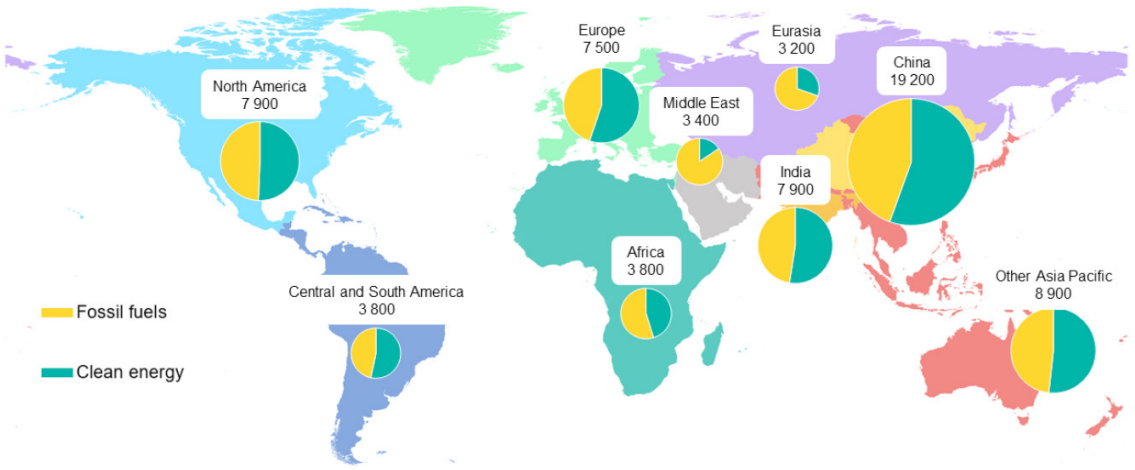
According to the IEA, the energy sector employed over 65 million people in 2019, equivalent to around 2% of the global workforce. The aftermath of the COVID-19 pandemic and the ongoing conflict in Ukraine have led to fuel shortages, fluctuating energy prices and inflation. In the past few years, the global energy system has been in crisis mode. Yet despite – or maybe because of – the crisis, demand for skilled employees in the energy sector is soaring.

'If you read the latest World Energy Outlook, the overall theme of the response to the conflict in Ukraine and the energy crisis is overwhelmingly taking us on a trajectory with more clean energy investment,' explains Daniel Wetzel, head of the Tracking Sustainable Transitions Unit at the IEA. 'In the short term, we are seeing a temporary resurgence of coal, but we've also seen that the surge in clean energy has mitigated that to a large extent. What that means for employment is that we are seeing an uptick of energy investment. That increase basically means a lot more jobs.'

Clean energy sector accounts for around half the energy workforce

In September 2022, the IEA published the *World Energy Employment report*[1], a comprehensive inventory of the global energy workforce, mapping the labour force across regions and technologies. The report shows that regional distribution of jobs is concentrated in locations where energy facilities are under construction and where upstream components are concentrated. For example, the vast majority of solar PV manufacturing for example is in China. In the EU, the REPowerEU plan, with its emphasis on energy efficiency, has increased the need for workers who can retrofit buildings. One of the key findings in the report is that about half of the global energy workforce is already in the clean energy sector. In the EU and in China, the figure has already surpassed 50% (see Figure 1). 'This is driven by the fact that energy is an infrastructure-intensive industry with low operating costs, and it's designed that way. So most of the jobs are going to be created in the development phase, whether that is manufacturing upstream components or building the actual plants,' explains Wetzel, lead author of the report.

Figure 1: Energy employment in fossil fuel and clean energy sectors by region, 2019. (Source: IEA, 2022)



Notes: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. Please see the Annex for definitions of regional groupings.

1. *IEA (2022). World Energy Employement. https://www.iea.org/reports/world-energy-employment?utm_content=buffer74b3a&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer*

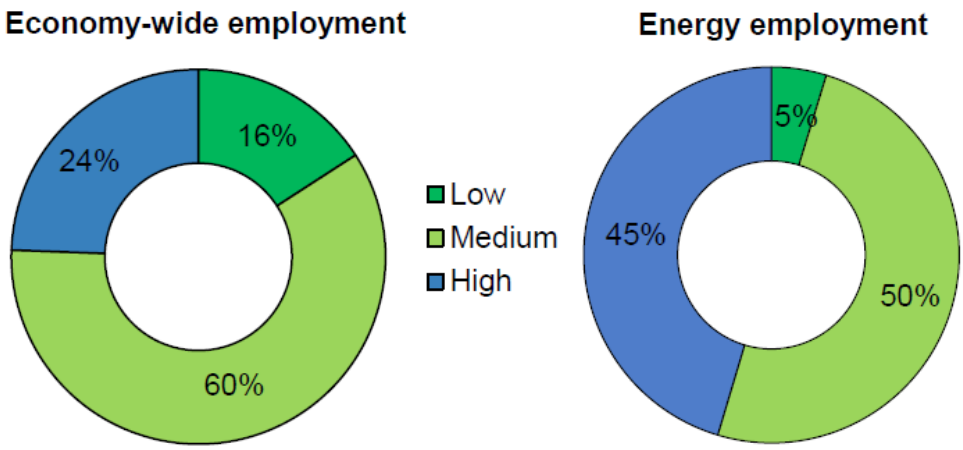
Highly-skilled technicians and engineers are in high demand

Compared to the average economy, the energy sector demands more skilled workers and in return offers higher wages. 'Energy is an industry that requires a lot more high- and medium-skilled employees and very few low-skilled employees compared to the economy-wide average,' explains Wetzel. 'Engineers are highly skilled, and account for around 45% of the energy workforce. The majority of jobs are in the medium-skilled professions, such as wind, and solar plant construction, energy retrofits, etc. However, traditional energy industries are sort of on either side of this: coal mining includes a high proportion of low-skilled jobs in the developing world while oil, gas, nuclear, employ highly-skilled people who are predominantly engineers. Many clean energy technologies offer a lot more opportunities to people in construction and manufacturing.'

In order to understand how to fill the labour gap, it is important to understand precisely what skills are needed to drive the clean energy transition. Currently, the IEA is working on an iteration of its World Employment Report that aims to identify the skills that are in particular demand. 'We are looking at the occupations that are most in demand in clean energy sectors and then ask what other industries have those similar occupations? If you take the general electrician certification, for example, how much additional training is needed to enable a general electrician to install a solar panel, versus installing a wind farm? How many more weeks of training do you need? How much more specialisation is needed to get them into that career? And what is the wage premium commonly associated with that?' asks Wetzel.

Using natural language processing to access a bigger data base, the results of the investigation will offer a list of the standard skills or standard certifications that the industry is looking for. 'Ideally, for key markets, like China, India, the US and the EU, we are aiming to provide a list of certifications that are required along with how much time they will take to achieve. So, we can design the curriculum such that these clean energy technologies are included into standard electrician training, in standard engineering training, and so on,' comments Wetzel.

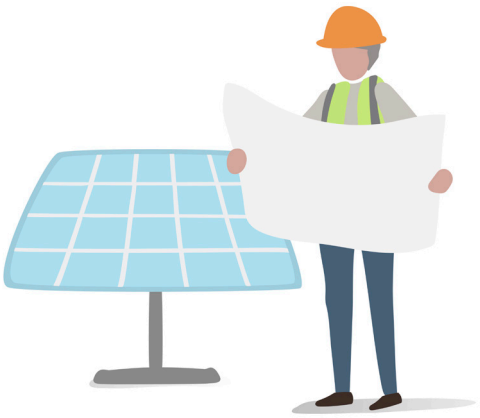
Figure 2 Global employment by skill level, 2019. (Source: IEA, 2022)



Finding suitable candidates is challenging

The higher the skillset requirements, the more difficult it is to find suitable candidates. 'It is fairly easy to find an 'okay' candidate. If the client is satisfied with 60%, we can fish someone out of our database rather easily. But to find the perfect candidate, we really need feet on the ground', explains Qihan Geng, director of the China branch of the Green Recruitment Company, a British boutique recruiting firm that specialises in green energy and the clean technology sector. 'If you ask the client to describe their ideal candidates, they will have a picture in mind: the right skill set, not a *job hopper*[2], innovative mindset, with experience related to the position and an interest in the job. Normally, that is not found in one person. Along the way, we are trying to make the client understand what is going on in the market, about the competitive package and transferable skill sets. It is also important to embrace current trends like remote working. Many of the traditional employers don't really embrace these trends, but they have to adjust. And sometimes the position is so niche, that it is really rare that one person meets all the requirements,' says Qihan Geng.

In China, it can be difficult for multinational companies to attract the best candidates, as Qihan Geng points out: 'A lot of candidates with a commercial background are seeking careers in Chinese state-owned companies, because they think that those are better for their career in the long term. It's not that multinational companies are not doing a great job, but they are not in favour among jobseekers.'



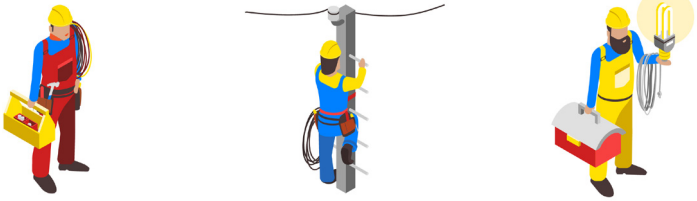
A little higher up the career ladder, the best candidates are often not even looking for a job: 'About 60% of the time, the candidates are passive job seekers and do not actively put their profiles on LinkedIn or other job boards. It is our job to identify them as suitable for the role and to convince them to have a conversation. The rest are active job seekers, who reach out to recruiters like us. Only a small percentage are people that are referred to us', explains Qihan Geng. 'It's part of our job to know where our clients are positioned in their marketplace. And then it's easy to find people and companies related to their business, whether that is their direct competitors, suppliers or downstream-related businesses. Naturally, someone that is working in a related field has the right skill set to work for these companies. We need to understand the sector, accumulate enough profiles and candidates, and develop our own talent pool. With the right keywords and the right lens of experience, it's easy to identify candidates. Of course, we also use external job boards and there is the traditional way of calling people and asking for referrals.'

2. *Here defined as someone who changes jobs within less than a year.*

Talking to people in the field is key to find niche roles

Just as it is difficult for companies to find the right candidate, it is a challenge for job seekers to find the right position. As a fresh graduate, it can be difficult to even know what roles exist. 'When I was looking for jobs, I knew I wanted to work in the renewable sector, but I was constantly receiving results for engineers. And I thought, maybe this dream role that I want doesn't exist,' recalls Emma Darnell. Emma graduated with a MSc in Marine Ecosystem Management from the University of St Andrews in the UK in 2022 and is now working as an environment and consent specialist at Ørsted. 'Your mind will often spring straight to engineering and technician roles, but there are so many roles that don't require an engineering background. The development of a wind farm, for example, has so many different stages that are not just that final construction or the design of a wind farm. Similar to other office jobs, you do have HR roles, project management roles, and health and safety teams. Wind farms are slightly unique in the sense of having stakeholder and environmental teams, as well as market development, media and communications, and legal and finance teams. You do not necessarily need to have one specific background to be able to do really well and have new knowledge and ideas. It is such a new and developing field and it is great to have a diverse team and think about challenges in different ways,' explains Emma.

In developing areas of employment, specific job titles are not always widely known. To find these niche roles, Emma has three suggestions: 'Firstly, there are quite a few really good podcasts out there that give insights into different careers in the energy sector and upcoming research. Secondly, reading news articles is a good way to keep up to date with current developments and to find out about conferences, symposia and networking events. Thirdly, LinkedIn is such a good way of reaching out to people. Search the company name that you're interested in and then see what roles other people have. Then it is so much easier to use those terms to search for positions. Everyone I contacted was open to having a chat. It is good to get a bit more insight into what their day-to-day is, because a job title or description can't always give you that much of a clear picture of what someone actually does.'

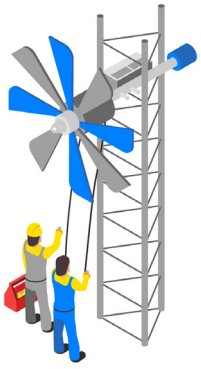


In the end, talking to a person in the role helped Emma to find her dream role: 'During my Masters, I worked on a project which involved looking at the impact of wind farms on bird populations, which sparked my interest. And I was thinking, maybe there is a career in this as well. I got in contact with a former graduate working at Ørsted as an environment and consent specialist and she introduced me to this role, which I thought was perfect. It marries up my interests of marine biology and the human aspects of working with stakeholders, and understanding policy.'

There is no doubt that as the clean energy sector develops there are enormous opportunities for medium- and highly-skilled workers. It is now the task of training establishments, recruitment firms and energy companies to ensure that the brightest new entrants to the workforce are able to identify those opportunities and enhance their skill sets so they can join in the drive towards net zero.'

By **Helena Uhde**

Consultant at Ea Energy Analyses, former Junior Postgraduate Fellow of ECECP



Monthly News Round-Up

ECECP highlights the key energy news headlines from the past month in the EU and China

European Parliament boosts renewables target to 42.5% by 2030

The European Parliament has approved a resolution that aims to raise the share of renewable energy in the total energy mix to 42.5% by 2030, aligning with the REPowerEU plan. The plan, launched last year, seeks to enhance energy savings, promote clean energy, and diversify energy supplies in response to global energy market disruptions caused by the Russia-Ukraine conflict. The updated Renewable Energy Directive also urges Member States to increase the amount of renewables in their energy mix to 45%. The Directive focuses on expediting permitting procedures for renewable energy projects, emphasising timely approval within 12 to 24 months, particularly in renewable priority areas. It specifies a 14.5% reduction in transport sector greenhouse gas emissions by 2030, emphasising the need to increase the use of advanced biofuels and non-biological renewable fuels like hydrogen. The European Parliament also stressed the importance of indicative targets for innovative renewable energy technology and stricter criteria for biomass use. This is to avoid the risk of subsidising unsustainable practices. The Directive calls for minimal negative impact on soil quality and biodiversity during biomass harvesting.

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EU reaches provisional agreement to empower consumers for the green transition

The European Council and Parliament have reached a provisional political agreement on a directive that is intended to empower consumers by amending the Unfair Commercial Practices Directive and the Consumer Rights Directive. The aim is to ensure consumers have the necessary information to make the appropriate green choices and to offer them better protection against greenwashing, social washing and other unfair commercial practices. Key measures include improving the credibility of sustainability labels by defining the key elements of the certification scheme, increasing the transparency and monitoring of claims related to future environmental performance, and prohibiting claims that a product has a neutral, reduced or improved environmental impact, based on unverified offsetting programmes. The provisional agreement would include a 24-month transition period for Member States to adapt to the changes.

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EU boosts green fuels for aviation

EU lawmakers have approved new rules requiring airlines to use more sustainable fuels across the bloc in a bid to decarbonise the sector, which accounts for 13.9% of the EU's transportation emissions. Under the new standards, 2% of jet fuel must be sustainable as of 2025, with this share increasing every five years to reach 70% by 2050. The European Parliament said that sustainable fuels should include synthetic fuels, certain biofuels produced from agricultural or forestry residues, algae, bio-waste, used cooking oil or certain animal fats. Green fuels will include recycled jet fuels produced from waste gases and waste plastic, as well as renewable hydrogen. Food crop-based fuels and fuels derived from palm and soy materials will not be considered green fuels. Sustainable aviation fuel supply remains low, accounting for less than 0.05% of total EU aviation fuel use. The new legislation forms part of the EU's 'Fit for 55' package, and will enter into force in January 2024 once endorsed by the EU Member States.

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EU Hydrogen Bank's pilot EUR 800 million auction to open on Nov 23

The European Commission (EC) has disclosed the terms for its green hydrogen auction, scheduled to launch on 23 November 2023, offering up to EUR 800 million as a fixed premium. The auction aims to cost-effectively bolster renewable fuel of non-biological origin (RFNBO) hydrogen production in the European Economic Area (EEA). This initiative is part of the European Hydrogen Bank plan, with financing from the EU Innovation Fund. The fixed premium, up to EUR 4.5 per kg of renewable hydrogen over a decade, bridges the cost-production gap. Eligible hydrogen must stem from newly installed electrolysers, with a minimum 5 MWe capacity at a single location. Virtual pooling of capacity is disallowed. Each bid's maximum grant is capped at one-third of the total budget, or approximately EUR 266.7 million for the inaugural auction.

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EU reaches 90% gas storage target ahead of winter

The EU has filled its gas storage facilities to 90% of capacity roughly 10 weeks ahead of the 1 November deadline, according to the latest figures released by Gas Infrastructure Europe. The gas storage regulation of June 2022 set a binding EU target for gas storage facilities to be 90% full 1 November each year, with interim targets for EU countries. Gas storage is key to security of supply in Europe as it can meet up to one-third of the EU's winter gas demand. The latest figures show that by mid-August 2023, gas storage levels reached 1 024 TWh or 90.12% of storage capacity (equivalent to just over 93 bcm of natural gas).

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LNG imports from Russia rise, despite cuts in pipeline gas

EU nations are importing 40% more LNG from Russia compared to the period before the Ukraine conflict escalated in 2022, defying the EU's intention to cut ties with Russian fossil fuels in the coming years. An analysis by NGO Global Witness states that between January and July 2023, EU countries purchased 22 million cubic meters of Russian LNG. Spain ranks as the second-largest global purchaser of Russian LNG, followed by Belgium. Russian LNG accounted for around 16% of the EU's total LNG imports from January-July 2023, Aurora Energy Research data show. This flies in the face of the EU's stated aim to end reliance on Russian fossil fuels by 2027. Prior to 2022, the EU imported about 140 bcm pipeline gas from Russia each year. This dropped to 62 bcm in 2022. The EU has already sanctioned Russian coal and seaborne oil imports. Russian LNG and gas are not subject to EU sanctions, but some politicians have urged European firms to avoid Russian LNG.

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Europe reaches 32 GW of installed offshore wind capacity

WindEurope statistics shows that Europe added 2.1 GW of offshore wind in H1 2023, with cumulative capacity reaching 32 GW. The Netherlands accounted for more than half of this additional capacity, with the UK, Germany, and Norway contributing the rest. However, this growth falls short of the additional 11 GW needed annually to meet Europe's energy and climate objectives until 2030. Trade body WindEurope stressed that regulatory obstacles including permitting and market design need to be addressed to create a viable business case for offshore wind investments, and that auction design improvements are necessary for cost indexation and to discourage uncapped negative bidding.

Wind turbine costs have surged by up to 40% in the past two years, making it imperative for governments to acknowledge these cost increases to ensure project viability. In 2022, Europe witnessed a dearth of new large-scale offshore wind investments, primarily due to inflation-induced cost escalation and investor concerns over government market interventions. However, 2023 has seen six projects secure final investment decisions, totaling EUR 15 billion in investment and 5 GW of new capacity.

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EU Commission approves Germany's EUR 6.5 billion 'carbon leakage' scheme

The European Commission has approved a EUR 6.5 billion German scheme to prevent energy-intensive companies from relocating production to countries with less stringent emission rules, also known as 'carbon leakage.' The scheme will cover part of companies' higher fuel prices between 2021 and 2030 resulting from the country's emission trading system (ETS). Depending on their emission intensity, companies will be reimbursed between 65 and 95 percent of their additional costs, but only if they invest at least 80 per cent of the aid in measures to lower emissions, for example by improving efficiency or switching to climate-friendly production technologies.

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Germany to issue tenders for up to 23.8 GW of hydrogen-fired power plants by 2035

Germany is set to host tenders for up to 23.8GW of hydrogen-fired power plants by 2035, according to Vice-Chancellor Robert Habeck. These plants will provide back-up power during periods of insufficient wind and solar power, and will also boost energy storage and demand-side response. Habeck outlined plans for 8.8 GW of hydrogen-powered plants that will operate with hydrogen from the start, and an additional 15 GW of hydrogen-fired power plants that will temporarily use natural gas until linked to the hydrogen network. The latter will transition no later than 2035. The goal is to tender 10 GW by 2026, and carry out an evaluation before proceeding with the remaining 5 GW. Germany is targeting power supply decarbonisation by 2035, requiring all power plants to operate in a climate-neutral manner. The initiative entails transforming and decarbonising fossil power plants, with an emphasis on technological advancement and conversion to renewable fuels such as hydrogen. Tenders will include hydrogen 'sprinter', hybrid, and H2-ready power plants.

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Germany passes modified fossil-fuel heating law

Germany's lower house of parliament has passed a controversial bill aimed at banning fossil-fuel heating, albeit in a watered-down version that may compromise the country's 2030 climate targets. Germany aims for climate neutrality by 2045 and sees this bill as vital in achieving that goal. The revised bill mandates new heating systems in certain areas to run on at least 65% renewable energy starting in 2023. Existing building owners have until 2028 to make these changes. New gas boilers will still be allowed if they are of the type that can be converted to hydrogen. The bill offers subsidies for new heating systems if combined with renovations, with the government offering up to USD 96,404 annually, sourced from the Climate and Transformation Fund.

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Estonia, Latvia and Lithuania agree to synchronise their electricity grids with the European grid by early 2025

Estonia, Latvia, and Lithuania have brought forward the deadline for synchronisation with the European grid from the end of 2025 to February 2025, according to a joint declaration by the prime ministers of the three countries. The relevant grid reinforcements are a Project of Common Interest (PCI) on the European Union's fifth PCI list under the TEN-E Regulation and have received financial support from the Connecting Europe Facility for Energy of more than EUR 1.2 billion. The full integration of the Baltic States into the internal energy market will also facilitate the uptake of renewable energy, supporting them achieve the European Green Deal objectives.

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France to launch EUR 4 billion CfD programme to support clean hydrogen production

The French government is committing EUR 4 billion between 2024 and 2026 for contracts-for-difference (CfDs) to boost low-carbon hydrogen production. These 15-year CfDs aim to bridge the cost disparity between clean and grey H2 derived from unabated fossil gas. Notably, 70% of the selection criteria for these contracts will be based on price, with a payout per tonne of CO_2 avoided, while 30% will be based on non-price aspects. Additional incentives will be granted to projects capable of redirecting renewable electricity to the grid during high-demand periods and those relying on 50% newly-built renewables. However, the French definition of 'low-carbon' hydrogen differs slightly from EU guidelines: hydrogen with 70% lower lifecycle emissions than grey hydrogen is classifed as low-carbon, even if produced from nuclear electricity or gas feedstock with carbon capture and storage.

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UK awards 21 licences for CCS projects in depleted reservoirs

The UK's North Sea Transition Authority (NSTA) has awarded a total of 21 licences to 14 companies in depleted oil and gas reservoirs and saline aquifers which cover around 12 000 km2 following the UK's first-ever carbon storage licensing round. The locations could store up to 30 $MtCO_2$/yr by 2030. Winners includes Enquest, Neptune Energy, Shell, BP and Esso. Shell, Perenco and ENI have been awarded licences off the coast of Norfolk in sites which could form part of the Bacton Energy Hub – a carbon storage, hydrogen and offshore wind project, which could provide low-carbon energy for London and the South East. The NSTA will assess the response and the quality of opportunities in locations across the UK before deciding when to run a second round. Six licences have already been granted by the NSTA and the country recently unveiled GBP 20 billion (EUR 23 billion) funding for these existing projects.

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UK government unveils GBP 650 million plan to boost fusion sector

On 7 September 2023, the UK government announced plans to bolster the nation's flourishing nuclear fusion sector and enhance global collaboration in line with the UK Fusion Strategy. This initiative comes after the decision not to participate in the Euratom Research and Training Programme, and, by extension, the Fusion for Energy Programme. The government is set to invest up to GBP 650 million by 2027, subject to business case approvals. This investment follows a previous commitment of GBP 126 million in November 2022 for UK Fusion R&D programs. The new package encompasses the creation of new facilities dedicated to advancing fusion fuel cycle capabilities and innovation, a comprehensive fusion skills package to cultivate the necessary expertise, continued support for international collaborative projects, and additional measures to accelerate fusion commercialisation, notably through enhancement of the renowned Spherical Tokamak for Energy Production program. More details on these innovative programs will be unveiled later in 2023.

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Poland looks to boost offshore wind target to 18 GW by 2040

Poland wants to accelerate its offshore wind auction schedule, in a bid to raise installed capacity from 11 GW to 18 GW by 2040. The country is currently building its first wind farms in the Baltic Sea. Recently, the government revealed plans to raise the auctioned capacity from 5 GW to an impressive 12 GW. Poland relies on coal for 70% of its power generation, and significant work is required if it is to meet its goal of phasing out coal in the near future. The government operates a contract-for-difference revenue stabilisation scheme for new projects, which is set to expand pending approval from the EU. The European Commission has greenlit a budget of EUR 22.5 billion for Poland's contract-for-difference scheme until 2030.

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China issues national guidelines on hydrogen standards

On 8 August, China's Standardisation Administration, the National Development and Reform Commission (NDRC) and four other key government agencies jointly unveiled the first national-level guidelines to establish standards for China's booming hydrogen energy industry. The guidelines are intended to lead to a system that includes more than 30 national and industry-level standards by 2025, covering the complete industrial chain including production, storage, transport and the use of hydrogen in sectors such as industry, transport, energy storage, and power generation. The government hopes the standards will help to realise the full potential of hydrogen China's energy consumption, paving the way for rapid development of the hydrogen industry chain over the next few years.

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Green certificates to cover all renewable power

China has renewed its Green Certificate policy to expand the scope of its domestic renewable energy certificate scheme to include not just solar and wind, but all types of renewables projects. According to the joint statement from NDRC, Ministry of Finance, and National Energy Administration (NEA), GECs will be the only acceptable proof of the environmental attributes of electricity in China, and the only certificate that validates renewable electricity consumption. One GEC represents 1 MWh of renewable electricity consumption and can be traded in the open market. Chinese companies buy GECs to certify that their electricity comes from renewable energy sources. The new move will allow improved tracking and reporting of renewable power consumption and ease the challenges for companies on carbon accounting and reporting.

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Fundamental rules issued for national power spot market

China's top economic planner NDRC and energy regulator NEA have jointly issued long-waited rules on establishment of a national power spot market. The new rules focus on development of the technical systems for a national spot market, as well as standardisation of market price limits and operational requirements. They will allow power trading across the country at prices which reflect real-time supply and demand dynamics. The move looks set to boost interprovincial transactions, increase consumption of renewable power, improve the reliability and efficiency of power supply, and unlock more business opportunities for distributed power generators, aggregators, energy storage and virtual power plants. The document is designed to accelerate the construction of a national unified power market system and promote optimal large-scale allocation of resources.

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China unveils system for recycling degraded solar and wind equipment

China has outlined a comprehensive plan for recycling of degraded solar PV panels. According to NDRC, the country aims to establish a disposal mechanism for decommissioned solar equipment by 2025. By 2030, a complete recycling system for solar PV plants will be in place, aligned with resource recycling capacity. At the same time, China plans to create industry clusters for recycling degraded solar PV and wind power equipment. Solar PV manufacturers are already required to handle retired equipment responsibly and are prohibited from disposing them in landfills. The government encourages both manufacturers and third-party recycling companies to engage in efficient recycling practices. Additionally, the government is pushing for re-manufacturing of key components such as solar PV inverters.

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NEA to strengthen power reliability data management

As renewables surge, China is prioritising real-time, reliable data management. The National Energy Administration (NEA) has recently issued a circular requiring development of a more refined and systematic data reporting, management, and evaluation system for power projects. By the end of 2025, all new conventional and renewable power generation units that have been operating for six months or more are expected to deliver real-time collection and reporting of reliability data. In addition, power transmission and transformation equipment must deliver reliable data collection for outage events. The coverage rate for real-time data collection in DC power transmission and power transmission/transformation loops should be at least 50%. A comprehensive power reliability management system is to be established by 2028.

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Five-year legislative plan unveiled for the energy sector

In September 2023, Xinhua News Agency published the Legislative Plan for the 14th National People's Congress (NPC) Standing Committee. The plan outlines a timeline from March 2023 to February 2028 during which government authorities aim to develop, modify, revoke, and interpret at least 130 laws. This includes 79 laws already in draft form, such as the Energy Law, Territorial Spatial Planning Law, Atomic Energy Law, and the revised Renewable Energy Law. Additionally, 51 laws are in the early stages of preparation, and are awaiting suitable conditions for submission and consideration, including the revised Electricity Law.

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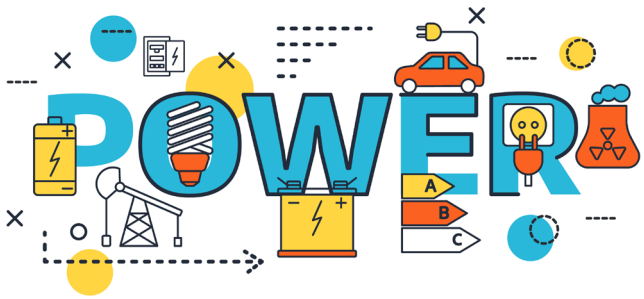

China issues plan to stabilise growth in power equipment manufacturing sector

On 4 September 2023, China's Ministry of Industry and Information Technology (MIIT) unveiled a comprehensive strategy to boost growth in the power equipment industry. The objective is to attain an annual growth rate exceeding 9% for the industry and approximately 9% in industrial value addition in 2023-24. The plan focuses on showcasing innovative electric power equipment in key power projects and accelerating its widespread adoption. It also advocates improvements to the industry's competitiveness by promoting the smart transformation of power equipment and advanced manufacturing clusters in the energy sector. China is committed to supporting power equipment manufacturers to expand their global footprint through strategies like Engineering, Procurement, and Construction (EPC), investments and multi-market collaborations.

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Renewable power consumption continues to grow

The National Energy Administration (NEA) has released its monitoring report on China's renewable power consumption for 2022. Actual consumption of non-hydro renewables reached 1 367.6 TWh in 2022, accounting for 15.9% of the total electricity consumption, up 2.2% compared to the previous year. National wind and PV power utilisation rates reached 96.8% and 98.3% respectively. Renewable power transmitted by 20 direct current ultra-high-voltage lines was 316.6 TWh, an increase of 10.3% year-on-year, and accounting for 56.2% of the total power transmitted.

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China unveils National Catalogue of Green and Low-Carbon Advanced Technologies

The Ministry of Science and Technology has issued a 'National Catalogue of Green and Low-Carbon Advanced Technologies' in an effort to ensure technological innovations are put to practical use. The catalogue consists of 85 technological achievements across six fields. These include 13 items related to energy-saving, emissions reduction, and low-carbon technologies, covering aspects such as energy-saving and emissions reduction measures for equipment and industrial processes, as well as waste heat and pressure utilisation, and efficient and clean use of coal. The catalogue will be a valuable reference for stakeholders when upgrading and transforming their production practices in order to achieve lower energy consumption and reduced carbon emissions.

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China pushes for green development of coal-based chemical industry

China's NDRC and five other departments have issued a notice that promotes development of the coal-based chemical industry. The notice encourages the construction of large and efficient 'gasification islands' for centralised production of raw materials and simultaneous development of various downstream products. In regions with abundant resources and a solid industrial foundation, the notice advocates innovative and integrated development of a modern coal-based chemical industry alongside renewable energy, green hydrogen, and CCUS, in a bid to boost the green development of the sector. However, China intends to impose strict controls on new coal-based chemical projects: the authorities are prioritising coal supplies for power generation and heating.

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China and South Africa sign power deals at BRICS summit

China and South Africa signed a number of deals during the 2023 BRICS summit, including on power sector cooperation. Noteworthy deals include a government-level framework agreement on accelerating renewable power investment in South Africa, and establishing a programme to supply emergency power equipment. In addition, South Africa's energy minister signed a joint MoU with eight Chinese companies and institutions to help tackle the energy crisis in the country, which is hampering its economic growth. In addition, a strategic partnership has been agreed between the State Grid Corporation of China and state-owned utility Eskom that will see upgrades of South Africa's power transmission and distribution infrastructure. In other deals, Chinese companies will help to upgrade South Africa's coal-fired power plants, offer technology to cut emissions, and share nuclear power expertise.

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China announces massive cross-border logistics and energy hub project in Russian Far East

China's Xuanyuan Group Industrial Development company plans to build a huge energy logistics hub in Russia's Far Eastern Amur region, close to the Chinese border.. A large fuel storage terminal will form part of the project. According to the group's CEO, Hailong Xue, the agreement envisages the construction of a terminal for storage and transportation of hazardous and non-hazardous goods, such as LNG, LPG, aviation fuel, helium, and other goods. The estimated cost of the project will be between CNY 4.3 billion and CNY 5 billion (EUR 0.55-0.64 billion), with the cargo terminal scheduled to open in 2027. Russian and Chinese companies will take part in the project, apparently on a 50-50% equity basis.

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Chinese firms sign new green deals with Saudi Arabia's ACWA Power

During the China-Saudi Arabia Economic and Trade Cooperation Conference on 11 September 2023, Saudi Arabia's ACWA Power, the world's largest private water desalination company, signed strategic MoUs with state-owned China Southern Power Grid International Company and MingYang Smart Energy Group Limited, a leading provider of integrated clean energy solutions. These agreements aim to foster collaboration in green energy, not only within China but also on a global scale. The collaboration will focus on critical areas such as green hydrogen, ammonia, global renewable energies, and integrated smart energy solutions. This marks a significant milestone in energy cooperation between China and Saudi Arabia, building on President Xi's successful visit to Saudi Arabia in December 2022.

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Power demand in rural China could be met by rooftop solar

Rooftop solar has the potential to meet energy demand in China's rural areas, according to a new report 'China Rural Rooftop PV Report,' jointly issued by the Energy Foundation and the Asian Infrastructure Investment Bank at a side event of the 2023 International Energy Transformation Forum held on 7 September 2023 in Suzhou. The report states that the current total rooftop area of rural buildings in China is approximately 27.3 billion m2, representing a residential PV installation capacity potential of nearly 2 TW and an annual electricity generation potential exceeding 3 000 TWh. Rooftop solar alone could deliver electricity to meet energy demand in households, industries, and transport, write the report's authors.

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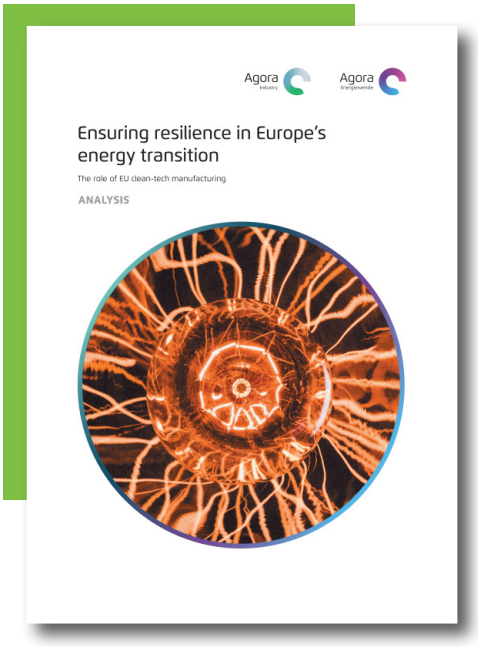
Featured Publication



Ensuring resilience in Europe's energy transition

The role of EU clean-tech manufacturing

Europe is highly reliant on imports of clean technologies such as solar PV or batteries. In addition to diversification of supplies and improved recycling technologies, it is also important for the EU to set proper minimum shares for EU clean-tech manufacturing, while providing suitable incentives for the establishment of clean-tech manufacturing in Europe. Based on an analysis by Roland Berger, this report published by Agora Energiewende identifies minimum shares of EU clean-tech manufacturing as an insurance against supply chain risks, and proposes a credible approach to closing the production cost gap essential for expanding clean-tech manufacturing in Europe, so that it can reach critical scale and develop local supply networks. The report concludes with recommendations on priority-setting in policy debates around the Green Deal Industrial Plan, including a package of measures for expanding EU clean-tech manufacturing so that it makes a lasting contribution to the resilience of Europe's clean energy transition.

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The Merit Order and Price-Setting Dynamics in European Electricity Markets

Over the past three years, European power markets have seen unparalleled price fluctuations, primarily driven by gas price volatility. Gas-fired power plants are often the marginal technology units in the merit order, setting the price in the electricity market. For this reason, questions have been raised about the functioning of Europe's electricity markets, alongside calls for the decoupling of gas and electricity prices. With the transition to a cleaner generation mix based on renewables, how is the merit order price-setting dynamic changing in the EU power system? Will the disproportionate role of natural gas in the pricing mechanism decrease in response to the rising proportion of solar and wind in the energy mix? This Science for Policy brief by the European Commission aims to provide some answers by analysing the price-setting dynamics in the European power market in 2022 and 2030. The objective is to clarify how wholesale electricity prices are set and how merit order dynamics are evolving as renewable energy sources increase their share. The results are based on an economic equilibrium model simulating the EU wholesale market hourly dispatch.

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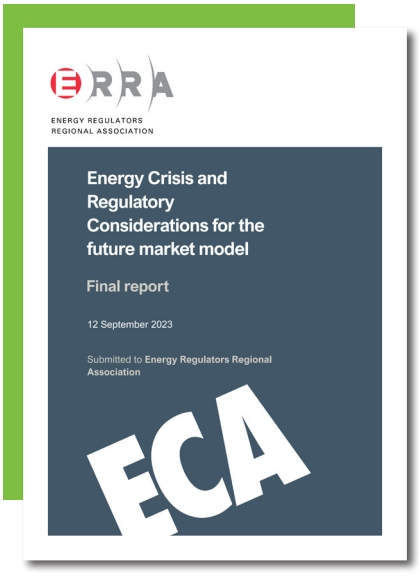
Energy Crisis and Regulatory Considerations for the Future Market Model



Prepared by Economic Consulting Associates for the Energy Regulators Regional Association (ERRA), this report highlights experiences from the recent energy crisis that can serve as a guide for EU Member States as they draw up response plans for future crises. Drawing on examples from a wide range of countries, with different energy markets and systems, the report provides an overview of short-term policy and regulatory measures adopted to address the crisis (mostly to support access to affordable energy) and lessons learned. In the context of evolving energy supply and market paradigms, the report includes an assessment of longer-term policies and measures, including electricity market design

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Green certificates with Chinese characteristics: Will green certificates help China's clean energy transition?

Green power trading is a market-oriented way to promote a clean energy transition in China, and the key instrument is the green certificate. This paper by the Oxford Institute for Energy Studies examines the history and goals of the green certificate policy, and the major new challenges that green certificates now face. While there are positive trends in trading volumes and pricing, China's green certificate market faces significant obstacles such as secondary trading, and transparency issues in relation to regulations, attributes, and pricing. The role of the green certificate is also under discussion — should it meet the low-carbon goal of private companies or contribute to provincial targets and quotas on energy consumption and renewable integration?. Whether the green certificate can play a larger role in facilitating the transition towards China's clean energy future will depend on the resolution of some of the major barriers that continue to affect the programme and reduce its attractiveness to potential buyers and sellers.

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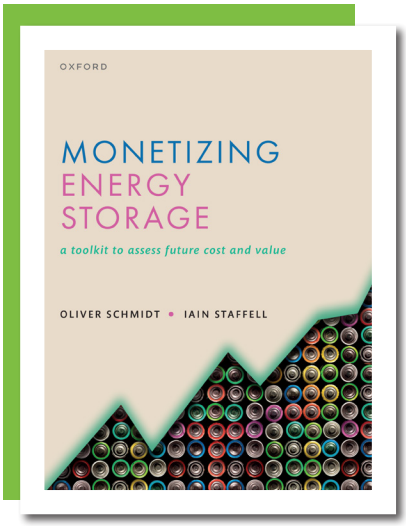
Monetizing Energy Storage

Energy storage is central to balancing variable low-carbon power generation with demand. From electric vehicles to stationary storage, the energy storage industry is projected to expand exponentially in the coming decades. However, assessing the future cost and value of energy storage is complex due to evolving technologies, diverse use cases, and varied global market structures. This book, written by Dr Oliver Schmidt and Dr Iain Staffell from Imperial College London, aims to demystify the commercial viability and potential roles of energy storage. The book equips readers with tools to evaluate economic potential and sheds light in the jungle of stacking revenue streams, identifying the applications and technologies that can make an energy storage project work. The report offers a companion website for interactive analysis, ensuring relevance amidst evolving technology landscapes. Published by Oxford University Press, this open access book aims to drive a wider understanding of the economic case for energy storage and expedite the energy transition.



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