Magazine of EU-China Energy Cooperation Platform

EU-China Energy Magazine

2023 June 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 to the latest issue of the EU-China Energy Magazine.

June was an extremely active month for ECECP. From June 19 to 21, and I would like to share with some of our exploits this month.

Thanks to the generous support of the Center of Science and Technology & Industrialisation Development, and the Ministry of Housing and Urban-Rural Development, ECECP participated and established our own booth at the 20th China International Exposition of Housing Industry & Products and Equipment of Building Industrialisation. Our booth served as an information and exchange hub, showcasing the platform's work and featuring European companies at the cutting edge of innovative energy solutions. More images from this event can be found on the following page.

The exhibition attracted a multitude of visitors, all keenly interested in EU companies' energy solutions and ECECP's efforts to promote EU-China energy cooperation, particularly in the area of building sector decarbonisation. In this issue, we delve deeper into this topic, exploring the role of wood in the decarbonisation of construction and scrutinising China's recent progress as well as challenges in the development of green buildings.

ECECP was very fortunate to have the opportunity to organise a visit to China's extraordinary nuclear fusion test facility EAST on June 26, 2023, with support from the EU delegation and the Institute of Plasma Physics, Chinese Academy of Science. It is truly inspiring to witness how international cooperation can facilitate significant technological breakthroughs in the pursuit of ultimate clean energy. This visit serves as a powerful reminder of the potential for open collaboration to deliver benefits for humanity as we move into the future.

At the time of writing, we are embarking on a study tour to the EU with the State Grid Energy Research Institute and the China Electricity Council. This is another exciting event on our agenda, featuring visits to Directorate General Energy of the European Commission, Hydrogen Europe, ENTSOg, Ricerca sul Sistema Energetico (RSE S.p.A.) and the Department of Energy, Systems, Territory and Constructions Engineering of the University of Pisa.

The success of these recent intensive activities and indeed the past four and half years would not have been possible without the guidance, support, and patience of Octavian Stamate, counsellor of energy and climate action from the EU Delegation in China, who will be leaving Beijing early next month. Octavian has been working closely with ECECP during the entirety of the platform's operational period. We extend our profound gratitude to him and hope he will join us again at the year's end project closing event.

We're also delighted to announce that our Assistant Team Leader, Helena Uhde, has recently earned her doctoral degree. On behalf of the entire team, we congratulate her on this impressive achievement and wish her a bright and prosperous future.

We invite you to delve into this issue of the EU-China Energy Magazine, filled with insightful updates in the energy sector. We hope it provides you with an engaging and informative reading experience.

Dr. Flora Kan
ECECP Team Leader


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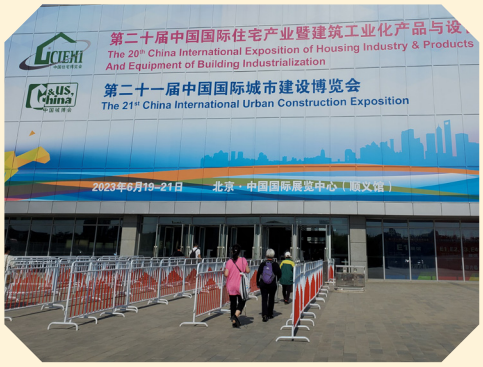
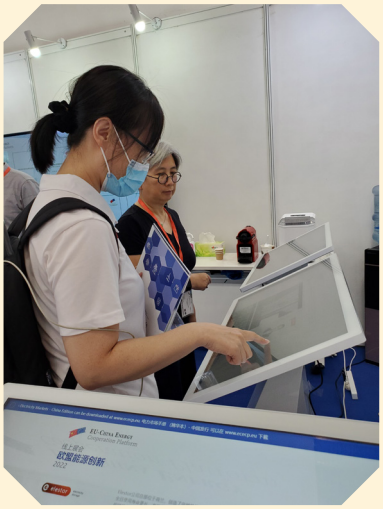
企业展示
Zero is the New Hero


第二十届中国国际住宅产业暨建筑工业化产品与设
The 20th China International Exposition of Housing Industry & Products
And Equipment of Building Industrialization
第二十一届中国国际城市建设博览会
The 21st China International Urban Construction Exposition
2023年6月19-21日 北京 · 中国国际展览中心（顺义馆）


EU-China Energy
Cooperation Platform


电力市场



Snapshot Highlights:

ECECP at the 20th China International Exposition of Housing Industry & Products and Equipment of Building Industrialisation

Can building with wood decarbonise construction?

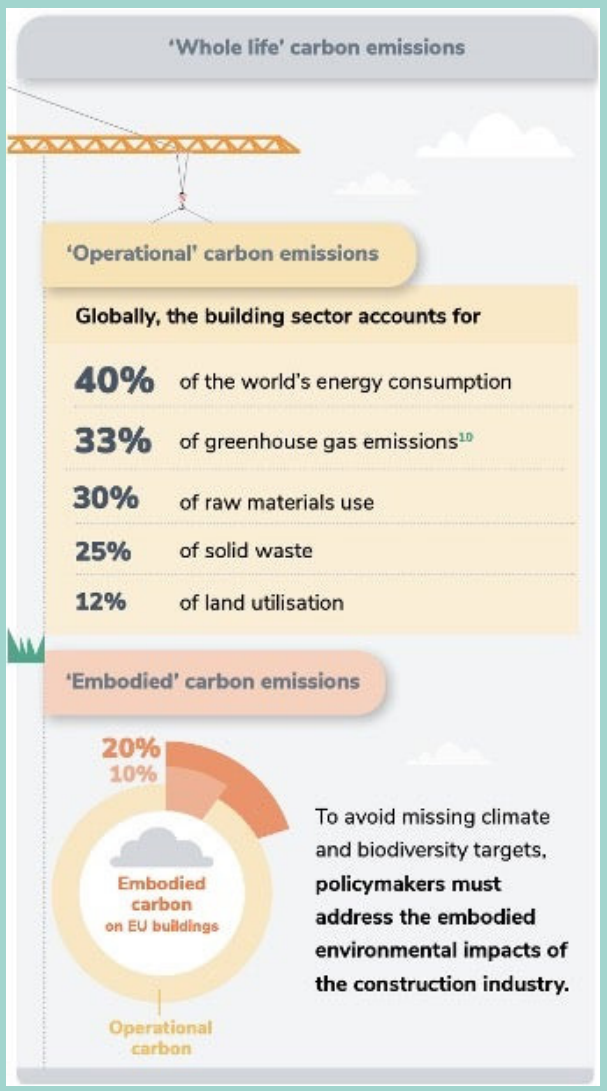
By replacing energy-intensive building materials and locking away carbon from the atmosphere, building with sustainable timber could save more than 100Gt of CO_2 by the end of the century – but there is a catch.

A building site using mass-timber construction. Credit: KK Law via naturallywood.com/Flickr.

The climate impact of the buildings and construction sector is still headed in the wrong direction. Despite booming investment to increase energy efficiency and lower energy intensity, emissions and energy consumption from buildings and construction have rebounded from pandemic levels to an all-time high.

By the latest assessment, the sector accounts for 34% of energy demand and 37% of energy and process-related CO_2 emissions. Operational energy-related emissions reached ten gigatonnes (Gt) of CO_2 equivalent in 2021 – 5% over 2020 levels and 2% over the pre-pandemic peak in 2019. Similarly, operational energy demand for heating, cooling, lighting and equipment in buildings rose by 4% from 2020 and 3% from 2019.

Decarbonising the sector is a priority if there is to be a chance of limiting global warming to even 2°C to avoid the most cataclysmic impacts of climate change. The sector desperately needs to further improve building energy performance, decrease building materials' carbon footprint, multiply policy commitments alongside action and increase investment in energy efficiency.



Aiming to do just that, last month agriculture ministers in Germany's states called for the use of wood in new housing projects to be made easier. The quota of wood in residential construction should be raised to 30% by 2030 (from 20% currently), they wrote in a joint letter, saying that forests and wood products make positive contributions to climate protection, resource efficiency and value creation.

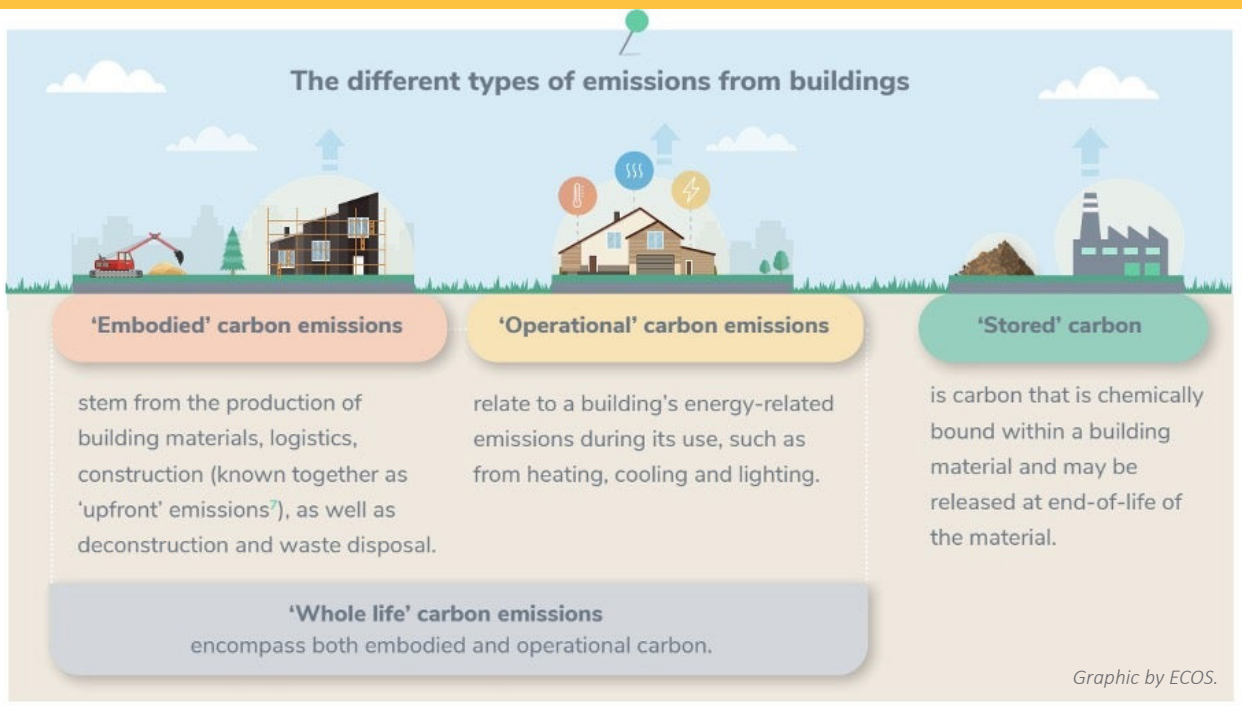
Indeed, wood has a far lighter environmental footprint than other building materials like steel and concrete, and even locks carbon away from the atmosphere. A recent study by the Potsdam Institute for Climate Impact Research, found that if most of the new urban population were housed in newly built timber buildings, constructed with engineered wood (wood composite materials), it would save around 10% of the carbon budget needed to limit global warming to 2°C this century.

Sending construction back to its roots

Emissions from major raw material production for conventional buildings, such as cement and steel, accounts for roughly 10% of global greenhouse gas (GHG) emissions. However, according to a new report from the Environmental Coalition on Standards (ECOS), an international network of environmental NGOs, building using timber structures from sustainable forestry can significantly lower that embodied carbon footprint by factors ranging from 10% to 67%.

In fact, 'using a wood building frame instead of concrete can reduce emissions by 75%, as well as reduce the whole life carbon of the building by 10–20%,' said Lauri Linkosalmi, director of product sustainability at Finnish wood and paper production group Stora Enso at a recent ECOS webinar.

The added benefit of structural timber – wood used as a building material for beams and columns – is its ability to store carbon for decades and sometimes centuries; potentially even matching the time needed to grow new trees. That could account for a vast amount of global carbon considering structural timber is 50% carbon by mass.



Graphic by ECOS.

As trees are harvested, their sequestered carbon is transferred into a wide range of products such as building structures, furniture and window frames, but they can also be transformed into short-lived products like bioenergy, paper and single-use items such as cutlery, which depletes wood resources at a faster pace.

To be of most use to the climate agenda, storage should last as long as possible; both to delay the eventual carbon losses and to control demand for harvested wood products. To that end, timber building materials would need to be maintained through multiple reuse and recycling loops in line with the circular economy. ECOS proposes a 'cascading' use of wood resources across the sectors that use wood – chemicals, construction, energy, furniture, packaging, paper and textiles – to both conserve forests and address the twin climate and biodiversity crises linked to forest harvests. Today's timber buildings are not designed with this circularity in mind, and it would require a systemic shift in industry practice to improve longevity, modularity and ease of construction.

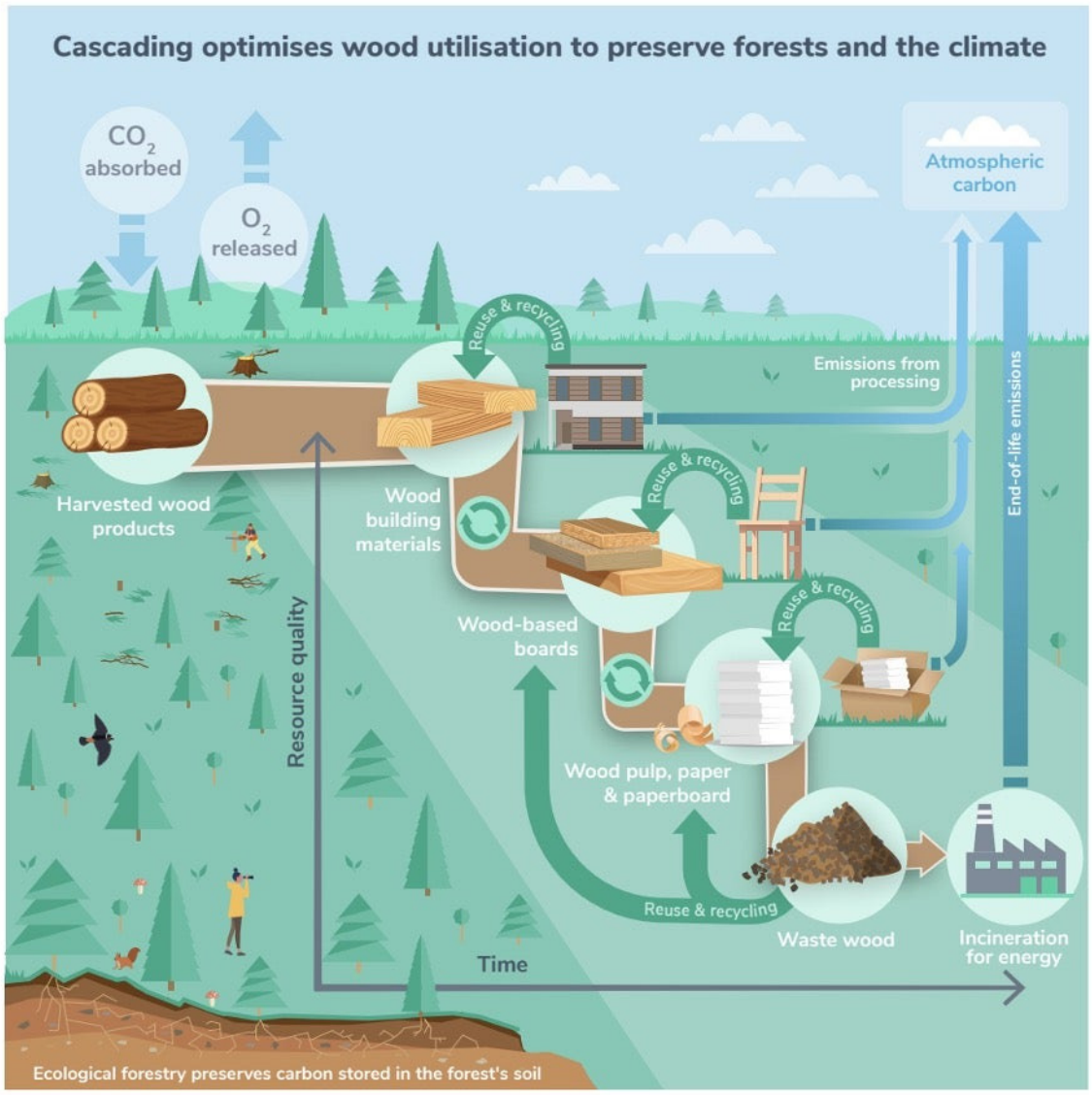
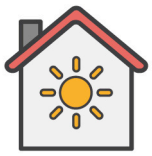


Figure 1 Cascading optimises wood utilisation to preserve forests and the climate

Based on: Höglemeier et al. (2015)[16] and MaterialDistrict (2020)[17].

Graphic by ECOS.



Research shows that if such mass-timber construction (using engineered wood for load-bearing wall, floor and roof construction) were to become the norm by 2050, annual carbon storage could be as high as 700 million tonnes of carbon instead of just ten million tonnes in a business-as-usual scenario. This would, however, require an optimised use of wood to prevent forest degradation and loss.

'This transition requires a whole value chain collaboration,' said Linkosalmi. 'Property owners and investors also need to demand more sustainable buildings, and we need to renovate our buildings so that they have less operational emissions.'

Planetary boundaries to timber construction

Nonetheless, there is a downside to mass-timber construction. Most net-zero scenarios, including those from the International Energy Agency and the Intergovernmental Panel on Climate Change, foresee a role for biomass in the energy transition, but if demand for forest products was to grow equally across the economy, there simply would not be enough biomass to go around.

'Timber buildings cannot be the green transition,' said Susanne Winter, programme director for forests at non-profit WWF Germany, at the ECOS webinar. 'A green transition needs first to maintain the ecosystems and their functionality for the climate: the nutrient and water circle, and the biodiversity. We have to stop the overconsumption. We will degrade forest ecosystems by building houses with wood. The planetary boundaries have to be our default settings.'

According to a 2021 report from Material Economics, a consultancy, EU national climate plans forecast a 40–100% increase in demand for forest and agricultural products for energy and materials than will be sustainably available – due, in large part, to the planned increase in bioenergy demand. In fact, global wood consumption is already overshooting the lowest risk boundary of what global forests can sustainably provide by 67%, with this overconsumption only likely to grow, according to a recent WWF report. And this increasing demand for forestry products is cutting the carbon sink capacity of forests, even in regions where forest cover is growing, such as Europe.

This is both environmentally and economically unsustainable for a variety of reasons: increased demand for short-lived wood products and bioenergy re-emit sequestered carbon faster than the forest can grow back. While afforestation is necessary, creating new forests can encroach on land needed for people to live on and produce food, or on other vital ecosystems such as grasslands and wetlands. Such demand for construction timber cannot be solely met with local production and risks increasing deforestation.

‘Very often the ‘ecological benefits’ are restricted to the sequestration of carbon, but we also need the humidity and cooling of the forest; we need the forest biodiversity for human health and the ecosystem services,’ says Winter. ‘In our study, we find that the sustainable limit of the forest harvest amounts to less than 50% of the annual growth, as we are already using way too much biomass.’

Using an open-source land system model, the Potsdam study assessed the impacts of increased demand for engineered wood on land use, and the associated CO_2 emissions, until 2100. Encouragingly, it found that if 90% of the new urban population were housed in newly built urban mid-rise buildings with wooden constructions, 106Gt of additional CO_2 could be saved by 2100 – about 10% of the carbon budget needed to limit global heating to 2°C. However, to achieve that, forest plantations would need to expand by up to 149 million hectares and harvests from unprotected natural forests would increase. Although it would be possible to do this without major repercussions on agricultural production, biodiversity would almost certainly suffer to some extent.

‘On the decarbonisation side, constructing future urban housing with engineered wood has two advantages: first, storing carbon long term in wooden structures; second, avoiding emissions from cement and steel production – emissions we would make if we kept building with conventional materials,’ the study’s lead author, Abhijeet Mishra, tells Energy Monitor.

‘[But] a transition like this would come with a heavy loss to biodiversity due to either additional wood removals or conversion of unprotected secondary forests to commercial plantations – mostly driven by increased demand for engineered wood to be used in construction. This loss of biodiversity happens even after we explicitly prohibit any human activity in old-growth forests and biodiversity hotspots in our simulations in response to higher demand for engineered wood in the future.’

Ecological forestry

Indeed, debates around forestry and carbon often pit conservation against harvesting and replanting – but there may be a happy middle ground. Ecological forest management, such as 'close-to-nature' forestry, promotes a reasoned level of harvest to reap various rewards.

By extracting some timber while also considering what vegetation is left to grow, foresters can enhance certain forest traits and functions such as their adaptive capacity. After the felling, the remaining forest is allowed to continue growing, encouraging natural regeneration. This allows the carbon sequestration to continue, compensating for – and sometimes exceeding – the carbon removed in the harvest.

In fact, the largest stock of forest carbon is stored underground in the soil and other organic matter. By aggressively harvesting trees through destructive methods like clear-cutting – fully removing the stumps, brush and residues – the soil is exposed to the elements, leading to decomposition and the release of GHGs. This phenomenon only gets worse as global temperatures rise, creating a pernicious feedback loop.

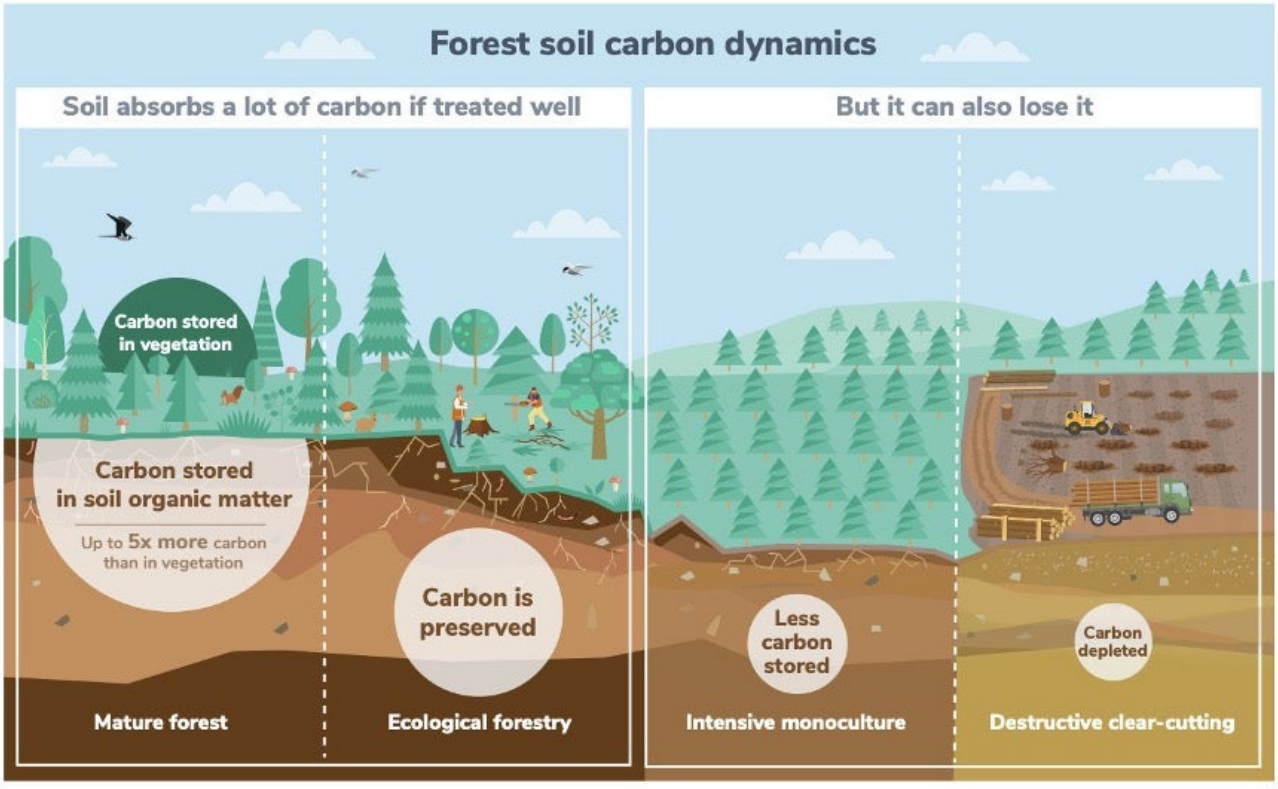


Figure 2 Forest soil carbon dynamics

Based on: IPCC (2007)[25].

Graphic by ECOS.

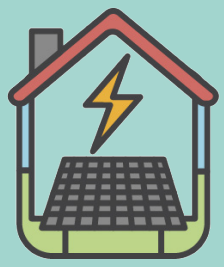
Europe cuts the path

Globally, Europe has been the bellwether when it comes to promoting use of sustainable timber in the construction industry. It has been a focus of the current Swedish EU Presidency – a country with 70% forest coverage.

'Sustainable timber buildings can certainly play a big role in the green transition,' said Sevim Aktas, policy officer at the European Commission's Directorate-General for Climate Action, at the ECOS webinar. 'By introducing a robust certification system, we will encourage responsible forest management. There are multiple work streams happening, with the Commission focused on reusing or recycling wood products at the end of their life and using timber as a feedstock. We are looking into what are the best practices, and which are the most productive ways of putting a policy framework together to support the process.'

Although the EU has regulated operational emissions of buildings for more than a decade, the bloc still has to properly address buildings' embodied emissions. Measures have thus far relied on a piecemeal range of policies on 'whole life carbon' (WLC) at the national level. However, the Commission is taking steps towards a systematic measurement and public disclosure of the carbon footprint of construction products, and of WLC emissions of buildings, in its legal proposals for a revised Energy Performance of Buildings Directive, as well as through a revised Construction Products Regulation – to take effect in 2030. When it comes to enforcement, the World Green Building Council EU Policy Whole Life Carbon Roadmap has already provided embodied carbon benchmarks for different types of buildings, based on which limits could be set aimed at reducing overall building emissions by 40% by 2030.

There are still some gaps in the science, though. For instance, the path for incentivising the use of timber from sustainably managed forests as a carbon storage solution remains unclear, as data and methodological issues impede a realistic modelling of the carbon storage benefits, according to Porteron. Nonetheless, sustainable timber holds exciting potential to be a key component in improving the climate performance of buildings, prolonging their lifetimes and boosting circularity; and ecological forest management approaches can already support forest carbon storage and provide truly environmentally friendly wood products.



Strong governance and careful planning will be required to ensure any form of sustainable transition to timber cities, even if old-growth forests and biodiversity hotspots are protected. If there is an important lesson from the recent biomass sourcing scandals surrounding another panacea climate solution, bioenergy and carbon capture and storage, it is this: everything in moderation.

Winter, in fact, has an outlandish idea about how to achieve that moderation. 'Build less new buildings,' she said, flatly, when asked for her key takeaway at the ECOS webinar. 'We keep demolishing buildings to build new ones; instead, we should be improving the old ones. That would be a real step forward for the building sector.'

By **Oliver Gordon**

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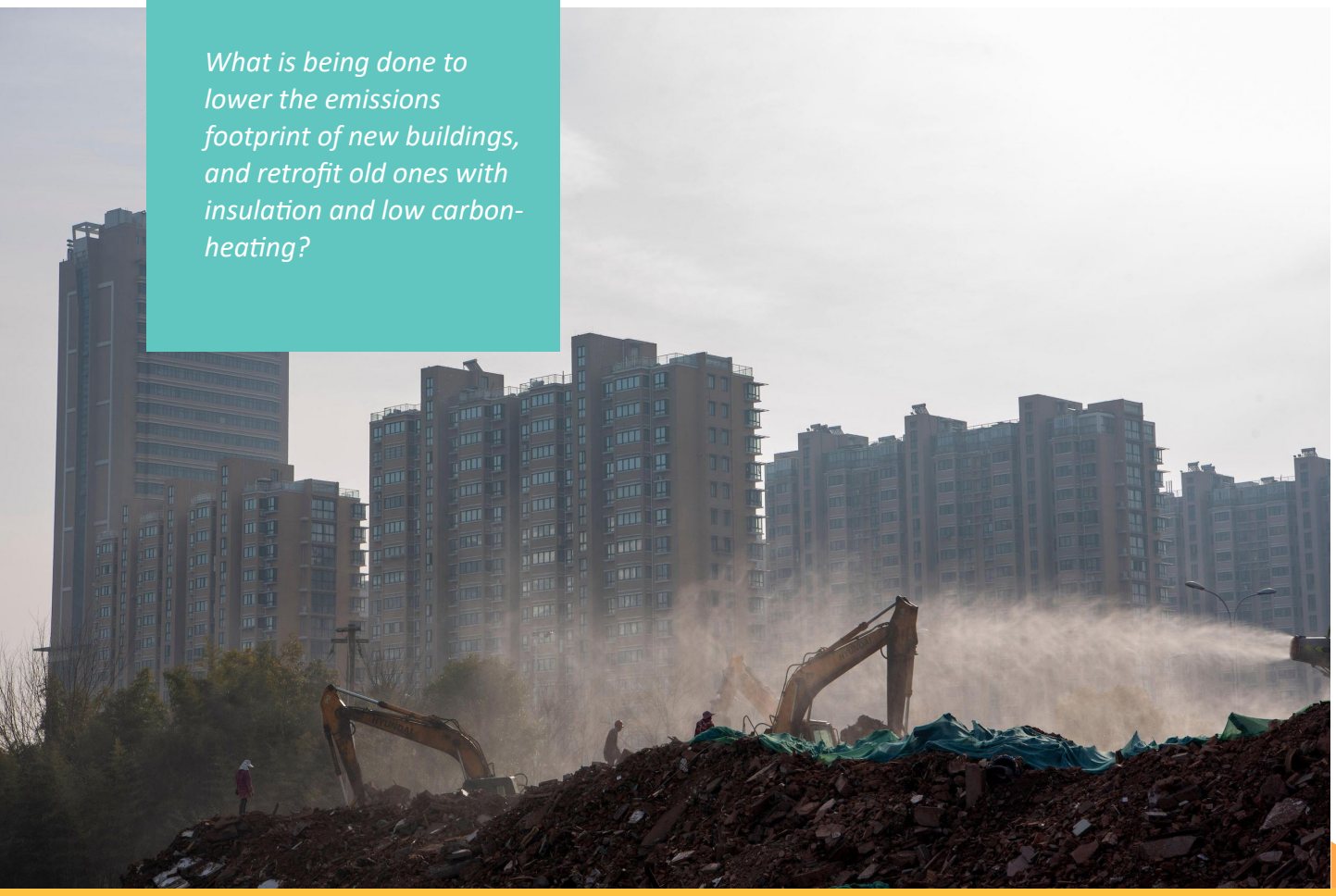
Green buildings: Ending the demolish and rebuild cycle in China

What is being done to lower the emissions footprint of new buildings, and retrofit old ones with insulation and low carbon-heating?



Demolishing old buildings in Hai'an, Jiangsu province, March 2022. For much of the past 20 years, the growth in China's property economy was fuelled by tearing down buildings to make room for new constructions, at a cost in carbon emissions (Image: Alamy)

'We can't be doing large-scale demolition and construction in the name of urban regeneration,' Ni Hong, China's housing minister, told reporters at this year's Two Sessions meetings. An era is coming to an end.

Since the 1980s, excavators, cranes and scaffolding have been Chinese cities' most conspicuous sights. And, particularly in the first two decades of this century, with the property economy booming, almost every city in China experienced the land requisition, demolitions, compensation and reconstruction that accompanied development. In 2009, a contributor to Guangzhou Daily even nominated the Chinese for demolition (拆 , chāi) – so widely visible on building exteriors – as the character of the year.

In China, the property industry has relied heavily on a debt-driven approach. During times of economic prosperity, property companies have often borrowed from banks to fuel their expansion. They use the loans to acquire land from local governments, which make it available by demolishing old buildings and changing the land use in and around cities. Then, the companies pre-sell the flats before they have finished building them. The funds obtained from these pre-sales are then reinvested in acquiring more land.

The Chinese for demolition (⿰, chāi) on the wall of an old building in Shanghai's Laoximen neighbourhood, 2020 (Image: Janusz Kolondra / Alamy)

While this debt-driven model enabled companies to achieve rapid growth and generate substantial profits in the short run, it also exposed them to mounting debts sometimes impossible to settle when the repayment period arrived.

The days of large-scale demolition and construction are now in the past. Since 2021's full implementation of the 'Three red lines' policy, which restricted financing for heavily indebted property firms, property development in China has flipped from aggressive expansion to rapid contraction. And there have been no signs of that contraction reversing, even since the policy was loosened in the second half of 2022. Repercussions have also been felt in the cement, steel and related high-carbon industries.

The construction and buildings industry, led by property development, is responsible for 42% of China's carbon emissions, taking into account the operational stages of buildings, as well as their construction. Rapid changes taking place within it have profound implications for the nation's overall carbon emissions. What are the opportunities and challenges facing the industry as it undergoes transformation in line with the 'dual carbon' goals, of peaking emissions before 2030 and reaching carbon neutrality by 2060?

Property, steel and cement slowdown

The 'Three red lines' policy for Chinese property firms came into full effect at the beginning of 2021. It set limits for such firms in terms of asset to liability ratio, net debt, and cash to short-term borrowing ratio to determine whether they can continue raising funds, and if so, to what level. A property firm in breach of all three red lines cannot raise funds to increase its interest-bearing debt.

This has limited the refinancing ability of many Chinese property firms operating on a high-debt, high-turnover model, and the sector has seen unprecedented debt distress since the second half of 2021. The resulting upsurge in half-finished buildings and mortgage defaults has also shattered people's decades-long faith in constantly rising house prices. The grand march of the property sector has come to a halt.

With the market rapidly changing, the central government has also been abandoning its earlier model of urban development. In 2021, a circular from the Ministry of Housing and Urban-Rural Development expressly demanded an end to large-scale demolition and construction works in the name of urban regeneration. The ministry called instead for more existing buildings to be kept in use. It encouraged cities to transition from a development model of expansion by constructing new buildings to operation by managing existing ones.

The drawing to a close of the era of large-scale demolition and construction ushers in new conditions for the production of building materials, and their associated carbon emissions. For two consecutive years now, production of crude steel has declined in China, after an all-time high of just over 1 billion tons in 2020.

The drop is down to falling demand downstream, Luo Tiejun, vice-chairman of the China Iron and Steel Association, told the Economic Daily. In its article, the Daily also cited a report by the China Metallurgical Industry Planning and Research Institute that projects a further small decline in steel demand in 2023, to about 910 million tons, also linked to falling demand from the construction industry.

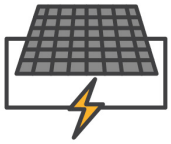
Construction of the 5.4-kilometre Linyi Yellow River Bridge under way in Shanxi province, April 2023. Despite recent large-scale infrastructure projects like this, China's steel industry – which produces most of the world's steel – is shrinking as construction of new buildings slows. (Image: Alamy)

The steel industry accounts for around 15% of China's total carbon emissions. Last year, the 'Guidance on promoting high-quality development of the steel industry', jointly issued by two government ministries, postponed the target date for peak carbon in the steel sector from 2025 to 2030. However, an analysis by thinktank the Institute for Energy Economics and Financial Analysis (IEEFA) suggests that carbon emissions from China's steel sector may in fact have peaked already, given the long-term decline in steel demand and the ongoing decarbonisation of steel production.

Shen Xinyi, a researcher at thinktank the Centre for Research on Energy and Clean Air, holds a similar view: 'The property sector accounts for 40% of China's steel consumption. Although China is moving forward with large-scale infrastructure projects and manufacturing is showing signs of recovery, increased steel demand from these two sectors is not enough to offset falling demand associated with contraction on the property side.'

The same is true for the cement industry, which accounts for about 9% of the country's total carbon emissions. National Bureau of Statistics data show that after reaching a five-year high of 2.39 billion tons in 2020, national cement production dropped 11% over the next two years, to 2.13 billion tons.

According to analysis by New York-based environmental group Natural Resources Defense Council: 'The development of the Chinese cement sector has reached a plateau stage, in which there is little projected increase in production or consumption.'



Cement and steel production causes emissions, but more comes from buildings once they are operational, mainly from people's day-to-day energy use. Lin Borong, associate dean at Tsinghua University's school of architecture, told China City News in 2021: 'In terms of full life-cycle, the operational phase accounts for around 70–90% of carbon emissions, while production of building materials accounts for 10–30%, and construction and demolition about 1% each.'

Distributed solar PV ushers in policy opportunities

Reducing carbon emissions in the operational phase can be done either by increasing the share of renewable energy in a building's energy supply or by reducing its energy consumption.

The construction sector can to a certain degree increase renewable energy self-sufficiency and improve the composition of energy use, by, for example, fitting buildings with distributed solar PV. However, current proposals for this are not large-scale enough to significantly dent building emissions. In a plan for green construction, issued in March 2022 as part of the 14th Five Year Plan (FYP), the housing ministry targeted 50 gigawatts (GW) of cumulative new installed capacity for solar PV in buildings,across the duration of the FYP period (2021–2025). For comparison, China's total new installed capacity for solar PV in 2022 was 87.41 GW.

Solar panels blanket the roof of a factory in Xiaoshan, Zhejiang province. A 2022 government plan for expanding renewable energy in China required at least half of new industrial parks and public buildings to be fitted with solar panels. (Image: Long Wei / Alamy)

Also, in 2022, the 14th FYP's 'Renewable energy development plan', jointly issued by nine government agencies, proposed improving rooftop coverage of distributed solar PV. This was to be done by putting solar panels – conditions permitting – on the roofs of government buildings, transportation hubs, schools, hospitals, industrial parks and related facilities, under a model that would see self-generation for self-use, with surplus power sent to the grid. The plan requires more than half of new industrial parks and large public buildings to be fitted with distributed PV, though it gives no direction on minimum installed capacity.

During the same period, according to the development plan, power substitution measures will also be introduced, actively driving the use of electricity in place of gas and oil, and promoting the electrification of cooking, domestic hot water, heating and other forms of energy use within buildings. By 2025, electricity consumption as a proportion of overall energy use in buildings is to exceed 55%.

Although the installation of distributed solar PV can to some degree increase the share of renewables for energy use within buildings, changing buildings' energy supply to renewables also concerns the transformation of China's overall energy generation and supply structures. So it would be unrealistic to expect distributed solar PV installation to bring about significant decarbonisation of buildings' energy use in the short term.

Even the housing ministry's green construction plan, with its focus on peaking then lowering emissions, targets only a replacement rate of 8% for renewable energy in urban buildings by 2025, just two percentage points higher than the 6% target for the end of the 13th FYP period (2016–20).

Reducing energy consumption in buildings

Given that increasing the share of renewable energy supplied to buildings requires transforming China's overall energy system, the more practical pathway for the construction sector is to bring down energy consumption within buildings. China is currently working both to raise energy consumption standards for new buildings and to retrofit existing buildings for energy efficiency.

In 2021, the housing ministry issued a document stipulating energy saving rates for new residential and public buildings in different regions of China. New residential buildings in the colder northern regions of China must, on average, run on 75% less energy than a building of the same size insulated to 1980s levels. The saving must be 65% in other climate zones, and 72% for public buildings.

So for example, if a 100-square-metre house in north-east China in the 1980s would have needed 40 kilowatt hours (kWh) per square metre for heating each month, a new-build with the same floor area must today get by on 10 kWh per square metre.

Wei Qingpeng, an associate professor at Tsinghua University's School of Architecture, told China Dialogue that, compared with countries at similar latitudes, energy-efficiency requirements for new housing in China are now relatively advanced, being higher than in the US and on a par with Europe. Wei caveats, however, that average energy-saving rates tend to be 10–20% lower in practice, given that developers often underbid to win a project then cannot afford to meet the full design requirements during construction. Even taking this into account, though, China is now a leading country in the management and application of new-build energy efficiency, Wei says.

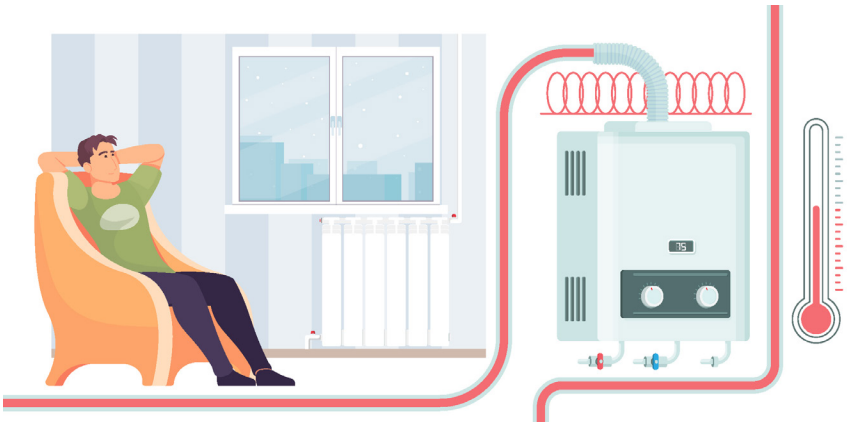
Insulating older buildings

At the same time as raising energy-efficiency standards for new housing, the housing ministry is also driving energy-efficiency improvements of older buildings, within the wider context of 'urban regeneration'.

That term entered mainstream use in China in 2020, when the recommendations of the 14th Five Year Plan included measures for implementing urban regeneration by 'boosting the renovation of old neighbourhoods and community development'.

At the end of 2021, the housing ministry, the National Development and Reform Commission and the Ministry of Finance issued a joint circular on 'Further clarifying the requirements for renovation of old urban neighbourhoods'. The document highlighted energy-efficiency renovations for buildings in northern China as a priority.

The factory floor of a workshop in Chongqing that produces insulation materials like rock wool, glass wool and polyurethane (Image: Alamy)



In 2022, the housing ministry's green construction plan, under the 14th FYP, proposed the completion of energy-efficiency renovations across more than 350 million square metres by 2025. More than 100 million of those square metres would be residential buildings, while 250 million would be public buildings.

The emphasis on renovating public buildings reflects the prevalence of multi-household residential buildings in China. In contrast to Europe and the US, where detached houses are common, the vast majority of urban housing in China consists of apartments, and it can prove tricky to coordinate multiple occupants in a residential block for purposes of retrofitting insulation. Wei says the key is to win the public's support and ensure that they benefit. 'Retrofitting residential buildings with insulation is now something that municipal housing and development bureaus throughout the country are pushing,' he adds.

It is easier to renovate public buildings than residential buildings, because of the relatively unitary nature of the stakeholders. But as Wei Qingpeng points out, property owners still bear the main cost of the work – even allowing for government subsidies and incentives – and this limits their enthusiasm for renovation. To resolve these problems, market mechanisms are needed, Wei adds.

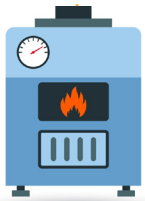
The challenges of popularising heat pumps

Aside from improving insulation, another way of reducing energy consumption is to lower the amount of energy needed for indoor equipment, particularly heating installations. According to a report published by the International Energy Agency and Tsinghua University, space and water heating for buildings account for 52% of overall energy consumption within China's construction and buildings sector.

In terms of reduced energy consumption for heating, there has been much interest in recent years in heat pumps.

A typical home heat pump transports about four times as much heat from outside as it consumes in electrical energy, so heat pumps are far more efficient for heating than gas boilers and electric heaters. With natural gas and electricity prices skyrocketing last year, the European Commission declared its intention to double the rate of heat pump installation. Most EU countries have now introduced financial incentives to achieve this goal, and in 2022 heat pump sales were up by nearly 40% in Europe.

China is the world's largest producer and exporter of heat pumps, accounting for nearly 40% of production, according to the International Energy Agency. Although heat pump sales were up by 11% globally last year, domestic sales in China virtually came to a standstill.



The main hindrance is expense, with a report from Soochow Securities clocking the upfront cost for purchasing and installing a heat pump at around 70,000–80,000 yuan (USD10,000–11,400). As a result, heat pump sales tend to be policy-driven.

From 2013–2017, in the context of the 'coal-to-electricity' shift for home heating in northern China, and the introduction of a series of policy incentives, China saw a boom in heat pump sales, with a compound annual growth rate reaching 32%. With the waning of the coal-to-electricity policy, the market for heat pumps subsequently stagnated. In 2021, the dual-carbon policy brought another surge of activity in the market for heat pumps, with sales rising by 13%.

That growth was only sustained for a year, however, due to overall economic conditions. In an op-ed last October under the headline 'Don't let heat pumps cool off', the Economic Daily proposed 'offering reasonable financial subsidies for installation of heat pump products along with a policy for preferential electricity pricing. This would allow for stronger support by means of electricity prices, particularly in areas where wind and solar power resources are ample, where electricity is underused, and where district heating cannot provide the necessary coverage.'

In Wei Qingpeng's opinion, it will be difficult to realise the economic advantage of heat pumps without marketising the prices for coal and gas.

'In Beijing, for example, gas for heating is priced at only about 2.8 yuan [USD 0.40 per cubic metre]', says Wei. 'The economic advantage of heat pumps is not particularly apparent with the gas price kept so low, so it's harder in Beijing to spread the idea of replacing gas boilers with heat pumps. In the Jiangsu-Zhejiang belt, on the other hand, the price of gas can be over 4 yuan, up to 5 yuan even, and this is when heat pumps' economic advantage becomes obvious.'

Wei explains that in some areas people can get a preferential rate on their electricity bill if they heat their homes with electric boilers. 'This makes no sense when highly energy-efficient heat pumps are available.'

By **Xia Zhijian**

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Finland is on track to meet some of the world's most ambitious carbon neutrality targets.

This is how it has done it

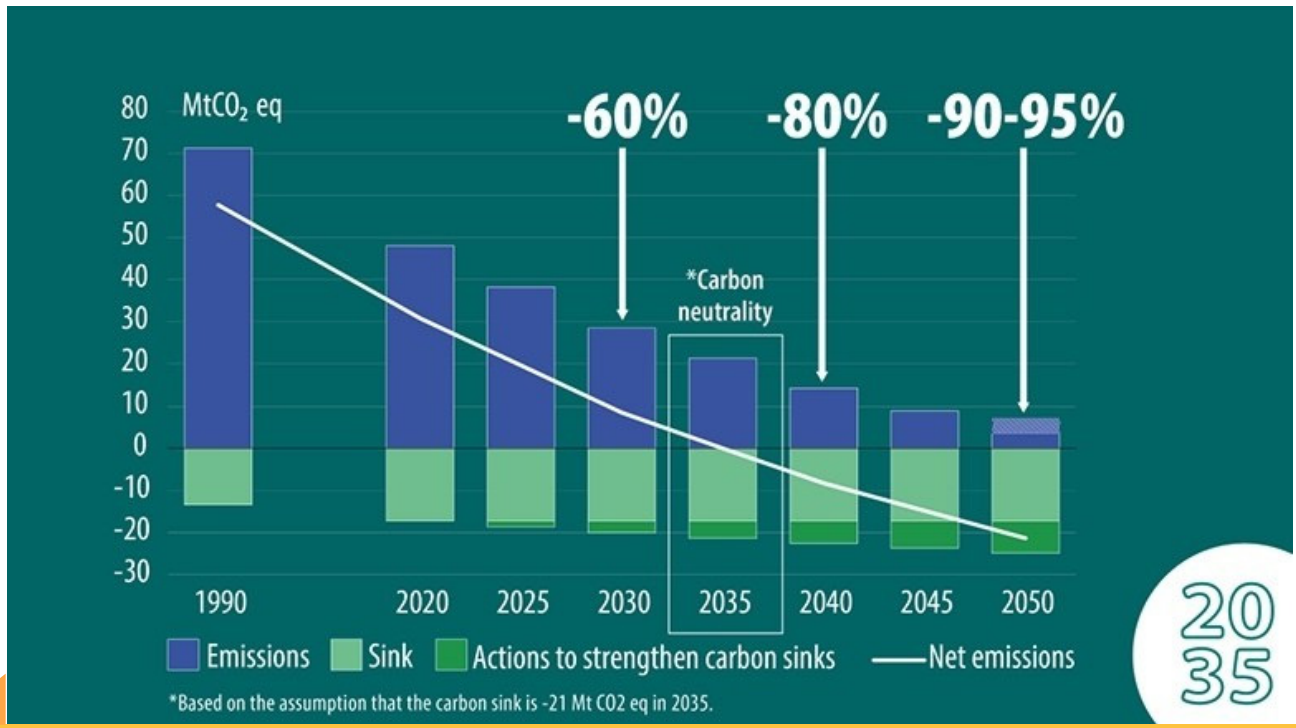
Finland aims to become carbon neutral by 2035, putting it fourth in the world and ahead of every other country in Europe. Nuclear is already a key part of its energy mix, but it is working hard to scale up wind and solar capacity. It is also shifting away from using its extensive forestry resources for fuel, as this creates carbon emissions, and is instead using legislation to promote increased use of wood in the construction sector.

Finland may only have a population of 5.5 million, placing it 118th in the global population rankings, but it is a world leader in many measures. It has been named the world's happiest country for six years in a row and is regularly placed in the top spots in global education rankings. Finland is also now marking itself out as a leader in carbon neutrality.

The country aims to become carbon neutral by 2035, putting it fourth in the world and ahead of every other country in Europe – Austria and Iceland are next, with 2040 targets. The only countries ahead of Finland are Bhutan and Suriname – which are already carbon neutral – and Uruguay, which aims to be carbon neutral by 2030.

Finland's carbon neutrality plan

Finland already has relatively low fossil fuel use – they made up 36% of its total energy supply in 2021, around half of the 70% average for International Energy Agency (IEA) members. This is because nuclear power provides around a third of its electricity – a share that is likely to rise following its start up of Europe's largest reactor, Olkiluoto 3, in April. The unit – Europe's first in 16 years and Finland's first in more than four decades – is expected to cover 14% of the country's electricity demand.



Finland is aiming to be carbon neutral in 2035. Image: Finland Ministry of the Environment

But there are still obstacles Finland has to tackle. In 2021, its land use and forestry sector became a net source of emissions for the first time, mainly because of high harvesting volumes and slower forest growth. On top of this, the resulting loss of natural carbon sinks has boosted Finland's net emissions, increasing the need for emissions cuts in other sectors, the government says.

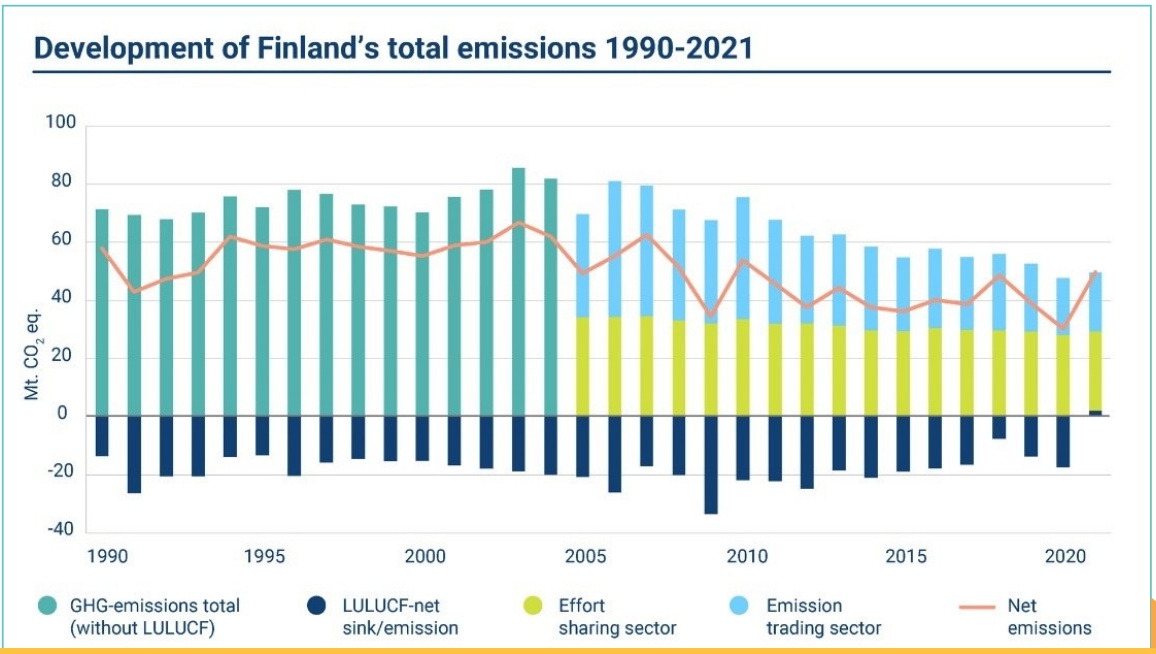
How will Finland get to carbon neutrality?

Finland's key policies to achieve climate neutrality by 2035 include:

- Having almost emissions-free electricity and heat production by the end of the 2030s
- Having a 'resource-wise' and low-emission transport system
- Lowering the construction sector's carbon footprint
- Boosting the energy efficiency of current building stock and moving to zero-emission heating.

The path to emissions-free electricity will primarily be laid by wind power. Onshore wind will make up a large part of Finland's growth in renewable electricity generation, and the country will also develop its first large-scale offshore farms, according to the IEA. Finland's wind power capacity grew by 75% in 2022 alone, the country's wind power association says.

At the same time, solar power will go from being a minor contributor to the grid to playing a much bigger role. Solar took one of the biggest portions of Finnish public funding for energy investments in 2018-2021, at EUR 37.5



Finland's land use, land-use change and forestry (LULUCF) became a net source of emissions for the first time in 2021. Image: Finland Ministry of the Environment

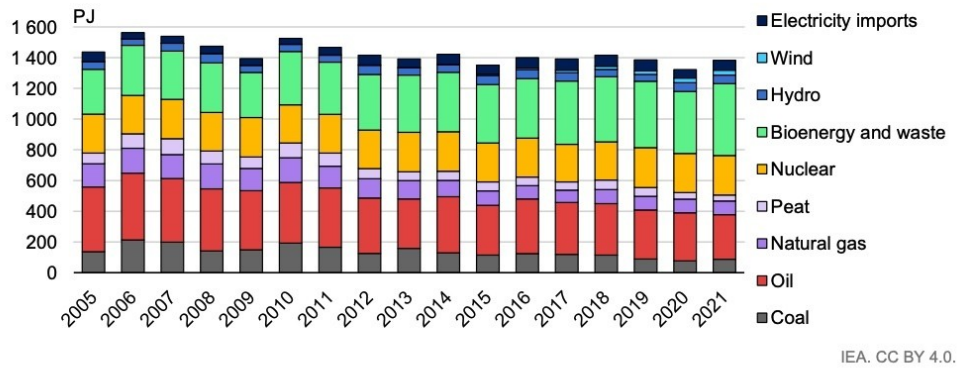
million (USD 40.2m) – behind only transport and hydrogen, both on EUR 40.2 million (USD 43m) – and the National Climate and Energy Strategy estimates capacity will jump to 5.3 gigawatts by 2030 from around 1 gigawatt in 2022.

Finland has more forest cover than any other country in Europe, at almost 75% of its total area. As a result, fuels derived from wood are key to its energy mix. These create many climate-warming emissions when burned, which is why the government wants to shift heating and cooling systems towards the use of non-combustion technologies such as heat pumps, waste heat recovery and geothermal energy, the IEA notes.

Decarbonizing Finland's transport sector

Finland has committed to a goal of having only zero-emission passenger cars and vans on sale by 2035. It is making strong progress in adopting electric vehicles, the IEA says, but it also points out that it is behind Norway, Sweden, Denmark and Iceland in doing so.

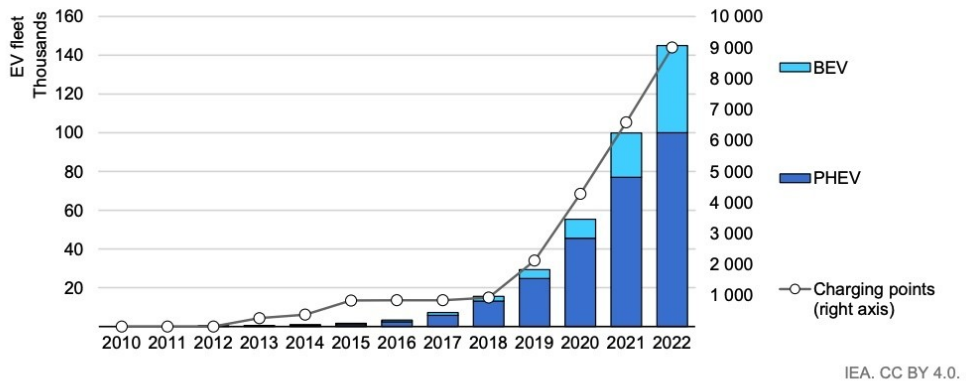
Figure 1.2 Total energy supply by source in Finland, 2005-2021



Source: IEA (2022).

Finland has cut the share of fossil fuels in its energy supply over the past decade. Image: IEA

Figure 3.11 Registered electric vehicles and public charging points in Finland, 2012-2021



Source: IEA (2023c).

Finland is making strong progress in boosting use of electric vehicles. Image: IEA

However, there is a need to address freight transport. It makes up 42% of fuel consumption on Finland's roads and its energy intensity rose between 2005 and 2020. In this area, the government sees hydrogen and hydrogen-based fuels as better decarbonization solutions than electrification.

This is because it is harder for trucks to use electric power compared with lighter vehicles, given the longer distances they have to cover. 'Truck batteries can also be heavy and large, affecting the amount of transportable cargo and how far they can travel before they need recharging,' EU research points out. It says that hydrogen's higher energy density solves the space problem and allows faster refuelling.

Cutting construction sector and building emissions

Finland will limit the carbon footprint of construction projects under its new Building Act, which comes into force at the start of 2025. The legislation also adds circular economy requirements, with accounting of materials needed on new buildings and buildings to be demolished.

A third of Finland's emissions are caused by the built environment, according to Matti Mikkola, Managing Director of the Federation of Finnish Woodworking Industries.

Finland is also looking at measures to use more wood in construction, instead of carbon-intensive materials such as concrete, the IEA says. Using wood in construction has the added benefit of keeping carbon locked into the product, unlike using wood as a fuel, Mikkola tells forest-sector website Forest.fi.

Within buildings themselves, Finland is working to boost energy efficiency through measures such as consumer awareness campaigns and smart meters, which are now in place at nearly all of its 3.7 million metering points, the IEA says.

Demand-side changes will be as critical as supply-side transformation to achieve a successful energy transition, the World Economic Forum's Fostering Effective Energy Transition points out, saying they could drive more than 40% of the reduction in energy-related greenhouse gas emissions over the next 20 years.

Finland is also offering EUR 4,000 (USD 4,280) subsidies for homeowners to switch from fossil fuel boilers to heat pumps. And a EUR 24 billion (USD 25.7 billion) renovation strategy aims to cut buildings' CO_2 emissions by 90% between 2020 and 2050 by making sure all repair and maintenance work introduces energy-efficient materials and systems.

'Finland is well placed to reach its [carbon neutrality] goals because of the hard work and investment it has already undertaken in nuclear plants and hydropower,' IEA Executive Director Fatih Birol says. 'And the country is a frontrunner in several key energy technologies, such as batteries and heat pumps.'

By **Ian Shine**

Smart grid in China, EU, and the US: State of implementation

Renewable energy sources integrated with energy efficiency represent an effective solution against the depletion of fossil fuel deposits. The resulting system to implement this solution is defined as the Smart Grid. Smart Grid overall state of play in China, the US, and the EU are equal to 18%, 15%, and 13%, respectively, reflecting the need for further investment to achieve full development. To understand the impact of smart grids, a complete methodology is required that can track the benefits so that they can be replicated elsewhere in the world, argue the authors of a recent report looking at the state of smart grid implementation

What is a smart grid ?

A smart grid is a network of transmission lines, substations, transformers, and other infrastructure that transports energy from a power plant to homes and industries. It is called 'smart' because it optimises the distribution of electricity, decentralises power plants, and minimises overloads and changes in electrical voltage.

A smart grid represents an opportunity to make the energy sector more reliable, available, and efficient, and so offers economic and environmental advantages[1].

Usual Grid		Smart Grid
Few Centralized Power Plants		Several Small Power Producers
Centralized Market	vs	Decentralized Market
Trasmission Based on Large Power Lines and Pipelines		Include Several Small-Scale Transmissions
Linear Distribution		Bidiretional Distribution

1. *SmartGrid.gov, The Smart Grid*

Smart grid momentum in China, the US, and Europe

In recent years, there has been growing political interest in the development of smart grids in several geographical areas, including the United States, the European Union and China. These regions have adopted various strategies and initiatives to promote innovation and investment in smart grids to achieve the goals of energy security, environmental sustainability, and economic competitiveness.

In China, the 14th Five-Year Plan aims to reduce energy consumption and raise the efficiency of the electricity grid. From this perspective, a smart, strong, and green electricity grid is a priority, alongside the need to integrate renewable energy supplies, which are experiencing strong growth in China. The State Grid Corporation in China plans to invest around USD 65 billion in grid expansion from 2020[2].

In the United States, the Grid Resilience and Innovation Partnerships (GRIP) Program of the Grid Deployment Office (GDO)[3] promotes the robustness and adaptability of the grid through the provision of around USD 10 billion in incentives. In addition, the Recovery Act's Smart Grid Investment Grant (SGIG) enabled financing of 99 projects through federal financial aid of up to 50 per cent of eligible costs[4].

In the EU, one of the three priority areas in the Trans-European Energy Networks (TEN-E)[5] is the implementation of smart grids, aiming in particular to foster the integration of renewable energies and strengthen the European energy market, as well as to enable intelligent consumption management for end consumers. With this object in mind, the EU Commission is supporting various energy transition initiatives in this field, such as the BRIDGE initiative which has already invested over EUR 1 billion in 93 projects; ETIP SNET, a platform to advise and connect stakeholders in the sector; and EIRIE, the online platform is interactive and multifunctional, connecting energy research and innovation communities throughout the EU[6].

Obstacles to the implementation of smart grids

The relatively slow adoption of smart grids is connected to a variety of factors that are not only technical but also related to socio-economic and regulatory factors.

Inadequacies in grid infrastructure, especially in rural areas, (cyber security, energy storage capacity, energy and data management, communication issues, grid stability, interoperability incompatibilities, and congestion relating to energy transfer capacity) witness to technical difficulties that individual regions may encounter when it comes to smart grid implementation.

Additionally, there are social and economic challenges, given the need for high capital investments as well as strong stakeholder engagement. Due to the high level of digitalisation and data processing involved in a smart grid, consumers need to be fully aware of the associated benefits and privacy-related issues. It is also vital for management and billing systems to be redesigned to take account of the specific nature of smart grid energy delivery[7 8].

All these potential obstacles represent priorities for political regulation. Weak, unclear, and uncoordinated actions are the main impediments to a rapid roll-out of the smart grid.

2. *Statista, State Grid Corporation of China's investment in grid expansion from 2010 to 2020, 2023*
3. *Grid Deployment Office, Grid Resilience and Innovation Partnerships (GRIP) Program*
4. *From SmartGrid.gov, Recovery Act: Smart Grid Investment Grant Program*
5. *European Commission, Trans-European Networks for Energy*
6. *European Commission, EU initiatives for smart energy systems*
7. *R. Kappagantu, S. Arul Daniel, Challenges and issues of smart grid implementation, Journal of Electrical Systems and Information Technology, 2018*
8. *S.R. Salkuti, Challenges, issues and opportunities for the development of Smart Grid, International Journal of Electrical and Computer Engineering, 2020*

The solutions lie in harmonisation of regulations, access to finance, establishment and promotion of standards, increased awareness, and prioritisation of technology issues. In particular, investment in technical know-how and coordination is a key requirement for the integration of various technologies, including enhanced metering infrastructure, distribution automation, and energy storage systems. Implementation of smart grid systems may be hampered by a lack of technical capability or interoperability problems[9].

How to reduce CO_2eq emissions: the smart grid contribution

Over the years, some of the fundamental moves to support alternative and renewable energy sources, such as the 1997 Kyoto and 2015 Paris climate agreements, have helped to give rise to an energy-earth relationship that is more widely known as sustainability. Today, there are technical innovations for every energy consumption industry, offering solutions that represent new challenges and opportunities for the deployment of environment-friendly energy sources, either totally or partially replacing fossil fuels if properly implemented[10].

IRENA's GET2050 analysis forecasts that renewable energy electrification (the electrification of end-use sectors coupled with renewable integration in the power generation sector) could deliver a 44% reduction in CO_2eq (GHG emissions) in respect of total energy consumption, compared to the reference case, which was calculated using data from IREA[11] and NREL[12] (see Figure 1).

Methodologies to measure smart grid benefits

While many countries such as the US, China, and the EU present a clear opportunity for smart grids, many less developed nations would benefit from such technologies but have not yet started along this path. Development of a methodology that quantifies the benefits of a project across its lifespan can provide justification for a wider rollout of the technologies13.

In this context, state-of-play methodology has a vital role to play in the evolution of smart grid technologies where they are initially being applied: China, the US, and the EU. Such methodologies include a range of actions: review the overall purpose and goals, identify functions, assess the main characteristics of a smart grid project, map each function onto a standardised set of benefits, establish the baselines for the project, identify and compile the data, quantify the benefit, monetise the benefit and estimate the relevant costs.

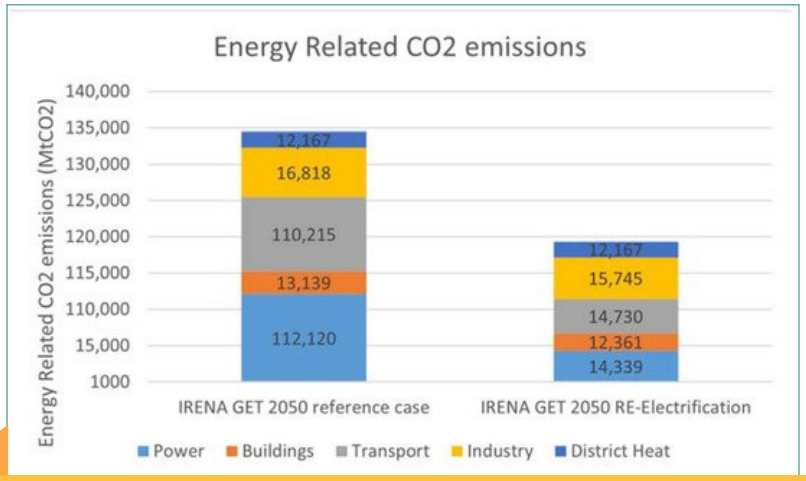


Figure 1: Projected energy-related CO_2 emissions.

9. *Farhangi H., The path of the smart grid, IEEE Power and Energy Magazine, 2010*
10. *Savinar, M.J.D. The Age of Oil Is Over; Matt Savinar Publishing: Santa Rosa, CA, USA, 2004*
11. *International Renewable Energy Agency. Electrification with Renewables, Driving the Transformation of Energy Services; international Renewable Energy Agency: Abu Dhabi, United Arab Emirates, 2019*
12. *Paul, D.; Cole,W.; Frazier, A.W.; Podkaminer, K.; Blair, N. The Four Phases of Storage Deployment: A Framework for the Expanding Role of Storage in the U.S. Power System; NREL/TP-6A20-77480; National Renewable Energy Laboratory: Golden, CO, USA, 2021*
13. *El-Hawary, M.E. The Smart Grid—State-of-the-art and Future Trends. Electr. Power Components Syst. 2014, 42, 239–250*

State of play for smart grids in China, the US and Europe

An assessment of the state of play for smart grids in China, the US, and the EU consists of an evaluation of every technology and integrated asset and is summarised in Figure 2.

The smart grid technologies considered in this work include wide area management system (WAMS) measured using the phasor measurement unit (PMU) installation as a parameter[14], distribution automation (DA), advanced metering infrastructure (AMI) using smart meter deployment as a parameter, customer technology (CT), and information and communication technology (ICT); the integrated assets included in the assessment are distributed generation (DG), energy storage system (ESS), electric vehicle (EV), charging infrastructure, and smart electricity markets (SEM).

Due to the lack of data, it has not been possible to carry out a complete estimate to include all the technologies mentioned above.

Considering the average of these values as % SG, it results equal to 18%, 15%, and 13%, respectively, for China, the US, and the EU. These results reveal that even in these developed countries, the smart grid is far from completion. Therefore, more technical and political efforts, as well as investments, are needed to achieve full smart grid implementation.

How to accelerate smart grid implementation

China's State Grid Corporation (SGCC) Executive Chairman, Mr. Xin Baoan said at Davos in 2021, 'We plan to invest USD 350 billion between 2021 and 2025 to upgrade our power grid and build new power systems with improved voltage regulation capability and better compatibility with renewable energy.' In Europe, investments of EUR 500 billion into the existing electricity grid are projected for the period up to 2050. On top of this, the European Commission's REPowerEU policy proposals foresee an additional EUR 29 billion of investments, while US through the Grid Innovation Program (GRIP) dedicated a USD 5 billion fund for projects in the field of innovative transmission, storage, and distribution infrastructures for the 2022-2026 period to make the grid more resilient and reliable[15].

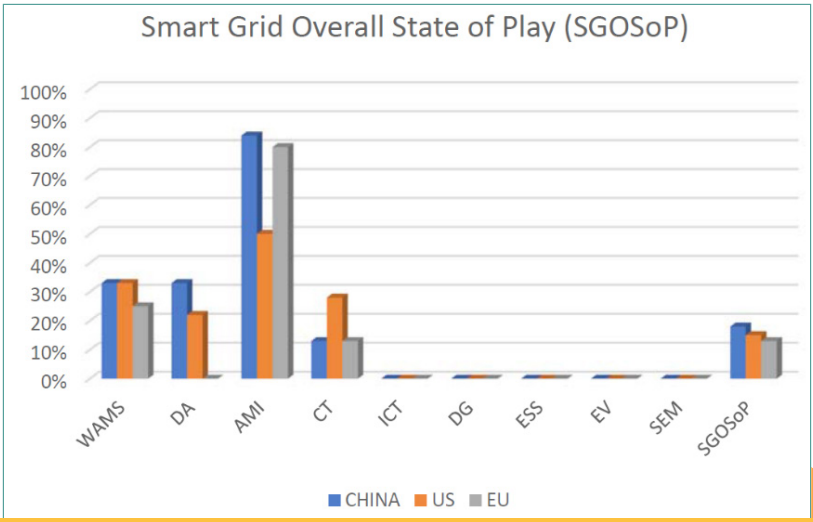


Figure 2: Smart grid technologies and integrated assets with their % state of play.

14. *Grasso, F.; Talluri, G.; Giorgi, A.; Luchetta, L.; Paolucci, L. Peer-to-Peer Energy Exchanges Model to optimize the Integration of Renewable Energy Sources: The E-Cube Project. Energ. Elettr. Suppl. J. 2020, 96.*
15. *Grid Deployment Office, Grid Innovation Program, 2022, https://www.energy.gov/gdo/grid-innovation-program*

Electrification of end uses such as space heating and land transportation will cause more carbon emissions to be transferred to the power generation sector. As a result, the electricity sector is set to become the largest source of carbon emissions by the 2030s. Such forecasts clearly underline the need to integrate more renewable energy generation into the electricity grid to offset the increase in emissions related to power generation.

While much work has already been done, more effort is needed to foster the further development of smart grids. For example, government policy needs to support synergies between framework developments for renewable power and specific electrification options to exploit the maximum benefits of both. Market structures must be well-designed, not just the technology and infrastructure: i.e., in several markets, consumer prices do not provide the necessary incentives to encourage flexibility actions such as demand response. Moreover, significant investment in smart meter infrastructure is needed to activate demand response. In the EU, close to 225 million smart meters for electricity and 51 million for gas are set to be rolled out by 2024, corresponding to almost 77% of European consumers for electricity and 44% for gas, with a potential investment of EUR 47 billion.

Electricity needs reliable and strong infrastructure for generation, transmission distribution, utilisation, and storage. All these functions are provided by the electric power system. Innovation and improvements to the current power system are vital to cope with renewable energy supplies. The solution to most of the current system inefficiencies can be met by an advanced and innovative electric power system: the smart grid.

The complete study is available as Open Access Paper in Energies 2021, Volume 14, Issue 18[16].

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16. *Sospiro, P.; Amarnath, L.; Di Nardo, V.; Talluri, G.; Gandoman, F.H. Smart Grid in China, EU, and the US: State of Implementation. Energies2021, 14, 5637. https://doi.org/10.3390/en14185637*

Batteries are the environmental Achilles heel of electric vehicles – unless we repair, reuse and recycle them

Electric vehicle advocates say the cars ultimately have a smaller carbon footprint than their fossil-fuelled counterparts and could resolve our energy concerns for good. Well, fair enough, but questions arise when we dig into the inner layers of electrical vehicles and see how sustainable their components are. In fact, the batteries that power electric vehicles may also be their Achilles heel.

Batteries are the most expensive component of an electric vehicle. If the battery pack is damaged, defective or simply old, this can lead to the vehicle being written off prematurely. Tesla is even producing 'structural' battery packs described as having 'zero repairability'.

Increasingly scarce and valuable resources, such as lithium and water, are needed to make these batteries. Despite this, they are often not designed for ease of repair, reuse or recycling. This has significant environmental impacts, ranging from the mining for materials and the water and energy used in making new batteries and vehicles, through to the hazardous waste from discarded batteries.

In other words, the answer to the question of 'Are electric vehicles really eco-friendly?' largely depends on how we manage the downsides associated with their batteries. Changes in how we design, produce, use and recycle electric car batteries are urgently needed. These changes can ensure that, in solving the problem of fossil fuel emissions, we also minimise other environmental harms.

Tackle the problems before they get too big

It's important to resolve these issues now, while electric vehicles make up a small fraction of the global vehicle fleet. Even in world-leading Norway, only 20% of cars on the road are electric. In Australia, fewer than 100,000 out of 20 million registered vehicles are battery-powered.

Yet already we are wrestling with the emerging concerns about their batteries. The performance of lithium batteries in an electric vehicle can degrade to 70-80% of its full capacity within six to ten years, depending on the owner's driving routine. At that point, the battery is barely reliable as the main energy source of the vehicle. Repeated fast charging can degrade a battery sooner.

Mining for the minerals that go into batteries, including lithium, cobalt, lead, nickel and copper, has big environmental impacts. AAP/Supplied by Fleet Space Technologies

Globally, about 525,000 batteries will reach the end of their useful life for powering a vehicle by 2025. That number soars to over 1 million by 2030.

There's life after EVs for batteries

However, the total lifetime of lithium batteries is 20 years. This means the end of a battery's usefulness in a vehicle doesn't necessarily mean it has to be discarded. These retired batteries can have plenty of other uses.

So how much capacity does a retired battery still have? As an example, an energy storage made of five repurposed Chevrolet Volt batteries can meet two hours of peak-use energy demand for five houses. The numbers become even more appealing for Tesla Model 3 batteries, which have three times the energy capacity of the Chevrolet Volt's.

That is a tremendous capacity still available in a retired battery. So why not use that?

And once the battery has reached the end of its useful life, most of the raw materials used to make it can be recovered. It is possible to extract over 95% of the valuable metals like lithium, nickel, cobalt and copper. The European Union already requires electric vehicle batteries to be at least 50% recyclable by weight, increasing to 65% by 2025.

An electric vehicle battery is often not designed to be as easy to repair or recycle as it could be. Biana de Marchi/AAP

However, the current lack of standardisation of battery packs presents a challenge for battery recycling. There are many different physical configurations, cell types and cell chemistries.

Reuse has a long value chain

The good news is that battery reuse is not a fictional utopia. Carmaker Nissan is already doing it on Koshikishima, an island in south-western Japan. Batteries are recovered from electric vehicles, have their health assessed and then allocated to suitable second-life applications.

These batteries can be reused in a solar farm, as an emergency household power supply, or for an electric forklift in a warehouse. Research shows this repurposing of batteries can get another 10-15 years' use out of them. That's a huge leap towards reducing their environmental impact.

So, who benefits from this scheme? Well, there's a long list.

In the first row, electric vehicles owners benefit immediately if their used batteries can be sold for a good price.

Reusing electric vehicle batteries could greatly reduce the emissions and resources that go into making new batteries. Shutterstock

In the longer run, the list of beneficiaries expands massively. Households can enjoy more reliable and cheaper energy simply by charging up their battery storage during off-peak hours for use at peak times when electricity costs are higher. As an initiative in Portugal showed, using repurposed electric vehicle batteries in this way could cut energy bills by 40%.

Reusing batteries is good news for the environment. Research suggests reducing the demand for new batteries in this way could cut greenhouse gas emissions from making batteries by as much as 56%.

The long list of benefits of giving electric vehicle batteries a second life, then recycling their materials, is enticing. Given the scale of the potential economic and environmental gains, along with the countless jobs such work can create, batteries could be more generous in their afterlife than in their first incarnation in electric vehicles.

By **Mehdi Seyedmahmoudian, Alex Stojcevski, and Saad Mekhilef**

Monthly News Round-Up

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

EU puts an end to electricity market crisis measures

The European Commission has announced its decision not to extend the emergency measures implemented last year to protect consumers from the sharp rise in energy prices. The Commission stated that these measures have contributed to stabilizing the European electricity markets, and the market conditions have significantly improved. Among the measures adopted at EU level was a controversial cap on revenues made by power plants running on renewables, nuclear power, or lignite, which made windfall profits from surging electricity prices without being affected by sky-high gas prices at the time. EU member states agreed the revenue cap in September last year, along with a range of other emergency measures to tackle the energy crisis, including a mandatory target to reduce electricity consumption by 5% at peak hours and retail price setting rules.

+ More

New rules on renewable hydrogen production adopted

On 20 June, the European Commission formally published two delegated acts in the Official Journal, outlining the EU's definition of renewable hydrogen. This marks the completion of the legislative process for these two long-awaited acts, which will come into effect in 20 days. The first act specifies the conditions under which hydrogen and related fuels are considered renewable fuels of non-biological origin (RFNBOs). The second act establishes a framework for calculating the life-cycle greenhouse gas emissions of RFNBOs. Together, these acts ensure that all RFNBOs are produced using renewable electricity. These rules apply uniformly to both EU-based projects and exports to the EU. As a result, this definition will have a significant impact on shaping the hydrogen and low-carbon fuels industry in Europe and worldwide.

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EU countries fail to agree energy reforms after coal subsidy clash

During the EU energy ministers meeting on 16 June in Luxembourg, EU countries were unable to reach a consensus on power market reform rules. Disagreements arose primarily from differing opinions on extending subsidies for coal plants. The talks were further complicated by Sweden's proposal to allow countries to prolong capacity mechanism subsidies for coal power plants. While Poland strongly supports this idea, objections were raised by Austria, Belgium, Germany, Luxembourg, and others. Negotiations will continue among EU ambassadors as they seek to find common ground on these issues. Additionally, ministers faced challenges in agreeing on the rules governing state support for renewable and nuclear power plants, with Germany and France holding conflicting positions on the matter.

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EU to boost hydrogen investments in Latin America

European Commission President Ursula von der Leyen recently visited Brazil, Argentina, and Chile to explore cooperation opportunities, with a particular focus on the hydrogen sector. During her visits, she unveiled plans for increased regional investments, with EUR 10 billion allocated through the EU's Global Gateway investment plan. In Brazil, the EU will provide EUR 2 billion to support local green hydrogen production. Discussions with Argentina centered around the exploration of potential energy exports to Europe. In Chile, the Fund for Renewable Hydrogen was inaugurated, with an initial budget of EUR 225 million, accompanied by a technical assistance project.

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EU and Argentina to cooperate on raw materials for energy transition

European Commission President Ursula von der Leyen and Argentina's President Alberto Fernández have signed a memorandum of understanding (MoU) to establish a partnership between the EU and Argentina focused on raw materials value chains. This MoU aims to ensure the development of a secure and sustainable supply of raw materials necessary for energy transition technologies, including electric vehicles. Argentina, known for its copper production and vast lithium reserves, will play a crucial role in this collaboration. The agreement will encompass five key areas of cooperation, beginning with the integration of sustainable raw materials value chains. Additionally, it will involve joint efforts in research and innovation, as well as a focus on strengthening education and training programs.

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Germany unveils draft program for climate neutrality by 2045

The German government has presented a draft of a comprehensive climate action programme aimed at achieving at least 65% greenhouse gas emission reduction by 2030 compared to 1990 levels. Key measures include expanding renewables to meet 80% of its power demand by 2030 and largely decarbonising the electricity supply by 2035, aiming for 215 GW of solar, 115 GW of onshore wind and 30 GW of offshore wind by 2030. Additionally, the draft program highlights measures to establish higher efficiency standards for buildings, decarbonise industries, promote electric vehicles, and restore forests. The draft program also addresses energy levies, climate checks for legislation, and streamlining procedures. The proposed measures will need to be approved by the government cabinet before implementation.

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German government reaches consensus on revised heating law

After a lengthy dispute, the German government has reached an agreement to mandate a 65% renewable energy share for heating systems in new buildings, effective from January 1, 2024. Existing buildings will not be impacted until the introduction of municipal heating plans in 2028. To facilitate the transition, the government will provide subsidies from its Climate and Transformation Fund. This legislation is a significant step towards Germany's goal of achieving climate neutrality by 2045, as the construction sector alone accounted for 112 million tonnes of greenhouse gas emissions last year, representing 15% of the total.

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Germany launches scheme to help struggling industry decarbonise

In response to soaring expenses for raw materials, energy, and labor, Germany has recently initiated a program allocating EUR 50 billion over 15 years to support manufacturers of steel, cement, paper, and chemicals to decarbonize their production processes. Funding will be drawn from a climate and transformations fund, replenished by emissions trading proceeds and other sources. Known as climate protection contracts, this initiative serves as a key element in Germany's strategy in counterbalancing similar schemes in other regions, which offer generous subsidies and more favorable legislation to attract companies away from Europe.

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Italy considers early coal phase-out by 2024

Italy may close its coal-fired power plants in 2024, one year ahead of schedule, if gas prices remain low, according to Environment Minister Gilberto Pichetto Fratin. To replace Russian gas imports after the Ukraine conflict, Italy increased coal-fired power production to 7.5% of the total last year, up from 4.6% in 2021. Minister Fratin emphasized the role of natural gas, the least polluting fossil fuel, in supporting Italy's energy transition until 2050, alongside the gradual expansion of renewable energy capacity.

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UK government to boost space-based solar technologies

The UK government has unveiled plans to invest GBP 4.3 million in the emerging space-based solar power sector to push forward with innovative projects. Space-based solar power works by harnessing energy from the Sun using panels on satellites, which then safely transmit the collected energy back to Earth. Renowned UK universities and tech firms are among the recipients, focusing on various aspects of the technology. Their efforts include developing lightweight solar panels capable of withstanding space's harsh conditions and creating wireless systems for transmitting solar power collected in space back to Earth.

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Dutch government accelerates permanent closure of Europe's largest gas field

The Dutch government has made the decision to permanently shut down the Groningen gas field, Europe's largest and crucial gas source for Western Europe, ahead of schedule. Originally slated for closure by October of the following year, the accelerated timeline comes in response to political pressure stemming from the adverse impact of earthquakes. Growing local opposition due to the earthquakes causing damage to numerous homes has led to the early closure. The announcement has prompted a surge of over 30% in Dutch front-month gas futures, reflecting concerns about a potential energy crisis in the region during the upcoming winter.

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France to invest in low-emission planes, sustainable aviation fuels

According to President Emmanuel Macron, France will invest EUR 300 million of public funds in the coming years to develop low-emission aircraft and engines. Additionally, EUR 200 million will be allocated to the development of sustainable aviation fuels (SAF), as part of efforts to promote environmental sustainability in the French and European aviation industry. Both public and private funds will be directed towards the advancement of small electric or hydrogen-powered aircraft, as well as renewable fuels. Notably, a SAF production plant will be constructed in Lacq, southwest France.

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Switzerland approves law targeting climate neutrality by 2050

Switzerland has approved a climate law that establishes the country's framework for climate policy with ambitious targets. The law mandates emission reductions of at least 64% by 2031-2040, 75% by 2040, and 89% by 2041-2050 (compared to 1990 levels). It also outlines sector-specific emission reduction targets for buildings (82%), transportation (57%), and industry (50%) by 2040. Incentive measures are introduced to support these goals. Financial support of up to EUR 204 million per year over a 10-year period will be provided to replace fossil fuel heating systems with climate-friendly alternatives. The government will also offer financial assistance to businesses adopting climate-friendly innovative technologies and processes, utilizing existing support measures.

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Sweden adopts 100% fossil-free energy target, easing way for nuclear

Sweden's parliament has approved a new energy target, shifting from a goal of '100% renewables' to '100% fossil-free' by 2040 and achieving net zero emissions by 2045. This change paves the way for the Swedish Government to proceed with plans for constructing new nuclear plants, despite a previous decision to phase out atomic power four decades ago. State-owned power utility Vattenfall is exploring the potential construction of 2.8 GW of new nuclear capacity at its existing Ringhals site on Sweden's western coast, including at least two small modular reactors (SMRs).

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China and Germany set for closer ties in fighting climate change

China and Germany have agreed to set a dialogue and cooperation mechanism on climate change and green transition during Chinese premier Li Qiang's visit to Germany. The five-year-long mechanism – memorandum of understanding (MoU) on climate cooperation – although lacks concrete deals, sets out several topics Germany and China will work on, including industrial emissions reductions and decarbonisation in typically hard-to-abate sectors such as cement, steel, chemicals and pulp and paper. The two countries also agreed to promote and strengthen the development of carbon markets and to strengthen exchanges on mitigation of non-CO_2 greenhouse gases.

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China issues measures on wind farm retrofitting, upgrading, and retirement

On 13 June 2023, the China NEA officially issued the management measures for the retrofitting, upgrading, and retirement of wind farms. This is the first time that guidelines have been provided for old wind farms. The document outlines the electricity pricing and grid access policies that can be followed for the transformation and upgrading of wind farms. It opens up the domestic wind market for the replacement of small wind farms with larger ones and the renewal of old wind farms with new ones. This move will significantly promote the wind power after-service market. Furthermore, the document encourages relevant companies, manufacturers, and research institutions to joint conduct researches on the recycling and utilization of waste materials from wind farms, in an effort to establish a sound wind power recycling system and contribute to the growth of the wind power recycling industry ecosystem.

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China rolls out roadmap to further improve NEV charging infrastructure

China State Council has issued new guidelines for the development of a comprehensive new energy vehicle (NEV) charging infrastructure across the country by 2030. The aim is to ensure widespread coverage of NEV charging facilities to support the rapid growth of the NEV industry. The guidelines emphasize the need to address existing deficiencies in the charging infrastructure on road networks and call for the establishment of charging networks that connect key cities for long-distance travel. The involvement of various stakeholders is encouraged, along with the promotion of innovative financing support from development financial institutions. Local authorities will be encouraged to allocate space for construction projects and provide subsidies. Additionally, significant efforts will be focused on establishing an effective charging network in rural areas. The construction of public DC fast charging stations in urban areas of county-level cities will be actively promoted.

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China extends NEV tax breaks through 2027

On 21 June 2023, China unveiled a CNY 520bn package of tax breaks aimed at boosting the purchase of electric vehicles over the next four years, extending an existing policy at a time when auto sales and broader consumption have been flagging. New energy vehicles (NEVs) purchased in 2024 and 2025 will be exempted from purchase tax amounting to as much as CNY 30,000 per vehicle. The exemption will be halved and capped at CNY 15,000 for purchases made in 2026 and 2027, the Ministry of Finance said in a statement. The tax breaks for NEV has been in place for years since 2014 and extended for three times, in a bid to boost NEV market share and help the country to reduce carbon emissions. The exemption applied to battery electric vehicles, hydrogen fuel-cell vehicles and plug-in hybrids.

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NEV penetration may reach 36% in 2023

Boosted by continuous supportive policies and increasing consumer enthusiasm for purchasing, the domestic market for new energy passenger vehicles in China is displaying robust signs of growth. According to recent projections from the China Passenger Car Association (CPCA), the sales volume of new energy passenger vehicles in China are expected to reach 8.5 million in 2023. Broader category of passenger vehicles includes sedans, SUVs, and MPVs will be totaled at 23.5 million. Annual penetration rate of new energy vehicles is expected to reach 36% this year. The actual situation closely aligns with these predictions. Some research institutions believe that a range of industry policies implemented by the government have unleashed the market potential of new energy vehicles, indicating a further recovery in demand for NEV vehicles.

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China sees surge in lithium reserves in 2022

According to recently released official data by the Ministry of Natural Resources, China experienced a 57% increase in its lithium reserves in 2022 compared to the previous year. The majority share of these reserves, accounting for 40%, was contributed by Jiangxi Province in East China. Nearly 40% of all mineral types discovered across the country reported an increase in reserves last year. In addition to lithium, minerals of strategic importance such as cobalt and nickel also saw their reserves grow during this period. China possesses a variety of lithium types, with the majority of its lithium mines located in Jiangxi, Qinghai, Sichuan, and Tibet. Lithium is playing a growing role in the green, low-carbon shift of the economy and the development of new energy vehicles.

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Solar PV manufacturing in China to grow to over 230GW in 2026

Solar PV manufacturing in China is expected to grow to more than 230 gigawatts in 2026, according to Wood Makenzie's recent study. This is more than sufficient to meet global market demand outside China which stands at around 170GW. The report also highlighted that the available module capacity for export in China is seen to grow to 149GW by 2026. Notably, China's local module manufacturing cost last year was only USD 0.24 per watt, significantly lower than the US (0.56), Europe (0.52), and India (0.33). Southeast Asia's manufacturing cost was close to China as it stood at USD 0.26 per watt. Analysts anticipate that China's dominance in PV manufacturing will not be undermined by US, EU, and Indian policies, and that its domestic market is expected to continue its sustainable growth trajectory.

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Russia to supply gas to China through Far Eastern route

Russian President Vladimir Putin on 13 June signed a law ratifying an intergovernmental agreement with China on cooperation in the field of natural gas, allowing supplies to be exported from Russia to China via the Far East route. The agreement envisages the construction of a cross-border section of gas pipeline, starting at a gas measuring station (GIS) near Dalnerechensk in Russia, crossing the Ussuri River, and ending at the Hulin, Northeast China's Heilongjiang Province. According to Russian Ministry of Energy, the opening of the Far East gas pipeline will increase the volume of natural gas supplied to China by 10 billion cubic meters per year. The design, construction and operation of the site in Russia is controlled by Gazprom, and on the Chinese side by China National Petroleum Corporation (CNPC).

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Qatar secures second major LNG supply deal with China

On 20 Jun 2023, China National Petroleum Corporation (CNPC) has signed a 27-year gas supply deal with QatarEnergy, the second major gas supply deal between the two countries in less than a year. Under the deal, China will purchase 4 million metric tonnes of liquefied natural gas (LNG) annually from Qatar. CNPC will also take an equity stake in the eastern expansion of Qatar's North Field LNG project, which is the equivalent of five percent of one LNG train with a capacity of 8 million tonnes per year. In an identical deal, QatarEnergy sealed a 27-year supply agreement with China's Sinopec in November 2022 for supplying 4 million metric tons a year.

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LONGi partners with Vision Grid Energy to develop hydrogen production in Spain

LONGi Hydrogen, a Chinese large-scale electrolyser and green hydrogen production solutions provider, announced a partnership with Vision Grid Energy, an vertically integrated green hydrogen producer and innovative energy technology company. Under this agreement, the two companies will pool their knowledge, technology, and market insights to develop green hydrogen production facilities in Spain as well as the technological solutions that address the evolving energy demands of industries, transportation, and communities. The strategic partnership between LONGi Hydrogen and Vision Grid Energy marks a significant milestone in hydrogen energy cooperation.

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China produces its first hydrogen fuel-cell locomotive

On 15 June, the first hydrogen fuel-cell locomotive in China, which was converted from an internal combustion locomotive, rolled off the production line of CRRC Datong Electric Locomotive Corp. With an output capacity of up to 2,000 kW, it is also the largest-capacity hydrogen fuel-cell locomotive in the world. It incorporates a modular design that allows the locomotive to adjust its output capacity from 800 kW to 2,000 kW, depending on the amount of load it carries. The advanced battery pack enables a travel time of up to 190 hours on a single charge, and it can be fully charged within two hours. It is estimated that more than 90 percent of the existing fleet of over 7,800 internal combustion locomotives in China could be converted to hydrogen fuel-cell versions, indicating significant potential for the emerging industry.

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First offshore carbon dioxide sequestration project launched in South Sea

On 1 June, China's first offshore carbon dioxide sequestration project at the million tonne level was officially launched in the eastern waters of the South Sea. This project aims to inject carbon dioxide, generated from offshore oil extraction, into subsea strata on a large scale. The successful implementation of this project indicates that China now possesses a comprehensive set of technologies and equipment for offshore carbon capture, processing, injection, sequestration, and monitoring. The operator of the project, China National Offshore Oil Corporation (CNOOC) Shenzhen branch, estimates that it will be able to sequester 300,000 tonnes of carbon dioxide annually, with a cumulative total exceeding 1.5 million tonnes. Additionally, CNOOC has initiated the country's first carbon capture, utilization, and storage cluster project with a capacity of tens of millions of tons in Huizhou, Guangdong province, which aims to capture carbon dioxide emitted in the Daya Bay area and transport it to offshore storage sites using pipelines and vessels.

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China Energy launches Asia's largest carbon capture project for coal-fired power sector

China Energy Investment Corporation (China Energy) has launched Asia's largest carbon capture, utilization, and storage (CCUS) facility for the coal-fired power generation sector in Jiangsu Province. Attached to a generation unit at China Energy's Taizhou coal-fired power plant, the facility captures 500,000 tonnes of CO_2 annually. Using amine chemicals, CO_2 is captured and stored as a nearly pure form after a process of low-temperature bonding and re-heating. The cost of producing a tonne of CO_2 is around CNY 250, and all CO_2 produced and captured can be utilized, as the company has already secured contracts with eight firms. Primary applications for the captured CO_2 include dry-ice manufacturing and the production of shielding gases for welding.

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Industry players push for battery swapping for heavy duty trucks

The electrification of heavy-duty trucks faces challenges such as high acquisition costs and long recharging times, making battery swapping a viable option. On 8 June, at the 2023 World Power Battery Conference held in Yibin, a joint initiative for heavy-duty truck battery swapping was launched by various industry stakeholders, including EV infrastructure alliances, SGCC, PetroChina, and CATL. The goal of this initiative is to establish a comprehensive plan for the interoperability and interchangeability of battery swaps for heavy-duty trucks, thereby promoting standardization. Additionally, CATL has recently introduced its own battery-swapping solution for heavy-duty electric trucks. This solution, called Qiji Energy, adopts a business model that separates the vehicle from the battery. It can result in cost savings ranging from CNY 30,000 to 60,000 per year for heavy-duty trucks that travel 200,000 kilometers annually.

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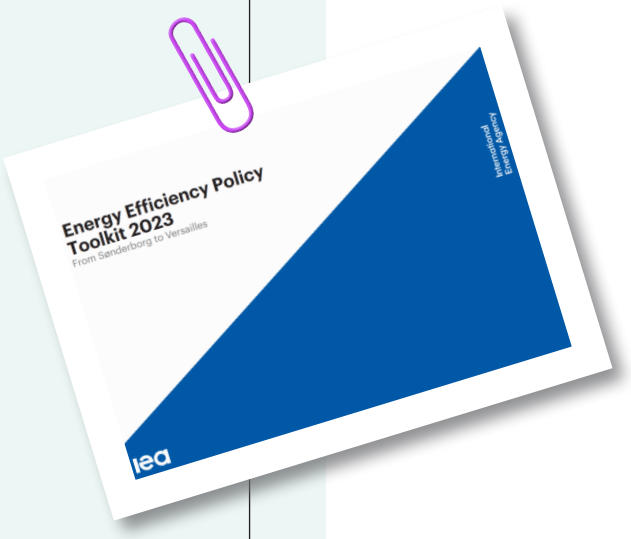
Featured Publication



Energy Efficiency Policy Toolkit 2023

This IEA toolkit, newly published at the 8th Annual Global Conference on Energy Efficiency, offers a practical framework for governments to expedite progress in energy efficiency through the design of effective policy measures, support for policy decisions and delivery of policy actions. It comprises two parts: the first part encompasses ten strategic principles derived from the recommendations of the Global Commission for Urgent Action on Energy Efficiency, which draw upon valuable insights from worldwide experiences to maximise the impact of energy efficiency policies and programs. The second section provides sector-specific policy packages covering appliance, building, industry, vehicle, city, cooking and financing sectors, with each package built on three essential elements: regulation, information and incentives. By showcasing how different measures can be strategically combined to achieve greater efficiency gains, these packages provide valuable guidance on how to optimise energy efficiency outcomes.

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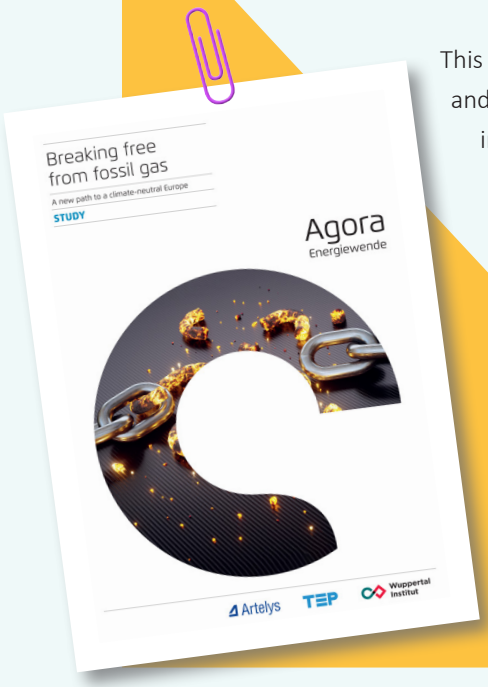
Breaking free from fossil gas: A new path to a climate-neutral Europe



This study, conducted by Agora Energiewende in collaboration with Artelys, TEP Energy, and Wuppertal Institute, delves into the pivotal role of both fossil gas and non-fossil gases in the EU's journey towards climate neutrality. Through detailed sectoral modeling of the energy, buildings, and industry sectors, the study presents a comprehensive European structural transition pathway away from fossil gas use by 2050. Furthermore, it assesses the implications of this pathway for the upcoming debate on the EU's 2040 greenhouse gas reduction target, for energy imports and security of supply, as well as EU financing needs. The report also offers a critical assessment of the rushed political targets set in the REPowerEU plan for renewable hydrogen and biomethane, based on feasibility, costs and their contribution to Europe's energy security. The findings from this analysis provide valuable insights that have significant implications for EU energy and climate policy-making.

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Building Resilience in Europe's Energy System

The escalating frequency and severity of climatic events, coupled with their impact on intermittent renewable energy sources, have rendered the energy system increasingly vulnerable to spikes in demand and infrastructure shortcomings. In light of this, the Centre on Regulation in Europe has conducted a study that focuses on new EU regulatory and legislative approaches to increase infrastructure resilience. It illustrates the consequences of climate-change related hazards through concrete case studies of electricity and gas networks hit by disasters such as wildfires, storms and extreme cold. The research recognises the pressing need for a broader definition of resilience in EU regulation, and for clear methodologies that will allow regulators to monitor operators' resilience assessment and investments. The benefits of resilience need to be measurable, in order to establish a basis for regulatory decisions on network development plans. The study notes that the Value of Lost Load (VoLL) plays a crucial role in monetising resilience, and proper evaluation in this area is urgently needed.

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Better, Faster, Cleaner: Securing clean energy technology supply chains

The global transition to net-zero demands a massive deployment of clean energy technologies. While there are no fundamental barriers to delivering the energy transition by mid-century, some key supply-side challenges must be addressed to avoid delays or increased costs, such as scaling up manufacturing and supply, environmental and social concerns around mining and manufacturing, and geographic concentration of clean energy supply chains. As part of the Energy Transitions Commission's series on Barriers to Clean Electrification, this Insights Briefing focuses on the issue of supply chain risks. Covering six key technologies for decarbonising the energy sector, including PV, wind, Li-batteries, power grid, heat pumps and electrolysers, the brief examines these risks by taking into consideration the entire supply chain, from mining to manufacturing, transport and logistics, and explores key actions that policymakers and industry can take to mitigate these bottlenecks. This Insights Briefing is accompanied by an EU Policy Toolkit, which summarises the EU's position across clean energy supply chains and its major policy priorities.

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2023 China Power Outlook

China's power market reforms have been evolving for 20 years, and have accelerated since the country announced its dual carbon goals. The latest power sector top-level design is intended to build a national unified power market that promotes a much higher penetration of renewables without compromising supply security and reliability. The coming years are a crucial time for China to achieve these goals. However, although much noticeable progress has been made, unique challenges add complexity when giving an account of China's power system and market reforms to an international audience. This RMI annual report aims to build a solid bridge between international audiences and China's power system and market progress, and to provide insights on the ongoing and emerging trends in China's power market reforms. By analysing specific components in the power market, including the electricity energy market, ancillary services market, capacity market, and transmission and distribution pricing, the report considers not only at recent market developments but also the outlook for power marketisation over the next one to three years.

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