*Magazine of EU-China Energy Cooperation Platform*

# EU-China Energy Magazine

2022 Summer Double 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.

*Disclaimer:*

*The views and opinions expressed in the articles of this magazine are the authors' own, and do not represent the views of ECECP.*

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# EU-China Energy Magazine

2022

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*Dear All,*

*Welcome to the 2022 summer double issue of the EU-China Energy Magazine.*

*At the time of writing, many parts of Europe and China are burning under record breaking summer heat. It shows no one can escape the impact of climate change – we are all in the same boat.*

*It has been two and half years since face-to-face business exchanges between EU and China were paused by the COVID pandemic. The need remains for innovative energy solutions in order to reach China's climate targets . ECECP is therefore organising a live virtual exhibition (Expo 2022) to support EU companies who wish to introduce their services and products to the Chinese market. From 27 – 29 September 2022, ECECP is offering 20 selected EU companies the opportunity to take part free of charge. The companies will be selected by a specially appointed Expo 2022 panel. The call details are available in the magazine and on our website.*

*In other news, two of our Junior Fellows are moving on into new roles. Susanna Farrell will be working at Hertfordshire Council while they sponsor her for the Chartered Public Accountant qualification. Polly James will start the competitive UK civil service fast stream in September and her first placement is in the Ministry of Defence in Bristol. We are sad to see them go but are excited for their future endeavours.*

*We would also like to welcome two new interns for the summer: Christina Hadjiyianni and Lale Anjani Asteraki, who will be assisting with the preparation of EXPO 2022 and will also be involved in the magazine. We look forward to working with you both!*

*Once again, I would like to say a big thank you to our editors Daisy Chi and Helen Farrell, who has recovered fully from COVID, for their hard work in delivering this issue of the magazine under extreme heat and pressure.*

*Flora Kan*
*ECECP Team Leader*

EU-China Energy
Cooperation Platform

# VIRTUAL EXPO
# EU ENERGY INNOVATION
# 2022

Expo 2022, 27-29 September

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## Dear Partners and Friends of the EU China Energy Cooperation Platform,

It has been two and half years since face-to-face business exchanges between EU and China were paused by the COVID pandemic. The need remains for innovative energy solutions in order to reach China's climate targets . ECECP is therefore organising a live virtual exhibition (Expo 2022) to support EU companies who wish to introduce their services and products to the Chinese market.

From 27 – 29 September 2022, ECECP is offering 20 selected EU companies the opportunity to take part free of charge. The companies will be selected by a specially appointed Expo 2022 panel. Participation will include:

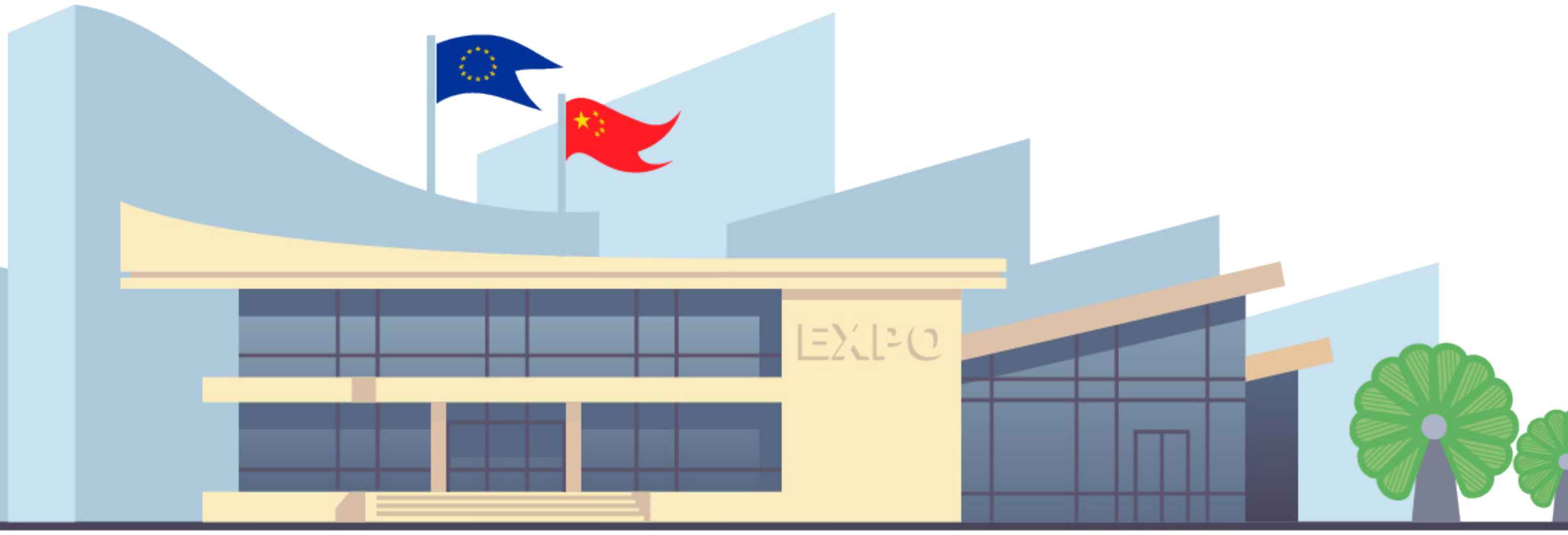
- subtitle provision for a video provided by the company (up to 15 minutes) introducing their clean energy solutions and services.
- hosting of the video on a Chinese video-sharing platform that is accessible freely in China.
- copywriting support and translation for one short case study (up to 1,000 words).
- publication of the case study on the ECECP WeChat account.
- inclusion in the EU China Energy Magazine special edition on EU Innovative Energy Solutions, to be published in December 2022.
- inclusion on a list of EU innovative energy solution providers on the ECECP website.
- Interpreting services.
- introduction to EU funded, free of charge advisory on IPR issues related to doing business in China and support to SMEs.

During Expo 2022, the mornings will be taken up with live online events streamed from Europe. In the 'main meeting room', journalists from the online energy news forum EnergyPost will conduct live interviews with end users, CEOs of exhibiting companies and so on.

Additionally, Expo 2022 will host five separate virtual exhibition halls, focusing on renewables, energy efficiency, energy storage, power grids and buildings. We invite our partners to propose innovative energy solution providers from the EU. Companies should contact ECECP by 5 August to register their interest.

We have four main selection criteria:

- Energy savings / carbon emissions reduction potential.
- Distinctive USP.
- Business readiness.
- Business potential.




## ◆ Key dates

| Key Dates | Event |
|---|---|
| **5 August 2022** | **Application deadline** |
| 20-August 2022 | Names of the 20 companies selected by the Expo 2022 panel will be announced |
| 10 September 2022 | Deadline for video submission |
| 20 August – 20 September 2022 | Preparation for Expo 2022 Material |
| 27 – 29 September 2022 | Expo 2022 |

## ◆ How to apply

**Email expo-application@ececp.eu. This should include:**

- A brief justification for your company's inclusion in Expo 2022 (maximum 1,000 words).
- An introduction to your company's products / services (to include technology readiness, business readiness); emission reduction / energy saving potentials; USP; number of existing or planned installations; company information (number of employees, turnover in the last three years) and contact details.
- A case study (maximum 1,000 words).
- A video introducing your technology and services (if available).
- If more than 20 companies apply to exhibit at Expo 2022, a selection panel will review the material submitted and select the companies based on the four criteria listed above.

The selection panel of five industry specialists (to be confirmed) will include:

- Team Leader of EU China Energy Cooperation Platform
- Chair of the Energy Working Group of the EU Chamber of Commerce in China
- Representative from EU Delegation to China

Your sincerely,

**Dr Flora Kan**
Team Leader
EU China Energy Cooperation Platform

*Note - www.EnergyPost.eu is an online publisher of energy news website, aimed at government, policymakers, business, influencers and strategic thinkers. It has a significant reach (40,000 monthly readers, 80,000 monthly website article impressions, 12,000 newsletter subscribers, 20,000 social media followers) into relevant sectors at a senior level.*

# Hydrogen

## – the second-best option for energy independence on the climate neutrality pathway

*Helena Uhde of ECECP met with Erik Rakhou, Associate Director at Boston Consulting Group and co-editor of the book 'Touching Hydrogen Future: Tour around the globe', to discuss what actions are needed for hydrogen to develop as a fuel in Europe as the continent searches to diversify away from the volatility of Russian oil and gas supplies.*

EU policy makers face a difficult dilemma: how to manage energy security and independence without losing sight of the climate neutrality target. With the launch of REPowerEU (which maps the bloc's plans to increase its energy security), they are signalling their determination to end the bloc's dependence on Russian gas and to accelerate the transition to clean energy. According to the plan, by the end of 2022 100 bcm of gas imports from Russia will be replaced by means of various strategies, including more LNG and pipeline imports from other countries, doubling the sustainable production of biomethane, increasing the production and import of renewable hydrogen, while accelerating renewable energy generation.[1]

It is a massive undertaking that requires a fundamental change in energy supply, production and consumption structures. In 2020, 83.5% of the EU's demand for natural gas was covered by imports; 15 EU Member States even had an energy dependency rate for natural gas of over 90%. Russia has hitherto been the largest, though not the only, source of imports of crude oil, natural gas and solid fossil fuels into the EU.[2]

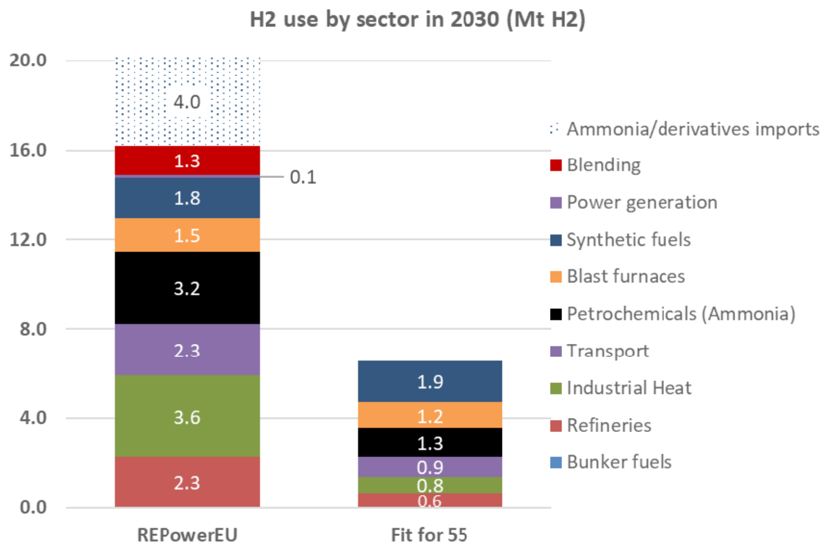
Reshaping the European energy system and ending the dependency on Russian fossil fuels requires a radical acceleration of efforts, leaving policy makers faced with difficult choices. At the press conference on REPowerEU on 8 March 2022, European Commission's Executive Vice-President Frans Timmermans was blunt: 'It is hard, bloody hard. But it is possible, if we are willing to go further and faster than we have done before.'[3]

## High hopes for hydrogen

One energy source that is receiving more attention in the REPowerEU plan is hydrogen, along with its derivatives, such as ammonia, methanol, e-kerosene, and e-petrol. While the 2030 target for renewable hydrogen in Fit for 55 is set at 5.6 Mt, the new REPowerEU strategy has increased the target to 20 Mt, with a view to replacing 50 bcm of Russian gas.

The enormous change becomes particularly clear in the planned use of hydrogen by 2030 (see Figure 1). The use of hydrogen in industrial heat, for example, is planned to increase 4.5-fold compared to the already ambitious

**Figure 1: Hydrogen use by sector in 2030.**




*Source: European Commission (2022): Implementing the REPower EU Action Plan: Investment Needs, Hydrogen Accelerator and Achieving the Bio-Methane Targets.*

1. *https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_1632*
2. *https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html*
3. *See 1.*

Fit for 55 targets. A more than 2.5-fold increase is envisaged in the transport sector. But even if the targets seem huge, they are not enough to meet the targets set by the 2015 Paris Agreement. A recent article by Boston Consulting Group (BCG) concludes that 565 Mt/year of low-carbon hydrogen and derivatives will be required to meet the Paris Agreement target for the mean global temperature to rise 1.5°C above pre-industrial levels; achieving the more achievable 2°C target would require least 380 Mt production per year globally.[4] The REPowerEU target of 20 Mt is only one-nineteenth of that, with half of that set to be imported into the EU.

## The second-best option

Critics denounce hydrogen as energy-intensive and expensive.[5] Elon Musk dismissed hydrogen storage as 'the most dumb thing' as recently as in May 2022.[6] While Erik Rakhou, Associate Director at BCG and hydrogen expert, does not agree based on latest global hydrogen technology developments, he believes that hydrogen should not be the first choice. 'Never use hydrogen first! It always comes second. Normally, you would always prioritise energy efficiency and electrification, and only if that is not possible, you would use hydrogen. It is a net zero tool, the second-best option. Secondly, on efficiency: yes, you lose energy in transport, in conversion, so you just have to look at the economics.'

The focus of hydrogen deployment should be on hard-to-abate sectors, such as the chemical industry, steel or ammonia production. 'For me personally, hydrogen is a fantastic means of transporting renewable energy, where we cannot transport it in the form of electrons. Energy is transformed into molecules and can thus be used in sectors that are difficult to abate, because some of the processes require molecules', says Rakhou.

## Tomorrow starts today

Recently announced large-scale projects using green power or otherwise net-zero compliant that aim to produce hydrogen or its derivatives, such as the HIF global eFuel plants in Chile, ACWA Power consortium's green ammonia production plant in Saudi Arabia, or Shell's hydrogen plant in the Netherlands, could take up to six years from public announcement to planned opening.[7]

But it is not only the electrolysers that need time. The construction of wind and solar plants, as well as transmission lines, also take years. 'It can take up to eight years to build transmission lines, if electrolysers are in places where there is no production,' states Rakhou.

Projections for hydrogen in the European Hydrogen Strategy 2020, which had less ambitious hydrogen targets than REPowerEU, assume that sectors that are difficult to decarbonise will be largely powered by hydrogen from 2030 onwards.[8] Rakhou does not consider it realistic to achieve this goal any earlier, given how long it takes to develop projects. For industrial processes, the changeover could take just three years. 'If you make the decision today and hydrogen is available, like in the Netherlands, you can start using hydrogen in industrial processes as early as 2025,' says Rakhou.

## Supporting the development and scale up of hydrogen

The development and scale-up of hydrogen must therefore be accelerated. 'We need to strengthen three areas: funding, infrastructure, and various enablers,' urges Rakhou, referring to the study 'How to Meet the Coming Demand for Hydrogen', which was recently published by BCG.[9]

4. *https://www.bcg.com/publications/2022/how-to-meet-future-low-carbon-hydrogen-demand*
5. *https://friendsoftheearth.eu/news/why-hydrogen-bubble-burst-europes-face/*
6. *https://www.forbes.com/sites/ianpalmer/2022/05/15/is-elon-musk-right-or-wrong-to-dismiss-hydrogen-as-a-storage-for-energy/?sh=722847dd3ac7*

In terms of funding, the roll-out of carbon contracts-for-difference was signalled within the framework of REPowerEU. These could create Europe-wide incentives for the development of green hydrogen, with electricity sourced from renewable energy facilities. In order to ensure that the development of renewable hydrogen complies with emission reductions, the European Commission published two delegated acts on 23 May 2022 that specify how renewable fuels of non-biological origin (RFNBOs) and their emissions are to be defined.[10] Increasing the innovation budget for cases where electrification is not possible, and conducting demonstration projects, could further encourage development.

In terms of infrastructure, Rakhou supports the expansion of electrolyser gigafactories. Examples include the 1 GW electrolyser project for a green hydrogen production complex in Esbjerg, Denmark, and a gigafactory in France to produce solid oxide electrolysers.[11] Other important actions to expand the infrastructure include increasing the availability of land at offshore sites for local renewable energy production, accelerating permitting processes and developing cross-border hydrogen infrastructure, which will be crucial for managing flexibility.

General enablers for hydrogen include other supporting factors such as the Hydrogen Accelerator and hydrogen support by means of recognition as an Important Project of Common European Interest ('IPCEI'). These are strategic funding projects that contribute to economic growth, employment and competitiveness for the EU's industry and economy. This signalling effect and financial support reduces the risk to investors. Certification is another enabling factor that could be introduced in order to distinguish renewable hydrogen from other commodities.

## International hydrogen cooperation

Under the 1.5°C global warming scenario, IRENA predicts that a quarter of total global hydrogen demand of about 150 Mt per year could be met through international

7. *https://www.uniper.energy/news/hif-global-and-uniper-sign-letter-of-intent-to-produce-sell-efuels*
*https://www.technicalreviewmiddleeast.com/power-a-water/power-generation/acwa-power-consortium-signs-us-900mn-epc-contract-for-neom-hydrogen-project*
*https://www.rechargenews.com/energy-transition/takes-guts-shell-gives-green-light-to-200mw-dutch-green-hydrogen-project-powered-by-offshore-wind/2-1-1253563*
8. *https://energy.ec.europa.eu/topics/energy-system-integration/hydrogen_en#eu-hydrogen-strategy*
9. *See 4.*
10. *https://ec.europa.eu/info/news/commission-launches-consultation-regulatory-framework-renewable-hydrogen-2022-may-20_en*
11. *https://www.hydrogen-worldexpo.com/industry_news/plug-power-to-provide-1gw-electrolyser-to-h2-energy/*
*https://www.h2bulletin.com/offshore-electrolyser-green-hydrogen/*

## Important Project of Common European Interest in the hydrogen technology value chain ('IPCEI Hy2Tech') [12]

On 15 July 2022, the European Commission approved the project 'IPCEI Hy2Tech' which supports the development of the hydrogen value chain, including generation, fuel cells, storage, transport and distribution of hydrogen and end-user applications, especially in the field of mobility, in line with the objectives of key EU policy initiatives such as the Green Deal, the EU Hydrogen Strategy and REPowerEU.

The project will receive up to EUR 5.4 billion of public support from 15 Member States: Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Italy, the Netherlands, Poland, Portugal, Slovakia and Spain, and is expected to unlock additional EUR 8.8 billion in private investments.

**List of direct participants, the Member States that support them and the different technology areas:**

| Hydrogen Generation Technology | Fuel Cells Technology | Storage, Transportation and Distribution Technology | End User Technology |
|---|---|---|---|
| 1s1 Energy* | 1s1 Energy* | Arkema | Alstom FR |
| Advent* | Advent* | B&T Composites* | Alstom IT |
| Ansaldo | Alstom | Daimler Truck | Bosch AT |
| AVL | Ansaldo | Enel | Daimler Truck |
| Christof Industries | Arkema | Faurecia | Fincantieri |
| De Nora | Bosch DE | NAFTA | HYVIA |
| Elcogen* | Daimler Truck | Neste | Iveco CZ |
| Elogen | De Nora | Ørsted | Iveco ES |
| Enel | EKPO | Plastic Omnium FR | Iveco IT |
| Genvia | Elcogen* | | Neste |
| H2B2* | Fincantieri | | Ørsted |
| Cummins | Genvia | | Plastic Omnium AT |
| John Cockerill | HYVIA | | Plastic Omnium FR |
| John Cockerill | Iveco | | |
| McPhy* | Nedstack* | | |
| Nordex | Plastic Omnium AT | | |
| Ørsted | Symbio | | |
| Sener | | | |
| Stargate | | | |
| Sunfire* | | | |
| Synthos | | | |

*SME

12. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_4544

## Action points for stakeholders to support the hydrogen economy

### Action points for power producers:

- Secure access to critical feedstock, e.g. renewable energy, natural gas, as well as sustainable $CO_2$, from which e-fuels can be produced in combination with hydrogen.
- Use of existing nuclear power plants to produce hydrogen in markets where there is no competitive gas or renewable energy.
- Systems thinking: How does the plant contribute to the energy system? For example, selling hydrogen derivatives or participating in electricity reserve markets by leveraging production flexibility.

### Action points for oil and gas producers:

- Secure access to critical feedstocks: renewable energy, natural gas and sustainable $CO_2$.
- Extend capabilities in transportation and global trade of hydrogen derivatives.

### Action points for technology players:

- Increase R&D capabilities for more efficient hydrogen production and transport technologies, i.e. how to reduce the need for critical minerals?
- Increase efficiency, i.e. how do we get more from less?

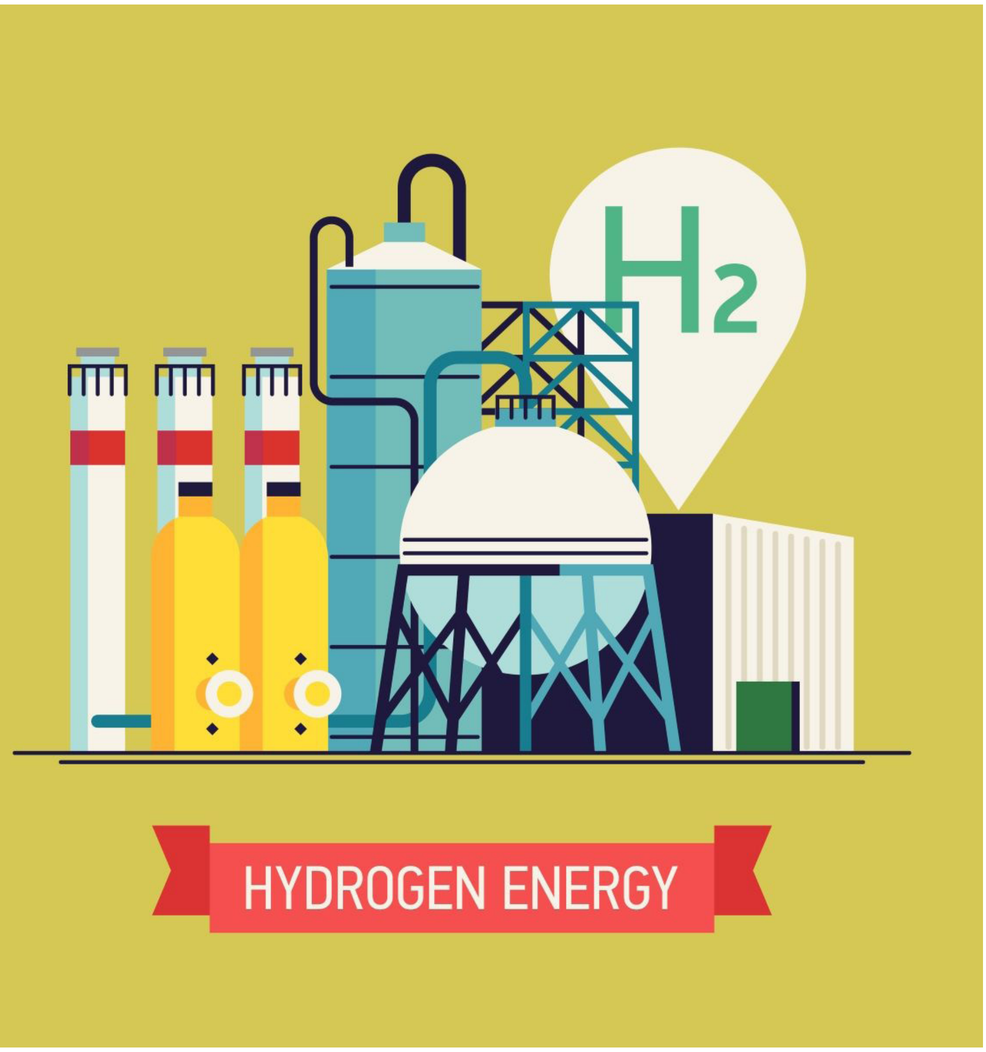
### Action points for policy makers:

- Facilitate industry demand for hydrogen, i.e. by setting targets for renewables and energy efficiency, as proposed in the Fit for 55 framework.
- Focus on making land and offshore sites available for renewable energy generation.
- Introduce standards for the transport and use of low-carbon fuels.
- Offer government support, e.g. through memorandums of understanding (MoU) for export hubs outside Europe, and thus reducing investment risk.
- Create markets and measures for transparent pricing to make hydrogen tradable.

*Sources: BCG (2022): How to Meet the Coming Demand for Hydrogen; ECECP interview with Erik Rakhou, Associate Director, BCG.*

trade, while the remaining three quarters would be produced and consumed domestically. Half of the targeted hydrogen volume of 20 Mt by 2030 is to be imported under the REPowerEU plan. This is well below today's oil trade volumes in the EU, where about 74% is traded internationally, yet it is above the current gas market, where cross border trade accounts for just 33% of consumption.[13]

Rakhou suggests that the hydrogen market could develop in a similar way to the market for LNG: 'Hydrogen is a globally tradable commodity because we have means of transport, be it as ammonia, as methanol, be it through the development of e-fuels, of liquid hydrogen or of pipeline systems,' he says. In order to evaluate the economic viability of trade, transport costs must be taken into account in addition to production costs at the site. 'That is why we are already thinking about building a hydrogen backbone connecting the production centres with the demand centres. Here, it is very important that the policy makers sign MoUs, so that private actors, based on initiatives like H2Global, can match the supply outside Europe with the demand in Europe using the right incentive mechanisms,' adds Rakhou.




## Acceleration of efforts required

The upcoming COP27 climate conference in November 2022 in Egypt will show whether policy makers worldwide are ready to take the necessary steps to reach net zero by 2050. According to Rakhou, prioritisation is needed above all to push hydrogen as the second-best option. 'I think net zero can be achieved, but we need to radically accelerate our efforts. My top three priorities for policy makers are i) enabling infrastructure, ii) demand targets, and iii) incentives. And then the market will work together to accelerate,' summarises Rakhou.

**Helena Uhde**

*ECECP Junior Postgraduate Fellow*

13. *https://www.irena.org/publications/2022/Jul/Global-Hydrogen-Trade-Outlook*

# Hydrogen reality check: **We need hydrogen — but not for everything**

### The myth: Hydrogen is a no-regrets solution for every sector

Hydrogen's versatility as a decarbonization solution has created a lack of consensus and clarity as to where it is truly needed. Hydrogen is sometimes described as the 'Swiss Army knife' of decarbonization, with a role to play in nearly every sector, as it can be burned to generate electricity or heat, serve as a carbon-free input to produce 'green' steel and fertilizer, and power everything from passenger vehicles to deep-sea cargo ships.

### The reality: Hydrogen should be prioritized for heavy industry and heavy transport

In theory, hydrogen can indeed be used to decarbonize almost every sector. But just because it can, doesn't mean it should. As one of several tools in the decarbonization toolbox, hydrogen should be prioritized in uses where energy efficiency and direct electrification are not possible. In particular, hydrogen's potential to decarbonize the heavy industry and heavy transport sectors quickly and cost-effectively makes it a necessary part of the clean energy transition.

One of the factors constraining global decarbonization is the scarcity and value of renewable electricity, of which is used to produce 'green' hydrogen. Already the world needs vastly more clean electricity infrastructure, as power consumption in 2050 is expected to double from population and economic growth alone — and only 10 percent of electricity today comes from solar and wind. Add in the electricity required to make green hydrogen to decarbonize heavy industry and transport, and power consumption could triple. Given this backdrop, at a macro level it is important to prioritize reducing electricity consumption and using renewable electricity most efficiently. As such, many of today's micro-level business cases of hydrogen for heating buildings, generating power, or fueling light-duty vehicles are better suited for investments in energy efficiency or direct electrification (see Exhibit 1).

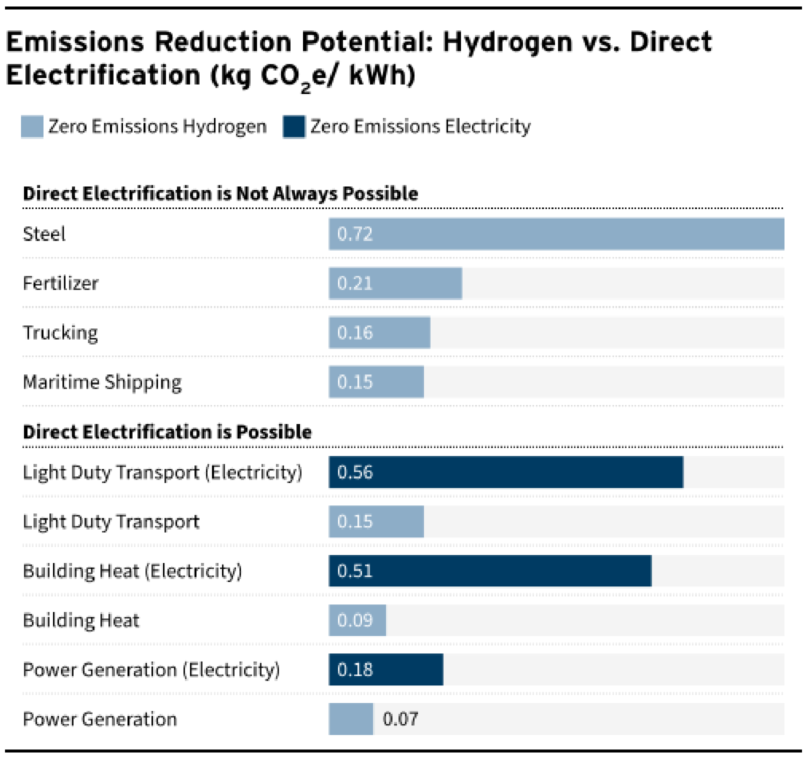
However, there are several applications where energy efficiency and direct electrification are cost prohibitive, impractical, or simply impossible. Enter hydrogen. Given its flexibility, technological maturity, and relative low cost, hydrogen is one of the primary solutions to decarbonize heavy industry and heavy transport such as steelmaking and shipping.

## The best tool for a difficult job

The specific applications where hydrogen shines can vary by geography, especially as several developed economies are land-constrained and limited in their ability to build out renewable capacity. But even before considering real-economy constraints, there are several no-regret, high-priority applications of hydrogen that should be a core focus of policies and investment today: fertilizer production, petrochemicals and refining, steel production, maritime shipping, and, in some markets, long-distance heavy-duty transport via both rail and trucks. These sectors all need hydrogen to decarbonize, are technology-ready to transition, and contribute substantially to global emissions. In time, hydrogen is likely to expand beyond these core applications.

Exhibit 1 illustrates the carbon abatement per kilowatt-hour (kWh) of zero-carbon electricity, either used directly in electrified end uses or indirectly through the creation of hydrogen. This quantitative assessment validates the governing philosophy of hydrogen's priority applications: use hydrogen where you can't electrify. Using electricity directly whenever possible provides the greatest emissions abatement potential, largely given the low round-trip efficiency of hydrogen's use in these applications (building heat, power generation, and light-duty transport).

**Exhibit 1: Emissions reduction potential per kWh of electricity input**




Note: Building heat compares a heat pump with a coefficient of performance of 2.92 and a hydrogen furnace of 80 percent efficiency to natural gas combustion. Power generation compares direct electrification and a 60 percent efficient hydrogen turbine to natural gas combustion. Light-duty vehicles compares a 50 percent tank-to-wheels efficient fuel cell electric vehicle and 70 percent tank-to-wheels battery electric vehicle to a 30 percent tank-to-wheels gasoline internal combustion engine, inclusive of electricity for hydrogen compression. Hydrogen replaces coking coal for steel, steam methane reforming–produced hydrogen for fertilizer, and diesel for trucking. Ammonia replaces heavy fuel oil in a 39 percent efficient internal combustion engine for maritime shipping.

*Source: Emissions intensity values from EIA*

## No-regret applications today


*Source : Linde*

Hydrogen is already in wide use today — the problem is that so much of it is emissions-intensive hydrogen derived from fossil fuels. Hydrogen production for fertilizer and oil refining presently contributes ~2 percent of global emissions. Using clean hydrogen to decarbonize these present-day uses of carbon-intensive hydrogen is a necessary application, and the EU has committed to replacing all 'gray' hydrogen derived from natural gas by 2030. Given the 1:1 swap between the clean and conventional hydrogen feedstocks, these sectors could serve as the locomotive in scaling up the supply chain and driving cost reductions for clean hydrogen technology.

Hydrogen is a top priority for steelmaking as well, given the magnitude of the sector's emissions and the limited alternatives for decarbonization. Steel manufacturing is responsible for ~8 percent of global emissions today, primarily due to the use of coking coal to remove the oxygen from iron ore to create pure iron, a chemical process called 'reduction.' Replacing coking coal with hydrogen in this reduction process is the most promising and mature solution to decarbonize steel manufacturing.

Similarly, maritime shipping — ~2.5 percent of global emissions and growing — has few decarbonization options for deep-sea voyages beyond hydrogen-based feedstocks. Electrification is possible for regional voyages, but for long-distance shipping, which accounts for most of the sector's emissions, hydrogen or its derivatives (i.e., ammonia or methanol) will be necessary. Biofuels do present an alternative to hydrogen-based fuels, but feedstocks are limited and are largely being prioritized for use in aviation rather than in the maritime shipping sector.

Heavy-duty trucking, representing roughly ~4.5 percent of global emissions, is likely to see a need for hydrogen for the heaviest of vehicles covering long-distance routes, given limitations of battery energy density and long charging times coupled with the distances required for travel.

## Longer-term applications for hydrogen

Aviation boasts several decarbonization options, with the feasibility varying based on size of aircraft and distance to travel. For shorter routes, electrification is an option. For longer routes, biofuels, synfuels, or hydrogen emerge as core solutions. However, there are technological, design, and regulation hurdles that must be met before hydrogen is ready for use in the sector; until then emissions-free aviation is restricted to use of 'drop-in fuels' that do not require a change in aircraft. To help expedite aviation's decarbonization once plane-side technology is ready, hydrogen infrastructure today should be built with an eye to providing a future supply to airports come 2030.

As grids look to fully decarbonize, they will require clean, firm power to move from 80 percent to 100 percent carbon-free electricity. Hydrogen is one of many options for filling this need, in the company of solutions including demand response, batteries, carbon capture and storage, and geothermal. Although the jury is still out on the winning economical solution, hydrogen's ease and flexibility —particularly as a seasonal storage resource — provides core advantages. When these resources will be needed to enable further power-system decarbonization varies grid-to-grid, but in general renewable electricity today should be added to the grid directly rather than used to make hydrogen to turn back into electricity.

## Where direct electrification likely wins

Heating buildings and transporting passengers in light-duty vehicles are applications likely better suited for direct electrification than for hydrogen, as seen in Exhibit 1. Heat pumps are a commercially available, lower-cost, and more efficient solution for building decarbonization in temperate and warm climates. The efficiency and availability of battery electric vehicles for passenger transport similarly often make direct electrification the preferred solution. However, there are likely to be instances where hydrogen could be a viable solution, such as in renewables-constrained locations or instances where an infrastructure swap for electricity is incredibly difficult.

In addition to directly using hydrogen for building heat and electric power generation, blending natural gas with hydrogen has received some attention. Blending hydrogen with natural gas does not require upgrades of pipelines, turbines, or boiler infrastructure, which are all different in a pure hydrogen system. However, the emissions reduction from blending hydrogen with natural gas is limited. Blending as much hydrogen as most pipelines can handle before degrading (~20 percent by volume) translates to only a 7 percent emissions reduction, given the lower volumetric energy density of hydrogen compared to the methane in natural gas.

Hydrogen is key to reaching our climate goals, but deploying hydrogen in instances where energy efficiency and direct electrification are better options will hinder our ability to quickly and cost-effectively decarbonize our energy system. To maximize the system-wide efficient use of valuable clean electricity, hydrogen should be used when these solutions are not possible. Fertilizer, oil refining and petrochemicals, steel manufacturing, and long-distance heavy-duty transport are no-regrets applications of hydrogen today, which may in time be joined by aviation and long-duration energy storage.

**Tessa Weiss** and **Thomas Koch Blank**

*Republished with permission from RMI, formerly Rocky Mountain Institute.*

# How mitigating methane emissions can help the EU to reach energy independence

Europe is facing the worst energy crisis since the 1970s. The spiking energy prices and worries about reliable supply fueled by the Russian invasion of Ukraine have revived discussions and calls to end the EU's dependence on fossil fuel imports from Russia. Achieving the EU's energy independence will require considerable effort and time.

One of the immediate options is to increase efforts to avoid methane emissions in the fossil fuels' value chain. The size of globally emitted methane is comparable with the EU imports of natural gas from Russia. The Middle East and North Africa region alone could provide consumers with 20 billion cubic meters (bcm) of natural gas if all methane leakages were avoided. Besides oil, gas and coal, bioenergy is also starting to be a substantial source of methane emissions[1]. These facts make one thing clear: the same measures that could help to solve the energy crisis will also alleviate the climate one.

The proposed EU Methane Regulation targeting energy-related emissions[2] will provide an essential regulatory tool both for limiting climate change and increasing efficiency in the use of fossil fuels. The EU is not a significant producer of fossil fuels, but it is one of the most important consumers. As a result of that, the EU is one of the world's largest importers of oil and gas. The draft Regulation demands full transparency of the methane emissions associated with the fossil fuels imported into the EU. This requirement will provide an incentive for major producers to avoid methane leakages, flaring and venting, also through dedicated initiatives involving technical assistance for partner countries, such as the recently announced 'You collect/We buy schemes'.[3] But the EU's ambitions extend beyond the fossil fuels' sector.

In mid-May 2022, the European Commission unveiled the REPowerEU strategic document, enlisting measures to both drastically reduce the EU's dependence on Russian fossil energy supplies and accelerate the clean energy transition. Among those measures, the Commission has suggested over a tenfold increase in the domestic production of biomethane, from the current 3 bcm to 35 bcm by 2030, doubling the biomethane production target indicated in the Fit for 55 Package, published in summer 2021. The document highlights the importance of producing biomethane from sustainable sources, mainly agricultural residues and biowaste.


To achieve this objective, the Commission identified several measures in the REPowerEU Plan: to establish industrial biogas and biomethane partnerships, encourage the establishment of energy communities, provide incentives for biogas upgrading into biomethane, promote infrastructure upgrading, R&D funding and simplified access to finance via Connecting Europe Facility (CEF), Cohesion Policy, Recovery and Resilience Facility (RRF) and the Common Agricultural Policy.

Although higher gas prices could incentivise biomethane production in the short term, additional

1. *Global Methane Tracker 2022, IEA.*
2. *Proposal for a regulation of the European Parliament and of the Council on methane emissions reduction in the energy sector and amending Regulation (EU) 2019/942, COM/2021/805 final.*
3. *JOINT COMMUNICATION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU external energy engagement in a changing world. JOIN(2022) 23 final. Brussels, 18.05.2022.*

could help boost biomethane production by alleviating energy security concerns. But it requires better policy coordination in four focus areas: (a) the development of a measurement, reporting and verification system of methane emissions from the agriculture and waste sectors; (b) continual improvement of best practices to mitigate methane emissions, e.g. by introducing further requirements concerning landfill gas management; (c) production of biomethane from sustainable sources; and (d) responsible operation of biomethane plants minimising potential methane leaks.

measures will be necessary to reach the ambitious 2030 target. To make biomethane more cost-competitive vis-à-vis natural gas in the longer term, the International Energy Agency (IEA) has suggested putting a value on avoided methane emissions. Some jurisdictions already allow for such possibility, i.e. offsets generated by installing the anaerobic digesters can be used for compliance under the California-Québec Cap-and-Trade system.

This could be an interesting option for the EU's contribution toward achieving the Global Methane Pledge (GMP). Such a pledge seeks a 30% reduction by 2030 compared to 2020 levels across all man-made sources of methane. Agriculture and waste are the major sources of methane emissions in the EU, accounting for almost 80% of the total. Moreover, boosting the biomethane production from agricultural wastes and residues would also help reduce GHG emissions in these sectors, which for the time being have not been at the forefront of the EU climate efforts. And a further reduction in these sectors will be necessary to achieve EU climate targets.

The EU circular economy strategy has already recognised an essential role of biomethane production via anaerobic digestion in reducing GHG emissions. Hence, the EU circular economy framework

The accelerated transition to the circular economy could help address climate change threats and energy security concerns. Achieving the European Green Deal will not be possible without reducing the methane emissions dominating GHGs in the agriculture and waste sectors. Captured methane could also provide a clean source of EU-produced energy. While some regulatory steps were already made in the waste sector in the 1990s, in the agriculture sector, there is still much to be done.

**Andris Piebalgs** and **Maria Olczak**

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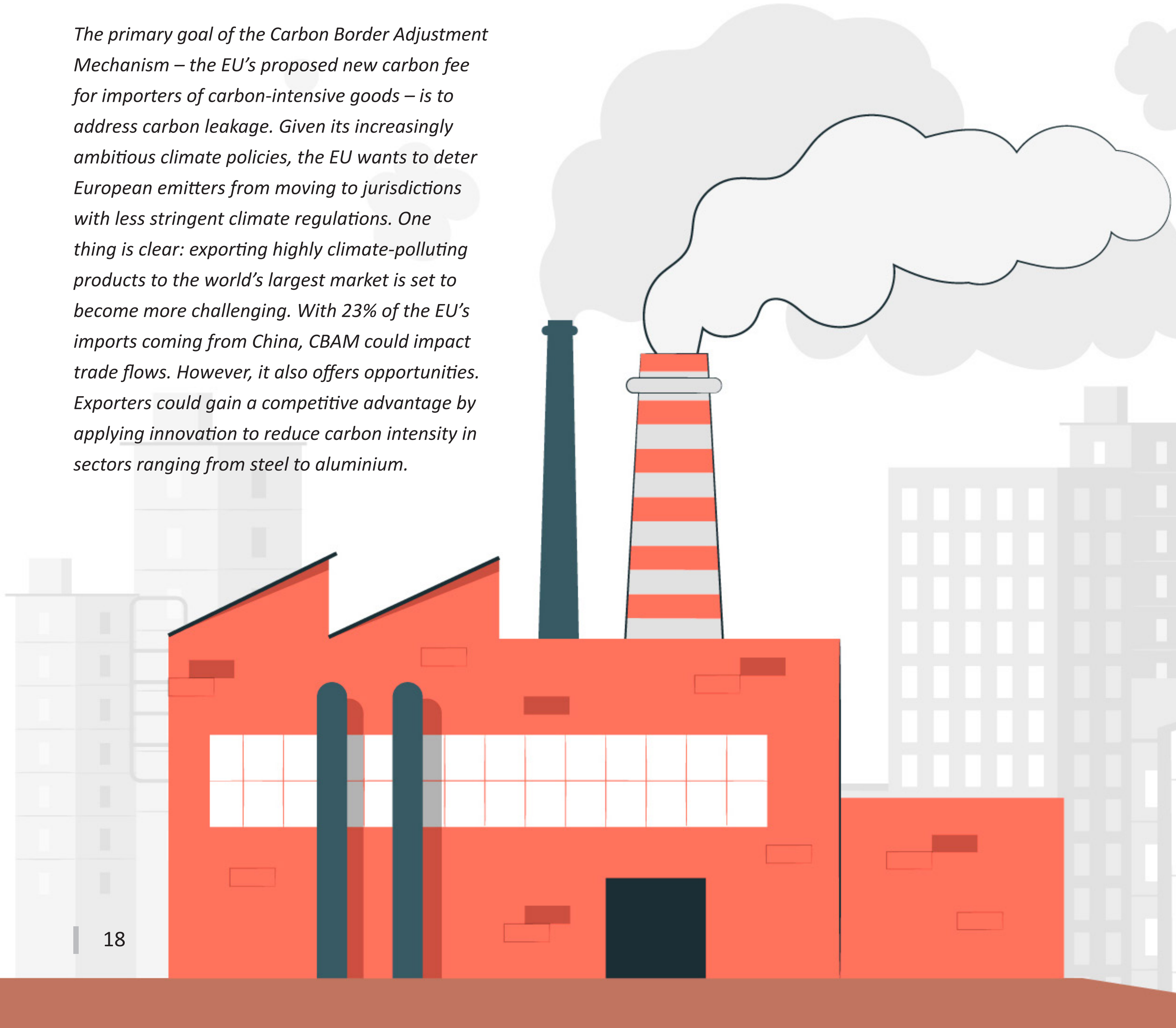
*Florence School of Regulation*[4]

4. *The article is based on the recent FSR Policy Brief written by the authors: Olczak, Piebalgs (2022) Energy security meets the circular economy: a stronger case for sustainable biomethane production in the EU. Issue 2022/34, April 2022.*

# CBAM:
## An incentive for low carbon technologies

*The primary goal of the Carbon Border Adjustment Mechanism – the EU's proposed new carbon fee for importers of carbon-intensive goods – is to address carbon leakage. Given its increasingly ambitious climate policies, the EU wants to deter European emitters from moving to jurisdictions with less stringent climate regulations. One thing is clear: exporting highly climate-polluting products to the world's largest market is set to become more challenging. With 23% of the EU's imports coming from China, CBAM could impact trade flows. However, it also offers opportunities. Exporters could gain a competitive advantage by applying innovation to reduce carbon intensity in sectors ranging from steel to aluminium.*



## CBAM as part of Fit for 55

In the midst of the Covid pandemic, the EU raised its climate ambitions. In July 2021 the European Commission published its proposals for the EU's green transition, the so-called Fit for 55 package. Its overall goal is to achieve at least 55% emissions reductions by 2030, up from the 40% that was already planned. If achieved, Europe will be on the way to becoming the first climate-neutral continent by 2050, thus living up to its Paris Agreement commitments. In addition to decarbonisation, the package aims to make the European economy stronger, more innovative, and resilient.

The Fit for 55 package consists of a number of legislative and non-legislative actions, as well as other initiatives. Its overall goal for renewable energy in Europe is for it to account for 40% of energy by 2030 (not just electricity). It strengthens Europe's carbon pricing mechanism, the EU Emissions Trading System. Energy efficiency is also part of the package, 'making it compulsory for the EU as a whole to reduce energy consumption, compared with consumption projections for 2030'. In addition, Fit for 55 envisions stricter emissions standards for cars and vans, including a phasing out of combustion engines by 2035, alternative (i.e. cleaner) fuels for aviation and maritime, a reform of energy taxation that would bring environmental attributes into focus, and capturing more $CO_2$ by restoring and preserving forests and soils.[1]

Even as it introduces ambitious climate policies, the EU is trying to dissuade Europe-based emitters from relocating to jurisdictions with less stringent regulations. For example, a company might face higher carbon prices, or more stringent requirements for energy efficiency, in its plants in the EU. It could therefore decide to move its production into a market with less restrictive climate policies, or none at all, in order to circumvent strict EU regulation, and then export products back into the bloc. This practice is referred to as 'carbon leakage'. The European Commission has said that avoiding carbon leakage is one of the core reasons for introducing CBAM.


## Ukraine conflict sparks energy sanctions

Much has happened since the European Commission introduced CBAM as part of the Fit for 55 package back in July 2021. The Commission's proposals were debated in the European Parliament and Council of the EU (or simply Parliament and Council), but this political and legislative processes was overshadowed by the outbreak of hostilities in Ukraine in February 2022. In response, Europe immediately imposed sanctions on some Russian fossil fuel imports, amongst other measures. In May 2022 the European Commission presented its formal energy-related response to the conflict, the REPowerEU Plan.

REPowerEU is the EU's 'response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine'. It is based on three pillars. First, energy savings. Measures include raising the Fit for 55 energy efficiency target from 9% to 13%, as well as behavioural changes to reduce energy wastage. Second, diversifying supplies, for example through the establishment of partnerships to import fossil gas from other markets. Third, an acceleration of clean energy. The renewable energy goal has risen from the Fit for 55 target

1. *Consilium Europa – The EU's plan for a green transition. 2021. https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/*

of 40% to 45% by 2030. Further, measures have been adopted that will facilitate the permitting and acceleration of large-scale renewables buildout as well as rooftop PV, heat pumps, renewable hydrogen, and biomethane. [2]

At the same time, further progress was made on the Fit for 55 package. The Parliament's position on CBAM was adopted with 450 votes in support, 115 against, and 55 abstentions.[3] The Council adopted its position on CBAM while France held the presidency (January-June 2022). Emmanuel Macron had defined CBAM as one of the early priorities when France took over the helm. [4]

The next step in the EU process for CBAM (and Fit for 55 at large) will be for Parliament and Council to reach an agreement between their respective positions – the so-called interinstitutional negotiations. CBAM will then need to be adopted in the two institutions and passed into law. Both Parliament and Council have backed and even extended the Commission's proposals. Accordingly, it is likely that CBAM will be passed into law by 2024.

## What are the details on CBAM?

As yet, there is no detailed outline of how CBAM will look, because the EU's legislative process is ongoing. Nevertheless, Parliament and Council seem to agree with the majority of the proposal published by the Commission in July 2021. Therefore, the Commission proposal provides a helpful guide when trying to determine the implications of CBAM.

The scope of CBAM would initially be limited. It would apply only to five categories of goods: aluminium, fertilisers, electricity, cement, and iron and steel. In terms of geographic scope, it would cover goods originating from all countries and territories outside the EU customs union. The proposal also leaves room for bilateral agreements and linked carbon prices. So, exemptions could possibly be granted to countries with strong climate commitments.

The Commission proposal foresees that only direct emissions would be covered, at least initially. These are defined as 'emissions from the production processes of goods over which the producer has direct control'. In a steel mill, for example, blast furnace emissions would be covered, while emissions from electricity used at the plant but sourced from the grid would not. However, the proposal gives leeway for the Commission to determine relevant calculation factors such as 'system boundaries of production processes, [or] emission factors' at a later stage.[5] The proposal envisions the inclusion of indirect emissions some time in the future, although stakeholders such as the European Parliament, think tanks and NGOs maintain there would be strong advantages in including indirect emissions from the start. [6]

The fact that carbon border adjustment is a new policy tool means CBAM might be operationally and administratively complex, at least at the outset. In the EU, each Member State would need to designate a competent authority to administer CBAM certificates, authorise declarants (authorised importers), and impose penalties. CBAM certificates would be based on the average weekly ETS price. In exporting countries, operators of installations (for example, an aluminium smelter in China)

2. *European Commission – REPowerEU Press Release. 2022. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131*
3. *European Parliament – Legislative train 06. 2022. https://www.europarl.europa.eu/legislative-train/carriage/carbon-border-adjustment-mechanism/report?sid=6001*
4. *Council of the EU – Press Release Fit for 55. 2022. https://www.consilium.europa.eu/en/press/press-releases/2022/06/29/fit-for-55-council-reaches-general-approaches-relating-to-emissions-reductions-and-removals-and-their-social-impacts/*
5. *European Commission – Proposal for a regulation of the European Parliament and the Council establishing a carbon border adjustment mechanism. 2021. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0564&from=EN*
6. *European Roundtable on Climate Change and Sustainable Transition – Border Carbon Adjustment in the EU. 2022..https://ercst.org/indirect-emissions-in-the-eu-cbam-2022/*

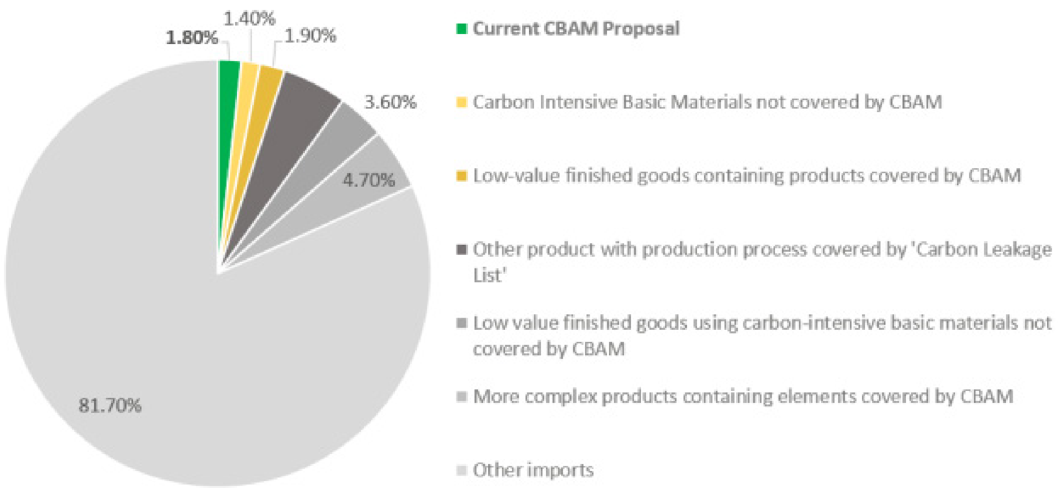
would calculate and report embedded emissions. Where actual emissions could not be verified, default values – based on average emissions intensities – would be used. The operator would be verified by an accredited national body in the third country. At the border, declarants would provide CBAM certificates equal to embedded emissions in their imports on a yearly basis. Customs authorities would prevent imports from non-authorised declarants.

A transitional period would apply from 2023-25, during which the importer would be obliged to report embedded emissions in the form of quarterly reports. The EU-based importer could be penalised for insufficient or incorrect reporting. However, during the transitional period 2025-35, free allocation of ETS allowances to EU-based emitters will be phased out gradually (10% per year). As the free allocation will be deducted from the CBAM fee, this effectively means that the importer will pay the full price only after 2035.

During the transitional period, the European Commission plans to present a report on extending the scope of CBAM. It would assess a possible extension to include indirect emissions and 'embedded emissions of transportation [and] goods further down the value chain' as well as other categories of goods and services[7]. Furthermore, the Commission proposal contains several references to so-called Delegated Acts and Implementing Acts. This means that there is plenty of scope for the Commission to further shape and interpret its original proposal once it is operational.

## CBAM implications in China

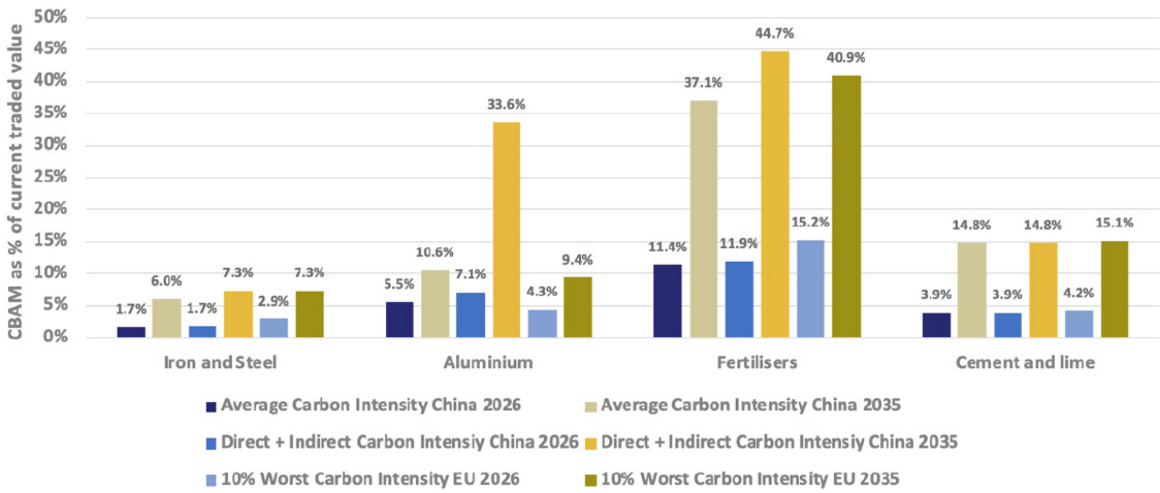
The EU and China are strong trade partners. In 2021, the EU imported goods from China worth close to EUR 500 billion – that is 22.4 % of the EU's total imports – making China by far the bloc's largest importer[8]. More than 90% of China's exports to the EU are machinery and manufactured goods (e.g. telecommunication equipment, data processing machines, and electrical apparatuses). These are unlikely to be covered by CBAM. In fact, the July 2021 proposal, if implemented, would cover less




*Amount of Chinese exports to Europe covered by CBAM (according to 2019 figures)*

*Source: Sandbag, E3G, and Energy Foundation (2021): A Storm in a teacup Link*

7. *European Commission – Proposal for a regulation of the European Parliament and the Council establishing a carbon border adjustment mechanism. 2021. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0564&from=EN*
8. *Eurostat – EU-China international trade in goods statistics. 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=China-EU_-_international_trade_in_goods_statistics#EU_and_China_in_world_trade_in_goods*




*Estimate of CBAM fees charged in 2026 and 2035*

*Source: Sandbag, E3G, and Energy Foundation (2021): A Storm in a teacup Link*

than 2% of China's total exports to the EU[9] (see graph). Therefore, the immediate impact of CBAM on China's exports will be limited.

The fees that importers of Chinese goods would have to pay depends on a few factors, including the emissions intensity of the product, the EU ETS price, and to what extent free allowances would be deducted (rising from 10% in 2026 to 100% by 2035). Climate thinktanks Sandbag, E3G and Energy Foundation[10] have taken the Commission proposal as their starting point, using China's average carbon intensity and an ETS price of EUR 60 per ton, to calculate the impact of CBAM. They found that CBAM fees in the year 2026 would range from 1.7% of the total traded value for iron and steel, around 5% for aluminium and cement, and over 11% for fertilisers. In the year 2035, the figure for iron and steel would be around 6%, for aluminium and cement around 12%, and for fertilisers, 37%. According to the authors, 'for import volumes equal to those recorded in 2019, the total CBAM payable for imports of Chinese goods in 2026 would be EUR 174 million, increasing to EUR 485 million in 2035 when free allocation is reduced to zero'.

Looking at fees alone does not give the full picture, because the net CBAM cost will be lower. In the words of Sandbag 'as free allowances are phased down, the full carbon costs will be transferred to EU producers, who will then aim to pass those costs through to consumers'. Accordingly, CBAM net costs in 2035 (when free allowances are fully phased out) would be EUR 209 million (43% of total fees). Overall, the effective cost of CBAM as a share of total EU-China trade volumes is very low.

## A green business opportunity

CBAM offers opportunities to Chinese producers in the five sectors affected. Operators of installations in China would have two options to report the emissions embedded in their goods. The first would be to rely on default values, which will likely be set on the average emissions intensity of an exporting country and for each good, increased by a mark-up to be determined by the European Commission at a later stage. The second option would be to quantify and report

*9. Sandbag, E3G, Energy Foundation – A storm in a teacup. 2021. https://9tj4025ol53byww26jdkao0x-wpengine.netdna-ssl.com/wp-content/uploads/E3G-Sandbag-CBAM-Paper-Eng.pdf*
*10. Ibid*

the actual emissions embedded in the goods they produce. Given that default values are based on averages plus a mark-up, they will often be higher than actual emissions. Moreover, both mark-up and calculation methodology are yet to be determined, leading to uncertainty risks for businesses that plan to rely on default values.

According to Byford Tsang, Senior Policy Advisor at E3G and co-author of the Storm in a Teacup report[11], quantifying and accurately measuring emissions will enable producers to reduce their exposure to CBAM. In addition, becoming better at measuring and understanding the emissions at a production site would be helpful for compliance with China's national emission trading system (as well as regional pilots). This will become especially relevant once these apply to more sectors and carbon prices go up.

Measures to reduce emissions are also important to reduce CBAM fees. Producers who have already, or plan to, apply advanced energy efficiency measures, or use new green technologies or circular economy concepts, will have substantially lower carbon intensities than peers that rely on fossil fuels and energy intensive equipment. Companies that quantify and reduce emissions will reduce the costs for CBAM fees, the resources needed for reporting and compliance, and the regulatory risk associated with uncertainties surrounding CBAM's implementation. As a result, companies that actively measure and reduce their carbon emissions will benefit from a competitive advantage.

*11. Ibid*

## Steel case study

The steel sector is the second largest emissions emitter in China, accounting for roughly 17% of total emissions, second only to power generation. Over 60% of global emissions from steel come from China, which is by far the world's largest producer. In 2021, China's government released a draft paper stating the Chinese steel sector would 'reach its carbon peak as early as 2025'. However, in early 2022, the final guidelines pushed the date for peaking back to 2030.[12]

Still, China harbours ambitious plans to decarbonise steel. Several Chinese producers have committed to be carbon neutral by 2050, including Baowu Steel, HBIS and Baotou Steel – which together account for over 15% of the country's total production. In May 2021, the China Steel Association launched the China Steel Environmental Product Declaration platform for iron and steel in order to better understand and manage the full-lifecycle carbon footprint. [13]

There are two pathways for decarbonisation of steel production. One focuses on the currently predominant production method: blast furnaces (BF) and basic oxygen furnaces (BOF), where steel is made from iron ore using coal as a reductant. Energy efficiency, biomass, or carbon capture can be applied, but full decarbonisation will not be easy to achieve. The other option is the electric arc furnace (EAF) route, which uses scrap steel or direct reduced iron (DRI) (which can be produced with hydrogen) as the main raw material.[14] If powered and electrolysed by 100% renewables, 'the H2-DRI approach has the potential to drive carbon emissions down to near zero.'[15]

CBAM fees are lower for steel producers using less carbon-intensive technologies. About 1.8 tons of $CO_2$ are emitted for every ton of steel produced through the BF/BOF route in China. If BFs are particularly energy and material efficient, carbon intensities could be around 1.4-1.7 tons of $CO_2$, and even lower if other mitigation technologies such as biomass or carbon capture

*12. Tsang B, Schäpe B - China's crucial role in decarbonising the global steel sector. 2022..https://chinadialogue.net/en/climate/opinion-chinas-crucial-role-in-decarbonising-the-global-steel-sector/*
*13. China Iron and Steel Association – EPD Programme press release. 2022. https://www.cisa-epd.com/news/newsDetailsPage?id=37*
*14. McKinsey & Company - Decarbonization challenge for steel. 2020. https://www.mckinsey.com/industries/metals-and-mining/our-insights/decarbonization-challenge-for-steel*
*15. Greening Steel Industry: the way forward. EU China Energy Magazine, May 2022.*

was used. The figure for EAF is around 0.5 tons of $CO_2$. However, as explained above, renewables-powered EAF using scrap steel or H2-DRI can achieve carbon intensities close to zero. [16 &17] Looking into current commodity prices, we can assume a price of roughly EUR 700 per ton of exported Chinese steel (both flat and long products). For carbon, we can assume an ETS price of EUR 85 per ton, which reflects the average price since April 2022.

Using the above carbon intensities and commodity prices, we can calculate that the CBAM fee per ton of BF steel could be around EUR 150, which is roughly 20% of the price at which one ton of Chinese-exported steel currently trades

16. *Hasanbeigi et al - Comparison of carbon dioxide emissions intensity of steel production in China, Germany, Mexico, and the United States. 2016. https://doi.org/10.1016/j.resconrec.2016.06.008*
17. *Koolen D, Vidovic D - Greenhouse gas intensities of the EU steel industry and its trading partners. 2022..https://publications.jrc.ec.europa.eu/repository/handle/JRC129297 *Comparison of methology from Hasanbeigi et al with Commission CBAM proposal*

in global commodity markets. High-intensity EAF and low-intensity BF might incur fees in the range of EUR 60-120, while there would be no CBAM fee imposed on renewables-based EAF. However, the boundary definitions of the above carbon intensities include activities such as coke making, pelletising, casting, hot rolling, processing and electricity use which involve indirect emissions. Thus, the emissions coverage is likely broader than the coverage defined by CBAM. If we assume a more limited coverage*, we can expect CBAM fees of roughly EUR 100 for BF, EUR 40-80 for BFs using energy efficiency and other forms of mitigation, and EUR 0 for all forms of EAF.

As described above, cost increases are expected to largely trickle down to the consumer level. Accordingly, part of the fees paid will be recuperated. Technologies with low carbon intensities would pay a substantially lower CBAM fee but could still benefit from raised prices. Sandbag, E3G, and Energy Foundation have compared CBAM fees and additional revenues from price increases. They estimate a price increase of EUR 82 per ton of steel by 2035 (once CBAM is fully implemented). According to their calculations, an average Chinese BF/BOF would pay CBAM fees of EUR 126 per ton of steel, therefore facing an effective loss of EUR 44 per ton. However, the relatively less polluting DRI pays an estimated CBAM fee of EUR 66 and would therefore be able to monetise EUR 16 of the price increase. Zero-emissions steel technologies, which wouldn't pay CBAM fees, could even pocket the total price increase of EUR 82.[18]

So, one opportunity for low carbon technologies is to capitalise on higher prices and pay either lower or zero CBAM fees. In addition, more sustainable producers can benefit from strategic competitive advantages. Given that both Europe and China have committed to reach net zero, the market for carbon-intensive steel will decline sharply. Therefore, companies which place an early focus on lower carbon technologies will set themselves on the path towards becoming the leaders of tomorrow's net-zero steel world.

18. *Sandbag, E3G, Energy Foundation – A storm in a teacup. 2021. https://9tj4025ol53byww26jdkao0x-wpengine.netdna-ssl.com/wp-content/uploads/E3G-Sandbag-CBAM-Paper-Eng.pdf*

## Invest in low carbon technologies now to reap dividends later


In July 2022, the European Parliament, the Council of the EU and the European Commission came together for initial talks on CBAM. Paolo Gentiloni, the European Commissioner for Economy, said there was a ‘broad convergence of views [hoping that the three EU institutions would reach an agreement] before the end of this year in order to start applying CBAM from early 2023’. [19]


While this suggests that Chinese exporters may soon be indirectly exposed to a fairly high carbon price, the number of sectors affected will be very small. Moreover, the initial obligation will only be to report emissions, with no payment of fees. Nevertheless, Chinese exporters will need to keep a sharp eye on developments, as the EU has given itself latitude to adjust and extend the CBAM once it has become operational.


That means companies investing in emissions reductions now are likely to reap dividends in the future. Producers that demonstrate their use of low-carbon technologies during the reporting-only phase will be well-positioned to benefit from lower (or zero) CBAM fees and increased prices once the scheme is fully implemented.

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*ECECP Junior Postgraduate Fellow*

*19. Politico Pro – Morning Energy and Climate Newsletter. 2022. https://pro.politico.eu/news/152025*

From academia to industry:

# Thoughts on the status quo of the new power system construction

It is mid-summer and the demand for electricity is peaking once again. According to monitoring data from the State Grid Corporation of China (SGCC), the electricity load in Shandong, Henan, Shaanxi and Xinjiang hit a record high on 24-26 June after consecutive days of scorching heat. Since June, the electricity load of seven provincial-level grids in Hebei, Shandong, Henan, Shaanxi, Gansu, Ningxia and Xinjiang, as well as the grid of northwestern China, have set a new record[1]. As the hot weather continues and more places lift Covid-induced restrictions and resume work and production, the grid in many parts of China will face greater pressure from the tight supply-demand balance.

On the one hand, energy security and supply have become the dominant theme in the development of the power industry since September 2021, when over 20 Chinese provincial regions resorted to power rationing. Now, in the wake of the Russia-Ukraine conflict and soaring energy prices worldwide, China is prioritising expansion of the power supply and stabilisation of energy prices, and has vowed to 'resolutely prevent power rationing' from happening again.[2] On the other hand, China remains committed to the national strategy of peaking $CO_2$ emissions by 2030 and achieving carbon neutrality by 2060 (commonly known as 'the carbon peaking and carbon neutrality goals'). At the 36th group study session of the Politburo of the 19th CPC Central Committee in January 2022, Chinese President Xi Jinping noted that 'the carbon peaking and carbon neutrality goals were not something imposed on us, but what we believed we must accomplish, for peaking carbon emissions and achieving carbon neutrality is imperative for China in this new stage of development to adapt to technological advancement and promote the structural transformation and upgrading of the Chinese economy'.[3]

1. *CCTV News. 'Due to continuous high temperature, many power grids see significant increase in load.' 2022-06-28. http://news.cnr.cn/native/gd/20220628/t20220628_525886495.shtml*
2. *www.gov.cn. 'Li Keqiang on an inspection trip to Yunnan: Make concerted efforts to increase support for market players in need and ensure employment and meet people's basic needs.' 2022-05-19.http://www.gov.cn/xinwen/2022-05/19/content_5691349.htm*
3. *People.com.cn. 'Xi Jinping: The carbon peaking and carbon neutrality goals are not something imposed on us, but what we believe we must accomplished.' 2022-05-23. http://politics.people.com.cn/n1/2022/0523/c1001-32428031.html*

In addition to rolling out effective measures to guarantee power supply in the short term, China's energy and electricity-related authorities need to figure out how to balance the need for short-term power supplies with the requirement for low-carbon transition and development in the medium and long term. They need to build a solid foundation for long-term power safety and security, and create a new power system in a more stable, rapid and scientific manner.

The twin targets of building a new power system and achieving peak carbon emissions and carbon neutrality serve the same higher purpose and have the potential to harmonise with each other. Systematic thinking is required to understand and solve the power supply problem, rather than criticism of or reliance on a particular power source. Meanwhile, the 'Plan for Building a Modern Energy System during the 14th Five-Year Plan Period' (hereinafter the Plan) makes it clear that the period 2021-25 is a critical window for laying the foundations for realising the carbon peaking and carbon neutrality goals.[4] It urges China to

4. *Notice of the National Development and Reform Commission and the National Energy Administration on Printing and Distributing the Plan for Building a Modern Energy System during the 14th Five-Year Plan Period. 2022-03-22, https://www.ndrc.gov.cn/xxgk/zcfb/ghwb/202203/t20220322_1320016.html?code=&state=123*

persist in vigorously developing a diverse mix of green flexible resources, effectively improving the flexibility of power systems, and laying the foundations for a new power system that can gradually incorporate an increasing proportion of new energy.

## Leveraging both renewable energy and coal-fired power and applying systematic thinking to ensure supply

The highly-anticipated Plan was issued in March this year. Unlike previous five-year energy plans, it spells out the logic guiding the development of China's energy and power system in the new era, placing an emphasis on 'modernisation' and systematic thinking.

The reference to systematic thinking signals that China's energy and power system is intended to shift from a single-energy (coal-fired power) system to a multi-energy one 'that can adapt to large-scale and high-proportion new energy, and values the integration of source, grid, load and storage'. To this end, the Plan proposes a demand-side response target, and for the first time sets a specific power system flexibility target. It also specifies a new positioning for coal-fired power, suggesting that it should shift from being the main power source to being a basic and system-modulating power source that provides reliable capacity, peak load and frequency modulation and other auxiliary services.

High-quality development of renewable energy and the repositioning of coal power are both key to the future development of China's power systems: both are set to contribute to and benefit from a new generation of safe and stable power systems.

A changed mindset, and rapid institutional reform, will be needed in order to accelerate the development of renewable energy. Renewable energy will be the main power source of the new power system, and will see a gradual increase in its share of installed capacity and electricity amount. According to a study conducted by SGCC, renewable energy was scaled up during the 13th Five-Year Plan period (2016-2020) and is now ready to transition to a new stage where sustainability, safety and efficiency of the entire power system should be taken into consideration.[5]

For high-quality development of low-carbon, green renewable energy, we should first recognise its key role in peaking carbon emissions and achieving carbon neutrality in the power industry. China needs to accelerate the development of renewable energy, so as to better meet the growing demand for electricity and facilitate the 'decoupling' of socio-economic development and carbon emissions.

Secondly, we need to acknowledge the complex technical and non-technical challenges that variable renewable energy brings to China's current power system, and actively deploy solutions for scenarios with large shares of renewable energy.

According to research by SGERI, renewable energy is about to enter an era of grid parity, but for end-users, cost parity includes not only the cost of power generation, but also that of transmission and distribution, as well as the rising costs of system safety. In terms of system safety, if renewable increases its share in the energy mix, it could lead to a system that is more vulnerable to variations in supply, and where the grid cannot be adequately regulated. Such issues need to be resolved.[6]

Therefore, to build a safe, efficient and low-carbon power system, China needs in advance to develop technologies, business models, market systems and mechanisms suitable for a power system

5. *Chen Guoping, Dong Yu, Liang Zhifeng. 'Analysis of and Thinking on High-quality Development of New Energy with Chinese Characteristics in Energy Transition.' Proceedings of the CSEE. 2020, 40 (17): 5493 – 5506*
6. *Huang Bibin, Zhang Yunzhou & Wang Caixia.(2020). 'Study on New Energy Development in the 14th Five-Year Plan Period in China and Problems Worth Attention.' Electric Power. 53 (1).*

with large shares of renewable energy, systematically reduce the utilisation cost and promote the integration of renewable energy.

Meanwhile, there is still a lack of policy and financial support for the transition of coal power plants. The existing operating rules, systems and mechanisms of China's electric power system are all grounded in a reality where coal power is the main energy source. If coal power is to be repositioned as a basic and system-regulating power source, these systems need to be reformed.

According to a study conducted by the School of Environment and Natural Resources of Renmin University of China, there are several technological and policy options for the transition and high-quality development of existing coal power plants, but to a varying degree each faces hurdles on the ground. Given the size of China's existing installed coal power capacity, decommissioning ahead of schedule may result in a loss of coal power assets worth trillions of yuan. If installed coal-fired capacity continues to expand, the potential loss will also increase. Meanwhile, without a mature auxiliary service market, no one is likely to pay for the flexibility value of coal power plants.[7] Another research paper by the Institute of Climate Change and Sustainable Development of Tsinghua University (ICCSD) and the Tsinghua-BP Clean Energy Research and Education Center (THCEC) finds that the development of carbon capture and storage (CCS) is greatly affected by the slowing cost reduction, while the potential for bioenergy with carbon capture and storage (BECCS) could be hampered by the limited availability of biomass resources.[8]

An opinion piece from Professor Yuan Jiahai of North China Electric Power University also stresses that 'the high-quality transition of coal power plants needs systematic institutionalised efforts'.[9]
He believes that the current temporary funding and short-term pricing policy support are not enough to sustain the transition of the coal power industry. His op-ed calls for the establishment of a power market mechanism and the electricity pricing policy as soon as possible, including a capacity cost recovery mechanism and a sound market mechanism for auxiliary services, to support the re-positioning of the coal power industry using market-oriented and systematic methods.

Any new development should be repeatedly tested and piloted before it is delivered on the ground and promoted at a larger scale. Like the reform of operating rules, mechanisms and systems, determination of the technical path for the power system cannot be rushed, but needs piloting and rigorous logic. This requires policy makers and enforcers to give plenty of notice of new arrangements, to move faster to launch pilot projects and institutional reform and build various power markets, and to produce market-oriented

7. *Zhang Xiaoli, Cui Xueqin, Wang Ke, et al. 'Carbon Emissions Lock-up and Its Impact on Emissions Reduction Targets in China.' China Population, Resources and Environment. 2020, 20 (8): 31-41*
8. *Li Zheng, Chen Siyuan, Dong Wenjuan, et al. 'Research on Low-carbon Transition Path of the Electric Power Industry under Carbon Constraint.' Proceedings of the CSEE. 2021, 41 (12): 3987-4001*
9. *Yuan Jiahai. 'High-quality Transition of Coal Power Plants Needs Systematic Institutionalized Efforts.' 2022-06-09. https://article.xuexi.cn/articles/index.html?art_id=17368620049304533716&item_id=17368620049304533716&study_style_id=feeds_opaque&t=1654670587961&showmenu=false&ref_read_id=3a97918f-cd9e-49a6-a557-9b51af1166de_1655265669242&pid=&ptype=-1&source=share&share_to=wx_feed*

and systematic solutions as soon as possible, in order to promote the high-quality development of renewable energy and the repositioning of coal power.

## Developing a diverse mix of low-carbon flexible resources is the long-term solution

Besides promoting the high-quality development of renewable energy and coal power, in order to build a safe, efficient and low-carbon new power system and adapt to a future power system with large shares of renewable energy, academics and business insiders generally agree that improved system flexibility is one of the keys to the development of China's power system.

According to an industry-specific research paper by Sealand Securities, insufficient peaking capacity is now the main factor limiting the integration of electricity generated from renewables. Based on analysis of statistical data provided by the Northwest China Energy Regulatory Bureau of National Energy Administration (NEA) on the reasons for wind and solar energy curtailment in major provincial regions, the paper finds that compared with 2015, when limited transmission capacity was the main factor, in 2020 insufficient peaking capacity caused a much higher share of curtailment, with the figure exceeding 90% in Ningxia, Qinghai, and Xinjiang.[10]

By the end of 2020, the proportion of flexible power sources in China reached 18.5%,[11] according to China Energy News, well on the way to the goal set in the Plan of 24% by 2025.

In China, it is often the case that a target announced in a policy document is exceeded in practice. As of May 2022, the installed capacity of China's renewable energy had exceeded 1.1 billion kilowatts, while that of new energy sources such as wind power, PV power and biomass power, excluding conventional hydropower and pumped storage, had exceeded 700 million kilowatts.[12] Taking into account the targets for installed renewable capacity set by many subnational and provincial governments for the 14th Five-Year Plan period, many experts predict that the Chinese government's aim to raise wind and solar installed capacity to over 1.2 billion kilowatts by 2030 is likely to be reached ahead of schedule, or even by the end of 2025. This means that the flexibility of the power system needs to improved faster.

Both academics and business insiders agree that a multi-pronged approach should integrate source, grid, load and storage. According to Professor Yuan Jiahai and Zhang Kai, in the near to medium term, current plans for development of energy storage and demand response are insufficient to support a power system with large shares of renewable energy. The conversion of coal power plants to allow more operational flexibility could provide the necessary stability to the power system during the transition period of 2021-2030 as it moves toward decarbonisation.[13] The NEA proposes vigorously promoting the retrofitting of coal power plants for energy-saving and low emission, for peak-shaving and for cogeneration(heating) over the next five years. By the end of 2022, it envisages that more than 220 million kilowatts of coal-fired power capacity will have been retrofitted.[14]

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*10. Sealand Securities. Energy Storage Report Series I: Space for China's Electrochemical Energy Storage Demand from the Perspective of Peak and Frequency Modulation. 2022-01-21. https://pdf.dfcfw.com/pdf/H3_AP202201241542283345_1.pdf?1643018429000.pdf*

*11. China Energy News. 'Increase 3 times in 5 years: how to achieve the target share of flexible power sources?' 2022-04-14. https://mp.weixin.qq.com/s/Fd5WINwbSH1hhvq-NeIXzg*

*12. NEA. China's total installed capacity of renewable energy has exceeded 1.1 billion kilowatts. 2022-06-24. http://www.nea.gov.cn/2022-06/24/c_1310631956.htm*

*13. Yuan Jiahai, Zhang Kai. 'Research on the Exit Path of Conventional Coal-fired Power Plants in New-type Power Systems under the Carbon Neutrality Goal.' Energy of China. 2021, 43 (6): 19-26.*

*14. National Energy Administration. 'National meeting on promoting best practices and technologies for coal power plant transition in three aspects held in Beijing.' 2022-04-25. http://www.nea.gov.cn/2022-04/25/c_1310572753.htm*

It should be noted, however, that increasing the flexibility of the coal power plants alone is not enough to meet all the flexibility or responsiveness demands of the future new power systems. The above-mentioned research by the ICCSD and THCEC finds that when the share of variable renewable energy is relatively small, the power system can effectively accommodate it simply by means of deploying retrofitted coal-fired units and interregional grid connectivity, but as the share continues to rise, a large number of energy storage facilities will need to be built in order to solve the system flexibility problem. In the study, analysis of multiple scenarios shows that when variable renewable energy reaches around 30% of generating capacity, it will be at a critical point for large-scale application of energy storage technology. This is likely to occur around 2030-35, according to the research group.[15]

## Policy recommendations

Energy policy makers need to seize the window of the 14th Five-Year Plan period to lay the foundations for a new power system that is aligned with China's carbon peaking and carbon neutrality goals.

During 2021-25, China should move fast to develop a diverse mix of low-carbon flexible resources and promote the high-quality development of renewable energy to meet the growing demand for electricity. Priority also needs to be given to establishment of power market mechanisms and various institutional reforms, so as to lay a good foundation for a new power system that can accommodate a growing share of renewable energy.

The authorities responsible for energy oversight must remain on their guard against the conventional coal-dependent mindset, and solve the power supply problem in a systematic and holistic way. While building and improving relevant mechanisms such as the auxiliary service market and the capacity market, China needs different implementation paths and mechanisms for the transition of coal power plants at different levels and of different types as soon as possible so that coal power can be repositioned within the power system.

**Wenwen XIE**

*Greenpeace Climate & Energy Campaigner*

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15. *Li Zheng, Chen Siyuan, Dong Wenjuan, et al. 'Research on Low-carbon Transition Path of the Electric Power Industry under Carbon Constraint.' Proceedings of the CSEE. 2021, 41 (12):3987-4001*

# Rebooting China's carbon credits:

## What will 2022 bring?

*The return of carbon credit trading is eagerly awaited, but there are several challenges ahead*

Carbon market players are watching closely to see how China's version of carbon credits, the China Certified Emission Reductions (CCER) scheme, will be rebooted.

Like carbon allowances, carbon credits are a tradeable item. They are essential for the operation of carbon markets and carbon pricing because they make profit possible via buying and selling.

China's national carbon market opened in July last year, and the first implementation period for allowance trading is already complete. However, market players eager to see the CCER scheme up and running again are still waiting.

This article looks at the scheme's history and explores some of the opportunities and challenges linked to bringing it back.

## Why China set up its domestic carbon credit market

China's targets to peak emissions before 2030 and reach net zero before 2060 have brought the attention of more Chinese people to carbon markets and the profit-making opportunities they provide. While the national carbon market is new, many don't realise that China has already been running such trading platforms for over 10 years. The country started issuing CCERs in 2012 before suddenly halting them in 2017.

CCERs are China's version of the Kyoto Protocol's Certified Emission Reduction or CER – a carbon credit that can be traded under the protocol's Clean Development Mechanism. A typical carbon market is made up of trading in both carbon allowances and carbon credits. Allowances, also known as quotas, limit the emissions a company can make: what the company does not use of these allowances, it can sell. Meanwhile, credits are earned by a broader range of economic actors for reducing emissions. Activities to reduce emissions can be profitable because credits can be sold on carbon markets.

In 1997, the Kyoto Protocol established the first three international carbon-trading mechanisms: Joint Implementation (JI) projects, Emissions Trading (ET) and the Clean Development Mechanism (CDM). Following on from the CDM, several parallel carbon credit standards appeared, including the Voluntary Carbon Standard (now called the Verified Carbon Standard) and the Gold Standard, each corresponding to different trading systems. These competed globally. In 2009, China's Beijing Environment Exchange proposed the Panda Standard at the Copenhagen climate talks.

China's first experience of carbon trading was under the CDM, which saw developing nations sell carbon emission credits to the developed world. The first of China's CDM projects was the Huitengxile wind farm in Inner Mongolia, registered in June 2005. But since June 2017, when the Beijing Haidian Beibu gas-fired cogeneration project was registered, China has seen no new CDM projects.

Development and trading of CDM projects in China peaked between 2007 and 2009, with a top price of 30 euros per tonne of carbon. In comparison, trading on China's regional trial carbon markets was at around 20 yuan a tonne, while the price on the new national market has held steady at about 50 yuan a tonne. Good carbon prices caused a boom in CDM projects, with 1,478 Chinese projects registered from June 2005 to June 2017, producing 900 million tonnes of carbon assets and trading worth hundreds of millions of dollars. Figures from the World Bank show that over 18,000 carbon credit projects were registered between 2002 and 2020, covering 4.3 billion tonnes of carbon. Half of those were under the CDM system, the remainder under other international standards.

One of the reasons for the drop in CDM projects was that in 2009 China announced its own climate action targets for the first time. These required domestic emissions reduction mechanisms and marked the start of a domestic market in carbon credits. In 2012, the National Development and Reform Commission (NDRC) set up the framework for CCER markets, issuing documents on project certification and trading in greenhouse gas reductions.

## The missing piece in the carbon market

In 2013, and to great fanfare, China launched seven regional carbon market trials, with each trying different approaches. As CCERs could be offset against carbon allowances or traded on the market, corporate groups with renewable energy interests set up carbon asset firms. There was a wave of innovation in low-carbon business ideas. One example was ‘carbon sink fisheries’ – the theory that commercial marine aquaculture of kelp, shellfish and even fish can create viable carbon sinks – of which several trials were soon up and running.

Between 2012 and 2017, the carbon price on regional exchanges ranged from 10 to 40 yuan a tonne, with most at around 20 yuan. CCER prices were linked with allowance prices. But the regional markets couldn’t play a full role in price discovery because they were fragmented and had small trading volumes, so the carbon price remained low. As the number of CCER projects grew, unhealthy competition on price became a problem. In March 2017, the NDRC announced that due to low trading levels and irregularities in some projects, no new CCER projects would be approved, although existing projects would continue to trade.

According to data from Refinitiv Carbon Research, the State Council approved 80 million tonnes worth of CCERs between 2012 and 2017, but only 32 million tonnes were sold. The glut kept carbon prices low, industry lost interest, and the oversupply of carbon assets got worse.

But credits are essential for a complete carbon market. To stimulate emissions cuts and help China achieve its dual carbon targets, more market actors need to get involved, not just those receiving carbon allowances. But they will only do so if there is profit to be made, hence the need for carbon credits such as CCERs, which they can sell. So, everyone is watching for when and how the CCER scheme may restart.

## Getting ready for the reboot

In 2018, responsibility for combatting climate change shifted from the NDRC to the Ministry of Ecology and Environment (MEE). In February this year, reports appeared that the MEE was expected to support the city of Beijing in setting up a national CCER market. Work to develop a CCER trading system

is almost complete and industry rumour was that it would start operating in the first half of 2022. Allowances for China's 2021 national carbon market were not in short supply, but there was still an appetite for CCERs. By early 2022, CCERs were trading at about 45 yuan a tonne. But in the spot market, CCERs were in short supply, and negotiations focused on carbon futures for the year after CCER restarted. This indicates strong demand for CCERs, but little supply.

Under current rules, CCERs can cover up to 5% of compliance obligations. During the first implementation period of the national carbon market, firms covered by the rules used 33 million tonnes worth of CCERs in this way, more than the total for 2012–2017. According to the Refinitiv data mentioned above, there were around 40 million

A power plant in Huaian, Jiangsu province (Image: Dongxu Fang / Alamy) tonnes of CCERs on the market when approvals were halted in 2017, but the bulk of those have now been used.

In the almost 11 months since the national market started, policymakers have borne in mind lessons learned from over-supply and made adjustments to avoid this happening again.

Globally, the sectors earning carbon credits are usually forestry, agriculture, carbon capture and storage, energy efficiency, fuel transitions, fugitive emissions, industrial gases, manufacturing, renewable energy, and transportation, with forestry being the most common.

In September 2021, the General Office of the Chinese Communist Party and the General Office of the State Council issued a document on reforms to ecological compensation mechanisms, shrinking the range of CCER projects to three core areas: forestry, renewable energy and methane utilisation. That document has had a far-reaching impact on the market's expectations for CCERs and investment choices. It signals that policymakers want to see high-quality CCER projects and avoid another over-supply. These areas are also key concerns for China as it moves toward its dual carbon targets: renewable energy is the foundation of a new electricity system; forestry is the most typical carbon sink, and China has targets on forest stock to meet; while methane utilisation will be necessary for China's vast agricultural sector and to help the natural gas industry move in a greener direction.

Meanwhile, the status of CCERs as multi-purpose financial assets has been strengthened. In July 2021, the People's Bank of China's standard for environmental equity financing tools (JR/T 0228-2021) came into force, backing the market trading of CCERs and other environmental assets. And on 12 April this year, the China Securities Regulatory Commission issued JR/T 0244-2022 on carbon financial products, setting out implementation processes for typical carbon finance products. Carbon credits are more financial in nature when compared with carbon allowances and can support the development and circulation of more derivative products. A more active carbon financial market, with a wider range of products, will attract more capital and positive feedback into the primary carbon emissions market. Those newly issued standards are part of the financial sector's preparations for the return of the CCER scheme.

## Challenges ahead

Preparations may seem complete, but some challenges have worsened over the last five years.

First, there have been significant changes in the renewables sector, a major part of the CCER scheme. Current CCER methodology requires projects to prove 'additionality' in their emissions reduction: the project should not be profitable or would not obtain financing without the sale of carbon credits. But in 2021, subsidies for sales of renewable energy in China were ended. In other words, the sector is now, in general, profitable. That leaves a question mark over the additionality of its emissions reductions. Ordinary renewable energy projects will therefore not necessarily qualify as CCER-suitable, meaning the CCERs which could potentially be provided by large numbers of proposed renewable projects may not materialise. With CCER status restricted to projects in the renewables, forestry and methane sectors, we may see shortages as the market expands.

Fortunately, in February, the city of Shanghai reduced the default emission factor – the coefficient for calculating emissions when real-time monitoring is not possible – for purchased electricity and heat, while in March the MEE reduced the emission factor for the national grid. Those changes reflect reduced emissions in the energy system as a whole. If mechanisms for dynamic adjustments to emissions factors can be implemented, demand for CCERs will hold steady, reducing concerns about supply and demand problems.

Another issue is the quality of reported emissions data. In 2021, Inner Mongolia's environmental authorities exposed a typical case of fraudulent reporting. And in early 2022, the MEE reported on another four cases. It is rare for a light to be shined on the third-party service providers calculating and reporting on emissions in this way. Some of those firms will massage data for their customers' benefit. The problem is linked to fierce price competition for carbon-consulting businesses. In response, the MEE has called for a crackdown, launching an initiative to oversee and improve the quality of carbon emissions reporting in the power sector, with working groups spending ten days or more inspecting each of 264 power firms across ten key cities. The fact that a central government ministry felt the need to intervene directly at the corporate level indicates how serious the problem is. Work to oversee and improve emissions reporting is set to continue. A review of data from the previous two years is also underway.

Alongside those two issues, many energy firms are calling for pricing mechanisms for 'green electricity' – generated from renewables, currently only solar and wind, to be expanded to include hydro, but unlikely to include nuclear – and carbon to be combined in a single system. Power and carbon are closely linked, yet in practice, they have separate pricing mechanisms and markets, and prices for both assets are disconnected. In guidelines for emissions reporting in some sectors, green electricity from renewable sources cannot be deducted from total power use. That means covered businesses which opt to buy green electricity end up bearing extra costs – which naturally makes them less likely to do so. It is also more expensive to run two markets than one, increasing overall social and economic costs.

There are signals that the CCER scheme is about to return. Since it was halted last year, policymakers have approached defining the future CCER project pool cautiously but have still sent some clear signals. The market has been attentive and responsive to those signals, and there is already pent-up demand – if not a land rush – in CCER investments and financing. It remains unclear when CCER approvals will restart, but the authorities and market actors have a rough sketch of the rules and prices.

And now, the stock of CCERs has been significantly consumed, and some experience with carbon allowances trading has been acquired. Clear warnings have also been sent about the importance of data quality. The national market presents new challenges for the CCER scheme, but everyone is keen to see it return.

All that remains is to wait and prepare.

**Xu Nan**

# Open innovation:
## The trajectory for smarter energy technology in Europe and China

The concept of open innovation was first proposed by Henry Chesbrough of the University of California, Berkeley. It refers to the process by which an enterprise integrates commercialised resources with internal and external innovations in one structure for technological research and development. This includes the commercialisation of internal technology using external channels, in contrast with the traditional closed innovation model. Open innovation opens the door to an improvement in user innovation, innovation networks, and collaborative innovation. As a management concept, open innovation has been applied in practice in large enterprises in Europe and the United States since the end of the 20th century, but it has only recently appeared on the horizon of management practice in China.

Today, open innovation has gradually become more widespread. No longer confined to large enterprises, it is now present in small and medium-sized enterprises, and is even evident in individual entrepreneurs and industrial clusters, from high-tech industries to traditional industries, thus driving the progress of research in the whole field of innovation. In the context of carbon peaking and carbon neutrality, the progress of energy technology also needs to break free from the traditional closed and linear innovation path and adopt an open innovation approach so that internal and external innovation resources can be integrated to promote the transformation and development of the energy industry.

With the further development of energy technology cooperation between China and Europe, a number of leading enterprises and R&D institutions have emerged, which are taking the lead in experimenting with open innovation, building a distinctive innovation ecology, and jointly promoting the transformation and development of China-EU energy technology innovation.

Due to the differences in market mechanism, enterprise culture and development stage, there are obvious differences between China and Europe in the field of open innovation. Europe had a head start, and its market-based innovation mechanism is relatively mature, with a number of well-established large enterprises rooted in the process of economic globalisation. Open innovation in Europe is characterised by a corporate-driven approach.

China's market-based innovation mechanism got under way later and has shallower foundations.

## Europe:

### Enterprise-driven open innovation practice

The open innovation network of enterprises consists of competitors, research institutes, governments, suppliers, customers, exhibitions, etc. Major enterprises have already successfully adopted the open innovation model. For example, US- based Tesla made all its technology patents open source to improve the universality of its technology. Eventually, the entire EV industry will be compatible with Tesla's standards, at which point Tesla will effectively control the industry's core resources, driving the development of the industry ecosystem and promoting innovation in the industry.

Apple integrates open innovation deep into its production and marketing activities, covering all subjects in the value chain, in order to internalise external resources and commercialise internal resources. On this basis, it establishes and develops a customer-centric business model, which can foster high customer loyalty and achieve a sustained competitive advantage. The same innovation model is widely used by large global companies in Europe, and more energy companies are introducing open innovation, hoping to open up the boundaries of corporate and institutional innovation activities and unleash more momentum for energy technology innovation.

## **Case 1.** Open innovation boosts Shell's transformation

In the context of the energy transition, Shell, a traditional oil and gas giant that has long ranked among the Fortune 500, has developed a comprehensive open innovation organisation model. The company has created an open innovation 'toolkit' that covers all aspects of innovation and is operated by Projects & Technology, one of Shell's three business units.

The P&T Department has three key responsibilities: Innovation and R&D, Technical Solutions and Deployment, and Project Implementation. The operation mode of the P&T Department fully reflects Shell's concept of technology integration, not just in terms of upstream and downstream, but also in terms of management, from R&D to application. In this organisation model, technology extends further than R&D. It represents the full range of technical system engineering, where R&D, engineering and construction are closely integrated.

Shell's open innovation tools extend to a variety of organisations and contributors, including internal R&D teams, global university students, universities, research institutes, industrial partners, external technology holders, etc., in order to meet the need for technological achievements over a wide range of stages, external units and cooperation purposes, to obtain more support from inside and outside the company, and to discover more innovation possibilities that can complement Shell's independent R&D activities.

| | Internal | Open innovation | | | | | | external |
|---|---|---|---|---|---|---|---|---|
| | Independent R&D | Shell Ideas360 | Shell GameChanger | External Tech Collaboration | Shell Small Business Innovation Initiative | Shell Tech Ventures | Shell TechWorks | Technology Purchase |
| Object oriented | Internal R&D team | Global University Students | Global Creative Providers | Universities, enterprises, research institutions | Scientific and technological innovation small enterprises | Scientific and technological innovation enterprise | Industry Partners | External Technology Holders |
| Organizational form | R&D Program | Creativity Competition | Idea solicitation, evaluation and verification | Joint R&D | Challenges, Acceleration Camps | Venture Capital (Entity Institutions) | Technical Cooperation (Entity Institutions) | Technology Purchase |
| Innovation Demand | Daily R&D | Disruptive ideas | Disruptive, verifiable ideas | Key Technical Support | Innovative Solutions | Quality Innovation Projects | Prototype technology for translatable applications | Mature Technology |
| Innovation Stage | All | Discovery | Discovery, Development | Development | Development, Demonstration, Application | Development, Demonstration, Application | Demonstration, Application | Demonstration, Application |
| Funding Sources | Self-owned funds | Self-owned funds, Cooperative sponsorship | Cooperative sponsorship, venture capital | Self-owned funds, Partner funds | Self-financing, government funding, partner funding | Venture Capital | Self-owned funds | Self-owned funds |
| Control mode | Complete control | Project Management | Project Management | Project Management | Project Management | Board seat control | Board seat control | Contract Management |
| Technology Exclusivity | Complete exclusivity | Partial exclusivity | Partial exclusivity | No exclusivity | No exclusivity /Partial exclusivity | Partial exclusivity | Partial exclusivity | exclusivity /No exclusivity |

*Source: Tsinghua Sichuan Energy Internet Research Institute Research Team*

## Case 2. Schneider Electric's open innovation practice

Schneider Electric SA, a global leader in energy efficiency management and automation, is committed to promoting an open ecosystem of technologies and partners. Schneider Electric makes full use of innovative technologies and adopts different ways of thinking, design and construction to seize opportunities and address energy dilemmas in the new energy world. As a practitioner of open innovation, Schneider Electric aims to leverage its expert resources, industry insights and practical experience to share the world's leading energy technologies and innovation trends with university students and entrepreneurs worldwide.

Schneider Electric has hosted the 'green energy efficiency global innovation case challenge' for the past 11 years. It is one of the world's largest student competitions, and its aim is to discover the innovative power in the transformation of green energy. The competition, which is held to be an 'incubator for sustainable talent and projects', is open to university students worldwide. It aims to stimulate young talent to contribute to the sustainable development of society, while looking for green, intelligent and innovative solutions that can enhance people's lives. Some of the ideas from the competition have already been transformed from innovation research projects to real-life practice, such as the GoGreen 2022 award winner Energy System Optimisation of Low-carbon Community project by Tongji University of China which has been implemented in a business district in Shanghai.

With the support of the China-EU Energy Technology Innovation Incubation Cooperation Demonstration Platform, Schneider Electric now plans to launch the Double Carbon Challenge, in collaboration with its Chinese and European partners. The winning solutions from the competition will have the opportunity to have innovation eco-partners and be 'incubated' into real products and applications.

Schneider also co-organises the 'Green Intelligent Manufacturing Win-Win Plan' with Contemporary Amperex Technology and Star Charge. Tsinghua Sichuan Energy Internet Research Institute and Rocky Mountain Research Institute participate in it as partner organisations, uniting ecosphere partners and integrating innovative technologies to provide manufacturing enterprises with a series of achievable and reusable joint creation solutions. The program will incubate a number of small and medium-sized enterprise eco-partners, allowing innovative technologies to realise the huge potential of industrial productivity and efficiency. The 'Green Intelligent Manufacturing Win-Win Plan' accelerates the digitalisation, intelligence and innovation capabilities of the entire green smart manufacturing ecosystem. Shortlisted enterprises will receive all-round empowerment through training, certification and project incubation in terms of technology, market and investment, and the final customer-ready solutions will be matched with commercial enterprises.

# China:

## Open innovation practices led by new research institutions

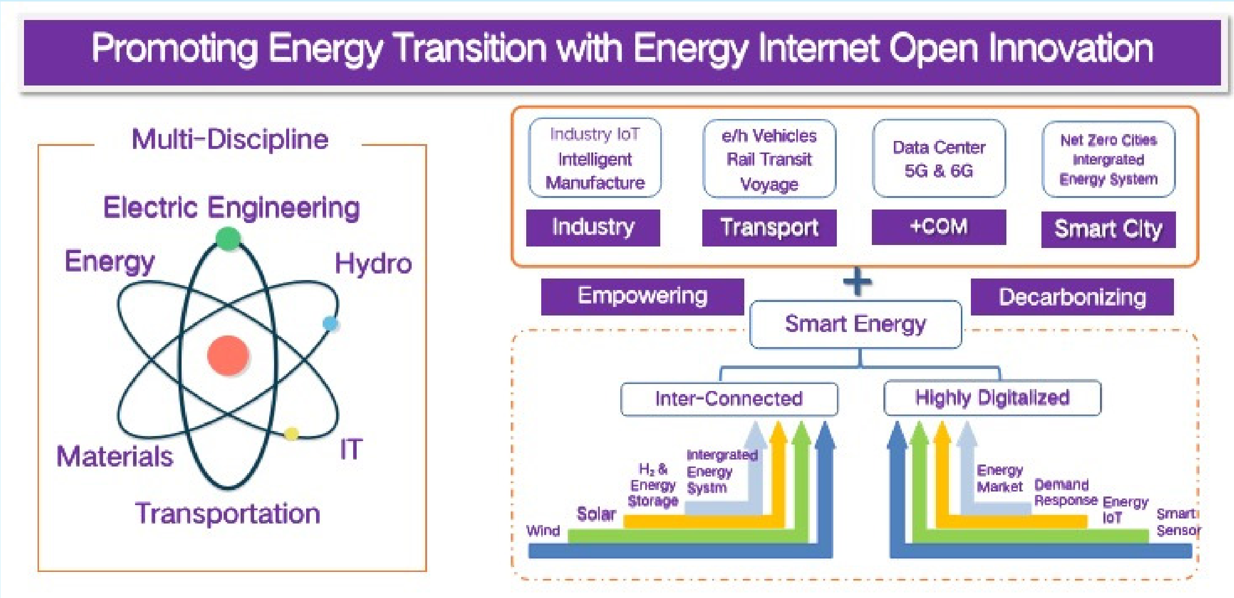
In the context of dual carbon, energy technology innovation requires the participation of many players. In addition to enterprises, new R&D institutions such as university institutes and innovation centres are often important promoters of energy technology innovation. Emerging R&D institutions tend to focus on the technological innovation needs of the leading regional industries, and are mainly engaged in scientific research, technological innovation and R&D services. They are capable of diversified investment, international construction, market-oriented operation and modern management, and are independent legal organisations with sustainable development capabilities. New R&D institutions are responsible for integrating market demand, scientific and technological resources, funds, talents and industrial technology development inside and outside the system. Through open innovation, they can allow resources to flow, and solve problems that cannot be solved in traditional organisations with well-defined boundaries.

## Case 3. Open innovation ecological development of Tsinghua Sichuan Energy Internet Research Institute

Founded by Tsinghua University and the Sichuan Provincial Government, Tsinghua Sichuan Energy Internet Research Institute relies on the interdisciplinary resources of Tsinghua University to carry out cutting-edge research and industry cultivation on the energy Internet, and is committed to promoting the construction of a clean, low-carbon, safe and efficient energy system. Since its establishment in 2016, Tsinghua Sichuan Institute has explored an open innovation system that integrates innovation resources from government, industry, academia, research, application, finance and services, system construction, industry cultivation and other aspects.

By integrating the advantages of Tsinghua University's multidisciplinary cross-fertilization academic resources, the Institute has gradually formed a team structure with Tsinghua technology as the main body, alumni technology as the support, and external technology as the supplement. It has created 10 interdisciplinary production and research integration research centres, including the new energy and energy storage research centre, the power carbon neutralisation research centre, and the energy source digital research centre, with more than 30 high-level R&D teams. Tsinghua Sichuan Energy Internet Research Institute has built a platform for talent convergence and entrepreneurship, and promoted the deep integration of scientists and entrepreneurs in scientific and technological innovation and industrial development, so as to jointly promote development.

Capitalising on its generous funding, Tsinghua Sichuan Institute has vigorously promoted international industrial technology innovation in the field of the energy Internet by building the Energy Internet International Innovation Center and other propitious platforms. Based on projects such as Energy Internet International Entrepreneurship Summit, EXCEL Innovation Acceleration Camp and X Plan Innovation Incubator, the Institute is committed to providing one-stop services such as investment and incubation, technology trading, resource matching, entrepreneurial training and intellectual property operation for startups, helping scientists and entrepreneurs to build the innovation chain from idea to sample, from sample to product and from product to commodity. At present, Tsinghua Sichuan Institute has accumulated more than 20 internally incubated enterprises and has worked with 39 external enterprises. Total financing has reached over CNY 5 billion.




*Source: Tsinghua Sichuan Energy Internet Research Institute Research Team*

## **Case 4.** Open innovation system of the National Smart Sensor Innovation Center

The National Smart Sensor Innovation Center is located in Jiading District, Shanghai, and was established in June 2018. Through its open industrial innovation ecosystem, it provides a platform that supports common technologies for small, medium and large enterprises in the industry chain such as smart sensor design, materials, manufacturing, equipment, packaging and testing.

By establishing R&D platforms for new sensor materials, processes, device structures, process manufacturing, testing, design services, and engineering services, the National Smart Sensor Innovation Center develops core technologies in materials, manufacturing processes, packaging, and device integration for a new generation of sensors, and promotes the industrialisation of key common technologies.

In addition, the National Smart Sensor Innovation Center also launched the China Sensor and IoT Industry Association (SIA) under the guidance and support of the Ministry of Industry and Information Technology (MIIT), which promotes the standardisation of the IoT industry’s core technologies and their applications through joint association members as well as provincial and municipal IoT associations, sensor alliances, and other relevant industry organizations with industry-university-research cooperation and integration of resource advantages to accelerate the development of core technologies for sensors, smart hardware and IoT applications.

## Implications for energy innovation in China and Europe

Open innovation is the inevitable direction for the future transformation and development of the smart energy industry in China and Europe. Energy technology innovation involves breaking the barriers imposed by geographical, industrial, disciplinary and other restrictions, and this process needs not only scientific and technological innovation with smart energy at its core, but also the encouragement of institutional and mechanical innovation of various market roles.

Talent is the foundation of energy innovation; China needs to innovate its mechanisms for the discovery and cultivation of talent, tap the potential of innovative talents through various channels, and promote the opening of the whole chain from idea generation to innovation development. Talent is the driving force of innovation, and energy innovation enterprises in both China and Europe should fully open up talent tapping channels, actively attract talent, and build talent interaction platforms that will foster internal and external innovators.

Technology is the driving force of energy innovation. The world needs an open technology cooperation ecology, bringing together universities and institutes, investment institutions, industry associations, government units, industry leaders and other parties to jointly incubate innovative technology solutions. By assembling an ecosystem that includes the top players in the energy innovation industry and integrating innovative technologies, the world can develop a whole series of feasible and reusable co-creation solutions for manufacturing enterprises, and empower them with training, certification and project incubation in all aspects from technology, market and investment. Energy innovation companies in China and Europe need to create an open energy innovation ecosystem, share innovation resources, and jointly discover, incubate and cultivate energy technology innovation solutions with growth potential.

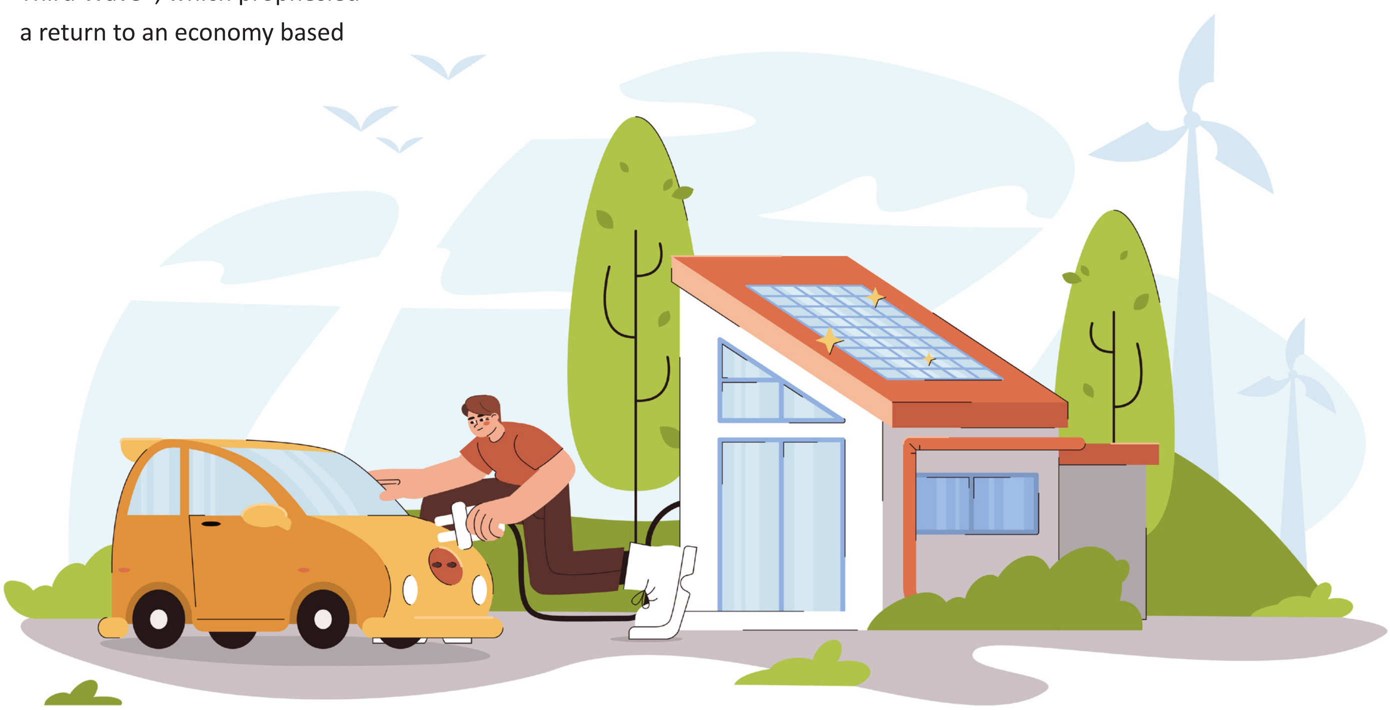
**Miaoqiang DAI** and **Weizhi HE**
with support from **Yuanlin ZHANG** (intern)
*Tsinghua Sichuan Energy Internet Research Institute*

# Prosumerism in the age of smart grids:
## A sociotechnical study

A recent report, 'Prosumerism and Energy Sustainability', by the EU's Joint Research Centre (JRC) explored several sociotechnical aspects of the development of prosumers as a market-shaping force, with a focus on the energy sector.

The term 'prosumer' stems from combining two words: producer and consumer. It first appeared in Alvin Toffler's 1985 novel 'The Third Wave' , which prophesied a return to an economy based on individuals and small groups of people operating as both producers and consumers of basic goods. A more contemporary use of the term appears on social media and video-sharing platforms such as Twitter, Facebook, and YouTube, where users are both producers and consumers of the digital content provided.

In the context of energy production, prosumers are becoming ever more important players. As the number of people installing solar panels on their properties increases, so does the share of renewable energy providing for our electricity needs - but also the challenges associated with managing an ever more complex grid.



Typical tools in the arsenal of a modern energy prosumer are photovoltaic (PV) panels, smart meters and home energy management systems. As technology improves, other larger-scale elements may be added, including large batteries in basements and other parts of a household, or connection of a household's electric vehicle's battery to the smart mini-grid. The concept of prosumerism in the energy field is being extended to include heating, not just electricity production. The adoption of electrified heating devices, such as highly-efficient heat pumps and other low-carbon heating systems like heat networks and biomass-based heating, has seen significant growth. The list of energy-related prosumer technologies and techniques is now fairly extensive (see Table 1).

Early research into prosumerism in the context of energy production was focused on how adoption of such technologies (e.g. solar panels) in individual, private accommodation affected prosumers' personal perception of general large-scale adoption. However, given the growing public support for the adoption of renewable technology for energy production on a large scale, the need for research around this particular socio-technical subtopic has abated.

Subsequently, the research has focused on developing a more accurate personal and psychological profile of individuals who choose to become prosumers, as well as how this choice has affected their behaviours around energy. It has been shown that becoming a prosumer does not significantly affect total energy consumption. However, the installation of rooftop PV cells does have a significant impact on behaviour, by raising the likelihood of choosing to run domestic

**Table 1: Summary of different prosumer technologies in energy.**

| Energy Source | Energy Technology | Output Power Type |
|---|---|---|
| Hydro power | Small hydro-turbines | Electricity |
| Wind | Micro-wind power | Electricity |
| Solar | Solar PV | Electricity |
| Solar | Solar thermal collector | Heat (water) |
| Solar | Solar air collector | Heat (air) |
| Biomass: Wood | Fireplaces | Heat (air or water) |
| Biomass: Wood | Wood burning boiler | Heat (water) |
| Biomass: Wood pellet | Wood pellet boiler | Heat (water) |
| Outdoor air heat (+electricity) | Air-source heat pump | Heat (air) |
| Outdoor air heat (+electricity) | Air to Water heat pump | Heat (water) |
| Various sources<br>(e.g., bio-gas, wood, wood pellet) | Micro-CH P/Stirling Engine | Heat and electricity |
| Hydrogen<br>(from renewable sources) | Micro-CHP/Fuel Cell | Heat and electricity |

*Source*: Juntunen, 2014, p. 20.

appliances at times of peak solar energy production (around the middle of the day). This is an important behavioural change: shifting patterns of consumption at different hours of the day is relevant if energy planners wish to ensure that the excess electricity produced at peak times can be absorbed into the system and used productively, at least until a full-blown energy storage infrastructure is developed to deal with the fluctuations of electricity production and consumption.

Another fruitful avenue for investigation into the sociotechnical aspects of energy prosumerism has focused on studying the preferences and levels of technical knowhow among prosumers. When utilities design smart grid structures and applications, they often assume the consumer is interested in technical data about the energy consumption of the household, in technical gadgetry and in generally having a pro-technical mindset and bias. Yet while this 'tech-savvy person' is certainly representative of a subgroup of the utilities' customers, it is in a minority. For the long-term success of utilities' strategies in developing a smart grid, it is very important for more typical consumers to be made the focus of a company's policies for expansion and development. As corporate strategy and sociotechnical analysis merge to create a realistic profile of the average prosumer, this will allow all stakeholders to adopt the utility company's planned innovations more smoothly.

Another productive intellectual debate has focused on the distinction between 'sufficiency' and 'efficiency' when it comes to energy needs. While a typical fridge today is more efficient than past models efficient, it is also larger. This development is evident in a number of appliances and goods, including cars, demonstrating our increased levels of comfort and affluence, which come at the expense of increased energy consumption.

Consider, for example, the size of a domestic fridge. If environmental considerations are prioritised, alongside a more rigorous scrutiny of the consumer's personal needs, a typical fridge is likely to be smaller compared to current fridges. 'Sufficiency' is therefore a concept that is just as important as efficiency when it comes to reducing the amount of energy and resources we consume as individuals and as a society. The social constructs that equate ever-increasing production and consumption with a better life pose a challenge to a rigorous analysis of one's needs based on 'sufficiency' (this is 'enough'). However, as we move forward in the future, a sufficiency-based assessment of needs and purchasing decisions is going to be increasingly important. In another example, looking at the indoor temperatures to which apartments, offices and other buildings are heated during winter, a decrease of just 1˚C or 1.5˚C would lead to substantial individual and national energy savings.

The JRC report concludes with a set of recommendations for policymakers, including:

- Applying sociotechnical rather purely technical or purely social perspectives when devising strategies for prosumers in the energy sector.
- Extending initiatives such as deployment of smart meters and PV cells to encompass disadvantaged areas, including social housing projects.
- Introducing policies that encourage the adoption of a 'sufficiency' principle as well as an 'efficiency' principle for utilisation of resources. (For example, houses above a certain size could be required to be climate-neutral.)

**Lucio Milanese**
*ECECP Junior Postgraduate Fellow*

# Monthly News Round-Up

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

**EU: Parliament backs green labeling for gas and nuclear**

The European Parliament votes to include gas and nuclear power plants in the EU 'taxonomy' rulebook from 2023. This is likely to become law unless a super-majority of states veto the move.

+ More

**EU: Lawmakers support mandatory use of green jet fuel**

The EU has approved targets that will require kerosene to be substituted with sustainable alternatives by 2025.

+ More

**EU: Commission proposes gas demand reduction plan**

Gas use in Europe should fall 15% by spring 2023, according to a new European Gas Demand Reduction Plan. The plan is intended to prepare the bloc for potential gas supply disruption this winter.

+ More

**Europe struggles to fill storage as Russia squeezes gas supplies**

Russia's Gazprom has announced it will cut natural gas supplies to Europe via Nord Stream 1 to 20% of capacity, citing technical issues. The announcement leaves Europe struggling to fill its gas storage facilities in the run up to winter.

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**EU: EUR 1.8 billion in clean tech decarbonisation projects**

The EU plans to invest in 17 large-scale innovative clean-tech projects, following a third round of awards under the Innovation Fund.

+ More

**EU: EUR 5.4 billion hydrogen project**

The European Commission has approved a Europe-wide IPCEI Hy2Tech hydrogen programme. By bringing together 35 partners from 15 member states, the project aims to support research and innovation and initial industrial deployment in the hydrogen technology value chain.

+ More

**G7 to set up Climate Club**

The G7 intend to set up an open, cooperative international Climate Club by the end of 2022, according to a statement released after the leaders' meeting in Ellmau, Austria on 28 June 2022.

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**UK: 25% windfall tax on oil and gas producers**

British lawmakers have approved a 25% windfall tax on oil and gas producers that will earn the government nearly USD 6 billion in its first year. The money will be used to offset surging consumer energy bills.

+ More

**Germany: 10 GW of new wind farms per year from 2025**

The German parliament has adopted a new onshore wind law (WindLandG) which aims to expand onshore wind by a massive 10 GW a year from 2025, and requires states to set aside 2% of territory for onshore wind generation.

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**Italy: New national guidelines for Agri-PV plants**

Agri-PV received a boost on 27 June 2022, when Italy's Ministry of Ecological Transition published its Guidelines for Agrovoltaic Plants to clarify the minimum characteristics and requirements for a photovoltaic system to be considered Agrovoltaic. Agri-photovoltaics combines croplands with the generation of energy produced by a photovoltaic plant.

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**UK: Britain exports electricity to Europe**

In April 2022, the UK switched from being a net importer to a net exporter of power to France, Belgium, and the Netherlands for the first time since 2017, following on from ramped-up LNG supplies to the UK and reduced nuclear power output in France.

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**Germany: Berlin set to benefit from country's largest heat storage facility**

Heating in Berlin will be secured by Germany's largest thermal energy storage facility, a 56 million litre hot water tank of 200MW-rated storage capacity. The facility will feed hot water into Berlin's district heating network from the start of 2023, offering the city increased security of supply.

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**France: Hot summer could limit nuclear output**

France faces tightened power supply this winter: EDF may be forced to reduce nuclear output because of anticipated prolonged high temperatures over the summer months.

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**France: EDF to be nationalised amid energy crisis**

On 19 July 2022, France's government outlined plans for a EUR 9.7 billion buyout that will give it full control of EDF. The move will give it a free hand in the running of Europe's biggest nuclear power operator as it grapples with a continent-wide energy crisis.

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**UK: Renewables subsidy auction secures 11GW of new capacity**

A fourth UK 'contract-for-difference' auction round has secured 11GW of new renewables capacity at a record low price. Tidal stream and floating offshore wind projects are included for the first time.

+ More

**Finland: Sand battery offers solution for renewable energy storage**

Finnish companies Polar Night Energy and Vatajankoski have built the world's first operational 'sand battery', which stores heat converted from renewable electricity for weeks or even months.

+ More

**Germany: World's first underground laboratory for deep geothermal energy research**

Research on deep geothermal energy is to receive a boost with the world's first underground laboratory, a interdisciplinary research platform called GeoLaB, established by the Karlsruhe Institute of Technology and its research partners.

+ More

**Denmark: New international sharing platform for offshore wind**

Offshore wind operators worldwide will benefit from a new international platform designed to share Denmark's extensive experience of offshore wind development. www.offshorewindtour.org has been launched by the Danish Energy Agency and the Ministry of Foreign Affairs.

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**Italy: World's first $CO_2$ battery nears commercial production**

Italian startup Energy Dome has begun commercial development of the world's first long-duration $CO_2$ battery in Sardinia, Italy. The battery, which uses carbon dioxide to store renewable energy on the grid, is ready for rapid global deployment.

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**Netherlands: Shell takes lead on Europe's largest hydrogen project**

Shell has announced a final investment decision on a 200MW green hydrogen plant in the Netherlands, which will likely be Europe's largest when operations start in 2025. The plant's capacity could rise to 400 MW.

+ More

## Carbon peaking plan for urbanisation

China's carbon peaking and neutrality plan for urbanisation and rural development was released on 13 July 2022. It promotes a wide range of energy-saving technologies and includes a number of targets including 50% rooftop solar coverage of new-build factories and public buildings by 2025.

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## Targets set for industrial energy efficiency

An 'Action Plan for Industrial Energy Efficiency Improvement', published on 29 June 2022, maps out key actions and targets for promoting green power consumption and energy efficiency in key industries including steel, petrochemicals, data centres, and the building sector.

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## Details published on measures to boost green consumption

In a public response, China's Ministry of Industry and Information Technology has detailed plans and focal points for the promotion of green consumption, particularly relating to EV, green building materials and home appliances.

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## Energy import value leaps 53.1% in Jan-Jun 2022

China's General Administration of Customs Statistics shows that the gross import value of energy products, including crude oil, gas and coal, increased by 53.1% in the first half of 2022 as commodity prices surge, amounting to CNY 1.48 trillion.

+ More

## Renewables account for 29.7% of power output in 2021

RES supplied 29.7% of China's overall power production in 2021, according to figures in a newly released report by China Renewable Energy Engineering Institute.

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## ULE technology reaches 93% of coal-fired capacity

China's ultra-low emission (ULE) coal-fired capacity reached 1.03 TW by the end of 2021, representing 93% of the current coal installations, according to a recent published annual report by the China Electricity Council, which reviews the power industry development in 2021.

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## Pressure on power industry builds as summer temperatures peak

China's summer peak power load is expected to reach over 1.3 TW in 2022, up 10% since 2021, with some provinces facing a power gap of over 3 000 KW at peak times, warns the China Electricity Council. Coal output remains lower than the 12.6 million tons per day that is required in order to stabilise power supplies.

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## Surge in number of pumped-storage plants in push for green energy

With more than 200 pumped-storage hydro stations scheduled for development, total installed capacity will reach 62 million kW by 2025, representing a CNY 100 billion market, according to a recent industry report.

+ More

## Record-breaking NEV sales leap 115%

Defying the economic headwinds, New Energy Vehicle (NEV) sales soared to 2.6 million in the first half of 2022, up 115% since 2021. The Chinese NEV fleet exceeded 10 million at the end of June, representing 3.23% of the country's automobile fleet.

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## CNEEEX to develop ETS price benchmark

Development of a Chinese carbon price index, offering a benchmark price for China's ETS, is now under development. Shanghai Environment and Energy Exchange (CNEEEX) announced it had begun work on the benchmark on the first anniversary of China's national carbon emissions trading scheme.

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### Hydrogen exchange facility to be launched in Shanghai

Shanghai Electric, CNEEEX and two other partners have signed a MOU on establishment of a Shanghai Hydrogen Exchange, a move that may help Shanghai to become an international hydrogen hub.

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### China leads hydropower installation in 2021

China is the only market that is keeping pace with the net-zero pathway for the hydropower sector. The country accounted for 21 gigawatts (GW) out of the 26 GW of new capacity that came online globally in 2021, according to the International Hydropower Association (IHA). China has 391 GW of installed capacity, followed by Brazil with 109.4 GW.

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### Construction begins at world's biggest hydro-PV project

On 8 July 2022, work began on the world's largest hydro-PV hybrid project, Yalong Hydro Kela Solar Power Station, Sichuan Province. With over 1 GW capacity, it could produce 2 TWh green power per year.

+ More

### Trina Solar claims record 24.5% efficiency for 210mm PERC cells

Chinese company Trina Solar has achieved an efficiency of 24.5% for 210mm p-type monocrystalline silicon PERC cells, breaking the world record for the 24th time.

+ More

### Refinery throughput falls for first time in 10 years

Throughput in China's refineries fell for the first time in more than a decade during the first half of 2022. It dropped by 6 per cent to 13.4 million bpd, with domestic demand impacted by Covid lockdowns and fuel export restrictions.

+ More

### Sinopec ushers in new era for China's sustainable aviation fuel industry

Sinopec Group has kickstarted China's sustainable aviation fuel (SAF) industry following a successful test run at the country's first large-scale biojet plant. The plant in Zhejiang province has the capacity to make 100 000 metric tons per year of on-spec biojet fuel from used cooking oil.

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### Air Liquide to open 75 GWh biomethane facility

French industrial gases supplier Air Liquide has unveiled plans to build its first biomethane production facility in China, aiming to bring it online by the end of this year, building on European biogas activity in China, led by Germany.

+ More

### China's Envision partners with Spain on carbon neutrality

China green tech firm Envision entered an umbrella partnership agreement with the Spanish government on 18 July 2022, to establish Europe's first zero-carbon industrial park in Spain. It is set to include a gigafactory for EV batteries, a digitalisation centre for renewables, a green hydrogen production plant, a wind power plant as well as an assembly line for smart turbines.

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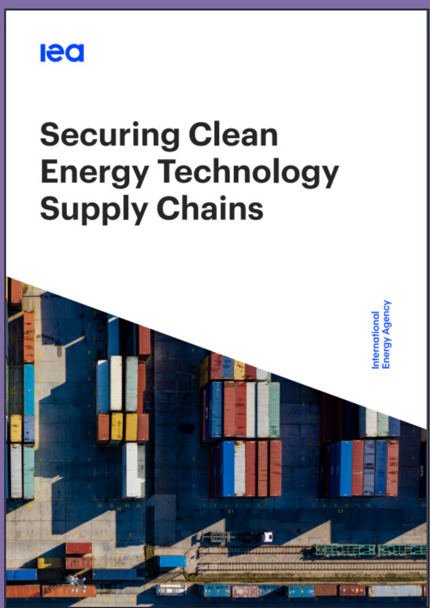
*This month, ECECP is trialing a new formula for our news section. We aim to highlight key energy news headlines in Europe and China over the past month, which means we can provide a wider selection of news for our readers. Please let us know how you feel about the change by emailing: magazine@ececp.eu*

# Featured Publication




## Securing clean energy technology supply chains

This special technical report by International Energy Agency assesses current and future supply chain needs for key technologies – including solar PV, batteries for electric vehicles and low emissions hydrogen – and provides a framework for governments and industry to identify, assess and respond to emerging opportunities and vulnerabilities. The IEA highlights five key strategies to build secure, resilient and sustainable supply chains: Diversify, Accelerate, Innovate, Collaborate and Invest.

The IEA's report contains data from two separate reports that provide a detailed examination of the EV battery and solar PV supply chains from raw materials all the way to the finished product, highlighting key vulnerabilities and risks at each stage.

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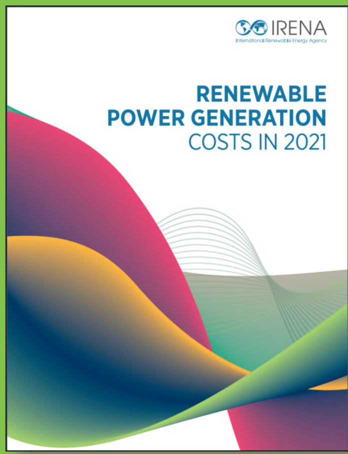
## Renewable power generation costs in 2021




This latest version of the annual renewable power generation costs report, published by the International Renewable Energy Agency, reveals that the global weighted average cost of renewable power continued to fall in 2021, as supply chain challenges and rising commodity prices have yet to demonstrate their full impact on project costs. The LCOE of onshore wind fell by 15%, offshore wind by 13% and solar PV by 13% compared to 2020, while the LCOE of CSP plant rose by 7%.

High coal and fossil gas prices in 2021 and 2022 have further undermined the competitiveness of fossil fuels, making solar and wind even more attractive. The report shows that in the G20 countries, almost two-thirds or 163 GW of newly installed renewable power in 2021 had lower costs than the cheapest available coal-fired option.

As to supply chains, IRENA's data suggests that not all materials cost increases have yet been passed through into equipment prices and project costs. This suggests that price pressures in 2022 will be more pronounced than in 2021 and total installed costs are likely to rise this year.

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## Towards a green & digital future


This Science for Policy report published by the EU Joint Research Center (JRC) examines how the green and digital transitions can achieve success. Both the green and the digital transitions are political priorities of the European Commission that will shape the bloc's long-term future. While these simultaneous, or 'twin', transitions, have the potential to reinforce each other in many areas, they are not automatically aligned. For example, digital technologies have substantial environmental footprints that go against the targets of the green transition. This is why a proactive and integrative approach to managing the twin transitions is important to ensure their successful implementation.

This report offers an analysis of how to ensure that the two transitions are mutually beneficial. In doing so, the study focusses on five of the most greenhouse gas emitting sectors: 1) agriculture, 2) buildings and construction, 3) energy, 4) energy-intensive industries, and 5) transport and mobility. Based on this analysis, the report sets out the key requirements for the success of the EU's green and digital transitions.

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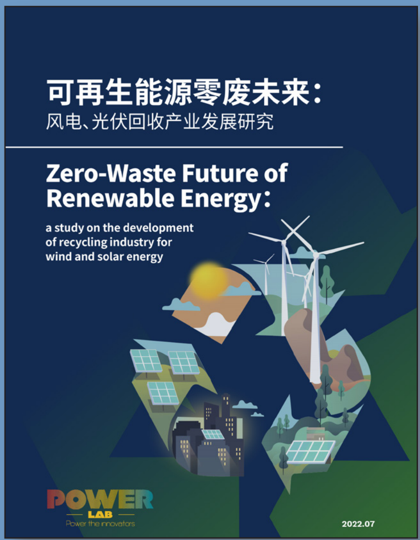


## Zero-waste future of renewable energy: a study on the development of recycling industry for wind and solar energy

China's wind power and PV industry is shortly to enter a decommissioning period. This report, from Greenpeace's PowerLab team, examines the status and market scale of China's wind power and PV recycling industry. By analysing the social impact of wind and PV recycling growth, and drawing on innovative practice around the world, the report provides a multi-dimensional picture of the after-life treatment market for wind and PV equipment, providing a useful reference tool for the industry.

The report estimates that by 2040, up to 280GW of wind and 250GW of PV modules will be decommissioned. It reveals the growing need for recycling processes when dealing with the impact of the carbon emissions, resource waste and environmental pollution associated with the two rapidly expanding industries. It warns that failing to deal with these impacts may endanger the competitiveness and reputation of the industry, and puts forward policy and market-oriented suggestions for a zero-waste future.

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## A strategy for the transition to zero-emission shipping

Prepared by Getting to Zero Coalition, a partnership between the World Economic Forum and the Global Maritime Forum, and the University Maritime Advisory Services (UMAS), this report analyses the transition pathways of the shipping sector. It shows the opportunities created by shipping's need for scalable zero-emission fuels and details how robust future demand from shipping could de-risk the business case for onshore production of green hydrogen serving multiple industries.

The report aims to provide more clarity on the essential elements of such a transition, including the political, technical, economic and commercial requirements, and the actions needed from the sector. Its objective is to add to the knowledge base in the sector, open up opportunities for debate and provide new insights into cross-industry actions and national, regional and global policy making.

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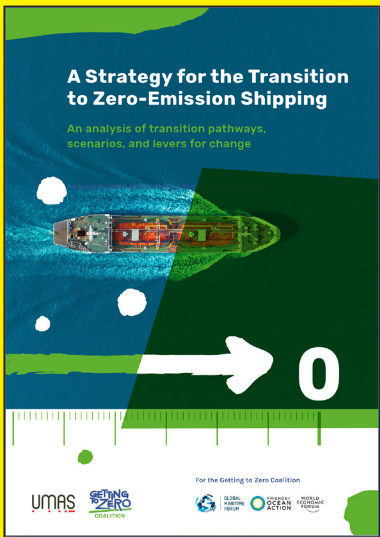

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