Magazine of EU-China Energy Cooperation Platform

EU-China Energy Magazine

2022 May Issue

Innovation

About ECECP

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

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

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

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

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

EU-China Energy Magazine

2022

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Dear All,

Welcome to the May 2022 issue of the EU-China Energy Magazine.

On 24 and 25 May 2022, we teamed up with the EU Chamber of Commerce China (EUCCC) and EnergyPost.eu to organise a two-day online conference on innovation for a low carbon economy. Participants heard from expert analysts about the latest trends and targets, as well as case studies featuring top EU companies that are ready to start work, e.g. with floating offshore wind turbines and sector coupling to use waste heat from data centres. We will make the conference videos available on our website.

Alongside the online conference, our May issue looks at how innovation can support the low-carbon transition: we start with a futurology perspective on innovation, and then move on to discuss the green credentials of heat pumps and the development of green steel, and ask whether the EU and China can align their carbon markets.

Don't forget to take a look at our round up of the latest energy news in Europe and China, and our selection of recent energy reports and publications.

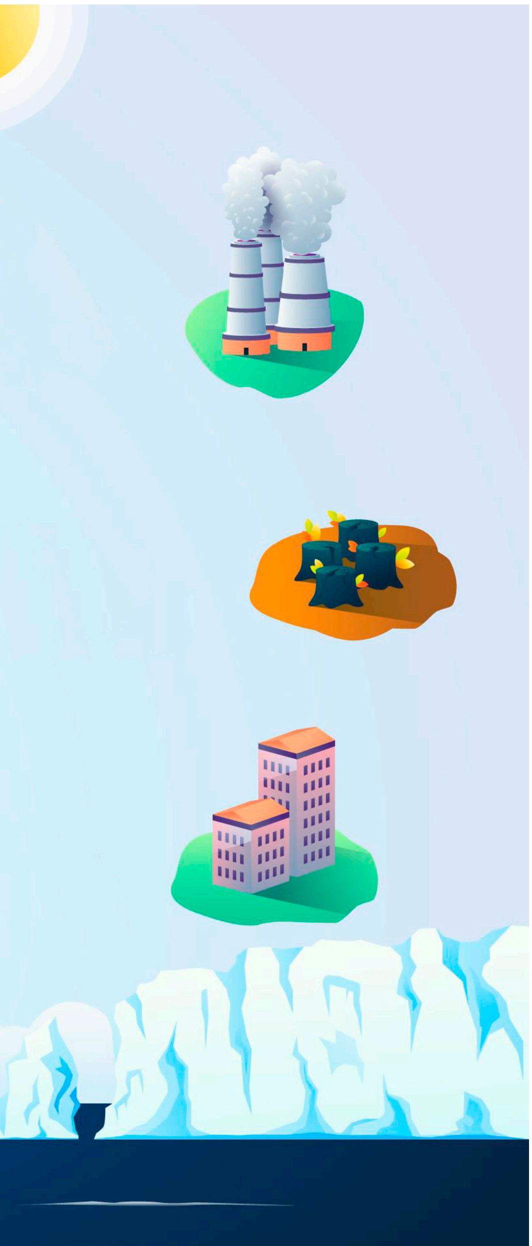
We hope you enjoy the content of this issue and always welcome feedback!

Last but not least, I would like to say a big thank you to our long-suffering editors, Daisy Chi and Helen Farrell, for once again delivering a very informative issue.

Flora Kan
ECECP Team Leader

Imagining futures:
a methodology for innovation

Climate change will fundamentally alter life on our planet. However, it is difficult to predict exactly what the impact will be. Innovations have the potential to slow climate change, mitigate its effects and help human life adapt to the changes. To create innovation, we must work out how to forecast what we will need to maintain a livable planet. But how can we second guess what the future will look like? ECECP Junior Postgraduate Fellow ***Helena Uhde*** *met with Elliott Montgomery, design researcher, strategist and educator, whose work centres on asking questions about social, technological and environmental impact.*



A devastating view of the future is painted by the 2022 Report of Working Group 2 of the Intergovernmental Panel on Climate Change (IPCC) in its overview of climate change impacts on ecosystems, biodiversity and human systems: widespread degradation of ecosystem structure and function, food insecurity, reduced water supply, the emergence of new human and animal diseases, and human mortality caused by extreme heat events are just some of the consequences predicted to have a high or very high probability.[1] The report is based on risk projections covering the near future (2021-2040), mid-term future (2041-2080) and long-term future (2081-2100), and does not create much hope for a viable planet worth living in. It prompts the question: is it even worth trying to stop climate change?

A spectrum of futures

In many places, the report reads like a dystopia - it seems almost impossible to stop the severe consequences of climate change. And indeed, there are quite a few films based on a climate dystopia narrative.[2] However, visions of the future that oscillate between dystopia and utopia offer a very narrow view of things and block our view of the full range of possibilities. Leah Zaidi, an award winning futurist, advocates imagining the future as a spectrum rather than a binary notion. She calls this a spectrum of 'polytopias' and explains it as 'stories that depict many people, many places, at many times. They demonstrate the incremental steps required to shift a system and how those systems interact with people along the way. Polytopias aim to capture the complexity and nuances of change itself.'[3]

Thinking in a spectrum rather than binary space opens up new possibilities, new facets and inspiration that we would otherwise fail to see. It offers a number of possible futures. This concept is also at the core of the work of Elliott Montgomery, assistant professor of strategic design and management at Parsons School of Design, The New School and cofounder of The Extrapolation Factory. In his work, Montgomery explores how the methods and approaches used in futurology can be employed to train the human imagination so that it begins to see more valuable and provocative scenarios.

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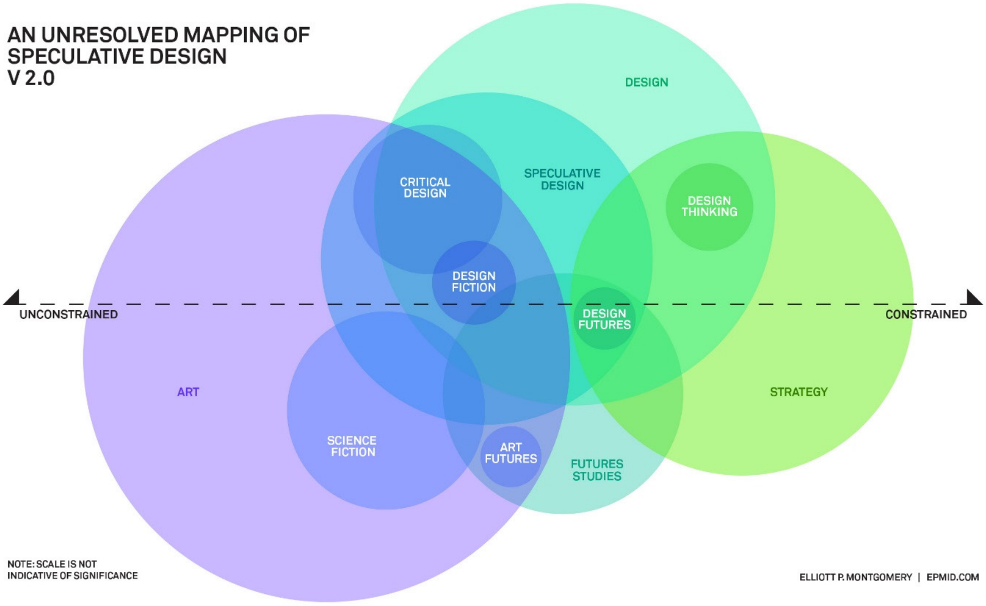
1. *IPCC. Climate Change 2022 - Impacts, Adaption and Vulnerability -Summary for policymakers. 2022. https://www.ipcc.ch/report/ar6/wg2/*
2. *Ledda T. Climate Dystopia: fiction or reality?. The Oxford Student. 2021. https://www.oxfordstudent.com/2021/09/03/climate-dystopia-fiction-or-reality/.*
3. *Zaidi L. Polytopias: The Missing Speculative Genre. 2022. https://www.linkedin.com/pulse/polytopias-missing-speculative-genre-leah-zaidi/*



Fgure 1: An Unresolved Mapping of Speculative Design. Source: Elliott Montgomery - EPMID.com.

Speculative Design as an approach for imagining futures

The framework that Montgomery uses is called speculative design, and was coined by Anthony Dunne and Fiona Raby, professors at London's Royal College of Art, as a form of design that 'thrives on imagination and aims to open up new perspectives on what are sometimes called wicked problems, to create spaces for discussion and debate about alternative ways of being, and to inspire and encourage people's imaginations to flow freely.'[4] Montgomery created a map (see Figure 1) to classify speculative design. In contrast to the more well-known term design thinking, speculative design is more in the field of art, but also overlaps with strategy.

One of Montgomery's clients is Sweden's Innovation Office, Vinnova. In the project 'Future Prototypes', a dialogue about possible futures is initiated by creating objects.[5] The project developed a number of change scenarios that Sweden might face in the coming years. 'We did a huge amount of work scanning for signals to better understand how changes are happening in the present moment. And from those signals we arrived at a series of drivers and finally at four scenarios', describes Montgomery. The scenarios are based on two key drivers of change: i) the level of disruption, or the magnitude of the change caused by climate change; and ii) the source of change. 'Will there be an impact from the top, from our government agencies, from big tech, from corporations? Or will the changes come as a result of work that's happening at the grassroots? General shifts in public opinion and choices, people doing different things and living their lives in different ways, consuming energy differently, etc.?' asks Montgomery. Based on the combination of polarities, four different futures were played out in the project. 'Each one of

4. Dunne A, Raby F. Speculative Everything - Design, Fiction, and Social Dreaming. 2013.
5. Vinnova. Future prototypes - when the future comes to visit the present. 2022. https://www.vinnova.se/en/m/emerging-innovations/future-prototypes/.

these stories feels believable. We can imagine a scenario where the Greta Thunbergs of the world start to gather really significant forces, and we all come together and start to make changes in our day-to-day lives, rallying on the streets, reducing consumption, flying less, etc. And things start to change in ways that have a dramatic impact on the world. We can also imagine a world where that type of engagement is the primary driver, and it's still not enough.' The four scenarios thus help to locate a spectrum of imaginable narratives of change. The aim is not to favour certain scenarios over others, but to create a discourse and to think about what measures could be taken.

One aim of this thinking game is to think about possible problems that arise from the visions of the future. 'Often in this work we try to imagine the problems that do not exist now because the conditions causing those problems have not yet materialised. But if we can start imagining these problems, then we can start thinking about what we need to do about these problems,'

"A good science fiction story should be able to predict not the automobile but the traffic jam."

– Frederik Pohl.

states Montgomery. Speculating about future problems in a proactive way can thus help us to understand the ties or tensions we may face in one of the futures.

There are many recent examples of how important it is to think about problems that were previously beyond the imagination. Before the pandemic, who would have thought of the extent of supply shortages? With the increase in electric cars, who foresaw the lithium shortage? Who predicted that an increase in renewable energies in the electricity market would lead to negative electricity market prices? In hindsight, these developments seem logical and clear - but they were not flagged up in advance.

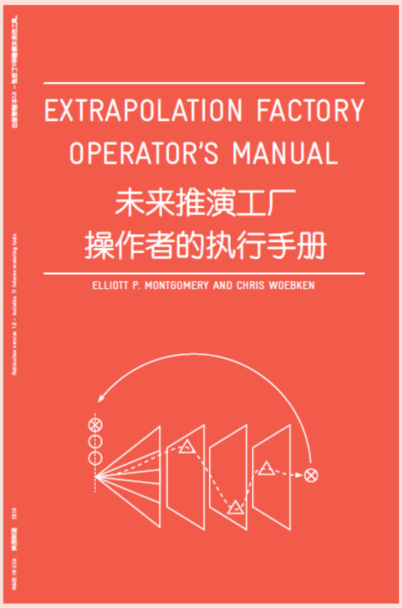
What-if? and social rule bending in the electricity sector

In the field of energy, speculative design could create a wider discourse, that reflects on the role that electricity plays and should play in our lives. For most people, electricity is an abstract construct that comes out of a socket on the wall. However, if we think of the availability of electricity in terms of comfort levels, such as keeping our computers and cell phones charged, the air conditioning running and the Internet working, electricity has a much more emotional value for us. This also changes the possible business models. In Germany, where customers can choose their electricity supplier, many people opt for one that supplies them with renewable energy. Studies have shown that while cost is the determining factor when purchasing electricity, other factors such as green energy or local generation play a role in the choice.[6] At this point it is worth asking

6. Mengelkamp E, Schönland T, Huber J, et al. The value of local electricity - A choice experiment among German residential customers. Energy Policy, Elsevier Ltd, 2019, 130 (April): 294–303.

Extrapolation Factory Operator's Manual

Elliott Montgomery and his cofounder Chris Woebken share their experiences on speculative design in their book 'Extrapolation Factory Operator's Manual'.[8] The authors are interested in seeing how other individuals and communities might be able to benefit from speculative design, and in finding ways to start new conversations on the topic. It is an open source book, and available in English and Chinese.



the 'what if' question. What if electricity had a completely different value, or consumers had different preferences? What if electricity didn't cost anything? What if electricity didn't need a grid for transmission? What if electricity were plentiful, or non-existent?

What if? questions can lead to technical innovations, but also to experimentation with social rule bending. 'Social rule bending is really the ease with which we could bend social rules if we all agreed to,' explains Montgomery. An example is our sleeping habits. We all usually sleep at night and sleep for one single stretch at the same time. Switching from a polyphasic sleep phase to monophasic sleep is a social norm that has made us into a productive workforce. By bending this social rule, perhaps more people would not divide their time into day and night, but sleep and be awake as they saw fit. 'This could alleviate the problems of peak loads during the day when everyone is awake. And so, this simple act of bending social rules, agreeing that the social rule we're sticking to might not necessarily be the best for some of the technological systems, could get us out of one of the challenges we're facing. No new technology would have to be invented for this,' says Montgomery.

Energy pilots

In an effort to make low-carbon energy technologies cost-competitive, Montgomery developed hypothetical business models by borrowing proven techniques from other sectors.[7] 'One of the key tensions that I was starting to find as I spoke with experts was that there are potentially different ethical expectations of businesses in the low carbon energy sector than there are in other sectors. In the low carbon energy sector, we do have quite high ethical expectations, while in other sectors, when a CEO does things that might not be entirely socially acceptable, they oftentimes seem to be given permission to behave in ways that are just not as admirable,' says Montgomery, describing the motivation behind the project. The hypothetical business models that Montgomery developed for low-carbon energy resources include a lottery that offers the chance to win a cash windfall each billing period, as well as high-end tourism, almost like the Richard Branson space tourism model, which would make electricity almost free for the masses. Representative physical

7. Montgomery E. The Energy Pilots. https://epmid.com/projects/The-Energy-Pilots.

8. Montgomery E, Woebken C. Extrapolation Factory Operator's Manual. 2016: 114. https://extrapolationfactory.com/Operator-s-Manual prototypes for the hypothetical business models were shown in public spaces to prompt a discussion about the feasibility and social impact of these hypothetical strategies.

Montgomery sees further opportunities for innovation in cooperation between different sectors, e.g. between energy and electronic gaming: 'What would happen if a big company in the electronic gaming sector were to collaborate with an energy company to create essentially the Pokémon Go of peer to peer energy networks? It could become this global sensation and you'd have millions of people playing the game. What would it mean for the low carbon energy sector to have that type of enthusiasm and fanfare where nobody can stop talking about it? How could that type of engagement be introduced into the energy sector through collaboration connection to those who are not necessarily already working in the energy sector, but could leverage their capacity and hold on society as a way to bring more eyes to the energy sector itself.'

Creating discourse

Speculative design is not necessarily about finding a solution to a specific problem. Also, when ideas are developed, which possibility is preferred is up for debate. Rather, it is about creating a discourse about the range of possibilities and changing the perspective from one single future perspective to a spectrum of futures. 'We might not be able to see all of the possibilities, and in fact we never can truly see all the possibilities, but we can see more of those possibilities as we look across the vista. Once we have an idea of where we do want to go or where we don't want to go, we can set a strategy, and the strategy starts to provide some of these answers or so-called solutions,' concludes Montgomery.

By ***Helena Uhde***

ECECP Junior Postgraduate Fellow

Speculative Design - Thought experiments

Design speculations can be seen as thought experiments that, inspired by other fields such as literature and visual arts, help us to think about difficult questions and to make a projection of how things could be. In their book 'Speculative Everything', Dunne and Raby (2013) provide several example frameworks for these thought experiments:

Example 1: Reductio ad absurdum.
A type of logical argument where one accepts a claim for the sake of argument and derives an absurd result by taking it to the extreme and concluding that the original claim must have been wrong because it has led to such an absurd result.

Example 2: Counterfactual.
To understand the importance of key events in the course of history, this thought experiment alters historical facts to see what might have happened if history had turned out differently.

Example 3: What if?
What if? scenarios are more future-orientated than in Examples 1 and 2. Narrative and plot are reduced to the essentials, e.g. to explore what could happen in a society under extreme circumstances.

The Extrapolation Factory's method

Building on established future visioning techniques, Elliott Montgomery and Chris Woebken have developed the 'Future Scope', a four-step methodology used by the Extrapolation Factory in workshops with clients to stimulate a discourse on futures:

Step 1: Selection of future scenarios from a curated instance database.

Step 2: Determination of the probability or improbability of the scenarios using the futures cone diagram and a set of lenses to assess their technological, environmental, social, political and economic implications.

Step 3: Imagining a future need, building on the selection of hypothetical scenarios, and design a product to meet that need.

Step 4: Creation of a physical prototype from found and hacked materials.

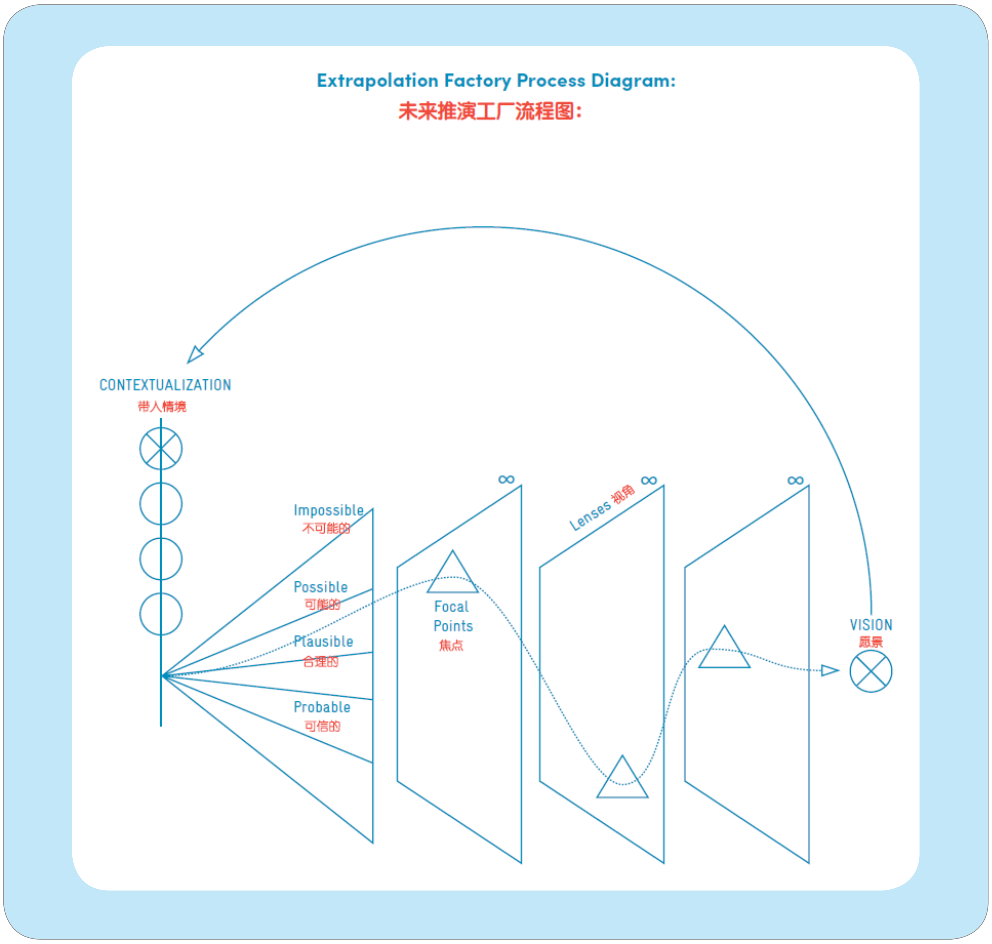
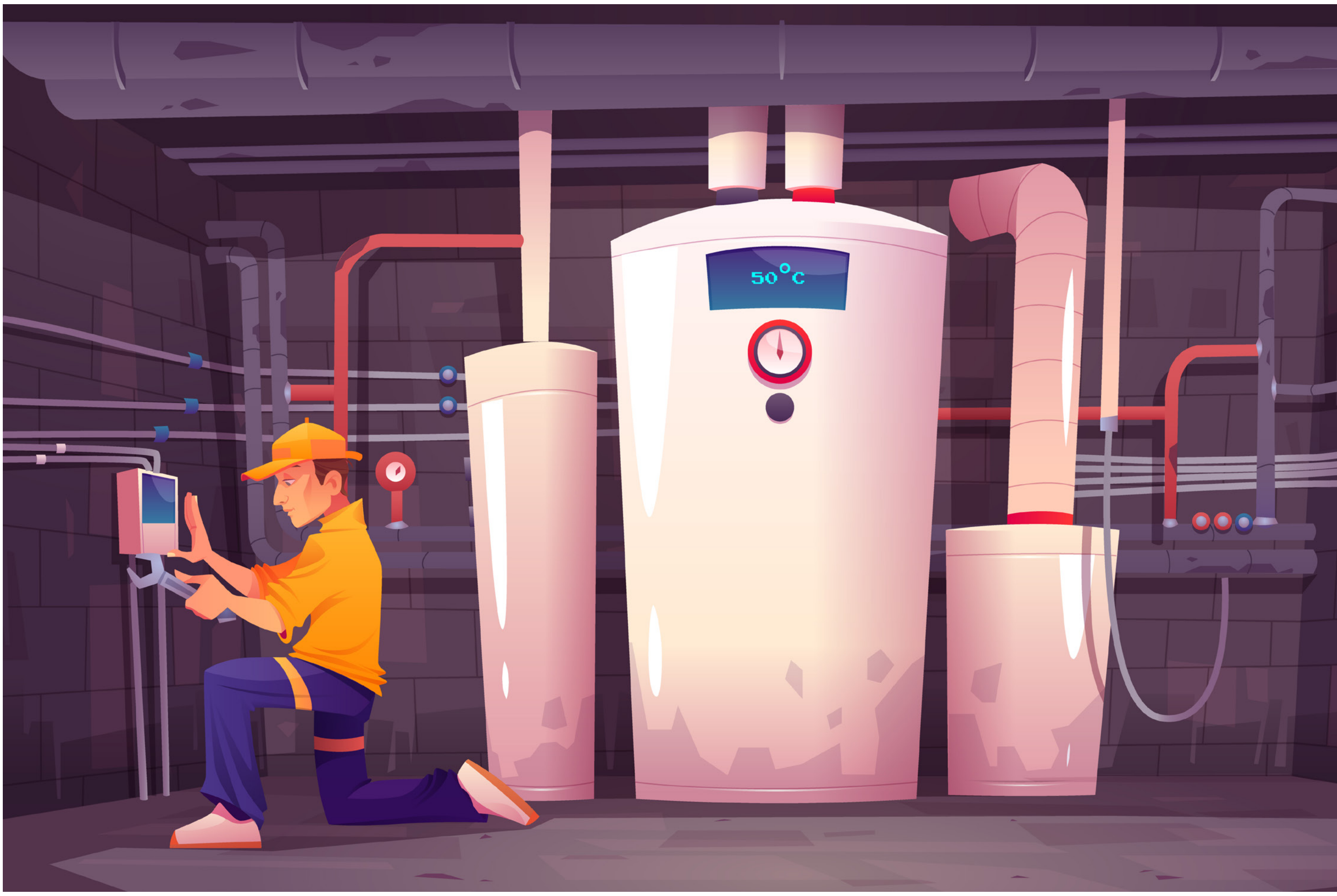


Figure 2: Extrapolation Factory Process Diagram. Source: Extrapolation Factory Operator's Manual.



Squeaky clean?

ECECP puts the green credentials of heat pumps under the spotlight

Even before gas prices started to rocket in 2021, heat pumps were being touted as the solution that would solve the problem of CO_2 emissions in the heating sector. They are key not only to reducing dependence on fossil fuels – and, in the case of Europe, on Russian gas – but also to decarbonising buildings. The IEA calculates that EUR 60 billion currently spent on gas imports could be saved if the bloc as a whole switched to heat pumps, and forecasts that by 2050 heat pumps will meet the majority of the world's heating needs.

Already, heat pump sales are at record levels. In Europe, they accounted for 25% of sales in the heating market in 2021[1]. In order to reduce greenhouse gas emissions by at least 55% before 2030, building emissions must fall by more than half relative to 2015 levels.

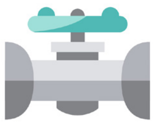
1. The_European_Heat_Pump_Outlook2021_2M_heat_pumps_within_reach_01.pdf

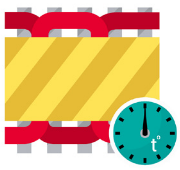
The EU has set ambitious targets for heat pump installation, aiming for 50 million heat pumps to be installed by 2030, with an annual growth of 16%. That will be about one third of the 150 million boiler installations in the bloc. To put the target in context, in 2017 83% of Europe's heating installations relied on fossil fuels.

Individual countries have set their own targets. In Germany, for example, the government announced in December 2021 that from 2025 any household heating system must run on renewable energy – which has been understood as an implicit endorsement of heat pumps. In the UK, the aim is for 600 000 heat pumps to be installed per year. Outside Europe, China leads the world in its promotion of heat pump water heaters.

An additional advantage is that a reversible heat pump can be used not just for heating, but also for cooling, according the authors of a recent RAP report by industry experts[2]: as the climate heats up, demand for air conditioning units is expected to double by 2030, and the RAP authors say heat pumps have the potential to offer

How does a heat pump work?





A heat pump is a device that transfers thermal energy from one point to another. A common example of this can be found in refrigerators, where the evaporation and cooling of a liquid is used to lower the temperature of the storage compartment. This technology can now also be used to extract the potential thermal energy in the air outside, or even from the ground, feeding it directly into your home. Here, it is compressed, and the heat is transferred using a series of coils.

Although they use a small amount of electricity to run, heat pumps are considered highly efficient and clean because they do not depend on fossil fuels to create heat. They perform well in moderate climates and can provide heating during the winter, even at temperatures of -20 degrees Celsius. There are two main kinds of heat pump, namely air source or ground source heat pumps.

The average co-efficient of performance for a heat pump is 3. This means that 3kW of heat is produced for each 1kW of electricity consumed. For a gas boiler the equivalent figure is 0.9.

cooling at far greater efficiency than traditional air conditioning units. Once a standard air to air heat pump has been installed, it is a relatively simple process to subsequently change the type of heat pump in a building.

There are hurdles to be overcome:

Affordability: homeowners are unimpressed by the sizeable upfront cost of a heat pump installation. That cost can start at EUR 9 430 (CNY 67 000), but can, depending on whether the existing insulation and radiators are compatible, reach EUR 53 000 (CNY 376 000). That is in marked contrast to the average cost of a gas boiler, which retails at around EUR 3 000 (CNY 21 300). As rapidly rising inflation eats away at take home pay, investing in a heat pump is an investment that fewer homeowners will be happy to make.

Nevertheless, the higher cost of gas means that the cost of installing and running a heat pump is now reaching parity with a gas boiler. Investments such as the new factory being built by Octopus Energy in Northern Ireland, which is set to manufacture heat pumps at the same cost as a gas boiler, will make heat pumps more competitive. Heat pump manufacturer Stiebel Eltron in Lower Saxony, Germany, aims to double production capacity by 2026, investing EUR 120 million in its expansion and creating 400 new jobs.

Peak load pressures? What is going to happen at times of peak demand, once the projected 50 million heat pumps are connected to the electricity grid? There are concerns that the system will need upgrading, particularly if reliant on renewable, and therefore variable, energy. Electricity grid companies play down these worries, but there is no doubt that careful planning and infrastructure investment will be required to meet the additional demand for electricity that will accompany a mass rollout of heat pumps.

Public opinion: Aside from the cost, consumers may be deterred by the different heat experience delivered by a heat pump. Rather than being able to respond to varying temperatures or situations, heat pumps maintain a constant temperature. This is very different to gas or oil fired boilers, which can be adjusted to deliver sharp variations in heat as required by the householder.

Additionally, householders may balk at the size of a heat pump, which involves a large air-conditioner-style box on an outside wall, and by the noise it makes: professional advice is to locate it on a wall far away from the master bedroom. The heat pump also requires installation of a water tank – something that householders have recently dispensed with following the advent of gas-powered combi boilers which heat water on demand, and an item for which they may be hard pressed to find space.

Meanwhile, plenty of housebuilders are simply unaware of heat pumps as an alternative to fossil fuel installations. New build houses are routinely entering the market with standard fossil fuel heating, simply because of that lack of knowledge.

Skilled installers? In order for a heat pump to be installed, a specialist survey is first required to assess the insulation of the property and its existing radiators. Without adequate insulation, the heat pump will be less efficient than a fossil fuel powered system. Small, older radiators will be incompatible with a heat pump system.

The installation itself is also complex, with the electrical wiring of many buildings unable to accommodate the extra electricity needed by heat pumps, which run on 220/240 volts like window unit air conditioners do. If a gas boiler breaks down, the easiest and cheapest solution for

2. *The perfect fit: Shaping the Fit for 55 package to drive a climate-compatible heat pump market.* *https://www.raponline.org/knowledge-center/the-perfect-fit-shaping-the-fit-for-55-package-to-drive-a-climate-compatible-heat-pump-market/*

a homeowner is to swap it with another gas boiler. Installing a totally different type of system that may have implications for the building's wiring is a big ask, and unlikely without some major subsidies[3].A recent UK study found that 80% of heat pumps were less efficient than fossil fuel boilers simply due to poor installation[4].

In Germany, the lack of skilled manpower is holding up installations. Hans Schmidt, owner of a heat pump firm in Bavaria, told Politico that it was near-impossible to find heating technicians in Germany. 'We're desperately looking for people,'he said. 'Once I called the job centre and said I need installers for heating systems. They started laughing.'[5]

The UK's Heat Pump Association has launched a mass drive to train up installers, raising the skills base from just 3 200 installers in 2021 to 50 000 in 2030. The plans include an expansion of its training facilities from 22 to 37, and introduction of a simplified syllabus. Meanwhile, the European Heat Pump Association (EHPA) is playing down the lack of installers, saying it is possible to upskill heating installers in just five days.

Green impact? Heat pumps use refrigerants called fluorinated gases. F-gases were developed in the 1990s to replace the ozone-killing chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). However, like CO_2, F-gases drive global warming and are stable, so will remain in the atmosphere for a long time.

In 2015, the EU imposed annual production quotas for F-gases in order to promote the use of alternatives. DG Clima, the European Commission's department responsible for F-gas regulation, is now mulling a steeper phase down in quotas, starting with a potential 50% cut from 2024. The danger now is that this could hold up the push for more heat pumps.

'Any new measure in the revised F-Gas Regulation that would limit in a foreseeable future the availability or the choice of refrigerants (bans, stricter quotas) would necessarily slow down the speed at which heat-pump equipment will be deployed,' warned an industry coalition in March 2022, made up of the manufacturers' group, EPEE, the European contractors association, AREA, and the EHPA.

Having a full range of F-gases available is necessary 'to speed up the massive deployment in a safe and highly efficient manner,' the group said in a letter to the European Commission.

But alarm bells may soon sound over widespread and growing use of gases that contribute to global warming.

Looking for answers: the Regulatory Assistance Project steps forward

Many of these issues are acknowledged by EU industry specialists. In its recent report, the Regulatory Assistance Project

3. https://www.energymonitor.ai/sectors/heating-cooling/can-heat-pumps-free-europe-from-russian-gas-dependency
4. https://www.theguardian.com/environment/2010/sep/08/heat-pumps-green-heating
5. https://www.politico.eu/article/eu-heat-pumps-stop-russia-gas/

(RAP) (a group of buildings and heat decarbonisation experts), has taken a look at the hurdles confronting the heat pump sector, and how EU policy could support a mass roll-out of heat pumps at the level required. Its main aim is to offer guidance on how to improve the EU's Fit for 55 package to encourage greater use of heat pumps.[6]

The paper demands a clear strategy and policy stability to drive long term investment and decision making, as well as a mix of different policy measures to ensure that the journey towards heat pumps is simple, provides good consumer outcomes and develops good jobs and skills.

Policies should include pricing mechanisms to ensure that heat pumps cost less than fossil fuel systems (including running costs); financial support to cover the additional capital costs associated with first-time heat pump installs, as well as the insulation and heating system upgrades that may be needed to get the buildings heat pump ready; and appliance standards to drive an eventual ban on fossil fuel heating.

The report acknowledges the different strategies for heating in Europe's Member States. In areas like the Nordic countries, where there is a greater penetration of heat pumps, consumers rely on communal heating infrastructure such as electricity grids, heat networks and gas grids, while in warmer states customers make heating decisions for their own individual properties, rather than as a community. Where consumers are looking to heat their own properties, they are likely to view the promotion of new technologies with caution. They are wise to look beyond the headlines. For example, while government and media trumpet the benefits of air-to-air heat pumps, the RAP report suggests cooler countries should consider introducing higher manufacturing standards or promoting ground source heat pumps.This is because in cooler countries, the COP ratio is likely to be lower because of the lower ground or surface air temperatures.

6. *The perfect fit: Shaping the Fit for 55 package to drive a climate-compatible heat pump marke.* thttps://www.raponline.org/knowledge-center/the-perfect-fit-shaping-the-fit-for-55-package-to-drive-a-climate-compatible-heat-pump-market/

In response to the concerns about the global warming potential of F-gases, the report notes that newer heat pump models can use refrigerants with lower global warming potential, which means they can operate at higher temperatures, potentially reducing the need to replace existing radiators.

To reduce running costs, RAP advocates ‘smart’ tariffs or ‘time of use’ tariffs, which will maximise the use of lower-cost electricity. It also proposes using under floor heating rather than radiators in order to achieve greater efficiency.

As far as installation goes, the report’s authors are firmly in favour of fitting heat pumps in new builds: the costs of installing at the time of construction are lower and the process is more straightforward compared to retrofitting heat pumps into older buildings. Policy moves to ban fossil fuel heating systems in new builds will help accelerate the adoption of heat pumps, the report suggests. The authors also note that heat pumps are particularly appropriate for industrial use, as they can be deployed either at scale or in small units.

Policy and regulatory reform form the mainstay of the RAP recommendations. They advocate capital support to eliminate upfront costs, pricing policies to support lower ongoing heat pump running costs, regulations to drive purchasing behaviour, and a framework of skills development and consumer protection to encourage take up of the technology. They also propose an additional carbon tax on heating fuels to push consumers towards carbon neutral alternatives. An additional move would be to adjust the EU’s proposed revision to the Emissions Trading System Directive, which proposes an emissions cap that would generate income for a social climate fund to reduce fuel poverty. The report suggests using that money to help fund heat pumps for low-income households and improve the economics of fuel-switching, and warns that policy and regulation are needed to support the ETS proposals.

The RAP authors single out the European Tax Directive for criticism, arguing that its rates are not related to energy or carbon content. They want to see tax rates that reflect the higher energy content and environmental impact of fossil fuels and unsustainable biomass. Such moves would give a boost to the electrification of the heating sector and therefore to heat pumps.

The Directive on Energy Efficiency is found wanting as it allows maintaining and even expanding heat generation from natural gas, and does not restrict the use of biomass in heating. The RAP report calls for an improved definition of district heating that would limit the use of gas and biomass.

Unsustainable biomass heating should be capped by a revised Renewable Energy Directive, the report advises. Electricity generated from renewable sources should count towards a mandatory renewable heat target; and if no cap is introduced, then a multiplier should be introduced for non-biomass renewable heat technologies, including heat pumps.

Regulation is another area in which revision is required, suggests the report. It backs the proposed reform of the Energy Performance of Buildings Directive (EPBD) to call for decarbonisation of buildings, not just energy performance, and calls for more stringent minimum energy performance standards.

The revised EBPD currently under discussion would require all new builds to be zero emissions by 2030, with public buildings required to meet these standards by 2027. The RAP report calls for this deadline to be brought forward to 2025.

Taken together, the RAP recommendations offer a useful overview of the proposed revisions to the Fit for 55 package, alongside their own suggestions for how to improve those revisions. They offer a number of proposals that the EU is likely to take into consideration, as the pressure to reduce emissions intensifies. There is a danger, however, of a 'one size fits all' approach to the introduction of heat pumps or low-carbon alternatives, with a combination of penalties and fixed costs to push homeowners and builders towards the technologies. The suggestions take little account of the squeeze on household income caused by general inflation and the recent massive spike in energy costs, and instead lean on the ETS scheme to provide funds to offset the costs for low-income households. Nor do they make allowances for the fact that, as governments reel from the costs of the recent Covid-19 lockdowns and associated social support, funds are not so freely available as they were in 2019. No figure is put on the cost of the measures proposed.

Conclusion:

In a crisis, it is always tempting to reach for simple, 'off-the-shelf' solutions. Heat pumps are a clear example where a single solution is being presented by governments and trade bodies as the answer to a complex issue. Little account is taken of the efforts already taken to introduce cleaner technology. For example, since 2005, all new gas boilers in the UK have been required to be condensing boilers, which offer 90% efficiency. Will householders be ready to invest again in a new technology?

There are other ways to heat a building without recourse to harmful gases or unpredictable upfront costs. For example, orientation of a building in relation to the sun will maximise its natural heating and cooling potential. Installation of solar panels or wind power can generate clean electricity to power standalone heaters. Thermal energy storage can tap into the constant temperatures of the sub-soil aquifer[7]. Targeting support at new builds, which have adequate insulation and radiator systems, will avoid some of the excessive costs associated with retrofitting heat pumps into older buildings.

Take a look at one alternative approach, in the Orkney Islands in northern Scotland. The windy climate means that the community generates an excess of electricity from wind power. Instead of being curtailed, the electricity is now being redirected to power smart quantum storage heaters in the islanders' homes. Each heater costs around EUR 820 (CNY 5 820).[8]

As the drive for heat pumps continues, governments are now confronted by the need to introduce costly subsidies and incentives if they are to meet their targets. Studies show that heat pumps are not as squeaky clean in practice as they are on paper, due to poor installation and other issues highlighted above. In current inflationary times, many will shy away from the high upfront costs. The climate and average temperature vary in each European Member State, and the chances are that the solutions for each Member State – be it type of heat pump, or type of heating technology - will also vary. Perhaps energy planners need to open their minds to the alternatives.

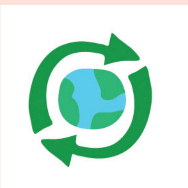
*By **Helen Farrell***

7. *EU-China Energy Magazine, April 2022. http://www.ececp.eu/en/eu-china-energy-magazine-2022-apr-issue-en/*
8. *https://localenergy.scot/casestudy/heat-smart-orkney/*

Can the EU and China align their carbon markets?

Pushing for a global carbon market might seem like a good idea but would be risky and complicated in practice. For now, collaboration is the way forward.

Illustration: Daniel Stolle / China Dialogue



The EU launched its emissions trading system (ETS) in 2005, and it now covers 11 000 emitters and almost half of European emissions. It uses a market-based cap-and-trade system to reduce greenhouse gas emissions from large power stations, industrial plants and flights within Europe.

Since then, several other national or sub-national carbon markets have either been fully launched or partly developed – notably in Canada, Japan, New Zealand, South Korea, Switzerland and the United States. But the EU has worked particularly hard to build a collaborative relationship with China – to help develop the carbon market concept – because China's size makes it the obvious market leader in Asia.

China's ETS began trading last year, and so far only covers the power generation sector, but 'the 2 162 companies it includes produce an estimated 4.5 billion tonnes of CO_2 emissions annually,' writes Renato Roldao in Energy Monitor. 'That compares with an EU ETS emissions cap in 2021 of 1.6 billion tonnes of CO_2.'

In 2014, the EU cooperated with China on designing and implementing China's carbon market and supporting a roll-out of seven regional pilot schemes across the country. Three years later, at the COP23 UN climate conference in Bonn, that cooperation facilitated the creation of China's national ETS. Commissioner Arias Cañete said at the event that the ETS would, 'undoubtedly send a strong signal to the rest of the world in support of carbon markets. The EU is therefore pleased to engage in even closer bilateral cooperation with our Chinese counterparts.'

The rationale underpinning this EU–China cooperation is that by sharing its experience with China, the market with the greatest potential to reduce global emissions, the most established carbon trading system, the EU, can expedite progress in the fight against global warming.

Barbara Pongratz, an associate analyst at the Mercator Institute for China Studies (Merics), told China Dialogue: 'The goal of EU–China dialogue on carbon markets is to combine knowledge and enhance our common understanding of ETSs.' Being the global ETS market leader, the EU was able to share knowledge gained from its experience. However, as Pongratz says, 'regular bilateral policy dialogues between the EU and China are a mutual learning process and, given the sheer size and complexity of the Chinese ETS, European stakeholders are learning a great deal from China's experience as well. ETS development is a procedure of constant exploration and enhancement.'

Differences in market design

China's ETS, being at an earlier stage of development, differs from the EU ETS in a number of ways. The main difference so far, Roldao says, is that China's system has no absolute cap, and is based instead on carbon intensity. Under this system, the emissions of individual companies are compared against the average carbon intensity of the relevant sector. Each emitter is allocated emission allowances free of charge, and if they can reduce the carbon intensity of their operations, they can sell surplus allowances.

This system is designed not so much to phase out coal in favour of renewables but to phase out the less efficient coal plants, so making the overall coal sector more efficient. As Roldao explains in his article: 'The same overall volume of electricity would be generated by coal as without the ETS, but the increased efficiency would lead to lower emissions overall.' In this way, the Chinese government can work towards its global warming targets without compromising the country's energy security.

China, like the EU, also makes use of scarcity as a policy tool to reduce emissions. Roldao writes: 'Once the cost of carbon is fully reflected in the cost of energy, it will change power plant cost structures, which is likely to accelerate reform of the Chinese power market, leverage green financing and galvanise the uptake of emission reduction technologies.'

Linking up carbon markets

For policymakers, faced with a proliferation of carbon markets around the world, an obvious next step is to gain synergies by linking up with other markets. The EU has for example linked up with Switzerland. China, too, is working with its neighbours to develop a regional carbon market, leveraging trade relations built over the years with the ASEAN bloc. Though regional ETS harmonisation makes sense, analysts at the Green Finance & Development Center say this is difficult to achieve in the short term, as the development of individual carbon markets in Vietnam, Indonesia, Thailand and the Philippines is still at an early stage. For now, the analysts suggest, 'the main focus should be to assist Southeast Asian countries in completing the infrastructure construction of the [regional] carbon market, improving the legislation of carbon market construction, building an effective MRV (measure, report, verify) system, and exploring the development of the pilot carbon market.'

Jessica Green, associate professor at Toronto University, writing in Nature magazine, says 'linking markets together should promote trading, smooth financial flows and lower the overall cost of reducing emissions. A global price on carbon emissions would emerge without the need for long and fractious diplomatic negotiations.' However, she points out the reality is more complex: 'Linked carbon markets are difficult to manage when many regulatory authorities compete. Interactions with other climate policies trigger unintended outcomes. Policymakers find it hard to keep prices at the 'right' level – neither so high that a carbon market becomes politically unacceptable, nor so low that it fails to change behaviour.'

If a regional carbon market is challenging, a global one is even more so. Pongratz says: 'The introduction of a global carbon market is an ideal scenario that, however, seems unrealistic at present. Several hurdles must first be overcome, as the different ETSs, especially those of China and the EU, are at different stages of development and use different approaches and mechanisms that are currently difficult to align.'

Alternatives to harmonising carbon markets

It will be some time before China can match the coverage and maturity of the EU ETS, Pongratz says. The EU, as the ambitious climate policy leader, is keen to accelerate the process and has exerted political pressure by proposing the Carbon Border Adjustment Mechanism (CBAM). This is essentially a carbon tax on imports of certain products to protect climate action in Europe and to prevent the 'carbon leakage' of European companies outsourcing their production to countries with weaker emissions targets. She adds: 'Using CBAM as a last resort, it wants other major emitters and trading partners to step up their carbon pricing efforts. The more developed carbon pricing systems in a specific country are, the less they will be affected by CBAM. CBAM should also serve as an incentive to push forward global debates on carbon pricing, one type of which is emissions trading.'

Green believes that, within a global system, national carbon markets should limit their links to other markets. She says China 'made the wise decision to remain independent, providing leeway to fix the problems that will inevitably arise. It should postpone any other linkages being considered. Similarly, policymakers

should reject offsets from other jurisdictions.'

Governments tend to avoid difficult political decisions. As a solution, Green favours the creation of a central carbon bank to manage allowances and prices. She points to the EU's Market Stability Reserve for the EU ETS, which performs similar functions: 'governed by detailed rules, it leaves little opportunity for member-state influence'. In theory, a central carbon bank could perform a similarly useful, independent intermediary role. In practice, she says, the likelihood of this happening on a global basis is slim.

Managing volatility in the EU ETS

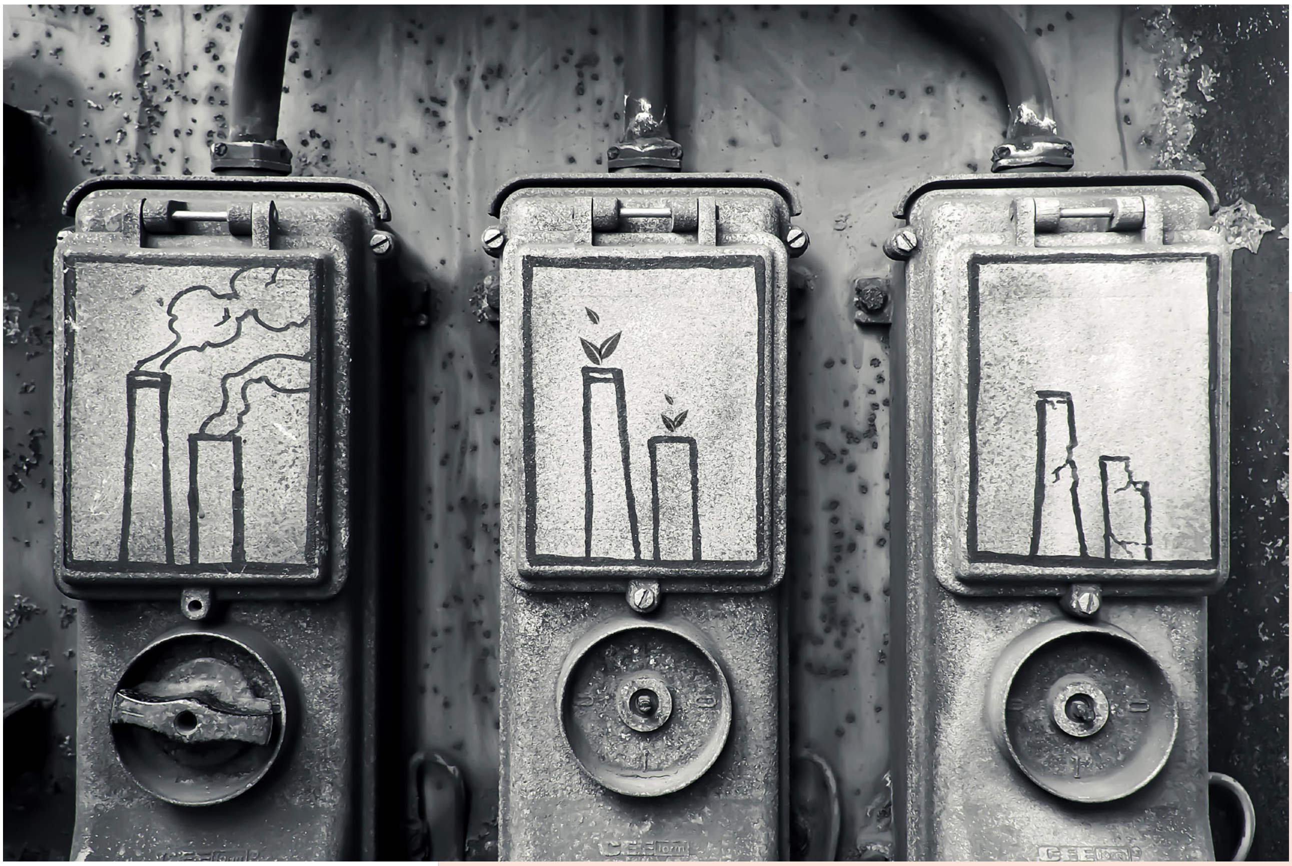
With carbon markets still in their

infancy, a global version may yet happen. When the EU was ready in 2017 to help China build its carbon market, its own ETS was struggling with an overabundance of allowances that had depressed the carbon price, giving industries little incentive to participate in the system. This problem has now been solved. Today, in Brussels, discussions are focused on the need to address the volatility of carbon prices – the forecast had been for around EUR 30/tonne, but they are now about EUR 100. This volatility is driven by several factors, including: the uncertainty caused by continual policy change (such as the goal for reducing greenhouse gas emissions across all EU economic sectors shifting last year from 40% by 2040 to 55%); the repercussions of the Covid-19 lockdowns on the global economy; and now the effect of economic sanctions on Russia for its war against Ukraine.

But one factor some policymakers don't like – or perhaps one they can do something about – is that many market participants are financial players speculating on EU carbon price movements. Since 2018, the number of active investment funds in the ETS has tripled, to more than 300, with non-EU financial players accounting for about a third of the market share. On the one hand, this speculation helps to develop the market by finding a true market value for carbon. On the other, it has also pushed up carbon prices for companies needing allowances, which in theory works against the main aim of the ETS of encouraging participation. Another factor for policymakers to consider, however, is that a higher price would help fund the development of green hydrogen, viewed by some as the technology of a decarbonised future.

One proposal is to restrict access to the EU carbon market for non-EU financial players. Other proposals include taxes on certain transactions, minimum holding periods to reduce short-term speculation and limits on financial positions. The aim is for greater price stability, but policymakers will also be looking to balance the competing needs of meeting the 2030 climate targets, finding the right price that fosters the growth of the carbon market, and not choking industry with too much costly regulation.

*By **James Norris***



Greening steel industry: the way forward

Momentum is gathering for decarbonisation of so-called hard-to-abate sectors, including the steel industry. One solution that is generally acknowledged to be among the most promising is green hydrogen. How can hydrogen better fit into iron and steel sector's future? Following a recent workshop held by the Rocky Mountain Institute (RMI), ECECP outlines some of the biggest hurdles confronting take-up of the new technologies, and the efforts needed to deliver the green transformation of the iron and steel sectors.

Over recent decades, the reduction of greenhouse gas (GHG) emissions has been a top priority for governments across the world that are racing to meet ambitious climate goals. While significant decarbonisation progress has been made in the electricity sector, other major energy-intensive industries such as chemicals, iron and steel are often described as 'hard-to-abate'. That is because the thermodynamic efficiency of core processes is reaching its limit and complete electrification is not technically feasible[1].

The pressure on the steel sector

Steel is an integral part of modern civilisation, providing critical material that underpins many other key industries such as construction and car manufacturing. However, in recent years the steel industry has been subject to growing criticism for its poor environmental performance. Globally, the steel sector is responsible for around 7% of the overall carbon emissions and one third of industrial emissions. Emissions approached 2.6 Gt CO_2 in 2020[2]. For every tonne of iron that is produced from iron ore, an average of 2.21 tonnes of CO_2 is emitted[3]. The great hunger for fossil fuels in the traditional production process, notably the current predominant blast furnace-basic oxygen furnace (BF-BOF), has made the steel sector the biggest carbon emitter of all the heavy industries. Since a sharp reduction in fossil fuels is needed to achieve our climate targets, massive changes are required to align the steel sector with the net zero pathway.

In fact, steel manufacturers are facing ever more pressure to decarbonise not only from regulators, who are setting more and more ambitious environmental targets and imposing stricter legislation, but also from investors voicing environmental, social and goverance (ESG) concerns. Downstream, car manufacturers have become the biggest driving force behind steel decarbonisation: they are keen to green their supply chains in order to differentiate themselves from other competitors, and so have exerted pressure on their steel suppliers, thus greatly contribute to drive the clean transformation of the steel sector, said Frank Peter, deputy executive director of Agora Energiewende, at the RMI workshop.

Alongside these external factors, the steel sector itself faces a changing landscape in the coming decade. More than 70% of the world's coal-based blast furnaces, which currently dominate steel production, are set to be decommissioned before 2030, and therefore will require mass reinvestment, according to Agora's Global Steel Transformation Tracker[4]. Meanwhile, emerging economies with rising steel demand will need at least 170 million tonnes of new capacity. If traditional coal-based production meets these needs, it will result in a long-term carbon lock-in which will jeopardise global climate goals. Due to the long lifetime of steel assets, the investment decisions made today will largely define the carbon future of tomorrow. Therefore, it is crucial that low-carbon technologies are embraced now.

Steel production: the green options

The steel sector has been taking innovative steps to improve its environmental performance. Since the 1960s, the energy required to make a tonne of crude steel has already dropped by 60 per cent, mainly thanks to energy efficiency improvements and the increasing availability of scrap

1. *IRENA (2022), Green hydrogen for industry: A guide to policy making, International Renewable Energy Agency. https://irena.org/publications/2022/Mar/Green-Hydrogen-for-Industry*
2. *Net-Zero Steel Sector Transition Strategy, Mission Possible Partnership (MPP), 2021,https://missionpossiblepartnership.org/wp-content/uploads/2021/10/MPP-Steel-Transition-Strategy-Oct-2021.pdf*
3. *https://worldsteel.org/wp-content/uploads/Fact-sheet-Hydrogen-H_2-based-ironmaking.pdf*
4. *https://www.agora-energiewende.de/en/service/global-steel-transformation-tracker*

steel which can be melted down and reused to produce secondary steel[5].

Today, the dominant modern blast furnace is currently operating close to its efficiency limit in the reduction process. In the meantime, the use of recycled steels also has limitations: impurities in scrap steel, such as copper, will accumulate over time, meaning that production of new crude steel will always be required for sectors such as car manufacturing that require high-quality steel. Even though continued technological progress is likely, the industry still has a long way to go to reach net zero.

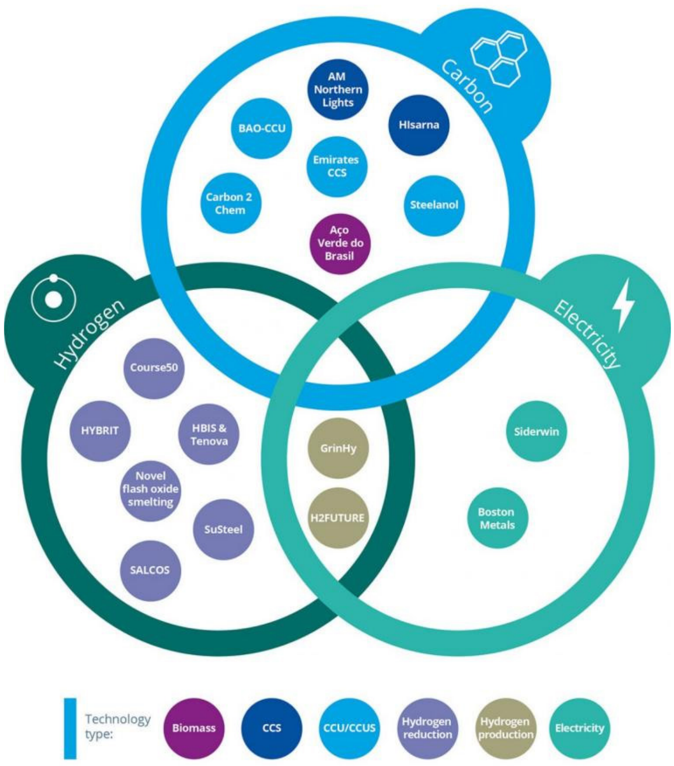
Against this backdrop, transformative and breakthrough approaches are required to green the steel sector. According to the World Steel Association (WSA), there are three general technological pathways to net zero: hydrogen; carbon capture, use and storage (CCUS); and direct electrification.[6] While there is no silver bullet to deliver the necessary change, a portfolio of technological options and combinations are now being explored across the world[7].

Growing interest in hydrogen

Even though coal remains the key fuel in the iron and steel sectors, it is clear that a fuel switch to other less carbon-intensive energy carriers has the potential to deliver significant emission reductions. In recent years hydrogen has become the new buzz word in the energy industries, and the global appetite for hydrogen-based solutions in the iron and steel making industry has grown. This is reflected in patent data and the growing emphasis on hydrogen deployment in policy frameworks, as well as a proliferation of announcements of pilots and demonstration projects.

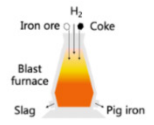
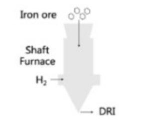
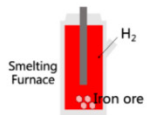
Take China as an example. It is home to 52.9% of global crude steel production[8]. Here, 258 hydrogen steel metallurgy related patents have been granted from 2002 to July 2021, with the pace picking up since 2017. Many more are likely to be granted around 2025, notes Frank Zhong, chief representative of the World Steel Association's Beijing office.

In early 2022, following China's announcement of dual carbon



Key breakthrough technologies and related projects in greening the steel sector.
Source: World Steel Association

5. https://worldsteel.org/wp-content/uploads/Fact-sheet-Energy-use-in-the-steel-industry.pdf
6. https://worldsteel.org/steel-by-topic/environment-and-climate-change/climate-action/breakthrough-technology/
7. *More low-carbon steelmaking technology options as well as their impacts and tradeoffs can be found in IEA Iron and Steel Technology Roadmap.*
8. https://worldsteel.org/steel-by-topic/statistics/annual-production-steel-data/P1_crude_steel_total_pub/CHN/IND

Classification	Illustration	Description	Pilot project	Merit	Limitation
Hydrogen-rich blast furnace (H2-BF)		H_2 injection in blast furnace	Baowu H2-BF project in Xinjiang; Thyssenkrupp H2-BF project in Duisburg	Less renovation cost, more economical	Less emission reduction potential
Hydrogen-based direct reduced iron (H2-DRI)		H_2 injection in shaft furnace	HBIS H2-DRI pilot plant; ArcelorMittal Germany H2-DRI project	Emission reduction potential could reach over 90%	More renovation difficulties, lower technology readiness level
Hydrogen-based smelting reduced iron (H2 –SRI)		H2 injection in smelting reaction furnace	Jianlong H2-SRI project in Inner Mongolia		

Hydrogen-based steelmaking routes. *Source: Closing the loop, RMI.*

pledges that give strong impetus to the take-up of green hydrogen, the government issued 'Guiding Opinions on Promoting High-Quality Development of the Iron and Steel Industry'. This paper designates 'formulating an action plan for hydrogen-based steel production' as a major task, further demonstrating its firm determination to develop clean hydrogen-based approaches. Later, in March 2022, China released its first Mid and Long Term Plan for Hydrogen, calling for an expansion to the application of hydrogen in industry and other fields, while exploring the demonstration application of hydrogen-fueled steel metallurgy.

Although hydrogen-based steel making is still in its infancy, a growing number of hydrogen-based steel production pilots are now being planned or are under construction across the world. According to Global Energy Monitor's Green Steel Tracker[9], of 59 green steel projects announced as of November 2021, 31 were hydrogen-based, with the majority located in Europe where the enabling structure is comparatively well established. These early pilots will play a major role in the ramping-up of the technology and proving the business case for green steel.

According to RMI's research, there are three main ways that hydrogen can be deployed in the steel production process: 1) as an auxiliary reducing agent in the BF-BOF route (H_2-BF) to improve the performance of conventional blast furnaces; 2) as the primary reducing agent in direct reduced iron (H_2-DRI); 3) in smelting reduced iron (H_2-SRI). By substituting hydrogen for coking coal and natural gas in the production process, CO_2 emissions can be reduced significantly.

In the steel industry, clean hydrogen-based production (produced through electrolysis using renewable power) could offer promising route to full decarbonisation of the sector. The H_2-DRI approach, coupled with an electric arc furnace that uses 100% green hydrogen, has the potential to drive carbon emissions down to near zero. This solution is highlighted in the International Energy Agency's Iron and Steel Technology Roadmap[10].

9. https://www.industrytransition.org/content/uploads/2022/05/green-steel-tracker-211108.xlsx
10. https://www.iea.org/reports/iron-and-steel-technology-roadmap

Cost and competitiveness, the biggest hurdles for green steelmaking

Some key challenges regarding cost and economics need to be addressed before the decarbonisation potential of hydrogen-based steelmaking technologies can be fully realised, declared key stakeholders in the steel sector during the workshop discussion.

If a hydrogen-fueled steel sector is to become a reality, sufficient clean hydrogen needs to be available at an affordable cost. The steel sector has low profit margins and is highly sensitive to fuel and energy prices. 'Accessibility and affordability will be key drivers for the hydrogen takeup', noted Mr Rao Wentao, chief scientist and hydrogen director at Baowu Clean Energy (a wholly-owned subsidiary of China's Baowu Steel Group). Right now, green hydrogen is expensive due to the high cost of renewable power and electrolysers. The cost of green hydrogen-based steel production could be between 20% and 30% higher, or even twice much, as traditionally-produced steel. According to Rao, the price of green hydrogen in China is currently over CNY 40 per kg, which is unaffordable for steel makers. The figure would have to at least halve to make economic sense. Nevertheless, with a dramatic cut in costs expected in the coming decade, the competitiveness of green hydrogen in steel manufacturing is likely to improve, especially if a carbon price is introduced.

Aside from the clean hydrogen cost gap, the huge upfront investment required for necessary hydrogen infrastructure, including transportation and storage, also represents a barrier to green steel production. If hydrogen is to be used in the steel industry, it needs to be produced on a large scale and be totally reliable. Steel production processes need to have a base load of supply, with storage to cope with the variability of renewable electricity generation. Such facilities will add to steel makers' financial burdens when switching to hydrogen. Moreover, if green hydrogen is to be adopted into the steel industry, Blast Furnace-Basic Oxygen Furnace (BF-BOF) will have to be replaced with DRI fueled by hydrogen, which in turn means that the mass installation of new DRI plants will be unavoidable. Such plants take several years to build, and will add significantly to the overall deployment cost[11].

Relocation: the broader challenge

The adoption of green hydrogen will add new variables into the steel industry's development, bringing broader challenges to the steel sector landscape.

Green steel production, using pure hydrogen instead of BF-BOF, needs a higher grade iron pellets than traditional steel production methods. This could potentially change where most steel is manufactured, and so shake up the mining industry[12]. Equally, according to RMI[13], there is a spatial mismatch between current steel production assets, which are designed to be close to coal-rich areas, and green hydrogen, which is produced from on-site electrolysers using cheaper renewable power to minimise the need for transportation. This represents another challenge to the steel industry as it evolves green production practices.

It is clear that extensive deployment of hydrogen-based steelmaking could involve large-scale relocation of the steel industry. Given that steel production is usually a key industry supporting the local economy, the relocation of the steel production would require comprehensive industry planning from a top-down perspective to mitigate potential resistance from existing communities that are dependent on the local steel industry.

11. See footnote 1.
12. https://about.bnef.com/blog/steel-industry-set-to-pivot-to-hydrogen-in-278-billion-green-push/
13. Closing the Loop: Value Chain Cultivation for Clean Hydrogen-Based Steel, RMI. https://rmi.org/insight/closing-the-loop/

Gearing up the green steel production ecosystem

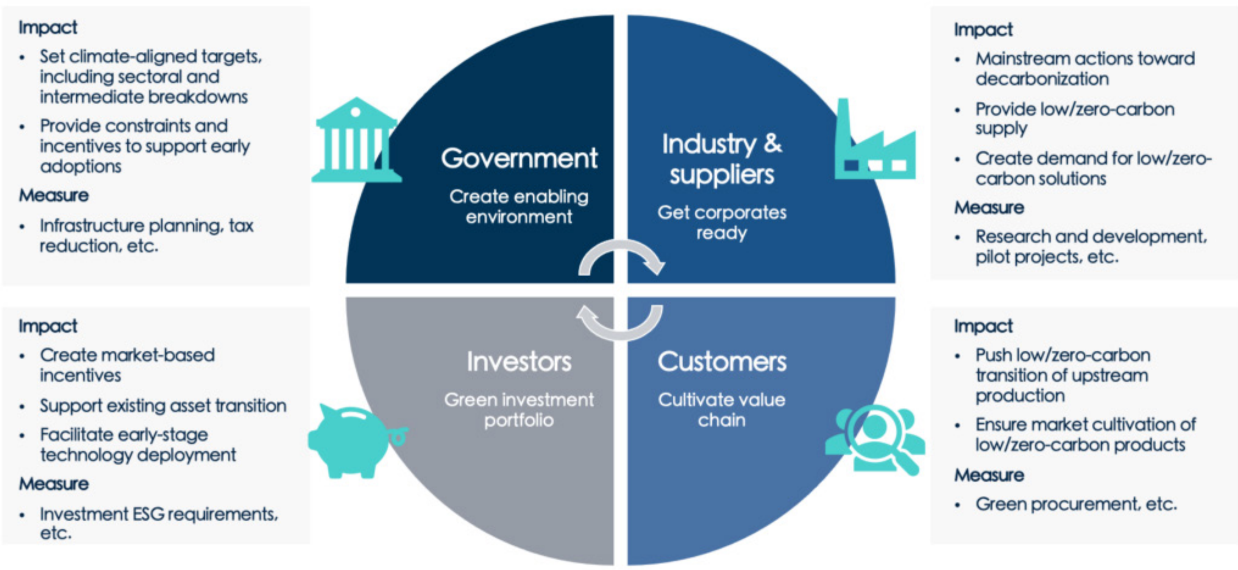
Right now, when green steelmaking technologies are still under development, the move from technology pilots to commercial deployment requires a strong business case for investment. This is turn needs enabling frameworks such as supportive policy instruments as well as close collaboration across the steel value chain to gear up a hydrogen-based steel ecosystem.

The steel sector is set to be one of the world's largest hydrogen consumers. Under RMI's zero-carbon scenario, 35 to 55 million tons of hydrogen will be required for steel production by 2050[14]. However, at present the use of hydrogen in the steel industry is still limited to demonstration projects: to justify the business case for investment, it needs to be at sufficient scale. Without sufficient demand for green hydrogen, hydrogen producers lack the incentive to deploy it at a large enough scale to drive down the cost, leaving green hydrogen as a high cost fuel that cannot generate enough demand. This is a typical 'chicken and egg' problem. Incentive policy frameworks and strong policy support in both the supply and demand side will be absolutely crucial to kickstart the hydrogen-steel partnership.

14. See footnote 13.

In the EU, multiple policies and funding support already cover various project stages for green steel making[15]. However, in China, policies to encourage the take-up of hydrogen in the steel sector remain limited. Although there is a replacement policy for steel production assets to gradually phase down underperforming BF-BOF capacity while encouraging 1:1 replacement with cleaner options, key players in the steel sector including Baowu, Jianlong and Ansteel all argued in the panel discussion that the policy needs to allow steelmakers more room for trial and error when testing new hydrogen-based technologies. Meanwhile, the industry is calling for incentive mechanisms to reward proactive efforts to reduce emissions. Demand side incentives that encourage green steel product procurement from downstream industries, and impose binding green hydrogen consumption quotas and targets, will be equally important to create a market for hydrogen-based steel, noted Frank Zhong from the World Steel Association.

What is more, the steel industry alone cannot shoulder all the risk and enormous upfront investment associated with this transformational hydrogen-based change. Top-level interventions and joint efforts from all stakeholders, including government, steel makers, hydrogen providers, as well as downstream consumers, will be of particular importance for cultivating the new ecosystem. 'A proper risk-sharing mechanism to mitigate the early challenges will need to be carefully designed,' stressed Harold Tian, head of technology and new business development in China at Thyssenkrupp. 'Actually, steel makers have nearly done everything they can to improve efficiency and reduce environmental impact. A larger decarbonisation potential exists in sector-coupling and synergetic development of upstream and downstream industries', said Tian. Government will therefore play a central role in facilitating such



Stakeholders' joint actions in cultivating the ecosystem. *Source: Closing the loop, RMI.*

15. *Ibid.*

cooperation. **Sweden's HYBRIT** offers a perfect model in this regard: the Swedish Energy Agency provides the necessary support while mobilising efforts to ensure progress is made.

In addition, joint research and development coordination among the steelmakers, research institutes, technology providers as well as industry associations needs to be aligned to achieve major innovative breakthroughs in green hydrogen metallurgy. It is crucial to maximise the value of key intellectual property and avoid technological monopoly.

The way forward

Despite the huge potential of hydrogen-based steel production to drive down carbon emissions, hydrogen represents only part of the equation in greening the steel sector. To achieve the transition to net zero, every possible solution will need to be deployed at maximum speed.

The development and application of clean iron and steel making solutions such as green hydrogen metallurgy still face tremendous challenges. They require significant investments, an enabling framework, sustained research, and innovation for breakthrough technologies, if new solutions are to enter the market. Last but not least, it is clear that governments, the steel industry and other stakeholders will all need to collaborate closely to overcome the technological and economic challenges, and to create the market conditions necessary to set the steel sector on the path towards a green future.

By ***Daisy Chi***

Maximising collective efforts - the case of HYBRIT

The Hydrogen Breakthrough Ironmaking Technology (HYBRIT) is a revolutionary process developed by a consortium of companies and the Swedish government: LKAB (mining), SSAB (steelmaking), Vattenfall (energy provider) and Sweden's Energy Agency (financial, scientific and technical support). The consortium's goal is to transition to fossil-free iron and steel production in the Swedish and Finnish markets by 2035. HYBRIT covers the entire process chain, from mining and processing iron ore to making steel, to ensure that fossil fuel use is close to being eliminated. LKAB, the largest iron ore producer in Europe, will replace coal with green hydrogen for the DRI process, while SSAB will switch to electric arc furnaces (EAF). Vattenfall will provide the fossil-free electricity required for both processes and develop the technology for large-scale underground hydrogen storage. In June 2021 HYBRIT successfully completed the test production of sponge iron. The first steel made with HYBRIT technology was rolled by SSAB in July 2021. The partners aim to demonstrate the technology on an industrial scale as early as 2026.

The process would lower the carbon footprint of 1 tonne of steel from 1.8 tons of CO_2 to 25 kg. Once HYBRIT is fully implemented in Sweden, it is expected to lower national carbon dioxide emissions by as much as 10%[16].

Source: Green Hydrogen Industry, IRENA

16. https://www.h$_2$-international.com/2020/11/12/hydrogen-breakthrough-in-steelmaking/

Why sustainable Buildings are critical for a resilient, healthier society?

Europe and its Member States are committing large sums to buildings renovations. The policy emphasis has been on insulation, energy savings and emissions reduction. The latest Healthy Homes Barometer 2022 by Velux draws attention to the health benefits of renovations that target damp, lack of daylight, excess noise or cold, and other indoor climate hazards. To get an idea of the scale of the problem, 34 million Europeans are unable to keep their homes warm, according to the report. It quotes the World Health Organization's calculations that show that investing in improving housing has a greater impact on health – over a two to four year period – than investing directly in healthcare. By investing in renovation an estimated EUR 600bn per year by 2050 can be saved through avoided healthcare spend, improved health and improved productivity.

In its recent Energy Efficiency First Principle (EE1) Guidelines, the European Commission recognised human health as one of the most important co-benefits of energy efficiency but at the same time acknowledged a lack of good available data to better quantify and assess these wider benefits.

The latest Healthy Homes Barometer 2022 aims to address this gap by providing new data on the impact of a poor indoor climate on health and life satisfaction and the economic benefits of investing in healthy buildings.

As the pandemic loosens its grip on Europe and with the revision of the Fit for 55 Package and not least the Energy Performance of Buildings Directive (EPBD) currently on the legislative table, the opportunity to make buildings sustainable has never been more timely. The EPBD proposal does acknowledge the importance of a healthy indoor climate, but lacks clear definitions and measures in terms of how to act on it. At the same time, the need for decent, affordable and sustainable housing is greater than ever.

'We should improve Europe's building stock and thereby the health and well-being of all European citizens. The good news is that we have a lifeline available for healthier buildings in Europe. Not only have EU Member States earmarked vast sums for renovating the building stock in their national recovery plans but the EU is also revising its legislation on buildings this year with the Fit for 55 Package,' says David Briggs, CEO, the VELUX Group.

Even before the Corona virus struck, the percentage of households where total housing costs represent more than 40% of disposable income was a shocking 9.4% for the overall EU population[1]. And with energy costs skyrocketing due to the Russian invasion of Ukraine, this figure is rising further. After all, Europe's buildings consume 40% of Europe's energy.

As a result of this lack of affordability, 15% of all Europeans currently live in deprived housing circumstances[2] with a subsequent negative impact on health and well-being. In total, one in three Europeans live in a home that is affected by an indoor climate hazard, such as damp, lack of daylight, excess noise or cold[3]. For those affected, the impact of their poor housing has been felt even more acutely during the various lockdowns of the pandemic, which forced them to spend more time at home.

1. *Etzebizitzako Behatokia, Observatorio Vasco de La Vivienda, 2021, "Housing policy in Europe during the pandemic"*
2. *WHO Europe 2019, "Healthy prosperous lives for all: The European Health Equity Status Report"*
3. *EU SILC data 2019*

At the same time, the pandemic and its many lockdowns have shown the importance of making indoor spaces safer and reducing the spread of airborne viruses, such as SARS-CoV-2. Buildings have a clear role to play in achieving this. To safeguard our indoor environment, the World Health Organization and health authorities in many countries recommend airing out rooms and spaces regularly – either through natural ventilation, such as opening a window, or through mechanical ventilation systems.

The impact of poor indoor climate on mental well-being

The health impact of indoor climate hazards, such as damp and lack of daylight, are already well known and include asthma, respiratory problems and cardiovascular disease. However, new studies have now started to document the impact of poor indoor climate on well-being and life satisfaction. For example, living with poor or no heating has been shown to have the same perceived impact on well-being and life satisfaction as being separated from a partner[4]. With 34 million Europeans unable to keep their homes warm[5], the potential impact on their well-being is significant.

This type of assessment into well-being and life satisfaction gives governments and policymakers a way to measure the value of building renovation in a more holistic way. Alongside the tangible benefits, such as energy savings, they can now also measure the positive impact on mental health.

Light and bright

Being exposed to enough daylight means you are almost twice as likely to feel energised, which also has a positive effect on your general health, improves your sleeping and reduces your risk of infections.

Cool, quiet and ideal for sleep

A cool quiet bedroom that promotes a good night's sleep contributes to overall good health and feeling energised.

Comfortable temperatures

Comfortable indoor temperatures – neither too hot, nor too cold – make you less likely to suffer from nose, throat and other upper respiratory infections.

Fresh air and ventilation

Airing out your home makes you feel more energised and also reduces the transmission of virus droplets.

The right level of humidity

Mould in your home makes you more likely to suffer from throat and other upper respiratory infections.

Comfortable sound

Excessive noise can impact your physical and mental health and lead to issues, such as sleep problems.

Nature

Creating a connection between indoor and outdoor areas improves the perception of a good indoor climate and gives a sense of improved well-being.

4. *RAND report.*
5. *EU SILC data 2019*

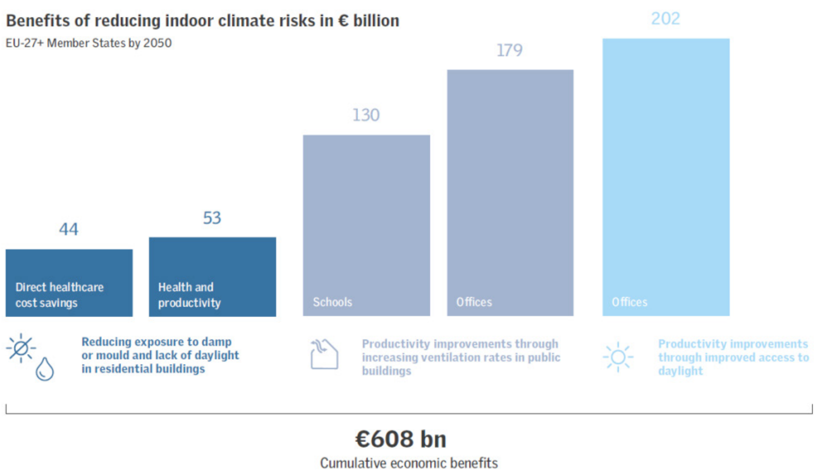
Buildings are political

With Europe on the cusp of a renovation wave that could tackle the climate crisis by decarbonising our building stock, the roll-out of national recovery plans as well as the need to step up efforts on energy efficiency, policymakers now have a unique opportunity to set the right legislative framework and push for investments in sustainable and healthy buildings.

Investing in housing is more than just improving living conditions and reducing climate impact. Healthy buildings can play an important role in reducing inequities and illness. Reducing exposure to damp and mould and rectifying the lack of daylight in residential buildings could result in mental well-being benefits estimated at almost 100 billion Euros per year[6], in addition to energy efficiency improvements. Data from the World Health Organization also shows that investing in improving housing has a greater impact on health – over a two to four year period – than investing directly in health[7]. The cumulative benefits of investing in renovation in terms of direct healthcare savings, improved health and improved productivity are conservatively estimated at 600 billion euros per year by 2050.

Research for the Healthy Homes Barometer 2022 was carried out in partnership with RAND Europe, a not-for-profit policy research organisation.

Find out more about the impact of indoor climate on health and life satisfaction as well as the benefits of investing in healthy buildings in the Healthy Homes Barometer 2022.



Key Healthy Homes Barometer findings

- 1 in 3 Europeans are exposed to an indoor climate hazard[8]
- 50 million European households are living in energy poverty[9], many of them unable to heat their homes in winter
- Ventilation is a simple and cost-effective way to safeguard indoor spaces against airborne viruses
- Indoor climate hazards affect our mental well-being and can increase the risk of depression[10]
- Reducing exposure to damp and mould and rectifying the lack of daylight in residential buildings has been shown to result in well-being benefits that are felt to be the equivalent of around 90 billion Euros per year[11], in addition to energy efficiency improvements
- Improving housing has a greater impact on health than investing directly in health[12]

*By **Velux***

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6. RAND report
7. WHO Europe 2019, "Healthy, prosperous lives for all: the European Health Equity Status Report"
8. EU SILC data 2019
9. FEANTSA press release, 16 July 2021
10. EU SILC data
11. RAND report
12. WHO Europe 2019, "Healthy, prosperous lives for all: the European Health Equity Status Report"

Decarbonising Ammonia Manufacturing: Three Scenarios for 2050

The International Energy Agency (IEA) Ammonia Technology Roadmap outlines the options for carbon emissions reductions for one of the most GHG-intensive production processes in the chemical and petrochemical sectors.

All mineral nitrogen fertilisers use ammonia from the outset, which makes ammonia an essential component of the global food production chain. Roughly 70% of all ammonia produced is used in the production of fertilisers, with the rest employed in other applications such as the manufacturing of explosives and plastics. A large fraction (30%) of global ammonia production takes place in China, with the EU, US, Russia, India, and the Middle East each accounting for between 8% and 10%. Ammonia production accounts for a significant proportion of global energy consumption (8.6 EJ, 2% of the world's total) and global CO_2 emissions (450 Mt, 1.3% of the world's total). Of the greenhouse gas emissions of the chemical and petrochemical sectors, ammonia accounts for one third. The hydrogen production step in the process of ammonia manufacturing is alone responsible for the largest level of emissions in the entire chemical industry.

The emissions impact of the ammonia manufacturing process justifies a concerted effort to reduce its effect on climate change, while maintaining its economic viability. The IEA's Ammonia Technology Roadmap focuses on decarbonisation paths for the ammonia-producing sector.

Currently, production of ammonia is based on the Haber-Bosch process, which consists of nitrogen fixation using a metal catalyst in high temperature conditions (typically 400°C-650°C) and pressures (typically 100-400 bar). The process converts atmospheric nitrogen and externally-provided hydrogen into ammonia, and requires about 45 GJ of energy per tonne of ammonia. While most ammonia production used to use electrolysis to provide the hydrogen required in the nitrogen fixation chemical reaction, electrolysis has slowly been substituted by natural gas-based steam reforming for hydrogen production. The reason for the change is that reasonably priced natural gas is widely available.

As of 2020, 72% of the global production of ammonia (185 Mt) relies on natural gas, 26% on coal gasification with the remaining part divided between oil products and electrolysis. The latter now accounts for a fraction of a percentage point.

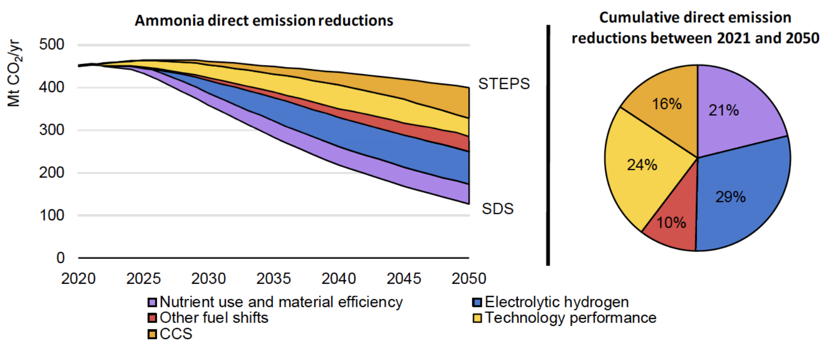
Technology pathways toward net-zero emissions

In broad terms, emissions from the production of ammonia can be reduced by a combination of a number of strategies, including (1) increasing the role of electrolysis for hydrogen production, and using renewable energy as the electricity source, (2) improving the operational efficiency of the process, (3) switching from coal to natural gas as the energy source for hydrogen production, (4) introducing carbon capture and storage technologies in the production process, (5) increasing the efficiency of fertilisers by adopting more advanced and innovative agricultural practices. The IEA report describes three potential scenarios for the evolution of ammonia production.

The first, the 'Stated Policies Scenario' (STEPS), is a 'status quo' scenario in which current trends are maintained between now and 2050 but no major change of direction is pursued. The second, 'Sustainable Development Scenario' (SDS), involves the reduction of total emissions from ammonia by about 70% and is consistent with the goals of the 2015 Paris Agreement. The third, 'Net Zero Emissions' (NZE), sees CO_2 from ammonia production decreasing by more than 95%, thus effectively eliminating the climate damage caused by the ammonia industry.

Figures 1 and 2, adapted from the IEA report, describe how CO_2 emissions can be reduced under the STEPS, SDS and NZE scenarios, breaking down the impact of technologies for each individual scenario. Below, we describe briefly what each scenario looks

Figure 1 **Ammonia direct CO_2 emission reductions in the Sustainable Development Scenario by mitigation strategy**

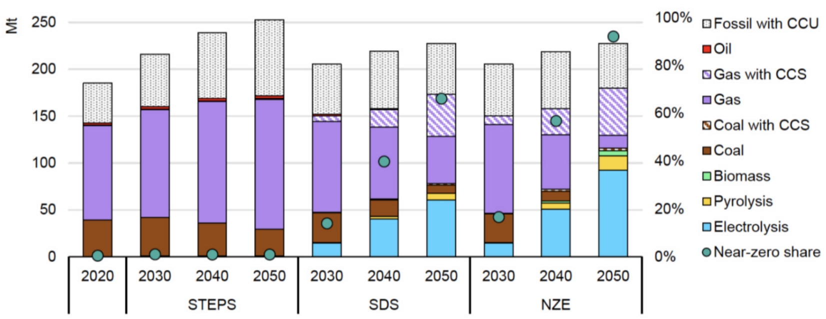


IEA, 2021.

Notes: STEPS = Stated Policies Scenario; SDS = Sustainable Development Scenario; CCS = carbon capture and storage.

Only an array of mitigation measures can significantly reduce emissions from ammonia production. Nutrient use and material efficiency, electrolytic hydrogen and CCS account for two-thirds of the cumulative emission reductions in the Sustainable Development Scenario.

Figure 2 **Global ammonia production by technology and scenario**



IEA, 2021.

Notes: STEPS = Stated Policies Scenario; SDS = Sustainable Development Scenario; NZE = Net Zero Emissions by 2050 Scenario; CCS = carbon capture and storage; CCU = carbon capture and utilisation for urea production. Near-zero share = aggregated share of near-zero-emission routes, excluding CCU.

like in terms of emissions, the efficiency of the use of ammonia in agricultural products, and the technologies involved in the production of ammonia.

The Future of Ammonia Production

Stated Policies Scenario. Within this scenario, the industry follows current trends, improving efficiency but ultimately underperforming climate goals. Under this scenario, ammonia production increases 37% by 2050, with total emissions falling only 10%. This is in part achieved by increased energy efficiency: coal-based hydrogen production falls from 26% to 15% and the share of natural gas rises from 70% to 80%. This process is largely underpinned by a predicted shift of ammonia production from China (which uses coal as a precursor much more than other industry players) to other regions such as India, the Middle East, and Africa, which predominantly employ natural gas as a precursor. Adoption of improved technology for extra energy savings is also taken into account, but no significant improvement in the efficiency of use of fertilisers is considered. The adoption of green hydrogen for ammonia production is extremely limited in this scenario. However, carbon capture in the ammonia production space expands significantly, thus preventing an increase in total emissions even with significant growth in the overall production of ammonia.

Sustainable Development Scenario. This scenario is consistent, insofar as it pertains to ammonia production, with the goals set out in the 2015 Paris Agreement of keeping the global temperature increase well below 2°C. Under this scenario, emissions related to ammonia fall by more than 70% by 2050. The IEA report outlines a 25% reduction in emissions due to energy efficiency achieved by (a) operational improvements, (b) switching from coal-based to natural gas-based production, and (c) adoption of the best available technologies (BAT). Figure 2 shows a breakdown of the different technologies employed for ammonia production.

A large fraction of carbon emissions reductions (30%) stems from the increasing adoption of electrolysis as a source of hydrogen, requiring 110 GW of electrolyser capacity. About 15% of emissions reduction is based on the adoption of CCU technologies, requiring 90 Mt of CO_2 storage. While no at-scale carbon capture and storage project has been launched to date yet, there is a growing expectation that this technology will grow significantly over the next decade and will play an important role in efforts to abate net levels of CO_2 in the atmosphere. The Sustainable Development Scenario requires significant capital investment. About USD 14 billion (CNY 94.5 billion) need to be deployed annually to achieve its fairly ambitious goals.

Net Zero Emissions 2050. This scenario involves a reduction in emissions exceeding 95% of current values by 2050. This is achieved by a mix of robust interventions and changes. The amount of coal-based production reaches near-zero by 2050, and more than 80% of the natural gas-based production involves carbon capture and storage to mitigate the impact of emissions. Electrolysis becomes the dominant source of hydrogen for ammonia production, accounting for nearly 40% of total production. This scenario is particularly ambitious and can likely only be realised with significant international cooperation. This would involve boosting ammonia trading using existing and new global infrastructure so that ammonia could be transported from regions where production using electrolysis is particularly cheap due to an abundance of renewable energy sources to regions where the levelised cost of electricity (LCOE) for renewables is significantly higher.

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

NEWS IN BRIEF

European Commission unveils REPowerEU Plan for energy independence

On 18 May 2022, the European Commission (EC) officially unveiled the REPowerEU plan, under which Russian fossil fuel imports will be phased out and EU's energy independence will be enhanced by means of energy savings, diversification of energy supplies, and accelerated roll-out of renewable energy.

The new plan aims to reinforce long-term energy efficiency measures, including increasing the binding Energy Efficiency Target from 9% to 13%, and to diversify energy supplies, notably through the newly-formed EU Energy Purchase Platform that is designed to purchase natural gas, LNG and hydrogen on behalf of the entire bloc.

The EC has amended the Fit for 55 Package by raising the 2030 target for renewables from 40% to 45%. To achieve this, a dedicated EU Solar Strategy will see solar photovoltaic capacity double by 2025 and 600GW of solar capacity installed by 2030. Solar panels will become mandatory on new public, commercial and residential buildings. The REPowerEU plan also calls for a simplification of the permitting processes for major renewable projects, with designated 'go-to' areas.

The EC has introduced a target of 10 Mt of domestic renewable hydrogen production and 10 Mt of imports by 2030, the aim being to decarbonise hard-to-abate sectors such as iron and steel production. Two Delegated Acts will clarify the definition and production of renewable hydrogen. EUR 200 million is allocated for renewable hydrogen research, with the first Important Projects of Common European Interest (IPCEI) identified by summer 2022.

To support the new strategy, which requires an additional investment of EUR 210 billion between 2022 and 2027, EUR 225 billion is already available in loans under the Recovery and Resilience Facility (RRF). In addition, the EC proposes to increase the RRF financial envelope with another EUR 20 billion in grants, funded by the sale of EU Emission Trading System allowances through auctions.

+ more

European Parliament adopts position on climate change

The EU Committee on Environment, Public Health and Food Safety of the European Parliament has formally adopted its position on laws to fight climate change through the reduction of greenhouse gas emissions and protecting jobs and citizens. Five reports of the Fit for 55 Package have been approved.

The Committee proposes reform of the EU Emissions Trading System (ETS) by creating a new scheme for buildings and road transport with the inclusion of citizens after 2029, phasing out free allowances from 2026 (to end by 2030), introducing a system of rewards and penalties from 2025, and mandating that all revenues must be used exclusively for climate action in the EU and Member States. In addition, rapid implementation of the EU Carbon Border Adjustment Mechanism (CBAM) as early as 2030 is called for to prevent carbon leakage and raise the bloc's global climate ambitions. Moreover, amendments were proposed to legislation covering GHG emissions in sectors not included in the ETS (around 60% of EU emissions): for the first time, all EU member states would have to reduce GHG emissions with targets ranging between 10% and 50%. Finally, MEPs agreed to increase the EU carbon sinks target for land use, land use change and forestry sector (LULUCF), which would de facto increase the EU's 2030 GHG reduction target to 57%.

+ more

100 EU cities selected to be climate-neutral and smart cities by 2030

The European Commission announced on 28 April 2022 the 100 EU cities from all 27 Member States and 12 cities from associated countries that have successfully applied to participate in the EU Cities Mission program. By 2030, the program aims to deliver 100 climate-neutral and smart cities, which will act as experimentation and innovation hubs so that all European cities can follow suit by 2050. EUR 360 million will be made available over the next two years to support these cities under the Horizon Europe scheme.

Each of the selected cities will draw up Climate City Contracts, setting out their climate neutrality plans across all sectors such as energy, buildings, waste management and transport, together with investment strategies. The cities will benefit from tailor-made advice, additional funding and financing opportunities, along with opportunities to join largescale innovation initiatives, pilot projects and demonstrations and other networking projects.

A total of 377 cities applied to join the program, and the EC has undertaken to support those that do not make it through the selection process using the Mission Platform and other funding schemes.

+ more

EU countries eye major offshore wind development schemes

Germany, Belgium, the Netherlands and Denmark have jointly pledged to build at least 65 GW offshore windpower capacity by 2030 and 150 GW by 2050 in the North Sea area. This move would deliver more than half the offshore wind capacity needed for the EU to reach climate neutrality. Agreement was reached at the North Sea Summit held on 18 May 2022 in the Danish city of Esbjerg.

In order to put these ambitions into action, energy ministers have signed a declaration that fosters regional cooperation, with a view to establishing new energy islands and hubs in the North Sea. The plan is for private stakeholders to play a key role in the initiative, and country leaders have called for stakeholders from across the value chain to participate. Power generation from these new projects will power 230 million European households and could also be used to produce hydrogen and green fuels for heavy industry and the transport sector.

Other EU countries are also keen to speed up deployment of offshore wind. Earlier in May 2022, the Norwegian government announced it would allocate areas for 30 GW of offshore wind production by 2040. The country, which currently has just two operational offshore wind pilots with a total capacity of 5.9MW, will install 1 500 offshore wind turbines in the sea that could match its current overall electricity generation. Norway hopes to export the surplus production to neighbouring countries, according to Prime Minister Jonas Gahr Støre. The next licensing round for new offshore wind areas will take place in 2025.

All these new announcements would help meet the European Commission’s target for 300 GW of offshore wind by 2050, a huge leap from the roughly 16 GW currently installed.

+ more

Uk boosts nuclear power development with new fund

The UK government has launched a GBP 120 million Future Nuclear Enabling Fund (FNEF) to support the development of new nuclear energy projects. The fund aims to unlock and accelerate new nuclear technologies including small modular reactors (SMRs), while encouraging new players into the market by providing targeted, competitively-allocated government grants to attract private investment.

Earlier, in its new Energy Security Strategy released in April 2022, the UK government announced an ambitious target for eight new large scale nuclear reactors as well as SMRs that could bring 24 GW of nuclear generating capacity online by 2050, with the potential to meet 25% of the UK's projected electricity demand. The new strategy also announced the immediate establishment of a new government body, Great British Nuclear (GBN), to lead on the constructions of these projects and deliver one each year in the course of the decade.

The FNEF announcement represents a concrete move towards nuclear power development and will help to accelerate the commercialisation of different technologies and demonstrate their readiness for the UK market.

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China unveils five-year plan for bioeconomy

China's National Development and Reform Commission (NDRC) has unveiled a plan to boost the bioeconomy during the 14th Five-Year Plan period (2021-25).

One of the key levers identified in the document for fostering and strengthening the bioeconomy is through promotion of bioenergy. The plan calls for development of biomass power generation as well as cogeneration. It also attaches great importance to the roll out of environmentally friendly bioenergy demonstration projects as one of the major pathways to tap the bioeconomy potential.

Detailed measures include: encouraging the construction of biogas demonstration projects in urban and rural regions with rich supplies of organic waste; expanding the biofuel industry by boosting biomass collection and organic manure production and utilisation; promoting the construction of industrial parks with biomass cogeneration, using biomass briquettes as an energy source; steadily developing cogeneration of heat and power by incinerating municipal waste; promoting clean heating using biogas, biomass briquette fuel and other biomass energy; and facilitating the demonstration and application of biofuels in the aviation sector.

China's bioeconomy is still in its infancy: it operates at a relatively small scale and there is a low level of competition in sectors such as power generation. National statistics show that by the end of 2021, installed biomass power generation capacity was 37.98 GW, accounting for just 3.57% of China's total installed renewable energy capacity.

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China's coal-fired power plants must upgrade or shut down

On 10 May 2022, Chinas' energy ministries jointly released a new notice to push for clean and efficient coal utilisation in key sectors. It raises the bar for energy efficiency in coal-fired power plants in a bid to boost efficiency upgrades and the phasing out of outdated production facilities.

According to the new document, coal consumption per unit of power generation for new-build coal-fired power units will have to reach a benchmark of 270 g/kWh and 285 g/kWh for wet-cooling and air cooling units respectively. The upgraded benchmarks for existing 300/600/1 000 MW coal-fired units are set at between 273 g/kWh and 311 g/kWh.

The notice specifies that local governments are responsible for specifying the time limits for upgrading and phasing out of existing coal-fired units (generally within 3 years) as well as an annual upgrading schedule. Existing units will have to upgrade above the baseline level within the prescribed time limit. Those that fail to complete the upgrade on schedule will have to shut down.

+ more

China to showcase 5G+ energy practice

China's National Energy Administration (NEA) and Ministry of Information and Technology (MIT) jointly issued a notice on 16 May 2022, calling for submission of best use cases for integration of 5G technology into the energy industry, the aim being to improve the digitalised, networked and intelligent development of the sector. The window for applications will close on 10 June.

Submissions are required to focus on six typical application scenarios, including smart power plant, smart grid, smart coal mine, smart oil and gas, energy integration, and intelligent manufacturing and construction. The best proposals will be introduced to the public so that they can be replicated and scaled up, the hope being that they can be applied in other contexts, and that related equipment will be innovated and promoted.

The public will be given an outline of best practice, as well as access to knowledge-sharing events, so that the selected cases will have maximum positive impact. Energy departments of local authorities are being encouraged to provide support in terms of approval, funding and other resources to facilitate deployment of the subsequent pilot projects.

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China launches EPD platform for steel sector

China's Environmental Product Declaration (EPD) platform for iron and steel industry was officially launched on 19 May 2022 in Beijing. The platform introduces Life Cycle Assessment, and is set to identify and monitor the industry's key environmental impacts such as carbon emissions, as well as to promote ongoing environmental performance improvements.

The platform aims to bring together key enterprises and organisations across the steel industry chain to promote the green, healthy and sustainable development of the steel sector. It is set to be a useful tool for iron and steel makers to obtain third-party verification for the environmental footprint of individual steel products.

According to China's Steel Industry Association, the platform will provide a means of dialogue between domestic and overseas stakeholders by using internationally recognised and standardised terminology in order to make members familiar with international carbon tax systems such as the EU's Carbon Border Adjustment Mechanism (CBAM). It will also facilitate trade activities, and help the downstream enterprises to become more aware with the environmental impact of steel manufacturing better: this may inform their green purchasing and support the scientific development of a carbon reduction roadmap.

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Six new nuclear reactors approved by China State Council

After years of preparations, comprehensive assessment and review, three new nuclear power projects, Sanmen II, Haiyang II, and Lufeng, were finally approved by the State Council at an executive meeting chaired by Premier Li Keqiang on 20 April 2022.

The projects, each of which will consist of two reactors, will require a total investment of RMB 120 billion (EUR 17 billion). All six reactors will adopt third-generation nuclear technologies: the four new units in Sanmen and Haiyang will feature the China-designed CAP1000 technology, while the other two units at Lufeng plant will use Chinese Generation III Hualong One reactors.

This is the first time that China has approved six nuclear units at one time since 2008. The new approval illustrates the government's firm determination to develop nuclear power as an integral part of its power supply.

In China's Modern Energy System Planning, which forms part of the 14th Five-Year Plan and was released in March 2022, the government announced that nuclear power installed capacity should reach 70 GW by 2025, up from 51 GW at the end of 2020. The plan also calls for active promotion of coastal nuclear power projects, as well as the use of nuclear energy to heat residential and industrial areas and desalinate seawater. This follows the successful commercial development of nuclear heating in Haiyang and Haiyan cities in 2021-22.

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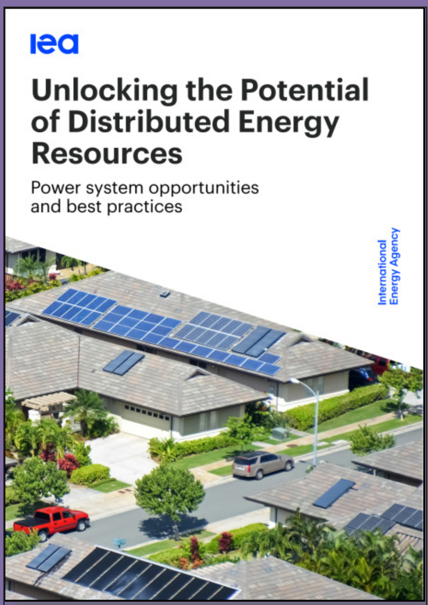
Reports Recommendation



Unlocking the Potential of Distributed Energy Resources

The rapid expansion of distributed energy resources (DER) such as rooftop solar panels and energy storage batteries is transforming the energy sector, adding new context for the way electricity is generated, traded, delivered and consumed.

In order to help policymakers, regulators and system operators across the world to better understand and cope with the changing energy landscape wrought by increasing uptake of DERs, this new report by the International Energy Agency (IEA) looks at the practical lessons learned and best practices by focusing on various case studies. These provide insights into key actions that could be taken to accelerate DER deployment and integration.

The report singles out five particularly promising technologies and solutions, including battery storage, EVs, electric water storage and space heaters, grid-connected smart buildings, as well as virtual power plants. With deeper digitalisation, the potential for DERs as valuable grid assets can be fully realised once the right incentives and market design are in place.

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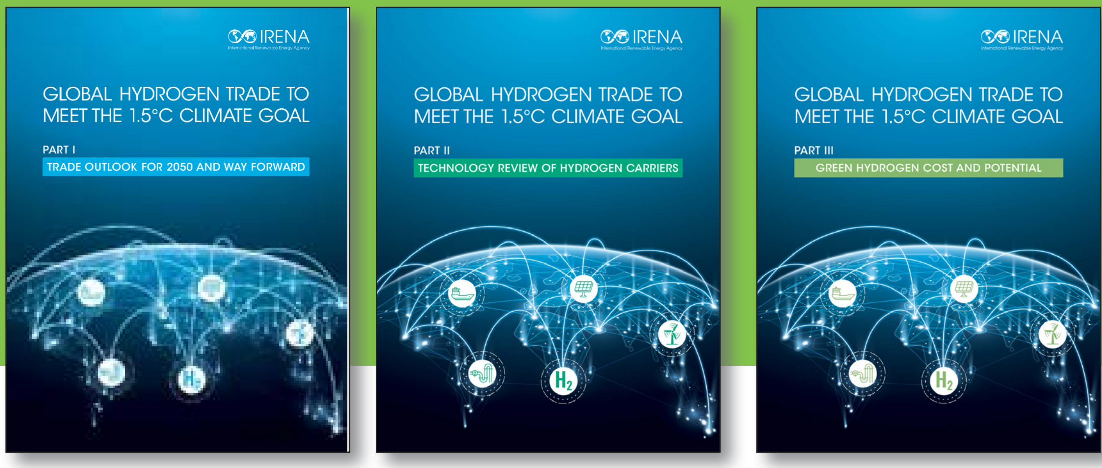

Global Hydrogen Trade to Meet the 1.5°C Climate Goal

The Global Hydrogen Trade to Meet the 1.5°C Climate Goal is a report trilogy published by the International Renewable Energy Agency (IRENA). Part I (yet to be published) covers all the components, from supply to infrastructure, to assess the outlook for the global hydrogen trade by 2050; Part II compares the transport of hydrogen by pipeline as compressed gaseous hydrogen with three forms currently used in shipping pathways: ammonia, liquid hydrogen and liquid organic hydrogen carriers (LOHC). Part III looks at the cost and technical production potential of green hydrogen for various regions and time horizons in 2030 and 2050 under different scenarios and assumptions.

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The time is now: smart charging of electric vehicles

Electric vehicles are a powerful resource for consumers as well as for power sector actors. The potential for their contribution to power system flexibility can best be served through smart charging, which can facilitate the integration of renewable energy and minimise EVs' impact on the power system.

This report by the Regulatory Assistance Project (RAP) lays the groundwork for a robust regulatory framework that can foster a market for smart charging tariffs and services. By analysing 139 tariffs and services available across Europe that specifically involve smart charging, the report probes some of the best practices and innovative approaches, providing useful insights for policymakers.

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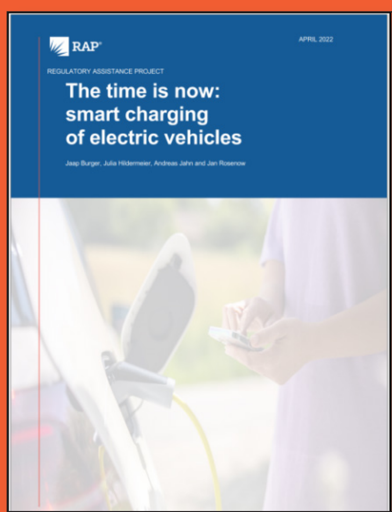

Corporate Green Power Procurement in China: Progress, Analysis, and Outlook

An increasing number of Chinese companies are incorporating renewables into their development strategies, with the aim of achieving their sustainability targets through green power purchasing and renewable utilisation. This annual report, published by the Rocky Mountain Institute (RMI), looks at the major policies, events, and market progress of the green power market in China. Its aim is to inform corporations with green power needs about their procurement options. Based on a review and analysis of the market in 2021, five procurement options are discussed that are currently available to corporate buyers, along with an assessment of their current status and challenges. The report also proposes four steps that can be used as a guideline for making renewable procurement decisions.

→ *Read More*

Demand-side solutions to address energy shortages

In this policy paper, Denmark's ZOE Institute highlights the potential of demand-side policies to ensure energy security in the European transport and housing sectors. It provides guidance on how these policies should be designed in order to be effective and socially balanced.

By examining a total of 68 demand-side measures proposed by various institutions in response to recent energy crisis, the paper applies a systematic Policy Instrument Impact Assessment to evaluate the primary energy saving potential, social impact as well as transformative potential of these measures.

In a bid to address the current surging energy prices, the paper calls for widening of the newly issued REPowerEU policy instruments to include demand-side measures that could help reduce final energy consumption, and proposes a series of national and EU level measures to coordinate the efforts needed to reduce energy demand.

→ *Read More*

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