"CHINA: Carbon Neutral by 2060"

- Innovation -

Day 1: Tonic for the Transition (opening session)

Participants

Viktorija Kaidalova - Head of Section, Foreign Policy Instrument, Delegation of the European Union to China
Chunping Xie - Policy Fellow at the Grantham Research Institute on Climate Change and the Environment, London School of Economics
Zhonghua Xu - VP, Head of TotalEnergies R&D for Asia and National Chair for Energy Working Group at the EU Chamber of Commerce in China
Simon Göss - Energy & Climate Analyst, Co-Founder at Carboneer
Matthew James (moderator) - MD, Energy Post

Highlights

China's energy transition

- China's energy demand growth poses two challenges: transitioning from coal to renewables, and meeting additional energy demand with renewables.
- Renewables are becoming competitive economically. Wind and solar power are becoming ever cheaper, energy storage costs are falling and network management is improving.
- China is still building more coal-fired power plants to meet its domestic electricity demand, raising the risk of stranded assets.
- There is a limit on the share of renewables the grid can absorb, because when renewable power increases, balancing mechanisms such as storage or generation from other sources, including coal, need to increase to provide flexibility.
- China has released guidance saying it will not build new coal power plants simply for electricity generation, which means that in the short-term China needs more coal power plants, but they are to support the future integration of renewables into the grid.

CCUS and carbon removal prospects

- CCS and CCU (i.e. carbon capture) are both carbon neutral at best but will play important roles for industries where there is little or no easy low-carbon substitute.
- Carbon removal (as opposed to just carbon capture) is carbon-negative, it's a nascent and complex market with different technological and nature-based solutions.
- Even with renewables growth, carbon storage capacity needs to grow from today's 14 billion tonnes to 5.6 gigatonnes per year. With carbon removal, we need to remove five to 15 gigatonnes of carbon from the atmosphere every year.
- The U.S. is a CCS and CCU frontrunner because it has a lot of infrastructure in place – more than 8,000 km of CO2 pipelines, especially for using CO2 in enhanced oil recovery. Europeans are catching up.
- In China, becoming carbon neutral by 2060 will require CCS in the power sector too, even if renewables are being built out at the current pace.
- China has several CCS and CCU demonstration and R&D projects underway across different sectors and types of technology.
- The EU is looking to develop a Europe-wide carbon transport system to connect countries to storage sites.

Innovation priorities

- Green hydrogen and energy storage are crucial for expanding renewables and creating a safe and reliable grid.
- Market integration is crucial. Europe's integrated market allows a buyer in Germany to bid for power from France, etc. China isn't there yet.
- There will be three major trends in the energy transition: low-carbon, electrification and the digital revolution.
- EVs-to-grid, where EVs provide energy storage for balancing the grid.
- Long-term energy storage, such as retrofitting coal power plants into storage facilities.
- Liquid air energy storage, which liquefies the air to store energy, is promising.
- Emissions Trading System: emission reductions in sectors that are in the EU ETS are higher than sectors that are not in the ETS, because they have to pay a price for their emissions.

Government policies and goals

- China's 2060 carbon neutrality goal shows that the government has linked climate action with the country's sustainable development strategy, framed within the concept of ecological civilisation.
- In China, Covid, the power crunch, and Ukraine have pushed the government to think more about energy security.
- An emissions trading system is a political instrument, and therefore prone to produce failure because politicians have different ideas of what it should do.
- China can learn from how the EU integrated industry sectors into its ETS.
- One of the big drivers for integrating industries into the Chinese ETS is the European carbon border adjustment mechanism (CBAM).

Technology innovation, cooperation and clear government policies are needed to push both China and the European Union towards their targets for net zero emissions by 2060 and 2050, respectively.

The two major energy markets, and emitters, are approaching the challenge from different starting points.

Europe's electricity market is already well integrated, allowing for higher renewable energy integration even without huge power storage capacity. The EU Emissions Trading System has seen ups and downs, with policy interventions driving price swings and uncertainty, but it has fundamentally driven emission reductions in the industries that trade on the market.

The EU's carbon border adjustment mechanism, along with the RepowerEU package of policies proposed in response to the war in Ukraine, will serve to further reduce fossil fuel use in the bloc, and especially reliance on Russian oil and gas.

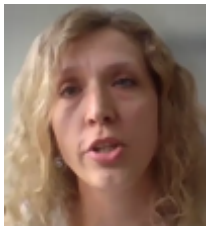
The development of carbon capture storage and use facilities is beginning to pick up in Europe too, although still in its early stages. The EU is now looking at developing a bloc-wide transport system that would allow CO2 emissions captured in one country to be piped to and stored in another.

China is starting from further behind, with a power sector dominated by coal, growing power demand and a less integrated national power market that limits the amount of renewables that can be integrated into the grid.

Innovation will be crucial to China's energy transition, including carbon capture for industrial sectors and power plants and the expansion of the country's new national carbon market to industries. Digitalisation, green hydrogen, electric vehicles and long-term energy storage will also be needed in China to increase renewables use and meet growing energy demand while reducing fossil fuel use.

Panel Discussion

This is a summary, not a verbatim transcript, of the key points made during the online panel event.



Viktorija Kaidalova
Head of Section, Foreign Policy Instrument, Delegation of the European Union to China

This event will showcase examples of how the deployment of key clean energy technologies can contribute to sustainable development and climate targets. The way we produce and consume our energy is essential in promoting a sustainable and climate-resilient model of development.

Europe is currently facing war in its proximity while being dependent on hydrocarbon imports from one source involved in the conflict. This is one reason for the EU to renew and honour its commitment to accelerate transition to a greener, cleaner, and low-carbon energy system.

The ambitious European Green Deal will put the economy and society on the most sustainable development path, while action to address environmental and climate challenges will help generate a more balanced and fairer economic growth. It aims to reduce CO2 emissions by 55 percent by 2030 compared to 1990, and the Fit-for-55 package of legislative proposals is designed to deliver on this goal in a cost efficient and competitive way.

We want to make our post-pandemic recovery not only greener, cleaner and healthier, but also more forward-looking in terms of creativity and deployment of new technologies. The next generation EU recovery budget will extend substantive financial support to projects in key sectors from 5G to artificial intelligence, and from clean hydrogen to offshore renewable energy. The RePower Europe policy package will move us in this direction.

The EU aims for climate neutrality by 2050, China by 2060. To reach these targets, it is essential to develop new low-carbon energy sources and to enable the quick deployment of related innovative technologies. The EU is ready and willing to share its industry-leading experience and cooperate with other countries. This could include sharing our best practices and regulatory approaches and developing joint projects, depending on the alignment of regulatory frameworks and coherence with EU policy priorities.

There is great potential for cooperation between the EU and China, if there is a level playing field and intellectual property rights are protected. The 2019 EU-China statement on energy cooperation identifies four main areas for joint activities, including boosting cooperation between innovative businesses to accelerate clean energy.

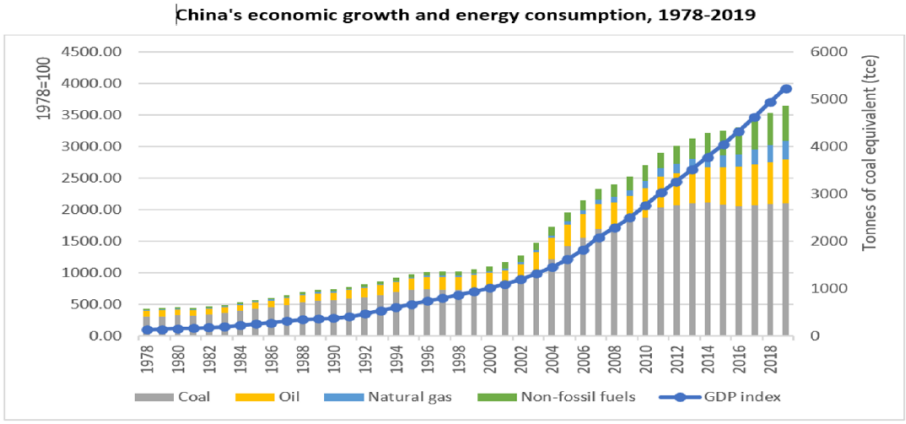
The EU-China energy cooperation platform that helped organise this event recently produced a comparative study, and I encourage everyone to read it.

Opening Presentations

Chunping Xie
Policy Fellow at the Grantham Research Institute on Climate Change and the Environment, London School of Economics

The world cannot go net zero unless China does

- China, because of the size of its economy and greenhouse gas emissions, must be a central player in the world as a whole and on climate action in particular.



Source: Authors, drawing on data from the National Bureau of Statistics of China.

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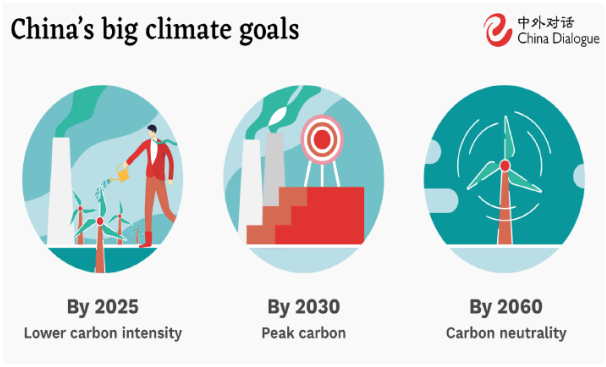
Strong economic expansion over the past four decades has taken China from low-income to upper-middle income status. This progress has been enabled by strong investment in infrastructure and means it's not possible for the world to cut emissions unless China does.

China's leadership on climate change



- In September 2020 President Xi Jinping announced at the United Nations General Assembly that ***China will aim for carbon neutrality by 2060***.

Over the last decade, China has moved from being a follower towards taking on a leadership role in global environmental governance.

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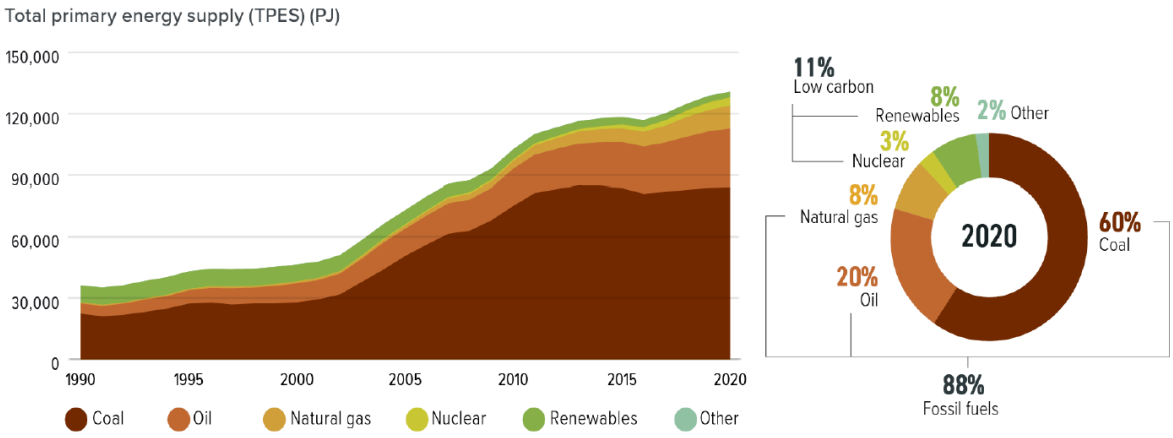
In September 2020 President Xi Jinping announced a goal for carbon neutrality by 2060. This shows that the Chinese government has linked low-carbon development and the carbon neutral transition with the country's sustainable development strategy, framed within the concept of ecological civilisation.

At COP26 in Glasgow, China and the U.S. jointly pledged to work together to tackle climate change, and China reiterated that it would phase down its coal consumption during the 15th Five-Year Plan.

Energy mix



Enerdata, 2021 *Due to rounding, some graphs may sum to slightly above or below 100%*

Coal has dominated China's energy consumption for decades. China's coal consumption accounted for 55-56 percent of the world's total in 2020, and it remains on course to become the world's largest economy. Continued growth in energy demand poses two challenges: transitioning from coal to renewables, and meeting additional energy demand with renewables.

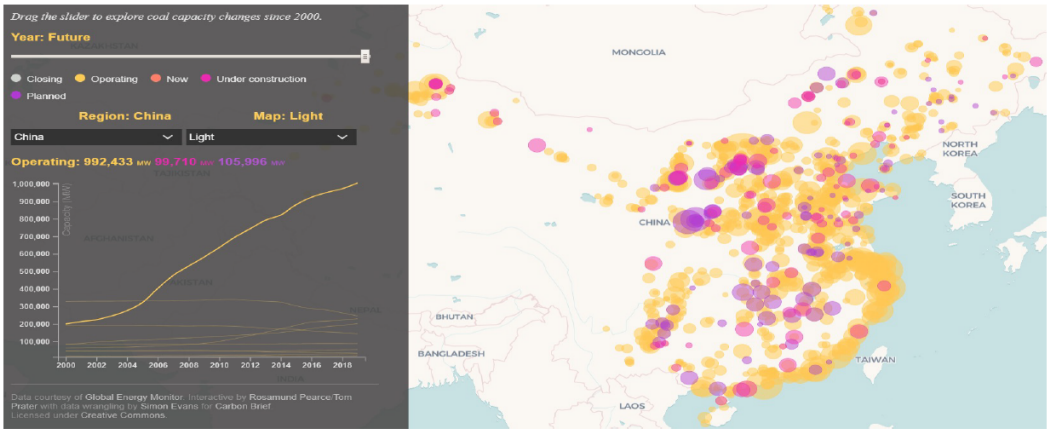
How to get there : energy transition

- ***Moving away from coal while supporting affected coal workers and communities.*** *The most crucial strategy for the new growth story is to stop building new coal-fired power plants – they cause significant damage to the environment and are very expensive. Bloomberg NEF, for example, suggests that solar farms and onshore wind are now the cheapest sources of new electricity for at least two-thirds of the world's population (Reback, 2019).*

- ***Speed up the transition to renewable energy to ensure security of energy supply.*** *Compared to fossil fuels including coal, oil and natural gas, renewable energy is much safe. Many renewables have become highly competitive economically, with wind and solar PV becoming ever-cheaper, energy storage costs falling, and network management improving.*

China's most crucial strategy is to stop building new coal-fired power plants. Many renewables have become highly competitive economically, with wind and solar power becoming ever cheaper, energy storage costs falling and network management improving. There is also an urgent need to support affected coal communities and the just transition. Energy security is another issue, especially in the context of the war in Ukraine. An increasing number of countries recognise that, compared with fossil fuels, renewables are much safer for national energy supply security.

Challenge: the urgency of limiting the use of coal



Cutting coal consumption and replacing it with cleaner energy, such as natural gas and renewables, has been a key part of China's energy strategy. But it is worrying that China is still building more coal capacity. It is deeply damaging to economies, societies, health and environment. There is no valid economic justification.

It's worrying that China is still building more coal-fired power plants to meet its domestic electricity demand. The current energy crisis could be promoting a new round of investment in fossil fuels, not just in China but around the world. The more China invests in coal generation today, the greater the risk that these assets may be stranded in the future.

Challenge: grid management

- ***Improve flexibility of power grids without building more coal-fired plants.*** *The increasing penetration by renewable energy is technically and economically feasible with a wide range of options rather than using more coal, including retrofitting existing coal-fired plants; forming an interconnected electricity market (market coupling); demand-side response; energy storage; etc.*

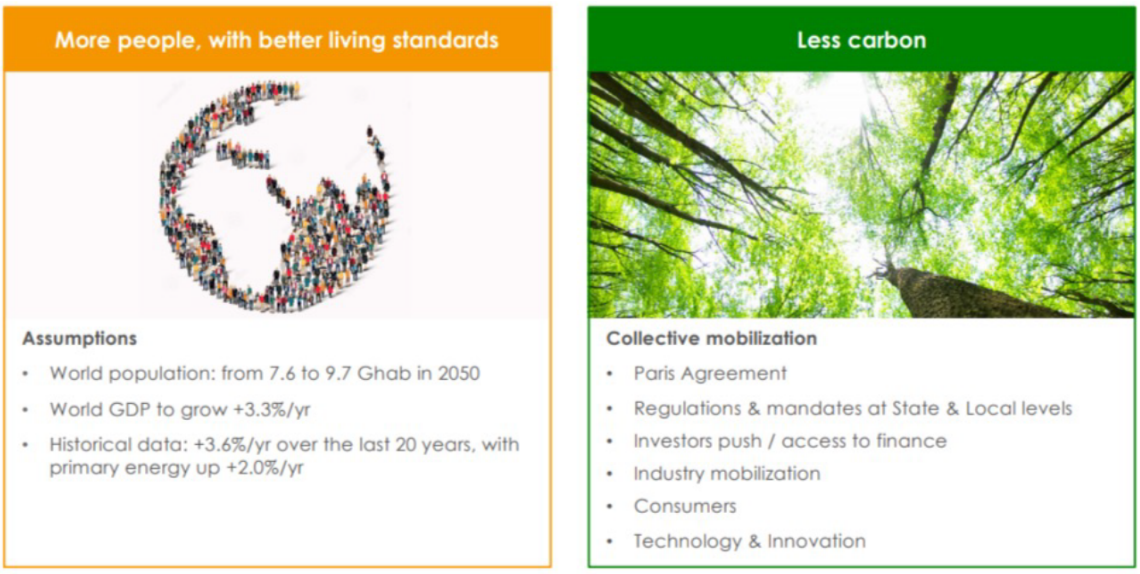
- ***Drive forward power sector reforms****, including better grid management and market-oriented pricing to avoid irrational prioritisation of coal-fired sources.*

Management of the grid is increasingly a major barrier to the large-scale penetration of renewables in China. There is currently a limit on the share of renewables the grid can absorb, because when renewable power increases, balancing mechanisms such as storage or generation from other sources, including coal, also need to increase to provide flexibility.

However, adding more coal capacity is not the only way to manage the intermittency of renewables. There are technically and economically feasible options, such as retrofitting existing coal plants for higher flexibility. An interconnected electricity market that addresses regional supply and demand mismatches at a larger scale will encourage demand-side response to improve the flexibility, promote the integration of energy storage and so much more.

Power sector reform is another challenge for China as a modern grid system is urgently needed, not only to upgrade the grid structure but also the technical guidance and standards for running the grid. The Chinese government will have to push forward market-based economic dispatch in a way that ensures the generation unit with the lowest cost has priority. This will improve renewable integration by taking advantage of renewables' nearly zero marginal cost.

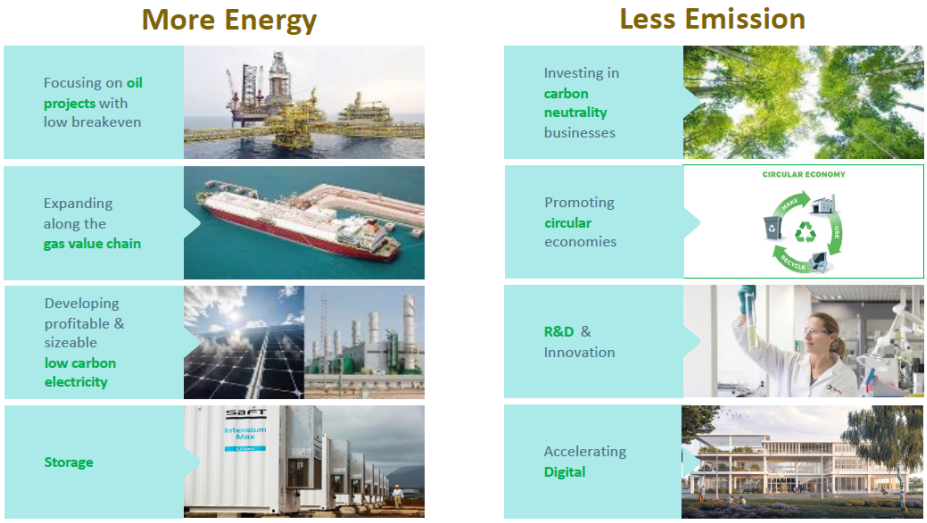
Zhonghua Xu
VP, Head of TotalEnergies R&D for Asia and National Chair for Energy Working Group at the EU Chamber of Commerce in China



Energy companies today need to provide more reliable, more affordable, cleaner and low-carbon energy solutions to more people with better living standards. So, energy security is key. And we need to reduce carbon emissions.

Last year TotalEnergies started the transformation to a total energy company. We plan to focus on everything from oil and gas, to electricity, to hydrogen, to wind.

Our Actions

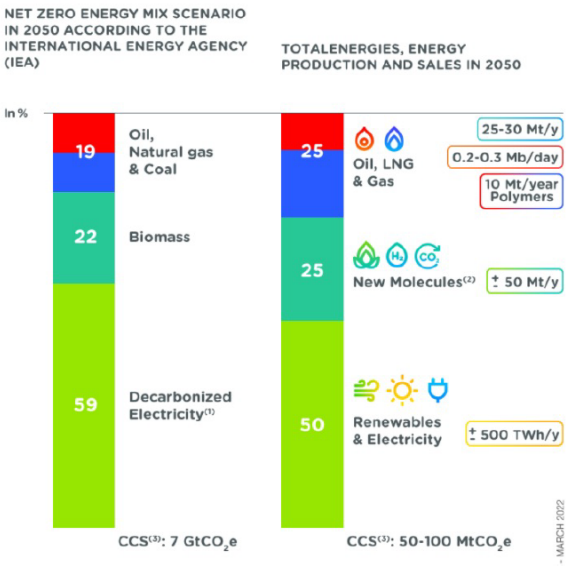


TotalEnergies

We have two key action plans. One is, provide more energy. So we're focusing on low-cost and low-carbon oil, and more on gas than oil, on promoting scalable, profitable renewable energy, and energy storage. Two, reduce emissions, which means we are developing carbon sinks and carbon capture and storage or use; promoting the circular economy with more degradable plastic and more plastic recycling; and accelerating digital solutions.

Energy is Our Life.

Rebuild our business to have a better future of sustainable development.

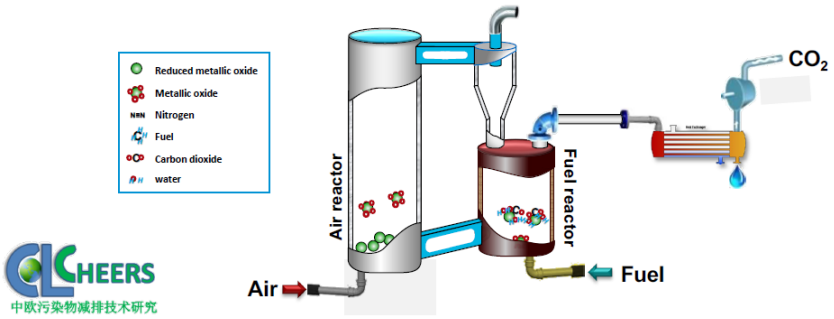


(1) Hydro, solar, wind and nuclear (2) Biofuels, biogas, hydrogen and e-fuel/e-gas
(3) Carbon capture and storage

TotalEnergies

Our energy mix is changing a lot out to 2050. Around 50 percent of our business will come from renewables and electricity, and we are increasingly focusing on the new molecules – green hydrogen, some blue hydrogen – and keeping some oil and gas in the mix because it's necessary for energy security.

CHEERs: Chinese European Emission Reduction Solutions



CHEERs：World Largest CLC-based Carbon Capture Demo
20 million €, 9 European-Chinese Partners

TotalEnergies

CHEERs – Chinese European Emission Reduction Solutions – is a Horizon 2020 programme funded by the European Commission and Chinese Ministry of Science and Technology of China. It's the world's largest chemical grouping-based carbon capture demo in China. This project will cost €20 million.

The European Commission expects that the success of this technology will reduce CO2 emissions by 15 percent. This technology could be applied for the power and thermal plants as well.

Energy WG of EUCCC

- 2000 members for EUCCC
- Energy WG has 200+ members, and WG focus on energy transition and carbon neutrality
- Promote EU-China cooperation on gas, renewable energy, hydrogen, electricity through advocacy, etc.
- Working closely with ECECP for European energy interest.
- 4 EU-China Innovation platform: hydrogen, offshore wind, Energy Storage and Smart Energy
- Dozens of high-level meetings
    - ✓ EU-China Energy Night
    - ✓ EU-China Hydrogen Summit, Offshore Wind Conference

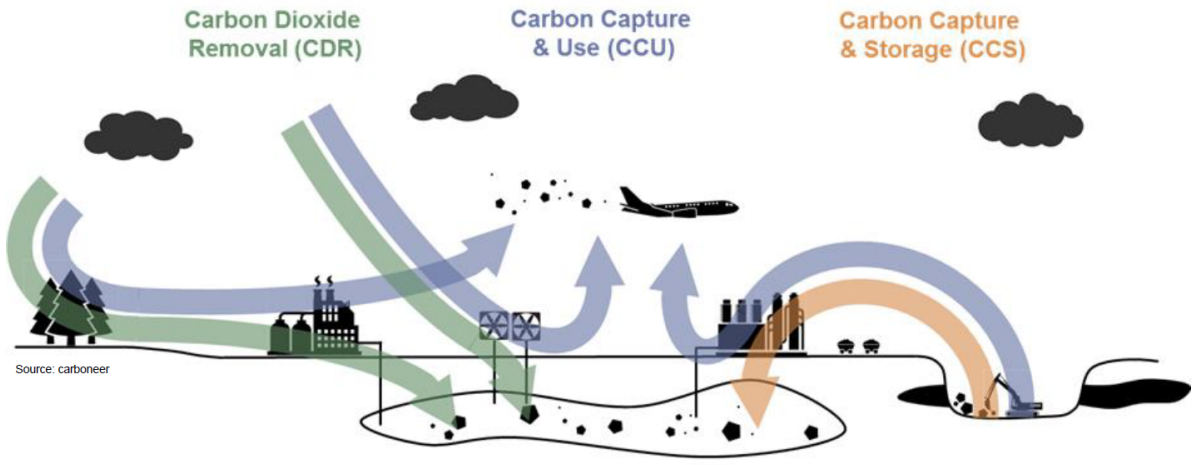
TotalEnergies

The European Chamber of Commerce in China has around 2,000 members, and the energy working group around 400 members. The working group promotes cooperation between the EU and China on gas, renewables, hydrogen and electricity. We believe one crucial element for successful EU-China cooperation is to build up a friendly ecosystem, so we are working with the ECECP and have developed four EU-China innovation platforms for hydrogen, offshore wind, energy storage and smart energy.

Simon Göss
Energy & Climate Analyst, Co-Founder at Carboneer

We've seen the topic of carbon capture and storage (CCS) and carbon removal taking off in the last one or two years. Are we ready for it?

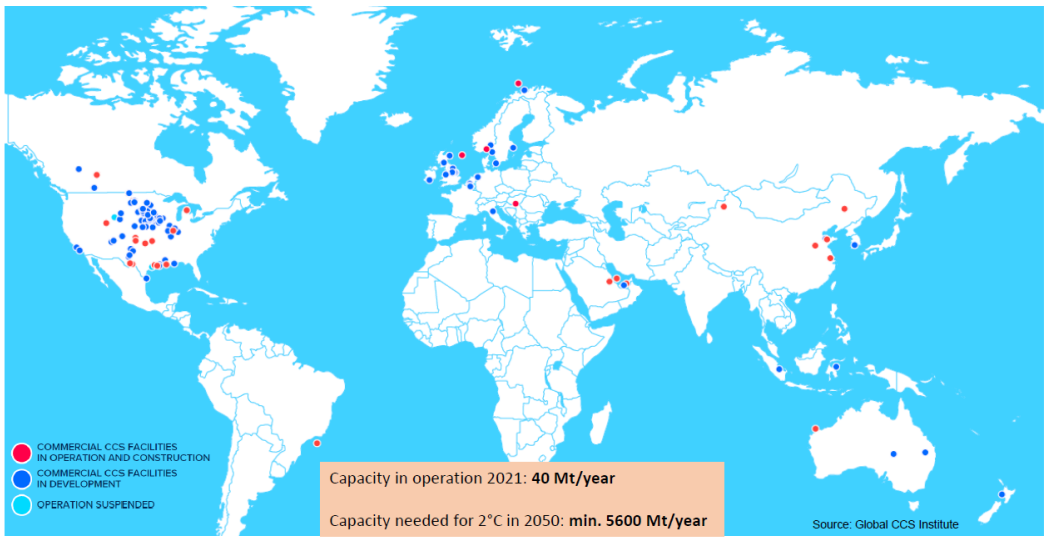
The basics



CCS captures carbon emissions from fossil fuels and puts them back in the ground. Carbon capture and use (CCU) either takes carbon emissions and puts them back into the ground or puts them into short-term use for products. CCS and CCU are both carbon neutral at best. Still, CCS and CCU will play important roles for industries where there is little or no easy low-carbon substitute.

On the other hand, carbon dioxide removal (CDR) takes greenhouse gases out of the atmosphere and stores them in long-term biological or geological sinks or long-term products such as bricks or concrete. So it means it's really carbon-negative. Carbon removal is a very nascent and complex market with different technological and nature-based solutions.

Global CCS landscape



This map shows in blue CCS facilities in development and in red CCS projects in operation. A lot of projects are underway, especially in the U.S., but also increasingly in Europe – the UK and on the coast of Norway, and in China.

Why is the U.S. a frontrunner? It has a lot of infrastructure in place – more than 8,000 km of CO2 pipelines, especially for using CO2 in enhanced oil recovery – and tax breaks. But the EU and UK are catching up with project developments, which I will go into a bit more in detail later.

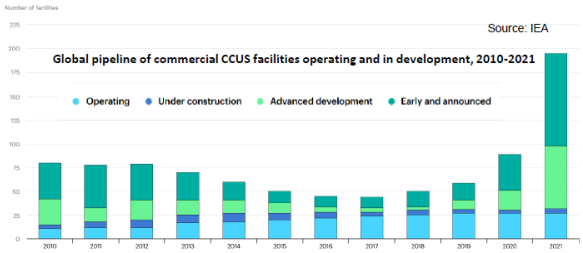
But what's necessary now is the upscaling of CCS. Even if we expand renewables globally, at the current pace or even faster, we need to grow the CCS storage capacity from today's 14 billion tonnes of CO2 to 5.6 gigatonnes per year. That's an increase of 140 times. It requires a lot of innovative approaches, investment, and policy innovations. The same is true for carbon removal. We also need to remove five to 15 gigatonnes of carbon from the atmosphere every year.

Different scale of CCS

› EU: mainly for industrial emissions, power sector less important

› US: front-runner with large projects and infrastructures

› China: different scale and carbon neutrality requires CCS in power sector



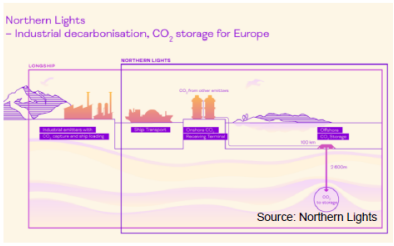
Different regions and countries have different starting conditions and circumstances for the transition to climate neutrality.

For example in the EU, power decarbonisation is accelerating especially due to the Russian invasion of Ukraine, with the RePower EU plan. Last week coal only provided 15 percent of the electricity mix in the EU, and Germany, one of the main coal-burning countries in the bloc, pledged to boost renewables to 80 percent by 2030. But industrial emissions are a different story and will require some CCS, both in the EU and Germany.

It’s a different scale in China because the energy system is so large. Becoming carbon neutral by 2060 will require CCS also in the power sector, even if renewables are being built out at the current pace in China.

CCS and Carbon Removal projects in Europe

Longship and Northern Lights: CCS-Infrastructure



Oslo Varme : Waste-to-Energy and CCS

Porthos: CCS-Infrastructure

Project Orca: Direct Air Capture and Storage

These are examples of CCS and carbon removal projects in Europe. The Longship and Northern Lights project is a cross-border CCS transport and storage infrastructure being developed in Norway. It's planned to start up in 2024 and should sequester up to 5 million tonnes of CO2 per year.

There's the Porthos CCS transport and storage project, northwest of the Rotterdam Harbour, with a capacity of around 2.5 million tonnes per year, expected to start up in the mid-2020s.

Oslo Varme is a waste-to-energy plant with a CCS stack, and is partly a carbon removal project because it absorbs biogenic waste being burned. It has a capacity of 400,000 tonnes per year.

Orca is a direct air capture and storage facility in Iceland. It filters CO2 out of the atmosphere and pumps it into the ground where it mineralises back into rock.

Incentivising innovation in carbon tech

› Carbon pricing and CBAM introduction:
  › EU ETS allowance prices now in the right territory

› Funding programmes at EU level:
  › Innovation Fund (10 bil. EUR) and Connecting Europe Facility (25 bil. EUR)

› EU certification scheme for carbon removal:
  › Sustainable Carbon Cycles and framework by end of 2022

So how do we incentivise these innovations? The best way is to integrate CCS into carbon pricing, as is currently done in the EU Emissions Trading System (ETS). Carbon prices are at a level that creates a business case for CCS. It will be interesting to see the impacts of instruments such as the EU carbon border adjustment mechanism, because it could mean that companies that import goods to Europe need to set up CCS facilities outside of the EU in order to avoid the carbon border adjustment cost.

We need funding programmes to kickstart those projects. In Europe projects are being funded with income from the ETS, and we have the Innovation Fund and the Connecting Europe facility.

Regulatory certainty is needed, along with clear definitions of what constitutes, for example, carbon removal and CCS. The European Commission is working on a certification scheme for carbon removal around the end of 2022.

Panel discussion

Matthew James
Managing Director, EnergyPost

Chunping – you didn't get to the slides in your presentation on recommendations or ideas for where innovation is most needed. Can you come back to that? Particularly with this idea of CCS and how that could change the picture.

Chunping Xie

Looking at where emissions come from, we should be focusing on four big systems: energy, land, transport and cities.

So renewables are very important. We've seen the cost of wind and solar falling very fast, as well as for renewables-enabling technologies such as energy storage, which could help integrate renewables into the grid.

Hydrogen is also very important. China's mid- to long-term plan aims to reach 100,000 to 200,000 tonnes of annual green hydrogen production capacity by 2025. The EU is more ambitious.

In the transport sector, electric vehicles are developing fast in China, but China also needs to pay attention to the need for charging infrastructure in the long term.

CCUS is still mostly in the demonstration phase, we need clear policy signals on whether to go ahead. This will give business a direction for moving forward. This is important for hard-to-abate sectors.

We need to keep nuclear on the table too for low-carbon solutions.

Matthew James

Zhonghua, TotalEnergies is investing in a number of these technologies such as storage, hydrogen and CCUS. Can you expand on that?

Zhonghua Xu

We need to balance carbon neutrality and energy security. At the end of last year China and Europe had emitted more CO2 even though we are aiming for neutrality. Why? Because we were short of power plants. So for carbon neutrality, we need to have a balance of energy sources. We need to be very clear what's needed in the short- or mid-term.

The focus of CCUS in China is different from in Europe. China is focusing more on reducing costs and creating a profitable business model. Europe is focusing more on CO2 storage.

Green hydrogen and energy storage are crucial for expanding renewables and having a safe and reliable grid. But there are still a lot of challenges for green hydrogen, in safety and infrastructure of green hydrogen transport. We need more innovation and investment.

Matthew James

Simon, you wrote an article for us on the requirements of innovation in markets, which is relevant to making sure that the investments in renewables and all these technologies are capitalised upon. Could you expand on that, please?

Simon Göss

The need for CCS, CCUS and carbon removal should not belittle the need to build out renewables and the need for the power sector to provide the main emission reductions. Both in Europe and China, because it's the cheaper way to decarbonise.

The dispatching model, how the power markets work, and especially in the difference between the EU and China, creates barriers for the expansion of renewables. In Europe we have the integrated power market. You can bid in one price zone in Germany from another EU country. The electricity

could just come from France as well, depending on the grid. You can trade for every 15 minutes of electricity.

That's not that easy in China for the entire country. But it wasn't easy to develop that in the EU either. It's taken since the 1990s to develop this kind of common electricity market, and China just started, I think, in 2012.

This is a point that should not be neglected. Developing efficient dispatching mechanisms and cross-border trading, especially between provinces, there might still be deficiencies in absorbing renewables into the grid.

On the one hand, policies can make strategic decisions to fund CCS projects, on the other hand, implementing a carbon price provides that signal for businesses to arrange their emissions in a way that conforms with the carbon pricing scheme. That's what we see in the EU with higher carbon prices.

China's carbon market just started last year. But price signals are important in guiding companies. You can guide them on certain things, but it's often met with resistance.

Matthew James

Zhonghua, Total's changes are fascinating because they can be used as an example of what is happening in the oil and gas sector, and how companies are changing with the transition. The company's transition doesn't just mean investing in new technologies, it also means re-skilling existing workforce and preparing the ground for the future. What are examples in your team?

Zhonghua Xu

We are shifting from being a traditional oil and gas company to an international multi-energy major, and not only bringing cash to new business sectors like renewables. We plan to spend $60 billion in the renewables sector.

But I think more important for TotalEnergies is that when we decided to enter a new business sector, we also needed to build up our competence. Our new company will focus on seven business sectors – oil, gas, electricity, solar, wind, biofuels, hydrogen.

For the new energy sector, the challenge of job skills is competitive. Solar, for example, is closer to the semiconductor business. Biofuels is closer to biotech, and wind to mechanical engineering.

In solar, we're competing with the big Chinese solar companies that have tens of thousands of employees. We may have several hundred. Last year TotalEnergies decided, after changing its name, to create a new division called One Tech, bringing together all technicians, engineers, technical service providers, etc., into one company.

We also decided to focus on offshore wind, because we have competence from offshore oil and gas and can better mobilise people from traditional oil and gas work.

Matthew James

Chunping, this is a cultural change. How important is it within the picture you described?

Chunping Xie

It will make a huge difference. More and more companies are joining the campaign for net zero from all levels of government, enterprises, and universities. This will make a huge difference. New business cases will encourage new joiners as well.

We need to think about how to leverage this private sector engagement. In some sectors, new innovation may not make a successful business case. This is where public funds should step in to set up a successful business case, or to invest in the business direction and then reach more private sector investment.

We also need more regulation and price signals, like the ETS. Carbon accounting systems for the whole of society are also important, with a carbon account for each company that tells you how much you're emitting and that if you're not innovating you will pay a price.

Matthew James

Zhonghua or Simon, do you want to react to that?

Zhonghua Xu

Traditionally our focus is to explore and produce oil and gas at a low cost, because the oil and gas market demand is almost balanced. We have a demand for 100 million barrels of oil per day, and production nearly at 100 million barrels of oil per day.

TotalEnergies doesn't have to demonstrate the difference between different sources of oil. But for renewable energy, we need to demonstrate the difference between solar and wind. So when a traditional energy company enters this new sector, it needs to build a new culture for innovation. Everything will be much quicker as compared with oil and gas.

Matthew James

Simon, did you have anything to add before we start looking at questions from our audience?

Simon Göss

The issue of different lead times is very real for traditional oil and gas projects, it takes decades from exploration to supplying the fuels. With renewable projects, if the permitting process and other

steps are streamlined you can complete a solar plant and bring it online within one year. That's a very different timeframe for business, and projects are smaller scale. It’s interesting to think about how to integrate that into a big corporate environment. It’s not easy.

Q&A

Question: Anjana Das (energy consultant at Integrated Research and Action for Development, a think tank in India)

India also has a large capacity of coal-based power generation, so CO2 capture is interesting to us.

First, are there any working CO2 capture demonstration projects in China working with a power plant? Because in the EU there were demonstration plants in around 2000, but they fell through.

Secondly, for Simon, I also visited the Northern Light CCS project, but interest from EU countries for joining was not so good. Has that mindset changed in favour of carbon capture?

Zhonghua Xu

I can answer the first question because I am coordinator for a CCUS committee in China. Yes, China is engaging in all different kinds of CCUS technology and demonstrations.

China had projects for chemical capture several years ago, and it’s home to one of the largest CO2 capture demo centres, where scientists aim to demonstrate the different CO2 capture technologies.

China is also working to develop direct air capture, and algae and biotech capture. For utilisation, China is focusing on from the CO2 to mineralisation and CO2 for enhanced oil recovery.

The CHEERs project, which I mentioned earlier, is one of the world’s largest projects for capture technology in a chemical grouping, located in southwest China.

So China has demos and R&D across all sectors, and a clear roadmap for CCUS development. My personal feeling is that today, compared to a few years ago, China is more interested in developing CCUS.

Simon Göss

The Jinje power plant in China is equipped with the first CCS stack, it’s a demo project from 2021.

The Northern Lights project is in Norway, and they are clear that it will be built. It has government support, and the developers are already discussing contracts with companies that want to store CO2. There is not much resistance in Norway because CO2 is stored offshore.

It would be very different in Germany where we have a very dense population and haven't had much oil and gas exploration in years. But I think the new German government has realised we will need some kind of CCS. It could be by developing a Europe-wide transport system, where European and German companies, such as cement, steel and chemical companies, would capture the CO2 and send it to be transported to international sites such as in Norway or offshore Netherlands.

That is being planned, but laws need to be changed in Germany to allow it, and an EU-wide regulatory framework is needed to facilitate transport.

Question: François Issard

What is the impact of the recent crises in the world on the emissions and energy mixes of big countries, including China? China is seeing a power crunch that triggered decisions that are bad for emissions, in favour of coal power and coal mining.

We're already feeling heat in Europe from NGOs and others about how we meet the COP26 and Paris objectives.

Chunping Xie

In China, the crises of Covid, the power crunch, and Ukraine have pushed the government to think more about energy security. It's a major focus for China's energy policy at the moment.

China is in a difficult position, because its economy is still growing quickly, which drives up energy demand. So for China, there will be two major steps: meet additional energy demand with renewables, and replace existing coal power plants with renewables.

Currently, only half of new electricity demand is met by renewables, maybe 50-60 percent. Around 40 percent of global wind and solar energy installations are in China. That is huge, but integration is important here too. The way the current grid system runs means that we need coal power plants to provide flexibility and energy security.

But China has released guidance saying it will not build new coal power plants simply for electricity generation, which means we understand that in the short-term we need more coal power plants, but these new plants are to support the future integration of renewables into the grid.

Another issue is electricity market reform. The cost of renewables is falling, but there will be additional costs for grid integration, which the grid companies are feeling. That's why they are not willing to bring in more renewables. So we need to reform the power market and support the integration of renewables into the grid.

Question: Guoyi Han

Flexibility and the lack thereof is clearly, increasingly, the major obstacle for massively accelerating renewable power uptake. In the range of flexibility options, where is innovation most needed and where should it be most prioritised for investment?

Simon Göss

Investment in China and cross-border grids and markets. But that's more of a policy and implementation decision than investment.

Zhonghua Xu

There will be three major trends in the energy transition: low-carbon, electrification and the digital revolution. Innovation should be more highly prioritised in these three areas.

There is a need for more renewable energy, we need a more reliable, cost-effective solution such as green hydrogen, and we need an energy strategy for digitalisation. There will be huge amounts of data, and if we can use it we can improve energy security and consumption efficiency. And electrification could create a better geographical balance of renewables and support e-mobility, which will change transportation.

Chunping Xie

I agree with digitalisation, it's important for promoting demand response. I would add EVs. There have been discussions around EVs-to-grid, which means EVs can provide energy storage for balancing the grid. EV batteries can also be used for storage once they're retired from vehicles.

The most important innovation for me is energy storage, especially long-term storage. We're working on an idea of retrofitting existing coal power plants to turn them into storage facilities. Thermal energy storage is promising. I've worked at the Birmingham Centre for Energy Storage, where we worked to develop the world's first liquid air energy storage, which liquefies the air to store it, and can be used over the long-term at large scales.

Question: Pasquale Capezzuto

Zhonghua, do you think that a huge amount of renewable energy supply may be a problem for the stability of the electric grid if it's without wide digitalisation and storage?

Zhonghua Xu

Digitalisation and energy storage are important. If we want to really stabilise the renewable or electricity grid it's a crucial issue to develop reliable energy storage. For reliable energy storage you need two things. One is energy density. Chemical storage is not high-density, liquid is the highest density. Two, we need more reliable long-term energy storage solutions.

Matthew James

We have the ETS in Europe and a limited ETS has started in China. Simon and Chunping, what can China learn from the EU ETS?

Simon Göss

I'd like to first comment on the issue of electric grid storage without digitalisation. The EU doesn't have large-scale storage, at least not in Germany, but we have an interconnected electricity market and grid. In that way you can easily get to 40-50 percent penetration of renewables without having to invest in hydrogen. The interconnected system balances supply and demand.

An emissions trading system is a political instrument, and therefore prone to produce failure because politicians have different ideas of what it should do. That's what we saw in the EU – instruments were put in place and not followed up on, and prices have reacted strongly to new announcements from politicians.

On the other hand, emission reductions in sectors that are in the EU ETS are higher than sectors that are not in the ETS, because they have to pay a price for their emissions.

The larger or broader the sectors in the ETS are, the more economically efficient the ETS will be. That's why, after the first stages in China, it's important to find out how the national emissions trading system works with the electricity sector, and the integration of industries should be a next step.

Lessons can be learned from how the EU integrated the different industry sectors with baseline emission levels and the best 10 percent versus the worst 10 percent. One of the big drivers for integrating the industries into the Chinese ETS is the European carbon border adjustment mechanism, because if Chinese industries are being integrated in the Chinese ETS, they can deduct the price they pay in China from the carbon border adjustment certificates.

What can be learned about how to manage an ETS? Make clear rules and follow up on what you said, because otherwise actors can make investments and suddenly the price crashes because the economy needs more CO2 certificates, and private investments can become void because they were based on higher ETS prices.

Chunping Xie

It's very important to expand the Chinese ETS coverage to include additional high-carbon industries. It currently only covers the power sector.

It's also important to reduce the total volumes of emission allowances and increase the proportion of allowance allocated via auction. And it's important to establish international cooperation mechanisms for carbon pricing.

Matthew James

We're talking about China, we're talking about Europe, we're talking about innovation and the transition. It's an incredibly broad topic, but I think that through the panel today, with different standpoints within the energy system, we've had good pointers in terms of where the focus should be and lessons that can be learned from Europe's experience and applied in China.

We've heard from Simon Göss about technology on CCUS, which is sure to grow, and from Zhonghua Xu on the changes taking place at TotalEnergies and how they are embracing seven energy sources. It's a huge cultural change.

The panel's tips for innovation include data management, electrification, digitalisation, storage, and electric vehicles, long-term storage and thermal energy storage specifically.

Can you give us some closing remarks?

Chunping Xie

People keep telling me innovation just doesn't make economic sense at the moment. That is why the government should step in with supporting policies and a clear sense of direction, so we know that these technologies will be helpful.

Simon Göss

Despite what is currently happening, with the war in the Ukraine, international cooperation needs to continue if we want to achieve anything close to a 2 degree Celsius climate target. Otherwise, these problems – such as the high temperatures in Pakistan and India – will be exacerbated and more problems will arise. We need to bring forward lessons learned from policy initiatives and technologies.

Zhonghua Xu

The energy transition is a long journey. We need innovation for technology, for policy, for business models and for cooperation. The European Chamber of Commerce of China just released a survey on carbon neutrality by a European company in China. Have a look at it if you want to understand the point of view of a European company on China's goal.

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