



China Carbon Forum | 中国碳论坛

An independent platform to foster trust and cooperation among China's stakeholders for climate action

Coal in the face of the energy revolution – building consensus for the decarbonisation of the power sector

Executive Summary

On March 8th, 2017, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, together with China Carbon Forum, co-organised an event titled “***Coal in face of the energy revolution – building consensus for the decarbonisation of the power sector***”. The event was the 28th event in the China Low Carbon Leadership Network (LCLN) event series, jointly organized by GIZ and CCF since 2010.

The LCLN events aim to encourage communication among leading local and international experts in China's climate change sector. The event series are funded by the German International Climate Initiative on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

The event featured a welcome address by Ms Sandra Retzer, Head of Sustainable Urbanisation, Transportation and Energy at GIZ China, followed by a keynote address from Mr Frank Peter, Deputy Executive Director at Agora Energiewende. Mr Peter then joined a distinguished expert panel to discuss the role of coal during the energy transition for both German and China, including Dr Gao Hu from the Center for Energy Economy and Strategy Development, Energy Research Institute, Ms Lena Hansen, Managing Director at Rocky Mountain Institute, and Mr Lauri Myllyvirta, Energy Analyst at Greenpeace East Asia. The panel was moderated by Mr Robert Earley, Board Member, China Carbon Forum.

Keynote Speech

A keynote speech was provided by Mr Frank Peter from Agora Energiewende, for about 25 minutes. Below is a summary of the key points discussed during the presentation.

- Phasing out coal is about much more than climate change. It involves, for example, structural change for industry, and migration issues within and between countries. Therefore, Agora Energiewende conducted a study which informed the German debate on this issue.
- The recently established German government decided to establish a commission that will consider how to reduce coal use in coming decades, define an end-point for coal use in Germany, and provide specific ideas on how to achieve these goals. This is consistent with Agora's research.
- The market for conventional coal power generation will decline in coming years, even without specific climate change policies. The reasons for this include increased efficiency of electrical use limiting growth in demand, even in emerging countries such as China. On the other hand, renewable energy is achieving increasingly low tendering results worldwide. Costs for PV and wind have dropped dramatically over the past decade, reaching the level of 4-5 US cents per kilowatt hour (kWh) around the world.
- In Agora's view, the new electricity demand that is coming to the market from electric vehicles, heat pumps and power-to-heat technology, are likely to move demand to the times when the wind is blowing and the sun is shining. And there will be flexibility in the sources of demand in the future, to match the supply from renewables. In this situation, conventional power sources will be used as back up for new energy, i.e. wind and solar.
- Government needs to plan for the phase out in a progressive and forward-looking manner, because although structural changes have been taking place in the German coal industry in recent decades, it still plays a major role in the economy of certain regions.
- In addition, coal mines and power stations typically have long investment cycles. For example, a lignite mine in Germany typically has a life-span of at least 30 years, or 40-50 years considering the post-closure treatment of the mine site. A new power plant would typically be in the market

for 35-40 years. Therefore, decisions on viability need to be made early in order to avoid the risk of stranded assets.

- Integrated coal mining and power generation has a total different economic approach than just burning imported coal. This has to be taken into account when considering the transition away from coal. The coal industry also has a lot of upstream and downstream impacts on other industrial production, which also needs to be considered during the transition.
- In Germany, you also need to consider the post-closure treatment of mines, including water treatment and environmental restoration. This requires financial resources, and if mines are closed before the end of their productive life due to climate policies, their ability to pay for restoration may be impacted.
- The Agora plan was intended to deal with all of these challenges, while achieving the goal of reducing coal use, and providing a practical picture of what the transition may look like.
- In Germany, we can see that just adding renewable energy generation will not reduce emissions. In fact, excess coal power has been exported, given Germany's connectivity to neighbouring countries. In addition, the CO₂ price established under the EU ETS has seen prices of 9-10 Euros per tonne, which has not been sufficient to steer investment away from coal and towards cleaner energy.
- For these reasons, a legally binding coal phase out seems like a feasible way to go forward. To help identify at what rate coal power capacity should be reduced, Agora developed a CO₂ track that defines the benchmark for this approach. In order to evaluate the effect of policy on the economy, power prices and on regions, they developed a reference case scenario to help value the costs of a faster coal decline compared by comparison.
- A coal phase out should address all the social and economic aspects involved. In addition, because the transition involves a long time-scale, covering multiple generations, there should be something of a societal consensus in order to move forward. Agora suggested a roundtable involving different stakeholder groups - an idea which helped inform the new government's establishment of a 'coal commission'.

- Agora's key steps for implementing a coal phase-out include an end date for coal use at 2040. They consider this as not very ambitious, but it provides a starting point for discussion.
- They also considered phasing out the German coal power fleet. As a first step, they make the point that you should not consider bringing new coal power to the market. This point has already been basically agreed in Germany, if only for economic reasons.
- When determining how existing coal power capacity should be reduced, it makes sense to start with the older plants, and move forward from there. As a trade-off with power generators, Agora propose an agreement that in exchange for reducing capacity, companies will face no further climate protection restraints in the power sector.
- Germany's coal production has a strong presence of lignite mines. The coal phase out should establish a principle of no new lignite mines, and no extension of existing lignite mines. The post-closure restoration of mine sites could also be funded by a dedicated fund with contributions from the users of lignite for power production. This is similar to what happens in the nuclear industry in Germany.
- Structural changes in coal mining regions also need to be dealt with. Agora proposed that 200-300 Euros million per year be set aside for the creation of new business options in those regions. The government should aim to ensure that the transitional change can be achieved within two to three decades.
- If emissions are reduced as a result of this coal phase out, it will have an impact on the effectiveness of the EU Emissions Trading Scheme. This needs to be considered, in order that the ETS not be weakened.
- The final key point in Agora's plan is to ensure the competitiveness of industries that use electricity as a primary source of their production.
- In Agora's plan, coal capacity should be reduced over time, broadly following three phases. In the first phase, some power plants can be closed, reducing existing overcapacity. Socially acceptable efforts to reduce the number of people employed in the coal industry should be identified. Given that the average age in the industry is high, government can identify ways to

reduce staffing by providing financial assistance without causing significant social dislocation. Coal regions should also start actively preparing for life after coal.

- During the second phase, there will remain a stable amount of coal power capacity in the market. Once over-capacity has been eliminated, every other reduction in capacity that follows will create security of supply issues which need to be dealt with. Government will also need to think about how new generation capacity will come to the market and be financed. There should also be re-education for workers that will not reach the end of their working life before the coal phase out is expected. Lignite mines will start closing, and work to restore the landscape can begin.
- During the third phase, investment in the security of supply should be finalised. All lignite mines should be closed, and post-closure care undertaken. The post-closure care for mines and decommissioning of power plants may require at least one third of the original employees, providing ongoing employment for some workers. This process will also help to ensure a useful landscape that can be used for productive practices such as farming or renewable energy.
- The Agora study showed what may be required for the ramping up of natural gas power generation capacity, which can be used as back-up supply. The study expects that about 10GW more gas capacity will be required in the market by 2030. However, almost no extra capacity will be required until 2025, during which time the focus will be on reducing over-capacity of coal power.
- If managed properly, the model shows that the effect on power prices would not be substantial. They expect that the impact would be just 5 Euros per megawatt hour, less than 10% of the original power price in the reference case. What's behind this is the fact that systematically reducing investment in coal power, allows for redirecting it to renewable and gas, which helps limit the effect on the electricity price.
- Agora also evaluates the effects of the transition on German industry, considering the electricity consumption intensity of various industries. The automotive industry has a major downstream impact on energy consumption, but not a strong reliance for production. The chemicals, metal production and food industries have much higher electricity intensity, implying a potential impact on profitability. This will need to be considered carefully.

Record of Discussion

The following is an edited synthesis of the discussion that took place at the event among panellists (around 60 minutes) and open Q&A with participants (25 minutes). As per convention, individual's comments are not attributed.

The panel identified key challenges for gaining consensus on phasing out coal, especially in Germany, including **security of supply, economic sustainability of the industrial sector and price impacts**. These issues have all played a part in recent negotiations for the new coalition government in Germany. The difficulty in creating consensus was the reason why the new commission has been established. Politicians are reluctant to take the first step in this process because it is so difficult politically, so the commission will be responsible for establishing the key dates and cornerstones of the transition.

In the past China has relied on coal for around 70% of total energy consumption, and the government is now working to reduce this to 60%. Air pollution has been a major driver of this shift, as well as the government's efforts to create a society based on "eco-civilisation", which will have clean air and water. Even so, the sheer volume of coal consumption in China remains very large, and it is fair to say that there is **not yet a consensus on the future role of coal in China**.

The panel suggested that while the US has backed off from its national-level commitments to reduce carbon emissions, there are encouraging signs from the state level, as well as in the economics of the energy sector itself. The cost of renewables is now driving the energy transition in the US. In the last couple of months, there have been bids to utilities coming in at under 2 US cents per kWh for wind power, and 3 US cents per kWh for utility-scale solar. This is transformative, because it means that new renewables are now cheaper than not only new coal power, but also **cheaper than running existing coal power plants**. Some coal plants have shut down due to the resulting lack of competitiveness.

The panel expressed the view, therefore, that this turning point away from coal will happen regardless. It will be aided by enabling policy at the state level, and to some extent at the national level, but not depend on it. The next question to address is what next, i.e. after overcoming the problem of economics, what stumbling blocks remain? The panel suggested that these are not just technical issues, but rather involve **re-aligning the incentives of different actors in the**

system, including recreating business models to enable integration of renewables and finding new jobs for people in the coal industry. These issues are relevant in both the US and China.

While there is a lack of clear consensus on the future of coal, the panel pointed out that **there is a consensus on where coal is not going**. This is a huge change from five years ago, when suggesting a coal peak by 2030 or 2040 seemed ambitious. In the last couple of years, however, we have seen the steel industry and cement industry associations say that their coal consumption will no longer grow. There is also a consensus that coal consumption will need to peak by around 2020 in order to achieve a CO₂ peak by 2030.

At the same time, the panel foresees **a long plateau for both coal consumption and CO₂**, whereby there is a slow decline over coming decades due to a continued large share of coal in the energy mix. This would not be consistent with the achievement of the Paris Agreement goals, or blue skies in China.

Consensus was also tested when coal consumption and heavy industry production started dropping quickly in 2014 and 2015, revealing that China was, in many ways not ready for the transition. Many regions were not ready and the financial position of SOEs was not prepared for exiting heavy industries, leading to social distress in some areas. During the last couple of years this led to stimulus from the government, to create demand for heavy industry. The panel noted that the question is now whether we are back to the old normal, or whether **the government is preparing regions dependent on coal and heavy industry to transition?**

The panel used the analogy of a wave to suggest that you have three options as an organization. First, you could create a sea wall to try and block the wave. Some organisations are responding in this way to the energy transition. Second, you can tread water, wait and see whether the wave will crest or not. Third, you can try to surf the wave. This means looking ahead at where the wave is going, work to learn new skills and capture the opportunity to ride the wave. How can companies move from the sea wall approach to the surfing approach? Some companies are making this change, including Shell and Exxon, who are starting to invest in solar companies in a significant way, as well utilities in the US that are starting to **open up to outside entrepreneurs and tech companies to create win-win business models**.

The panel expressed the view that a key challenge lies in how to encourage stakeholders to engage with the energy transition. **Part of the solution is through increased transparency**, especially

in terms of data, to help facilitate analysis and collaboration based on trust. This is a challenge being engaged with in the US, but faces some difficulty in being realised in China.

In the US, there is a mixed record from companies in the power sector. **Many of the leaders are some of the largest utilities in US, mostly on the west coast**, including San Diego Gas and Electric and Pacific Gas and Electric. There are also some unexpected leaders, such as Xcel Energy in Colorado, which was one of the largest coal utilities in the US and is now the leader in wind power, with a plan for half of its generation to come from wind in the next few years.

The panel noted that there are substantial differences between the situation faced by China's energy sector, with that faced in the US or Europe. China's economy is still growing rapidly by international standards, and **there is much room for electricity consumption to grow in some key sectors**. On the one hand, China must ensure enough energy supply to satisfy demand, while also working to achieve decarbonisation, and SOEs have to balance both demands. In the last five years, 800 million tons of coal mining capacity has been closed under the government's program to phase out coal mining overcapacity. For companies that previously relied on coal mining, this has a very significant impact and they need to find new ways to survive. At the same time, advanced coal capacity must meet the continuing demand for energy. Although coal consumption had been declining since 2014, the panel noted that coal consumption increased last year.

China's ten large coal bases are not yet 'victims' of the coal transition as they have been positioned to meet the continued demand and have not been subject to large-scale closures. While over a long time horizon, say 50 years, these areas may choose to shift their focus towards renewables and clean tech, **their economy has been designed around coal, and so currently they continue to rely on it for their economic growth**. This is the challenge of China's particular circumstances.

The panel discussed the role for civil society in facilitating the energy transition in China. They noted that so far **the most significant contribution has been to advance the issue of air pollution on to the national agenda**. The government has responded by acknowledging that this is an issue which needs to be solved. It was also suggested that people in Beijing are not generally aware of the significant contribution that coal burning makes to Beijing's air pollution, although this may be well known in nearby areas such as southern Hebei and Tangshan. 50-60% of the air pollution in the region does come from coal, and the fact that air pollution is now considered important has led to government efforts to phase out coal. The panel also discussed the fact that coal is responsible

for about half a million premature deaths per year, according to research, and human health will be significantly improved through a phase out of coal.

The Chinese public has a strong preference for renewable energy, as shown by opinion surveys. Whether this translates in to policy change, or to consumption decisions by individuals installing solar panels and purchasing renewable electricity generation directly, is still to be seen. In Germany, this was an important part of the process, where individuals became 'prosumers', and even set up their own collectives and renewable energy power plants.

The panel suggested that incumbent utilities in the coal industry in Germany have not been proactive in supporting change. The industry has a long history, and the labor unions have also campaigned to protect coal. In this sense, the German debate tends to identify the 'losers' in the energy transition quite easily, more so than the 'winners'. **If the issue of regional adjustment could be solved, identifying an up-side, then the discussion could be shifted** from winners and losers, to identifying the solutions to the challenge.

Some unions, however, are now proactive in supporting the transition. The trade union for mining, chemicals and energy workers is heavily opposing other unions, such as for the services sector and metals industry, in **moving towards progressive consideration of this issue**. This will help to encourage a change in the conservative thinking prevalent in the mining industry. Regional politicians also act according to political interests, and the impact of mining workers protesting to the economic ministry asking for "no end to coal" is significant. This gives regional politicians leverage to try get as much as possible for regions during the transition, including significant financial support.

For China, the panel suggested that the State Council's plan to reduce capacity is the biggest challenge facing coal mining companies. For instance, in southern China, most coal mines are very small and the majority have already been shut down. Miners in these areas need to find new jobs, and there is no room for negotiation. Mines in these regions tend to be unsafe, with low efficiency and high costs. **For the ten coal bases**, however, efficiency is much higher, and **there is not yet a significant risk of job losses**.

The panel said that government mandate is important for the energy transition. If there is no clear consensus on a solution to the challenges, an approach such as the dedicated commission in Germany is a useful way to foster democratic debate and push forward the debate. However,

political will is important in order to mandate the commission to identify solutions, give clear time frames, and identify the next steps.

While there may currently be a lack of political will at the national level in the US Initiative, the panel said that the emergence of 'America's Pledge' is significant. The initiative aims to aggregate and quantify the actions of states, cities and businesses and other non-national actors in the United States to drive down their greenhouse gas emissions consistent with the goals of the Paris Agreement. It already has more than 2,500 members, and would be the 3rd largest economy in the world by country. This suggests that **there is indeed a consensus emerging in the US, but it is bottom-up rather than top-down**. The panel also noted that in the US, President Trump's support for coal power comes in the face of an increased rate of coal power plant retirements. Last year, every 15 days a plant either retired or announced retirement. This supports the view that a consensus is evolving, even without the White House.

In China, national policy direction is critical to driving change. The panel said that policies on power market reform and energy transition are very positive in this regard. Ensuring the successful implementation of these policies, therefore, is important for China's future success. China is planning to implement wholesale power markets in some provinces. The way in which this is done is important, because **power markets can be structured either to support the status quo, or to transition away from coal and encourage the integration of renewables**. If successful, these measures will build confidence for these policies to be implemented more widely.

In addition, China's Five Year Plans for national social and economic development provide strong guidance to local leaders. Three key energy-related indicators have been imposed: economic energy efficiency targets, intensity of energy-related carbon emission targets, and share of non-fossil energy as a proportion of total energy consumption. In order to achieve these targets, the government has to mobilise the resources, and each province can develop a certain amount of wind, solar and biomass to achieve them. In order to achieve the CO₂ intensity target, local governments make a judgement about the extent to which they need to deploy renewables and decarbonise the energy system. **If local officials do not meet these targets, they will not hold a leadership position during the next term**. Overall, the current Five Year Plan aims to reduce coal to 58% of total energy consumption by 2020, down from 60% now.

The State Council has also issued important mandates, such as ten principles to combat air pollution. These concrete actions include building new renewable energy and transmission lines and

reduction of coal use, in a systematic way. As a result of such measures, the panel suggested that **there is indeed a consensus to reduce coal consumption at the central government level in China.**

The panel expressed the sense that, when it became clear that China will shut down overcapacity, the ice was broken to some extent, and that the coal industry which was seen as almost untouchable in the past would no longer be protected by government. Regions that are highly dependent on coal, therefore, should think about what's next. Even if coal still has a future, there may be structural changes. The German nuclear debate provides a good example. After Fukushima, the government went from extending the lifetime of nuclear power, seeing the political mood, and then deciding to end nuclear generation, purely due to change in mind-set. This should be a warning to every region dependent on one product. **There is a need to diversify risk instead of relying on coal**, and to avoid being surprised by an event which may see a quicker than expected move away from coal.

Indeed, the panel noted that in China, the transition away from coal has gone faster than the government has targeted. In 2014 the State Council issued a new Energy Strategy, and in 2012 the previous Five Year Plan was released. Neither of these documents contained a plan to peak coal. Instead, overcapacity occurred because growth in demand for electricity slowed substantially and non-fossil energy growth was faster than expected. This reflected that economic structural change was happening organically, and faster than government targets.

China still has very energy-intensive economic structure, however, and the panel suggested that since the global financial crisis, the government has been effectively re-carbonising the country's economic structure by stimulating smokestack industries. Given this energy-intensive structure, **there is much potential for transformation to happen faster than we think.** While coal production bases may be somewhat secure for now, the panel suggested that coal power bases (which overlap somewhat with production bases), are being affected. These centres were established in the west to supply power to the east. Due to overcapacity across the country, eastern regions are not eager to buy from the west, meaning that utilisation of transmission lines is very low.

The good news is that, as yet, there has not been much political backlash to slow the development of renewables, and there is consensus that coal overcapacity is a problem. However, the panel suggested but this should be watched closely. This challenge has been faced by other countries where, once it is clear that demand growth is slowing and growth in renewables is fast enough to

meet additional demand, the need for coal power will reduce. This process is politically hard, and the panel expressed the hope that there will **continue to be resolve to keep going on the path to decarbonisation.**

In terms of winners from the energy transition, the panel suggested that **China has unique opportunities to improve livelihoods, especially for regions dependent on heavy industry.** Given the economic structure, reliant on heavy industry and investment, the share of household income to GDP is far lower than for other major economies, around 40%. The energy transition is largely about increasing that share. In other countries, increasing consumption may not be the solution to reducing emissions, however in China private consumption is much less energy, resource and CO₂ intensive than the capital expenditure which represents about half of the economy currently.

The panel discussed China's long-term energy transition strategy. By 2030, non-fossil fuels should provide at least half of all power generation, and by 2050, they should provide at least half of the overall energy mix. In the meantime, installed coal power capacity will be limited to 1,100 GW. Challenges remain, however, for example 34 GW of coal power plants were installed last year, larger than wind and second only to solar PV. Many local governments clearly still have high expectations for coal power plants. Also, 'clean coal technologies' are advocated, including low-emissions coal power, coal-to-gas and coal-to-oil technology. Coal rich provinces are opting to develop 'clean coal bases'. We can see that although the central government has given a clear policy direction, **high-level strategy is far removed from everyday decision-making**, and there is a need to resolve this in local areas that rely on coal.

There is an ongoing discussion about the extent to which end-of-pipe solutions, or 'clean utilisation of coal', should be deployed to combat air pollution, compared with efforts to shift towards renewable energy. The panel mentioned a recent study by Tsinghua University, which found that one third of Chinese cities, including Beijing, cannot meet national air pollution standards using end-of-pipe solutions, i.e. the best filters on factories and the cleanest gasoline cars, let alone the more stringent WHO guidelines. Therefore, **a move to clean energy is necessary in order to achieve blue skies.**

Given that over the last five years, the mainstream view has changed from one of coal use for decades to come, to a view of a plateau and slow reduction, the panel suggested the next step is to **build consensus that China can in fact reduce coal use in time to meet the Paris Agreement targets.** According to estimates, to reach these targets, developed countries will need

to stop using coal by 2030, China by 2040, and the rest of the world by 2050. That is an intimidating challenge for many countries, and there is much work to do. At the same time, more than 20 countries have announced coal phase outs so far, and the panel hopes that this will create a virtuous circle of momentum in the right direction.

The panel noted that in the US this critical turning point, and building momentum for renewables, has driven many stakeholders to dig in on old business models. Success is not guaranteed, but the key levers are at state-level, where leadership is needed not only to force higher adoption of renewables, but also to **drive stakeholder engagement in a consultative way**. The discussion needs to ask what are new business models? How do we reform markets to enable this future? And, how do we align economics with the incentives that currently exist in order to achieve our goals?

In China, there has been a huge level of investment in renewables. But we need to address not only how to build renewables, but also how to use them, i.e. integrate them in to the system. The last major round of power market reforms did not gain much traction. How do we ensure that it succeeds this time? Allowing markets to rationalise allocation of resources and integrate renewables will force many coal plants out of the market. That is indeed the purpose of reform, but there is a **hard realisation** to deal with, in terms of **what to do with the plants that become uneconomic**.

The panel also noted that beyond coal, the next question for Germany, and other countries, is if we need consensus on the future of oil and gas? Heat and transport also need to see emissions reductions, and this issue looms at the horizon of the German debate. Electric mobility in particular will have a heavy impact on Germany's industrial structure, is linked to need to reduce oil consumption, and needs to be actively considered. The panel suggested that Germany **needs to be innovative going forward, looking for the next 'big thing'**. While digitalisation took off in California, Germany should explore innovation for reform of heavy industry, such as utilisation of Hydrogen, carbon-free synthetic oils etc. This is important to secure the German business model with industries linked to R&D that provide solutions to the energy transition.