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Policymaking and Energy Supply and Demand in China's Domestic Economy

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Testimony before the U.S.-China Economic & Security Review Commission
Hearing on Hearing on China's Energy Plans and Practices

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I would like to thank you for the opportunity to contribute to the deliberations of this commission. My remarks today will focus on the role of fossil fuels in China's energy mix, the current successes and potential challenges of meeting domestic energy demand through fossil fuels; the demand trajectory over time as well as the challenges this presents to China's carbon neutrality pledge. I will also discuss briefly the short term constraints that are informing China's longer-term trajectories by looking at the causes of China's energy shortages in the second half of 2021 and the ensuing policy priorities. I argue that fossil fuels are likely to remain a dominant source of China's energy supplies for the next decade and beyond. The long-term trajectory will be shaped by China's economic growth rates and the pace of structural rebalancing, policy efforts to enhance energy efficiencies as well as efforts to develop and promote new technologies. But the lack of clear roadmap means that future trends could be determined by near term choices, which seem to be increasingly informed by concerns about energy security. This should not be taken to mean that China is walking back from its commitments, but that the short term realities are constraining long term ambition, as is currently the case in many other countries.

Recognizing that fossil fuels will play a role in the energy transition means that, at least to begin with, measuring, reporting and reducing emissions from the entire value chain will be critical. As the US is gradually becoming a large exporter of oil and gas to China, reporting emissions—and offsetting them—along the entire value chain in a transparent manner would be an important step. Engagement should span both government (on all levels) and industrial stakeholders, especially in the context of rising concerns about technological and financial decoupling. Collaboration on CCUS and abatement technologies will also help scale up these technologies and make them more widely available to other fossil fuel consumers, even though this should not replace efforts to promote non-fossil fuels and encourage an accelerated deployment of non-fossil sources in the energy mix.

1. Fossil fuels are the backbone of China's energy system and its political economy

Since China's Reform and Opening up in 1978, the country has undergone a profound transformation. Its Gross Domestic Production (GDP) in 1978, according to the World Bank, was roughly half the size of the Italian economy, while it is now set to overtake the US and become the world's largest. Per capita GDP has grown by nearly 24 times as industrialisation and urbanization have transformed the country's economy and energy consumption trends.

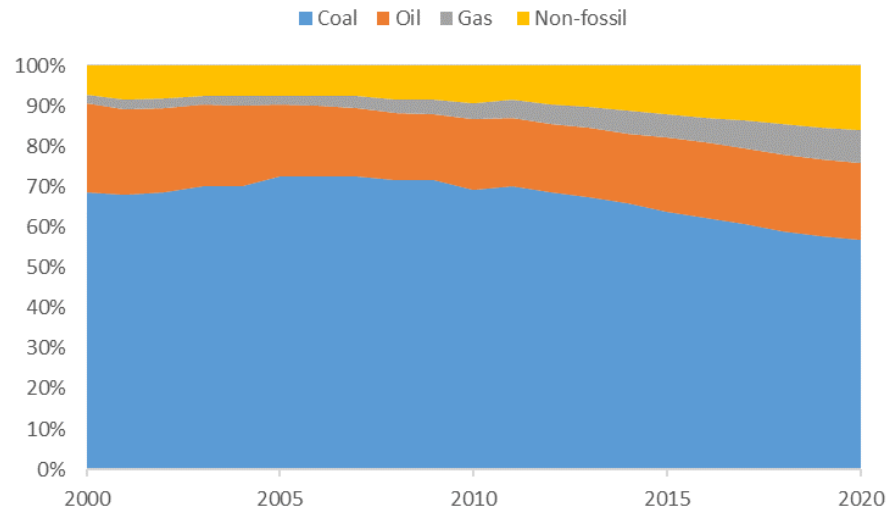
Fuelling the country's rapid industrialization and urbanization process is a voracious appetite for energy, with primary energy consumption increasing rapidly, from 1.5 billion tons of standard coal in 2000, to 5 billion tons standard coal in 2020, according to China's National Bureau of Statistics, accounting for one quarter of global energy use[1].

1 It is important to note that throughout the 1980s and 1990s, despite strong economic growth in China, the availability of energy efficient technologies led to a dramatic improvement in the country's energy intensity (energy consumption per unit of GDP). Primary energy demand rose on average by more than 8 per cent per year between 2000 and 2010, slowing to 3.4 per cent in the five years to 2015 and just over 3 per cent over 2015-2020. IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021, https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-32e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf

Indeed, while the country's economic structure has changed significantly since the start of the Reform and Opening period, shifting from a predominantly agricultural economy to one dominated by industry and increasingly services, the industrial sector rapidly became the largest consumer of energy, accounting for almost two-thirds of China's primary energy demand. Similarly, China has relied heavily on energy-intensive industries to drive economic development as industry now generates around a third of China's GDP.

Due to this development model, China became the world's largest energy consumer in 2009 and its biggest emitter of energy-related CO2 emissions since 2005[2]. Moreover, despite impressive growth in renewables since 2000, fossil fuels still accounted for 85 per cent of China's primary energy mix in 2020 with coal accounting for 57 per cent and oil for one-fifth. Natural gas accounted for an additional 8 per cent (Figure 1). For the sake of comparison, the US in 2020 relied on fossil fuels for 79 per cent of its primary energy consumption, but coal accounted for 10 per cent, with natural gas and oil each representing 35 per cent of energy consumption[3]. Fossil fuels are therefore prevalent in many countries' energy supply structures but China is heavily dependent on coal, a factor that contributes to the country's large emissions profile.

Figure 1: China's energy mix, per cent



Source: National Bureau of Statistics

2. China's coal conundrum

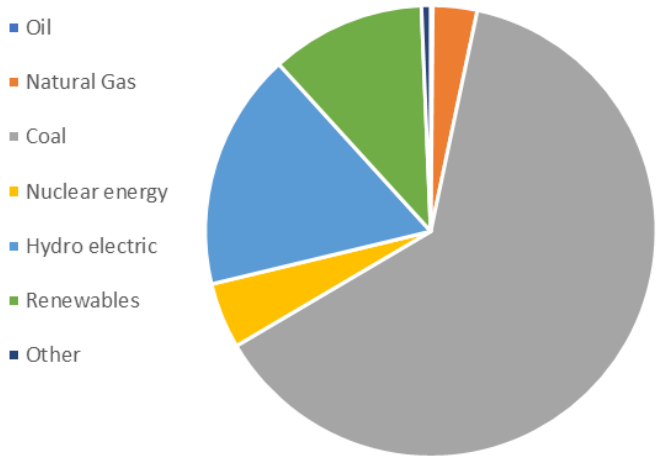
Coal is used in China predominantly for electricity and heat generation, with the latter accounting for 60 per cent of total coal use and industry representing an additional 33 per cent in 2020[4]. That year, China had 1,080 GW of installed coal-fired power capacity – more than half of global coal capacity, although this was still within the 13th Five Year Plan (FYP; 2016-2020) target of keeping coal-fired power generation under 1 100 GW.

2 IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021, https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-32e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf

3 EIA https://www.eia.gov/energyexplained/us-energy-facts/

4 Buildings, agriculture and non-energy use account for the rest of coal demand, according to the IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021, p.23

Figure 2: China's electricity generation by fuel

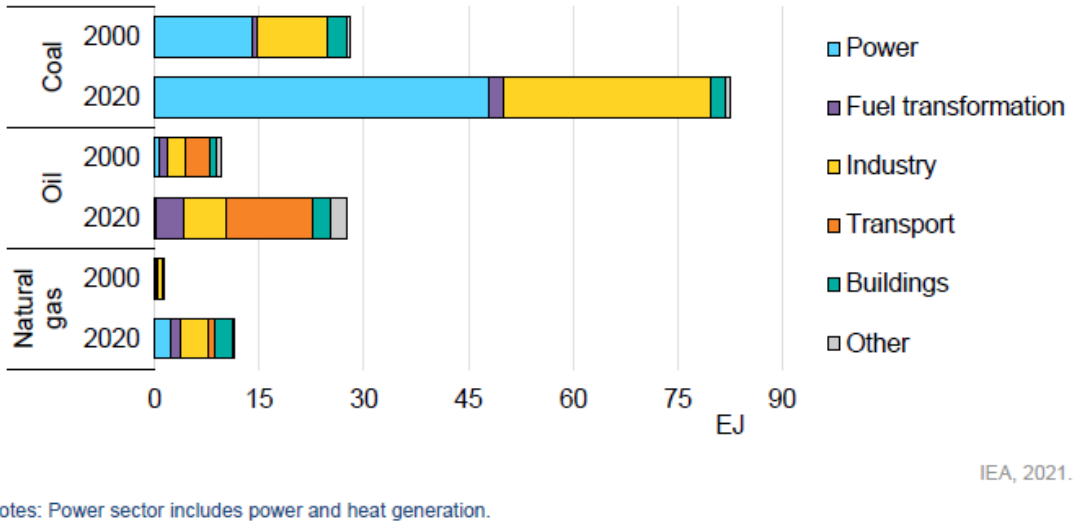


Source: BP Statistical Review, 2021

Moving away from coal is challenging given that it is intrinsically linked to industrialisation. The country's economic growth been led by an investment boom in manufacturing and the associated infrastructure, alongside an effort to localize production of the energy-intensive basic products used to construct roads, factories, and buildings. Moreover, since many of these heavy industries are dominated by state-owned companies that benefit from access to cheap capital – through the country's state-owned banks – as well as cheap labour and land, they have been able to reinforce their position as pillars of economic growth and development.[5]

From 2002 to 2013 coal contributed 77 per cent of the overall increase in the country's primary energy demand, with cement, chemicals and steel plants alone accounting for half of this increase. An additional 15 per cent of the total increase in coal demand were driven by the use of electricity generated to fuel these industries, primarily through coal-fired power plants.

Figure 3: Fossil fuel consumption by sector in China



Notes: Power sector includes power and heat generation.

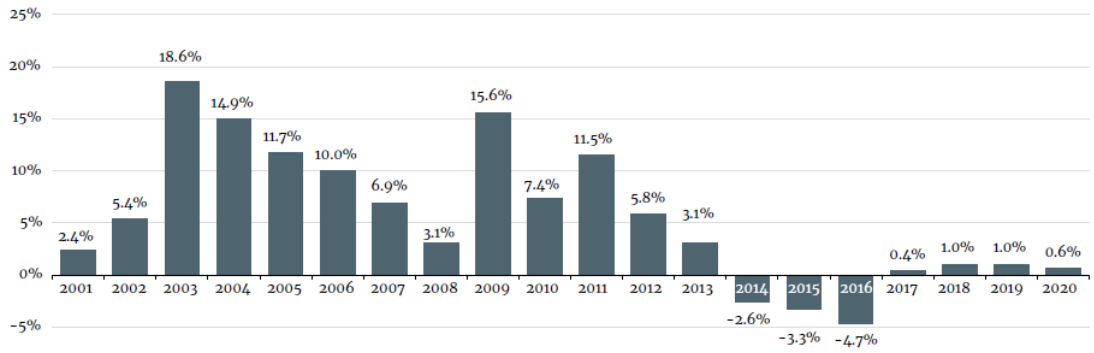
Source: IEA

5 Barry Naughton, *The Chinese Economy Transitions and Growth*, Cambridge, Mass.: MIT Press, 2007.

With growing effort to tackle local air pollution and rebalance the country's economic structure toward a more consumption-led development model, starting in 2014, Chinese coal consumption fell for three consecutive years. This was due to a combination of policies discouraging coal use; a cyclical slowdown in coal-consuming sectors including iron, steel and cement as well as a shift in economic activity from manufacturing to the service sector[6]. In its 13th Five Year Plan (FYP; 2016-2020), the government sought to reduce coal's share in primary energy consumption to below 58 per cent by 2020, compared to 64 per cent in 2015, a target that it achieved and even exceeded. The share of coal in the energy mix dropped to 57 per cent in 2020[7] and to 56 per cent in 2021[8]. But this decline was the result of government efforts to eliminate excess capacity by shuttering old and inefficient power plants, phasing out small coal boilers used for public heating and industrial steam, and reducing coal use at the household level because small-scale coal use contributes significantly to emission of air pollutants. The policy focus was on improving air quality and remediating industrial overcapacity concerns while also supporting China's climate pledges, which consisted of peaking carbon emissions by 2030. But since the pledge did not include an absolute level of emissions (which it still does not) this did not necessarily constrain coal use. The 13th FYP did, however, include an ambition to keep coal consumption below 4.1 billion tons of coal, which it successfully achieved.

But even though China has reached these FYP targets, since 2017, Chinese coal consumption has been rising as energy intensive manufacturing sectors rebounded and heavy construction activity has been growing. In the wake of the COVID-19 pandemic, China's economic expansion has led to a surge in coal consumption and subtle shifts in government policy given renewed concerns about energy security. There have been growing signs that the government is easing restrictions on coal fired power plants, even as it vows to peak carbon emissions by 2030 and reach carbon neutrality by 2060.

Figure 4: Annual growth rate of coal consumption



Source: Sino-German Energy Transition Project

Already in 2020, new coal plant approvals increased substantially as some provinces restricted renewable development, citing inadequate ability to absorb renewables. The China Electricity Council—the industry association representing China's big 5 power companies and the main advocate of major expansion of coal-fired power plants—along State Grid expect China will add hundreds of GW of new coal plants through 2025 to meet growing demand, even as the average

6 David Sandalow, Guide to China's Climate Policies, https://chineseclimatepolicy.energypolicy.columbia.edu/en/coal-3
7 Sino-German Energy Transition Project, China Energy Transition Status Report 2021, June 2021, https://www.energypartnership.cn/fileadmin/user_upload/china/media_elements/publications/2021/China_Energy_Transition_Status_Report_2021.pdf
8 Statistical bulletin of National Economic and Social Development, National Bureau of Statistics, 28 February 2022, http://www.stats.gov.cn/tjsj/zxfb/202202/t20220227_1827960.html

utilisation hours of thermal power plants remains well under 50 per cent[9]. In 2021, construction of an additional 33 GW of coal fired capacity started[10], the most since 2016, with 25 GW of new coal power plants added to the grid. In early 2022, China restarted 7GW of projects that had been frozen in 2021 due to the leadership's efforts to control high emissions projects.

During the 14th Five Year Plan (spanning 2021-2025), the government reportedly plans to add 28 GW of coal fired generation[11] and retrofit 42GW coal power capacity as "matching facilities" that should improve the utilization of renewable power projects. A policy document published in October 2021 set a target of retrofitting 150GW of coal power plants during the 14FYP for the purpose of improving coal utilization efficiency, reducing coal consumption, and promoting clean energy consumption[12]. Yet China's 14th Five-Year Plan, issued in March 2021, called for "controls" on the pace and scale of coal power construction through 2025[13], a pledge reiterated by President xi at the Leaders' Summit on Climate in April, followed by a pledge to gradually "phase down" coal use in the next five-year plan cycle (2026-2030)[14].

With growing pressure to phase down and eventually phase out coal, China's decision makers recognise that they must cap coal capacity additions and gradually wean the country off its coal addiction. Structural changes to the economy and the rapid addition of renewable energy sources will help promote this shift, but there is still a debate within China about the role of coal in the energy transition with arguments made the China should prioritise coal for energy security and as a means of facilitating renewable utilization.

The argument seems to be gaining ground. The National Energy Administration, China's de facto Energy Ministry has highlighted that coal remains an "important support" for peak power generation "under extreme conditions," and that coal will maintain its "fundamental role" in China's electricity structure for "a certain period.[15]" The NEA asserts that China should use coal plans as peaking units for moderating intermittent renewable electricity and as stability mechanisms to secure the grid. While in principle, no new coal-fired power plants will be added in the 14th FYP for power generation alone, supportive units that secure electricity supply will be considered. Indeed, phasing out coal is hugely problematic. This is because China's coal fleet is young and efficient (yielding more energy and less pollution per unit of coal). In addition, reducing employment in the coal sector creates substantial worker placement challenges and a strain on local government finances. Finally, there are still concerns in Beijing that it could undermine the country's energy security.

And in the aftermath of the US-China trade war, the COVID-19 pandemic, Europe's energy crisis in 2021 and more recently, the Russian invasion of Ukraine, there are growing questions internationally about China's role in global supply chains, increased volatility in global energy markets as well as concerns within China about how best to insulate itself from a potential decoupling with the West or

9 Sino-German Energy Transition Project, China Energy Transition Status Report 2021, June 2021, https://www.energypartnership.cn/fileadmin/user_upload/china/media_elements/publications/2021/China_Energy_Transition_Status_Report_2021.pdf

10 "Most coal power plants since 2016 entered construction in China in 2021, investment in coal-based steelmaking accelerated", CREA Briefing, February 2022, https://energyandcleanair.org/wp/wp-content/uploads/2022/02/EN-China-coal-and-steel-briefing-Feb_2022.pdf

11 Circular from the National Development and Reform Commission and the National Energy Administration on Carrying out the Transformation and Upgrading of Coal-fired Power Plants, October 2021, http://www.gov.cn/zhengce/zhengceku/2021-11/03/content_5648562.htm

12 Liu Hongqiao, "Analysis: Beijing Rethinks Coal in the Aftermath of 2021's Energy Crunch", 3 March 2022, https://liuhongqiao.substack.com/p/analysis-beijing-rethinks-coal-in?s=r

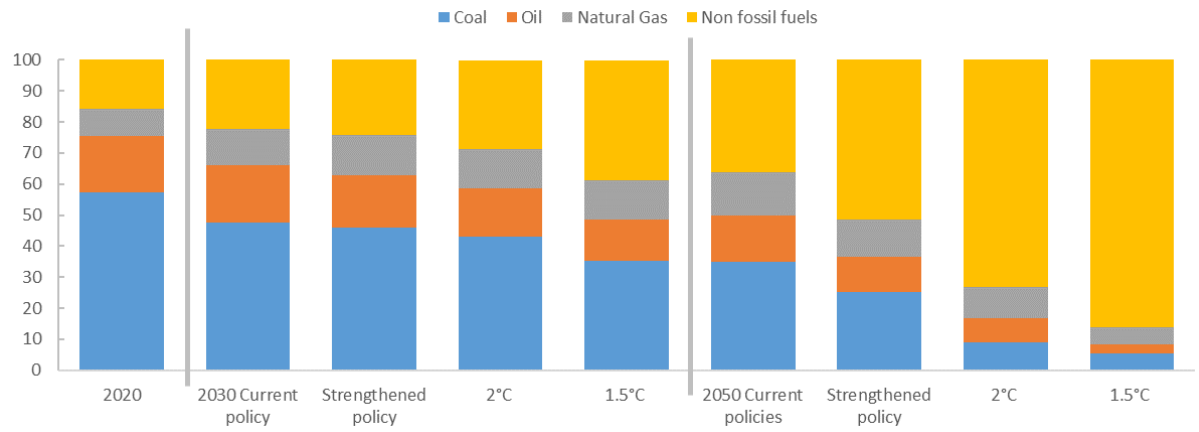
13 Full Text of the 14th Five Year Plan can be found here http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

14 "Full Text: Remarks by Chinese President Xi Jinping at Leaders Summit on Climate", Xinhua, 22 April 2021, http://www.xinhuanet.com/english/2021-04/22/c_139899289.htm

15 Quoted in Liu Hongqiao, "Analysis: Beijing Rethinks Coal in the Aftermath of 2021's Energy Crunch", 3 March 2022, https://liuhongqiao.substack.com/p/analysis-beijing-rethinks-coal-in?s=r

even sanctions. So the question of energy security has been rising rapidly on the political agenda. This suggests that coal consumption is unlikely to peak before 2025 and the pace of decline then varies considerably, depending on the policy choices. But even in some of the more ambitious scenarios put forward by Tsinghua's Institute of Climate Change and Sustainable Development (ICCSD)[16], for instance, fossil fuels still account for over half of China's energy mix through 2030, with coal falling to 35 per cent of the mix in 2030 and oil dropping from 18 per cent currently to 13 per cent. But since overall energy use is set to grow, oil demand levels only start to fall in the mid-2030s.

Figure 5: Total primary energy consumption and its composition in major years under different scenarios



Source: Tsinghua ICCSD

These concerns around energy security, namely supply security and affordability have also been key factors in China's oil and gas policies. But while China is by and large self-sufficient for coal, it relies heavily on global oil and gas markets for its supplies.

3. Limiting China's thirst for oil… but not just yet

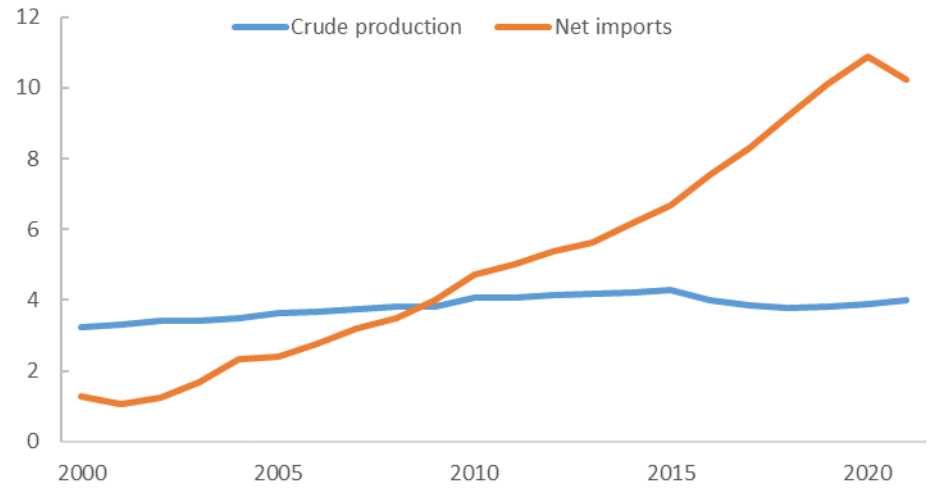
Demand for oil and natural gas has also grown considerably since 2000. Oil use has increased at an annual average rate of 5%, complementing the use of coal in heavy industries and meeting rapidly rising demand for personal transport and freight. Gas demand has grown more dramatically since 2015 with strong policy support, particularly for industrial uses, as well as residential and commercial space and water heating. The share of gas in power generation, while still limited to under 5 per cent in 2020, has been growing in light of its ability to support peak shaving and the intermittency of renewable sources. But despite significant domestic production of oil and gas, China relies heavily on imports, which met over 70% of its consumption of oil and 45% of gas in 2020. China surpassed the United States to become the largest importer of oil in 2017 and became the largest net importer of natural gas in 2018, ahead of Japan.

China's domestic oil production averaged just under 4 million barrels per day in 2020, which is just shy of Iraq's oil production. But production growth has slowed while demand continues to rise strongly (crude imports averaged 10 mb/d in 2021). Meanwhile, the continued growth of oil consumption is undermining China's efforts to constrain and eventually reduce its carbon emissions. According to the International Energy Agency, in 2019, oil combustion contributed 15% of the country's carbon dioxide emissions from energy, up from 13% in 2010. But replacing oil in end uses is easier said than done: Oil is used in transport, which accounts for over half of the country's total

16 This authoritative report by Tsinghua University, is reported to have been one key input into President Xi's 30-60 pledge. Jiankun He, Zheng Li, Xiliang Zhang, "China's Long-Term Low Carbon Development Strategies and Pathways", Springer, July 2020

oil demand, as a feedstock for petrochemicals which accounts for another 23 per cent of oil end use and to a lesser degree in power generation and industrial use.

Figure 6: China oil imports and domestic production, mb/d



Source: China Customs, National Bureau of Statistics

Concerns about energy security and import dependency on oil can be tackled through increases in domestic production as well as through switching to other energy sources. Beijing's efforts to develop and electric vehicle supply chain have been devised with a view to responding these challenges and enhancing China's industrial competitiveness. But these options do not necessarily help tackle environmental degradation: the electrification of the fleet, if fuelled with domestic coal, is not conducive to the 30-60 targets. Coal can also be used as a feedstock for petrochemicals and while this helps to satisfy supply security imperatives, it undermines environmental ambitions.

Nonetheless, China continues to electrify transport at a rapid pace. In 2020, there were around 367 million internal combustion vehicles in China, with 19.3 million sold in 2020 alone (1.1 million EVs were sold in China that year, bringing the total EV count to 4.9 million, or 1.75 per cent of the fleet).[17] But with strong increases to China's overall vehicle fleet, electrification will not materially dent oil demand in the coming decade. Policy makers have already introduced emissions limits for all vehicle types that are among the most stringent in the world, with additional efforts to support sales of alternative-fuel vehicles. According to CNPC, China's largest oil company, oil demand for transport is set to peak in 2025 but by 2030 will fall back to 2020 levels. Steeper declines in demand due to substitution are only expected after 2030. But oil demand for petrochemicals is expected to continue rising until 2030 and only gradually fall through 2050 before declining more sharply in the following decade.

4. Natural gas: A bridge fuel for China

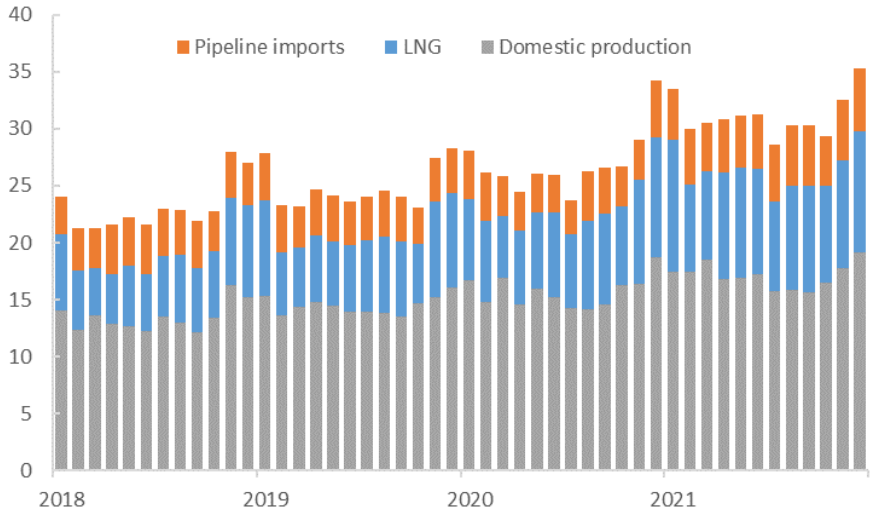
China's total gas consumption reached 320 bcm in 2020, rising to 370 bcm in 2021 and roughly doubling from 2015 levels. Domestic production accounted for 204 bcm that same year. Gas is the fastest growing fossil fuel in China as it is considered a clean fuel and very much part of the country's energy transition away from coal. The 13th FYP had originally included a target for gas to account for

17 Wang Zi, '2020年全国机动车保有量达3.72亿辆 机动车驾驶人达4.56亿人', People, 7 January 2021, at http://auto.people.com.cn/n1/2021/0107/c1005-31992870.html.

10 per cent of the energy mix—largely due to fuel switching away from coal—but that target was revised down to 8 per cent, which was ultimately met (and exceeded). Unlike many OECD countries, gas in China is used predominantly in the industrial and commercial sectors. According to the National Energy Administrations Natural Gas Development Report, in 2020, industrial demand accounted for 37 per cent of total gas use, while power generation consumed an additional 16 per cent[18] and the chemical industry 9 per cent. While the NEA attributes the additional 38 per cent of consumption to city gas, this is a combination of residential use, estimated at around one-fifth of total consumption, as well as gas used in transport and commercial uses.

Throughout the 13th FYP, the government promoted coal-to-gas switching in industrial and residential use as a means of phasing out dispersed coal, suggesting that this gas demand is unlikely to be displaced rapidly. Indeed, residential and industrial uses are expected to continue growing in the future as more coal is phased out. In the power sector, gas is also likely to play a larger role as a balancing fuel to help deal with the intermittency of renewables[19].

Figure 7: China's gas supplies, bcm



Source: China customs, NBS, OIES

This suggests that gas demand in China will continue to rise for at least another decade, with most estimates in China expecting its use to peak around 2040. Even though estimates of future demand vary widely, the country's incremental gas demand is likely to rise by averages of anywhere between 20 and 30 bcm every year (this is equivalent to the monthly gas consumption of Netherlands or Italy). Nonetheless, the share of gas in China's energy mix is unlikely to exceed 15 per cent.

The Chinese government has sought to maintain and expand domestic upstream production in a bid to limit the country's import dependency[20] and has made efforts to develop overland pipeline supply routes as well as attract flows of LNG. Domestic production in China is expected to peak at around 300-350 bcm in the mid-2030s, suggesting that China will grow increasingly dependent on imports. There are few viable alternatives to gas in the near term: indeed, even in the power sector, where

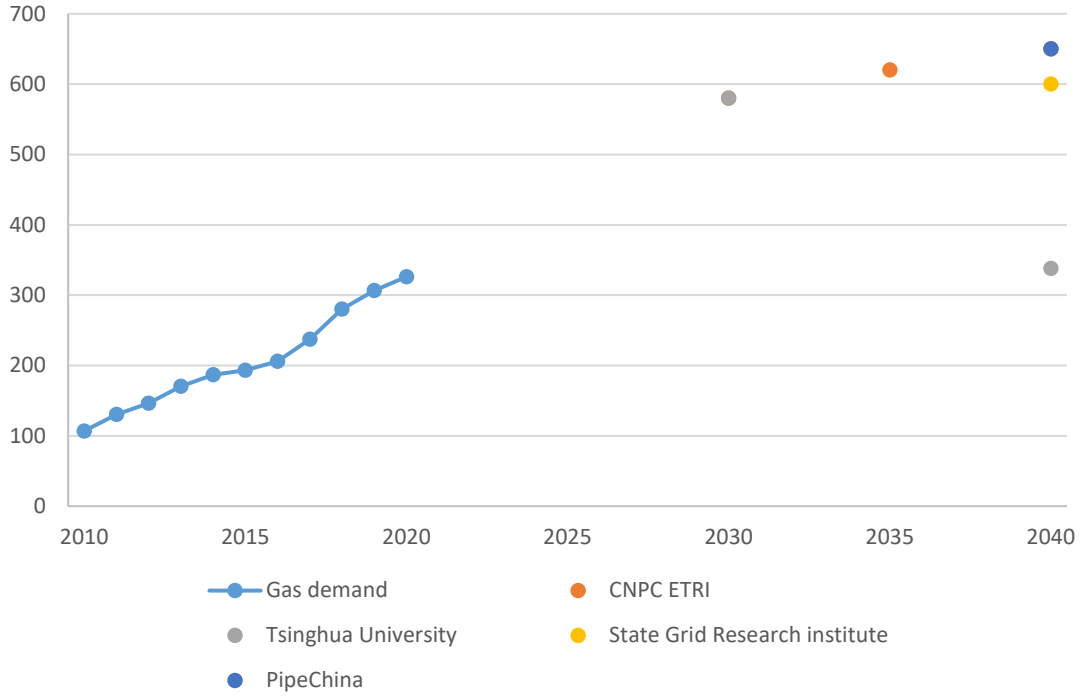
18 National Energy Administration, "China's Natural Gas Development Report (2021)", http://www.nea.gov.cn/1310139334_16294604014501n.pdf

19 See Yan Qin, "Natural gas in China's power sector: Challenges and the road ahead", OIES Energy Insight 80, December 2020, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/12/Insight-80-Natural-gas-in-Chinas-power-sector.pdf

20 See Zhe Ruan, "The Chinese majors' responses to the collapse in global oil prices and the COVID-19 pandemic: an upstream perspective", OIES Energy Insight no 78, November 2020, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/11/Insight-79-The-Chinese-majors-responses-to-the-collapse-in-global-oil-prices-and-the-COVID-19-pandemic-an-upstream-perspective.pdf

renewable energy sources are encouraged and being added, gas will be required to play a balancing role. More rapid deployment of renewables would limit the growth of gas demand, but not displace it entirely.

Figure 8: Estimates of China's future gas demand, bcm



Source: CNPC ETRI 2060 Energy Outlook, 2021; Tsinghua ICCSD, State Grid Energy Research Institute, OIES research

Even though there is no set path for how China will achieve net zero, fossil fuels are likely to remain dominant until 2030 as the country continues to develop economically and urbanise. The pace of demand growth depends on the rate of economic expansion as well as on measures to enhance energy efficiency, while the scope and speed of the subsequent fall in fossil fuel consumption depends equally on policy choices and on technological innovation. Deployment of carbon capture utilisation and storage technologies would allow fossil fuels to play a larger share of future energy uses. As of early 2022, however, China has published no detailed plan for CCUS, and has not issues targets or commercial incentives. It will be important to see if a CCUS plan is issued in the context of the 14th FYP or the carbon peaking plans given the likelihood that coal will play a significant role in the nation's energy mix for many years to come[21].

The long-term trajectory is therefore informed by China's economic growth rates and the pace of structural rebalancing, policy efforts to enhance efficiencies as well as efforts to develop and promote new technologies. But the lack of clear roadmap means that future trends could be determined by near term choices, which seem to be increasingly informed by concerns about energy security.

5. China's energy insecurity stems from domestic policies

Chinese decision makers have long been concerned about supply security and the risk of imports being curtailed by hostile power. Yet in reality, China's energy outages have all resulted from domestic policies. In September-October 2021, China experienced a severe electricity supply crisis

21 Philip Andrews-Speed, "China's policies and actions on carbon capture, utilization, and Storage (CCUS)", Oxford Energy Forum 130, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/01/OEF-130.pdf

that affected 20 provinces. Industrial activity was curtailed, and even households suffered prolonged outages in some areas. China has already experienced outages, none of which have been related to an external source curtailing supplies. For instance, in 2003–2004, when soaring economic growth outpaced the construction of new power plants, China suffered from power cuts. In 2005, the country faced a shortage of gasoline because the oil companies preferred to export gasoline and diesel to offset losses because of the domestic pricing mechanism. In 2010, provinces curtailed industrial activity in a bid to meet energy intensity targets. In all these cases, the principal causes were domestic and usually involved either poor policy coordination or a clash between market forces and government plans and administrative measures. 2021 was no different.

The 2021 power crisis resulted from the tensions between long-term aspirations and short-term reality and between the market and the plan. At the heart of the outages was the mismatch between the price of coal, which continues to be set by market forces, and the wholesale tariff for coal-fired power generators, which remains tightly constrained. Rapid economic growth in the first half of 2021 drove rising coal demand. In its efforts to control inflation, the government discouraged coal miners from raising prices, until the upward pressure was too great. When coal prices accelerated upwards, power generators reduced both their purchases of coal and their generation of power. In response, the government ordered coal mines to increase production while also raising the tariff range at which coal-fired generators could sell their output. This, in turn, has led to a renewed emphasis on coal as a key element of domestic energy security.

In addition to pricing distortions, mixed policy signals also contributed to the power outages: Coal mining in China has been constrained by efforts to reduce overcapacity, by mine safety inspections, environmental protection, and corruption probes. At the same time, the 'dual control' policy (central-government mandated caps on provincial energy consumption and energy intensity) led provinces to slow rising energy use[22]. The demand surge and limited supplies then came as a complete surprise to Chinese coal importers or more broadly, to macroeconomic and energy planners. Yet in early 2021, the China Electricity Council was warning of power shortages and in June 2021 the NDRC was looking to increase coal output. The slow response from utilities and provincial governments may in part be a signal that they need clearer marching orders from the government[23], especially since they are expected to assume much of the responsibility for the low-carbon transition.

6. One step forward, two steps back

Even though the power shortages have largely subsided in early 2022 as coal production in China recovered, issues of availability and reliability of supplies will remain a concern. Supply security, namely improving domestic production and supply capacity, topped the agenda in both government and CCP annual work meetings, highlighted also in an op-ed penned in the People's Daily entitled "The energy rice bowl must be in one's own hands[24]". While accelerating the development of low-carbon energy came a close second, decision makers are calling on all political actors to "correctly recognise and grasp peaking emissions and carbon neutrality" so that the phase-out of conventional energy will be done based on safe and reliable new energy supplies. Interestingly, over the past few months, the terminology used by China's leaders has alternated between "reducing" coal and "phasing out" coal, with the latter arguably beginning to be used more widely. Similarly, in previous policy statements,

22 For more discussion on these contributing factors see Philip Andrews-Speed, Michal Meidan, "The 2021 energy crisis: Implications for China's energy market and policies", Oxford Energy Forum Issue 131, March 2022
23 Michal Meidan, Philip Andrews-Speed, "China's power crisis: Long-term goals meet short-term realities", November 2021, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2021/11/Chinas-power-crisis.pdf
24 The energy rice bowl must be in one's own hands, People's Daily, 7 January 2022, http://opinion.people.com.cn/n1/2022/0107/c1003-32325750.html

the government talked about "first building [new energy supplies] then breaking [old supplies]" but is now discussing "breaking while building".

In the near term, the emphasis on coal is clear, but equally renewable targets are ambitious: China's Electricity Council expects the country will add 140-150 GW wind and solar capacity combined this year—compared to an estimated 134 GW of renewable capacity in 2021—with wind accounting for around 50 GW and solar for up to 100 GW, bringing China's non-fossil fuel installed capacity to 1300 GW in 2022, or over half of installed capacity. But coal—ideally "clean" coal—remains the backbone of China's energy system.

These contradictory policy signals will likely remain through this year and perhaps even into 2023, especially as the Russian invasion of Ukraine has generated considerable uncertainty and price volatility in global energy markets. Yet even before the invasion, a high level Politburo standing committee study group on 24 January 2022 focused on "Deeply analysing the situation and tasks, and promoting the carbon peak and carbon neutrality efforts[25]" and summarised the issues as four "relationships" that must be handled:

- The first is the relationship between development and emissions reduction. Emissions reduction, argue China's top leaders, is about creating synergies between low carbon transformation and economic growth. It is not about reducing productivity or not emitting at all.
- The second is the relationship between the whole and the part: finding ways to meet the central government's target while pursuing province-appropriate strategies.
- This dovetails with the third relationship, between long-term goals and short-term goals as the leadership warns against looking for quick successes, and urges local and industrial leaders to move forward gradually, referring again to the need to "correctly recognise and grasp peaking emissions and carbon neutrality" (essentially asking local officials not to rush into anything).
- The final relationship is between the government and the market, which remains an ongoing balancing act.

From the government's statements, it is therefore clear that China's energy transition must go hand in hand with the country's economic transformation and will advance insofar as it supports economic expansion. But if the two are at odds, economic stability still seems to prioritised.

This has further been exacerbated by the Russian invasion of Ukraine with energy security and stability rising even higher on the policy agenda. Soaring commodity prices will place considerable pressure on the Chinese economy and could become a distraction in this politically important year. With a leadership transition at the end of the year, in which Xi Jinping will be sworn in for an unprecedented third term in office, Beijing would have likely preferred to avoid the inflationary pressure related to higher commodity prices and the geopolitical challenges associated with the crisis. Moreover, the surge in oil-indexed gas and LNG prices will weigh on China's importers (and to a lesser degree on end-users given domestic price controls) while power plants will seek to switch back to coal where possible. And given China's informal ban on Australian coal alongside volatility in Indonesian coal exports, domestic production will likely increase, complicating China's environmental pledges.

7. Industrial actors take their cues from the government

Even though China's decision makers remain committed to the 30-60 targets, short term actions and policy choices matter greatly, as discussed above. Approvals of new coal fired power plants as well as steel and cement plants will lock in emissions for decades to come and government signals around the short term policy priorities will also inform corporate strategies.

25 https://english.news.cn/20220125/da5884c906d348ae94fb463d154bae93/c.html

China sees state-owned energy companies as playing a central role in the country's economic and technological development. China's energy SOEs are among the world's largest energy companies: State Grid is likely the world's largest electricity grid owner and operator. China's Big Five state-owned power generation companies (produced approximately 44 per cent of China's electricity in 2019, a percentage roughly unchanged from previous years.[26]

SOEs remain tasked with achieving policy goals related to employment, investment, and social stability. SOEs still employ a huge fraction of the urban workforce,[27] and are especially dominant in regions that rely on older manufacturing or extraction industries.[28] Further, SOE reform has tended to strengthen existing SOEs through forced mergers, aiming to create national champions that dominate certain sectors rather than encouraging competition. In addition to asset ownership, SOEs have a lead role in planning and advising the government. Whereas both outside observers and officials may portray government targets as based on objective technical conditions, in practice there is a large element of industry bargaining inherent in such targets.

And while the state-owned companies have recognized the importance of decarbonizing China's energy system, they were arguably more focused on adapting their strategies to other political priorities such as price reform, at least until late 2020 and increasingly now to energy security. In the oil and gas sector, for instance, the majors have had to contend with new private actors as well as PipeChina, the new central SOE that was created in late 2019 to manage pipelines and thereby address anti-competitive behaviour by SOEs that had stalled construction of national infrastructure. In recent years, China's oil majors had tended to use control over liquefied natural gas (LNG) terminals, pipelines, and other oil and gas assets to hinder competition, and were reluctant to grant third-party access to pipelines or terminals, or to construct pipeline interconnections. The central government's creation of PipeChina to manage and expand pipeline assets and encourage third-party access, was an attempt to resolve these issues.[29]

Since China's dual carbon pledge, however, the SOEs have been issuing their own carbon peaking plans and looking to align with the latest priority from the central government. One recent review has found that SOE plans released so far lack specifics and suggests that many firms are waiting for more direct, industry-specific signals from central leaders.[30] China's oil companies have made initial plans for carbon neutrality, although they have not aggressively sought to transform their businesses[31].

Going forward, the role of China's SOEs in the energy transition will depend on central government policy and whether they receive clear policy guidance and strictly enforced mandates. In the absence

26 Anders Hove, Michal Meidan, Philip Andrews-Speed, "Software versus hardware: how China's institutional setting helps and hinders the clean energy transition", OIES Paper CE2, December 2021, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2021/12/Software-versus-hardware-how-Chinas-institutional-setting-helps-CE2.pdf

27 Karen Jingrong Lin et al., 'State-owned enterprises in China: A review of 40 years of research and practice', *China Journal of Accounting Research* 13(1), March 2020, at https://doi.org/10.1016/j.cjar.2019.12.001.

28 Andrew Batson, 'Mapping China: base and superstructure', Andrew Batson's Blog, 16 April 2015, at https://andrewbatson.com/2015/04/16/mapping-china-base-and-superstructure/.

29 Erica Downs and Sheng Yan, 'Reform Is in the Pipelines: PipeChina and the Restructuring of China's Natural Gas Market', Columbia University, Center on Global Energy Policy, 16 September 2020, at https://www.energypolicy.columbia.edu/research/commentary/reform-pipelines-pipechina-and-restructuring-china-s-natural-gas-market.

30 Edmund Downie, 'Getting to 30–60: How China's Biggest Coal Power, Cement, and Steel Corporations Are Responding to National Decarbonization Pledges', Columbia Center on Global Energy Policy, 25 August 2021, at https://www.energypolicy.columbia.edu/research/report/getting-30-60-how-china-s-biggest-coal-power-cement-and-steel-corporations-are-responding-national.

31 Anders Hove, Michal Meidan, Philip Andrews-Speed, "Software versus hardware: how China's institutional setting helps and hinders the clean energy transition", OIES Paper CE2, December 2021, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2021/12/Software-versus-hardware-how-Chinas-institutional-setting-helps-CE2.pdf

of strong policy signals – including personnel policies and incentives structures – the SOEs will likely tend towards risk-averse decisions, protecting existing business activities and hindering innovation. The future direction of SOE reform will also need to be well defined: if SOEs are encouraged to become more economically competitive, they could resist clean energy policies that hurt short-term profits but conversely, could also be discouraged from investment in assets that could become stranded. Or, SOEs could be guided, by economic or administrative signals to invest massively in fields where such investment will likely be needed.

8. The role of fossil fuels in China's energy mix and future trajectory

Despite China's heavy reliance on imported oil and gas, given its large domestic reserves of coal (and to a lesser degree oil and gas), the country remains relatively self-sufficient for its energy needs. In terms of energy security, this could be considered a success.

While China's decision makers have been concerned about the strategic vulnerabilities associated with imported oil and gas (including supply cut offs and sanctions limiting energy flows), geopolitical events around the world have not resulted in reduced supplies for China[32], although they have translated to higher prices (as they have for all other consumers). And as argued above, to date, supply disruptions in China have all been the result of domestic policies.

To the extent that China's fossil fuel use has allowed it to maintain supplies for its economy, and the large domestic resources offer it some degree of control over prices, its reliance on fossil fuels is largely a positive contributor for the country's ability to continue its economic expansion. The political groups associated with fossil fuels and heavy industry are, however, both a help and a hindrance: The existence of large state-owned groups and important constituencies has allowed and will continue to enable to government to determine outcomes, as long as policy signals are clear and consistent. In the absence of strong policy signals, however, as discussed above, the SOEs will likely tend towards risk-averse decisions, protecting existing business activities and hindering innovation.

But while China's reliance on fossil fuels (given the relative abundance of domestic supplies) offers it some supply security, the environmental cost has been rising, challenging the country's ability to continue relying on unabated fossil fuels. China accounted for 27.9 per cent of global emissions in 2019 compared to 7.5 per cent in 1980.[33] Based on various estimates, China's emissions have grown by a factor of 4 since 1990, reaching around 13.7 billion tons of CO_2-equivalent in 2020[34], or 9 t CO2 per capita – 45 per cent higher than in the rest of the world[35].

Energy sector CO2 emissions reached more than 11 Gt in 2020 and made up almost 90 per cent of China's total GHG emissions, compared with under 60 per cent for the rest of the world, reflecting its emissions-intensive energy mix and a large heavy industry sector. About 70 per cent of China's energy-related emissions in 2020 came from coal, 12 per cent from oil, 6 per cent from natural gas. Clearly then, the reliance on fossil fuels comes at the expense of China's energy transition. Kicking the fossil fuel can down the road will make it politically more challenging and economically costlier to reach

32 Michal Meidan, "China's Energy Security at 70", OIES Comment, October 2019, https://www.oxfordenergy.org/publications/chinas-energy-security-at-70/

33 'China: What share of global CO_2 emissions are emitted by the country?' Oxford Martin School, accessed on 23 February 2021, at https://ourworldindata.org/grapher/annual-share-of-co2-emissions?tab=chart&stackMode=absolute&time=1753..latest&country=~CHN&region=World.

34 'China: Country Summary', Climate Action Tracker, 21 September 2020, at https://climateactiontracker.org/countries/china/, based on data from the International Energy Agency; Lauri Myllyvirta, 'Analysis: China's CO2 emissions surged 4 per cent in second half of 2020', Carbon Brief, 1 March 2021, at https://www.carbonbrief.org/analysis-chinas-co2-emissions-surged-4-in-second-half-of-2020.

35 IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021, https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-32e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf

China's 2060 targets. Concerns about energy security and reliability of supplies are impeding rapid progress toward the phase out of fossil fuels, and mainly coal, in China. This should not be taken to mean that China is walking back from its commitments, but that the short term realities are constraining long term ambition, as is currently the case in many other countries.

Recognising that fossil fuels will play a role in the energy transition means that, at least to begin with, measuring, reporting and reducing emissions from the entire value chain will be critical. As the US is gradually becoming a large exporter of oil and gas to China, reporting emissions—and striving to reduce or offset them—along the entire value chain in a transparent manner would be an important step.

Bilateral and multilateral efforts should include engagement on improving data reporting and monitoring—including on quantifying upstream emissions—and industrial emissions. Engagement should span both government (on all levels) and industrial stakeholders, especially in the context of rising concerns about technological and financial decoupling. Collaboration on CCUS and abatement technologies will also help scale up these technologies and make them more widely available to other fossil fuel consumers.

The US-China statement on methane emission reductions, issued in Glasgow in November 2021, is an important basis for collaboration. US efforts to reduce methane emissions by remediating abandoned coal mines could prove valuable for China. While methane emissions from coal in the US account for a smaller share of total emissions than in China, reclamation projects that employ dislocated energy workers touch on key questions of social justice in China's energy transition and could be valuable experiences. This should not replace efforts to promote non-fossil fuels and encourage an accelerated deployment of non-fossil sources in the energy mix.