

Implications of Continued Coal Builds in the 14th Five-Year Plan of China

July 2020



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ACKNOWLEDGEMENTS

This report is produced by the Center for Global Sustainability at the University of Maryland. Funding for this project was provided by Bloomberg Philanthropies and ClimateWorks Foundation. We are grateful for helpful comments from Kai Zhang, Junjie Kang, Fuqiang Yang, Jiehong Lou and Alicia Zhao. We also thank Global Energy Monitor for their inputs on data.

Suggested citation: Cui, R, J. Song, N. Hultman, D. Cui, M. Edwards, H. McJeon, 2020. "Implications of Continued Coal Builds in the 14th FYP of China." Center for Global Sustainability: College Park, Maryland



Summary

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CONTINUED GROWTH IN CHINA'S COAL POWER CAPACITY

China's coal power sector has been financially troubled in recent years. Due to overcapacity and competition from renewables, coal plants on average are running below 50% of their full capacity and over half of them are operating at a loss. However, due to emerging economic conditions, 57 new coal plant projects (78 GW) progressed toward completion between January and May 2020, as China loosened curbs on new builds. In total, 98 GW of coal-fired power plants are currently estimated to be under construction and an additional 53 GW recently got permitted. These trends all indicate that China's total installed coal capacity is likely to continue to grow during the 14th Five-Year Plan (FYP) period (2021-2025).

NEAR- AND LONG-TERM OUTCOMES

Continued coal power expansion creates three negative outcomes. First, it will greatly exacerbate financial strains within the coal sector itself, by further lowering the average utilization to about 3,840 hours (below 45% of full capacity) in 2025—even under a high demand growth scenario of coal power. Second, it will negatively impact China's long-term economic and social development, as well as human health. And third, it will create additional obstacles to stabilizing global climate.

OPPORTUNITIES: CHINA'S 14TH FIVE-YEAR PLAN

While current economic conditions have created significant near-term uncertainties about the timing halting coal construction in China, the need for this action will not go away and early action will be beneficial. Opportunities remain to consider such an approach within the 14th FYP, especially for regions with high economic and environmental constraints.

These opportunities within the 14th FYP require:

- The reevaluation of the “risk and early warning indicator system for coal-fired power planning and construction” for individual provinces;
- A specific implementation plan for the “No New Coal” strategy;
- The development of a well-constructed, regionally balanced, and appropriately paced coal phaseout strategy; and
- A comprehensive long-term power sector plan between 2035 and 2050, to which the near-term actions under the 14th FYP should be linked.

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Introduction

The transition of the global energy system from burning coal and other conventional fossil fuels to safer, cleaner and cheaper renewable sources has accelerated in recent years. China, as the world's largest coal producer and consumer, will play a critical role in this energy transition. At the same time, challenges like health and competitiveness create the need for near-term choices that have important implications for achieving domestic social, policy, and economic goals. In this context, China's own vision of a sustainable future and its development agenda to continuously improve the well-being of people and protect the ecological environment are well served by the multiple benefits of accelerating a coal phaseout.

The earlier rapid growth in coal power capacity in China has been slowed significantly in recent years, owing to policy efforts to address economics, overcapacity, and air quality concerns. During the current 13th Five-Year Plan (2016-2020), progress has been made in scaling down the expansion of coal power capacity. Since 2015, the central government has issued a series of policies and regulations that cancelled or suspended approximately 159 GW of coal projects due to provincial governments' over-permitting. Moreover, 38 GW of small, old, inefficient plants were shut down during 2015-2018 to combat local air pollution and to address overcapacity.¹

Overall, China's total installed coal power capacity reached 1,040 GW in 2019 and provided 62% of its total electricity generation.² Specific targets and action plans are being made across individual provinces to continue retiring obsolete plants through the end of 2020.

Since early 2020, emerging economic conditions have made it increasingly challenging to balance multiple competing societal and economic priorities. After a long period of rapid development, China's economic growth is slowing down, and further exacerbated by the COVID-19 pandemic. In the first quarter of 2020, China's economy shrank by 6.8%, which is the first contraction since 1992.³ Incentivizing economic recovery is therefore a political priority, and local officials are aware of the importance of maintaining GDP targets in the last year of the existing 13th Five-Year Plan (FYP). A recent economic stimulus plan put an emphasis on infrastructure projects to create jobs and boost tax revenue. As China loosened the curbs on new builds, this strategy reignited a round of coal power expansion, with some previously suspended projects now restarting. Unfortunately, such actions will provide mostly short-term and relatively small local economic gains.

Recent overall development of new coal projects are thus showing troubling signs of backsliding. In particular, between January and May 2020, we find 12 coal-fired power plants (17.5 GW) were newly permitted and 45 other plants (61 GW) underwent other significant milestones toward operation.

The total permitted coal capacity during the five months is larger than that in all of 2017, 2018 or 2019 (Figure 1a). During the same period, 24 projects (19.5 GW) started operation, 8 projects (11.3 GW) (re-)started construction, and another 13 projects (30 GW) went through planning or (pre-)permitting process (Figure 1b).⁴

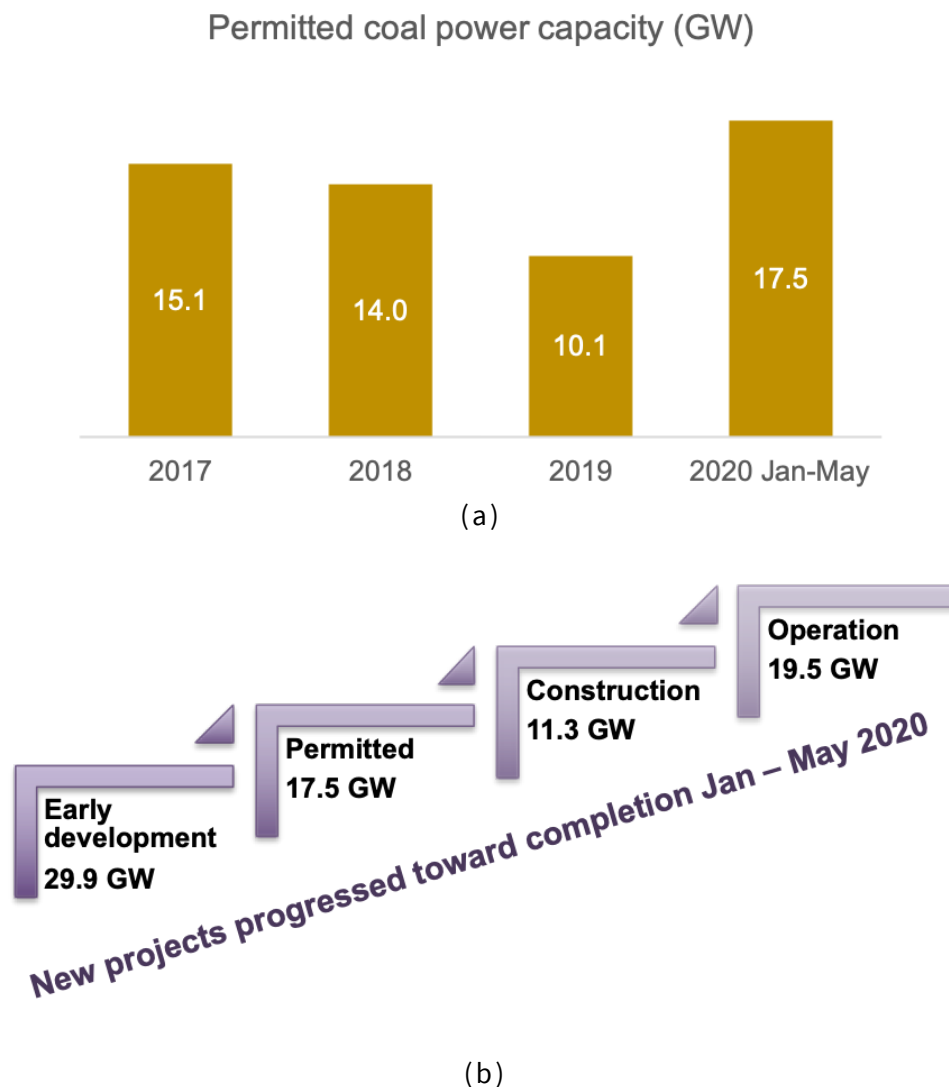


Figure 1. New coal projects progressed toward completion in early 2020: (a) newly permitted coal capacity during the first five months of 2020 is already larger than that in the full years of 2017, 2018 or 2019; (b) 57 new projects (78 GW) progressed toward completion.

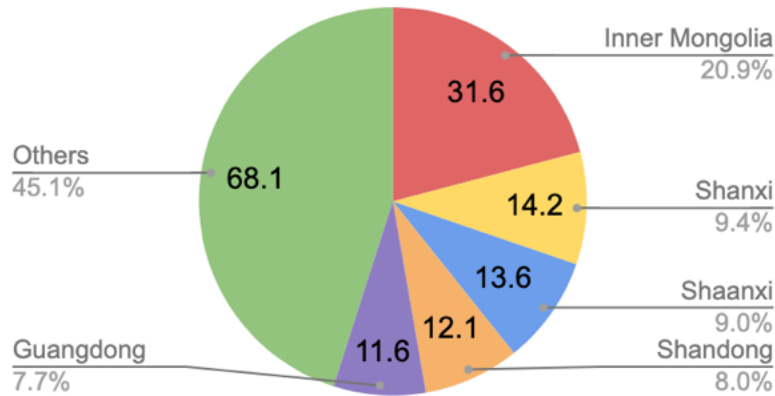
Continued coal builds during the 14th FYP

The current project pipeline indicates that without intervention, coal power capacity is likely to continue to grow during the 14th FYP (2021-2025).⁵ A total of 151 GW of new coal plants, including 98 GW under construction and 53 GW permitted, will most likely be implemented in the next five years, close to two-thirds of total coal installed capacity in the US.⁶ Together, they represent approximately a 15% increase from existing coal capacity. Different estimates also show between 41 to 98 GW of coal projects going through the planning or (pre-)permitting process, although it is uncertain how far and how quickly they can proceed.

For the 151 GW of projects already under construction or permitted, we find that the potential increase in coal capacity is expected to be concentrated in several provinces. The top five provinces account for over 50% of the total under construction and permitted coal capacity (Figure 2a). Inner Mongolia has over 20 GW under construction and another 10 GW permitted, equivalent to a 37% increase from its existing coal capacity. Shanxi, Shaanxi, Shandong and Guangdong all have over 10 GW under construction or permitted, representing a 23%, 33%, 12%, and 19% increase from its existing level, respectively. Moreover, large percentage increases (above 20%) within the province are expected in Guizhou, Jiangxi, Hunan, and Gansu during the next five years (Figure 2b).

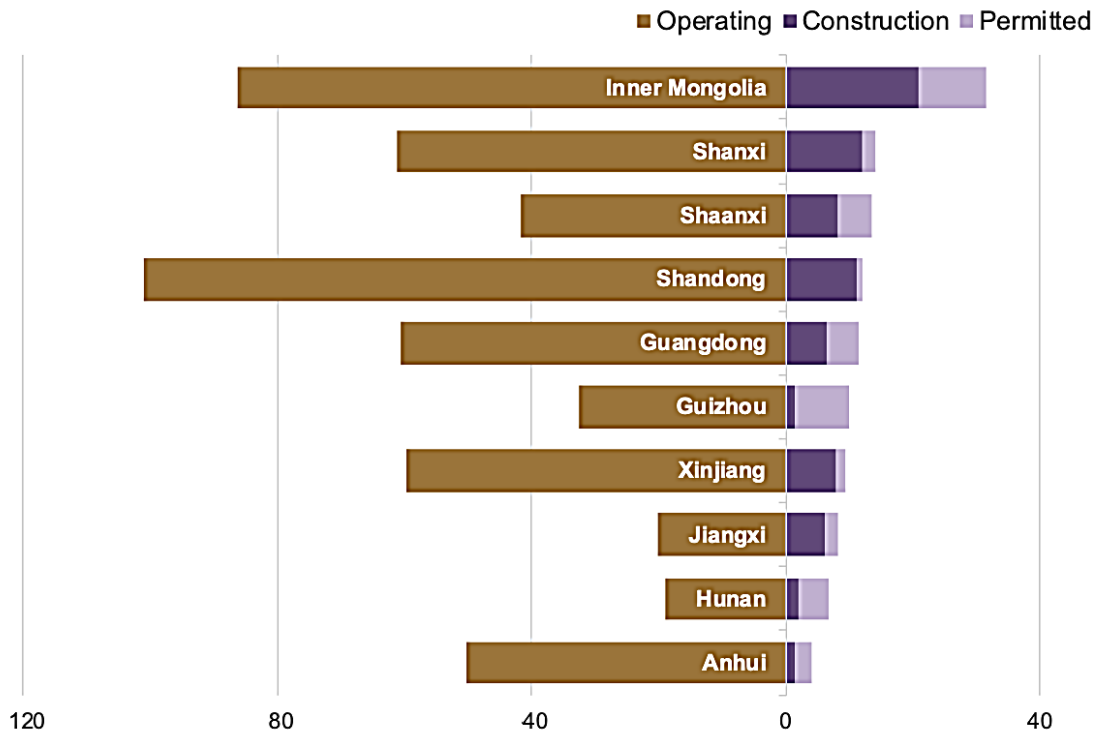


Construction and permitted coal capacity by province (GW)



(a)

Top 10 provinces with construction and permitted coal projects (GW)



(b)

Figure 2. Potential increase in coal capacity during the 14th FYP is expected to be concentrated in several provinces: (a) the top five provinces account for over 50% of the total under construction and permitted coal capacity; (b) many provinces among the top 10 are expected to see large percentage increases from existing coal capacity.

Policy and resource constraints to new coal plants

Recent policies by the central government call for strict control or suspension of new approvals and constructions of coal power projects in 15 provinces, which may affect about 70 GW, or 46%, of projects already under construction or permitted (Table 1).

Six provinces are rated as high risk of capacity redundancy, while nine are rated as high risk of resource constraint, according to the 2023 risk and early warning indicator system for coal-fired power planning and construction.⁷

Building upon the warning system, the recent policy guidance on resolving overcapacity in the coal industry calls for strictly controlling or suspending approvals and constructions of new coal projects in these provinces.⁸ Shanxi and Xinjiang, in particular, have relatively high risks in terms of both capacity redundancy and resource constraint, but at the

same time, have approved and are building a large number of new coal projects.

By looking at individual plants, however, we find greater economic and environmental constraints than the current warning system suggested. Almost all of the under construction and permitted projects are located in regions with limited room for coal expansion (Figure 3). In particular, 81% of the new plants are in highly polluted regions with potentially large health impacts, and 61% are in regions with high water risk and resource constraint.⁹ In addition, half of the new plants are located in provinces where the average annual coal plants' operating hours are already below 4,500 hours (51% of full capacity). Overall, 97% of these projects face one or more of the limitations above.

| Province | Construction (MW) | Permitted (MW) | % Increase | Overall risk | Redundancy of Capacity | Resource Constraint |
|--------------|-------------------|----------------|------------|--------------|------------------------|---------------------|
| Shanxi | 12,060 | 2,100 | 23% | High | High | High |
| Shaanxi | 8,310 | 5,320 | 33% | High | Low | High |
| Shandong | 11,050 | 1,050 | 12% | High | Low | High |
| Xinjiang | 8,040 | 1,320 | 16% | High | High | High |
| Anhui | 1,450 | 2,710 | 8% | High | Low | High |
| Gansu | 2,350 | 1,320 | 20% | High | High | Low |
| Henan | 3,560 | 0 | 5% | High | Low | High |
| Ningxia | 2,020 | 100 | 7% | High | High | Low |
| Zhejiang | 1,320 | 114 | 3% | High | Low | High |
| Shanghai | 0 | 1,300 | 9% | High | Low | High |
| Heilongjiang | 910 | 245 | 6% | High | High | Low |
| Hebei | 440 | 700 | 2% | High | Low | High |
| Tianjin | 1,050 | 0 | 9% | High | Low | High |
| Jilin | 0 | 90 | 1% | High | High | Low |

Table 1. New construction and permitted coal capacity in 15 provinces with high risks in capacity redundancy or resource constraint.

A large share of the new projects is located in three provinces in the North China Grid, Inner Mongolia, Shandong, and Shanxi. It is, however, highly uncertain that growth in electricity demand within (or outside, e.g. several projects in Shanxi are to deliver electricity to Hubei) the grid region can absorb such large capacity additions.

Similar questions apply to new projects located in Shaanxi and Xinjiang in the Northwest China Grid. Moreover, many provinces in these two grid regions have abundant renewable resources with great potential to meet increasing demand with the clean and increasingly cost-competitive alternative energy.

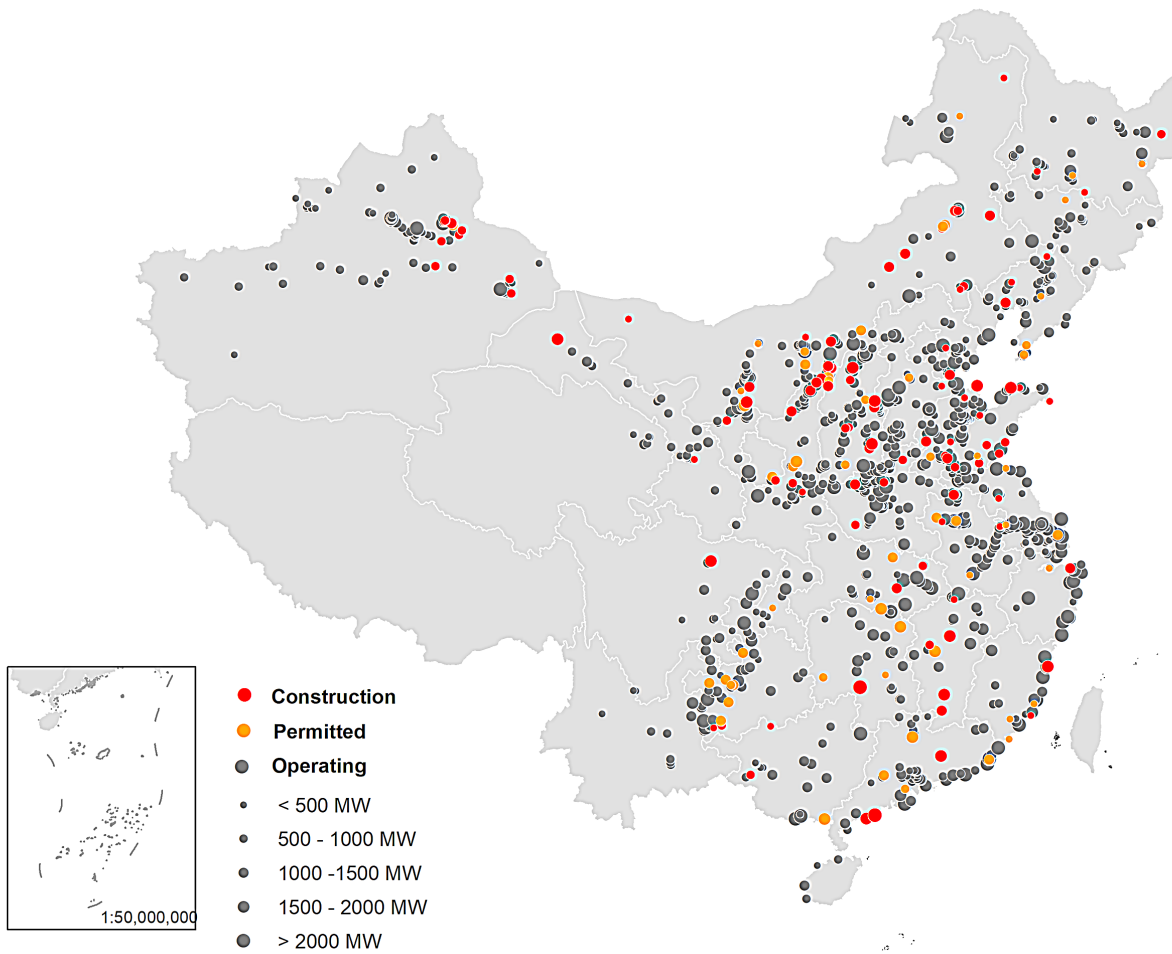


Figure 3. Location of operating, under construction, and permitted projects. Almost all of the new projects are located in regions where either coal plants' utilization is already low, and/or air pollution, health impact, or water resource constraint is high.

Economic implications within the coal power industry

Continued new coal construction is not only detrimental to broader economic and development goals, but greatly exacerbates financial strain within the coal sector itself. China's total installed coal power capacity has tripled since the beginning of the century. More recently, in the past decade, coal plants' utilization rate has started to decline, sometimes significantly—indicating that growth in capacity has outpaced the growth of demand for coal power (Figure 4). Due to overcapacity and competition from clean energy, coal plants have been running at declining operating hours in recent years, with the annual national average at 4,293 hours in 2019 (below 50% of capacity).¹⁰ These low utilization levels further undermine the already precarious financial viability of coal plants. Under such conditions, profitability of coal power companies has continued to decline, and now more than 50% of them are operating at a loss.¹¹

The ongoing economic challenge of the coal power industry is likely to be exacerbated by continued new builds. With the additional 151 GW of under construction and permitted coal capacity implemented by the end of the 14th FYP, coal plants' utilization will continue to decline. Total installed capacity will reach 1,203 GW by 2025, assuming existing plants (1,060 GW up to May 2020) retire after a 40-year lifetime. To better understand the potential implications of these trends for coal plants' utilization, we developed three alternative scenarios with different assumptions of total electricity demand and share from coal.¹²

Under the first scenario, total electricity demand will increase at an average annual speed of 2-3%, reaching 9,300 TWh by 2030, and the share from conventional coal decline from the current level of 62% to 50%.¹³ This is equivalent to an average of 0.2% annual growth in coal power generation (high coal scenario). The second and third scenarios assume the power system transition is compatible with the cost-effective pathways under the well-below 2°C and 1.5°C goals, respectively. Specifically, total electricity demand will increase to 9,500 TWh and 10,000 TWh by 2030, and the share from conventional coal decrease to below 40% (medium coal scenario) and below 20% (low coal scenario), respectively.¹⁴

With a defined pathway for the growth in coal capacity, we find that the annual average operating hours of coal plants will drop to 3,840, 3,050 and 2,180 in 2025 under high, medium and low coal scenarios, respectively (Figure 4). A significant decrease in operating hours will further erode project returns, prolong project payback periods and jeopardize the recovery of capital investment. Therefore, curbing new investment in coal plants is critical to at least maintain the annual operating hours at 4,000.¹⁵ This would avoid near-term financial losses and distress within the industry. This strategy would therefore also allow for a more structured energy planning process over this decade that would unlock a balanced and orderly transition to a cleaner energy system.

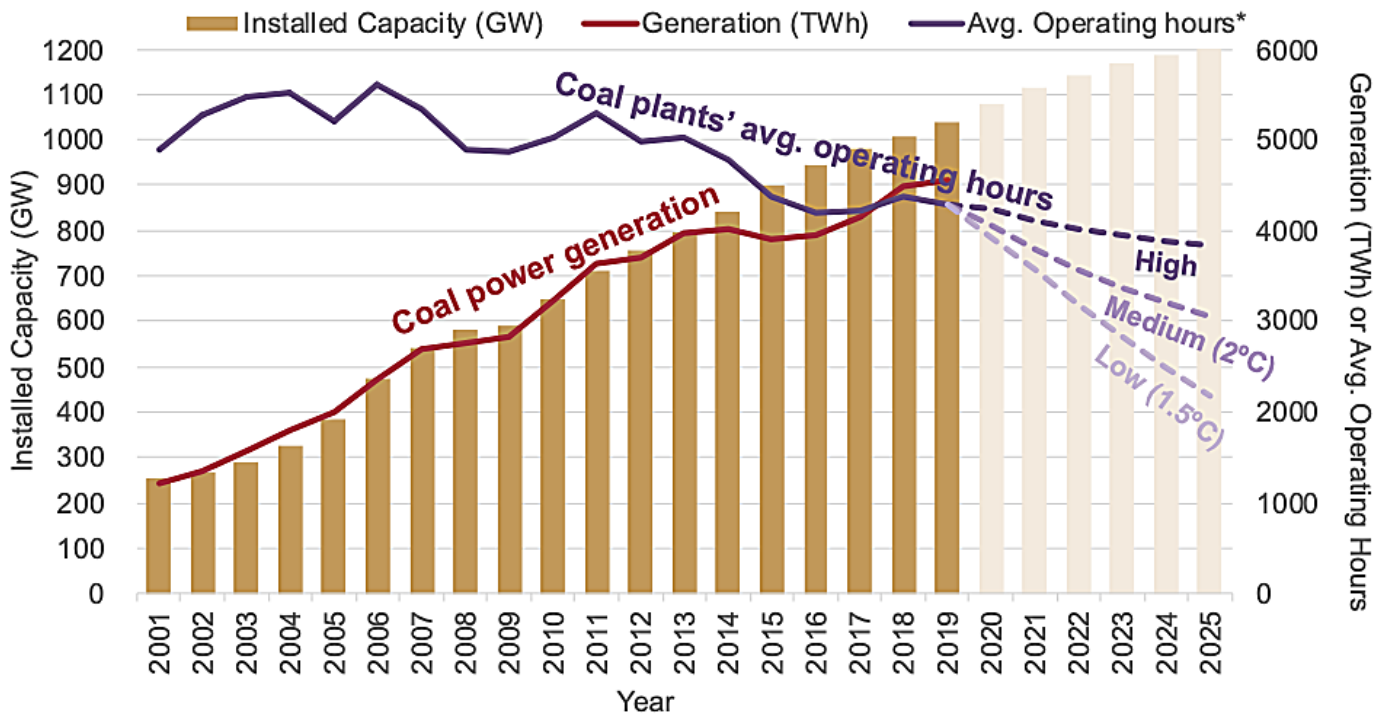


Figure 4. Historical and estimated coal power capacity, generation and average operating hours. With additional 151 GW capacity implemented through 2025, coal plants' utilization will continue to decline at various speeds across high, medium and low coal power generation scenarios. 16

Impacts of delayed actions on the "no new coal" strategy

A structured and rapid decarbonization of China's existing heavily coal-reliant power system will bring multiple benefits, but faces near-term challenges. A well-constructed, regionally balanced, and appropriately paced coal phaseout strategy is a critical part of the medium-to-long-term success in realizing these benefits. Unfortunately, these challenges would be exacerbated with continued expansion of new, large, and expensive coal power infrastructure that are designed to operate over several decades. Success in addressing these challenges requires one immediate action: stopping new builds as part of a "no new coal" strategy. This strategy can be implemented successfully, with limited economic impact, in the context of a gradually reduced utilization of existing coal plants, and a carefully structured plant-by-plant retirement schedule based on technical, economic and environmental criteria.¹⁷

Current economic conditions have created significant near-term uncertainties about the timing of such a "no new coal" strategy, but the need for it will not go away and early action will be beneficial. Opportunities remain to consider such an approach within the 14th FYP, especially for regions under high economic and environmental constraints.

But even beyond this planning process, continuing a rapid, well-constructed coal transition in China is essential for the next decade. By 2030, non-fossil sources will generate more than half of total electricity;¹⁸ and by 2050, phaseout of conventional coal plants will be needed to realize domestic health and economic goals while at the same time reducing CO2 emissions compatible with the Paris climate goals. The coal phaseout is no longer an "if" or "when" question, but rather a "how" question.

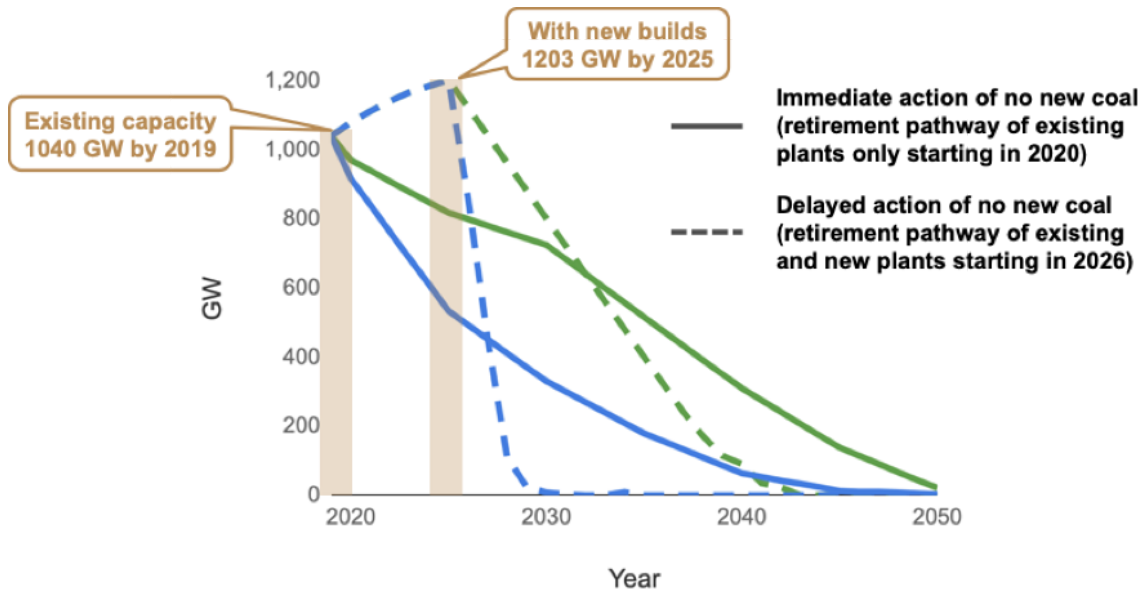
Immediate action on "no new coal" is the most effective near-term strategy toward a successful, high ambition coal phaseout, which makes sense economically and immediately not only for realizing overall healthy economic and development goals, but also for the coal power industry as a whole. Moreover, delayed actions of "no new coal" will largely increase the costs of future actions to get back on track towards the long-term goal, due to the lock-in effect of energy infrastructure, premature retirement of newly added plants and shortened operational lifetime of existing plants,¹⁹ and increased risks of stranded assets.

With immediate actions of “no new coal” and a structured phaseout of all existing coal plants, a total of 1,040 GW, beginning in 2020 can achieve the well-below 2°C and 1.5°C goals with guaranteed 30-year lifetime for existing coal plants. However, with the new builds, total installed capacity continues to grow during the 14th FYP to 1,203 GW by 2025. As a result, with delayed action, the new phaseout pathways are shifted to a higher starting point and a steeper line of reduction towards the climate goals. At the national level, coal phaseout is accelerated by almost 10 years to 2042 under well-below 2°C and by about 15 years to 2030 under 1.5°C (Figure 5a). Across provinces, impacts vary and are more concentrated in several regions (Figure 5b). In particular, three provinces in the

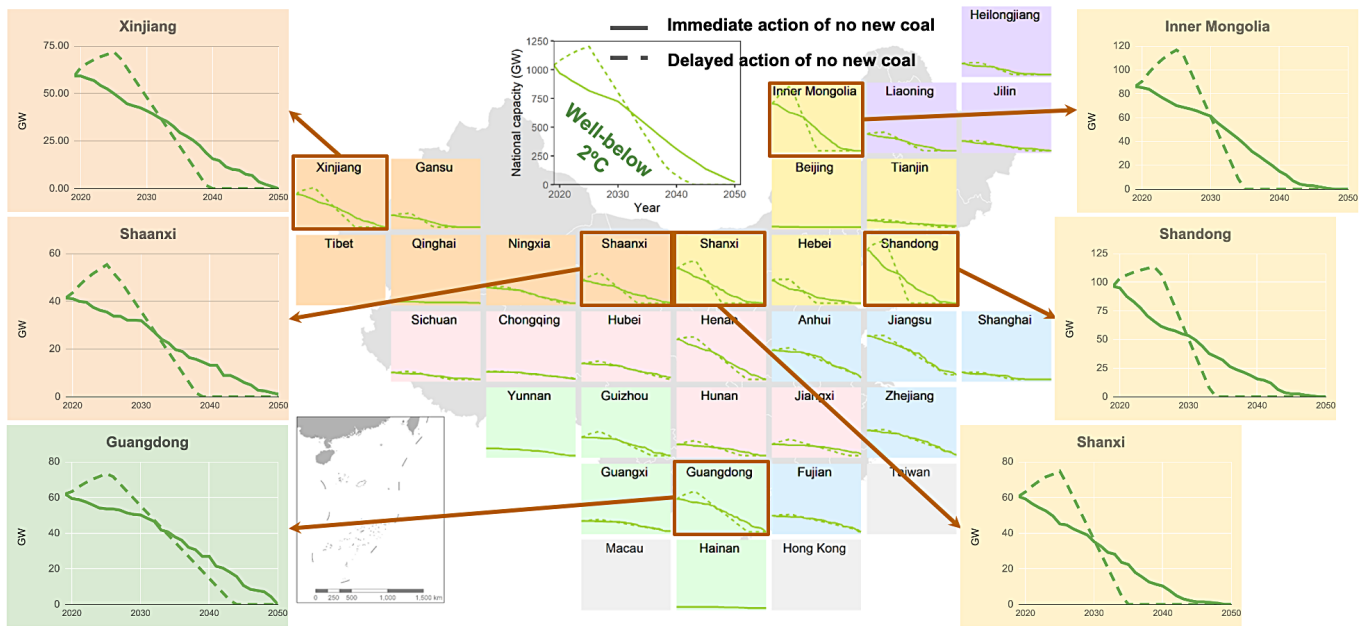
North China Grid, Inner Mongolia, Shandong, and Shanxi, are among the top five with large capacity additions. With the new builds, their phaseout pathways will be accelerated by over 10 years to 2035 to achieve the well-below 2°C goal. For Shaanxi and Xinjiang, delayed actions of “no new coal” also accelerate the phaseout pathways by over 10 years to around 2040 under well-below 2°C.

Overall, as a result, delayed actions of “no new coal” will significantly increase the risk of stranded assets. Not only do building these large, new plants require a large amount of upfront investment that are likely to be stranded, but also stranded assets of existing plants increase as they are forced to retire even more rapidly.





(a)



(b)

Figure 5. National and provincial coal phaseout pathways compatible with Paris climate goals: (a) delayed actions of the “no new coal” strategy after the 14th FYP will accelerate the national retirement pathways by 10 years under well-below 2°C and by 15 years under 1.5°C; (b) provinces with large capacity addition are mostly affected, especially those in the North China grid region.

Vision for the 14th FYP and beyond

Coal phaseout presents substantial challenges that call for not only technological solutions but also economic, societal and institutional changes. To make the process more effective and less painful, a carefully designed, integrated strategy is needed, articulating not only the long-term goals and pathways, but also the near-term actions moving towards them. Decisions made today can alter the level of challenges for tomorrow by a significant margin. Careful planning and implementation can go a long way toward reducing the impacts on vulnerable groups and coal-dependent sectors and regions.

Despite the temporary benefits for employment and tax revenue in the near term, continued building of new coal power plants during the 14th FYP is not a sustainable solution to the economic slowdown. On the contrary, new builds trade a short-term and small overall gain for a long-term cost to health and other development goals, while also undermining the performance and financial viability of the entire coal industry and therefore their ability to plan an organized phaseout. In the medium-to-long term, continued expansion of coal capacity will only disrupt a well-designed coal phaseout strategy and thereby significantly increase the stranded assets and costs of future actions towards China's sustainable transition and global long-term decarbonization to address climate change.

In response to the recent movement of a new round of coal power development, the economic and policy stimulus plan should emphasize the exclusion of coal-fired power plants from the “new construction” project list and encourage investments in the green alternatives in the economic recovery package. Moreover, the following strategies are recommended specifically for the coal power sector plan of the 14th FYP:

- Revisit the “risk and early warning indicator system for coal-fired power planning and construction” for individual provinces, taking into account projects already under construction and making economic performance of coal plants as a binding indicator;
- Set up specific goals on the implementation of the “no new coal” strategy during the 14th FYP, and may start from a number of provinces with high economic and environmental constraints;
- Define and identify low-hanging fruit plants based on technical, economic, and environmental attributes of coal plants, and develop the retirement target and plan of low-hanging fruit for each province; and
- Identify applicable coal plants for flexibility retrofits to enhance their ability to support renewable electricity into the grid.

This is a critical moment to make the right decisions for the 14th FYP that gets us on the right path towards China's long-term development and climate goals. It is important to start by articulating a comprehensive long-term power sector plan between 2035 and 2050, and the near-term actions under the 14th FYP should be developed by linking them to the medium- and long-term goals. A structured, high-ambition coal phaseout strategy that helps minimize the negative impacts on the coal industry and make their transition economically and socially viable, highly depends on an immediate halt of new construction of coal plants.



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