

Strategies for Financing Large-scale Carbon Capture and Storage Power Plants in China

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A substantial proportion of the world's new coal-fired power plants through 2030 will be built in China (as has been the case for the past 15 years), and CO₂ capture and storage (CCS) is the only viable solution to decarbonise these power plants at large-scale. However, as yet, there are few strong incentives or national policies to support the commercial demonstration and deployment of CCS in China. We review the status of CCS technologies and analyse possible financial models and strategies to develop integrated large-scale CCS projects using only existing financial resources and incentive structures.

We consider five hypothetical scenarios for financing a large-scale CCS demonstration project in China using 50% equity and 50% debt financing. The scenarios range from a reliance strong to weak reliance on public support as well as other measures such as tax-exempt status, enhanced oil recovery and the use of venture capital. Given standard assumptions across the scenarios, the on-grid tariff required to make a CCS project viable ranged from US\$58.8/MWh under the high support scenario to US\$74.7/MWh under the low support scenario.

Without any debt financing or other support mechanisms, developing CCS in a generic USCPC power plant requires either an on-grid tariff of US\$86/MWh or carbon price of US\$51/tonneCO_{2,eq}. If the required on-grid tariff could be reduced to below US\$60/MWh, it would be economically viable to bring CCS into commercial operation. Over half of the extra cost of CCS comes from the capture process, while a third is spent on CO₂ transportation,

storage and monitoring. Because capital costs are much lower in China compared with OECD countries, the cost of capture in China is very sensitive to fuel cost assumptions.

Aside from corporate equity investment and commercial loans, the Chinese national government, local governments, foreign governments, multilateral banks, venture capital, and CCS special funds could each provide different levels of support for demonstrating CCS. In addition, the economics of a CCS power plant could be enhanced through a range of mechanisms including EOR, domestic or international carbon markets, and a premium electricity tariff scheme. Based on several hypothetical financing scenarios, we found the required on-grid tariff could be lower than the current tariff levels of nuclear and natural gas power plants. EOR, though not a long-term option, can significantly improve the economics of a CCS power plant in China. On the other hand, if a global (or Chinese) carbon market price reaches US\$25/tCO₂e, a CCS project with limited support mechanisms would reduce the on-grid tariff to US\$58.8/MWh.

The economics of operational flexibilities has not been investigated and may offer significant value enhancement opportunities. It is also worth investigating whether it is possible to separate the CO₂ capture investment and financing from that for base power plants, which could ease the capital requirement for carbon capture and allow public financing to focus on additionality. Separating capture facilities from base plant may be easiest for post-combustion facilities since virtually all coal-fired generation, whether in China or elsewhere, is pulverised coal, whereas for other configurations it may be difficult to separate base plant and capture facilities.