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IEA: An Energy Sector Roadmap to Carbon Neutrality in China

In September 2020, President Xi Jinping announced that China will "aim to have CO_2 emissions peak before 2030 and achieve carbon neutrality before 2060". China is the world's largest energy consumer, energy producer and CO_2 emitter, accounting for one-third of global CO_2 emissions. It emits more CO_2 from its cement and steel sectors alone than the European Union does from all its energy sectors combined.

Despite impressive growth in renewables and hydropower over the past two decades, and being the largest market for solar, wind and electric vehicles, China remains heavily dependent on fossil fuels. In 2020, around 85% of China's total primary energy needs were met by fossil fuels. It is by far the largest coal-consumer in the world, which accounts for almost 60% of its total primary energy needs; oil accounts for about a fifth.

CO_2 emissions from fuel combustion and industrial processes reached more than 11 Gt in 2020, mostly from fuel combustion. Coal-fired power stations alone, including combined heat and power plants, were responsible for more than 45% of China's entire energy and process related emissions and 15% of global emissions in 2020.

Following President Xi's announcement, the Chinese government invited the IEA to co-operate on long-term strategies by setting out pathways for reaching carbon neutrality in China's energy sector. The result was the report, "An Energy Sector Roadmap to Carbon Neutrality in China", published in late September. Stretching to more than 300 pages, it shows that achieving carbon neutrality fits with China's broader development goals, such as increasing prosperity and shifting towards innovation-driven growth. Two pathways are considered: the Announced Pledges Scenario (APS), which reflects the enhanced targets China announced in 2020; and the Accelerated Transition Scenario (ATS), which explores the implications of a faster transition and the socio-economic benefits it would bring beyond those associated with reducing the impact of climate change.

As in the rest of the world, no single technology can deliver the emissions reductions required to reach net-zero. Decarbonising the entire energy sector requires the deployment of a wide range of technologies, tailored to the needs of individual parts of the energy sector and to China's circumstances. With a plethora of mentions, however, the report makes clear that CCUS (with 239 mentions), BECCS (22) and DAC (27), will have a major role to play if China is to achieve its ambitions.

The APS sets out a pathway to carbon neutrality in China's energy sector in which emissions of CO_2 reach a peak before 2030 and fall to net zero in 2060, in line with stated goals. Initially the biggest contributions to emissions reductions come from gains in energy efficiency, particularly in industrial processes, space heating and cooling, and road vehicles. Renewable electricity, mainly wind and solar PV, accounts for a third of total emissions reductions in 2030, with the contribution of renewables rising to almost 40% in 2060 as these energy sources become dominant in electricity generation. Innovative near-zero emissions technologies such as CCUS play an important role over the projection period. Initially, CCUS

is focused on addressing emissions from young existing assets in the power sector and heavy industry by retrofitting carbon capture equipment. Later, the removal of CO_2 from the atmosphere comes into play, where BECCS and DACCS are deployed to offset emissions in sectors where emissions are hard to abate, mainly from heavy industry and long-distance transport (road freight, shipping and aviation). CCUS accounts for 8% of the total cumulative emissions savings to 2060.

Energy sector CO_2 emissions follow roughly the same path to 2025 in the ATS as in the APS as many of the additional measures take time to take effect, but then fall by 4% per year between 2025 and 2030. Power generation accounts for about 60% of the overall reduction in emissions in 2030, and industry and transport combine for 30%. Indeed, the accelerated clean energy transition in the ATS boosts clean energy innovation in areas such as CCUS and hydrogen. This is exemplified by the increasing role for CCUS in the ATS that starts in the next decade, where CO_2 capture reaches 360 Mt in 2030, compared with just 20 Mt in the APS.

The report points clearly to the fact that, whether China follows the pathway announced by President Xi or the accelerated transition, the world benefits. Apart from the reduction in emissions, currently 27% of global emissions that, on their own, could lower global average temperature by almost 0.2°C by the end of the century, the global leadership in clean energy innovation could make an even greater contribution by providing other nations with the concrete examples that they themselves may then put into practice.

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