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# China's Direct Air Capture Potential

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China has been a major contributor to worldwide climate mitigation efforts. As the world's largest emitter, the estimated emissions from fossil fuels in 2016 was said to be equivalent to approximately 1% of the remaining carbon budget under a 2°C scenario [1]. Key targets for lowering carbon dioxide (CO2) emissions set forth in China's Intended Nationally Determined Contribution (INDC), under the Paris Agreement, includes peaking CO2 emissions by 2030, lowering CO2 emissions per unit of GDP by 60–65% from 2005 levels by 2030, and increasing the share of non-fossil fuels in primary energy consumption to around 20% by 2030 [2]. President Xi further restated this commitment during his speech to the UN General Assembly [3], including an ambitious goal to achieve net zero emissions by 2060. The INDC outlines a portfolio of low-carbon technologies and mechanisms to reduce greenhouse gas emissions, including setting up a national carbon market. However, the latest speech by President Xi gave very few details on how the net-zero goal for 2060 will be met.

To achieve true carbon neutrality by 2060, various notable scholars propose the use of negative emissions technologies (NETs) [4]. A specific capture technology gaining widespread attention among scientists is direct air capture (DAC), which enables the direct extraction of CO2 from the atmosphere. Fuhrman et al., (2020) [5] used the Global Change Analysis Model (GCAM 5.3) to simulate how negative emissions technologies, in general, and direct air capture (DAC), in particular, will contribute to China's meeting this target. Their results confirmed the need to deploy NETs at very large scales, up to 1.5 GtCO2 per year of DAC.

In order to make a meaningful contribution to CO2 emissions reduction, we require carbon-neutral energy and/or heat to operate DAC. Due to the variation in DAC separation technologies, there is a disagreement on the actual amount of energy required. However, we know that DAC is an energy-intensive operation [6]. The energy requirement varies between 0.32 and 4.73 MWh per tonne of CO2 [7] removed from air. 35 DAC also requires considerable water input (1 t of Ceq, DAC (e.g. amines) requires approximately 90 m3 of water [8]). These considerations may limit the selection of possible DAC locations in China to areas where these resources are available in order to reduce costs. Research on the best locations to site DAC facilities in China is still relatively sparse. However, considering the energy requirements would suggest that co-location with renewable facilities such as wind or solar farms for supply of energy is a good route [9].

Research on efficient adsorbents, and DAC location studies are currently ongoing at the Energy Plus Laboratory affiliated with Shanghai Jiao Tong University. We hope to harness the favourable policy environment and recent technological advances in the field of carbon capture to design a prototype system capable of being upscaled to capture 1ton/day of CO2!

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