New report ranks clean solutions for reducing China’s reliance on coal power

BEIJING, 3 April 2023 - China’s impressive growth of renewable energy (RE) generation and rapid increase in summertime electric peak loads has created a need for a more flexible electricity system, crucial for managing the variations in renewable energy sources while ensuring energy supply reliability and security.

The need for flexible generation capacity has led to a sharp increase in the development of new coal power plants as a stopgap measure.

There exists a range of technologies that can help Chinese system operators to manage rising shares of variable renewable energy and rising electric peak loads, a new report from the Centre for Research on Energy and Clean Air (CREA) and the International Society for Energy Transition Studies (ISETS) shows. Successful deployment of flexibility and storage technologies is an integral aspect of China’s efforts to create a New Energy System (新型能源系统) with clean energy sources as its backbone.

The key technologies include more flexible operation of existing coal power plants, pumped hydro, battery storage, green hydrogen, thermal energy storage, demand-side response and vehicle-to-grid.

The report surveyed 38 Chinese domain experts for their perception of how the different technologies rank on technical feasibility, economic viability, enabling infrastructure, environmental performance and supporting market arrangements affecting the prospects for these technologies.

The report found that despite the existence of many clean flexibility technologies, their potential to be deployed on a large-scale to meet the fast-growing demand for managing additional variations introduced by China’s rapid growth of renewable generation in the short run are limited by several major issues, such as long lead times, high development
costs and strict topological requirements for pumped hydro, rising mineral prices for battery storage and high costs for hydrogen production via electrolysis.

Retrofitting existing coal-fired power plants to be more flexible in their operation offers an immediate solution to satisfying the demand for system flexibility, allowing less power to be generated from coal and creating space for more clean energy in the grid. However, this will lead to lower operating hours for these power plants, which necessitates market and regulatory reforms to create more effective and technology-neutral remuneration mechanisms for acquiring system flexibility services, such as ancillary and capacity services. These mechanisms, once created, will also provide incentives for clean flexibility technologies to thrive when they become more mature.

“Coal power transition serves as an important leverage point for necessary market reforms that are integral to creating a clean, flexible, and resilient power system in China,” said Muyi Yang from the International Society for Energy Transition Studies (ISETS) and co-author of the report.

Apart from making coal plants flexible in their operations for immediate results, there are other long-term technological solutions to ensure a better mix of RE in China’s power production. These technologies rely on storing energy when there is excess, and can be converted to electrical power when needed. These technologies include:

- Electricity storage using grid-connected batteries and hydrogen, including vehicle-to-grid
- Mechanical storage such as pumped hydro
- Thermal for sensible heat storage, latent storage

From the perspective of GHG and air pollutant emissions, demand side response, vehicle-to-grid, pumped hydro, and green hydrogen were seen as the preferable technologies.

“A range of available flexibility technologies can help the power system accommodate the variations renewable energy brings. But our experts’ survey shows that China hasn’t yet created the conditions for clean flexibility technologies to compete against coal power. Stronger and better-designed economic incentives are needed for clean flexibility technologies to make a breakthrough,” said Xing Zhang, co-author of the report.

Despite these limitations, the country’s RE generation is still progressing well. In 2022, renewable energy sources generated 31.3% of the total national electricity with 45% of the country’s total power generation installation capacity. RE deployments, especially wind
and solar projects, are moving fast. In 2022 alone, China installed 152 GW of RE, or about 76.2% of newly installed power generation capacity.

As installation of renewable energy picks up in China, it is equally important to ensure that there is space in the grid to accommodate it.

“Preparing innovative storage technologies for a new energy system in China requires creating an ecosystem for their thriving. In this process, R&D is important, but if done in isolation, it will not produce the expected outcomes. Instead, a more systemic approach is needed,” said Xunpeng Shi from the International Society for Energy Transition Studies (ISETS) and co-author of the report.

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Note

CREA, in partnership with ISETS, produced the report related to this press release.

The report and all other CREA publications, can be found here: energyandcleanair.org/publications.

About CREA

The Centre for Research on Energy and Clean Air (CREA) is an independent research organisation focused on revealing the trends, causes, and health impacts, as well as the
solutions, to air pollution. CREA uses scientific data, research and evidence to support the efforts of governments, companies and campaigning organisations worldwide in their efforts to move towards clean energy and clean air. We believe that effective research and communication are the key to successful policies, investment decisions and advocacy efforts. CREA was founded in 2019 in Helsinki, Finland, and has staff in several European and Asian countries.

About ISETS
The International Society for Energy Transition Studies (ISETS) is an independent, non-profit, global membership organization based in Australia that facilitates a just, equitable and inclusive transition of energy and relevant sectors towards a sustainable low-carbon future with consideration of economic development, social equity, and environmental stewardship through international partnerships.

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