



## Potentials for Power-to-Gas based subsurface energy storage in China

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The renewable energy power generation capacity has been rapidly increasing in China recently. However, the contradiction between power supply and demand is becoming increasingly prominent due to the intermittency of renewable energies. Meanwhile, the mitigation of carbon dioxide (CO<sub>2</sub>) emissions in China needs immediate attention. Power-to-Gas (PtG) based subsurface energy storage, a closed carbon cycle based on an extension of “power to gas to power” technology, can convert surplus electricity into combustible gases by consuming CO<sub>2</sub> and meet the requirements of long-term energy storage with its large capacity [1] [2] [3]. A discussion of the entire PtG energy storage technology process and the current research progress are presented here to show the details of this innovative idea. The comparative study of different geological storage schemes shows their progress and limitations. A full investigation of the distribution and implementation of global PtG and carbon capture and storage (CCS) demonstration projects provides references for the application in China [4]. Based on some applied and modified techno-economic modules [5] and ecological effects analysis, the opportunities and challenges are coexisting in the application of PtG based subsurface energy storage in China. However, the site selection, energy efficiency, and the economy still need adequate discussion. To increase the possibility of applying PtG based subsurface energy storage in China, innovation of electrolysis and methanation technology, system energy efficiency optimization, energy gas storage and transportation risk control, leakage pre-warning system, techno-economic feasibility, ecological effects, geological conditions, the distribution of carbon dioxide emission source, the distribution of existing gas storage, the distribution of the West-east pipeline project (WEPP), and the impact of the policy should all be comprehensively considered.

Keywords: Renewable energy; Power-to-Gas; Subsurface energy storage; Underground gas storage; Carbon dioxide; Methane

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