

THE SCENARIO ANALYSIS OF SHALE GAS DEVELOPMENT IN CHINA BY APPLYING NATURAL GAS PIPELINE OPTIMIZATION MODEL

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Overview

As an emerging unconventional source of energy, shale gas has been an economically viable step towards a cleaner energy future in U.S. China also has shale resources that are estimated to be potentially the largest in the world. In addition, China has enormous unmet and pressing needs for a clean alternative fuel to substitute coal. Nonetheless, besides the uncertainty of economically producing shale gas, China faces the problem of transporting the gas efficiently overland with its limited pipeline network capacity and coverage. The aim of this study is to identify the potential bottlenecks in China's gas transmission network, which could be one of the most critical constraints for shale gas development in the near future.

Methods

We examine this through optimistic, medium and conservative domestic shale gas production scenarios on 2020, by taking references from IEA's projection and China's shale gas plan. To quantitatively assess each shale gas development scenario, we formulated a gas pipeline optimization model, which is aiming to minimize the gas demand that are unable to meet. We used ArcGIS to digitize the map and to generate the essential connectivity parameters. Other parameters, such as the pipeline capacity and gas domestic production and gas import quantity, are collected from national and provincial "twelfth-five year" plan and the "Atlas of the Chinese Natural Gas Pipeline".

Results

First of all, 52% of the shale gas produced in Sichuan province and Chongqing municipal won't be able to be transmitted out by pipeline under the optimistic production of shale gas, due to pipeline capacity and coverage limitation.

Secondly, even under the conservative scenario of shale gas production, there are still 9 % of the total demand unable to meet, with 62 out of 191 trunk pipelines in the model have been 100% occupied.

Comparing the results between conservative and optimistic supply of shale gas, Sichuan, Chongqing, Beijing, Shanghai, Jiangsu, Anhui and Henan will be influenced.

Conclusions

Pipeline network in China is not sufficient in meeting the growing natural gas demand in 2020 under all of the three scenarios of shale gas production. It implicates that, if shale gas could be produced in considerable scale, substantial pipeline expansion and new pipeline constructions should be in place as soon as possible to transmit the gas efficiently to reduce the gas demand shortage in Beijing, Shanghai, Jiangsu, Anhui and Henan. If the pipeline constraints could be overcome, China will reduce 24% dependency on LNG import under the optimistic shale gas supply scenario in 2020.