



Global impact of uncertainties in China's gas market



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ABSTRACT

This paper examines the uncertainties in Chinese gas markets, analyze the reasons and quantify their impact on the world gas market. A literature review found significant variability among the outlooks on China's gas sector. Further assessment found that uncertainties in economic growth, structural change in markets, environmental regulations, price and institutional changes contribute to the uncertainties. The analysis of China's demand and supply uncertainties with a world gas-trading model found significant changes in global production, trade patterns and spot prices, with pipeline exporters being most affected. China's domestic production and pipeline imports from Central Asia are the major buffers that can offset much of the uncertainties. The study finds an asymmetric phenomenon. Pipeline imports are responding to China's uncertainties in both low and high demand scenarios while LNG imports are only responding to high demand scenario. The major reasons are higher TOP levels and the current practice of import only up to the minimum TOP levels for LNG, as well as a lack of liberalized gas markets. The study shows that it is necessary to create LNG markets that can respond to market dynamics, through either a reduction of TOP levels or change of pricing mechanisms to hub indexation.

1. Introduction

China's gas market plays an important role in the global gas market and its importance is expected to increase over time. In the 2015 World Energy Outlook 2015 (IEA, 2015b), the International Energy Agency (IEA) forecasted that China has the highest growth prospects in natural gas demand from 2013 to 2040 globally. With current consumption of about 200 billion cubic meters (bcm), China is the world's third-largest gas consumer (BP, 2016) and its gas consumption is projected to grow to about 600 bcm by 2040 (IEA, 2015b). In total, Chinese gas demand as a share of world gas production is expected to increase from 5% in 2015 to 11% by 2035 (IEA, 2015b). This increased demand is met partially by increased domestic production, with the bulk supplemented by imports from both pipelines and LNG. IEA estimates that Chinese import dependence is set to increase from 30% of demand in 2015 to 40% with total imports up to 200bcm by 2035 (IEA, 2015a).

Despite high growth in the early 2000s, the trend of increasing Chinese demand for natural gas seems to be dying down, with the growth rate in natural gas consumption reaching historical lows in recent years (Shi and Variam, 2015). While slow economic growth is an obvious reason, there are many other initiatives in China that will cast great uncertainties on China's gas sector and the global gas market. The uncertainties could be due to technical reasons (such as reduction of shale gas production costs), regulatory reasons (such as limitation of

coal usage for local pollution reduction and CO₂ abatement), institutional reasons (such as pricing reforms and market liberalization), or a combination of some or all of them.

This confluence of increased significance, import dependence and the Chinese gas market as wildcard when it comes to supply and demand creates much uncertainty for global gas players (Ratner et al., 2016). In particular, the uncertainties have a great impact on LNG trade as it is expected that the glut in the world gas markets, in particular the LNG markets, will be unlikely to disappear before 2020 due to factors such as contract arrangements, high capital intensity, and long lead times for project development (Shi, 2016b).

While there are studies in the literature that examined the various outlooks of China's gas supply and demand (Ratner et al., 2016; Shaikh and Ji, 2016; Sun et al., 2013; Wang et al., 2013; Wang et al., 2016; Wang and Lin, 2012, 2014; Zhang, 2014; Zhu et al., 2014); to the best of our knowledge, there is no study quantifying the impact of China's gas market uncertainties on regional and global gas markets. The regional and global impacts of China's gas market sector development remain a relatively new issue for most energy researchers (Shi and Variam, 2015). Although many observers predict a slump in gas prices once the global market faces diminished Chinese demand (Butler, 2015), such impacts are not quantified.

The current paper not only reviews and analyses the factors contributing to demand and supply uncertainties in China, but also

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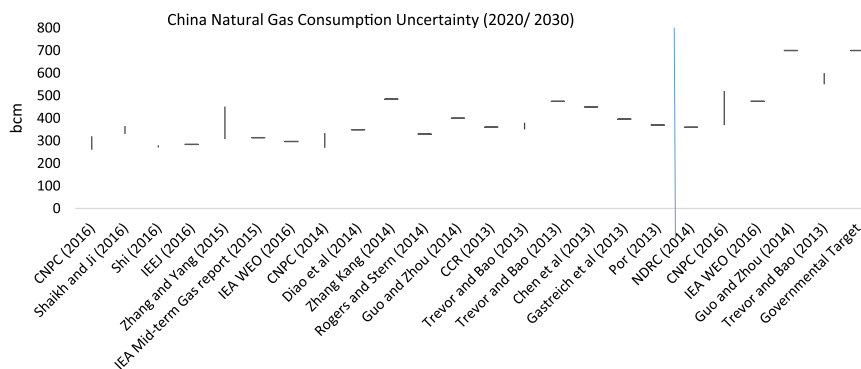


Fig. 1. China Natural Gas Consumption Uncertainty, 2020 and 2030. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

Source: Author's compilation; Note: Estimates to the left of the blue line represents estimates in 2040

estimate the impact of uncertainties on the world gas production, gas prices, pipeline and LNG trade. Questions to be answered in this paper include: (1) what are the magnitude of uncertainties in China's gas market? (2) what factors have led to these significant uncertainties? (3) what would the uncertainties mean for the world gas market?

This paper aims to contribute to the understanding of the comprehensive global impacts from China's gas market uncertainties, which are expected to provide reference for the international gas industry, in terms of project development and contract negotiation. It should also be able to offer implications on the ongoing changes in price indexation and trading hub initiatives in East Asia, which is closely related to market conditions as demonstrated by a recent study (Shi and Variam, 2016).

The paper proceeds as follows. Section 2 explains the methodology and the model. Section 3 reviews and analyses both supply and demand uncertainties in the literature. Based on the analysis and reviews, a group of policy scenarios are proposed in Section 4, which also presents the modeling results and discussions. Section 5 discusses the global and regional impact of the results. The last section concludes the paper with policy implications.

2. Model and methodology

This paper is presented as two main interrelated parts. The first part is a qualitative study where we review the relevant factors underpinning the uncertainties in China's gas supply and demand. Based on these reviews, a group of scenarios that represents different uncertainties are proposed. The second portion consists of a quantitative examination of how global gas markets evolve under different scenarios of Chinese demand and supply change using a global gas market and trade model.

The global impact of China gas market uncertainties is simulated by the Nexant World Gas Model (WGM) (Nexant, 2016). The WGM model, which covers every country that produces or consumes gas, is formulated as a linear programming model with minimization of global gas procurement costs (including production costs and transport costs) as the objective. The model is a mirror of gas sector in reality without dynamic intervention of government. Strategic government intervention can be modelled as infrastructure start dates, and change in price indexation (wherever applicable), taxes and production subsidies. The model includes all known sales contracts including source and destination, Annual Contract Quantity (ACQ), start and end dates, price formula, and active and planned infrastructure. The model minimizes cost of production and transportation to meet projected demand, subject to infrastructure constraints. Flows within nodes are constrained according to the available infrastructure and within the bounds of long term contracts where appropriate. Countries are modelled as nodes in WGM. The model captures flows at the node level by pipeline and LNG and contracted and un-contracted flows are

separately identified. While most countries are modelled as single node, larger countries are further divided into several nodes. Nodes are balanced on a quarterly basis to account for seasonal demand variations, supply swing, flexibility of delivery infrastructure and storage capacities. The model is optimized at node level but the results are aggregated to country and even regional blocks to simplify the presentation.

Detailed explanation of the model, the regional classification, key assumptions and inputs, and the discussion of results from reference scenario can be found in Shi and Variam (2016).

3. Chinese gas market uncertainties

3.1. Demand uncertainty

Generally, opinions seem to align around a largely optimistic view on the natural demand in China. While demand growth is relatively assured, the rate of demand growth is uncertain. The uncertainty on the magnitude of future growth is clearly illustrated in the disparities between official, academic as well as private sector forecasts. According to a review of existing literature on forecasts of Chinese demand from governmental, industry and academic sources, the range of demand forecast for 2020 lies between 270 bcm to 500 bcm and 400 bcm to 700 bcm for 2030 (Fig. 1; Compiled from CCR, 2013; Chen, 2013; CNPC, 2016a; Diao et al., 2014; Gastreich et al., 2013; Guo and Zhou, 2015; IEA, 2015a, 2016; IEEJ, 2015; NDRC, 2014a; Por, 2013; Rogers and Stern, 2014; Shaikh and Ji, 2016; Shi, 2016a; Trevor and Bao, 2013; Zeng and Li, 2016; Zhang, 2014; Zhang and Yang, 2015). The magnitude of the degree of uncertainty is best illustrated by the fact that even the differential between the highest and lowest forecasted demand is more than China's gas consumption in 2015 (196 bcm, as reported by (CNPC, 2016b)) and close to the size of the global traded LNG in 2015 (245 Mt, about 300 bcm) (GHGNL, 2016).

Further evidence of uncertainty can be observed from frequent revisions of not only private sector forecasts, but also official state goals and targets. In November 2014, the State Council (2014b) released the "Energy Development Strategy Action Plan (2014–2020)" which forecasted that natural gas will account for more than 10% of the total primary energy consumption of 4.8 Gt coal equivalent by 2020, equivalent to 360 bcm annual consumption (State Council, 2014b). This represented a downward revision from an earlier more ambitious official estimate of 400–420 bcm per annum by 2020 (Rogers, 2015). The 2014 figures were downgraded again in 2015 to about 295 bcm per annum, in alignment with the November 2014 IEA World Energy Outlook (WEO) New Policies Scenario (Rogers, 2015). Such almost annual revisions of natural gas consumption estimates are reflective of the current state of uncertainty in the Chinese gas markets.

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