How shale gas will shape China’s future? An evaluation based on dynamic Energy-CGE model

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Abstract

The potential of shale gas development in China is huge but research that assesses the impacts of shale gas development on China’s economy and carbon emissions are rare. This paper used a dynamic CGE model with energy and carbon emission modules to evaluate the impacts under different scenarios. The results implied that large scale of shale gas development will stimulate economy, when the supply of shale gas increases by 500\% from 2010 to 2030, the GDP in 2030 will be 2.59\% higher than BAU scenario; technology change that reduces the costs of shale gas utilization will not further stimulate economic growth on the basis of large scale exploitation, but will improve the diffusion of gas and make the energy structure cleaner therefore contribute the carbon mitigation. Hence, it is important for policy makers to take into account the varied effects of different shale gas promotion approaches.

Keywords: Shale Gas, low carbon development, economy, dynamic CGE model

1. Introduction

Projections from various sources indicate that China’s shale gas reserve is huge and policies encouraging shale gas development are in place [1]. For example, IEA projects China’s shale gas production in 2040 as 260 billion cubic meter, ranking the NO.1 in the world [2]. Once the potential of shale gas reserve in China is sufficiently exploited and utilized, it will have profound impacts on China’s energy markets and then affect the whole economy through price transmission mechanism. Meanwhile, the substitution effects of shale gas for coal will also influence China’s carbon emissions.

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However, uncertainty due to geological conditions, access to resources and pipelines, water availability and population makes the prospects of China’s shale gas development quite ambiguous. Such ambiguity has partially been solved by technology-oriented research [3]- [5], while the overall impacts of shale gas on China has rarely been evaluated.

This paper aimed to evaluate the development of shale gas on China’s economy and low carbon development. More specifically, this paper is intended to answer three questions. 1) Through which mechanisms will shale gas influence China’s economy and low carbon development? 2) What are the impacts that shale gas development will have on China’s economy and low carbon development? 3) What are the policy implications for the evaluation results?

2. Methodology

2.1. Model description

In order to assess the economic and environmental impacts of China’s shale gas development, a dynamic Computable General Equilibrium (CGE) model with energy and carbon emission modules is developed. In this model, the inputs are various policy scenarios, and the outputs are economic indicators such as GDP, employment and industry structure, and environmental indicators such as carbon emissions. The base year for this model is 2010 and time horizon is 2010-2030, the economy is divided into 15 sectors and they are listed in table1. The nesting production function structure is shown in figure 1. The economic growth in the model is driven by the endogenous accumulation of physical and knowledge capitals and exogenous increase in labor supply [6].

Table 1. List of Sectors in CGE model

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Label</th>
<th>Full Name</th>
<th>Label</th>
<th>Full Name</th>
<th>Label</th>
</tr>
</thead>
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<td>Agriculture</td>
<td>AGRI</td>
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<td>ROIL</td>
<td>Other Material Manufacturing</td>
<td>OMM</td>
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<tr>
<td>Coal mining &amp; washing</td>
<td>COAL</td>
<td>Electricity generation</td>
<td>ELEC</td>
<td>Equipment Manufacturing</td>
<td>EM</td>
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<tr>
<td>Oil &amp; gas extraction</td>
<td>OILGAS</td>
<td>transportation</td>
<td>TRANS</td>
<td>Product Manufacturing</td>
<td>PM</td>
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<tr>
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<td>Water utility</td>
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<tr>
<td>Gas Processing</td>
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<td>Steel Manufacturing</td>
<td>STEEL</td>
<td>Services</td>
<td>SERV</td>
</tr>
</tbody>
</table>

Figure 1. Nesting production function structure
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