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A barrier analysis for the development of distributed energy in China: A case study in Fujian province



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HIGHLIGHTS

- Using stakeholder analysis, this paper focuses on one typical building DE project.
- Conflicts between core stakeholders make the DE project cannot be completed.
- The barriers are related to the role of electricity consumers in DE projects.
- The barriers are also related to current Chinese natural gas and LNG market.
- Drivers such as regulation, incentives and so on should be built and modified.

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ABSTRACT

Distributed energy (DE) is receiving lots of attention from the Chinese government. A number of DE projects have been constructed in China. However, there are still numerous problems with DE projects. What hinders the development of DE in China? The Huadian Jimei distributed energy project (HJDE) is a typical DE building project that was not completed successfully. This paper focuses on this DE project to explore the barriers to DE development. The research group conducted 13 semi-structured interviews with representatives of institutions and corporations involved in the HJDE project to collect information. Based on the information, three types of problems were determined, and the results indicate that these conflicts between the core stakeholders make DE projects unsuccessful. These problems result from institutional barriers to DE, rooting in the development policy and the current energy market. Moreover, several key stakeholders are not able to play an active role in the design or management of DE projects. The Chinese government will put a much greater effort into the development of future DE projects. Many national support policies and rules will be announced, which are easy to practical use. Under these conditions, 1000 DE projects will be successfully completed until 2015.

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1. Introduction

Due to the sustained rapid economic development, energy consumption in China has been increasing for decades, from 1455 million tons of standard of coal equivalent (Mtce) in 2000 to 3245 Mtce in 2010. Energy consumption is a major contributor

Abbreviations: CHD, China Huadian Corporation; HJDE, Huadian Jimei DE project; CHP, Combined heat and power plants; LNG, Liquefied natural gas; CNOOC, China National Offshore Oil Corporation; Mtce, Million tons of standard of coal equivalent; CR Gas, China Resources Gas Group Limited; NEA, National Energy Administration; DE, Distribute energy; SGCC, State Grid Corporation of China; GHG, Greenhouse gas; XM CST, Xiamen Cheng Shin Rubber Industry Co. Ltd.

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to the rising concentrations of greenhouse gas (GHG) emissions in the earth's atmosphere (IPCC, 2006, 2007), and China has become the number one producer of CO₂ emissions and the third largest producer of SO₂ emissions in the world (Wang et al., 2011). As the largest developing country, China has actively participated in reducing GHG emissions. At the Copenhagen World Climate Conference in 2009, the Chinese government promised to reduce the intensity of carbon dioxide emissions per unit of GDP by 40–45% by 2020, based on 2005 levels (Wang et al., 2011). Furthermore, carbon emission targets have been written into “the People's Republic of China national economic and social development 12th Five-Year Plan” as binding indicators. It is difficult for China to reach the above-mentioned targets, however, because of coal-dominated energy industries in China and rising energy consumption, both of which will remain in place for a long time. The Chinese energy system should be changed and

improvements in energy efficiency and the promotion of clean and renewable energy development could play a pivotal role in GHG reduction (Lin et al., 2010).

Distributed energy (DE) is a power generation system or synthetic energy cascade multi-generation system located within the electric distribution system at or near the end-users that is not for the purpose of large-scale transmission of electricity (NEA, 2011). DE systems can employ a wide range of technologies including: combined heat and power plants (CHP), photovoltaic systems, small wind turbines and other systems using renewable energy sources (e.g., biogas digesters) (Ren and Gao, 2010). DE has the potential to play an important role in improving energy efficiency and promoting clean and renewable energy development; therefore, it has recently been receiving an increased amount of attention from the Chinese government. In China, the natural gas-fuelled CHP system is the dominant DE technology (Ren et al., 2010), and by the end of 2009, the total installed capacity of gas-fired DE stations was approximately 5.0 GW (Wang, 2011), 0.97% of total installed power generating capacity. Table 1 shows the total projects and installed capacity of gas-fired DE in China.

In 2011, two important policies by the NEA for the development of DE were announced: the Distributed Generation Management Approach (draft for consulting) and Guidance on the Development of Natural Gas Distributed Energy. The former grants the investment licenses for DE projects to five groups, including power investors, electricity users with legal person, independent micro-grid operation enterprises, specialised energy service companies and individuals who install and use distributed generation facilities of a certain scale. The power grid enterprises should provide convenient, timely and efficient service access to the grid for DE systems. The Guidance on the Development of Natural Gas Distributed Energy document promotes a program with 1000 natural gas DE projects and 10 demonstration areas featuring the typical characteristics of DE, which will be completed at the end of 2015. The total installed capacity will expand to 50 GW by 2020, which is projected to be approximately 3% of total installed power generating capacity in China in 2020. These steps indicate that the Chinese government is making great strides to develop DE. As a result, many DE projects have been constructed in the last year. However, there are still a number of problems with these projects. Many approved projects could not be completed, and even a number of projects that were constructed could not survive for a variety of reasons. In short, the development of DE in China is currently facing many types of problems.

The Huadian Jimei distributed energy project (HJDE) is the first DE project in Fujian province. It was constructed in the same year in which the Guidance on the Development of Natural Gas Distributed Energy was announced. So it is incredibly meaningful for the entire province and even for the whole country. According to the plan, the first-stage of the project was to start in February 2011 and be completed in December 2011. However, it has still not been completed as of July 2012. Using stakeholder analysis, this paper focuses on this typical DE building project to explore the barriers for the development of DE. These barriers will hinder the

constructions of other DE projects built after HJDE project and therefore should be addressed. Section 1 outlines the general situation of DE in China. Section 2 introduces the HJDE project in detail, and Section 3 focuses on methodology, i.e., stakeholder analysis. The last part of the paper presents the results of the stakeholder analysis along with a discussion of the results.

2. Background

2.1. Background of Fujian province

Fujian province is situated on the south-east coast of China facing Taiwan across the Taiwan Straits. The province borders Zhejiang province in the north-east, Jiangxi province in the north-west and Guangdong province in the south-west. Fujian province is one of the more developed provinces in China; by the end of 2010, its total population was 36.93 million with the GDP per capita of RMB 39.91 thousand ranking tenth out of all of the provinces in China (National Bureau of Statistics of China, 2011). Moreover, Fujian province is the main body of the Western Shore Economic Zone, which is projected to undergo rapid development in next 10 years.

Compared with other provinces, Fujian province lacks fossil fuels for energy production, as there is no oil or gas in the region. The primary means of energy production in Fujian province are coal and hydroelectric power. The output of both is likely to be steady and will not sharply increase in the next 20 years, although energy consumption is rapidly increasing. The gap between the production and consumption of energy will continue to increase over time. Fig. 1 illustrates the total primary energy production and consumption in Fujian province from 1990 to 2010 (Statistics Bureau of Fujian Province, 2011). As a province of China, Fujian province has the responsibility of achieving the carbon emissions targets established by the central government. To meet these targets, a sufficient, stable clean energy is necessary.

Fujian province has a number of good harbours with excellent marine traffic. A Liquefied Natural Gas (LNG) receiving station is located in Xiuyu harbour, which is presented in Fig. 2. It is the first LNG receiving station in Fujian province and the second LNG receiving station invested in and constructed by the China National Offshore Oil Corporation (CNOOC). The station could receive 2.6 million tons of LNG per year upon its completion in 2007. Moreover, there is a 356.13 km pipeline that supports the facility on the mainland. The pipeline goes through Fuzhou, Putian, Quanzhou, Xiamen and Zhangzhou city and will provide clean

Table 1
The total projects and installed capacity of gas-fired DE in China at the end of 2009. Reference: the recommendations and development of natural gas-fired DE stations in China, 2011.

Region	Total projects and installed capacity
Shanghai	Greater than 20, 20 MW
Beijing	Greater than 10, 900 MW
Guangdong	12, 2.26 GW
Other provinces	1.70 GW
Total of China	5.00 GW

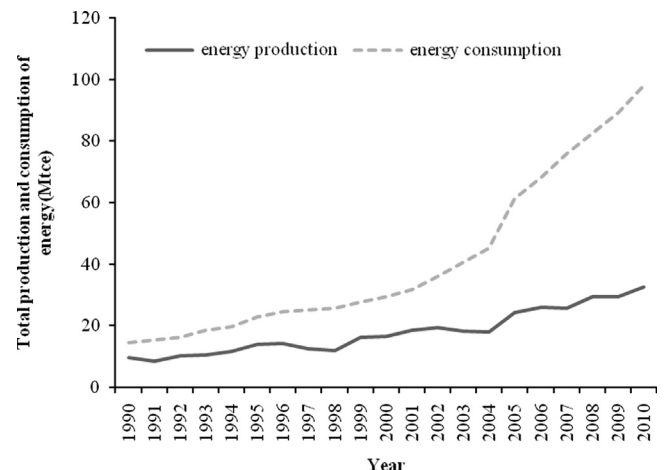


Fig. 1. Total primary energy production and consumption in Fujian province from 1990 to 2010.

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