



Study on cross-strait energy cooperation under the new circumstance

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ABSTRACT

The paper systematically reviews the conditions of energy supply and demand in Taiwan and further investigates the energy issues it has been confronted with as well as its objective of energy policy adjustment. In view of the trend of supply-side reform in mainland China energy sector under the New Normal economy and the background of the “Belt and Road” initiative, the paper points out the significance and development prospects of cross-strait energy cooperation. Main contributions of this paper are: by forecasting the future trend of power demand growth in Taiwan, the power shortage in the future of Taiwan is analyzed. On this basis, the paper analyzes the existing contradictions between Taiwan’s energy transition policy and its current problem of power shortage, and the feasibility as well as the significance of electricity transmission to Taiwan for the first time.

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1. Introduction

Taiwan is confronted with the shortage of energy resources. Serving as an independent energy supply system, imported energy accounts for 97.95% of the total energy supply,¹ which has led to the vulnerability of energy security system in Taiwan. In addition, the energy supply structure in Taiwan shows its strong reliance upon coal, oil and natural gas and the proportion of these three resources has increased from 83% in 1989 to over 90% in 2016.² Therefore, improving the autonomy of energy supply plays an important role in energy security in Taiwan.

Given the excessive dependence on overseas energy supply, the fluctuating price in international energy market exerts great impact on the energy supply security in Taiwan. In the meanwhile, energy substitution becomes an increasingly urgent problem owing to the reduction of global greenhouse gas emission and exhaustion of

traditional energy resources. Energy security not only affects the economic development of Taiwan, but also plays an important role in its social stability. Therefore, it has become a central issue of energy policy in Taiwan to establish a clean, safe, stable and reliable energy supply system through policy means, which also takes into account the cost and environmental requirements.

On the other hand, under the macro background of “Three Superimposition”,³ mainland China has slowed down in economic growth and the conditions of economic supply-side driven growth have changed a lot. The problems in energy industry have turned from original shortage to excess capacity. Accordingly, there is a need in considering the long-term energy development under the “New Normal”. Fierce competition in energy industry promotes energy companies to actively seek “out” and export capacity. Under these circumstances, how to seek energy cooperation, is of great significance in achieving the sustainable development of energy industry on both sides of Taiwan strait.

This paper starts with the review of the current energy supply and demand situation in Taiwan, and further analyzes the energy issues it confronted with as well as its objective of energy policy

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¹ As is defined by the International Energy Agency (IEA), nuclear power can be classified as self-produced energy, and then imported energy occupies 90.6%.

² “Energy Bureau of Ministry of Economic Affairs” in Taiwan: 2016 Energy Industry Technology White Paper, 2017, 6.

³ It means that simultaneously deal with the slowdown in economic growth, make difficult structural adjustments, and absorb the effects of previous economic stimulus policies.

adjustment. By forecasting the future trend of power demand growth in Taiwan, the power shortage in the future of Taiwan with the energy transition policy is analyzed. On this basis and considering the trend of supply-side reform in the mainland energy sector under the New Normal economy, the paper illustrates the significance of cross-strait energy cooperation and puts great emphasis on the feasibility, cost as well as yield of electricity transmission to Taiwan.

Compared with previous studies, the main contributions of this paper lie in that: firstly, it analyzes the energy issue Taiwan confronted with under the background of the “denuclearization” energy restructuring and illustrates the fundamental reasons for the power supply shortage with regard to the large-scale power failure recently happened in Taiwan; secondly, it forecasts the future power demand of Taiwan and analyzes the contradictions between its energy transition policy and its power shortage; thirdly, it elaborates the sub-structure the energy industry in mainland China faced with in the new normal as well as the influence of the “Belt and Road” initiative on the cross-strait energy cooperation; finally, it makes in-depth analysis of the feasibility, cost as well as yield of electricity transmission to Taiwan.

The remainder of this paper is organized as follows. Section 2 presents the current conditions of energy supply and demand in Taiwan. The power demand forecast is described in Section 3. Section 4 provides the significance of cross-strait energy cooperation. Further discussions related to the cross-strait energy cooperation are presented in Section 5. Section 6 shows the outlook of power transmission from mainland to Taiwan. Section 7 is the conclusions and policy recommendations.

2. Conditions and problems of energy supply and demand in Taiwan

2.1 Energy supply and demand in Taiwan

According to the data of “Energy Bureau of Ministry of Economic Affairs” in Taiwan, in 2016, oil accounts for 48.9% in the supply structure of primary energy, coal for 29.4%, natural gas for 13.7%, nuclear power for about 6.3%, and renewable energy for only about 1.4%. Table 1 below shows the energy supply (import) and consumption in Taiwan in the past 5 years.

It can be seen from Table 1 that Taiwan's energy structure is dominant by fossil energy and its reliance on energy import is rather high, for its self-produced energy only takes up 2.05% of the total energy supply. In terms of the sources of energy import, Taiwan's oil is mainly imported from countries in the Middle East such as Saudi Arabia (31%), Kuwait (21%) and Iran (8%); its providers of liquefied natural gas cluster in Asian countries like Qatar (42%), Malaysia (17%) and Indonesia (14%); while its bunker coal mainly comes from Australia (63%), Indonesia (17%) and Russia (15%).

Therefore, Taiwan is confronted with an increasingly grave situation in energy security, regardless of the source or price of supply. On one hand, from the perspective of supply source, energy imports in Taiwan mainly rely on the Middle East and the Asia-Pacific region, with major routes in the sea and alternatives inadequate. In the event of harsh weather such as storms, energy supply would be affected. Take the instance of electricity, liquefied natural gas (LNG) is used for generating power in Taiwan, which is mainly imported from the Asia-Pacific region. However, the supply would be cut off at any time due to weather conditions, causing widespread power blackout. In addition, Taiwan's energy structure is highly dependent on fossil fuels and meanwhile the closedown of the “4th Nuclear Power Plant” gradually leads Taiwan's power development enter into the “denuclearization” stage, while its research and application of new energy technology fails to keep

Table 1

Supply and Demand Conditions of Primary Energy in Taiwan (Unit: million tons oil equivalent).

Item	2012	2013	2014	2015	2016
Total Energy Supply	127.43	129.72	133.65	131.49	131.93
Self-produced Energy	2.69	2.66	2.54	2.61	2.71
Crude Oil	0.01	0.01	0.01	0.01	0.01
Natural Gas	0.35	0.30	0.30	0.30	0.26
Biomass and Waste	1.56	1.56	1.52	1.53	1.48
Hydroelectric Power	0.49	0.47	0.37	0.38	0.56
Renewable Energy ^a	0.24	0.27	0.28	0.31	0.32
Imported Energy	124.74	127.06	131.11	128.88	129.23
Coal and Coal Products	38.28	39.64	39.55	39.04	38.73
Crude Oil and Petroleum Products	60.89	61.45	64.60	63.28	64.47
Liquefied Natural Gas	15.02	15.12	15.92	17.05	17.77
Nuclear Power Generation	10.54	10.85	11.05	9.51	8.25
Total Energy Demand	127.43	129.72	133.65	131.49	131.93
Energy Sector	7.1	7.1	6.9	6.8	6.7
Energy Consumption	74.0	75.0	75.5	74.9	75.6
Transport Sector	39.2	40.2	40.0	39.2	39.1
Industrial Sector	11.9	11.9	12.1	12.3	12.7
Agricultural Sector	0.9	0.9	0.9	0.9	0.9
Residential Sector	11.1	11.1	11.3	11.4	11.4
Service Sector	10.9	10.9	11.2	11.1	11.4
Non-energy Consumption^b	20.5	22.2	22.7	23.1	22.9

Data Source: “Energy Bureau of Ministry of Economic Affairs” in Taiwan.

Note:

^a Renewable energy includes solar photovoltaic, wind power and solar thermal energy.

^b Non-energy consumption only contains lubricating oil, asphalt, solvent oil.

abreast of the current situation, which makes it more reliant on energy import. On the other hand, in terms of supply price, the international market exerts much influence on the import price of energy in Taiwan. When geopolitical events occur, international energy price would be substantially raised and further impose heavy burden on energy import. For instance, after the outbreak of Fukushima nuclear accident, Japan has greatly increased its import of natural gas from the Asia-Pacific region, which consequently put up the overall gas price in the Asia-Pacific region. At present, the expenditure of imported energy in Taiwan accounts for about 6% of GDP, with per capita expenditure of NT \$ 40,000 a year. Additionally, Taiwan pushes down local energy prices, which places growing, or even overwhelmed, burden on the local energy industry (for example, [Taiwan Power Company](#)).

2.2 Energy structure in Taiwan

Problems concerning energy structure in Taiwan are mainly concentrated on power structure. From the perspective of Taiwan's historical power statistics, although its power consumption almost remains steady in recent years, its maximum power loads have indeed been increasing. From 2011 to 2016, the maximum of Taiwan's power load has increased about two million kilowatt. However, the electrical power capacity of the main power supplies such as thermal power and nuclear power remains unchanged, with the electrical power capacity in 2016 the same as that of in 2011. The total installed generation capacity of Taiwan in 2016 is 49,906 kW. As is displayed in Fig. 1, coal, gas and nuclear power account for 85.3%, and other types of power generation are only about 14.6% including renewable energy. According to the characteristics of power supply, the power structure in Taiwan can be divided as follows: baseload power (to meet the basic power demand), peak-load power (quick start to meet the peak supply) and the power between the two-adjustable intermediate power. The imaginary power structure of Taiwan Power Company is supposed to be: base load accounts for 55–65%, intermediate load for 15–30% and peak load for 10–15%. In 2013, the actual proportion of the three types of

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