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# Status and Development Suggestions of Wind Heating in Northern China

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## Abstract

Driven by concerns about CO<sub>2</sub> emissions and environmental pollution, the development of the China's wind power industry has accelerated in recent years. In China, most of wind power plants are located in the "three north" region (northeast, north, northwest), those areas are very cold in winter, and the heating period lasts for 4-6 months per year, thus heat demand is very large, so wind heating conversion was proposed and it has become a hot point to exploit for investors. This paper provides a brief overview of the development of the wind power in China, discusses some of the current challenges in the application of wind power heating in northern China, such as technical challenges, supporting policies and benefit pattern, finally puts forward four pieces of advice for improvement. This paper hopes to play a reference in China's future development of wind power heating projects, which helps to control air pollution and optimize the energy structure.

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*Keywords:* wind energy; heating; the northern region

## 1. Introduction

By the end of 2016, China wind installed capacity has reached 168,732 megawatts, surpassed the United States as the leading global investor in this sector. However, due to the small size of the market and lack of cross-transmission capacity, wind curtailment and energy waste appeared gradually in China, which refers to the phenomenon that wind power generation is not put on grid and the wind turbines have to be shut down, hindering further development of wind power industry in China[1]. At the same time, environment problems in China northern region are increasingly serious, especially in winter heating period, the oppressive haze—part from the existing coal-fired heating methods which are mainly coal-fired heating has seriously disturbed people. Wind power is a kind of clean energy, the development of wind power heating is of great significance to promote consumption of abandoned wind, on the other hand helps to reduce coal use and alleviate air pollution, so it's called "a key open two locks"[2].

The curtailment of wind installed capacity always maintains at a high level in "three-north" region, leads to a waste of energy, performance of key areas in 2015 is as follows.

Table 1. Wind waste situation

	Inner Mongolia	Gansu province	Xinjiang	Jilin province
Abandoned wind electricity (kwh)	9.1 billion	8.2 billion	7.1 billion	2.7 billion
Ratio(of the total generating capacity)	18%	39%	32%	32%

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The “wind power heating” is to utilize electric boiler combining with heat storage device to replace the traditional coal-fired boiler by using "abandoned wind" at night to generate electricity, link wind farm and heating stations together through the configuration of electric boilers and thermal storage devices (or regenerative electric boilers), then connects them to urban heating network. In low-load period, the electric boiler begins to operate to increase the electrical load and converts the electric into heat, some of these heat is used directly for heating in this period and the other part is stored in the heat storage device to be offered when the electric boiler is shut down at the peak[3].

**2. Reserves and development of wind energy in China**

As shown in Fig. 1, China’s land wind resources are mainly distributed in the “three-north” region, which is of high latitude. Reserves are particularly large in northwest area due to the high altitude with small surface ups and downs, it is China's most abundant wind energy area. North China is located in plain, suitable for construction of wind plant for its flat terrain, convenient transportation and non-destructive wind speed, furthermore, there are intensive population and plenty of enterprises consuming energy. Wind reserves in three north areas are shown in Tab.2.

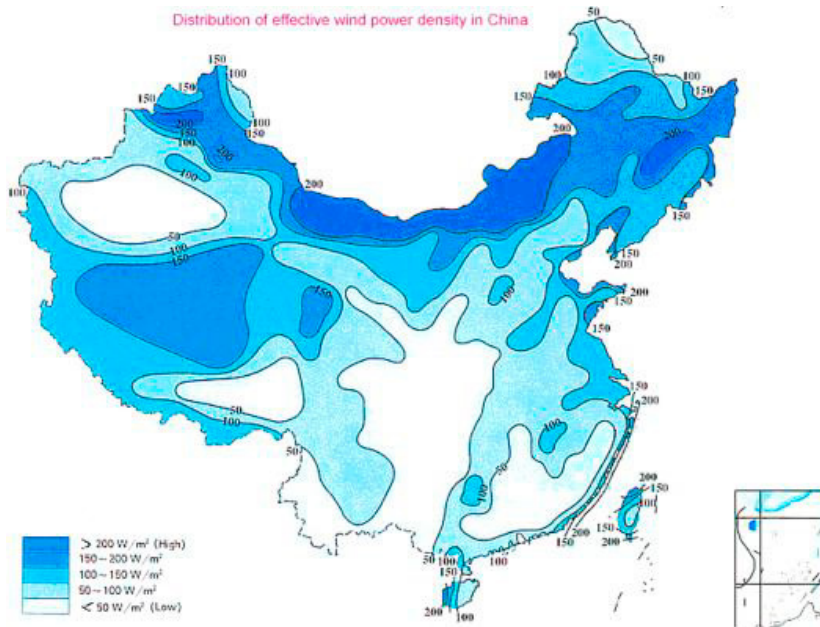


Figure 1. Distribution of effective wind power density in China

Table 2. Wind energy reserves in the "Three North" region

Region	Province (municipality)	Wind resource reserves (million kilowatts)							
		Less than 50W/m²	50-100 W/m²	100-150 W/m²	More than 150W/m² reserves	More than 150W/m² acreage (km²)	Total reserves	Technical exploitation amount	Technical potential exploitation amount
North	Beijing	433	55	9			498		1
	Tianjin	343	121	34			498		3
	Hebei	4074	1561	658	1107	7378	7400	896	52
	Shanxi	4056	661	41	55	369	4813	43	3

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