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Paul Recknagel

Wind Power in China 2008

An Analysis of the Status Quo and Perspectives for Development

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Abstract

This study reviews the status quo of wind power in China in the year 2008 and offers an outlook to future development, in order to provide a sound basis for the alignment of the German Development Corporation's (GTZ) wind power activities with actual market conditions. Government policies as well as other determinants of wind power development are analyzed in-depth and possible pitfalls for development are identified. As a conclusion, the study presents recommendations for measures to promote a long-term sustained development of wind power in China.

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Finally, I want to show my deepest appreciation to my family for their love and unfailing support.

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Abbreviations

ADB	Asian Development Bank
BCSE	Australian Business Council for Sustainable Energy
BMU	*Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit*
CAGR	Compound Annual Growth Rate
CDM	Clean Development Mechanism
CEPRI	China Electric Power Research Institute
CLYPG	China Longyuan Power Group
CMA	China Meteorological Association
CNY	China Yuan Renminbi
cp.	compare
CRED	Center for Renewable Energy Development
CREIA	Chinese Renewable Energies Industry Association
CWPP	GTZ China Wind Power Project
DE	domestic enterprise
EEG	*Erneuerbare Energien Gesetz*
EEP	EU-China Energy and Environment Programme
ERI	Energy Research Institute
EWEA	European Wind Energy Association
FIE	foreign-invested enterprise
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GTZ	*Gesellschaft für Technische Zusammenarbeit*
GW	gigawatt
GWEC	Global Wind Energy Council
IGES	Institute for Global Environmental Studies
IMAR	Inner Mongolia Autonomous Region
IPCC	Intergovernmental Panel on Climate Change
IPP	independent power producer
m	meter
MW	megawatt
NDRC	National Development and Reform Commission
NEA	National Energy Administration
NREL	National Renewable Energy Laboratory
O&M	operation and maintenance
OECD	Organisation for Economic Co-Operation and Development
PPA	power purchase agreement
R&D	research and development
RE Law	Renewable Energy Law
REEEP	Renewable Energy and Energy Efficiency Partnership
REN21	Renewable Energy Policy Network for the 21st Century
SWERA	Solar and Wind Energy Resource Assessment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP	United Nations Environment Programme
US	United States
VAT	value added tax
WERT	Wind Environment Research & Training Initiative (BMU & GTZ)
WED	Danish-Chinese Wind Energy Development Programme
WTG	wind turbine generator
WTO	World Trade Organisation

1 Introduction

1.1 Background

The last two years mark a turning point in public perception of human-induced climate change as a problem of global importance.[1] The widespread acceptance that *"most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas [GHG] concentrations"* [2] has increased political pressure on governments to reduce GHG emissions. At the same time, rising oil prices have made the reduction of dependence on energy imports and diversification of the energy mix strategic imperatives for many countries around the world.

While governments worldwide are confronted with this dual challenge, it is of special relevance to China. On the one hand, China has recently become the world's largest emitter of CO_2, accounting for 24% of global annual CO_2 emissions.[3] China is therefore one of the most important players to effectively mitigate global warming and pressure from governments around the world on China to join emission reductions efforts is mounting. On the other hand, energy demand is growing exponentially and China is increasingly relying on energy imports to satisfy energy needs.[4] Worried that growing dependency on energy imports may be accompanied by foreign-policy and economic pressures that might threaten national security as well as social and political stability, China has implemented a number of policies to address this issue ranging from policies to save energy and reduce energy intensity, to the diversification of oil supply sources and routes, the support of equity oil overseas acquisitions and the build up of strategic oil reserves to the diversification of the energy portfolio.[5]

In line with the objective to diversify the composition of the energy mix, China's leadership is increasingly realizing the need to reduce emissions and support renewable energy development. At a recently held *Politburo* study session, President Hu Jintao exclaimed: "*Our task is tough, and our time is limited. Party organisations and governments at all levels must give priority to emission reduction and bring the idea deep into people's hearts*".[6] To address the issue of energy security, the Chinese government has adapted a two-pronged approach. While measures to promote energy savings and efficiency curb the increase in energy demand, the support of renewable and nuclear energy reduces dependency on energy imports and contributes to the broadening of the foundation of energy supply.[7]

This study focuses on China's renewable energy policy and the development of wind energy in China in particular. Commitment by the highest levels of government and a host of favourable policies have

[1] Main drivers of public awareness of climate change were Al Gore's movie "An Inconvenient Truth" (May 2006), the Stern Report (October 2006), the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007) and the Nobel Peace Prize for Al Gore and the IPPC (December 2007).

[2] IPCC (2007), p. 10

[3] Netherlands Environmental Assessment Agency (2007), *online* / The Climate Group (2008), p. 5

[4] In 2006, China relied on imports for 50% of its total oil consumption. China started to import gas in 2006, and has become a net importer of coal in 2007. The energy imports are expected to increase markedly in future, accompanied by a growing impact on international fuel trade. (cp. OECD/IEA (2007), p. 325 et seqq.)

[5] cp. OECD/IEA (2007), p. 175 et seqq.

[6] cp. Watts (2008), *online*

[7] China is also supporting the development of a natural gas market as well as R&D and deployment of clean coal, coal-to-liquid and biofuel technologies.

triggered a boom in renewable energy in China, especially in the wind power sector. A major step in the development of renewable energy in China has been the *Renewable Energy Law* that came into effect in January 2006. In addition, the government has set ambitious targets for energy intensity reduction, and share of renewable energy of primary energy consumption.

China is on the way to become the world leader in renewable energies. In 2007, investment in renewable energies in China amounted to approximately US$ 12 billion, second only to Germany. In terms of installed renewable energy capacity, China leads the world with 151 GW of installed capacity, largely due to the widespread utilization of hydropower for electricity generation.[8] According to a report by the United Nations Environmental Programme, China is the world's leading manufacturer of solar cells, with an estimated annual production capacity of 3.000 MW.[9] China's wind power market was the third biggest worldwide in 2007 and growth rates continue to exceed expectations. In 2009, China is expected to take the lead as the largest manufacturer of wind turbines.[10]

Hydro power represents the most important source of renewable energy in China and plays an important part in the power generation portfolio, most notably since the construction of the Three Gorges Dam. Hydro capacity is expected to double to 290 GW until 2020, but concerns about the social and environmental impact of large-scale hydro power are becoming stronger.[11] Although China is the world's leading solar manufacturer, installed solar photovoltaic power capacity amounts to a mere 0.01% of total power generation capacity (80 MW, approx. 50% of which are off-grid).[12] Solar power equipment is produced almost exclusively for export. Considering China's enormous energy demand and the pace of its growth, deployment of solar photovoltaic power is not viewed as a first-rate solution to satisfy China's energy needs, since it features high costs and low efficiencies compared to other renewables like hydro or wind power. While China does not have significant amounts of solar PV capacity, it is the biggest market for solar thermal systems for heating and hot water supply with 64,5% of global capacity, amounting to 68 GW.[13] Biomass covers 13% of primary energy demand, mostly used in rural households for heating and cooking. In 2007, only 0,28% of power generation capacity were fuelled by biomass. The government plans to expand biomass capacity from 2 to 30 GW by 2020.[14] Despite the impressive progress of recent years, renewable energies - excluding hydro - only contribute less than 1% to China's electricity supply and the skies above China's urban areas continue to be shrouded by smog.

Since coal-fired power generation accounts for 82,9% of total electricity supply, it is no surprise that half of China's emissions are attributable to power generation.[15] With electricity demand growing rapidly alongside the economy, dependency on coal as the major source for power generation is likely to persist. However, as the most important source of renewable energy next to hydro, and growth of installed capacity constantly accelerating, peaking at about 130% in 2007, wind power is one of – if

[8] Hydro power accounts for 145 GW out of 151 GW renewable energy capacity (2007). Cp. The Climate Group (2008), p. 8

[9] Data from 2007. cp. May (2008), *online*

[10] cp. Schwartz/Hodum (2008b), *online*

[11] cp. The Climate Group (2008), p. 8

[12] cp. The Climate Group (2008), p. 8 et seqq.

[13] cp. REN21 (2008), p. 12

[14] cp. cp. The Climate Group (2008), p. 11

[15] cp. Shi (2008b), p. 1