

THE STATUS OF HYDROPOWER IN CHINA

CHUNNA LIU

Research Center for Sustainable Hydropower Development, China Institute of Water Resources and Hydropower Research, Beijing, 100038, PR China

XIN SUI

Research Center for Sustainable Hydropower Development, China Institute of Water Resources and Hydropower Research, Beijing, 100038, PR China

ZHENLI HUANG

Research Center for Sustainable Hydropower Development, China Institute of Water Resources and Hydropower Research, Beijing, 100038, PR China

At present, China has an abundance of energy resources and the gross amount of hydraulic resource ranks first in the world; however, because of low level of development, hydraulic resource has a broad development prospect. With the rapid economic development, China faces energy pressure and environmental pollution. The appropriate solution of energy bottleneck is the key to healthy, rapid and sustainable development. In this paper, we analyze the regional distribution of hydraulic resources in China, including conventional hydropower, small hydropower and pump-storage hydropower. Then the challenges of developing hydraulic resources are described, regarding to the China's actual conditions. At last, through analyzing the national development plan of hydropower, we predicted its potential development, in order to achieve the goal of 15% energy generation from renewable sources in China, the vigorous development of hydropower is necessary.

1 INTRODUCTION

As one of the consequences of fast growing economy, increasing energy demand has imposed great pressure on China's power supply. Meanwhile, the depletion of fossil fuel resources together with the urgency to cut carbon emission necessitates the structural change towards renewable energy.

As the largest developing country in the world, China has been making continuous efforts in developing renewable energy. Although the current energy system in China relies extraordinarily on fossil fuel, with more than 70% of energy produced from coal, the share of renewables has been gradually increasing, especially in recent years.

Table 1. Installed capacity of renewables (Data source: NEA 2012)

| | 2005 Installed capacity(GW) | 2010 Installed capacity(GW) | Annual growth rate(%) |
|------------|-----------------------------|-----------------------------|-----------------------|
| Hydropower | 117.4 | 216 | 13 |
| Wind Power | 1.26 | 31 | 89.7 |
| Solar PV | 0.07 | 0.8 | 62.8 |
| Biomass | 2 | 5.5 | 22.4 |

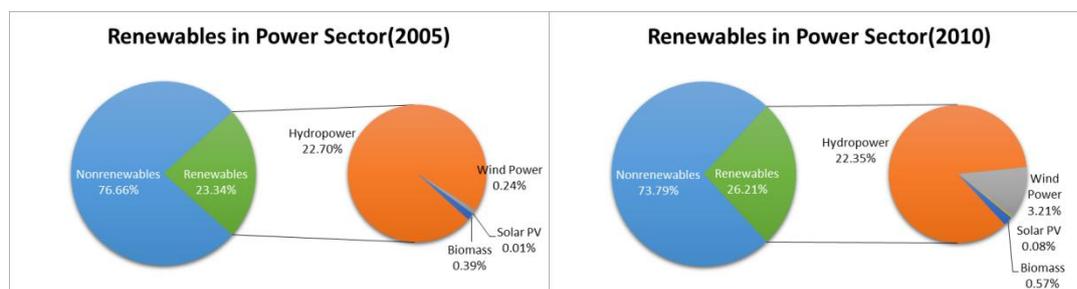


Figure 1. Installed capacity of renewables in power sector (Data source: NEA 2012; Xu 2007; CEC 2011)

Low operational cost, mature technology and stable performance have allowed hydropower to be one of the primary renewable energy source in various countries all over the world. Among the benefits hydropower brings about, low carbon emission and good renewability serve the goal of sustainable development specifically. The estimated theoretical potential of hydropower is 39900 TWh globally, and China has both the largest theoretical and technical potential in the world.

2 WATER RESOURCES IN CHINA

2.1 Uneven spatial distribution

The spatial distribution of hydropower resources in China is quite uneven. Nearly 70 percent of available hydropower resources are concentrated in the southeast.

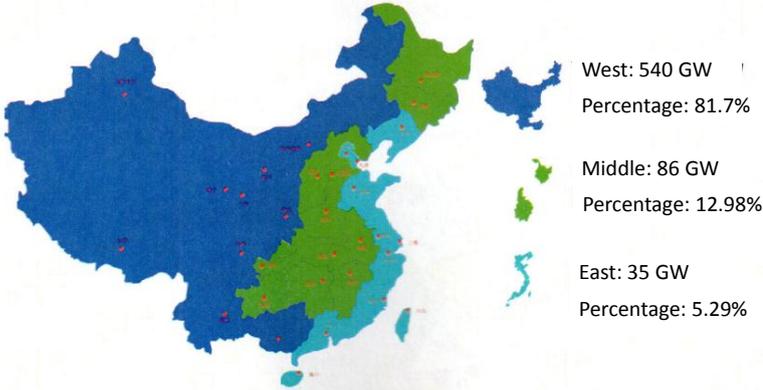


Figure 2. The distribution of hydropower potential

Most hydropower resources in China are distributed along the mainstream of rivers, which makes it favorable to construct large-scale hydropower base (Cai 2009). Given such natural endowment, 13 large-scale hydropower bases were set up, based on major watersheds draining the country, as is shown in Figure 5.



Figure 3. Large-scale hydropower bases in China

2.2 Scale

The extremely uneven spatial and temporal distribution of hydropower resources has made it not only favorable, but also necessary to build large scale hydro projects.

3 HYDROPOWER CONSTRUCTION

3.1 History of development

In spite of the fact that China has large potential in hydropower, the Chinese hydropower started relatively late compared to industrialized countries.

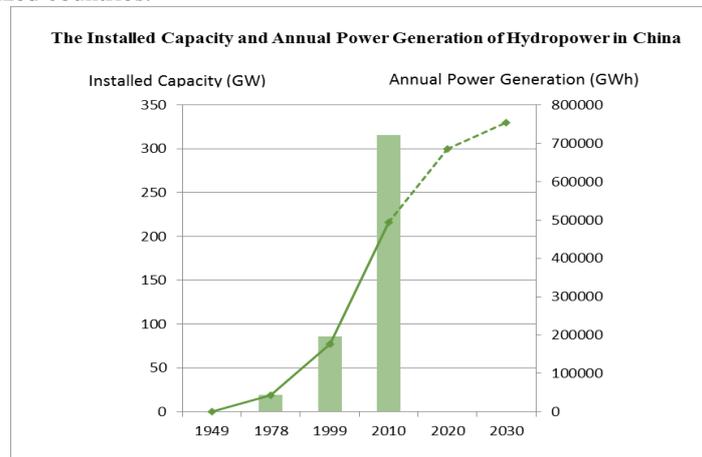


Figure 4. The installed capacity and annual power generation of conventional hydropower in China (Data source: NBSC 2000, NBSC 2011, People 2010)

3.2 Current status

From decades of learning and practices, China has attained its knowledge and experience in hydro technology and project management.

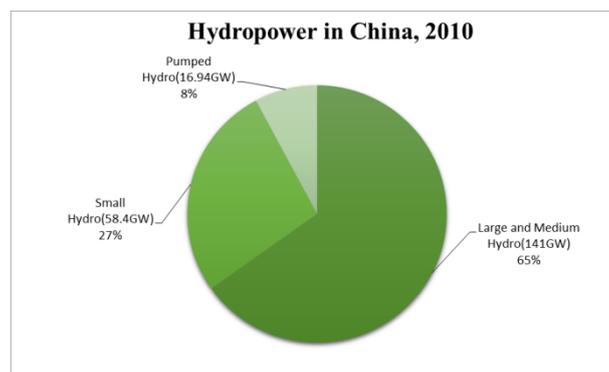


Figure 5. Installed capacity of hydropower in China, 2010 (Data source: NEA 2012)

3.3 Comparison with Norway

Situations in China and Norway are quite different, from both countries' natural endowments to their social and economic backgrounds. However, as Norway is on a more advanced stage of development, there is a lot China could learn from Norwegian experience of constructing and managing hydropower, especially in the social and environmental aspects.

Table 2. China-Norway Comparison

| | China | Norway |
|--------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Natural endowments | Abundant hydropower resources, uneven temporal and spatial distribution | Abundant hydropower resources, excellent geological condition |
| Exploitation level | 29% | 63% |
| Energy demand | 2010 per capita electricity consumption 2942 kWh, the demand keeps rising as economy grows | 2010 per capita electricity consumption 25177 kWh, major exporter of electricity |
| Project scale | 300 MW + hydro power plants take up 72 of total installed hydropower capacity | 10 to 200 MW hydro power plants take up 60 of total installed hydropower capacity |

4 FUTURE PLAN

There is little doubt that China will continue developing its renewable energy actively in the next decade. The country has set a national target of achieving 11.4% non-fossil fuel participation in its primary energy consumption by the year 2015, with hydropower being one of the key players. Furthermore, by 2020, the participation rate of non-fossil fuel is expected to be raised to 15%.

China's 12th five-year plan claimed to increase the installed capacity of hydropower to 290 GW by 2015, with special attention paid to environment protection & nature conservation, population relocation policy, technology innovation, project management and international cooperation.

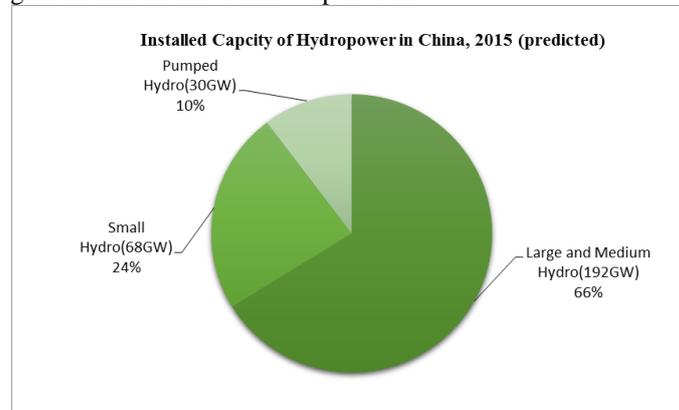


Figure 6. Installed capacity of hydropower in China, 2015 (Data source: NEA 2012)

5 CONCLUSION AND DISCUSSION

Through analyzing the national development plan of hydropower, we predicted its potential development, in order to achieve the goal of 15% energy generation from renewable sources in China, the vigorous development of hydropower is necessary.

REFERENCES

- China Digital Science and Technology Museum(CDSTM)., 2006. Water resource distribution. Available from: http://amuseum.cdstm.cn/AMuseum/diqiuziyuan/er2_0_1.html
- China Electricity Council, 2011. 2010 Statistics of electric power industry.
- China National Association of Engineering Consultants (CNAEC)., 2002. The development of small hydropower in rural areas in China. Available from: <http://www.cnaec.com.cn/Info/Show.asp?ID=163652>
- China power, 2012. Current status and prospects of pumped hydro storage in China. Available from: <http://www.chinapower.com.cn/article/1203/art1203418.asp>
- H, Xu., 2007. Current status and future trend of power sector in China. Available from: <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1215.pdf>
- International Energy Agency, 2010. Key Stats 2010.
- J, Cai., 2009. Hydropower in China. Available from: <http://hig.diva-portal.org/smash/get/diva2:276817/FULLTEXT01>
- M, Zeng., K, Zhang., D, Liu., 2013. Overall review of pumped-hydro energy storage in China: Status quo, operation mechanism and policy barriers. In *Renewable and Sustainable Energy Reviews* 17 (2013) 35–43. Available from: www.elsevier.com/locate/rser