

INNOVATION OF RENEWABLE ENERGY GENERATION TECHNOLOGIES AT A REGIONAL LEVEL IN CHINA: A STUDY BASED ON PATENT DATA ANALYSIS

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Overview

China's total energy consumption has, for many years, been amongst the highest in the world. China's annual primary energy consumption accounted for more than 90%, while the utilization rate of wind energy, solar energy, biomass and other renewable energies is still low. During the 12th Five Year Plan (FYP) period, the renewable energy industry was included as a key support of sustainable development and green growth. However, in China there is not only national policy support, local governments have also developed a lot of preferential policies to encourage enterprises to develop renewable energy industries and technologies.

Innovation is a key element of national power. A country's ability to develop new inventions or methods of production is always accompanied by the creation of wealth, leading in turn to higher technologies and fostering further innovation through the development of derivative products. China, as the leading developing country, has made huge progress in terms of technological innovation, especially in the fields of renewable energy industry.

In this paper, after Section 1: Introduction, Section 2 presents some background information; Section 3 explains why patents were chosen as an indicator of technological innovation and concludes with a review of the literature; Sections 4 and 5 explain the methodologies applied and the database, respectively; Results will be shown in Section 6, while Section 7 concludes and presents ideas for future research.

Methods

Revealed Technological Advantage Index (RTA), Relative Patent Advantage Index (RPA) and Revealed Patent Advantage Index (RPA*)

Results

Solar energy and wind power both account for an extremely large proportion of applications. The applications relating to these two technologies increased rapidly from 2006 to 2010, the period of the 11th Five Year Plan (FYP), and reached a peak 2011. From then on, the number of total applications for both solar energy and wind power decreased slightly in 2012 and dramatically in 2013. The numbers for 2014 and 2015 remained relatively steady. The other four technologies: geothermal energy, ocean energy, hydro power and biomass & waste energy - all represented very small proportion of total applications but one can clearly see that the growth rates are increasing over time.

If one compares the absolute patent applicants and RTA or RPA, it is noticeable that both Guangdong province and Shandong province, which ranked in the second tier in total patents applications, have negative (read no) specialization in this field. On the other hand, both Inner Mongolia and Qinghai show very strong specialization but the total number of applicants' are quite small. In Inner Mongolia, wind power technologies accounted for more than 60% of the total number and in Qinghai province solar energy technology's share is also over 60%.

Conclusions

As one can see, leading regions in terms of the number of both patent applications and REGT patent applications, such as Guangdong and Shandong provinces, do not show evidence of a specialization in these renewable fields, while other innovative regions, such as Jiangsu and Zhejiang provinces, did show evidence of a positive specialization in REGT but with relatively weak advantage levels. In China, both central government and local government should do more to promote innovation processes in these four regions. Moreover, against the background of high per capita income and strong R&D input levels, these four regions should consider developing high-tech technologies such as new materials and energy efficiency technologies.

On the other hand, some western regions like Inner Mongolia or Gansu province, which are strategically and economically important due to their richness in natural resources and their special geographical positions, should focus further on both solar and wind energy technology innovation. Smart grid-related technologies should be considered for long-term energy and electricity distribution.

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