Renewable and Sustainable Energy Reviews 79 (2017) 274–285

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Renewable and sustainable energy of Xinjiang and development strategy of node areas in the "Silk Road Economic Belt"

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ARTICLE INFO

Keywords:
Xinjiang
Renewable and sustainable energy
Silk Road Economic Belt
Development strategies

ABSTRACT

As an important energy base of China, Xinjiang is the key part of the "Silk Road" economic belt development strategy and is in an superior position. This paper analyzes the problems exist in the sustainable energy industry based on the distribution status of sustainable resources of Xinjiang. The evaluation index system of the application level of Renewable Energy Systems (RESs) is discussed using the wind farm as an example. Besides it investigates the advantages and disadvantages of the development process of each node in the "Silk Road" economic belt areas according to the current situation of the resources, economic and social development. Suggestions for the development of each area are proposed in the end. This paper will contribute to the sustainable development of renewable energy industry and economy in Xinjiang.

1. Introduction

China has always been challenged by great pressure coming from high energy demand, constraints to energy supply, severe damage of energy production, ecological environment consumption, and also weak energy technologies.

As suggested by the coal energy consumption and GDP growth in China shown in Fig. 1, China has maintained GDP growth at approximately 7.5% since 2012 [1], and its economic growth has turned into the new normal.

China proposed a "revolution" to promote the energy consumption, supply, technology and system in June 2014, among which, the revolution of energy production and consumption are the major goals. China commits itself to change the traditional energy layout dominated by coal to a diversified supply mode. The basic patterns of energy transportation in China are the large-scale and long-distance North-South coal transportation, the North-South oil delivery, the West-East gas transmission and the West-East power transmission, which are shown in Fig. 2.

On January 1, 2013, the State Council released the 12th Five-year Plan for Energy Development proposing the construction of five national integrated energy bases in Shanxi, Ordos Basin, Eastern Inner Mongolia, the Southwest and Xinjiang [2], as shown in Fig. 2. Integrated energy resources refer to the thermal power and new energy resources (hydropower, wind power, solar energy, etc.). For instance, Hami in Xinjiang has large reserves of coal resources and high quality coal in shallow burial depth and centralized distribution [3]. In addition, it is one of the 1000 kW wind power and photovoltaic bases in China, and also a large energy base where coal electricity and such clean energies as wind power and photovoltaic are developed on a large-scale basis.

In September 2013, President XI Jinping proposed the strategic vision of the "Silk Road Economic Belt" on his visit to Kazakhstan. The "Silk Road Economic Belt" covers an area of 50 million square kilometers in total and has a population of about 3 billion. It has abundant resources and is unique in terms of the potential market scale with eastward connection to the Asia-Pacific economic circle and a westward link to the European economic circle. Countries along the Road and Belt are highly connected in terms of economy and has formed great partnership potentials in the win-win development of transportation, finance and energy fields. It is known as the longest economic corridor with the greatest development potentials globally.

Xinjiang, as an important energy base in China, it connects advanced provinces in East China eastward, and links to the Central Asia countries westward. It has a key geological location and obvious location advantages. In addition, with the connection with the Central Asian countries in terms of history, culture, customs and habits, Xinjiang has gained unique superiorities as a strategic hub on the "Silk Road Economic Belt". The introduction of the "Silk Road Economic Belt" strategy brings new energy that accelerates the development of Xinjiang under industrial development and creates large space for the economic growth in Xinjiang. Xinjiang is now at the stage

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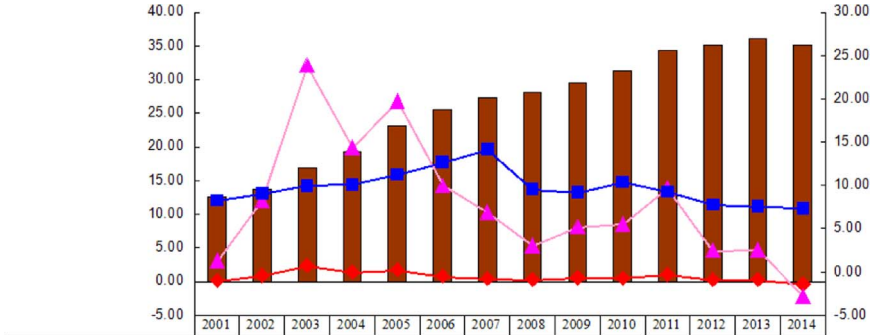
http://dx.doi.org/10.1016/j.rser.2017.05.031
Received 3 March 2016; Received in revised form 23 March 2017; Accepted 10 May 2017



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Consumption/Million t	12.62	13.66	16.92	19.36	23.19	25.51	27.27	28.11	29.58	31.22	34.25	35.20	36.10	35.10
Consumption Elasticity	0.16	0.91	2.39	1.43	1.75	0.79	0.49	0.32	0.57	0.53	1.04	0.32	0.34	-0.37
Consumption GR/%	1.34	8.24	23.88	14.40	19.76	10.01	6.93	3.06	5.24	5.54	9.70	2.50	2.56	-2.77
GDP GR/%	8.3	9.1	10.0	10.1	11.3	12.7	14.2	9.6	9.2	10.4	9.3	7.8	7.6	7.4

Fig. 1. Coal energy consumption and GDP growth in China.

of transformation from the later part at the beginning of industrialization to the middle part, while the main support of economic growth is the heavy industry supported by coal, iron & steel and chemical industries. Energy and energy products play a key role in the "road map" of industrial development in Xinjiang. Influenced by the "material-based consumption" energy supply and consumption mode where coal serves as the primary resource, Xinjiang gains growth in the ten thousand yuan GDP in the tide of energy saving and emission reduction of industries in China, with increased energy consumption by 6.46% per the ten thousand yuan GDP in 2014. Despite the development, it receives much stress on energy saving, emission reduction, ecological environment and water resources [4–6].

This paper investigates important nodal cities and areas including Hami, Changji and Shihezi in the "Silk Road" economic belt, reviews the distribution of renewable energy resources in Xinjiang, summarizes existing problems and proposes the suggestions for development of related industries in nodal areas. This study will contribute to the sustainable development of both energy resources and economy in Xinjiang.

2. Current conditions of renewable energy resources in Xinjiang

As an important strategic energy base in China, Xinjiang tops the list with proved reserves of various major energy resources including oil, gas, coal and also new energy resources. In 2012, the central government listed Xinjiang as the 14th large scale coal base in China, and clearly presented on the Central Panel for Work in Xinjiang that Xinjiang should be built into the "three-base and one channel" of energy resources in China: a large scale coal, coal electricity and coal chemical industrial base, a large scale oil and gas production, processing and storage base, a large scale wind power base and an onshore national energy resource channel [7].

Xinjiang is rich in reserves of renewable energy resources including wind power, solar energy, dry air energy and biomass, thus having superior development conditions. In particular, solar energy and wind energy resources have gained remarkable achievements in their development and utilization. Building Xinjiang into a new energy resource industrial base will foster new energy resource industries in the Central and Western Asia areas, which will prompt the development of new

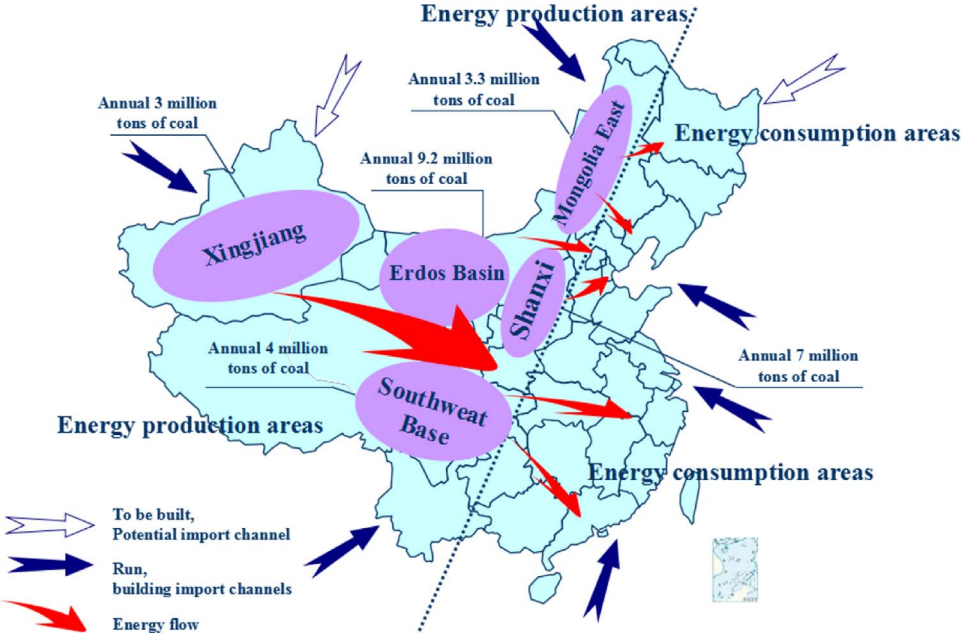


Fig. 2. Energy flow in China.