

Adaptability of “Twelfth Five-Year” Plan for Energy Industry to Environmental Protection

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Abstract: In China, long-term contradiction and short-term problems of energy development are intertwined currently, and the international pressure of climate change is increasing. This paper will discuss whether could we meet the goals proposed in the “Twelfth Five-Year” Plan for energy industry in current development trend based on the method of scenario analysis, in order to provide a basis for policy formulation and adjustment.

Keywords: energy industry, twelfth five-year plan, environmental protection, adaptability.

INTRODUCTION

In China, currently, long-term contradiction and short-term problems of energy development are intertwined, domestic and international factors influence each other, resource and environment constraint will be further intensified, and energy conservation and emission reduction situation will be even more severe. Meanwhile, the energy structure is mainly based on coal, extensive pattern of development and utilization also increased pressure on resources and the environment. Large amount of water resources was consumed or contaminated, accumulation of coal gangue occupied and polluted a large number of land, areas affected by acid rain reached 1.2 million square kilometers, and the major pollutants and greenhouse gas emissions were all top-ranked worldwide. It's difficult for domestic ecological environment to constantly bear extensive development, the international pressure of climate change is increasing, which demands urgently for green transmission. The “Twelfth Five-Year” Plan for energy industry proposed definite requests: By 2015, carbon emission per unit of GDP should be 17% lower than that in 2010, sulfur dioxide and nitrogen oxide emission per KWH of coal-electricity should both drop down to 1.5 grams, emission intensity of particulate matter (PM2.5) produced by energy development and utilization should fall by more

than 30%, and land reclamation rate in coal mining area should be over 60%. This paper will discuss whether could we meet the goals proposed in the “Twelfth Five-Year” Plan for energy industry in current development trend based on the method of scenario analysis, in order to provide a basis for policy formulation and adjustment.

ADAPTABILITY OF ENERGY PLANNING TO ENERGY CONSERVATION AND EMISSIONS REDUCTION TARGETS

Energy saving target

According to the “Twelfth Five-Year” Plan, the energy consumption per unit of GDP in 2020 will drop by 31% compared with that in 2010. Currently, the “Twelfth Five-Year” Plan has preliminary planned to stipulate that the descent range of energy consumption indicators per unit of GDP shall be 16% within next five years, namely energy consumption per unit of GDP will decrease from 1.034 tons of standard coal in 2010 to 0.869 tons in 2015 (By 2005 prices). Energy consumption per unit of GDP is the ratio of primary energy's total supply and GDP, it's also the main indicator reflecting energy consumption level and saving situation, and directly reflects the dependence of economy development on energy. Moreover, it reflects various aspects such as the situation of industrial structure, technical equipment levels, and

energy consumption structure and utilization efficiency. It might be difficult to improve the descent velocity of the energy consumption during the period of “Twelfth Five-Year” Plan if only temporarily enforce energy saving policies to reduce energy consumption per unit of GDP such as power rationing without vigorous transformation of economic development pattern or improvement of energy utilization efficiency and equipment technical level.

Compared to the completion situation of the “Eleventh Five-Year” Plan, the “Eleventh Five-Year”

Plan required that energy consumption per unit of GDP in 2010 should be 20% lower than that at the end of “Tenth Five-Year” Plan. By the end of 2009, two municipalities Tianjin and Beijing had already reached the energy saving target; while Hubei, Hunan, Guangxi and other 22 provinces (regions and cities) had completed more than 80% of the progress. However, the energy saving and emission reduction work in west region lagged far behind as a whole. That showed the process in west region was relatively slower than that in mid-eastern region for the influence of economic and technical factors.

Table-1. Regional energy consumption index per unit of GDP during 2007-2008 (TCE/10KRMB)

region/year	2007	2008	2009	2010
North China	1.727	1.610	1.491	1.428
Northeast China	1.526	1.450	1.287	1.227
East China	0.953	0.905	0.858	0.826
Central south China	1.133	1.076	1.030	0.996
Southwest China	1.867	1.771	1.591	1.227
Northwest China	2.503	2.376	2.223	2.197

Data sources: China Statistical Yearbook (2008-2011).

According to regional energy consumption index of per unit of GDP during 2007-2008 (table 1.), this paper fitted the trend figure of regional energy saving and emission reduction situation in next five years (figure 1 to

6), and get fitted linear equations, which were used to evaluate that how much energy consumption per unit of GDP might decrease during the period of “Twelfth Five-Year” Plan.

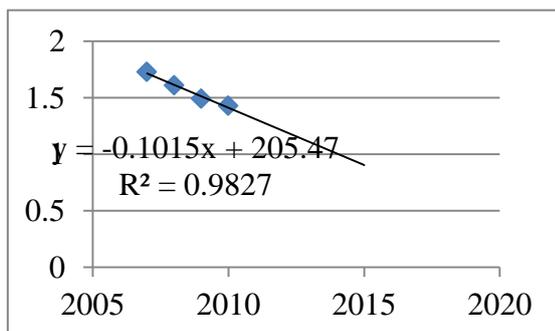


Fig-1. Energy consumption prediction per unit of GDP in North China

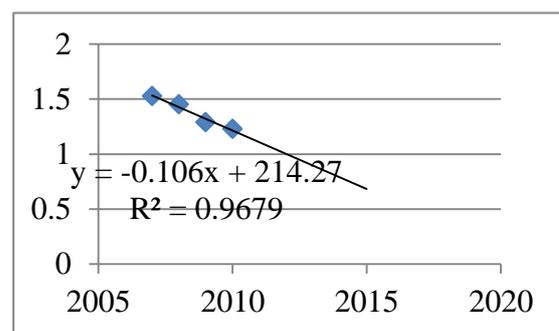


Fig-2. Energy consumption prediction per unit of GDP in Northeast China

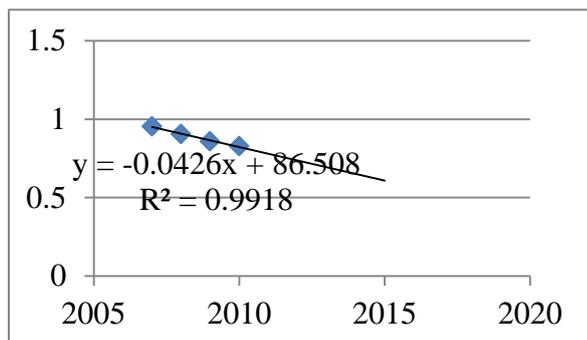


Fig-3. Energy consumption prediction per unit of GDP in East China

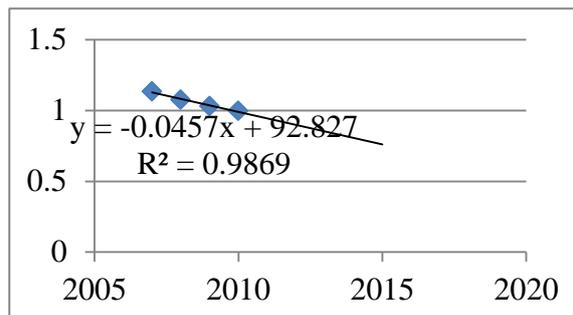


Fig-4. Energy consumption prediction per unit of GDP in Central south China

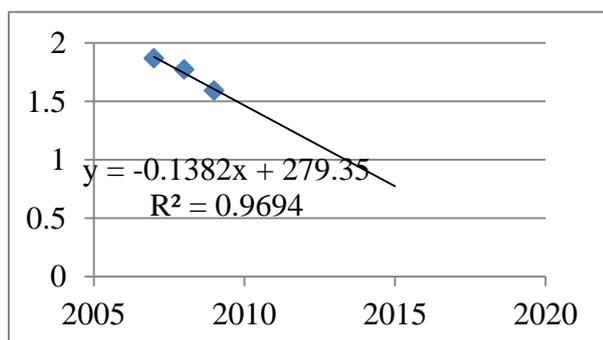


Fig-5. Energy consumption prediction per unit of GDP in Southwest China

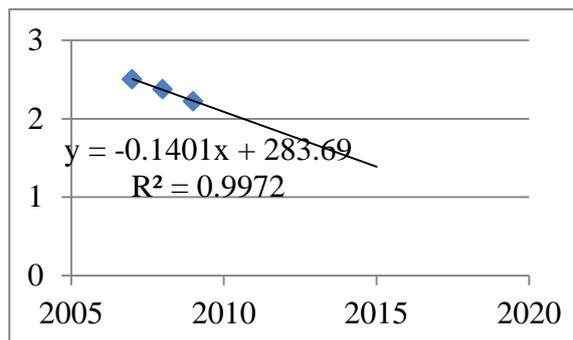


Fig-6. Energy consumption prediction per unit of GDP in Northwest China

According to the fitting formula, this paper draws a conclusion that if the rate of descent keeps invariant, the average level of energy consumption per unit of GDP may reduce to 94.8 tons of standard coal per million Yuan in North China, 68 tons of standard coal per million Yuan in Northeast China, 48.3 tons of standard coal per million Yuan in East China, 74.2 tons of standard coal per million Yuan in Central South China, 87.7 tons of standard coal per million Yuan in Southwest China and 138.9 tons of standard coal per million Yuan in Northwest China. Furthermore, the energy consumption per unit of GDP in 2015 is 78.7 tons of standard coal per million Yuan based on the weighted average calculation of regional GDP proportion, 23.89% lower than that in 2010 (while the target was 16%). The result indicates that the energy saving situation could well meet the requirement proposed in the “Twelfth Five-Year” Plan by 2015 if continue implementing current energy saving and emission reduction efforts.

Emission reduction target

Faced with challenges of climate change, executive meetings of the State Council decided to

bring the clause “CO₂ emissions per unit of GDP should be 40%-45% lower than that in 2005 by 2020” in Copenhagen Commitment into medium and long term national economic and social development plans as a constraint index, and formulated relevant methods of domestic statistically analyzing, monitoring and assessing. In August 2012, the “Twelfth Five-Year” Plan of energy saving and emission reduction pointed out that national chemical oxygen demand and sulfur dioxide emissions should be controlled under 23.476 million tons and 20.864 million tons respectively, 8% lower than 25.517 million tons and 22.678 million tons in 2010, decreased by 6.01 million tons and 6.54 million tons respectively; total emissions of national ammonia nitrogen and nitrogen oxides should be controlled under 2.38 million tons and 20.462 million tons respectively, 10% lower than 2.644 million tons and 22.736 million tons in 2010, decreased by 0.69 million tons and 7.94 million tons respectively. The State Council issued the “Twelfth Five-Year” Plan for controlling GHG emissions on January 13, 2012, the main objective was that reduced CO₂ emissions per unit of GDP significantly, which should be 17% lower than that in 2010 by 2015.

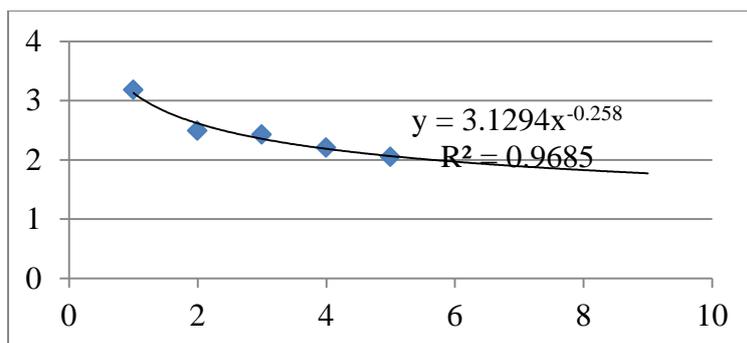


Fig-7. Trend and forecast of CO₂ per unit of GDP during 2005-2011

The paper fitted national CO₂ emissions per unit of GDP from 2012 to 2015 according to the data during 2005-2011, and then estimated how much it might reduce during the period of “Twelfth Five-Year” Plan. Using related tools can make trend figure 7, and then we can get the fitted equation. Since carbon emission per unit of GDP is a kind of carbon constraint, it will be increasingly difficult to reduce the emission in the process of implementing energy saving and emission reduction work, thus we will use exponential function to fit. It follows that theoretically, the national energy consumption per unit of GDP may reduce to 17.753 tons per billion Yuan, 19.46% lower than that in 2010 (while the planned rate was 17%) which could well reach the target if continue implementing current energy saving and emission reduction efforts.

ADAPTABILITY OF ENERGY PLANNING TO RENEWABLE ENERGY DEVELOPMENT TARGET

The target of the “Twelfth Five-Year” Plan is that clean energy (including nuclear power) accounts for 11.4% of primary energy consumption in 2015. Table 2 and table 3 indicate that clean energy (including renewable energy and nuclear power) capacity will be 0.58 billion tons of standard coal, accounting for 12.3% of total capacity (4.714 billion tons of standard coal). It follows that it will reach the target proposed during the period of the “Twelfth Five-Year” Plan for clean energy with the implementation of the energy plan.

Table 2. Production capacity and installed capacity in various energy industries during the “Twelfth Five-Year” energy plan

index	unit	2012	2015	Average growth rate
1、 Coal				
Coal production	Billion tons	3.66	4.1	3.86%
Coal installation capacity	Billion KWH	0.82	0.96	5.39%
Standard coal consumption	gram/KWH	326	323	
2、 Oil				
Oil production	Billion tons	0.2	0.2	0.00%
Import volume	Billion tons	0.12	0.37	45.55%
External dependence		58%	65%	
3、 Natural gas				
Natural gas production	Billion CBM	106.73	176	18.14%
Coal-bed gas	Billion CBM	12.5	30	33.89%
Import volume	Billion CBM	42.5	93.5	30.06%
NG installed capacity	Million KW	38.27	56	13.53%
4、 nuclear power				
Installed capacity	Million KW	12.57	40	47.09%
5、 renewable energy				
Utilization per year	Million TCE	286(in 2010)	478	10.82%
Gross generation	Billion KWH	884.5	1203	10.80%
1.hydropower (not including pumped storage)		759.5	910	6.21%
2.grid-connected wind power		100.4	190	23.69%
3.solar power		3.5	25	92.59%
4.biomass power		21.143	78	54.52%

Table 3. Production capacity in various energy industries in 2015

index	unit	2015	Million TCE
Coal production	Billion tons	4.1	2929
Oil production(including import)	Billion tons	0.57	814
NG production (including import)	Billion CBM	269.5	358
Coal-bed gas production	Billion CBM	30	33
Nuclear power capacity (7812utilization hours)	Thousand KW	40000	102
Utilization amount of renewable energy	Million TCE	478	478
Total			4714

CONCLUSIONS

In this paper, after calculating energy consumption per unit of GDP, carbon emissions per unit of GDP and renewable energy production based on current trends, the conclusion shows that energy consumption per unit of GDP in 2015 is about 78.7 tons of standard coal per million Yuan, 23.89% lower than that in 2010, and reach the 16% target; CO₂ emission per unit of GDP is about 17.753 tons per billion Yuan, 19.46% lower than that in 2010, and also reach the 17% target; total capacity of clean energy (including renewable energy and nuclear power) is 580 million tons of standard coal, accounting for 12.3% of total capacity (4.714 billion tons of standard coal), and realize the target of clean energy proportion as well.

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