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[Baoding]

A global “Electric Valley” for sustainable energy production?

A litmus test for the world’s commitment to renewable energy

Introduction

Title:
“Baoding. A global “Electric Valley” for sustainable energy production?
A litmus test for the world’s commitment to renewable energy”

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Introduction

China is the factory of the world providing us with a large variety of products at an affordable price. Lowering prices on renewable energy and energy efficiency products is also a key issue in our battle to mitigate climate change.

Baoding is recognized by the Chinese Government as a first and only industrial base for development of China's new energy sector. The world needs a dramatic increase in renewable energy if we are to be able to secure a sustainable energy supply for the global economy and avoid dangerous climate change. Baoding is therefore a key to global sustainable development.

This is an introduction to Baoding providing an overview of Baoding's rapid development, potential future role, some preliminary results and assessments, as background for a visit to Baoding by China Council (CCICED) and OECD embassies in Beijing.

The report provides a global overview of the situation for renewable energy, both from a business as usual perspective and from a perspective where significant reductions are achieved. Then an overview of Baoding is given, including the current production of renewable energy, brief presentation of two of the new and leading Chinese renewable energy companies and projections for Baoding's future renewable energy production. Thirdly the report provides an assessment of Baoding's potential to contribute to global CO_2 emissions reductions by becoming a world leading producer and exporter of renewable energy goods.

A more full report with analysis of Baoding's renewable energy sector and recommendations is under development to provide information to domestic and international stakeholders on how they, in different ways, can support Baoding to reach its full potential. Increased trade, technology transfer, education and joint strategic cooperation are key issues. This will also include full CO_2 emissions reduction potential.

In order to be able to tackle the climate change challenge we need to marry the best of East and West. Baoding is a place to commit to such a lasting partnership. In many ways Baoding is a litmus test for the world's commitment to renewable energy.

1. Analysts agree: The world needs renewable energy

Global warming and global energy demands

With the increasing global concern regarding energy supply and global warming, many leading institutes invest significant resources in efforts to forecast the energy needs and the different available solutions that can meet the future energy demand. Even if the detailed figures are different in the various scenarios - such as the ones of the International Energy Association's (IEA) *World Energy Outlook 2007*, the oil-company Shell and the UN Intergovernmental Panel on Climate Change (IPCC) - conclusions are basically the same: The trend of energy demand under a business as usual reference scenario will climb rapidly with a growth rate of around 50% between 2005 and 2030.

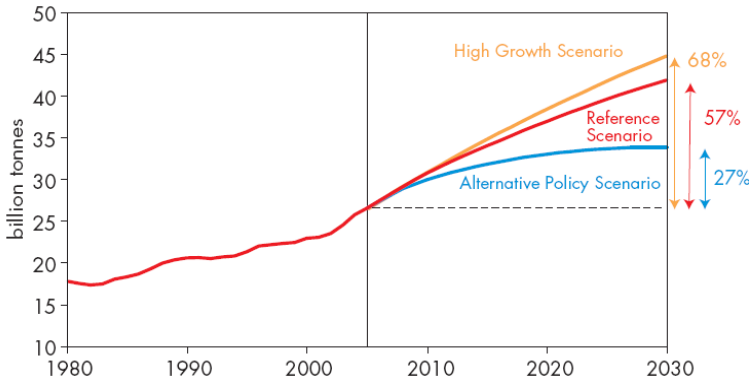

Figure 1: Energy related CO_2 emissions by scenario (IEA 2007).

There is a scientific consensus (IPCC) that business as usual till 2030 will provoke global warming of more than an average +2° Celsius during this century, the estimated threshold for large scale changes in the global climate system. The effects of such warming are predicted to be severely detrimental, first and foremost for the populations in the developing world including China.

Main authoritative scenarios agree that USA, the European Union (EU), China and India by 2030 will be the main energy consumers with China becoming the world's largest. Some $22 trillion of investment in supply infrastructure is needed to meet projected global demand where China will account for $3.7 trillion (IEA 2007) from 2005 to 2030. China's primary energy demand is projected to double from 2005 to 2030, relying heavily on CO_2 intensive coal. This effectively implies that *how* China's energy needs are provided over the next decades will decide to what degree mankind can reduce global CO_2 emissions in the 21st century.

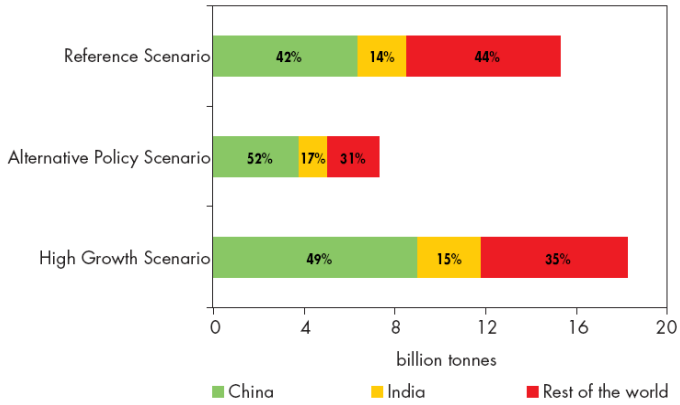

Figure 2: Energy related CO_2 emissions by region and scenario for 2030, country totals (IEA 2007). The increased percentage of total for China and India reflects the recognition that China and India have legitimate development needs and that most CO_2 emission reductions therefore shall happen in the OECD countries (here in the group "Rest of the world").

IEA's alternative policy scenario demonstrates that a reduction of energy related CO_2 emissions by at least 27% versus a reference scenario is possible, provided that new policies for sustainable energy development now under discussion are being implemented (ref. figure 1 above). The role of renewable energy in the future will, however, depend on the choices of the four main parties: USA, EU, India and China.

> Successful application in China of alternative policies that are now under discussion is estimated to result in a 15% reduction of China's primary energy demand till 2030 (IEA 2007), which equals a reduced consumption of more than 500 million tons of oil and thereby effecting a reduction of future CO_2 emissions by 1250 million tons.

The role of Wind and Solar PV Power

The Global Wind Energy Outlook (Global Wind Energy Council 2006) examines the future potential for wind power up to year 2050. The report estimates that wind energy has potential to account for 35% of primary energy demand by 2050, provided that all policy options for renewable energy and energy efficiency are adopted. By 2020 wind power may account for 16.5 % of global energy demand, thereby saving 1.5 billion tones of CO_2. Under the reference wind power scenario wind energy will supply just 5 % of the world's electricity by 2030 and 6.6 % by 2050.

SUMMARY OF GLOBAL WIND ENERGY OUTLOOK SCENARIO FOR 2030

Global Scenario	Cumulative wind power capacity (GW)	Electricity output (TWh)	Percentage of world electricity (High Energy Efficiency)	Annual installed capacity (GW)	Annual investment (€ bn)	Jobs (million)	Annual CO_2 saving (million tonnes)
Reference	364	892	5 %	24.8	21.2	0.48	535
Moderate	1,129	2,769	15.6 %	58.3	45.0	1.14	1,661
Advanced	2,107	5,176	29.1 %	129.2	84.8	1.44	3,100

SUMMARY OF GLOBAL WIND ENERGY OUTLOOK SCENARIO FOR 2050

Global Scenario	Cumulative wind power capacity (GW)	Electricity output (TWh)	Percentage of world electricity (High Energy Efficiency)	Annual installed capacity (MW)	Annual investment (€ bn)	Jobs (million)	Annual CO_2 saving (million tonnes)
Reference	577	1,517	6.6 %	34.3	28.8	0.65	910
Moderate	1,557	4,092	17.7 %	71.0	54.2	1.39	2,455
Advanced	3,010	7,911	34.3 %	168.6	112.0	2.80	4,747

Figure 3: Summary of Global Wind Energy Outlook scenarios till 2030 and 2050 (GWEC 2006).

For the advanced scenario to kick in the report estimates that the capacity for wind power generation by 2030 needs to double in Europe, increase six-fold in North America, and increase more than thirteen-fold in China and South Asia. To realize the full potential of wind power to address global energy demand, rapid development of the wind power sector is particularly needed in China and India.

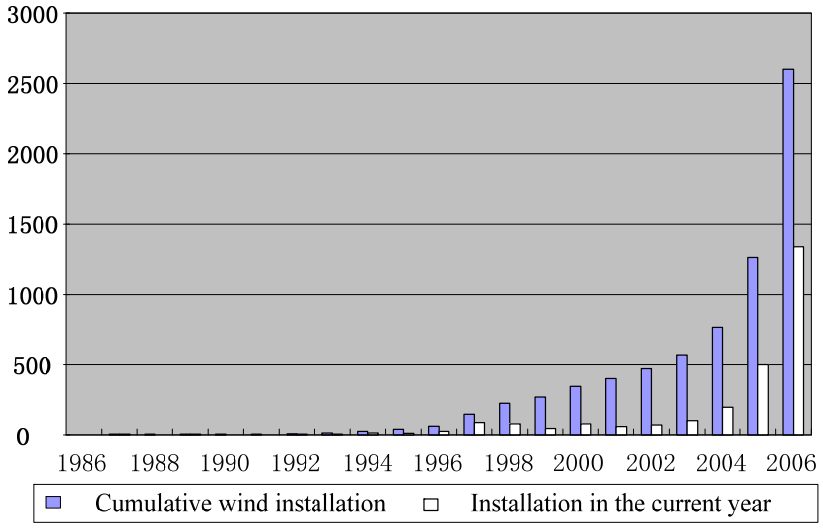

Figure 4: The Increase of Wind Power Installed Capacity in China, unit = MW. China New Energy Report 2007.

Compared with the wind power industry the solar photovoltaic (PV) industry is still young and large scale contribution to global energy demand lies further into the future. The European Photovoltaic Industry Association (EPIA) estimates current (2007) global solar PV capacity to 9 GWp.[1] The EPIA

[1] European Photovoltaic Industry Association (EPIA): "Global Market Outlook for Photovoltaics until 2012: Facing a

"pessimistic" scenario projects a global increase in solar PV capacity to ca. 33.5 GWp by 2012. The "positive" policy driven scenario presupposes follow up and/or introduction of support mechanisms, namely feed-in tariffs, in a large number of countries. Given current policy trends this scenario is considered more realistic and projects global capacity to increase to 44 GWp. This will mean that the global PV market will in 2012 be five times bigger than in 2007.

Solar PV power is on the way to become a major global energy source. The European Commission's Joint Research Centre (ECJRC) projects that solar PV power could contribute over 10% of global electricity supply by 2030, 20% by 2040 and 60% by the end of the century.[2] The *China Solar PV Report 2007* projects that solar PV power in China will increase 180-fold from 2004 till 2030, from 0.0078 TWh to 14 TWh. By 2050 solar PV in China may reach installed capacity of 100 GWp with an annual production of 150 TWh.

The ECJRC projects that renewable energy may contribute 80% of world energy demand by 2100.

A boom in policies and tools supporting renewable energy

The framework conditions for the renewable energy sector are improving rapidly globally, providing increased security for investments in the sector and spurring innovation and strategic partnerships among those aiming to become leading energy companies in a future low carbon economy.

Policy targets for renewable energy currently exist in at least 66 countries worldwide, including all 27 European Union countries, 29 U.S. states (and D.C.), and 9 Canadian provinces. Most targets are for shares of electricity production, primary energy, and/or final energy by a future year. Most targets aim for the 2010–2012 timeframe, although an increasing number of targets aim for 2020. There is now an EU-wide target of 20 percent of final energy from renewable by 2020, and a Chinese target of 15 percent of primary energy from renewable by 2020. Besides China, several other developing countries adopted or upgraded targets during 2006/2007.

Sunny Future", 2007.

[2] Quoted from Li Junfeng and Wang Sicheng: "China Solar PV Report 2007", published by CREIA, Greenpeace China, EPIA and WWF 2007.

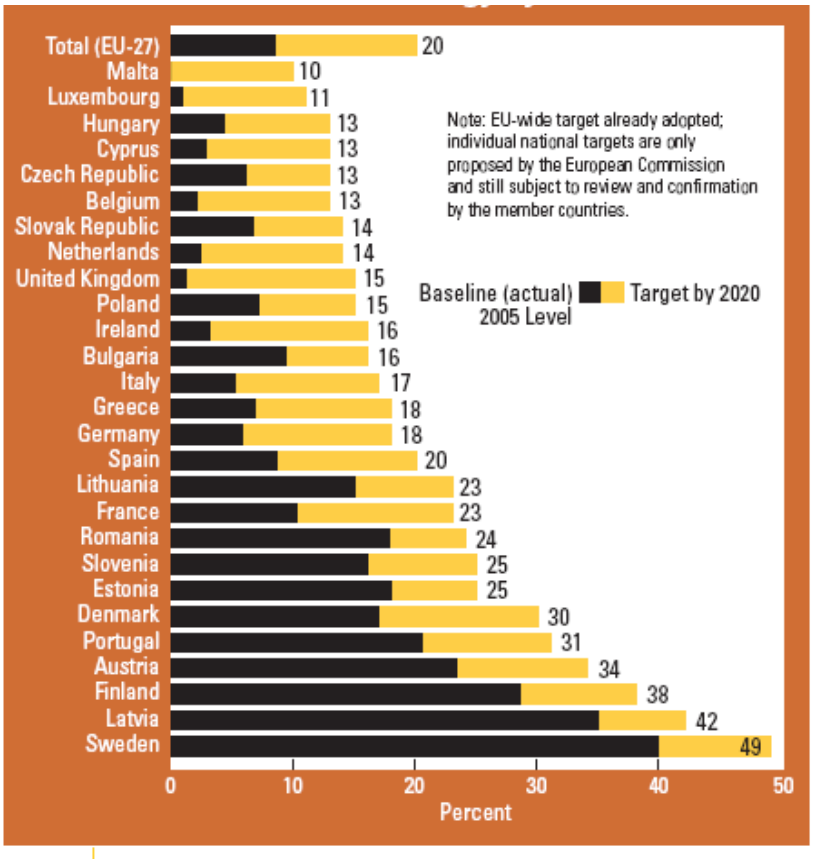

Figure 5: EU targets for renewable energy, share of final energy by 2020.

National policies to promote renewable energy have mushroomed in recent years. At least 60 countries — 37 developed and transition countries and 23 developing countries — have some type of policy to promote renewable power generation. The most common policy is the feed-in law, a legal obligation on utilities to purchase electricity from renewable sources. By 2007, at least 37 countries and 9 states/provinces had adopted feed-in policies, more than half of which have been enacted since 2002. Strong momentum for feed-in tariffs continues around the world as countries enact new feed-in policies or revise existing ones. At least 44 states, provinces, and countries have enacted renewable portfolio standards (RPS), also called renewable obligations or quota policies. There are many other forms of policy support for renewable power generation, including capital investment subsidies or rebates, tax incentives and credits, sales tax and value-added tax exemptions, energy production payments or tax credits, net metering, public investment or financing, and public competitive bidding. And many developing countries have greatly accelerated their renewable electricity promotion policies in recent years, enacting, strengthening, or considering a wide array of policies and programs.

China's targets for Energy Efficiency, Wind Power and Solar Energy			
	Current status	2010	2020
Energy efficiency		20% per unit GDP	
Wind power	6 GW (2007)	5 GW installed capacity	30 GW installed capacity
Solar energy	100 MW (2007)	300 MW installed capacity	1800 MW installed capacity

Figure 6: China's targets for Energy Efficiency, Wind Power and Solar Energy.

On state/provincial level, municipalities around the world are setting targets for future shares of renewable energy for government consumption or total city consumption, typically in the 10–20 percent range. Some cities have established carbon dioxide reduction targets. Many cities are enacting policies to promote solar hot water and solar PV, and are conducting urban planning that incorporates renewable energy.

The conditions for the renewable energy sector are certainly improving, but still many practical challenges remain in order to realize the potential of this sector. In the IEA business as usual scenario the share of renewable energy in the global energy mix grows from 8% in 2003 till only 9% in 2030. This is one of many clear signals that price of renewables need to come down in order for them to become mainstream. For this challenge China can play an important role. A good example of this is the solar thermal development where China has two thirds of the global market. System costs have fallen dramatically over the years and solar heating is therefore relatively affordable today, thanks to a combination of low-cost labour, cheap materials, and competition among a large number of domestic solar companies. Chinese companies now produce solar hot water heaters at costs that are one-fifth to one-eighth those found in the United States and Europe.

Baoding: A Chinese “Electric Valley” for the world?

Background; status, policies, development

Baoding is located in the middle of Hebei province in the People’s Republic of China, 140km south of Beijing and nearly halfway to the provincial capital Shijiazhuang.

Figure 7: Baoding (Hebei Province), the pilot city for renewable energy in China.

Baoding was approved as a National Development Zone in 1992 and is one of the 53 national level development zones in China. In 2002 the Baoding High-Tech Development Zone began developing a renewable energy industry. In 2003 Baoding was recognized by the National Ministry of Science and Technology as the first and only industrial base for development of China’s new energy sector.

Baoding’s industries related to renewable energy (wind, solar, energy efficiency) are becoming increasingly important in Baoding’s economic structure. In 2007 the renewable energy sector contributed 12% of the city’s GDP, a factor that is expected to increase to 40% by 2050. The last three years Baoding’s total GDP grew with an average of 14% per year, reaching 1.37 billion RMB in 2007, with the renewable industry being a main locomotive.

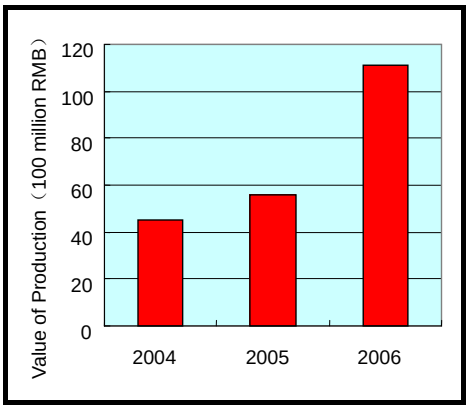

Figure 8: Gross production of new energy industry of Baoding 2004-2006

In 2006 the Baoding municipal government committed itself to the concept of Baoding as “China’s Electricity Valley” and decided that the corresponding further development of the renewable energy should be the nucleus of Baoding’s further development. The “valley” consists of companies and knowledge milieus focusing on wind power, Solar PV energy, solar thermal energy, biomass energy and energy efficiency. The municipal government also made a development plan for Baoding as China’s “Electricity Valley” with supporting policies including tax benefits for companies and investors.

Baoding Municipal Government targets for Wind Power and Solar PV

Wind Power Industry Development

In the next 5-10 years, 3-5 new players will emerge for wind turbine manufacturing, and 3-5 for blades, about 3 for control systems and over 10 for other components and spare parts. The production capacity of wind turbines will reach 1,600 MW, production capacity for blades will increase to 2,400 MW and the total production value exceed RMB 30 billion / year.

Solar PV Industry Development

In the next 5-10 years, three or more new players will come into the PV market, total production capacity will surpass 800 MW and the total value increase to RMB 50 billion / year. New products like silicon-film battery will be made.

Source: Baoding Municipal Government Development Plan for “China Electricity Valley” (2006)

The first half of 2007 there were more than 150 enterprises working in the new energy and energy equipment industries of Baoding. At the same time a group of enterprises developed that now are leading in China, such as ZhongHang (Baoding) HuiTeng Windpower Equipment Co. Ltd (“HuiTeng”) – China’s biggest domestic blade manufacturer - , and TianWeiYingLi New Energy Co. Ltd (“YingLi”), China’s biggest whole industry chain solar cell manufacturer.

Rocketing Chinese renewable energy companies

Zhonghang (Baoding) HuiTeng Windpower Equipment Co.

HuiTeng Windpower is the main domestic supplier in China of wind turbine blades, selling to most of the Chinese complete wind mill manufacturers. In 2007 HuiTeng's production capacity rocketed and reached 1528 MW and its domestic market share reached 40%.

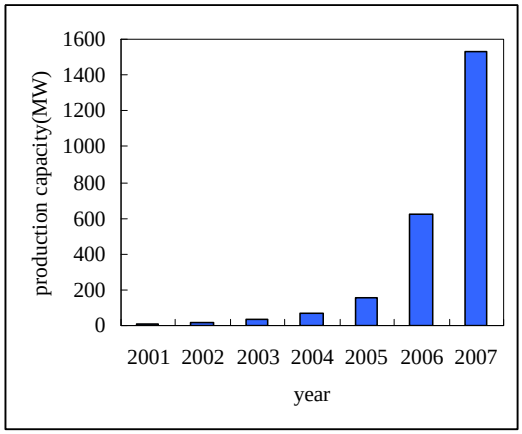

Fig. 9: HuiTeng production capacity 2001-2007.

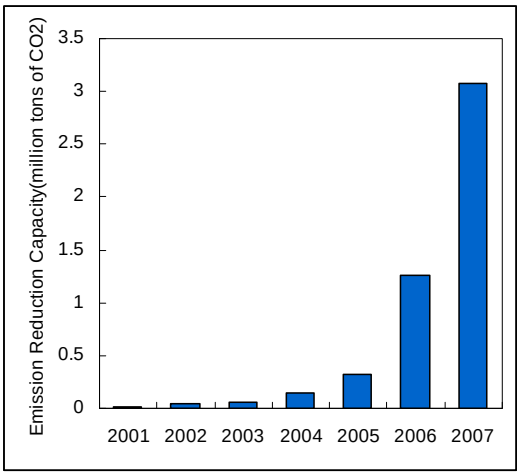

Fig. 10: HuiTeng CO_2 emission reduction capacity.

HuiTeng's estimated contribution to CO_2 emission reductions (through supplementing coal in the energy mix) increases rapidly and can be estimated to 3 million tons in 2007 (ref. methodology below). HuiTeng's annual income is rocketing: In 2005 sales income reached about 125 million RMB, in 2006 quadrupling to about 500 million RMB, and in 2007 total sales is expected to have reached 3.2 billion RMB – increasing more than six-fold from the previous year.

Baoding TianWeiYingLi New Energy Company

TianWeiYingLi ("YingLi") is the main manufacturer of solar photovoltaic production in Baoding. In 2007, its production capacity reached 200 MW - more than six times its production capacity in 2003.

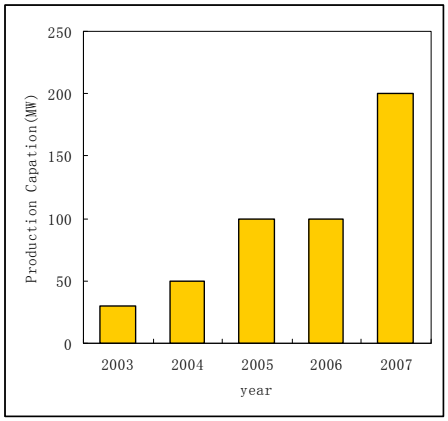

Figure 11: YingLI production capacity 2003-2007.

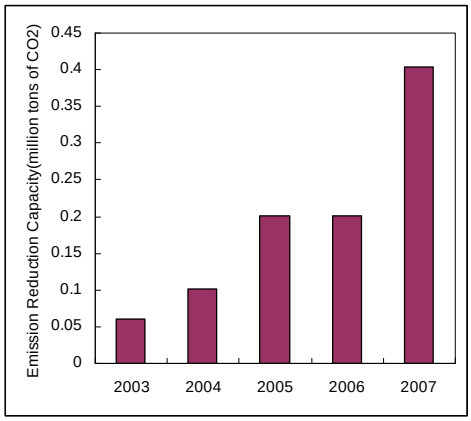

Figure 12: Yingli CO_2 reduction capacity 2003-2007.

In 2004 YingLi's income from sales was 124 million RMB; in 2005 more than quadrupling to 530 million RMB, and in 2006 reaching 2 billion RMB in sales income. The CO_2 emission reduction effect of YingLi products also increase rapidly, and reached a total of 400 000 tons in 2007 (for methodology see below.)

Baoding companies HuiTeng Wind and YingLi Solar compared with peers		
Company	*Revenue*	*Growth*
HuiTeng (2006)	0.5 billion RMB	400%
Suzlon (2007)	6.8 billion RMB (app.)	74%
Vestas (2006)	42 billion RMB (app.)	8%
YingLi (2006)	2.0 billion RMB	380%
REC (2006)	5.9 billion RMB (app.)	77%

Figure 13: Baoding renewable energy companies compared with peers including leading European enterprises.

As indicated in Figure 13 the Baoding companies are still relatively smaller than the largest companies in their sectors but it is also clear that the Baoding companies are growing very, very fast.

Baoding's potential to reduce CO_2 emissions globally

The total capacity generated of wind power and Solar PV energy in Baoding between 2002 and 2007 will result in approximately 118 million tons CO_2 reduction after 20 years of use. With current and projected development trends, this is set to grow exponentially.

Methodology:

In the period 2002-2007 436 MW of PV products were produced in Baoding. And assuming that the life time of PV equipment is 20 years and generating time is 2000 hours per year, the power generation within these products life time becomes 17.44 TWh. According to the Statistics of the Chinese National Electric Power Industry in 2007, the total coal consumption for power generation is 357 g/kWh. If the carbon content is calculated by 77%, this means that 17.578 m tons of CO_2 emissions will be avoided through using Baoding solar PV products. In the same period 2488 MW of wind power products were produced in Baoding. Calculated in the same way, this will lead to generation of 99.52 TWh of electricity power, equal to saving 35,529,000 tons of oil (tce) and avoiding emissions of 100.31 million tons of CO_2.

Challenges and the way forward

Baoding faces many obstacles and challenges, some simply arising from the fact that the development is so rapid. The renewable energy industry in Baoding report practical challenges related to access to and secure supply of necessary raw materials, lack of skilled personnel, room for improvement of necessary public services, intellectual property, market access, and not optimal conditions for innovation. The need and positive potential in technology transfer from the West is obvious. On a policy level, there is room for improvement of goals and framework conditions, maybe particularly with regards to Solar PV.

For the final report WWF will develop three different scenarios for the capacity of CO_2 emissions reduction by the renewable energy industry in Baoding considering the factors technology, cost and energy demand. This will be a signal to policy makers that Baoding development is partly in their hands and there is now an opportunity to support a success story.

One of the overall challenges is to link the availability and potential for mass-production of low cost renewable energy products in Baoding, to recognised needs and existing money flows in Chinese and global society. What role may for instance the Clean Development Mechanism under the Kyoto Protocol play in ensuring investments in developing Baoding's renewable industry further? Can training and development of skills in Baoding become part of OECD countries' development programs? And where do we find the win-win partnerships between Western renewable energy companies with state of the art technology and the rocketing Chinese renewable energy companies with potential for mass-production of low cost renewable energy products to the world?

These are issues WWF will follow up in our coming report on Baoding.


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