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China's energy policy in the light of climate change and options for cooperation with the EU

Note

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Authors: Mr. Jonathan Holslag
Bondgenotenlaan 28
3400 LANDEN

Administrator: **Camilla BURSI**
Policy Department Economy and Science
DG Internal Policies
European Parliament
Rue Wiertz 60 - ATR 00L08
B-1047 Brussels
Tel: +32-2-283 22 33
Fax: +32-2-284 90 02
E-mail: camilla.bursi@europarl.europa.eu

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TABLE OF CONTENTS

KEY FINDINGS AND RECOMMENDATIONS

Since the 1990s, China has been making impressive headway with its new comprehensive energy strategy and moved away from its obsession with coal and oil. Nowadays, it looks for renewable and clean sources of energy in order to deal with scarcity, environmental hazards and security risks. In this paper it is found that the EU's response to this new policy is only partially successful.

Without a doubt, Europe has facilitated China's shift to clean energy sources. European companies also successfully secured a part of the burgeoning Chinese green energy market. Yet, what is called "green" is certainly not always as green as it is ought to be. Several **clean energy projects cause severe collateral damage** and externalize environmental costs to other economic sectors or other regions in the world. The EU fells short to deal with these new challenges.

Europe should increase its efforts to complement the delivery of technologies with **supporting sub-national authorities** implementing them. This is necessary to prevent that pollution will relocate as economic development moves westward.

Apart from these environmental concerns, the EU should not be too confident about its position as a leading supplier of clean energy systems. The government and companies work hand in hand to develop China from a consumer market to a key competitor with international reach. For Europe this asks for comprehensive and well-organized programmes to **enhance its proper know-how**.

Another economic concern relates to the competition for overseas deposits of **natural gas.** It makes no sense to try to enter into a full-blown contest with China, but the EU needs to move towards a coherent and united strategy to secure its increasing natural gas demand. The consolidation of its **internal energy market**, the development of new upstream and downstream technologies, and a solid foreign energy policy should be a priority. Europe should also extend cooperation with China to upstream projects in Africa, Asia and Latin America, but it needs to do this as a **strong partner, not as a mere supplier of capital and know-how**.

In sum, a convincing response to China's evolving energy ambitions should be at least **as much about policies as about technologies.** Any European answer should maintain a careful balance between environmental and economic interests.

1. INTRODUCTION

Innovation is China's only way out of the Malthusian trap, and its government is well aware of this. For the People's Republic's mere survival, new clean sources of energy are a matter of life and death. Scarcity of conventional natural resources, international competition and the disastrous environmental damage due to the huge emission of gasses: all these factors instigated Beijing to embark on an impressive strategy to make its production and consumption of energy more sustainable. To start with, this paper briefly introduces China's new *comprehensive energy security* policy. Subsequently, it sheds a light on how the European Union tries to take advantage of this move, by stepping up its efforts to promote green energy and simultaneously tapping China's vast market. Afterwards, an assessment is made of the success of this European approach for wind and solar energy, clean coal technologies, natural gas, hydropower and bio-fuel.

2. CHINA'S COMPREHENSIVE ENERGY POLICY

2.1. The evolution of China's energy consumption

"Supply of energy is the crucial to our development," Deng Xiaoping stressed in 1988. Ever since, China's energy consumption has indeed been soaring. This evolution has been discussed in numerous reports with alarming charts and figures. For this paper it suffices to offer some key data. Between 2000 and 2006, China's share in global energy consumption increased from 10 to 15 percent. The People's Republic developed into the world's second-largest energy consumer and is set to pass the United States as the number one between 2015 and 2020.

More than 70 percent of the surge in its energy demand is caused by swift industrialisation. Even though energy efficiency steadily improves, the growing scale of industrial production continues to push energy consumption up to new heights.[1] The share of private energy consumption as well is on the rise. China sees its rural population replacing organic sources of energy with fossil fuels. The expanding number of private cars is another explanation for this remarkable increase. In 2005, 24 per 1,000 Chinese citizens owned a motorized vehicle. By 2020, this is expected to rise to 30 and 55 respectively. However, it should be emphasized that the Chinese energy use per capita only amounts to one third of a European citizen and one seventh of consumption per capita in the United States.

With more than 70 percent of national consumption coal has been the most important source of energy, followed by oil (21 percent), hydro power (5.6 percent) and nuclear energy (0.7 percent). Between 1997 and 2006, China's use of fossil fuels increased from 960 to 1,550 million tons of oil equivalent. This period, consumption of oil grew from 174 to 324 million tons.[2] China surpassed Japan as the second largest oil consumer. The use of natural gas increased from 18 to 47 billion cubic metres.[3] The reference case scenario of the US Energy Information Agency (EIA) predicts oil consumption to double again by 2030.[4] By then, consumption of gas will quintuple.

2.2. New priorities

Whereas China's economic takeoff was mainly powered by fossil fuels, for the consolidation Beijing tries to reduce its dependence on these particular sources. The People's Republic relies more and more on foreign supply of oil and gas. In the early 1990s, it was still a net-exporter of mineral fuels, but in 1996 it became a net-importer. Between 1993 and 2006, net-imports of oil surged from 0 to 51 percent.[5] Ever since, Beijing has been fretting about this increasing import dependence. On the one hand, its concerns related to energy security.

[1] Hu, Jin-Li and Wang Shih-Chuan (2006), Total-Factor Energy Efficiency of Regions in China, *Energy Policy*, vol. 34 (17).
[2] BP (2006), *Statistical Review 2006*, BP London.
[3] Ibid.
[4] EIA (2006), *International Energy Outlook 2006*, EIA, Washington.
[5] BP (2006), op. cit.

It became well aware of the increasing strategic vulnerability as a consequence of harsh competition with other countries and long insecure supply lines.[6] The government is also worried about the susceptibility to soaring and volatile commodity prices and the repercussions in terms of inflation and social stability. On the other hand, Beijing starts to face the unsustainable burden of burgeoning fossil fuel consumption on its habitat.[7] In 2005, Pan Yue, vice-minister of the State Environmental Protection Agency warned that "The economic miracle will end soon because the environment can no longer keep pace."[8]

Since the 1990s, China gradually shifted its energy policy from a fixation with coal and oil to a strategy that aims at saving energy and the diversification of supply, both geographically and among the available sources. In 1996, the Ninth Five-Year Plan spent attention to the conservation of energy and ordered the exploration of alternative sources.

In 1998, the State Development and Planning Commission (SDPC) and Ministry of Science and Technology launched a joint Incentive Policy for Renewable Energy. In 2001, China's Tenth Five-Year Plan highlighted renewable energy in the power industry's development strategy. "New energy development," the plan says, "should be a long-term strategy in energy implementation." It underlined the importance of commercializing photovoltaic and wind technologies, hydro-power, bioelectricity, geothermal energy, etc. In 2005, the Chinese Standing Committee of the National People's Congress enacted the Renewable Energy Promotion Law that promotes the development of the renewable energy market by establishing standards and encouraging private and public users. Concrete aims followed in 2006, when the National Development and Reform Commission in China (NDRC) revealed a plan to allocate 266 billion USD to renewable energy by 2020. The money will be spent on increasing hydropower production to 300 million kilowatts, wind power to 30 million kilowatts, solar energy to 1.8 million kilowatts and biomass to 30 million kilowatts. As part of the massive greenhouse gas reduction plan China intends to replace 12 million tons of oil with 2 million tons of bio-diesel and 10 million tons of bio-ethanol every year.

Renewable energy also is a clear priority in the Eleventh Five Year Plan, whose main ambition is the promotion of social and ecologically sustainable growth. In June 2007, China issued its National Climate Change Program, the first ever drafted by a developing country. This document encompasses various projects to restructure its economy, promoting clean technologies and improving energy efficiency. If these targets are achieved, China will emit 1.5 billion tons less carbon dioxide by 2010 while still continuing to grow rapidly. By 2020, it plans to develop 120,000 megawatt of renewable power.

[6] Zhang, Jie (2001), 9/11 yujing Zhongguo shiyou anquan [9/11 advance warning for China's oil security], *Jingji guancha bao* [Economic Observer], October 1, 2001; Zhao, Yining (2005), Quanqiu nengyuan hezuo: Zhongguo quexi?" [Global energy cooperation dialogue: China's absent?], *21 shiji jingji daobao* [21st Century Business Herald]; Zha, Daojiong (2005), Cong guoji guanxi jiaodu kan Zhongguo, de nengyuan anquan [China's energy security viewed from an international relations perspective], *Guoji jingji pinglun* [International Economic Review], no. 11–12; Downs, Erica (2007), China, Brookings Energy Securioty Series, Brookings Institution, Washington.

[7] Li, Junfeng, Shi, Jinli and Ma, Lingjuan (2006), *China: Prospects for Renewable Energy Development*, Energy Research Institute, Beijing; Karplus, Valerie (2007), *Innovation in China's Energy Sector*, Working Paper 61, Stanford University, March 2007.

[8] Quoted in: Economy, Elizabeth (2007), The Great Leap Backward, *Foreign Affairs*, vol. 85 (5), pp. 38

This would account for 12 percent to 16 percent of its total installed energy production capacity. China has set an objective of fulfilling 30 percent or more of its total energy needs with renewable sources by 2050. All in all, the People's Republic's clean energy policy rests on two main pillars: increasing efficiency and switching to less polluting sources. The latter includes as well renewable energy like wind, water and solar power as the efficient use of finite sources like clean-coal, gas and nuclear energy.

2.3. Results

China has booked remarkable results. In 2005 and 2006, it had the world's largest total investment in renewable energy sources with expenditures totalling 7 billion USD. By the end of 2006, China's renewable energy utilization amounted to 200 million tons of coal, representing 8 percent of total energy consumption in China. The production of hydro-power contributed the most to this surge. Electricity generated by dams doubled between 1997 and 2006. Zhang Guobao, vice-minister of the SDRC, made it clear that "China views hydropower as a clean energy source and an important part of our overall energy strategy in the years ahead."[9] Apart from dramatic projects like the Three Gorges Dam, China will ensure that installed capacity of smaller hydro power projects for rural areas will increase by more than 6 million kilowatt annually. Currently, 1,600 out of more than 2,000 districts nationwide have built small hydropower projects, and nearly 800 of them rely mainly on power supply by such projects. China is expected to have the capacity to generate 150 million kilowatts from hydroelectric power by 2015. The production of wind energy rocketed as well. In 2006 alone, 600 million USD was invested and brought the installed capacity in excess of 5,000 megawatt. According to the Brussels-based Global Wind Energy Council, China added nearly 1,350 megawatts of wind-generated electricity in 2006. China is now the eighth largest wind power producer in the world; analysts estimate that the total potential wind power generating capacity in China is in excess of 1 million megawatt. China's solar energy heaters grew to a scale of 90 million square meters by the end of 2006, accounting for up to 75 percent of the world's total holding.[10]

[9] China Invests in Hydro Power, *China Daily*, 27 September 2004.
[10] Chao, Liang (2004), Priority given to efficient hydropower, *China Daily*, 29 October 2004.

3. THE EU-CHINA PARTNERSHIP ON CLEAN ENERGY

The EU and China established a policy dialogue on energy in 1994 that convenes high-level European and Chinese representatives from industry and administration. Ever since, cooperation in this field has been intensifying: especially with regard to clean energy. About every year, both parties organize a bilateral energy conference that deals with particular energy sources and technologies from a technical and practioneers perspective. In 1999, a delegation of the European Parliament, the European Commission and high-ranking representatives from the industry, called on China to make an assessment of the co-operation between the EU and China in energy-related areas. From that moment, clean technologies gained prominence as focal point of the energy partnership.

In 2004, China and the European Commission jointly unveiled the five-year Energy Environment Programme (EEP), set up to encourage the formulation of good energy policies via assistance to central administrations and local authorities, and to stimulate the development of new technologies by providing funds for feasibility studies.[11] During the following years, the Programme was extended to various specific areas like biomass resources, rural power supply and offshore wind power. Between 2004 and 2006, not less than 22 workshops and conferences were organized in the framework of the EEP. In 2005, both parties signed two Action Plans, one with the objective of promoting Clean Coal Technologies and the other on Industrial Co-operation on Energy Efficiency and Renewable Energies.[12] The same year, a Memorandum of Understanding (MoU) to develop a new strategic dialogue on energy and transport as well as a Joint Declaration on Climate Change. In 2006, Commissioner Andris Piebalgs signed another MoU with the Chinese government on near-zero emissions power generation technology.[13]A growing number of joint projects came to existence, entailing all different energy sectors. Between 2001 and 2006, the EU has spent and approximate amount of 65 million USD to the support clean energy in China.[14]

Besides the European institutions, various member states initiated proper programs. Germany, The United Kingdom, Finland, the Netherlands and Denmark take the vanguard. Germany manages joint projects in all clean energy sectors. Between 2001 and 2006, various German national and Lander governments contributed at least 40 million USD to the promotion of new technologies. The UK runs 7 small-scale programs with China. In 2007, Finland offered 3 million USD of technical assistance to "support Nordic energy utilisation solutions" and Finnish energy technology exports like gas boilers, heat distribution systems and electricity. The country also set up a working group to investigate the opportunities for boosting environmental and energy technology trade with China.[15]

[11] More information about the Energy Environment Programme (EEP), see: www.eep.org.cn/index.php.

[12] *Towards a closer EU-China co-operation in the field of Energy*, Speech 06/105, China-EU Energy Conference, 20 February 2006.

[13] *European Commission and China step up co-operation on clean coal technologies and other energy issues*, Press Release IP/06/190, 20 February 2006.

[14] For an overview of all projects, see the website of the EU Delegation in Beijing: www.delchn.cec.eu.int/en/Co-operation/Project_Fiches.htm.

[15] Ahola, Eeva (2006), *Finnish energy technology heads to China, Ministry of Trade and Industry*, 9 March 2006.

Between 2001 and 2006, the Netherlands spent up to 35 million USD to clean energy projects in the People's Republic. In Western China, it runs a large-scale project to provide green electricity to remote villages.[16] Cooperation is also strengthened in the wind power branch.[17] In total, 9 European member states started clean energy projects with the People's Republic.

What drives Europe to funnel substantial means and time into the energy partnership with China? Unmistakably, there exists a sincere concern that the damage due to soaring energy consumption threatens both the international environment and the sustainability of China's role as the world's economic engine.

A German diplomat recalled: "More than 5 percent of our trade depends on the extent to which China succeeds in merging economic growth with environmental protection."[18] Enlightened self-interest is also applicable to China's position as a leading export market for European clean energy technologies. For instance, between 2001 to 2006 exports of wind mills to the People's Republic amounted to 201 million USD.[19] The same period, 230 million USD hydro power turbines were sold.[20] Photovoltaic systems represented a total export volume of 196 million USD.[21] Third, the EU is a key stakeholder in the formulation of a comprehensive energy security strategy that prevents China from manoeuvring itself into collision course with the EU with regard to the supply of mineral fuels.[22] Stimulating China to diversify its energy sources is expected to mitigate competition for conventional sources like oil and gas.

[16] Ontwikkelingssamenwerking met China, Embassy of the Netherlands to China, see: www.hollandinchina.org/new/index.php?option=com_content&task=view&id=218&Itemid=1110.
[17] *Nederland wil klimaatprojecten opzetten met China*, VROM, Amsterdam, 6 June 2006.
[18] Interview with German diplomat, Brussels, 4 September 2007.
[19] Comtrade (HS 2002, 85023).
[20] Comtrade (HS 2002, 8410).
[21] Comtrade (HS 2002, 854140)
[22] Interview with EU Commission Official, 4 October 2007.

4. ASSESSING THE EU CLEAN ENERGY COOPERATION WITH CHINA

The EU-China joint efforts to promote clean energy appear to be a double win-win situation. Not only, are both partners making headway with limiting environmental damage; the EU and China have also stepped up their commercial exchanges. But what are the prospects for the future? To what extent will China's conversion to more efficient and environment friendly energy policies contribute to the protection of *common goods* and the preservation of natural wealth? Will the European Union continue to succeed validating its scientific and technological lead at the Chinese market? Will the contest for energy sources between both players be mitigated? Following paragraphs will test these on 5 different areas: wind and solar energy, clean coal technologies, natural gas, hydropower and bio-fuel.

4.1. Wind and solar energy

Many European companies successfully bid for a part of China's expanding wind energy market. The Spanish wind turbine fabricant Gamesa, the Danish Vestas and German Nordex are top-5 suppliers of wind power installations to China. In 2006, over 50 percent of the large capacity windmills installed in China were imported from Denmark. Apart from the obvious ecological improvements resulting from this cooperation, economic returns to the European Union are and will remain uncertain. A first element is the pricing mechanism for wind power. The current system asks firms to submit bids that state how much they would charge for wind power from potential sites. Instead, many companies would like to see a feed-in tariff system, which guarantees wind farms a fixed premium above regular prices.[23] Second, government purchases are organized through a bidding system that pushes prices too low. Third, an increasing number of domestic companies is pilling into the sector and risk to trigger a downward spiral of price wars that squeezes profits for European companies.[24] Nowadays, four fifths of the necessary equipment is imported, but in 2006 China embarked on a policy to help domestic companies securing their part. The government also mandated that 70 percent of wind components have to be sourced locally by 2010, which means that most foreign wind companies are building factories in China, or working with a local partner.[25] In October 2007, even the defence sector rushed in. The Commission of Science Technology and Industry for National Defence ordered military industrial enterprises to accelerate the development of wind power and announced that it will set up two to three wind power generator manufacturers by 2020 with an annual production capacity of 2,000 sets. China will create eight to ten other manufacturing enterprises by 2015, producing wind power equipment components with an annual production capacity worth 2.66 billion USD.[26] A final constraint relates to the protection of intellectual property rights. Already, China's immature wind power companies are reported to make use of European and American technology to strengthen their own position. Hence, direct economic gains for the EU, both in terms of job-creation and profits, should not be overemphasized.

[23] *Study on the Pricing Policy of Wind Power in China*, Chinese Renewable Energy Industries Association (CREIA), Greenpeace and the Global Wind Energy Council (GWEC) Beijing, 26 October 2006.
[24] China Could Be Top Wind Market in 3 Years, *Reuters*, 24 September 2004.
[25] China to build wind farms offshore, *China Daily*, 17 May 2005.
[26] Military industry encouraged to explore wind power, *Xinhua*, 20 September 2007.

Similarly, the EU's eagerness for China's solar energy market might be short-lived. In this branch, European companies do not have to deal with intricate pricing mechanisms, as they mainly deliver the hardware. Likewise to the wind power sector, Chinese companies have been learning fast and start to challenge Western companies.[27] The Chinese government conceived a policy to build-up a leading photovoltaic industry that encompasses the entire production process from silicon supply to advanced systems. "Chinese cell and module manufacturers are rapidly establishing a significant share of the world market," a recent report signals "their production capacity increases are unrivalled."[28]

It appears that these companies are also intensively supported to position themselves to profit from the worldwide rush for solar energy. The government funds specialized fairs and finances a program to acquaint technicians and officials from 60 Asian, African and Latin American countries with (Chinese) solar-heating and photovoltaic products. Specialized in cost effective state-of-the-art photovoltaic systems, China's Suntech Power grew into the world's third largest solar energy company, and realized a successful international expansion.[29]

For both wind and solar power, China moves away from its reliance on foreign technologies. After a decade of absorbing foreign know-how, Chinese companies are more and more able to deliver qualitative products and seem to be successful in their first steps in overseas markets. If this trend persists, the People's Republic will evolve from a bonanza for European companies to an important concern due to restrictions in the domestic market on the one hand, and international competition on the other. It is not unlikely that EU-based production capacity will move to the People's Republic. In 2005, the first indications also became visible that the EU-China trade flows in solar systems might reverse as Chinese firms started to export high-end products to Germany.[30] It is recommended that the EU:

. Continues encouraging China to invest in wind and solar power;

. Stimulates demand for wind and solar power in its internal market;

. Supports European wind-power companies in conducting cutting-edge research and development;

. Protects future innovations in wind and solar power technology;

. Prepares for competition with Chinese wind and solar companies in third markets;

. Pursues an active export promotion policy towards other countries in Asia and elsewhere.

[27] *Development of China's Solar Cell Industry Annual Report 2006-2007*, FriedlNet and Partners, April 2007.
[28] *The Strategic Research Agenda*, Assembly of the Photovoltaic Energy Technology Platform, Berlin, 12 June 2007, p. 3.
[29] Suntech (2007), *Annual Report 2006*, Suntech, Wuxi.
[30] Hug, Rolf and Schachinger, Martin (2006), Chinese solar modules penetrating the German market, *The Solar Server*, 10 November 2006, see: www.solarserver.de/solarmagazin/solar-report_0806_chinese_e.html.

4.2. Clean coal

The EU is China's largest supplier of clean coal expertise and systems. In 2006, the European Commission and the Chinese government inked a MoU on clean coal technologies that aims at encouraging the development of technology for the capture and underground storage of carbon dioxide emitted from coal-fired power stations. The EU also assists China to build by 2015 a new power station to demonstrate technologies both for carbon capture and storage. Individual member states like Germany, the United Kingdom and the Netherlands launched projects to promote their know-how and products on the Chinese market.[31] According to Chinese sources, German companies conquered a market share as big as 50 percent in the treatment, desulflurization etc., of coal emissions. There is still much to explore, and the Chinese partners are rather slow getting acquainted with new technologies and their applications.

Yet there are two key challenges. Europe concentrates its cooperation mainly on the national level. Even though this is understandable for many logical economic reasons, the ecological problems are mainly located at the Province and District level. While the national government has been insisting since several years that coal power plants should be operated more efficiently, lower-level authorities are still investing in outdated technologies and small ineffective plants to meet their immediate needs. Hence, there is still much work to do, but it is not certain whereas European companies will be able to profit. As the government initiated a massive program for research and development on clean coal, it is a matter of time, a 10 years according to a leading scientist, before the Chinese companies themselves will be able to fulfil many of the national needs by themselves and to reach a level of expertise that is sufficient to curb the harmful emissions of coal centrals significantly.[32] Therefore it is recommended that the EU:

. Continues supporting China to modernize and to replace its coal power plants;

. Starts more projects at Provincial and District level;

. Continues investing in proper research and development that can be trade at the Chinese market;

. Maintains a leading edge in terms of innovation to anticipate on Chinese competition.

4.3. Natural gas

China's growing appetite for overseas natural gas deposits challenges European interests at three levels. First, European energy companies are likely to face more competition from their Chinese peers to obtain concessions. Until now, Western concerns had a leading edge due to their historical international presence, former investments in exploration projects, and their technological expertise to drill for gas in difficult places like offshore-sea and very deep sources. This lead will gradually diminish. Chinese companies become prominent investors in all parts of the world. Compared with most Western firms, they are funnelling more capital into exploration and research, and are prepared to take risks.[33]

[31] Philibert, Cédric and Podkanski, Jacek (2006), *International Energy Technology Collaboration and Climate Change Mitigation, Case Study: Clean Coal Technologies*, OECD/International Energy Agency, Paris.
[32] Interview by email with vice-director China Coal Research Institute (CCRI), Tangshan, 3 October 2007.
[33] For the period between 2001 and 2030, the IEA expects China's investments in gas to surpass these of Europe.

Moreover, through many joint ventures with more advanced Western firms, the national champions from the People's Republic start to acquire the know-how they need to bid independently for difficult extraction projects.[34]

Second, China's quest for foreign energy sources, e.g. natural gas, stems much more from a political strategy. Even though, Chinese experts and officials more and more underline that Beijing's steering capacity in the realization of energy needs is limited; the reality shows that state-owned energy companies are intensively supported and guided by the government. In this regard, the establishment of politics-to-politics relations is a much more important modus operandi than business-to-business partnerships. This high degree of political backing is incompatible with the approach of most European companies that are much less embedded in an overarching diplomatic charm offensive. In addition, the political and diplomatic arguments that are used to coax up to foreign partner governments often run opposite to the political benchmarks and expectations of the EU. The subsequent loss of diplomatic clout in turn reduces the chance for the EU and individual member states to pursue an energy policy that enshrines standards like transparency and good governance.

Finally, China's emergence as a new destination for natural gas changes the geo-economic landscape, and diminishes the EU's leverage that stems from its position as a leading export market for Russian and African gas. It is obvious that Russia now tries to optimize its central position as land bridge between east and west, by creating new gas pipelines to China. "It's no secret that we want to be the biggest supplier of natural gas to the Asia-Pacific region," Gazprom deputy chairman Alexander Medvedev said.[35] Albeit several delays, the new gas pipeline between Siberia and Eastern China is due to be completed between 2011 and 2013. Delivery volumes will total 30-40 million cubic meters per year. This new tilt towards China does not imply that Russia wants to burn its bridges with the EU, but it will weaken the EU's position to negotiate prices. It is also striking that while European energy companies, BP and Shell, where expelled from gas excavation projects in Siberia and Sakhalin, Chinese and other Asian companies were invited to step up their presence in Russia. A similar evolution can be expected if China continues its plans to divert gas more gas from Northwest Africa to facilities at the Gulf of Guinea. Plans are still at the drawing table, but the Chinese company CNPC is reportedly interested in connecting gas deposits in the region to an LNG-terminal in Nigeria.

It should also be stressed that China is only at the very beginning of its attempts to secure foreign gas deposits. The IEA expects Chinese gas imports to quadruple by 2030. This evolution has to be put in the context of a global economy in which several other actual and emerging powers try to safeguard and to extend their own lines of supply. For instance, despite several bilateral agreements on energy cooperation, it remains to be seen how India's economic re-launch will interplay with China's whopping need for natural gas. Competition for concessions in Myanmar already indicates that this is not going to suit political stability in such places. With Japan, China still vies for the gas deposits in the East-China Sea. In Latin America it locks horns with the United States and gives countries like Venezuela and Columbia new leverage to distance themselves from Washington.

[34] Interview with Shell experts, the Hague, 4 July 2007.
[35] Putin Tells Asia: Russia Is Here to Stay, *Moscow News*, n° 36, 13 September 2007.

Concluding, regarding natural gas, it is recommended that the EU takes following measures:

. To step up investments in path-breaking technologies for the excavation and utilization of gas;

. To increase and to coordinate its efforts to secure and to diversify foreign sources;

. To conclude partnerships with China in upstream activities, i.e. drilling, LNG and transport;

. To initiate a round-table within ASEM on energy security;

. To support regional initiatives for energy security;

. To propose a forum on energy within NEPAD or the AU with China and other players;

4.4. hydro-power

Another challenge is the environmental impact of China's hydro-power projects. The consequences of large-scale dam projects like the Three-Gorges Dam is well documented, but the impact of China is also felt in adjacent countries. Several dams that were constructed in border provinces bring negative ecological and economic consequences in neighbouring riparian states. In Southeast Asia, Myanmar, Thailand, Laos, Vietnam and Cambodia are at risk by hydro-power projects in the upper reaches of the Mekong (Lacang) and the Salween (Nu). In the 1990s China started the construction of three dams in Manwan, Dachaosan, and Xiaowan.[36] The latter, worth 2.7 billion USD and good for 4.2 million kilowatts, is the nation's second-largest power project after the Three Gorges Dam. It will take 5 to 10 years to fill the reservoir of this dam, and during this process half of the Mekong's upper flow debit will be consumed.[37] China plans to erect 2 to 5 more dams on the Mekong.[38] In 2003, the State Development and Reform Commission approved plans for the construction of 13 dams on the Nu River prepared by the Huadian Corporation and the Provincial government of Yunnan.[39] After local and international protests, Premier Wen Jiabao suspended the original project in February 2004, but officials from Yunnan keep lobbying for green light and will likely obtain a partial approval.[40]

The Mekong and the Salween are the economic lifelines for approximately 70 million people who live from fishing and agriculture. As much as 50 per cent of Vietnamese rice production is located in the Mekong delta and 50 per cent of the protein Cambodians eat comes from their domestically caught fish supply. Since the Chinese dams on the Mekong became operational, river levels have gone up and down much faster.

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[36] Xiaowan Dam, A Reservoir for Progress, China Daily, 16 September 2002. Further information: Lu Yi, He, Youhua and Yang, Jian (2004), Da Meigonghe Ciquyu Jingji Hezuo Lingyu Tantao [Discussion of the Greater Mekong Subregion Economic Coooperation], *Jingji Wenti Tantao* [Discussion of Economic Issues], January 2004, pp 96–100; Wang, Qin (2004), Zhongguo Canyu Meigonghe Ciquyu Jingji Hezuo Jiqi Jinzhan, [China's Participation in the Greater Mekong Subregion's Economic Cooperation and Progress], *Nanyang Wenti Yanjiu* [Southeast Asian Affairs], 32 (1), *pp. 39–46.*

[37] *Cronin, Richard (2007), Destructive* Mekong Dams: Critical Need for Transparency, School of International Studies, NTU, Singapore, p. 2.

[38] Liebman, Alex (2005), Trickle-down Hegemony? China's Peaceful Rise and Dam Building on the Mekong, *Contemporary Southeast Asia*, vol. 27 (2), pp. 288.

[39] *China's Nu River*, International Rivers Network, Berkeley, 2007.

[40] Yardley, Jim (2007), Seeking a Public Voice on China's 'Angry River', *New York Times*, 26 December 2005; Song, Luo Hua et al. (2005), The Exploitation of Hydroelectric Resources in the Nu River and the Sustainable Development of Minority Areas, *Natural Sciences Journal of Yunnan Normal University*, n° 4 2005.

While since then only a fifth of the river's annual flow comes from China, the prior proportion ranged between 50 and 70 per cent. Erosion, vanishing mangroves, disturbed fish migration, and salt irrigation water emerged as undeniable symptoms. Beijing has been slow in sharing information on its river diverting projects along the Upper Mekong Basin. Until now, it has refused to join the Mekong River Commission (MRC), a forum that comprises Cambodia, Laos, Thailand and Vietnam, and that aims at ensuring the equitable use of the river system as well as addressing issues of fisheries management, safe navigation, irrigated agriculture, watershed management, environmental protection, flood management and hydropower development.[41]

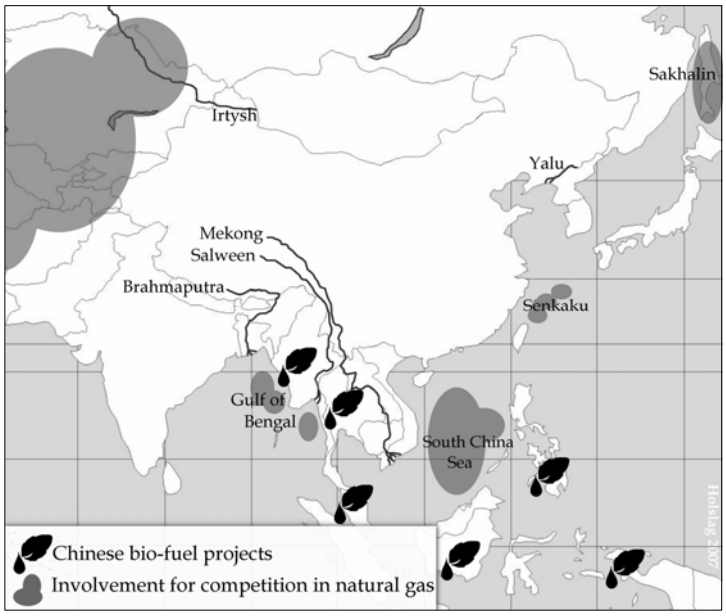

Figure 1. China's comprehensive energy policy in a regional setting. Source: Various sources.

There are other concerns elsewhere. India and Bangladesh fret about the possible diversion of rivers from Tibet to South Asia. The Tibetan plateau is the principal watershed in Asia and the source of 10 major rivers. About 90 percent of the rivers' length is located in the lower riparian states in South Asia. In 2003, China finished a dam along the Sutlej (Langqen Tsangbo) near to the border with India.[42] Observers warned that this construction could lead to disasters. Flash floods and landslides in 2004 and 2005 turned the attention towards the new artificial lake.[43] China reportedly also plans to divert 200 billion cubic metres of water annually from the Brahmaputra to the Yellow River by building a dam at Yarlung Tsangpo that would generate a projected 40,000 megawatt of electricity.[44]

[41] For more information about the Commission, see: Backe, Bruzelius (2007), *The Mekong River Commission: Does It Work, and How Does the Mekong Basin's Geography Influence Its Effectiveness*, Ministry of Development, Norway; Greacen, Chris and Palettu, Apsara (2007), Electricity sector planning and hydropower in the Mekong Region, in Lebel, L. ed. *Democratizing Water Governance in the Mekong Region*, Mekong Press, Bangkok; Ratner, Blake (2003), The Politics of Regional Governance in the Mekong River Basin, Global Change, *Peace and Security*, vol. 15 (1), pp. 59-76.
[42] Menon, MS. (2006), Concerns over Chinese barrage on Sutlej, *The Hindu*, 20 July 2006.
[43] China Quietly Builds a Barrage on Sutlej, *Hindustan Times*, 30 June 2006.
[44] Bagchi, Indrani (2007), China agrees to discuss river-sharing, *Times of India*, 9 September 2007.

Although Beijing has maintained that the project is still in a conceptual stage, various sources confirmed that work has begun with the target to finish it by 2015. India has castigated China for being slow in sharing information on the status of the rivers in the run up to landslides, which have caused flooding in Northeastern India and Bangladesh.[45] Despite two MoUs on the provision of hydrological information, signed in 2002 and 2005, officials and experts in New Delhi complain that China is only fulfilling the strict minimum of it.[46] In Central Asia, neighbouring countries are alarmed about increasing industrialization in the Western Chinese Province of Xinjiang. Pollution and water extraction from the upper stream parts of the Ili (Yili He) and Irtysh (Erqisi*)* river already damaged crop growing and fishing in Kazakhstan. Now these countries are apprehensive that China will deal a final blow by starting new hydro-power projects.[47] In China's Northeast, the Provinces of Jilin and Heilongjiang are shedding the dust of their economic rustbelts and started an impressive resurgence. This evolution sparks new interest for hydro-power generation along the Yalu River at the border with North-Korea.[48] Experts fear that new barrages will threaten agricultural and fishery along the river mouth.

China's ambitious hydro-power projects have a tangible impact beyond its borders and bring several challenges for regional development and stability. To start with, there is a severe risk that vulnerable communities who live along the rivers might be deprived from crucial sources of income like fishery and agriculture. Here, China's ambitions contradict with the EU's aim to "promote the development of the less prosperous countries of the region" by "addressing the root causes of poverty".[49] Second, there is the negative environmental impact. In this regard, the European Union vows to strengthen cooperation to prevent the degradation of "common goods" and to "to promote sustainable resource management".[50] Finally, China's insufficient communication with neighbouring states on shared rivers raises suspicion and might develop into a new source of tensions. We are still far away of grave conflicts, but it does certainly not benefit the EU's attempts to foster "preventive action in a framework of international cooperation".[51] Yet, China understands that it can not push its projects through at the expense of good relations with its neighbours. This allows the EU to undertake following action:

. Promoting the culture of cross-border impact assessment and river management;

. Initiating talks on water-sharing in the ASEM;

. Raising the issue and tabling constructive proposals via the EU-China dialogue on energy.

[45] China denies plan to dam Brahmaputra river, India Times, 22 November 2006.
[46] Ministry of Water Resources, India (2002), *India-China Cooperation*, Ministry of Water Resources, New Delhi, see: http://wrmin.nic.in/index3.asp?subsublinkid=290&langid=1&sslid=372.
[47] Hrkal, Zbyněk, Gadalia, Alain and Rigaudiere, Pierre (2006), Will the river Irtysh survive the year 2030? *Environmental Geology*, vol. 50 (5), pp. 717-727.
[48] Xu, Damao, Chen, Chuanyou and Liang, Weiyan (2002), Hydro power development at the Yalu Tsangpo River, *Engineering Science*, vol; 4 (12), pp. 23-41.
[49] *Europe and Asia: A Strategic Framework for Enhanced Partnerships*, Communication from the Commission, COM (2001) 469, European Commission, Brussels, p. 15.
[50] Ibid, p. 16.
[51] Ibid.

4.5. Bio-fuels

China's ravenous appetite for bio-fuels, i.e. bio-diesel and ethanol, opens several new doors for cooperation with the European Union. The People's Republic is especially in need of specialized machinery. Until now, only a few German companies were able to play an important role in the fulfilment of this demand.[52] In the short term, there are certainly more commercial opportunities to tap. European and Chinese research institutes could also join forces to improve technologies for the extraction, processing and the application of bio-fuels. Again, it will be a matter of protecting intellectual assets and to anticipate on growing competition for the middle-long term. It should also be stressed, that the Chinese government does not want to leave bio-fuels entirely to the private sector. Apart from subsidies and other official support, Beijing also considers building "national champions", i.e. Chinese state-owned or parastatal companies that are intensively backed and guided by the government.

Another challenge relates to the supply of bio-fuel. At this stage, the EU has not yet made up its mind about whether or not it should open its market to imports, or whether it would resort to its own agricultural potential. Depending on the outcome of this ongoing debate, the EU will face China as another influential buyer on the international market. The People's Republic has no other choice but to spread its wings to find foreign suppliers. Food security remains the political priority, and given the limited available land per capita, dependence on external sources of bio-fuel will add up to 70 to 80 percent of national consumption.

The dash for new markets brings another risk, namely that doing well to the environment in one domain, causes severe environmental damage in another. China clearly positions itself into the centre of Asia's bio-fuel market. In January 2007, the Chinese government agreed with the Philippines to buy 400,000 to 500,000 hectares of land for the production of bio-fuel. Various sources confirm that this surface might expand to more than 8 million hectares. In February 2007, China's energy giant CNOOC purchased a 5.5 billion USD concession in Papua and Kalimantan, Indonesia. The contract entailed 1 million hectares of land for developing crude palm oil-based bio-diesel and sugarcane or cassava based bio-ethanol. In Myanmar, Malaysia and Thailand China is the largest buyer of bio-fuel. In these countries, Chinese firms bought up large terrains and start to erect new plants for processing crops into exportable fuel. In Africa and Latin America as well Chinese diplomats and businessmen try to secure new deposits. In this rush for resources, China disregards the formulation of ecological benchmarks, and refuses to assess the environmental impact of its expanding footprint. Contrarily to the EU, China seems to have no hurry to attach environmental conditions to its imported bio-fuels. There are no guidelines for Chinese investment projects abroad. What is more, China's appetite for bio-fuels is embraced by elites in several developing countries, but their haste to make quick profits often goes at the expense of sustainable development and food security. Thailand exported too much palm oil, mainly to China, and consequently had to import the same commodity at higher prices to meet domestic demand. The governments of Indonesia, the Philippines and Myanmar are carrying through ambitious projects to grow bio-fuel crops. Yet, by shifting from labour-intensive subsistence agriculture to mechanized mono-cultures, many small-scale peasants end up in uncertainty. It is clear that this turbulent enthusiasm for bio-fuels needs to be funnelled into a more balanced approach that takes all aspects from production to consumption into account.

[52] Du, Denny (2007), Sino-German Lihua kicks off bio-diesel project, China Chemical Reporter, May 2007.

The European Union should stimulate this development, and therefore it has to:

. Help companies to explore new technologies for the efficient production and using of bio-fuels;

. Stimulate research on the sustainable farming of bio-fuel crops;

. Limit reliance on and diversify the origin of foreign supplies;

. Build a competitive internal market for bio-fuels with a minimum of subsidies;

. Develop measurable technical and environmental standards for imported bio-fuel:

. Raise the issue of sustainable import policies in the EU-China energy dialogue;

. Develop a joint action plan on sustainable import policies bilaterally with China;

. Promote sustainable farming and exporting in developing countries, within the ASEM and ACP framework.

5. CONCLUSION

China made impressive headway with its new comprehensive energy strategy. The EU's response on these new energy policies has been only partially successful. Without a doubt, Europe has been facilitating and contributing to China's shift to clean energy sources. European companies also have been successful in securing a part of the burgeoning Chinese green energy market. Yet, what is called "green" is certainly not always as green as it is ought to be. Several clean energy projects cause severe collateral damage and externalize environmental costs simply to other economic sectors or other regions in the world. The EU fells short to deal with these challenges.

In addition, Europe should also increase its efforts to complement the delivery of technologies with the support of their implementation by sub-national authorities. Whereas the national government and most developed costal provinces are already convinced believers, inland local governments are more reluctant due to a lack of expertise and information. If this shortcoming is not addressed properly, pollution will simply be replaced as economic development moves westward.

Apart from these environmental concerns, the EU should not be too confident about its position as a privileged vendor of clean energy systems. As the Chinese government and companies are working hand in hand, it is likely that the People's Republic will develop from a consumer market, to a key producer with international aspirations. For Europe this requires stronger and well-organized programmes to improve its proper know-how. In addition, the EU should protect its proper expertise and technologies. Given China's burgeoning financial reserves, sharing know-how should not only stem from charity and environment-friendly generosity; it should imply a mature relationship in which intellectual property is valued as an tradable good that suits China's commercial and environmental needs.

Another economic concern relates to the competition for overseas deposits of gas. It makes no sense to try to enter into a full-blown contest with China, but the EU has to move forwards to a coherent and united strategy to secure its natural gas demand. Priorities are the consolidation of the internal market, supporting the development of new upstream and downstream technologies, and a solid foreign energy policy. Europe should expand cooperation with China to upstream projects in Africa, Asia and Latin America, but it should do this as a strong partner, not as a mere supplier of capital and know-how. In sum, a convincing response to China's evolving energy ambitions should complement innovative technologies with solid policies.