Editorial

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China, characterised by the world's largest population with about 1.3 billion inhabitants, is one of the most rapidly growing economies in the world. According to the official statistics, in the past 24 years since 1980, its annual GDP growth rate recorded a high of 9.5%, and the real term GDP has increased by 7.8 times. This achievement, however, has given rise to problems of net energy imports, environmental pollution and ecological destruction at home, cross-border pollution, and mounting carbon dioxide (CO_2) emissions.

Looking ahead, the Chinese government is targeting to quadruple its GDP in 2000 by the year 2020. However, it is likely that this target may result in considerable negative effects on these already problematic energy-related issues, unless the government takes more comprehensive and effective action. Because of its huge potential impact, the study of China's economic development and related energy issues, examination of the possible national strategies and the strategic implications for the world are vital not only for China itself but also for the rest of the world.

This special issue of the *International Journal of Global Energy Issues* (*IJGEI*), 'China's Sustainable Energy Strategies in the 21st Century', focuses on problem-oriented analyses on China's current status and future outlook of energy, and constructive suggestions on energy related strategies in the 21st century.

Selection of the papers for inclusion in this special issue was done by an editorial board, with this writer serving as the chair, consisting of Dai Yande of the China Energy Research Institute, Kokichi Ito of the Institute of Energy Economics Japan, and Zhang Aling of the Tsinghua University of China. Including the meeting for establishing the board on March 24th, 2004, we met two times in Japan and two times in China, with at least three members attending. Seventeen papers were submitted for this special issue, and of which the board selected 11 papers for inclusion. The other papers were passed over because they did not fit the theme of this special issue or the nature of *IJGEI* and, in a few cases, due to quality problems.

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Some papers, in nature, look more like a report than a research paper, but they were selected because they contain useful data and give an excellent overview of the related energy status and future prospect as well as policies in China.

The selected papers fall into three broad groups, i.e. four papers on overall energy outlook and comprehensive strategy analysis, six papers on individual analysis by energy source, such as fossil fuels, renewable energy and nuclear power, and one paper on building energy demand.

Papers on overall energy outlook and strategy analysis

The first paper, by Dai and Zhu, gives a scenario analysis of China's energy demand to the year 2020. It shows that different economic development models and different policy packages will result in markedly different primary energy demand, which may range from 2400 to 3200 Mtoe (million tons of oil equivalents) in 2020. The key recommendations are: to strengthen energy conservation; to prepare an integrated energy strategy for adjusting the energy mix; and to change the economic development pattern and foreign trade pattern by measures such as increasing imports of energy-intensive products and decreasing or halting exports of these products.

Li's paper gives a long-term energy outlook to the year 2030 in China by an econometric model consisting of macroeconomic, energy and environment sub-models. It shows that in the coming 30 years, China's GDP growth will be around 7% annually, and the continuation of rapid economic growth could result in a number of difficult issues, such as energy security, environment protection and the reduction of CO_2 emissions. It suggests that China should solve these problems through its own efforts. The first step is to establish an empowered actor, and then to establish a comprehensive and coherent strategic energy system. Energy conservation should be promoted as a national policy with the highest priority; measures such as the development of renewable energy, the diffusion of international commercialised cleaner coal technologies and establishing an emergency response system, should be conducted with higher priority; but measures such as imposing an environmental tax, the industrialisation of coal liquefaction and food-based fuel alcohol, should be given careful consideration. It also points out that international cooperation, such as establishing an Energy Community in the Northeast Asia region, is an important strategic option.

The paper by Zhang, Zhang and Wu presents the challenges and strategy of China's energy system development to the year 2050. It concludes that energy conservation should be kept at a high priority in the future, while improvement in the energy diversity by development of renewable energy, nuclear and other new energy technologies will be the solution to fill the long-term energy demand. It also shows that successful implementation of such a strategy will greatly mitigate CO_2 emissions in the short term and further reverse the increasing trend of CO_2 emissions from the energy sector.

The paper by Komiyama, Li and Ito presents a consistent international energy projection to the year 2020 by an integrated econometric model, focusing on China's energy impacts on the world and Northeast Asia. It was found that China will become a more important player in the world energy market and in terms of CO_2

emissions, and a considerable increase in oil demand in China would increase Northeast Asia's dependence on the Middle East, thereby underlining a serious energy security problem in this region. Then, it suggests that it is imperative for Northeast Asian countries to pursue the following major tasks:

- fuller exercise of bargaining power given their collective position as a massive regional consumer of oil, and strengthening of ties of dialogue and cooperation as equal partners with oil producing countries
- establishing a regional emergency response system jointly
- promotion of cooperative resource development and procurement inside and outside the region
- conditioning of world oil markets to make the supply and demand structure more flexible.

Papers on individual analysis by energy source

There are six papers in this group. The paper by Yu and Zheng discusses China's coal market outlook to the year 2020. It forecasts that China's coal demand will reach 2.3–2.9 billion tons in 2020, accounting for over 60% of primary energy consumption. However, coal supply will be faced with obstacles in fields such as the detailed exploration degree of coal reserves, the level of mining technology and mine safety, the production capacity building of mines, transport conditions, and environmental impact. It concludes that the government should adopt more comprehensive measures, including improvement in energy efficiency, strengthening coal production and transport capacity, rationalising coal mines' disposition and coal production structure, raising the levels of coal mining technologies and mine safety management. The following paper, by Cheng, Yu and Wu, focuses on China's clean coal technology. After a detailed analysis of China's development situation, and technical and economic evaluation of each technology, it forecasts that advanced power generation technology will account for a greater proportion of total power, coal liquefaction will put into operation, and flue gas desulphurisation and denitrogenation will find wide application and dissemination by 2020.

Liu and Shan's paper on China's oil development strategy contains useful data with respect to oil resources, and gives an overview of oil production and demand in China. It concludes that China should restrict oil consumption to no more than 350 million tons in 2010 and 450 million tons in 2020. In order to secure the oil supply, the following measures should be adopted: to save oil and develop alternative energy; to stabilise domestic oil production and diversify oil imports and overseas resource development; to accelerate gas industry development; to establish oil strategic reserves.

There are two papers on renewable energy. The paper by Zhang, Chen and He gives an overview of the context of China's renewable energy development and utilisation in terms of driving forces, current status, future targets, barriers and public policy. On the other hand, Li and Chen's paper develops a model for the

optimisation of hybrid wind–PV power generation systems in remote rural areas.

The paper by Li focuses on China's nuclear power development. It shows that there are many disadvantages, such as weak competitiveness and the disposal problem of radioactive wastes, but the nuclear power capacity is very likely to increase from 6.7 GW in 2004 to more than 31 GW in 2020 and 50 GW in 2030.

Paper on building energy demand

The last selected paper, by Kang and Wei, evaluates the impact of implementing building energy efficiency policies and promoting related technical improvements on China's building energy demand by 2020, by using the LEAP (Long-range Energy Alternatives Planning system) model and scenario analysis method. It shows that with the enforcement and adoption of a comprehensive building energy efficiency policy and technical improvement measures, in 2020, China's energy consumption in the building sector might decrease from 860 Mtce without these actions to 480 Mtce: the potential of the energy saving will amount to 380 Mtce. The key recommendations are:

- the government should influence the public to adopt a 'rational' lifestyle through an energy efficiency awareness campaign
- compulsory minimum energy efficiency standards should be introduced to control marketing of new buildings and building service equipments
- market-based measures, such as metering heating (cooling) mechanisms, evaluating systems and labelling systems on building energy consumption and incentives to encourage the utilisation of high-energy efficiency buildings and service equipment, should be implemented.

It is hoped that the readers of this special issue of *IJGEI* will find these papers interesting and useful.