

# Energy Economics: New Challenges and Solutions

– Review of the 4th Asian Conference of the International Association for Energy Economics (IAEE)

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The 4th Asian Conference of International Association for Energy Economics (IAEE), themed “Energy Economics: New Challenges and Solutions”, was held in Beijing, China, from September 19 to 21, 2014. Nearly 400 delegates from 28 countries and regions shared state-of-the-art research findings in the field of energy economics and explored possible solutions to energy and environmental challenges. This is the first IAEE event ever held in China’s mainland, and it will play an important role in promoting the development of energy economics and coping with the real challenges we face.

## 1. Background of the Conference

The world is facing new challenges for sustainable

development, especially in relation to energy and the environment. First, emerging economies like China and India are developing fast, and the energy consumption of these countries increases with corresponding rapidity. To meet their energy demands, the dependence on imported energy is also increasing rapidly, and the issue of energy security becomes ever more serious (Fan Y, Ji Q, Zhu L, Li JP, 2013). Second, the United States has made a breakthrough in unconventional energy technology, which may lead to changes in the world energy supply structure and adjustments in the geopolitical landscape (IEA, 2012). In addition, the issue of nuclear safety has attracted much attention, and the role of nuclear energy remains a focus of debate. Finally, the world faces the challenge of climate



change, and low-carbon green growth is the trend for future development (He JK, Teng F, Qi Y, 2014). Faced with these changes and challenges, an energy system revolution will be required in order to ensure energy security and promote sustainable development (He JK, 2014).

As an emerging and rapidly developing interdisciplinary field, energy economics will play a fundamental role in coping with these challenges. Against this background, the 4th Asian Conference of International Association for Energy Economics (IAEE) was held in Beijing, China under the theme of “Energy Economics: New Challenges and Solutions”.

## 2. Brief Overview of the Conference

Established in 1977, IAEE is a worldwide, nonprofit, professional organization, headquartered in the United States. As a forum for experts and scholars to exchange ideas and information about energy and related topics, IAEE now has more than 4,000 members from over 85 countries, with branches in 28 countries. Every year, IAEE invites representatives from governments, businesses, and research institutions across the world to attend its (global and regional) conferences, which have considerable influence around the world.

The 4th Asian Conference was jointly hosted by the Institute of Policy and Management (IPM), Chinese Academy of Sciences (CAS), and the China University of Geosciences (CUGB-Beijing). Prof. FANG Xin, member of the CAS Presidium, and Prof. HE Jiankun, former Vice President of Tsinghua University, served as Co-Chairs of the conference, and Prof. FAN Ying, Director of the Center for Energy and Environmental Policy Research (CEEP), acted as Scientific Committee Chair.

Mr. ZHANG Guobao, former Minister of National Energy Administration, attended the conference and delivered a lecture during the opening ceremony. In their gracious welcome addresses, the Vice President of CAS LI Jinghai, Vice President of the National Natural Science Foundation of China HE Minghong, Vice President of China University of Geosciences LEI Yalin, and the CEO of Shanghai International Energy Exchange CHU Juehai stressed the importance of energy economics research.

The conference lasted two and a half days, with 14 eminent energy economists delivering lectures at four plenary sessions, while more than 220 scholars made presentations at 48 parallel sessions. In addition, the conference included a special workshop entitled “Petroleum Futures Market: International Experience and Implications for China”, as well as the Best Student Paper Competition, and two technical tours.

## 3. Hot Topics in Energy Economics Research

During the conference, a wide range of topics of current interest in the area of energy economics were discussed, with many valuable outcomes.

### 3.1 A new understanding of energy resources

With the depletion of conventional energy resources, unconventional energy is likely to play an increasingly important role in the future. According to the International Energy Agency, the remaining technically recoverable sources of conventional and unconventional natural gas are 462 tcm and 328 tcm respectively, and the remaining technically recoverable sources of conventional and unconventional oil are 2,678 billion barrels and 3,193 billion barrels, respectively (IEA, 2012). Clearly, unconventional energy has great development potential and may well have important implications for future world energy development. Wumi Iledare, IAEE President, spoke about the successful development of unconventional hydrocarbon resources in the United States, and its global implications. He pointed out that a glut in the gas market has led to low natural gas prices, making natural gas competitive with other fuels, which may have a significant impact on the future energy mix. In addition, the United States may become less dependent on imported oil and gas, making it a less attractive destination than countries of the Asia-Pacific region for oil and gas exporters, which again may have significant implications for the international energy market structure. However, Iledare also noted the question then arising as to whether this success could be replicated in other countries and regions.

Energy efficiency improvement is also seen to play an important role, as an “invisible energy resource”. Prof. B. W. Ang from the National University of Singapore, Editor-in-Chief of the journal *Energy Economics*, pointed out that energy efficiency improvement has significant advantages in terms of cost effectiveness, environmental sustainability, and energy security. According to Prof. HE Jiankun from Tsinghua University, energy efficiency improvement and energy saving should be seen as the “first energy”. However, although energy efficiency has contributed to energy savings, how energy efficiency is measured will present great challenges. To make this energy resource visible, Prof. B. W. Ang argued that a transparent, credible, robust, and practical economy-wide energy efficiency accounting system is needed for quantifying improvements and tracking progress.

### 3.2 Environmental externality of energy consumption and energy system transition

The environmental externalities of energy consumption



are becoming increasingly serious, especially in the context of climate change. To cope with these challenges and to promote sustainable development, an energy system revolution will be necessary (He JK, 2014). Prof. HE Jiankun observed that sustainable development faces great challenges across the world as a result of climate change, and low-carbon development has become a global trend. New energy revolution is a fundamental way to achieve low-carbon development, and promote humanity's transformation from an "industrial" to an "ecological" civilization. Under this concept of an ecological civilization, environmental capacity is a scarce resource and production factor, and augmenting "carbon productivity" is a fundamental goal of the new energy revolution (He JK, Teng F, Qi Y, 2014); reconfiguring industrial structure, improving energy efficiency, reducing energy intensity per GDP, and improving energy structure can play a significant role in increasing carbon productivity. In addition, there are essential differences between the new ecological civilization and the present industrial civilization in terms of development targets, patterns, and ideas, and innovation in energy economics will also play a necessary part in supporting the energy revolution.

### 3.3 Energy demands and carbon emissions in emerging economies

Emerging economies are developing fast and their energy demands are increasing rapidly, leading to rapidly increasing greenhouse gas (GHG) emissions that have become a matter of global concern. China is the world's largest energy consumer and GHG emitter (IEA, 2012), and its future energy demands and GHG emissions have important implications for the world as a whole. As noted by ZHAO Dadi from the Energy Research Institute of China National Development and Reform Commission, the relatively low price of coal as compared to alternative energy means that low-carbon energy will face more intense competition. To reduce coal consumption and cause GHG emissions to peak earlier, energy pricing reform is necessary. In addition, legislation and policy must be improved to control total energy consumption and total coal consumption, to substitute natural gas and renewables for coal, and to use clean coal technology more widely. Prof. WANG Yi, Director-General of the Institute of Policy and Management, CAS, summarised the existing studies on CO<sub>2</sub> emissions in China, noting that China's CO<sub>2</sub> emissions would probably reach their peak in 2030, depending on economic development, population growth, energy consumption, domestic environmental and climate policy, and international negotiations. Because coal consumption is the biggest source of CO<sub>2</sub> emissions and coal plays a dominant role in China's primary energy consumption, future consumption of coal will

be a significant determinant deciding when CO<sub>2</sub> emissions will peak. Prof. ZOU Ji, Deputy Director of the National Center for Climate Change Strategy and International Cooperation, analyzed the development trajectory of both developed and developing countries, based on the Kuznets Curve. He further pointed out that it's possible for the developing countries to attain a certain level of development with fewer GHG emissions through innovation in their approach to development – controlling population growth, reducing energy intensity, and adjusting energy structure.

Climate mitigation policy will also affect future carbon emissions, and the cost of GHG mitigation is critical for policymaking (Fan Y, 2011). Prof. David I. Stern from the Crawford School of Public Policy at the Australian National University analyzed how substitution elasticities in production and consumption affect the marginal and total costs of mitigation, and concluded that although lower substitutability increases the average abatement cost, total costs are reduced by lower substitutability because of lower GDP and emissions growth.

### 3.4 The role of the market in energy resource allocation

The distribution of energy resources in different regions is unbalanced, and the energy market plays an important role in energy resource reallocation. However, whether market mechanisms can promote energy system transition remains controversial. Prof. Adonis Yatchew from the University of Toronto analyzed the power and failures of markets, based on the history of development of the world economy. He concluded that market mechanisms would play a fundamental role, and that appropriate policies and programs are also necessary to correct for market limitations.

Many domestic and foreign experts participated in a special workshop entitled "Petroleum Futures Market: International Experience and Implications for China". The key message was that China's oil demand would continue to increase, and that China would play a dominant role in the future world energy market. For this reason, it will be necessary to build an oil futures market that reflects supply and demand conditions in China and provides a hedging instrument against market risks. The critical issue is that related institutional improvements and capacity building are prerequisites for a properly functioning market. In addition, market transparency is very important, and rules and regulations are required to limit excessive speculation and excessive price fluctuations.

### 3.5 Policy innovation to ensure energy security and promote energy system transition

To ensure energy security and promote energy system transition, policy system innovation will be essential. Prof.

Hans-Joachim Ziesing from the Free University of Berlin shared the experience of transition in the German energy system, with particular reference to policy targets and policy instruments, including climate policy, energy efficiency policy, renewable energy policy, and nuclear policy. He concluded that a well-designed, effective, coherent, robust, and adaptive policy framework is necessary for energy transition and climate change mitigation, encompassing laws and regulations, technology standards, taxation, subsidy, cap and trade, research support, and voluntary agreements.

Energy and environment are common global issues, and regional and global collaboration is needed to cope with these common challenges. Masakazu Toyoda, CEO and chairman of the Institute of Energy Economics, Japan (IEEJ), stated that Asian countries need to work together to overcome their common challenges, and that possible areas for energy cooperation included more greater energy conservation, the cleaner use of fossil fuels, lower-cost renewable energy, and safer nuclear energy. Philip Andrews-Speed, principal fellow at the National University of Singapore, summarised the key supporting factors for energy cooperation in Asia under changing market conditions as desire, trust, commitment, need, and timing. Offering a Chinese perspective, ZHANG Zhongxiang, a distinguished professor at Fudan University, said that China's global quest for oil and natural gas has received unprecedented worldwide attention and scrutiny because of their high-profile energy diplomacy and a number of controversial issues, including the management and operation of Chinese national oil companies (NOCs) and misconceptions and misunderstandings about China's quest for energy security, both inside and outside China. He concluded that both China and the West need to depoliticise China's global quest for energy security.

#### 4. Prospects for the Future Development of Energy Economics

Energy economics was originally based on the resource depletion theory, and has developed and been further enriched by the escalation of environmental and climate issues. In light of these developments, the particularity of the energy resources and externality of energy consumption

now forms the core of energy economics. From the perspective of topic development, the new trends in energy economics development are as follows.

1) There is a critical balance between free competition and market regulation. Monopoly is a natural characteristic of energy resources and infrastructure, and the means of introducing market competition into the oil and electricity field – and then regulating these markets – are critical issues. Clearly, how to use both the visible and invisible hands to improve the efficiency of resource allocation remains a long term and genuine problem.

2) The external cost of energy consumption must be addressed. In the cost-benefit analysis of energy consumption, externality costs should also be considered, and then the environmental management and sustainable development can be financed. However, it is difficult to assess these externality costs accurately because the externality of GHG is global. As a result, it becomes necessary to introduce variables to substitute these externality cost estimates in the energy-economy system. This new trend has significant implications for emissions trading and climate negotiation.

3) The concept of the energy security has been extensively expanded. New perspective on energy security is not only limited by the availability of the fossil energy, but also relates to renewable energy and nuclear energy development, as promoted by policy.

4) Innovation is also being explored in energy economics research theory and methods. New theories and methods include big data, large systems, and behavioural economics, providing new tools for energy market research, energy policy design, and behaviour simulation in emission trading schemes, as well as offering new insights for policy making.

5) Economic development and energy technology development affect each other, and both are affected by policy. The interaction between the energy economy and energy technology development is a hot topic, and there are many international journals focusing on both of these aspects.

As an interdisciplinary field, energy economics is developing fast in response to the process of coping with the challenges of energy security and climate change, and will play an increasingly important role in supporting policy making and promoting global sustainable development.

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