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INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS

IAEE Newsletter

Third Quarter 2007 International Association for Energy Economics

President's Message

At the outset, please allow me to welcome members from IAEE's newest affiliate, the Nigerian Association for Energy Economics. With the establishment of this presence in Africa, IAEE now has affiliates on six continents, thus making us even more of a "global organization…concerned with energy and related issues in the international community", as our Mission Statement encourages us to be.

The wide range of the research and policy interests of IAEE members was clearly in evidence at the 8th European conference. Participants from around the world gathered in Florence in early June to exchange ideas on topics including oil supply and OPEC, demand-side management and energy efficiency, the latest innovations in market-based instruments to address environmental issues, and challenges of evolving market regulation in an expanding Europe – to mention but a few. Our thanks to the host affiliate, Italy's AIEE, for assembling a program organized around more than 200 presentations, including a significant number of student-authored papers. As many of you will no doubt have noticed, the participation of students in IAEE-sponsored conferences has increased sharply over the last few years, in line with the growing student membership in our association. To a significant degree, this heightened awareness and interest of students in the activities of the IAEE can be traced back to the diligent efforts of the student interns on Council who have led the charge in developing programs and services attractive to tomorrow's energy professionals. This year's interns, Phillia Restiani from Australia and Christian Redl from Austria, are continuing this tradition of advocacy and action, with the objective of identifying ways to make membership in our association an increasingly attractive proposition for all students of energy economics. It is also important to point out that this year we have the support of OPEC's Fund for International Development to thank for this increased student participation. OFID's financial support has allowed us to provide travel grants to a number of students from developing countries to attend IAEE-sponsored conferences.

Your Council has also undertaken an assessment of possible initiatives aimed at broadening the membership and at enhancing the value proposition offered to IAEE members. In Florence, for example, Council agreed to continue with ongoing improvements to the *Newsletter* and to fund an initiative aimed at developing a family of products that would make proceedings from our conferences available on-line through the IAEE website. We are also considering expanding Council responsibilities to include focused efforts on communications with members generally and, more-specifically, on our web-based presence. Changes have also been made to the student section of the IAEE website (www.iaee.org/en/students/) in an effort to make it more user-friendly and more responsive to expressed student needs.

And now, it's your turn! We want to hear from you as to what kinds of initiatives you would like Council to undertake or to support on behalf of all members. With that in mind, we have developed a short (*really* short) web-based form (www.iaee.org/en/membership/survey.aspx?id=3) that you are invited to use to bring such initiatives to Council's attention. These could be activities of interest to members that you would propose to undertake and for which you would like IAEE support, or ideas that you want Council to explore and consider undertak-

(continued on page 2)

IAEE INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
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CONTENTS

Editor: David L. Williams / Contributing Editors: Paul McArdle, Tony Scanlan and Marshall Thomas

President's Message *(continued from page 1)*

ing. The message here is quite simple: this is *YOUR* association – please help us identify ways in which we can better serve you and all of our fellow members. Thanks in advance for your cooperation! I look forward to hearing from you.

Finally, I would also encourage you to attend the two IAEE-sponsored conferences still on the calendar for this year. Between September 16 and 19, the IAEE/USAEE North American conference will invite participants to consider issues relating to "Developing and Delivering Affordable Energy in the 21st Century". As noted by the G8, the International Energy Agency, and the World Energy Council, among others, access to affordable energy is one of the key challenges facing governments and energy industries across the globe. A few months later, on November 5-6, the Chinese Association for Energy Economics will host the 1st IAEE Asian conference. To be held in Taipei, this conference will focus on "Asian Energy Security and Economic Development in an Era of High Oil Prices". For more information on conference programs, registration, and accommodations, please consult the Conferences section of the IAEE website (www.iaee.org/en/conferences/). I look forward to seeing you in Houston and Taipei!

Andre Plourde

Editor's Note

The theme of this issue is geopolitics and energy policy.

Gilbert Metcalf and Kevin Hassett recommend changes in energy tax policy to shift us away from fossil fuels and towards renewable energy. These recommendations would reduce the cost to federal taxpayers while better aligning private and social interests.

Heinz Riemer deals with aspects of a common external energy policy of the European Union, which is gaining importance in view of the numerous ideas and initiatives at the European level in the field of energy, climate and environmental policy. It looks at the reasons for this approach, analyses the recent decisions and agreements of the European Council in this respect and assesses the preconditions for the successful pursuit of European interests in the international and global context.

Ole Gunnar Austvik notes that present high energy prices create the prospect of expensive oil and gas developments in the Norwegian and Russian Barents Sea. He focuses on understanding the geopolitics of developing the regions resources.

Tarjei Kristiansen writes that there is renewed interest in nuclear power generation due to its economic competitiveness and zero CO_2 emissions, and the current political debate about "energy independence." He describes nuclear power generation development including nuclear capacity uprates, life-time extension, the economics of nuclear power, and the latest trends in generation.

Ernesto Marcos notes that energy is a strategic activity for Mexico. The development of this sector explains the behavior of its basic economic variables; but it is still controlled by State monopolies. Based on the recent oil bonanza, the Government taxed Pemex with 8% of GDP in 2006. Oil production peaked in 2004 and exports will decline irreversibly. He identifies 10 strategic tasks for the modernization of energy in Mexico

Xin Ma, writes that the Chinese National Oil Companies are rapidly expanding their business and operations around the world. It is commonly claimed that they are pressured by their government for security of supply reasons. However, a closer analysis reveals that the companies' concern for commercial survival and excellence are equally important drivers in their overseas expansion efforts.

DLW

IAEE Mission Statement

The International Association for Energy Economics is an independent, non-profit, global organisation for business, government, academic and other professionals concerned with energy and related issues in the international community. We advance the understanding and application of economics across all aspects of energy and foster communication amongst energy concerned professionals.

We facilitate:
- Worldwide information flow and exchange of ideas on energy issues
- High quality research
- Development and education of students and energy professionals

We accomplish this through:
- Providing leading edge publications and electronic media
- Organizing international and regional conferences
- Building networks of energy concerned professionals

Announcement
10th Annual USAEE/IAEE/ASSA Meeting
New Orleans, Louisiana, USA January 4-6, 2008

Hot Topics in Energy Modeling

Presiding: **Carol Dahl**, Colorado School of Mines

Reid W. Click and Robert J. Weiner, George Washington University – *Resource Nationalism Meets the Market: Modeling Political Risk and the Value of Petroleum Reserves*

Erin Baker, University of Massachusetts, Haewon Chon, University of Maryland, Leon Clarke, Joint Global Change Research Institute, and Jeffrey Keisler, University of Massachusetts – *Uncertainty, Climate Change, and Advanced Solar R&D*

Thomas K. Lee, Marymount University and John Zyren, U. S. Energy Information Administration – *The Source and Transmission of Volatility in Petroleum Markets*

Cynthia Lin - University of California, Davis -- *Do Firms Interact Strategically?: A Structural Model of the Multi-Stage Investment Timing Game in Offshore Petroleum Production*

Discussants: **Douglas Reynolds**, University of Alaska-Fairbanks
James L. Smith, Southern Methodist University
Frederick L. Joutz, George Washington University
Wumi Iledare, Louisiana State University

Abstracts will be posted soon at http://www.iaee.org/en/conferences/

The meeting is part of the Allied Social Science Association meetings (ASSA). For program information and pre-registration forms on the larger meeting (usually available in September) go to http://www.vanderbilt.edu/AEA/anmt.htm. Also watch for the USAEE/IAEE Cocktail Party.

Newsletter Disclaimer

IAEE is a 501(c)(6) corporation and neither takes any position on any political issue nor endorses any candidates, parties, or public policy proposals. IAEE officers, staff, and members may not represent that any policy position is supported by the IAEE nor claim to represent the IAEE in advocating any political objective. However, issues involving energy policy inherently involve questions of energy economics. Economic analysis of energy topics provides critical input to energy policy decisions. IAEE encourages its members to consider and explore the policy implications of their work as a means of maximizing the value of their work. IAEE is therefore pleased to offer its members a neutral and wholly non-partisan forum in its conferences and web-sites for its members to analyze such policy implications and to engage in dialogue about them, including advocacy by members of certain policies or positions, provided that such members do so with full respect of IAEE's need to maintain its own strict political neutrality. Any policy endorsed or advocated in any IAEE conference, document, publication, or web-site posting should therefore be understood to be the position of its individual author or authors, and not that of the IAEE nor its members as a group. Authors are requested to include in an speech or writing advocating a policy position a statement that it represents the author's own views and not necessarily those of the IAEE or any other members. Any member who willfully violates the IAEE's political neutrality may be censured or removed from membership.

DEVELOPING & DELIVERING AFFORDABLE ENERGY IN THE 21ST CENTURY

September 16-19, 2007 Post Oak Hilton Houston, Texas - USA
27th USAEE/IAEE North American Conference
United States Association for Energy Economics International Association for Energy Economics
Houston Chapter, USAEE

Conference Structure

This year we have chosen plenary session themes that reflect key policy challenges and uncertainties for developing necessary energy infrastructure in North America and elsewhere. The concurrent sessions will expand on the themes outlined below. Papers on other topic ideas are, of course, welcome, and anyone interested in organizing a session should propose the topic and possible speakers to: Wumi Iledare, Concurrent Session Chair (p) 225-578-4552 (f) 225-578-4541 (e) wumi@lsu.edu. The conference will also feature workshops, public outreach and student recruitment sessions.

LNG • Upstream access and supply • Downstream infrastructure development • Shipping capacity and costs • Contracts, project financing, gas market integration, risk management	**Electricity Market Design** • Importance of market design • Market design policy evolution in the USA • Comparison of different market structures • Efficiency of regulatory versus market structures
Supply and Access • Oil – conventional & unconventional resources, geopolitics • Refining – capacity, technology • Natural gas – access and geopolitics • Role of National Oil Companies	**Electricity Infrastructure** • Building transmission – who? how? New technologies? • Managing grids: Independent system operators, traditional utilities • Smart grid and other IT applications • Building new generation including alternative energy sources
Legal and Regulatory Considerations • Siting energy facilities • Increasing regulatory efficiency • Managing legal uncertainties • EPAct 2005: an evaluation	**Energy Trading** • Oversight – veracity of price data • Volatility – impact, management • Oil, gas, coal, electricity price linkages • Impact of market structure
Alternative Energy & Efficiency • Mass-scale solar power, wind power • Coal gasification • Biofuels – amount, timing, delivery infrastructure • Energy efficiency	**Human Capital** • Trends in skills needed • Impact of demographics and societal trends on career choice • Role of educational institutions • Role of media and reporting on perceptions of the energy sector
Science and Technology • Role of IT (upstream oil & gas, demand-side management, smartgrid) • Frontier technologies: nanotechnology, biotechnology, material sciences • Energy storage and energy efficiency • Science of climate change and carbon sequestration	**Other Energy Delivery Infrastructure** • Refining capacity • Petrochemicals • LNG regasification terminals • Pipelines

Register for this informative conference by visiting our website at: http://www.usaee.org/USAEE2007/

For questions please contact USAEE:
David Williams, Executive Director, USAEE/IAEE, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122 USA
Phone: 216-464-2785 / Fax: 216-464-2768 / E-mail: usaee@usaee.org

Accommodations: The Hilton Houston Post Oak, our conference venue, is located in the center of Uptown Houston, Texas business district, just one block from the famous Galleria Shopping Mall. We have a special room block at the following rates per night: Single/Double Room -- $139.00. Details about accommodations and transportation can be found on the conference website at http://www.usaee.org/USAEE2007/accommodations.html

Travel Documents: All international delegates to the 27th USAEE/IAEE North American Conference are urged to contact their consulate, embassy or travel agent regarding the necessity of obtaining a visa for entry into the U.S. If you need a letter of invitation to attend the conference, contact USAEE with an email request to usaee@usaee.org The Conference strongly suggests that you allow plenty of time for processing these documents.

Visit our conference website at: http://www.usaee.org/usaee2007/

1st IAEE Asian Conference

CPC, Taipei, Taiwan
5-6 November 2007
Hosted by: International Association for Energy Economics
Chinese Association for Energy Economics

Asian Energy Security and Economic Development in an Era of High Oil Prices

✷ **Keynote Speaker: Dr. Mohan Munasinghe**
Chairman of Munasinghe Institute for Development

Main Themes:

- ✷ Asian Energy Security & International Games
- ✷ Energy Supply: Middle East, Southeast Asia, and Russia
- ✷ Regional Energy Market & Demand
- ✷ Environmental Issues & Impacts on the Energy Industry
- ✷ Energy Efficiency & New Energy Technology
- ✷ Economic Impacts on Energy Policy & Price Control
- ✷ Energy and Poverty Issues in Asian Countries
- ✷ Energy Strategy of Newly Developing Asian Countries

Conference Committee:

Wenent Pan: General Conference Chairman;
Hueyching Yeh: Program Committee Chairman;
Luiwei Chen: Organizing Committee Chairman;
Edward K. M. Chen: Sponsorship Committee Chairman

General Program Committee:

Majid Al-Moneef; Geoff Bertram; Yunchang J. Bor; Jean-Philippe Cueille; Larry C. Chow; Reza Farmand; Einar Hope; J. Y. George Hsu; Chunghuang Huang; Hoesung Lee; Chiyuan Liang; Hueichu Ruby Liao; Kenichi Matsui; Mohan Munasinghe; Victor Ng; Anthony D. Owen; Hi-chun Park; Andre Plourde; Frank Pool; Deepak Sharma; Daigee Shaw; Sang Yul Shim; Ram M. Shrestha; Anoops Singh; Kingmin Wang; Yiming Wei; ZhongXiang Zhang

Registration & Accommodation

Registration fee for one speaker is US$100 and US$525 for non-speakers. Registration & hotel reservation have to be done in advance. Please visit http://caee2007@cier.edu.tw to download the forms.

Conference Enquires

1st IAEE Asian Conference Secretariat
Chung-Hua Institution for Economic Research
75 Chang-Hsing Street, Taipei,
TAIWAN 106, ROC.
Tel: 886-2-2735-6006 ext 630
Fax: 886-2-2739-0615
Email: caee2007@cier.edu.tw
Official Conference Website: caee2007.cier.edu.tw

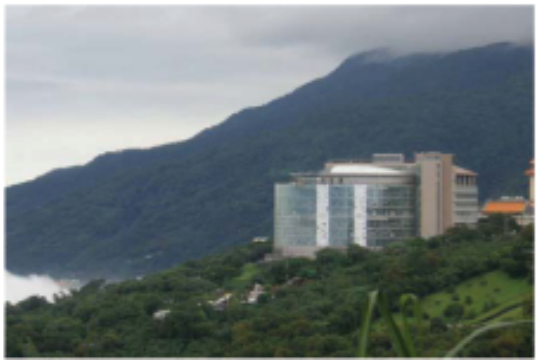
Discover Taipei

Taipei, Taiwan's capital, is a metropolitan city with rich mixes of traditional Chinese and Taiwanese cultures. The internationally renowned National Palace Museum has an inexhaustible collection of precious historical Chinese arts and antiques. Yingge, which is in Taipei County, is a pottery town with hundreds of characteristic pottery plants and shops.

To learn more about Taipei attractions, please visit the following websites:
http://www.taiwan.net.tw/lan/cht/index/index.asp
http://taipeitravel.net/
http://www.taoyuanairport.gov.tw/CKSeng/

Welcome Reception

A special reception will be held in the Chinese Culture University on the evening of November 4. Beside the picturesque scenery of a beauteous sunset and the best view over Taipei City, one can enjoy wonderful performances of Chinese martial arts and music. Don't hesitate to register early for the offer is limited!



Jacques Percebois Receives Outstanding Contributions to the Profession Award

Editor's Note: Jacques Percebois, Professeur des Universites, Universite de Montpellier received the IAEE *Outstanding Contributions to the Profession* award at the Florence IAEE regional conference on 11 June. Following are his acceptance remarks.

Past President Jean-Philippe Cueille presents award to Jacques Percebois

I would like to say that I am extremely honored to receive this award. When I look at the list of well-known researchers who have received this award before me, I realize the significance of this prize and thank the organizers for their trust.

Through my teaching and research activities, I have studied nearly every type of energy, i.e., oil, gas, coal, renewable and nuclear energy. However, I have specialized in two major fields: the economics of natural gas and energy pricing, which involves price determination for the final consumer or Third Party Access on the networks.

During the next few minutes, I would like to share some personal views regarding the international energy outlook.

Today, the main issue is to determine whether fossil energy depletion will occur in the short or the long-term. If this depletion is to take place in the near future, what energy mix is to be chosen as a substitute? This decision is difficult to make in a context where the main uncertainty concerns future technological progress. In the past, potential technological progress has often been underestimated over the entire energy chain. However, progress in the energy field has always been slow as energy consumption often relies on equipment with a long service life. Therefore, in order to develop energy substitutes, it would be necessary to modify the structure of energy production and user facilities. It should be recalled that fossil energy still represents 88 % of primary energy consumed in the world.

The Peak Oil Delayed Again?

Today, the ratio of proved reserves to the worldwide yearly crude oil production is equal to 44 years compared to 30 years in 1973, 41 years in 1960 and 22 years in 1950. Therefore, this ratio which represents a "snapshot" of the resources depletion rate must be examined with care. Due to the rise of oil prices, market operators are increasingly developing crude oil explorations in areas which are not readily accessible, thus more costly, and also reinforcing research and development efforts resulting in new technological advances (for example, horizontal drilling and exploitation of sea-bed resources). Proved reserves are the amount of oil which is technically and economically exploitable, with a probability of 95%. Probable reserves represent the amount of oil which will be produced with a probability of 50%. Possible reserves represent the amount of hypothetical oil which will only be produced if its selling price strongly increases due to high extraction costs. This will occur with a probability of 5%.

The peak oil theory, which was developed in 1959 by the Texan geologist Dr. Hubbert, shows that the production of an oil reservoir varies according to a Gaussian curve, i.e., it is at its maximum when half the reserve is reached. Consequently, in theory, the date of an oil field peak can be determined based on the amount of proved reserves as well as that extracted from initial exploitation. The peak is reached when extracted quantities are equal to the amount of oil still to be extracted. The problem we are faced with is that the accurate level of proved reserves remains uncertain. This level is based on the oil price and the potential of technological advance observed in the exploitation-production phase. According to Dr. Hubbert, an acceptable approximation of the production is achieved by offsetting the oil strike curve by 35 years. Thus, in 1959, he predicted that the USA oil production would reach its maximum at the beginning of the 1970s, given that the oil strike peak was observed in 1940. This theory was confirmed and thus became famous. However, the question is whether this theory can be extrapolated.

According to the IEA, international proved reserves exceed 1,200 billion oil barrels, whereas according to the ASPO (the Association for the Study of Peak Oil) they do not exceed 780 billion oil barrels. As a result, some experts predict that peak oil will be reached in 2010; others believe it will occur in 2030 or even in 2050. It should be noted that oil reserves estimations made by oil companies and States are

often "strategic"; they are either overestimated or underestimated. In some cases, certain companies or countries refuse to provide this type of information, such as Russia today.

The percentage of oil strikes depends on the strategy of oil producers. It should be recalled that in 2005, international oil consumption amounted to 85 million barrels/day, i.e., nearly 4,200 million tons/year, compared to 56 million barrels/day in 1973. The 5 oil majors (ExxonMobil, ChevronTexaco, BP, Royal Dutch Shell and Total) represent 15% of international oil production, control 5% of proved reserves and make 30% of exploration-production investments. National companies from OPEC countries are responsible for 36% of the world production, control around ¾ of proved reserves, but only make 8 to 10% of exploration-production investments.

It should be noted that the first 12 international companies are public organizations based on the classification of available oil reserves. The first private oil company is Exxon, which is only in the 13th position. Even if the oil incomes of Arab-Persian Gulf countries exceeded 300 billion dollars in 2005, it is obvious that they have not been entirely reinvested in the energy sector.

The significant rise in crude oil prices observed in 2005 and 2006, which can be explained by economic issues (high increase in Asian demand) as well as political considerations (conflicts in the Middle East), has increased the profitability of Canadian bituminous shales. As a result, Canada reached the second position in the world in terms of crude oil proved reserves with 14% of international reserves, behind Saudi Arabia (21%). If crude oil prices remain stable between 50 and 60$ in the future, we may assume that new oil reserves will be discovered all around the world. The main question is to define whether the oil demand will continue to grow knowing that the increase in price will favor energy savings and the use of alternative energies (in particular, nuclear, gas and coal). However, it should be recalled that there are many captive uses for oil, especially in the transport field, and oil often represents the "swing" energy in energy balances. As opposed to alternative energies (gas or coal), oil is easy to transport. Pessimistic observers believe that the oil percentage in the energy mix will strongly decrease by 2030, whereas optimistic observers think that it will remain the main source of energy in the international primary energy balance until 2040, and even until 2050.

Natural Gas: Is There a Decreasing Trend?

Natural gas represents 24% of the world energy balance and has two main characteristics: as opposed to oil, its transport is costly and there are no captive uses for this type of energy. It is an accepted fact that natural gas is "cleaner" than oil regarding CO_2 emissions, and compared to other energies, its market penetration rate has been the highest over the last years, especially in the power generation field. The worldwide ratio of proved reserves to yearly production amounts to 65 years. The major part of produced gas is consumed locally, as opposed to oil; 55% of the world oil production is marketed internationally. The percentage of gas sold on the world energy market amounts to around 23%; the major part is distributed essentially via gas pipelines (80%) and the remainder as liquefied natural gas (LNG) (20%). In actual fact, there are three main actors in the international gas market: the American, European and Asian areas. Selling conditions vary greatly from one area to another.

The United States represents a major gas importer and imports 16% of its gas needs, mainly from Canada via gas pipelines (the Province of Alberta). It is also possible to observe that LNG is imported from the Arabo-Persian Gulf and Africa. The American production is ensured by 6,800 producers, including 21 "majors". It is a very fragmented and competitive market where gas is negotiated through spot contracts and medium-term contracts (1 or 2 years) which are index-linked to spot prices. North-American gas reserves are strongly diminishing, and as a result, the United States should import increasing amounts of LNG from the rest of the world. In the European Union, including 25 State Members, natural gas represents 24% of the energy balance and half of the needs are currently imported from three countries: Russia, Algeria and Norway. This dependency rate should reach 80% in 2030. Imported gas exchanges are based on long term contracts (20 to 25 years), including relatively strict clauses: take-or-pay clauses which require importers to pay for the gas even if their deliveries are voluntarily interrupted, indexation clauses based on crude oil and petroleum product prices. A similar system is employed in Asia, where the main importer is Japan.

Gas prices tend to vary according to oil prices either due to a formal price indexation, or because a certain correlation is observed in the markets due to arbitrations between both substitutes. Today, the amount of proved natural gas reserves is similar to that of crude oil, but because gas production is lower than oil production, the ratio of proved natural gas reserves to yearly production is greater. It should be noted that three countries possess 60% of world natural gas reserves: Russia (30%), Iran (15 to 16%) and Qatar (15 to 16%). As natural gas is a cleaner energy compared to oil and as it represents a diversification

factor, and, therefore, reduces vulnerability, this energy has been favored in industrialized countries over the last years. By 2030, 50% of the new power generation should be ensured by natural gas in OECD countries (IEA source) and 50% of the new natural gas consumed within the OECD should be used for power generation.

However, this trend favoring natural gas has to be limited for two reasons: the increase of political risks and the preservation of index clauses. The "gas war" between Russia and the Ukraine in 2006, as well as political tensions between Russia, on the one hand, and Bielorussia and Georgia, on the other hand, have induced European countries to focus more on supply security. The rise in gas prices, in correlation with oil prices, has encouraged market operators to geographically diversify supply sources (Egypt, Nigeria and, in the long term, Iran), and to consider increasing coal use for power generation.

Coal: A Big Cemeback?

Regarding the level of reserves, coal is the most abundant energy source as the ratio of proved reserves to yearly production exceeds 250 years. The worldwide distribution of reserves is relatively homogeneous even if some countries are better endowed than others. This is the case for the United States (whose resource endowment amounts to 25% of world reserves, i.e., 5 times the crude oil reserves in Saudi Arabia), China, India, Russia, South Africa, etc. A great part of coal consumed in the world is used for power generation; 40% of the power generated in the world comes from coal against 15% from nuclear energy. Nevertheless, the CO_2 content per kWh produced from coal is twice as much as the CO_2 content per kWh produced by a gas turbine. For many observers, as coal represents around 26% of the world primary energy balance, its comeback could represent a major threat for the environment. Certain authors believe that technological progress could solve this issue as coal could be employed for more diversified uses in the future, such as hydrogen and liquid fuel production.

"Clean coal" techniques for producing electricity as well as the development of "CO_2 storage" technologies should promote the use of coal. Increasing productivity in a coal-fired plant enables a reduction in the amount of CO_2 emitted per kWh.

Today, Europe represents the third coal consumer in the world behind China and the United States. These three countries represent 71% of the worldwide coal consumption. Faced with the decline of its own production, Europe has increased its imports. In 2005, Europe imported 40% of its coal and this percentage should reach 66% in 2030. Because its price is not index-linked to oil and gas prices and does not significantly depend on political uncertainties, coal remains in great demand. Many experts assume that the price of coal should remain stable in spite of the worldwide concentration of major providers and the relatively significant price rise observed over the last months due to the increasing demand and the difficulties encountered by some coal exporters.

Nuclear: A Newly Convincing Option?

Nowadays, nuclear power satisfies only 7% of the world primary energy consumption, 15% in the European Union of 25 State Members and 38% in France. This represents 15% of the power generated in the world, 32% in the European Union and 78% in France. There are 442 nuclear power reactors in the world; 143 are installed in the European Union (59 in France) and 103 in the United States. All around the world, many supply contracts have been cancelled since the end of the 1970s and many European countries have decided to stop using nuclear energy by 2020 or 2030. Only Finland, France, Russia and Asian countries (Japan, China, Korea, Taiwan, and India) are currently developing projects. Some countries have decided not to build new nuclear power reactors for economic or environmental reasons, such as, the existence of low-priced coal in the United States, the fear of a nuclear accident and the opposition of populations to the construction of new nuclear plants and to nuclear waste storage in Europe. Above all, certain economic and environmental issues could explain the possible "revival" of nuclear energy: the rise in oil and gas prices and especially the desire to reduce global warming due to CO_2 emissions. As a result, The United States, Great Britain and even Italy wonder what option to choose.

Nuclear energy is an unpopular type of energy, however it has many advantages. The "border station" cost per nuclear kWh is more competitive when hydrocarbon prices are high. Nuclear has the advantage relative to coal of not generating any CO_2 emissions, and this advantage is considered as a significant asset when priority is being given to restricting global warming. However, nuclear energy can be frightening for two main reasons: firstly, due to its military origin and to the accidents which have occurred in the past (such as Chernobyl), and secondly, due to the management of nuclear waste whose lifetime can exceed dozens, and even hundreds, of thousands of years.

According to the European Commission, the nuclear option is to be considered seriously insofar as it may be the best solution for improving energy independence of the European Union in the fight against global warming.

Renewable Energy: A Concept Which is Slowly Emerging

Promoting energies without greenhouse gases currently involves favoring wind, photovoltaic and thermal solar energies as well as nuclear energy. Around the world, wind energy is being particularly encouraged with a far from negligible global capacity of 58,264 MW at the end of 2005, the equivalent of the nuclear power generated in France. Several countries have large wind farms, 18,445MW in Germany, 10,027MW in Spain, 9,181MW in the USA, 4,253MW in India and 3,122MW in Denmark. By 2010, we are expect global capacity to be around 150,000MW. In 2005, France decided to favor the use of its modest wind farms (800MW), and, therefore, develop the use of renewable energy sources so that by 2010, 10% of primary energy consumption (21% of electricity consumption) will be provided by hydraulic and wind energy. This objective will undoubtedly not be met in 2010, but it could be as early as 2013.

Promoting renewable energies requires both research funding and financial incentives. It should be recalled that all energies have, at a certain point in time, been helped by governments: the very high national coal subsidy, the tax benefits given to the petroleum industry in order to encourage renewed exploration as well as military and civil nuclear research subsidies. Today there are three instruments enabling promotion of wind or photovoltaic energies: the very profitable feed-in tariffs (the additional cost being paid by the consumer or the tax payer), "green certificate" programs in which electricity providers have to acquire a minimum amount of green electricity produced by operators holding a certificate, and government biddings to develop such facilities. However, efforts in favour of renewable energies are not limited to the electricity industry. This also concerns bio-fuels, the petroleum products preserve. A 2003 European directive set at 5.75% the amount of bio-fuels to be incorporated in petrol and diesel for 2010, and the objective is to reach 20% by 2020 in Europe.

Energy Savings: The Real Energy Revolution

We can ask ourselves if the real energy revolution will not be, in the near future, the significant decrease in the energy content of the GDP, in other words, large scale energy saving. The potential for energy savings is considerable. It depends on promoting technologies, on the one hand, and favoring new behaviours, on the other hand. The energy efficiency of the European Union has improved since the first oil crisis but few efforts have been made over the last few years. Whereas technical progress remains irreversible, the same cannot be said for the behaviour of economic agents. The recent increase in hydrocarbon prices should logically lead to more concerted efforts. When the access costs to energy are high, a "price transparency" policy is required in order to rationalise energy uses. Two sectors are particularly concerned because of the potential energy savings they represent, plus the fact that they largely relate to individual behaviours: the transport and housing sectors.

The residential sector represents nearly 40% of final energy consumed in Europe. Current available technologies allow us to develop the construction of energy saving buildings even with a "positive energy coefficient", meaning that the buildings generate more energy than they consume. Nevertheless, there is much inertia and the setting up of a "white certificate" (energy savings) system from 2006, in France as in several countries, should lead to substantial gains.

The transport sector represents more than 30% of final energy consumption in the European Union, but this sector did not succeed in terms of energy efficiency. Even if today motors are more fuel efficient, the savings achieved in this area are more than offset by the growing number of vehicles. Hybrid petrol/electric vehicles have been developed, but their capacity remains limited due to electricity storage issues. As for vehicles powered by hydrogen cells, they are still at the prototype stage. In order to promote the use of public transport, a behavioral revolution is required and technical progress in itself is not enough.

Strategies known as "factor 4" aiming to divide greenhouse gas emissions by four by 2050 are realistic, but they require political support which is often lacking globally, if the implementation of Kyoto obligations is something to judge this by. The objective is to divide the energy content in half and to divide at the same time by half the "greenhouse gas" content of this energy.

The heart of the current problem does not involve the scarcity of energy resources. Fossil fuel reserves will be undoubtedly abandoned well before being exhausted. The problem is about the rational and economic uses of these resources aiming at avoiding irreversible damage to our environment as a

result of global warming. Three objectives are considered as global priorities, although their respective importance can vary between countries. However, it should be recalled that policies are not always easily compatible:

1) the search for competitive energy where the access cost must reflect the positive and negative externalities that are associated with it. Confidence in the mechanisms of market is the rule and the role of the government should be limited to creating the conditions for externality contracts (CO_2 emission trading, green or white certificates, etc.)
2) the search for supply security, in order to give the priority to national resources and favoring the diversification of imported energy sources. The role of the government here is to finance the search for new technologies and to do this in a way which is often protectionist or even "patriotic".
3) The fight against global warming aiming to implement joint and cooperative policies with other States, in the hope of preserving a threatened environment considered as a "common public good". The approach here is resolutely altruistic as, without minimal cooperation, this objective is unobtainable.

The search for an acceptable compromise between confidence in the market, regarding prices, recourse to state intervention, in relation to promoting new technologies, and the wish for a cooperative strategy concerning environmental issues, all constitute a major challenge for energy, but it should be recalled that State preferences are not always compatible in this area.

Careers, Energy Education and Scholarships Online Databases

IAEE is pleased to highlight our online careers database, with special focus on graduate positions. Please visit http://www.iaee.org/en/students/student_careers.asp for a listing of employment opportunities.

Employers are invited to use this database, at no cost, to advertise their graduate, senior graduate or seasoned professional positions to the IAEE membership and visitors to the IAEE website seeking employment assistance.

The IAEE is also pleased to highlight the Energy Economics Education database available at http://www.iaee.org/en/students/eee.aspx Members from academia are kindly invited to list, at no cost, graduate, postgraduate and research programs as well as their university and research centers in this online database. For students and interested individuals looking to enhance their knowledge within the field of energy and economics, this is a valuable database to reference.

Further, IAEE has also launched a Scholarship Database, open at no cost to different grants and scholarship providers in Energy Economics and related fields. This is available at http://www.iaee.org/en/students/ListScholarships.aspx

We look forward to your participation in these new initiatives.

Margaret McQualie Receives IAEE Journalism Award

Editor's note: At the Florence IAEE regional conference, Margaret McQualie of Platts received the IAEE *Journalism Award* for excellence in written journalism on topics related to international energy economics. Her acceptance remarks follow.

Margaret McQualie receives the IAEE Journalism Award from Past President Jean-Philippe Cueille

First, I would like to thank the International Association for Energy Economics for this terrific award and for inviting me to come to Florence to receive it.

My work as an energy journalist has taken me to many beautiful cities but never before to Florence, so this is a wonderful occasion for me on two counts.

Like most Irish girls, I was educated at a convent school, and on one trip home to Ireland many years ago I happened to bump into my former head nun. She asked me what I was doing with myself and I delightedly told her that I had achieved my ambition and had become a journalist.

I was very pleased with myself. I told her I was travelling all over the world, meeting lots of interesting people and generally having a great time.

We chatted on for a while and eventually it was time to say goodbye. I thought I had impressed her with my brilliant career. In fact, I had no idea what she really thought.

Her parting words, delivered in a sad tone and with a grave shake of her head, were: "So you haven't done anything with your life then."

In other words, I hadn't become a teacher or a civil servant. Journalism was a poor substitute for a proper career.

She certainly took the wind out of my sails and I went away from the encounter feeling utterly deflated.

Little did I think then, though, that I would be writing about energy more then twenty years later and enjoying every minute of it.

When I first started covering OPEC for Platts in the mid-1980s, the tools of my trade were a pen and notebook. There were no mobile phones, no internet, no wireless.

If two or more reporters found themselves in a lift with a talkative minister, once the lift doors opened, we raced each other to the nearest landlines in hopes of being first with the story.

During one OPEC meeting on the island of Brioni in former Yugoslavia, the fastest way of getting to the press room was by bicycle and anyone watching us race along the seafront might have wondered whether we were gearing up for the Tour de France.

As you can imagine, covering an OPEC meeting then meant that reporters had to be fairly fit.

Now, because of all the technical gadgetry available to journalists, someone can say something and it will be out on the wires in minutes or even seconds.

There have been huge changes on the global energy scene since I began working as a journalist.

Oil prices plummeted to single digits in the mid-1980s and again in the late 1990s. Now oil prices are at unprecedented high levels and there are concerns in some quarters, despite the many capacity expansion projects underway or planned, that future supply may not be able to keep pace with surging demand.

Despite the big changes I have seen over the past two decades, the basic story – the question of whether there is enough oil to meet demand or whether there is too much – remains the same.

And while access to information and the emphasis on speedy news delivery have never been greater, the basics of journalism also remain the same. We may need to be fast, but more important than speed are accuracy, honest and clarity.

I enjoy every aspect of my job, but the bit I like best is when the headlines have been flashed, the main facts of the story have been published and it's time to look more deeply into the story, to find the perspective and insight that people like yourselves provide.

I want to thank all the economists and analysts I have relied on over the years to give me that perspective.

I also want to thank my editors and colleagues at Platts who have helped make my work a great deal of fun.

Thank you all very much.

An Energy Tax Policy For the Twenty-First Century

*By Gilbert E. Metcalf and Kevin A. Hassett**

The United States's energy tax policy is rooted in a twentieth century objective to encourage the development of the domestic energy sector. With the new geopolitical realities of the twenty-first century, it is an opportune time to revisit our policies. Current federal energy tax policy is premised in large part on a desire to achieve energy independence by promoting domestic fossil fuel production. This, we argue, is a mistake. The policy also relies heavily on energy subsidies, most of which are socially wasteful, inefficient, and driven by political rather than energy considerations. Finally, the energy taxes that are in place could be more precisely targeted to specific market failures, and these higher taxes themselves would encourage the production of alternatives more efficiently than current subsidies.

We Cannot Drill Our Way to Energy Independence

It is widely held that the United States must reduce its reliance on foreign oil. The concern over our vulnerability to OPEC supply disruption is understandable given the fact that the United States imports over 60 percent of the oil it consumes each year. Of the oil we import, 40 percent comes from OPEC countries and nearly half of that from the Persian Gulf region. Many are also concerned that oil monies help countries like Iran pursue activities that are contrary to American foreign policy.

As a response to these concerns, current tax policy promotes domestic oil and gas production in a variety of ways. We provide a production tax credit for "non-conventional oil," essentially a subsidy for coalbed methane and we provide generous depreciation for intangible expenses associated with drilling as well as generous percentage depletion allowances for oil and gas. In addition, the Bush Administration has consistently lobbied to allow additional drilling on the Alaskan North Slope.

This supply response ignores a fundamental fact: oil is essentially a generic commodity priced on world markets. Even if the United States were to produce all the oil it consumes, it would still be vulnerable to oil price fluctuations. A supply reduction by any major producer would raise prices of domestic oil just as readily as it raises prices of imported oil. In addition, if the U.S. reduces its demand for oil from countries such as Iran, it has little effect on Iran, as that country can just sell oil to other countries at the prevailing world price. Indeed, this effect has been made abundantly clear by historical experience. The U.S. has cut its dependence on Iranian oil to zero, buying no oil directly from that nation since 1991. Despite the U.S. import ban, Iran was the world's fourth-largest net oil exporter in 2005.[1]

A policy of energy independence that depends on boosting domestic oil and gas supply through subsidies has several defects. First, subsidies reduce production costs and so do nothing to discourage oil consumption. Second, the policy encourages the consumption of high cost domestic oil in place of low cost foreign oil. A policy to encourage the United States to use up domestic reserves and so become increasingly vulnerable in the future to foreign supply dislocations seems especially peculiar to us. Third, it is expensive. The five-year cost simply for the incentives mentioned above total nearly $10 billion according to the most recent Administration budget submission.

Assuming reliance on oil is unattractive, a clear sign that policy is headed in the wrong direction is the high and even recently increasing dependence on oil of the U.S. economy. Petroleum comprised nearly 48 percent of primary energy consumption in the United States in 1977. Since this peak, it fell to a low of 38 percent in 1995 before inching up to just over 40 percent in 2005.[2] Even going back to 1977, the 16 percent drop in the oil share from its peak to 2005 falls far short of the percentage reduction in oil share of other developed countries. The United Kingdom, for example, has reduced its oil share from a peak of 50 percent to just under 36 percent, a decline of 29 percent. France has reduced its oil share by 48 percent, and Germany by 22 percent. In Asia, Japan has reduced its oil share by 39 percent and even China has reduced its oil share by more than the United States with a 26 percent reduction. Our current policies are leaving us increasingly vulnerable relative to other major oil consuming nations.

One might argue that because the United States is such a large producer of petroleum products – we are the third largest supplier behind Russia and Saudi Arabia – that our domestic supply incentives help reduce the world price of oil. Our efforts, however, are but a drop in the bucket. One of us has estimated that the domestic oil production incentives in our tax code have lowered world oil prices by less than one-half of one percent.[3]

To summarize, energy independence as popularly construed has little economic content. If reliance on oil is a problem, then supply subsidies make little sense, as they just encourage additional reliance on oil.

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See footnotes at end of text.

Energy Subsidies are Misguided

The single largest energy tax expenditure in the U.S. budget is the tax credit for alcohol fuels, with a five year revenue cost of $12.7 billion. The $.51 per gallon credit primarily benefits corn-based ethanol. The subsidies to corn-based ethanol are politically motivated, as evidenced by the 54 cent a gallon tariff on imported ethanol. There is even debate in the scientific literature about over whether ethanol takes more energy to produce than it contains.[4] Even taking an optimistic read of the literature, corn-based ethanol is expensive, and provides little new energy to the economy. One study indicates that shifting all of the current corn crop to ethanol production would replace just 12 percent of our gasoline consumption. This shift would reduce greenhouse gas emissions by less than three percent.[5]

In addition to the ethanol subsidy, the federal tax code provides investment tax credits for solar and geothermal power production and advanced coal burning power plants under section 48 of the tax code. Recent research shows that the 20 percent investment tax credit for new integrated gasification-combined cycle coal plants makes this technology cost competitive with new pulverized coal plants. The subsidy for solar generated electricity, however, is not large enough to make solar cost competitive with natural gas or other shoulder or peaking power plants.[6]

Section 45 of the tax code provides production tax credits for wind power, biomass, and other renewable power sources. The tax credit is currently 1.9 cents per kWh. The section 45 and 48 tax credits are the second largest energy tax expenditure with a five year cost of over $4 billion. The production tax credit for wind and biomass makes these two power sources cost-competitive with natural gas.[7] The problem with production tax credits is that they must be financed somehow – either with reduced federal spending elsewhere in the budget or with higher taxes. Presumably the credits are in place to encourage non-fossil fuel electricity production. The credit, however, distorts behaviors among non-fossil fuel power sources.

A better approach on both these counts would be to levy a tax on the power sources that one wishes to discourage. If, for example, the concern is carbon emissions, then a carbon tax is an appropriate response. A tax of $12 per metric ton of carbon dioxide in lieu of production tax credits for wind and biomass would make these renewable sources competitive with natural gas.[8] Unlike the subsidies, however, the tax would raise revenue which could finance reductions in other distortionary taxes.[9] In units perhaps more familiar to most readers, a carbon tax of this magnitude would raise the price of gasoline by ten cents if it were fully passed forward to consumers.

Other production tax credits in the tax code include a production tax credit for electricity produced at nuclear power plants (section 45J). Qualifying plants are eligible for a 1.8¢ per kWh production tax credit up to an annual limit of $125 million per 1,000 megawatts of installed capacity for eight years. This limit will be binding for a nuclear power plant with a capacity factor of 80 percent or higher thereby converting this into a lump-sum subsidy for new nuclear power plant construction.

To summarize, alternative energy subsidies that are currently in place play political favorites, and would be unnecessary if the types of energy that policymakers view as undesirable were taxed at an efficient rate.

Poorly Designed Energy Taxes

First, we note that the literature suggests that our energy tax rates may well be too low. Taking into account accident externalities, congestion, and unpriced pollution, one recent paper finds that the optimal gasoline tax in the United States is $1.00 per gallon, over twice the current rate taking into account federal and state motor vehicle fuel taxes.[10]

Second, our one tax policy to discourage low-mileage automobiles, the gas guzzler tax, contains a loophole large enough to drive an SUV through. The gas guzzler tax is a tax on automobiles that obtain less than 22 miles per gallon and explicitly excludes sport utility vehicles, minivans, and pickup trucks. This excluded class of vehicles represents 54 percent of the new vehicle sales in 2004.[11] The light truck category (comprising SUVs, minivans, and pickup trucks) is the fastest growing segment of the new vehicle market, growing at an annual rate of 5.5 percent between 1990 and 2004. In contrast, new car sales are falling at an annual rate of 1.6 percent. Unofficial Congressional estimates suggest that phasing out the SUV loophole over four years would raise roughly $700 million annually once the phase-out was complete. Optimal tax policy does not support treating similar assets differently, and current policy introduces a significant distortion that could easily be fixed.

We Can Do Better

A twenty-first century U.S. energy tax policy would include 1) an end to energy supply subsidies; 2) a green tax swap; 3) an end to the gas guzzler tax loophole and possible use of "feebates"; and 4) conservation incentive programs. Ending subsidies to fossil fuel production would level the playing field among energy sources and shift us from a policy of promoting fossil fuel supply to encouraging a reduction in fossil fuel consumption. In addition, it would move us away from the reliance on inefficient corn-based ethanol.

Second, we should implement a green tax swap. A green tax swap is the implementation of environmentally motivated taxes with the revenues used to lower other taxes in a revenue neutral reform. For example, Congress could reduce reliance on oil and other polluting sources of energy through the implementation of a carbon tax. The revenues could be used to finance corporate tax reform or to finance reductions in the payroll tax.[12] Consider a tax of $15 per metric ton of carbon dioxide. Focusing only on carbon[13] and assuming a short term reduction in carbon emissions of ten percent in response to the tax, a $15 per ton tax rate would collect nearly $80 billion a year, a number which represents 28 percent of all corporate taxes collected in the U.S. in 2005. Assuming the carbon tax was fully passed forward into consumer prices, it would raise the price of gasoline by 13 cents a gallon, the cost of electricity generated by natural gas by 0.6 cents per kWh and the cost of electricity generated by coal by 1.4 cents per kWh.

We note that a carbon tax is preferable to a carbon cap and trade system as is currently implemented in Europe. While a carbon charge and a cap and trade system could be designed to bring about the same reduction in carbon emissions in a world with no uncertainty over marginal abatement costs, the instruments are not equivalent in a world with uncertainty. Given the uncertainties with respect to the introduction of new technologies to reduce carbon emissions, tax and permit systems can have very different efficiency costs. Because global warming depends on the stock of carbon in the atmosphere rather than emissions in any one year, the expected efficiency costs of a carbon charge policy are likely to be much lower than the costs of a carbon cap and trade system.[14]

Moreover, while a cap and trade system could be designed in which the carbon permits are sold rather than given away, experience to date suggests that they will be given away. In that case, governments give up substantial revenue with cap and trade systems with which they could lower other distortionary taxes as discussed in this policy brief. In a related vein, cap and trade systems generate substantial rent seeking behavior as firms lobby for grandfathering and generous allowances of permits once a program is put in place. While firms are likely to lobby over the specific carbon charge rate and possibly coverage of the tax, a carbon charge is not conducive to lobbying over allocations as are permit systems.

If a carbon tax is not to Congress's liking, it could raise the gasoline tax, index it for inflation, and return the additional revenue through a tax reduction. A gasoline tax increase is less efficient than a carbon tax at reducing carbon emissions.[15] The gasoline tax increase, however, would move us in the direction of the optimal Pigouvian tax on motor fuels taking into account other pollution externalities as well as congestion and accident externalities.[16]

Next, we should eliminate the gas guzzler tax loophole for SUVs and light trucks. Congress might also consider strengthening the gas guzzler tax by shifting to a "feebate" approach where low mileage vehicles are taxed at increasing rates as under the current gas guzzler tax and fuel efficient vehicles receive a tax subsidy. This could be structured to be revenue neutral if desired.

Our final energy tax proposal is to increase the conservation investment incentives that were recently introduced in the Energy Policy Act of 2005. In a study of energy conservation incentives contained in the Energy Tax Act of 1978, we found that the tax credit was much more successful at raising investment levels than a comparable energy price increase.[17] We speculated that the credit program may have publicity effects that spur investment that the energy price increase does not have. In addition, uncertainty over the permanence of future energy price increases makes the certainty of the tax credit at purchase more valuable. A conservation credit that is technologically neutral would be a worthy accompaniment of a higher tax on carbon based fuels if reducing reliance on these forms of energy is a policy objective.

The policies we advocate shift us away from fossil fuels and towards renewable energy. They also reduce the cost to federal taxpayers while aligning private and social interests. This is the making of a twenty-first century energy policy.

Footnotes

1 BP (2006)
2 Energy Information Administration (2006)
3 Metcalf (2006)
4 Pimentel and Patzek (2005), Farrell, Plevin, Turner, Jones, O'Hare, and Kammen (2006).
5 Hill, Nelson, Tilman, Polasky, and Tiffany (2006).
6 Metcalf (2006). It may make solar competitive at the residential level in some parts of the country.
7 ibid.
8 ibid.
9 The advantage of taxes over subsidies for clean power extend beyond the distortionary cost of financing the subsidies. The subsidies lower the cost of electricity and so encourage increased consumption.
10 Parry and Small (2005).
11 U.S. Census Bureau (2006), Table 1027.
12 Metcalf (2005) discusses how a carbon tax could be used to finance corporate tax integration.
13 Greenhouse gases also include methane, nitrous oxide and fluorocarbons.
14 See Newell and Pizer (2003).
15 Pizer, Burtraw, Harrington, Newell, and Sanchirico (2006) present model results showing that focusing climate change policies only on the transportation and electricity sectors doubles the cost of a given carbon emissions reduction.
16 Note too that the motor vehicle fuels tax is sometimes justified as a use charge for highways. To the extent this is true, the current gas tax is even further from its optimal Pigouvian level.
17 Hassett and Metcalf (1995).

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Speaking with a Common Voice On Perspectives for an EU International Energy Policy

*By Heinz Riemer**

At this year's first meeting of the European Council in Brussels at the beginning of March under German presidency, the heads of state and government of the now 27 member countries of the European Union along with the President of the European Commission laid down guidelines for an integrated climate protection and energy policy and passed an action plan called *Energy Policy for Europe*.

Before that, on 10 January 2007, the EU Commission had presented a comprehensive energy package in which it addresses energy policy measures to improve competition, security of supply as well as climate and environmental protection. The European Council has largely confirmed this energy package and supports these objectives. The aim of the EU of developing a unified, long-term energy policy that takes into consideration the central topics of energy policy in an even-handed way has been greeted Europe-wide in its basic orientation, and this with the knowledge that rising demand for energy worldwide, Europe's continued and rising dependency on energy imports, and global climatic warming require common, concerted action on the part of EU countries.

Against this background, further enhancement of energy efficiency and ongoing development of renewable energies have rightly been given a prominent place.

- To this end, the European Council has endorsed a binding target of a 20 per cent share of renewable energies in overall EU energy consumption by 2020. In autumn this year, the EU Commission is to present concrete proposals for each national set of objectives which are to be laid down in consultation with the member countries.
- One component of the action plan is also the objective of saving 20 per cent of the EU´s energy consumption compared to projections for 2020, as estimated by the Commission in its 2006 Green Paper on Energy Efficiency. Also on this point, implementation by way of national targets still has to be achieved.

These targets, which are generally regarded as very ambitious, are supposed to serve not least of all climate protection, for which equally ambitious aims also have been laid down. The European Council has resolved to assume a voluntary obligation on the part of Europe to take on a pioneering role by reducing greenhouse gas emissions by 30 per cent insofar as other industrial nations also lay down comparable targets. Independently of international accords, it has defined a binding, autonomous target for the reduction of greenhouse gas emissions by the year 2020 of 20 per cent relative to the base year of 1990. The distribution of the burdens of reduction to individual member countries still has to be negotiated in detail.

The above-mentioned European energy action plan from March of this year also deals with the topics of the internal European market for electricity and gas, security of supply as well as energy technologies. It contains not least of all also clear guidelines for an effective European energy policy on the international level in which Europe is to speak with a common voice. It is to be welcomed that European politics has recognized the need to act on this matter and in future wants to pursue the securing of energy supplies as one of the main pillars of a common foreign policy because, in this area too, European co-ordination within an internal European market that is integrating ever more strongly is not only imperative, but ineluctable. Especially in a period in which competition for finite energy resources is increasing worldwide and other importing countries and regions are securing their energy interests through foreign policy, Europe should develop a common understanding of its energy interests in relation to non-EU countries and present as far as possible a united front to the outside world. In a community of 27 countries, a coherent energy foreign policy on the Union level can be shaped and formulated more efficiently than solely by the individual member countries.

With the emphasizing of the external dimension of European energy policy, the circumstance is also taken into account that, according to estimates of the EU Commission´s Baseline Scenario, Europe's dependency on energy imports will rise to 65 per cent in 2030 compared to today's dependency of more than 40 per cent. Major advances in energy savings and the enhancement of energy efficiency which the Commission wants to achieve, along with envisaged higher proportions for renewable energies in the energy mix can only limit energy imports, but not replace them.

Energy needs in Europe will, therefore, realistically not be able to be met for the foreseeable future without substantial energy imports — which are essentially the hydrocarbons, oil and gas, along with coal. Europe's energy supply in the future will continue to be tied to a significant degree to the

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international and global contexts. It must, therefore, be seen as an important objective to arrange energy imports from non-EU countries in an economically and politically stable way that minimizes risk. This, in turn, presupposes a geopolitical situation that is as stable as possible and increasingly requires also the political support and flanking of energy projects and current supplies.

It must be seen, however, that action plans and declarations of intent do not amount to concrete policy. A strategy for a coherent energy foreign policy on the European level requires a long-term concept and staying power. The European Council's energy action plan underscores in this sense also that the development of a common concept for energy foreign policy has to be accelerated.

In the energy action plan, the principles take into account that there are already dialogue processes in which the consuming countries co-operate with the producing countries. A co-operative approach is, therefore, being pursued which needs to be developed further in a pragmatic way. This must be borne by the conviction that it is indispensable to create supportable and calculable political relations with producing and transit countries as well as simultaneously contributing as far as possible to stability and international dependability in the countries and regions concerned. Good political foreign relations are fundamentally important for the European Union also in the area of energy. These relations must be consolidated in order to find pragmatic solutions in which all the relevant players can and want to take part — energy-producing and energy-consuming countries, transit countries and also the energy companies — integrated into a stable partnership on both the political and business levels. With regard to Russia, which in the future will remain important for Europe as an energy supplier within the framework of a diversified energy supply-mix, the action plan addresses the need to negotiate and conclude a follow-on agreement for the current partnership and co-operation accord, in particular with reference to questions concerning energy. A lot will depend upon incorporating essential, already accepted principles of the Energy Charter and the Transit Protocol.

For a common European energy foreign policy to come about and be successful in the long run, it will be important to reshape and further develop the present state of uncertainty between national and European jurisdictions and interests in a way consistent with the friendship among member countries. The question concerning how a balance can be ensured between the necessary harmonization within the internal European market as well as the bundling of interests to strengthen Europe's weight on the world energy markets, on the one hand, and the principle of subsidiarity with differing national policy approaches as well as the interest in the sovereignty of member countries with regard to energy policy, on the other, is still waiting for an answer. This answer demands not only a balancing of interests between the supranational and the national levels and a capacity to compromise and reach consensus, but also requires that member countries renounce protectionist approaches, and that exaggerated pretensions to centralize and regulate on the supranational level can be avoided. Express reference must be made to the fact that for the latter aspect, independent competence in the area of energy policy is to date not yet in sight.

In the EU's foreign policy relations, the role of political flanking and of a moderate degree of mutual integration is the right path for co-ordinating a forward-looking energy policy. It can, therefore, only be welcomed that the European Council has spoken out in favour of a European energy policy which should resolutely make efforts to speak with a common voice in negotiations with Europe's international partners (energy producers, energy importers, developing countries).

Despite all the need to act politically, one fact from the perspective of a company operating Europe-wide must not be left unmentioned: To secure energy supplies in Europe it is also important that the distribution of roles between business and politics be preserved. In the future it will continue to remain primarily a task of companies to ensure the security of external energy supply for Europe and to take on the challenges on international markets with strategies which comprise both cautious long-term action to secure energy supplies as well as the ability to respond flexibility to short-term changes in the security situation. In the future the companies must continue to commercially represent the diversification of energy sources, suppliers, transportation routes and types of transportation, to maintain and extend the required infrastructures with high levels of investment, and to maintain Europe as an attractive market for energy suppliers in competition with other importing regions.

In the interests of a secure energy supply, including the supply of natural gas in Europe, globally operating companies are needed which can take on risks, which, with their powers of absorption and bundling, can stand up to producers and potent competitors from other importing regions, and can participate in large-scale international energy import projects, including the upstream, transit and transportation areas. They must be sufficiently strong in the global competition, must not dominate national markets and, mediated by their own business interests, must make a contribution to ensuring that a balanced competitive playing field develops in an integrated internal European energy market.

Multi-Greenhouse Gas Mitigation and Climate Policy

Guest Editors: Francisco C. de la Chesnay and John P. Weyant

This Special Issue of *The Energy Journal*, entitled Multigas Mitigation and Climate Policy, presents the results of the most recently completed study organized by Stanford University's Energy Modeling Forum (EMF), commonly referred to as EMF-21. Edited by John Weyant, Stanford Univ., and Francisco de la Chesnaye, U.S. EPA, the 520-page volume is the largest and most comprehensive international, coordinated study on greenhouse gas (GHG) scenarios to date.

This Special Issue provides a complete report on a comparative set of analyses of the economic and energy sector impacts of multigas mitigation of anthropogenic GHGs, including carbon dioxide (CO_2) and the more potent non-CO_2 GHGs including methane (CH_4), nitrous oxide (N_2O) and a set of fluorinated gases (PFCs, HFCs and SF_6). In 2000, energy-related CO_2 emissions accounted for about three-quarters of global emissions, with the combination of non-CO_2 gases making up the rest on a CO_2-equivalent basis.

The objectives of this study were to: (1) conduct a multigas policy assessment to improve the understanding of the affects of including non-CO_2 GHGs and terrestrial sequestration into short and long-term mitigation policies; and (2) advance the state-of-the-art in integrated assessment and climate economic modeling. Nineteen energy-economic modeling teams from Asia, Europe, and the U.S. along with international experts on non-CO_2 GHGs and forestry participated in the study. Many of the modelers who participated in EMF-21 have now formed a new international consortium (supported by the new EMF-22 study) to develop the next round of global economy, energy, and GHG scenarios.

Results from EMF-21 provide reference projections of all GHGs to 2100 and also estimate the economic effects of meeting a stabilization target of 4.5 Wm-2 (watts per square meter) relative to pre-industrial times, which corresponds to an equilibrium temperature increase of 3.0°C. Although the models project that CO_2 emissions grow throughout the century, the range of reference case projections is quite large, with projections from some models showing slightly more than a doubling and others showing an approximate five-fold increase over the century. The reference emissions for CH_4, the second most important GHG, show about a doubling of emissions over the century. For the climate stabilization case, all models show that climate mitigation under a multigas policy leads to an appreciable reduction in both marginal costs and effects on global GDP.

The two principal insights from the study are: (1) the range of economic sectors from which non-CO_2 GHGs originate is far larger and more diverse than for CO_2; and (2) the mitigation costs for these sectors and their associated gases can be lower than for energy-related CO_2 alone. Taken together, these two factors result in a more diverse portfolio of potential mitigation options, and thus the potential for reduced costs, for a given climate policy objective.

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CONTENTS

The Geopolitics of Barents Sea Oil and Gas: The Mouse and the Bear

*By Ole Gunnar Austvik**

Land and sea areas in the European arctic region are dominated by Norway and Russia. The first offshore seismic surveys were undertaken on the Russian side in the 1970s, leading to the discovery of the giant fields Shtokmanovskoye, Ledovoye and Ludovskoye. Further south in the Pechora Sea many smaller fields were identified. To the east of Novaya Zemlya, in the Kara Sea, the Russians discovered two other giant gas fields: Leningradskoye and Rusanovskye (Moe 2004). On the Norwegian side there has been less exploration. The first licenses for oil and gas exploration were awarded in 1980, leading to the discovery of the Snøhvit gas field in 1984. There are also potential oil and gas deposits in the disputed area between Norway and Russia, where no drilling has as of yet taken place. The seismic surveying conducted in the area by the Soviet Union prior to 1982 provided cause for optimism (the Russians are said to have identified the large Fedinsky High field in this area).

Taking the two countries together, more than 100 wells have been drilled in the Barents Sea. Assessments indicate that there are some 5-6000 mtoe (million tons of oil equivalents) in the area; 80 % of this on the Russian side. Some three quarters is expected to be natural gas. At present Snøhvit is the only offshore field considered commercially viable and under development. Exploration activities have, however, not been very intensive on either the Norwegian or the Russian side. The assertion that 25 % of world unknown reserves are to be found in the Arctic (U.S. Geological Service) remains unfounded. But there is no doubt that reserves are substantial in a global context. The exploitation of most of the resources depends, however, on the availability of new sub-sea technologies, substantial amounts of capital, political will and, on the Russian side, a trustworthy statutory and political framework.

Geopolitics is defined as the study of the way geographical (and often also historical and social) factors help explain the power of nation states (reference.com). In classical formulations the links and causal relationships between political power and (physical power over) geographic space were emphasized (Kjellen 1917). In the more economic and political integrated world of today, the term seeks to understand how control over territory influences political power and political and economic outcomes through factors, mechanisms and institutions in the international economic and political system (Agnew & Corbridge 1989). Hence, the geopolitics of any resource rich region is to be understood not only from the area's own resource endowment. The size and location of other energy resources, how available they are, who controls them, their cost, how regional and global energy markets balance, and energy prices in general, are also important. From this perspective, we will focus on some basic elements for an understanding of the geopolitics of Barents Sea oil and gas developments.

Norwegian – Russian Energy Relations

During the Cold War security issues dominated policies in the North, with Norway under the U.S. and NATO umbrella. Norway and Russia competed in energy markets, but their adherence to opposite economic and political poles oriented exports to a large extent to different markets. Norwegian oil and gas was almost entirely directed to Western European countries (and some oil to the U.S.), while more than half of Soviet exports were devoted to Eastern Europe and the Soviet Republics. After the break-up of the Soviet Union, international economic and political integration processes have become more comprehensive in depth and scope than ever before. Russia has notably increased its exports to Western Europe. A stronger awareness has emerged of joint interests in market developments, prices and contractual terms between Norway and Russia.

As Russia moves (slowly) towards a market economy and integration into the EU and world economy, she is converging with Norwegian petroleum policies in some areas (Austvik & Tsygankova 2004). Even though Russia has no EEA (European Economic Area) agreement with the EU, she is integrated into EU energy markets (although not in such a one-sided manner as Norway), and been influenced in similar ways as Norway by downstream market changes and policy measures, such as market regulation and taxation. Russian gas policy is, however, not "domestified" within the EU and they have been able to arrange their petroleum industry in a rather independent manner. As a result Gazprom has not been forced to unbundle its activities, and instead strengthened its position over the past years as a producer and transporter of gas within Russia.[1]

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See footnotes at end of text.

There are significant structural differences between the oil and gas sectors. There has been a struggle over competence between the government and the oil companies, while there has been less political interest in changing the non-competitive structure of the natural gas industry. The government has made efforts to strengthen the direct control of the Gazprom "monster". For example, Gazprom still wants to sell her gas before a field is developed (Miller 2006) in contradiction to the principles of EU market liberalization. Furthermore, President Putin is accused not only of letting Gazprom exploit market power, but also for using it to rebuild Russia as a super-power, this time by the means of energy rather than weapons.

The fact that Russia is still not fully integrated in the international economy, as for example in terms of membership in the World Trade Organization (WTO), has also had some negative impacts on the country. Relatively low competitiveness of Russian products and a number of out-dated production technologies developed during the Soviet era are still in operation, giving her a technological disadvantage.

So far foreign companies' participation in the Russian oil and gas sector has been limited. The new German-Russian consortium to build the Baltic gas pipeline may be a signal from the Russians that they may involve themselves more directly with foreign companies in the future. On the other hand, the problems that Shell has experienced in Sakhalin II and BP now in the Kovytka field, demonstrate that the Russians may continue to be rather reluctant to involve international oil and gas companies. Russians primarily seem now to wish to develop oil and gas fields by their own efforts, and invite international sub-entrepreneurs in projects rather than expand shared ownership with international oil companies.

Norway has on her side developed and maintained a highly professional petroleum administration led by a state enterprise (Austvik 2007). Norway has been rather successful in making industrial arrangements efficient and to the interests of the Norwegian government and companies. The highly competent and specialized Norwegian petroleum "cluster" is well positioned for the development of fields on both Russian and Norwegian sides. The sub-sea technologies developed at Ormen Lange and Snøhvit, horizontal drilling expertise, laying of long-distance sub-sea pipelines, LNG-technology and other innovations are important elements with respect to "know-how". Parts of this Norwegian technological leadership are shared by sub-contractors in a European and international network.

The question of knowledge, good relations and confidence building become important for how Norway and Russia can cooperate in the Barents region. Communications should be improved on a practical level, the competence of the Norwegian petroleum system should be enhanced and possibly be exported to (parts of) the Russian system. Likewise, the Russians could (or should) invite a Norwegian company to play the role as operator of a field (such as Stockman). To develop and operate such a new giant field, is not only a question of technological, but also managerial and organisational competence.[2] Norway could also invite Russian companies to participate in her petroleum industry.

If engaged on the Russian side, however, the Norwegian industry needs to be supported politically by stable and predictable law making, taxation policies, political good will, and infrastructural development, secure sub-deliveries, etc. Norwegian authorities should be instrumental in the provision of this support, but the industry could also need the support of EU countries and the U.S. EU and American companies may become partners with Norwegian companies and/ or suppliers to projects on both Norwegian and Russian sides.

Environmental Challenges

The Barents area with its cold climate and waters represents a rather vulnerable environment with respect to the conservation of wildlife, bio-diversity, fisheries and nature. In 2003, the Norwegian government decided to continue oil and gas exploration in the southern parts of the Barents Sea minus some areas defined as especially vulnerable. Environmental regulations are stricter here than further south on the NCS (Norwegian Continental Shelf). A more integrated plan for the entire Barents Sea concerning resource management, the environment and economic and political interests was presented in spring 2006 (Ministry of Environment 2006).

The biggest environmental threats at present are, however, considered to come from the Russian side. There is already a risk of oil spills from the increased traffic of Russian oil tankers off the Norwegian coast. There are plans to build a 2 mbd oil pipeline to Murmansk. This would increase the traffic of oil vessels along the Norwegian coast substantially, and demonstrates the need for proper regulations.

Environmental concerns raised by increased petroleum activity in the area, lead to calls for greater cooperation between Norway and Russia. The industry has argued that the best way of influencing Russian environmental standards and practices is by showing practically how it can be done on the

Norwegian side, and by offering environmentally sound partnerships with partners on the Russian side. This would reduce environmental risks for the Norwegian coastline and waters as well. However, the situation also demonstrates a need to create a broader European and international understanding about these challenges.

Jurisdictional Issues

There are several jurisdictional issues that are not clarified in the area. Firstly, the disagreement over the marine delimitation of the economic zone and the continental shelf between Norway and Russia (the "disputed area") has not been settled. Norway maintains that it should follow the median line principle, while Russia argues that it should follow the sector line principle. The difference represents some 175.000 square kilometres, an area larger than the Norwegian North Sea south of the 62nd parallel. Negotiations have been going on for 30 years.

Russia has argued that some sort of condominium could be established in the area without settled borders. Norway has maintained that cooperation can only be established when a delimitation line is drawn. For fisheries, however, an interim arrangement was made in 1978 in the so-called "Grey Zone", regulating the parties' right to inspect vessels in the area. This zone covers some, but not all, of the disputed area within 200 miles, but also some undisputed Norwegian and Russian waters.

There is no international disagreement about Norwegian sovereignty over the Spitsbergen Archipelago (Svalbard). Through the Spitsbergen Treaty of 1920, Norway was granted "full and absolute sovereignty" over the islands, defined by coordinates (often called the "Svalbard box"). However, according to the Treaty, Norway cannot discriminate subjects of other signatories and cannot impose higher taxes than needed for the administration of the islands.

There is some controversy pertaining to the provisions of the Spitsbergen Treaty; especially when it comes to the sea areas beyond territorial waters and the ocean floor. It is not known whether or not they are promising areas for petroleum activities. Norway maintains, however, that the provisions of the Treaty do not apply to the economic zone around the islands, and instead provide unrestricted Norwegian jurisdiction; the continental shelf around Svalbard is a continuation of the continental shelf of mainland Norway (except for the 12 mile territorial waters around the coastline of Svalbard). Some signatories have, contrary to this, argued that Svalbard is entitled to its own economic zone, governed in the same way as the islands.

Norway established a 'Fisheries protection zone' of 200 miles around Svalbard with non-discriminatory regulations in 1977 (same principle as the economic zone but so far only valid for fishery).[3] It entailed the introduction of a 200-mile exclusive economic zone (EEZ), according to United Nations Convention on Law of the Sea (UNCLOS). As fish do not know the borderlines of international waters, the two countries, and states that have received a Barents quota from one of them, may take part of this quota in the EEZ of the other. The proportion of catch between Norway and Russia is fixed (mostly 50/50) but the total catch is negotiated yearly. There have been disagreements over what is a sustainable catch in the area, where Russians have argued for higher catches than Norway. Those with a Barents Sea quota should accept Norwegian inspections (catch, size, etc.) in the Protection zone. Several countries deny the Norwegian interpretation of her rights in the area.

The "Loophole" is an area between Norwegian and Russian EEZs and the fishery protection zone around Svalbard, and is judicially international water. The Norwegian-Russian management system for fisheries has sought to include control of vessels also in this area. It is, however, a lack of clarity as to the authority to perform inspections in the area, and regulations must, therefore, be done through diplomatic channels to the countries were the vessels are registered.

Foreign and Security Policy

Access to petroleum resources, and energy trade and prices has had great significance both for the military systems and for the development of modern societies. The petroleum resources of the world are still found in countries with considerable political instability, with room for major market disturbances. For Norway, security political dimensions to the oil and gas activities have been particularly in focus in connection with the possibilities of production in the polar areas. For Russia, the continued great strategic significance of the Kola bases suggests that petroleum activity may seem negative for the operational conditions of her Northern fleet, and particularly for her submarines.

Submarines will more easily remain undetected, as noise from petroleum activities may be stronger. The larger submarines must pass between Bear Island and Norway because of sea depth. Activities in

this area make it easier for submarines to pass to and from Russian Barents Sea. This can, of course, be a disadvantage and advantage to both sides. Platforms can be used for radar equipment, electronic warfare, and helicopter bases, meteorological and oceanographic data collection. With the consequences also for surface vessels and aircraft, this may lead the Russians to adjust their strategy for their Northern fleet. They will most likely be negative towards any attempt at limiting their access to the Atlantic Ocean.

As Norway is a mouse compared to the Russian bear, it is necessary for Norway to co-operate with other countries in securing her interests. The question of Norwegian control becomes a central one. Obviously, Norway needs relevant military capability in this area herself, as a minimum for doing sufficient "policing activities" at sea and to remain credible to the Russians and other countries. States that are strategically vulnerable to a loss of Norwegian energy production, such as Germany and the UK, form a new resource for military assistance that might be exploited. Countries that receive Norwegian gas, along with the U.S. and its concern over global energy balances, share a clear interest in the shaping of Norwegian foreign and petroleum policy, and helping to secure the area. Joint military interests can also be developed with the Russians, except in those areas that are related directly to Norwegian-Russian controversies.

Security-of-Supply is in economic terms often a question of understanding the dynamics of the political economy of oil and gas. Norwegian policies are challenged domestically and internationally by Russia, the EU, EU countries and the U.S., in developing a way of understanding that is beneficial to security-of-supply for consuming nations, and at the same time also to Norwegian interests, so that Norway can attain a maximum sustainable price over time.

In developing a strategy to handle this situation Norway must anticipate the attention of other nations. As a Western European country, Norway is relatively isolated in her interests as a petroleum exporter, although she may find partners in several single areas. Developments in EU and EU countries as well as in Russia and other gas exporting countries are important. Gazprom as a single company and its position as a market leader is of great importance. Market developments and economic interests will have to become part of Norway's traditional foreign and security relations. This will also be expected from foreign companies and governments.

When Will Production Expand?

The geopolitics of Barents Sea energy must be understood in the context of how and to what degree the international economic and political system regards the area a petroleum producing region. Present high prices create the prospect of expensive field developments that in a low price scenario would not be profitable. Unrest in the Middle East and company interests in attaining profit, together with energy consuming countries' push for more energy and a desire to improve their security-of-supply situation, are heavily influencing domestic petroleum policies and contributing to a speeding up of field developments in both Norway and Russia.

Looking a decade or two ahead, energy diversification, improvements in energy efficiency as well as growth in production of renewable energy sources could change the present optimistic prospects for the huge reserves to be produced, to a pessimistic one. The Stone Age did not come to an end because there was a lack of stones. Hence, the development of the area depends not only on production cost and technology in a harsh and difficult climate, but also on international energy prices and policies, on bilateral relations between Norway and Russia, as well as on multilateral relations between these countries and the major powers in the world.

Consequently, there may still be time before offshore production expands substantially in the Barents Sea. With the ice melting going on in the area more sea becomes open. The challenges of global warming are in the Arctic areas not only environmental. Higher temperatures also open up for more oil and gas exploration. If high energy prices persists, the ice melting could contribute to a rush of companies and countries pushing for a speeding up of developments.

Footnotes

1 See Stern 2005 for a comprehensive discussion of Gazprom positions and developments.

2 An example: When the Norwegian petroleum industry was in its infant stage, Mobil was in 1973 assigned the role as operator of the huge Statfjord field, although it owned only 15 % of it. Statoil owned 50 % but did not, at the time, have the competence to do the job. However, in 1987, Statoil competence had improved to such an extent that the company (according to agreement) took over as operator of the field. The arrangement proved to be very important as part of building the Norwegian petroleum cluster (see i.e. Ryggvik 1997).

3 The Svalbard Treaty regulates fisheries in territorial (12 miles) and inner waters.

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Endogenous Technological Change and the Economics of Atmospheric Stabilisation

Guest Editors: Ottmar Edenhofer, Carlo Carraro, Jonathan Köhler and Michael Grubb

Few dispute that technology innovation will be central to tackling the diverse energy challenges of this Century – but the economics of innovation remain poorly understood and inadequately represented in most economic models.

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CONTENTS

Nuclear Power Generation

*By Tarjei Kristiansen**

Nuclear power is defined as the controlled use of nuclear chain reactions to free energy for work, including momentum, heat, and the generation of electricity (Energy Information Administration, 2007). Nuclear power generation is currently limited to nuclear fission and radioactive decay; energy is generated when a sufficiently concentrated fissile material like uranium creates nuclear fission in a controlled chain reaction which also generates heat. The heat can be used to boil water, produce steam, and drive a steam turbine — the turbine can be used for mechanical purposes and to produce electricity.

Nuclear power generation provides 7% of the world's energy and 15.7% of the world's electricity (IEA, 2006). The U.S. produces the most nuclear energy, with nuclear power supplying 20% of consumption, and France generates the highest share of its electrical energy from nuclear reactors — 80% as of 2006 (EIA, 2004 and Beardsley, 2006).

Currently, there is somewhat of a political groundswell in several countries where "nuclear" substitutes for fossil-fuel-generated electricity. A key issue is its low emissions of greenhouse gases which can assist governments to reach targets specified in the Kyoto Protocol.

Additional rationales to support further growth of nuclear capacity:

- Transparent cost structure and low exposure to the variations in global fuel prices; nuclear is the *only* power generating technology where all costs are explicitly priced
- Support for price stability by providing inexpensive baseload generation
- Security of natural gas supply which may be weakened in the future due, for example, to "unstable" deliveries from Russia.

The World Nuclear Association (2006a) categorizes price stability and security of supply as national benefits and non-zero greenhouse gas emissions as a global environmental benefit. The World Nuclear Organization encourages governments to combine their regulatory and safety-oversight responsibilities with efficient licensing procedures for new plants and to introduce incentives to accelerate the transformation to clean-energy economics provided by nuclear generation.

The "800-pound gorilla" issue for the public is the still-unresolved problem of safe, secure waste storage for indefinite periods. Post 9-11, the likelihood of severe radioactive contamination caused by accidents or sabotage, including the possibility that rogue organizations or nations can produce or purchase nuclear weapons is a universal concern. Proponents believe that such risks are small and can be contained or diminished by utilizing new reactor technology. Critics claim that nuclear power is an uneconomic, unsound and potentially dangerous energy source, especially compared to renewable energy, and that new technology cannot be relied on to reduce risk.

Development of Generation Capacity

Most of the existing nuclear power generation is located in Europe, the U.S. and Japan. Globally there are about 440 existing nuclear power plants with a total installed capacity of 368 GW. Worldwide 20 countries have new plants under construction or development. The majority of new build capacity in the next two decades is likely to occur in Russia, the U.S., India, China and Japan.

Global installed nuclear capacity increased relatively quickly, from less than 1 GW in 1960 to 100 GW in the late 1970s, and 300 GW in the late 1980s. Since the late 1980s, capacity has increased at a lower rate, only reaching 366 GW in 2005 (primarily due to Chinese expansion of nuclear power). During the 1970s and 1980s, more than 50 GW of capacity was under construction, but by 2005, only about 25GW of new capacity, mostly baseload, was planned (2006a).

China remains the biggest potential growth market for nuclear reactors and nuclear materials including other commodities. It is expected that new build will be concentrated in Asia (China, India, Japan, South Korea) and Russia. At some point, however, Ukraine, Brazil, Mexico and other countries will consider new generation. Russia's ambitious plan to build 40 GW of new nuclear capacity by 2030 would increase its share of nuclear energy in electricity generation to 25%. Plans in the EU include two 1600 MW European pressurized water reactors (one coming online in 2011 in Finland and another in 2012 in France). The UK's energy review of July 2006 favors nuclear power to replace the coming retirement of its existing nuclear fleet and to meet commitments under the Kyoto Protocol.

In a longer perspective, from 1990 to 2004, world capacity increased by 39 GW

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See footnotes at end of text.

(12%, due both to net addition of new plants and uprating of some existing) and electricity production increased by 38% (Uranium Information Centre, 2007). The relative contributions to this increase were new capacity 36%; capacity uprates 7%; and availability increases 57% (see Figure 1).

The capacity factor is similar to availability; it is a measure of the amount of electricity generated versus the maximum amount a unit can generate in the same period. The capacity factor is a function of the technology, the cost structure (i.e., a strong relationship between the capital costs and the capacity factor), the downtime (the length of time to maintain and refuel a plant) and the wholesale price level (including the steepness of the supply curve). We note that in some cases the calculation of the capacity factor is flawed by using a unit's original nameplate capacity rather than its capacity after upgrades, improvements, and the like, thus creating an "inflated" capacity factor. As an example, although it generates a large share of its electricity from baseload nuclear, France's capacity factor is smaller because it uses nuclear power for regulating purposes (Stricker and Leclercq, 2004).

The average capacity factor over the last five years for the world's major nuclear plants has been higher than the cumulative average because during the start-up phase of new plants, unplanned outages are more frequent, and reliability usually increases over time (Morgan Stanley, 2005).

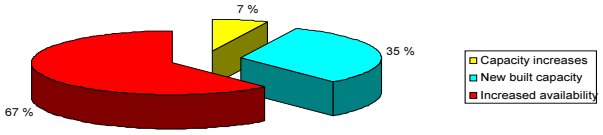

Figure 1
Reasons for Increased Nuclear Generation Worldwide Since 1990

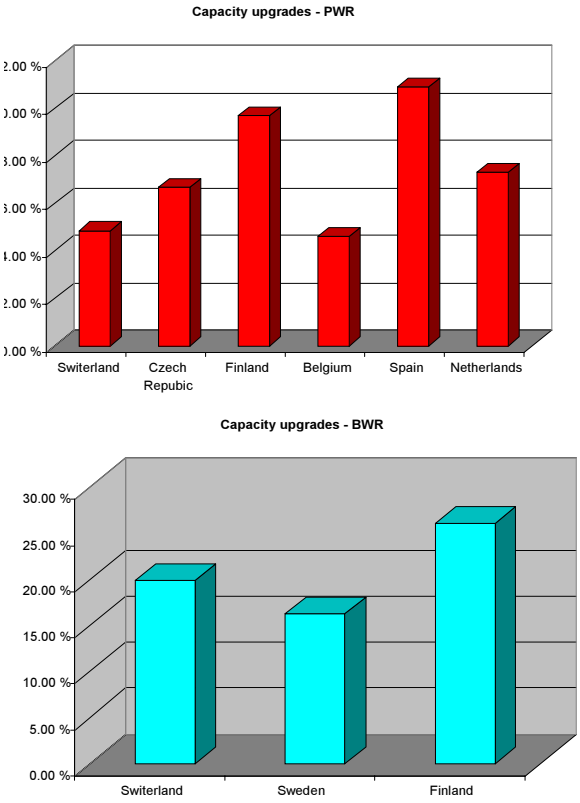

Figure 2
Nuclear Capacity Upgrades by Technology (PWR and BWR) and Country.

Nuclear Uprates

Rising fossil fuel prices and mandatory pollution control equipment when added to fossil power plants including CO_2 allowances drive up the cost of fossil-fueled electricity generation. In the meantime, the cost of nuclear generation has remained relatively stable and has become competitive with fossil generation. Owners have realized increased returns on investment (ROI) in nuclear plants from power uprates and modernizing equipment to achieve higher efficiencies in the steam cycle (Carter, 2006). *Nuclear plants have increased electricity output through power uprates* by increasing the heat output of their 1960s-1980s-era reactors. *Nuclear plants have increased electricity output through modernizing* by taking advantage of design advances in components including reactor cores, steam turbines, moisture separators, steam generators, and fluid flow instrumentation (Carter, 2006).

Figure 2 shows historic and planned capacity upgrades by technology (pressurized water reactor - PWR and boiling water reactor - BWR) for selected countries. The available data (Uranium Information Centre, 2006) is limited but we note that BWR technology appears to have a larger potential for upgrades. Hence it would be desirable to see applications for capacity upgrades in other countries that have these technologies. However, France prefers to invest in new capacity rather than upgrades while Germany still operates under its moratorium with specified nuclear outputs until the phase-out of its major capacity by 2020. EU political experts and investment banks such as Morgan Stanley, UBS and Deutsche Bank believe that Germany must abolish its nuclear moratorium if it wishes to meet its targets under the Kyoto Protocol.

Power uprates are normally undertaken during regular maintenance periods to avoid keeping units out of operation for longer periods. Power uprates were unusual in the 1970s, 1980s, and early 1990s. However, improved technology, rising fossil fuel prices and growing demand have made uprating attractive. In some jurisdictions, the consolidation of nuclear units resulting from mergers and acquisitions encourages power uprates to achieve higher ROI. In the U.S., the Energy Policy Act of 2005 increased government subsidies to encourage new construction.[1] Capacity uprates are significant for Sweden, the U.S. and East European countries. All of the remaining reactors in Sweden will most likely be uprated in the near future, and in the U.S. as much as 5GW could be added between 2005 and 2010.

Life-time Extensions

Most nuclear plants were originally licensed for a period of 30-40 years with potential extensions. The license period is based on economic analyses, and a pay-back time according to the projected ROR based on the electrical rate structure of the era (Carter, 2006).

Earlier experience demonstrated that several aging phenomena observed in nuclear power plants were manageable and that life extension was technically feasible. Similarly, research was conducted to determine the effects of aging on the passive long-lived components in light water reactors. Utilities provide experience, data and component samples on topics vital to license renewal/decommission procedures, such as thermal aging, embrittlement of cast austenitic stainless steel, environmentally assisted cracking, and steam generator tube integrity (Carter, 2006).

Most reactors in Europe are about 20-25 years old and companies usually have 40-year operating licenses. Experts believe the technical limit of their common designs is about 60 years. Generally, existing plants seek to obtain lifetime extensions because it makes sense economically to operate them as long as possible since the construction costs are largely sunk.

Lifetime extensions produce different benefits depending on the owners' options, for example, not replacing retired plants, replacing nuclear with fossil-fuel, or newbuild (nuclear or fossil). The replacement of a nuclear plant with fossil fueled capacity could increase the electricity prices, thus contributing to company profits (Morgan Stanley, 2005).

Economics of Nuclear Power Generation

Prices for uranium have more than tripled. However, since variable costs are small compared to the capital costs, the impact is limited. More important is any incremental change in generation capacity imposed by commissioning, decommissioning, capacity upgrades or availability reductions/increases.

Uranium Markets

Unlike other metals, uranium is not traded on an organized commodity exchange but in most cases through contracts negotiated directly between buyer and seller (Cameco, 2007). Fewer than 100 companies buy and sell uranium in the West.

The structure of uranium supply contracts may vary as:

- A single fixed price or is
- Based upon various reference prices with intrinsic economic corrections.

Contracts normally specify a base price (for example the uranium spot price) including rules for escalation. In these contracts, buyer and seller agree on a base price that escalates over time based on a predetermined formula, depending on macroeconomic indices including GDP or inflation (Cameco, 2007).

A spot market contract usually entails a single delivery and is normally priced at or near the published spot market price at the time of purchase (Cameco, 2007). However, 85% of all uranium has been sold under long-term, multi-year contracts with deliveries starting one to three years after the contract is signed. Long-term contract terms range from two to ten years, but typically run three to five years, with the first delivery occurring within 24 months of contract award. They may also include a clause that allows the buyer to freely choose the size of delivery within specified limits (for example annual volume plus/minus a percentage).

The nuclear fuel cycle is characterized by utilities purchasing enriched uranium in intermediate forms (Cameco, 2007). Sometimes the utility's buyer will purchase enriched uranium product but contract separately for fabrication. Many utilities will typically invite two or three suppliers to submit competing offers for each stage in the four-stage fuel cycle. Sellers consist of suppliers in each of the stages as well as brokers and traders.

Uranium markets are thus differentiated by intermediate forms but also geographical location. The major marketplaces include the Americas, Eastern and Western Europe, the Far East, the Commonwealth of Independent States (CIS), and China. Most of the fuel requirements for nuclear power plants in the CIS are supplied from the CIS's own stockpiles. Often producers within the CIS also supply uranium and fuel products to western purchasers, increasing competition.

Uranium Prices

Until 1985 the West supplied more uranium than was reprocessed from commercial nuclear facilities and military programs. By the end of the 1980s, prices had dropped below 10 USD/lb for yellowcake. As producers then began to curtail operations or exited the business entirely, western uranium inventories

shrank significantly. Since 1990, uranium requirements have exceeded supply; now global demand for uranium is expected to increase steadily through the next decade to a peak of over 200 million pounds annually of yellowcake (Energy Information Administration, 2007). Figure 3 shows the development of the uranium-U3O8 price from March 1987 to January 2007.

Uranium spot prices reached an all-time low of 7 USD/lb in 2001, but as of January 2007, uranium sells at 72 USD/lb.[2] Uranium is at the highest price (adjusted for inflation) in more than 20 years;[3] its price has risen seven times from July 2003 to January 2007 due to the scarcity of sources. The continuing price escalation has caused significant mining expansion among the uranium majors and the entry of numerous smaller companies.

However utilities almost exclusively purchase all uranium through long-term contracts. The price for these contracts charged by French Areva was around 23 USD/lb in 2006 and thus substantially lower than the spot price (Areva, 2007).

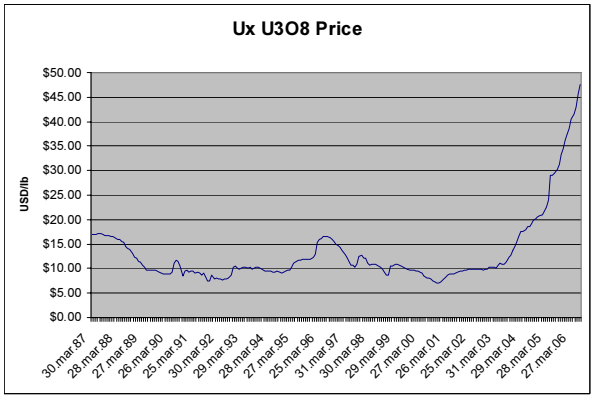

Figure 3
Spot Price Development of Uranium-U3O8 from March 1987 to January 2007 (Source: The Ux Consulting Company, LLC, http://www.uxc.com/)

Capital Costs

The capital costs of a nuclear plant depend on plant size, multiple unit sites, design improvements, standardization, and performance improvement (World Energy Council, 2007). The capital costs are accounted for through depreciation.

In a deregulated market, private companies must accept shorter output contracts and the risks of future competition. These conditions shorten the return on investment (ROI) period and thus support power plants with lower capital costs (Stenzel, 2003). In many countries, licensing, inspection and certification of nuclear plants have created delays and additional construction costs. Gas-fueled and coal-fueled plants are not subject to such regulations. During construction a power plant does not create revenue and, therefore, longer construction times lead to higher interest payments on borrowed construction debts. However, in some regions, the regulatory processes for siting, licensing, and constructing have been standardized to make construction of newer, safer designs more attractive to investors. Examples are Japan and France where construction costs and delays are down because of streamlined government licensing and certification procedures.

The capital costs for a nuclear plant contributes to about 70% of the total costs of nuclear-generated electricity, assuming a 10% discount rate (Grimston, 2005). Capital costs incurred while a plant is under construction include costs for the necessary equipment, engineering and labor. These are often termed "overnight" costs and exclude interest incurred during the construction period and financing costs. The capital costs also include engineering-procurement-construction (EPC) costs, owners' costs and various contingencies. When electricity sales begin, the owner pays back the sum of the overnight and financing costs.

Variable Costs

Variable costs include operation and maintenance (O&M) costs. O&M costs are influenced by availability of the nuclear plants and by safety regulations and manpower costs (World Energy Council, 2007). Historically, the reductions in O&M resulted from cuts in staffing and downtime. Moreover, nuclear O&M costs have stabilized at levels comparable with other baseload generation (World Nuclear Association, 2006a).

OECF-NEA studies (2005) show that the fuel costs have remained fairly stable over time due to lower uranium and enrichment prices including higher burnups. Typically new fuel rods now last 10-15% longer.

Fuel accounts for approximately 20% of total nuclear generation costs. In recent years, fuel cycle costs have decreased significantly, leading to reduced fuel costs for all types of nuclear power plants globally (World Energy Council, 2007). The nuclear fuel cost components include natural uranium (U3O8), uranium conversion to UF6, uranium enrichment, and nuclear fuel fabrication. Table 1 shows the nuclear fuel cost components as of January 2007. If we assume that one kilogram gives 3.4 GJ or 315 MWh, taking the total cost and dividing it by the energy gives 7.03 USD/MWh or 5.45 EUR/MWh. Currently uranium (U3O8) amounts to approximately 57% of the total fuel cost while enrichment amounts to around 28%. Costs for nuclear waste management are around 2 Euro/MWh (Morgan Stanley, 2005). Variable costs also include O&M costs which are in the range 3.54 to 5.23 Euro/MWh (World Energy

Council, 2007).

Figure 4 shows the nuclear fuel costs sensitivity when the uranium, enrichment, fuel fabrication and conversion prices are increased with twice the absolute value and decreased with half the absolute value. The greatest impact is from the uranium price and the enrichment price. A 100% increase in the uranium price results in a 57% increase in the total fuel price while a 100% increase in the enrichment price results in a 28% increase in the total fuel price. The component costs of producing nuclear fuel (conversion, enrichment and fabrication) do not vary substantially. Thus the impact of increases in the price of uranium on the total generation cost is small. For a large PWR a five-fold increase in uranium price will only double the fuel cost (World Energy Council, 2007).

item	cost	unit	amount	unit	cost USD
U3O8	72,00	USD/lb	8,00	kg	1269,84
conversion	11,50	USD/kg	7,00	kg	80,50
enrichment	130,00	USD/SWU	4,80	SWU	624,00
fuel fabrication	240,00	USD/kg	1,00	kg	240,00
total					2214,34

Table 1
Nuclear fuel Cost Components

The variable costs of operating nuclear plants continue to remain low. In the U.S. they were 1.72 cents/kWh in 2003 (World Nuclear Association, 2006a). In Europe a level of 1 euro cent/kWh has been obtained in France and Finland (World Nuclear Association, 2006a). The balance among O&M costs, fuel, and spent fuel (including waste management) costs correlates with age. O&M costs tend to rise as plants age; spent fuel charges drop as the funds dedicated to it accumulate.

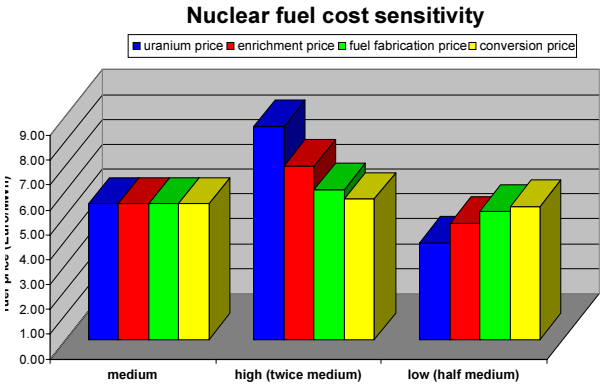

Figure 4
Nuclear Fuel Cost Sensitivity

Full Generation Costs

The World Nuclear Association (2006a) states that nuclear generation has become more competitive primarily due to cost reductions in construction, financing and plant operations, waste management and decommissioning. Construction costs per kW have decreased substantially because of standardized design, shorter construction times and more efficient generation technologies. Financing costs for new plants are expected to decrease with the application of new technology methods, and the streamlining of licensing procedures will reduce regulatory costs and uncertainty by establishing predictable technical parameters and timescales from design certification to construction and operations. Operating costs have decreased with increasing capacity factors. Lower marginal costs (below coal and gas) have made refurbishment and capacity uprates popular. The marginal cost change very little with varying uranium prices and thus accommodate price stability and encourage lifetime extensions for existing units. Waste and decommissioning costs are included in the operational costs and represent a small share of the lifetime operational costs. The bottom line is that even when considering both capital and operating costs, nuclear today is less expensive than fossil-fueled electricity generation.

Several studies (e.g., Morgan Stanley, 2005 and UBS, 2005) estimate the full generation costs of new nuclear power plants to be 42-43 EUR/MWh (a possible reduction in investment costs could give a cost below 40 EUR/MWh). The studies estimate the full generation costs (excluding carbon costs) of a new CCGT and a new coal plant to be 42 EUR/MWh and 39 EUR/MWh respectively.

Table 2 shows the costs in the study by IEA and OECD-NEA (2005); these may even be an underestimate because they do not account for recent increases in fossil fuel prices.

Critics of nuclear power argue that any of the environmental benefits are offset by safety compromises and by the costs related to construction and operations, including costs for depleted-fuel disposal and plant decommissioning and retirement. Proponents of nuclear power argue that nuclear energy is the only power source which explicitly factors the estimated costs for waste containment and plant decommissioning into its overall cost, and that the quoted cost of fossil-fuel units is deceptively low for this reason.

Other issues relevant to nuclear power economics are:

- Nuclear plants are inclined to be most competitive in areas where other fuel resources are not promptly available; for example, France has almost no natural supplies of fossil fuels (Palfreman, 2006)
- Most new natural gas-fired plants are planned for peak load supply. The larger nuclear and coal plants are more difficult to regulate in their instantaneous power produc-

Generation costs (USD/MWh)	**5% discount rate**	**10% discount rate**
Nuclear	23-31	30-50
Coal	25-50	35-60
Natural gas	37-60	40-63

Table 2
Summary of Generation Costs from IEA and OECD-NEA (2005) study.

tion, and are generally considered baseload supply. The market price for baseload power has increased less quickly than peak load supply. Some new experimental reactors, particularly pebble bed modular reactors, are specifically designed for peak load supply

- Current nuclear reactors give back around 40-60 times the invested energy when using life-cycle analysis. This is more efficient than coal, natural gas, and current renewables except large hydropower (World Nuclear Association, 2006b).

Summary

We have described nuclear power generation development including capacity uprates, life-time extensions and the economics of nuclear power. Nuclear power generation has gained public interest due to its economic competitiveness, zero carbon dioxide emissions, and its potential for energy independence. Global consumption is increasing rapidly, creating a need for significant new generation capacity (mainly baseload) in the coming decades. Yet few plans to meet global demand with nuclear exist in the EU, although some plans exist in Asia and Russia.

Plant owners have realized increased ROI by extending the output of their licensed plants (capacity available) through uprating and modernizing equipment to achieve higher efficiencies in the steam cycle. From an economic view it makes sense for owners to run nuclear units as long as possible since construction costs are largely sunk and the plants are profitable. The marginal generating costs of capacity uprates and life-time extensions are roughly only one third of those for new nuclear plants (World Energy Council, 2007).

Uranium is generally traded through contracts negotiated directly between buyer and seller. Uranium spot prices have risen almost seven times from July 2003 to January 2007 due to the scarcity of sources. The continued price escalation has triggered expanded mining by the uranium majors and the entry of numerous smaller companies. However most utilities buy their uranium almost exclusively through long-term contracts priced at substantially lower prices.

The coming decades should create expanded opportunities for nuclear power worldwide. For example, more than 80% of installed European capacity will be over 30 years old by 2020 and will be retired from 2010 to 2030 (World Energy Council, 2007).

Due to global cost reductions in construction, financing and plant operations, waste management and decommissioning, the World Nuclear Association (2006a) forecasts that nuclear will remain competitive. For new nuclear power projects we conclude that:

- Standardized design, shorter construction times and more efficient generation technologies will sharply reduce construction costs per kW,
- Financing costs for new units will decrease as new technologies develop,
- License streamlining will reduce regulatory costs and uncertainty by establishing predictable technical parameters and timescales from design certification to turnkey operation,
- Eventually, regional solutions will arise to safely transport and store global nuclear waste.

Footnotes

1 See for example, http://www.eia.doe.gov/oiaf/aeo/conf/pdf/rankin.pdf
2 The price rose especially fast because of recent flooding at Cameco's Cigar Lake mine in Canada; the mine was on track to produce around 15% of the world's supply by 2011 but that now appears unlikely.
3 The higher price has stimulated new prospecting and reopening of older mines. Cameco and Rio Tinto are the two largest producers (each with 20% of production), followed by Areva (12%), BHP Billiton (9%) and Kazatomprom (9%).

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Hybrid Modeling of Energy-Environment Policies: Reconciling Bottom-up and Top-down

Guest Editors: Jean-Charles Hourcade, Mark Jaccard, Chris Bataille and Frédéric Ghersi

Over the last two decades, energy-economy modelers of all stripes have begun to realize that energy and climate change policy cannot be approached solely with either a financially denominated macroeconomic 'top-down' approach, be it CGE or otherwise, or a purely technologically denominated 'bottom-up' approach. Large scale shifts in the energy system, like those that effective climate policy may require, will involve similarly large changes in technology and the micro- and macrostructure of the economy, demanding realistic modeling of all these dynamics.

This is the 'hybridization' challenge, to bring technological explicitness and micro- and macroeconomic realism together in one integrated policy analysis package, and it has given rise to several distinct hybrid modeling approaches. Yet, while individual publications over the past decade have described efforts at hybrid modeling, there has not yet been a systematic assessment of their prospects and challenges. To this end, several research teams held a workshop in Paris on April 20, 2005 to compare and share their hybrid modeling strategies and techniques.

This 177-page special issue, edited by Jean-Charles Hourcade, Mark Jaccard, Chris Bataille and Frédéric Ghersi, is composed of an introductory editorial, which summarizes the various modeling approaches represented in the issue and speculates on future methodological advances, and detailed articles from each of the participating modeling teams (WITCH, IMACLIM-S/POLES, ObjECTS MINICAM, CIMS, E3MG, an MCP CGE, AMIGA, and EPPA-MARKAL). By presenting the state of the hybridization art in one easily accessible package, this issue is a unique and useful tool to the wider modeling community grappling with the world's energy and environmental policy issues.

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Mexican Energy Sector Modernization Tasks, 2006-2012

*By Ernesto Marcos Giacoman**

Presentation

Energy is a strategic sector for Mexico. It is the foundation of our economy, an important factor in our relations with the globalized world, and has the capability of performing a priority function in driving our future development.

It is so significant for Mexico, that the energy sector cannot be treated in isolation from the rest of the economy. In fact, in large measure the development of the sector explains the behavior of our basic economic variables.

In the last 5 years, Mexico has experienced the most favorable international economic situation recorded in the modern history of the country.

Because of high oil prices, oil export revenues during the Fox Administration (2001- 2006) amount to more than $135 billion U.S. dollars. More than twice that enjoyed by President Zedillo's government. This means $70 billion U.S. dollars of additional foreign currency generated directly by the energy sector during the last six-years.

Based on this oil bonanza, the Federal government has promoted Pemex's use of the off-balance sheet mechanism known as Pidiregas in order to finance practically all of the productive investment that Congress authorized for Pemex during recent years (Pidiregas debt is now at over U.S. $50 billion). If we also take into account the unprecedented increase in remittances from Mexicans working abroad (U.S. $60 billion); the substantial savings on the service of the public debt for having enjoyed the lowest interest rates that have prevailed in the last 48 years (U.S. $35 billion); and the effect on our trade balance as a result of the robust, sustained expansion our main trade partners have recorded (U.S. $100 billion), we are talking about extraordinary funds, in foreign currency, of more than $300 billion U.S. dollars in the same period.

These elements largely explain the macroeconomic equilibrium attained. All three derive from external factors over which we have no direct influence. These truly extraordinary amounts were not available in previous administrations. The question we must ask ourselves is: What did the Fox administration do with this extraordinary flow of foreign currency that Mexico received during this six-year period?

Table I clearly shows that a production maximization policy is evident. Pemex has spent over $50 billion dollars in the last six years, mostly borrowed, to maximize production of oil and gas. Also shown is the natural decline of Cantarell. In 2005, it still represented 60% of national production. Further the best case scenario for Cantarell is 1.4 MMBD for 2008 compared to 2.2 MMBD in 2004. And finally, it will be extremely difficult to compensate for this reduction with production from other fields.

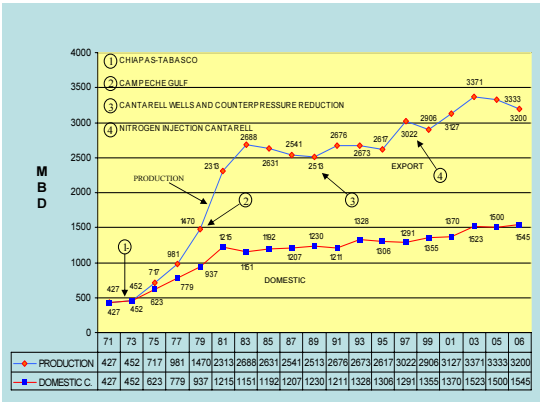

Table I
Production and Domestic Consumption of Oil (million barrels of oil equivalent)

Oil Production and Exports: Production-Reserves Ratio

If we analyze the impact of the strategy of maximum petroleum exploitation adopted in recent years, we must conclude that the outcome has been the exhaustion of proven reserves to critical levels. They have fallen more than 50% in the last 6 years, which means that they are only enough for a little over 9 years at current production rates, when in year 2000 the reserves to production ratio was 23 years. The reserves replenishment rate with respect to extraction was 28% on average in the last six years.

Production of the super-giant Cantarell field has begun to decline irreversibly. We must remember that in 2005 this field represented 60% of national production with 2.2 million barrels per day. In the best of cases, Cantarell's production will drop by 800 thousand barrels per day from its peak, by 2008. In such a short term, it is extremely difficult to have additional production available from other fields in order to compensate for this announced fall in the Cantarell production.

Crude volumes for export also reached their maximum level three years ago, in 2004. And if we analyze the oil products trade balance, including gasoline, diesel and fuel oil, we conclude that net exports of liq-

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Reserves	Reserves	New Discoveries		Develop. And Delimitation		Revisions	Production	Reserves
	31/12/2000	Volume	%	Volume	%			31/12/2006
Proven	32,614.4	+785.6	8.6	+1,931.4	20.8	-10,348.3	-9,646.0	15,514.2
Probable	12,196.2	+ 1,292.5	12.8	-1,150.0	-13.0	+ 2,965.5	-	15,257.4
2P	44,810.6	+2,078.1	21.4	+781.4	7.6	- 7,382.5	- 9,646.0	30,771.6
Possible	11,343.4	+ 3,065.6	30.7	- 917.3	- 9.9	+ 1,096.9	-	14,604.7
3P (Totals)	56,154.0	+ 5,143.7	52.0	- 135.9	-2.4	- 6,285.6	- 9,646.0	45,376.3

Source: Informe de la Reserva de Hydrocarburos PEMEX

* Some figures do not add up due to rounding

- Total proven hydrocarbon reserves dropped 52% in the period 2000-2006, from 32.6 to 15.5 BBOE. Revisions and reclassifications represent 50% of this reduction.
- R/P for proven reserves (1P) declined from 22.2 to 10.3 years. R/P for crude oil only is less than 10 years.
- Probable reserves registered a 26% increase, from 12.1 to 15.3 BBOE, derived from reclassification of proven reserves. But 2P reserves had a decrease of over 30%.
- Even more critical: reserve replacement ratio was only 28% on average for the last 6 years.

Table II
*Reserves and Production of Hydrocarbons **
(millions barrels of oil equivalent)

uid hydrocarbons have been declining since 2003. This trend seems to be irreversible.

We urgently need to design and begin applying a national strategy for hydrocarbon reserves, directed not just to the discovery of new fields, but also to the use of more efficient methods of utilization that make it possible to recover a larger proportion of the hydrocarbons stored in the subsoil, and from other deposits that can be attractive at current crude prices, converting fields with reserves currently classified as probable, into proven reserves.

No matter what the scenario, great effort and substantial resources are urgent in order to reactivate mature fields, increase the production of marginal fields and develop new ones to compensate for the decline at Cantarell. In this context, it is of the utmost importance to assess the oil potential of the geological structures located in deep waters of the Gulf of Mexico. We recommend the elaboration of an integral strategic plan to confirm the real existence of oil deposits in the Gulf, and to do so seriously, with the greatest technical meticulousness. The oil future of our country depends on this great project.

First Task: State Energy Policy

We recommend establishing a National Council for Planning and Governance of the Energy Sector that should be participative, transparent and open. This council would be responsible for formulating a new public policy on energy, not Government, but State policy, with the contribution of experts from all areas of energy. The objective should be to avoid the industry continuing to be a "fiscal deposit". This council would establish the crude oil production and reserves replacement goals through realistic investment projects, with funds guaranteed for several years. It should conceive of the energy sector as a whole, so that we do not commit nonexistent volumes of gas for electrical generation without at the same time promoting natural gas development projects that ensure the supply Mexico requires.

Second Task: Strategic Associations

The promotion of strategic associations with international companies, both public and private, will allow Pemex to comply fully with oil production goals and turn the energy industry into the indispensable driving force to accelerate the development of the country. The cases of STATOIL in Norway and PETROBRAS of Brazil are examples of successful state companies that develop appropriate technologies and meet aggressive exploration and production goals through international alliances.

To achieve this, agreement between the executive and legislative branches is indispensable.

Energy Security: The Case of Natural Gas

The topic of natural gas production and importation must be approached from a prospective of supply security for the country.

Because Mexico is a net exporter of oil, we have not been concerned with the topic of energy security. We are used to thinking that this is a focus for traditional importers. The growing dependence on foreign sources of supply to meet our needs for natural gas, however, can endanger its availability for strategic uses, where in many cases practically speaking, it cannot be substituted, such as combined-cycle power generation.

The country's vulnerability in terms of natural gas supply will remain at least for the rest of this decade: around one-third of the gas sold domestically is imported through pipelines from the United States.

In the mid-nineties, the Mexican government began a process of gradually opening up the natural gas market for the purpose of introducing healthy competition into the pipeline transportation, storage and distribution phases of the gas industry. This new regulatory context is the one that has allowed the CFE

to contract for the long-term importation of LNG (liquied natural gas) for later processing through private re-gasification plants in Altamira and Ensenada. We must remember that CFE is already the largest gas-consumer company in the entire North American market – including the United States and Canada.

It is important to advance in the design of a new framework of rules and regulations for natural gas with the purpose of establishing the terms and conditions of gradual, orderly participation by private and social groups investment in exploration and production of dry non-associated natural gas.

The investment and production goals Pemex has announced for basins that produce non-associated dry gas surpass $5 billion U.S. dollars, just for the first 3 years of the new administration. Notwithstanding, the expected production increase resulting from this investment effort is barely one billion cubic feet per day, maintaining the deficit of supply. This figure will have to be at least doubled in order to strengthen the country's sovereignty in relation to gas supply security.

Third Task: Natural Gas.
We recommend establishing an interdisciplinary group of professionals related to the natural gas industry, assigned to design new forms of participation of social and private investment – exclusively Mexican in a first stage – in the exploration and production of non-associated gas. There must be a secure supply of natural gas in order to cover the estimated gap in domestic production and guarantee the supply of this strategic input for Mexico's development.

Restructuring of the Electric Sector

Electric power is the most important, generalized input of the Mexican economy. Its price, quality and supply reliability determine our economy's level of competitiveness like no other factor. Looking to the long term, thinking about the country we would like to have around the year 2030, we have to design the structure of a strong, competitive electric industry capable of driving the rest of the economy toward the most advanced markets.

If we want lower electric power rates, we need to generate our own electric power at lower costs, transmit it throughout the national grid efficiently, and distribute it to the smallest user competitively. Quality and security of supply are also critical for competitiveness.

It is absolutely necessary to provide legal security for investments made by independent power producers, and to attract bigger investments that make it possible to create a competitive, efficient electric power generation market. Every opportunity to generate cheaper, high quality electric power must be encouraged. Control of the electric industry in the hands of the State is guaranteed by the centralized ownership and operation of the national transmission system.

Fourth Task: Electric Sector
We recommend a restructuring of the electric sector based on three main components:

1) Creating a competitive electric generation market that ensures ever lower costs and permits participation by all sectors through distributed energy systems;
2) Maintaining state control of the national transmission network, favoring access to the most efficient producers; and
3) Promoting regulated competition in the distribution and commercialization phases, thinking always of the benefit to the end consumer.

We recommend placing the design of the strategies for operating these facilities in the hands of local governments, where the power generation and distribution assets are located, for the benefit of the producer regions. This policy would drive development of the south-southeast part of the country: Tabasco, Chiapas, Veracruz, but also Guerrero, Colima and other states that are big energy resource producers and that until now have not participated in the direct benefits they generate for the rest of the country.

Reinforcement of State-owned Energy Sector Companies

The challenges our country will have to face in relation to energy require strong, competitive, government-owned companies. We are convinced that, under current conditions, only the Mexican State can guarantee their operation and soundness for the benefit of the country. That is why radically reinforcing and modernizing these companies is indispensable.

It is necessary to turn these Government-owned Energy Agencies into real public companies: with autonomous operation, without interference by other interests; with independent, professional corporate government bodies; transparent management of funds and a rendering of accounts to the entire popula-

tion. Congress has already received bills to make structural changes in the organization and operation of the sector's government-owned companies, to direct them toward these objectives.

Fifth Task: Government-Owned Companies

Two directions are required for reinforcing the government-owned energy companies: one fiscal and the other autonomous operation.

We recommend finalizing and approving the proposal of a new tax regime for Pemex and for CFE. The bill recently approved by Congress, of a new tax formula for Pemex, represents an advance, but does not yet allow the company to put its finances in order again. We need to move decisively in the direction of effectively capturing the "economic rent" derived from the exploitation of hydrocarbons because they are nonrenewable resources, and tax the other productive activities of Pemex and CFE like any other industrial activity by means of a system equivalent to that of the Income Tax.

We also recommend converting the sector's government agencies into real publicly-owned energy companies; enacting a new organic law for these state-controlled companies designed to allow them to compete in international markets, permitting them to explore and produce not just in Mexico, but beyond our borders as well, with autonomous operation, professional, independent boards of directors that respond to the mandate to maximize Mexico's energy wealth.

It is important to consider the advisability of distributing shares representing the capital of the state-owned energy companies to all Mexicans, because they are the real owners of Mexico's oil wealth, as the most effective public scrutiny mechanism to make sure that the mandate to manage the sector to the benefit of the entire population is performed punctually.

Reinforcement of Institutions for the Governance of the Energy Sector

The indispensable complement of this bill for the overhaul of government-owned companies consists in the design of a legal framework and a new institutional architecture that are compatible with the new energy policy; that guarantees the governance of the oil industry and of the electric industry, and directs them to the proposed objectives. The rule of the State over energy resources must also be modernized.

Substantial changes to the regulatory framework of the sector are also required, as well as the creation and strengthening of independent regulatory entities. The presence of new participants in the sector demands that the Energy Regulatory Commission (CRE) be reinforced for sound management of the country's oil and gas resources.

Sixth Task: Regulatory Context

The sixth task refers to the establishment of a new legal context for the sector that effectively applies the state's energy policy, oversees our renovated public companies in their compliance with performance agreements to increase productivity, and provides for the equitable distribution of benefits derived from this strategic activity.

The presence of new participants in the sector demands that the Energy Regulatory Commission be reinforced and/or that a new National Oil and Gas Office be created for sound management of our non-renewable resources. As important as the organizational structure that is adopted, will be having the appropriate institutions and regulations in place.

Productivity of the Energy Sector's Government-owned Companies

The number of people employed by the government-owned companies has increased significantly in recent years, particularly in the case of Pemex. Furthermore, operating expenses as well as administrative expenses have grown at a pace faster than inflation and faster than the companies' level of activity.

Labor liabilities of the sector's three companies also show high growth rates. And in no case have they been properly funded to insure the payment of pensions in the future. These trends must be reversed in the interest of increasing productivity, and austerity measures must be adopted that make it possible to lower the current expense, thereby releasing additional funds for productive investment.

Seventh Task: Productivity Increase

We recommend applying an extensive austerity program on the expenditures of Pemex, the Federal Commission of Electricity and Compañía de Luz y Fuerza del Centro, as well as undertaking a variety of initiatives to increase productivity. Do more with what we already have. Using the available resources with flexibility, to mobilize them toward the most productive projects.

The austerity policy must encompass all the significant items of the entities current expenses and in-

clude the goods and services procurement contracts used for operating and maintaining facilities, as well as the costs of the investments the government-owned companies make and set in motion. New contract models have to be adopted for public works and for provision of the specialized services the sector's companies require, with the aim of achieving a commitment by the contractors and specialized suppliers to attain productivity goals that will make us more competitive.

The savings obtained would be channeled into productive investment of the same entities that generate them.

Links Between the Energy Sector and the Domestic Industry

The growing imports of oil products and petrochemical precursors for industry are the result of the oil industry's chronic under-investment in refining activities and petrochemistry. This deficiency prevents adding value to our production of hydrocarbons, with the multiplying effect of this on employment, industrial production and the generation of taxes that would derive from such greater production.

Mexico's refining capacity has not grown for two decades. Because of this, we import more than a quarter of the country's needs of products, which resulted in a trade deficit of these products of almost $5 billion dollars last year. During that same year, Pemex Refinación channeled subsidies into the sale of gasoline and diesel equivalent to the investment cost of new refining capacity that would have substituted for these imports permanently. The current administration's explanation is that the refining and petrochemical projects cannot cover the international reference (opportunity cost) prices of their oil input. The evolution of the international markets during the last years was a unique opportunity to adjust the current price formulas, align domestic prices to those that really prevail abroad and correct this situation. But as in so many other areas of public policy, the opportunity was allowed to go by.

For similar reasons, the domestic chemical industry that has the fundamental elements necessary to be one of the country's most competitive sectors, also reports a trade balance deficit of more than $9 billion dollars and has experienced the disintegration and breakdown of its production chains.

Eighth Task: Stimulation of the Production Chains

It is imperative, through direct assignment of budget funds and the arrangement of strategic alliances in the sector, to promote the construction of at least 3 new, high-conversion, refining modules, with capacity of 150 thousand barrels per day each, until attaining self-sufficiency in high quality refined products. The investment required to achieve this goal is on the order of $10 billion U.S. dollars.

A similar amount is what is required to reconfigure and modernize the existing refineries in order to produce gasolines and diesel that are ultra low in sulfur, to rehabilitate pipelines and storage and distribution terminals, as well as to stimulate new investments in infrastructure necessary to operate the new refineries.

In the petrochemical sector, the value chains of our chemical industry must be encouraged to integrate, guaranteeing long-term supply at competitive benchmark prices of basic input and raw materials produced by Pemex.

Energy Prices as the Basis of our Economy's Competitiveness

In relation to prices of fuels, raw materials for industry and electricity rates, there is a clear misalignment of domestic in relation to international prices. In good measure, this situation is a result of the uncompetitive tax system Pemex and CFE are subject to. It is not valid to propose a reduction in energy prices without establishing the specific mechanism to attain that goal. Prices can be subsidized artificially for a time, but this would send us back very quickly to the black hole of inflationary public finances.

It will not be possible to lower energy prices permanently without far-reaching reform. Lastly, it is the unit costs of the gas, oil and electricity, and how the benefits derived from their production are distributed, that must determine energy prices in Mexico.

Ninth Task: Competitive Prices

In a first stage, on the basis of the prevailing administered prices mechanism, we recommend adopting a price policy for our energy products that, under the principle of their opportunity-cost for the country, insures competitive costs for the industry, aligns consumer prices with international prices – making explicit the taxes that prevail on these products- and encourages the integration of the production chains inside Mexico, and not abroad.

In a second stage, the sector would be able to establish more dynamic mechanisms regulated by the competition of different supply sources so that prices stay competitive in the long term.

Energy and the Environment

The challenge of maintaining the sector's facilities and pipelines, as well as of reducing adverse effects on the environment, require permanent, not crisis, solutions. The energy infrastructure has to be kept in good condition to avoid a future repetition of the natural and social disasters that their deterioration has caused.

Climate change is a phenomenon with serious consequences for our country. In the coastal states we are at risk of experiencing devastating climate events, and even lose part of our coasts due to the rise in sea level. International comparative studies attribute to Mexico, 3% of the total effects of greenhouse gas emissions worldwide, and classify us as the biggest source of emissions in all of Latin America.

Therefore, we have to work with the international community to stop global warming, drastically reducing the volume of polluting emissions that we generate. And it is the energy sector that directly or indirectly contributes almost all the greenhouse effect emissions. It is crucial to tackle the problem so that the products and processes of our energy industry are compatible with proper care of the environment.

At the same time, Mexico is rich in potential renewable energy sources. We have the highest solar index in North America; regions with great wind power potential like La Ventosa; geothermal fields, rivers and coasts, biomass and idle thermal capacity. The capacity of our countryside to produce ethanol from sugar cane and other farm products is outstanding. Sustainable development of the energy sector must have renewable energy sources as its backbone; an indispensable strategy for ensuring a clean, reliable, secure energy supply for the Mexico of tomorrow.

Tenth Task: Environmental Safety and Protection

We must be inflexible in overseeing and supervising safety in all public and private energy sector facilities and plants. To do this, the necessary budget must be allocated in Pemex for proper infrastructure maintenance, thereby reinforcing the environmental safety of the industry.

Along this line, putting into motion all the viable options for electric generation from renewable sources is absolutely essential. As soon as possible, we must diversify the country's primary sources of energy. For this purpose, we recommend expanding the geothermal fields; using the biogas generated by garbage and the biomass, such as cane bagasse; expanding generation by mini-hydraulics as well as the large hydroelectric plants; building large eolian energy fields in Oaxaca, Zacatecas, Hidalgo and Baja California, and investing in technological R&D to take advantage of the tidal energy potential on our coasts, solar energy, and any clean form of micro-generation that allows users to generate electric power for their own consumption and place their surpluses into the domestic transmission network.

It is likewise necessary to bolster the energy saving and efficiency programs, by assisting industries with financial support to lower their energy consumption, as well as the energy performance of home appliances, machinery and transportation vehicles to reduce their polluting emissions, and by issuing Mexican official standards that improve energy efficiency, without increasing costs. We recommend stimulating joint generation in industries that have usable thermal capacity and improving the quality of our fuels for transportation and industry.

Conclusion

To sum up, what our energy sector needs is a policy of reinforcement of state-owned companies that should be pragmatic, global and unbiased, with mechanisms that ensure effective distribution of the profit and benefits of the sector to the advantage of all Mexicans.

Chinese National Companies' Overseas Investment: Myth and Reality

*By Xin Ma**

Chinese National Oil Companies (NOCs) have in the last few years captured the world's attention by their rapid business expansion around the world. It is claimed that their overseas activities are strongly supported by their government for the purpose of enhancing security of oil supply. It is commonly argued that their current behaviour is not sustainable because of the tendency to overbid for assets and because they are increasingly exposing themselves to reputational and political risks that they are not equipped to handle. Many have predicted that once the security of supply panic is replaced by rational thinking, China will follow the example of its neighbour, Japan, and start to rely more on market mechanisms rather than on direct administrative means to secure its oil supply.

However, it is becoming increasingly clear that China's NOCs are driven as much or more by their own ambitions than by government policy. It is a mix of commercial and broader economic concerns in addition to the security of oil supply considerations which motivate their overseas investments and explain the strong support from the government.

The Three National Oil Companies (NOCs)

There are three main wholly state-owned, integrated national oil companies in China: Chinese National Petroleum Corporation (CNPC), China Petrochemical Corporation (Sinopec) and China National Offshore Oil Corporation (CNOOC). CNPC and Sinopec are both integrated petroleum companies which jointly dominate the onshore upstream exploration and production inside China. CNOOC is a much smaller NOC, but it has a better corporate structure, higher standards of corporate governance, and a more commercial corporate culture than the other two. It dominates offshore exploration and production inside China. All three NOCs are holding companies of respective subordinate limited companies which hold the core businesses and productive assets, and which were partially privatised through overseas Initial Public Offerings (IPOs). See Figure 1 for the ownership structure of the three NOCs.

The Overseas Investments of the NOCs

Overseas investment by the Chinese NOCs only started in 1993. By the end of 2005, their operations had been expanded to around 35 countries through bidding, farm-ins and corporate acquisitions. Their overseas equity production has increased from zero to about 0.5 million barrels per day, equal to the whole of Argentina's oil consumption.

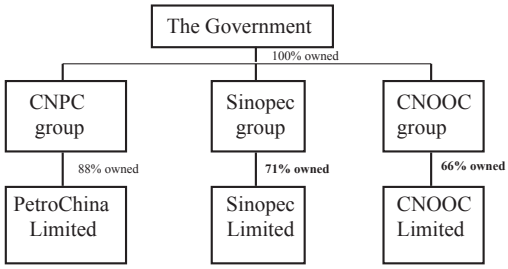

Figure 1

Their overseas investment caught the attention of the world not only by its speed and massive scale but also on account of the distinct business practices of the NOCs and the consequent controversy aroused surrounding certain high profile bids. In 2005 CNOOC lost to Chevron Texaco in its bid for Unocal despite a US$18.5bn offer, as a result of strong political opposition from U.S. lawmakers. In the same year CNPC secured its purchase of PetroKazakhstan, the largest overseas takeover transaction of a Chinese company. A year later, CNOOC successfully acquired a 45% stake in an offshore oil block at a cost of US $ 2.27 billion in Nigeria.

China's NOCs have displayed more willingness than their western counterparts to do business in countries with special concerns, such as Sudan, Iran and Myanmar. CNPC's investment in Sudan includes not only upstream oil and gas operation and production, but also refineries and pipelines. Oil from Sudan makes up one-tenth of China's imported oil and these investments are worth more than three billion U.S. dollars. A few years after signing an MOU, Sinopec's efforts in Iran are expected to bear fruit with a contract to develop the huge Yadavaran oil field.

The companies enjoy strong government support, especially in Africa. China's involvement in Africa often takes the form of a package of deals comprising privileged government loans, infrastructure contracts and oil supply. For example, one of Sinopec's oil exploration deals in Angola is coupled with $2 billion in aid from a Chinese policy bank.

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Government Concerns About Security of Supply

This scramble for overseas oil is commonly attributed to a push by China's government to enhance security of oil supply. The logic behind this appears to be straightforward.

The country's oil consumption has more than doubled in the past decade from 3.7 million barrels per day in 1995 to 6.9 million barrels per day in 2005. Although China has a long history of basing its petroleum policy on self-sufficiency, the country became a net importer of oil in 1993 and is now the second largest oil importer after the U.S. More than 40% of its current oil consumption is met by imports and this trend of rising imports is set to continue. Additionally, 47% of China's oil imports are from the Middle East and 30% from Africa. More than four-fifth of these imports have to be transported through the high-risk passage through the Malacca Straits. In this context China has every reason to feel vulnerable in terms of security of supply: increasing import dependency; high international prices; instability in the Middle East; threats from piracy, and, given the lack of a strong Navy to counter the U.S., the remote possibility *in extremis* of a U.S. blockade. With its history of central planning, the government lacks the experience to regulate and mitigate risks related to the international oil market.

For these reasons, the NOCs are seen as the agent of the Chinese government to go overseas, secure equity oil, promote long-term relationships with oil producing countries, and invest and lobby for the building of transportation routes which favour China, all in order to enhance the security of oil supply.

However, as has been claimed by many experts and even by the governments of oil consuming countries such as France and Japan, the market is a better and more efficient means to secure oil supply. Even in China this is becoming increasingly understood. It has been claimed that control of equity oil could increase the bargaining power of the Chinese government in an international political crisis and push physical oil eastwards rather than westwards. But the control of equity oil far from its shores does not significantly increase the security of supply for the country. Indeed, a large part of Chinese NOCs' overseas investments are through PSA contracts and under many of these contracts the Chinese NOCs receive a share of revenue instead of physical oil. Even they do receive physical oil, the quality may not be suitable for Chinese refineries and the transportation cost to China may also be too high to ensure commercial viability.

Even if the quality of equity oil is suitable for the Chinese refineries and the transportation cost is commercially acceptable, the price of the oil is normally pegged to international oil prices of crude oil with similar quality. Therefore, Chinese refineries could simply import from the international oil market at a lower overall cost and risk. Also, if the blockade of transportation routes at a time of war is what the Chinese government fears, the supply of much of China's overseas equity oil will also be interrupted by such a blockade.

Government Desire to Mitigate the Risk of Price Fluctuation

If security of supply is not the main driver behind Chinese NOCs overseas investment, what is the real rationale? Is the government seeking to mitigate the risks caused by the fluctuation of international oil price?

It has been argued that direct investment overseas could mitigate the impact of oil price fluctuations on the economy of a country. This is especially important because international oil prices have become increasingly volatile in the past few years. As a net importer, China pays more to import a certain amount of oil when the oil prices increase. However, high international oil prices will tend to push up the income of the NOCs operating internationally and, therefore, any dividends and taxes received by the government from these NOCs should also rise. However, according to the current regulations, state owned enterprises do not pay dividends to the Chinese government. Therefore, the profitability of the NOCs may not have a lot to do with the revenue income of the government, let alone the small share of overseas equity oil as a percentage of total imported oil. Additionally, most of the NOCs' overseas investments are still in the stage of exploration and development, far from providing a return. Therefore, the tax benefit to the Chinese government is negligible, not to mention the impact of overbidding and the lower rate of return on these investments.

NOCs' Own Ambition?

Contrary to widespread perception, the main drivers behind the Chinese NOCs overseas investment may be their own commercial ambitions. First, all the three NOCs have been floated overseas. As publicly-listed companies they are required by their shareholders, at least by their overseas shareholders, to maximise shareholder value by increasing their return on capital employed and booking reserves. These NOCs have each stated ambitious aims themselves, to grow into international oil companies like BP and Shell. However, all three are currently based mainly inside China, with domestic production and revenue accounting for more than 90% of their total production and revenue. The reserve potential inside China is very limited and most of the main oil provinces have peaked and are depleting.

With more than three million staff to employ, the NOCs have to seek new business opportunities in order to survive. Overseas expansion could provide the NOCs with not only new reserves, but also work opportunities for their employees, not to mention more contracts for the large Chinese petroleum services industry covering engineering, drilling, and other oilfield services as well as manufacturing.

In order to gain opportunities as new players with not much experience in an already crowded market, China's NOCs have no choice but to start by bidding high, or go to places that are shunned by their competitors, such as Sudan or Myanmar. The extra costs and risks that have to be borne by these NOCs may be likened to an entry fee for them to have the chance to work side-by-side with international majors, get acquainted with international practice, give their senior managers international experience, and, to put it simply, to 'learn by doing'.

Government Deceived by NOCs?

If this is all for the good of the NOCs, has the government been deceived into supporting these overseas investments on the pretext of security of supply? Probably not. The Chinese government's support for its NOCs is not in nature any different from that of other governments, despite the choice of target countries. Most governments provide greater or lesser degrees of assistance to support the export of investment, goods and services. China's willingness to do business with countries that are shunned by others has its roots in its diplomatic philosophy of non-interference in other countries' internal affairs. In this, China is not alone. For example in Sudan, they are partnered with NOCs from India and Malaysia.

The support of its NOCs is actually in accordance with the economic policy objective announced by the Chinese government some years ago to establish between thirty and fifty of its best state-owned enterprises as 'national champions' with international competitiveness by 2010 in order to maintain national competitiveness in the globalised economic environment.

The government not only encourages these companies to fully employ both domestic and international resources but also to operate in both domestic and international markets. Therefore the support of the overseas activities of its flagship companies is in accordance with the economic policy of the government. In Africa for example, government support not only applies to the oil companies, but also to many engineering, manufacturing and construction companies. It is the sensitiveness of natural resources that makes these particular transactions more visible and controversial.

Will they Succeed in the Future?

Is the growth of Chinese NOCs' overseas investment likely to continue or will it falter, as in the case of the Japanese oil companies? The distinctiveness of the Chinese NOCs should help them avoid repeating the experience of Japan. However, there are a few pitfalls which, if not recognised and addressed, may yet lead to failure.

Two main factors distinguish the oil companies of China and Japan. First of all, the overseas activities of Chinese NOCs' are driven more from an economic and commercial perspective than by pure security of supply concerns. Second, , China's domestic petroleum industry is very large, employs more than three million people, has more than sixty years of experience and possesses a degree of technological competitiveness. As long as economic logic persists, the overseas activities of Chinese NOCs' are likely to continue. Also, because their investments are more commercial driven than those of their Japanese counterparts in the past, once experience and skills have been acquired and certain comparative advantage has been established, their investment behaviour is likely to be progressively rationalised.

There are a few pitfalls that both the government and the Chinese NOCs should seek to avoid and which could drastically undermine the overseas investment strategy. First of all, it is likely that tension will arise between the Chinese government and the minority shareholders due to their different perspectives. The Chinese government will continue to be reluctant to cede control over the petroleum sector which is seen as being a strategically important sector for the Chinese economy. The minority shareholders, in contrast, are likely to push for less government control over certain issues and, as a consequence, disputes between the two may arise.

Secondly, sustained overseas acquisition requires a large amount of capital commitment over several decades. The Chinese NOCs could run into financial difficulties and become insolvent if oil prices decline.

Thirdly, through these overseas investments, the Chinese NOCs and their government are exposing themselves to higher levels of geo-political and social risk that they are not very experienced in managing. One high profile failure in dealing with sensitive issues relating to the environment, social responsibility or human rights could cause irreversible damage to the reputation of Chinese NOCs and of the government, and result in a sudden decline in their overseas investment.

Welcome New Members!

The following individuals joined IAEE from 4/1/07 – 6/30/07

Aishatu Abba Kyari
Nigerian Natl Petroleum Corporation
Nigeria

Iyas Abouwarda
TU Berlin
Germany

Anna Marie Aeloiza
Schlumberger
USA

Randeep Agarwal
Australia

Sabastine Akongwale
United Kingdom

Simons Akorli
Univ of Sheffield Mgt School
United Kingdom

Wadah Majid Al Taha
Emaar Financial Services
United Arab Emirates

Ali M Al-Hussain
Saudi Arabia

Julien Allaire
France

C Emre Alper
Bobazici University
Turkey

Meshal M Al-Samhan
KISR
Kuwait

Nelson Anaback
USA

Offiong A Anyanwu
Bureau of Public Enterprises
Nigeria

Lisa Barrick-Uchytil
Freeman
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Wassim Benhassine
Pantheon Sorbonne University
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Nuno Bento
France

Ulrich Berner
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Christopher Bettini
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Marc Oliver Bettzuege
Ches Institut An
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Nadine Bret Rouzaut
Institut Francais du Petrole
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Stephen M Brochu
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Jennifer L Brown
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Martin Bruck von Oertzen
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William Budding
Technology Training Corporation
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Nadia Campaner
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Jon Campbell
General Electric
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Jeff Carmichael
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Bertrand Charmaison
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Souhila Cherfi
University of Oran
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Electric Power Research Institute
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Matthew Commons
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Grant Davies
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Joeri F de Wit
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Kristin Dietrich
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Gerard Doorman
Institutt for Elkrafteknikk
Norway

Catriona Douglas
United Kingdom

Jayesh D'Souza
Florida Intl Univ
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Colm O Duibhir
Bord Gais
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Alexander Ehlert
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Ingo Ellersdorfer
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Can Erbil
Brandeis Univ Dept of Econ
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Frank Erzinger
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Jean Michel Esperne
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Henrik Friedemann
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Jonathan Friedman
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Alexandre Gobeil
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Samuel Obeng Mireku
IEA Gambia
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University of Abuja
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Veli-Pekka Saajo
Energiamarkkinavirasto
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Thibault Sabatier
Total
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Kaweh Sadegh-Zadeh
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Tunji Salami
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Abubakar S Sambo
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Pablo Serber
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Benoit Sevi
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Sean Shafer
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Arun Sharma
Maersk Oil America Inc
USA

David Ray Shaw
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Venkataraman Shivkumar
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Charlie Wilson
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Tobias Wittmann
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Yuk Y Yan
Hong Kong Baptist University
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Jameelah O Yaqub
University of Ibadan Nigeria
Nigeria

Naheem A Yinusa
NNPC
Nigeria

XiaoJiang Yu
Hong Kong Baptist University
Hong Kong

Tauhida Zayyad
United Kingdom

Announcement

1st Joint IAEE/MEEA/ASSA Session

New Orleans, Louisiana, USA January 5, 2008

Oil and Energy Issues

Presider: Serdar Sayan, TOBB University of Economics and Technology

Mohamed Abdelaziz, Georgios Chortareas and Andrea Cipollini, University of Essex - *Stock Prices, Exchange Rates, and Oil: Evidence from Oil Exporting Countries in the Middle East*

Shawkat Hammoudeh, Drexel University - *Do Oil-Rich GCC Countries Finance US Current Account Deficit?*

Joyce M. Dargay, University of Leeds, Dermot Gately, New York University, and Hillard G. Huntington, Stanford University - *Determinants of World Oil Demand, 1971-2006*

Peter Hartley and Ken Medlock, Department of Economics and James A. Baker III Institute for Public Policy, Rice University - *Empirical Evidence on the Operational Efficiency of National Oil Companies*

Nathan Balke, Southern Methodist University, Stephen Brown, Federal Reserve Bank of Dallas and Mine K. Yücel, Federal Reserve Bank of Dallas - *Globalization and Oil Prices: Demand versus Supply Shocks*

Discussants: **Riza Demirer**, Southern Illinois University-Edwardsville
Hadi Salehi Esfahani, University of Illinois at Urbana-Champaign
Gokhan Ozertan, Bogazici University
Ahmet Faruk Aysan, Bogazici University
Mehmet Serkan Tosun, University of Nevada, Reno

The meeting is part of the Allied Social Science Association meetings (ASSA).

For program information and pre-registration forms on the larger meeting (usually available in September) go to http://www.vanderbilt.edu/AEA/anmt.htm. Also watch for the USAEE/IAEE Cocktail Party.

Scenes from the 9th IAEE European Energy Conference

10–13 JUNE, 2007 – Florence, ITALY












The 9th IAEE European Energy Conference "Energy Markets and Sustainability in a Larger Europe"

The sustainability of the European Energy system, under its economic, social, technological and environmental aspect, is certainly a topic of great controversy, especially after the recent widening of the European boundaries to include the eastern countries. Whilst the solution at a regulatory and technological profile seems to be close at hand, the efficient and effective implementation of such solutions seems to be still very far; a situation due not only to the market failures but also, and in the first place, to the failures of the political class.

"Energy markets and Sustainability in a Larger Europe" was the theme to the 9th IAEE European Energy Conference organized by AIEE (Italian Association of Energy Economics) at the Grand Hotel Baglioni in Florence, from June 10th to the 13th. The Conference was a proper occasion to evaluate the position Europe is in with regards to the objectives of Sustainability and to define which choices should be pursued in the near future. The more than 350 students, participants and researchers coming from all around the world allowed addressing a number of energy related topics with representation for all the different interests at play.

The first plenary session focused on "Economics of Energy Efficiency". Chairing this session, **Pippo Ranci**, Director of the Scuola di Regolazione di Firenze, had some very interesting thoughts. Amongst others he mentioned how efforts to improve efficiency in both the energy industry and the final uses lead to certain substantial benefits regarding not only cost reduction, a diminished dependence on energy importation and supply security but also to a greater protection of our environment. Concerning the measures that lead to an increase in energy efficiency of the final uses, given that some of these "pay for themselves", others need to be subsidized in a way that allows for a simple understanding, an easy administration and adjustability, such that in the long run the incentive may have a stable structure in order to favour the decisions made by the operators.

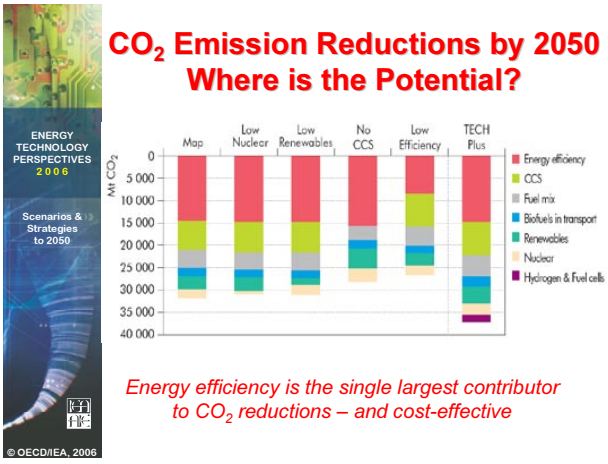
The potential of energy saving in the various industries, starting with the real estate one, was quantified by **Eberhard Jochem**, Professor for the Centre for Energy Policy and Economics (CEPE) and the ETH Zurich. According to the Professor, the path leading to efficiency is still very long, even if the benefits deriving from a more efficient energy conversion, in most cases, greater than the co-benefits. The latter include the increased efficiency of final uses, the decreased environmental and social costs (as a result of the decrease in public health related problems), the increased opportunity of exporting goods with a high efficiency rate and the low costs of adapting to the climatic changes (especially through co-operation on an international level)

According to **Ana Palacio**, Senior Vice-president of the World Bank, for the construction of a larger Europe energy is not only the most important topic but also a key element in Europe's future strategic decisions. She stressed how the energy "problem" is always more of international dimensions and yet how it is very hard for the countries involved to reach a common solution; an outcome probably due to the lack of co-responsibility towards such issues. Today, however, it is of great importance to focus our strengths in obtaining an increase in energy efficiency, a necessity in order to face the climatic changes affecting the environment.

Claude Mandil, General Director of the International Energy Agency, stressed the potential of energy efficiency in neutralizing issues regarding security of supply and CO_2 emissions. According to any scenario of a number taken into consideration by the IEA, development of strategies towards energy efficiency lead to a decrease of at least 50% in CO_2 emissions until 2050.

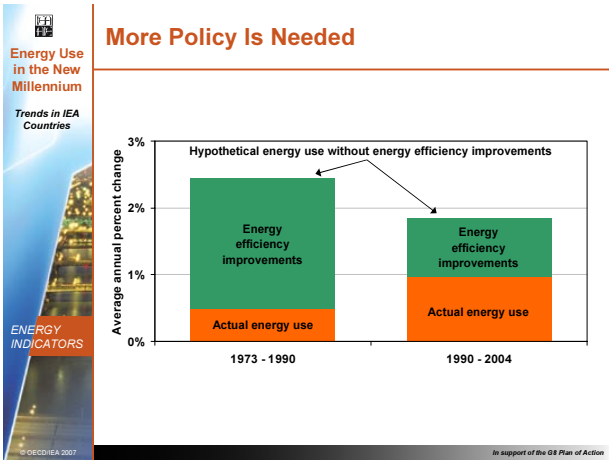
He also emphasized how in the years between 1973 and 1990, i.e., in the years following petrol-shocks, the strategies activated towards energy efficiency proved to be more effective than those implemented in the following 15 years.

Concluding his presentation Mandil pointed out the need for energy policies considering that certain barriers to the development of energy efficiency call for regulatory intervention in order to "restore the direct link between customer and price signal". Such effort will require continuous work and systematic analysis of end uses, as well as new technology, policy, and engagement of stakeholders and experts.



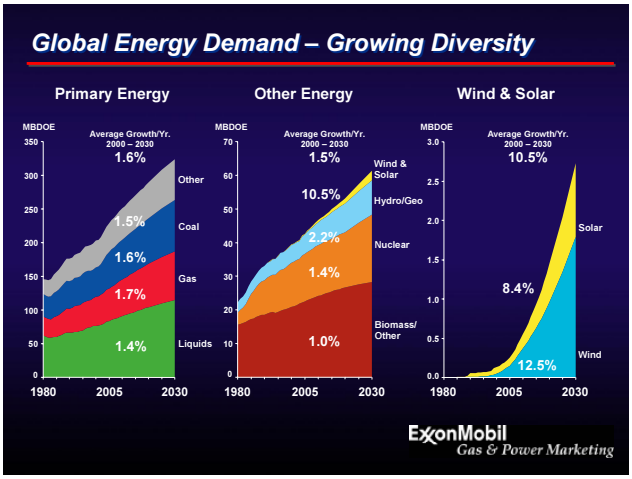
Energy efficiency is the single largest contributor to CO_2 reductions – and cost-effective

The second plenary session was dedicated to "Security of Supply". **Richard F. Guerrant**, European Marketing Director for Exxonmobil Gas&Power, and **Massimo Orlandi**, CEO of Sorgenia, both spoke of how through a more liberalized and more competitive GNL market it would be possible to lessen geopolitical risks and increase the level of competition. By opening the market to competition investments would be stimulated, unlike the present situation where clearly there is a lack of such assets throughout the entire GNL value chain, going from the production level to the commercial one.



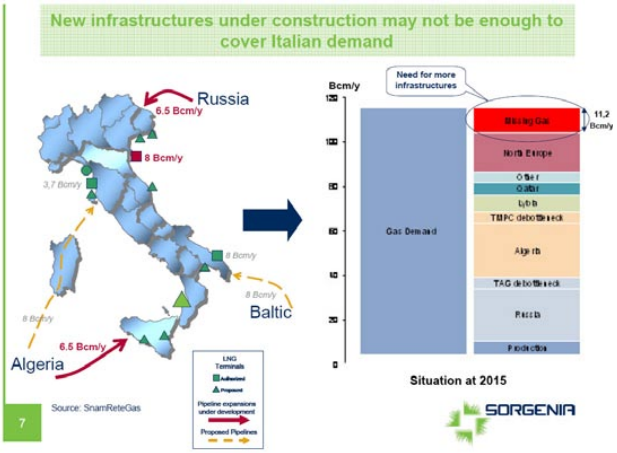
Particularly, Guerrant discussed the perspective of GNL on a global scale. According to the projections, from now until 2030 an increased capacity of gas importation will be necessary for all regions of the world (USA, Europe, Asia) to cope with a demand growing at an estimated rate of about 1.7% annually, superior to the 1.6% estimated growth rate of demand of primary sources.

Focusing on the Italian situation, Massimo Orlandi emphasized how new pipeline projects that are currently being developed could satisfy the Italian demand increase for natural gas but at the same time make it even more dependant on countries such as Russia and Algeria (from an estimated 61% in 2006 to a 71% in 2015). Also, it would lead to an even more concentrated national market, where ENI, ENEL and Edison already control 70% of it. These predictions highlight the need for new GNL terminals in Italy, with new infrastructures developed by new operators, not incumbents, and new supply deals with other countries may very well contribute to a more open gas market.



In the session "A Wider EU Energy Markets", **Lord Howell of Guildford** commented through a wider perspective on the most relevant issues on a global scale. In his opinion, the gap between what the different governments of the world claim to be their objectives and reality is so big that in itself it is sufficient for a worsening of the issues at hand. Furthermore, the constant build up of geopolitical tension in certain "hot spots" around the world is certainly a contributing factor.

On a more European level, **Alessandro Ortis**, President of the Authority for Energy, expressed his disappointment for the very slow process towards a unified and open market, pointing out those goals that should be pursued: more integration, more harmonization, more efficiency and more sustainability.

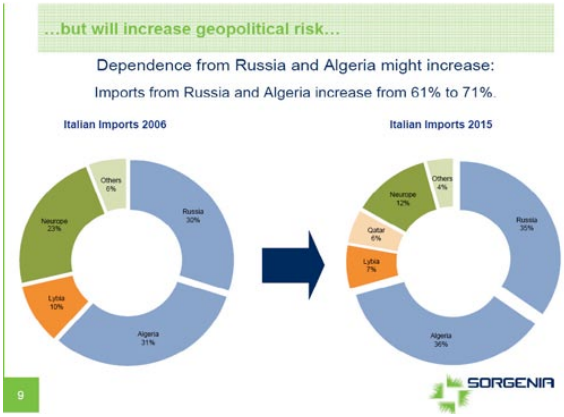


Empirically, the lack of important investments in infrastructures, necessary for a better integration between the networks and an increase in storage capacity, furthers the possibility of obtaining a more efficient market, just like the absence of a uniform, harmonized regulation on European level is an obstacle to the creation of one unified market.

With regards to the national market situation Ortis underlined the longing for anti-collusion measures in order to complete the "unbundling" process that was initiated through the liberalization of the markets but that still has not become effective.

Concerning the recent proposals that have been made by the European Commission in the field of energy efficiency, Renewables and CO_2 emissions, he felt it was necessary to recall that in order to reach such ambitious targets it would be necessary for the involved countries to have binding numeric objectives.

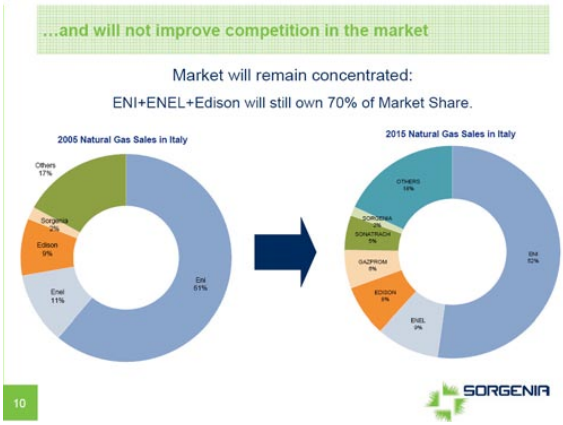
Still defending the emission trading instrument, the president of the Energy Authority made it clear that in order to successfully tackle the climatic changes problem it would be vital for the effort to be not



only on behalf of the industrial and energetic sectors. It is only through the consumers, who act on the demand curve, that we may shift towards products with a lower CO_2 emission content, such as to avert the risk of delocalization of production to less restrictive (regarding CO_2 emissions) countries, a scenario that would only add the problem of unemployment to the CO_2 emissions one.

What will be the consequences of a wider and more competitive European market? In **Domenico De Luca**'s (CEO to EGL Italia) opinion, the results will be a price decrease for consumers together with all sorts of other positive side effects. Amongst these we will find the limitation of profits typical of vertically integrated firms and a convergence of prices on the various international markets.

What should, nonetheless, be kept in mind is certainly that a price reduction policy, determined by crossed subsidies, does not usually lead to a transparent or fair competition as it usually reduces to inefficiency and lack of investment. Finally, De Luca, emphasized how a mature energy market will not necessarily lead to a perfectly uniform level of prices on the different European markets as the different EU members present themselves with different resources (oil, gas, carbon, nuclear, etc.) and different technologies such that the most appreciable result we can hope for will probably be overcoming energy shortages.



The last session, "Implementing Renewables", was moderated by **Roberto Vigotti**, chairman to the IEA Rewp Group, whom identified the barriers to an increased use of renewable sources. He mentioned the lack and inconsistency of incentives, both public and private, the bureaucratic difficulties of obtaining the appropriate licences, energy systems incompatible with such renewable sources, and lastly a deficiency of qualified personnel as well as an insufficient awareness of the sector.

Seeing the present policies will not lead us to a sustainable energy future, with efficient and clean technologies, it is essential that hefty investments be made during the next decade combined with the effort to lessen the above mentioned barriers. Plenty of obstacles stand in the way of this process, the political inactivity, the opposition coming from certain stakeholders and the bureaucracy. This is why a considerable effort in this direction will have to be made in order to overcome an industry that operates with strategies based on short-term logic.

How is it possible to produce and use energy in an efficient and sustainable fashion, to guarantee security of supply, safeguard the environment and competition? According to **Fabrizio Barbaso**, General Director of the DG-Tren of the European Commission, it is vital to keep a long-term vision and a global leadership in order to promote a strong development of renewables and energy efficiency. Actually, the EU set an ambitious target regarding renewables, energy efficiency and CO_2 emissions with a combined target on European level of 20%. However, the single countries are left with the possibility of promoting the most appropriate renewable sources considering their needs. Each country will have to produce a National Action Plan containing detailed objectives, and strategies in order to achieve certain objectives regarding bio fuels and other indicators.

What came clearly to light during the conference was that there is no one shared solution, but rather a number of interesting proposals to be considered. The path to a truly sustainable Europe is still very long and complex. Energy efficiency, environment and renewables will definitely be the pillars of the new sustainable energy system. However, as **Carlo Andrea Bollino**, Conference chairman, did point out: "there are times to think and times to act. Now is the time to act. The aim of this conference was to contribute to a sustainable energy future, and thus we believe to have made a significant step in this direction".

Manuela Gusmerotti and Quinto Antonini

Publications

Annual Oil Market Forecast & Review 2007. Price: £650. Contact: CGES Marketing, 17 Knightsbridge, London SW1X 7LY, United Kingdom. Phone: 44-20-7309-3610. Fax: 44-20-7235-4338. Email: marketing@cges.co.uk URL: www.cges.co.uk

Accelerate – 20 Practical Lessons to Boost Business Momentum. Dan Coughlin (2007). 279 pages. Price: n/a Contact: The Coughlin Company, PO Box 1245, Fenton, MO 63026, USA. Phone: 1-636-825-6611. Email: info@thecoughlincompany.com

The Battle for Barrels – Peak Oil Myths & World Oil Futures. Duncan Clarke (2007). Price: $60.00. Contact: Energy Asia, 20 Upper Circular Road, Unit #01-18, The River Walk, Singapore 058416, Singapore. Phone: 65-64380933 Fax: 65-64380733 Email: admin@EnergyAsia.com

Atlas of Global Development – A Visual Guide to the World's Greatest Challenges (2007). Price: $19.95. Contact: World Bank Publications, PO Box 960, Herndon, VA 20172-0960, USA. Phone: 1-703-661-1580. Fax: 1-703-661-1501. Email: books@worldbank.org URL: www.worldbank.org/publications

The 2007 Foreign Companies in Russia Yearbook & CD-ROM (2007). Price: $995.00. Contact: Business Monitor International Ltd, Mermaid House, 2 Puddle Dock, London EC4V 3DS, United Kingdom. Phone: 44-20-7248-0468 Fax: 44-20-7248-0467 Email: yearbooks@businessmonitor.com URL: www.businessmonitor.com/yb/russia.html

Saudi Arabia. Gene Lindsey (2006). Price: $14.95. Contact: Hippocrene Books, Inc., 171 Madison Avenue, New York, NY 10016, USA. Phone: 212-685-4371. Fax: 718-454-1391. Email: pgress@hippocrenebooks.com URL: www.hippocrenebooks.com

Arab Oil & Gas Directory 2007. Price: Euro 760.00. Contact: APRC, 7 avenue Ingres, 75016 Paris, France. Phone: 33-1-45-24-33-10. Fax: 33-1-45-20-16-85. Email : aprc@arab-oil-gas.com URL : www.arab-oil-gas.com

Natural Gas Survey, Middle East & North Africa 2007. Price: Euro 820.00. Contact: APRC, 7 avenue Ingres, 75016 Paris, France. Phone: 33-1-45-24-33-10. Fax: 33-1-45-20-16-85. Email : aprc@arab-oil-gas.com URL : www.arab-oil-gas.com

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Special Issue in Energy Economics: Modeling of Industrial Energy Consumption. Edited by Lorna A. Greening, Gale Boyd and Joseph M. Roop. Price $35.00. URL: www.sciencedirect.com/science/journal/01409883

Calendar

21-22 August 2007, Shared Services Asia Summit 2007 at Raffles City Convention Centre, Singapore. Contact: Fiona Tan, Producer, IQPC Worldwide, 61 Robinson Rd, Singapore, Singapore. Phone: 65 6722 9373 Email: fiona.tan@iqpc.com.sg URL: www.iqpc.com.sg

21-22 August 2007, Drilling Waste Management China 2007 at Venue to be confirmed, Beijing, China. Contact: Felicia Chen, Producer, IQPC Worldwide, Singapore, Singapore. Phone: 65 6722 9388 Email: enquiry@iqpc.com.sg URL: www.iqpc.com/cn/drillingchina

22-23 August 2007, Offshore Gas Production at Marina Madarin Hotel, Singapore. Contact: Rita, Marketing Manager, IBC Asia (S) Pte Ltd, Singapore. Phone: 65 68355 160. Fax: 65 6733 5087 Email: rita.parasurum@ibcasia.com.sg URL: www.ibc-asia.com/offshoregas

26-31 August 2007, 6th International NCCR Climate Summer School: Land Surface -- Atmosphere Interactions in a Changing Climate at Grindelwald, Switzerland. Contact: Monika Waelti, Ms, University of Bern, NCCR Climate Management Centre, Erlachstrasse 9a, Bern, CH-3012, Switzerland. Phone: +41 31 631 31 45. Fax: +41 31 631 43 38 Email: nccr-climate@giub.unibe.ch URL: http://www.nccr-climate.unibe.ch/summer_school/2007/

27-31 August 2007, Specialised Arbitration & Advocacy Skills in International Oil & Gas Disputes at Old Course Hotel, St Andrews, UK. Contact: Hugh Gunn, CEPMLP - Centre for Energy, Petroleum and MIneral Law & Policy, University of Dundee, Carnegie Building, Dundee, DD1 4hn, United Kingdom. Phone: +44 (0)1382 385871. Fax: +44(0)1382 385854 Email: c.seminars@dundee.ac.uk URL: www.cepmlp.org

28-29 August 2007, Data & Knowledge Management for Asian Oil & Gas 2007 at Kuala Lumpur, Malaysia. Contact: Li Zhengxi, Producer, IQPC Worldwide, Singapore. Phone: 65 6722 9388 Email: enquiry@iqpc.com.sg URL: www.iqpc.com.sg

29-31 August 2007, Asia Bulk Liquid Storage, Transportation & Terminals at Raffles City Convention Centre, Singapore. Contact: Rita, Marketing Manager, IBC Asia (S) Pte Ltd, Singapore. Phone: 65 68355 160. Fax: 65 6733 5087 Email: rita.parasurum@ibcasia.com.sg URL: www.ibc-asia.com/asiabulkliquid

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3-7 September 2007, Negotiating & Documenting Petroleum Industry Transactions at Dundee, UK. Contact: Hugh Gunn, CEPMLP - Centre for Energy, Petroleum and MIneral Law & Policy, University of Dundee, Carnegie Building, Dundee, United Kingdom. Phone: +44 (0)1382 385871. Fax: +44(0)1382 385854 Email: c.seminars@dundee.ac.uk URL: www.cepmlp.org

3-5 September 2007, IET Course of Distributed Generation at NaREC, Blyth, Northumberland, UK. Contact: Elizabeth Jarvis, Event Organiser, Institution of Enginerring and Technology, Michael Faraday House, Six Hills Way, Stevenage, Herts, SG1 2AY, United Kingdom. Phone: 0141 427 0735. Fax: 0141 419 0812 Email: ejarvis@theiet.org URL: http://conferences.iee.org/disgen/index.htm

3-14 September 2007, Master of Petroleum Business Engineering, session 1 at Groningen, The Netherlands. Contact: Evanya Breuer, Manager Customer Relations, Drs., Energy Delta Institute, P.O. Box 11073, Laan Corpus den Hoorn 300, Groningen, Groningen, 9700 CB, The Netherlands. Phone: +31 50 524 83 12. Fax: +31 50 524 83 01 Email: breuer@energydelta.nl URL: www.energydelta.org

3-6 September 2007, BioEnergy 2007 at Jyvaskyla, Finland. Contact: Petteri Rasanen, Project Manager, Jyvaskyla Fair Ltd, Finland. Phone: 358-14-334-0022 Email: petteri.rasanen@jklmessut.fi URL: http://seminaarit.ohoi.fi/default.asp?seminarID=6

3-5 September 2007, IET Course of Distributed Generation at NaREC, Blyth, Northumberland, UK. Contact: Elizabeth Jarvis, Event Organiser, Institution of Enginerring and Technology, Michael Faraday House, Six Hills Way, Stevenage, Herts, SG1 2AY, United Kingdom. Phone: 0141 427 0735. Fax: 0141 419 0812 Email: ejarvis@theiet.org URL: http://conferences.iee.org/disgen/index.htm

4-5 September 2007, Advanced Global Biofuels Summit 2007 at Shangri-La Hotel, Bangkok. Contact: Philip Parba, Producer, IQPC Worldwide, Singapore. Phone: 65 6722 9388 Email: enquiry@iqpc.com.sg URL: www.iqpc.com/th/biofuels

5-6 September 2007, Black Sea Oil and Gas Summit (BSOGS) at Istanbul, Turkey. Contact: info@bsogs2007.org, Organization Member, Turkish Association of Petroleum Geologists (TAPG), Izmir Cad.II.No:47/14, Ankara, 06440, Turkey. Phone: +90 312 207 21 87. Fax: +90 312 285 55 66 Email: info@bsogs2007.org URL: http://www.bsogs2007.org

10-14 September 2007, Negotiating & Managing Natural Gas Contracts at Dundee, UK. Contact: Hugh Gunn, CEPMLP - Centre for Energy, Petroleum and MIneral Law & Policy, University of Dundee, Carnegie Building, Dundee, DD1 4HN, United Kingdom. Phone: +44 (0)1382 385871. Fax: +44(0)1382 385854 Email: c.seminars@dundee.ac.uk URL: www.cepmlp.org

11-12 September 2007, SCADA for oil & gas Sectors at Grand Copthorne Waterfront, Singapore. Contact: Rita, Marketing Manager, IBC Asia (S) Pte Ltd, Singapore. Phone: 65 68355 160. Fax: 65 6733 5087 Email: rita.parasurum@ibcasia.com.sg URL: www.ibc-asia.com/scada

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