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IAEE Energy Forum

Fourth Quarter 2015 International Association for Energy Economics

President's Message

I am writing this shortly before the USAEE/IAEE host the 33rd North American Conference in Pittsburgh, Pennsylvania, close to most productive part of Marcellus shale play. The theme of the conference is the remarkable North American energy renaissance and its many implications. There are also sessions on the continuing changes in electricity markets. These have resulted particularly from the increased competitiveness of natural gas, but also the continued introduction of new technologies and government regulations, especially with regard to the environment. Energy finance and risk management is another important theme of the conference.

In the latter regard I would like to mention our association with GARP (the Global Association of Risk Professionals), which IAEE views as very strategic in light of the large membership of that organization and their interest in applying risk management tools in the energy sector. GARP is a not-for-profit global membership organization dedicated to preparing professionals to make better-informed risk decisions. They determined that the Pittsburgh conference qualified for 21 GARP continuing professional development credit hours.

The relationship with GARP will also be deepened by the 39th Annual IAEE International Conference to be held at the Norwegian School of Economics (NHH) in Bergen, Norway, from June 19-22, 2016. The theme of that conference is the role of expectations and uncertainty in influencing energy market outcomes and energy policy. Topics to be addressed include business strategies and decision models under uncertainty, energy derivatives markets, effects of uncertainty on long-term contracts versus spot trading in energy markets, energy risk assessment, financing energy investments, new technologies, environmental effects of energy production and use, and uncertainties associated with geopolitics. The conference will be preceded by a conference on real options to be held in Oslo and Trondheim from June 15-18 and three pre-conference workshops on June 19 focusing on academic presentation skills, capacity markets and the future of utilities.

The first IAEE conference in 2016 will be the 5th IAEE Asian Conference, hosted by the University of Western Australia Business School in Perth from February 14–17. This is, of course, in the southern hemisphere summer, so northern hemisphere members are encouraged to think about visiting the beautiful beaches in Perth while avoiding the snow and ice back home! The conference is also being held while the Perth Arts Festival is on, so you can also spend an evening watching a show at the open air Quarry Amphitheatre. The conference theme is meeting Asia's energy challenges. To set the scene, the first plenary will discuss forecasts of Asian energy demands and supplies, trades and energy infrastructure needs. Other sessions will focus on financing energy production and infrastructure investments to meet Asian demand, energy pricing issues within Asian economies and possible changes in the structure of Asian LNG, coal and other energy commodity markets, national security and strategic implications of meeting Asian energy demand growth, environmental effects of increasing energy production and consumption, and the future of nuclear power and potential new energy technologies in Asia.

Next year, IAEE will add a new conference region to our schedule, with the first conference in the Caspian region to be held in Baku, Azerbaijan, from August 28-31. The theme will be the challenges and opportunities associated with energy production and use in the Caspian region. To set the wider context, the opening plenary will discuss global energy market trends followed by a session on oil and gas price dynamics and ex-

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Editor: David L. Williams

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pectations. Three following plenaries will then focus on regional energy security, regional strategies for alternative and renewable energy, and unlocking Caspian energy potential. Topics to be discussed include petroleum economics, geopolitical issues, energy markets and regulation, challenges in natural gas supply and transportation, energy policy, the relationship between energy and economic growth, and regional electricity trade.

The final IAEE conference of 2016 will be the 34th USAEE/IAEE North American Conference to be held in Tulsa, Oklahoma, from October 23-26. This will return to the theme of unconventional oil and gas with the optimistic title "Implications of North American Energy Self-sufficiency". However, a topic for discussion will be whether energy efficiency and non-fossil energy technologies may be needed to enable North American energy self-sufficiency. Other issues to be addressed include the implications of US LNG exports, US oil and/or oil product exports, the implications of reduced North American imports or increased exports for world energy markets, substitution toward natural gas in electricity generation, and policy reform in the new energy environment. A visit to Tulsa will also give you extensive opportunities to see major facilities associated with the US oil industry.

Before I leave the subject of IAEE conferences, I want to thank Turkish Association for Energy Economics for hosting the very successful 2016 International Conference in Antalya, and the Latin American Association for Energy Economics for hosting the Latin American conference in Medellin, Columbia.

The IAEE is also making gains on other fronts. I am very pleased to announce that in 2015 we started a new affiliate in Slovenia, have affiliates under development in Portugal and Ghana. I also would like to take this opportunity to welcome the Korea Electric Power Corporation as our newest institutional member.

With regard to our journals, I am pleased to announce that we have a continued increase in submissions to *The Energy Journal*. As those of you who continue to receive the physical journal would have noted, there was a large increase in the size of the final two issues in 2015. This was needed to clear our backlog of accepted articles. We have also decided to produce two large volumes in 2016, while from 2017 we are moving to six issues instead of the current four. We also were very pleased with the very positive assessment of the *Economics of Energy and Environmental Policy* (EEEP) in our most recent survey of members. We are currently searching for a new managing editor for EEEP and have had some extremely good applicants for the position. Let me take this opportunity to thank Jean-Michel Glachant for his outstanding job as foundation managing editor.

The most recent survey of our members also delivered the judgment, especially from our tech-savvy younger members, that our web site needed refreshing. I am pleased to announce that a major revision of the site is in progress and should be completed by the end of the year.

I also am pleased to announce that we are adding some new resources to the IAEE web site. One in particular that I want to mention is the Data Links project. This will provide links to sources of energy data, both paid and free, available on the internet. We have populated the site with many links already, classified roughly according to the IAEE system for energy economics specializations. Please visit the site and suggest new links. We want this to be a dynamic living resource and something to increase visits to our web site and further the reputation of IAEE.

The final IAEE initiative I want to bring to your attention is the summer school program. The first two of these were held in 2015. One was in Istanbul and followed on from the IAEE International Conference. The other was held in Harbin, China. Both were successful, drawing many participants and leading people to ask for more. We have established a process whereby regional affiliates can place bids for such events analogous to bids to host conferences. Details are available from the IAEE web site.

Peter Hartley

IAEE Mission Statement

The International Association for Energy Economics is an independent, non-profit, global membership organisation for business, government, academic and other professionals concerned with energy and related issues in the international community. We advance the knowledge, 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

With your smart device, visit IAEE at:

International Association for Energy Economics

Editor's Notes

In this issue we compleete our coverage of *What Will be the Impact of the Drop in Oil Prices?* and introduce six articles on the topic of *Energy Risk.*

Philip Walsh examines the developments in the trading of energy derivatives in China since 2010 and highlights the continued intent on the part of the government to establish energy exchanges and trading platforms across all major energy commodities. However, while some have been launched the timing on others remains unclear.

Hisham Khatib notes that the discount rate is important in comparing projects and assessing their profitability. It is greatly affected by risk. Renewables increased the risk of existing power investors, so also the prospect of carbon pricing. All this needs to be reflected in the choice of the discount rate for new energy projects.

Maria Garbuzova-Schlifter and Reinhard Madlener report on a study to explore risks associated with energy performance contracting (EPC) projects in Russia. The data was obtained from an AHP-based questionnaire survey, conducted among EPC practitioners in Russia. Risks related to financial and regulatory aspects contribute most to the riskiness of EPC projects.

Douglas Reynolds suggests China may be in recession, which could be a major factor in recent oil price declines. He further shows that "peak oil may be imminent," if you compare current conditions with the American and Former Soviet Union's past peaks in oil production, where both regions had small second production cycle increases. Shale oil is only 5% of world production, which is not enough to compensate for conventional oil production declines.

Ryan Opsal reports that in China's quest for energy security in the 21st century, it has started to develop sources of sanctions and containment resistant oil supplies that would allow partial immunity to politically oriented oil supply disruptions in the event of future hostility with the United States and its allies.

Andreas Economou posits that in the midst of the great clash between, on the one hand, the development of energy-efficient pathways and a decarbonised world and, on the other, the security of supplies and impediment of 'peak demand', OPEC has exerted its market power masterfully.

Jikhan Jeong reports that due to falling oil prices, the bidding price of a marginal plant in Korea has decreased. As a result, the wholesale electricity price also has dropped. Therefore, the renewable and distributed energy industry may be sluggish. In this regard, KEPCO will play a crucial role in stimulating a new energy industry as a public enterprise in Korea.

Nam Foo addresses the impact of declining oil prices on the economic performance of countries in the Asia-Pacific region. He discusses some policy implications of how governments in the region can manage an extremely volatile energy market and the record low crude oil prices to enhance economic stability and prosperity.

Joseph Essandoh-Yeddu and Rossitsa Yalamova note that prevailing low oil prices threaten the economic viability of most of Africa's proven oil fields, as the break-even price of developing them is, on average, higher than the prevailing price.

Christian Growitsch and Leon Leschus develop the reasoning that in the medium term the U.S. could become a swing-producer on international oil markets helping to abolish long lasting oil price shocks and strong cyclic price fluctuations with extreme global oil price risks a thing of the past.

Corine Frischknecht, Ludovic Gaudard, and Franco Romerio say energy supply is jeopardized by various natural hazards almost everywhere.These phenomena create different types of risk, which, taken together, may dramatically affect society. An integrated risk assessment and management, in the case of major risks, is of utmost importance. Some technical insights are provided by our contribution.

Jared Anderson notes that yieldcos were recently darlings of the investment world, and while many risks facing this new investment vehicle have been reported, potential changes to net metering policies have received less attention. Potential changes to this policy could be important determinants of future yieldco performance in some cases.

Vid Pahor, discusses the introduction of risk management into his Company's business strategy to provide stable operations and reduce exposure to risks in an uncertain business environment.

DLW

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 IAEE's political neutrality may be censured or removed from membership.

39th International Conference

19 - 22 JUNE 2016 | BERGEN | NORWAY

ENERGY: EXPECTATIONS AND UNCERTAINTY

CONFERENCE OVERVIEW

The 39th IAEE International Conference takes place in Bergen, Norway, at the Norwegian School of Economics (NHH), 19 - 22 June 2016, with the main theme *Energy: Expectations and uncertainty: Challenges for analysis, decisions and policy*. Energy systems are becoming increasingly interdependent and integrated, raising the importance of changes in resources, markets, technology, policy, environment and climate. Methods, analyses and results that take explicit account of uncertainty and expectations from an economic and decision-making perspective will be highlighted.

The role of expectations and uncertainty can be approached from at least two different angles or levels with regard to time perspective, i.e.

- The analysis and handling in the short and medium terms of expectations and uncertainty at the firm and market levels.
- The analysis and handling in the longer term of expectations and uncertainty with regard to three broad areas: 1. Resources, technology and innovation, 2. Environment and climate, and 3. Policy and regulation.

The objectives of the Conference are to contribute to a better understanding and handling of expectations and uncertainty in energy, economic and environmental systems along these dimensions, and to place these topics within the broader themes of energy economics generally addressed by the Association.

Bringing together researchers, industry specialists, executives and policy makers, the conference gives opportunity for networking and learning opportunities.

www.iaee2016nhh.no

CONFERENCE VENUE

The conference is held at the Norwegian School of Economics (NHH), the leading national centre for research and education in economics and business administration.

NHH offers a 2-year MSc in Energy, Natural Resources and the Environment - an example of NHH's focus on energy economics.

NHH and Norway provide a perfect environment for the conference. As a country endowed with great natural assets, Norway has achieved a good track record of developing these for economic gain, whilst preserving its environmental capital.

For further information about the venue please see www.nhh.no.

Bergen is an international city packed with history and tradition, a small-town with charm and atmosphere. Bergen is an excellent starting point for exploring the Norwegian fjords, voted the world's most unspoiled tourist destination by the National Geographic.

www.visitbergen.com

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NHH

SNF

NAEE Norwegian Association for Energy Economics

The 39th IAEE International Conference ENERGY: EXPECTATIONS AND UNCERTAINTY

CALL FOR ABSTRACTS

TOPICS TO BE ADDRESSED

The general topics below are indicative of the subject matters to be considered:

- Energy demand, energy efficiency and the economy
- Energy resources and security of supply
- Energy risk assessment and analysis
- Energy technology, R&D and technology policy
- Environmental policies, greenhouse gas emissions and energy markets
- Financing and investment in the energy sector
- Fossil fuel markets and non-renewable resources
- Geopolitics and energy markets
- Infrastructure and regulation for wholesale transmission and transportation of energy
- Regulatory design, market integration and uncertainty
- Renewable energy and new energy technologies

A more detailed listing of topics can be found at: www.iaee2016nhh.no.

Abstract submission deadline:

Friday 15 January 2016

www.iaee2016nhh.no

CONCURRENT SESSION ABSTRACT FORMAT

We welcome contributions from researchers and industrial sector representatives. Authors wishing to make concurrent session presentations must submit an abstract that briefly describes the research or case study to be presented.

The abstract must be no more than two pages in length and must include an overview of the topic including its background and potential significance, methodology, results, conclusions and references (if any). In the forthcoming months an abstract template will be available at the conference website. All abstracts must conform to the format structure outlined in the template, and must be submitted online. Please see www.iaee2016nhh.no for details.

Those who wish to distribute promotional literature and/or have exhibit space at the conference are invited to contact: iaee2016.conference@nhh.no.

PRESENTER ATTENDANCE AT THE CONFERENCE

At least one author of an accepted paper or poster must pay the registration fees and attend the conference to present the paper or poster. Authors will be notified by Thursday 3 March 2016 of the status of their presentation or poster. Final date for extended abstracts submission: Monday 18 April 2016.

Multiple submissions by individuals or groups of authors are welcome, but the abstract selection process will seek to ensure as broad participation as possible. Each author may therefore present only one paper or one poster.

STUDENT EVENTS

Students may, in addition to submitting an abstract, submit a paper for consideration in the IAEE Best Student Paper Award Competition.

We also encourage students to participate in the Student Poster Session and to submit a paper for consideration in the Special PhD Session.

Students may inquire about scholarships covering conference registration fees.

For more information, please visit www.iaee2016nhh.no.

Photo: Statkraft, Visitnorway.com, Business Region Bergen, Ganeshfoto, Sebastian S. Eide.

The Future of Energy Derivatives in China – 5 years on

By Philip R. Walsh*

In the first quarter 2010 issue of the IAEE Forum I wrote about the future of energy derivatives in China. At that time there were plans for the introduction of a crude oil futures trading contract which would have been the second of its kind in China, the first being a fuel oil future contract that began trading on the Shanghai Futures Exchange (SHFE) in 2004. This raised the question of whether or not China would experience the development of multi-product energy derivatives at the domestic level or would regulatory controls and state-owned energy monopolies limit the success or even deter altogether the creation of futures markets in China? Five years on it is worth looking at the current state of energy derivatives in China's domestic energy sectors to shine some light on the answer to that question. I will not get into the history of energy derivatives development or the role that energy derivatives trading can take in China as one can go back and read my article in 2010 to get that background. Instead I will focus on the developments, or lack thereof, that have occurred since 2010 in derivative trading related to crude oil, fuel oil and gasoline, natural gas, coal and electricity.

Energy Derivatives in China from 2010 to 2015

Fuel oil derivatives remain the longest active energy derivative instrument in China. Established in 2004 this futures contract reached a point in 2009 where fuel oil trading on the Shanghai Futures Exchange (SFE) was almost five times that of heating oil futures being traded on the New York Mercantile Exchange (NYMEX). However, in the past five years the volume of trading in fuel oil futures on the SFE has dropped substantially. For example, the September 2009 Fuel Oil Futures contract volume was over 5.7 million trading lots (a trading lot is equal to 50 tons of fuel oil) while the September 2015 Fuel Oil Futures contract traded less than 1800 lots during its trading term. This decline can be attributed in part to economic conditions, a consumption tax on fuel oil that saw a shift to natural gas use in electricity generation and physical competition for feedstock by lower cost petroleum bitumen blends. Interestingly, bitumen futures were introduced in 2013 and in its early history have proven to be quite active. As a comparison, the September 2015 bitumen futures contract volume exceeded 4.6 million trading lots (a trading lot for bitumen is equal to 10 tons). Once the darling of domestic energy derivatives trading in China, fuel oil has, in recent times, appeared to have lost much of its luster.

In 2010 it was thought that the introduction of crude oil derivatives was imminent. In 2015, announcements have been made that crude oil futures will be traded through the Shanghai International Energy Exchange, referred to as the INE. The INE was introduced earlier in 2015 as part of the China (Shanghai) Pilot Free Trade Zone (Shanghai FTZ) and has since been approved by the China Securities Regulatory Commission (CSRC) as an exchange for the operating and trading of crude oil futures. In addition, the trading of these contracts will be the first Chinese commodity market to be completely open to foreign investors. One of the aims of the INE is to establish a crude oil futures contract that will provide a local benchmark. The Dubai Mercantile Exchange (DME) crude futures contract has been used as a proxy for Asian crude but is seen to be relatively illiquid. A INE traded crude oil futures contract is also seen as a future competitor to the more globally referenced Nymex or Brent crude futures contracts. However, there remain some concerns regarding the launching of this derivative product including the fact it will be priced in the local currency when traditionally, crude oil futures contracts have been priced in $US. This adds complexity to investing in the product as risk is seen to exist in both the commodity and the currency. In addition, foreign investment may be wary of the impact the major state-owned oil companies might have in influencing this futures market especially given the fact that China remains the world's largest user of oil and that government regulatory policy regarding domestic energy pricing remains uncertain, especially in light of the recent economic turmoil. This latter issue also raises concerns about the ability for domestic investors to add liquidity to a domestic crude futures market. At this time, a formal announcement is pending regarding the approval of a domestic futures contract.

As for natural gas, in 2013 China began pricing domestic production by indexing it to oil and liquefied natural gas (LNG). This pricing control has impacted approximately 60 percent of the natural gas sold in China. Market-oriented pricing remains available to LNG, offshore natural gas and non-conventional sources such as coalbed methane and shale gas. In an attempt to test the potential for providing spot trading options for natural gas within the domestic natural gas market the government opened the Shanghai Petroleum and Gas Exchange (SHPGX) in July of this year for a two month trial period. Registered in Shanghai FTZ, this exchange was formed to promote the trading of both conventional pipeline natural gas and LNG. There are ten shareholders involved in SHPGX with the largest holding belonging to the state-owned Xinhua News Agency at 33 percent. China's three largest oil and gas producers each own ten percent. The operations of SHPGX are overseen by the government economic planning agency, The National Development and Reform Commission, and the National Energy Admin-

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istration. Both domestic and foreign parties can become member dealers in the exchange and can trade natural gas at a listed price or through a bidding process. Presently only spot trading of natural gas is undertaken with no indications at this stage that a domestic natural gas futures contract will be developed. While the SHPGX represents an optimistic first step to natural gas derivative trading in China, the state ownership and its large contribution to the overall natural gas supply mix, as well as the current regulatory oversight of pricing, limits the likelihood of any near-term development of such a contract.

Of all of China's energy sources, coal has proven to be the one commodity that has seen a move over the past five years to establish futures markets. China is the world's largest consumer of thermal and coking coal. The Zhengzhou Commodity Exchange (ZCE) introduced China's first thermal coal futures contract trading in 2013. During its first year of trading China's large coal companies increasingly began using coal futures to hedge against the declining price for thermal coal. Since its inception to the end of 2014 the exchange has traded approximately 20 million contracts (200 tons per lot priced in Yuan). Earlier in 2013 the Dalian Commodities Exchange (DCE) began trading coking coal futures following up on its launch in 2011 of a coke futures contract. The introduction of derivatives trading in coal is relatively new and indications are that it may provide some help in managing risk for China's coal industry but it is early days yet and the long term sustainability of this derivative instrument remains to be seen.

For the electricity sector in China, there have recently been some announced changes that impact the potential development of an electricity derivatives market. In March of this year, the Chinese government announced changes to the electricity market that will encourage competitive energy pricing and reduce the government monopoly on power generation, transmission and distribution. At present, three companies manage the national system operations, transmission, distribution and sale of electricity. The most prominent is State Grid Corp. with control of approximately 80 percent of the electricity transactions occurring in the country. In the generation of electricity, there are five major generation companies producing about half of China's power. Electricity prices in China are fixed by the government and generating facilities provide electricity when directed to by the government. While these proposed reforms will increase competition in power generation and retail distribution, transmission will remain a utility function of the state-owned transmission companies who will be charging rates for transmission. These reforms all set the stage for the establishment of an electricity trading platform whereby generators can arrange to market electricity directly to customers at negotiated market rates. Furthermore, the government has indicated its willingness to study the potential for electricity futures and derivatives but it seems that it will be at some undefined future point in time.

So five years later are we any clearer in dealing with the question asked at the beginning of this article? Well, some aspects of energy derivative development appear clearer than others. For one thing, there has been legitimate intent on the part of the Chinese government to reform the energy sector including reducing, to some degree, the level of control of state-owned energy monopolies. In addition, some real and proposed movement has taken place in establishing energy exchange and trading platforms involving energy derivatives (albeit in a somewhat disparate way in terms of which energy source). What is also clear is that the Chinese government appears intent on using the Shanghai FTZ as the home for all energy trading including derivatives that would involve unrestricted foreign investment. What is unclear is the length of time involved in developing these platforms across the various forms of energy currently being produced and consumed in China or the extent to which the government will perform its regulatory function. It would appear that the government recognizes the need to provide ways to make energy transaction pricing more transparent and competitive but only in a way that doesn't benefit market makers at the expense of local consumers. How they handle this balancing act will ultimately determine the level of energy derivative activity in China.

References

Gloystein, Henning, "Like it or not, China's crude oil futures will be a global benchmark", September 10th, 2015. http://www.reuters.com/article/2015/09/10/china-crude-futures-idUSL5N11F04A20150910

http://www.platts.com/latest-news/oil/singapore/china-fuel-oil-demand-fades-further-amid-shift-27291990

http://www.wsj.com/articles/china-energy-exchange-targets-a-market-gap-1433188050

http://business.financialpost.com/investing/worlds-first-bitumen-futures-make-strong-debut-in-shanghai

Huang, Kaixi, "Oil and Gas Exchange in Shanghai Starts Two-Month Trial", July 2nd, 2015. http://english.caixin.com/2015-07-02/100824690.html

Shen, Feifie, "China Issues Rules to Reform Electricity System, NE21.Com Says", March 23rd, 2015. http://www.bloomberg.com/news/articles/2015-03-23/china-issues-rules-to-reform-electricity-system-ne21-com-says

Wong, Fayen, "UPDATE 3 – China thermal coal futures debut", September 26th, 2013. http://www.reuters.com/article/2013/09/26/china-coal-futures-idUSL4N0HM0H720130926

www.quandl.com/data/SHFE/

Yep, Eric, "China Energy Exchange Targets a Market Gap", June 1st. 2015. http://www.wsj.com/articles/china-energy-exchange-targets-a-market-gap-1433188050

Portuguese Affiliate Formed

The Portuguese Association for Energy Economics (Associaçao Portuguesa de Economia da Energia — APEEN) was established on May 18, 2015 laying the foundations of a new IAEE Affiliate. On this occasion, the ME^3 Meeting on Energy and Environmental Economics was also organized at the University of Aveiro gathering together energy professionals, academicians, students and government representatives. Contributed sessions of the conference were held on the topics of Renewable Energy; Environmental Impact and Energy Policy; Energy, Allowances and Environmental Policy; Energy and the Macroeconomy. At the conference, IAEE was introduced by President-Elect Gürkan Kumbaroğlu who also delivered a keynote speech on the geopolitics and economics of natural gas supply in the region. At the conference, APEEN's founding members held a meeting approving the Association by-laws. The inaugural meeting was followed by a reception with APEEN President Jorge Vasconcelos and IAEE President-Elect Gürkan Kumbaroğlu addressing the invitees and welcoming the foundation of APEEN. APEEN's Founding President is Jorge Vasconcelos, and its Vice Presidents are Isabel Soares, Jorge Sousa, Julia Seixas, Maria Jose Clara, Carlos Costa Pina, Pedro Neves Ferreira, Gabriela Prata Dias, Antonio Cardoso Marques, Ligia Pinto, Patricia Silva and Margarita Robaina. Marta Ferreira Dias is the Secretary and Mara Madaleno the treasurer.

Below is the release carried in the Portuguese press relating to the Affiliate's formation.

PRESS RELEASE

Iberia can become a regional gas hub with American shale gas

Iberia, the west gate of Europe, may increase its importance in parallel with developments in the United States' energy sector.

Prof. Gürkan Kumbaroğlu, President-Elect of IAEE, mentioned the significance of the Iberian Peninsula in his keynote speech at the energy economics conference held at Averio University organized parallel to the inaugural meeting on the establishment of the Portuguese Association for Energy Economics.

Kumbaroğlu highlighted the importance of two territories for Europe's energy supply security, one of them being Turkey on the east end, and the other being Portugal on the west end. He said:

"Rapid developments worldwide increase the importance of energy more significantly today than yesterday. Diversification of supply and competition in energy are most important issues for Europe to secure affordable and reliable energy supply. Recent developments on shale gas extraction in the US will affect the trade balances. The energy importance of U.S.A. for the world markets is increasing day after day as first gas exports in the form of LNG are expected to start soon. In this case, the Iberian Peninsula can become a new energy gate for Europe. Namely, energy can become a significant revenue item for Turkey in the east and for Portugal and Spain on the Iberian Peninsula."

Kumbaroğlu, who indicated the strategic importance of the countries on the Iberian Peninsula, said "The establishment of the Portuguese Association for Energy Economics in Averio, a prospective new Affiliate of IAEE, marks a benchmark for the creation of energy economic awareness, networking and interaction in the territory. It is a great advantage that the founding members involved in this formation are outstanding names from all different backgrounds of the energy sector in Portugal."

Kumbaroğlu indicated that the IAEE recognizes the importance of the Iberian Peninsula and said "we participated in the creation activities of the Energy Saving Portuguese Association (APEEN) where the foundation for the Portuguese Affiliate of IAEE will be launched."

IAEE will provide an interdisciplinary forum for members from Portugal through the Portuguese Association for Energy Economics, an upcoming IAEE Affiliate, featuring the exchange of ideas and experiences about the energy industry worldwide. Important names from the Portuguese energy world including Jorge Vasconcelos, Isabel Soares, Jorge Sousa, Marta Ferreira Dias, Mara Madaleno and Margarita Robaina lay the foundations of a successful start.

For a press releases in Portuguese please visit http://www.iaee.org/documents/pr_Portugal014.pdf

The Discount Rate - A Tool for Managing Risk in Energy Investments

By Hisham Khatib*

Introduction

The life-cycle costs of a project and its feasibility, for a given output, depend on three factors: (i) the investment cost, (ii) the operational costs and (iii) the discount rate utilised. Many planners think that the discount rate is the most important of these three factors. It greatly affects the whole economics of the project and the decision making, particularly in capital-intensive projects like those of the energy industry[1]. The discount rate almost governs the project's feasibility and the decision to proceed with the investment or not. It is also the base for calculating the levelised cost of electricity (LCOE) for different generating facilities.

The Discount Rate

The discount rate is the opportunity cost of capital (as a percentage of the value of the capital). The opportunity cost of capital is the return on investments forgone elsewhere by committing capital to the investment under consideration. In investment decisions, the opportunity cost of capital is the cut-off rate, below which it is not worthwhile to invest.

The value of the nominal discount rate is a function of three factors: inflation, risk-free real return and the extent of risk in the project.

Calculating the Discount Rate

In many countries, energy projects financed by the government use a different discount rate than that used by the private sector investors operating in a liberalised market. Normally, government investments are less risky, because they are mostly in regulated utilities and industries. The discount rate of the private energy sector investments is influenced not only by risk, but also by returns in the bond market which can change significantly from one period to another. Both discount rates are, however, significantly influenced by availability of capital for investment and the cost of borrowing.

Period	Arithmetic Average (%)		
	Stocks	Treasury Bills	Treasury Bonds
1928-2012	11.26	3.61	5.38
1962-2012	11.10	5.17	7.19
2002-2012	8.71	1.65	5.64

Period	Risk Premium(%)	
	Stocks-Treasury Bills	Stocks-Treasury Bonds
1928-2012	7.65	5.88
1962-2012	5.93	3.91
2002-2012	7.06	3.08

Source: Aswath Damodaran, January, 2013

Average rates of return on treasury bills, government bonds, corporate bonds and common stocks, 1926–2012 (figures in annual percentages)

Energy Business Investment Projects

Investors in energy projects expect a rate of return from projects to compensate them for the following: a minimum acceptable real return available in the market (risk-free rate of interest), the risk of investing in the project, taxation and also inflation. The rate of return will be calculated in real terms thus ignoring inflation.

Return on equities (capital gains plus dividends) fluctuates in the stock market. Recently, this equity risk premium was 5.75%, in mature markets[2].

Regulated energy utilities have a risk, which is lower than the average market risk. A stock's sensitivity to change in the value of the market portfolio is known as beta. In a competitive market, the expected risk premium varies in direct proportion to beta. This is the capital asset pricing model (CAPM)[3], simply defined as

expected risk premium on a stock = beta × expected risk premium on market

real discount rate = real risk-free rate + (market risk premium × beta)

Therefore, investment in an asset/project that has a beta of 0.6 means that the real discount rate for this investment will be equal to 4.2 per cent; (0.7 per cent (which is the risk free rate) + (5.75 per cent market risk premium x 0.6)).

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Risk in Energy Investments

It is necessary to discuss the risk in energy investments – mainly the discount rate of electricity utilities. Utilities, in many cases, are regulated monopolies, particularly in developing economies. They have well-defined markets and also established technologies; correspondingly, they have a lower discount rate, a lower beta than the average equity.

Electricity utilities, because of their secure market and established consumer base, have less risk than the market average. This has also allowed them to borrow at lower rates, thus reducing the burden on their consumers. To allow for expansion, their borrowing requirements are at least twice their depreciation allocation. It has also to be realised that the discount rate for such projects can be reduced by capital structuring and allocating risk.

In liberalised markets generation projects have a higher risk and correspondingly higher beta value than distribution utilities. Nuclear installations have a higher risk than other forms of thermal generation and, correspondingly, utilities with nuclear generation have a higher beta than other generating utilities, depending on the extent of their nuclear component. Long-life facilities, like large coal-firing plants, carry more risk than modern CCGT gas-firing facilities. Investments in big long-lead-time pulverised coal-firing generating units are riskier than investment in smaller short lead-time CCGT plants that easily fit the load curve. Generally speaking, regulated utilities have a lower risk/discount rate than the average equity. Beta between 0.4 and 0.9 are normal for regulated utilities depending on the type of business and extent of regulation. The regulatory environment, in particular, has a marked influence on the discount rate of investment in energy projects. The prospects of future carbon pricing will increase the risk for certain generation investors, which need to be considered in their discount rates.

The introduction of new renewables (solar and wind) produced new challenges that significantly increased the risk of returns on existing and new investments in base load generation. Renewables carry less risk, their investment cost is reducing, and execution times are short, also in most cases they are assisted by subsidies, therefore their discount rate is low. Renewables are a must dispatch generation and their output can be on the expense of established traditional base load generation, significantly reducing the base load generation output and correspondingly its profitability and increased its risk. This rendered negative electricity pricing to become not uncommon in few European markets.

For nuclear generation, the risk in investment, execution times, financing costs and regulations are considerable. They would not be carried by a market investor in the OECD without firm guarantees and subsides, which are becoming scarce. An important factor behind these high estimated costs to build nuclear reactors is the delay that these projects often face during licensing and construction that increases the capital burden, often at high interest rates. This is also a reason why the economics of nuclear power may be more favourable in countries such as Russia, China, UAE and South Korea where projects tend to stay on schedule. A recent MIT study recommended that the discount rate for new nuclear projects should be as high as 11.5%[4].

Weighted-average Cost of Capital

For project evaluation, mostly in North America, utilities use the revenue requirements method (RRM). It is a project evaluation method that discounts future costs (revenue requirements) into their present value using the utility's weighted-average cost of capital (WACC). WACC is the weighted-average cost of the firm's equity and debt:

$$\text{After-tax WACC} = r_d(1-T_c)D/V + r_eE/V$$

Where: r_d is the return on debt, r_e return on equity and T_c corporate tax rate, and D is debt ratio, E equity ratio and $V = E + D = 1$.

WACC is a common tool used by energy investors for discounting cash flows and assessing the viability of the investment. It, unlike the discount rate, does not directly reflect risk; but this should be embedded in the choice of the expected return and the cost of debt.

Footnotes

[1] Khatib, Hisham: "Economic Evaluation of Projects in the Electricity Supply Industry", 3rd Edition, The Institution of Engineering and Technology (UK), 2014.

[2] Damodaran, Aswath: "The Global Landscape in Jan. 2015". http//aswathdamodaran.blog.com.

[3] Brealey/Myers/Allen: "Corporate Finance", McGraw-Hill Int. Ed., 2006 and later.

[4] Massachusetts Institute of Technology (2003). "The Future of Nuclear Power" .

Risk Analysis of Energy Performance Contracting Projects in Russia

By Maria Garbuzova-Schlifter and Reinhard Madlener*

Introduction

Energy Performance Contracting (EPC) projects carried out by Energy Service Companies (ESCOs) and other Energy Service Providing Companies (ESPCs) in the Russian market are considered key for the country's energy-efficient technical modernization. EPC projects are typically complex projects of an interdisciplinary character that bear technical and performance risks for ESCOs. These aim at refinancing their investments through a guaranteed amount of energy savings that results from the implemented energy conservation measures (ECMs) at the client's site. Depending on the form of the underlying contract, ESCOs may also be subject to investment and financial risks. In order to be able to guarantee the anticipated energy savings and, hence, to actually achieve the expected profits, ESCOs need to know the main EPC project risks and, provided some of the risks cannot be eliminated, to manage and mitigate these (Garbuzova-Schlifter and Madlener, 2014a; Garbuzova-Schlifter, 2015; Hansen, 2006; Mills et al., 2006; Wang and Chou, 2003). In Russia, however, most ESCOs and ESPCs lack expertise in the risk analysis and management in EPC projects, and most financiers rank EPC projects by default as "risky" investments. As a consequence, ESCOs and ESPCs suffer from limited access to funds at reasonable rates. Overall, in spite of promising expectations, the development of the high-potential market for energy services in Russia has been rather disappointing so far.

Aim and Scope of Study

To fill the existent research gap on this topic, we recently conducted a comprehensive study with the aim to identify, classify, and rank the main risk factors and causes of risk that ESCOs and ESPCs face under the vulnerable market conditions prevailing in Russia. The focus was put on three distinct sectors (hereafter "focus sectors"), in which most EPC projects up to now have been executed in the Russian market: (1) industrial; (2) housing and communal services, focusing on multi-family apartment buildings (MFABs); and (3) public.

Methodology

With reference to the international scientific, business and governmental literature, a list of general risks associated with planned or already realized EPC projects was produced. In a next step, the general risks identified were validated by Russian EPC practitioners in six semi-structured interviews conducted in Moscow in May 2013. This led to a comprehensive list of risks that Russian ESCOs and ESPCs may face when executing EPC projects in each of the focus sectors. The specific risks identified were then classified by us into risk factors and causes of risk, and ranked in terms of their contribution to the riskiness of an EPC project for each focus sector. The ranking was in line with the results of a web-based questionnaire survey conducted from February to April 2014 among experts employed by 162 ESCOs and ESPCs in Russia. This questionnaire consisted of two parts. The first part contained general questions about the participating companies. Between the first and the second part of the questionnaire, a filter question was inserted that allowed the respondents to select the focus sector where they believe to have the most expertise and experience with when assessing risk factors and causes of risk associated with EPC projects. After selecting the focus sector, the participants were directed to the second part of the questionnaire, which serves the multi-criteria decision making part of the survey that was based on the Analytic Hierarchy Process (AHP) method (Saaty, 1977; 2000).

Results

The response rate achieved in the questionnaire survey was 23.5%. The majority of the surveyed companies indicated that they do not employ a risk manager; however, 40% of these companies stated that they apply a formal approach for EPC project risk assessment. Fee-for services, fixed price, and shared savings were identified as the most applicable contractual forms for realizing EPC projects in Russia.

In accordance with the respondent's preferences elicited from the AHP-part of the questionnaire, the risk factors and causes of risk related to financial issues

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	Risk factors	Local priorities	Structural adjustment		Causes of risk	Local priorities	Global priorities	Rank
A	Risks of project preparation & execution phases	0.110	3/22	1	Project tendering exclusively price-based	0.291	0.035	16
				2	Lack of reliable data for baseline estimation of energy consumption of a client	0.194	0.023	21
				3	Unreliable energy certification provided by an external energy audit company	0.515	0.061	5
B	Contractual risks	0.114	2/22	1	No explicit risk pricing in EPC	0.536	0.044	10
				2	Poor prior risk division between an ESCO and a client	0.464	0.038	13
C	Technical & operational risks	0.084	3/22	1	Improper operation of the installed equipment by a client	0.292	0.027	19
				2	Improper verification of energy savings (approach/instruments)	0.482	0.044	11
				3	Energy supply disruptions	0.226	0.021	22
D	Financial risks	0.159	3/22	1	Poor investment capacity of an ESCO	0.271	0.047	8
				2	No long-term funding without a governmental or third-party guarantee for a loan	0.309	0.053	7
				3	Delayed energy saving payments from a client	0.420	0.072	3
E	Client's risks	0.109	3/22	1	Client's bankruptcy risk	0.210	0.025	20
				2	Fluctuation in client's energy consumption due to undisclosed changes in productive capacity	0.318	0.037	14
				3	Difficulty of an ESCO to prove energy savings have been achieved for a client	0.473	0.056	6
F	Human & behavioral risks	0.107	2/22	1	Lack of management & technical expertise	0.466	0.036	15
				2	Client's mistrust of an ESCO	0.534	0.041	12
G	Political & regulatory risks	0.165	3/22	1	Poor & unstable legislation base for EPC projects	0.390	0.069	4
				2	Lack of tax exemptions for EPC or an ESCO	0.419	0.074	2
				3	Cross subsidization	0.192	0.034	17
H	Market risks	0.151	3/22	1	Unpredictably fluctuating energy prices	0.202	0.033	18
				2	Poor market demand & lack of incentives to invest in energy efficiency	0.277	0.045	9
				3	High interest rates for bank or third-party lending	0.521	0.085	1

Source: Own compilation

Table 1: Ranking of risk factors and causes of risk associated with an EPC project executed in the Russian industrial sector

contribute most to the riskiness of EPC projects. Table 1 provides the ranking of risk factors and causes of risk that arise in EPC projects executed in the industrial sector as an example. More details on project risk ranking for the housing and communal services sector and the public sector can be found in Garbuzova-Schlifter and Madlener (2014b) For example, the *high interest rates for bank or third-party lending* was ranked highest among the potential causes of risk regarding EPC projects that are executed in the industrial sector, and second highest for projects executed in the housing and communal services sector. This result is not too surprising, since for most banks and other lenders, EPC is still a relatively new concept in Russia. Most lenders lack the technical expertise to evaluate and verify the return on investment of an EPC project that equals to the actual amount of energy savings achieved. Moreover, EPC projects are in most cases long-term projects executed under vulnerable market conditions. By contrast, for the EPC projects implemented in the public sector, where a governmental body may presumably serve as a guarantor, high interest rates do not seem to contribute much to the riskiness of EPC projects (this cause of risk was only ranked 12th). Nevertheless, according to our results, it seems that obtaining a governmental loan guarantee represents a difficulty for the majority of the Russian ESCOs or ESPCs engaged in the public sector.

Another important result from our study is that issues related to the regulatory aspects of the EPC projects executed in all three sectors were found to contribute significantly to the riskiness of such projects.

Conclusion

Risk analysis and management should be integrated into daily business activities of ESCOs and ESPCs that operate in the Russian market. This would allow systematic capturing of most of the risks and, hence, increase the transparency required by the third-party lenders in order to provide the necessary funds for EPC projects in all three focus sectors in the Russian market studied. The results from our survey study signal a strong need for improving the existing regulatory framework for EPC projects. Moreover, besides the improvements needed for the general regulatory framework of EPC, we conclude that for each focus sector an individual contracting scheme of a typical EPC should be elaborated. Such individual regulations for EPC projects would allow a better reflection of sectorial particularities during the EPC project conclusion and execution phases.

References

Garbuzova-Schlifter, M., & Madlener, R. (2014a). Foreign direct investments in carbon footprint reduction projects: The case of the Russian energy market post-2012 (Project final report). E.ON Energy Research Center Series 6(1). Aachen, Germany: E.ON ERC.

Garbuzova-Schlifter, M., & Madlener, R. (2014b). Risk analysis of energy performance contracting projects in Russia: An analytic hierarchy process approach. FCN Working Paper No. 10/2014. Aachen, Germany: Institute for Future Energy Consumer Needs and Behavior (FCN), E.ON ERC, RWTH Aachen University.

Garbuzova-Schlifter, M. (2015). The growing ESCO market for energy efficiency in Russia: A business and risk analysis, PhD Thesis, School of Business and Economics, RWTH Aachen University (in prep.).

Hansen, S. J. (2006). Performance contracting: Expanding horizons (2 ed.). Lilburn, GA: The Fairmont Press.

Mills, E., Kromer, S., Weiss, G., & Mathew, P. A. (2006). "From volatility to value: Analysing and managing financial and performance risk in energy savings projects". Energy Policy, 34(2), 188-199.

Saaty, T.L. (1977). "A scaling method for priorities in hierarchical structures", Journal of Mathematical Psychology, 15(3): 234-281.

Saaty, T.L. (2000). Fundamentals of decision making and priority theory with the analytic hierarchy process (vol. 6), Pittsburgh, PA: RWS Publications.

Wang, M., & Chou, H. (2003). "Risk allocation and risk handling of highway projects in Taiwan". Journal of Management in Engineering, 19(2), 60-68.

Peak Oil May Be Imminent

By Douglas B. Reynolds*

China and Oil Demand

There is inconsistency surrounding China's official GDP statistics. For example, in an Economist article (*Economist* 2015a) about China's North East industrial area, it shows a graph that has a zero growth rate for that specific region. However, within the same article, it is explained that sales in a specific retail store are way down, and not at the same level, which would normally indicate that there is a recession in China's North East industrial area, not zero growth. In another *Economist* article (*Economist* 2015b), Chinese coal demand is revealed to be down 8% from a year ago, and coal imports are down 38%. Such a decline in coal use is not consistent with an official Chinese growth rate of 7%. Moreover, Europe, Russia and Japan are all in economic slumps which might imply that Chinese exports are probably in a slump. So a decline in industry, a decline in coal demand and a possible decline in export markets all point to one conclusion: China could be in a recession and may not have an official 7% growth rate. It is possible, though, that other non-coal, non-export and non-industrial sectors are booming such as real estate construction growth and service sector growth which may be able to overcome an industrial decline. Yet, growth in services would still need more coal fired electric power, while growth in construction would still need more steel. This leads to the conclusion that China may be in a recession.

If it is true that China is in a recession, then the story of the recent oil price decline has more to do with Chinese, Japanese, Russian, Brazilian, and European oil demand stagnation, due to slow economies, then with Saudi Arabian and shale oil supply increases. Indeed, Europe has had declining oil demand for a decade.

The usual story of the oil price decline is that Saudi Arabia has increased oil supplies, or at least has not reduced them, for the purpose of putting shale oil producers out of business. However, the Saudis would have to pursue such a goal for a long time to put American shale oil out of business. If any one U.S. shale oil company cannot pay their bills, they can declare bankruptcy and those shale oil assets would be resold at a low price to new investors looking at the temptation of available shale oil returns. Those new investors will simply buy up the old assets of the bankrupt firm and find out-of-work shale oil workers to run a new company and start up a new shale oil firm at the same location and with the same reserves as the old bankrupt business, which is to say, you cannot kill the American shale oil industry that easily, it will just reinvent itself. A Saudi induced oil price decline can temporarily reduce drilling and production, but then as soon as prices revert to high levels, the rush will be back on.

However, over the last year, Saudi Arabia has not changed its oil production levels by much if at all. It's only commentators, who see no change in Saudi production, and who are interpreting this as a sign that the Kingdom is actively manipulating markets that's making it seem as if Saudi Arabia is actively doing anything. Commentators see this because they probably remember how Saudi Arabia did manage oil prices to some degree in the 1970s and 1980s and still think of Saudi Arabia as a great oil price manipulator. Unfortunately, now that the Saudi's have mature oil fields, there may be less room for changes in their level of oil output than in earlier years, as is often the case in mature oil fields. If you temporarily reduce oil output in a mature field, you create oil reserve destruction. So, you don't want to make a lot of sudden changes in the level of oil production, geologically speaking, lest it cause you to produce less oil in the long run. Plus, if Saudi Arabia reduces its oil production, it can hurt some of its refineries' profits. Saudi Arabia also wouldn't invest in a lot on new oil fields, just to put shale oil producers out of business, as that would produce more non-performing assets and have little effect on the long run American supply market.

All of this suggests that the oil price declines of the past year are demand side price declines more than they are supply side price declines, but the dynamics are about to change.

The Recent Trend in Supply Increases

With the fall in oil prices, there has been much discussion that there is a new horizon of ever expanding shale oil supplies, and even such proclamations that the price of oil will soon reach $20 per barrel. Yet much evidence shows peak oil to be imminent. To explain, you need to understand the worldwide Hubbert curve trend shown in Figure 1 and as explained in Reynolds (1999a, 1999b and 2014). Figure 1 shows average yearly production of oil in millions of barrels per day (mbd) as a function of cumulative production in billions of barrels. The Hubbert trend is the upper curve, and the actual production is the lower curve. Notice that every time the actual oil production gets close to the Hubbert

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trend the price of oil rises, and vice versa when production goes well below the trend which is shown in Reynolds and Baek (2012). The trend peaked in 2005 then plateaued until 2009 whereupon high prices and some technology had an effect on the production engineering and a new 2nd Hubbert curve trend emerged even for conventional oil.

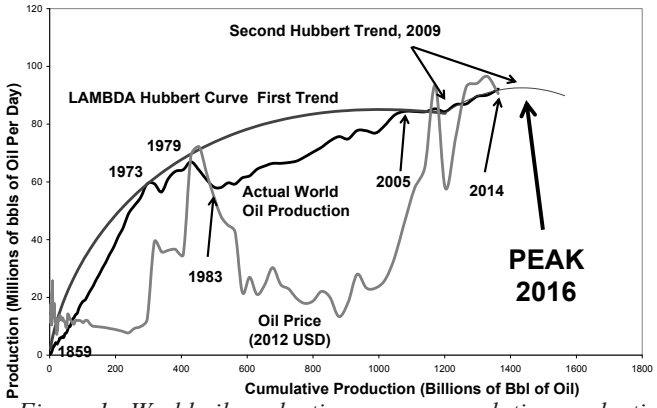

Figure 1, World oil production versus cumulative production.

When actual production comes close to the trend, oil prices rise.

The 2nd Hubbert cycle, starting in 2009, has followed a new trend in the tradition of Reynolds and Kolodziej (2009). The amount of extra oil production above the old Hubbert trend is, so far, about 8 mbd, of which 5 mbd is from the U.S. including a little more than 1 mbd from North Dakota's Bakken Shale and more than 3 mbd from Texas and New Mexico mostly from the Eagle Ford and Permian Basin fields. Canada has added an extra 1 mbd since 2009 mostly from tar sands production and some shale oil. This means shale oil is about 5% of world production, and mostly from the three main American regions, Canadian tar sands is about 2% of world production, and conventional oil is 93% of world production. Much of the rest of the increase in world oil supplies, since 2009, is from conventional oil in the Middle East.

This sudden rise in a 2nd Hubbert trend after an initial peak in the first Hubbert trend is not unusual, see Brandt (2010 and 2007) and Hubbert (1962). We have seen these sudden conventional rises of 2nd Hubbert cycles in the past in large regions, such as in the U.S. in 1977, see Reynolds and Zhao (2007), and in the Union of Soviet Socialist Republics (U.S.S.R.), also known as the Former Soviet Union (FSU), in 1985, see Reynolds (2000) and Reynolds and Kolodziej (2008). The 3rd Hubbert cycle of the FSU in 1996 was due to a fundamental change in institutions, prices, technologies and property rights, see Reynolds and Kolodziej (2007), the likes of which are not on par with what is happening for the world's 2009 2nd Hubbert cycle. So comparing the 1996 FSU 3rd Hubbert cycle to the world's 2009 2nd Hubbert cycle would be inappropriate. Therefore, the 2009 world's 2nd Hubbert cycle has more in common with the 1977 U.S. and 1985 U.S.S.R. cycles rather than the 1996 FSU cycle.

If, though, we compare the 1977 U.S. 2nd Hubbert cycle and the 1985 U.S.S.R. 2nd Hubbert cycle to the world's 2009 2nd Hubbert cycle, where the former large region histories had only temporary increases in supplies before a new peak occurred, then that suggests that within the next few years, worldwide conventional oil will peak. If conventional oil does peak then a mere 1% per year reduction in conventional oil production would require a 20% per year increase in oil shale and tar sands production to keep world supplies even—a difficult task for only three major shale oil regions and a tar sand region to attain given their already high levels of production. While the shale oil regions have already sustained a better than 20% growth rate over the recent past, they would need a 40% or greater growth to sustain growing world economies. Such growth rates will become harder to sustain as the fields become more densely exploited. For example the U.S. sustained a greater than 7% growth rate in oil production for decades at the beginning of the 20th century, but that entailed the use of many fields and regions. The U.S.S.R. sustained a 10% growth rate in the early 20th century for many decades, also using many fields and regions, so a 40% growth rate with only three regions would be a challenge. Even if tar sands can increase by about 10% per year from a 2 mbd base, that still does not look to be enough to maintain a level world production rate, let alone have worldwide increases in production, should conventional oil production soon peak.

If we look outside of the U.S. for new shale oil fields and regions, there has yet to be a lot of shale oil production, even though there are many potential fields. It is telling that the shale oil industry has had about ten years of high oil prices and technological breakthroughs that would normally help to get more shale oil regions on-line, and yet only the three major regions, the Bakken, the Eagle Ford, and the Permian, have emerged worldwide to produce a lot of new energy liquids. Most other shale regions have not yet developed, even with the high oil prices of the past decade, or those regions have shale gas and not oil. Since only 60% of the world's 2nd Hubbert cycle increase is from shale oil, and since such a performance of rapid increases will be hard to sustain for the three major regions, and since other shale oil regions have yet to develop even with these past high oil prices, then, the conclusion must be that producers will be hard pressed to increase shale oil production fast enough to fill the void between normal world oil demand growth and world conventional oil supplies as soon as conventional oil peaks.

With so much of the discussion of the lower oil prices being attributed to shale oil, there is a disconnect between the real cause for the recent decreases in prices—a slowdown in demand—and the perceived cause—an increase in oil production.

Fiscal Systems Changes

The other aspect of the coming peak in oil production is that oil producing governments around the world will quickly ratchet up their oil fiscal system taxes and government takes, as soon as oil prices begin to rise. According to Johnston (2003) there are different fiscal systems such as profit taxes, production sharing agreements and royalty schemes, which are used by oil producing countries and provinces in order to share the wealth of oil production. The idea is that these governments are trying to use a fiscal system in order to maximize revenue, but also to maximize their industrial development, their employment and even their environmental protection. The usual idea behind such fiscal systems is that the regional government hires a set of consultants to find a maximizing system, and as such the driving factor of the oil production supply side market is these various fiscal systems, i.e., the fiscal systems determine oil supply and indirectly the price of oil.

Another way of looking at fiscal systems is that instead of the fiscal system determining the supply and the price of oil, it is the price of oil that determines the fiscal system. This is Reynolds' (2002) idea of the Walmart or Neiman Marcus strategy coming into play. The idea is that when oil prices are low, governments pursue a strategy of having low government takes in order to induce more investment and increase exploration and development, which indirectly maximizes production quantities, rather like how Walmart makes money by having low prices but high quantities of sales. When oil prices are high, governments then pursue a strategy of having high government takes which can inadvertently reduce exploration and development but which maximizes the revenue per barrel of oil, rather like how Niemen Marcus makes money by having high prices even as it has a low quantity of sales. This suggests that when oil prices change, so will all the fiscal systems of the world.

While the ratcheting up of fiscal system government takes will not quickly effect current world production up or down, it may indeed affect current exploration and development downward, especially in shale oil regions, and, therefore, the high oil prices can induce a slowdown of new oil production coming on line, rather than speeding it up as one might expect in a high oil price environment. Therefore, rather than a counter cyclical spiral of first increases in prices followed by increases in supply followed by decreases in prices, you can have a pro-cyclical pattern of downward supply and upward prices followed by even less supply and even higher prices. That is, once peak oil starts, oil prices will rise. Once oil prices rise, fiscal systems will tighten due to the Neman Marcus strategy. Once fiscal systems tighten, you may get oil production declines rather than oil production increases. Consequently, supply is constrained all the more and oil prices rise all the more, inducing even greater government takes and so on. (Full disclosure: I invest in futures.) It could be a true oil price shock of epic proportions.

This hypothesis of the price effecting the fiscal system more than the fiscal system effecting the price is possibly about to occur on a massive scale as oil prices are about to shock upward. Assuming there are enough research economists left out there to do the research, after the financial crisis cut backs, then this would be an excellent field of study. However, oil prices won't shock upwards next decade, but more like next year or next blue moon (two to three years) or maybe even next month.

The Oil-Economy System

The world's economy is really an oil-economy system that should be viewed as a physical-engineering system that relies on oil dependent technologies. When oil supplies decline, the oil based system is forced to use less oil, and consequently less oil-dependent technologies which then reduces productivity which must of necessity reduce GDP. Once GDP declines, monetary and fiscal policies, which are used to increase economic growth, kick in. However, the G-8 (the top 8 developed countries) central banks' abilities to use monetary policies are limited right now due to all of the quantitative easing already carried out for the 2008 financial crisis. Plus the G-8 governments' abilities to use fiscal policies are limited due to all the debts already accrued to fight the same financial crisis. Therefore, the G-8 central banks and governments have no more leverage to change economic policy. The world economy, then, may be rather less like riding an elephant with slow changes in momentum and slow turns and more like riding a surfboard where the slightest perturbation can cause a quick flip, which is exactly what happened to the former Soviet Union in the late 1980s. If the 2nd Hubbert oil cycle peaks soon, then oil prices will increase quickly, and then as happened in the U.S. and the West in 1970s, and as happened in the U.S.S.R. in the late 1980s, see Reynolds (2011a and 2011b), the peak in oil supplies could create a wage and price

spiral that should increase the velocity of money and push all of that Federal Reserve quantitatively eased pile of high powered money back into the economy. This may create, as happened during the fall of the Soviet Union, hyperinflation with stagflation.

At that point, many will clamor for governments to put in place additional safety nets as the world's economies suffer, yet governments around the world may soon enough be experiencing peak government and will not be able to help many people. Then it will be up to the free markets to overcome an oil shock, it's just that there is very little ability for free markets to change the oil supply side and much more ability for free markets to change the oil demand side. Indeed, it was the oil demand side that saved the U.S.S.R. when it endured a massive recession while the FSU adjusted its entire economy. The former Soviet oil shock of the late 1980s did not make the economy more efficient as much as it simply forced people to live with less. See Orlov (2008). Therefore, as the world is forced to endure an oil price shock, preparation cannot be done on a government level but on an individual, regional and corporate level. As the Netherland Bureaus for Economic Policy Analysis (CPB 2004) states about oil supply disruptions, "Establishing and maintaining well-functioning markets appears to be an efficient approach in realizing a secure supply of energy." It is just that this does not mean we will have cheap supplies of energy.

References

Brandt, Adam R., (2010). "Review of mathematical models of future oil supply: Historical overview and synthesizing critique," *Energy*, 35, pp. 3958 – 3974.

_____, (2007). "Testing Hubbert," in *Energy Policy*, Volume 35, pp. 3074-3088.

CPB, (Centraal Planbureau) Jeroen de Joode, Douwe Kingma, Mark Lijesen, Machiel Mulder, Victoria Shestalova (2004). *Energy Policies and Risks on Energy Markets: A cost-benefit analysis*, Netherlands Bureau for Economic Policy Analysis (CPB), The Hague, the Netherlands, February 2004, p. 3.

Economist, (2015b). "Coal, Black moods; Coal's woes are spreading. But it still has its fans," *The Economist*, June 6, 2015.

Economist, (2015a). "The north-east; Back in the cold; After promising signs of a renaissance, China's old rustbelt suffers a big setback," *The Economist*, January 3, 2015.

Johnston, Daniel, (2003). *International Exploration Economics, Risk, and Contract Analysis*, Tulsa, Oklahoma, Pennwell Corp.

Hubbert, M.K. (1962). *Energy Resources, A Report to the Committee on Natural Resources: National Academy of Sciences, National Research council*, Publication 1000-D, Washington, D.C..

Orlov, Demitry, (2008). *Reinventing Collapse: The Soviet Example and American Prospects*, New Society Publishers, (June 1, 2008).

Reynolds, Douglas B., (2014). **"**World oil production trend: Comparing Hubbert multi-cycle curves," Ecological Economics, Volume 98 (2014) pp. 62–71.

_____, (2011a). "Peak oil and the Fall of the Soviet Union: Lessons on the 20th Anniversary of the Collapse." The oil drum, May 27, 2011, www.theoildrum.com/node/7878 .

_____, (2011b). "Peak oil and the Great Stagflation: Lessons from the Fall of the Soviet Union," *Energy Politics*, Fall 2011, http://www.energypolitics.org/issues/fall-2011 .

_____, (2002) *Scarcity and Growth Considering Oil and Energy: An Alternative Neo-Classical View*, The Edwin Mellen Press, 240 pages.

_____, (2000) "Soviet Economic Decline: Did an oil Crisis Cause the Transition in the Soviet Union," *Journal of Energy and Development*, Volume 24, Number 1, pp. 65-82.

_____, (1999a) "The Mineral Economy: How Prices and Costs Can Falsely Signal Decreasing Scarcity," *Ecological Economics*, Volume 31, Number 1, pp. 155-166.

_____, (1999b). "Oil Scarcity Should Be a Concern," USAE Dialogue, Volume 7, number 1, pp. 12-13.

_____, and Jungho Baek (2012), "Much ado about Hotelling: beware the Ides of Hubbert," *Energy Economics*, 34 (2012), pp. 162-170.

_____, and Marek Kolodziej, (2009). "North American Natural Gas Supply Forecast: The Hubbert Method Including the Effects of Institutions," Energies 2009, 2(2), 269-306; doi:10.3390/en20200269

_____, and Marek Kolodziej, (2008) "Former Soviet Union Oil Production and GDP Decline: Granger Causality and the Multi-Cycle Hubbert Curve" *Energy Economics.* Volume 30, pp. 271-289.

_____, and Marek Kolodziej. (2007) "Institutions and The Supply of Oil: A Case Study of Russia" *Energy Policy*, Volume 35, pp. 939 – 949.

_____, and Yuanyuan Zhao (2007). "The Hubbert Curve and Institutional Changes: How Regulations in Alaska Created a U.S. Multi-Cycle Hubbert Curve," in *The Journal of Energy and Development*. Volume 32, Number 2, Spring 2007, pp. 159 – 186.

China's Innovative Approach to Energy Security

By Ryan Opsal*

Despite the deteriorating political situation in Venezuela, China keeps lending massive amounts to the country, disbursing $5 billion this year alone.[1] Why does China continue to make such large investments in politically unstable countries, like Venezuela? In the majority of these cases, the answer is obvious: oil. However, this still doesn't explain why China continues to deepen relationships with some countries, and not others.

China's choices for loan programs are not only based on access to ample oil reserves, but are also highly political, and are at the forefront of Chinese national security thought. In many of these cases, the host governments themselves provide an added level of usefulness for their stalwart political opposition to the United States, which creates a value-added source of petroleum. China has made a concerted effort to forge partnerships with Venezuela, and oil suppliers in similar political situations vis-à-vis the United States and the West, over the past two decades. China reaps economic gains through these relationships, but it is the security gains that are particularly interesting. These relationships serve to prepare and harden energy supply lines for The Middle Kingdom in response to a potentially hostile United States in the Asia-Pacific that could impose some type of political or economic stress on the state through sanctions or a Cold War style containment policy. If China continues this strategy, it would boost the energy security of the state and would re-shape the security environment in Asia, directly impacting the amount of coercive leverage available to the United States and its allies in any future conflicts.

The strategy begins to reveal itself when one considers the extreme importance of secure sources of petroleum to Chinese national security, and the evolution of Chinese security considerations, which radically shifted after party leadership witnessed the first demonstration of modern warfare conducted by the United States during the First Gulf War. This presentation revealed just how far China lagged militarily behind Western powers, and perhaps even more devastating was the eventual realization that even Japanese weapons technology far outstripped anything fielded by the Chinese military. This event spurred China to action and forced a reorientation of their security strategy. At its core, China understood it had to rapidly develop its military power and at the same time cultivate coping strategies for a militarily, economically, and politically powerful United States in the Asia-Pacific and further abroad. In a sense, the past twenty-five years of Chinese military modernization has been directed with the intent of developing the ability to resist American power and influence. This capacity to resist would be required in the case of any conflict, especially over Taiwan, and now includes many asymmetric capabilities.

Understanding that the United States has the greatest potential to pose a future threat to China, the government has also noted the trajectory of U.S. foreign policy over the past twenty-five years, and determined there is a recurring, salient feature of that policy: sanctions. In fact, since the end of the World War II, the United States has frequently stopped short of open conflict and relied instead on containment and sanctions to degrade its principal adversaries. The first policy step by the U.S. tends toward the implementation of sanctions, whether dealing with large states, or small. From Iran to Russia, this is the favored first-step. Sometimes, sanctioned states can resist this type of economic pressure for quite some time depending on the type of sanctions and their own resources. However, states without sufficient domestic energy supplies, are backed into an incredibly weak position. Strategic commodities are essential to state survival, and China is no exception as a massive oil importer. It simply cannot forgo substantial oil imports, and if tankers were in some manner prevented from reaching Chinese ports, they would be left in a very precarious position.

Understanding China's strategic concerns and its threats, we can begin to explain some of the bilateral agreements, and burgeoning relationships, made by China, like the one with Venezuela. Many commentators believe China engages in these equity deals, loans, and other bilateral agreements to "control" these sources of oil and send them directly back to China, buffering their own supplies. However, as several analysts have pointed out, the majority of the oil produced under these agreements is not shipped directly back to China, but is instead sold on the spot market, to the highest bidder. The only oil shipped back to China from these sources is the oil that is profitable to be shipped back. The tendency is then to believe that these bilateral agreements are a traditional preference of China, without any actual value aside from boosting reserves and revenue for the national oil companies. But, this misses the security benefits of these oil sources entirely.

China wants to foster strong relations with these suppliers because they are a

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See footnotes at end of text.

source of, what can be termed, sanctions-resistant oil supplies. This falls in line with the grand strategic approach of China by enhancing their abilities to counter and resist American hard power in the Asia-Pacific, utilizing both symmetric and asymmetric means. Following this logic, we can conclude that the potential for the emergence of a new containment style policy, enacted by the United States, is at the forefront of the minds of China's leadership. If relations deteriorated to this level, much of the market based oil supplies available to China would most likely dry up, severely crippling the state until the situation was resolved. Even if the U.S. opted merely for more traditional sanctions on China's energy supplies, these sources of relatively secure oil will matter. This is a strong possibility: the United States, even now, still has export restrictions in place on China, as a fallout from the Tiananmen Square crisis in 1989.

Country	Exports	Total "Sanctions-Resistant" Exports
Venezuela	15551965	79159231
Russia	24348420	**Total Chinese Imorts**
Sudan	2375687	281742074
Iran	21411546	**Percentage of Imports Resistant to Sanctions**
Kazakhstan	11980620	0.28 (28%)
South Sudan	2490992	

2013 Oil Exports to China by Country, in metric tons

Some of the key oil-based relationships China has been developing are with Russia, Iran, Venezuela, Kazakhstan, Sudan, and South Sudan. These six exporters accounted for nearly 80 million metric tonnes of exports to China in 2013, covering over 28 percent of China's oil imports,[2] most with the ability to increase future export capacity. Further strengthening the bilateral relationship these countries have with China, Sudan, South Sudan, Venezuela, Russia, and Iran, five out of the six states mentioned, are current targets of U.S. based sanctions.[3] This makes them more politically opposed to the United States, and increases their reliance on China even further as a reliable import partner. With secure energy suppliers, the large and growing Chinese flagged tanker fleet would then simply transport this crude back to the mainland, immune to any financial or political repercussions. While the amount of oil received from these suppliers would not be enough to keep prices at satisfactory levels in China, nor is it a panacea for China's energy security requirements, it certainly buys time by buoying supplies at a critical juncture, adding to government and industry controlled stocks on the mainland.

Absent the direct application of military force against their global oil infrastructure, China would have the capacity to remain partially immune to any energy-based sanctions, by continuing to import from several countries that will resist cooperating with Western powers on a sanctions package, and would do all they could to hold on to China as a key export partner. This is a major advantage for Chinese energy security, as it reduces leverage and coercive power that can be applied in the future by any powers hostile to its strategic interests. As a result of this reduction in leverage over China's oil supply chain, the United States will have to give serious consideration to the efficacy of any sanctions program, or containment policies, implemented in the future.

Footnotes

[1] http://www.reuters.com/article/2015/04/20/venezuela-china-idUSL1N0XH0NW20150420

[2] http://data.un.org/

[3] http://www.treasury.gov/resource-center/sanctions/Programs/Pages/Programs.aspx

MEMBER GET A MEMBER CAMPAIGN A SUCCESS

Sarah Jezernik Wins Complimentary Registration to attend the Pittsburgh USAEE/IAEE North American Conference

IAEE's *Member Get a Member* campaign was a smashing success with 27 new members added in the April to August period.

Members had their membership expiration date advanced three months for each new member referred. Advancements ranged from three months to 21 months as 17 members referred new members.

Dr. Sarah Jezernik, Deputy General Manager, PLINOVODI d.o.o., Slovenia, referred the most new members – 7! She won complimentary registration to the Pittsburgh USAEE/IAEE North American Conference. In the process, she has helped to establish a new Affiliate of IAEE in Slovenia and hopefully her organization will help support a forth coming IAEE conference in the country.

We encourage members to recommend their friends and colleagues to join IAEE.

The Rise of OPEC

By Andreas Economou*

Introduction

Amid the big drop of the international dated Brent benchmark to $47 per barrel in January 2015, down from $111/bbl. in June last year, a great debate was initiated about the main causes and consequences of this drop. Consensus has now emerged, attributing the unexpected imbalance of supply and demand as the prime factor of the price shock. The rapid growth of U.S. tight oil production was confronted by a sluggish growth in global demand for petroleum liquids. Yet OPEC's decision to maintain its current production levels at 30.0 mmbpd[1] in November 2014 besets researchers and industry alike, with the changing dynamics of the oil market that lie ahead. A priori discussions pertain to the impairment of OPEC dominance on the supply-side of the oil market, the declaration of a 'price war' against the high-cost shale production in North America and the ceding of OPEC pricing power to the U.S.

Fundamentally the sentiment expressed in the OPEC debate will set the base for the continuation of the oil price cycle. There are now serious concerns that the current strategic decisions of the market participants are based on false expectations about OPEC strategy based on misconceptions regarding its behaviour. Until adequate consensus is developed, higher price uncertainty will reign, putting at risk sustainability in the global energy markets and the world economy.

Price Response

As oil prices started to fall precipitously in the second half of 2014, the immediate reaction of market participants was to expect OPEC to intervene and lower its production quotas in order to rebalance supply-demand (Figure 1). Alas, the organisation, led by Saudi Arabia, had very recently shown clear signals that it was not willing to influence the course of oil prices, at the expense of its long-term market power. Following the 2008 financial crisis, the oil price recorded its first significant collapse since early 2012. Similar to the current conditions, the then sluggish world economy backed by heightened Eurozone sovereign debt concerns and the consequent weak economic outlook was confronted by the ample supply of non-OPEC crude oil in the market. As a result oil prices collapsed by 31% in the course of three months, from $125/bbl. in March, down to $95/bbl. in June 2012. OPEC at its 161st Ordinary Meeting, on 14 June 2012, concluded that its production quotas would remain unchanged at 30.0 mmbpd despite strong dissent from Iran, Venezuela, Nigeria and Angola.[2] The organisation, in defending its market share, had decided to keep prices at reasonable levels thus not only protecting its supply-side dominance, but also protecting its crude from global 'demand destruction' as a result of fuel substitution and improved efficiency.[3]

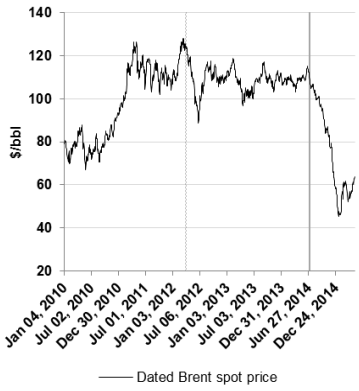

Figure 1. Daily spot Dated Brent price in USD per barrel; 04 January 2010– 30 April, 2015.
Data: U.S. EIA

Relatedly ahead of the recent collapse, in November 2014 OPEC's 166th Ordinary Meeting concluded that its crude oil production would be maintained at the level of 30.0 mmbpd.[4] Yet OPEC's announcement was strongly denounced by oil market participants, who saw this decision as a declaration of a "price war" against the high-cost shale production in North America. The intense debate that followed suggests that OPEC has chosen to defend its long-term market share against a high price, by slowing down the rise of the production growth coming from unconventional deposits.[5] This argument is based on the premise that low oil prices are below the level necessary for U.S. shale producers to at least cover their exploration and production costs (breakeven), and thus the pre-shock growth rate of output cannot be maintained. The predominant view has been that Saudi Arabia, the organisation's de facto leader, abandoned its leadership role as the global 'swing' producer; and that hence OPEC has ceded its pricing power to the U.S. According to this logic, which implies a competitive market regime, the marginal cost of U.S. tight oil production would become the new ceiling for global oil prices.[6]

In the face of such criticism, the organisation defended publicly its decision by stating that OPEC is "neither dead nor at war"[7], and rightly so. Evidently the recent downturn of oil prices was neither related to, nor stemmed by, OPEC expanding or managing its output. First, the market oversupply did not originate from OPEC and thus why try to police it (Figure 2)? In the aftermath of the 2008 oil price shock, supported by the high oil prices, the world oil market witnessed an unprecedented boom in U.S. tight oil production from seven key shale formations.[8] Since 2010, the U.S. production has been increasing on average by 10.35% per annum, while in 2013-14 alone, it increased on average by 15.64%; adding 2.16 mmbpd of new production in a saturated global market. As of 2014, total U.S. crude oil production reached 8.6 mmbpd, up from 5.0 mmbpd in 2008.

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See footnotes at end of text.

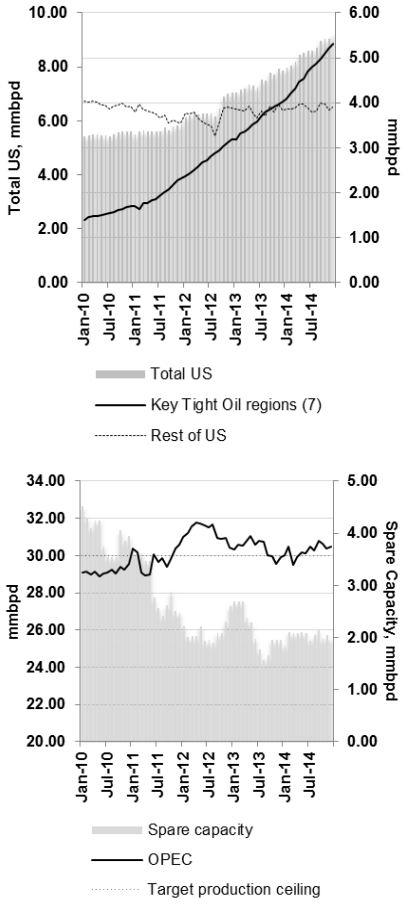

Figure 2. Monthly production profiles from the U.S. and OPEC in million barrels per day; January 2010–December 2014.

Data: Oil and Gas Journal; U.S. Energy Information Administration.

Comparing EIA's annual U.S. tight oil production projections to 2040[9], between 2012-14 the observed upward revisions are remarkable. Considering as reference the 2014 estimates, EIA revised upwards its projections for 2015 onwards by 259.51% or 3.17 mmbpd since 2012; and by 75.64% or 1.82 mmbpd since 2013. Its latest reference case projections estimate that production from shale deposits in the U.S. will peak at 4.8 mmbpd in 2021. However, as of January 2015, the U.S. was producing 9.2 mmbpd in total, of which 4.5 mmbpd are extracted by shale deposits.[10] At the same time, OPEC crude oil production profile remained largely unchanged since 2010. Indicatively, OPEC crude oil production during 2010-14 averaged at 30.26 mmbpd. Its member states production allocations remained unchanged since 2009, even though OPEC spare capacity declined by 2.53 mmbpd following the unplanned production outages in Libya and Iran, and it is currently below 2.0 mmbpd. OPEC crude oil production quotas remained at 24.85 mmbpd (excluding Iraq) and its target quota ceiling at 30.0 mmbpd, since December 2008. Saudi Arabia's crude oil production in 2014 averaged at 9.7 mmbpd, only 400,000 bpd above U.S. production (as of December 2014).

Second, any OPEC output reduction would have been immediately met by the surging non-OPEC supply leading to a vicious circle of further production cuts. Even without any new additions or upward revisions of U.S. shale oil reserves in 2014, there are still over 50 billion barrels remaining of technically recoverable shale oil resources.[11] That means that under the favourable economic environment supported by an OPEC output reduction, this upward production trend would have continued, not least, at the same pace. Given that non-OPEC producers are regarded as price takers and thus produce at or near maximum capacity, in the absence of any exogenous supply shocks or a spike in global demand OPEC would have been led to a catastrophic continuum of further output reductions. Even with WTI prices below $50/bbl., the U.S. production growth continued at a slower pace, supported by companies with lower drilling and debt service costs amid higher well productivity, although a sharp decline in drilling activity occurred.[12] Meanwhile, as can be followed from Figure 3 that plots the 'Call on OPEC', defined as the residual crude oil demand that cannot be served by non-OPEC supply, the organisation's crude demand remained also relatively stable. The 'Call on OPEC' during 2010-14 averaged at 30.06 mmbpd, only 21,000 bpd below the average OPEC actual production (30.27 mmbpd), whereas in the second half of 2014 it increased by 450,000 bpd, to 29.65 mmbpd. Towards 2020, the 'Call on OPEC' is set for a gradual increase, by 2.6 mmbpd, which indicates that any expectations of OPEC reversing its strategy over the next Ordinary Meeting on 5 June 2015 are unwarranted.

Third, OPEC defends its long-term interests and business objectives, meaning that subsidising higher-cost production and the alternative energy sources or conservation efforts to replace oil at the expense of the organisation's market share is not the role of any of its members. Essentially the highly efficient OPEC producers with ample low-cost capacity saw their market share being replaced by non-OPEC production of poor-efficiency.[13] OPEC market share has been in decline since 2012, due to the rising North American supply and the collapse in Libyan output, at 38.9% as of December 2014; a decrease by 3.06% from its recent peak of 42.96% in September 2008. The U.S. surpassed Saudi Arabia and became the world's largest petroleum liquids supplier in December 2012. By the end of 2014 the spread between the market shares of the two increased at 3.30 mmbpd or 3.46% of the total in favour of the U.S. Moreover, crude oil's market share in the global energy mix has been in steady decline since 2004 (43.9%), down to 40.6% of the total in 2012. Given the vast amount of low-cost crude oil reserves in OPEC nations and the strong fiscal dependency of their economies to oil rents, a permanent diversification of the energy markets poses a serious threat, based on which 'price ceiling' is becoming increasingly relevant to the OPEC price band.

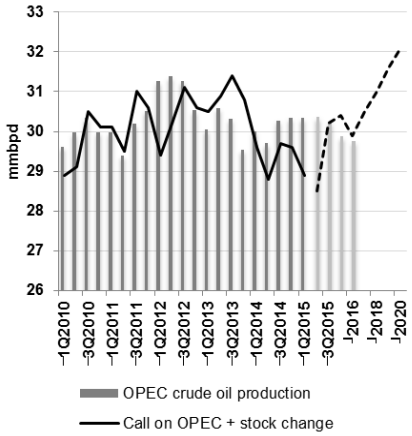

Figure 3. Quarterly actual and predicted 'Call on OPEC' in million barrels per day; Q1 2010–2020.

Data: International Energy Agency.

Beyond Crude Oil

The post-2000 era of persistent high-oil prices at and above $100/bbl. offered not only a favourable economic environment for boosting U.S. unconventional production of crude oil but it also created an economically sustainable environment for policies, subsidies and investments towards developing pathways to

an energy efficient and carbon-emissions-limited world. Since 2000, non-fossil fuel investments quadrupled, increasing from $65 billion to a high point of $310 billion in 2011.[14] The International Energy Agency argues that of the $8 trillion investment in energy efficiency to 2035, 90% will be spent in the transport and building sectors. The transportation sector is the only sector that continues to support crude oil consumption and it accounts for around 63% of the total, as of 2014. Based on the production costs of alternative transportation fuels, in the long-term, and conditional to other parameters, several alternative options may become competitive on an energy basis at a $60/bbl. oil price range.[15] As such, as the oil price increases, more fuels become competitive. On a per kilometre basis the alternative transportation fuels compete with gasoline when the oil price is at near $150/bbl. In fact in January 2015, the International Renewable Energy Agency argued that low-oil prices have already had negative effects on electric cars and biofuels as these compete directly with the petro-fuelled cars.[16]

Putting the above in the context of OPEC's decision, historically, conventional wisdom has been that the organisation defends a price floor and a price ceiling in order to ensure an economically sustainable flow of revenues and to avoid "demand destruction" for its crude in the long run, mainly by limiting the entry of substitutes and technical change. Whereas the ceiling was not relevant in the price band before the 2000s, in recent years the perception that OPEC would respond to defend prices from rising too high has become increasingly important. Between 2000-12 crude oil's share in the global energy mix decreased cumulatively by 8.82%, at an annual average change of minus 0.68%, as it has historically been found to be very responsive to positive price shocks. In particular its share declined markedly following the 1979-80 oil shock, by 5%, while it increased by 3.5% during the prolonged low-oil prices of the 1990s and continues to fall steadily since prices spiked in 2003; already down by 4% in 2012 (Figure 4). Hence OPEC attempts to face a new realisation, according to which the need to protect its crude from competition, arises not only from the world oil market but also crucially from the global energy market. In this context the oil-exporting organisation has extended its dominant stance into the global energy industry. An irreversible substitution of petroleum liquids by an alternative source of energy does not necessarily require a transportation fuel as efficient as gasoline or diesel, but does require enough technological maturity to overcome the cost-barriers via a continuous stream of investments towards Research and Development. Each percentage drop of crude oil's share in the global energy mix means that the OPEC member states, whose economies are strongly dependent on oil rents, are driven out of business.

OPEC Behaviour

Undoubtedly the persistent high oil prices, not least since 2010 onwards, induced adverse effects on OPEC crude in terms of the strong non-OPEC supply response, the negative impact on world growth and inflation affecting petroleum demand, and the encouragement of substitutions. Yet, the market participants stood upon false expectations about OPEC strategy based on misconceptions regarding its behaviour. Despite popular belief, historically, OPEC only managed to control either its price or output. In general over the past fifty years its strategy has served its goals remarkably well.[17] The only major exception has been its aggressive high-pricing strategy in the 1980s that resulted in both a significant loss of its market share and diminishing oil prices. As such, the organisation has learned that it is better off in the long run by maintaining its exports' share of non-OPEC demand, and increasing its market share as necessary.[17] Target bands for the 'optimal price' could only apply under normal market conditions, as their effectiveness is subject to assumptions about the future of highly uncertain parameters (i.e., economic activity, income and price elasticities, etc.).[18] Thus the preferred price target, or 'monopoly ceiling', of $75-80/bbl. marked in 2009 by King Abdullah of Saudi Arabia[19], has been mistakenly regarded as a long-term strategy. The Arab oil exporters (excluding Iraq) alone have access to $1.29 trillion of international financial reserves[20] to buffer any lost revenues due to curtailed oil exports. This so-called 'Core' within OPEC[21] has the material spare capacity, political stability and ample financial reserves to act collectively and exert market control. The rest of OPEC countries struggle with the weak structure and high costs of each country's oil industry, their poor institutional and political capacity and their high budgetary needs due to the geopolitical and social turmoil.

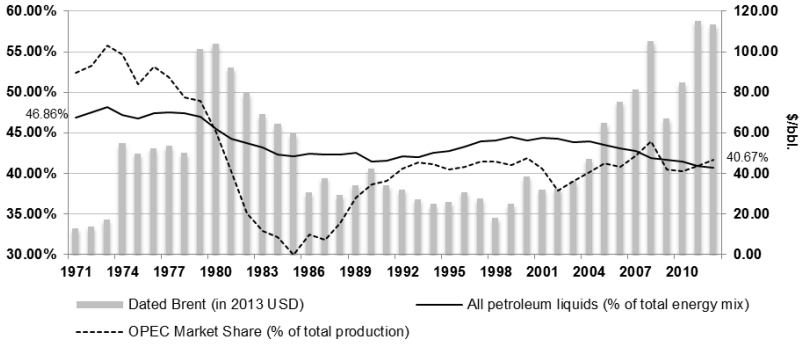

Figure 4. Annual comparison of OPEC market share and crude oil's share in the global energy mix as a percentage of the respective totals; 1971–2012.
Data: International Energy Agency; Oil and Gas Journal.

Conclusion

Noting the compelling nature of a temporarily 'free market', OPEC and its GCC[22] members more specifically, are the only producers best equipped to survive through this uncharted era. The real challenges, self-inflicted as these may be, fall in general on non-OPEC producers. Looking ahead, the external and internal dynamics, such as regional instability and domestic growth in petroleum consumption, will still play a pivotal role in the future of the organisation. Yet Saudi Arabia is allowing price discovery, in view of a coordinated long-term strategy of sustainable investment and output policies with the objective of maximising OPEC market share and ergo the oil rents accruing to its members. OPEC has repeatedly expressed that the central pillar of its policy is to seek stable oil prices amid well-balanced oil markets. To achieve this goal, OPEC is seeking consensus, which dictates that the new non-OPEC supply growth is beneficial for the oil market but it requires some sort of collective control, especially since the global economy has yet to recover from its deep recession and the backstop technologies are in play. Historically OPEC has been an especially challenging economic organisation to manage endogenously. Currently, its maturity has stemmed these challenges exogenously, to the energy market as a whole. The industry, governments and policymakers need to realise this bigger picture and reconsider their strategies accordingly, as OPEC has masterfully done.

Footnotes

[1] Million barrels per day.

[2] OPEC. (2012). *OPEC 161st Meeting concludes* (No 2/2012, 14 June 2012). Retrieved from http://www.opec.org/opec_web/en/2313.htm

[3] Stevens, P., & Hulbert, M. (2012). *Oil prices: Energy investment, political stability in the exporting countries and OPEC's dilemma* (EEDP Programme Paper: 2012/03). London, UK: Chatham House.

[4] OPEC. (2014). *OPEC 166th Meeting concludes* (No 7/2014, 27 November 2014). Retrieved from http://www.opec.org/opec_web/en/press_room/2938.htm

[5] Stevens, P. (2014). Déjà vu for OPEC as oil prices tumble. *Chatham House*. Retrieved from http://www.chathamhouse.org/expert/comment/16368

[6] Kaletsky, A. (2015). A new ceiling for oil prices. *Project Syndicate*. Retrieved from http://www.project-syndicate.org/commentary/oil-prices-ceiling-and-floor-by-anatole-kaletsky-2015-01

[7] Saudi Arabia's Minister of Petroleum and Mineral Resources, HE Ali I. Al-Naimi, address at the German-Arab Friendship Association in Berlin, on March 4, 2015 (Access: http://www.saudiembassy. net/announcement/announcement03041501.aspx).

[8] The seven key Tight Oil regions are: Bakken, Eagle Ford, Haynesville, Marcelus, Niobara, Permian and Utica.

[9] U.S. Energy Information Administration. (2015a). *Annual projections to 2040*. Retrieved from Annual Energy Outlook database.

[10] U.S. Energy Information Administration. (2015b). *Short-Term Energy Outlook* (February). Washington, DC: U.S. Department of Energy.

[11] EIA's most recent published estimates on U.S. remaining shale oil reserves date back in June 2013, at 58.0 billion barrels per day. We estimated that during 2013-14 the total U.S. tight oil production amounted at 2.75 billion barrels, 46% of the total U.S. crude oil production.

[12] U.S. Energy Information Administration. (2015c). *Shale gas and tight oil: A game changer for the U.S. energy market and a possibility for North Africa*. Presentation presented at the Annual Conference on Middle East and North Africa Energy. London, UK: Chatham House.

[13] Production efficiency is defined as the actual production divided by the maximum production potential.

[14] International Energy Administration. (2014). *World Energy Investment Outlook*. Paris, France: Organisation for Economic Co-operation and Development.

[15] International Energy Administration. (2013). *Production costs of alternative transportation fuels*. Paris, France: Organisation for Economic Co-operation and Development.

[16] Clark, P. (2015, January 18). Falling oil prices threaten electric cars and biofuels. *Financial Times*. Retrieve from http://www.ft.com/cms/s/0/73087796-9e79-11e4-a37e-00144feab7de.html#axzz3a7eRTjht

[17] Gately, D. (2011). OPEC at 50: Looking back and looking ahead. Paper presented at the Conference on "OPEC at 50". Tulsa, Oklahoma: National Energy Policy Institute.

[18] Gately, D. (1995). Strategies for OPEC's pricing and output decisions. *The Energy Journal*. *16*(3), 1–38.

[19] Saudi King sees fair oil price at $75-80: report. (2009, May 26). *Al Arabiya*. Retrieved from http://english.alarabiya.net/articles/2009/05/26/73884.html

[20] Economist Intelligence Unit. (2015). *Macroeconomic data: Oil exporters*. Retrieved from The Economist – Intelligence Unit database.

[21] Saudi Arabia, Kuwait, United Arab Emirates and Qatar.

[22] Gulf Cooperation Council. Originally known as the Cooperation Council for the Arab States of the Gulf.

Trinidad & Tobago—an Oil Pioneer With a Bright Future

By Paul Tempest*

This article will focus on the long-term future. In my view, Trinidad and Tobago today stands on the brink of an energy opportunity offering an extended period of rapid growth and enhanced economic prosperity bringing a boost to employment, education and training through huge new investment opportunities in the energy sector.

I quote from Anthony E. Paul's contribution to Boopsingh and McGuire's book, *From Oil to Gas and Beyond:*

> "Trinidad & Tobago stands at the gateway of one of the last unexplored deep-water extensions of a major river delta system in the world. T & T stands to benefit from the experiences of other deep-water developments round the world, so that development cycles and costs should be lower than bench-marks round the world..."

This means that Trinidad & Tobago can expect to be highly competitive in a steadily expanding market for internationally traded gas.

I fully endorse this together with the convincing detailed background and conclusions enshrined in this authoritative new volume. It is by far the most comprehensive, wide-ranging and well-judged analysis I have seen. It provides both a well-written overview of the history of oil and gas development in and around these islands over the past century and an up-to-date assessment of where new opportunities will probably lead.

Just as Trevor Boopsingh's first book, *Oil, Gas and Development – A View from the South* published in 1990, won top awards and was widely applauded throughout the Caribbean to find a wider audience among the governments of several other emergent nations and among the oil and gas multinationals, I am sure that the new book will strike similar resonance world-wide. Trevor will be remembered as a sound petroleum engineer and top civil servant, but above all as a thinker of global stature who was constantly looking around and forward on behalf of his country.

May I add a short explanation of where I am coming from. I first came to Trinidad on several occasions in 1981-83 carrying the proposals of the UK Government to finance development of your new gas resources by a gas purchase contract for the gas to be liquefied and transported as LNG to the UK. The contract was modeled on the maturing 20-year LNG contract for British Gas, then publicly owned, to import LNG from Algeria. (It has since been adapted to import vast quantities of LNG from Qatar.) I was back in Trinidad for a month in the following year heading an eight-person World Bank energy mission where the World Bank had decided to use Trinidad as its global model for LNG, other downstream gas development, and marketing worldwide. The credit for this rests with Trevor Boopsingh, Ken Julian, and Patrick Manning (Energy Minister and later President).

My prediction – offered without hesitation – is that the development of the Orinoco deep-water gas resources off Trinidad could double the per capita income in these islands within 10 years, from the first confirmed discoveries and development, and could double again within another 10 years. This would lead to prosperity on a scale unseen in the Caribbean – at least four times the present level with a production horizon of 50 years.

Trinidad & Tobago has the opportunity to become the Qatar of the Americas, North, Central and South, with long standing markets for its gas in the U.S., Europe, and probably Brazil. Qatar, you will know, has the highest per capita income in the world. Up to World War II, however, Qatar was among the worst poverty-stricken economies in the world – nomad Bedu dependent on their camels and abundant fish.

How did Qatar achieve such immense prosperity in so short a time? Two points:

- It welcomed the multi-nationals,
- It preserved its own national interest and national identity.

I should explain why I am so close to Qatar.

Before I first came to Trinidad in 1981, I had been sent by the Bank of England to supervise the transition of the new Gulf currency authorities prior to the independence of the Lower Gulf states in December 1971. The Qatar and Dubai Currency Board, where I was the General Manager, very quickly became the Qatar Central Bank and the Central Bank of the United Arab Emirates (UAE),

*Paul Tempest was the first Chairman of the British Institute of Energy Economics appointed by the UK Department of Energy in 1979 and its Vice-President in 2000-2009. Today he is Secretary of the International Steering Panel of the Windsor Energy Group of which he was Executive Director (CEO) from its foundation in 1999 until 2009. He is also a Past President of IAEE. This article is adapted from a speech given in Trinidad and Tobago by Tempest on the occasion of the book launch of *From Oil to Gas and Beyond,* by Trevor Boopsingh and Gregory McGuire.

operating to the same prudent, sensible guidelines as those used by the Central Bank of Trinidad & Tobago today. All of these three institutions, like the Bank of England, were firm, strong, financial pillars that had no difficulty in surviving the global financial and banking meltdown of 2007-09, the worst in global history since World War II.

I have been invited back many times by my good friends in Qatar, and have observed their success with pride and their few mistakes with dismay.

First and foremost, Qatar welcomed the leading multi-nationals who brought state-of-art technology, complete finance packages and the best experience of efficient exploration and development. But, for Shell there was one serious snag. Shell had discovered the offshore Qatar gas with one well almost onshore and the next close to the Qatar-Iran median line. This is the second largest gas field in the world. It extends far into the offshore waters of Iran. Meanwhile, however, Shell had fallen out of favour with the Qataris following a huge explosion at a Shell-run downstream plant at Umm Said. The Qataris referred the dispute to the International Court in The Hague and Shell's presence in Qatar was reduced to one man.

I was selected as a well-respected friend of Qatar and newly appointed Head of International Energy in Shell to secure a reconciliation. It was not an easy task, and took some time. Today, Qatar leads the world in gas-to-liquids (GTL) technology brought in by Shell where Qatar now represents a very large pearl in its vast global treasure of technological achievement and development success.

Two Final Points for Trinidad & Tobago

While I was with Shell, I was engaged in similar problems in Venezuela. With regards to the development of deep-water Orinoco gas, I do not think Venezuela presents any problems at all today as a competitor. They have many higher domestic energy priorities and, given recent political turbulence, it is unlikely, in my view, that the multi-nationals will wish to go back and invest heavily until government attitudes change. Once Trinidad begins to produce deep-sea gas or oil, those attitudes of the Venezuelan government will most probably soften and the vast hydrocarbon resources, some quite shallow, of the Venezuela Orinoco basin and delta will be unlocked, most probably with the vital cooperation of Trinidad & Tobago – bringing even more employment and prosperity to these islands.

My final point regarding Trinidad & Tobago is on how to attract the leading multi-nationals to develop the deep sea gas on terms acceptable to the Trinidad & Tobago government. The multinationals have to be assured of continuity of government support while the government retains the bulk of the net profit. This they will determine by applying their corporate requirement of meeting a worldwide corporate rate of return which satisfies their shareholders and other stakeholders. If the Trinidad & Tobago Government cannot fully understand this and tries to claw back more than the share agreed, the multinationals, one by one, will walk away.

The secret, learned by the UK Government in 1975-1990 in the North Sea is never to deal on these mega-projects with a single multi-national. In the North Sea, we licensed development to consortia of two, three or four major multi-nationals, such as Shell/Exxon on a 50/50 basis. This was highly successful, and the UK went in five years from insignificant oil production in 1975 to self-sufficiency by 1980 and then on to become a substantial net exporter of oil over an extended period.

So finally, Trinidad & Tobago, TOES IT![1] Do not dither or delay if a discovery is made from one of the seven exploratory wells in the current drilling programme. Ignore any politician or political party that advocates delay and presents excuses. This is your future and that of your children and grandchildren. It could be beyond your and their wildest dreams. The first spurt of oil, gas, or condensate from one of these seven wells will begin to change everything. Ignore the opposition, the environmental and maverick doomsters who preach the extinction of the hydrocarbon era within 50 years. They are talking poppycock.

Footnote

[1] The expression *TOES IT!* has long been used all over Trinidad and Tobago in place of HURRY UP or GET GOING or GET READY. It derives from the sprinter preparing for the start – his or her fingertips are on the ground with heels raised to deliver maximum power and acceleration through the toes.

A Brief History of Oil and Gas in Trinidad & Tobago

The transition of Trinidad & Tobago from oil to gas dates from a detailed timetable drawn up by Trevor Boopsingh in the late 1970s and an investment programme endorsed by the World Bank in 1980-84.

Oil production began in 1908, reached a peak at around 240,000 barrels per day before entering a slow

persistent decline to the level of 80,000 barrels per day today.

Gas production was the newcomer on the block from the late-1970s. By 1982, seismic and exploratory drilling indicated that there was much more gas to be found. Downstream industries sprang up – methanol, urea, fertilisers, and LNG. By 2000 Trinidad had emerged as the leading global exporter of methanol and ammonia and its first Atlantic LNG train had a capacity of 3.3 million tons pa.

By 1996 natural gas production had already exceeded oil production (based on energy equivalents). By 2001 gas income surpassed oil revenue. There was plenty of gas to maintain momentum. A second LNG export train was added in 2002 and a third in 2003.

In 2005, Methanol Holdings (Trinidad) Ltd. commenced the construction of the world's largest methanol plant at an estimated cost of US $450 million. Methanex of Canada then increased the methanol export capacity of Trinidad & Tobago to 6.5 million tonnes.

Since then the export of gas to the United States was adversely affected by a flattening market demand and much lower gas prices. The rapid development of U.S. shales has more recently provided strong competition to higher-cost imported LNG.

Today there is a new phase of optimism in T & T oil and gas. Onshore, the depletion of shallow resources looks inevitable but a new wave of drilling for deeper deposits is widely expected to produce some favourable results. Offshore, attention is focussed on a programme of seven wells in deep water.

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This growth in energy demand will involve importing substantial amounts of energy from locations outside the region, with impacts on suppliers and other customers of those suppliers, and international and national security. It also will require substantial investments in infrastructure within the region, and policies to cope with the pollution and other externalities associated with ballooning energy consumption.

Exporting countries within the region, such as Australia, will need to develop more robust institutions for handling trade-offs between domestic consumption and export of energy commodities. Improving the efficiency of their energy supply systems will not only contribute to their own economic growth, but also enable them play a more constructive role in helping the importing countries of Asia meet their aspirations.

Key topics

Forecasting Asian energy trends

- Demand and supply
- By primary energy source; geography and economic sector
- Inter- and intra-regional trade
- Infrastructure requirements
- Improved access
- Financial implications
- Financing investments
- Energy pricing issues
- Use of spot and derivatives markets
- Taxing energy production and consumption
- Controlling escalating investment costs

Environmental implications

- Policies to control air and water emissions
- Responsible upstream development, land access, community acceptance
- Increasing energy efficiency
- Potential role of new energy technologies

Electricity market development

- Wholesale market structures
- Paying for ancillary services and adequate capacity
- Balancing competition and regulation
- New pricing paradigms and smart grids
- Nuclear power in Asia including possible new technologies
- Engineering and economic challenges of accommodating renewables

Political implications

- Geopolitical consequences of increased Asian energy imports
- Implications of increased foreign investment in energy infrastructure
- Coping with sovereign risk
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- The future of nuclear power and new energy technologies in Asia
- Australia's role in meeting Asian energy demand growth
- Electricity markets: "Best practice" and restructuring in Asia
- Fiscal policies affecting energy markets
- Political dimensions of Asian energy demand

Speakers

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- **Dr Fereidun Fesharaki**, Chairman, FG Energy
- **Ken Koyama**, Chief Economist & Managing Director, Institute of Energy Economics, Japan
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Who should attend?

- Energy company executives and managers
- Energy policy analysts
- Government employees in energy resource planning
- Academics specialising in energy policy and analysis
- Electricity pricing and market analysts
- Energy consultants
- Energy company planners
- Energy risk and derivatives specialists
- Financial sector economists focused on energy industry lending
- Oil and natural gas executives
- Executives concerned with energy prices and rate setting
- Electricity and gas utility regulators
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Western Australia produces over forty per cent of Australia's export income and is regarded as one of the world's major centres of the energy and resources industries.

Australian LNG has grown to the point where there are now four (soon to be ten) LNG projects in operation. Australia is increasingly important as an LNG supplier, particularly in the Asia Pacific region. Projects under construction will boost national capacity to 86 million tonnes before the end of the decade, and are likely to make Australia the world's largest LNG producer.

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Falling Oil Prices: Impacts on the Korean Power Sector and the Role of KEPCO

By Jikhan Jeong*

In general, the power market consists of energy, capacity, and an ancillary service market. Fuel costs take up the biggest part of the energy market. Korea's wholesale energy market is a cost-based mandatory pool system. Korea's wholesale electricity price is made up of the variable price and the capacity price. The variable price compensates for the cost of fuel, which results from generating companies' production of electricity. The System Marginal Price (SMP) is a variable and market-clearing price applied to all power systems in Korea except for that of Jeju island (Suduk Kim et al., 2013). The SMP depends on the bidding price of a marginal plant. The bidding price of the plant is predetermined based on fuel cost and plant performance. Recently, oil prices have crashed over the past few months. The oil price is an indicator of the Liquefied Natural Gas (LNG) price for power generation, since the LNG price for power generation is strongly correlated with the oil price in Korea. As Figure 1 shows, the LNG price for power generation in Korea has followed the recent oil price trend. Therefore, as the oil price has dropped over the past few months, the fuel cost of power generation from oil and LNG has decreased.

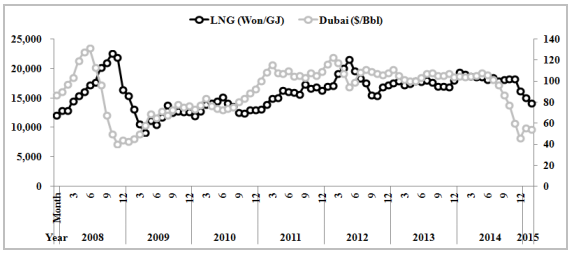

Figure 1. LNG price for power generation in Korea and oil price in spot market.

*Source: Oil price obtained from Petronet, LNG price for power generation obtained from Korea Gas Corporation.

Furthermore, the marginal plant is usually an LNG power plant; therefore the SMP is mostly determined by the LNG plant. As of 2014, the marginal price ratio set by LNG power plants is 94.9%. Therefore, even though the share of electricity generated from oil resources was 4.1% and that from gas resources was 22.95% in 2010, the impact of the falling oil price has dramatically influenced the wholesale price in the Korean power market. As Figure 3 shows, fuel costs for oil and gas power generation have decreased due to the falling oil price. As a result, the bidding price for LNG power plants has also decreased, and the SMP has dropped. So what will happen in Korea's power sector in the short term?

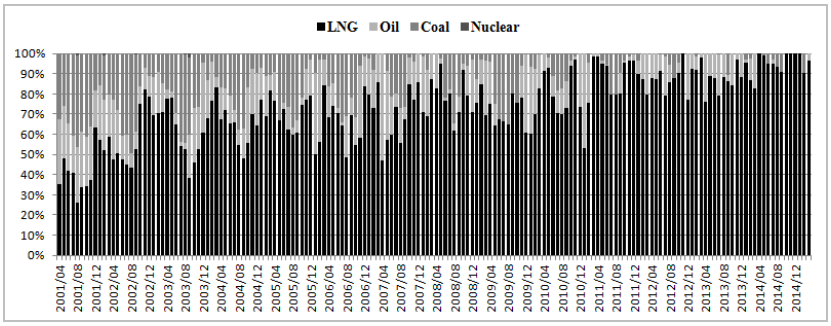

Figure 2. The marginal price ratio set by fuel types.

*Source: Electric Power Statistics Information System.

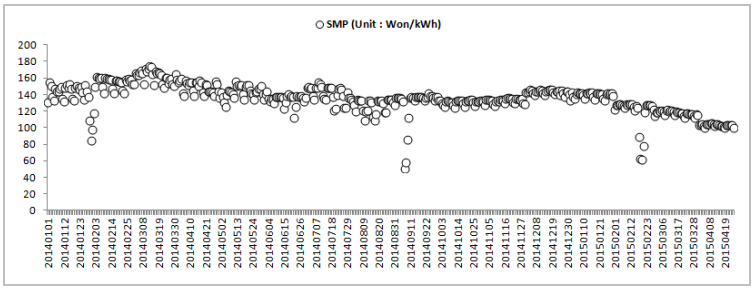

Figure 3. Price trend in SMP.

*Source: Electric Power Statistics Information System.

First, cheaper electricity prices have threatened the investment on renewable and distributed energy from the private sector in Korea. As the price of electricity gets cheaper, the end users will lose their motivation to install small-scale renewable and distributed energy such as roof-top solar cells due to its lower profitability and higher uncertainty. Furthermore, the oil price influences the financial performance of renewable energies based on economic feasibility among renewable energy sources and others (Juan C. Reboredo, 2015). In addition, investments in utility-scale renewable energy will likely decrease due to the increasing cost competitiveness of other types of fossil fuel power plants. Furthermore, electric vehicles are not yet a feasible substitute for oil-based vehicles. Therefore, in the short-term view, as the oil price drops, the renewable and distributed energy industry may be sluggish.

Second, it's possible that carbon emissions from the power sector may increase. As the price of electricity becomes cheaper, electricity consumption will increase. Furthermore, people may be less likely to understand the importance of saving electricity due to its cheap price. Therefore, the carbon emissions from fossil fuel generation will go up due to increasing electricity consumption and its lower fuel cost. In addition, as the share of electricity generated from renewable energy grows slowly, its impact on reducing carbon emissions will not be as

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significant as expected. In this regard, if there are no suitable technologies for reducing carbon emissions from fossil fuel generation, it is possible that carbon emissions from the power sector will be larger than in the case of a high oil price level.

Third, the Korea Electric Power Corporation (KEPCO)'s profit will increase, since KEPCO can buy electricity at a cheaper price in the wholesale market. As Figure 4 shows, the KEPCO stock price has increased as the oil price has dropped, by enabling KEPCO to buy electricity more cheaply than before. Also, large incumbent companies such as KEPCO can take advantage of their economic scale, internal R&D capacity and cumulative learning effects when they drive an innovation forward (Christophe Defeuilley, 2009). On the other hand, the profitability of generation companies operating peak load power plants will be hampered by the decreasing wholesale price. In addition, it will be unlikely for private companies to invest in a long-term, risky, uncertain new energy business. In this case, private companies will be likely to focus on short-term investment and proven new energy technologies.

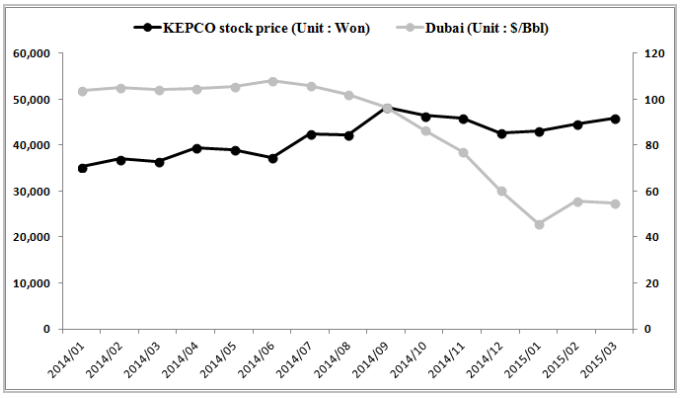

Figure 4. KEPCO's closing stock price.

In conclusion, the recent drop in oil prices may be a threat to a new energy industry including renewable and distributed energy; therefore, the role of KEPCO as a leading public enterprise will be more crucial in supporting stable growth in the new energy industry and improving social welfare. In particular, as of 2014, the Korea Ministry of Trade, Industry and Energy (MOTIE) announced its plan to stimulate a 'new energy industry,' including an energy storage system (ESS), electric vehicle (EV) services, a micro-grid, a solar energy rental service, and others. KEPCO is a single seller in Korea's retail market, and owns both distribution and transmission. Therefore, with its growing profitability, it will be affordable for KEPCO to invest in a new energy industry and stimulate knowledge spillover through a power sector value chain. In fact, KEPCO will increase investments by 54 percent in 2015 compared to the previous year. To be specific, up to 1 trillion won will be invested in new energy businesses such as smart grid, ESS and renewable energy to support green and smart innovation. Above all, it's clear that the role of KEPCO will be crucial in leading the long-term investment and stimulating knowledge spillover in the new energy industry.

References

Christophe Defeuilley, Retail competition in electricity markets, Energy Policy, Volume 37, Issue 2, February 2009, Pages 377–386.

John E. Bistline, Natural gas, uncertainty, and climate policy in the US electric power sector, Energy Policy, Volume 74, November 2014, Pages 433–442.

Juan C. Reboredo, Is there dependence and systemic risk between oil and renewable energy stock prices? Energy Economics, Volume 48, March 2015, Pages 32–45.

Suduk Kim, Yungsan Kim and Jeong Shik Shin, The Korean Electricity Market: Stuck in Transition, Evolution of Global Electricity Markets, June 2013, Pages 679-714.

Electric Power Statistics Information System: < http://epsis.kpx.or.kr>

Korea Gas Corporation: <www.kogas.or.kr>

Petronet: <www.petronet.co.kr>

Falling Crude Oil Prices: The Impact on the Economy of the Asia-Pacific Region

By Nam Foo*

Introduction

The global energy market is an important primary driver of economic activity to sustain a nation's economic growth. Volatility in the global energy market such as changing crude oil prices and availability of oil reserves continue to affect the economic growth prospects of particular nations.

There are several agencies from different sources, such as British Petroleum (BP), International Energy Agency (IEA) and the World Bank who share a common view that the global energy markets are under stressed. The reasons for the declining oil price are echoed in global economic conditions, such as a downward revision of energy demand forecasts following global economic stagnation, emerging differences in global economic performance, geopolitical uncertainty, and ongoing debates about the proper roles of government and markets.

Many factors have affected 2014's steep fall in crude oil prices. Among them are the increase in United States (U.S.) shale oil production, a slowdown in economic growth in China, the European Union (EU) reducing demand for oil, and concerns of political insecurity and uncertainty across the world. Among these factors, geopolitical risk has increasingly concerned most countries. The recent crisis in Ukraine and political collusion between Saudi Arabia and the United States are major contributors to the current uncertainty of the energy market.

The aim of this paper is to discuss some policy recommendations in the Asia-Pacific region. At present there is extremely high uncertainty in the business environment. One way to build business investors' confidence is through appropriate policy decisions. Successful and transparent governance is the key role to ensure economic stability and prosperity in this region.

A decline in crude oil prices can undermine the global economy in many ways. A tumbling in oil prices can undermine global investments, the oil and energy industry, and the economies of the oil-producing countries. Global investment, particularly in the oil and energy sector, has been hit hard by the extreme level of oil prices. The seven major internationally well-known oil companies – Royal Dutch Shell, BP, Exxon Mobil, Chevron, Total, ENI and Statoil have agreed that they need at least the crude oil price of US$125-US$135/barrel to be profitable (Salameh, 2015).

Lower crude oil prices are not all bad news. On the one hand, decreasing oil prices can drain hundreds of dollars from petroleum producers, exporters and oil companies. On the other hand, lower crude oil prices can benefit some economies. For instance, many European countries, the USA and Japan are helped as a result of lower crude oil prices by shifting hundreds of billions of dollars into stimulating their economies because household demand picks up. This paper discusses the costs and benefits of falling oil prices for the Asian-Pacific economies.

Falling Energy Prices and the Asia-Pacific Region

Countries in the Asia-Pacific region have grown phenomenally since World War II, despite the oil price shocks in the 1970s, a sluggish world economy in the early 1980s, a rising protectionism and currency appreciation in the late 1980s, and the Asian financial crisis in 1997.

The 2015 growth projection for this region is 6.2 percent, which is slightly softer than the actual growth as expected (ADB, 2014). However, the growth outlook in this area seems to remain steady and stable despite the significant decline in energy prices in 2014. The Asia Development Bank reports that a steep decline in crude oil prices can offer a golden opportunity for many beneficial reforms in the Asia-Pacific region. For example, lower oil prices can increase purchasing power, lower industries' production costs and lower inflation.

Falling crude oil prices certainly can benefit the nations' economies in many ways as mentioned above. To a certain degree, it can also cause significant tension and uncertainty for global economies, such as the political tension in Ukraine and Iraq. Unlike the situations encountered in the rest of the world, in the Asia-Pacific region, lower oil prices can have a broad impact on the economies, with opportunities arising to address many longstanding macroeconomic issues. Therefore, declining world crude oil prices is not necessarily bad news for oil exporters. The impact of the steep decline in oil prices seems to offer a win-win situation for both oil exporters and importers in this region. For instance, Indonesia, one the major oil importers has taken advantage and benefited by transforming their costly and expensive fuel

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subsidy program. Lower crude oil prices also offer advantages for major oil importers. By diverting substantial funds for much-needed infrastructure and other growth projects, these nations can avoid stoking inflation.

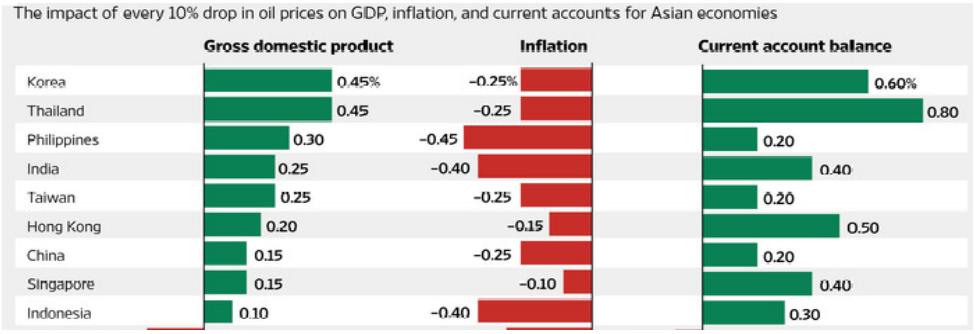

Figure 1: Asia's windfall from oil's collapse
Source: The Wall Street Journal, 2015

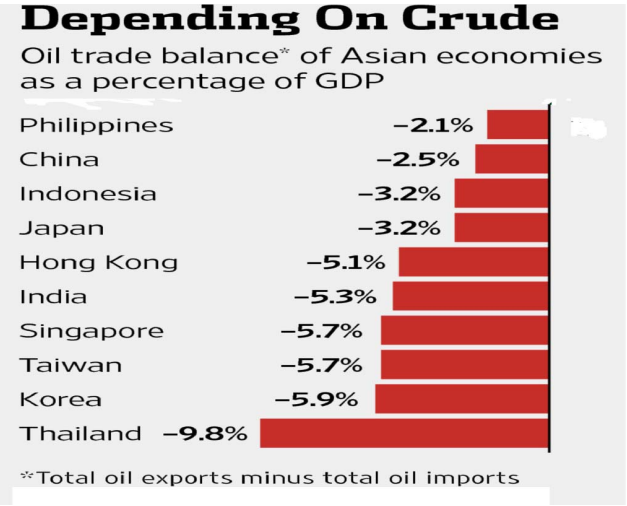

Figure 2: Major oil importers in Asian economies as a percentage of GDP
Source: The Wall Street Journal, 2015

Figure 1 shows Asia's windfall as a result of the sharp dive in oil prices. Declines in the oil price should boost these countries' economy by half a percentage point. The figure shows that the slip in oil prices benefited Asian economies, particularly in countries with a lack of natural resources such as the four Asian Tigers: Hong Kong, Korea, Singapore and Taiwan. These Asian economies are net importers of oil and gas, so they have benefited as a result of falling oil prices.

Figure 2 shows the major net oil importers in Asian economies. These Asian economies depend on importing crude oil to sustain their nation's productivity. In Figure 2, Malaysia has been excluded. However, it is worth noting that Malaysia is *the* major net oil exporter among the ASEAN economies. So Malaysia is feeling the pain in the short-run, but if Malaysia's oil production continues to be suppressed in response to the depletion of its oil reserves, Malaysia will turn from net exporter to a net importer of crude oil. Thus, in many respects, this would be good news for the Malaysian economy.

There are opportunities for oil importers to leverage the short-term loss into long-term gain when the oil price falls. The major oil exporters, such as Malaysia, can seize the opportunity of low crude oil prices to focus on other industries, such as manufacturing and assist this through innovative research and development. Oil exporters can develop high-skilled manufacturing industries, such as aviation and aerospace, road haulage and shipping. By taking advantage of low commodity prices with their competitive real exchange rate, these countries tend to make these industries more competitive for global trading.

Manufacturing and services industries in the Asia-Pacific region, which have substantial energy costs are also beneficiaries from the sharp dive in crude oil prices. The transport sector, for instance, is a significant winner because petrol is one of its major input costs. Energy intensive heavy manufacturing industries such as cement, steel and metals refining requiring substantial energy power will also be beneficiaries. Low crude oil prices certainly provide a positive impact in many industries across the region by stimulating consumer spending as a result of lowering inflationary pressures and subsequently boosting economic growth.

Policy Challenges and Opportunities

Falling crude oil prices can impact decision making in monetary, fiscal and structural policies. However, the impetus to shift these policies depends on whether a country is an oil importer or exporter.

Because the crude oil price is expected to continue at a record low over the 2015-16 period, this can ease inflation pressures for central banks, at least in the short-run. For oil importers, in this situation, the low inflation rate could provide the central banks greater flexibility by loosening monetary policy or providing forward guidance. For oil exporters, monetary policymakers will have to balance the need to support growth in order to keep the inflation rate at the comfort zone and stabilise its currency at a level investors will feel confident.

From a fiscal policy perspective, fuel subsidisation is one of the standard schemes introduced in most of the developing Asia-Pacific countries, such as India, Indonesia, and Malaysia. In some cases, this fuel subsidisation comprises more than 5 percent of these countries' subsidies. However, this particular fuel

subsidy benefits middle-income households disproportionately. In fact, with the record low oil prices, the government may impose a policy to encourage production that is more fossil fuel or energy intensive. Instead of offsetting the medium-term incentives for increased oil consumption, policymakers may redirect current energy tax policies especially in Asia-Pacific countries with low tax rates (Baffes, *et.al.,* 2015). In general, fuel subsidisation can generate inequality and inefficiency. As a result, many countries have undertaken a structural reform and decided to abolish this subsidy policy in 2013-14.

From a structural policy perspective, the fall in crude oil prices certainly strain the public finances for major oil exporting countries. Asia-Pacific countries that are heavily relying on crude oil as a major export must reshape their policy to redouble efforts to diversify their trade activities. Investing in innovative research and development, and so-called "elaborately transformed manufacturing" such as aircraft parts, medical instruments, and civil engineering and telecommunications equipment is the key to ensuring the long-term prosperity of the nation (Drum & Ghosh, 2015).

In the context of oil importers, lower oil prices can make substantial savings, which will help rebuild these countries' fiscal position after the global financial turmoil. Therefore, governments in the Asia-Pacific countries can reorient their income distribution towards better-targeted programs to support poor households, rebuild major infrastructure, such as schools, hospitals and better road systems, as well as make human capital investment.

Conclusion

The decline in oil prices certainly has macroeconomic, financial and policy implications. However, falling oil prices present another window of opportunity for both oil importing and exporting countries in the Asia-Pacific region. A sharp decline in oil prices is a benefit to those Asia-Pacific countries without natural resources and relying on fuel imports to sustain their economic growth. By saving substantial money on fuel consumption, these countries can reallocate these funds to invest in the country's major infrastructure. By contrast, for oil exporting countries experiencing significant revenue loss, the sharp dive in oil prices is not all bad news. These countries, at least can use this opportunity to readjust their policies by transforming the economy into other high-tech sectors, which can sustain their economic growth.

References

Asia Development Bank (ADB) 2015. Cheap Oil Can Benefit Asia - ADB Report [Online]. Manila ADB. Available: http://www.adb.org/news/cheap-oil-can-benefit-asia-adb-report [Accessed 6 April 2015].

Baffes, J., Ayhan Kose, M., Ohnsorge, F. & Stocker, M. 2015. The Great Plunge in Oil Prices: Causes, Consequences, and Policy Responses In: The World Bank. (ed.). Washington: Department of Economics.

Biswas, R. 2015. *Oil slump to fuel Asia-Pacific growth* [Online]. Hong Kong: China Daily Asia. Available: http://epaper.chinadailyasia.com/asia-weekly/article-3826.html [Accessed 8 April 2015].

Drum, M. & Ghosh, V. 2015. Innovation the key to post-boom prosperity. The West Australian, 7/04/2015.

International Energy Agency (IEA). 2014. The World Energy Outlook 2014. Paris.

Kumagai, S. 2015. *Asian economies benefit from falling crude oil prices* [Online]. Tokyo: Japan Research Institute. Available: http://ajw.asahi.com/article/views/opinion/AJ201503060049 [Accessed 8/04/2015 2015].

Olayele F.B. 2015. The Geopolitics of Oil and Gas. *Energy Forum*, 2nd Quarter, 25-27.

OPEC 2014. World Oil Outlook 2014. Vienna.

Salameh, M. G. 2015. What is Behind the Steep Decline in Crude Oil Prices: Glut or Geopolitics? *Energy Forum*, 2nd Quarter, 25-28.

CONFERENCE OVERVIEW

North America, if not the United States alone, is expected by many to soon be energy self-sufficient. Horizontal drilling, coupled with hydraulic fracturing, reversed the downward trend in production of both crude oil and natural gas. As a result, the lower-48 US will be exporting natural gas by the time we meet in Tulsa. The debate over crude oil exports from the US will likely still be raging, and is likely to be an element of the 2016 US Presidential election. The production turnaround has shaken world energy markets, and the operation of our energy markets produced substantial reductions in CO_2 emissions through economic substitution from coal to natural gas in power generation. When we add advances in renewables and the promise of industrial-capacity battery systems, the potential for North American energy self-sufficiency appears to be on the near horizon. So, the focus of the 34th USAEE/IAEE Conference will be to provide a constructive and collegial forum for extensive debate and discussion, based on solid research and evidence, to facilitate deeper and broader understanding of the implications of this transformation for North America and the rest of the world.

The Tulsa conference will bring together business, government, academic and other professionals to explore these themes through a series of plenary, concurrent, and poster sessions. Your research will be a significant contribution to this discussion. Speakers will address current issues and offer ideas for improved policies taking full account of the evolution of the North American energy sector and its implications for the rest of the world. The conference also will provide networking opportunities for participants through informal receptions, breaks between sessions, public outreach, and student recruitment. There also will be offsite tours to provide a direct and close-up perspective on Oklahoma's dynamic energy landscape.

Tulsa became known as the Oil Capital of the World at the turn of the twentieth century, and, for a time, Oklahoma was the number one oil producer in the world. The first oil field waterflood was carried out in Oklahoma in May 1931, and the first commercial hydraulic fracturing was performed in Oklahoma in 1949. More recently, Oklahoma companies have led the way with the application of horizontal drilling and hydraulic fracturing techniques to commercialize the vast shale gas and oil resources in Oklahoma and across the country.

Cushing, Oklahoma is the pricing point for the most active commodity futures contract in the world, home to nearly 80 million barrels of crude oil storage, and is the junction for numerous crude oil pipelines collecting and moving crude oil from around the Mid-Continent and Canada to refining centers. The influence reaches from the wellhead, through the midstream, to the refinery and beyond.

In addition to Oklahoma's long-standing role in oil and gas, it is the fourth largest generator of wind energy in the country. The State has five hydroelectric projects, including a rare pump storage facility.

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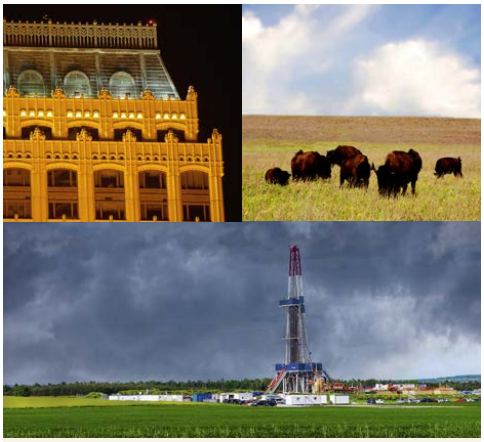

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The general topics below are indicative of the types of subject matter to be considered at the conference. A more detailed listing of topics and subtopics can be found by clicking here: http://www.usaee.org/usaee2016/topics.html

- US oil and gas exports
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- Financial Markets and Energy Markets
- Political Economy
- OPEC's role in a changing energy world
- Energy Supply and Economic Growth
- Energy and the Environment
- International Energy Markets
- Energy Research and Development
- Public Understanding of and Attitudes towards Energy
- Other topics of interest include new oil and gas projects, transportation fuels and vehicles, generation, transmission and distribution issues in electricity markets, etc.

34TH USAEE/IAEE NORTH AMERICAN CONFERENCE CALL FOR ABSTRACTS

We are pleased to announce the Call for Abstracts for the 34th USAEE/IAEE North American Conference, *Implications of North American Energy Self-Sufficiency*, to be held October 23-26, 2016, at the Hyatt Regency Tulsa, Tulsa, OK, USA.

CONCURRENT SESSIONS

There are two categories of concurrent sessions: 1) current academic-type energy economics research, and 2) practical case studies involving applied energy economics or commentary on current energy-related issues. This latter category aims to encourage participation not only from industry but also from the financial, analyst and media/commentator communities. In either instance, papers should be based on completed or near-completed work that has not been previously presented at or published by USAEE/IAEE or elsewhere. Presentations are intended to facilitate the sharing of both academic and professional experiences and lessons learned. It is unacceptable for a presentation to overtly advertise or promote proprietary products and/or services. Those who wish to distribute promotional literature and/or have exhibit space at the Conference are cordially invited to take advantage of sponsorship opportunities – please see www.usaee.org/usaee2016/sponsors.html Those interested in organizing a concurrent session should propose a top ic and possible speakers to Professor Ron Ripple, Concurrent Session Chair (ron-ripple@utulsa.edu) Please note that all speakers in organized concurrent sessions must pay speaker registration fees and submit abstracts.

CONCURRENT SESSION ABSTRACT FORMAT

Authors wishing to make concurrent session presentations must submit an abstract that briefly describes the research or case study to be presented.

The abstract must be no more than two pages in length and must include the following sections:

a. Overview of the topic including its background and potential significance
b. Methodology: how the matter was addressed, what techniques were used
c. Results: Key and ancillary findings
d. Conclusions: Lessons learned, implications, next steps
e. References (if any)

Please visit http://www.usaee.org/usaee2016/PaperAbstractTemplate.doc to download an abstract template. All abstracts must conform to the format structure outlined in the template. Abstracts must be submitted online by visiting http://www.usaee.org/usaee2016/submissions.aspx. Abstracts submitted by e-mail or in hard copy will not be processed.

Student Poster Session

The Student Poster Session is designed to enable students to present their current research or case studies directly to interested conference delegates in a specially designed open networking environment. Abstracts for the poster session must be submitted by the regular abstract deadline and must be relevant to the conference theme. The abstract format for the Poster Session is identical to that for papers; please visit http://www.usaee.org/usaee2016/PaperAbstractTemplate.doc to download an abstract template. Such an abstract should clearly indicate that it is intended for the Student Poster Session – alternatively that the author has no preference between a poster or regular concurrent session presentation. Abstracts must be submitted online by visiting http://www.usaee.org/usaee2016/submissions.aspx. Abstracts submitted by e-mail or in hard copy will not be processed. Poster presenters whose abstracts are accepted should submit a final version of the poster electronically (in pdf format) by August 19, 2016 for publication in the online conference proceedings. Posters for actual presentation at the conference must be brought directly to the conference venue on the day of presentation and must be in either ANSI E size (34in. x 44in.) or ISO A0 size (841mm x 1189mm) in portrait or landscape format.

Presenter Attendance at the Conference

At least one author of an accepted paper or poster must pay the registration fees and attend the conference to present the paper or poster. The corresponding author submitting the abstract must provide complete contact details—mailing address, phone, fax, e-mail, etc. Authors will be notified by July 7, 2016, of the status of their presentation or poster. Authors whose abstracts are accepted will have until August 19, 2016, to submit their final papers or posters for publication in the online conference proceedings. While multiple submissions by individuals or groups of authors are welcome, the abstract selection process will seek to ensure as broad participation as possible: each author may present only one paper or one poster in the conference. No author should submit more than one abstract as its single author. If multiple submissions are accepted, then a different author will be required to pay the registration fee and present each paper or poster. Otherwise, authors will be contacted and asked to drop one or more paper(s) or poster(s) for presentation.

The deadline for receipt of abstracts for both the Concurrent Sessions and the Student Poster Session is Thursday, **May 19, 2016**.

STUDENTS

In addition to the above opportunities, students may submit a paper for consideration in the Dennis J. O'Brien USAEE/IAEE Best Student Paper Award Competition (cash prizes plus waiver of conference registration fees). The paper submission has different requirements and a different deadline. The deadline for submitting a paper for the Student Paper Awards is June 21, 2016. Visit http://www.usaee.org/usaee2016/bestpapers.html for full details.

Students are especially encouraged to participate in the Student Poster Session. Posters and their presentations will be judged by an academic panel and a single cash prize of $1,000 will be awarded to the student with the best poster and presentation. For more details including the judging criteria visit http://www.usaee.org/usaee2016/postersession.html

Students may also inquire about scholarships covering conference registration fees. Please visit http://www.usaee.org/usaee2016/scholarships.html for full details.

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Current Drop in Oil Prices: Impact on Africa

By Joseph Essandoh-Yeddu and Rossitsa Yalamova*

From a peak of $112 per barrel (bbl) for Brent and $105 per barrel for West Texas Intermediate (WTI) in June, 2014 the crude oil benchmarks fell to $62/barrel and $59/barrel, reepectively, in December, 2014, thus a drop of almost 50%. (1)

OPEC Influence

OPEC[1] prevailing global market production share is about 30%, down from almost 50% since the 1970s, largely due to the growth of non-OPEC giants like the United States, Russia and Norway. (2)

For situations of declining prices in the past, OPEC would have normally stepped in to stabilise prices by cutting production. However, not this time; in an unprecedented move during the last quarter of 2014, the cartel decided not to intervene in its 30 million barrels a day quota. With over $800 billion in foreign reserve assets at peak, Saudi Arabia, with the largest reserve capacity to bail out the OPEC group by production cuts, this time refused to intervene. (3)

In theory, OPEC's 12 member countries have equal voices when it comes to making decisions about output policy. In practice however, Saudi Arabia has the largest production and the loudest voice and can easily withstand lower prices compared to the other OPEC members.

Impact of Low Oil Prices on Africa

With the price of Brent crude at its lowest since 2010, the budgets of a number of Africa's top oil producers, are being impaired significantly since more than 70% of their revenues stem from oil production and most would not have sufficient fiscal buffers to cope with the slump in oil prices. (4)

On the other hand, some oil companies hope that lower oil prices could calm down often inflated expectations by African governments over future oil and gas wealth. Unrealistic expectations by local authorities are often said to be a key road block to progressing projects. (5)

This paper discusses the impact of the relatively low oil prices on some selected countries in the sub regions beginning with northern Africa.

Northern Africa

Algeria

Algeria earned $60.15 billion from its petroleum exports in 2014. These revenues represented 95.5% of the country's foreign earnings, highlighting Algeria's significant dependence on petroleum exports.

With the relatively low oil prices, the country has deferred a number of key infrastructure projects, even though, the government says it has sufficient cash reserves to meet its development budgets for the next three to four years without any issues. Algeria's 2015 budget has been based on an oil price of $60 per barrel. (4)

Tunisia

Tunisia, however, is said to be going ahead with the development of its unconventional oil and gas resource despite the prevailing low oil prices as the country expects its first production by 2020 if the existing schedule is maintained, expecting that prices would have recovered by then. Nonetheless, declining oil prices could still threaten the shale oil development. (5)

Tunisia is a relatively small hydrocarbon producer. Production of petroleum and other liquids has been steadily declining from its peak of 120,000 barrels per day in the mid-1980s to about 60,000 barrels per day in 2013. (6) Thus the low prices are already worsening declining oil revenues due to the declining volumes.

Libya

Libya also has about 26 billion barrels of shale oil resources (6). Low oil prices would, therefore, not be good news for shale oil exploration for a country already going through a civil conflict that has curtailed its oil production.

Western Africa

Nigeria

Nigeria faces growing fiscal challenges as oil accounts for more than 70% of

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See footnotes at end of text.

the country's revenue; it would need $123 per barrel to balance its budget. (4)

The country through its national oil company - Nigerian National Petroleum Cooperation (NNPC) – operates oil joint ventures with multinational companies including Shell, ExxonMobil, Chevron, Total and ENI that account for around half of Nigeria's oil output. NNPC contributes about 60% of the funding requirement while the foreign firms provide the 40% balance. $13.5 billion has been the level set for the joint venture budget and has been maintained in the past three years but oil revenues declined from about $15 billion the previous year to $13 billion in 2014 compelling the government to reduce its capital budget for the joint venture oil operations by 40% to $8.1 billion for 2015, The initial budget was $13.5 billion. (7)

Nigeria, being an OPEC member, has also been particularly badly affected by the shale oil boom in the United States. In 2007, Nigeria was supplying more than one million barrels per day of its light, premium-quality crude to the United States. By 2013, the average volume had decreased to 239,000 barrels per day, and in 2014, it was just 54,000 barrels per day. There was no Nigerian crude import in July, 2014 when the global oil price first slumped, thus it becomes the first casualty of the U.S. shale oil boom. (8)

Angola

The U.S. shale oil boom also altered oil trade with Angola. The country's exports to the United States fell to 4.9 million barrels per day in July, 2014 down from 21.9 million barrels per day in March 2007. (**6**). This drop in export revenue in addition to the revenue loss from the lower oil prices also means Angola will have to find other markets for its crude. Export revenue is projected to fall by over $10 billion or 7% of GDP in 2015. (4)

Gabon

Gabon on the average produces about 241, 700 barrels of oil per day, a decline from almost 400,000 barrels a day in the 1990s. (9) The oil price slump is, therefore, already affecting the declining revenue from the oil sales.

Just as Nigeria and Angola, Gabon oil exports to the United States was also wiped out by the shale oil boom, and more so since the latter used to be Gabon's main export market. The oil industry contributes 50% of government revenue and 80% of exports. (4)

Ghana

With average production of 100,000 barrels a day, oil has become a major source of revenue for the government of Ghana. Annual oil revenues had risen from $709 million in 2013 to $780 million in 2014 but is projected to drop to $215 million in 2015 due to the low oil prices. (10)

Ghana officially commissioned its first oil from its only major commercial field – Jubilee, on 15th December, 2010. More production is expected from other fields neighbouring Jubilee in the medium to long term, the most prominent being TEN (Tweneboa-Enyenra-Ntomme) field where oil production is expected to commence by the close of 2016. The Plan of Development for TEN commenced in 2014 and the cost is estimated at $4.5 billion. With the on-going development of the TEN field, average production is expected to exceed 150,000 barrels per day by the close of 2016, but with oil price below $60 per barrel, the schedule of completion of the project is likely delayed since the project economics were based on an oil price of $80 per barrel. (11)

Niger and Chad

One of the major regions on the continent that the industry has largely neglected over the past decade is said to be the interior basins of West Africa. However, with the discovery of geological continuity between the landlocked states of Niger, Chad and South Sudan a lot of activity particularly by China is underway. China National Petroleum Corporation (CNPC) has made 77 discoveries from 99 exploration wells drilled in the region from 2009 to 2013, and most of the discoveries have been at depths of 1,300-1,800 meters, with costs under $5 million per well. (11)

CNPC has been working in parallel on projects in Niger and neighboring Chad and wants the two countries to agree to construct a pipeline that would run from Niger to Chad to link up with a 650 km ExxonMobil-operated oil pipeline in Cameroon to facilitate export of the oil from their production fields. With the prevailing low oil prices, the project is likely to be delayed.

Crude production in Niger has risen from about 6,000 barrels per day in 2011 to the current levels of around 20,000 barrels per day. (4)

Crude oil production in Chad on the other hand, has been declining from about 115,000 barrels per

day in 2011 to current daily levels of about 97,000 barrels. (6) Falling oil prices would therefore worsen revenue generation for the country.

Eastern Africa

Landlocked Uganda has found 6.5 billion barrels of oil near the border with the Democratic Republic of Congo (DRC), whilst about 600 million barrels of oil have been discovered onshore in northwestern Kenya. However, the region is severely lacking in infrastructure and logistical solutions to its impending oil production. Kenya and Uganda, therefore, are building a 1,500 km export pipeline to the Kenyan coast. The $4 billion pipeline project commences this year (2015) and is expected to be completed by 2017 as the two countries plan to start commercial oil production by 2018. (11)

East African countries with oil have made developing regional oil infrastructure a strategic priority and the Uganda-Kenya pipeline could also provide an alternative export route for South Sudan's crude[2] while the DRC has also expressed an interest in the facility.

Reduced revenue due to the falling oil prices however, could stall the progress of the project by delaying its financial closure.

South Sudan could also be significantly affected by the falling oil prices. The country agreed in 2012 as part of the negotiations leading to its independence, to a fixed payment for the use of the pipeline that goes through Sudan. Thus falling oil prices would erode its profit margin.

The oil price slump is also compelling oil companies working on the Tanzania's $30 billion LNG project to reduce exploration budgets for 2015 and consequently, delaying financial closure to the project. Tanzania's gas reserves are estimated at 50 Tcf following new discoveries since 2010 and the country is now considering exporting LNG in addition to other gas monetization options. (5)

Southern Africa

South Africa is embarking on diversification of its primary energy sources to include shale gas[3]. It has commercially viable shale gas reserves which it intends to develop in the nearest future but any prolonged low oil prices could starve major oil developers involved in the project of adequate cash and consequently, affect any existing time schedule for the project.

Impact on Renewable Energy Deployment in Africa

The impact of the lower oil prices could also have a negative impact on commercial scale deployment of renewable energy technologies, particularly in Africa. Wind power may still remain competitive but sustained lower oil prices could stall a number of solar power projects. For instance, levelised cost of grid-quality solar photovoltaic electricity varies from 18-30 cents per kilowatt-hour or unit of electricity for most cases depending on the solar insolation and the location. At $60 per barrel oil price, light crude oil-fired thermal power translates into 11-13 cents per unit of electricity depending upon the plant's efficiency and configuration. Equivalent diesel power plant costs are 15-17 cents per unit of electricity. (12)

Discussion/Viewpoint

Even though, OPEC is not intervening for now, the prevailing low oil prices are also hurting economies of its members since the group needs an average oil price of at least $100 per barrel to balance their annual domestic budgets.(4) Saudis might be taking direct aim at the U.S. shale industry and indirectly maintaining pressure on other high-cost non-OPEC production but there is a risk of oil glut that could sink the already low prices further if OPEC fails to cut production during the Spring season when oil demand is usually low. Secondly, Saudi Arabia failing to act,risks collapsing the petroleum cartel which had at times swayed into politics in support of a member state in its over 50 years of the group's existence. The Saudis could be seen as unprepared to sacrifice when some members of the block are in dire need and could also put the credibility of OPEC at stake making it no more relevant.

In any case, some of the OPEC members see $60-$70 per barrel as a reasonable price for producers and consumers. (7) However, for most emerging oil producing countries particularly in Africa where the resource is largely in deep waters, OPEC not intervening may not go down well. (3)

Some advanced economies also have not escaped the impact, however, those of the West appears to be less concerned since oil revenues comprise less than 40% of their economies. In fact, the OECD[4] member countries which include the West are taking advantage of the low-price environment to increase their strategic stocks. IEA says OECD stocks could, by middle of 2015, come close to the all-time high of 2.83 billion barrels reached in August 1998, shortly before WTI prices sank to an average monthly low of $11.22 per barrel. (13)

Unfortunately, for most African countries, they have not developed the infrastructural capacity to stockpile in such times of low oil prices.

Also, unlike the West, Russia has more than 50% of its GDP based on oil revenues and for that matter is highly negatively impacted.

The West apparently standing aloof is also directly linked to the on-going crisis in Ukraine where Russia is supporting the insurrection in the east of the country whilst the West is on the side of the pro-Europe group in Kiev. The West might see this as an opportunity to weaken the Russian economy in addition to economic sanctions in already place against the country.

Russia however is a major player in the international economy and politics. In 2013, EU accounted for 57% of Russian exports and 46.5% of Russian imports, making the Union by far Russia's most significant trading partner. EU admits that its standoff with Russia is definitely affecting the economies of the two neighbours and it is in their mutual interest to seek a peaceful and timely resolution to the Ukrainian conflict. (14)

Thus, the stand-off between the West and Russia is affecting growth of both major economies and contributing to the slowing growth of the global economy as well. Should the low prices be sustained in the medium-to-long term however, economies that are able to re-structure would overcome, shale oil output would fall, and some African countries would regain their original markets.

Conclusion

In summary, the prevailing global situation puts energy supply security, geopolitical sensitivity and price volatility on the international energy agenda. The stand-off between the West and Russia, the major economic and political powers over the Ukrainian crisis is doing the global economy no good, contributing to its slow growth. Declining global economic growth however is reducing demand for oil culminating in a significant drop in prices. Prevailing low oil prices are hurting African countries and some advance economies as well.

Footnotes

[1] Organisation of Petroleum Exporting Countries.

[2] South Sudan currently relies on a pipeline through its northern neighbour, Sudan, from which it broke away after a 22-year civil war. Continuing disputes between the two countries have disrupted flows.

[3] The country is facing electricity shortages that are crippling economic output and leading to increased political pressure to come up with alternative sources of energy.

[4] Organisation for Economic Cooperation and Development.

References

1 http://www.dailyfx.com/crude-oil,

2 2015 Crude Oil Forecast, energyandcapital.com/Oil_Industry

3 BBC News, Business report, by Richard Anderson, Are low prices here to stay, 24 February, 2015.

4 IMF, World Economic Outlook Update, January, 2015

5 A Platt.com, News Feature, African Energy Outlook, January, 2015.

6 US EIA, Country Analysis Note, 2015.

7 A Platt.com News Feature, OPEC Guide, February, 2015.

8 US EIA Short Term Energy Outlook, Statistics, 2015.

9 BP Statistical Review of World Energy, 2014

10 Ministry of Finance, Ghana, www.mofep.gov.gh/2015BudgetStatement

11 A Platt.com, News Feature, African Energy Outlook, March, 2015.

12 Energy Commission, Ghana, Strategic National Energy Plan 2006-2020 www.energycom.gov.gh/PlanningandStatictics

13 IEA Oil Market Reports, February-March, 2015.

14 European Union Committee, House of Lords, 6th Report of Session 2014-15; EU and Russia: Before and Beyond the Crisis in Ukraine.

Crude Oil Prices in Movement

By Christian Growitsch and Leon Leschus*

Between last June and January this year crude oil prices slumped by around 60 percent. This downturn has essentially two explanations. First, global oil supply increased strongly in the last year. Second, oil demand developed below market expectations. Global oil production increased by nearly 4 mb/d in 2014: the United States produced oil in such quantity not seen in decades. The use of new technologies, namely fracking, made it possible to get access to unconventional oil in shale-formations, which had not been economical before. But also Russia increased its oil production strongly up to levels last seen during times of the Soviet Union. The Russian government tried to counteract falling revenues due to lower oil prices by increasing its quantities sold. Both developments drove production. The corresponding global excess supply put global oil prices under downward pressure. In addition, the Organization of Oil Exporting Countries (OPEC) contributed to this well supplied oil market. At their meeting on November 27, 2014 OPEC-members decided not to reduce their production quotas. In the run-up of the meeting it was speculated that Saudi Arabia, the biggest oil producer in the OPEC, would cut production to stabilize global crude prices. However, Riyadh's Minister of Petroleum Ali al-Naimi opted against production cuts. From an economic perspective, this decision can be interpreted as Saudi Arabia's decision to resign from the position of the world's crude oil swing supplier. In fact, on November 27 last year OPEC gave up its idea of controlling global oil prices.

The economic consequences of this decision are ambivalent. While the oil importing countries benefit, the oil price decline puts the business case of U.S. fracking industry in question. This industry has significantly higher production costs for crude oil than producers in Middle East; the price levels of the beginning of 2015 can be considered predatory for them. Also, some OPEC-members as Venezuela and Iran opposed the decision to keep the oil-production quotas unchanged. These countries need a relative high oil price to finance their national budget. Above that they suffer from enormous redistribution effects. The ECB calculated that due to the lower oil prices not much less than two trillion U.S. dollars went from the oil exporting to the oil importing countries.

The world economy overall benefits from lower oil prices, however. Oil intensive industries face less energy costs in their production process. Also, transport costs decrease. Especially the chemical industry, the transport sector and airlines benefit from lower crude oil prices. Furthermore, households spend less money for gasoline and heating oil. The global economic effect of a larger oil price decrease is, therefore, significant. According to the International Monetary Fund a longterm decrease of 10 U.S. dollars per barrel in oil prices leads to an additional growth of 0.2 percent of the global economy. Allthough oil prices started to recover in the last weeks the oil price is still 45 U.S. dollars under the level of last summer. Hence, the global economy benefited from a growth impulse of 0.9 percent.

How long the world economy will benefit from the low oil prices is, however, questionable. The current oil price downturn could cause higher oil prices in the future: oil producers could limit or stop their investments in oil exploration and future production projects. This would have a reducing effect on the future global oil supply. The consequences of omitted investments will, to a large extent, be noticed in the long run rather than in a short time perspective. It takes approximately five years from the decision to invest to see real oil production. Hence, for a transition time, new oil sites will go online although they might not be profitable today. This time delayed reaction of the oil supply to price developments is the reason for cyclical price fluctuations. Nevertheless, the strong price decreases in the second half of 2014 pushed U.S. unconventional oil producers to reduce their oil output in the short run. In contrast to conventional oil fields, unconventional wells need to be replaced every year to keep the oil flow stable. According to oil-service-company Baker Hughes the numbers of oil rigs in the United States decreased from over 1600 in October to 679 in late April. That is the lowest number in four and a half years. The number of U.S. rigs fell twenty-one weeks in a row. As a result, oil production decreased, which pushed prices up to about 60 U.S. dollars per barrel (WTI).

It is likely that during the year 2015, market exits from U.S. oil producers will continue. Therefore, the U.S. Energy Information Administration reduced its forecast for the oil supply in the U.S. for the second quarter 2015. A lower growth in oil supply would underpin increasing oil prices especially as the global oil demand seems to strengthen again. In the last week of April crude oil inventories in the U.S. decreased and Saudi Arabia decided to increase export oil prices for the U.S. and European market, which was interpreted by market participants as a sign that in these markets oil demand is growing. Furthermore,

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production losses in important oil producing countries continue to be a risk in the following months. The closure of Libya's most important oil export port, Es Sider, triggered price increases during April. There are still pronounced upward price risks mostly related to the worsening of the political environment in Northern Africa and the Middle East.

With increasing oil prices the growth impulse for the international economy is turning down. For the U.S. the situation is two sided: on the one hand the U.S. economy is still a large importer of oil, facing higher prices again. On the other hand the U.S. oil industry will benefit from a relatively high oil price and become profitable again. Technological progress might become a game changer, again. The productivity of working rigs might continuously increase due to realized efficiencies in the oil production process and cost cuts. As a result, U.S. oil-companies might be able to cope with lower oil prices. This, will incentivize investing again. In the medium term the U.S. could, therefore, become a swing-producer on the international oil market. Hence, the U.S. shale oil industry could help to abolish long lasting oil price shocks and strong cyclic price fluctuations in future. That will especially be the case when U.S. oil companies become able to reactivate stopped drilling facilities in a short time horizon. As a consequence, the international oil price would stabilize at a comparably low level. Extreme global oil price risks could be a thing of the past.

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Energy Risk Flying Under the Radar: Yieldcos and Net Metering

By Jared Anderson*

Energy businesses are fraught with risk, from political uncertainly to commodity price fluctuation to various financial obstacles. And while renewable energy industries like solar are not directly impacted by commodity price movements, new asset classes like yieldcos are currently under pressure from numerous angles, including uncertainty with regard to future net metering policy.

Yieldco is short for "Yield Company," in which "yield" refers to income. "YieldCos are similar in concept to an MLP (master limited partnership) in the oil and gas sector or a REIT (real estate investment trust) in the real estate sector. All three investments are designed to provide a dependable stream of cash flow to investors," according to Louis Berger.[1]

Yieldcos use income from completed projects – often solar installations – with long-term power purchase agreements (PPAs) to distribute returns to investors in the form of dividends. All yieldcos are structured differently, meaning they consist of assets that vary from utility-scale, commercial/industrial and residential rooftop projects.

The prospect of higher interest rates, changes to renewable energy policy and stock market turbulence are all risks to the yieldco business model which have recently been highlighted. But the role of net metering has received less attention.

Net metering "allows utility customers who generate electricity on-site, usually from a solar PV rooftop system, to run their meter backward by sending the excess electricity generated back to the grid, or utility company. In turn, the utility company must pay the retail rate for the electricity sent back to the grid. This was done because it is the easiest way for the utilities to accommodate solar with their old meters and antiquated billing systems," according to clean energy entrepreneur Jigar Shah.[2]

Forty-four states, Washington, D.C. and Puerto Rico have net metering policies in place.

The net metering concept has come under attack from utilities who fear their traditional revenue sources are drying up as more people sell power back to the grid from on-site renewable energy operations, while energy efficiency measures simultaneously chip away at bottom lines based on volume of power sold. It appears net metering, as traditionally applied, is unsustainable and lots of work is currently underway to find new models that more adequately reflect current power market trends.

But where does that leave investments like yieldcos that are supported by PAs designed – particularly in the rooftop residential sector - around net metering policies? It appears existing systems would not be greatly impacted, but new projects constructed under different net metering terms could change the yieldco investment calculus going forward, according to Jamie Mandel and Jeff Waller, experts at the Rocky Mountain Institute.

For example, a yieldco with a large percentage of long-term PPAs based on a bundle of rooftop solar installations calculated at a given cost per kilowatt hour could look much different if net metering policies are changed. Currently many net metering arrangements pay retail rates for the power generated by a residential rooftop system. But if this changes, what happens to yieldcos built around the old net metering system? These investment vehicles need to add new assets in order to continue growing and paying out returns and potential net metering changes cloud that future growth picture.

Indeed, President and CEO of NRG Home, Steve McBee, said his only concern with regard to the company's yieldco structure is the "uncertainty" around net energy metering. "I would trade certainty for some potential modification to the net metering rules," he said in an interview with Utility Dive.[3]

8point3 Energy Partners LP is a limited partnership between First Solar and Sun Power that did an initial public offering this past June, which raised $420 million from investors. Class A shares were valued at $21. By mid-October those shares were trading at about $12.50.

In its registration statement filed with the US Securities and Exchange Commission, 8point3 clearly identifies uncertainty around future net metering policy as an investment risk:

> "Our Residential Portfolio may be adversely impacted by the failure to expand existing limits on the amount of net metering in states that have implemented it, the failure to adopt a net metering policy where it currently is not in place, the imposition of new charges that only or disproportionately impact customers that utilize net metering, or reductions in the amount or value of credit that customers receive through net metering […] Limits on net metering, interconnection of solar energy systems and other operational policies in key markets could limit the number of solar

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energy systems installed in those markets. For example, California utilities limit net metering credit to 5% of the utilities' aggregate customer peak demand. California has adopted legislation to establish a process and timeline for developing a new net metering program with no cap on participation. If the caps on net metering in California and other jurisdictions are reached or if the amount or value of credit that customers receive for net metering is significantly reduced, future customers will be unable to recognize the current cost savings associated with net metering. Net metering is used to establish competitive pricing for prospective customers and the absence of net metering for new customers would greatly limit demand for residential solar energy systems." - 8point3 Energy Partners LP[4]

Inasmuch as net meting policies are still very much a topic of debate in the US, there are more pressing risks facing yieldcos over the short term. The potential risk associated with net metering changes may currently be overshadowed by stronger headwinds, over the longer term however, yieldcos with large residential solar portfolios in states where net metering is likely to be changed could be impacted. Investors looking at yieldcos should consider the size of the company's residential portfolio and the states in which those systems are located in order to more accurately evaluate potential risk associated with this relatively new asset class.

Footnotes

[1] "What You Need to Know About How Clean Energy YieldCos Work," Greentech Media, July 10, 2014. http://www.greentechmedia.com/articles/read/what-you-need-to-know-about-how-yieldcos-for-clean-energy-work

[2] "Solar To Eat Costs of Net Metering if Utilities Cough Up Data," LinkedIn Pulse, May 29, 2015. https://www.linkedin.com/pulse/solar-eat-costs-net-metering-utilities-cough-up-data-jigar-shah?redirectFromSplash=true

[3] "What happened when NRG Energy disrupted its own business model?

Its biggest new subsidiary, NRG Home, is building a business around empowering customers," Utility Dive, July 1, 2015. http://www.utilitydive.com/news/what-happened-when-nrg-energy-disrupted-its-own-business-model/401472/

[4] "8point3 Energy Partners LP REGISTRATION STATEMENT UNDER THE SECURITIES ACT OF 1933," US SEC, June 10, 2015. http://secfilings.nasdaq.com/edgar_conv_html%2f2015%2f06%2f10%2f0001193125-15-218889.html#D876955DS1A_HTM_ROM876955_12

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Natural Hazard Risk and Energy Supply

By Corine Frischknecht, Ludovic Gaudard, Franco Romerio*

Natural hazard risk (NHR) represents a major challenge for most societies. Hundreds of thousands of people die every year due to geological (earthquake, tsunami, landslide, volcanic eruptions) and hydro-meteorological (hurricanes, storms, floods, droughts) events. Direct economic losses amount to tens of billions of dollars (1). Energy supply is disrupted by these events; the socio-economic and environmental consequences may be dramatic.

The wind storm that hit Quebec in 1998 destroyed 1'400 power pylons, damaged 3'000 Km of transmission lines, and left more than 3 million people in the dark for several weeks is perhaps the most quoted example of the impact of natural hazard on energy supply. However, natural events always hit the energy infrastructures, as experienced more recently in New York, USA (hurricane Sandy, 2012), Tacloban, Philippines (typhoon Haiyan, 2013) or in Cannes, France (floods, 2015).

In general, experts define the NHR as the product of a hazard (H), vulnerability (V) and elements at risk (E) (2, 3). H represents the probability of occurrence, within a specific period of time in a given area, of a potentially damaging natural phenomenon. E includes population, build-up area, infrastructures, economic activities, etc. V measures the proportion of E that can be lost as a result of the occurrence of a natural phenomenon and is usually expressed on a scale from 0 to 1 (from no to total losses). In terms of vulnerability, one makes the distinction between physical and systemic vulnerability. The former concerns for instance a building that can be impacted in a seismic region; the latter, a network disruption, for instance an electric power system, which may collapse due to cascading effects of an outage.

NHRs are sometimes called "Un-Natural risks", because the Force of Nature is most of the time only partially responsible of a disaster (4). In fact, NHR can mainly be mitigated by reducing the elements at risk vulnerability. In some cases (landslide and floods), it is also possible to avoid or reduce the size of a natural event, or at least not to increase it, for instance by avoiding cutting trees over an area prone to landslide or making the soil impermeable to infiltration of water. In case of volcanic eruption or earthquake, nothing can be done to avoid their occurrence.

In the field of energy transformation, consumption, and transportation, one should also consider the risk definition used by engineers. In their perspective, the technological risk (TR) is given by the probability of occurrence of a certain event (P) times the consequences (C) (5, 6). Haimes states "risk is defined as a measure of the probability and severity of adverse effects" (7). Engineers focus on the probability of occurrence of adverse effects to mitigate risk.

The risk definition as an "expected value" is sometimes used in economics, although here the consequences of a certain event may be either negative or positive. The risk management goal in that case is to tip the balance towards positive outcomes. In the field of NHRs, only negative outcomes are considered. But E, for instance a power plant, which may be jeopardized by a natural event, should still be able to provide a net benefit to society.

The "expected value" approach is appropriate as far as one focus on objective risk, and not on a decisional or behavioural phenomenon. Indeed, thanks to Bernoulli, we know that what matters in the decisional process is the "expected utility" and not the "expected value". The expected utility theory and later the prospect theory have shown how risk attitude and risk perception (subjective risk) influence our decisions and behaviour (8, 9).

The challenge when we deal with natural hazard, energy, risk assessment and management is that one should consider different types of risk associated with this combination. At present, there is no approach that allows integrating in a single "formula" all aspects. Although the "formulas" mentioned above are quite similar, one should recognize that it is very difficult to integrate the concepts and analytical tools from different disciplines. At present, one should develop a semi-quantitative synthesis of the more relevant risks in order to have a broad picture of the chain of events that can be provoked by a phenomenon like hurricane Katrina (USA, August 2005), the Tōhoku earthquake and tsunami (Japan, March 2011) or the floods in Thailand (October 2011).

The Tōhoku earthquake had a Mw magnitude of 9.0 and triggered a huge tsunami, which hit the Fukushima Daiichi nuclear power plant with a wave 15 meters high (10). The flooding switched off the cooling system. The partial meltdown of reactors 1, 2 and 3 as well as several hydrogen explosions could not be avoided. Hundreds of thousands hectares of soil were contaminated by the radioelements escaped from the reactors thousands of people were evacuated.

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Relatively large amounts of contaminated water were dumped into the Pacific Ocean. The consequences of this accident are many and concern the natural environment, the society and its economy as well as its energy supply.

The Fukushima nuclear accident clearly shows how complex the assessment of the entire spectrum of risks related to a cascading event is. Two other examples allow being more precise. The health risk for the people that were exposed to radiation is defined by the probability of developing a cancer or leukaemia in the coming years or decades after the exposure (11, 12). The probability for an individual is very low, but when it is applied to a large population, it can affect a quite large number of people. One should recognize that uncertainties are quite high, in particular the dose-effect relationship, as shown in the case of Chernobyl (13).

54 nuclear power plants (50 GW) were closed in the aftermath of the Fukushima accident. To avoid blackouts, Japan had to take drastic measures to reduce power consumption. Furthermore, to partially compensate for the nuclear power plants closure, it had to import huge quantities of natural gas. As a result, the balance of trade turned negative. This huge event shows the necessity to assess all risks related to such a natural event, considering vulnerabilities, in order to manage this kind of "major risk" in an appropriate manner.

In conclusion, "integrated risk management" is a necessity in a world prone to major risks. "Integrated risk assessment" is a pre-condition for an "integrated risk management". However, the methodology is still in its infancy. Specific problems, such as the role of uncertainty, make the problem even more complex. Furthermore, as mentioned above, one should also take into consideration the subjective side of risk, which is fundamental for risk management. Case studies that consider a broad spectrum of risks are very important. Among these risks, the risk related to energy supply is an essential piece of the puzzle, because energy, in particular electricity, plays an increasingly important role in society. These are the topics that we are developing in an article to come.

References

(1) SwissRe Ldt. (2015). "Natural catastrophes and man-made disasters in 2014: convective and winter storms generate most losses". Sigma, 2: 1-45.

(2) Fournier d'Albe E.M. (1979). "Objectives of volcanic monitoring and prediction." Journal of the Geological Society, 136(3): 321-326.

(3) UNDRO (1991). Mitigating Natural Disasters: Phenomena, effects and options. A manual for policy makers and planners. New York: United Nations.

(4) World Bank and United Nations (2010). Natural hazards, UnNatural disasters. The Economics of Effective Prevention. Washington D.C., The World Bank.

(5) Farmer F.R. (1967). "Reactor safety and siting: A proposed risk criterion". Nuclear Safety, 8(6): 539-548.

(6) USNRC (1975). An assessment of accident risks in U.S. commercial nuclear power plants. Reactor Safety Study, WASH-1400. Washington D.C.: US Nuclear Regulatory Commission.

(7) Haimes Y.Y. (2004). Risk modelling assessment and management. Hoboken, NJ: John Wiley & Sons, p. 4.

(8) Von Neumann and Morgenstern O. (1953). Theory of games and economic behaviour. Princeton: NJ. Princeton University Press.

(9) Tversky A., Kahneman D. (1992). "Advances in prospect theory: Cumulative representation of uncertainty". Journal of Risk and Uncertainty, 5 (4): 297–323.

(10) Ranghieri F., Ishiwatari M. eds. (2014). Learning from Megadisasters. Lessons from the Great East Japan Earthquake. Washington D.C.: The World Bank.

(11) ICRP (1991). "1990 Recommendations of the International Commission on Radiological Protection". ICRP Publication 61. Ann. of the ICRP, 21(1-3).

(12) ICRP (2007). "2007 Recommendations of the International Commission on Radiological Protection". ICRP Publication 103. Ann. ICRP, 37 (2-4).

(13) Cardis E. et al. (2006). Cancer consequences of the Chernobyl accident: 20 years on.
J. Radiol. Prot., 26: 127-140.

ELES, d.o.o. and Risk Management

By Vid Pahor*

ELES d.o.o., the Transmisssion System Operator (henceforth referred to as: ELES) is responsible for the safe, reliable and uninterrupted transmission of electricity in the Republic of Slovenia as well as for the development, construction and maintenance of the transmission system.

ELES is the guardian of the Slovenia's electric power system, which is closely linked to transmission networks of the neighbouring countries and integrated into the European electric power system. ELES is a member of the European Association of Transmission System Operators ENTSO-E, CIGRE, CAO and CASC auction houses and involved in numerous international projects.

The transmission network of the Republic of Slovenia is managed by ELES. It connects the generators of electricity with its consumers and allows for international cross-border connections through which Slovenia exchanges electricity with Austria, Italy and Croatia. The transmission network is a high-voltage system, which consists of 400, 220 and 110 kV voltage level transmission lines and a number of substations in the systemic length of 2,843 kilometres, which represents the backbone of the electric power system in Slovenia and through which over 20 TWh of electricity flows each year.

ELES, d.o.o., is a public 100% state-owned Company, which employs 530 people, and which, in addition to providing stable and high-quality transmission of electricity, is also expected to demonstrate appropriate business performance.

The Company's Risk Management System and the Risk Catalogue

A careful address and management of both technical and business risks are essential for quality performance of the mission and the achievement of business success. Therefore, in these uncertain economic conditions, ELES adopted risk management in the business strategy of the Company so as to ensure stable operations and achievement of the objectives.

In developing the risk management system, ELES set as its main objective the reduction in exposure of the Company's business to the risks and an easier identification of opportunities that arise in a turbulent business environment.

The product of the system is a Company's Risks Catalogue, i.e., a collection of important operation and strategic risks, which the Company addresses and demonstrates on the common denominator. The Catalogue sets out the risk management system with an umbrella structure, method of managing individual risk groups by business areas, with the analysis and the method of management as well as the relations of strategic risks to the risks in the processes; the Appendix includes "specification of strategic risks and risks by business segments".

The Risks Catalogue is an important document in managing the Company's business operations; therefore, it constitutes a business secret and is available to those responsible for achieving targets and to the management and supervisory bodies.

By way of applying internal regulations, ELES defines on a regular basis, i.e., at least once a year, and at important events, also a regular checking and updating of the adequacy of the risks and measures structure as regards the set objectives and current business circumstances.

The method of managing the risks is defined by the Company's internal regulation and the prescribed methodology. This ensures a uniform approach to the identification and evaluation of the risks and inclusion of the risk management system into a uniform system of corporate governance.

A uniform system of corporate governance which, in addition to risk management /pursuant to ISO 31000: 2009 /Risk Management – Principles and Guidelines/ combines quality management systems / pursuant to DIN EN ISO 9001: 2008/, environmental management /pursuant to DIN EN ISO 14001: 2005/ occupational health and safety / pursuant to SIST-TS BS OHSAS 18001: 2012/, information security / pursuant to BS PAS ISO/IEC 27001: 2005/ and asset management / following best practice BSI PAS 55 - ISO 55000/1/2/ as well as the Company's commitment towards business excellence pursuant to the EFQEM model, additionally contribute to the good management of the business operation and the reduction in the exposure to operation risk.

In recent times, we have introduced a system of corporate integrity so as to reduce exposure to risks of fraud and unethical and imprudent business operations. In this system, ELES develops and monitors risk management measures.

In order to reduce the exposure to the "compliance" risk, ELES has introduced IUS-ALERT[1], with which ELES weekly informs the holders of the business lines about all amendments and supplements to the legislation and monitors their responses.

To better monitor the management of the exposure and to increase responsive-

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See footnotes at end of text.

ness, ELES monitors risk management indicators and efficiency measures. Attention is also focused on the achievement of performance indicators (KPIs) on the process' and strategic objectives, while their discrepancy from the tolerance limits is the signal for an immediate verification of the adequacy of the risk structure and measure as to the objectives and current business circumstances. The achievement of the performance indicators, KPIs, indirectly highlights also the past performance of risk management, which indicates the likely future behaviour in managing the exposure of operations and identification of opportunities that arise in a business environment.

Developments in this field are guided and monitored by the Risk Committee, which focuses on monitoring progress in managing exposure, examines the suitability of acceptable Risk Appetite, whereat it takes into consideration the importance of the Company's activity and requirements in the performance of public utility service of the transmission system operator and connects the business areas in the identification of risks and designing of measures. The member of the Committee is also a representative of the Internal Audit, who by way of applying findings and recommendations, additionally contributes to better management of operations and thereby to the reduction of the exposure of the Company's business to any such risks.

The Committee is run by the Adviser to CEO on Risk Management, while the executive directors of the business areas and the heads of departments are members of the Committee. To carry out operational duties as per areas, ELES has organised a team for risks at the level of assistant executive directors, which represents an appropriate hierarchical level for the quality execution of tasks[2].

The most significant risks are addressed and monitored thought the expert councils and the Council of the Chief Executive Officer, where the measures are designed as the management's decisions.

Method of Tackling the Risks and the Reduction of Exposure

The risks are addressed as per processes. In doing so, ELES stems from the good practices of ISO 31000: 2009 /Risk Management - Principles and Guidelines/ standard. The responsibility for its management is inseparably connected with the responsibility for achieving the objectives, while the roles in managing risks are also clearly defined, i.e., in identifying, assessing risks and designing management measures and the updating of their structures.

The executive directors of the areas, responsible for achieving the objectives, firstly examine the internal and external context of business performance in their processes, whereby they identify the internal and external regulatory requirements and the business environment, the state of the objectives, the policies, the relations and understanding of internal and external stakeholders and other circumstances affecting consideration of the risks and develop the risk areas-groups to be addressed. The identified process-operation risks are upgraded with the management risks of these processes, and evaluated, while measure are taken for the risks, which exceed the acceptable level of Risk Appetite, which are determined every time by the Risk Committee, while others are addressed and valued during the modernisation of the structure. In this way, ELES continues to deal with the significant risks. Based on the experience, ELES has developed value scales to evaluate the impact and likelihood of materialisation of risks. Said scales provide a common "denominator" for the evaluation of risks across different business areas.

In addition to focusing on the process and strategic risks, the Company addresses and manages also specialised areas of risks pursuant to the requirements of the labour and environmental protection legislation and standards of information security.

The executive field directors periodically analyse the operation management, including risk management, and on that basis makes an annual statement on the field/area management. In the audit of transactions and processes the Internal Audit also examines the adequacy of the risk and measure structure and notifies the Chief Executive Officer of the Company and the Supervisory authorities on its findings and recommendations.

By doing so, ELES rounds up the risk management in the Company, i.e., from their identification, evaluation through the design and monitoring of realization and the effectiveness of measures, to ex-post checking of the adequacy of the risk structure and the objectives of the measures as regards to the situation and current business circumstances.

By way of applying the aforementioned presented method, ELES – in addition to the strategic risks[3] – addresses 18-operation-process risks in six business areas in the Company.

The main risks are related to the basic activity of the system operator, i.e., providing a stable and high-quality transmission of electricity. These include the risks of system operation, construction and maintenance of infrastructure of the transmission system and risk management with the Company's assets. The strongest measures are earmarked for these risks, i.e., in addition to the risks of internal and external regulatory framework that directly affect the core business and the Company's business performance and risks arising from project management, procurement and financial business.

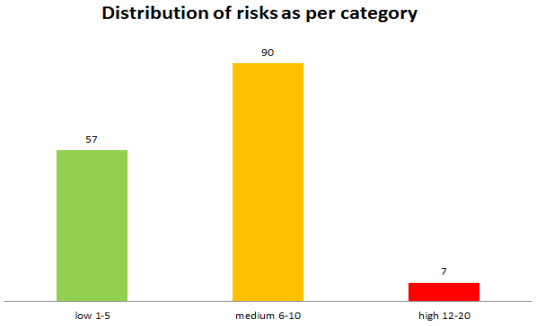
The adjacent graph shows the distribution of risks identified as per category of high, medium, low. Despite the imposed measures, single highly-assessed risks remain and require constant attention and monitoring of actions imposed.

The introduction of the tolerable Risk Appetite almost halves the number of identified risks, onto those for which the measures are taken and onto those which are monitored and studied upon the structure risk and measures updates.

The following identifiers of the Company's business areas, apply to all graphs that follow in this article:

Vodstvo	Company Managment
PUSP	Assets and Project Management Division
POS	Transmission System Operation Division
PIPO	Transmission Network Infrastructure Division
PPD	Corporate Services Divison
PITK	Information and Telecomunications Division
JN	Public Procurement
Skupaj	Total

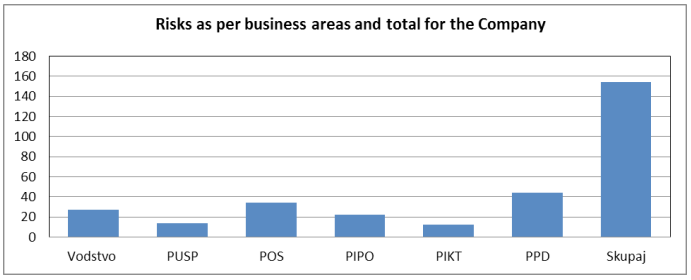
1. Company Management risk a. Corporate integrity risks b. Human resources risks c. Public relations risks d. Management systems risks	**2 . Assets and Projects Management risks** a. Regulatory risks for the sustainable development of the Company b. Risks of planning, development, selection of technology and methods c. Project management risks d. Analytics, diagnostics assets appropriation risks e. Property risks	**3.Transmission-System Operation risks** a. Operation and management risks b. Risks of allocation of cross-border transmission capacities c. Risks of ancillary services provision
4. Transmission Network Infrastructure risks a. Construction of transmission network risks b. Maintenance of transmission network risks	**5. Corporate services risks** a. Procurement of goods and services risks b. Financial risks	**6. IT and Telecommunications risks** a. IT risks in business processes b. Telecommunications risks for Transmission System Operation

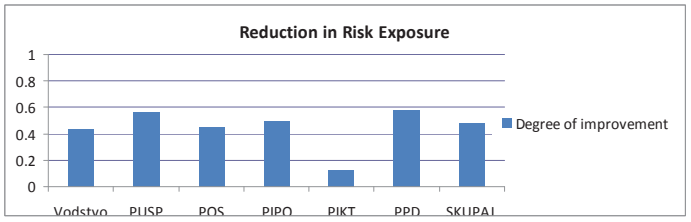


By defining measures as per business areas, ELES significantly reduces exposure to the Company's business risk in both basic activities, i.e., the achievement of business performance and compliance. In doing so, ELES monitors the implementation of measures and assesses their effectiveness. ELES estimates that with the measures introduced, ELES reduces by half the exposure of the Company to business risks; however, varying according to individual business areas.

Despite the identified measures, some of the risks still exceed the acceptable level since the major underlying reasons for them remain in particular outside the Company, or the estimated costs of more powerful measures are too high in relation to the effects of the risk management; hence, ELES pays special attention to the latter and the strategic risks.

In addition to the operational-process risks, ELES also addresses the strategic risks, which are defined as important risks that decisively influence both the fundamental system operator's activity as well as the business performance of the public company. ELES ensures the management of these risks by way of applying the measures on the processes and with the monitoring of the management hierarchy, while their aptness is tested at the Strategic Conference of the Company.





Conclusion

The risk management system and handling thereof reduces the exposure of the Company's business operations to the risks, while it ensures to the responsible ones to achieve objectives and assists them in identifying opportunities in the turbulent business environment.

Given the characteristics of the maturity model, ELES developed a uniform top-down managed risk management system, with a strong support of the top management /tone at the top/, defined strategic risks, defined organisation for the development and monitoring of the system with uniform methodology and pro-

cess, dedicated team aims to disseminate awareness and knowledge on the necessity of managing risk exposure of operations and continuously updates the risk structures and measures.

ELES progressively further develops the Risk Managing System according to the needs and requirements of the Company's management bodies.

Footnotes

[1] "regulatory alert system", through the IUS INFO portal

[2] The organisation of the risk management system is optimised pursuant to the needs of the Company and the policies of the top management, which is responsible for the establishment of an appropriate control environment.

[3] Among the most important strategic risks, ELES included the risk that have a decisive influence both on the objectives of the underlying activities as well as the system operator' business performance.

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IAEE/Affiliate Master Calendar of Events

(Note: All conferences are presented in English unless otherwise noted)

Date	Event, Event Title and Language	Location	Supporting Organization(s)	Contact
2016				
February 14-17	5th IAEE Asian Conference *Meeting Asia's Energy Challenges*	Perth, Australia	OAEE/IAEE	Peter Hartley *hartley@rice.edu*
April 14-26	9th NAEE/IAEE International Conference *Energizing Emerging Economies: Role of Natural Gas & Renewables for a Sustainable Energy Market and Economic Development*	Abuja, Nigeria	NAEE NAEE/IAEE	Wumi Iledare *wumi.iledare@yahoo.com*
June 19-22	39th IAEE International Conference *Energy: Expectations and Uncertainty Challenges for Analysis, Decisions and Policy*	Bergen, Norway	NAEE	Olvar Bergland *olvar.bergland@umb.no*
August 28-31	1st IAEE Eurasian Conference *Energy Economics Emerging from the Caspian Region: Challenges and Opportunities*	Baku, Azerbaijan	TRAEE	Gurkan Kumbaroglu *gurkank@boun.edu.tr*
September 21-22	11th BIEE Academic Conference *Theme to be Announced*	Oxford, UK	BIEE	BIEE Administration *conference @biee.org*
October 23-26	34th USAEE/IAEE North American Conference *Implications of North American Energy Self-Sufficiency:*	Tulsa, OK, USA	USAEE	David Williams *usaee@usaee.org*
2017				
June 18-21	40th IAEE International Conference *Meeting the Energy Demands of Emerging Economic Powers: Implications for Energy And Environmental Markets*	Singapore	OAEE/IAEE	Tony Owen *esiado@nus.edu.sg*
September 3-6	15th IAEE European Conference *Heading Towards Sustainability Energy Systems: by Evolution or Revolution?*	Vienna, Austria	AAEE/IAEE	Reinhard Haas *haas@eeg.tuwien.ac.at*
2018				
June 10-13	41st IAEE International Conference *Security of Supply, Sustainability and Affordability: Assessing the Trade-offs Of Energy Policy*	Groningen, The Netherlands	BAEE/IAEE	Machiel Mulder *machiel.mulder@rug.nl*
September 19-21	12th BIEE Academic Conference *Theme to be Announced*	Oxford, UK	BIEE	BIEE Administration *conference @biee.org*

Publication

Economic Development in the Middle East and North Africa: Challenges and Prospects, Mohamed Sami Ben Ali, Editor (2015). 208 pages. Price: US$77.00. Contact: Palgrave Macmillan, VHPS, 16365 James Madison Highway, Gordonsville, VA 22942, USA. Email: consumerorders@mpsvirginia.com

Calendar

11-13 November 2015, Rigless Interventions at TBA, Perth, Australia. Contact: Susy Angryany, Angryany, PetroEDGE Asia, 88 Joo Chiat Rd, Singapore, 427382, Singapore. Phone: +65 6741 9927, Email:susy@asiaedge.net, URL: http://atnd.it/28683-0,

11-12 November 2015, 9th Annual Mining & Developing the Pilbara Conference at Ibis Styles Hotel, Karratha, 35-45 Searipple Road, Karratha WA, 6714, Australia. Contact: Informa, Australia, Informa Australia, Level 18, 347 Kent Street, Sydney, NSW, 2000, Australia. Email: info@informa.com.au, URL:http://atnd.it/28514-0,

16-19 November 2015, European Energy Markets Course at Brussels, Belgium. Contact: Boryana de Haan, Energy Delta Institute, Netherlands. Phone: 088-1166834, Email: dehaan@energydelta.nl, URL:www.energydelta.org/mainmenu/executive-education/introduction-programmes/european-energy-markets-course,

16-18 November 2015, EPCIC Contract Management at TBA, Kuala Lumpur, Malaysia. Contact: Susy Angryany, Angryany, PetroEDGE Asia, 88 Joo Chiat Rd, Singapore, 427382, Singapore. Phone: +65 6741 9927, Email: susy@asiaedge.net, URL: http://atnd.it/28688-0,

16-19 November 2015, Power Purchase Agreement (PPA) at Singapore, Singapore. Contact: Ryan Zul, Infocus International Group, 0. Phone: +65 6325 0339, Email: ryan@infocusinternational.com, URL:www.infocusinternational.com/ppa,

16-17 November 2015, Refining Capital Projects Conference & Exhibition at DoubleTree by Hilton Hotel Houston - Greenway Plaza, 6 Greenway Plaza East, Houston, 77046, United States. Contact: Theo, Larn-Jones, Petrochemical/Refining Update, 7-9 Fashion Street, London, E1 6PX, United Kingdom. Phone: +44 2074 224 320, Email: theo@petchemupdate.com, URL: http://atnd.it/33938-0,

16-17 November 2015, Oil & Gas Chemistry 2015 at Webster, United States. Contact: Conference Team, MacroproWorks, 302 W. Bay Area Blvd, Webster, 77598, USA. Email: macropro2014@gmail.com, URL:http://atnd.it/34171-0,

17-17 November 2015, Digitalisering van de energie-industrie at Hotel Veenendaal, Bastion 73, Veenendaal 3905 NJ, Netherlands. Contact: Remco, Arts, Euroforum, Netherlands. Phone: +31 402972746, Email: r.arts@euroforum.nl, URL: http://atnd.it/34398-0,

17-18 November 2015, Nuclear Ventilation 2015 at The Haydock Park Hotel, Penny Lane, Haydock, WA11 9SG, UK. Contact: Rosie Perkins, United Kingdom. Phone: 0207 973 1260, Email: r_perkins@imeche.org, URL: http://atnd.it/34750-0,

17-19 November 2015, European Refining Technology Conference 20th Annual Meeting at Rome Cavalieri, Waldorf Astoria Hotel and Resorts,Via Alberto Cadlolo, Rome, 00136, Italy. Contact: Rebecca Hancock, Global Technology Forum, 0. Phone: 0207 316 9307, Email: rebecca.hancock@incisivemedia.com, URL:http://atnd.it/27059-0,

17-19 November 2015, UOG 2015 Israel's 2nd Annual International Oil and Gas Conference at InterContinental David Tel Aviv Hotel, 12 Kaufman Street, Tel Aviv-Yafo, 61501, Israel. Contact: Cordelia, Evans, Universal Oil and Gas, 1st Floor, Eastcheap Court, 11 Philpot Lane, London, EC3M 8BA, United Kingdom. Phone: +44 (0)20 7332 6983, Email: cordelia.evans@universaloilgas.com, URL: http://atnd.it/22841-0,

17-18 November 2015, Water 2015 at Radisson Blu Portman Hotel, 22 Portman Square, London, W1H 7BG, United Kingdom. Contact: Becky Nye, Marketforce, 3 Sutton Lane, London, EC1M 5PU, United Kingdom. Phone: +4402077608699, Email: conferences@marketforce.eu.com, URL: http://atnd.it/28397-2,

17-20 November 2015, Well Integrity Management with Gordon Duncan at TBA, Brisbane, Australia. Contact: Susy, Angryany, PetroEDGE Asia, 88 Joo Chiat Rd, Singapore , 427382, Singapore. Phone: +65 6741 9927, Email: susy@asiaedge.net, URL: http://atnd.it/28773-0,

18-19 November 2015, Petrochemical Operations, Maintenance and Safety Conference and Exhibition at DoubleTree by Hilton Hotel Houston - Greenway Plaza, 6 Greenway Plaza East, Houston 77046, United States. Contact: Theo Larn-Jones, Petrochemical Update, USA. Phone: +44 207 422 43 22, Email:theo@petchemupdate.com, URL: http://atnd.it/36058-0,

19-20 November 2015, Platts Oil and Gas Acquisition and Divestiture Outlook at The Westin Galleria Houston, 5060 West Alabama Street, Houston, 77056, United States. Contact: Nate , Connors, Platts, 1111 Bagby Street, Suite 2200, Houston, 77002, USA. Phone: 857-383-5747, Email: nathaniel.connors@platts.com, URL: http://atnd.it/33274-0,

23-24 November 2015, 2nd annual Project Financing in Oil and Gas at Holiday Inn Regents Park, Carburton Street, London, W1W 5EE, United Kingdom. Contact: Julia Rotar, SMi Group, 47-51 Great Suffolk Street, 2nd Floor South, Harling House, London, SE1 0BS, United Kingdom. Phone: +4402078276088, Email: jrotar@smi-online.co.uk, URL: http://atnd.it/27341-0,

24-25 November 2015, Queensland Gas at Brisbane Convention & Exhibition Centre, Corner of Merivale St & Glenelg St, South Bank, 4101, Australia. Contact: Tony Richens, Reed Exhibitions Australia, Tower 2, 475 Victoria Ave, Chatswood, NSW, 2067, Australia. Phone: +61294222499, Email:tony.richens@reedexhibitions.com.au, URL: http://atnd.it/20585-0,

24-25 November 2015, Australian Utility Week 2015 at Luna Park Sydney, 1 Olympic Dr, Milsons Point NSW 2061, Australia, Sydney, 2061, Australia. Contact: Khairunnisa, Abdllah, Clarion Events, 78 Shenton Way, Singapore, 079120, Singapore. Phone: +6565903970, Email: Khairunnisa@clarionevents.asia, URL:http://atnd.it/30806-0,

24-25 November 2015, Argus European LPG Markets 2015 at Le Meridien Piccadilly, 21 Piccadilly, London, W1J 0BH, United Kingdom. Contact: Melissa Wong, Argus Media, 175 St John Street, London, EC1V 4LW, United Kingdom. Phone: +44 020 7780 4369, Email: melissa.wong@argusmedia.com, URL:http://atnd.it/30131-0,

2**4-25 November 2015, Australian Utility Week 2015 at Luna Park Sydney, 1 Olympic Dr, Milsons Point NSW 2061, Australia, Sydney, 2061, Australia.** Contact: Khairunnisa, Clarion Events, 0. Phone: +65 6590 3970, Email: Khairunnisa@clarionevents.asia, URL: http://atnd.it/30806-0,

24-26 November 2015, Intergas VII - Oil, Gas & Petrochemicals Conference & Exhibition at CICC Cairo, El Nasr Rd. Nasr City, Cairo Governorate, Cairo, Egypt. Contact: Susan Jaques, 0. Phone: +44 207 978 0096, Email: Intergas@thecwcgroup.com, URL: http://atnd.it/27210-0,

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