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INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS

IAEE Energy Forum

Third Quarter 2015 International Association for Energy Economics

President's Message

I first want to talk about some of the progress we have made on our strategic plan.

President-elect Gurkan Kumbaroglu has been doing an incredible job extending IAEE's reach into new countries in the Eurasia region and we will have an exciting new location – Baku Azerbaijan – to hold a conference in late 2016. We also are very hopeful that we will be able to start new affiliates in some of the countries in the Eurasia region.

IAEE has also partnered with two conferences in Singapore later this year and next year to build momentum for the Singapore International conference in 2017. For example, the IAEE is organizing a roundtable at SIEW on the future structure of energy markets in Asia. We also are very optimistic about re-invigorating the Singapore chapter of IAEE.

I would also like to mention three other upcoming conferences. First, we have the NorthAmerican Conference in Pittsburgh from October 25–28, which will be focusing on the Dynamic Energy Landscape – and given the events of this century, no-one can deny that our energy economy is undergoing massive transformations in how and where energy is produced and consumed, with consequent impacts on prices, trade, policy, employment, and the environment.

After Pittsburgh, the next conference is the 5th IAEE Asian Conference to be held in Perth, Australia from February 14–17, 2016. It will focus on Meeting Asia's Energy Challenges. A major part of the transformation of the global energy landscape since 2000 and into the next few decades will involve strong economic growth, and hence dramatic increases in energy demands, in the large population countries in Asia. Meeting these demands will have equally dramatic impacts on international trade in energy commodities, international relations and national security, environmental amenity and the need for massive investments in infrastructure. For those of you living in the northern hemisphere, you may also wish to observe that February in Australia is in the height of the swimming season and Perth has some fabulous beaches.

At another end of the world, so to speak, the next international IAEE Conference will be hosted in Bergen, Norway from 19–22 June, 2016. It will focus on the role of expectations and uncertainty in the energy industry and the challenges it presents for analysis, decisions and policy. The conference will highlight methods, analyses and results that take explicit account of uncertainty and expectations from an economic and decision-making perspective. Before or after the conference you can take some time out to tour the beautiful scenery of Norway sculpted by the massive forces of ice in the dramatically different climates of what was only only yesterday in geological terms.

The IAEE is also about much more than publications and conferences.

We have launched a Distinguished Lecture series with Ben Schlesinger, Gurkan Kumbaroglu, Georg Erdmann and Ron Ripple chosen as distinguished lecturers this year. If you are interested in having one of these people visit to provide a lecture to your group, please contact IAEE headquarters. So far, presentations have been given or arranged for Nigeria, Saudi Arabia, Azerbaijan, Germany and Pakistan.

The IAEE Summer School program has also gotten off to a good start with a course on electricity economics held in Istanbul after the IAEE 2015 international conference, and a week long course on energy economics that is going to be held in Harbin, China in August.

If your local affiliate would like to host a summer school, we have instigated a pro-

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Editor: David L. Williams

Call for Editor-in-Chief EEEP

The *Economics of Energy & Environmental Policy* (EEEP) invites applications for the position of Editor-in-Chief (EIC). A search committee has been appointed by the Vice President for Publications, who has the responsibility to nominate a candidate for the approval of the IAEE Council, to initiate the search for a distinguished individual.

The journal focuses on policy issues involving energy and environmental economics. EEEP is a peer-reviewed, multidisciplinary publication that provides a scholarly and research-based, yet easily readable and accessible source of information on contemporary economic thinking and analysis of energy and environmental policy issues. The publication encourages dialogue between business, government and academics and improves the knowledge base for energy and environmental policy formation and decision-making. EEEP produces original papers, policy notes, organized symposia on specific policy issues, feature articles, book reviews and commentaries on current energy and environmental policy issues and studies.

Candidates should bring along exceptional skills in energy and environmental economics and research, teamwork and communication. The EIC has the responsibility for nominating the Associate Editors, a Managing Editor and the Editorial Board, and for proposing future directions for the content of the journal. Candidates should have broad experience in peer-review and publication of scientific manuscripts as well as superior leadership and management skills. As a member of the scientific community, the Editor will also have strong interpersonal skills and the ability to bring/build a broad network of contacts, domestically and internationally. The EIC must be free of any political agenda or ideological slant related to energy. This search is effective immediately. The ideal starting point for the successful applicant is Sept 1, 2016. Applicants should compile the following as a single pdf document and send by email to anne.neumann@iaee.org:

- Cover letter
- CV (including record of peer-reviewed publication, editorial experience, and other prior involvement with professional journals).
- A short statement (max 1 page) about your leadership and management philosophy and experience.
- A short statement (max 1 page) describing your vision for the future of EEEP and how it should serve its readers.
- A sample of recently published peer-reviewed work

The deadline for applications is 5:00pm CET on September 30, 2015. We consider candidates without regard to race, sex, color, creed, religion, age, national origin or sexual orientation. Current compensation is $7,500 per published issue plus reimbursement of necessary travel costs.

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President's Message (continued from page 1)

cess similar to bidding for hosting a conference. You can get further details from IAEE headquarters.

We are also making changes to some of our administrative procedures in order to keep members engaged with the Association after they attend a conference or present a paper to be refereed at one of our journals. This year, we have introduced a Young Professional membership category in an attempt to keep student members involved with the IAEE after they graduate. Many delegates signed-up under the Young Professional registration category for the IAEE 2015 international conference in Antalya.

We have also started a program to keep past presidents of IAEE involved with the association after they retire by giving them reduced registration rates at conferences. You should take time to speak to some of these folks at our conferences. They will let you know that debates about energy policy are not as new as we might think, and that we have much to learn from them not only professionally but also in terms of how we can continue to advance the Association.

We are also extensively revising the IAEE web site since many of you – especially the younger folks who have grown up in the digital age – told us the web site was old-fashioned and out of date. However, the changes are not just superficial. Look for exciting new additions to the web site, and substantive improvements to existing features, in the near future.

We are also making small changes regarding our publications. We do not want to mess too much with a successful formula, but we think these modest changes will bring net benefits.

I could go on, but I think you get the idea. I just want to end by saying a few words about energy economics. I think the young people in our association have been wise to choose to specialize in this branch of applied economics. It is a very exciting time in the energy industry with so much technological and other change going on. However, it is not just the engineers who can get involved in this excitement about new technologies.

There is a very real need to have economists remind us all of costs versus benefits – that there are always two hands to economic analysis. Every choice comes at an opportunity cost. We also need economists to analyze the effects of different institutional arrangements on the choices that are made – incentives matter.

Economists also are essential to point out the important role of decentralized decision-making processes. Not all wisdom resides in the heads of a handful of policy makers – whether they are elected politicians or appointed public servants. Markets allowed and encouraged entrepreneurs like George Mitchell to experiment and find a way to exploit the natural gas, and later oil, that was long known to reside in the pores of very low permeability shale rocks. He was derided as wasting his time, but he persisted and eventually his effort paid off. Markets, and market access, were an extremely important enabling factor in his perfection of shale extraction technology.

Finally, let me emphasize that one of the truly great things about the IAEE is that it is an organization where theorists, econometricians, and students with bright new ideas, can interact with people working in the industry who can quickly remind the academics that at the end of the day, this is an applied discipline that has to come up with realistic implementable solutions.

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

We've gotten a good response to our question: *What Will be the Impact of the Drop in Oil Prices?* The synopses below will give you a good idea and you can read more later. And we'll continue the subject in the Fall issue. Before we get to those, however, we're please to, once again, have a summary of the 2015 edition of the *BP Statistical Review of World Energy*. Spencer Dale and Alexander Naumov have done a masterful job of explaining the energy supply and demand changes that took place in 2014.

Daniel Huppmann and David Livingston posit that the decline in crude oil prices heralds a new era of crude – Saudi Arabia passing the baton of swing producer to U.S. shale oil, a rebalancing of intra-OPEC dynamics, and a new role of oil driven by climate concerns rather than "fear of the peak".

Jim Krane and Mark Agerton note that unique characteristics of U.S. shale oil production have allowed it to assume part of the "swing supply" role rejected by OPEC in November. Emerging data show that falling oil prices appear to have brought about deep cutbacks in shale drilling and reduced volumes of new oil. Shale producers' ability to respond quickly to prices is a valuable asset in an industry characterized by volatile cycles of over-production and shortage.

Les Deman posits that with oil prices plummeting into the $40s earlier this year, many analysts were thinking about a replay of the 1980-2008 super cycle. Prices are now closer to $60/B and there is talk about a similarity to the 1990-1996 cycle. There is sufficient precedent to choose either one, but there is a case to be made that that this cycle will truly be different.

Thomas Tunstall notes that after the recent plunge in crude oil prices, forecasts for the industry now vary widely. An analysis of factors likely to influence price suggest that no rebound will occur in 2015.

Lavinia Rocha de Hollanda and Rafael da Costa Nogueira shed some light on the current effects, and possible developments, the recent oil price decline has had on the Brazilian economy, through micro and macroeconomic approaches.

Duccio Basosi and Riccardo Basosi discuss the possible consequences of the recent downfall in oil prices for the prospects of the transition towards a low-carbon economy. They conclude that, while the fall in oil prices is not necessarily good news for the prospects of the energy transition, political and cultural variables can counterbalance purely economic ones and play a bigger role than oil prices over both the intermediate and long term.

Alexandre Andlaurer argues that the second half of the year is apt to see another oil price decline: supply is everywhere, he says, and though demand is increasing it is not apt to match the supply side.

DLW

Get Your IAEE Logo Merchandise!

Want to show you are a member of IAEE? IAEE has several merchandise items that carry our logo. You'll find polo shirts and button down no-iron shirts for both men and women featuring the IAEE logo. The logo is also available on a baseball style cap, bumper sticker, ties, computer mouse pad, window cling and key chain. Visit http://www.iaee.org/en/inside/merch.aspx and view our new online store!

Joy Dunkerley

Joy Dunkerley, economist, and one of a handful of co-founders of the International Association for Energy Economics (IAEE), died peacefully at the Washington hospice on June 5, aged 82.

A longtime resident of Washington DC, Joy contributed to many aspects of the city, through her professional and charitable work, through her sponsorship of the arts and associations, and at a personal level in the many friends she made and helped in the District.

Joy was born in Paignton, Devon in England, although her seafaring family came from Tynemouth in the North East of England, where she spent her wartime childhood. As a young woman, Joy studied economics at the London School of Economics (an institution that she remained closely involved with throughout her life), before winning a Fulbright Scholarship to study in the US. Returning to London, she worked at the Economist, before moving to Paris, where she took a post at the OECD. She was married in Paris to Harold Dunkerley, also an economist, enjoying a partnership that lasted until his death in 1996.

The following years involved a succession of moves across the globe including time spent in Viet Nam, Colombia (where her children were born), Ghana and the UK. She arrived in Washington on the inauguration day of Richard Nixon in 1969.

Her more than 45 years in the city were fruitful ones. Working at the Brookings Institution and at Resources for The Future, Joy was at the forefront of the burgeoning field of Energy Economics, a branch of the discipline which acquired particular importance in the aftermath of the 1970's oil shocks. Her co-authored books (A Time to Choose, and How Industrial Societies Use Energy), as well as numerous articles and projects, helped influence energy policy both in the US and abroad, particularly in India.

Not simply a researcher and author, Joy was also a keen and talented organizer, helping to turn a fledging IAEE, from a local collection of experts, in academia, industry and government, into a respected international body with nearly 100 chapters world -wide and a membership of over 4000. She was a lead organizer of the first annual meeting of the IAEE in 1979, was elected one of its first Presidents, and was instrumental to building the IAEE's activities in the UK, its first international chapter.

Although it looks simple in retrospect, it was extremely difficult to work out the protocols and institutional relationships to support a far-flung institution that attempted to be much more than an academic association. Its objective was to actively involve experts in industry and government as well, so it could become an institution that could affect government energy policies worldwide. By 1985, 6 years after its founding, the IAEE had become successful, and much of this was due to Joy's extraordinary organizational skills and intelligence.

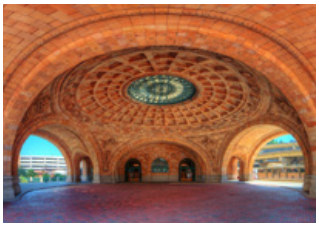
She received the Adelman-Frankel Award from the IAEE, its top honor, for her unique and innovating contributions to the field of Energy Economics in 2000. In her later years she worked for the Office of Technology Assessment (OTA), and authored a comprehensive study on the future of Nuclear Energy for the Atlantic Council. In retirement, she continued to do research in other fields, publishing On Eagle's Wings, a definitive English language history of the pioneering aviation company Aeropostale, as well as her autobiography.

Outside her professional work, Joy threw herself into the life of the city, working on Walter Fauntroy's election campaign for mayor, providing meals for the homeless through her church, and actively supporting a range of cultural groups, including the Opera Lafayette, and numerous local theatre companies. One of the first women members of the Cosmos Club, she spent many years in various organizing roles helping to promote and develop the Club.

Always elegant, of cheerful disposition, and quick to welcome and entertain, she continued to develop an eclectic group of friends, welcoming newcomers to the District right up to a week before her death. A tennis player of great quality, she retained a deadly drop shot into her 80s.

Joy is survived by her sons Mark and Guy, her stepdaughter Madeleine, her stepdaughters-in-law Marilia and Ildiko, and five grandchildren.

CONFERENCE OVERVIEW




Massive transformations in how and where energy is produced and consumed are drastically changing our energy economy. This dynamic energy landscape is challenging government and industry decision makers to formulate a clear path forward. Policy and investment decisions need to balance the use of natural resources with impacts on the environment and local economies. One answer is to stimulate innovative technologies to enable access to increasing supplies of energy as well as more efficient consumption. But doing this requires appropriate policies, incentives and mandates, something that challenges even the most well informed policy makers.

The conference will bring together business, government, academic and other professionals to explore these themes through a series of plenary, concurrent, and poster sessions. Speakers will address current issues and offer ideas for improved technical, commercial, and policies covering all facets of energy development and use. 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 the region's dynamic energy landscape.

The 2015 conference will be held in Pittsburgh, Pennsylvania, one of the main centers of American energy. The region around Pittsburgh contains a rich history of energy, with the discovery of the Coal Hill seam in 1762, the commercialization of the Drake Oil Well in 1859, and the formation of Westinghouse Electric Company in 1886. Today, the Pittsburgh area is a U.S. leader in energy development. The region is ranked 25th for the number of employees in energy-related industries. Among other things, it is the center of one of the most active natural gas plays in North America, the Marcellus Shale, and is the locus of the first U.S. nuclear power plants being built in over 30 years. Over the past three decades, Pittsburgh has had a remarkable environmental evolution and has been repeatedly named one of America's most livable cities. The Pittsburgh region is fortunate to support a diverse mix of energy activities including nuclear, coal, natural gas, and renewables. The region is home to a host of energy businesses, research facilities, industry groups, and world-class colleges and universities, many of which have active energy centered policy and academic programs. Finally, more than $1 billion per year in government-funded research flows through the region's academic, corporate and government energy research centers, assuring that new ideas and new technologies constantly emerge.

TOPICS TO BE ADDRESSED INCLUDE:

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 at: www.usaee.org/usaee2015/topics.html

- Energy Demand and Economic Growth
- Energy Supply and Economic Growth
- Financial and Energy Markets
- Energy and the Environment
- Non-fossil Fuel Energy: Renewables & Nuclear
- International Energy Markets
- Energy Efficiency and Storage
- Energy Research and Development
- Political Economy
- 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.

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33RD USAEE/IAEE NORTH AMERICAN CONFERENCE SESSIONS & SPEAKERS



Visit our conference website at:
www.usaee.org/usaee2015/

PLENARY SESSIONS

The 33rd USAEE/IAEE North American Conference will attract noteworthy energy professionals who will address a wide variety of energy topics. Plenary sessions will include the following:

- The Dynamic Energy Landscape: Natural Gas in the U.S.
- Renewable Energy Integration
- Water at the Well-site: Production, Handling and Disposal
- Industrial Resurgence
- Future of Coal
- Climate
- Electricity Markets
- Geopolitics
- Energy Infrastructure
- Energy Finance & Risk Management

SPEAKERS INCLUDE

Farid Abolfathi
Senior Director, IHS Risk Center, Member IHS Forecast Steering Committee and International Forecast Council

Jared Anderson
Editor, *Breaking Energy*

Jay Apt
Professor Tepper School of Business and Engineering and Public Policy, Carnegie Mellon University

Peter C Balash
Senior Economist, U.S. Department of Energy

Grace M Bochenek
Director, National Energy Technology Laboratory U.S. Department of Energy

Terry Boss
Senior Vice President of Environment, Safety and Operations, Interstate Natural Gas Association of America

Rusty Braziel
President, RBN Energy

Guy Caruso
Senior Advisor, Energy and National Security Program, CSIS

Kathleen B Cooper
Senior Fellow and Professor of the Practice of Economic Policy, Southern Methodist University

Mario S DePillis
Senior Consultant, ET Analytics

Tom Duesterberg
Program Director, Executive Director, Manufacturing and Society in the 21st Century, Aspen Institute

John Dumas
Director of Wholesale Market Operations, ERCOT

Jerald J Fletcher
Professor and Director Natural Resource Analysis Center, West Virginia University

William Furlow
Senior Manager Business Development, Society of Petroleum Engineers

Howard Haas
Chief Economist, Monitoring Analytics

Maria Hanley
Technical Project Monitor, DOE-NETL

Jamie Heller
President, Hellerworx Inc

David A Hounshell
David M. Roderick Professor of Technology and Social Change, Carnegie Mellon University

Amy M Jaffe
Executive Director of Energy and Sustainability, University of California, Davis

David H Knapp
Managing Director - Energy Intelligence Research Division, Energy Intelligence Group

Vello Kuuskraa
President and Chairman, Advanced Resources International, Inc.

Julian Lamy
Research Assistant, Carnegie Mellon University

Meagan Mauter
Assistant Professor, Chemical Engineering, and Engineering and Public Policy, Carnegie Mellon University

Kenneth B Medlock
Senior Director of the Center for Energy Studies (CES), James A. Baker III and Susan G. Baker Fellow in Energy Resource Economics, Baker Institute, Rice University

Martha Gilchrist Moore
Senior Director, Policy Analysis and Economics, American Chemistry Council

Edward Morse
Managing Director, Citigroup

M Granger Morgan
Lord Chair Professor of Engineering, Department of Engineering and Public Policy, Carnegie Mellon University

Christopher Nichols
Senior Analyst, DOE-NETL Office of Strategic Energy Analysis and Planning (SEAP), U.S. Department of Energy

Eliza Northrop
Research Analyst II for the International Climate Action Initiative, World Resources Institute

Jonathan Pershing
Principal Deputy Director, Department of Energy, Energy Policy and Systems Analysis

Benjamin Schlesinger
President, Benjamin Schlesinger & Associates LLC

Michael Sell
Senior Vice President, ERP Program Manager, Global Association of Risk Professionals (GARP)

James Spencer
President & CEO, EverPower

David J Spigelmyer
President, Marcellus Shale Coalition

Ingmar Sterzing
Director, Asset Management, LS Power

Glen Swindle
Managing Partner, Scoville Risk Partners

Tina Vital
Energy Investment Analyst

John Walsh
Director of Consulting Services, CETCO Energy Services

Steve Winberg
Program Manager, Global Laboratory Operations, Battelle Global Laboratory Operations

James F Wood
Director of the Advanced Coal Technology, US-China Clean Energy Research Center, West Virginia University

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CAEE AMEE

Energy in 2014 – After a Calm Comes the Storm

By Spencer Dale and Alexander Naumov*

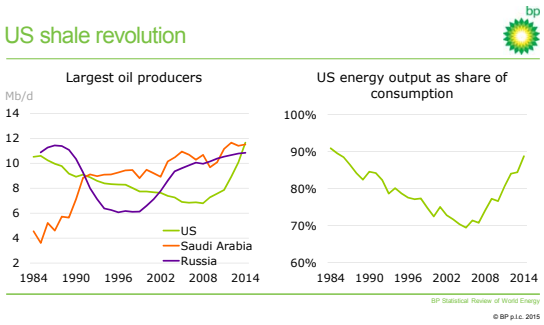
Introduction

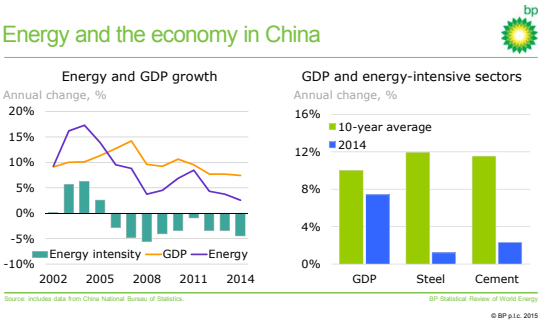
For several years global energy markets have been characterized by what can be described as eerily calm conditions. The turbulent and unsettled events of last year provided a stark reminder that, in energy, after a calm comes the storm: uncertainty and volatility are the norm rather than the exception. The global energy system is huge and moves only slowly, but it does move. In 2014, it moved in earnest driven by some of the longer term forces which are likely to shape the energy landscape over coming years. This paper reviews developments in global energy markets in 2014 based on the 2015 edition of BP Statistical Review of World Energy.

As ever, there were many factors, specific to particular markets and fuels, that contributed to the energy story of 2014. But there were also several broader, more encompassing forces, acting across fuels and geographical borders. Three factors in particular were instrumental in shaping movements in global energy markets in 2014: the ongoing shale revolution in the U.S.; structural economic transition in China, and the continued focus on climate and environmental issues. Consider these three factors in turn, starting with the U.S. shale.

In recent years the U.S. shale industry has gone from strength to strength profoundly changing the global energy supply picture. At its height last year, more than 1800 rigs were operating in the major U.S. oil and gas plays, drilling around 40,000 new wells. Capital spending in the shale industry is estimated to have reached around $120 billion in 2014, more than double its value 5 years earlier. The increase in productivity is even more striking, with productivity in tight oil plays increasing 7-fold since 2007.

As the result, U.S. oil production rose by 1.6 Mb/d in 2014, by far the largest growth in the world, and the first time any country has increased its production by more than 1 Mb/d for three consecutive years. The level of U.S. oil production in 2014 exceeded the previous peak set in 1970 – peak oil indeed! And perhaps most significant of all, the U.S. passed both Saudi Arabia and Russia to become the worlds' largest oil producer for the first time since 1975. U.S. shale gas also continued to grow strongly, with U.S. production accounting for nearly 80% of the total increase in global gas supplies in 2014. The revised data in this year's Review, suggest that the U.S. overtook Russia in 2013 to be the world's largest producer of oil and gas combined.





We are truly witnessing a changing in the world order of energy suppliers.

The implications of the shale revolution for the U.S. are profound. U.S. net imports of oil in 2014 were less than half their 2005 peak levels. The U.S. is no longer the world's largest oil importer; China now holds that dubious honour.

In 2007, just prior to the financial crisis, the U.S. was running a current account deficit of 5% of GDP – a key part of the so-called global imbalances that underpinned the financial crisis. Importantly, U.S. energy imports accounted for almost half of that deficit. Just seven years later, in 2014, U.S. energy imports comprised just 1% of GDP, and U.S. production accounted for almost 90% of its energy needs – a level not reached since the mid-80s. And as we discuss below, the impact of the U.S. shale revolution spread far beyond its national borders.

The second factor shaping global energy markets last year were developments in China, driven by the faster pace of its structural economic adjustment. Chinese GDP growth slowed to 7.4% in 2014, significantly weaker than the double-digit growth rates in the first 10 years or so of this century. This slowing was accompanied by a continuing shift in the pattern of growth, with real estate investment and parts of industrial production decelerating sharply. As a consequence, growth in some of China's most energy-intensive sectors such as steel and cement – sectors which had thrived during China's rapid industrialization – virtually collapsed in 2014, while more service-orientated parts of the economy came to the fore.

This changing pattern of economic growth caused the growth of China's energy consumption to slow sharply to just 2.6% in 2014, less than half its average

* Spencer Dale is Chief Economist at BP p.l.c.; Alexander Naumov is a Global Oil Markets Economist with the firm. The Statistical Review data and a more detailed analysis can be found at www.bp.com/statisticalreview

over the past 10 years (6.6%) and the weakest rate of growth since the late 90s. Although the slowdown in China's energy growth is striking, the implied reduction in energy intensity – i.e., the reduction in the average amount of energy needed to produce each unit of GDP – was not particularly exceptional relative to that seen over the past 20 years or so. What was extraordinary – and is perhaps the single most striking data point in this year's Statistical Review – was that this slowing in the growth of China's energy demand caused China's coal consumption to essentially stall in 2014. Given that China accounts for over 50% of world's coal demand, developments in China had profound impact on global coal markets and carbon emissions as we shall see shortly.

Even though this restructuring of the Chinese economy is likely to continue, it is likely that the improvement in energy efficiency may not persist at the very rapid pace seen in 2014. Those exceptionally low levels of growth reached in the energy-intensive sectors are perhaps unlikely to be sustained, pointing to the possibility of some bounce-back in energy demand. More generally, we might expect to see the rate of decline in China's energy intensity to taper off gradually as it converges to the levels of more developed economies.

The third over-arching factor acting across the global energy landscape in 2014 was the continuing focus on climate and environmental issues. Climate concerns were an obvious focus last year as global leaders and campaigners mapped their course to Paris at the end of this year. Considerable attention was also placed on broader environmental concerns, with a number of significant regulatory announcements, including in both the U.S. and China. These policy initiatives, together with changing societal preferences and technological improvements had an important bearing on the fuel mix and the role of non-fossil fuels.

Renewables accounted for almost a third of the total increase in primary energy in 2014, and an even greater proportion of power generation growth. The share of non-fossil fuels in primary energy consumption reached an all-time high of almost 14%. Due to a combination of slower energy demand and the shift in the fuel mix, global carbon emissions from energy use have risen by just 0.5% last year, the slowest rate of growth for over 15 years, excluding the global recession of 2009.

The best place to start tracing how did these different forces – the strength of U.S. shale, the rebalancing of China's economy, and the continued focus on climate and environmental concerns – play out across the global energy markets, is by looking at key features in last year's data.

Key Features of 2014

The big overriding picture of 2014 was one of surprisingly weak growth in energy demand, coupled with greater resilience in energy production growth and a consequent softening in energy prices. Growth of primary energy consumption slowed to just 0.9% last year, which, absent the financial crisis, is the slowest growth of energy demand since the late 90s. As in much of the past decade, all of the increase in demand was from emerging economies, with energy consumption in the OECD continuing to fall.

Consumption grew more slowly than recent averages in all regions except North America (0.9%) and Africa (2.8%), with a notable fall in EU demand (-3.9%). The sharp deceleration in energy demand occurred despite the global economy expanding (3.3%) at a similar rate to 2013. Instead, the slowdown in energy demand reflected a further fall in energy intensity (-2.3%). A significant part of that reduction can be traced to one-off weather-related impacts, particularly in the EU. But over and above that, was the impact from the rebalancing of the Chinese economy.

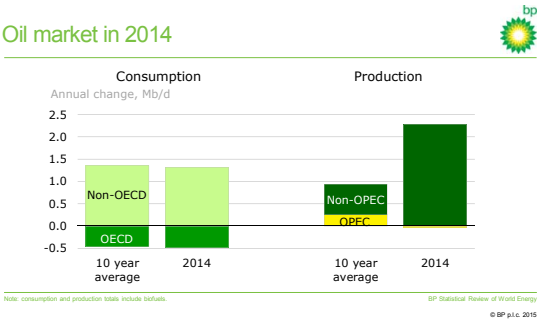
Energy production grew by 1.4% in 2014, similar to 2013, but weaker than its 10-year average (2.2%). This relative stability in aggregate supply growth masked significant differences across fuels: with a sharp acceleration in oil supply offset by the first decline in coal production since the Asian financial crisis in 1998. Although developing economies accounted for all of the increase in energy demand, supply growth was dominated by the OECD, which accounted for over 80% of the increase in supply. Over the past 10 years or so, the OECD has enjoyed a significant improvement in its energy balance with a corresponding deterioration in the non-OECD balance.

To uncover the stories underpinning those developments we need to delve deeper yet by looking at the individual fuels.

Fuel by Fuel

Oil

Oil was at the epicentre of the 2014 energy storm, as a number of the over-arching forces came together. The data for 2014 as a whole make clear that the sharp fall in oil prices was a supply story. The increase in oil consumption in 2014 was very close to its recent historical average. There was nothing exceptional about demand growth in 2014. In contrast, supply growth last year was almost off the charts, with global production increasing by over 2 Mb/d, more than double its 10-year average.



On the demand side, oil consumption grew by 0.8 Mb/d, entirely driven by increase in non-OECD demand (1.3 Mb/d), led by China (390 Kb/d). As in 2013, the gains in Chinese oil demand were driven by gasoline consumption, supported by the increasing purchasing power of Chinese households. In contrast, growth in the demand for fuels which are more exposed to the rebalancing away from heavy industry and infrastructure, such as diesel, remained very weak by historical standards. OECD oil consumption fell by almost 500 Kb/d in 2014, in line with its 10-year average, with slightly larger than usual declines in Japan (-220 Kb/d) and Europe (-200 Kb/d), offset by growth in the U.S. (70 Kb/d) where lower pump prices stimulated transport demand in the second half of the year.

The supply strength was driven by non-OPEC production, which increased by 2.1 Mb/d in 2014 – the largest increase on record. U.S. production set the pace, but Canada (315 Kb/d) and Brazil (232 Kb/d) also enjoyed record increases in production, with output in both countries reaching record highs. In contrast, OPEC production was broadly unchanged (36.6 Mb/d). The share of production across OPEC members continued to be affected by supply disruptions in the wake of the Arab Spring. Relative to production levels at the end of 2010, total supply disruptions to both OPEC and non-OPEC production increased a little to close to 3 Mb/d, with those disruptions concentrated in Libya (1.3 Mb/d) and Iran (860 Kb/d).

The exceptional growth in non-OPEC supply far exceeded incremental supply disruptions which, together with a softening in the growth of oil consumption relative to 2013, led to a growing supply imbalance and a consequent build-up of inventories. OECD commercial inventories built steadily in 2014 and recent data showed stocks hitting a record high in May, with U.S. commercial crude stocks at their highest levels since 1930.

As the supply imbalance widened and stocks accumulated, prices began to fall. Dated Brent peaked in the second half of June and Brent forward markets, which had generally been backwardated since early 2011, moved into contango in July. The possibility that OPEC may respond to the growing abundance of supply by reducing its production targets probably provided some support to prices through the summer and autumn, with dated Brent drifting down to around $80 by the time of the OPEC meeting in late November. But the decision by OPEC to maintain its production levels and protect its market share broke the markets' back: prices fell sharply, with dated Brent ending the year at around $55 and reaching a daily low of $45 in mid-January. Dated Brent averaged $99 in 2014 – the first time it has averaged less than $100 since 2010.

One key message to draw from these events is that, even in the oil market, prices work! The high levels of innovation and investment driving the record supply gains which underpin the current surplus were set in motion by a decade of high oil prices. And likewise, the market now appears to be responding to the prompt of lower oil prices. Data so far this year point to a strengthening of demand growth and the number of U.S. oil rigs has more than halved since its peak in October last year.

Refining

The exceptional strength of crude supplies spurred a notable increase in refinery runs, which were up over 1 Mb/d in 2014, more than double their 10-year average. Refinery runs were stronger than the increase in product demand as refineries were incentivised to increase product stocks and so reduce pressure on crude storage. U.S. refineries led the way, with throughputs increasing by over half a million barrels a day – the largest annual increase since the mid-80s – driven by the strength of U.S. supplies and the consequent discounting of U.S. crude prices.

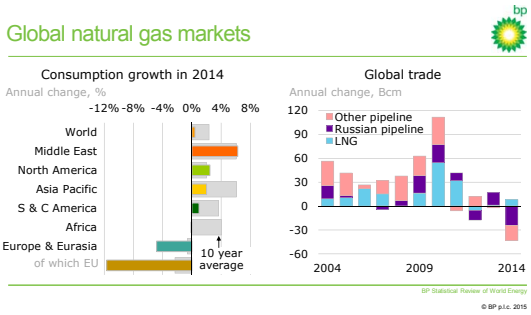
This lengthening in refining runs was broadly matched by the expansion in refining capacity: even with material reductions in the OECD, capacity still increased by 1.3 Mb/d. This growth in capacity was driven by new refineries in China (790 Kb/d) and the Middle East (740 Kb/d), causing spare capacity to edge higher to almost 7 Mb/d above its level in 2005, when we think the global utilization rate was close to its effective maximum. Much of that spare capacity was concentrated in China and the Middle East, which have undertaken significant investments in refining capacity in recent years. Global refinery utilization remained at 79.6%, its lowest level for almost 30 years.

Natural Gas

The main story on natural gas was one of exceptionally weak demand. Global gas consumption grew by just 0.4% (12 Bcm) in 2014, which, with the exception of the financial crisis, is the weakest rate of

growth for almost 20 years. In contrast, growth in global gas production (1.6%, 52 Bcm) was relatively robust, causing gas prices across the globe to decline through the course of the year. This general weakening in gas prices also coincided with a further narrowing of the differential between regional gas prices, reflecting the increasing integration of global gas markets.

The weakness in global gas demand in 2014 was driven in large part by EU demand, which fell by almost 12% (-51 Bcm), the largest decline in EU demand on record and causing gas consumption in Europe to fall back to levels not seen since the mid-90s. A large part of this weakness stemmed from the exceptionally mild winter with the heating degree days in Europe at one of their lowest levels on record. Gas consumption in Asia Pacific was also relatively subdued, with growth slowing to 2.0% (13 Bcm) in 2014, significantly weaker than its 10-year average (6%). The main exception to this story of global gas weakness was, predictably, the U.S., where ample supplies of domestic gas supported consumption, which grew by almost 3% in 2014.



U.S. gas production increased by over 6% (39 Bcm), almost double its 10-year average and accounting for almost 80% of the increase in global gas production. All of that growth was due to increases in shale gas, which grew by over 13%, with the vast majority of that growth stemming from Marcellus and Utica shale. Gas production in the EU fell by almost 10% (-14 Bcm) in 2014, taking production to its lowest level since the early 1970s. The vast majority of that fall (13 Bcm) was accounted for by the decision by the Dutch government to cap output from the main Groningen field reflecting concerns about possible earthquakes.

Global gas trade fell last year marking only the second decline on record. The weakness was driven by over 6% decline in pipeline trade, the largest decline since our trade data began in 1989. Despite the reduction in European gas output, an even bigger fall in demand meant that gas imports to the EU declined sharply, with pipeline imports from Russia and elsewhere falling by almost 9%, their largest decline on record. The weakness in pipeline gas trade was further compounded by the dispute between Russia and Ukraine, which resulted in Russia's gas exports to Ukraine being turned off between June and December last year. Indeed, lower exports to EU and Ukraine, caused Russia's gas production to fall by over 4% (26 Bcm). The decline in pipeline gas trade was partially offset by an increase in global LNG supplies, which after a pause of two years, increased by 8 Bcm in 2014, with much of that expansion coming from Papa New Guinea.

Coal

For many years, the fortunes of coal have been inextricably linked to China. That was true as China industrialised rapidly, causing coal to be the fastest growing fossil fuel over the first 10 years or so of this century. And it was equally true in 2014 as Chinese demand braked sharply and coal became the slowest growing fossil fuel. Global coal consumption grew by just 0.4% (15 Mtoe), its slowest rate since the Asian crisis in 1998, whilst global production fell (-0.7%, -28 Mtoe). Coal prices responded to this weakening in the coal market, with 2014 prices falling to their lowest level in 5 years.

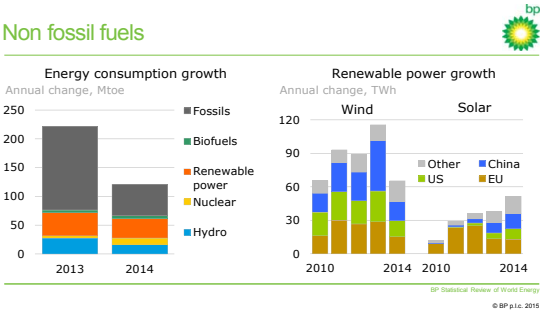
China's coal consumption grew by just 0.1% (1 Mtoe) in 2014, compared with 2% in 2013 and an average of almost 6% over the past 10 years. Chinese coal production was even weaker, falling by 2.6% (-49 Mtoe). About two-thirds of the slowdown in China's coal consumption can be explained by the general weakness in China's energy demand. Over and above that, coal lost out relative to other fuels, being disproportionately exposed to heavy industrial sectors most severely affected by the economic rebalancing.

Outside of China, India provided the main source of strength for the global coal market, where both consumption (11.1%, 36 Mtoe) and production (6.4%, 15 Mtoe) grew strongly and posted the largest increments to the global demand and supply of coal. The vast majority of the increased demand for coal in India came from the power sector, enabling total power generation in India to increase by almost 10% in 2014, its strongest rate of increase since 1989. In that context, it's worth remembering that India has one of the largest numbers of people without access to electricity. In a similar vein, Africa (2%) also increased its consumption of coal in 2014. For those most-affected regions, coal can play an important role in improving the accessibility and availability of energy, which is essential for the well-being of their citizens and for the strength of their economies.

Non-Fossil Fuels

Despite a backdrop of slowing energy demand and weak growth in fossil fuels, non-fossil fuels continued to grow robustly, increasing by 3.7% in 2014, comfortably above their 10-year average (3.2%).

The relative resilience of non-fossil fuels meant that they provided a bigger contribution (67 Mtoe) to global energy growth than fossil fuels (55 Mtoe) for the first time for over 20 years, other than when the world economy has been in recession. This is despite the fact that non-fossil fuels accounted for less than 15% of total primary energy. Part of the explanation lies in the fact that year-to-year growth of non-fossil fuels is relatively insensitive to changes in demand conditions, with fossil fuels in effect acting as the swing energy source in response to the energy demand slowdown in 2014.

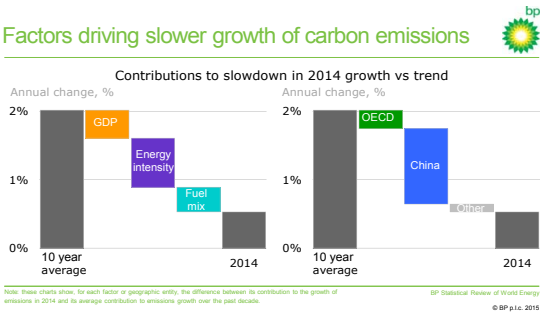


Global hydro (2.0%, 17 Mtoe) and nuclear (1.8%, 10 Mtoe) power generation both grew in 2014, driven by policy, capacity growth and by weather in the case of hydro. Renewable energy grew by (12%, 34 Mtoe) in 2014, a little below its 10-year average (15.3%). This slowing was driven by wind (10.2%, 15 Mtoe), which grew at less than half its 10-year rate (23.5%), in part reflecting less public policy support in the EU and U.S.. Solar power, which is far less advanced in its development cycle, continued to grow at a breakneck speed (38.2%, 12 Mtoe). However, growth in renewables slowed far less sharply than that for overall energy demand, such that the growth in renewables (including biofuels) accounted for almost a third of the total increase in primary energy in 2014, and more than 40% of the increase in power generation.

Carbon Emissions

The slower growth of energy demand, together with the shift in the fuel mix, had important implications for the growth of carbon emissions. Global carbon emissions from energy use grew by just 0.5% (187 $MtCO_2$) in 2014 marking the slowest rate of growth for over 15 years, other than in the immediate aftermath of the financial crisis. This compares with the average annual growth rate over the past 10 years of 2.0%.

Decomposing the emissions growth into its underlying drivers shows that around a quarter of the slower rate of carbon emissions in 2014 relative to its 10-year average can be attributed to weaker GDP growth: global GDP grew by 3.3% in 2014, compared with a 10-year average of 3.7%. The most important driver – accounting for around half of the slower rate of emissions – was the faster rate of improvement in energy intensity. This largely reflects the changing structure of the Chinese economy, together with last year's unusually mild European winter causing the one-off fall in heating demand. The remainder of the slower growth reflects the greater than average reduction in carbon intensity associated with the changing fuel mix in 2014, particularly the slowdown in coal and the greater contribution of non-fossil fuels. In terms of the contributions of different geographical regions, the vast majority of the slowdown in carbon emissions can be attributed to China, reflecting both the sharp slowdown in consumption growth and the shift in the fuel mix away from coal.



The question is whether these developments in China are likely to persist – potentially signalling the beginning of a lower trend in emissions growth – or whether they are likely to reverse in the near future. There are good reasons for thinking that some of the slowdown in the growth of China's carbon emissions was part of the broader structural rebalancing of the economy that is taking place and is likely to continue. But the extent of the slowdown in 2014 probably also reflected a number of one-off and erratic factors that are unlikely to be repeated and may even get partially reversed.

Conclusions

Following the earlier calm, more normal stormy conditions returned to the world of energy last year. In years to come, it is possible that 2014 may come to be seen as something of a watershed for the energy industry. Not so much because of the near-term volatility associated with the sharp fall in oil prices and the various adjustments that triggered. That volatility is more a return to business as usual. But rather because some of the longer-term trends which are likely to have a huge bearing on the shape of the energy sector over coming years, came to the fore.

The heights scaled by the US shale revolution, sparking a new world order of energy supplies. The rebalancing of the Chinese economy and the implications this has for global energy demand and the fuel mix. And the increasing focus on climate and environmental issues as we all try to tackle the twin challenges of using energy efficiently and sustainably, whilst ensuring it is available and affordable to those that need it most.

Stumbling to a New Equ'oil'ibrium: Understanding the Current Upheaval in the Global Crude Oil Market

By Daniel Huppmann and David Livingston*

The precipitous decline in crude oil prices over the past year has sparked a renewed discussion around the drivers of the oil market and the role of OPEC (Huppmann and Holz, 2015; The Economist, 2014). The decision by OPEC ministers in November 2014 not to reduce their quota (OPEC, 2014) can be interpreted in multiple ways: was OPEC deliberately driving out U.S. shale oil producers by depressing the price? Or were OPEC members instead overtaken by market forces beyond their control?

The Economics of Oil – A Crudely Dismal Science?

The tools with which analysts have availed themselves in considering such questions are many, but all are incomplete. Only a select few in Riyadh, and perhaps Vienna, can answer with some degree of certainty which reasoning the oil ministers were following. The rest are left to, at worse, simply fit events to the contours of their respective world views, tilting at speculative windmills. At best, oil market watchers can seek to distinguish between different market structures and identify strategic behaviour using econometrics and empirical methods.

Smith (2005) illustrates that most observable patterns of suppliers reacting to shocks are in fact consistent with multiple alternative theories of market structure: cartel, oligopoly, and perfect competition; this makes econometric tests ambiguous at best. Numerical simulations based on bottom-up assessments (e.g., Huppmann and Holz, 2012) also only offer indications of the underlying fundamentals and the market structure. Furthermore, identifying whether changes in supply are driven by available capacity, fluctuations in demand, changes in expectations, or strategic considerations by individual players is virtually impossible due to the lack of readily available and reliable data. "Cheating" by individual OPEC members (i.e., oversupplying their quota) further adds to the opaqueness of the market, just as OPEC's reliance on using stated reserves as the basis of quota calculations created an incentive for each member to overstate its reserves, obscuring an accurate picture of the cartel's true economically recoverable volumes.

As a consequence, academics and policy analysts trying to make sense of current events in the crude oil markets are left with anecdotal evidence, stylized theoretical considerations, and a great deal of guesswork and speculation. Conventional wisdom holds that OPEC exerts market power via two channels: a long-term under-investment in production capacity, which creates a permanent scarcity; and, at the same time, a short-term withholding of available production capacity, whereby OPEC members and Saudi Arabia in particular use their swing producer role to dominate the market. The spare capacity held by Saudi Arabia also serves as an important deterrent to substantial investment by fringe suppliers, as a decision by the Kingdom to open its taps could quickly undermine the profitability of any new or planned project on the upper end of the cost curve.

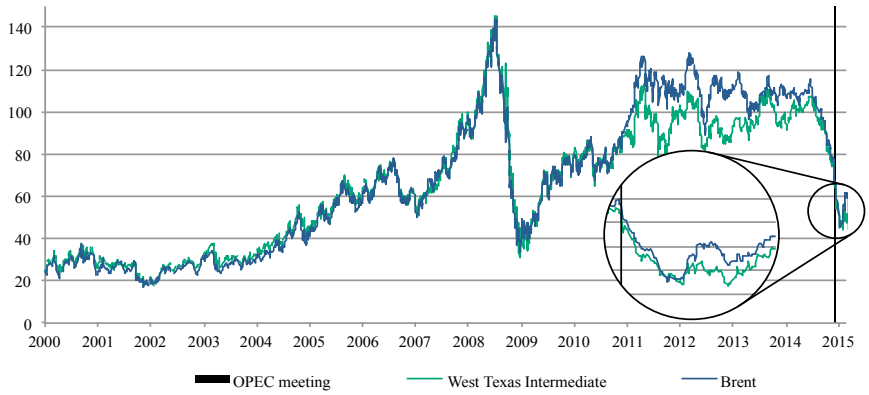


Figure 1: Daily crude oil price until May 4, 2015, West Texas Intermediate (WTI) and Brent, in nominal USD/bbl; the OPEC meeting on Nov 27, 2014, is marked for illustration.

Source: EIA, http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm, accessed May 11, 2015.

Is Saudi Arabia Losing its Swing?

We believe that this duality of short- and long-term market power exertion is not quite valid any more: By 2018, Saudi Arabia's refining capacity will have increased by almost 60 percent, to 5.7 million barrels per day (mmb/d) from 3.3 mmb/d in 2013 (Saudi Aramco, 2013). This build-up of domestic refining capacity addresses a number of sectoral and societal challenges: a desire to mus-

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cle its way up the global petroleum value chain in order to appropriate a larger share of the rents; increased competition from Canada and others to supply the strategic U.S. Gulf Coast refining market with heavy and medium sour crude; and a broad desire to catalyse further domestic industrial development and job creation (Livingston, 2015).

The push also portends a shifting role for Saudi Arabia in global oil markets, as the Kingdom relinquishes its status as the world's swing producer. The country's crude oil consumption has been rising by six percent per annum, driven by growing petrol and diesel demand as well as increased electricity generation from crude oil. Comparatively rare elsewhere in the world, crude-burning power plants continue to be built in Saudi Arabia. More than 60 percent of Saudi Arabia's power generation in 2013 came from crude oil or crude-derived products (diesel or heavy fuel oil). Total domestic crude burnt for power generation accounts for 0.8 mmb/d at present, and is on track to reach 1 mmb/d within five years (Krane, 2015). In addition, approximately 1.4 mmb/d of crude production that was available for export prior to 2013 will be needed to feed new domestic refineries that have come online or will be completed in the next several years.

Taken together, these factors point to Saudi Arabia's crude oil export capacity possibly declining to less than 5 mmb/d by 2020, despite the country recently registering record production capacity of 10.3 mmb/d (OPEC, 2015). This would also portend the elimination of the country's spare capacity, a key feature of the market that has been called upon in recent years to help balance supply and demand when prices suddenly spiked.

Even if Saudi Arabia wishes to maintain flexibility in its export volumes in pursuit of continued influence within OPEC and the broader market, this will be complicated by the growing role of foreign players in its refining sector. Saudi Aramco's 2014 refining capacity plans are shared among three refineries. These include the 0.4 mmb/d "Satorp" joint venture with Total in Jubail and the 0.4 mmb/d "Yasref" joint venture with Sinopec at Yanbu, coming fully online through 2015, as well as a 0.4 mmb/d wholly-owned refinery at Jazan scheduled for completion in 2018. These are in addition to joint ventures with Sumitomo Chemical, ExxonMobil, and Shell at existing refineries (EIA, 2014). To the degree that joint venture partners seek to maximize profits and throughput at these refineries, it will impinge upon Riyadh's scope to ramp up and down production swiftly, as the swing producer has been expected to do in the past (or at least prior to the November 2014 OPEC meeting).

A Gulf Apart

Concurrently, the shifting fortunes of other key producers previously relegated to the sidelines threatens to dramatically re-shape intra-OPEC dynamics. The IEA estimates Iran's total production capacity at 3.6 mmb/d and, largely as the result of Western sanctions tied to the dispute over the country's nuclear program, spare capacity is estimated at around 0.76 mmb/d (IEA, 2015). While new production capacity could take some time to materialize and the long-term damage done by previous shut-ins is not completely known, the vast majority of this spare capacity (0.65 – 0.7 mmb/d) could be ready to enter the market within six months of any nuclear deal and subsequent lifting of sanctions.

Moreover, the country is believed to hold approximately 30 million barrels of oil in floating storage, enough to sustain an additional export level of approximately 0.18 mmb/d over a six-month period. It is not inconceivable that Iran, along with Iraq – the second largest producer within OPEC despite ISIS-instigated violence and an ongoing dispute with the Kurdish government – could together exceed Saudi Arabia's production capacity by 2020. As OPEC grows increasingly multipolar, with various players pursuing different price targets and strategies based upon their particular fiscal situation, the trajectory of the cartel towards the end of this decade becomes more uncertain.

How to Interpret the Price Precipice?

To return to the question posed at the outset, what was the driving force behind OPEC's failure to cut supply in November 2014? Was it a demonstration of strength meant to humble U.S. unconventional production, or a tacit recognition that shale is the new swing supplier in the market?

There is a third interpretation between these two extremes, and one which likely maps more closely to the pragmatic nature of Saudi-led OPEC: the primary strategy is one of triggering industry consolidation, as well as eliciting valuable information, from the drop in oil prices. There has been substantial speculation regarding the price level required for U.S. shale producers to operate at a profit and continue investing at a rate sufficient to stay on the "treadmill" of production growth amidst exponential decline curves in shale wells. Anecdotal evidence initially suggested prices around 80 USD per barrel were necessary for shale oil producers, but more recent information suggests that the break-even price has already

decreased considerably due to further technological progress, reduction in input costs, and movement of rigs away from marginal zones to focus on more productive zones, both within and among individual shale plays (Wood Mackenzie, 2015).

Nevertheless, rig counts have begun to fall in the U.S. shale patch, and the financial sustainability of small shale players, pressured by credit rating downgrades and shrinking oil-price linked revolving credit facilities, will likely be under continued scrutiny over the course of 2015 (Livingston, 2014a). From the middle of 2015 onwards, the global market will have a clearer indication of OPEC's commitment to the current strategy following the June 2015 meeting, along with a sense of the true impact upon shale production as previous hedges booked by shale companies when prices where higher begin to expire.

Should OPEC hold firm, all of the anticipated results – from consolidation in the shale industry, to further information on the response of non-OPEC producers to various price levels, to the liquidity and price stability in the oil market introduced by growing global crude oil stores – in one way or another benefit Saudi Arabia. The country is sacrificing higher profits by allowing prices to dip, but it is also reasserting – in an increasingly visible way – its dominance in the market even as its spare capacity slips away.

There is another possible contributor to the price decline that has not received enough attention in public discussion: the potential presence of multiple market equilibria. These are mostly ignored in standard economics, but can occur if the aggregate demand function is convex (Wirl, 2008), or if the supply functions of individual suppliers are not monotonically increasing. The latter effect can be rationalized in the form of "backward-bending supply curves" due to target revenue behaviour by individual suppliers (Alhajji and Huettner, 2000). According to this model of supplier behaviour, a small country can only reasonably re-invest a certain level of oil revenue. As a consequence, these suppliers do not seek to maximize profits – instead, they cut back production when prices are high and expand production when prices are low. This is not in line with textbook economics, but may make sense for small countries fearing Dutch-disease style repercussions or large swings of their budgets.

Given that crude oil demand is very inelastic in the short run, even a few countries slightly expanding their production in response to the shale oil glut last summer may have exacerbated the price-depressing effects; after a while, other suppliers such as Russia and Venezuela, highly dependent on oil revenues to finance their state budgets, followed suit, even when they are aware that this would put further downward pressure on prices.

Following this logic, the recent price decline can be interpreted as a switch from a high-price equilibrium to a low-price equilibrium. Absent an effective mechanism to coordinate and enforce production cuts or an unanticipated shock to rattle markets, this new equilibrium may prove surprisingly durable. For example, even if many shale oil suppliers cease operations in this low-price environment, the technology, the expertise and the infrastructure is in place to quickly ramp up production should prices creep upwards again. Added to this are growing volumes of crude oil storage, in addition to shale oil wells that are being drilled but not completed, that together act as a sort of growing, implicit "spare capacity" on the part of the United States. These factors will likely combine to mitigate price spikes, if not general volatility, over the near to medium future.

The Prospects for Oil in a Climate-conscious World

There is no scarcity of crude oil over the coming years – indeed, quite the opposite. For a 2°C warming target to be realistic, about a third of crude oil reserves will have to remain in the ground (McGlade and Ekins, 2015). Rather than the "peak oil" phenomenon that drove both public perception and public policy over the past several decades, the challenge going forward will be one of deliberating over how to reconcile reserves with global climate targets. A paradigm shift regarding the role of oil in the global economy has been the subject of growing discussion following the notion of a "carbon budget" introduced by climate scientists and energy analysts in the academic community (e.g., McKinnon, 2015).

Importantly, the growth in unconventional crude oil including tar sands and pre-salt reservoirs has meant that the lifecycle climate impacts of oil products are becoming more varied, depending on physical characteristics, processes employed, and the slate of products ultimately produced (Gordon et al., 2015). This is in sharp contrast to the very stylized representation of the emissions from fossil fuel combustion currently used in large-scale Integrated Assessment Models (IAM), and highlights the need to integrate these insights into global economy-energy-environment-climate models.

While there are clearly choices to be made between different global oils on the basis of climate considerations, policymakers and the market have thus far treated petroleum as a single homogenous commodity. This, however, is quickly beginning to change. The government Sweden recently submitted

formal inquiries to Canada within the UN climate negotiation process, asking for further details on its plans for managing the GHG emissions associated with the Alberta oil sands, and how the latter's growth would be reconciled with Canada's economy-wide climate targets (Government of Sweden, 2015). Elsewhere, California and the European Union have begun to implement emission intensity standards that, though recently watered down, provide a foundation for creating a market differentiation between crude oil products (and other fuels) of varying lifecycle GHG emissions (Livingston, 2014b).

Finally, powerful institutional investors and shareholder groups are beginning to put new pressure on publicly-traded oil companies to disclose more information on the GHG intensity of their fossil fuel portfolios and their general approaches to climate risk. Both BP and Shell have recently been subject to successful shareholder resolutions along these lines, and have – significantly – officially endorsed the resolutions in a move that heralds a new era of engagement on these issues.

Saudi Arabia, along with many of the Gulf OPEC members, likely possesses some of the least GHG-intensive oils worldwide given the ease with which they are extracted. This would bode well for these producers in a future where climate regulations distinguish between various crudes, creating premiums for high performers and penalties for laggards. It implies fascinating possible future directions for Saudi strategy, along with that of many other producers at various positions along the GHG spectrum. However, this scenario remains far too uncertain and speculative to be anything but a distant consideration, if that, in corporate boardrooms and government ministries.

For now, whether by force or by choice, the cartel is moving to capture market share on the back of falling prices, without the help of any regulation, divestment, or other climate consideration. The latter will only add, over time, to the complexity of an already-confounding market. So too, will the possible new swing producer role of U.S. tight oil supplies, not to mention the prospect of an OPEC with growing market share but deteriorating internal cohesion. It is tempting to seek iron-clad certitude in the oil market's structure and direction, but never has this been more dangerous. The market is like the sand in the Saudi desert: the less tightly we seek to grip it, the more parts of it we can hold at once.

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OPEC Imposes 'Swing Producer' Role upon U.S. Shale: Evidence and Implications

By Jim Krane and Mark Agerton*

Introduction

When OPEC declared in November that it would not cut production to boost oil prices, shock waves cascaded across the global oil sector. Oil prices had been dropping since June 2014, and OPEC's announcement propelled prices lower. By December, oil prices were half of what they had been in June. Now, emerging data show that those shock waves also disrupted the booming growth in the U.S. shale oil sector.

Starting in January, U.S. shale producers reacted to the new price environment by idling rigs and reducing the number of wells drilled. Those actions, in turn, reduced the amount of new oil brought to market. The cutbacks accelerated through February and March.

Taken together, it appears that market signals produced a collective "swing" response from shale producers that is helping to balance global markets, but via a new and untested channel. Since the 1970s, most of the market-reactive cuts in crude oil production have been orchestrated by the OPEC cartel.

Shale's unique characteristics are now allowing it to assume a swing role. These include a cost structure that differs from the front-loaded investment required by conventional oil and gas production. Shale allows short lead times and smaller initial investment, along with lower barriers to entry and exit. Since shale wells are characterized by steep production decline curves, companies invest in real time, drilling and producing when prices warrant. When prices are too low to support drilling, production is restricted by the natural limits of fluid flows within low-porosity rock. Shale oil production withers without constant investment.

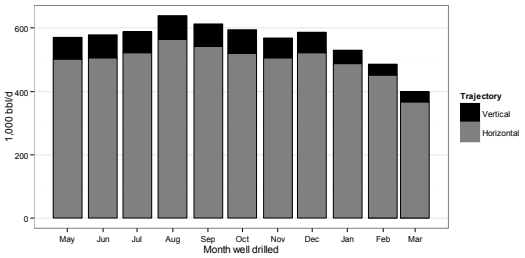
This process heralds a new dynamic in the oil sector, one in which the short-run U.S. supply response to price fluctuations is much more elastic. Past experience has shown that price corrections have largely been unable to affect conventional oil production, given the long investment lead times and the much shallower production decline curves. Conventional projects, whether onshore or offshore, tend to produce oil for years or decades, compared to shale wells, where flows typically drop off within a few months.

During times when conventional oil production overshot demand, markets would continue to be oversupplied until an intervening body like OPEC – or in prior decades, the Texas Railroad Commission – stepped in to reduce quotas.

To date, there has been little quantitative evidence of a non-OPEC supply response to the collapse in oil prices. Anecdotal reports have described declining investment, job cuts, and a 60% drop in the number of onshore drilling rigs in operation. The U.S. Energy Information Administration (EIA) forecasts that onshore U.S. production will shift into decline in the current quarter.[1]

Missing from these reports are figures detailing numbers of wells drilled, whether levels of new oil production had declined, and, if so, which basins bore the brunt of those declines.

We present emerging data from the Austin-based analytics firm Drillinginfo to reveal an industry in retrenchment. The data show firms setting aside drilling plans in less-productive zones and focusing efforts on their most productive acreage and highest efficiency extraction techniques. The following sections illustrate the magnitude of shale's short-term price response.



Source: Drillinginfo; Scaled to compensate for number of days in month.

Figure 1: New national oil production by well trajectory

National Results

Across the continental United States, data from Drillinginfo show a 30% decline in estimated new oil production brought onstream in a given month, from about 580,000 barrels per day (bbl/d) in May 2014 to just over 400,000 bbl/d in March 2015. Although new production fluctuates between May and December, Figure 1 shows the steep drop in new production that starts to take hold after December, after falling oil prices became a concern. Monthly production growth slipped by 10% in January, 17% in February and by another 9% in March.

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See footnotes at end of text.

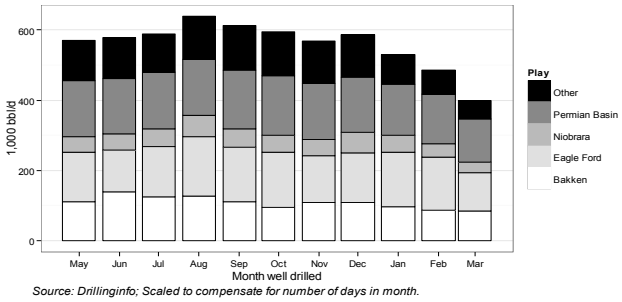
It bears emphasizing that the slowdown in growth, where it applies, does not mean that overall U.S. oil production has decreased. It means that production growth is occurring at a decreasing rate.

New oil-directed well starts showed greater declines, dropping by 48%, from 1,851 in May 2014 to under 971 in March. Drilling dropped by the largest amount, 23%, in January, as oil prices reached new lows below $50/bbl. As the new price environment held roughly constant, monthly drilling dropped again by 9% in February and 19% in March.

Nationwide, drilling cutbacks affected vertical wells more than the horizontal wells typically drilled in hydraulic fracturing in shale plays. Overall a total of 658 horizontal wells were drilled in March 2015, representing a 35% drop from May 2014. Just 313 vertical wells were drilled in March, down 63% from May.

Play-by-Play

Among major oil-rich shale plays, the reactions to OPEC's late November decision appeared first in the Permian Basin of West Texas and the Bakken formation in North Dakota. New production in January was down 8% from December in the Permian and 11% in the Bakken. (In the smaller Niobrara play in Colorado, new production in January was 17% below that of December.) By contrast, the falling price of oil did not appear to affect production in South Texas' Eagle Ford formation. There, new production rose by 9% in January over the previous month.



Source: Drillinginfo; Scaled to compensate for number of days in month.

Figure 2: New national oil production by play

By March 2015, however, falling global oil prices had undermined activity in all three major oil shale plays – the Permian, Bakken and Eagle Ford – by nearly equal amounts. Each play saw predicted new production drop by 24% below levels in May 2014.

Other signs of a slowdown are evident in the falling rig count, as well as rising average well productivity. Data from Baker Hughes shows the number of land-based U.S. drilling rigs nearly halving from 1,594 in early May 2014 to 696 one year later.

At the same time, productivity of horizontal, oil-directed wells was up 11%, from an average of 456 bbl/d per well in May 2014 to 515 bbl/d in March 2015. Rising well productivity conforms to expectations that firms would shift away from low-producing wells in non-core areas and concentrate on drilling horizontal wells in their most productive acreage.

Methodology

The Drillinginfo index tracks new onshore wells that have been drilled across most of the lower 48 U.S. states since May 2014. The index predicts peak monthly production from each new well by averaging actual results from neighboring wells. The index thus provides a short-term indicator of drilling activity and probable output at precise locations.

It is worth emphasizing that the Drillinginfo production index estimates *maximum monthly new oil production* that is likely to flow from a given well drilled in a given month. This "new production" is a fraction of overall U.S. oil production. Thus, even if the index showed zero new production for March, production could still rise, as wells drilled earlier in the year came online. Given the recent spate of drilling of wells that have gone uncompleted, data for most recent months may actually overestimate production.

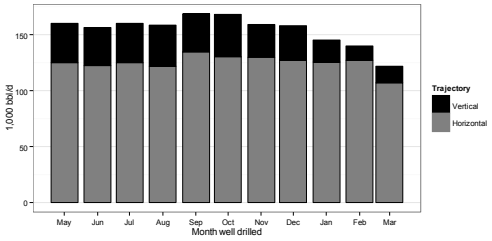
Our second data source, the standard Baker Hughes rig count, details the number of drilling rigs (oil and gas, horizontal and vertical) operating in each U.S. county in a given week. The rig count comprises the industry's main indicator of activity, despite offering no indication of number of wells drilled or expected production.

Permian Basin

Among the major U.S. oil formations, the earliest fall-off in drilling appears to have occurred in the Permian Basin. After a strong October, a steep 65% reduction in vertical drilling took place, from 364 oil wells drilled in October to 129 in March 2015. Many of these vertical wells are in the eastern Permian's Midland Basin where production involves enhanced oil recovery using vertical "infill" wells in mature fields. Infill drilling, like that of shale, allows producers to cut activity when prices dictate.

Horizontal drilling in the Permian remained relatively constant until January, when it, too, began to decline. By March 2015, horizontal drilling was down by 32% from its peak in December 2014.

As mentioned, production in the Permian was an early casualty of the OPEC decision, down 24% overall between May 2014 and March. However, estimates of new production from vertical wells dropped by a much larger 54%, with horizontally drilled wells down by just 17% over the same period.

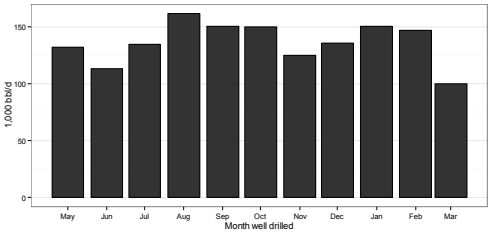


Source: Drillinginfo; Scaled to compensate for number of days in month.

Figure 3: New oil production from Permian basin by well trajectory

Eagle Ford Formation

The Eagle Ford shale of South Texas was initially advantaged by proximity to transport infrastructure and Gulf Coast refineries. Drillinginfo data show that predicted new oil production actually increased in December and January, when other regions were beginning to pare back. However, as low prices persisted, drilling and new production fell dramatically. From February to March, drilling in the Eagle Ford dropped by 33%, from 250 wells to 167 wells. New oil production dropped by 28%.



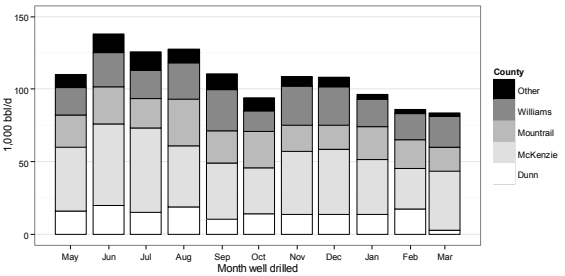
Source: Drillinginfo; Scaled to compensate for number of days in month.

Figure 4: New oil production from Eagle Ford Shale

The Bakken Formation

The story in North Dakota's Bakken Formation also reveals a steady downward trend. Measured from last June, when Bakken drilling and new production reached a recent peak, March saw 45% fewer wells spudded and a nearly 40% reduction in new oil. The fall-off between January and February was particularly steep.

The North Dakota Department of Mineral Resources' mid-April report supports these findings, describing an atmosphere of continuing decreases in rig numbers and well completions. Due to the high cost of shipping oil to market from North Dakota, crude prices at the wellhead hovered near $30/bbl, at a time when West Texas Intermediate was selling above $55 in Cushing, Okla. The rig count dropped nearly 60% in less than four months between January and April. "Oil price is by far the biggest driver behind the slowdown," the report states. "Operators report postponing completion work to avoid high initial oil production at very low prices …"[2]

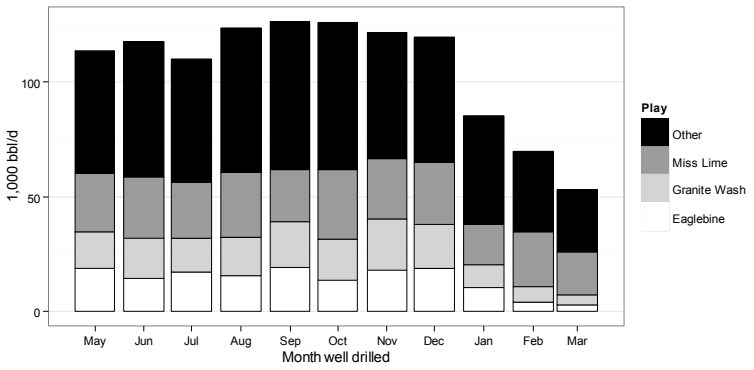


Source: Drillinginfo; Scaled to compensate for number of days in month.

Figure 5: New oil production in Bakken Formation by county

Other Areas of Onshore Oil Production

Decreases in oil production and drilling frequency are also in evidence in some smaller and lesser-known tight oil plays, as well as areas that lie outside the geographical boundaries of the major shale formations. Four areas in particular underwent sharp declines in both new wells drilled and new oil production, Drillinginfo data show. Those were the Eaglebine formation in East Texas, the Mississippian Lime formation in Kansas and Oklahoma, the Granite Wash in Oklahoma and Texas, and areas denoted on Figure 6 by "other," which include locations outside of defined formations. Breakeven costs in these areas tend to be higher than those in major plays. Combined, these four areas saw new oil production drop by 24% between May 2014 and March 2015, with a pronounced 56% drop from 120,000 bbl/d in December to just under 53,000 bbl/d in March.



Source: Drillinginfo; Scaled to compensate for number of days in month.

Figure 6: New oil production from minor plays

Slipping new production coincides with a declining well count. The number of oil-directed wells drilled in these four areas shrank from 641 in May to 248 in March.

Discussion

Beyond the statistics above, there are solid economic and geologic reasons why North American light tight oil (LTO) is well suited to become a global source of "swing supply," as well as strong rationale

why decreases in production might lag expectations. LTO is relatively high-cost in comparison to most conventional oil production. Standard economic theory predicts that when prices decline, high-cost suppliers should be the first to halt production as price dips below cost.

Reality is more complex. As mentioned, shale oil production has attributes that allow it to respond in a more elastic manner than conventional projects, which involve years of planning and big initial capital expenditures. Once costs are sunk, conventional production tends to proceed, not least because big startup investments may be accompanied by large shutdown costs, such as in offshore production. In these cases, financial models typically require years of steady production regardless of short-term price volatility. In similar fashion, unconventional oil sands production in Canada, typically more expensive than LTO on a per-barrel basis, is also less responsive to price fluctuations once investments are sunk.

But a number of countervailing factors have also supported LTO production despite lower prices. Costs of oilfield services and land have come down as producers drill fewer wells, allowing some producers to stay in business. Firms have also hedged production or sold volumes forward, which insulates them against current prices and requires that they keep drilling. Likewise, some firms remain at work because they have already paid crews or find it costly to cancel contracts.

Finally, wells drilled in different regions of a formation produce different quantities of oil. Wells in "sweet spots" might remain profitable in a price environment that does not support production elsewhere. Put another way, falling prices have driven up average well productivity.

Conclusion

The U.S. shale sector has been an early responder to the low oil price environment that has characterized markets since November. Few other producers have responded in similar fashion. Of those which have cut, only the slowdown in Canada's shale basins appeared related to falling prices.[3]

Although the actual changes in output are modest, the implications are not. The swing producer role held by Saudi Arabia since the mid-1970s appears to be in flux. At times when the Saudis decline to adjust production in line with market signals, that role may revert to higher-cost areas of production, including North American shale.

In contrast to the production quotas orchestrated by OPEC – and in an earlier era, by the Texas Railroad Commission – the ongoing response is being driven by independent actions of firms responding to price signals. In the case of shale, unique characteristics allow this to happen. These include relatively high costs, short lead times for investment, steep production decline curves, and requirements for continuous investment and drilling to maintain output.

U.S. shale will probably be unable, by itself, to assume the mantle of global swing supplier. For one thing, American crude tends to serve domestic markets; producers are currently prohibited by law from exporting U.S. crude oil. For another, falling costs have allowed firms to reach profitability at lower prices. The CEO of one shale producer announced in May that steady oil prices of $65/bbl would allow his firm to resume production in Texas and North Dakota.[4]

The price-responsiveness of shale may even help reduce the duration of the current oil bust. By contrast, the last oil downturn extended for nearly two decades, between the mid-1980s and early 2000s. It was exacerbated by the onset of huge projects in Alaska, the North Sea, and the Gulf of Mexico that could not respond to falling oil prices.

Shale's low barriers to entry, which allowed small companies and investors to quickly move into the oil business, appear to be complemented by low barriers to exit, which allow them to move away when prices reverse. If OPEC and Saudi Arabia shift away from their swing producer roles, the nimble characteristics of U.S. shale producers appear ready to provide global markets with alternate and useful source of spare capacity.

Footnotes

[1] Short-Term Energy Outlook, U.S. Department of Energy, May 12, 2015; http://www.eia.gov/forecasts/steo/report/us_oil.cfm

[2] Director's Cut, April 14, 2015. North Dakota Department of Mineral Resources; https://www.dmr.nd.gov/oilgas/directorscut/directorscut-2015-04-14.pdf

[3] International Energy Agency Oil Market Report, Apr. 15, 2015. https://www.iea.org/oilmarketreport/omrpublic/currentreport/

[4] Bradley Olson. "Shale Giants See Growth Again After 40% Price Climb." Bloomberg News. May 5, 2015. http://www.bloomberg.com/news/articles/2015-05-05/eog-resources-will-resume-major-oil-growth-at-stable-65-price

Fifty Shades of Black

Summary of the Annual Discussions of the Windsor Energy Group
6-8 March 2015, Windsor Castle

The 13th annual WEG meeting at Windsor Castle addressed the global challenges facing energy companies and governments at a time of low oil prices and growing political uncertainty.

Key Factors Affecting Energy Prices

- This international expert gathering indicated that, with a large surplus of energy, high stock-levels and weak demand, energy prices may well stay depressed for at least three years. This projection would of course be invalidated by any major interruption in the supply of internationally traded oil, gas or coal.
- Upstream investment, shale projects and low-carbon energy projects are being shelved as a consequence.
- Governments from energy-producing countries face difficult choices as their energy revenues fall. Many governments have budgets based on $100 per barrel. As a consequence, some countries are ill-prepared to face new and growing political, economic and social uncertainties.
- Equally, among the OECD governments, many are finding the cost of low-carbon subsidies and rising underpinning of alternative energy too expensive.
- The coming year will see financial uncertainty as shale exposure in junk bonds comes apparent. These loss-making contracts are said to amount to 20 per cent of U.S. junk bonds. U.S. shale producers in the U.S. have continued producing at a loss in the hope of consolidation.
- The wildcat nature of U.S. shale combined with improvements in extraction means that U.S. shale production will respond quickly to any sudden upward movements in oil prices.
- The immediate outlook is therefore for a big increase in global energy debt, large budget deficits by many governments reliant on energy revenue and some major restructuring of the energy industry as consolidation takes place.

The Big Picture--Energy Demand and Future Cost

Within much of the OECD world, low growth, confused markets and energy paradoxes have tended to erode confidence in future economic prosperity. Yet non-OECD countries now account for 58% of global primary energy demand. A continued increase in their global share, barring severe global depression or major interruptions to supply, worldwide, is more or less assured while oil prices remain well below $80. Nonetheless the recent steep fall in non-OECD oil import costs is likely to release budgetary and private sector funds to accelerate economic activity and thereby increase their imports of oil, coal and gas. Unexpected boosts to supply have also already produced much new economic activity in the U.S., re-ignited exploration planning in Australia and produced rising coal imports in Germany.

Few participants expect current market conditions to persist for more than five years. As the industry draws in its horns and global investment in new sources of energy supply begins to dry up, there will be intense pressure on Saudi Arabia. Supported by other OPEC members and many non-OPEC exporters and much of the international oil industry, the Saudis may well be tempted to reverse their current policies that are aimed at retaining market share at the cost of coping with severe cuts in export revenue. Another major oil price explosion within this period is therefore beginning to look increasingly possible.

Oil and Energy Wars--The Quick and the Dead

The collapse of oil prices is already bringing major change in how global energy markets operate. Gas contracts linked to oil prices are being re-written. High-cost and high-risk upstream projects are being shelved. Rig-counts have shrunk; rig rates slashed; energy jobs are shrinking; more political turmoil has emerged in many regions; new risks of piracy and a new fear of other military interference on the main supply-routes; cyber-hacking – major companies have found that hackers can pose a real threat. Out of this confused reaction to the oil price fall, the most puzzling is the Russian response.

The Russian Factor

Russia has issued barely veiled threats to curtail exports of gas and oil to any state that steps too far out of line in failing to comply with the Kremlin's directions. Russia's leaders seem to believe that the collapse of the oil price was part of a deliberate conspiracy to undermine, weaken and ultimately secure

the collapse of the Russian economy. Given a different reading of the situation, this may be no more than part and parcel of international diplomatic exchanges, although both sides seem to be increasingly aware of the dangers of escalating local conflagrations and the (still remote) risks of blundering blindly into World War Three.

An About Turn on Climate Change

Within the last five years the pendulum of scientific opinion has swung back to pointing out the dire consequences of increased pollution of the atmosphere. Between 1990 to 2035 greenhouse gases, notably carbon dioxide trapped in the atmosphere, are now expected to double. The consequences are likely to be catastrophic – most notably within 35 to 50 years - a possible breaking down of the Gulf Stream and a disruption of the monsoons, each having severe and chaotic impacts on global agriculture, food supply, access to fresh water and heavy damage to agriculture and fisheries. Meanwhile, the principal remedies of Carbon Capture and Storage remain at the prototype stage and still very far from profitable commercial exploitation worldwide.

Turmoil in the Middle East

Detailed reports by our "front-line" WEG specialists focussed on Iraq, Syria, Saudi Arabia and Libya. The latest news of atrocity, hardship and misery for refugee and displaced minorities is particularly grim. A special session devoted to ISIS assumed a continued spread of terrorist attacks both within the Middle East and elsewhere.

The Sunnis led by Saudi Arabia have come under pressure and challenge not only from Iran but also their own Shia communities. Although ISIS has long-standing and deep anti-Western roots it enjoys popularity among many younger Moslem expatriate groupings worldwide. These may prove very difficult to control by tighter supervision of the internet.

In our Windsor Consultations, the optimists suggested that, in the light of past experience, it might take about ten years before ISIS could be infiltrated and broken down. The pessimists pointed to the high level of unemployment of Moslem youth in Western states and the acute frustration and disappointment that this has engendered.

By creating their so-called "caliphate", ISIS has also provided a new threat to the Arab monarchies. ISIS believes that a successful confrontation with Western forces in Syria could complete a prophecy leading to ultimate triumph for Shia over Sunni Islam. There is, however, little will in the West to become embroiled on the ground in Syria.

Ukraine, Crimea, Caucasus and Central Asia

A strong case was made for the legitimacy of Russia in attempting to protect its military assets in Crimea and to reassert its influence on the states of the Former Soviet Union. Within this energy sector, many of Russia's ties and trading systems are still intact. Relations, however, have been strained by aspirations of several states to construct new gas and oil lines to supply oil and gas direct to Europe and China in overt competition with the new Russian oil and gas export pipelines. Meanwhile the central Asian states are struggling to cope with high levels of unemployment, high inflation, increasing social tension, political in-fighting and rising internal terrorism. Meanwhile Russian overtures to Iran seem to be delivering a clutch of new nuclear and energy supply contracts and the future possibility of wider political alignment with China based on a joint energy accord.

Power Games in Asia

All the South East Asia states have become watchful of increasing Chinese challenges in the South China Sea. Almost all can see no end to their thirst for imported oil, gas and coal. North Korea's claims that its new nuclear missiles can reach California has rattled the dovecotes. The discussion concluded that South East Asia was slipping into angry rivalry and self-generated nationalism. In global terms, the move in China for population restraint to be relaxed from one to two children per family could result in a doubling of the Chinese population within less than 50 years. This will bring enormous pressures on the Chinese government that already struggles to cope with its existing population and increased demand for imported energy and minerals. Severe air pollution is affecting the economy and the Chinese are pursuing tougher measures on emissions as a practical necessity. China is a reluctant dragon facing a perfect storm.

U.S. Energy Policy

President Obama's green agenda, now assisted by the fuel substitution of gas for coal, was dissected

in detail. Credit was given for the tougher efficiency standards for cars and trucks, for the closure of old coal-fired power plants and for not interfering with the speed of the new shale developments. Ironically U.S. coal is now being exported to Europe adding to the EU's carbon footprint. Cheap shale exports are not however likely to become a reality and if exports do take place they will head to the Pacific Rim.

Other Sessions

Other separate sessions were devoted to:

- The new threats of cyber warfare. Both upstream and downsteam energy operations are at risk of cyber-attack. Aramco has already suffered a serious attack. Companies and governments are therefore working on countermeasures.
- The growing role of Turkey as regional energy arbiter offering an energy corridor. Internal energy demand remains strong and Turkey is therefore going ahead with a Russian-built nuclear power station.
- Science and new technology has an important role to play. Already shale drilling is much faster and effective. The golden grail is to find affordable carbon capture and storage. Even more important is new end-use technology indicating a doubling of energy end-use efficiency within 20 years.
- The Baltic states remain heavily dependent on Russian gas, although a new floating LNG platform in Lithuania offers regional diversity of supply from Norwegian feedstock.
- The Multinationals – "the survival of the fittest". As energy debt grows there is expected to be a growth in merger and acquisition as the energy sector contracts.
- Lean times for governments in energy-producing countries as they milk ever thinner cash-cows. Several governments face growing deficits and potential instability where subsidies have to be withdrawn or cut.
- A Nuclear Re-think–China, India and the Middle East are committed to large-scale nuclear power. However smaller nuclear plants are now offering greater flexibility, lower capital costs and improved efficiency.
- Brazil remains committed to its major offshore developments although Petrobras is in turmoil, leaving the company with the biggest corporate debt in the world. Venezuela is undergoing a major crisis with the economy in a mess. Trinidad with major gas potential may become the Qatar of the Caribbean, if not of the Americas.
- Australia has a number of high cost gas projects under development. Ambitious plans for more energy production are being shelved at present due to low energy prices.
- The Arctic is experiencing record amounts of shipping and continues to attract companies and governments interested in the region's vast energy reserves.
- Lord Deben, who chairs the UK independent committee on climate change, described how green energy would continue to grow as economies of scale came to bear.
- The swamping of EU economic, energy and environmental priorities caused by the German and Swedish decisions to phase out nuclear energy and by the German decisions to import large volumes of U.S. coal.

Ian Walker/Paul Tempest

Participants in the discussions included:

***London Ambassador*s: A**lgeria, Bahrain, Cameroon, Hungary, India, Japan, Jordan, Kazakhstan, Kuwait, Latvia, Poland, Qatar, Russia, Turkey.
***Lead Speakers/Chairs*:** Lord Howell, HE Khaled Al-Duwaisan, Lord Deben, James Clad, Lady Judge, Spencer Dale, Dr Herman Franssen, Prof Bill Arnold.
***Major Companies*:** Aegis, BP, Bosphorous, Chevron, Christal, Dow, Elion, Exxon-Mobil, Hitachi, Jogmec, Petrofac, Shell, Worley Parsons.

The 5th International Association for Energy Economics Asian Conference will discuss solutions to meeting continuing enormous growth in Asian energy demand over the next few decades.

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 and issues to be discussed include:

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
- International lending agencies as financiers of energy infrastructure
- Promoting free trade and efficiency in national and international energy markets
- Eliminating energy subsidies

Learn more at
business.uwa.edu.au/iaee-2016

Perth, Western Australia

Perth is the world's ninth most liveable city, located in a booming economy and the same time zone as large parts of Asia.

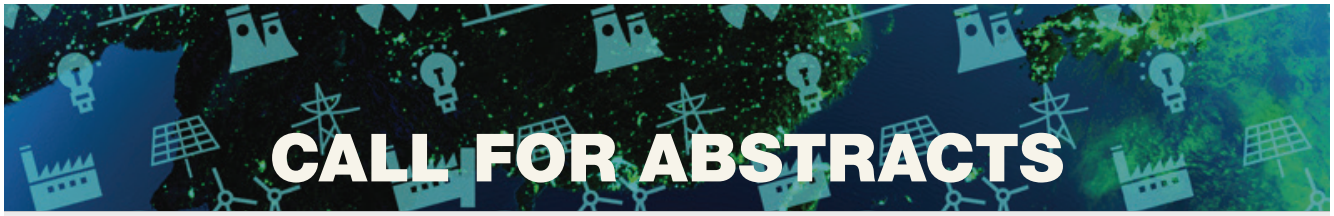
Perth is the capital of Western Australia, connecting Australia to Asia and the Indian Ocean rim. Home to around two million people, Perth enjoys a sunny Mediterranean climate and is only a short distance from the renowned vineyards of the Swan Valley, the white sands of the Indian Ocean, and stunning landscapes of the Goldfields. During February, Perth will be experiencing its iconic Summer weather.

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.

Conference host

THE UNIVERSITY OF WESTERN AUSTRALIA



Concurrent sessions

There are two categories of concurrent sessions: 1) **Academic research** on energy economics, 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 IAEE or elsewhere.

Those interested in organising a concurrent session should propose a topic and possible speakers to Liam Wagner, Concurrent Session Chair (l.wagner@griffith.edu.au). Please note that all speakers in organised concurrent sessions must pay speaker registration fees and submit abstracts.

Note: 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 (see **business.uwa.edu.au/iaee-2016**).

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)

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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 28 October 2015 of the status of their presentation or poster. Authors whose abstracts are accepted will have until 11 December 2015 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.

Key dates

- Abstract submission deadline: 9 September 2015
- Student Best Paper Competition deadline: 16 October 2015
- Submission deadline for full paper for inclusion on Conference website: 11 December 2015
- Early registration deadline: 11 December 2015

Best Student Paper

IAEE is pleased to announce its 2016 Perth Conference Best Student Paper Award Program. A top prize of US$1000 will be given for the best paper in energy economics. Three runner-up prizes of US$500 each will also be given. All four winners will receive a waiver of registration fees to the Conference and will be notified by 16 November 2015.

Student Poster Session

A poster session, featuring up to 20 poster presentations relevant to the conference theme, will be presented during the lunch period on Monday 15 February. The posters will be located in the foyer of the Business School where conference participants will be able to freely move around and talk with the authors of the various posters. Authors who wish to submit a poster must clearly mark their submitted abstract as an abstract for the poster session and not a concurrent session paper. A US$750 award will be given for the best student poster. The deadline for submissions is 16 October 2015.

Student scholarships

Registration fee scholarships are also available to students attending the Conference. The scholarship application deadline is 13 November 2015.

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Edgardo Curcio

Edgardo Curcio, economist and founder of the AIEE (Italian Association of Energy Economists) passed away on June 23.

Born in Rome, on December 25, 1930, he started his career in 1953 as Commercial & Marketing Director at API and then at Bombrini Parodi Delfino Group. In 1968 he became manager for chemical investment and strategy at ENI. He continued his career at ENI until 1980, then he started working for AGIP as General Manager (Executive Vice President) for planning, development & public relations; industrial investment analysis - strategic planning - new ventures in foreign countries - R&D planning and control. From 1991 to 1993, he was Vice President of Sogesta, a company of the ENI Group, organizing training courses in energy economics for foreign students.

After retiring from Eni in 1993, in 2000 he formed, together with a number of colleagues and energy experts, the Energy Advisors group of which he was managing director and partner: a new consulting company specializing in the electricity sector and the environment, providing technical, managerial, legal and financial assistance on projects and energy processes, sales, optimization of the energy supply and brokerage for electricity and gas supply contracts, developing new initiatives and projects, studies, surveys, analyses and reports in the energy sector.

This lead to long and successful managerial activity in energy economics.

In 1987, he took part in a IAEE international conference in Brussels and learning about its activity and structure came back to Rome with the idea of creating an Italian affiliate. On January 20,1989, the AIEE - Italian Association of Energy Economists was born. An excellent leader, a skilful organizer who in a few years transformed the young Italian affiliate into one of the most efficient and well organized IAEE affiliates, with a large number of members and activities and taken as a model by many new IAEE affiliates.

In 1995 the AIEE organized the first Rome IAEE International Conference, "Energy Strategy for Europe", a great success that increased the association's prestige and membership. This was followed by two other conferences, with the support of the European Commission, on "Energy Efficiency in Household Appliances and Lightening", in Naples and Florence. Due to his excellent skills and great contribution to the IAEE, in 1997 he was elected Vice President for Finance and joined the IAEE Board. In 2005 the IAEE awarded him its Outstanding Contribution to the IAEE Award "for many years of support and contribution to the Italian Affiliate and the IAEE".

He lead the AIEE for almost 25 years, being its president until 2013 when he was named Honorary President.

A creative, resourceful, open-minded person, full of ideas and initiatives, he transformed the AIEE into one of the most important Italian energy forums; a perfect networking between the industrial, scientific and academic world.

In 2001 he started a new adventure, organizing the first energy post graduate masters course in "Management of Energy and Environment", to form a new generation of energy experts. This is now at its 13th edition and has prepared more than 250 young energy managers. He encouraged a sustained academic activity of the AIEE engaging it in the organization of various energy training courses with various Italian and foreign universities.

In 2005 he created "The Energy Foundation", ancillary to the AIEE, with the purpose of making energy studies and research, better communicated with richer and more correct information.

He founded the "Prize for Sustainable Energy" that the Energy Foundation awards every year to an Italian or foreign personality that has made a special contribution in the field of sustainability and clean energy. It has been decided that the next prize will bear his name as a celebration and recognition for his special contribution to the Italian energy world.

Edgardo Curcio was not only the AIEE President , HE WAS THE AIEE! He was its creator and its organizer.

He gave the Association an identity that was different from corresponding associations in other countries: the idea of concreteness. He had not only an academic insight but also a keen attention to the role of the market.

This substance was appreciated by the industrial players and decision makers of our country, who supported the AIEE for the development of sustainable energy policies and also gave it wide international recognition.

Working with Edgardo Curcio was always stimulating, creative and challenging to develop new ideas and cutting-edge projects in a climate of harmony and cooperation.

We will miss him very much.

The Oil Price Plunge: Is it Really Different this Time?

By Les Deman*

Oil price cycles are nothing new. Over the past 40+ years, since the Railroad Commission of Texas stopped setting oil prices via prorationing, we've witnessed 5 major cycles (including the current one).[1] As Figure 1 shows, cycle magnitude and duration (peak to peak) has varied. The typical driver behind most commodity price cycles is the market's perception of supply-demand tightness and for the most part, crude oil's price fluctuations seem to fit that rule (Figure 2). Today's market is trying to discern whether this is a short cycle or a long one because the impact on demand and supply growth would be markedly different.

Whichever way this cycle goes, there is precedent.The short cycles were typically precipitated by either a demand or supply shock and the effects have been mostly transitory. Moreover, both the demand and supply effects were generally as expected; that is, high oil prices depressed demand while drilling activity increased and low oil prices had the opposite effect. For example, looking at the 1990-96 cycle, there was a 37% price decline from the 1990 peak to the 1994 trough. As a result, world oil demand growth began to accelerate (Figure 3), increasing at an average rate of 2.3% from 1994 to 1997 after having been depressed from 1990-1993 (only 0.8% per annum). On the supply side the global rig count fell from over 2200 rigs in late 1990 to under 1500 in early 2003 (Figure 4). Similar effects were seen following the 44% price plunge from 1996 to 1998 and the 36% drop between 2008 and 2009.

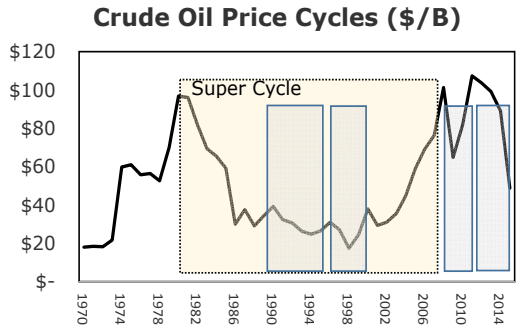

Figure 1. U.S. imported crude oil prices ($2015). Shaded areas indicate oil price cycles.
Source: U.S. Energy Information Administration April 2015.

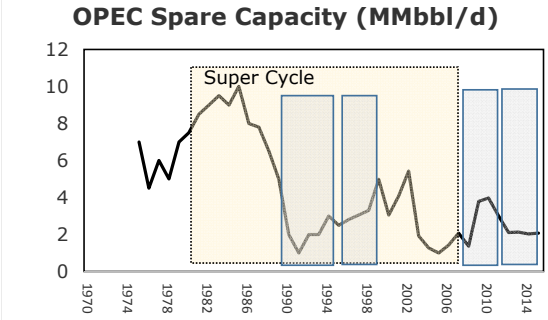

Figure 2. OPEC spare crude oil production capacity.
Source: 1974 - 1995 Energy Outlook 2035, British Petroleum, January 2015, p-32. 1996-2014 Short Term Energy Outlook, April 2015, U.S. Energy Information Administration.

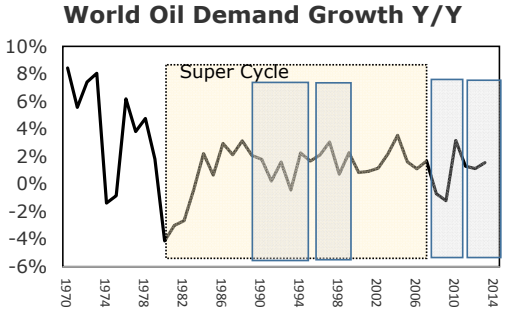

Figure 3. Dashed line is 3-year average.
Source: BP Statistical Review of World Energy, June 2014.

The Super Cycle (1980 – 2008). The mother of oil price cycles began in the early 1970s when OPEC production cuts (Arab Oil Embargo) sent the price of imported U.S. crude oil up from <$20/B in 1972 to over >$60/B in 1975 ($2015). Another supply tightening due to the Iranian Revolution and Iran/Iraq war sent the price up to nearly $100/B in 1980.The supply and demand effects were textbook. Oil demand growth disappeared and non-OPEC oil production accelerated.

By 1985 OPEC crude oil production had fallen below 16 MMbbl/d from 30 MMbbl/d in 1979. With the Saudi's bearing the brunt of the decline (output fell from over 10 MMbbl/d in 1980 to under 4 MMbbl/d in 1985), they slashed prices and raised production. Imported U.S. oil prices fell to roughly $30/B in 1986. OPEC oil production did not exceed 30 MMbbl/d until 1998, but the 1981 price peak was not breached again until 2008. In part, the delayed price effects appear to be the result of the growth of strategic storage buffers in many OECD nations and growing OPEC productive capacity as a result of investments in new fields and in existing reservoirs.

The massive oil price decline between 1982 and 1986 show the expected reactions by both consumers and producers. World oil demand growth began trending higher in 1985, but there are clearly growth cycles that correlate with the smaller price swings (1993, 2002 and 2009). A more permanent legacy can be seen in OECD demand, where policies to reduce oil use took hold (higher taxes, mandatory efficiency standards, etc.). Since 1981 oil demand growth in the OECD averaged only 0.5% and both North America and Europe appear to have passed their demand peak.

On the supply side global drilling activity fell from a peak of over 6000 rigs in 1981 to 1800 rigs in 1986. (The U.S. plunged from a peak of 4500 rigs to 700.) Beginning in 1990 we see several mini drilling cycles that correspond to the smaller price swings. Oil production growth (ex OPEC & FSU) also saw a

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See footnotes at end of text.

flattening after 1984. Although the rig count continues to be driven largely by oil prices, there appears to be little correlation between production growth and rig count after 1990.

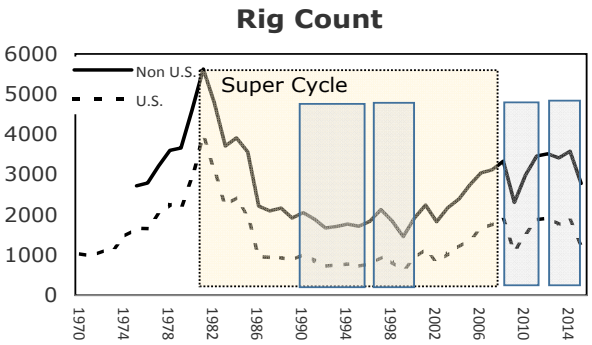

Figure 3. Dashed line is 3-year average.
Source: BP Statistical Review of World Energy, June 2014.

2015 and Beyond. There are few of the historical catalysts behind the current oil price plunge. Surplus OPEC capacity in 2014 is estimated at 2.1 MMbbl/d by the EIA, having fallen from a recent peak of 3.6 MMbbl/d in 2011.This is the smallest surplus since 2008. One can only speculate on the Saudi strategy that precipitated the recent price plunge.Possibly the Saudis are short-run focused, hoping that lower prices provide a quick fillip to Asian economic growth, stymie unconventional oil investment in North America and encourage more production discipline among OPEC members and the "free riders" such as Russia, Mexico, etc.

This short-run strategy could play out similar to previous mini cycles.With oil futures for WTI and Brent rising about $2/B per year[2] the market expects a 2020 price close to $70/B ($2015).While $70/B is about 35% below the post-recession peak in 2011, it is roughly equal to the post 2000 average real oil price. With the exception of the 2008 economic crash, OPEC did not do badly over this period. OPEC crude oil production rose from about 28 to 30 MMBBL/d, with the Saudis contributing 65% of the gain. While low oil prices might raise oil demand, recent forecasts[3] have world oil demand growth continuing, even with prices that ramp up to $100/B by 2025. Oil producers could fare worse than a 10-25 year period with a slowly rising real oil price.

The larger threat to OPEC and other oil producers is a world where there are minimal price effects on both oil demand and supply. If so, will the Saudis replay their 1985 strategy--attempting to negate recent energy efficiency trends, pulling capital from unconventional oil developments and hoping to assure a market for their oil for at least another generation? Over the first four months of 2015 real U.S. imported oil prices are averaging only 55% of the last peak (2011). This downward price trajectory has exceeded the 1990-94 decline (36%) but is shy of the 1980-86 plunge (69%).

Playing out the 1980-86 scenario would result in an additional 50% decline in the global rig count by 2017 and non OPEC production would be flat over the next 5 years. Whether improvements in horizontal drilling, fracking and other unconventional production technologies can offset the effects of lower prices is open to debate. At least one forecast (AEO-2015) shows production growth until 2020 in the U.S. and Canada with prices <$50/B.

Oil demand accelerated in the 2nd half of the 1980s from the positive price and income effects of lower oil prices, but there are analysts who question whether we would see a similar boost in today's environment. Many nations are instituting policies to reduce carbon emissions via mandatory efficiency targets and carbon taxes.[4] These policies, including LNG substitution for oil and the adoption of new technologies, could well result in non OECD oil demand peaking within a decade or so.[5] Under this brave new world oil prices could be in a flat to declining pattern.

"The best cure for low oil prices is low oil prices" is an old saying in the oil patch. However, savvy oil producing nations and petroleum companies would be wise to heed the other adage that says "hope for the best, but plan for the worst."

Footnotes

[1] I've adapted the NBER definition of business cycles: "…a significant decline in economic activity spread across the economy, lasting more than a few months…." My arbitrary measure of a significant decline is a price drop >25%.

[2] NYMEX and CME early May 2015.

[3] EIA, Annual Energy Outlook 2015 (April 2015).

[4] The Wall Street Journal reported: "Almost 1400 climate policies had been enacted globally by 2013 according to the IEA from less than 200 in 2006." May 7, 2015.

[5] A good discussion of peak oil demand can be found in: Amy Myers Jaffe. "Never Mind Peak Oil – Here Comes Peak Demand." The Wall Street Journal, May 6, 2015.

Oil Prices in 2015

By Thomas Tunstall*

Since the recent drop in oil prices from $100 per barrel to around $50 per barrel, predictions about where prices are going have been all over the board. Estimates have been as low as $20 per barrel and as high as $200. That's quite a wide range. What's interesting is that until the recent plunge in prices, it had become quite fashionable to claim that oil prices would never fall below $100 per barrel. Yet, seasoned industry observers would likely have commented that if oil had reached a permanently high plateau of $100, it would be first time something like that ever happened.

Now in some quarters, there is talk that oil may never reach $100 per barrel again. It seems that memories are often short. If we were to look at the history of oil prices over the past hundred years or so, we would see an industry landscape replete with booms and busts, gluts and shortages. This latest iteration is no different.

For the near term, two things appear very likely. Oil prices are headed lower. And unfortunately, the resulting lower gasoline prices will not provide the expected offsetting boost to the economy from consumer spending that many are forecasting.

Oil price impacts can perhaps best be understood in a macroeconomic context that makes use of measures such as gross output, as an alternative to the more usual fixation on gross domestic product. The use of gross output and its contribution to a fuller understanding of macroeconomic dynamics comes to us by way of three particular insights:

Production processes have a time-oriented structure.
Capital is not homogeneous, but instead exhibits heterogeneity.
Consumer spending does not drive the economy the way we believe.

While the above points may seem unremarkable, it is useful to compare/contrast these with traditional Keynesian analysis, which tends to give them short shrift. First, aggregate supply and demand in Keynesian macroeconomics are assumed to occur simultaneously, which is an overly simplistic and inadequate model of the way products and services are actually matched up with demand. Second, capital in many industries - including the oil and gas industry - cannot be readily repurposed to other uses. Capital is not homogeneous, but rather heterogeneous. And lastly, we continue to place too much emphasis on the impact of consumer spending as a panacea that we constantly try to conjure up in order to lift us out of our economic troubles. Because of our obsession with the power of consumer spending, we place too little emphasis on the impact of entrepreneurial and business-to-business activity farther up the supply chains that are the real drivers of economic activity.

The first issue dealing with the way time influences an economy can also be thought of as a lag effect. Factors set in motion in an economy often have significant momentum associated with them. The path of least resistance for supply chains and networks that are firmly in place is usually to continue functioning as they have in the past. As a result, events related to economic activity along a particular supply chain create inertia, which can make change difficult.

Over the past few years, U.S. energy companies have pushed oil production up from around 5 million barrels per day in 2008 to over 9 million barrels per day in 2015 - not too very far from the record levels of just over 10 million barrels per day in 1970. The success of new production techniques has unleashed an additional 4 million barrels per day over that time frame by establishing new supply chains in energy producing areas such as North Dakota and South Texas. While capital reductions have been announced by several energy companies, no producer is anxious to dismantle its existing supply chain.

As we know, the precipitating event for the huge price drop in oil occurred at the OPEC meeting held in November 2014, when the cartel confounded global expectations by deciding not to curb production in order to stabilize prices. Non-OPEC members, such as Russia, also indicated that they would maintain crude oil production at current levels. Market reaction in terms of prices for Brent and West Texas Intermediate crudes was swift, prompting oil prices to fall from over $100 in July 2014 to as low as $45 in early 2015 .

Because unconventional techniques are drilling intensive, with wells completed for as little as $6-8 million and in 10-15 days or less, it was believed that production could be curtailed quickly. And, yes, that much is certainly true compared with the hundreds of millions and multi-year windows required for deepwater rig completions. But it still doesn't mean that unconventional production can be turned off like a faucet.

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The cutbacks that have been initiated by producers in the U.S. have been steady, but still slow. Like a diesel locomotive that requires a mile or more of track to come to a stop, it is not at all clear whether slight muting of oil production in the U.S. will be significant enough to keep from overwhelming existing storage facilities. Further, producers are apparently stockpiling crude oil in the belief that prices will go up. Evidence of the effect of inertia is manifest in that there has not been a sharp, significant drop in oil production in the U.S. As these events continue to unfold, a tipping point is certainly a possibility that may drive prices to new lows in this particular cycle.

Oil prices haven't been this low since 2009. And markets take time to respond to changing circumstances. After a multi-year run of oil prices consistently above $80 a barrel (and more often around $100), oil producers across the globe have been reluctant to cut back production because they have become dependent on the revenues.

Many industry observers and analysts maintain the belief that oil prices will rebound to previous levels. For example, T. Boone Pickens went on record in December 2014 on CNBC saying that within 12-18 months, oil would be back at $100. (Caveat Emptor: T. Boone also said in 2005 that worldwide oil production would reach an absolute peak of 84 million barrels per day. Instead, daily world production topped 90 million barrels in 2013 and has continued to rise since then.)

Though crude oil production continues to be diverted into storage because the current cost is believed to be extraordinarily low and temporary, the existing storage capacity has limits. The closer we get to those limits, the more storage costs will increase. Pressure will mount to unleash the oil on the market at some point. When this happens, crude oil prices will be driven even lower.

So while new drilling techniques with the use of hydraulic fracturing and horizontal drilling have ushered an unexpected bounty of oil and gas, the science is only part of the story. True, advancements in engineering techniques play an important role, but the motivation and behavior of the exploration and production companies does as well. In short, it may take a while before we see production - which has outstripped demand - come back into alignment.

Another factor poised to put downward pressure on oil prices is a strong dollar. Right now, no central bank in the world wants to raise interest rates. Nonetheless, sooner or later it is bound to happen, and the first to do so will be the U.S. Fed. By raising interest rates, a strengthened U.S. dollar will push oil prices down as well.

Still further is the prospect of a nuclear deal between Iran and other countries. When this occurs, as appears likely, it will have the effect of bringing additional supply on the market, which will increase global supply and also put pressure on oil prices. The rest of OPEC appears to have no plans to cut production either.

On the flip side is the issue of demand. Evidence is mounting that China may be in the process of a protracted slowdown. As the world's largest single oil importer, the country buys nearly 7 million barrels each day. Yet government stimulus has been periodically required to prop up massive and questionable infrastructure spending. China is maintaining its construction boom in suburbs and rural areas by erecting scores of buildings that may never be occupied. For one eerie example of a different kind of ghost town, google: Ordos China Ghost City. In fact it's hard to not envision some sort of correction in the Chinese economy. After all, how many empty buildings can the country continue to build?

Taken together - the increase in supply bumping up against weakening demand portends a predictable outcome: falling prices. Yet the near-term impact from low oil prices was widely expected to be a positive boost to the U.S. economy. So far this hasn't happened. Why?

Michael Gapen, chief United States economist at Barclays has gone on record in January 2015 saying that household consumer spending contributes roughly 65 percent of gross domestic product, compared with about 1 percent from oil and gas industry investment. He and other economists have indicated that the benefits of lower energy prices will be felt much more broadly than the expected drag on some industries and regions.

This type of analysis is a gross oversimplification of the macroeconomy. Nonetheless, it is consistently repeated and rarely challenged.

The 65-70 percent of gross domestic product that the press and Wall Street economists regularly trumpet supposedly driven by consumer spending is what occurs at the final stage of the supply chain - what we call consumption. At this last stage of the value chain, the transactions become more numerous and markups are often at their highest, which makes the impact of consumer spending appear larger than it actually is.

What's missing from the picture is the magnitude of the business-to-business transactions that occur earlier in the supply chain. Driven by entrepreneurial activity, raw materials are developed, undergo

some kind of production process, and are then distributed to retail channels. GDP only measures this final phase. When all of the intermediate transactions are tallied, we find that in the U.S. economy, transactions between businesses as measured by gross output constitute nearly 60 percent of economic activity. Instead of the widely-reported 65-70 percent, consumption (or consumer spending) actually clocks in at only a little over 30 percent of economic activity.

Viewed in this manner, it is clear that too much emphasis is placed on the consumer, and too little placed on business activity that develops raw materials, puts them through production processes and then distributes them to retailers. If we put consumer spending in its proper context, we can start to see why the economy may not bounce back as quickly as many analysts have predicted.

Another misconception that still confounds mainstream economic thought is the assumption that aggregate supply and aggregate demand curves react instantaneously. Such thinking leads to the supposition that while oil price declines will hurt energy producers, lower gasoline prices will benefit consumers, who will spend more and make up the difference from an overall economic standpoint. And eventually, that scenario may pan out. But there will be a lag effect. Consumers will not immediately spend the surplus created by lower gas prices - if they ever, in fact, do so at all. If they save the surplus, the money then becomes investment, and so it will take a while before the impacts show up later in economic statistics as consumption.

Another issue likely to cause the economy to take time to recover is the general belief that capital is largely homogeneous. Yet equipment or facilities, or even human skills that are defined as capital have elements of specificity associated with them. That is to say, capital manifests heterogeneity. As a result, one type of capital cannot necessarily be readily substituted for another. At best, refitting or conversion may be required, which also takes time.

The time element associated with converting capital, as well as with the business-to-business transactions that start as resource development, then go through a production process, and finally are distributed to retailers create a lag effect. Keynesian economics has led us to believe that investment and consumption are instantaneous. They are not. And since the economy is constantly changing and evolving, the products consumers may eventually decide to spend their surplus on may not have even come to market yet.

In short, the prospect for higher oil prices at least through 2015 remains dim. Too many factors are acting in tandem to keep prices depressed. And a quick fix from lower gas prices is unlikely to pick up the slack in the economy in the near term as many have predicted. Normal economic lags, combined with far too much faith in the power of consumer spending alone tell us that from an economic perspective, the road ahead will be a bumpy ride.

The Implications of the Recent Oil Price Drop on the Brazilian Economy

By Lavinia Rocha de Hollanda and Rafael da Costa Nogueira*

Introduction

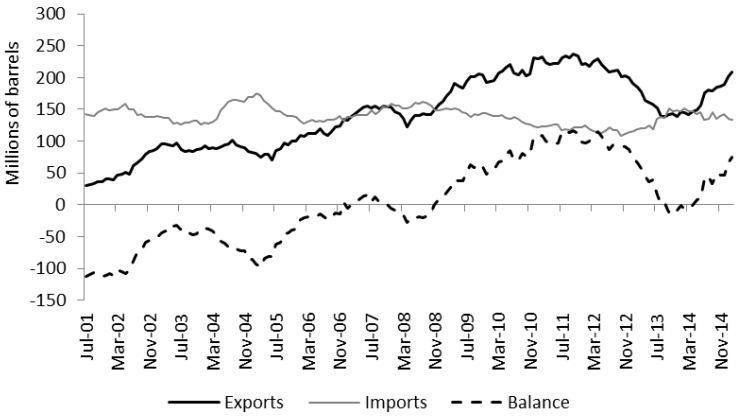
Oil price movements have diverse impacts on different countries worldwide, which, amongst other factors, depend on the oil industry´s contribution to the economy, and the flow of oil and oil products in the country's trade balance. In Brazil´s case, there are also some particular characteristics of the oil sector that have to be considered when analyzing the economic impact of oil price volatility in Brazil.

The Brazilian national oil company, Petrobras, is a state-owned, publicly listed company that has a dominant presence in Brazil's oil sector. The company holds major positions in the entire value chain of the oil and gas sector, including major upstream areas both onshore and offshore, and also midstream and downstream assets. More than 90 percent of Brazilian oil production came from Petrobras in 2014, which also owns 13,686 billion bbl reserves and nearly all the national refining capacity. In addition to that, Petrobras is one of the biggest Brazilian companies, both in terms of assets and in market capitalization (US$ 264.4 billion[1] and US$ 64.2 billion[2], respectively). Therefore, when studying the economic effects of the drop in oil prices in Brazil's economy, it is mandatory to understand how they affect Petrobras.

From the macroeconomic scenario, Brazil has been a net exporter of oil since 2008 (Graph 1). Yet, the country still imports a significant volume of oil products, such as gasoline and diesel (Graph 2), and light oil (>= 31°API), to blend with its local production of heavier oil.

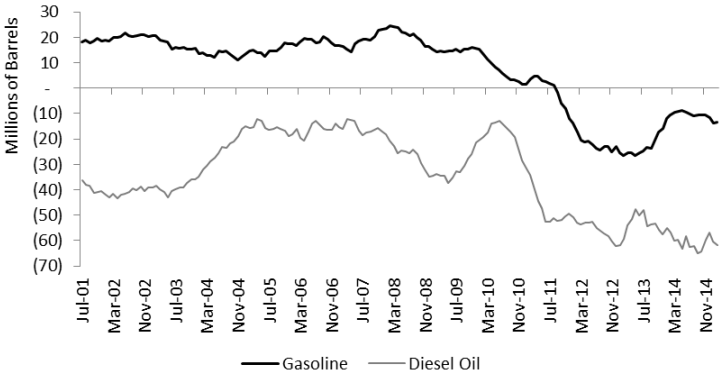
Also, as the majority shareholder in the company, the government has been able to impose price policies on Petrobras' domestic product market. At least since 2010, the prices of gasoline, diesel, LPG and fuel oil have been controlled at the refineries by the federal government, as an attempt to reduce its potential impact on consumer inflation indexes[4]. Thus, a drop in oil prices have mixed effects on the company's finances: on one hand, it should negatively affect its E&P business revenues. On the other hand, the company should benefit from the midstream segment, as domestic fuel prices at the refinery are currently higher than in the international market.

This article presents a brief discussion on the impacts of the recent oil price drop in Brazil, by pointing its consequences to the country, through both micro and macroeconomic perspectives.



Graph 1: Brazilian Oil Trade (trailing 12 months)

Source: Own elaboration from ANP[3] data.



Graph 2: Brazilian Oil Products Trade Balance (trailing 12 months)

Source: Own elaboration from ANP data.

The Microeconomic Effect: Can Petrobras Dodge Price Impacts?

Despite Petrobras' idiosyncrasies, the recent oil price drop already had, and should continue to have, a strong negative impact on the E&P segment; the case being the same with other oil companies worldwide. The results of all major oil companies have been affected by revenue decreases and asset impairments adjustments, and there is no reason why it should be different for Petrobras' E&P segment. Petrobras released its 2014FY financial results last April, and reported an impairment of US$ 3.3 billion due primarily to the drop in oil prices.

However, this negative effect should be compensated by the gains from the reduced costs of importing oil products, so both the refining, transportation and

* Lavinia Rocha de Hollanda is Head of Research at Fundação Getulio Vargas, Centro de Estudos FGV Energia (FGV Energia). Contact information: lavinia.hollanda@fgv.br Rafael da Costa Nogueira is a Researcher at the same institution.

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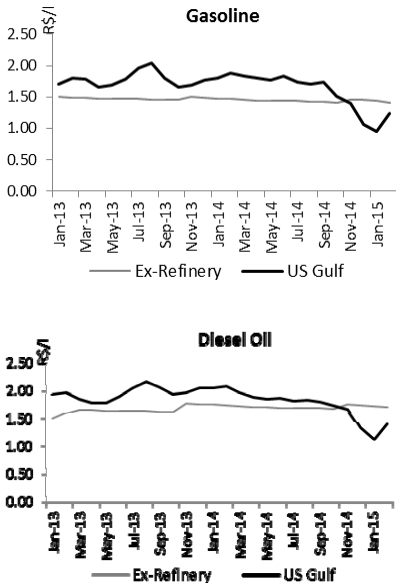

Graph 3: Ex-refinery vs. US Gulf (real prices)*

Source: Own elaboration from MME[5] and EIA data. *Deflator: Brazilian CPI (IPCA).

marketing (RTM) and distribution segments should benefit from lower oil prices. As shown in Graph 2, Brazil is a net importer of gasoline and diesel oil, paying international prices, but selling them at a controlled price by the government (Graph 3) - Petrobras has had a historic role in cushioning oil price volatility. Speaking solely from this perspective, oil product prices considerably reduced by lower crude prices should be music to the company´s ears.

The net effect is still unclear but, besides international oil price movements and their potential effects on the company's businesses, Petrobras has had a very turbulent year in 2014. The company has been on the news because of allegations of corruption and mismanagement. Also, net leverage has been increasing over the past few years, having reached US$ 80.4 billion at the end of 2Q14 (3.9x EBITDA), to fulfill an ambitious investment plan of US$ 220.6 billion in the period between 2014 -2018.

As a result of the above facts, the company has put its Investment Plan under review and has delayed the publication of its audited financial results from 3Q14. The figures for 2014, published on April 22, 2015, have shown a major asset write off, which amounted to nearly US$ 17 billion. Apart from the US$ 3 billion impact on oil asset prices, this number includes US$ 2.0 billion due to corruption, US$ 1 billion from petrochemical assets and US$ 11 billion as impairment adjustments for the RTM segment. Naturally, it has damaged the company's annual result, which has disclosed an annual negative net result of US$ 7.2 billion (-192% YoY).

Petrobras has also announced a US$ 13.7 billion asset divestment plan, 30 % in E&P (both in Brazil and abroad), 30% in RTM and 40% in Gas & Power. Even though the divestment from non-core assets may allow the company to reduce its leverage and focus on its main areas, the current global scenario in the oil industry raises some doubts on whether Petrobras will succeed in selling its assets at a favorable price.

It is clear that Petrobras´ future is still very unclear. According to 2014´s financial statements, the company´s net leverage exceeded 4.7x adjusted EBITDA. That figure, added to the need for a high CAPEX in order to obtain increasing revenues from oil production and accomplish deleverage targets, creates a fuzzy scenario for the company's near future.

In this quite complex context, it is difficult to disentangle the impacts of the recent decline in oil prices on the company´s numbers. Putting aside the extraordinary measures that had to be taken in order to reposition the company after all the events of 2014, the net effect will impact the prices on both E&P and RTM business. Revenues suffer from price decline, and the E&P segment becomes directly affected, as has been shown by recent oil company results worldwide. On the other hand, the cost of capital goods and services used in production is declining as well, which should have a positive effect on production costs for Petrobras. The effect of the recent increase in domestic oil product prices should be seen in the results for 1Q15 as well, which will be due on May 15, 2015. As mentioned previously, we expect a positive outcome from the RTM area to partially compensate for E&P segment losses.

Finally, Petrobras is working on a new investment plan for 2015 to 2019, which is expected to be released soon. This investment plan will signal to the market how the company will reposition itself in the new scenario. If the company is to maintain the level of production of 2,212 Mbpd registered in December 2014 throughout 2015, it will be able to deliver an 8.7% increase YoY in oil production. However, the E&P segment director has recently stated a target of 4.5% increase YoY in oil production for 2015, and 2.8% YoY for 2016, which could indicate a slowdown on future investments in E&P activities. It is a clear message that the company is suffering from mismanagement, aggravated by the oil price drop.

In short, Petrobras has been going through tough financial distress recently, and oil price declines act as a headwind for the company's plans. Brazilian ambition to become self-sufficient in "quality oil" and oil products has been put aside, since oil growth targets and refining facilities[6] have been reviewed. Moreover, the regulatory framework and the macroeconomic scenario also hinder getting back on track with high production growth.

Regulatory Framework and the Macroeconomic Effects: How Big are Oil Price Impacts on Brazil?

Brazil's economy expanded only 0.1 % in 2014. Besides that, a planned primary surplus of 1.8 % of GDP for 2014 ended up being a 0.6 % deficit, and Brazilian CPI (IPCA) increased 6.41 % last year. 2015´s negative perspectives have embodied Brazil. It is almost a consensus among analysts that the Brazilian economy will shrink in 2015. Inflation is skyrocketing and the market forecasts an 8.29%[7] increase for 2015, way above its target's top limit of 6.5 %. The deteriorated macroeconomic scenario

has motivated a budget austerity plan in the new presidential term. Despite that measure, consumer and investor confidence is still disturbed, and political protests have risen. Consequently, the real (Brazilian currency) has registered a big loss recently, peaking at R$ 3.29/US$ on March 13, 2015.

Due to Petrobras' major role in the Brazilian oil sector, to measure the scale of the oil price decline in macroeconomic impact for Brazil, we should first understand how big Petrobras' economic contribution is. Table 1 shows Petrobras' economic contribution in Brazil, and its proportion to Central Government net revenues. The evolution of the company's contribution shows that, on average, almost 13% of the Brazilian Central Government net revenue comes from Petrobras. The company also has an important role in the country's development, helping to finance the Federal Government's funding and investments, and being a major demander in the local industry of services and goods.

In the beginning of 2015, PIS[8]/Cofins[9] (both federal taxes) had their rates raised, and Cide[10] returned to be effective last May 1, after a two-year waiver. Those actions result from the country's new austerity plan, i.e., a plan of budget cuts and tax increases. The federal government has returned to targeting primary surplus, so the need for revenue increase became even higher. For some economists, the exit of a capital and credit rating downgrade would follow without budget cuts. Subsequently, borrowing costs for the population and the currency crisis would emerge.

Economic Contribution (R$ Million)	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Economic Contribution in Brazil	**48.6**	**48.6**	**56.7**	**52.1**	**62.0**	**69.4**	**62.2**	**63.8**	**58.5**	
(% Central Government Net Revenue)	*10.8%*	*10.8%*	*12.6%*	*11.6%*	*13.8%*	*15.4%*	*13.8%*	*14.2%*	*13.0%*	*12.9%*
ICMS	***17.7***	***18.1***	***23.1***	***24.7***	***28.7***	***37.1***	***39.4***	***43.4***	***48.0***	
(% Central Government Net Revenue)	*3.9%*	*4.0%*	*5.1%*	*5.5%*	*6.4%*	*8.2%*	*8.7%*	*9.6%*	*10.6%*	*6.9%*
Cide	***7.8***	***7.8***	***5.4***	***5.7***	***6.9***	***7.5***	***2.0***	***0.0***	***0.0***	
(% Central Government Net Revenue)	*1.7%*	*1.7%*	*1.2%*	*1.3%*	*1.5%*	*1.7%*	*0.4%*	*0.0%*	*0.0%*	*1.1%*
PIS/Cofins	***11.6***	***11.9***	***12.7***	***12.5***	***14.8***	***14.9***	***16.0***	***15.9***	***16.2***	
(% Central Government Net Revenue)	*2.6%*	*2.7%*	*2.8%*	*2.8%*	*3.3%*	*3.3%*	*3.5%*	*3.5%*	*3.6%*	*3.1%*
Income Tax and Contributions Excluding Profit	***11.4***	***10.7***	***15.5***	***9.1***	***11.7***	***9.9***	***4.9***	***4.6***	***-5.6***	
(% Central Government Net Revenue)	*2.5%*	*2.4%*	*3.4%*	*2.0%*	*2.6%*	*2.2%*	*1.1%*	*1.0%*	*-1.3%*	*1.8%*
Economic Contribution Abroad	**3.8**	**3.5**	**4.4**	**3.3**	**4.8**	**5.9**	**6.9**	**6.1**	**6.1**	
(% Central Government Net Revenue)	*0.8%*	*0.8%*	*1.0%*	*0.7%*	*1.1%*	*1.3%*	*1.5%*	*1.4%*	*1.4%*	*1.1%*
Total	**52.4**	**52.1**	**61.2**	**55.4**	**66.8**	**75.3**	**69.1**	**69.9**	**64.7**	
(% Central Government Net Revenue)	*11.6%*	*11.6%*	*13.6%*	*12.3%*	*14.8%*	*16.7%*	*15.3%*	*15.5%*	*14.3%*	*14.0%*
Central Government Net Revenue	**450.7**	**513.3**	**583.6**	**611.6**	**779.1**	**817.9**	**880.8**	**991.1**	**1013.9**	

Table 1: Petrobras' Economic Contribution (Current Prices)
Source: Own Elaboration from Petrobras and Brazilian National Treasure data.

Brazil's dependency on Petrobras has been growing over the years (Table 1). So, cuts on the company's CAPEX and the decrease of oil production growth targets will hit the Brazilian public finance directly. Some of Petrobras' executives have publicly indicated that the company's investment will probably range from US$ 129 billion to US$ 141 billion from 2015-2019, according to the investment plan to be released. The previous investment plan presented a target of US$ 221 billion of investments for the same time frame, meaning that a 41 % decrease in investment is expected for the period.

Cuts in CAPEX have other direct impacts to the economy, besides tax collection. Many projects will not develop as expected, triggering a wave of mass dismissals in the entire oil production chain, ranging from demand for capital goods and services for exploration activities, to resizing refinery capacity. In this scenario, foreign investment from major oil companies could be a way to compensate for the economic impact that the reduction of Petrobras' investments should have on Brazil.

However, the Brazilian regulatory framework for the oil and gas sector may pose several challenges for attracting international companies´ interest in investing in Brazil, especially in a global scenario of reduced oil prices. The sole operator rule for the pre-salt areas requires Petrobras to participate as an operator, and with at least a 30 percent share, in any forthcoming auction of pre-salt E&P areas. Clearly, in a scenario of financial distress, the company may experience difficulties with accessing the credit market. The 30 percent mandatory participation, together with the obligation to operate pre-salt areas, restricts important possibilities of E&P risks mitigation, also constraining joint ventures with other oil producers. Finally, high local content requirements also represent a significant hurdle for attracting foreign investment to the sector; thus, leaving a significant investment to be made by Petrobras.

Conclusion

The recent oil price decline can differently affect a country, depending on its micro and macroeconomic structures. For producer countries that deeply rely on the oil industry, the price slump has a major impact on public finances. On the other hand, it may benefit countries that are major consumers by reducing fuel prices and helping to boost the country's GDP. However, in Brazil, the economic net effect of oil prices are unclear, due to Petrobras' major role in the country´s oil production and its historic role in cushioning oil price volatility for domestic consumers.

The company has been going through a very turbulent period, due to financial issues derived from mismanagement and corruption activities. The fall in oil prices also adds a negative impact on its operations. So, considering Petrobras' development importance to the sector and to the country, the path for recovery will be a long and winding road, and a drop in prices may make it even longer.

The good news is that the new macro scenario in Brazil might be an important catalyst for the revision of some aspects of the regulatory framework, as it has already been publicly stated by government officials[11]. Local content requirements, as well as the sole operator clause, have started to be questioned and revisited. The critical macroeconomic situation, together with the threat of higher levels of unemployment, has given momentum to their simplification efforts by federal authorities.

Regulatory relaxation, along with recent Petrobras' actions towards compliance improvements, should contribute to easing the implications of the recent oil price decline in Brazil. However, the negative effects may last longer than desired.

Footnotes

[1] Exchange rate used in the article is R$ 3.00/US$.

[2] For May 13th , 2015.

[3] Brazilian federal regulatory agency for the oil and gas sectors.

[4] In November 2014, amidst news on corruption scandal surrounding Petrobras and cash flow pressures, the Board decided to allow an increase in gasoline and diesel domestic prices (3% and 5%, respectively), in order to improve the company's revenues.

[5] The Brazilian Ministry of Mines and Energy (MME).

[6] "Complexo Petroquímico do Rio de Janeiro (Comperj) and the second refining unit of Refinaria Abreu e Lima (RNEST) are both under construction and have been removed from the Downstream CGU in the quarter ended December 31, 2014 and assessed for impairment individually." (Petrobras 2104FY Results, page 30).

[7] Central Bank Focus Report at May 11th, 2015.

[8] PIS (Social Integration Program) is a social tax contribution paid by companies in order to finance the payment of unemployment insurance and abandonment to the employees who earn up to two minimum salaries.

[9] COFINS (Contribution for Social Security Financing) is a federal contribution also paid by tax destined to social security that covers retirement and health care.

[10] Cide (Contributions of Intervention in the Economic Domain) is a contribution that is for the improvement or activities linked to the sector in which its incident.

[11] Accordingly to Brazilian Newspaper "Valor Econômico" (http://www.valor.com.br/brasil/4036526/nova-regra-de-conteudo-local-pode-valer-em-junho-diz-anp - in Portuguese)

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The 2015 Countershock and the Prospects for a Low-carbon Energy Transition

By Duccio Basosi and Riccardo Basosi*

The Incipient Energy Transition and the Downfall of Oil Prices

For some years now, the need for a transition to a low-carbon economy has been recognized globally as a crucial element of any credible attempt to prevent the expected increase in global temperature from exceeding pre-industrial levels by more than 2° C. As is well known, according to the United Nations International Panel on Climate Change (IPCC) and a large majority of scientists, beyond this threshold, rising temperatures may trigger potentially catastrophic and irreversible effects.[1] At the global level, the Kyoto Protocol of 1997 endorses the objectives of "the enhancement of energy efficiency in relevant sectors of the national econom[ies]" and "research on, and promotion, development and increased use of new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies".[2] These objectives have also been endorsed by most relevant state participants. For example, the United States and China, the two largest economies in the world, issued a joint statement in this regard on 12 November of 2014, stressing their "longer range effort to transition to low-carbon economies".[3] On its part, the European Union has passed legislation to "reduce its greenhouse gas emissions by 20%, increase the share of renewable energy to at least 20% of consumption, and achieve energy savings of 20% or more" by the year 2020.[4]

The timing and feasibility of the transition are contested by the main energy companies and oil-producing countries which continue to expect both an absolute growth of global energy consumption and a dominant role for fossil fuels for decades to come.[5] Nevertheless, many analysts from different backgrounds see bright prospects both for energy saving and efficiency, and for the growth of renewable energy sources in the energy mix: for example, based on the actual reduction of energy use per unit of global GDP in recent years, former ENI Director of Strategy and Development, Leonardo Maugeri, has defined energy efficiency[6] As for renewables, the authoritative IRENA, based in Abu Dhabi, estimates that these could cover 36% of global energy consumption by 2030[7] In any case, between 2005 and 2015, the capacity of wind and photovoltaic power has increased by 9 and 36 times, respectively, surpassing any forecasts made at the beginning of the millennium.[8]

However, commentators have noted that such an incipient energy transition took place during a period of relatively high prices of oil, the raw material that still represents about 30% of world energy consumption and virtually all energy consumption in the transportation sector. Beginning their increase around the year 2000, crude oil prices touched 147 $/b in 2008 and, after a sharp but brief fall in 2009, stabilized around 110 $/b between 2010 and 2014. In the second half of 2014, prices began to fall, down to 47 $/b in January 2015 (followed by a partial recovery up to about 60 $/b in May when we are writing this). In this context, various commentators have expressed the view that, if the regime of low oil prices were to stabilize, the energy transition would be jeopardized by the lack of incentives for energy saving measures and the weakened cost competitiveness of renewable energies.[9]

Oil Prices and the Energy Transition: Theoretical and Empirical Frameworks

That there is a relationship between the trend in crude oil prices and the prospects of sustainable energy solutions is a well established fact.[10] In part, such a relationship is a direct one as far as the transportation sector is concerned. It is easy to surmise, for example, that lower fuel costs can lead individuals to opt for higher consumption, while automakers, shipbuilders and aircraft manufactures could adopt less stringent standards in energy saving measures (including a possible slowdown of the development of electric and hybrid cars). On the other hand, the relationship is also an indirect one, to the extent that natural gas and coal prices generally move in the same direction of those of oil (indeed, gas prices are in part indexed on crude oil prices). While oil now covers only a residual percentage of electric power generation and heating, the fall in oil prices can result in the increased competitiveness of natural gas and coal in these sectors, with negative effects on energy saving in general and with penalizing consequences for the development of wind, thermal solar and photovoltaic power.

The experience of the first countershock in oil prices, in 1986, seems to confirm this pattern – indeed, to a certain extent, it is its archetype. In the second half

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See footnotes at end of text.

of the 1980s, absolute oil consumption began to rise again after a five-year break;[11] energy saving trends slowed down;[12] government subsidies to renewable energy development shrank globally.[13]

In the current framework, it has been estimated that oil prices below 70/80 $/b would disincentivize energy efficiency, while oil prices below 70 $/b would make many investments in renewable energies financially problematic.[14] In short, one should conclude that the energy transition is put at risk by the current fall in oil prices.

However, if this is the theoretical framework, it seems appropriate to reflect also on the dynamics that led to the recent fall in oil prices. Most analysts agree that the 2014 price decrease was the result of several factors: on the demand side, stagnation in Europe and Japan and the slowdown of the growth rates of emerging economies (in particular China); on the supply side, the boom in unconventional oil production from shale oil, tar sands and deep offshore fields. As for the price collapse of the latter part of the year, however, all observers agree that it depended on Saudi Arabia's decision not to play the role of swing producer, and to start a price war instead (against the shale oil industry, against Russia and Iran, or both, depending on interpretations).[15] In short, as has often been the case in the past, today supply and demand interact with the (geo-)political choices of some particularly influential participants on the market. Forecasts on how long the price war could last vary. However, the partly "political" nature of the recent slump seems to rule out the possibility that the price will stabilize around 50 $/b. Both the futures market and many analysts indicate a likely price around 70/80 $/b for the near future, reflecting the notion that the exhaustion of the resource is not imminent, but the trend towards increasing extraction costs is a fact.[16] In short, if the recovery of crude oil prices from their lows in January 2015 were to be consolidated, the room for competitiveness of energy efficiency and renewables should grow in proportion.

Lessons From the 1986 Countershock

Regardless of "how low" (or "how high") the future price of oil will be, there are other elements to be taken into consideration when assessing the prospects of the energy transition, which make the picture less deterministic. Also from this point of view the experience of 1986 seems to provide much food for thought. Indeed, it is undeniable that the countershock in oil prices represented, in that context, an incentive to boost oil – and more generally fossil energy – consumption. And yet, it is useful to note that such a recovery of the fossil paradigm was also the product of a successful political and cultural counteroffensive, which affected deeply the demand side of the equation. Such a counteroffensive was most radical in the United States, the most technologically advanced country, whose economy alone accounted for a quarter of the world economy. Here, during the presidential campaign of 1980, the debate on future energy choices assumed a symbolic character that largely transcended the theme of energy per se: according to Republican candidate Ronald Reagan, who was to come out on top, giving up oil meant in fact to "give in" to OPEC, to increase the perceived vulnerability of the United States, to abjure the principles of the market economy, or even to give up the freedom of movement guaranteed by private cars. In short, the battle to change the country's energy policies, undetaken by president Jimmy Carter a few years earlier, was now depicted successfully as alien to the "American way of life" (although Carter himself had been very keen on presenting it as a quintessentially American endeavour, comparable to the Manhattan Project or the space race). The success of the Reagan counteroffensive manifested itself in the strengthening of the Rapid Deployment Joint Task Force stationed in the proximity of the Persian Gulf, in the drastic cuts to research and development funds on renewable energy and in the virtual abolition of the CAFE standards on fuel consumption. At a more symbolic level, Reagan ordered the removal of the solar panels installed by the Carter administration on the roof of the White House.[17] In the other industrialized countries, the assault was less radical but, as an analyst wrote in 1990, everywhere the prospects of the energy transition clashed with "the general tightening of government budgets and changing national policies in the 1980s".[18]

From this point of view, the interruption of the energy transition that had started in the 1970s can be seen as a consequence of the rise of the "neoliberal" ideas that characterized the 1980s. On the other hand, in a far-sighted analysis dating from 1987, scientists Paolo Degli Espinosa and Enzo Tiezzi observed how the 1970s discussion about the energy future had been timely, but also flawed by the notion, then in vogue, that the oil shocks of 1973 and 1979 indicated the imminent depletion of oil reserves (according to a well-known study of the CIA from the 1970s, this would have occurred as soon as 1985). To the extent that the efforts of the 1970s towards less oil-dependent economies had been built largely on this prophetical premise, they could not remain unscathed when the prophecy went unfulfilled.[19] What seems most relevant here, however, is that the prospects for the development of energy saving measures and renewable energies had already been crippled at the time of the 1986 countershock.

Conclusions

Compared to the 1980s, today the situation seems partially different. Capitalism, especially in its "neoliberal" form, does not appear to be in its heyday and is potentially more vulnerable to criticism. International public opinion seems to be more attentive to the risks of climate change and finally, as noted in the opening of this article, the low-carbon energy transition appears to have been endorsed by many governments and international organizations.[20] In this context, according to IEA Director Maria van der Hoeven, low oil prices could even represent an unexpected opportunity for many countries to introduce a carbon tax to encourage energy conservation.[21]

It must be said, of course, that in many cases the real will of governments to move from words to deeds seems dubious. It also seems appropriate to recall that "green" slogans can be easily hijacked and distorted, both by governments in search of soft power and by private companies in search of visibility on the cheap. In this context, the mobilization of global environmental movements can represent a crucial factor of pressure and control from below, both about the seriousness of the commitments made at the governmental level, and about the speed with which these are turned into consistent policies.

On the road of the low-carbon energy transition there are still many obstacles, both in terms of political will, and in terms of technology and infrastructure (suffice it to think of the problems of the electricity grids, challenged by the passage from a few large suppliers to many decentralized suppliers from photovoltaic plants). If anything, the story of the early 1980s shows that an incipient transition can be stopped and reversed and that a fall in oil prices may be an ingredient of the turnaround. At the same time, the same story also shows that if low oil prices are not necessarily good news on the way for the transition, the factors involved are many and the game remains open.

Footnotes

[1] See the latest IPCC report: IPCC, Climate Change 2014: Synthesis Report (Geneva: IPCC, 2014).

[2] Kyoto Protocol to the United Nations Framework Convention on Climate Change, http://unfccc.int/essential_background/kyoto_protocol/items/1678.php (cited 3 May 2015).

[3] U.S.-China Joint Announcement on Climate Change, 11 November 2014, available at https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change.

[4] European Commission, 2020 Energy Strategy, http://ec.europa.eu/energy/en/topics/energy-strategy/2020-energy-strategy. Recently EU institutions have advanced even more ambitious goals: European Commission, Roadmap for moving to a low-carbon economy in 2050, http://ec.europa.eu/clima/policies/roadmap/index_en.htm.

[5] See, for example: ExxonMobil, The Outlook for Energy: A View to 2040 (2015), http://cdn.exxonmobil.com/~/media/global/reports/outlook-for-energy/2015/2015-outlook-for-energy-us-version.pdf ; BP, BP Energy Outlook 2035 (2014), http://www.bp.com/content/dam/bp/pdf/Energy-economics/Energy-Outlook/Energy_Outlook_2035_booklet.pdf; OPEC, World Oil Outlook (2014), http://www.opec.org/opec_web/static_files_project/media/downloads/publications/WOO_2014.pdf.

[6] L. Maugeri, Con tutta l'energia possibile (Milano: Sperling & Kupfner, 2011), pp. 285-299 [Beyond the Age of Oil (Westport: Praeger, 2010)].

[7] IRENA, Rethinking Energy (2014), p. 28, http://www.irena.org/rethinking/IRENA_REthinking_fullreport_2014.pdf#page=20.

[8] G. Silvestrini, Due Gradi (Milano: Ambiente, 2015), p. 101. The Global Wind Energy Council's 2014 report showed wind-generated power to have reached 3.3% of the world's total electricity generation, http://www.gwec.net/wp-content/uploads/2014/04/GWEC-Global-Wind-Report_9-April-2014.pdf. According to the IEA's Technology Roadmap (2014), total global photovoltaic capacity overtook 150 gigawatts in early 2014, http://www.iea.org/publications/freepublications/publication/technology-roadmap-solar-photovoltaic-energy---2014-edition.html.

[9] See for example, Moisés Naim, "The consequences of the consequences", Oil Magazine, March 2015, p. 29.

[10] J. Reboredo, "Is there dependence and systemic risk between oil and renewable energy stock prices?", Energy Economics 48 (March 2015); S. Managi and T. Okimoto, "Does the price of oil interact with clean energy prices in the stock market?", Japan and the World Economy 27 (August 2013), pp. 1-9; I. Henriques and P. Sadorsky, "Oil prices and stock prices of alternative energy companies", Energy Economics 30, no. 3 (2008), pp. 998-1010.

[11] IEA, Key World Energy Statistics (2014), p. 28, http://www.iea.org/publications/freepublications/publication/keyworld2014.pdf.

[12] Maugeri, Con tutta l'energia, pp. 289-291.

[13] See chart and data in M. Laughton, "Introduction", in M. Laughton (ed.), Renewable Energy Sources (London: CRC Press, 1990), p. 17.

[14] Maugeri, Con tutta l'energia, p. 78.

[15] For a broad overview: P. Rimbert, "Pétrole et paranoïa", Le Monde Diplomatique, April 2015, p. 2.

[16] See, for example, the opinion of the president of Husseini Energy Co., Sadad Ibrahim Al-Hussein, as expressed in the interview with John St. Jean, "The Great Unknown", Oil Magazine, March 2015, pp. 19-20.

[17] The same data set cited above, shows that, well before 1986, total IEA governments investments in renewable energies had dropped from their 1980 peak of $1350 million to around $700 million in 1984. See chart and data in Silvestrini and Butera, Il futuro, p. 30. On Reagan: G. Troy, Morning in America (Princeton: Princeton University Press, 2005), pp. 25-30 and 140-143. On Carter: K. Mattson, What the Heck Are You Up to, Mr. President? (New York: Bloomsbury, 2010).

[18] Laughton, "Introduction", p. 17.

[19] Paolo Degli Espinosa and Enzo Tiezzi, I limiti dell'energia (Milano: Garzanti, 1987), p. 22.

[20] See N. Klein, This Changes Everything (New York: Simon & Schuster, 2014).

[21] Maria van der Hoeven, "Use cheap oil to put a price on carbon", 15 December 2014, http://www.energypost.eu/maria-van-der-hoeven-iea-use-cheap-oil-put-price-carbon/. Indeed, in the appropriate tax context, low oil prices could also lead to lower production costs for photovoltaic panels, thus indirectly financing the transition.

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
2015				
October 25-28	33rd USAEE/IAEE North American Conference *The Dynamic Energy Landscape*	Pittsburgh, PA, USA	3RAEE/USAEE	David Williams *usaee@usaee.org*
2016				
February 14-17	5th IAEE Asian Conference *Meeting Asia's Energy Challenges*	Perth, Australia	OAEE/IAEE	Peter Hartley *hartley@rice.edu*
February 18-19	9th NAEE/IAEE International Conference *Theme to be Announced*	Abuja, Nigeria	NAEE NAEE/IAEE	Adeola Adenikinju *adeolaadenikinju@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 *Forging Regional Engagement between the East-West Strategic Corridor: Energy, Trade and Transportation*	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*

June OPEC Meeting: the Start of Another Oil Price Decrease?

By Alexandre Andlaurer*

Oil Prices Increase: Speculation?

After a strong rebound in oil prices in the first months of 2015, questions are now being raised on the nature of the increase and its sustainability. Here are some potential explanations:

- First, it looks like that the sharp decrease in the number of rigs in the U.S. came as an (misleading) indicator forecasting lower production. Rig counts plunged by approximately 60% and U.S. production levelled off for the first time since the shale boom began.
- Second, the lower oil price environment has raised the consumption of oil products around the world.
- Third, the cut in investments by all oil companies is a sign that production will decrease.

These arguments are reasonable but what is really behind them?

The Increase in Supply is Everywhere (despite the cut in capex)

More than $100bn of spending by the world's energy companies has been slowed, postponed or cancelled. As an example, one of the biggest developments to be shelved is Shell's Arrow liquefied natural gas plant in Australia, accounting for almost a quarter of the planned spending reduction. On the other side of the world, some Canadian oil sands projects have been cancelled with a cut close to $10bn.

What does this mean? From the natural gas point of view, and LNG, it is clear that production would be lower, as prices are doubly put under pressure: U.S. natural gas support prices (and future exports + coal transmission belt) and oil prices plunge with the link to European and Asian natural gas prices. From an oil production point of view, it looks like that the cut in investment will not hit production for the next five years. And especially not in the next three years. The results from the integrated oil companies in Q1 2015 showed, conversely, some impressive oil (liquids) production growth. ENI alone increased production by 5% vs. Q1 14, while Total and Royal Dutch Shell increased respectively by 15% and 1% compared to the previous quarter, Q4 14.

When asking 25 CEOs from oil & gas companies around the world, an expert reported that the answer was the same. None has cut oil production for the next five years. So where should the lower production come from? OPEC countries, Russia, Brazil, Canada?

This seems not be the case.

- In Canada, where the Canadian oil sands are said to be unprofitable (which is true), production reached an all time high at 4mbpd. Suncor, Canada's largest integrated oil and gas firm, said oil sands production rose to a record 0.44mbpd compared to 0.39mbpd a year earlier. No slowdown is expected in the next three years.
- In Russia, oil and gas condensate production, among the world's largest, remained at a post-Soviet record level of 10.7mbpd in April. The lower investment and ban on technology will not affect production before 2019.
- Despite Petrobras' problems with corruption, and challenging extraction, the company posted a new oil production high of 0.8mbpd in April (and this is true for all its partners) from its offshore subsalt region, the state-run oil company said on Tuesday (19/05/2015). Petrobras is producing 80% of Brazil's oil and gas from the subsalt polygon, an area where large oil reserves are trapped by a layer of mineral salts far beneath the seabed.
- On the OPEC side, Saudi Arabia's crude exports rose in March to their highest in almost a decade, with 7.9mbpd shipped, up from 7.35mbpd in February, the highest level since November 2005. The Oil Minister Ali al-Naimi said Saudi Arabia produced some 10.3mbpd of crude in March. This eclipsed its previous recent peak of 10.2mbpd in August 2013, according to records going back to the early 1980s. In Libya, production is still a third (436kbpd) of the pre-war level. Mr Sanallah, the chairman of the national company said that Libya and Iraq would also be focusing more on recapturing market share, regardless of OPEC quotas. That is true. And there is only upside in the next two years. Finally, Iran could also add 0.5mbpd in 6 months, but we are more conservative on this one as this seems more like a long-term discussion.

* Alexandre Andlauer is Head of the Oil & Gas Sector at Alphavalue, co-author of "Shale Oil World Revolution" and Founder and President of U.S. Shale Investment. He may be reached at a.andlauer@alphavalue.eu

At a glance, the disruption is still close to a 10-year record for the Middle Eastern countries, but everybody is looking to increase their production and get market shares.

- Finally, in the U.S., the number of rigs has become an obsolete indicator in tracking production. There is obviously a lag between the fall in the number of rigs and production, as there is a link with hedges from shale oil companies, but rig counts have become a misleading indicator. Flying to quality (less wells, but much more productive), horizontal drilling, technology improvements and efficiencies are elements that are not well represented by the number of rig counts. Also, the new trend of uncompleted wells upsets the expectation on production, but let us show what the impact could be. The number of uncompleted wells in the U.S. (which must be fracked or abandoned) is 2,500. Based on a 400kbpd IP, production should be 1mbpd. 60% of costs have been spent on these uncompleted wells, so completion seems inevitable. Some of the production is offset by the high declining rate. But it is still high enough to keep production rising by another 300kbpd without new rigs in the U.S. for 2015. Let's take as an example North Dakota. At the end of March, there were an estimated 880 wells awaiting a completion service. To maintain production near 1.2mbpd, 110 to 120 completions must be made per month, according to the DMR. Seven months remain, or 840 wells, to be completed to stabilise production. 40 remain to increase production with no more rigs. But there are still 80 active rigs. In other words: even without new rigs, production can rise in the U.S. in 2015.

All in all, supply should be up by 0.8mbpd in 2015 from non-OPEC countries. April marked the 12th consecutive month in which OPEC production ran above the groups' self-imposed 30mbpd target.

Demand is Revised up on Lower Oil Prices

Consensus figures see demand as high as +1.3mbpd for 2015 vs. 2014. Oil demand continues to surprise on the upside. And the U.S. looks to be the main swing consumer. Low taxes, the biggest consumer in the world, and the start of the driving season are the key explanations for this. Demand from refineries is the strongest at this time (driving season) of year when production should rise by more than 5% yoy according to the American Automobile Association. The latter said road travel was expected to reach a 10-year high. In other words, consumption in the U.S. should grow by 400kbpd in 2015, thanks to lower oil prices. In Europe, Vitol recently said it expect consumption to increase by 0.5mbpd.

Also, demand should be analysed in India and China, the key growth drivers of the last five years. Sensitivity to lower oil prices at the pump is low, as the trend is more driven by new cars than by people willing to drive more with low oil prices. In China, crude imports hit a record 7.4mbpd in April, with healthy car sales. The increase has also been driven thanks to the start-up of 39mb of commercial storage. Nevertheless, China's fuel demand will grow by 3.1%, according to the EIA. This compares with an 11% jump in 2010. Annual growth has averaged 5.2% in the past ten years

For sure, the rebound in consumption is here, and it is visible. But this short-term higher oil demand driven by lower oil prices (at least in the first months of 2015) is unlikely to offset the structural long term trend as the world's economy is experiencing transformational changes: gains in industrial productivity, efficiency of new cars, rapid urbanisation, bets on renewables etc.

OPEC Meeting, a Non-event, Shale Oil Producers Still the Swing Producers

Supply is increasing everywhere, as demand is too. What could change in the second part of the year is the size of that increase of supply and demand. On one hand, no further upward revision in oil demand (maybe downward). On the other, greater production from shale oil players. The dynamics in H2 would be on the supply side. The reason? Oil prices are at a level where the producers are happy and back to business, however, the positive impact from lower oil prices is also true but usually only in the first six months, abd then comes to an end.

During the first quarter results, shale oil companies clearly highlighted their ambitions, first to bring rig numbers back as oil prices are at $65/bbl: in mid-May the number of rigs drilling for oil totalled 659, just one less than the week before (the end of the trend?). Also, companies mentioned they will complete wells in the coming months (Q3) as already 60% of costs has been spent. The completion of the wells is an indicator to follow, as mentioned earlier: The reduction in completions happens four months after the rig count reduction according to people involved in completion. A starting point right now.

Last, but not least, shale oil producers have already decreased costs by 15% in three months, with a potential of 25% for the full year. The $65/bbl (on WTI) is heading towards $50/bbl in the next two years. Support for funding of these companies has found generous private equity investment over the last few months: a lot of cash has been invested. Blackstone has set $9bn aside for energy investment. EnCap

and Warburg Pincus are sizing up the market, armed with $5bn and $4bn, respectively.

So what could be the price for oil?

With its ability to bring production to a couple of millions of barrels in 20 days, shale oil producers are the new swing producers. What does this mean for oil prices? Probably more volatility in a low range with a stop and start system from this type of producer accounting for 6% of the world's production in 2015. So before shale oil production is disrupted, the oil price should reach $50/bbl, and stay there for a while. What happens afterwards could be this scenario: a $50-$70/bbl range, and the story repeated until other countries change the strategy, nothing expected for 2015, or even before 2018.

And what about the OPEC Meeting?

There is a general consensus that oil prices will recover amongst OPEC countries. And that they have been successful in their strategy to lower production in a high break-even area (which is true when taking rig counts as an indicator) with a visible impact at some time towards the end of 2015. Under this condition, and regarding the production increase from OPEC countries to support the health of their population, it is hard to believe that the OPEC Meeting on 5th June will decide on a cut in production.

The timing of this OPEC Meeting corresponds with the start of the U.S. driving season (a pick-up in demand may not continue to support prices down the road) and this is a perfect cocktail to start a decrease in oil prices. Unless demand accelerates, the rally is in danger.

Obviously, there could always be a geopolitical development that may completely change the picture. The market is very sensitive to relative excess supply; it can go away in a blink, say, if OPEC changes its policy. But fundamentals, notably in the U.S., have not changed much, oil prices could reach again the $50/bbl in H2 2015.

Over 2020, oil prices could again trend upward, as Russia's problems and the Middle Eastern lack of investment could start to impact production, which would not at that time be supported by higher shale oil production (which has a limit of 8mbpd vs. 4.4mbpd today).

!!Congratulations to IAEE Past President, Lars Bergman!!

Lars Bergman, Past President of the IAEE, was awarded H.M.The King's Medal of the 12th dimension with the ribbon of the order of the Seraphime for his valuable contributions to Swedish society. The ceremony took place on the 16th of June, 2015 at The Royal Castle of Stockholm.

There are seven dimensions of the Royal medal, with the 12th dimension being the highest. The ribbon of the Seraphime order is the second highest from the top.

Congratulations, Lars!!

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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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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.

Highlights of the 8TH NAEE/IAEE Annual International Conference, 27-28 April 2015

The 8th NAEE/IAEE Annual International Conference, with the theme *Future Energy Policy Options: Assessment, Formulation and Implementation*, was held in the ancient and historic city of Ibadan, Oyo State, Nigeria, 27-28 April 2015. The Conference attracted over two hundred and fifty participants from different parts of the world including the United States of America, Turkey, United Kingdom, South Korea and Ghana. The participants cut across diverse areas of expertise: policymakers (including the Deputy Governor of Oyo State), industry players, academics, and students. It featured presentation of eighty two papers on diverse topics in different subject areas captured under nineteen specialised sessions viz: Appropriate Technological Options; Financial and Energy Markets; Energy and the Environment; Non-Fossil Fuel Energy: Renewables and Nuclear; Contemporary Global Energy Market Dynamics: Issues, Prospects and Strategic Options; International Energy Markets; Energy Efficiency; Energy Research and Development; Political Economy of Energy; Public Understanding and Attitudes towards Energy; Climate Change and Energy Industry; Energy Pricing, Investment and Financing; Clean Energy Technologies; Renewable Energy Technologies and Infrastructure; Legal Issues in Energy Infrastructure Development; Energy Infrastructure Development and Risk Sharing; Public Private Partnership in Energy; and Energy Sector Reforms: Assessment of Challenges, Outlook and Options.

This highlight examines eight papers presented at the Conference from the general subjects of petroleum, natural gas, shale oil, electricity, renewable energy, nuclear energy, and environmental protection. In a paper titled "Developments in Global Oil Market: Causal Factors and Prospects", Professors Akin Iwayemi and Adeola Adenikinju examined the developments in the world oil market in the light of future prospects and implications for Nigeria, particularly in the light of the interwoven relationship between economics, politics, geography, geology and technology, which relationship has produced the complex nature of the world oil and energy markets. They called for greater understanding of the evolving and unfolding new global energy market in order to develop an orderly strategic response in Nigeria; particularly, the identification of effective ways of integration of the petroleum sector with the rest of the economy.

In his presentation, Professor Omowumi Iledare analysed the strategic options available to Nigeria in the area of managing its oil and gas resources for maximum development in an era of falling oil prices; noting particularly how the country loses an estimated 18.2 million U.S. Dollars daily from flared gas and suggested, inter alia, the use of gas to generate more electricity for domestic, commercial and industrial markets and regional industrial markets. Still on gas flaring, Ladeinde Ayodeji Olaoluwa and Laniran Temitope Joseph examined the impact of fines on the volume of gas flared in Nigeria and conclude that imposition of fines did not significantly impact the volume of gas flared and advocate for firm penalties and cancellation of waiver grant system to oil companies regarding gas flaring.

Ayorinde Joshua Ogunyiola provided a gripping analysis of shale oil development and its implications for OPEC exporting nations, especially Nigeria. The analysis reveals that Nigeria's macro-economy is largely affected by the recent global shift in energy markets. Oil revenue has declined alongside exchange rate and external reserves with external debt rising. The presenter recommends greater diversification of the economy from over dependence on oil revenue to reduce macroeconomic instability.

In their paper titled "Resetting the Protective Clock: An Appreciation of the Legal Responsibility of Electricity Supplier to the Consumer in Nigeria", Dr Balkisu Saidu and Barrister Safiyya Ummu Mohammed decried the lack of available and accessible redress mechanism to consumers of electricity who do not enjoy regular power supply in Nigeria. This, they observed, is in spite of the categorical and clear provisions of the Electric Power Sector Reform Act 2005, which makes it obligatory for the regulator of the electricity supply industry in the country, the Nigerian Electricity Regulatory Commission, to establish standards for compensation to consumers who do not enjoy regular power supply.

Friday Ohuche and Phebian Bewaji examine the Institutional Frameworks and Regulation of "Energy Mix" Markets and their implications for Energy Regulatory Reforms in Nigeria and find that the microeconomics of energy production is becoming sensitive to cost structures with implications for efficiency and affordability. Hence, different primary energy sources face different cost and pricing structures and developing a single omnibus regulatory framework is challenging. They further find overlapping and disparate institutional and legal frameworks for regulation, which tend to stifle growth of several energy markets, particularly the renewable energy market.

In a fascinating exposé, Jean Balouga considered the question "Should Nigeria be concerned about the coming of Thorium? It is the presenter's view that the negative impact of oil price volatility have combined to make the advent of thorium in the global energy market highly probable, which advent will most likely cause a dire and permanent shock to the global energy industry and economy; with implications better imagined than experienced particularly in oil-dependent countries like Nigeria.

Abiodun Edward Adelegan and Victor Oriavwote evaluated the issues and implications of oil theft, environmental degradation and social disequilibrium in the Niger Delta region of Nigeria. Their findings revealed a strong link between oil theft, environmental degradation and social disequilibrium in the region. They advocate for the establishment of youth empowerment programmes and poverty alleviation programmes; institution of a deterrent regime as well as orchestrating collaboration of all stakeholders to reduce or stamp out the menace, particularly in the light of the crashing crude oil price and its attendant consequences on the economy of the country.

Dr Balkisu Saidu
Editor, NAEE Newsletter
Usmanu Danfodiyo University, Sokoto, Nigeria

MEMBER GET A MEMBER CAMPAIGN A SUCCESS

Nevenka Hrovatin Wins Complimentary Registration at the Antalya IAEE International Conference

IAEE's Member Get a Member campaign was a smashing success with 20 new members added in the January to March period.

Members had their membership expiration date advanced three months for each new member referred. Advancements ranged from three months to 33 months as 20 members referred new members.

Professor Nevenka Hrovatin, Faculty of Economics, University of Ljubljana, Slovenia, referred the most new members – 11! She won complimentary registration to the Antalya International Meeting. In the process, she is helping to establish a new Affiliate of IAEE in Slovenia and hopefully her university will help support a forth coming IAEE conference in the country.

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

The following individuals joined IAEE from 4/1/15 to 6/30/15

Aliyu Abdulhakeem Ajikobi
CEPMLP Univ of Dundee
UNITED KINGDOM

Antonio Abreu
USP
BRAZIL

Gustavo Fabian Acosta
ITBA
ARGENTINA

Adewole Adebisi
CPEEL
NIGERIA

Adejumo Adedapo
NNPC
NIGERIA

Adetoyinbo Adeyemi
EEI
NIGERIA

Ogunlusi Adeyemi
EEI
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Romi Agarwalla
University of California, Berkeley
USA

Frederique Agnes
EDF
FRANCE

Hilda Estella Agudelo Velez
EPM
COLOMBIA

Aqueela Ahmed
Coventry University
UNITED KINGDOM

Olumide Aina
Ibadan Electricity Distribution
NIGERIA

Silete Edem Akakpo
IFIS Univ Paris Est Marne La Vallee
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Alastaire Sena Alinsato
Univ D Abomey Calavi
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Muhammad Alshiha
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George Asiamah
Queens University Belfast
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Kehinde Atoyebi
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Aishatu Bakari-Lawal
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Barine Barido
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Calendar

27-28 July 2015, Mozambique Coal Conference at Hotel Avenida Maputo, Avenida Julius Nyerere 627, Maputo, 3236, Mozambique. Contact: Informa Australia, Informa Australia, 18/347 Kent Street, Sydney , NSW, 2000, Australia. Email: info@informa.com.au, URL: http://atnd.it/23536-0,

29-30 July 2015, 9th Annual Mining & Developing the Pilbara Conference at Ibis Styles Hotel, 35 - 45 Searipple Road, Karratha, 6714, Australia. Contact: Informa Australia, Informa Australia, Level 18, 347 Kent Street, Sydney, 2000, Australia. Email: info@informa.com.au, URL: http://atnd.it/26545-0,

05-07 August 2015, 14th Annual Outage Management for Power Plants at Grand Hyatt San Antonio, United States. Contact: Tyler , Kelch, Marcus evans, 600 E Market St, San Antonio, TX, 78205, USA. Phone: +1 312-757-6197, Email: tylerke@marcusevansch.com, URL: http://atnd.it/23424-0,

August 09 - September 09 2015, Disruption and The Energy Industry Conference at Swissotel Sydney, Australia . Contact: Informa Australia, Informa Australia, 18/347 Kent Street, Sydney, NSW, 2000, Australia. Phone: +61290804300, Email: info@informa.com.au, URL: http://atnd.it/28503-0,

11-13 August 2015, Reserves Estimation Unconventionals Houston at Houston Marriott Medical Center, 6580 Fannin Street, Houston, TX, 77030, United States. Contact: Stephanie, Roberts, Hanson Wade, 52 Grosvenor Gardens, London, SW1W 0AU, United Kingdom. Phone: +44 (0)20 3141 8700, Email:stephanie.roberts@hansonwade.com, URL: http://atnd.it/28732-0,

18-19 August 2015, 6th Annual Land Access Forum at Stamford Plaza Brisbane, Margaret St, Brisbane QLD, 4000, Australia. Contact: Informa, Australia, Informa, Levels 18, 347 Kent Street, Sydney, NSW, 2000, Australia. Email: info@informa.com.au, URL: http://atnd.it/23537-0,

18-20 August 2015, Advanced Data Management for Oil & Gas at Kuala Lumpur, Malaysia . Contact: +65 6325 0339, Infocus International Group, 0. Email: ryan@infocusinternational.com, URL:http://www.infocusinternational.com/data,

24-27 August 2015, Power Purchase Agreement (PPA) at Johannesburg, South Africa. Contact: Ryan Zul, Infocus International Group, 0. Phone: +65 6325 0339, Email: ryan@infocusinternational.com, URL:www.infocusinternational.com/ppa,

25-27 August 2015, 4th International Conference Wind Turbine Towers at Swissotel Bremen, Hillmannplatz 20, Bremen, 28195, Germany. Contact: Barakaki Vasiliki, IQPC GmbH, Friedrichstraße 94, Berlin, 10117 , Germany. Phone: +49 (0)30 20 91 33 87, Email: barakaki.vasiliki@iqpc.de, URL: http://atnd.it/26313-0,

25-27 August 2015, South East Asia Australia Offshore and Onshore Conference at Darwin Convention Centre, Stokes Hill Road, Darwin, NT, 0800, Australia. Contact: Informa IIR, Informa IIR, Levels 18, 347 Kent Street, Sydney, NSW, 2000, Australia. Email: info@informa.com.au, URL: http://atnd.it/17517-0,

25-27 August 2015, Mining the Territory Conference at Darwin Convention Centre, Stokes Hill Road, Darwin NT, 0800, Australia. Contact: Informa, IIR, Informa, 18/347 Kent St, Sydney, NSW, 2000, Australia. Phone: 61 2 9080 4300, Fax: 61 2 9080 4300, Email: info@informa.com.au, URL: http://atnd.it/17518-0

27-28 August 2015, Platts Asian Petrochemicals Market 2015 at Grand Hyatt, Shanghai, Jin Mao Tower, 88 Century Avenue, Pudong, Shanghai, 200121, China. Contact: Sheryl, Tan, Platts, Marina Bay Financial Centre, Tower 3, 12 Marina Boulevard, 23rd Level, #23-01, Singapore, S018982, Singapore. Phone: +65 6216 1191, Email: sheryl.tan@platts.com, URL: http://atnd.it/28681-0,

01-04 September 2015, Asia-Pacific's International Mining Exhibition - AIMEX at Sydney Showground, 1 Showground Road, Sydney Olympic Park, 2127, Australia. Contact: Tony , Richens, Reed Mining Events, Brazil. Phone: +61 2 9422 2499, Email: tony.richens@reedexhibitions.com.au, URL: http://atnd.it/19717-0,

02-03 September 2015, Kalimantan Coal Conference at Novotel Balikpapan, JL Brigjen Ery Suparjan No 2, Balikpapan East Kalimantan, 76112, Indonesia. Contact: Informa Australia, Informa Australia, Sydney, Sydney, New South Wales, Australia. Email: info@informa.com.au, URL: http://atnd.it/26561-0,

07-09 September 2015, Business Development in the Oil & Gas Sector at Radisson Blu Edwardian, Grafton, 130 Tottenham Court Road, London, W1T 5AY, United Kingdom. Contact: Lydia, Polydorou-Evangelou, IFE Training, 149 Tottenham Court Road, London, W1T 7AD, United Kingdom. Phone: +44 (0)20 7017 7190, Email: iff.marketing@tfinforma.com, URL: http://atnd.it/28263-0,

07-09 September 2015, 5th World Sustainability Forum (WSF 5) at Centre for Teaching and Research, University of Basel, Hebelstrasse 20, Basel, 4031, Switzerland. Contact: Franck Vazquez, MDPI AG, Klybeckstrasse 64, Basel, 4057, Switzerland. Phone: 0041 61 683 77 35, Email: wsf5@mdpi.com, URL:http://atnd.it/28031-0,

07-09 September 2015, Global LNG at Radisson Blu Edwardian, Grafton, 130 Tottenham Court Road, London, W1T 5AY, United Kingdom. Contact: Lydia, Polydorou-Evangelou, IFE Training, 4th Floor, Maple House, 149 Tottenham Court Road, London, W1T 7AD, United Kingdom. Phone: +44 (0)20 7017 7190, Email:iff.marketing@tfinforma.com, URL: http://atnd.it/28265-0,

07-10 September 2015, Power Purchase Agreement (PPA) at Manila, Philippines. Contact: Ryan Zul, Infocus International Group, 0. Phone: +65 6325 0339, Email: ryan@infocusinternational.com, URL:www.infocusinternational.com/ppa,

07-09 September 2015, Managing and Negotiating Engineering, Procurement and Construction (EPC) Contracts for Energy Industry at Kuala Lumpur, Malaysia . Contact: +65 6325 0339, Infocus International Group, 0. Phone: +65 6325 0339, Email: ryan@infocusinternational.com, URL:http://infocusinternational.com/epcenergy ,

08-09 September 2015, Disruption and The Energy Industry Conference at Swissotel Sydney, Australia. Contact: Informa Australia, Informa Australia, 18/347 Kent Street, Sydney, NSW, 2000, Australia. Phone: +61290804300, Email: info@informa.com.au, URL: http://atnd.it/28503-0,

08-11 September 2015, CWC World LNG Series: Asia Pacific Summit at Grand Hyatt Singapore, 10 Scotts Road, Singapore, 228211, Singapore. Contact: Elizabeth Bogue, The CWC Group, 0. Phone: +44 207 978 0768, Email: ebogue@thecwcgroup.com, URL: http://atnd.it/22234-1,

08-09 September 2015, Disruption and The Energy Industry Conference at Swissotel Sydney, Australia. Contact: Informa Australia, Informa Australia, 18/347 Kent Street, Sydney, NSW, 2000, Australia. Phone: +61290804300, Email: info@informa.com.au, URL: http://atnd.it/28503-0,

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IAEE ENERGY FORUM
Volume 24, Third Quarter 2015

The *IAEE Energy Forum* is published quarterly in February, May, August and November, by the Energy Economics Education Foundation for the IAEE membership. Items for publication and editorial inquiries should be addressed to the Editor at 28790 Chagrin Boulevard, Suite 350, Cleveland, OH 44122 USA. Phone: 216-464-5365; Fax: 216-464-2737. Deadline for copy is the 1st of March, June, September and December. The Association assumes no responsibility for the content of articles contained herein. Articles represent the views of authors and not necessarily those of the Association.

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