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IAEE Energy Forum

Fourth Quarter 2016 | International Association for Energy Economics

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INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS

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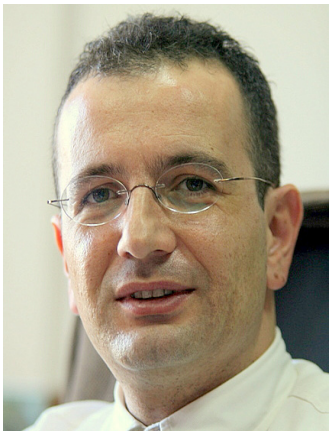
Editor: David L. Williams

President's Message



I'd like to start my last Presidential Message in the *Energy Forum* by expressing my gratitude to participants of our 1st Eurasian Conference which took place on 28-31 August this year in Baku, Azerbaijan. In spite of great difficulty and various local obstacles, we succeeded in making this conference a success. Such a success that we have been invited for a repeat performance next year. Once again IAEE has demonstrated its capability and excellence in a new region and planted good seeds.

It has been my ambition and passion to take the IAEE flag to new countries around Turkey and enlarge our membership in the Caucasus and Balkans. In the Balkan peninsula, Slovenia turned out to be a role model for new Affiliates as it has been growing very rapidly in membership and performing very actively in local events. I've been taking advantage of the geographical closeness so as not to miss their events. The most recent organization by our Slovenian Affiliate, the Energy Economics & Industry Conference that took place on September 29 turned out to be a great success again. Albania and Croatia are in IAEE's target list and candidate to be our next stop in the Balkans. While speaking of the Balkan countries, I'd like to note my appreciation to our colleagues in Greece where we've established another new IAEE Affiliate earlier this year.

Our next potential Affiliate emerges in Israel, and it is my great pleasure to participate in the upcoming Israel Energy & Business Convention. With its significant oil & gas resources in the Eastern Mediterranean, Israel has a key role in shaping the future supply routes. In this context, naturally a role for IAEE emerges as well in contributing to the discussion of Eastern Mediterranean hydrocarbons from an economic angle.

The Middle East with its vast oil & gas resources has been a region of interest to the global energy economy since the discovery of these resources, essentially for over a century. We've been discussing issues related to the region since the foundation of IAEE, yet have weak presence in the region except Saudi Arabia. We hope to see our Middle Eastern colleagues in our conferences, hopefully the next IAEE Eurasian conference at the latest, and expand in the region with new events and conferences.

Another region of weak IAEE presence is Africa with the exception of Nigeria. We've identified a strategic development plan to invest in Africa as well aiming to contribute to the reduction of energy poverty.

Turning to the other extreme, a region where we are the strongest and are centered, we arrive at North America. Our 34th North American Conference coming up on 23-26 October is taking place in Tulsa, Oklahoma this year.

Finally, I would like to announce the launch of a new service at IAEE, which is the Speakers Bureau. To check out this new service visit the IAEE website where you can

(continued on page 2)

President's Message (continued from page 1)

search worldwide for renowned speakers according to area of expertise.

And my last words in my last Presidential Message in the *Energy Forum*, before leaving this exciting challenge in the hands of our next President Ricardo Raineri, goes to IAEE Council Members as well as to IAEE Executive Director David Williams in appreciation of all their dedicated work for IAEE. I want to express my profound gratitude to all for all their support throughout my term as President of IAEE. It has been a great pleasure and honor for me to lead this truly global Association with the support of a wonderful international team. I wish the incoming 2017 president Ricardo Raineri and all our members the very best.

Gurkan Kumbaroglu

NEWSLETTER DISCLAIMER

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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

Editor's Notes

As we mentioned in the thrid quarter issue, LNG is a very popular subject. We conclude our examination of the subject in this issue. Included in this issue is the annual summary of the BP Statistcial Review which we're fortuante to be able to run each year. This year, we're greatful to **Spencer Dale** and **Kai Dunke**r for their writing.

Seyed GholamHosein Hassantash raises the question: Despite the heavy dependence of Russia' economy on the price of oil, why doesn't that country make any effort to reverse the downward trend of the crude oil price? The fact is that by reducing its crude oil production, Russia can force Saudi Arabia and OPEC to cut back their production as well, thus gaining much revenue from the export of its oil and gas. With the arrival of shale oil and gas, the U.S. has emerged as a serious competitor, whose rivalry gets intense at higher levels of the oil price. Hence is there an unwritten agreement between Russia and Saudi Arabia over market share, but for how long? Perhaps the secret in Russia's plan is in the question; Who will yield to pressure first? Russia or Saudi Arabia?

Mamdouh Salameh writes that the shale revolution has made the United States the world's third biggest crude oil producer after Russia and Saudi Arabia and it is projected to make the United States within 2-3 years the world's third biggest LNG producer and exporter after Qatar and Australia. He provides furhter details.

Doug Reynolds explores whether China is in a recession or not, "Is China in Recession? A Cursory Look At Its Energy Statistics." He notes how some of the energy statistics are inconsistent with a stated 7% rate of economic growth especially when considering other early economic development countries.

Matthew Schmidt, Philipp Hauser, and **Dominik Möst** note that U.S. shale gas has altered the global natural gas landscape. Current developments, however, indicate that U.S. LNG faces significant challenges in the near future. An oversupplied Asian-Pacific market and a European market tied to Russian pipeline gas look to thwart a profitable U.S. LNG trade. The mid to long-term prospects for U.S. LNG rest on increased demand in China or a consequential implementation of climate policy globally.

Jikhan Jeong points out that due to falling oil prices and the declining operating rate of LNG power plants in South Korea, the planned import of 20% of South Korea's LNG needs from U.S. shale gas by 2020, may not be possible. He explains why.

Thomas Tunstall writes that export markets for U.S. LNG producers are under siege. More established markets that had been targeted by LNG exporters may no longer be viable, which will require revamped business models.

Ionut Purica, using data from the Eastern European region (EU member countries and Ukraine), analyzes the import of gas (LNG included) given the vulnerability of the region stemming from its single source of imports. A proposed North-South gas interconnector in the region, ala an historical route from the Varangians to Greece, would increase safety of supply and geo-strategic reliability of the Eastern border of EU and NATO.

Sreekanth Venkataraman writes that the excitement in Washington about the potential for using LNG exports as a geopolitical weapon in the long run needs to be tempered with caution. The LNG exports from U.S. are unlikely to be a game changer in the EU and Asia is expected to offer little succor as well.

DLW

!! Congratulations !!

2015 USAEE/IAEE Working Paper Best Paper Award

USAEE and IAEE are pleased to announce the winner of the 2015 USAEE/IAEE Working Paper Best Paper Award. Congratulations go to:

Brantley Liddle
Asia Pacific Energy Research Centre, Tokyo, Japan
and
Perry Sadorsky
Schulich School of Business, York University, Toronto, Canada

for their paper entitled:

"How much does Increasing the Share of Non-fossil Fuels in Electricity Generation Reduce Carbon Dioxide Emissions?"

Over 25 papers were received into the Working Paper Series in 2015. Papers were judged based on their contribution to the literature, scholarship, and originality. The review committee was composed of Kevin Forbes (chair), Catholic University of America, Ying Fan, Beihang University, and Anastasia Shcherbakova, University of Texas at Dallas**.**

The committee noted that the overall quality of the papers was excellent and would like to thank all of the authors for their submissions.

For more details regarding the USAEE/IAEE Working Paper Best Paper Series please click here.

Russia and the Oil Market (Or Duel of the Oil Titans)

By Seyed GholamHosein Hassantash

Seyed GholamHosein Hassantash has held various positions in the National Iranian Oil Company (NIOC) including, Director General of the Ministerial Office of the Oil Ministry, NIOC board member and Manager of the Administrative Affairs Department and Advisor to the Oil Minister on Economic Affairs. He was President of the Institute for International Energy Studies from 1997 to 2002.

Russia is amongst the world's top three producers of oil (crude oil and condensate), the U.S. and Saudi Arabia are the other two. Russia is also the world's second largest producer of natural gas after the U.S, but is the number one exporter. In crude oil, Russia is the world's second largest exporter, following Saudi Arabia.

In 2013 and before the global collapse of crude oil prices, 50% of Russia's Federal budget and about 68% of its export revenues came from oil and gas exports. Now, with the current price of crude oil and the fact that the natural gas price is derived from that of crude oil, Russia's economy is, at least in the short term, being hurt and must be under enormous pressure. Ironically, Russia has so far shown no effort to reverse the decreasing trend of oil prices and displays no willingness to cooperate for that purpose.

In the quartet meeting of Russia, Saudi Arabia, Qatar and Venezuela, held in February in Doha, (which was convened chiefly due to the tireless efforts and struggles of Venezuela), Russia stood beside Saudi Arabia in only accepting to stabilize their crude oil outputs at the levels they were at the end of January 2016. This hardly made any difference to the market, and at least in the case of Russia it was perceived as more of a joke, since most of the earlier estimates showed that Russia has basically no capacity to further raise it oil production anyway.

Such inaction by Russia to control the price of oil has to be scrutinized and requires further study of the long term economic and energy policies of that country. Here, I will attempt to raise a few points in the hope of paving the way for further discussions by experts in the field.

In recent months, Russia's total crude and condensate production has been some 10.7-10.8 million barrels per day (mbpd). Given that Russia's domestic oil consumption is just under 3.5 mbpd, a little more than 7 mbpd of crude oil and condensate are exported. In recent months, the global oil market supply has been exceeding the demand by about 1.5 mbpd, which is the main cause of the fall in its price.

Let's assume that Russia alone cuts its oil output and exports by 2 mbpd, which will no doubt raise the oil price by about $ 15 per barrel. If Russia's oil is taken to be priced around $ 35 per barrel, she will lose $ 70 million per day because of that 2 million barrel cut in output. But if the remaining 5 million barrels are sold by only $ 14 per barrel more, then that loss of $ 70 million is already compensated for in full. That way, Russia can preserve oil by cutting back its exports while earning the same revenue. Besides, once crude oil prices rise, natural gas prices will follow suit and thus Russia, the world's largest exporter of natural gas, can benefit greatly from this as well.

Perhaps Russia need not even really have to bear the burden of the cut alone. Al-Naimi, the oil minister of Saudi Arabia, as the pivotal member of OPEC, has at times said that if non-OPEC producers were ready to cooperate in reducing their outputs proportionately, OPEC and his country would reciprocate in kind. Therefore, if Russia is prepared to cut back on its oil production by just 1 mbpd, OPEC and Saudi Arabia will be deprived of any excuse not to lower their output as well. Then, if OPEC yields to this pressure and agrees to cut back another 1 mbpd, Russia will benefit hugely from its oil and gas exports at relatively much lower costs.

But the problem is not that simple. The main excess supply of oil in the market that has in recent years caused the fall of the oil price comes largely from the unconventional shale oil of the United States, which is the source of the rise in the country's oil production.

Since 2004, production of shale oil has become technically possible, all needed infrastructures have been developed and the conditions under which its production would make economic sense have gradually become clear. Hence, it is now clear at what oil price production from shale field would make economic sense and profit. Besides, all drilling and other facilities are in place and as soon as production from a shale field becomes viable, its production can quickly be pumped into the market. There are many drilled but incomplete fields in various zones ready to be swiftly completed and equipped to boost oil output of the U.S.

The U.S. has, therefore, emerged now as a serious competitor to both Russia and Saudi Arabia, and this competition gets intense at higher levels of the price of oil. Rivalry between Russia and America doesn't end with just oil. The U.S. is becoming a gas exporting country through the export ofsee that the press in the U.S. too is sometimes playing the tune of 'the beginning of crumbling of an outdated Oligarchic system that supports Al Qaeda and ISIS, at least ideologically'. Even the U.S. Presidential can-

didate Donald Trump of the Republican Party (which has traditionally closer ties with the Saudi family) is at a dilemma to determine whether he likes Saudi Arabia or wants it destroyed!

Maybe the Russians too have felt that Saudi Arabia is off track? If a coup de grace knocks out the Saudi government before it hits the Russian economy, then the problem is already fixed for Russia. As a result, the exit of the Saudi oil, or at least a significant portion of it, from the global market will not only push its price up, but will create such a shortage in the global energy market that even the rise in the production of shale oil will not be able to compensate for, and will provide a huge opportunity for the Russians.

But this opportunity will turn into a threat if Putin, or his replacement, fails to use appropriate mechanisms to stop the resources curse from reappearing. liquefied natural gas (LNG). The potential for producing gas from its shale gas fields is even greater than that of shale oil. Further development of shale gas fields in the U.S. is contingent upon the global price of oil, because, as cited earlier, the price of gas is derived from that of oil. In fact, the price of oil is the criterion for economic justification of all types of energy production.

Export of energy, particularly natural gas, is not just an economic issue for Russia. As the largest supplier of natural gas to Europe, Russia perceives Europe's dependence on its gas as leverage in its foreign policy, is extremely determined to maintain it, and tolerates no competition in this regard. The U.S. has been against Europe's dependence on Russian gas right from the beginning (in the 80s and before the collapse of the Soviet Union).

Americans believe that expansion of facilities in Europe for the import of LNG is the best way to secure their gas needs. Meanwhile the U.S. is trying to become a major exporter of LNG and Europe happens to be its best market. The first LNG cargo of the U.S. is expected to be marketed next year. Although the drop in the global price of oil has for now delayed many LNG projects in the U.S., once the oil price regains strength, work on those projects will be resumed and the Russians will find maintaining that leverage quite hard.

In light of above facts, it is likely that Russia and Saudi Arabia have come to an explicit and written or an implicit and unwritten agreement on what the Saudis call protecting their 'market share'. If such an agreement does in fact exist, it raises the question as to how long it can actually last. The prevailing conditions in the oil market will not last forever, and the supply of oil and gas will not always remain more than the demand. In the midterm, an economic development, especially in resolving economic crises of the industrial countries, and the right move in emerging economies, will boost the growth rate of their economies, raise global energy demand which will in turn increase the price of oil.

Or, lack of adequate investment in the production of oil, gas and other energy carriers (because of low prices and hence uneconomical projects) will lead to a shortage and push prices up. How long can Russia and Saudi Arabia actually put up with the market share challenge? More importantly, how long can the two rivals withstand the losses caused by the low price of oil and the resulting economic pressures? Perhaps this is the clue to the secret in Russia's hindsight planning in that agreement; who will yield to the pressures first? Russia or Saudi Arabia?

The actual dependence of the Saudi economy on oil is more than that of Russia on oil and gas. Some 85% of Saudi's export revenues come from oil exports. However, the potential dependence of Saudi Arabia on oil is far more than that of Russia. The Russian Federation is the main body of what has remained from the Soviet period, especially in the fields of industry and technology. Prior to the downfall of the Soviet Union and the ensuing Mafia style looting that climaxed in Yeltsin's era, some huge industries were active in that country.

There is just no comparison between Russia and Saudi Arabia in technical, industrial and scientific bases needed for economic development and freeing the country from dependency on a single commodity. It must be noted, however, that the high prices of oil and revenues generated by export of oil and gas in the post-Soviet era were in fact poisonous for the Russian economy because they simply intensified its dependence on a single commodity and the resulting ailments. Americans must have hoped that the sleeping White Bear would never again awaken to regain its previous superpower status and that the Russian economy would be plagued by the single commodity phenomenon and the inauspicious resources curse. In that sense, and if Russia intends to be saved from such a predicament, a low oil price could be an opportunity (a blessing in disguise) for that country. Perhaps that is why Vladimir Putin has recently issued some executive orders to rid Russia's economy of dependence on oil and gas export revenues.

On the other side, Saudi Arabia has stepped into an era of serious challenges. Following the demise

of King Abdullah, the balance of power in the kingdom has undergone radical changes and the internal power struggle in the House of Saud has intensified. At the regional level too, the Saudis have been dragged into a costly, far-reaching and seemingly unending war in Yemen. Besides, the U.S. has visibly turned away from its former allay. The story has long been forgotten that back in 1945 President Franklin Roosevelt met with King Abdul-Aziz Bin Saud on the deck of a U.S. warship in the Suez Canal and offered him America's support for Saud's family in return for a guarantee of oil for the the U.S. The United States of America is no longer in need of the Saudi's oil. One can also see that the press in the U.S too is sometimes playing the tune of 'the beginning of crumbling of an outdated Oligarchic system that supports Al Qaeda and ISIS, at least ideologically'. Even the U.S Presidential candidate Donald Trump of the Republican Party (which has traditionally closer ties with the Saudi family) is at a dilemma to determine whether he likes Saudi Arabia or wants it destroyed!

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In Memory of Al Troner

Al was a unique character. I met Al in the mid-1980s when he worked at Dow Jones/Telerate's regional energy services. We became friends and he told me of his desire to get out of the daily reporting, do a higher degree, and expand his horizons. I offered him a scholarship to do a graduate degree and work with my team in Hawaii. He spent a couple of years with our group before he joined PIW's Asia-Pacific bureau. Over the years, we met and often exchanged stories, participated in conferences together, and co-chaired a condensate conference. I was touched when he kept telling people, "Once you work for Fereidun, you always work for him no matter where you are." He was always full of stories and loved focusing on topics and areas that only a few cared about! Then he learned so much about the topic, he became the subject expert. He loved complicated condensate streams, high acid crude streams, and difficult small streams that most had not even heard of. He understood the economics, chemistry, and logistics. His history of journalism in Italy added a flare to his stories and approach to the problems that was unique. He touched the heart of many people and developed disciples all over the world. I will miss him deeply. He will be missed by so many in his extended family of friends and colleagues.

Fereidun Fesharaki

Energy in 2015 - A Year of Plenty

By Spencer Dale and Kai Dunker

INTRODUCTION

This article highlights developments in the energy market in 2015, and also looks ahead to what 2015 can tell us about future trends. It is based on the *BP Statistical Review of World Energy 2016*, which is the 65th edition of this annual publication.

In 2015, the global energy markets were in a state of flux as both energy demand and supplies were changing in profound ways.

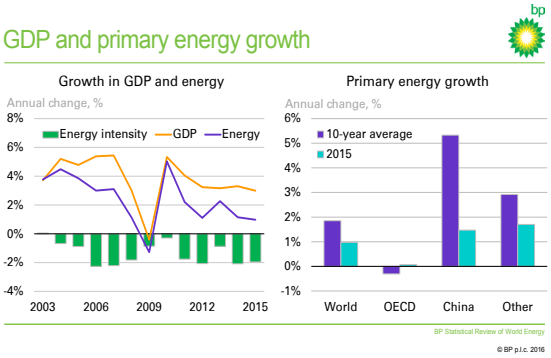
On the demand side, the strong growth in energy consumption associated with the rapid industrialization of China, especially energy-hungry industrial production, and its integration into the global economy, was waning. This transition in energy demand was reinforced by global efforts to improve energy efficiency and reduce energy intensity as exemplified by the pledges and determination demonstrated at the COP21 meeting in Paris. The pledges are likely to lead to further policies aimed at shifting the fuel mix towards cleaner, lower-carbon fuels, with renewable power, along with natural gas, as the main beneficiaries. However, these efforts will need to be intensified if the world is to have any hope of achieving the goals set in Paris.

While energy demand was in a process of transition, rapid technological and productivity gains increased the abundance of global energy supplies. In the case of fossil fuels, this is exemplified by the U.S. shale revolution. However, the technological advances within non-fossil fuels are even more striking, as sharp cost reductions have gone hand-in-hand with rapid growth in supplies. For example, solar power production has increased more than sixty-fold in the space of 10 years, doubling capacity every 20 months.

Spencer Dale is Group Chief Economist of BP p.l.c.; Kai Dunker is a Natural Gas Economist with the firm. *The BP Statistical Review of World Energy* **and a more detailed analysis, as well as the** *BP Energy Outlook to 2035* **can be found at http://www.bp.com/energyeconomics.**

KEY FEATURE OF 2015

The gradual transition towards slower growth in energy demand was again compounded by cyclical weakness in 2015. Global economic growth remained lacklustre at 3%, with much of this weakness concentrated in the more energy-intensive industrial sectors. One manifestation of this weakness in industrial production was that power generation grew less rapidly than total energy for only the second time in 30 years.



As a consequence of the combined impact of gradual transition in energy demand and cyclical weakness, global energy demand grew by just 1.0% in 2015. Though this was similar to the 1.1% growth seen in 2014, it was almost half the average rate seen over the past 10 years (1.9%).

The sluggish growth in energy demand meant that energy intensity – the average amount of energy needed to produce a unit of GDP – declined by 2%. Although broadly similar to the rate of decline seen for much of the past 10 years, it is striking that in a year when energy prices fell sharply, energy intensity still declined as much as it did.

The weakness in energy demand was driven by Non-OECD countries where consumption increased by just 1.6% in 2015, less than half of their average growth over the past 10 years. The main driver was China, where growth in energy consumption slowed to just 1.5% -- its weakest rate of growth since the late 1990s in the period prior to rapid industrialization. Even so, China remained the world's largest growth market for energy.

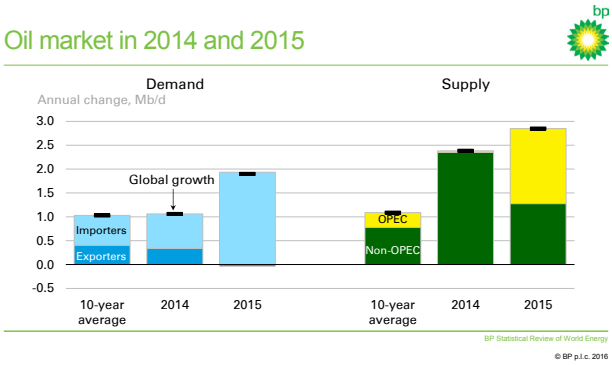
In terms of individual fuels, 2015 was mixed. Despite the weakness in overall energy demand, 2015 saw solid growth in several areas. Oil (growth of 80 Mtoe, 1.9%), was lifted by the sharp fall in oil prices and saw its share in primary energy increase for the first time since 1999. Natural gas (54 Mtoe, 1.7%) bounced back from the weather-induced weakness of 2014, and renewable energy in power (48 Mtoe, 15.2%) also grew. However, coal saw its largest decline on record (-71 Mtoe, -1.8%,), due to large falls in the U.S. and to a lesser extent in China, with its share in primary energy falling to its lowest level for a decade.

Despite these differences across fuels, one can identify common features of how these twin forces of slower demand growth and abundant supply impacted energy markets in 2015.

One such feature is that energy prices reacted to the imbalance between demand and supply: prices of oil, natural gas, and coal fell sharply in 2015. The extent of the price falls was amplified by the fact that, unlike in the past, key suppliers did not adjust their production to stabilise prices. OPEC did not respond to the rapid gains in U.S. tight oil by reducing production, nor did the Russian gas exporter respond to increasing competition from liquefied natural gas (LNG) in Europe. The response of suppliers reflects that ceding market share in order to support prices is less attractive when the underlying cause of the imbalance is structural, rather than a temporal shock.

Another feature is that price signals in the energy market worked. That is, in response to lower prices in 2015, demand for some fuels was boosted, while supplies in the form of current activity and future investment were severely curtailed in others. However, in some markets, notably oil, the adjustment process was offset by non-price led developments. Even so, an adjustment process does appear to be underway, and the underlying effect was that the fuel mix of primary energy shifted in 2015.

FUEL BY FUEL



Oil

In 2014, developments in the oil market were driven by exceptional growth in non-OPEC supplies, led by U.S. tight oil, which triggered a sizeable supply imbalance and a consequent fall in oil prices. Oil demand and supply responded to this sharp fall in prices in 2015, although this adjustment was offset by non-price led developments.

Global oil demand expanded strongly in 2015, growing by 1.9 Mb/d, nearly twice its 10-year average of 1.0 Mb/d. This expansion was driven by net oil importers with the U.S. (0.3 Mb/d), EU (0.2 Mb/d), China (0.8 Mb/d), and India (0.3 Mb/d) all recording unusually strong growth, while, in contrast, demand growth within oil exporters was weaker than usual.

The strength in oil demand was most pronounced in the consumer-focused fuels, particularly gasoline and jet fuel. Demand for these fuels was supported by a rise in consumers' purchasing power due to low oil prices. In contrast, growth in diesel consumption was more subdued, as it is more reliant upon industrial activity.

On the supply side, the impact of low oil prices was most immediately felt within U.S. tight oil. U.S. oil rigs peaked in October 2014 at a little above 1600, falling by around two-thirds by the end 2015. The strong gains in rig productivity meant that the slowing in output growth was less pronounced. Total U.S. production still increased by 1.0 Mb/d in 2015, reinforcing the U.S.'s position as the world's largest oil producer. Even so, the increase in U.S. production was considerably smaller than in 2014 (1.7 Mb/d), largely due to U.S. tight oil which peaked in March 2015.

Longer lead times and higher levels of sunk capital meant other Non-OPEC production was less affected than U.S. tight oil. Total non-OPEC supply increased by 1.3 Mb/d, with Brazil, Russia, the UK and Canada all registering production increases in 2015.

The apparent comparative resilience of non-tight oil producers in relation to price is partly a matter of timing. Investment in oil and gas-related projects is estimated to have fallen by about $160bn in 2015 – around a quarter off its 2014 level, which is the largest proportionate fall since the late 1970s; and capital spending has continued to fall sharply in 2016. Although some of the reduction in nominal spending was offset by cost deflation, the lower levels of investment will inevitably detract from future supply growth. A key uncertainty for the near term is whether this fall in capex will cause the oil market to tighten excessively over the next few years.

However, oil markets in 2015 were not just characterized by price-sensitive demand and supply reacting to lower prices. OPEC production increased by 1.6 Mb/d to a new record of 38.2 Mb/d. The two main drivers were Iraq (0.7 Mb/d) and Saudi Arabia (0.5 Mb/d), which together accounted for the majority of the increase. Despite adjustments in the price-sensitive components of oil demand and supply, the net result was that the increase in aggregate global oil production of 2.8 Mb/d again outstripped that of demand, further adding to the supply imbalance.

The adjustment to lower prices has continued so far in 2016, with indicators pointing to solid demand growth and a decline in non-OPEC supply. Based on current trends, it seems likely that the oil market will move broadly into balance in the second half of 2016. Although this means that oil stocks will stop

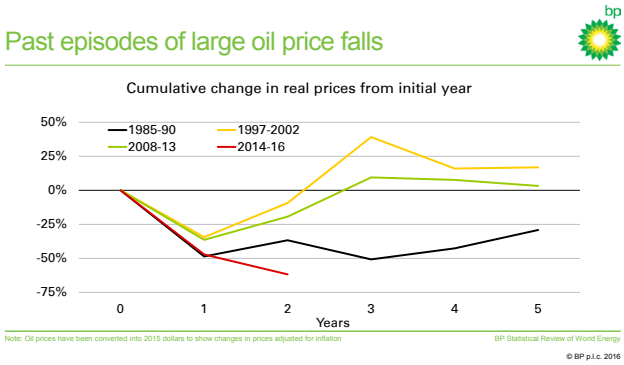
accumulating, it will still leave a significant overhang of inventories, reflecting the increase in crude and product stocks in recent years. OECD commercial inventories, for example, rose by 280 Mbbls in 2015, ending some 350 Mbbls above their 5-year average. Although comparable data for the non-OECD are not available, it is likely that non-OECD inventories also rose further. The market will only truly return to normal when the sizeable stock overhang has been worked off.

The persistent supply imbalance and growing inventory levels weighed on oil prices, which fell sharply towards the end of 2014 and into 2015. Dated Brent averaged $52 in 2015, its lowest nominal annual average since 2004, and almost 50% below its 2014 level.

Comparing the recent fall in prices with previous episodes of sharp price declines shows a pattern closer to that seen in the mid-1980s, than in either 2008-9 or 1997-8.

The latter two shocks were driven by sharp contractions in demand growth that reversed relatively quickly. In contrast, the mid-1980s price fall was driven in large part by new sources of supply, as new production from the North Sea and Alaska came on stream. This led to a more protracted period of weak prices as the market had to absorb gradually the additional supply.

Although different in many respects to the mid-1980s, the underlying cause of the current price weakness was also supply driven, in this case an increase in supply from U.S. tight oil. As a consequence, prices have been lower for longer than in either 2008-9 or 1997-8.



Refining

Meanwhile, the sharp increase in crude supplies and a fall in prices led to a buoyant year for refining. Refinery throughput rose by 1.8 Mb/d in 2015, more than triple its 10-year average growth, with margins increasing to near-record highs. Reflecting the diverging trends in product demand, gasoline cracks reached their highest levels on record, whereas diesel cracks fell back. The strength of margins encouraged refiners to increase product stocks, easing pressure on crude storage capacity and taking OECD product stocks to more than 100 Mbbls above recent averages.

The increase in refining runs dwarfed the expansion in refining capacity (0.5 Mb/d), such that refining utilization increased by 1 percentage point to 82.1%, its fastest increase since 2010. Indeed, capacity grew at its slowest rate for over 20 years, as past decisions to delay several projects in China were felt. More recently, restrictions on China's so-called teapot refineries were relaxed, also helping utilization to increase.

Improvements to U.S. infrastructure meant that, despite the abundance of supplies, North American crude differentials narrowed further last year, with Brent-WTI averaging around $3.7/bbl and the spread between WTI and Western Canadian Select (WCS) averaging just $11.9/bbl.

2015 also saw the repeal of the ban on U.S. crude exports outside of North America which dated back to the aftermath of the Arab Oil Embargo in the mid-70s. Given the easing in U.S. production growth in 2015 and declines so far in 2016, relatively little U.S. crude has been exported so far. But the lifting of the ban means there is now more of a natural ceiling to the Brent-WTI differential as and when U.S. production begins to pick up again.

Natural gas

The global natural gas market, much like oil, revolved around lower prices as continued strong growth in global production was combined with subdued demand outside of the power sector.

Henry Hub fell 40% relative to its 2014 average, while the Japan/Korea Marker fell 46%, and NBP 21%. These price falls, which were exacerbated in Asia and Europe by the decline in oil prices, helped to balance the market by allowing gas to gain share in the power sector, which is the most price-sensitive component of gas demand. Overall, aggregate gas consumption increased by 1.7%. Although significantly stronger than the weather-induced weakness in 2014 (0.6%), this was still below its historical average of 2.3%.

However, this broad global narrative disguises considerable variation across regions. On the demand side, the key source of weakness was Asia, where growth in gas consumption slowed to just 0.5% (3 Bcm). The main reason for Asia's slow growth was China, where growth fell to below 5%, down from

double-digit growth seen over much of the past 10 years. This fall reflects both the general slowdown in China's energy demand, as well as increasing competition from alternative fuels. In the U.S., a mild winter and weak industrial production meant gas demand outside of the power sector fell in 2015. In contrast, gas consumption in the EU (16 Bcm, 4.6%) bounced back from the depressing effects of an exceptionally mild winter in 2014. The Middle East also recorded strong growth (26 Bcm, 6.2%), as new sources of production came on stream.

On the supply side, the U.S. remained the global powerhouse, with output growing by over 5% (39 Bcm), accounting for more than half of the increase in world production. All of this increase was driven by U.S. shale gas, since conventional U.S. gas production fell. In addition to the U.S. and the Middle East, there were also notable supply increases in Norway (7.7%, 8 Bcm), China (4.8%, 6 Bcm) and Australia (9.4%, 6 Bcm).

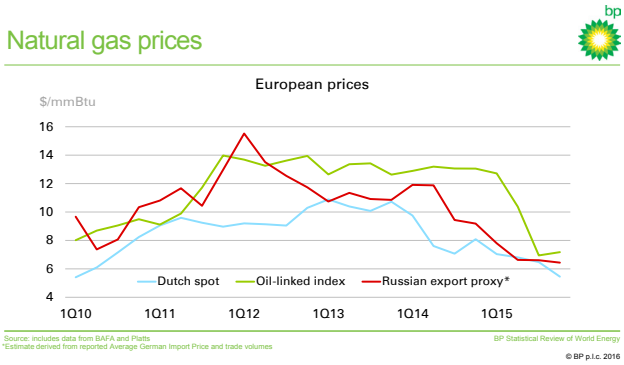
Standing back from the differences across countries, three general features of the gas market in 2015 can be identified. First, natural gas gained significant share from coal within several major power markets around the world. These gains were most striking in the U.S., where the increasing price competitiveness of gas relative to coal allowed gas to overtake coal as the dominant source of energy in the U.S. power sector by the middle of 2015.

Second was the changing trade pattern of global LNG. LNG supplies rose by around 6 Bcm in 2015, with increases in Australia, Papua New Guinea, and Qatar more than offsetting the disruptions to Yemeni supplies. At the same time, the deceleration in China's gas consumption, combined with falls in South Korea and Japan, meant that after being the primary growth market for LNG over the past 5 years or so, Asian LNG demand fell in 2015. As a result, LNG flows were diverted west, with increased imports to the Middle East, North Africa, and Europe. This shift in the pattern of trade flows went hand-in-hand with a sharp narrowing in price differentials, as the Asian premium over European gas prices virtually disappeared.

This convergence in prices is consistent with the global gas markets becoming increasingly integrated. As global LNG supplies grow in importance and, as a consequence, global gas trade becomes increasingly price sensitive; the impact of shocks in one part of the world, (in this case weak Asian demand), will increasingly be transmitted to other parts of the globe.

The final feature to highlight about the natural gas market in 2015, concerns the greater abundance of LNG flowing into Europe, and the corresponding fall in European gas prices. In particular, how the Russian exporter responded to this increased competition.

Given that much of Russia's gas exports to Europe are indexed to oil, one option would have been to maintain that link, although the flexibility built into those contracts might have resulted in some loss of demand. The alternative would have been for Russia to compete on price in order to maintain their market share. Unfortunately, since rebates and discounts are granted on a contract specific basis, it is not possible to observe Russian gas prices directly.



However, it is possible to approximate Russian export prices to Germany by using data on Average German Import Prices (AGIP) and the composition of those imports. Although the resulting proxy is crude, it does suggest that Russian export prices to Europe fell more quickly in 2015 than a simple link to oil prices would have implied and have remained close to European spot prices.

This suggests that Russia has competed on price in order to maintain its market share. Much like OPEC's response in the oil market, the option of giving up market share in order to support prices is less attractive if the source of the price weakness, (in this case increased supplies of **LNG),** is expected to persist.

Coal

2015 proved to be a year of large falls in the coal market: global consumption (-71 Mtoe, -1.8%) and production (-159 Mtoe, -4.0%) recorded their largest falls on record, and coal prices fell by around 20%.

To a large extent, coal was a casualty of the larger, secular, forces driving global supply for, and demand of energy.

The main manifestation of the technological wave driving energy supplies was the shift in the fuel mix in the U.S. power sector. There the strong growth in U.S. shale gas forced down U.S. gas prices, causing

gas to displace coal in the power sector. That switch, which was reinforced by tightening environmental policies, caused U.S. coal consumption to fall sharply (-57 Mtoe, -12.7%).

In contrast to 2012 (the last time U.S. coal consumption fell sharply), the general abundance of global coal supplies in 2015 meant that the surplus of domestic U.S .coal could not easily be exported to other parts of the world. Instead, U.S. coal production also fell markedly (-53 Mtoe, -10.4%).

The transition underway in energy demand was seen most starkly in China. As China's period of rapid industrialization has come to an end, its demand for coal has slowed sharply. In 2015, China's coal consumption fell for the second consecutive year (-29 Mtoe, -1.5%), as Chinese industrial production decelerated more sharply than the rest of the economy, and as coal lost out to increasing competition in the power sector.

Chinese coal production fell by a similar amount (-37 Mtoe, -2.0%). Indonesian production also fell sharply (-41 Mtoe, -14.4%) as its key export market, China, contracted.

Following two consecutive years of falling Chinese coal demand, a key question for the global coal market going forward is whether Chinese coal consumption has peaked? There are powerful structural factors pushing in this direction: most notably, the shifting pattern of Chinese growth towards slower, more service-orientated growth; and the determination of the Chinese authorities' to switch to cleaner, lower-carbon fuels. However, the falls in coal consumption last year were compounded by a sharp slowing in some of China's most energy-intensive – and coal-intensive – sectors: output in iron, steel, and cement all fell in absolute terms last year. The sharp slowing in these energy-intensive sectors was in part driven by cyclical elements which are unlikely to be repeated. Overall, the net impact of these opposing structural and cyclical for**ces on future Chinese coal demand is unclear.**

NON-FOSSIL FUELS

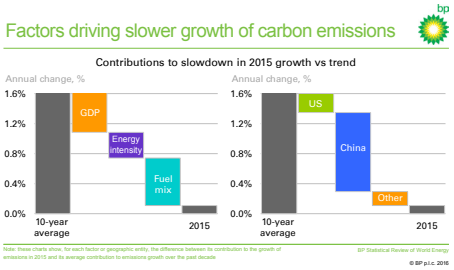
While coal markets experienced the largest contraction on record in 2015, non-fossil fuels grew by 3.6%, slightly higher than its 10-year average.

Renewable energy in the power sector grew by over 15%, supported by improving technology and falling costs. Although the share of renewable energy in the global energy mix remains small at 2.8%, its strong growth accounted for all of the increase in global power generation in 2015, and 38% of the entire increase in global energy consumption.

While the growth of renewable energy continued to be led by wind power (17.4%, 125 TWh), solar power is catching up fast. It expanded by nearly 33% (62 TWh) in 2015, with China overtaking Germany and the U.S. as the largest generator of solar power.

Meanwhile, hydro and nuclear energy grew more modestly. Global hydro power increased by just 1.0% (38 TWh) as it was held back by drought conditions in parts of the Americas and Central Europe. Nuclear energy increased by 1.3% (34 TWh), as rapid expansion in China offset secular declines within mainland Europe. This gradual shift of nuclear energy away from the traditional centres of North America and Europe towards Asia, particularly China, looks set to continue over the next 10-20 years.

CARBON EMISSIONS

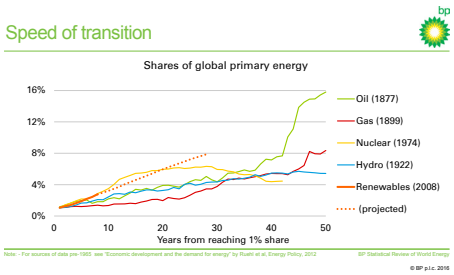


The most striking development in 2015 was for carbon emissions. The slower growth of energy demand, together with a shift in the fuel mix away from coal towards lower carbon fuels meant that carbon emissions from energy use were essentially flat last year (0.1%). This was the slowest growth in nearly a quarter of a century (other than in the immediate aftermath of the financial crisis), and stands in sharp contrast to the average 1.5% a year growth in carbon emissions over the past 10 years. Some of the slowdown in 2015 is a natural consequence of weaker economic growth relative to the average of the past, but the majority reflects a faster rate of improvement in both energy efficiency and the fuel mix.

The vast majority of the turnaround in carbon emissions can be attributed to China. Its carbon emissions fell slightly in 2015 (-0.1%) for the first time in almost 20 years. This raises the important question as to whether this slowing in the growth of Chinese carbon emissions will continue. As with the decline in Chinese coal consumption, there are good reasons for thinking that some of this slowdown reflects structural forces that are likely to persist and grow in importance. However, the decline likely also reflects some cyclical factors particularly the contraction in some of China's most energy-intensive sectors, which are unlikely to keep repeating and may well unwind in future years.

PAST CLUES TO FUTURE TRENDS

Before concluding, it is interesting to look at the profound changes in global energy markets which took place in 2015 and what clues they hold about future trends. There are three key issues of interest for the future that can be drawn out of energy market developments in 2015: China, renewable energy, and carbon emissions.



Regarding the first issue, developments in China have to a large extent, driven the recent slowing in global energy demand. This is not so much due to the slowdown in economic growth but rather to rapid declines in energy intensity as China's pattern of growth has adjusted from energy-intensive industrial growth to service-sector growth.

Put differently, if China's energy intensity had not declined over the past 5 years, global energy demand would have been almost 5% higher – roughly equivalent to the entire energy consumption of France, Germany, and Belgium combined – even with the slowdown in Chinese GDP growth. Future trends in China's energy intensity matter as much, if not more so, for energy demand as its economic growth.

However, the level at which China's energy intensity will start to stabilize is uncertain, and will depend on the success of its twin policy objectives of improving its level of energy efficiency, and of shifting towards a more service-based (and hence less energy-intensive) pattern of growth.

The second issue is how quickly the share of renewable energy within global demand is likely to expand under the impact of the technological wave. The key lesson from history is that it takes considerable time for new types of energy to penetrate the global market. Starting the clock at the point at which new fuels reached 1% share of primary energy, it took more than 40 years for oil to expand to 10% of primary energy; and even after 50 years, natural gas had reached a share of only 8%. Some of that slow rate of penetration reflects the time it takes for resources and funding to be devoted in scale to new energy sources. But equally important is the highly capital-intensive nature of the energy eco-system, which has many long-lived assets, and provides a natural brake on the pace at which new energies can gain ground.

The growth rates achieved by renewable energy over the past 8 or 9 years have been broadly comparable to those recorded by other energies at the same early stage of development. Indeed, thus far, renewable energy has followed a similar path to nuclear energy. The penetration of nuclear energy plateaued relatively quickly as the pace of learning slowed and unit costs stopped falling. In contrast, BP's Energy Outlook assumes that the costs of both wind and solar power will continue to fall as they move down their learning curve, underpinning continued robust growth in renewable energy. Consequently, the path of renewable energy in the Energy Outlook implies a quicker pace of penetration than any other fuel source in modern history. Yet even then, renewables share of primary energy will barely reach 8% in the next 20 years. Thus, the simple message from history is that it takes a long time for new energies to gain a substantial foothold within global energy mix.

The third issue relates to the stalling growth of carbon emissions in 2015. This equated to a fall in the carbon intensity of GDP--the average amount of carbon emissions per unit of GDP—of 2.8%. In the past 50 years, there have been only two other occasions in which carbon intensity of GDP has fallen by as much, and they both coincided with sharp upward movements in oil prices.

However, the IEA 450 scenario – a commonly used benchmark for the progress the world needs to make to achieve the goals agreed at Paris – suggests that the carbon intensity of GDP has to fall at an average rate of close to 5.5% p.a. on a sustained basis for the next 20 years. So while 2015 was a step in the right direction, it was only a small step in meeting the Paris goals.

CONCLUSIONS

To summarize, 2015 was a year of transition towards a new energy world as recent developments in both demand and supply came to a head. On the demand side, waning energy-intensive industrial demand growth in China, coupled with global efforts to improve energy efficiency and reduce energy intensity, is fundamentally changing global energy demand going forward. And on the supply side, a wave of technological and productivity gains, exemplified by the U.S. shale revolution and rapid expansion of renewables, have led to an abundance of global energy supplies. These factors have collided in 2015 resulting in weak global energy demand growth and the slowest growth of carbon emissions in nearly a quarter of a century, despite a continued fall in energy prices.

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U.S. LNG Exports Could Prove a Game Changer in the Global Gas Market

By Mamdouh G. Salameh

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See footnotes at end of text.

The U.S. shale revolution and the rising shale oil production have had a seismic impact on the global oil market contributing in no small measure to the steep decline in crude oil prices since July 2014. Equally U.S. liquefied natural gas (LNG) exports could have a similar impact on the global gas market possibly weakening further current low gas prices. The irony, however, is that without relatively higher gas prices, the potential and prospects of sizeable U.S. LNG exports could be restricted.

In December 2015, the United States Senate lifted the ban on U.S. crude oil exports. The historic decision sent a clear message to the rest of the world that America is ready to fully engage on the global energy stage.

Two months later, the Senate is approaching a final vote on another sweeping piece of legislation that would strengthen the United States' energy future by streamlining the federal approval process of U.S. LNG exports.[1]

In a world of low energy prices, the cost of shipping LNG from the United States to Europe or Asia is prohibitively expensive. Countries such as Qatar, Algeria and Norway can export LNG to Europe at a much-reduced cost, pricing the United States out of the market. In Asia, Australia, Malaysia, Brunai and Indonesia export LNG at prices the United States can't match, at least for spot exports and short-term contracts.

The plunge in oil prices since the summer of 2014 has dragged down the value of LNG, which is often sold on oil-linked contracts and dampened the excitement over U.S. exports. The economics of shipping gas from the U.S. was compelling two years ago, but is now marginal. Deteriorating market conditions have put the brake on any new investments in U.S. LNG.

The growth of LNG production in the United States is a charged political topic because of the standoff between Russia and the West over the Ukraine. Russian energy giant Gazprom recently shrugged off the potential for U.S. LNG exports in European markets noting that Russia can beat the United States on price. But given the number of natural gas projects under construction in North America, it is only a matter of time before the United States becomes influential in global gas markets.

Though export costs make it difficult for the United States to enter European and Asian markets, should oil prices begin to rise, the linkage between LNG and oil prices in Asia will make the United States more competitive, and subsequently influential.

MAJOR HURDLES TO U.S. LNG EXPORTS

Future U.S. LNG exports will face stiff competition from leading exporters of LNG in the world, namely Qatar, Russia and Australia.

Qatar has the distinction of being the world's largest LNG exporter, accounting for 32% of global LNG exports, the third largest proven reserves of natural gas in the world amounting to 24.5 trillion cubic metres and the lowest production costs of LNG in the globe.[2] Qatar's LNG accounts for 80% of all LNG exports to Asia. Japan, South Korea, India and China are the main importers of Qatar's LNG.[3]

Qatar has exceptionally low LNG supply costs, very large scale plants, ships and marketing operations. Additionally, the plants are already constructed so there is no exposure to rising costs or overruns.

However, Qatar faces formidable challenges: First, a changing landscape in the global LNG market with more competitors entering the market and the emergence of new LNG-exporting hubs. Second, the increase in supply will lead to lower prices. Third, the availability of alternative supplies in Asia will allow buyers to negotiate hard over long-term supply contracts.

In Asia, Qatar faces challenges from Australia and eventually the United States. Australia is the biggest rival in the Asian market and will likely continue to be so. In 2014, Qatar exported 77.4 million tons of LNG while Australia exported 20.8 million tons.[4]

However, Qatar's main advantages are its geographical location between main markets in Asia and Europe and its reputation for reliability. There are also disadvantages like its long distance from East Asian buyers relative to Australia.

As the world's lowest-cost producer of LNG, Qatar may be more able to withstand lower prices than

many of the new supply points coming online, a new report by Standard Chartered Bank has shown. The key for Qatar in the long run is to ensure it maintained market share by adapting rapidly to changing market dynamics.

Qatar does not have any plans to extend capacity soon so it cannot deter new entrants into the LNG business. However, Qatar's response has been buying up the competition.

Still, Qatar faces diminished market share and the possibility of lower prices just as the country embarks on $200 billion of infrastructure spending before hosting the 2022 soccer World Cup.

When it comes to attempting to undermine Russia's pipeline exports to Europe, the United States is at a disadvantage. Natural gas transportation by pipeline is significantly cheaper in most cases than building and employing expensive LNG port infrastructure. In terms of natural gas production and distribution, Russia's operating costs are low and their export infrastructure is already built. Some of Russia's most important markets, including those in Central Europe, already have spot prices around $6.60 per one million British thermal units (mmBtu). Even now Russia's natural gas prices have not bottomed out and prices at LNG hubs remain just as low.

While Qatar will continue to be one of the world's largest producers and exporters of LNG well into the future, Australia could overtake Qatar to become the world's largest exporter of LNG by 2020. Against Qatar's 77 million tonnes of LNG production capacity, Australia will have 85 million tonnes by the end of this decade, and by the mid-2020s the U.S. may have built a production capacity of 50 million tonnes or more.[5]

However, Australia is a much higher-cost producer than Qatar and doesn't act strategically since its LNG industry is split between many different companies. Qatari LNG will continue to be very profitable, but prices will decline and it won't be able to be the swing producer or strategic player anymore.

Plunging global oil prices may turn hopes for cheap LNG supplies from the United States into a costly disappointment for Asian buyers. The steep slide in crude oil prices since June 2014 has exposed cracks in the assumption by Japan and other Asian buyers that cheap U.S. LNG would muscle into high-value Asian energy markets from 2016. The oil price drop has raised the possibility that some U.S. Gulf Coast LNG export plants may be mothballed before they ever get a chance to supply world markets.

When Brent crude was selling at $100/barrel, oil-linked natural gas contracts typically would translate to around $14 per mmBtu, giving U.S. LNG a big price advantage. This advantage has disappeared with the recent decline in crude oil prices. With crude at $38/barrel, LNG indexes to $5.32 per mmBtu. U.S. LNG producers have been targeting prices of $11 or $12 per mmBtu to be profitable.[6]

Global LNG balances are easing fast, shifting the market's concerns from how demand can be met to how supplies can be absorbed, the International Energy Agency (IEA) said in its latest medium-term gas report. The shift, it said, "will shape LNG markets over the next few years."

A total of 164 billion cubic meters (bcm) of additional LNG export capacity will be operational globally by 2020, adding 40% to current levels, the IEA forecasts. Australia will add 44% of the new supply, becoming the world's largest LNG exporter by the end of the decade. The U.S. will be the second-largest contributor, adding 35% of the new capacity, ranking third as an exporter behind Australia and Qatar. As the gas gushes, Asia's LNG market is being transformed.

Today, buyers have a choice. They can buy LNG at an oil-linked price or at a Henry Hub-linked price or on a European gas-based price. Prices at the Henry Hub, a storage and delivery point in Louisiana, are considered the benchmark for all U.S. natural-gas pricing.

As things stand, Australia is on track to dethrone Qatar as the world's top LNG producer and exporter by 2020 provided there is no slackening in Australia's huge investments in its LNG industry as a result of the glut in the market and the continuing decline in gas prices.

Existing contracts coming out of the United States are based on Henry Hub spot prices index, with a fixed fee added for liquefaction and transportation costs. U.S. energy company, Cheniere, has signed several 20-year contracts for its Sabine Pass LNG facility, located in Louisiana, on the border with Texas. The contract terms typically run about 115% of the price of U.S. natural gas (currently $2.81 per mmBtu with an additional $3.00 for liquefaction fees. After other charges for shipping, insurance and regasification are factored in, the total cost of U.S. natural gas at LNG terminals in Europe is anywhere from $7 t0 $8 per mmBtu. In short, the United States is only marginally competitive at current LNG prices and can't beat Russia's low potential operating costs.[7]

The same disadvantages the United States faces in Europe also apply to Asia. LNG prices in South Korea, China and Japan are about the same as they are in Europe, only the cost of shipping is more because of the longer distances involved. With new LNG export capacity coming online in Australia, the

United States has to compete with projects that are as capital intensive but closer to their export markets.

U.S. SCALE OF INFLUENCE

Whilst the United States does not threaten Russia's market share in Europe or Qatar's or Australia's in Asia, the potential for U.S. LNG exports does improve Europe's leverage against Russia by providing an alternative source to draw from. Moreover, it helps create an LNG price ceiling when negotiating with Russia or other suppliers of natural gas. In time, the growth of North American LNG will force traditional import partners to undercut the price of new sources of natural gas.

The exact scale of U.S. LNG exports in unclear and largely dependent on price. Most likely exports will be in the order of 50 bcm, a sizeable addition to the global LNG supply. In addition, between now and 2020, the United States and Australia alone could increase the global LNG supply by as much as 150 bcm; the market in 2013 was just 325 bcm.[8] The Sabine Pass LNG facility will ramp up production later this year, but other facilities still under construction will not see first production until 2017 or 2018 at the earliest. Russia and other competitors still have a few years to secure markets and undermine potential U.S. LNG contracts by offering lower prices.

The global growth of LNG markets will help European markets move away from contracts indexed to oil prices, as an alternative to creating natural gas pricing hubs. This will eventually enable natural gas and oil prices to decouple, as is the case in the United States. Even Russia has begun transitioning in some cases, the most notable example being Gazprom's May 2014 deal with Italy's ENI basing it on spot prices instead of Gazprom's preferred oil-indexed contracts.

Should oil prices rise, Asian LNG prices would see the biggest change, dominated as they are by oil-indexed long-term contracts. Because the Asian market is roughly five times the size of Europe's, most of the contracts signed by U.S. LNG exporters have been with the region. South Korea, China and Japan are also three top importers, offering more potential and greater opportunity.

The United States is also in a position to exploit local markets in need of natural gas such as Brazil, Argentina and Mexico, countries far away from LNG suppliers.

With all these factors in mind, the five U.S. LNG projects that are already under construction will eventually come online, much like those under construction in Australia. But many U.S. projects without final investment decisions may not be built at all.

Ultimately, the United States will not be able to compete with Russia in Europe and Qatar and Australia in Asia directly. Even so, U.S. LNG exports are likely to have a significant impact holding down energy costs for consumers in Europe, Latin America and Asia. They will also provide tough competition for anyone hoping to build rival LNG plants such as the proposed projects in East Africa, the West of Canada or Russia.[9] By the end of the decade, the U.S. is likely to be the world's third-largest exporter of LNG after Qatar and Australia (see Figure 1).

Combined with the new supplies from Chevron's huge Gorgon and Wheatstone projects in Australia, which are scheduled to come on stream this year, exports from the U.S. are making it a buyers' market for LNG.

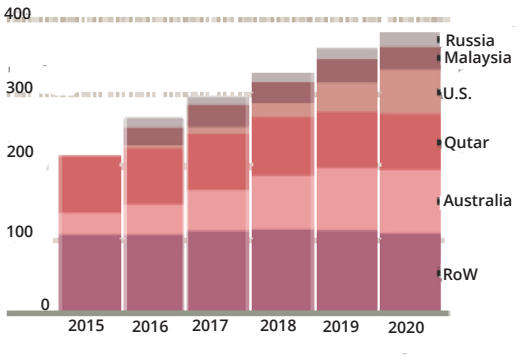

Figure 1
Source: Courtesy of Wood Mackenzie

A decade ago, this prospect seemed wildly unlikely. U.S. gas production was in decline and by the 2010s the country was expected to be a large importer of LNG, not an exporter. The shale revolution, the result of advances in production techniques that made it possible to extract gas at commercially viable rates from previously unyielding rocks, meant that U.S. production started rising again in 2006, and since 2011 it has been breaking new records every year.

The U.S. Department of Energy has received applications to export LNG from 54 projects. If they all went ahead, they would have the capacity to liquefy about 60% of the entire gas production of the U.S.[10]

So far, however, just five plants have started construction: Cheniere's Sabine Pass and its Corpus Christi project in Texas; Freeport LNG, also in Texas; Cameron LNG in Louisiana; and Cove Point LNG, on the east coast in Maryland.

Those projects have been able to make progress because they were fast enough at signing up customers on long-term contracts that guarantee their revenues. Since the end of 2014 those customers,

mostly utilities in Europe and Asia, have been reluctant to make any further commitments.

CONCLUSIONS

The shale revolution has made the United States the world's third biggest crude oil producer after Russia and Saudi Arabia and it is projected to make the United States, within 2-3 years, the world's third biggest LNG producer and exporter after Qatar and Australia.

Whilst the United States does not threaten Russia's market share in Europe or eventually Qatar's or Australia's in Asia, future U.S. LNG exports will have a positive impact on the U.S. economy and will significantly help hold down energy costs for consumers in Europe, Latin America and Asia. They will also improve Europe's economic and geopolitical leverage when negotiating new deals with Russia.

Moreover, U.S. LNG exports will help create an LNG price ceiling and will also provide tough competition for anyone hoping to build rival LNG plants such as the proposed projects in East Africa, the West of Canada or Russia.

Footnotes

[1] Brigham A. McCown, *U.S. Energy Exports: First Comes Crude, Then Comes LNG*, accessed on 16 March 2016 on: http://www.ft.com/cms/s/0/f1773832-b5ee-11e5-b147-e5e5bba42e51.html#ixzz434mCuJfX.

[2] BP Statistical Review of World Energy, June 2015, p. 20.

[3] Ibid., p. 28.

[4] Mamdouh G Salameh, *Australia Chases Qatar's Gas Crown*" (an article published by the Crawford School & the Asia & the Pacific Policy Forum of the Australian National University on 25 September, 2015).

[5] Ibid.,

[6] Ibid.,

[7] *How U.S. LNG Production Will Ultimately Exploit Global Markets* accessed on 16 March 2016 at: www.stratfor.com.

[8] Ibid.,

[9] Ibid.,

[10] Ed Crooks, *Cheniere Energy's shipment turns US into gas exporter*, Oil & Gas Journal, January 10, 2016.

Is China in Recession? A Cursory Look At Its Energy Statistics

By Douglas B. Reynolds

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According to CNBC (2016), China's oil company, CNP, states that China is expected to have oil consumption for 2016 at a level of 11.32 million barrels per day (mbd), which CNP says represents a 4.3% increase above 2015's oil consumption implying that China used 10.85 mbd in 2015. CNP also says that the 2015 level was 4.8 per cent higher than 2014, implying that China consumed 10.3 mbd in 2014. However, BP statistics show China used 11.05 mbd in 2014, not 10.3 mbd. Furthermore, if we believe the BP statistics for 2014, then that means that China consumed almost 2% less oil in 2015 than in 2014. Therefore, it is possible that China used less oil in 2015 compared to 2014, rather than more oil, even though China's GDP growth rate in 2015 was stated to be 7%. In addition, Reuters (2016) says that China imported 20% more oil in February 2016. However, this can just as easily signify a lack of internal oil production as a growing demand. So either China's previous oil statistics are wrong or China is in a recession.

According to Dargay et. al (2007), developing countries with an average level of income between $4,000 and $12,000 per capita (2015 dollars), such as South Korea thirty years ago or Japan right after World War II tend to have an increase in automobile ownership at about twice the rate of income growth. Furthermore, the gasoline usage for such a country usually averages one gallon a day per car. Right now, China is in that income range. So, if we believe China's GDP growth statistics, that it is growing at 7% per year for 2015, and that China has 170 million automobiles, then there should have been roughly an extra 20 million cars in China in 2015. But if China had an extra 20 million cars, then it should have consumed an extra 20 million gallons of gasoline a day or an extra half million barrels of oil a day just for transportation alone, let alone for extra heating, chemical production and industrial process. So either China's previous oil statistics are wrong, or China is in a recession. That is, China's economy is not slowing, China is in recession.

Some pundits might justify the reduction in oil use by proclaiming that China is becoming more fuel efficient, or becoming more consumer and service oriented. Consider the idea that China's economic structure is changing. South Korea provides a good example. The Korean economy was said to be an export driven economy, and indeed for the 15 years prior to Korea's 1996 accession into the OECD, a rich country organization, Korea averaged 12.5% per year increase in exports. However, even after Korea's accession to the OECD, it still averaged 10.5% per year export growth. So even a developed country, which used export driven growth to become developed, will continue to grow using exports after it is developed. Therefore, China too should be using exports to drive its growth no matter what stage of development it is in. However, China's export growth rate in 2014 was only 4%, and according to the Economist (2015), China's growth rate of exports looks to have declined during 2015. Therefore, based on oil consumption and the decline in exports during 2015, China looks to have had a recession in 2015. But there is more.

According to the Economist (2015), China used 10% less coal in 2015 compared to 2014 and imported 28% less coal. The Guardian (2016) states that China's coal use "fell 3.7% in 2015, following a 2.9% drop in 2014," ostensibly to clean up its environment. Such a decline in coal use, though, for the purposes of cleaning up the environment would require that natural gas consumption increase in order to compensate for electric power demand. Since China's 2014 natural gas usage was 185 billion cubic meters, then in order to compensate for such a large drop in coal use, China would have had to have doubled or even tripled its natural gas usage in order to keep the economy growing at 7%. However, much of the LNG exporters in the Pacific Rim are not able to sell their natural gas and a natural gas pipeline from Russia isn't complete, so where is all the natural gas coming from?

The oil and coal statistics (if we believe the BP statistics over CNPs) are interesting in comparison to historic growth rates and energy use. Before 1700 the United Kingdom growth rate according to Maddison (2004) was half a percent per year. After the early coal-induced Industrial Revolution started, from 1720 to 1850, the growth rate of England was 1 percent per year, and the GDP per capita doubled. The growth in coal use, though, was 2% per year, i.e., double the growth rate. The growth rate of the United States from 1900 to 1950, during the early oil-induced second Industrial Revolution of the 20th century,

was 3% per year, but that required a 7% per year increase in oil use, i.e., double the rate of growth in GDP, but also continuing increases in coal use. In both early industrializing cases, these economies saw growing international trade, advances in technologies and freer market-based economies. Plus, in both cases the economic growth required more coal.

The Soviet Union, for example, was able to use 10% more oil per year even while its coal use was estimated to be increasing at 5% per year for much of the 20th Century, and it grew at about 7% per year. China from 2004 until 2014 used 5% more oil per year while its growth rate averaged close to double digits. Although China energy intensity looks to have declined, Czerckleyi (2016), it would normally need more energy if its consumer service industry were to grow. Either history is wrong or there is something amiss with China's statistics and we need to state the obvious: China is in a recession.

The reason China is not accurately revealing its growth statistics is a mystery. It reminds one of the Cold War when the Soviet Union routinely did not give out its economic statistics, which were considered a state secret due to the relation between economic growth and the Soviet Union's military capabilities. The Soviets also sometimes kept their oil production and oil reserve data secret too. Back then Sovietologists had to "read between the lines," to figure out what was really happening with the Soviet Union politically and economically. Although, just to be fair, journalists also had to read between the lines to know what Washington or NATO leaders were thinking. Nevertheless, now we need to read between the economic and energy statistics to figure out what is really happening in China.

One reason for China to keep a tight lid on its economic statistics is because it does not want another Tiananmen Square style protest to rock its single party system, but that doesn't explain why Western economists who follow China closely are not declaring a recession. If we read between the lines of Western economists who are watching China closely, they too might be afraid to rock the China boat for fear of riots in China. However, another pertinent reason that Western economists may fear to speak out on China is that Western banks and Western financial institutions, which have investment or financial dealings with China, could be pushed into financial crisis.

Nevertheless, it should be every economist's responsibility to proclaim accurate statistics on China's GDP. Misleading information about China can only make the world's economy worse off over the long run, not better off. The evidence suggests that China was in a recession in 2015. Indeed if China's economy declined by 7%, then that might suggest a reduction in oil use of a half million barrels a day which fits the oil data more closely. That also helps explain the dramatic decline in oil prices over the last two years.

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U.S. LNG: Global Game Changer or Fading Hype?

By **Matthew Schmidt, Philipp Hauser, Dominik Möst**

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See footnote at end of text.

With the ongoing reverberations from output gains prompted by the surge in hydraulic fracturing in the U.S. being felt on a global scale, most attention has been devoted to the impact on the oil market. While marked by a more segmented and heterogeneous character, global natural gas markets have similarly been infused with increasing instability. Investments made in LNG and pipeline projects prior to the global economic downturn have come online in the midst of a protracted period of soft global demand coupled with a surge in U.S. shale gas production (Hartley 2015). With production in the U.S. increasing each year since 2006 and expected to reach levels upwards of 340 bcm/a by 2030, outpacing domestic consumption, plans for the large scale export of LNG are currently being pursued. This is noteworthy considering the development of new LNG terminals just a decade ago as the U.S. was gearing up to increase their import capacity. This dramatic development is illustrated in Figure 1. Whereas in 2006 net imports were projected to increase to 5,100 bcm/a by 2015, in 2015 the level of net imports have fallen to under 1,000 bcm/a.

With many of these terminals needing to be retrofitted, the commissioning process is still ongoing, having deferred LNG shipments until most recently. The projects currently in commission and those slated to be completed by 2020 are scheduled to infuse the global market with an additional 175 bcm/a. This is set to endow the U.S. with the third-largest export capacity worldwide (IEA 2015).

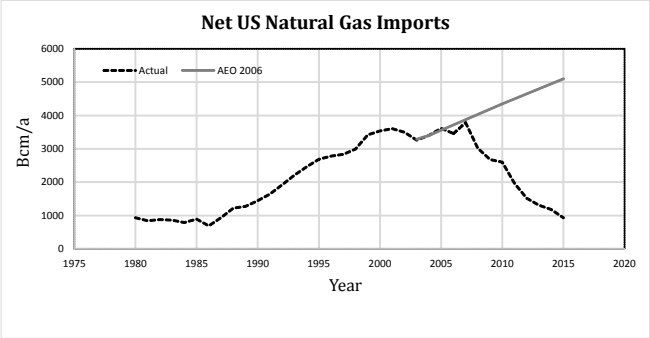

Figure 1: Projected and actual development of U.S. net natural gas imports
Source: Own illustration based on EIA (2006) and EIA (2016b)

As highlighted by Moryadee, Gabriel, and Avetisyan (2014), the potential for U.S. LNG was initially staked to lucrative arbitrage opportunities. In 2012, significant price disparities existed between the U.S. ($3-4 MMBtu) and the European ($9-11 MMBtu) and Asia-Pacific market ($15-16 MMBtu). Furthermore, the international push to decarbonize power systems has prompted the call for an uptake in natural gas usage, e.g., China, as a transitional fuel to accompany the development of renewable generation capacities (Holz, Richter, and Egging 2015). With respect to the European market, recent geopolitical flare ups with Russia have spurred policymakers to call for an increase in the diversification of its import structure (Richter and Holz 2015). The European Commission maintains that this move aims not only to counteract perceived abuses of market power by Russia but also to increase security of supply by diversifying import sources (Tusk 2014). Given this incentive structure, U.S. LNG has been perceived as possessing the potential to put pressure on prevailing structures globally. In this vein, industry experts have eyed the potential for intensifying the shift away from globally fragmented market segments towards the establishment of a global market regime. With implications of this magnitude having been put forward, a brief discussion of the current state of affairs in the LNG market is needed to shed light on the realistic short to long-term impact of U.S. LNG.

GLOBAL LNG GLUT STIFLES EXPORT POTENTIAL IN ASIA-PACIFIC MARKETS

As with any set of long-term investments, a range of economic and political uncertainties can derail projections. In the case of U.S. LNG, the market dynamics have been significantly impacted by a wave of recent developments. A prime example of this concerns the prospects of U.S. LNG in Asia-Pacific markets, initially the most attractive outlet for U.S. LNG. Since investments were laid out post 2010, the prices of oil-indexed contracts in the Asia-Pacific have begun to trend downwards. With oil prices falling to record levels, gas prices have correspondingly sunk. Most recently, the Asia-Pacific natural gas benchmark has fallen all the way to $8.00 MMBtu, depressed by a very mild winter and the reactivation of nuclear power plants in Japan following the Fukushima disaster in 2011. Figure 2 illustrates just how dramatic the fall in regional gas prices has been over the past four years.

According to analysts, as it currently stands Japan has secured enough LNG to meet its demand for the rest of the decade (Meyer, Hume, and Sheppard 2016). As the Asia-Pacific market has been envisaged as the prime market for U.S. LNG, current developments do not bode well for their prospects. To

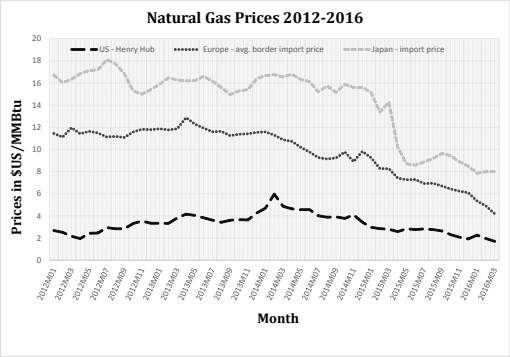

Figure 2: Development of regional gas prices from 2012-2016
Source: Own illustration based on The World Bank (2016)

add to these misgivings, Australia is also in the process of ramping up its LNG export capacities (75 bcm/a by 2020), which naturally increases the competition in the Asia-Pacific LNG trade (Rogers 2015). The first shipment from one of the world´s newest and largest LNG projects (Gorgon) arrived in Japan at the end of March (EIA 2016a). Hence, the prospects for a profitable U.S. LNG trade in the Asia-Pacific region hinge on natural gas prices firming up post 2020 or the emergence of new markets that can be exploited.

Regarding new markets, a significant unknown in the future demand structure in the Asia-Pacific region revolves around the energy policy objectives in China. With China making strong overtures to engage in climate protection efforts by altering its existing power generation structure to bring down carbon emissions, an upsurge in the country´s natural gas demand is highly plausible (Paik 2015). This could put upward pressure on long-term prices that would benefit U.S. LNG. That being said, it is obvious that a switch from carbon intensive energy carriers to natural gas (with a significant lower emission factor) strongly depends on policy decisions, which are frequently subject to change. Hence, demand predictions are highly uncertain as they depend on the effects of local emissions from coal technologies, especially SOx and NOx, as well as the pressure coming from international climate policy aims to introduce a uniform global carbon price. It is also important to note that not only Australia has contracted out new LNG capacities to China, Russia also signed off on a pipeline project with China in 2014 to deliver 30 bcm/a of gas over 30 years starting in 2019 (Paton and Guo 2014). While the completion of the pipeline project continues to be tenuous due to the recent plunge in oil prices, the realization of this project would further undermine U.S. LNG prospects in the country.

EUROPEAN MARKETS SHOW SIGNS OF GROWING COMPETITION BUT RUSSIA CONTINUES TO HOLD SWAY

Even with current conditions proving to be increasingly challenging for U.S. LNG, the effects of existing excess global LNG supply making its way to Europe has already shown an impact on the prevailing design of contractual structures and the strategic behavior of individual suppliers. Accompanied by an ongoing liberalization process that has supported increased market integration and an uptake in hub formation primarily in Northwest Europe, a wave of contract renegotiations as well as a trend toward adopting hybrid pricing schemes in place of oil-linked price formulas has emerged. The influx of greater volumes U.S. LNG on spot markets in Europe could prompt traditional European suppliers, e.g., Russia, to shift volumes of pipeline gas onto hubs in order to deflate prices and undercut the economic viability of LNG imports (Rogers 2015).

While Gazprom itself has shown itself to be reticent in engaging in spot market trading, such a development could aid in the maturation of gas-on-gas (GoG) pricing dynamics in Europe (Henderson 2016). This could especially have a significant bearing on relaxing the rigid contractual structures that continue to prevail in Eastern and Southern Europe. With increasing global liquidity and competition, U.S. LNG could likewise prove to be influential in hindering the exercise of cartel-like behavior from dominant suppliers (Medlock 2012). While this would enhance consumer welfare, with Russia possessing over 100 bcm/a of shut-in gas, the proposition that U.S. LNG can make inroads in Europe in the short to mid-term is questionable at best (Paik 2015).

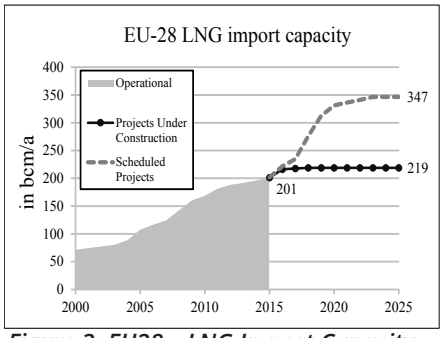

Figure 3: EU28 – LNG Import Capacity
Source: Own illustration based on GIE (2015)

It should also be noted that as of 2015 enough LNG capacity was installed to meet 43% of Europe´s gas demand. As the Figure 3 illustrates, the LNG capacity in Europe has grown around twofold to just over 200 bcm/a in the last ten years. The acute underutilization of this infrastructure (2014: 24% in use[1]) highlights the comparative economic and structural advantage Russian pipeline gas enjoys. Moreover, even before the current dip in natural gas prices, the European market had been assessed as being a secondary option for U.S. LNG. The price differentials in play are considered to be too insignificant to sustain profitable trading conditions.

EU ENERGY UNION: RAY OF HOPE FOR U.S. LNG´S LONG-TERM PROSPECTS?

Boosting the long-term prospects of U.S. LNG, the European Union (EU) has put

forward a proposal outlining the creation of an Energy Union (European Commission 2015). A central element of the draft concerns its dwindling domestic natural gas production and the plan to diversify its supply. As Figure 4 highlights, LNG makes up only around 15% of the EU´s import structure. U.S. LNG could go a long way to enhancing the influence of market fundamentals in Europe and securing the future gas supply considering the decreasing trend in domestic production. If the EU decides to utilize public funds to incentivize the construction of LNG terminals, especially in countries in Eastern and Southern Europe where oil-indexed Russian pipeline gas holds sway, U.S. LNG could provide an attractive diversification option. It should, however, be noted that the European pipeline network has yet to be fully integrated across Europe, which would likely diminish the price effect of an infusion of U.S. LNG (Hauser and Möst 2015). Regarding the current push to diversify the EU´s supply, the draft of the Energy Union also holds out the prospect of developing shale gas domestically. While currently economically unfeasible, public subsidization could undercut the long-term prospects of U.S. LNG in Europe.

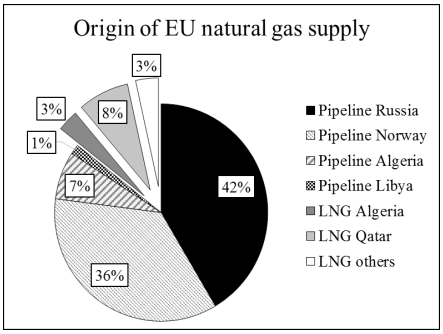

Figure 4: Origin of EU natural gas supply
Source: Own illustration based on BP (2015)

Looking long-term, Europe continues to work towards reaching its climate targets, e.g., 40% reduction in carbon emissions by 2030 and 80% by 2050. In advancing these goals, natural gas has been envisioned as playing a significant transitional role in the eventual de-carbonization of the power system. However, the situation currently playing out in countries such as Germany where the increasing volumes of renewable power supplies are crowding out natural gas as a power generation fuel has contributed to a dip in demand. While the planned decommissioning of the nuclear fleet in Germany by 2022 and the targeted increased stringency in climate policy measures throughout Europe seem to entail an uptick in natural gas demand in the mid-term, recent projections do not necessarily confirm that this supply gap will buoy natural gas deployment (Christie 2012). Even with its dwindling domestic supply, the future prospects for an upswing in the usage of natural gas in the power sector in Europe depends on its price leverage over lignite coal which in turn depends greatly on favorable carbon price dynamics (Neumann and Von Hirschhausen 2015).

SUMMARY

Going from a net importer of gas to being set to become one of the largest LNG exporters worldwide in the span of a decade, shale gas has boosted the U.S.´s prospects of becoming a significant global LNG player. While the initial optimism was well placed, current developments reflect a global market that is becoming ever more contested as demand fades. This brief analysis has highlighted the short to long-term challenges that U.S. LNG is likely to face. An oversupplied Asia-Pacific market and a sluggish European market tied to Russian pipeline gas are dampening the necessary price dynamics needed to open up outlets in the near term. The mid to long-term prospects for U.S. LNG rest on the exploitation of new markets such as China and a consequential implementation of climate policy globally needed to stimulate demand. Nonetheless, U.S. LNG is capable of contributing a large volume of liquidity to the global market. With respect to the European market, this does show indications of fostering growth in competition and improving consumer welfare in the long-term.

Footnote

[1] Own calculation based on capacity data of GIE (2015) and LNG import data of BP (2015)

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MEMBER GET A MEMBER CAMPAIGN A SUCCESS

Ibrahim Almojel Wins Complimentary Registration to attend the Tulsa USAEE/IAEE North American Conference

IAEE's *Member Get a Member* campaign was another smashing success in the May 1 to August 31 period.

Members had their membership expiration date advanced three months for each new member referred.

Ibrahim Almojel of Saudi Aramco referred the most new members. He won complimentary registration to the Tulsa USAEE/IAEE North American Conference.

The Obstacles to South Korea's Willingness to Import Shale Gas from the U.S.

By Jikhan Jeong

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South Korea is an energy-poor country. To be specific, 82% of energy usage relied on energy imports in 2012. Importantly, South Korea is the second largest liquefied natural gas (LNG) importing country in the world. SouthKorea relies heavily on Middle Eastern countries for its LNG imports. In detail, the amount of imported LNG in 2014 was 29,713,418 tons. Of its overall imported LNG, 36% came from Qatar, 11% of it was imported from Indonesia, 10% came from Oman, and 10% of it from Malaysia. In this regard, South Korea has a strong willingness to diversify its LNG import portfolio and reduce its LNG import price in the objective of energy security. In particular, according to the announcement from the Ministry of Trade, Industry and Energy (2012), the South Korean government planned to import shale gas from the U.S., in case the oil price is more than $80/barrel. In order to decrease dependency on a single vendor, South Korea will limit the share of imports of U.S. shale gas to 20% of its total gas imports by 2020. However, the LNG import price in South Korea is mainly linked to the Japanese Crude Cocktail (JCC). Therefore, if the oil price is less than $80/barrel in the future, the imported price of shale gas from the U.S. will lose cost-competitiveness compared with the imported LNG price from other countries such as Qatar. In this regard, if the recent fall in oil prices continues until 2020, South Korea's motivation to import shale gas from the U.S. will likely be considerably weakened.

On the other hand, as seen in Figure 1, almost, 44% of imported LNG is used for power generation.

Therefore, the amount of power generation from LNG significantly influences South Korea's demand for imported LNG. The South Korean wholesale electricity market is a cost-based mandatory pooled system; therefore, all power plants, including LNG power plants with an installed capacity of more than 20MW, must take part in the pool and bid the total amount of power generation. The power plant's actual amount of power generation is determined by merit order and the total amount of electricity demand. However, due to an increase in the amount of bidding from base-load generation, including coal and nuclear power generation, from 349.5 billion kWh in 2014 to 362.4 billion kWh in 2015, the amount of power generation from LNG power plants decreased from 106.4 billion kWh in 2014 to 113.3 billion kWh in 2015.

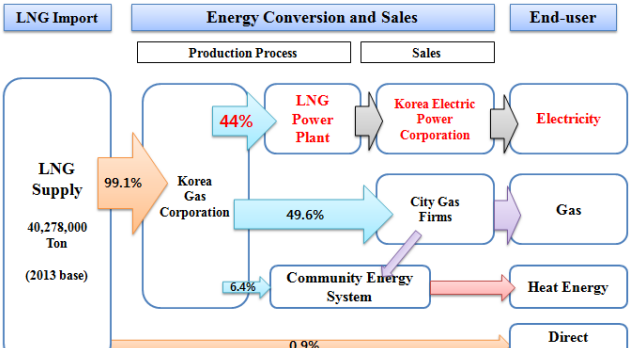

Figure 1. LNG Supply and Demand Flow in South Korea
Source: Korea Energy Economics Institute (2014)

In addition, the South Korean wholesale electricity market price (= System Marginal Price [SMP]) is determined by the power generation cost of marginal power plants. The LNG power plants have mostly played as marginal power plants. However, their share of this marginal power plant group decreased from 94.9% in 2014 to 90.2% in 2015. Furthermore, the LNG power plants' heat per unit price has decreased from 78,662 Won/Gcal in 2014 to 59,910 Won/Gcal in 2015 due to falling oil prices. Consecutively, SMP also decreased from 142.26Won/kWh in 2014 to 101.76 Won/kWh in 2015. As a result, operating rates of LNG power plants and their profitability have decreased from 2014 until now. Moreover, the trend will likely continue due to the increasing share of power generation from base-load power generation and falling oil prices in the future. Furthermore, according to the 7th basic plan for long-term electricity supply and demand, the installed capacity of nuclear power will grow from 20,716MW in 2015 to 26,729MW in 2020 and that of coal will grow from 26,274MW in 2014 to 37,638MW in 2020. In the long-term view, it is possible that due to increasing the installed and operating reserve margin in South Korea's electricity market, the operating rate of LNG power generation will decrease, even if some of the unprofitable LNG power plant could be offloaded. In this case, the amount of LNG imports for power generation from the U.S. could fall.

Overall, even though South Korea has a strong motivation to import shale gas from the U.S. to diversify its LNG portfolio and weaken its energy import dependency, it is possible that South Korea's willingness to import shale gas for power generation from the U.S. could be weakened due to falling

oil prices and the decreasing operating rate of LNG power plants. Therefore, industry decision makers should closely investigate the change in the oil price and its effect on the imported LNG price in Asia. In addition, in order to promote the sale of shale gas, the U.S. should consider diverse possible scenarios suitable for different oil price levels, and when they evaluate the LNG importing countries' willingness to import shale gas for power generation from the U.S, decision makers should closely study the LNG importing countries' electricity market structure and its generation mix.

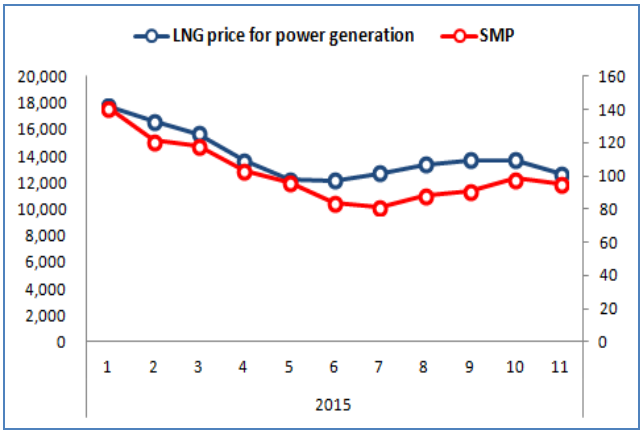

Figure 2. LNG Price for Power Generation and SMP from Sept. to Nov. in 2015.

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U.S. LNG Markets In Transition - Again

By Thomas Tunstall

INTRODUCTION

LNG companies in the U.S. have had a rough go of things over the past couple of decades. Before the shale revolution, LNG shippers were spending billions of dollars on import facilities along the Gulf Coast. At the time, the U.S. was running short of natural gas supplies, and forecasts for the future were not promising. In order to augment the expected shortage of supply, import facilities were built to receive LNG shipments from abroad, which would regasify the supercooled, liquid methane, and send natural gas out through pipelines.

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Of course, the billions of dollars spent on import terminals, as we now know, have become sunk costs that will never be recovered. This led the LNG companies to consider options for export, which although entailing a lengthy permitting and construction process, appeared to be an auspicious prospect. Ever resilient, the industry pivoted and began spending billions of new dollars to repurpose the import facilities to instead export liquefied natural gas.

The landscape certainly looked attractive. As recently as 2013, natural gas prices in Japan were as high as $16-17 per thousand cubic feet (mcf), and $11-12 mcf in Europe, while selling for as little as $2 in the U.S. The market for LNG export appeared very promising indeed. However, much as world crude oil markets have been upended by a glut of worldwide production, so now have natural gas markets.

Export terminals in the U.S. - similar to the case of the import terminals - are again unexpectedly facing potential economic peril. While both crude oil and natural gas are sources of energy and serve as the raw materials for a variety of products, there are some important differences that are not always fully appreciated and can shed light on the current situation.

NATURAL GAS VS. CRUDE OIL

This history of natural gas development has tracked differently than that of crude oil for a variety of reasons. Perhaps most importantly, oil became a global market decades ago, with the advent of supertankers. Crude oil, after all, is easier to store and transport by sea. For natural gas, the process is more complex. It must be supercooled to minus 260 degrees Fahrenheit, loaded onto LNG carriers and then regasified at its destination. Due to previous technological limitations, natural gas has remained a comparatively regional market, although that is now changing.

Natural gas is priced in cubic feet/meters or BTUs. Oil and condensates are priced and measured in barrels. The applications are different. Most transport fuels in the U.S. derive from oil, essentially dwarfing natural gas as a vehicle fuel. The reasons are two-fold. One is infrastructure. In the U.S., for example, there are approximately 168,000 public gasoline refueling stations, compared with only about 900 public natural gas refueling stations. The other issue is the premium that drivers must pay for natural gas powered vehicles and, as applicable, home refueling stations. Taken together, this adds as much as $10,000 to the cost of ownership.

So although we don't have global natural gas markets yet, the seeds of change were planted in 1996 when Qatar opened the world's first large LNG export facility. Now twenty years later, while Qatar remains the largest LNG exporter in the world, other countries are also entering the market.

In the U.S., the prospect of LNG export was inconceivable even just a few years ago. U.S. natural gas production was thought to have peaked in 1973, as its decline continued until the late 1980s. The recent resurgence as a result of the shale revolution is due at least in part to the fact that the natural gas industry in the U.S. was finally fully deregulated in 1993. It was at that point that all remaining price regulations associated the Natural Gas Wellhead Decontrol Act of 1989 were finally phased out, which at one time actually included a prohibition on using natural gas to generate electricity. Full deregulation of natural gas production paved the way for the next phase of the industry.

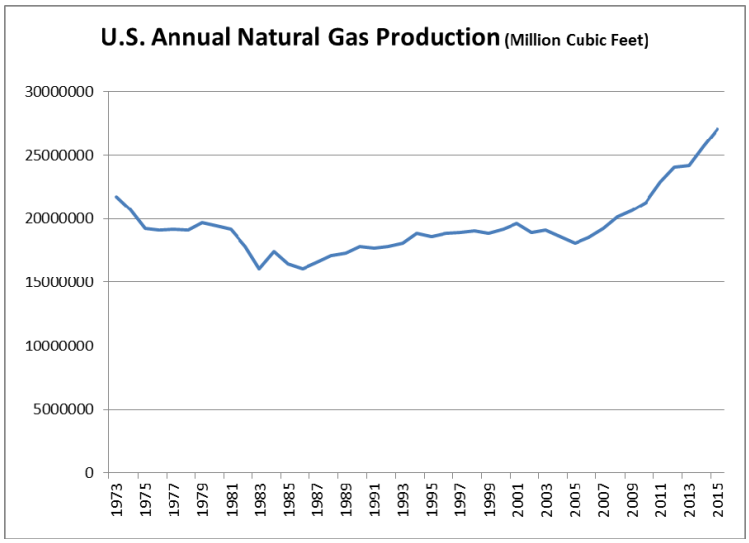
THE RISE OF UNCONVENTIONAL EXTRACTION TECHNIQUES

In 1981, George Mitchell drilled his first well in the Barnett Shale near Fort Worth in an attempt to extract natural gas from shale rock. Halfway into 1997, Mitchell at last used hydraulic fracturing techniques to produce unprecedented amounts of natural gas from shale.

Meanwhile, during the 1993-2005 time period, U.S. natural gas production overall fluctuated between

18-19 trillion cubic feet annually. Following success in the Barnett Shale in the late 1990s, production began apace a few years later in the Haynesville, Marcellus and Eagle Ford shale formations across the U.S.

During the initial phases of the shale revolution, particularly from 2000-2010, natural gas prices remained extremely volatile, which is often typical of markets immediately following deregulation. During that timeframe, natural gas prices ranged from around $2 per mcf to over $10 per mcf.



Source: Energy Information Administration

However, starting in 2006, U.S. natural gas production began a steady increase, finally surpassing 1973 levels in 2011. Production has risen every year since. By 2012, natural gas prices became much less volatile, generally trading between $2-$3 per mcf, where they remain today. U.S. natural gas production continues to set new records and is now in excess of 27 trillion cubic feet annually.

With so much natural gas supply, several companies along the Gulf Coast are in various stages of permitting, constructing or operating LNG export facilities. In February 2016, Cheniere Energy shipped its first cargo of LNG to Brazil. Unfortunately, other traditional LNG export markets no longer look as attractive as they once did. In fact, it is fair to say that export markets for U.S. LNG producers are under siege.

IMPLICATIONS FOR LNG EXPORTERS

Spot prices in Asia - which constitutes 70 percent of global demand - hit $4.24 per thousand cubic feet on April 25, 2016, in large measure because Australia is now reliably shipping large quantities of natural gas to Japan. In Europe, Russia's Gazprom has indicated willingness to lower prices for natural gas buyers in the event of increased import competition from LNG suppliers. This admission makes it very likely that prices in Europe could fall to around $7 per mcf - more or less at the break-even point for U.S. LNG shippers - as a response to competition.

Other countries seeking to capitalize on unconventional shale techniques will also have an impact on world markets. Argentina, for example, is estimated to hold over 800 trillion cubic feet of recoverable natural gas and plans to develop its own shale prospects.

Viable markets for U.S. LNG export are steadily shrinking, which will cause industry players to once again rethink their business models. Several long and short-term realities will impact world natural gas markets in the coming years.

NATURAL GAS PARADIGM SHIFT

The price of natural gas has been traditionally been regulated or linked to the price of oil. However, this is beginning to change. Long-term fixed-price contracts are, in fact, becoming harder to obtain. Natural gas will increasingly be sold on a spot price basis, instead of long-term contracts linked to oil prices. This will occur because of the producer-created excess of supply that in turn makes buyers wary of long-term fixed-price commitments.

Although the fundamentals have been clear for some time, the realization that natural gas will be inexpensive and reliable for decades in the U.S. is still sinking in for many people. Low-cost, stable natural gas prices will also be increasingly the case for the rest of the world. Prices globally will continue to converge.

Even though natural gas is not crude oil, the evolution of global natural gas markets will mimic those of the oil industry. While natural gas is more expensive to store and ship than crude oil, the increased volumes available for sale and the wider use of natural gas-related applications will push down costs for midstream functions over time.

In the U.S., the shale revolution is already encouraging the use of natural gas for a wider range of applications, including electricity generation, manufacturing feedstock and vehicle fuel. Smaller scale liquefaction units will expand the role for LNG, both in the U.S as well as other countries - including developing nations. More natural gas storage capacity will be created worldwide as well.

Crude oil based fuels will be displaced to at least some degree by natural gas. It seems clear that greater numbers of fleet, passenger and big rig vehicles will be produced and driven in the U.S. Diesel demand, in particular, may come under pressure because LNG is well-suited to larger engine applications such as locomotives, ocean-going ferries, and cruise ships that typically run on diesel fuel.

The U.S. will be a reliable, stable supplier of natural gas for decades to come, which will maintain pressure on other worldwide suppliers to become more stable and efficient themselves. Ironically, this will strengthen competitors by forcing operating discipline on countries such as Russia and Australia.

The good news is that LNG companies are actively looking for ways to vertically integrate forward. Investment is either being considered or even now underway in onshore and offshore regasification facilities in other countries, as well as for local manufacturing plants. Floating regasification terminals, for example, are currently operating in Egypt, Jordan and Pakistan. Other opportunities to expand LNG export markets in developing countries with accessible coastlines will likely follow suit.

The unexpected abundance of natural gas supply represents more opportunities to broaden LNG use and applications worldwide, particularly in new niches and markets. This will be critically important for U.S. LNG export entities because the more established markets in Asia and Europe - that had been targeted - now instead have suppliers located closer and thus better able to compete on price than U.S. firms.

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All IAEE & USAEE members are invited to attend the following sessions to be held during the Allied Social Science Associations (ASSA) annual meeting in Chicago, Illinois, January 7, 2017.

If you are interested in registering for this conference visit
https://www.aeaweb.org/conference/2017/preliminary

IAEE/NABE Session

The Oil Market After the Bust: Assessing the New Environment

Saturday, January 7, 2017 10:15 am, Swissotel Chicago, Vevey 2 Room

Panel Moderator: Mine Yucel, Federal Reserve Bank of Dallas
Rabah Arezki, International Monetary Fund
Jim Diffley, IHS Markit, Inc.
Amy Myers Jaffe, University of California, Davis

IAEE/USAEE Session

Sustainability, Volatility, and the Evolution of Energy Markets

Saturday January 7, 2017 12:30 pm, Swissotel Chicago, Vevey 2 Room

Presiding: Alberto J. Lamadrid, Lehigh University

Analyzing the Risk of Transporting Crude Oil by Rail

Charles F. Mason, University of Wyoming
Capacity and Utilization: The Effect of Returns in Electricity Markets

Jeffrey C. Peters, Stanford University
Utility Pricing In The Prosumer Era: An Empirical Analysis Of Residential Electricity Pricing In California

Felipe Castro, University of California-Berkeley
Build Wind Capacities at Windy Locations? Assessment of System Optimal Wind Locations under Feed-in Tariffs

Frank Obermuller, University of Cologne
Discussants:
Lucy Yueming Qiu, Arizona State University
Inez Azevedo, Carnegie Mellon University
Jesse Jenkins, Massachusetts Institute of Technology
Julia Frayer, London Economics International, LLC

IAEE/AEA Session

What Drives Energy Transitions? Environment, Innovation and Scale

Saturday, January 7, 2017 2:30 pm, Swissotel Chicago, Vevey 2 Room

Panel Moderator: Kenneth Medlock, Rice University

Doug Arent, National Renewable Energy Laboratory
Antoine Halff, Columbia University
Kenneth Gillingham, Yale University

Please visit the IAEE/USAEE Cocktail Party for members and friends, Saturday, January 7th in St. Gallen 3 Room of the Swissotel, 6:00 – 7:00pm.

We invite you to attend this event!

From the Varangians to the Greeks – Strategic Impact of U.S. LNG Exports to Eastern Europe

By Ionut Purica

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In 1976 Richard Dawkins coined the name of 'meme' for mind entities that generate collective behavior and change, similar to evolution, induced by genes. Looking at recent years we think that there was a sort of collective behavior in concentrating on the East –West direction for gas pipelines under the meme name of the silk road. This is a good thing as long as one keeps in mind the big picture. The choice of TAP versus Nabuco has contributed to break the collective almost obsession of Nabuco over the last few years.

Let's get two steps back and look at the map of the silk road. There are several areas of North – South crossing roads: one is the Russian Federation to China, in the East; another one (see Figure 1.) is the Norway to EU and the North Africa to EU in the West.

Looking at the change of energy paradigm in the world today one may identify another North – South road, in Eastern Europe. This is not a new road since the history of this part of the world records as very popular at the end of the first millennium.

Directive 2008/114/CE defines gas critical infrastructures along with other critical ones. The security of these critical infrastructures needs interconnectors (pipelines) that will be able to transport gas both ways. The discovery of non-conventional (shale and offshore) gas reserves in Poland, Ukraine, Romania and Bulgaria, together with the potential opening of the Baltic Sea, the Mediterranean, and Black Sea for LNG imports from all over the World (e.g., Qatar, USA) provides a likely new gas source for the countries on this road. Along with supplemental imports to the countries mentioned, there is a need for gas in Finland, the Baltic States and Greece. Diversification would be welcomed in order to increase security of supply. (See Figure 2)

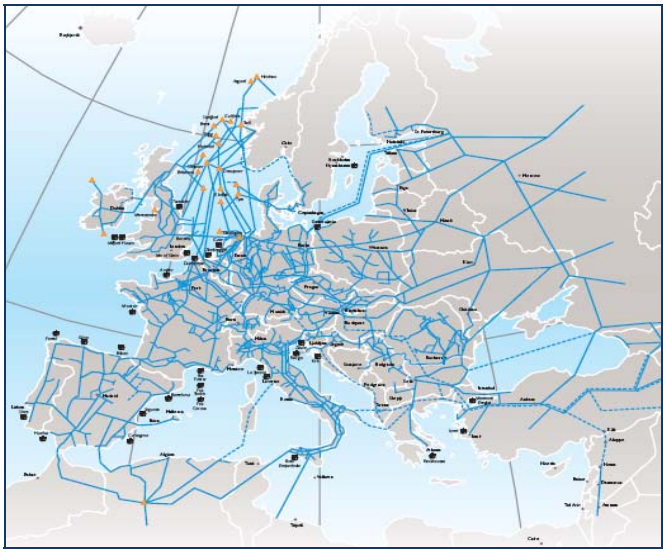

Figure 1. North-South connections in the West EU gas network. No connections in Eastern EU.

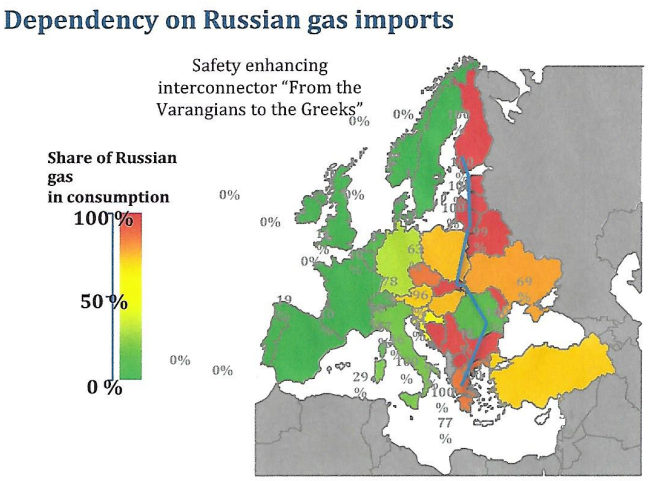

Figure 2 Dependency on Russian Gas Imports
Source: CEDIGAZ-Estimate of international gas trade by pipeline in 2009.

The table below shows an interesting story, i.e., that with the nonconventional reserves the region may substantially extend its gas supply availability and its overall energy security.

Maybe it is time to take a 90 degree turn from the East – West line in this region and think of an interconnector of gas critical infrastructures along the old road from the Varangians to the Greeks.

In the table above we have on purpose not mentioned the potential imports from the USA. These quantities are likely to change the geostrategic status of the region. The import market size is about 65 Gcm/y. Presently this is coming from the Russian Federation, This creates a strong vulnerability for most of the countries in the area. U.S. imports are facilitated by the recent LNG terminal in Lithuania and by a potential construction of LNG terminals in Greece and Romania (if Turkey opens the Bosphorus for LNG tankers). Since all these countries are NATO members the safety of an investment in LNG terminals and the interconnector would seem quite secure. Related to the evolution of consumption (that is decreasing in some countries) the gas demand forecast is positive and the price of U.S. imported LNG could boost demand. Given the price differential between gas in the U.S. and gas in this area, U.S. exporters can afford to come in this market and be very competitive.

Country	Reserves Gcm	Production Gcm/y	Consumption Gcm/y	Shale Gas Gcm	Imports Gcm/y
Finland	0.0	0	3.6	0.0	3.6
Estonia	0.0	0	0.7	0.0	0.7
Latvia	0.0	0	0.62	0.0	0.62
Lithuania	0.0	0	3.4	0.0	3.4
Poland	121.8	4.3	15.4	4190.9	11.1
Ukraine	107.6	18.2	53.7	3624.6	35.5
Romania	934.5	11	13.8	1444.2	2.8
Bulgaria	0.0	0	2.9	481.4	2.9
Geeece	0.0	0	4.5	01.0	4.5
Total	1163.8	33.5	98.62	9741.0	65.12

	Years		
Reserves/Consumption	12	Imports for 35 years (Gcm)	2262.3
Reserves/Production	35		
Reserves+shale/Consumption	111		

Source
1 BP Statistical Review, 2012. Data for reserves, production and consumption except for Estonia and Latvia.
2 EIA Technically Recoverable Shale Oil and Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States, June 2013/Data for shale and gas.
3 https://www.cia.gov/library/publications/the-world-facebook/ data for Estonia and Latvia consumption 2010

Critical Gas Infrastructures Interconnector from the Varangians to the Greeks

Moreover, there is also an effect of potential gas price increase in the US given by the impact of exporting into higher price markets overseas; we think this may be overcommed by a proper regulatory activity of the U.S. Government given the strategic (not only commercial) importance of the gas market in East Europe and the need to reduce the vulnerability of these economies.

Finally, it is important to notice that such an interconnector should not be seen as an isolated project but included in the EU and international gas pipes network. Its main role is to increase security of supply in the region and through this to allow better competition with the associated effect on prices. To make such a project a reality, a joint effort is needed to generate the project's credibility that will attract the investment needed. It may not be easy but we think it would be worth trying to build a long term, secure and strategic market for U.S. exports of LNG.

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U.S. LNG Exports: Serious Headwinds Cloud Long Term Prospects

By Sreekanth Venkataraman

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While there has been an undeniable glee at how the U.S. LNG exports could potentially give Washington geopolitical leverage by allowing it to ship cheap energy to its allies in Europe and Russia, that enthusiasm was always laced with a caveat that LNG exports were more likely to be a geopolitical weapon only in the long run. However, it seems that even the long term prospects need to be tempered with caution.

Take the case of Europe for instance. While the construction of new LNG terminals in the EU are believed to have the potential of enhancing the long term prospects, several essential conditions need to be factored in before enthusiasm over long term prospects of U.S. LNG exports can be justified. Firstly, price parity needs to be achieved between U.S. gas prices and Russian gas prices, which are lower. Critically, the U.S. LNG exports must be able to compete with Russian piped gas, which is still cheaper than LNG and one cannot discount the possibility that new Russian pipelines may depress gas prices further, if completed (Nord Stream 2 and Turkish Stream). While several EU member states have asked the EU Commission to stop the Nord Stream 2 project, the current tensions between Russia and Turkey have increased the chances of its completion. There is also much speculation about Russia's likely response to U.S. LNG exports. If Russia's gas strategy mimics that of Saudi Arabia's oil strategy, it could push European gas prices to levels that could force the shut-in of U.S. LNG exports.

Secondly, forecasts of European demand for LNG are not clear. While the high demand scenario (42% in the next 10 years) bodes well for the U.S. LNG industry; a low demand scenario foresees very little growth in imports because of the uncertainties and low economic growth. This uncertainty raises the question whether the suppliers will have sufficient risk appetite to be able to play an important role in EU's energy future. Thirdly, the role of Iran in EU's energy security cannot be ruled out as sanctions over Iran ease. In fact, the EU Energy Chief's recent statement that Iranian LNG could start to play a significant part of EU's energy mix in the next 3-4 years should send the alarm bells ringing in the Capitol. The EU has estimated that by 2030, the bloc could be importing between 25 and 35 bcm of LNG from Iran. This belief is fueled by the fact that Iranian authorities are looking to complete three LNG plants that were in the works before the sanctions were imposed early in the decade. While there are doubts (due to high domestic demand and high price vis a vis Russia) over Iran's claims about their export potential (beyond their immediate neighbors), one cannot entirely discount the fact that any delay over processing of export applications by Washington can mean the EU could potentially develop a greater reliance on Iranian gas for their energy needs.

Turning our attention to Asia: until recently, American gas was directed primarily to the Asian markets, where prices were generally higher than in Europe. Owing to a number of reasons such as nuclear energy coming back online in Japan, etc., the demand of LNG has slowed significantly in Asia, leading to a lowering of gas prices. Fresh supplies from U.S. and Australia have contributed to a further plummeting of the average spot price of gas to a 7 year low of $4.24 per million BTU. Amongst other factors, the unwillingness of Asian importers to buy more gas on the spot market – given they have already contracted to purchase more than they currently need – has been a principal factor responsible for the decline. So, how do the long term prospects in the major epicenters of Asia such as Japan, Korea, China, India look?

The chance of substantial demand growth for LNG in Japan is bleak. The Japanese government as a matter of policy looks at gas as a medium load for power plants. Coal and nuclear serve as baseloads for power plants while renewables are meant for peak load applications. In other words, the system is not willing to depend too much on gas and consequently, the share of gas in the power sector is slated to come down from 48 % to 25-30% in the next few years. While Japan may be likely to buy somewhere between 20-30 million tons of gas between 2019 and 2024 , it should not be construed as demand growth as the country will look to buy from existing projects with unsold volumes, which are significant. The demand for natural gas in Korea is on a permanent decline and this is largely due to the resurgence of coal in Korea. While the supply replacement will happen in the mid 2020's, the supply replacement volume is not likely to be drastic (unlike Japan) because they entered the LNG market much later.

The demand for natural gas in China has hit the brakes, growing at barely 1-2%. The slowdown in the growth of the economy, while one of the contributing reasons, is not the culprit. The real culprit is the high price of gas – both domestic and imported. The government increased the price of gas just prior to the collapse of world oil prices to $10.85 per mBTU, which is nearly 5 times more than the price of gas in U.S. At prices as high as these, there is bound to be a drastic slowdown in the growth. Would the demand see a revival if the prices were reduced? Unlikely, because the other issue is the economy is presumably growing much slower (around 4% p.a) than recorded by official estimates (7% p.a). Add to that, the uncertainty surrounding the long term outlook for the Chinese economy and the possible continued slowdown for the next couple of decades, the long term prospects for LNG look uncertain. The situation in India, on the other hand, is the exact opposite of China. There is little demand for imported LNG because domestic gas prices are very low owing to cross subsidization. LNG demand in both India and China could see better days if the respective governments keep away. Plausible but not very likely.

There is a belief that the demand slowdown in the traditional big importers can be compensated by the new demand emerging from countries such as Thailand, Indonesia and some of the Arabian countries. The demand for LNG from all these countries may amount to nothing more than the LNG demand from Korea, the second biggest importer of LNG. The volume is not insignificant but surely, it is not enough to compensate for the demand slowdown.

Despite the serious headwinds in the LNG Industry globally, there are optimistic viewpoints that claim the longer-term view for global LNG remains positive, with Asia set to be a significant LNG buyer globally and U.S. becoming a force to reckon with on the global natural gas export scene. Even if the Asian LNG market provides a relief to the suppliers in the medium-long term (once the price of LNG in Asia is indexed to the regional gas fundamentals and there is a shift away from short term contracts), the competition is also likely to get stiffer with a major threat coming from Australia. Gorgon, Australia's most recent LNG project and the most expensive in the world, has the potential to catapult Australia to the position of top gas exporter globally. All this means that the U.S., in its new role of a natural gas exporter, will have to brace up for a dirty fight. Not all of the gas producers will survive and those that do will have to probably pour several billions of dollars into building liquefaction capacity. Only the most resilient are likely to survive, with probably only a few making a satisfactory return on investment.

Report from the SAEE Conference, Luleå, Sweden

One week before the official start of the academic year in Sweden, the SAEE2016 conference was held in Luleå, Sweden. For two days 150 participants from academia as well as from the public and private sector gathered to listen to 15 concurrent and 2 plenary sessions. The conference was arranged by the Swedish Association for Energy Economics (SAEE) and hosted by Luleå University of Technology. The aim of the conference was to advance the knowledge about economic, technical, social and institutional prerequisites for a sustainable transformation of the Swedish energy system and explore its dynamic consequences on energy markets, technologies and systems as well as on the development of technology and markets.

In the open session, the participants were made welcome by Professor Robert Lundmark, head of the organizing committee. The Vice-Chancellor of Luleå University of Technology, Johan Sterte, also welcomed the participants to the university and highlighted the well-renowned energy research (both within the field of energy economics and energy sciences) conducted at the university. Finally, Professor Lars Bergman, chairperson of the Swedish Association for Energy Economics, made an address highlighting the Swedish energy research in general and stressed the need for more focused and deliberate public research funding towards energy economics research.

The concurrent sessions was thematic and based on the conference topics. The range of presentations, both in terms of issues and research area, were good. Each concurrent session was arranged to include three presentations with each presentation have 30 minutes allocated. This was a deliberate structure to give time for a more detailed presentation and longer discussions at the end of each presentation. Abstract, presentations and selected full paper are available on the conference website (www.ltu.se/saee2016).

In the two plenary sessions, the challenges facing the Nordic energy market in general and the Swedish in particular were discussed. The invited speakers included the Swedish Minister of Energy Ibrahim Baylan; Mikael Odenberg, the Director General of Svenska Kraftnät (the Swedish TSO); Anne Valdaz Nilsson, the Director General of the Swedish Energy Markets Inspectorate; Hans Kreisel, CEO SKellefteå Kraft; Torbjörn Wahlborg, Senior Executive Vice President Vattenfall AB and; Tomas Kåberger, Professor in Energy and Environment at Chalmers University of Technology and Director General of the Swedish Energy Agency, 2008-2011. Thus, the topics discussed included a wide range of areas and issues.

Baylan highlighted the newly finished parliamentarian agreement. The details are too complex and intricate to be fully described in this report. But the general aim of the Swedish energy policy is to promote "efficient and sustainable energy use and a cost-effective energy supply" that would "facilitate the transition to an ecologically sustainable society". In order to achieve this Sweden is facing several difficult and complex challenges. For the longer term, two ambitious priorities have been put forward: (i) a fossil fuel-independent vehicle fleet by 2030 and (ii) zero net greenhouse gas (GHG) emissions by 2050. Several elements will shape the success of these goals, including cost-effective policy instrument, technology innovation and energy market developments. An important analytical approach is also system analysis of the combined effect of these elements. In connection to this, the development of renewable, alternative fuels is an important area. A large research area is in the production of ethanol from cellulose, what is called a second-generation biofuel.

The Swedish electricity mix consists roughly of 50 percent hydropower and 40 percent nuclear. Renewable electricity has gained market share during the last decades, especially wind power, which makes up the remainder. As pointed out by Hans Kreisel, CEO Skellefteå Kraft and one of the invited keynote speakers, the Swedish energy sector faces major upheavals in forthcoming years. In addition to the big political questions surrounding the future

of nuclear power, the phasing out of fossil fuels using wind and solar power as possible replacements, digitalisation along with new consumer values and the transition towards a sustainable society will also help reshape the energy landscape. Hans Kreisel goes on and identifies a number of future energy challenges divided into macro- and micro trends.

Mikael Odenberg is Director general of Svenska Kraftnät, the Swedish TSO which is also in charge of the interconnectors to Sweden's neighbouring countries. He elaborated on the challenges that the Swedish and Nordic electricity system is facing from a TSO point of view. He pointed out that, in Sweden 50 percent of the generation comes from hydropower and 40 percent from nuclear. In Norway there is almost 100 percent hydropower, while Finland has combined heat and power, condensing power plants and some nuclear generation. In Denmark there are coal fired condensing power plants and a huge amount of wind power. The Nordic integration has considerably improved the efficiency. We can produce the electricity where the variable production cost is the lowest. The integration improves our security of supply and makes it easier for us to handle and balance the increasing amount of volatile wind generation. Especially the last point was highlighted. The share of renewables, in Sweden mostly wind power, is increasing rapidly. This development with an increasing share of very volatile generation is now changing the properties of the power system and creates different system challenges for the TSO. We have an increased need to deal with internal bottlenecks in our north- south transmission structure. And some years ago we had considerable upgrades of the generation capacity in all our nuclear power plants, which called for investments in the grid surrounding the plants. Odenberg point out that investment towards 4,700 MEuro during the coming ten years is needed. It means that we are more than ten folding our investments, which in itself, of course, is a huge challenge. But here we have to decide; which plans will come true? When will the wind parks be built? And above all – where will they be built? Generation in the south, close to the consumption, means less need for grid investments and location to the north the opposite. And this is nothing that we as a TSO can influence. Our role is purely reactive, Odenberg states. If this becomes the case we will have enough time to adopt. Our view is that we will be able to handle the nuclear phase-out partly with further grid investments and new links both domestically and to neighbouring countries, partly through an increased elasticity on the demand side and with support from smart grid technologies and electrification of the vehicle fleet and partly with help from batteries and new storage technics. Today we do not have all the answers on how to handle all these challenges. Obviously there are no national solutions. We have to deal with them in a Nordic context and you can say that focus in the Nordic TSO cooperation is now shifting from grid planning to the operational system challenges that we are facing. And this is not purely engineering problems. If we are going to handle the situation we will need the support of the market. There will be a need to further develop the market design in order to give the market participants stronger incentives than they have today to act in a way that supports the system as a whole.

Robert Lundmark

The 2nd IAEE Summer School in Beijing Successful

The 2nd IAEE Summer School in Beijing, titled Energy Finance: Risk and Opportunities, was held during July 10-17, 2016 in Beijing, China. The summer school is hosted by the International Association of Energy Economics (IAEE) and the School of Economics and Management, Beihang University (BUAA) in China; and co-hosted by Center for Energy and Environmental Policy Research, Chinese Academy of Sciences (CEEP-CAS) and Committee for Low Carbon Development Management, Chinese Society of Optimization, Overall Planning and Economic Mathematics (CLCDM). It was the second IAEE summer school held in China. There were 53 Students from 4 countries who participated in the summer school and accomplished a 6-day course and a 1-day seminar. The summer school was held in the New Main Building at Beihang University. Prof. Ying Fan, Dean of the School of Economics and Management, Beihang University, opened the event with a welcoming speech.

The theme of the summer school was Energy Finance: Risk and Opportunities, including energy economics, energy investment, energy markets, energy derivatives and many applications. Prof. Ronald D. Ripple, the vice president of IAEE, from the University of Tulsa was the principal instructor. Students who participated in the summer school were mainly Master and PhD candidates from 17 universities or institutes, as well as a few young faculty and undergraduate students.

Prof. Ronald D. Ripple gave the 6-day lectures during the summer school. He is the Mervin Bovaird Professor of Energy Business and Finance in the School of Energy Economics, Policy, and Commerce in the Collins College of Business at The University of Tulsa. He has studied oil and natural gas markets for over 34 years and published numerous articles and reports typically focusing on oil and natural gas markets and the financial derivatives markets that support them. During the lectures, Prof. Ripple provided detailed introduction and explanation of energy finance in terms of risks and opportunities. Combined with real energy projects, he spent the first three days introducing the basics of project finance evaluation, in which capital budgeting evaluation model, capital asset pricing model, and levelized cost of electricity were introduced in detail. Meanwhile, numerical examples were presented in Excel to demonstrate the application of these. On the second three days of the lectures, a very detailed introduction of investment opportunity, energy derivatives – futures – and high frequency trading. Prof. Ripple provided a real case in Excel file to demonstrate the main approach in energy finance. A 30-minite Q&A session was reserved for each class in order to have an interaction with students.

A 1-day workshop, titled Research Advances of Energy Finance in China, was held during the summer school. Six speakers specializing in energy finance gave presentations and had lively discussions with students. The speakers are Prof. Liyan Han and Prof. Ping Li from Beihang University, Prof. Qiang Ji from Chinese Academy of Sciences, Prof. Yudong Wang from Nanjing University of Science and Technology, Prof. Yu Wei from Southwest Jiaotong University, and Prof Dayong Zhang from Southwestern University of Finance and Economics. The topics of the presentations included carbon asset, oil price co-movement, modeling and forecasting, and the relationship between oil prices and the stock market.

The summer school finished on July 17th. Prof. Ying Fan attended the closing ceremony and made a closing speech. She expressed deep appreciation to Prof. Ripple, acknowledged the support from IAEE and the organizing team led by Prof. Ping Li and her students. Prof. Fan and Prof. Ripple then awarded every student a Certificate of Attendance with the signature of IAEE Executive Director Mr. David Williams.

IAEE hosts Summer Schools in China every year. The first one was in Harbin last August with a great success. The summer schools are becoming a major series of events in the field of energy economics by attracting graduate students and young professionals from both domestic and international arenas to start or enhance their career.

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IAEE/Affiliate Master Calendar of Events

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

Date	Event, Event Title and Language	Location	Supporting Organization(s)	Contact
2016				
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				
April 3-5	6th ELAEE Conference *New Energy Landscape: Challenges For Latin America*	Rio de Janeiro	ALADEE	Luciano Losekann luciano.dias.losekann@gmail.com
April 23-25	10th NAEE/IAEE International Conference *Theme to be Announced*	Abuja, Nigeria	NAEE	Wumi Iledar wumi.iledare@yahoo.com
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 esiadow@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
November 12-16	35th USAEE/IAEE North American Conference *Riding the Energy Cycles*	Houston, TX, USA	USAEE	David Williams usaee@usaee.org
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*
2019				
May 26-29	42nd IAEE International Conference *Local Energy, Global Markets*	Montreal, Canada	CAEE/IAEE	Pierre-Olivier Pineau *pierre-olivier.pineau@hec.ca*
August 25-28	16th IAEE European Conference *Energy Challenges for the Next Decade: The Way Ahead Towards a Competitive, Secure and Sustainable Energy System*	Ljubljana, Slovenia	SAEE/IAEE	Nevenka Hrovatin *nevenka.hrovatin@ef.uni-lj.si*

IAEE INTERNATIONAL ASSOCIATION for ENERGY ECONOMICS
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Calendar

23-26 October 2016, 34th USAEE/ IAEE North American Conference -- Implications of North American Energy Self-Sufficiency at Tulsa, OK, USA. Contact: Phone: 21-464-2785, Fax: 216-464-2768, Email: usaee@usaee.org, URL: www.usaee.org

24-27 October 2016, European Energy Markets Course at to be determined. Contact: Phone: +31 (0) 88 1166837, Email: bakker@energydelta.nl, URL:https://www.energydelta.org/mainmenu/executive-education/introduction-programmes/european-energy-markets-course

24-25 October 2016, Offshore WIND Conference 2016 at Amsterdam, Netherlands. Contact: Phone: +31 (0)10 209 2689, Email: lhe@navingo.com, URL:https://go.evvnt.com/66209-0

24-24 October 2016, Infrastructure Gas Mozambique at The Radisson Towers, Maputo, Mozambique. Contact: Phone: +27(0)81777 0028, Email:enquiry@africaninfex.com, URL: https://go.evvnt.com/59717-0

24-26 October 2016, Offshore Energy Exhibition and Conference 2016 at Amsterdam RAI, Europaplein 22, Amsterdam, NL-1078 GZ, Netherlands. Contact: Phone: +310102092674, Email: pmu@navingo.com, URL: https://go.evvnt.com/63156-0

24-26 October 2016, Petrochemistry & Natural Resources - 2016 at Dubai. Contact: Phone: +91 7799790002, Email:petrochemistry.conference@scientificfederation.com, URL: http://scientificfederation.com/petrochemistry-conference/

25-26 October 2016, Platts 18th Annual Financing US Power Conference at Crowne Plaza Times Square, New York, United States. Contact: Phone: 857-383-5733, Email: christine.benners@spglobal.com, URL: https://go.evvnt.com/60944-0

25-27 October 2016, Oil and Gas Future Logistics Forum 2016 at Houston Marriott West Loop By The Galleria, 1750 West Loop South, Houston, TX, 77027, United States. Contact: Phone: +4402031418700, Email: info@hansonwade.com, URL: https://go.evvnt.com/61530-0

25-26 October 2016, Platts 9th Annual Appalachian Oil & Gas Conference at Fairmont Pittsburgh, 510 Market Street, Pittsburgh, PA, 15222, United States. Contact: Phone: 857-383-5733, Email: christine.benners@spglobal.com, URL: https://go.evvnt.com/62069-0

25-27 October 2016, Smart Metering 2016 at Berlin, Germany. Contact: Phone: +49 30 20913387, Email: stefanie.ullrich@iqpc.de, URL:https://go.evvnt.com/62211-0

25-27 October 2016, POWER-GEN Russia at Expocentre, 14, Krasnopresnenskaya nab, Moscow, 123100, Russia. Contact: Phone: 447983390561, Email: leec@pennwell.com, URL: http://atnd.it/37696-0

25-27 October 2016, Argus Rare Earths 2016 at Midtown Shangri-La Hangzhou, 6 Changshou Road, Kerry Central, Yan'an Road, Hangzhou, 310006, China. Contact: Phone: +6564969922, Email: yuanchang.yu@argusmedia.com, URL: https://go.evvnt.com/66779-0

25-26 October 2016, Marine Energy Event 2016 at Amsterdam RAI, Europaplein 22, Amsterdam, 1078 GZ, Netherlands. Contact: Phone: +310102092689, Email: lhe@navingo.com, URL: https://go.evvnt.com/66210-0

26-28 October 2016, Argus California Carbon and LCFS Summit at The Silverado Resort and Spa, 1600 Atlas Peak Road, Napa Valley, 94558, United States. Contact: Phone: 7133607566, Email: bel.cevallos@argusmedia.com, URL: https://go.evvnt.com/59809-0

October 31 - November 04 2016, Large Energy Projects Course at to be determined. Contact: Phone: +31 (0) 88 1166837, Email:bakker@energydelta.nl, URL: https://www.energydelta.org/mainmenu/executive-education/executive-master-programmes/executive-master-of-gas-business-management

03-05 November 2016, 12th Nanotechnology Products Expo (User Submitted) at Australia. Contact: Phone: 7025085200, Email:nanoexpo@insightconferences.com , URL: http://nanoexpo.conferenceseries.com/

06-10 November 2016, 2016 ANS Winter Meeting and Nuclear Technology Expo at Las Vegas, United States. Contact: Phone: 0017083526611, Email:meetings@ans.org, URL: https://go.evvnt.com/65661-0

07-10 November 2016, World Ethanol and Biofuels Conference, Brussels, Belgium at Steigenberger Wiltcher's Hotel, Avenue Louise 71, Brussels, 1050, Belgium. Contact: Phone: +44(0)2033773658, Email: Enquiries and bookings registrations@agra-net.com, URL: https://energy.knect365.com/world-ethanol-biofuels/purchase/select-package?utm_source=evvnt&utm_medium=referral&utm_campaign=evv

07-11 November 2016, Gas Strategy Development Course at Madrid, Spain. Contact: Phone: +31 (0) 88 1166826, Email: sanders@energydelta.nl, URL:https://www.energydelta.org/mainmenu/executive-education/specific-programmes/gas-strategy-course

07-10 November 2016, World Ethanol & Biofuels Conference, Brussels, Belgium at Steigenberger Wiltcher's Hotel, Avenue Louise 71, Bruxelles, 1050, Belgium. Contact: Phone: 020 3377 3658, Email: registrations@agra-net.com, URL: https://go.evvnt.com/67818-0

07-08 November 2016, Platts Inaugural Gasoline, Naphtha & LPG Conference 2016 at The Mainport Hotel Rotterdam, Mainport Leuvehaven 77, Rotterdam, 3011 EA, Netherlands. Contact: Phone: 02071766300, Email: conf_registrations@platts.com, URL: https://go.evvnt.com/61567-0

07-09 November 2016, 7th Annual Operational Excellence in Oil and Gas Summit at Norris Convention Center, CityCenter, 816 Town and Country Blvd., Suite 210, Houston, TX, 77024, United States. Contact: Phone: +4402073689556, Email: stefania.fedele@iqpc.co.uk, URL:https://go.evvnt.com/62807-0

08-10 November 2016, Deepwater Operations Conference and Exhibition at Galveston, TX, United States. Contact: Phone: 9188319701, Email:jenniferm@pennwell.com, URL: http://atnd.it/54741-0

09-10 November 2016, Platts Inaugural Gasoline, Naphtha & LPG Conference at The Mainport Hotel Rotterdam, Leuvehaven 77, Rotterdam, 3011 EA, Netherlands. Contact: Phone: +44 (0) 20 7176 6300, Email: conf_registrations@platts.com, URL: https://go.evvnt.com/61567-0

14-15 November 2016, Refining Engineering & Construction 2016 Conference & Exhibition at Omni Houston Hotel, Four Riverway, Houston, Texas, 77056, United States. Contact: Phone: 02074224321, Email: karla@petchem-update.com, URL: https://go.evvnt.com/62688-0

14-18 November 2016, International Gas Value Chain Course at Vienna, Austria. Contact: Phone: +31 (0) 88 1166826, Email: sanders@energydelta.nl, URL: https://www.energydelta.org/mainmenu/executive-education/introduction-programmes/international-gas-value-chain

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