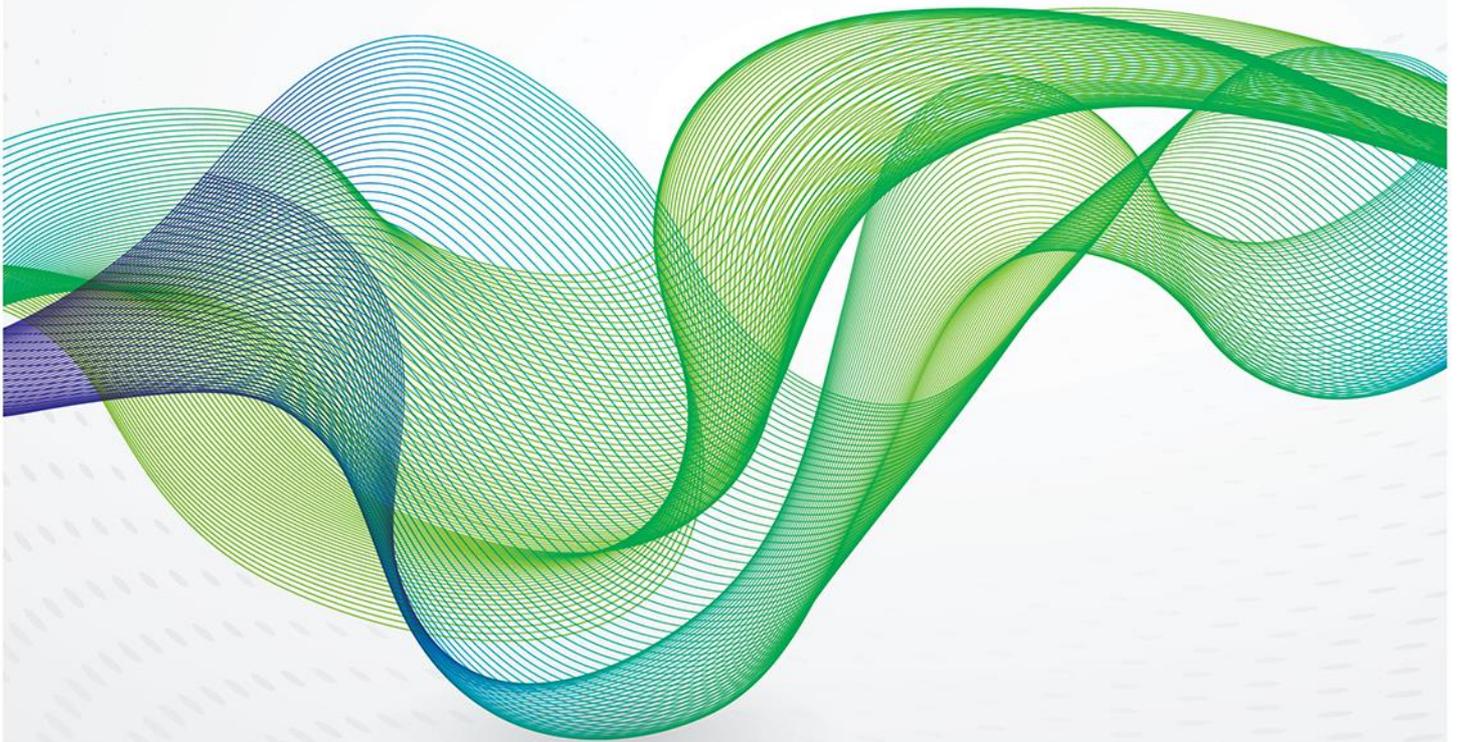


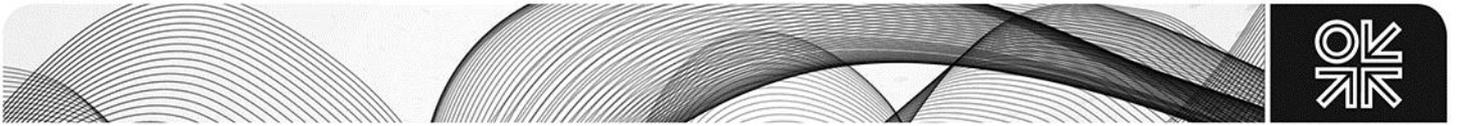


THE OXFORD
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FOR ENERGY
STUDIES

June 2014 - Stockholm

OIES Brainstorming Proceedings, 2014





The Oxford Institute for Energy Studies held its twenty-fifth Brainstorming meeting in Stockholm on the 12th and 13th June, with kind support from the Swedish Energy Agency.

The OIES Brainstorming is an annual forum of invited participants, to review developments in international energy markets. Proceedings are conducted under the Chatham House Rule.

The meeting comprised six sessions:

Global Economic Outlook

The Geopolitics of Energy

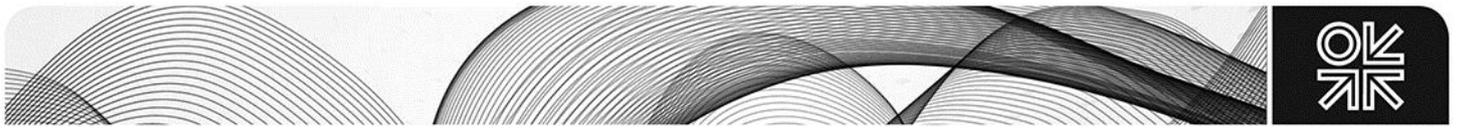
The Oil Market

The Gas Market

The US Energy Scenario and Implications for Global Energy Markets

The Power Sector, Decarbonisation and Climate Change

The contents reflect views expressed by participants of the meeting and do not necessarily represent the views of the OIES. The contents should not be construed as a forecast of any kind.



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1. Global Economic Outlook

The OIES Brainstorming meeting opened with a review of the outlook for the global economy in 2014 – the main issues were summarised and then thrown open for discussion.

1.1 Review of the Global Economy - calm within the geopolitical storm?

Briefly, the current economic scenario can be described as one where despite significant geopolitical upheaval over the past twelve months, the world economy has remained in a state of relative equilibrium – although very difficult to characterise.

The risks to the world economy are generally seen as represented by four key factors, in no particular order:

the risks to US economic recovery

the relevance of emerging markets in driving global economic growth

the pace of the slowdown of China's economy

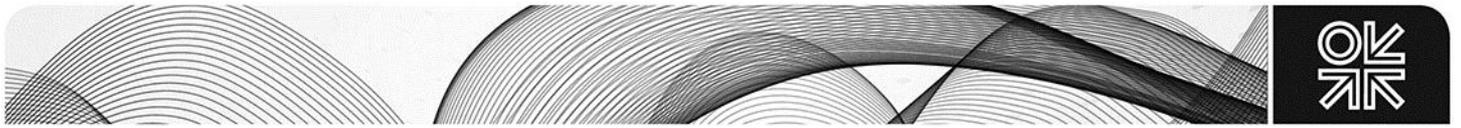
the risk of deflation in the euro zone

These risks underpin the question of whether or not the world economy will generally be in better shape in 2014 and 2015 than it was in 2013.

First quarter data indicates that the global economic outlook for 2014 is disappointing. It shows a significant first quarter contraction of roughly 3% in the US, plus a slowing down of growth in China to around 7%. Although growth in the European economy is no longer negative, it is stagnant – growth was 0.2% compared with 0.3% in the last quarter of 2013, and there are worries about deflation.

Despite this negative outlook, there is reason to be optimistic specifically on the US economy, which is likely to improve in 2014 with positive knock-on effects for the world economy. Some of this is due to an improvement in competitiveness - productivity has been good, there have been modest wage increases, and the Dollar remains relatively weak. Improvements in productivity are being driven, in part, by a reduction in energy costs catalysed by the 'shale revolution'. Besides this, there are two broad reasons why the US economy is likely to do better in 2014: first, although the political situation remains messy, there have been no shutdowns or paralysing political disagreements similar to those in 2013. And second, fiscal policy has improved – there was a 2% tightening last year, along with the ending of tax cuts. There has been no fiscal tightening this year. Although these are marginal effects, they are likely to lead to better growth in the US in 2014 – and, a better picture for the US economy is likely to lead to a better situation for the world economy. Generally, most risks to US economic recovery appear to be on the upside. The downside risks relate not to the economy *per se* but to politics and the continuing difficulties of future consensus between and within political parties.

The idea that emerging markets have been and can be the 'saviours' of the global economy is not entirely accurate, and is attributable to excessive optimism rather than solid economic evidence. Collectively, emerging markets exhibited strong growth and were important contributors to world economic growth until 2011. However, setting aside the role of Chinese demand, many have since exhibited problems with their corporate governance and with corruption. In India, which experienced a slowdown from 9% GDP growth in 2009 to roughly 5% in 2013, there are signs of economic reform following the election of a new government in April. But given the economy's structural problems these are likely to require time to take effect. In other emerging markets – specifically South Africa, Brazil, Indonesia and Turkey – there are no big negatives, but at present they are not major contributors to world economic growth.



Turning specifically to the risk of a slowdown in China, concern has grown during the past 12 months over the sustainability of economic growth. Although short term economic policy appears favourable, there are serious structural problems. These are particularly reflected in corporate sector indebtedness, which currently stands at 140% of GDP. This is significantly higher than in previous years and higher than that of any other economy, including the US. Should China's economy slow down, it will most likely be unable to refinance this debt, with potential knock-on effects. As it stands, economic growth at 7% is already relatively weak by Chinese standards, and at some stage we could see a period of significantly weaker growth in China – but it is difficult to predict exactly when this will start to bite.

In the Eurozone, the outlook is relatively positive compared with 2013 primarily due to the fact that a potential breakup appears to be off the agenda after Germany (Merkel) backed the ECB (Draghi) plan to support the Euro. However recovery may be limited as weaknesses continue to persist, specifically within the banking system. Further, the data substantiates worries over deflation, as macroeconomic indicators are already very weak and it would be relatively easy for them to tip into the negative zone. A comparison with the Japanese economy of 15-20 years ago, shows, in fact, that the signs in the Eurozone are ominous. Although the ECB may be slow to act it has shown that it can and will act to avert economic crises if necessary, and this helps counter this particular risk to some extent.

Generally, the issue of 'secular stagnation' (that is, negligible economic growth, which leads to lower longer-term investments, and eventually, to declining levels of per capita income) and economic growth *per se* are not as pertinent to the US and European economies as dealing with structural issues – for instance, inequality is likely to remain a main feature for these economies going forward. Dealing with the effects and speed of technological change also represent a challenge and an opportunity, and this has been visible in the past few years – for example, many companies which dominated the mobile telephony, aerospace and car industries three years ago are no longer in operation.

To summarise, the world economy in 2014 is likely to be characterised by low inflation, low interest rates, and slightly lower economic growth and many underlying nuances.

1.2 Discussion

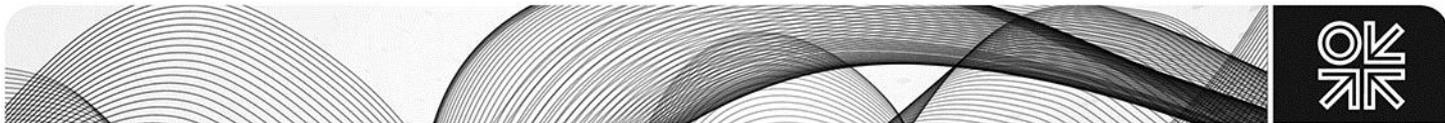
The discussion covered four broad areas:

- the nature and impacts of the anticipated slowdown in China
- the role of quantitative easing in the US versus Europe
- the oil industry within the global economy
- the role of changing consumer preferences

1.2.1 Emerging Markets and the Chinese Slowdown

The outlook for emerging markets raised several questions, particularly in relation to an anticipated slowdown in China's economy. One question related to the implications for world energy demand of the fact that emerging markets are unlikely to be 'engines of growth' in 2014 – this is pertinent given that over the last few years, the bulk of the growth in energy consumption has come from emerging markets. Another question raised was with regard to the pace of the slowdown in China, and whether we can expect a 'soft' or 'hard' landing as a result of the corporate indebtedness problem.

One view was that there appear to be all the signs of an economic slowdown in China – for instance, world commodity prices (with the exception of oil) are slightly lower, and much of the reason for this can be traced to the Chinese economy. The slowdown is also reflected in the equity markets and the banks. Construction machinery sales in China, an important indicator of construction activity, were also down by 30%, further signalling a slowdown.



However, a counter-view was that although Chinese government policy on rebalancing the economy from investment-led towards consumption-led growth has resulted in some of the indicators, such as construction activity, showing weaknesses, the current rebalancing can have long-term positive effects on the global economy. This difficulty in disentangling effects that may be negative in the short term, but positive in the long term for the global economy, makes it difficult to predict the nature and impacts of the slowdown. Regardless of the causes, the Chinese government will, ideally, be trying to achieve a soft landing – however, as investment is currently 50% of the Chinese economy any landing is likely to be felt quite sharply.

A related view on energy demand was that it would be relatively weaker than expected not just due to the changing energy mix in China, but also due to the adoption of energy efficiency worldwide, both at national and industrial levels. A counterintuitive argument however was that the pursuit of energy efficiency requires substantial capital investments, and when the economy slows down, so does the asset turnover – eventually leading to the loss of a large part of the benefits of energy efficiency in the first place.

A question was raised as to whether and how the market was discounting an expectation of a slowing in China's growth rate, projected at around 5%. It was pointed out that market expectations tended to centre on headline growth numbers rather than relative changes, and that 5% of the Chinese economy is still quite significant.

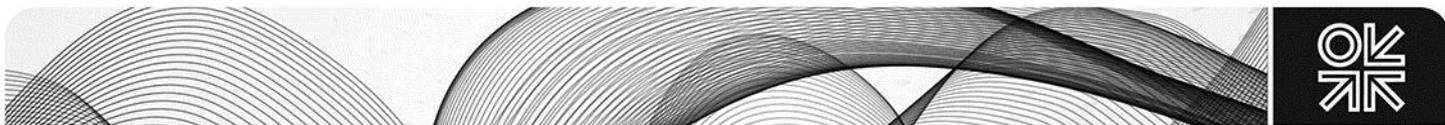
Regardless of these relative effects, a widely shared view was that market perceptions have a very strong influence on economic outcomes. The Japanese case provides an illustration of this. In December 2012, it was strongly believed within Japan that the economy was trapped in a deflationary cycle. However, following the election of the Abe government and its implementation of seemingly drastic measures to improve the economy, the market perception turned favourable. It was pointed out that the popular term used to describe the Abe government's approach, 'Abenomics', is quite ambiguous in its meaning and cannot be pinpointed down to a definition even within Japan, but it catalysed a change in market perceptions with positive effects for the economy. Given its recent experience, Japan is taking a cautious view on internal instability, rising costs and structural problems in China, but the general consensus remains that the potential for growth in China is declining.

1.2.2 Quantitative Easing in the US, versus Europe

The discussion then turned towards macroeconomics - and problems in the US and Europe. One concern was the use of Quantitative Easing (QE) and the fact that different national and supra-national economies were at different stages of QE – for instance, there is a rollback in the US and potentially in the UK, whereas Europe is in a completely different phase of the QE debate. A point that arose was whether these different stages of monetary policy and geographically differentiated application of QE present major risks and impacts on credit flows to emerging markets.

One view was that there is a difference between liquidity requirements and the need for structural changes, and that the distinction between the two may be blurred in the application of policy, with the risk of the problem of structural change becoming intractable. France's economy is an illustration – where structural problems have continued to persist with the added problem of a 'disconnect' between political parties and the public. One view was that the situation in France is analogous to the UK economy roughly 30-40 years ago, where political parties keep proposing change but are unable to implement it. Inward investment in France was down by 70% in a single year due to the state of politics and fiscal policies, as the political establishment has been unable to implement policy change.

A final point on the US economy was that broadly, the corporate sector is globally cash rich and more confident investing in the US than in previous years, and there is also a lot of acquisition activity.



1.2.3 Oil Industry within the Global Economy

The discussion touched briefly upon the issue of the stable oil price and its implications for the oil industry. It was noted that there appears to be a disconnect between the story of high costs supporting high oil prices: costs have doubled whereas the oil price has been fairly stable. A counter-view was that the doubling of the cost base occurred around 2003-05, and that the cost base has remained relatively stable in the last few years.

Another view was that despite the perception of stable oil prices, they are in fact four times higher than they were at the beginning of the century. Cost inflation within the energy sector is increasingly seen as driven by the price of other commodities – thus the question arises as to whether participants see anything happening outside energy markets which could drive the costs down.

This new oil price environment may engender a change in the way business is done within the oil industry, which has tended to think in a very linear way – for instance, when oil prices go up, costs go up. Historically, it was this perceived linear relationship between costs and prices that led the industry to point out to regulators, governments and markets that they should not be assessed on profits but rather on reserve replacement. This has turned out to be a costly strategy, and reverting to being assessed on profitability is, perhaps, the more attractive option to oil companies. This new environment may reduce the focus on new discoveries and exploration and increase the drive for cost efficiency within oil companies. .

1.2.4 The Role of Changing Consumer Preference

The final area of discussion was the role of consumer preferences in influencing economic recovery, and the prospects for energy markets. There are some industry sectors (directly relevant to energy) which have responded to consumer preferences within short timeframes – the automobile industry constitutes a prime example. These shifts in consumer preference have been visible over the period of the economic crisis. For instance, the ability to finance large cars declined and smaller cars became more prevalent in the automobile sector; however, the beginnings of recovery could signal a return to a preference for SUVs, as consumer wealth rises again. A concurring view was that from a purely macroeconomic perspective, declines in commodity and oil prices might lead to rises in real incomes and therefore consumption – and that the effects of this are likely to be greater in emerging markets such as China, with rising numbers of middle class consumers.

Another point related to the nature of an economic recovery in which industry caters increasingly to the younger demographic. The global economy can be seen as characterised by connectivity, a new individualism, and a different kind of democracy – these elements could bring about changes in the structure of the energy sector, where there is a greater demand for off-grid or decentralised solutions. An example of this can be seen in the success of Tesla in some markets, which although regarded as a niche upmarket purchase, wiped out its competition. We are likely to see these shifts in consumer behaviour play out further in automobiles. A counter-view was that although these changes were significant, they were marginal and discontinuous signals of a redirection in consumer behaviour.

The session closed with a summary of the main observations – we are living in a world of low inflation and low growth (barring certain countries). As a consequence of that we are going to see, from a secular perspective, low interest rates. However, there are underlying nuances to this outlook, as discussed in the session.



2. Geopolitics of Energy¹

The second session opened with a brief reference to the previous Brainstorming, when the discussion focused on the Arab uprisings, and the probability of a US/Israeli strike on Iran. The Arab Spring has since moved into winter, and the question that arises in 2014 relates to whether there are any limits to new Arab uprisings, and the implications of these for global energy markets. Specifically, four countries/world regions were flagged up for discussion based on recent geopolitical developments:

Iraq in relation to the Middle East, GCC and US involvement

the situation in Libya

Russia and Ukraine

The situation in the South China Sea.

2.1 Iraq and the Middle East

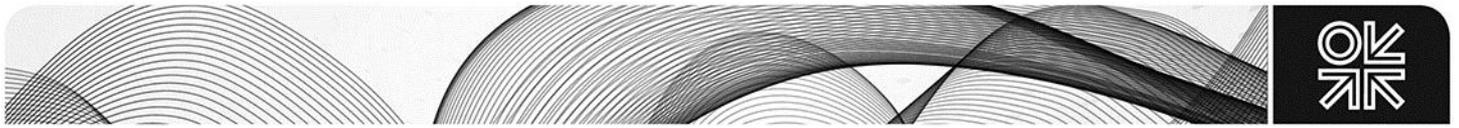
The developments in Iraq over the last 48 hours, when ISIS militants captured Mosul, came as a surprise. However, the possibility of a loss of government control in the north of the country has, in fact, been evident for several months. The area around Fallujah and Ramadi was entrenched in fighting in the run-up to the elections and the government was unable to remove militant groups from these areas. The whole political dispensation now appears to be at risk and the constitutional government may not be able to continue in its current form. This poses a general risk to production in southern Iraq, potentially affecting exports of 2.6 million barrels per day, though the risk of an immediate output disruption from the south remains low.

The fallout of the situation in Iraq is compounded by outages/production declines in other OPEC countries. Production is down in Libya and although Saudi Arabia, as the swing producer, remains capable of replacing volumes at short notice, we are beginning to see concerns about supply. There are huge implications for regional geopolitics – especially for Iran, Syria and for Iraqi Kurdistan (the Kurdistan Regional Government or KRG). The question of Iranian oil production and exports has risen in significance, and this could herald a swifter deal on nuclear negotiations with the US, as well as negotiations between the GCC and Iran on managing the situation in Syria and Iraq. Given US reluctance to redeploy ground troops, it is likely that Iran will be the next port of call for the Maliki government. The Kurdish region is likely to seek to further its own political agenda in the north of Iraq and progress its cause for independence.

A question arose as to the likelihood of Iraq continuing as a united country. One view was that the continuation of constitutional politics is not possible, given the collapse of the security forces in the first stage of the insurgency and the complete marginalisation of other Sunni parties.

Another point related to the implications of the situation for the KRG's relationship with Turkey, one of its biggest investors. Turkey's position on independent Kurdish oil exports is somewhat nebulous – the sense has been that Turkey wanted to see the pipeline route open and also wanted to give the KRG plenty of opportunity to strike a deal with Baghdad. However, as the KRG relies on fiscal transfers from Baghdad, which were being withheld, a fiscal crisis has developed, and even several exports of oil cargoes a month are unlikely to resolve it. While the Kurds could view the current situation as an opportunity to press for full independence, any such move would constitute a defiance of Iraq's sovereignty. It was also pointed out that Baghdad protested strongly following allegations that two tankers comprising 30,000-50,000 barrels of oil originating from the Kurdish region were allegedly sold into the Atlantic market. The major crude importers are unlikely to purchase KRG crude until there is a clear signal from the official marketers of Iraqi crude – doing so would risk legal

¹ The proceedings in this section are based on geopolitical developments at the time of the Brainstorming.



complications and future relations with Baghdad. Greater independence for the KRG is not impossible, but the sense is that they would remain a part of Iraq.

It was noted that Iraq's Sunni insurgency is extremely heterogeneous and there is a patchwork of interests in the South— a worst case scenario would be the breakup of the southern region into various Shia interests with regional agendas being supported by external powers. Another view was that the international system is unlikely to allow the dismemberment of Iraq. Such a situation could result in two or more 'phantom states' with no clarity over who to negotiate with within those states. It was also noted that the situation in the south, although relatively safer, could nevertheless have ramifications for oil prices, especially the price at the back end of the forward curve, given the amount of investment and the complexity of the projects needed to increase production in Iraq.

Another question raised was on the possibility and nature of US intervention – one response was that, given US foreign policy, which has been focused on extracting the US from 'impossible' military situations, a large scale redeployment of troops in Iraq is unlikely.

A final question related to the wider implications of this situation on regional countries. One view was that Saudi Arabia has altered its foreign policy stance towards countries such as Iran and Syria in the last year, adopting a damage-limitation and solutions-focused approach.

2.2 Libya

Libya experienced a rapid recovery in oil production immediately after the overthrow of Gaddafi. However, there were underlying difficulties for the oil sector. From July 2013 to around February 2014, there were local protests, with a lot of confusion on the ground and intermittent interruptions to production operations by different groups. The market interpreted this disruption as a transient phase that would eventually be resolved. However the period from February onwards was another phase in Libya's geopolitical problems – the Prime Minister was forced to stand down and the resulting political blow-back seriously undermined his credibility. The expectation that Libya would transition to a post-revolution government has yet to be met.

Although the conflict is often portrayed as a black and white struggle between two factions there are in reality many different, loosely aligned groups. These represent a complex web of different allegiances and disagreements over who will control Libya and its oil resources in the post-revolution period. Despite this escalation, the risk of descent into civil war remains low, because of the fact that the majority of the population are against a further escalation in violence.

Nevertheless, it is too early to start painting an optimistic picture about the return of security and stability to Libya. Given the fractiousness of allegiances, it is unclear what political leadership will emerge. The elections are also due to take place with a very short lead-up, which limits the ability of Libya's current leaders to begin the reform process.

In terms of the implications for oil markets, production from Libya has gone down to zero and the situation is 'as bad as it can get'. The question arises as to how long this situation will persist. Libya may be on the path of gradual recovery this year in supply terms, but even when Libya achieves stability we may find that its capacity has been seriously damaged. Production could come back in 2015 but this may be at levels of 1 - 1.2 million barrels per day in contrast to 1.5 million barrels per day previously.

It was pointed out that the lack of upstream investments and exploration efforts had seriously impacted Libya's potential production. A question arose as to what form a resolution to the situation may take – military or diplomatic - and the possibility of a division of the country. The fact that there are not two, but numerous warring factions within Libya mean any potential division of the country would be extremely complicated and virtually impossible.



2.3 Russia and Ukraine

One view was that, contrary to popular opinion, the Ukrainian crisis has been as much a sudden and unexpected development for Russia as for the west. It does reflect, however, just one of the consequences of a geopolitical shift in Russia over the last decade. After a period of westward orientation, including the pursuit of G8 membership and attempts to position itself as an equal partner, Russia perceived that Europe was resistant to increasing its political and economic linkages with Russia. The Russian leadership, therefore, decided that this push for closer relations with the west was not working, and has reoriented their geopolitical strategy back towards a position similar to that held by the former Soviet Union.

Ukraine has always been under strong Russian influence, as a buffer zone between Russia and the west, and the prospect of NATO or the EU at the Russian border has been unacceptable to Russian leadership. Therefore, the possibility of Ukraine moving towards the EU solicited a strong reaction from Russia and what happened in Crimea was the result of this. The worst-case scenario of Russia invading Ukrainian territories and dividing Ukraine is unlikely to happen. The future of Russia-Ukraine relations will depend on how effectively the situation in the eastern provinces is brought under control.

One view on the imposed sanctions was that they have pushed Russia to develop and promote its indigenous industry and services, including financial services. For instance, the sanctions led to the Bank of Russia's credit card systems being affected for a couple of days which provided the opportunity for Russia to develop its own payments system. The sanctions have therefore created an unintended effect. Russia is also being pushed more towards China in terms of economics and diplomacy. China, however, has its own agenda, which may not match Russia's (and Russia is cautious about this).

The question arose as to what Putin's objectives were in his approach to dealing with the situation in Ukraine. It was suggested that there were two main factors. The first was that, militarily, the prospect of NATO troops on their doorstep is absolutely unacceptable for Russia. The second, focused on problems with the domestic economy: an unhappy population, and a recession which began in 2013. The Sochi Olympics helped raise the government's profile, but not by enough. Putin's response to Crimea reportedly resulted in a surge of 20% in his support amongst Russians.

2.4 South China Sea

The situation in the South China Sea is likely to continue to be volatile given the tensions between China and Vietnam. There has been a marked increase in the level of assertiveness in Chinese diplomacy - this is in contrast to the Deng era. There is also potential conflict within China – the military divisions are not directly guided by Chinese leaders and the Chinese Premier needs to consider the army's stance on the issue,

3. The Oil Market

The session opened with a review of the oil market and was then opened to discussion. The session focused on three features of the market:

expectations on demand and supply

the stability of the oil price

the changing dynamic between costs and prices in the oil industry

3.1 Review of the Oil Market – stable benchmark, volatile differentials?

On the demand side, growth appears to be stabilising at around 1.2 million barrels per day, commensurate with stable oil prices. A slow pickup in industrial activity and lower growth in China has led to negligible gasoil /diesel demand growth– however, the US holds potential for future gasoil growth due to the strength of the industrial dynamic, and the need to transport coal, oil and ethanol has boosted demand. At the same time, strong consumer demand has boosted gasoline consumption. There has been a continued decline in fuel oil demand, which has been compounded by the growth in gas and a change in shipping dynamics. Generally, a slowdown in world trade and efficiency improvements in the use of vessels has led to a steady decline in the use of fuels, which is likely to continue, creating potential problems for the refining sector.

As a result of these trends, refiners are experiencing a squeeze on their margins - to the extent that many are being forced to shut down. However, only 25% of global refining has been impacted by this squeeze, as the remainder are located in countries with controlled pricing. The 25% includes refiners in Japan, Australia, Taiwan, Thailand, South Korea and Europe. Recent examples of refinery shutdowns in Europe include the Tenerife refinery and the Essar refinery in the UK.

On the supply side, the oil sector has gone through ‘the perfect storm’. The year began with the expectation of excess supply – with expected production increases from Libya, Sudan, Iraq and West Africa. The key question is, since no significant recovery is expected in Libya and given the uncertainty in West Africa and the Iraq situation, whether we can get through the summer without a price spike. However, there are no signs of a tight physical market in the next couple of months – in part due to weak demand in refining. With refining margins weak, the upside potential of the oil price is limited. In the absence of recent geopolitical upheavals, the market would be in a situation of excess supply.

The long-term oil price is set by supply issues, and currently, \$100/barrel oil is sufficient to ensure that most upstream projects are profitable, barring complex projects. Companies have, however, delayed or cancelled projects due to cost escalations, and these could take a chunk out of the supply profile. The effect of this, however, in terms of an inflection in the supply curve, is likely to be felt only 2-3 years down the line. It is notable that it has been difficult to forecast supply trends in North America: Projections of lower US supply growth in 2014 proved to be wrong and the US is expected to add around 1 million b/d this year. Rig activity, in total, has also been stable for the last 18-24 months.

Moving to the price environment in relation to profits – reducing costs has become a priority for oil companies. Cost indicators have been rising, faster than inflation, by 10% a year for the last two years. This rise would have been acceptable to companies if the price had also risen, but the stability in oil prices, combined with rising costs has narrowed profit margins. Both upstream companies and refiners are affected by the current cost-price dynamic.

3.2 Discussion – the oil price equilibrium

A question raised was that, despite macroeconomic uncertainty and geopolitical shocks, the oil price has been remarkably stable. What are the reasons for this and which parts of the oil market have been absorbing the impact? What would it take for the oil price to break out of its narrow range?

One view was that the equilibrium in the oil price is purely serendipitous. The primary factor has been the rise in US production offsetting declines in non-US production - the MENA region, Brazil, Nigeria, and Angola, combined with an increase in demand of roughly 1 million barrels per day. Without the rise in US production, we might have been seeing a much higher oil price. Another view highlighted the increased importance of Saudi Arabia as the stabilising swing producer, as it has an interest in ensuring stable prices (For instance, the drop in Iranian production was compensated for by Saudi Arabia).

However, another view was that the current situation reflects early gains to US producers, with the supply curve skewed to the left. The situation could alter in the future, but there are improvements

being made in operational efficiency. These have led to actual production beating expectations: the EIA had to revise its production figures to account for another 1 million barrels per day of light tight oil in 2014. However, there will be a point at which this gets difficult (for instance, due to cost inflation delaying the outcomes of new production) and the rate of growth could slow in the next 2 years. In this context the role of Saudi Arabia as the swing producer remains important and the threats developing around Iraq, particularly if they were to lead to a loss of spare capacity in Saudi Arabia, are of greater short-term concern in relation to the oil price equilibrium.

A related view focused on the rising cost structure of the industry. The highest costs are on the upstream side. The IHS upstream capital cost index doubled from 2000 to 2008, but since then there has been no growth. The operating cost index is up 80% from 2000. This signals that the fiscal terms and the government 'take' have had an impact on costs. The cost structure has risen since the 1980s due to more difficult resource bases and this has had an impact on total industry costs. There are many examples of the increasing complexity of new sources of production that are needed to offset depletion going forward – the problems with the Kashagan field, for instance.

Although the oil price has stayed stable, spreads have been volatile – so changes in underlying dynamics are being reflected in the price differentials. The market can, therefore, no longer be viewed as one great pool, but as a number of pools. We could end up with a stable benchmark but volatility in the differentials.

A point was made relating to the role of expectations in oil price formation; the 'real' driver behind the flat price is the futures market, which is driven off expectations by thousands of market participants, many of them trading just the differentials. However, the market is well supplied because the oil price, even after taking out the cost factor, is very high. This led to the view that we may be seeing a different type of investment model in operation - with tight oil increasingly important at the margin.

One reason that prices have remained stable within a narrow range is because markets are betting on a response from Saudi Arabia if the prices were to move up or down. The big question is then, what would happen if Saudi Arabia does not react as expected?

The session ended with the view that we may enter 2015 the same way we did 2014. The US is likely to add 1 million barrels per day, and production from Iran and Libya could potentially add to the market. The price is likely to continue to trade within the current narrow range, due to the presence of automatic stabilisers – but the overall scenario depends very much on whether OPEC, and particularly Saudi Arabia, will hold the line.

4. The Gas Market

In brief, the situation in the gas market can be characterised as one where the world outside North America (within the OECD) is charging far too much for gas, and the non-OECD is charging too little to support production. This, compounded with rising project costs and the move away from oil-linked pricing towards hub-based pricing for gas supply contracts, heralds a relatively unsettled period in the gas market.

The session focused largely on the following areas:

the development of gas markets in Asia

the LNG trade

the decline in the European gas market

the Russia-Ukraine situation



4.1 Review of the Gas Market

The year 2013 was generally disappointing for gas markets. Gas prices moved up outside of North America. The current consensus is that Henry Hub will remain under \$5 per MMBtu, with the long run marginal cost of dry gas thought to be roughly \$7 per MMBtu. This could, however, be proven wrong. Given the level of anticipation, there are surprisingly no new Final Investment Decisions (FIDs) on any LNG development projects.

Asia, and specifically China, had a relatively better year. Chinese gas demand grew by a little over 13% and there were new imports from Myanmar and Turkmenistan. Of significance is the China-Russia gas deal which constitutes the largest trade deal in the region for many years, under which China will import 38 Bcm of Russian gas for a period of 30 years. This creates significant potential to unlock gas in eastern Siberia for export to China – but this is going to take some time to operationalise. At present there is also very little information on the gas price that was agreed upon – there is speculation that it may be oil-linked (albeit not to JCC) with a very strong price review clause. It is likely that several aspects of the deal will need revisiting and further consideration before the gas actually begins to flow. The deal highlights the growing importance of China as a gas market in Asia – it has the only significant and logical ongoing price reform in the region focused on the operationalization, within a few years, of a Shanghai citygate benchmark price – the so-called “Shanghai hub”.

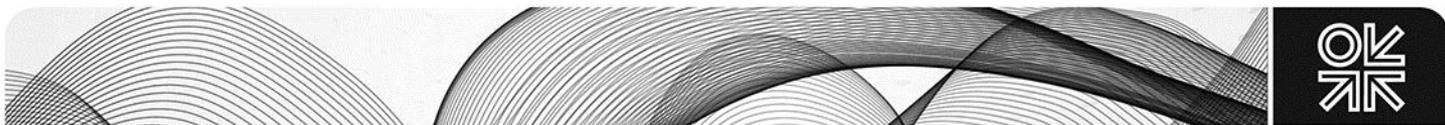
In contrast, Asia’s other large emerging market – India – has been very slow to reform, and the situation after the election of the new government in May has continued to be disappointing. The previous government proposed linking the domestic gas price to a weighted average of the netback of Indian LNG imports and international benchmarks including Henry Hub, the UK’s NBP, and Japan Customs Cleared (JCC). This shows that the fundamental distinction between price level and price formation continues to be problematic for policymakers – for instance, the dynamics of Henry Hub are based on the North American market and have little to do with conditions in India’s upstream sector. However, a positive feature of the proposed reform was that it has explicitly moved the determination of prices away from government control and towards being set by the dynamics of demand and supply. The new government has postponed the price reform and instituted a fresh review of gas pricing. The postponement is likely to put off new upstream investments and delay any potential new production by at least a year.

A final point on Asia is that there is a contractual impasse on LNG pricing, with a lot of strip contracts being signed for periods of 3-5 years as buyers cannot find deals to protect themselves against the consequences of the expansion of hub based pricing over the decade. This has already begun on a small scale in Singapore, with the expectation that China will follow and possibly Japan.

Moving on to the LNG market more generally, project costs have become too expensive, signalling the need for greater competition in the market. There are currently too many supply-side and demand-side dynamics to predict what the global LNG supply situation will be in 2020 and beyond, but it is likely that a surplus will begin earlier than expected, around 2015-16 rather than 2018.

In Europe, the decline in gas markets continues. Approximately 10 years of growth have been lost (15-20 in some European markets) for various reasons - relating to low GDP growth, availability of cheap coal and the push for renewables, with inadequate market structures to absorb the associated costs and risks. European hub prices have fallen by 40% since the start of the year to around \$7 per MMBtu. At a Henry Hub price of \$4.50 and a European price of \$7 per MMBtu, it is unlikely that any significant volumes of US LNG will come to Europe, as the economics will not make sense for LNG offtakers. While this is not to suggest that these differentials constitute a long term trend, they are indicative of much more complex price dynamics than many have been assuming in relation to North American LNG exports.

Turning to the Russia-Ukraine situation – both sides seem determined to arrive at an agreement on pricing and the fact is that there is no short term substitute for Russian gas in Europe of any size whatsoever, unless it is LNG returning from Asia. It is also unlikely that there will be any significant



alternative supplies which will allow Europe to substantially reduce imports of Russian gas for at least 10 years. The big uncertainty here is: what is going to go down faster – indigenous European production, or European demand?

Finally, turning to MENA gas – there is no sign that any of the MENA countries have taken effective measures to reform their domestic gas prices. Overall, the situation in the gas market is one where the regional gaps have narrowed slightly, but we still have a world where gas prices are either too high or too low to incentivise production, relative to the domestic policy environment.

4.2 Discussion

A question that arose is whether shortened contract periods and changing price discovery mechanisms could have any impact on infrastructure financing. One view was that there would be no impact in Europe as there were, in any case, no infrastructure requirements due to low demand. Infrastructure financing is more of a concern in Asian and Latin American countries where there are markets in which gas is still replacing oil products.

Another question was whether Russian gas could constitute a competitor to MENA (and specifically Qatari) gas. One view was that, with the exception of Qatari LNG, there is a prospect that MENA countries could in fact, become net importers of gas in the absence of any domestic pricing reform.

Another view highlighted the role of Russia's market power in relation to changes in regional and global gas dynamics. Rosneft is seeking third party access to the Power of Siberia pipeline, and Novatek recently announced a hybrid pricing model for LNG. Russia and China have also begun negotiations on the western Siberia (Altai region) pipeline route, where upstream investments have been made. High cost Yamal gas from Russia breaks even at below \$8 per MMBtu at the German border, significantly lower than the \$12 that would be needed to incentivise European shale gas. While Russian producers potentially have the market power to compete with Qatari gas, they would consider it a 'race to the bottom' to do so given the much lower Qatari cost base. While Russian oil indexed take-or-pay contracts continue to operate, Gazprom has been forced to bring its prices into line with those of hubs in the competitive European gas markets.

A final comment was on the view from Japan. The rationality of oil indexation is being questioned and the Japanese government is keen to develop hub based pricing, but the view is that an Asian hub could take years to develop. Japanese LNG imports stand at 80 million tonnes – the highest ever – primarily due to nuclear shutdowns. The restart of nuclear stations is likely to be delayed this year, but following restarts Japan's LNG demand may start to decline.

5. The US Energy Scene

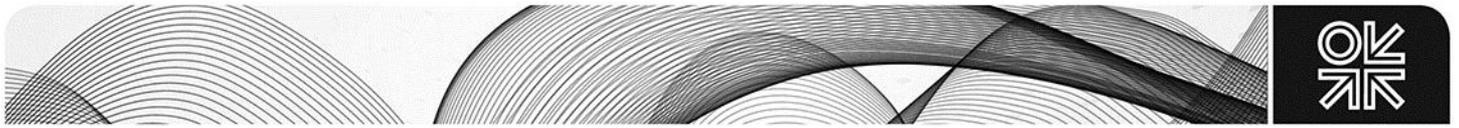
The rise of the US as an energy producer and its potential to supply the world market have significant implications for energy markets. The session focused on three areas:

the potential for replication of the US shale revolution

US oil exports and their potential impact on world markets

the state of US gas markets and their impact on the rest of the world

It is worth noting that although much of the attention focused on the US relates to shale, it is actually coal that remains, in absolute terms, the fastest growing fuel of the last decade. It is very likely that the displacement of coal from the US, particularly to Asian developing economies, will continue, and this should be taken into account when thinking about the future composition of energy markets.



5.1 Can the shale revolution spill over to other countries?

One view related to whether the ‘catalysts’ of the US shale revolution could be replicated elsewhere. One of the factors frequently cited as the key to the success of shale and tight resources in the US is the private ownership of mineral rights. However, the pace of development of shale resources in Canada – which does not have private mineral rights – has been just as rapid. The shale revolution cannot, therefore, be put down solely to property rights. Crucially, the size of the exploration blocks makes a difference, as does the scale of the companies that are drilling, the diversity and number of players, and the number of different ideas and attempts that can be applied to extract resources. Other constraints, such as the development of the service industry, can be resolved.

Another frequently cited success factor is the ability of the US private sector to finance companies, and the dynamism of the service sector and private sector – is the US experience too expensive to be replicated elsewhere? Again, one view was that companies do not have to be financed in the same country in which the resources are being explored for – for example, Canadian companies have access to capital in Canada for risk taking overseas.

5.2 US oil exports

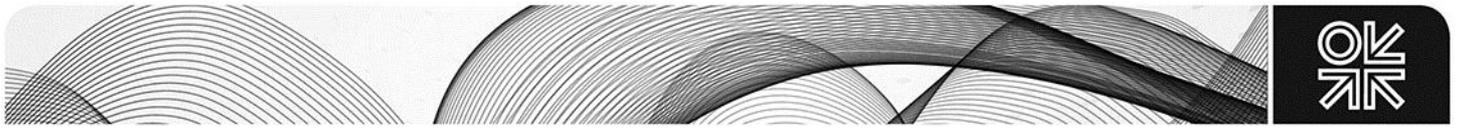
A key question relates to the implications of the potential lifting of the US ban on crude exports. Would European refiners, for instance, want to purchase US crude to produce gasoline to sell on the export market?

It was pointed out that the US ban applied to certain grades of crude only, and it is possible for companies to come up with strategies that could chip at the edges of the export ban. It may be difficult to continue the ban in the long-run. Currently, companies can request an export license after providing details of source, transport and destination, which then goes through an approval process. For instance, US crude exports to Canadian refineries stand at 290,000 barrels per day, so the processes are essentially in place, but the political decisions may take a year or two to materialise. There are some ambiguities over US crude exports – product exports are allowed, but not crude, from the wellhead. However, when the crude is put through a gas-liquids separation unit, policy applicability is less clear. Companies are nevertheless working towards exports, for instance from the Eagle Ford reserve.

Very light crude condensate is likely to find a market in Asia, which currently has the capacity of roughly 450,000 barrels per day of condensate splitters – the market potential in Asia is likely to expand further when the Panama Canal enlargement is completed. A question arises as to whether this constitutes good news for Asia, and reference was made to the overcapacity in refining in some Asian countries, such as India and Japan – the latter is currently implementing a reduction in refining capacity.

A related question was the impact of potential US oil exports on European refining, given their adverse position. Is it possible that US exports could lead to US refiners’ margins falling back to the world average, making European refineries relatively more competitive? One view was that US refineries have inherent price and cost advantages – for instance, energy costs are 20-25% of their margins versus 50-60% for European refiners. Additionally, labour costs are higher in Europe. European refiners have also been hit by the supply of product from Russia, Asia and the Middle East, and European refineries are smaller and less sophisticated than newly constructed refineries in Dubai and Saudi Arabia.

Another view related to whether there was any need for governments to prop up refineries in Europe or elsewhere. From the point of view of economics, world trade flows continuously change as do cost differentials, and policies should change according to countries’ comparative advantage. A response to this was that governments perceive refining capacity as part of the security of supply, which in turn



is viewed as a public good. A counter-view was that storage could just as easily substitute for refineries.

This prompted several views on the concept of security of supply. The view from Sweden was that a well-functioning market that delivered requisite supplies ensured security of supply regardless of a country's refining capacity. However, it was pointed out that the IEA considered refining capacity to be a component of security of supply – for instance, it expressed concern over the decline in Australia's refining capacity, combined with the fact that their level of strategic reserves was below IEA criteria. Another view was that governments need to be clearer about the concept of security of supply and reveal to citizens which risks can be catered for at reasonable cost and which cannot. A related view was that policy also needs to be clearer – for instance, a greater amount of renewables on the system potentially means less security of supply as renewables are intermittent.

5.3 North American Gas Market

One view was that gas production in North America has migrated from dry gas to liquids rich plays. A key factor relates to the long run marginal cost of dry gas and the consensus is that it stands at \$7 per MMBtu, but previous consensus on costs and prices has never proved to be (even directionally) correct. There are two further questions that will shape the future of gas markets; first, what would happen to gas demand and pricing if US exports begin, and second, what about the potential for gas in transportation? The latter has potentially been oversold in the short term, but we cannot rule out the possibility that, with high oil prices, it constitutes a big opportunity, particularly in the trucking sector which is relatively price elastic.

Another element of the North American gas market relates to the development of hubs. Henry Hub has dominated as the primary hub for gas over the past decade. However, the development of the Marcellus hub is significant, and becoming increasingly established.

The view that the shale revolution is unlikely to be entirely replicated in other countries, was reiterated. Further, it was pointed out that there are stranded assets in Canada and Alaska (Canada does not need the gas and Alaska cannot market it profitably) and thus there is continued pressure towards exports, but this is unlikely to happen in the short term.

A final point related to a view from Russia which regards US and Canadian LNG projects as a potential bubble, since there is overcapacity and underutilisation. However, Russia is also sensitive to possible competition from US exports. This view strengthened after the Ukrainian crisis. Further, all LNG technologies lie with OECD countries and Russia has no capability to develop LNG projects without these technologies. Given this, Russian projects are higher cost and more sophisticated than say Canadian LNG projects, and nearly all of them face delays particularly if sanctions are imposed in relation to providing finance and equipment to Novatek, Rosneft and Gazprom.

6. The Power Sector, Decarbonisation and Climate Change

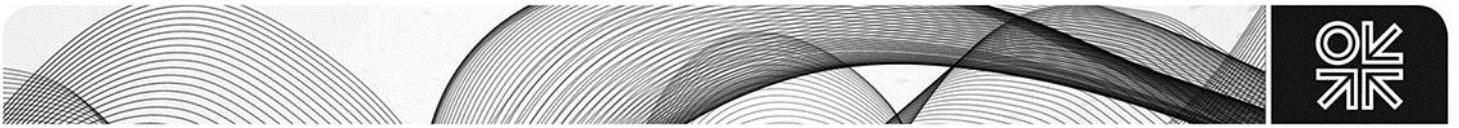
The session focused on two aspects:

the problems of integrating renewables into market structures designed for fossil fuels

issues in developing countries, particularly cost-reflective pricing

6.1 The Policy Problem

The power sector, along with the transportation sector, represents the biggest opportunity to bring about an emissions reduction on a large scale through policies advocating decarbonisation. In developed countries, the model of electricity market liberalisation constitutes a single energy-only market that delivers prices that are based on the system marginal cost, and are designed primarily



with fossil fuels in mind. Renewable energy, such as wind, runs intermittently, and when it runs the marginal cost is zero.

As renewable energy is intermittent, it requires backup generation – and as coal is being backed out of many developed-country markets (primarily Europe), this will be gas fired. However, theoretically, the introduction of renewables into the current market would result in a system with either a zero marginal cost or a very high marginal cost – as investors in backup generation would need to be paid a very high price in order to justify their present investments in backup capacity. The fundamental problem in the power sector relates to market design. Two solutions are currently being proposed in countries such as the UK: first, to introduce separate markets for energy, balancing and capacity – in other words, more complex markets; and second, a return to a single buyer model which coordinates electricity from renewables with fossil fuels – in other words, a potential return to central planning.

The problem is compounded by the fact that developing countries, such as India, which adopted the model of electricity market liberalisation in the early 1990s to move away from central planning, are currently mid-way through its implementation. If they were to continue through to complete implementation, then in the absence of any binding emissions reduction targets or phasing out of coal, these countries could potentially end up with an electricity sector comprising renewables with coal as backup generation – constituting a massive policy contradiction.

The problem reduces to one of investment. In developed countries, this pertains to investment incentives to enable renewables and decarbonisation. In developing countries, there is the additional issue of electrification. The policy problem lies in the design of the sector as well as in the lack of a binding global consensus on carbon emissions, given that efforts to decarbonise in Europe could potentially be offset by higher emissions in other parts of the world.

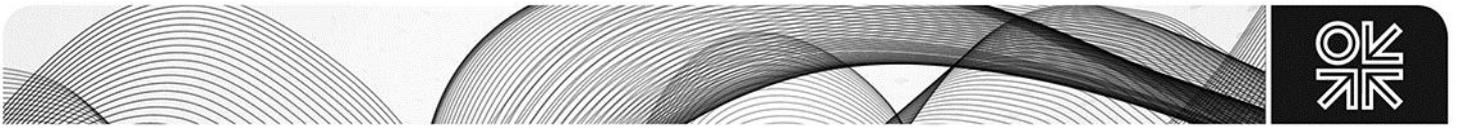
6.2 Discussion

It was pointed out that, in many countries adopting electricity market liberalisation, policymakers either tend to not understand the fundamental economics of the policy decision, or they do not communicate it to the public. Electricity market reforms tend to be successful when there is excess capacity – in the absence of this, prices will tend to go up rather than down, especially in countries where they are not cost reflective to begin with.

One view was that most policy on electricity is predicated on the assumption of rationality on the part of consumers, and that further research was needed in behavioural economics to understand the implications of changes in market design. Another view was that the problem of the finances of utilities in developing economies like India was often treated as separate from the process of electricity sector reform *per se*, yet utilities are crucial in the delivery process. It was also noted that distributed generation could change the material basis of the whole market.

Yet another view was that policy irrationality is reflected in the fact that some countries prefer to keep domestic energy prices low, thus disincentivising domestic production, whilst simultaneously being willing to pay several times as much for imports to fill the deficit. For instance, Mexico was willing to pay Venezuela a higher price for gas than for their own domestic gas. Conversely, it was pointed out that in the Middle East, electricity was being produced from oil which could be sold on the export market for \$100 a barrel. A question arose as to why renewables were then promoted in the Middle East at all – one view was that this is due to a shortage of gas and a reluctance to burn coal, leaving renewables as the next best option.

The discussion turned to the problems in Japan, where drastic changes were made in the power sector as a result of Fukushima. After nuclear power went offline, it resulted in the promotion of oil-fired generation along with electricity-saving measures. Currently, emissions are 15% higher than 1990 levels, and in general, electricity costs for industrial consumers have increased by 40% after Fukushima. Power sector reform has repeatedly been delayed.



A further aspect concerned the 'social pact' between governments and citizens in resource-abundant versus resource-scarce countries, which essentially lead to similar outcomes in terms of keeping prices down. Further, the elimination of subsidies is difficult due to the lack of transparent data on taxes and revenues to determine the extent of reform required.

A further example of policy irrationality is reflected in government directives on energy efficiency which preclude price adjustments, for instance, in Saudi Arabia, amongst other countries. A counter-view was that this prevented the rebound effect of energy efficiency policies. However, another view was that price signals were important for energy efficiency, in addition to all the other aspects, such as building specifications.

A final view was that one technology that had the potential to resolve a lot of the fundamental conflicts in the power sector was solar. In countries with abundant solar resources, solar energy tends to match demand patterns very closely in comparison with other intermittent renewables – for instance, solar energy is most abundant during the late morning and afternoon in these countries, which match with business hours.

The Brainstorming meeting ended with a summary of the main sessions.²

² See Executive Summary.