The 32nd JCCP International Symposium
"Innovation Challenges of Oil Industry for the Future Generations"

The guest of honor, chairmen and panelists of the symposium

The 32nd JCCP International Symposium was held over two days, from January 29 to 30, 2014, under the auspices of the Ministry of Economy, Trade and Industry (METI). More than 400 people from the ministry, oil-producing countries, foreign embassies in Japan, governmental agencies, and domestic companies and organizations attended the event held at Hotel Okura Tokyo.

1. Theme

The theme of this year's symposium was "Innovation Challenges of Oil Industry for the Future Generations." It was discussed in detail in two sessions held on the second day, from the perspectives of "Management Strategy and Human Resource Development for Changing Times" and "Technical Possibilities and Environmental Approaches for the Future."

The global oil situation is undergoing dramatic changes brought about by the shale oil and gas revolution, the construction of large-scale, export-oriented refineries in emerging nations, and the increasing need to address environmental issues. The oil industry as a whole must therefore gain an accurate awareness of such movements of the times from a long-term standpoint and continue its efforts for innovative technical development and management improvement.

Based on this understanding, the symposium was held with the objective of exchanging information and views with leading authorities from oil-producing and oil-consuming countries who consistently address the challenge of innovation in their respective capacities.

2. Overview

(1) First Day (January 29): Opening Ceremony

The symposium opened at 2:00 p.m. on January 29 with a welcome address by Mr. Keizo Morikawa, President of JCCP, followed by a greeting from the guest of honor, Mr. Takayuki Sumita, Director-General of the National Resources and Fuel Department at METI.

In his speech, Mr. Morikawa explained the objectives of the 32nd JCCP International Symposium as follows: "The world energy situation is undergoing remarkable structural changes. There has been a change in the demand-supply structure in emerging countries in the Middle East and Asia due to their economic growth, shale oil and shale gas development brought about by technological innovation, deeper oil well

Mr. Takayuki Sumita, Director-General, National Resources and Fuel Department, METI, giving a speech as the guest of honor

exploration, responses to global environmental issues and reassessment of nuclear power generation. These are the challenges and changes we face today as both producers and consumers of oil. To fulfill our mission of achieving sustainable and stable supply of oil, we must assess these changes, formulate a management strategy for the future, improve the technologies required for implementation of the strategy, and nurture the next generation of leaders. In order to fulfill this common mission, greater importance than ever before will be placed on dialogue and information-sharing between oil-producing and consuming countries."

Next, Mr. Sumita spoke as follows: "Especially in the Japanese oil industry, it is important to have a global view and to promote the healthy development of the oil industry from a broad perspective. One of the tools for securing a stable oil supply is cooperation with oil-producing countries. More concretely, Japanese cooperation in human resource development and technology transfer has particularly important significance. JCCP activities and the JCCP international symposium have played important roles in such cooperation, and the symposium, in particular, is expected to initiate a new era of innovation in the oil industry."

(2) Keynote Speech

Following the opening speeches, a keynote speech was given by Prof. Paul Stevens, a Distinguished Fellow at the Energy, Environment and Resources Department at the Royal Institute of International Affairs (Chatham House), based in London. Titled "Global Implications of the Technological Revolution in the Production of Gas and Oil," Prof. Stevens' speech focused on the technological revolution that is taking place in the oil industry today, and discussed its immediate impact on the oil and gas markets and its future, long-term global impacts. A detailed summary of the speech is provided on pages 9 to 13 in this issue of *JCCP NEWS*.

(3) Special Lectures

Prof. Stevens' keynote speech was followed by four special lectures.

The first lecture was by Dr. Mohammed Al-Madi, OPEC Governor, Ministry of Petroleum and Mineral Resources, Saudi Arabia. In his lecture titled "Transformative Technologies: Lessons Learned from Successes in the Energy Industry," Dr. Al-Madi explained how technological innovations and technical investment are transforming the oil industry, and introduced the King Abdulla Petroleum Studies and Research Center and the open network innovation model as examples of actual initiatives being implemented in Saudi Arabia.

Next, Mr. Abdulla Haji A. M. Al Abdulmalek, Executive Director–Administration Directorate, Qatar International Petroleum Marketing Co., Ltd. (Tasweeq), gave a lecture on "Sustainable HR Strategy at Tasweeq." In addition to general HR strategies, Mr. Abdulmalek discussed HR strategies under the Tasweeq Mission to "nurture Qatari workers (Qatarization) and present Qatar as a leader in business ethics" and the Graduate Development Program as concrete examples of HR development programs at Tasweeq.

Following Mr. Abdulmalek, Mr. Win Maw, Deputy Director General, Energy Planning Department, Ministry of Energy / Myanmar, gave a lecture on "The Current Status and Future Vision of Oil and Gas Sector in Myanmar." He first explained the structure of the energy sector in Myanmar by providing an overview of energy-related ministries and government agencies, organizations such as the National Energy Management Committee, and national companies, then discussed the present state of oil and gas production in the country, the conditions of mining sites, the privatization of refineries, and joint venture schemes. Mr. Maw closed his lecture by expressing his wish that "the participants of the symposium will return with best insights about these potential opportunities of technical and fiscal management in Myanmar oil and gas sectors."

Following Mr. Maw, Dr. Fereidun Fesharaki, Chairman, FACTS Global Energy (FGE), gave a lecture on short-term oil and gas markets. Under the title of "Dynamic Challenges and Opportunities in the Global Oil and Gas Industries," he shared his views on the five demand centers in the world (China, Middle East, Latin America, India and Africa), the three supply centers

Dr. Mohammed Al-Madi, OPEC Governor, Ministry of Petroleum and Mineral Resources, Saudi Arabia, giving a speech at the reception

Special lecture: Mr. Abdulla Haji A. M. Al Abdulmalek, Executive Director–Administration Directorate, Tasweeq

in the world (United States, Iraq and Canada), issues in demand facing the industrialized nations, issues in the oil refining business, and the characteristics of the natural gas market.

Unfortunately, Mr. Zach Henry, Director of Energy Dialogue, International Energy Forum (IEF), who was scheduled to give a lecture, could not make an appearance due to an unexpected, urgent matter.

(4) Reception

A reception was held after the keynote speech and special lectures, and Mr. Atsushi Taketani, Director, Petroleum Refining and Reserve Division, National Resources and Fuel Department, METI, gave a welcome speech, followed by Dr. Mohammed Al-Madi, OPEC Governor, Ministry of Petroleum and Mineral Resources, Saudi Arabia, who gave a speech on behalf of the oil-producing countries, and Mr. Jun Arai, COO, Showa Shell Sekiyu K.K., who led a toast after giving a brief greeting on behalf of the Japanese side.

(5) Second Day (January 30): Discussion Sessions

Two discussion sessions were held on the second day. Discussion Session 1 was held in the morning, chaired by Mr. Yutaka Yamazaki, Executive Vice President, JGC Corporation, and Discussion Session 2 in the afternoon, chaired by Mr. Takashi Matsushita, Director, Managing Executive Officer & General Manager, Manufacturing & Technology Department, Idemitsu Kosan Co., Ltd.

In Session 1, themed "Management Strategy and Human Resource Development for Changing Times," five panelists gave presentations on their company's management strategies and human resource development initiatives and visions. Dr. Dinh Van Ngoc, President & CEO, Binh Son Refining and Petrochemical Co., Ltd., gave a presentation titled "PVN's Human Resource Development (HRD) and Management Strategy to Meet the Increasing Demand and Challenges of Human Resources for the Refining and Petrochemical Industry in Vietnam"; Mr. Nofal Said Khamis Al Saidi, General Manager, HRS, Oman Oil Refineries and Petroleum Industries Company (Orpic), gave a presentation titled "Human Capital Management Draft Framework"; Mr. Abdulla Ibrahim Al Marzooqi, Manager, Strategic Studies' Business Development Department, Corporate Support Division, Abu Dhabi Oil Refining Company (TAKREER), gave a presentation titled "Nationalization: The Challenges and Solutions to Contemporary Human Resourcing"; Mr. Sami Hussain Malallah, Training & Career Development Manager, Training & Career Development Department, Kuwait National Petroleum Company (KNPC), gave a presentation titled "Employee Development Strategy"; and Mr. Nobutaka Nohara, Executive Officer, General Manager, Corporate Administrative & Financial Affairs Division, JGC Corporation, gave a presentation titled "Development of Globally Competitive Human Resources."

As chairman of the session, Mr. Yamazaki summarized the presentations as follows: All of the panelists in this session today are from the management of a national company or oil and gas company, and have emphasized their awareness of the need for human resource development and their management responsibilities to serve their country. Based on this awareness, they are putting together a management strategy and a strategy for human resource development in response to changing needs against the social environment and industrial history in their country. I would like to see a further deepening of understanding about the management and human resource development strategies in different countries, and hope Japanese companies will extend their help in the development of human resources in various countries

Special lecture: Mr. Win Maw, Deputy Director General, Energy Planning Department, Ministry of Energy / Myanmar

Special lecture: Dr. Fereidun Fesharaki, Chairman, FGE

with the cooperation of the Japanese government.

In Session 2, themed "Technical Possibilities and Environmental Approaches for the Future," five panelists gave presentations on the technical and environmental vision and initiatives of their company. Mr. Dhani Prasetyawan, Vice President, Refining Technology, PT Pertamina (Persero), gave a presentation titled "Energy Management System"; Mr. Abdulqader Alkamali, Chairman of ADNOC Group Environmental Committee and Vice President HSE, Abu Dhabi Gas Industries Ltd. (GASCO), gave a presentation titled "Pollution Prevention through Resource Conservation"; Mr. Saad Noori Mohammed Al-Darraji, Director General, Midland Refineries Company, Ministry of Oil-Iraq, gave a presentation titled "Technical Possibilities and Environmental Approaches for the Future"; Prof. Gautam Kalghatgi, Principal Professional, Research & Development Center, Saudi Aramco, gave a presentation titled "Engine Development Trends and the Implications for Transport Fuels"; and Mr. Itaru Matsuhiro, Executive Officer & General Manager, Technology & Engineering Center, Idemitsu Kosan Co., Ltd., gave a presentation titled "Philosophy and Strategy of Idemitsu for the Future of Petroleum Refining Industry – In Pursuit of Harmony between Value of Hydrocarbons and Conservation of Environment."

As chairman of the session, Mr. Matsushita summarized the presentations as follows: All of the presentations in this session today spoke about environmental protection as a priority issue in all aspects of refinery management, including the designing of refinery facilities and initiatives for quality enhancement and operational improvement, and emphasized the need to make active efforts to introduce and develop new technologies. For environmental protection, the oil industry in oil-producing countries and Japan have accumulated experience and technologies through refinery operations, and possess invaluable knowledge that cannot be purchased from licensors but can only be acquired through the actual management of a refinery. In order for the oil industry to maintain good relations with local communities as a good corporate citizen, oil-producing countries and Japan must mutually share their technologies and know-how as future energy suppliers and create a win-win relationship between oil producers and consumers.

3. Closing Statement

After the discussion sessions, Mr. Masataka Sase, CEO & Executive Director of JCCP, delivered a closing statement as follows: Today, we are seeing a great deal of changes in the energy sector. In the Middle East and Asian countries and other emerging countries, demand for energy is increasing due to their economic advances, and we are also seeing innovation and technology in shale oil and shale gas development, deep sea oil field development, and construction of new refineries. Energy demand balance is changing due to all these factors. In this symposium, the speakers have taken up related matters and gave presentations that shared ideas about the direction of responses for future generations, and initiatives for human resource development and technological innovation. I think we had a highly fruitful two days.

This was the 32nd time that JCCP organized the international symposium since its founding in 1981. Held annually, it aims to provide a venue for exchanges between oil-producing countries and Japan, and to contribute to the stable supply and demand of energy by promoting mutual understanding. I would like to once again thank everyone for their participation and contributions in making this symposium meaningful.

<by Akio Yamanaka, Councilor, Administration Dept.>

The 32nd JCCP International Symposium Program

"Innovation Challenges of Oil Industry for the Future Generations"

Date	Time	Proceedings
Jan. 29 (Wed)	14:00 – 17:45	Opening ceremony Opening address Mr. Keizo Morikawa, President of JCCP Guest-of-honor speech Mr. Takayuki Sumita, Director-General, Natural Resources and Fuel Department, Agency for Natural Resources and Energy, METI Keynote speech Prof. Paul Stevens, Distinguished Fellow, Energy, Environment and Resources Department, Royal Institute of International Affairs (Chatham House) Special lectures Dr. Mohammed Al-Madi, OPEC Governor, Ministry of Petroleum and Mineral Resources Mr. Abdulla Haji A. M. Al Abdulmalek, Executive Director – Administration Directorate, Qatar International Petroleum Marketing Company Ltd. (Tasweeq) Mr. Win Maw, Deputy Director General, Energy Plannng Department, Ministry of Energy / Myanmar Dr. Fereidun Fesharaki, Chairman, FACTS Global Energy (FGE)
	18:00 – 20:00	Reception
Jan. 30 (Thu)	9:30 – 12:00	Session 1 "Management Strategy and Human Resource Development for Changing Times"
	13:30 – 16:00	Session 2 "Technical Possibilities and Environmental Approaches for the Future"
	16:00 – 16:05	Closing address: Mr. Masataka Sase, CEO & Executive Director of JCCP

Keynote Speech

Country	Speaker	Speech Title
U.K.	Prof. Paul Stevens Distinguished Fellow, Energy, Environment and Resources Department, Royal Institute of International Affairs (Chatham House)	Global Implications of the Technological Revolution in the Production of Gas and Oil

Special Lectures

Country	Speaker	Speech Title
Saudi Arabia	Dr. Mohammed Al-Madi OPEC Governor, Ministry of Petroleum and Mineral Resources	Transformative Technologies: Lessons Learned from Successes in the Energy Industry
Qatar	Mr. Abdulla Haji A. M. Al Abdulmalek Executive Director – Administration Directorate, Qatar International Petroleum Marketing Company Ltd. (Tasweeq)	A Sustainable HR Strategy at Tasweeq
Myanmar	Mr. Win Maw Deputy Director General, Energy Planning Department, Ministry of Energy	The Current Status and Future Vision of Oil and Gas Sector in Myanmar
USA	Dr. Fereidun Fesharaki Chairman, FACTS Global Energy (FGE)	Dynamic Challenges and Opportunities in the Global Oil and Gas Industries

Session 1: Management Strategy and Human Resource Development for Changing Times

Chairman: Mr. Yutaka Yamazaki, Executive Vice President, JGC Corporation

Country	Speaker	Speech Title
Vietnam	Mr. Dinh Van Ngoc President & CEO, Binh Son Refining and Petrochemical Co., Ltd.	PVN's Human Resource Development (HRD) and Management Strategy to Meet the Increasing Demand and Challenges of Human Resources for the Refining and Petrochemical Industry in Vietnam
Oman	Mr. Nofal Said Khamis Al Saidi General Manager, HRS, Oman Oil Refineries and Petroleum Industries Company (Orpic)	Human Capital Management Draft Framework
UAE	Mr. Abdulla Ibrahim Al Marzooqi Manager, Strategic Studies & Business Development Department, Corporate Support Division, Abu Dhabi Oil Refining Company (TAKREER)	Nationalization: The Challenges and Solutions to Contemporary Human Resourcing
Kuwait	Mr. Sami Hussain Malallah Training & Career Development Manager, Training & Career Development Department, Kuwait National Petroleum Company (KNPC)	Employee Development Strategy
Japan	Mr. Nobutaka Nohara Executive Officer, General Manager, Corporate Administrative & Financial Affairs Division, JGC Corporation	Development of Globally Competitive Human Resources

Session 1 panelists

Session 2 panelists

Session 2: Technical Possibilities and Environmental Approaches for the Future

Chairman: Mr. Takashi Matsushita, Director, Managing Executive Officer & General Manager, Manufacturing & Technology Department, Idemitsu Kosan Co., Ltd.

Country	Speaker	Speech Title
Indonesia	Mr. Dhani Prasetyawan Vice President, Refining Technology, PT Pertamina (Persero)	Energy Management System
UAE	Mr. Abdulqader Alkamali Chairman of ADNOC Group Environmental Committee and Vice President HSE, Abu Dhabi Gas Industries Ltd. (GASCO)	Pollution Prevention through Resource Conservation
Iraq	Mr. Saad Noori Mohammed Al-Darraji Director General, Midland Refineries Company, Ministry of Oil	Technical Possibilities and Environmental Approaches for the Future
Saudi Arabia	Prof. Gautam Kalghatgi Principal Professional, Research & Development Center, Saudi Aramco	Engine Development Trends and the Implications for Transport Fuels
Japan	Mr. Itaru Matsuhiro Executive Officer & General Manager, Technology & Engineering Center, Idemitsu Kosan Co., Ltd.	Philosophy and Strategy of Idemitsu for the Future of Petroleum Refining Industry — In Pursuit of Harmony between Value of Hydrocarbons and Conservation of Environment

* Presentation materials from the symposium are available on JCCP's website (http://www.jccp.or.jp) for your reference.

Keynote Speech

Global Implications of the Technological Revolution in the Production of Gas and Oil

Prof. Paul Stevens, Distinguished Fellow, Energy, Environment and Resources Department, Chatham House

A technological revolution is taking place in the oil upstream sector. Today, I wish to look at the global implications of this. I shall start by describing what this technological revolution is that I am going to be talking about. Then, I will look at what the immediate impact has been on the oil and gas markets, and will look to the future and ask the question, "What are the future global impacts likely to be as we move forward?"

In order to do so, I firstly need to answer a key question. That is, "To what extent can the shale gas revolution, which is being experienced in the United States, be replicated elsewhere, what are the opportunities, what are the problems, and what are the barriers?"

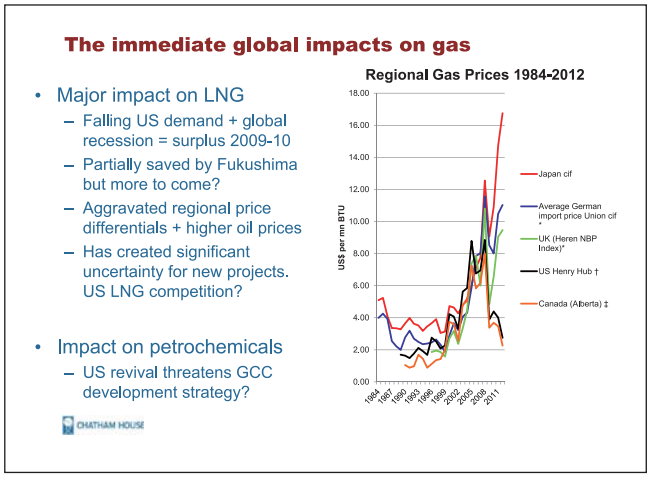
Technological Revolution

Let me start by talking a bit about what I mean by the technological revolution. I would suggest that a main component of the revolution has been extended-reach horizontal drilling. I believe the record for the lateral bit at the moment is 12.5 kilometers, but I read that figure about three months ago, and I suspect, given the rate of technological change, that it is probably now longer. The second main component is hydraulic fracturing, whereby water, sand and chemicals, at very high pressure, are injected into the formation to break up the shale and release the gas or oil.

I have also added two other elements to the technological revolution. The first is 3D seismic and the second is coiled tube drilling. I think these are going to play an increasing role in the way in which the revolution develops.

Now, a few characteristics about these technologies: The first is that they are not new technologies. They have been around for quite a long time. Horizontal drilling was developed in the 1930s, and the first well was fracced in 1947. A second point is that these technologies were developed largely by private companies, but on the back of a large amount of public R&D funding in the United States. This is an extremely important part of the story, because this was funding for fundamental research in basic science. The third characteristic is that the technologies have been improving constantly, at a rapid rate. This is in part owing to a learning-by-doing process as operators get together and exchange information.

Immediate Global Impacts on Gas

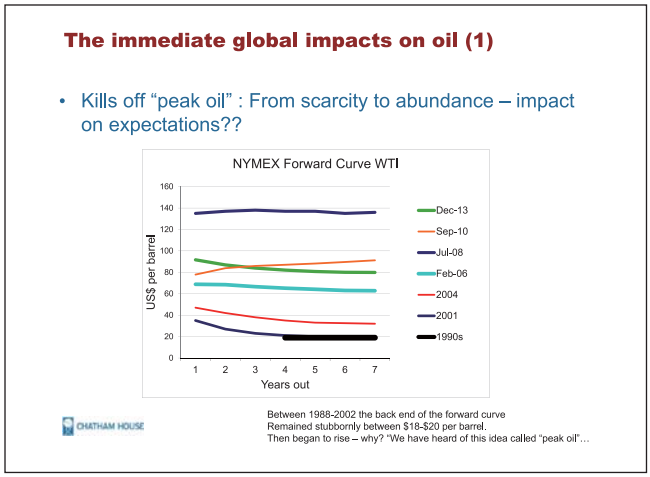


What has the immediate impact been on gas? Of course, the main impact has been via LNG. The period from 2009 to 2010 saw a falling demand in the United States and a global recession, and the result was a surplus in LNG with a downward pressure on LNG prices. Another impact has been an aggravation of regional price differentials. Slide 1 shows the price of gas starting in 1984, and from the period of around 2002 to 2008, there was a degree of convergence of gas prices among different regions. However, that has been destroyed as a result of the shale gas revolution, and a huge price differential emerged, in part driven by the shale gas

revolution but also by higher oil prices, because gas prices are contractually linked to the oil price.

All of this has created significant uncertainty for new projects, and there is a great deal of concern, for example in Australia, as to how much U.S. LNG is going to come into the market, and what sort of competitive results will come from that. Another impact is that the fall in domestic gas price in the United States has created a revival of the U.S. petrochemical industry.

Immediate Global Impacts on Oil (1)



What about the impact on oil? A good consequence is that the "peak oil" argument is now dead and buried. Slide 2 shows the forward curve from NYMEX. It is interesting to note that four to seven years out and between 1988 and 2002, the backend was stubbornly between $18 to $20 a barrel. That was viewed as the long-term price of oil. From 2004 to 2006 to 2008, however, the curve at the backend has risen. In other words, price expectations changed.

An interesting question, to which there is yet no sensible answer, is "Why did price expectations change? What was going on?" When buyers were asked why they are willing to pay so much more in the future for oil, they said they heard of "peak oil," and it sounded like a reasonable argument to push out the future price. Today, we are seeing an attitude that moves from this idea of scarcity to one of abundance. It is too early to say what effect these expectations may have on the industry, but they will have some sort of effect.

Immediate Global Impacts on Oil (2)

The second immediate impact on oil relates to the situation in the United States. Between 2007 and 2012, seaborne crude imports in the United States fell by 2.2 million barrels a day. As the country began moving slowly toward the magic goal of energy independence, it also effectively began moving toward a reduction in oil imports. Before all this, roughly half of the U.S. trade deficit was energy, but the United States' move toward energy independence could bring significant impacts on the balance of trade, and therefore have implications for the value of the dollar.

It has also given rise to speculation about the impact on U.S. policy. We are hearing people say that the United States will no longer have interest in what is happening in the Middle East, and it will lose all interest in policing the sea lanes because it no longer imports oil. Both arguments are nonsense. Superpowers police sea lanes, whether or not they import oil, and U.S. foreign policy in the Middle East has a lot to do with other things besides oil.

It has also had an impact on crude price differentials. As a result of new technologies, there is a surplus of light sweet crude, and a large portion of West African crude, which used to go to the United States, is now going to Asia.

Interestingly, between 2012 and 2020, there is estimated to be 8 million barrels a day of new refinery capacity in Asia, but on close examination, that new capacity is wrongly configured. It is geared for a world in which there will be a shortage of light sweet and a surplus of heavy sour, whereas in fact the world we are moving into is exactly the opposite. It will be interesting to see how this plays out.

Before Consideration of Future Impacts (1)

Future global impacts? The replicability of the US experience? Why the "shale gas revolution" in the USA?

Characteristic	USA
Favourable geology	Yes
Lots of drill core data to help identify "sweet spots"	Yes
Weak environmental regulation for fracking	Yes
Tax credits + Intangible drilling cost expensing	Yes
Property rights to the landowner	Yes
Pipeline access easy –large network + common carriage	Yes
Selling gas into a "commodity supply" market very easy	Yes
Dynamic and competitive service industry	Yes
Population familiar with oil and gas operations	Yes
Licensing large areas with vague work programs	Yes
Significant government investment in basic R & D	Yes
High liquids content in the gas	Yes
Started by rising gas prices	Yes
Favourable access to finance	Yes

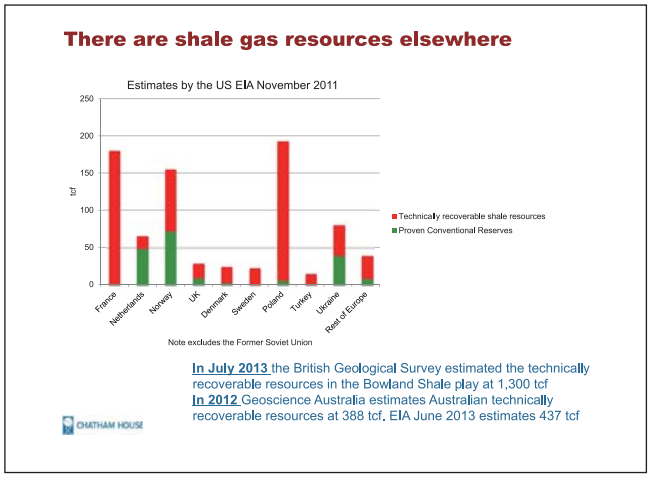
Before we can consider the impact on the gas and oil markets, we need to answer my initial question, "How

far can the shale gas revolution, which occurred in the United States, be replicated elsewhere?" To answer this, we must ask, "Why did the United States have a shale gas revolution?" The list for examining this question is long, and each item is answered with a yes. Here are a couple of examples. With regard to property rights of a landowner, in the United States, subsoil hydrocarbons are the property of the landowner. If I am a landowner in the United States and you come to me and ask if you can dig up my backyard and look for shale gas, I will say with great pleasure you can dig up my backyard and here are my bank account details, because if you find any shale gas it's mine, and I get the benefit. As someone said, the development of shale gas is like having the circus coming to town.

Another example is the U.S. gas market. The U.S. gas market has an extensive pipeline network. It is a commodity supply market, and it is easy to sell gas in the United States. The list goes on and on.

At the same time, however, there is no question that there are significant shale gas resources in other parts of the world as well.

Before Consideration of Future Impacts (2)



This next slide is the sort of slide that would receive an "F" if a student gave it to me. The green bar represents proven gas reserves, and the red bar represents technically recoverable resources. The rule of thumb in the United States says that if you have a figure for technically recoverable resources, about 10% of that might be regarded as recoverable reserves. The point of the slide, however, is to illustrate that there are resources elsewhere, and particularly in China and Latin America. So, the question is, "Can these potential resources be converted into gas molecules in a gas pipeline?"

Before Consideration of Future Impacts (3)

Future global impacts? The replicability of the US experience?
Why the "shale gas revolution" in the USA?

Characteristic	US A	EU	UK	Aus
Favourable geology	Yes	?	?	?
Lots of drill core data to help identify "sweet spots"	Yes	No	No	No
Weak environmental regulation for fracking	Yes	No	No	No
Tax credits + Intangible drilling cost expensing	Yes	No	?	No
Property rights to the landowner	Yes	No	No	No
Pipeline access easy –big network+common carriage	Yes	No	No	No
Selling gas into a "commodity supply" very easy	Yes	No	?	No
Dynamic and competitive service industry	Yes	No	No	No
Population familiar with oil and gas operations	Yes	No	No	No
Licensing large areas with vague work programs	Yes	No	No	?
Significant government investment in basic R & D	Yes	No	No	No
High liquids content in the gas	Yes	?	?	?
Started by rising gas prices	Yes	?	?	No
Access to favourable finance	Yes	No	No	No

Earlier, I mentioned some characteristics of the United States. If you look at other parts of the world and apply those characteristics, instead of getting a long list of yes's, you will have a long list of no's. This is true for the U.K., as well as for Australia. This means there are many barriers to the development of shale gas. Thus, even if there are hopes for a shale gas revolution in such countries, don't hold your breath. Shale gas revolution will occur eventually, but not so quickly.

Future Global Impacts for Gas (1)

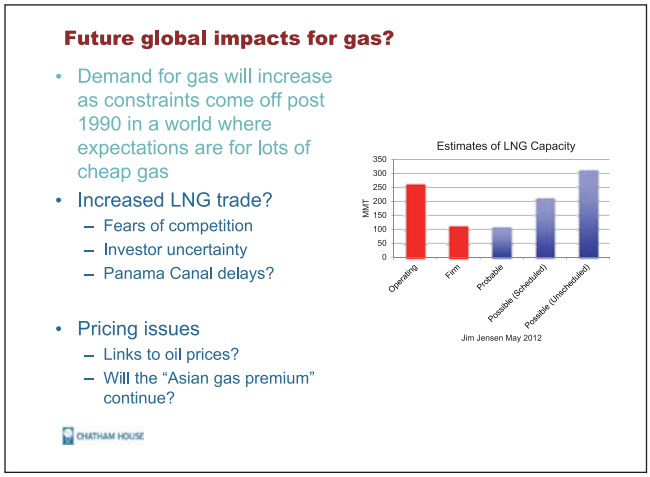
So, what about the future global impacts for gas? Gas is a strange creature. It is strange, because energy people get very excited when they talk about gas. They say gas is a wonderful fuel, it has high conversion efficiency, it is clean, it is easy to use, and so on and so forth. Yet, within the history of gas consumption in the primary energy mix, the share of gas hardly changed up to about 1990. After 1990, it began to increase slightly but not much.

Why is this? The answer is because there are a whole series of constraints upon the burning of gas. For example, the premium fuel argument that was used in the European Union and the United States said that gas is such a wonderful fuel that it should not be burned, but should be saved for premium usage. Thus, in 1975 the European Union and the United States both passed legislation that prevented the building of new gas-fired power stations. These constraints are beginning to come off, and when they do come off, the results are expected to be spectacular.

The best example is the U.K. The graph shows that by 1990 about 20% of primary energy came from gas. Ten years later it was 40%. This is because the constraints

came off. I suspect that in a lot of countries where the constraints come off, gas demand will increase. This will be aggravated or encouraged in a world where there are expectations that the shale gas revolution will occur and there will be lots of cheap gas.

Future Global Impacts for Gas (2)



There will certainly be an increase in LNG trade. This slide shows an estimate from Jim Jensen as to what LNG capacity might look like. However, there are fears of competition, investment uncertainties, and lots of other little bits and pieces.

One caught my attention the other day. Only about less than 10% of the world's LNG tanker fleet can go through the Panama Canal because of size constraints. The Panama Canal is in the process of being expanded, and when it is finished, about 90% of the LNG fleet will be able to go through the canal. The problem is that the expansion has run into serious financial problems, so that it will not be completed on time and could be delayed.

There are also pricing issues, and there is growing concern in many gas markets about the contractual link between gas prices and oil prices. This is most obvious in Europe. European gas consumers are asking why they are paying so much for gas when considering what is happening to U.S. gas prices. The answer, of course, is because the oil price has gone up, but then they ask what oil price has got to do with gas price, and are demanding a change in these contracts. In fact, Gazprom is under huge pressure from European gas consumers to move away from those sorts of contracts.

Another interesting issue is whether the Asian gas premium will continue, and again, this is all going to be dependent upon what happens in terms of the replication of the shale gas revolution.

Future Global Impacts for Oil

Tight oil will increase and continue to increase in the United States. Last year, U.S. oil production increased 15% in a single year, marking the largest percentage increase of any oil producer in the history of the industry. The IEA came out with a statement early last year that said by 2014 the United States will overtake Saudi Arabia. My response to that is, "So what?" In this context, size does not matter. Saudi Arabia's importance in the world oil market stems from the fact that it is willing and able to carry significant amounts of spare capacity and use that spare capacity in a responsible manner to keep the oil market balanced. The United States, with its thousands of producers, could never even begin to approach that sort of role.

Another issue is the application of various technologies in a different way, and particularly to fallow oil fields. Since only about 35% of oil in place is recovered, this leaves a lot of oil to be recovered. If technologies such as horizontal drilling and fraccing are applied to fallow oil fields, oil might begin to flow again.

Another important impact for oil relates to changing trade patterns. Essentially what is happening is that oil, which traditionally flowed from the Middle East to the West, is now flowing more and more from the Middle East to the East. This has all sorts of implications for oil markets and geopolitics.

Lastly, there is the problem of what I have come to call "OPEC's dilemma." OPEC's dilemma is a simple idea. Ever since the Arab uprisings kicked off at the beginning of 2011, Arab producer governments sought to increase oil prices. They wanted and needed more revenue to counterbalance the needs of the young, disaffected population.

Recent statistics in Saudi Arabia between 2010 and 2013 show that government current account spending increased 40%. The government thus wants to increase prices, but doing so would lead to demand destruction. According to the IEA's new policy scenario up to 2035, 68% of the increase in oil demand will come from the Middle East, India and China. The significance of this is that all three regions have a long history of highly subsidized oil prices to their consumers. This is changing, however. It started to change in India in 2002, and in China in 2009. It is also being talked about in the Middle East, but now is not a particularly good time to be increasing energy prices. The implication is that if the price stays high, it will increasingly be passed on to

the final consumers of oil products.

At the same time, higher prices will increase supply. This is in large part due to the technological revolution that I have been describing. In 2011 there was a joke amongst oil analysts regarding who will be the next member of OPEC, and the answer was North Dakota, simply because of the increase in oil production that was coming from there.

Now, the problem is that this sort of increase in oil production calls for higher prices. Thus, a situation is created where the price needs to be high, but that high price will lead to demand destruction and increase supply.

This is rather reminiscent of the period from 1980 to 1986 immediately after the first two oil shocks of the 1970s, which ended in the price collapse of 1986. There are differences between then and now, but the situation nonetheless suggests that higher prices are unsustainable.

Thank you very much indeed for your attention.