



Joint IEA-IEF-OPEC Report
on the Third Symposium on Energy Outlooks
22 January 2013, Riyadh

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Executive Summary

The International Energy Agency (IEA), the International Energy Forum (IEF) and the Organization of the Petroleum Exporting Countries (OPEC) jointly hosted the Third Symposium on Energy Outlooks at the headquarters of the IEF in Riyadh, Saudi Arabia, on 22 January 2013. The Symposium included more than 100 experts from industry, government and academia who shared their insights and exchanged views on current and future trends in global energy supply and demand, energy market behaviour, non-OECD oil stocks, the outlook for shale oil, and a variety of other issues facing energy markets today.

Session I

The first session of the Symposium covered key takeaways from the Second Symposium held in January 2012 and the main findings of the IEA's and OPEC's short-, medium- and long-term outlooks.

The discussion of the short-term outlooks focused on the prospect for economic recovery and oil demand among the world's largest consumers. The participants noted that non-OPEC supply growth outside North America has been slower than was expected, and discussed the likelihood of similar growth in 2013. The session on short-term outlooks concluded with a conversation about OPEC's crude production, natural gas liquids (NGLs) and OPEC spare capacity.

In discussing the medium- and long-term outlooks, Symposium participants focused on the broader assumptions employed by the IEA and OPEC, including population growth, changes in age distribution, rising urbanisation, economic growth, energy and environmental policies, and developments in technology. On the demand side, speakers addressed the impact of policies in oil consuming countries and the continuing shift in energy demand towards emerging market and developing economies, namely those outside the OECD. On the supply front, the conversation touched on supply from natural gas liquids, biofuels and non-conventional sources, including the outlook for US tight oil production. Contributors in this session emphasised the uncertainties that weigh on the long-term outlook and the impact they can have on the investment process.

Session II

The second session focused on the growing importance of inventories outside the OECD, their potential impact on the oil market and the continuing and even growing gaps in relevant data. The discussion revealed that shifts in oil demand and trade patterns away from the OECD are making data on commercial stocks held in OECD countries less representative of global market trends, and may increase the importance of non-OECD inventories in world oil balances. The participants noted that while there are numerous initiatives to build strategic petroleum reserves in emerging and other major non-OECD oil consuming countries, there is uncertainty about their reserve targets and demand outlooks. It was acknowledged that while the future role of non-OECD stocks is far from certain, better data would clearly be beneficial.

Session III

Discussions in the final session focused on the current status of tight/shale oil resources and the uncertainties regarding their future. The session began with an exchange about the advances in North American shale oil, and covered the potential for similar resource development in other regions.

A number of experts painted an optimistic picture of unconventional resources in the United States, albeit with critical caveats. Other speakers noted that the positive results seen in the US have garnered more attention than the numerous shale plays that are not economically viable. There was general agreement that the true potential for US shale oil production remains highly uncertain and, among other factors, will depend on resource size, quality, well productivity, the pace of exploration and the industry's ability to address resource-related constraints and challenges.

The session concluded that a number of factors might slow the pace of unconventional resource development on a global scale, including environmental concerns regarding the fracturing process, water availability, suitable infrastructure and human resource constraints.

The way forward

After a thorough examination of the energy outlooks produced by the IEA and OPEC, the Symposium identified the primary similarities and explored the differences between the two, including definitions, historical baselines, data sources and the presentation of results.

Better crude and products stocks data, particularly from non-OECD nations, will benefit analyses of short-term oil market behaviour and may help reduce uncertainty over demand outside the OECD. Additionally, more data on natural gas liquid supply would provide further clarity for energy market participants.

To enhance all energy outlooks, the Symposium recommended a harmonisation of definitions, where possible and appropriate, and the timely and increased use of disaggregated data. Participants also highlighted the need for a better exchange of data and information through an improved Joint Organisations Data Initiative (JODI), especially on non-OECD stocks.

The Third IEA-IEF-OPEC Symposium on Energy Outlooks offered an opportunity for a variety of experts to discuss energy market trends, outlooks, and uncertainties. Recognising that energy markets have become increasingly complex and interrelated, the Symposium's experts emphasised that the sharing of insights and analyses illustrates the diversity of views on oil and energy outlooks, and could contribute to a better understanding among all energy market participants.

1. Introduction

The IEA and OPEC regularly publish energy and oil outlooks covering the short-, medium- and long-term. On the occasion of the International Energy Forum Ministerial, each organisation submits a focused energy analysis to be presented to IEF Ministers.

The International Energy Agency (IEA), the International Energy Forum (IEF) and the Organization of the Petroleum Exporting Countries (OPEC) jointly hosted the Third Symposium on Energy Outlooks at the headquarters of the IEF in Riyadh, Saudi Arabia, on 22 January 2013. The Symposium included more than 100 experts from industry, government and academia who shared their insights and exchanged views on current and coming trends in global energy supply and demand, energy market behaviour, non-OECD oil stocks, the outlook for shale oil, and a variety of other issues facing energy markets today.

These annual Symposia are part of a wider, joint programme of work agreed upon by the IEF, IEA and OPEC and endorsed by Energy Ministers at the 12th IEF Meeting in Cancun, Mexico in March 2010.

To facilitate discussions during the Symposium, the IEF prepared an introductory paper, in consultation with the IEA and OPEC. The introductory paper compared the outlooks over different time horizons, as shown in the table below.

	IEA	OPEC
Short-term	Oil Market Report (OMR), published December 2012	Monthly Oil Market Report (MOMR), published December 2012
Medium-term	Medium-Term Oil Market Report (MTOMR), published October 2012	World Oil Outlook (WOO 2012), published November 2012
Long-term	World Energy Outlook (WEO), published November 2012	World Oil Outlook (WOO 2012), published November 2012

2. Key findings from the Second Symposium on Energy Outlooks, and presentation of the latest IEA and OPEC projections

The session began with a presentation from the IEF on the conclusions from the Second Symposium held in January 2012 and from the Symposium introductory paper, published in January 2013. The IEF's presentation was intended to stimulate debate on IEA and OPEC projections, data, methodologies and assumptions, but applies to energy outlooks produced by governments, industry and academia as well.

The IEF presentation noted that energy and environmental policies are not only key drivers for energy supply and demand, but are also one of the most uncertain assumptions in each outlook.

The IEF highlighted the importance of understanding how each organisation establishes a baseline for a given month or year. Clarifying the differences in historical supply and demand data could be an area of fruitful cooperation among the IEF, IEA and OPEC. Additionally, as non-OECD demand grows in importance, the organisations could work together to better understand and model non-OECD data.

The IEF presentation also identified a number of areas where discussion between the IEA and OPEC could reduce the differences between their outlooks. These areas include conversion factors, demand forecasts for China, India and the Middle East, the treatment of strategic petroleum reserves in emerging markets, ethane, spare production capacity, bunker fuels, biofuels, natural gas liquids, the impact of energy and environmental policies, regional differences in demand and supply, and long term price and cost assumptions.

Short-term outlook

The discussion on short-term outlooks covered market developments during the previous year, the global economic outlook, and oil demand forecasts for 2013. The group discussed the implications of slower-than-expected growth in supply from sources outside OPEC and North America and the consequences if that pace continued through 2013. OPEC crude production, NGLs and spare capacity were also covered. The session concluded with a discussion of the uncertainties that may cloud near-term energy outlooks.

This session also revealed that the European sovereign debt crisis, high unemployment in the OECD, and inflation risk in emerging economies remain as obstacles to short-term demand growth.

There was a consensus that, while positive economic growth is expected for 2013, many uncertainties regarding the global economic recovery remain. Economic projections have been revised down since the spring of 2012. Speakers in this session noted that

during 2012, the IEA and OPEC continually adjusted their demand projections downward. Nevertheless, despite the uncertainty clouding the global economy, some macroeconomic indicators suggest that the global economy turned the corner in the second half of 2012, and that this positive momentum is likely to carry into 2013. Demand growth in the coming months will depend on a number of factors, including growth in Japan, China and India, and economic developments in Europe and the US.

On the supply side, discussants noted that the IEA and OPEC had adjusted their non-OPEC supply projections downward during 2012, due mainly to a series of unexpected outages, disruptions and project delays. For 2013, Symposium participants expect an increase in oil production of 0.9 million barrels per day (mb/d), though numerous issues that affected non-OPEC supplies during 2012 remain. As was the case in 2012, North America is expected to lead non-OPEC supply growth in 2013, driven mainly by shale oil from the US.

One major challenge for demand forecasts is the lack of comprehensive and timely data. For example, OECD inventory data is often subject to substantial monthly revisions. There are also limited data from large, growing consumers, such as China and the Former Soviet Union, and oil supply & demand data is not always submitted on time.. There was agreement that better crude and products stocks data from high demand countries would aid the analysis of short-term oil market behaviour and reduce uncertainty about demand levels. There is a need for more data on liquid supply, including liquids from unconventional sources. In this regard, the role of an enhanced Joint Organisations Data Initiative (JODI), with the cooperation of several international organisations, was reemphasised.

Medium- and long-term outlooks

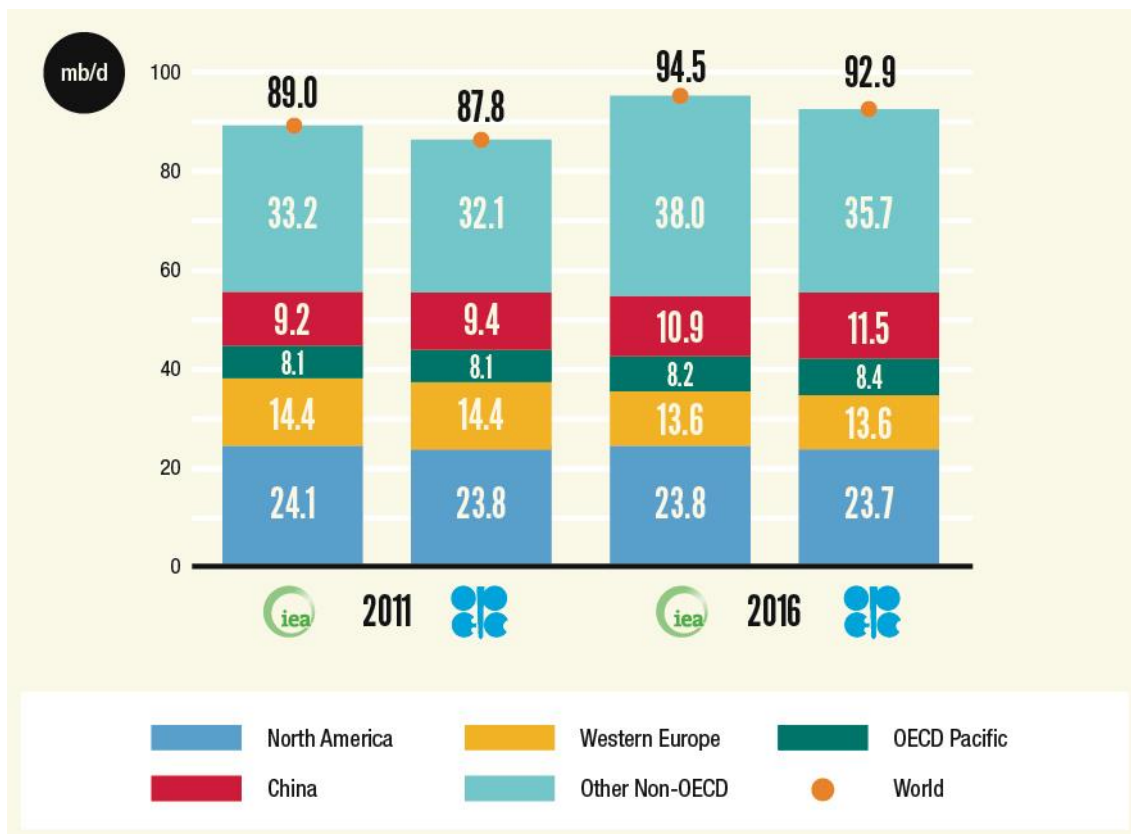
In discussing the medium- and long-term outlooks, Symposium participants focused on the macro assumptions employed by the IEA and OPEC, including population growth, changes in age distribution, rising urbanisation, economic growth, energy and environmental policies, and developments in technology. Speakers addressed the impact of policies in oil consuming countries and the gradual shift in energy demand towards emerging economies, namely those outside the OECD. The deliberations also touched on supply from natural gas liquids, biofuels and non-conventional sources. Contributors in this session emphasised the uncertainties that weigh on long-term outlooks and the impact they have on the investment process.

The session also addressed the surge in unconventional oil and gas production in North America, the potential impact of greater energy efficiency, and the effect that energy and environmental policies can have on energy demand.

For the medium-term, the session noted that IEA and OPEC have somewhat different views on global economic growth. The IEA assumes the global economy will grow an

average of 4.0% annually from 2013 to 2017, while OPEC posits that the global economy will grow 3.6% per annum through 2016.

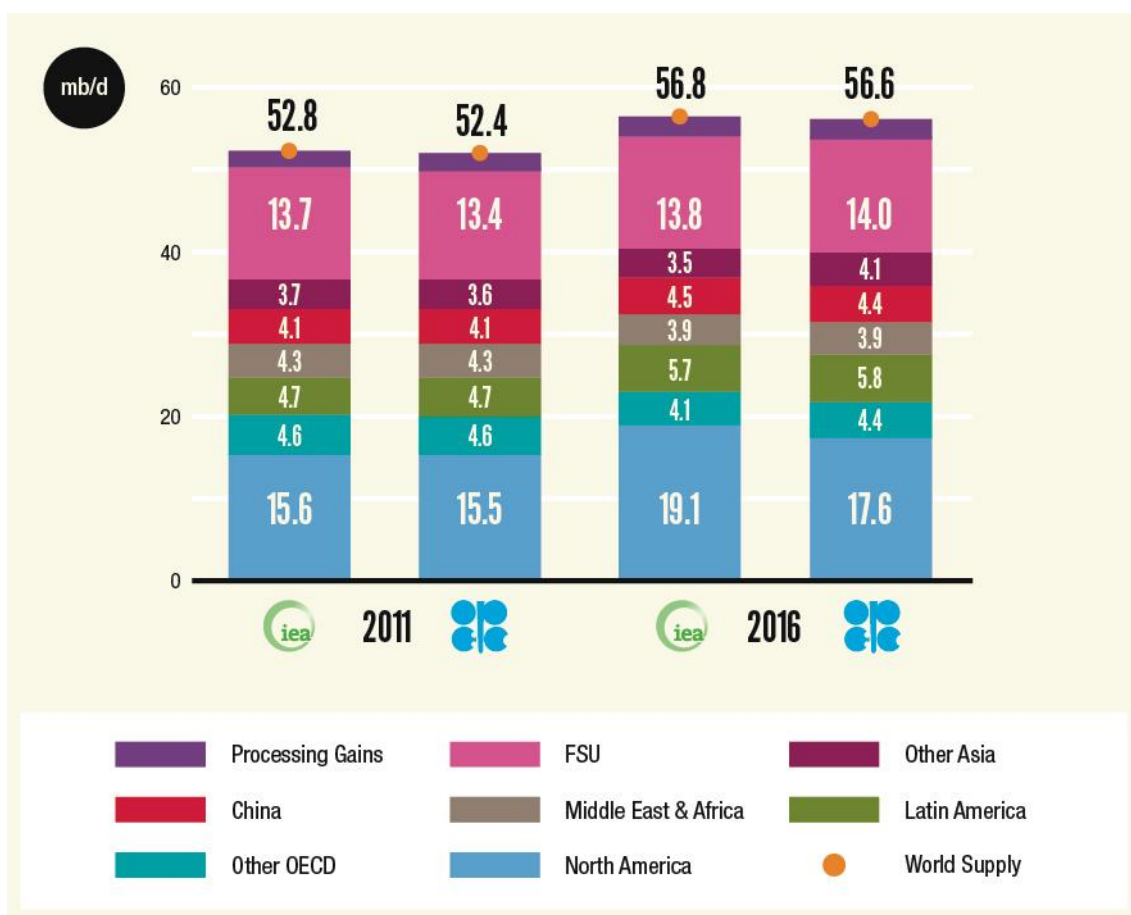
On the demand side, the session noted that both the IEA and OPEC expect robust growth in global oil demand over the medium-term, as highlighted in the graph below.



The IEA expects global oil demand to average 94.5 mb/d by 2016, an annual growth of close to 1.1 mb/d through 2016, while OPEC puts global oil demand in 2016 at 92.9 mb/d, representing an annual average growth of just over 1.0 mb/d to 2016.

At the regional level, the session noted that both the IEA and OPEC expect oil demand growth to be driven by non-OECD countries. However, the IEA and OPEC differ in their projected growth rates for non-OECD countries, creating a difference in oil demand projections at the regional level.

On the supply side, the IEA and OPEC both project high growth in global oil supply over the medium-term and expect supply to meet the projected increase in demand by 2016, with non-OPEC supply accounting for 56.8 mb/d by 2016, according to the IEA's projection, versus 56.6 mb/d as projected by OPEC and shown in the figure atop page 9.



The IEA and OPEC have very similar outlooks on non-OPEC supply growth over the medium-term, though at the regional level there are differences between their respective projections through 2016. The session noted that North America is likely to dominate non-OPEC supply growth over the medium-term, driven by an increase in shale oil production. However, some discussants in this session acknowledged that there are numerous challenges and constraints facing the development of shale oil, including labour, infrastructure, financing, cost, and legislation.

Speakers also noted that the IEA and OPEC both anticipate an increase in OPEC spare capacity through 2016, though with slightly different assessments of the total increase. OPEC forecasts a steady increase in OPEC spare capacity over the medium-term to reach 8.0 mb/d by 2016, whereas the IEA expects spare capacity to reach 6.9 mb/d by 2016.

Overall, the speakers noted that both organisations foresee an ample supply in the world oil market through 2016 to accommodate demand growth, in light of rising OPEC spare production capacity, OPEC NGLs and unconventional oil production, and non-OPEC supply.

Participants in the session noted that under all considered scenarios, global primary energy demand is expected to grow. As economies expand, global population will grow and living standards across the world are expected to improve. Oil, gas and coal will

continue to be the most widely used fuels, accounting for over 82% of total energy consumption in 2035.

There was consensus that oil will continue to be the single largest component of primary energy demand through the projection period, although its share in the energy mix may fall. However, there are considerable uncertainties concerning the evolution of future demand, including economic growth assumptions, car ownership growth in developing countries, and technological change—especially in the transportation sector.

There was also consensus that oil resources, both conventional and non-conventional, are sufficient to meet future demand. In addition, there was agreement that uncertainties complicate investment decisions, especially in an industry with long lead-times, huge upfront capital requirements and long payback periods.

On future price assumptions, the discussants noted that the IEA and OPEC form their long-term oil price assumptions based, in part, on their forecasts of the marginal cost of oil supply. However, they have differing views on the level of long-term oil price assumptions.

The participants noted that energy and environmental policies are so crucial to the future of energy demand and supply, thus their predictability is vital to better understand the effects that policy implementation may have on energy outlook results.

Another area of uncertainty is the potential of petroleum liquids derived from non-conventional oil and gas resources. The future of this resource is still unknown as many factors, both technical and policy-related, will have an influence over the long-term.

Other significant long-term ambiguities are supply and demand price elasticities, the future roles of coal, natural gas and renewable energy, and the potential impact of technology on future demand. Projections that incorporate the full range of these uncertainties are likely to diverge substantially.

3. The Growing Importance of Inventories Outside OECD Countries and their Implications for the Oil Market

This session addressed the following topics:

- Will an increase in oil demand from developing countries prompt the growth of non-OECD stocks that compare to those in OECD countries?
- How is the expansion of the refining sector affecting stock levels?
- What is the current status of strategic petroleum reserves in emerging and other major non-OECD oil consuming countries? By how much can we expect reserves to grow in emerging countries?

- What more can be done to improve the quality of stocks data from non-OECD countries? How can we minimise the gap between reported stocks and the implied inventories derived from other sources?

The participants noted that OECD inventories and their forward demand covers have been an important driver of market psychology and an explicit indicator used by OPEC, the IEA and others to measure the health of the global supply-demand balance. In addition, they noted that global inventories are the “shock absorbers” for global oil markets, arbitraging flows across time and distance while providing a cushion for geopolitical developments, severe weather and other exogenous events.

The experts found that shifts in oil demand and trade patterns away from the OECD are reducing the utility of commercial stocks held in OECD countries, and may increase the importance of non-OECD inventories. They noted that while there are numerous initiatives to build strategic petroleum reserves in emerging and other major, non-OECD oil consuming countries, there is uncertainty about their reserve targets and demand outlooks. Participants acknowledged that the future role of non-OECD stocks is far from certain, yet improved data would be beneficial.

The speakers in this session suggested that increasing oil demand in developing countries will not necessarily lead to stock levels similar to those in OECD countries, given the combination of low initial capacity, longer transit distances, and non-OECD demand growth versus declines in the OECD. They acknowledged that while the average non-OECD forward days of coverage may not reach typical OECD levels, the total stock levels might, especially when accounting for additional oil-at-sea.

The participants noted that one useful measure of non-OECD stocks is the comparison of OECD stock changes with the implied inventory changes suggested by global supply and demand balances. Supply and demand balances over the prior year illustrate shifting patterns in oil stocks. One expert suggested that China alone has been the largest swing factor in the global stock changes.

Participants noted that stocks data for non-OECD countries are limited. However, by examining oil production, refinery throughputs and product consumption, reasonable estimates of non-OECD stocks are obtainable. This method suggests that non-OECD countries have reserved 30-35 days of daily crude production, 4-10 days of refinery crude throughput, 20-27 days of product consumption plus product exports and 15-25 days at the refinery. The experts recognised that this method is not as useful in understanding the role of non-OECD stocks in global oil balances, as the bottom-up approach is based on data from sources like JODI and has been, at best, a substitute in the transition from the inadequate “miscellaneous-to-balance” characterisation of the last several decades. The speakers acknowledged that more complete, reliable and

timely non-OECD stock data from JODI, both on levels and changes, represent critical enhancements that would improve the understanding of global oil market balances.

Participants noted that downstream changes and expansions have led to major shifts in both the scale and location of inventories. The US experience indicates that coastal and barge-fed refineries carry about 10 days of gross inputs of crude and 20-25 days of product, while inland, pipeline-fed plants hold only 4 days of crude and 15 days of product. Non-OECD refineries are expected to have more days of gross input, to compensate for the lower level of development of internal infrastructure and to account for a greater susceptibility to crude supply disruptions. New refineries also require considerable tankage on both sides of the plant, as do pipelines going in and out of the plants. The participants concluded that the shift in refining capacity away from the Atlantic Basin and select, Asian OECD members toward growing, non-OECD demand centres will be a major source of growth for non-OECD inventories.

The discussants noted that there are many initiatives to build strategic petroleum reserves in emerging and other major, non-OECD oil consuming countries including China, India, Cambodia, Indonesia, Laos, Myanmar, Philippines, Thailand and Vietnam. The experts noted that strategic petroleum reserves are beneficial to oil market stability and commended the efforts of Asian countries to hold inventories and increase their strategic reserves. However, participants also recognised that uncertainty remains regarding reserve program targets and demand outlooks.

4. Tight/Shale Oil Outlook

This session addressed the following topics:

- Is the rapid expansion of shale oil production in the US sustainable? What are the main challenges to realising shale oil's potential in the US?
- Could the case of US shale oil be replicated outside North America? Where and to what extent?
- How is shale oil production technology evolving?
- What is the outlook for other streams related to shale oil and gas activities? Is another surge in NGLs production on the horizon? What are the implications of additional volumes of natural gas from shale plays for oil demand, gas to liquids output and the downstream?

The discussions in this session revealed that there is considerable interest in unconventional (shale) gas and oil. A number of experts expressed an optimistic outlook for the future of unconventional resources in the United States, but highlighted some important points that may slow growth in the US and are likely to impact the pace of

expansion beyond its borders. Among the factors that could limit expansion, experts acknowledged that environmental concerns related to fracturing, water usage and disposal, infrastructure (i.e., fracturing equipment, horizontal drill rigs) and a shortage of personnel with related experience.

While some forecasts predict that the US will be self-sufficient in petroleum as early as 2015, this seemed overly optimistic to the participants. Nonetheless, the US experience has yielded significant volumes of both natural gas and light oil, which were considered to be much less abundant a decade ago.

There was general agreement that the surge in output from US shale resources has been one of the foremost stories in the oil-and-gas industry in recent history. However, moving forward, the experts acknowledged that the US shale oil production potential remains highly uncertain, depending on resource size, quality, well productivity, the pace of drilling and the constraints and challenges it faces. They recognised that today there is a wide range of views on the potential for shale oil production, from 2.5 mb/d to 4.5 mb/d. The participants acknowledged that the industry is experiencing substantial supply growth that has yet to be fully understood.

Some participants expressed concern that the discussions in this session were overly optimistic and that a much more conservative view of shale resource potential merits discussion. On this point, the experts highlighted the need to identify the shale “sweet spots”, as it takes many years to identify the economic portion and appropriate technologies to develop resources. The experts noted that very positive results make better headlines than the numerous shale resources that are not economic. For example, around 55 shale plays are actively being developed in the US, with only a few truly showing success at this early stage.

The participants noted that shale gas is far better understood than shale oil, and the former’s abundance has reduced gas prices to levels that have curbed development. They acknowledged that the price differential between natural gas and oil has caused many companies to shift their focus to shale/tight oil, with noted successes in the Bakken, Eagle Ford and Barnett plays. Many significant shale oil plays such as the Monterrey in California could also prove very promising, as illustrated by early successes there. Considerable debate persists regarding the oil potential of other shale plays, such as the Niobrara and Austin.

The experts noted the renaissance of many industries in the US due to the recent availability of relatively cheap natural gas. Cheap and abundant gas is stimulating US manufacturing, energy production and the utilisation of natural gas for transportation through new smaller scale gas-to-liquids efforts.

The session concluded that environmental concerns over the fracturing process, water use and availability, and a shortage of infrastructure and personnel were slowing the production of shale resources globally. Participants noted that additional supply from

non-conventional resources, as well as significant additions from conventional oil and gas exploration, imply that the concept of peak oil is of little value to the discussion at the Symposium.

5. Conclusion

The Third IEA-IEF-OPEC Symposium on Energy Outlooks served as a platform to enable the roughly 100 participants to identify and discuss the similarities and differences between the outlooks produced by the IEA and OPEC. The Symposium helped to promote clarity and understanding of the data, assumptions, methodologies and the analyses included in the IEA and OPEC outlooks.

The Symposium identified a number of areas for cooperation among the three organisations in future technical meetings and Symposia on Energy Outlooks.

The Symposium covered the growing role of non-crude liquids in meeting demand growth, shifts in the geographical structure of demand, refining capacity development, methodologies for assessing oil supplies, and the importance of timely, accurate data to inform short-, medium- and long-term forecasts. In examining long-term outlooks, experts evaluated the importance of policy changes, the evolution of upstream costs, as and the effect of population growth and demographic changes on supply and demand.

There was general agreement that the surge in the output from US shale resources has been one of the foremost stories in the oil-and-gas industry in the recent past. However, experts acknowledged that US shale oil production potential remains highly uncertain, depending on resource size, quality, well productivity, and the pace of drilling.

The Symposium recommended moving towards a harmonisation of definitions, where possible and appropriate, and the increased use of disaggregated data to enhance the outlooks. In addition, it highlighted the need for a better exchange of data and information through an improved JODI, especially on data for non-OECD stocks.

Experts recommended further joint technical meetings on specific areas of interest, including a working group of oil market analysts and statisticians to address definitional issues in JODI.

The Symposium participants noted that while energy and environmental policies are key drivers of future energy demand and supply, they are also among the most uncertain components of energy outlook assumptions. Such policies will play an important role in determining the future of energy efficiency and transportation technology developments. Participants highlighted the need to better understand the effect that different policy assumptions may have on the results of the outlooks produced by the IEA and OPEC.