



Joint IEA-IEF-OPEC Report

on the 2nd Symposium Energy Outlooks

23 – 24 January 2012, Riyadh

Executive Summary

The International Energy Agency (IEA), the International Energy Forum (IEF) and the Organization of the Petroleum Exporting Countries (OPEC) jointly hosted the second Symposium on Energy Outlooks at IEF Headquarters in Riyadh, Saudi Arabia, on 23-24 January 2012. Held under the Chatham House Rule, the Symposium gathered experts from a diverse range of energy fields. The Symposium offered a platform for sharing insights and exchanging views about energy market trends and short-, medium- and long-term energy outlooks, including analysis of market behaviour and discussion of the key drivers of the energy scene along with the associated uncertainties.

A background paper prepared by the IEF (attached), and presentations by co-hosts IEA and OPEC on their short-, medium- and long-term projections set the scene and served to stimulate debate on the future of the energy sector, its main drivers and the associated uncertainties, as well as on the methodologies and assumptions applied to a range of regularly published outlooks on the global energy market.

The first session was dedicated to recent market developments and near-term prospects. It covered market behaviour over the past year, the economic evolution in the world's major regions, as well as the patterns of oil demand in major regions/countries for 2011/2012. It also addressed recent poor performance of non-OPEC supply and examined the likelihood of this being repeated in 2012. OPEC crude production, NGLs and spare capacity were discussed. Other important areas were also covered, such as refining, stocks, products specifications, biofuels mandates and growing non-refinery products volumes and their implications for the downstream sector.

There was a consensus that, while positive economic growth is expected for 2012, many uncertainties remain with regards to the global economic recovery and the health of the financial system. Downside risk was thus emphasized.

The second session focused on the IEA's and OPEC's medium and long-term outlooks, and discussed their findings and their main assumptions, in particular population growth, including the importance of changes in age structures and the trend towards urbanization, price patterns, economic growth, energy and environmental policies, as well as technological evolutions.

In the medium-term, the session noted that both IEA and OPEC expect continued growth in global oil demand and foresee a well-supplied world oil market with OPEC spare production capacity, OPEC NGLs and non-conventional, and non-OPEC supply all rising.

In the long term, in addition to looking at the main assumptions behind the outlooks, the session also emphasized the many uncertainties that surround the longer term.

The session noted that under all scenarios global primary energy demand continues to grow, as economies expand, the global population grows and living standards across the

world improve. There was a consensus that oil will continue to be the single largest constituent of primary energy demand throughout most of the projection period. However, its share in the global energy mix will fall. The session also noted the considerable uncertainties concerning how future demand will evolve, in particular with regard to energy and environmental policies. Other key uncertainties relate to economic growth assumptions, patterns of car ownership growth and usage in developing countries and technological change, especially in the transportation sector.

There was also a consensus that oil resources, both conventional and non-conventional, are sufficient to meet future demand.

The Symposium also heard details of the outlooks for the downstream sector. It was noted that surplus refinery capacity is emerging, particularly in the Atlantic region. This raises the prospect of potential refinery closures.

The Symposium identified the main similarities and differences between the IEA's and OPEC's outlooks and discussed the reasons behind these differences, such as those related to definitions, data sources and uses or presentation of the results. The differences in historical baseline figures were also discussed.

There was an agreement that better crude and products stocks data, particularly from high demand-growth countries, will help analyzing short-term oil market behavior and reduce uncertainty over demand levels for these countries. More data on liquid supply, including NGLs, would also be of benefit. In this regard, the role of the Joint Organizations Data Initiative (JODI) with the cooperation of several international organizations has been commended and its enhancement emphasized.

The IEA-IEF-OPEC Symposium on Energy Outlooks offered an opportunity to discuss energy market trends and outlooks, as well as the associated uncertainties. Recognizing that energy markets have become increasingly complex and global, it underlined that sharing insights and analyses among the organizations and other experts is mutually beneficial and helps reflect the diversity of views on oil and energy outlooks and could contribute to a better mutual understanding.

With this in mind, the third Symposium on Energy Outlooks will be held in 2013.

1. Introduction

The IEA and OPEC regularly publish energy and oil outlooks covering the short-, medium- and long-term. In addition, on the occasion of the International Energy Forum, each organization contributes by submitting a focused energy analysis to be presented to IEF Ministers. Short-to long-term energy outlooks are also published by other government, consultancy, banking and academic institutions.

The IEA, IEF and OPEC jointly hosted the second Symposium on Energy Outlooks at IEF Headquarters in Riyadh, Saudi Arabia, on 23-24 January 2012. Held under the Chatham House Rule, the Symposium offered a platform for sharing insights and exchanging views about the short-, medium-, and long-term energy outlooks, including analysis of market behaviour, discussion of the key drivers of the energy sector, and a review of the associated uncertainties. The Symposium discussed the short-, medium-, and long-term projections of the IEA and OPEC based on their latest publications. The agenda of the Symposium and the introductory paper are attached to this Report (Annex I and II).

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

To facilitate discussions during the Symposium, an introductory paper was prepared by the IEF, in consultation with the IEA and OPEC. The Introductory Paper compared the short-, medium- (to 2015) and long-term (to 2035) projections. For the short-term, the IEA's latest projections from their monthly Oil Market Report (OMR) published in December 2011 were used and compared to the OPEC's projections from its Monthly Oil Market Report (MOMR), also published in December 2011. For the medium-term, the IEA's latest projections update published in December 2011 OMR were used and compared to the mid-term point of projections in the OPEC World Oil Outlook (WOO 2011) published in November 2011. For the long-term, OPEC's projections are taken from the WOO 2011 and the IEA's from the World Energy Outlook 2011 (WEO, 2011).

The Symposium sought to identify major similarities and differences between the IEA and OPEC's short-, medium- and long-term outlooks in terms of underlying assumptions, in particular related to the economy and policies, and demand and supply projections, and to highlight areas where improved comparability and understanding could be useful.

2. Recent market developments and near-term prospects

Discussion in this session focused on market development over the past year and discussed the shape of economic recovery in the world's major regions, as well as the patterns of oil demand in major regions/countries in 2011/2012. The session noted the recent poor performance of some elements of non-OPEC supply and examined the likelihood of this being repeated in 2012. OPEC crude production, NGLs and spare capacity were also covered.

Participants also discussed refining capacity, inventory levels, product specifications, biofuels mandates and growing volumes of non-refinery products and their implications for the downstream sector. The session concluded with a discussion of the uncertainties affecting near-term energy outlooks.

To facilitate the discussions in this session presentations by co-hosts IEA and OPEC on their short-term projections set the scene and served to stimulate debate on the projections, data, methodologies and assumptions applied to a range of regularly published outlooks on the global energy market as well as the degree to which uncertainties influence these projections at any given point in time.

The session noted that the European debt crisis continues to constitute a major uncertainty for short-term demand prospects. Volatility has been a noticeable feature in oil markets in recent months, reflecting the general uncertainty in financial markets over prospects for the global economy. Economic risks and supply disruptions have surprised the market to the downside, with demand growth weakening but not disappearing altogether.

There was a consensus that, while positive economic growth is expected for 2012 many uncertainties remain with regard to the global economic recovery and the health of the financial system and, thus, risks are skewed towards the downside. As a reflection of this, consensus economic projections have been revised down since spring last year. Some participants noted the value of probability analysis for demand forecasts. The session noted that during 2011, IEA and OPEC continually adjusted downwards their demand projections. Nevertheless, despite the uncertainty clouding the global economy, they now expect demand growth to pick up in 2012 compared to 2011. Short-term economic risks lie mainly to the downside and demand side risks are also skewed to the downside. How demand will move in the next few months depends on many developments, including Japan nuclear power startup, growth rates in China, and economic developments in Europe and US.

On the supply side, the session also noted that IEA and OPEC continually adjusted their non-OPEC supply projections downward during 2011, due mainly to a spate of unexpected outages, disruptions and project delays. Conversely, they expect a solid increase for 2012 between 0.7 – 1.0 mb/d, although a lot of the issues affecting non-OPEC supply during 2011 still remain. The session also noted the steady growth in OPEC NGLs and the higher OPEC crude oil production in 2011, as well as the comfortable level of OPEC spare production capacity. Both outlooks expect the requirements for OPEC crude oil and stock change to average around 30.0 mb/d this year.

The influence of non-fundamentals on the market was also highlighted. However, many uncertainties remain with regard to the global economic recovery and the health of the financial system, and, thus, risks were rather skewed towards the downside.

The session identified the main similarities and differences between the IEA's and OPEC's

outlooks and discussed the reasons behind these differences, such as those related to definitions, data sources and uses or presentation of the results. The differences in historical figures were also reviewed.

IEA and OPEC outlined their methodologies for forecasting short term demand. The IEA noted that income is a main factor in its demand model; however its methodology recognizes the importance of many other factors including seasonality, fuel substitution and international and domestic price levels. The IEA noted that oil intensity is assumed to carry on declining year-on-year by around 2-3% p.a. in its outlook. In its model price elasticity is not a driving assumption but rather a result, and it is very low over the short term, especially in the non-OECD regions. OPEC's methodology for forecasting short term demand mainly depends on crude oil price expectation over the forecast year, GDP growth, weather (usually assumes normal weather conditions), and subsidies removal. However, both organizations recognized that on many occasions there are events difficult to predict (such as weather related issues, major disasters, conflicts, etc).

One major challenge for demand forecasting stems from a lack of data. In this respect, the session noted that there are major gaps in data coverage; OECD inventory data is far from perfect, with substantial monthly revisions. There is also a lack of data from major developing market consumers (China, FSU, etc.). There is also a lack of data for important flows (e.g. bunkers use for Singapore) and uncertainty in the economic data. Production data from companies/countries are not always submitted on time. In addition, the symposium noted that there could be improvement in the flow of data on the number of projects executed, and startup date. There was agreement that better crude and products stocks data from high demand countries will help analyzing short-term oil market behavior and reduce uncertainty over 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 Organizations Data Initiative (JODI) with the cooperation of several international organizations was reemphasized.

The session highlighted the usefulness of understanding how each organization establishes data for the base month or year. This issue could be an area for joint work between the two organizations, to clarify the differences in historical demand data and to some extent in the forecast. Improving the understanding of the treatment of non-OECD demand and energy intensity could be another area for joint work.

The session also pointed to a number of areas where there is scope to discuss analytical issues among organizations – not necessarily to come to a common view, but to ensure a better understanding of each stakeholder's. Examples include conversion factors, demand growth in some regions, such as China, India and the Middle East, the treatment of Strategic Petroleum Reserves (SPR) in emerging markets, ethane, spare production capacity, bunker fuels, biofuels, processing gains, NGLs, and the links between GDP growth, oil prices and oil demand (oil intensity and price elasticity).

3. Medium and long-term outlooks

This session discussed the main findings of the IEA's and OPEC's outlooks as well as the assumptions behind them, in particular population growth, including the importance of changes in age structures and the trend towards urbanization, price patterns, economic growth, energy and environmental policies, as well as technological developments. It addressed issues related to demand, in particular the impact of consuming country policies, as well as to all forms of energy supply, especially for liquids, including both conventional and non-conventional resources and biofuels. The session also emphasized the uncertainties that surround the longer term, and the implications that this has for making appropriate investment decisions.

The session also addressed the gradual shift in energy demand toward emerging economies (non-OECD region); the impact of energy and environmental policies on energy demand and the resulting wide range of possible demand levels; and finally, the implications on and the associated challenges for the downstream sector.

To facilitate the discussions in this session, the IEA and OPEC's medium and long term outlooks were presented.

For the medium term, the session noted that IEA and OPEC have somewhat different views on global economic growth.

For economic growth, the IEA report assumes 3.9% in 2011/2012 and growing by an average of 4.6% annually during 2013-2016, with an assumed reduction in oil use intensity of 3% annually.

OPEC's WOO-2011 assumes that the global economy grows by 3.9% in 2011, and then by an average of 3.9% per annum in the medium-term to 2015. It assumes that decisive action is taken in a timely manner to make sure the global economy remains on the path of recovery.

The IEA report also offers an alternative demand case, based on lower underlying economic growth assumptions and slower efficiency gains; where economic growth averages some 3% on average from 2011-2016, versus 4.4% in the base case, and oil intensity diminishes by 2% per year instead of 3% in the base case.

For oil price, the IEA medium-term assumes nominal Brent crude falling from \$109/bbl in 2011 through to \$91/bbl in 2016, based on the prevailing futures strip. OPEC's WOO-2011 assumes that oil prices will remain in the \$85-95/bbl range over the years to 2020 in nominal terms.

On the demand side, the session noted that IEA and OPEC expect moderate growth in global oil demand over the medium term. The IEA expects global oil demand to average 93.8 mb/d by 2015, an annual growth close to 1.1 mb/d over the years to 2015 on average, while OPEC puts global oil consumption in 2015 at 92.9 mb/d, an annual average growth

of just over 1.2 mb/d over the years to 2015. The higher demand figures by the IEA over the medium-term can be traced to the difference in the base year demand level.

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 extent of the projected growth in non-OECD countries differs, creating a difference in the oil demand projections at the regional level. The IEA projection for oil demand in non-OECD countries in 2015 is 2.2 mb/d greater than OPEC's projection, some of which is due to differences in historical data.

On the supply side, the IEA and OPEC both project high growth in global oil supply over the medium term to meet the projected demand increase by 2015, with non-OPEC supply reaching 55.66 mb/d by 2015 according to the IEA projection versus 55.3 mb/d by OPEC. They are very similar on non-OPEC supply growth over the medium term, though at a regional level the differences between IEA and OPEC projections by 2015 are substantial in some regions and small in others.

The session also noted that IEA and OPEC are both expecting an increase in OPEC crude production capacity over the medium term until 2015, but with slightly different assessments of the level of capacity increase. OPEC foresees a steady increase in OPEC spare capacity over the medium term to reach close to 8.0 mb/d by 2015, not far from the IEA which expects spare capacity to reach 6.8 mb/d by 2015.

Overall, the session noted that both organizations foresee an easing of the world oil market in the medium term to 2015 with rising OPEC spare production capacity, OPEC NGLs and non-conventional oil, and non-OPEC supply.

For the long term outlooks, apart from looking at the main assumptions behind the projections, the session also emphasized the uncertainties that surround the longer term.

The session noted that under all considered scenarios global primary energy demand continues to grow, as economies expand, the global population grows and living standards across the world improve. Oil, gas and coal will continue to be the most widely used fuels, accounting for over 80% of total energy consumption in 2035. Their resources are clearly sufficient to meet foreseeable global energy demand.

There was a consensus that oil will continue to be the single largest constituent of primary energy demand throughout most of the projection period, although its share in the energy mix will fall. However, there are considerable uncertainties concerning the evolution of future demand, in particular with regard to energy and environmental policies. Other key uncertainties relate to economic growth assumptions, car ownership growth in developing countries and technological change, especially in the transportation sector.

In this respect, the session noted that the IEA assumptions and projections in the “Current Policy” scenario most closely resembled those in OPEC’s Reference Case.

There was also a consensus that oil resources, both conventional and non-conventional, are sufficient to meet future demand. In addition, there was a common recognition and emphasis upon the fact that uncertainties complicate the making of appropriate investment decisions, in an industry with long lead-times, huge upfront capital requirements and long payback periods. However, looking 20 years into the future, the participants noted that the differences between the outlooks in the central scenarios of the two Organizations, in the range of 1-2 mb/d by 2035, are rather small given the level of uncertainties ahead.

On future price assumptions, the session noted that IEA and OPEC outlooks form their long term oil price assumptions based, among other considerations, on their expectations for marginal costs of oil supply. However, they have diverse views on the level of long-term oil price assumptions. In this respect, the participants noted that what may seem like similar outcomes in term of supply and demand are achieved using very different price assumptions.

The participants noted that, because energy and environmental policies are one of the key drivers for future energy demand and supply, and are also among the most uncertain areas for energy outlooks, it is important to explore and better understand the effect of policy implementation on the results of the outlooks.

Other significant long-term ambiguities relate to supply and demand price elasticities, which affect the assessment of the sustainability of any given oil price, the future role of coal, natural gas and renewable energies, and the possible role of technology in affecting future demand patterns. When the results of projections are shown with the ranges that reflect such uncertainties, outlooks may actually diverge substantially.

Another area of uncertainty is the assessed potential of petroleum liquids derived from non-conventional gas resources. This resource base may prove to be bigger or smaller than currently expected, but uncertainty is still rife as many factors, both technical and policy-oriented, will have an influence over the long-term.

The Symposium also heard details of the outlook for the downstream sector. It was pointed out that a surplus capacity is emerging, particularly in the Atlantic basin. This underscores the increasing potential for refinery closures. However, capacity additions will be required both because of the expanding need for new capacity in the Asia-Pacific and the Middle East, as well as the further demand shift towards middle distillates and light products. Targets that have been set for biofuels present a particularly large uncertainty for the downstream sector. The evolution of future crude quality also represents a major challenge for the downstream sector. In this respect, the participants suggested it would be of value to study the mismatch between the crude supply quality and the required product types, and its implications on the downstream sector.

The session identified the main convergences and differences between the IEA's and OPEC's outlooks and discussed the reasons behind these differences, such as those related to definitions, methodologies, data sources and uses or presentation of results. It noted that energy and environmental policies are one of the key drivers for future energy demand and supply; and that they are also one of the most uncertain areas of the outlooks.

In addition to the topics identified in session I, this session pointed to further areas that could be discussed among organisations to ensure a better understanding of each outlook. Examples include impact of energy and environmental policies, long term elasticity assumptions for supply and demand, long term regional differences in demand and in non-OPEC supply, and long term price and costs assumptions.

4. Summary of the discussions

The IEA-IEF-OPEC Symposium on Energy Outlooks offered an opportunity to review uncertainties affecting the short, medium and long-term markets, including the impact of income levels and prices on demand. The symposium also discussed the growing role of non-crude liquids in meeting demand growth; shifting of the geographical structure of demand, refining capacity development; and methodologies for assessing oil supplies, and importance of timely, accurate data for short-term forecasts. Longer term issues examined included the importance of policy changes, upstream cost evolution, as well as the effects of population growth and demographic changes.

The meeting identified the main similarities and differences between the IEA's and OPEC's outlooks and discussed the reasons behind these similarities and differences, such as those related to definitions, methodologies, and the presentation of results.

The Symposium recommended moving towards harmonizing definitions, where possible and appropriate, and the use of more disaggregated data, in a more timely manner, to enhance the outlooks. In addition, it highlighted the need for a better exchange of data and information through a strengthened and improved JODI.

Moreover, it recommended exploring the possibility of further joint technical meetings on specific areas of interest. For example, the working group of oil market analysts and statisticians could work on definitional issues in the JODI.

The Symposium noted that energy and environmental policies are one of the key drivers for future energy demand and supply; however, they are also an area of high uncertainty. Such policies will play an important role in determining the extent of energy efficiency and transportation technology developments. In this respect, some participants recommended the need to explore and better understand the effect of different policy assumptions on the results of the outlooks. They also recommended studying changes of GDP in different scenarios.

5. Conclusion

The IEA-IEF-OPEC Symposium on Energy Outlooks reached its objective of offering a platform for experts to discuss energy outlooks. It also helped in identifying and discussing the similarities and differences between the outlooks, in order to advance clarity and understanding in terms of the data, assumptions, methodologies and the analysis of the results of these outlooks.

In this respect, the symposium identified a number of areas that could be endorsed by the three organizations for follow-up in future joint technical meetings and Symposiums on Energy Outlooks. These include:

- Data definitions and clarifying (the reasons for) differences in historical data
- Presentation of results, e.g. regional breakdown of supply and demand.
- Non-OECD demand and energy intensity
- Demand growth in some regions, such as China, India and the Middle East,
- Costs, long-term price assumptions; ethane, bunker fuels; elasticity assumptions for supply and demand; and conversion factors,
- NGLs, unconventional oils and biofuels.
- Better exchange of data and information, including upstream and downstream capacity expansion plans, through a strengthened and improved JODI.

Participants commended the efforts made by the three Organizations and praised the areas of cooperation that they have identified and included in the Cancun Declaration.

In this context, the third Symposium on Energy Outlooks will be held in 2013.

Annex I



IEA-IEF-OPEC Symposium on Energy Outlooks

23rd - 24th January 2012

IEF Headquarters

Riyadh, Saudi Arabia

Monday, 23 rd January 2012	
13:00 to 14:00	Light Lunch
14:00 to 14:15	Welcome and opening remarks Secretary General, IEF
14:15 to 17:30	Session I Recent market developments and near-term prospects The session will discuss and elaborate upon technical issues related to demand, supply and stocks Session Chair: Professor Paul Stevens, Senior Research Fellow, Chatham House Presentations by the IEA and OPEC Technical interventions and/or presentations by the invited experts
20:30	Dinner – Ritz-Carlton Hotel
Tuesday, 24 th January 2012	
9:30 to 12:30	Session II Medium and long-term outlooks The session will discuss technical issues related to overview of the medium and long-term outlooks, demand, downstream and supply Session Chair: Peter Hughes, Director, Head of Energy Practice, Ricardo Strategic Consulting Presentations by the IEA and OPEC Technical interventions and/or presentations by the invited experts
12:30 to 14:00	Lunch
14:00 to 16:00	Session III Wrap up The session will summarize and discuss the main insights of the previous two sessions Session Chair: Said Nacet, Energy Director, IEF Panelists: Chairs from session I and II, representatives from IEA, OPEC
16:00 to 16:15	Closing remarks IEF, IEA, OPEC
	Note: The event is held under the Chatham House Rule.

Aneex II



IEA-IEF-OPEC

Symposium on Energy Outlooks

23rd-24th January 2012

Riyadh

Introductory paper

NB. This introductory paper was prepared by IEF, in consultation with IEA and OPEC.

Executive Summary

The IEA and OPEC regularly publish energy and oil outlooks covering the short-, medium- and long-term. In addition, on the occasion of the International Energy Forum, each organisation contributes by submitting a focused energy analysis to be presented to IEF Ministers. Short-to long-term energy outlooks are also published by other government, consultancy, banking and academic institutions.

The first Joint IEA/IEF/OPEC Symposium on Energy Outlooks was convened in Riyadh on 24 January 2011. The second Symposium on Energy Outlooks will be held on January 23rd-24th 2012 in Riyadh.

On the short term, IEA's and OPEC's short-term reports note that the European debt problems continue to weigh heavily on the market and oil prices, volatility has been a noticeable feature in oil markets in recent months, reflecting the general uncertainty in financial markets over prospects for the global economy. Overall, both reports expect positive economic growth for 2011 and 2012 with no assumption of double-dip recession. However, many uncertainties remain with regards to the global economic recovery and the health of the financial system, and, thus, risks have been skewed towards the downside. During 2011, IEA's and OPEC's reports have continually adjusted their demand projections downward, from initial forecasts of around 1.4 mb/d and 1.2 mb/d to 0.73 mb/d and 0.86 mb/d for the IEA and OPEC respectively. Nevertheless, despite the uncertainty clouding the global economy, demand growth is expected to pick up in 2012 compared to 2011, with growth forecast at 1.26 mb/d (IEA) and 1.07 mb/d (OPEC). On the supply side, the IEA and OPEC reports continually adjusted their non-OPEC supply projections downward during 2011, due to mainly to unexpected outages, disruptions and project delays, with growth estimates currently at 0.06 mb/d and 0.17 mb/d. Conversely, they expected a solid increase for 2012 of 1.0 mb/d and 0.7 mb/d respectively, though a lot of the issues affecting non-OPEC supply during 2011 still remain. They also noted steady growth in OPEC NGLs and higher OPEC crude oil production in 2011, while spare production capacity remained at a healthy level.

For the medium term, the IEA's and OPEC's reports have somewhat different views on global economic growth and oil price assumptions. The difference between the two reports over the medium term economic growth stems from their assumptions about the economic growth in non-OECD countries. Both the IEA and OPEC expect robust growth in global oil demand over the medium term. However, the IEA global medium term demand projection is higher than the OPEC's figure by 2015, due to the difference in the base year demand level. But, in terms of demand growth, the IEA medium term projection is lower than the OPEC growth figure, despite IEA assuming higher economic growth. At the regional level, both the IEA and OPEC expect oil demand growth to be driven by non-OECD countries. However, the extent of the growth in non-OECD countries differs, creating a difference in the oil demand projections at the regional level. On the supply side, the IEA and OPEC both project high growth in the global oil supply over the medium term to meet the projected demand increase by 2015. However, their

medium term global oil supply forecasts differ by around 0.8 mb/d by 2015 as the case in the oil demand. They are very similar on non-OPEC supply growth over the medium term, though at a regional level, the differences between IEA and OPEC projections by 2015 are substantial in some regions and small in others. The IEA and OPEC are both expecting an increase in OPEC crude production capacity over the medium term until 2015, but with slight different assessments of the level of capacity increase.

Over the long term, the IEA WEO and OPEC's WOO see that under all scenarios global primary energy demand continues to grow, as economies expand, the global population grows and living standards across the world improve. By 2035, both outlooks are very similar and project world energy demand will be more than 51% higher than it is today. Oil, gas and coal will continue to be the most widely used fuels, and their resources are clearly sufficient to meet global energy demand, accounting for over 80% of total energy consumption in 2035. They noted that for both oil and natural gas, an increasing share of global supply will come from non-conventional sources such as those produced from shale and tight sands formations. In addition, the IEA WEO and OPEC WOO's growth rates by fuel type are relatively comparable, although the OPEC Reference Case projects slightly faster growth in hydro, biomass and other renewable demand, while the IEA Current Policies Scenario projects faster growth in oil and coal. Both IEA and OPEC expect that oil will continue to be the single largest constituent of primary energy demand throughout most of the projection period, although its share as a proportion of total fuels will fall. However, they pointed out to considerable uncertainties concerning how future demand will evolve, in particular with regard to energy and environmental policies. Other key uncertainties relate to economic growth assumptions and technological change.

The IEA and OPEC outlooks form their long term oil price assumptions based on their expectations for marginal costs of oil supply among other considerations. However, they have diverse views on the level of these marginal costs and hence long-term oil price assumptions and investments.

In this regard, this introductory paper provides a comparison of the IEA's and OPEC's short-, medium- and long-term energy outlooks. It discusses technical issues related to overview of the short- medium and long-term outlooks, demand, stocks and supply. It identifies the main convergences and differences between the IEA's and OPEC's outlooks and discusses the reasons behind these differences, such as those related to definitions, methodologies, data sources and uses or presentation of results. It notes that energy and environmental policies are one of the key drivers for future energy demand and supply; however, they are also one of the most uncertain areas of the outlooks.

Differences in scenarios, in methodology, in the level and regional distribution of projected demand for crude, in regional cost assumptions translate into differences in the level of projected investments in producing fields and for additional capacity that may be needed to satisfy demand by 2035. Moreover, the large differences in the projected demand for crude between the various scenarios translate into huge uncertainties in regard to what

would be needed in terms of investments.

Finally the paper points to a number of areas where there is scope to discuss analytical issues among organisations– not necessarily to come to a common view, but to ensure a better understanding of each outlook. Examples included demand growth in some regions, such as China, India and the Middle East, impact of policies, marginal cost and price assumptions, ethane treatment, definition and availability of spare capacity, bunker fuels, biofuels, seasonality patterns in oil demand and supply, long term non-OPEC supply, processing gains, NGLs, and the links between GDP growth and oil demand.

1. Background and Introduction

The IEA and OPEC regularly publish energy and oil outlooks covering the short-, medium- and long-term. In addition, on the occasion of the International Energy Forum, each organisation contributes by submitting a focused energy analysis to be presented to IEF Ministers. Short-to long-term energy outlooks are also published by other government, consultancy, banking and academic institutions.

The first Joint IEA/IEF/OPEC Symposium on Energy Outlooks was convened in Riyadh on 24 January 2011. The first symposium noted that methodologies and definitions are important factors in identifying the reasons behind the differences in the outlooks. It recommended to move towards harmonizing definitions, where possible and appropriate, and disclosing more data, in a more timely manner, to enhance comparability between outlooks. It called for better exchange of data and information through a strengthened and improved JODI. Finally, the first symposium recommended that similar events covering short, medium and long-term energy outlooks, be held on a regular basis in order to promote a deeper understanding and dialogue on this important issue.

In this connection, the IEA, IEF and OPEC will be holding a second Symposium on Energy Outlooks on January 23rd-24th 2012 in Riyadh. The Symposium will offer a platform for sharing insights and exchanging views about energy market trends and short- medium- and long-term energy outlooks, including analysis of market behaviour and discussion of key drivers of the energy scene and associated uncertainties.

This event is part of a wider joint programme of work agreed by the three organisations and endorsed by energy ministers at the 12th International Energy Forum (Cancun, March 2010) as part of the Cancun Declaration¹.

This introductory paper provides a comparison of the IEA's and OPEC's short-, medium- and long-term energy outlooks. It discusses technical issues related to overview of the short- medium and long-term outlooks, demand, stocks, downstream and supply. It aims to:

¹ <http://www.ief.org/Events/Documents/CANCUNMINISTERIALDECLARATION.pdf>.

- Identify the similarities and major differences between the IEA and OPEC's short-medium- and long-term outlooks in terms of economy, demand and supply projections;
- Identify the similarities and the major differences between the assumptions used in determining the projections; and
- Highlight areas where improved comparability and understanding of the similarities and differences could be useful.

This paper compares the short-medium (to 2015) and long-term (to 2035) projections. For the short-term, the IEA's latest projections from their monthly Oil Market Report (OMR) published in December 2011 are used and compared to the Short-Term in OPEC's Monthly Oil Market Report (MOMR), also published in December 2011. For the medium-term, the IEA's latest projections update published in December 2011 OMR are used and compared to the mid-term point of projections in World Oil Outlook (WOO 2011) published in November 2011. For the long-term, OPEC's projections are taken from the WOO 2011 and the IEA's from the World Energy Outlook 2011 (WEO, 2011).

2. Recent market developments and near-term prospects

This section will review market development over the past year and discuss the shape of economic recovery in the world's major regions, as well as the patterns of energy demand in major regions/countries. The section will address the recent developments in non-OPEC supply and the likelihood of their being repeated along with OPEC crude production and NGLs. On the downstream, the session will discuss refining capacity, inventory levels, and their implication on the downstream sector. Finally the session will discuss the uncertainties surrounding the energy outlooks.

To facilitate the discussions in this session the IEA and OPEC near-term outlooks are summarized below. The IEA short-term projections are taken from IEA's Oil Market Report (OMR) published in December 2011 and from OPEC's Monthly Oil Market Report (MOMR), also published December 2011.

2.1. Short-Term Outlook

2.1.1. Economic Growth

The IEA report uses the IMF World Economic Outlook's GDP projections, alongside other secondary sources, while OPEC's GDP data is assessed internally utilizing a model based approach, and compares a variety of sources, including publications of official, semi-official and private institutions. The two reports observe that the global economy entered a phase of increased uncertainty in the second half of 2011, characterized by weakening and uneven global activity and growing downside risks. This is mainly due to the sovereign debt crisis in the Euro-zone, persistently high unemployment in the advanced economies, and inflation risk in the emerging economies. This has contributed to the downward revision to world economic growth in 2011 and 2012. Both reports note that

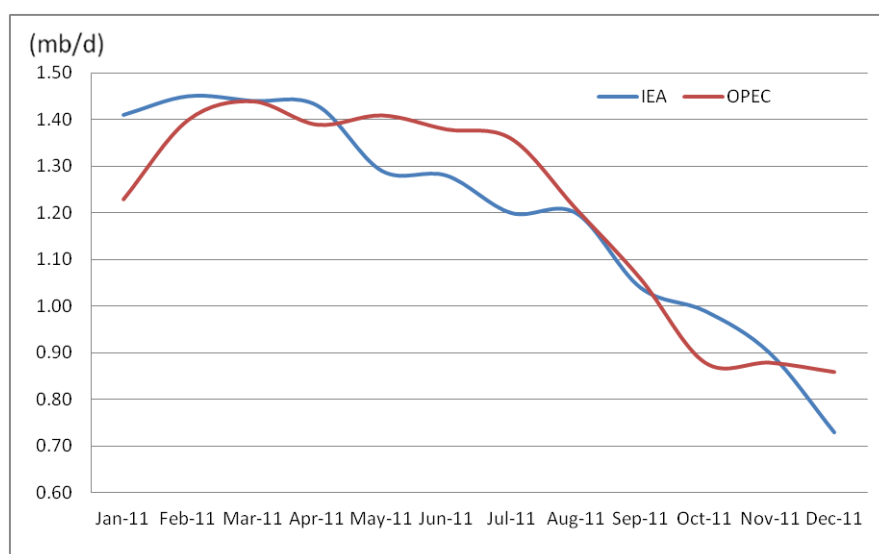
emerging economies continue to lead the way, but the rapid rates of growth in recent years are moderating to a more sustainable pattern. Overall, **both reports assume positive economic growth for 2011 and 2012 with no double- dip recession incorporated in base scenario projections.** However, they warn that the downside risks to the world economy are very real and very serious and close monitoring will be needed on developments in Euro-zone debt crisis, US economy and slowing activity in developing economies.

The IEA is slightly more optimistic than OPEC in its assumption for global economic growth prospects for 2011 and 2012. The IEA report expects the world economy to grow by 3.85% in 2011 and 3.91% in 2012, versus 3.6% in both years for OPEC. However, given the economic uncertainty and a number of cautionary signs on the economic side, the IEA OMR also tests the impact on oil demand projections of a one-third lower GDP sensitivity.

2.1.2. Oil Demand

IEA and OPEC have continually adjusted their demand projections downward during 2011, Figure (1), driven mainly by slowdown in global economic growth and tighter credit conditions as well as weather related issues and revisions to baseline data. The main reason for the slowdown of demand growth is the shaky state of the US and Euro-zone economies and efforts by China and India to moderate fuel consumption growth. Nevertheless, despite the uncertainty clouding the global economy, the IEA and OPEC expect demand growth to pick up in 2012 compared to this year. But they warn that weaker-than-expected economic growth would significantly limit oil consumption as risks are skewed towards the downside.

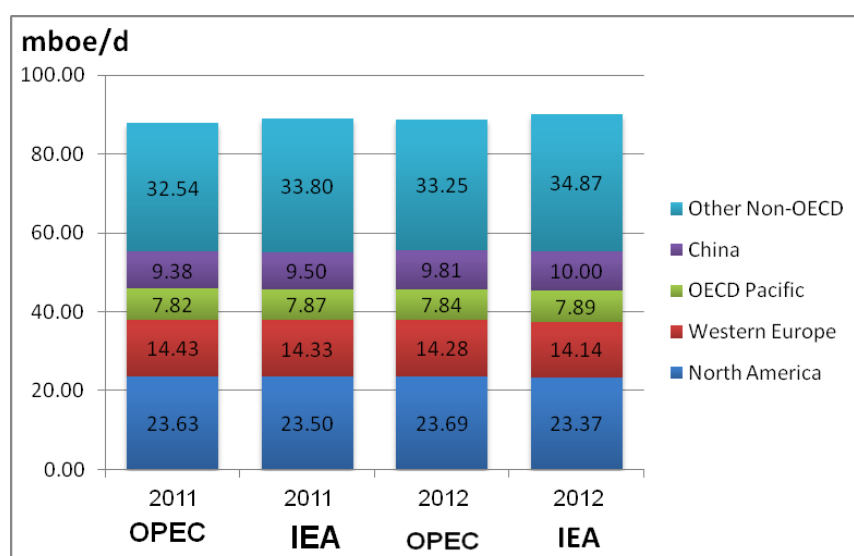
Figure (1): Revisions of world oil demand growth projections for 2011



Despite downward revisions, global oil demand growth remains positive and has so far shown great resistance to weak global macroeconomic tides, attributing the entire growth to non-OECD countries. Both reports are forecasting healthy demand growth for both 2011 and on into 2012. The IEA December 2011 report expects an increase in oil demand of around 0.73 mb/d in 2011, to reach 89.0 mb/d, Figure (2). OPEC's December 2011 report expects growth of 0.86 mb/d to a global demand total of 87.8 mb/d.

For 2012, OPEC expects demand growth of 1.07 mb/d to a total daily volume of 88.87 mb/d. The IEA's report assumes demand growing by 1.26 mb/d for a total daily demand of 90.3 mb/d. Downside risks from a worsening Euro zone economic situation also remain and could negatively affect oil demand in the coming months. For example, when the IEA replicated a lower GDP case of around 2.6% in its model, the global oil demand in 2012 falls short of its current expectations by 1.26 million b/d, and ultimately grows by only 220,000 b/d.

Figure (2): World oil demand



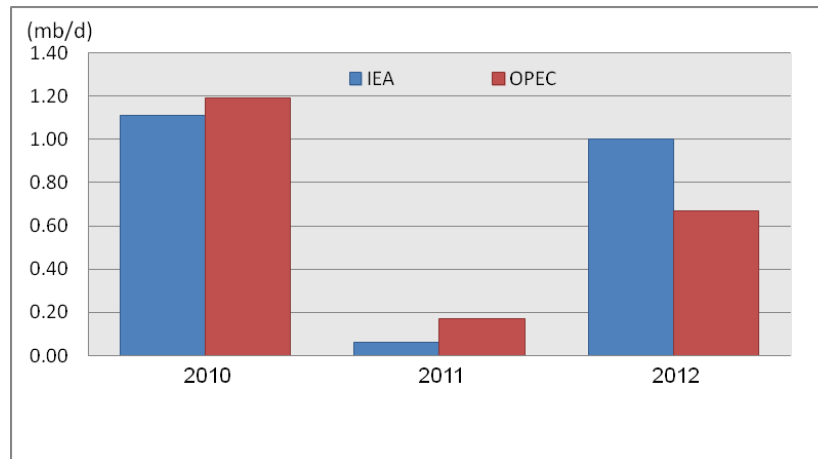
The differences between IEA and OPEC's global demand figures grew from around 200,000-300,000 b/d in 2007-2008 to 500,000 b/d for 2009 and to 1.6 mb/d in 2010. For 2011 and 2012 the differences went down to 1.2 and up to 1.4 mb/d respectively. **Part of these differences can be explained in term of definitional differences in the measurement of demand for some regions (e.g. ethane use, treatment of stocks in apparent consumption).**

2.1.3. Oil Supply

Turning to supply, Figure (3) shows that the growth in non-OPEC supply in 2010 is very similar in both OPEC and IEA reports. The relatively strong increase of more than 1.1 mb/d in non-OPEC supply in 2010, is largely the result of projects coming on-stream, which had been delayed following the onset of the recession and the resulting

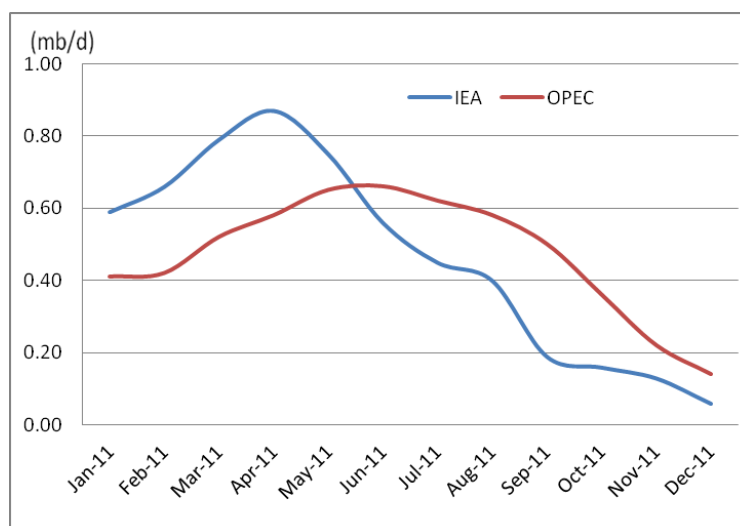
drop in oil prices, and due to higher prices and spending in the aftermath of the earlier recession.

Figure (3): Non-OPEC supply growth



However, the IEA and OPEC reports continually adjusted their non-OPEC supply projections downward during 2011, and their expected growth slid to around 0.06 and 0.17 mb/d respectively, mainly due to unexpectedly high levels of production stoppages, see Figure (4). Indeed, more than 600,000 b/d has been off-stream over the second and third quarters of 2011, due to equipment failures in the North Sea, problems with up-graders in the Canadian oil sands, technical and fiscal issues in the Caspian, political unrest in the Middle East, strikes in Argentina and Gabon, and tropical storms in Australia.

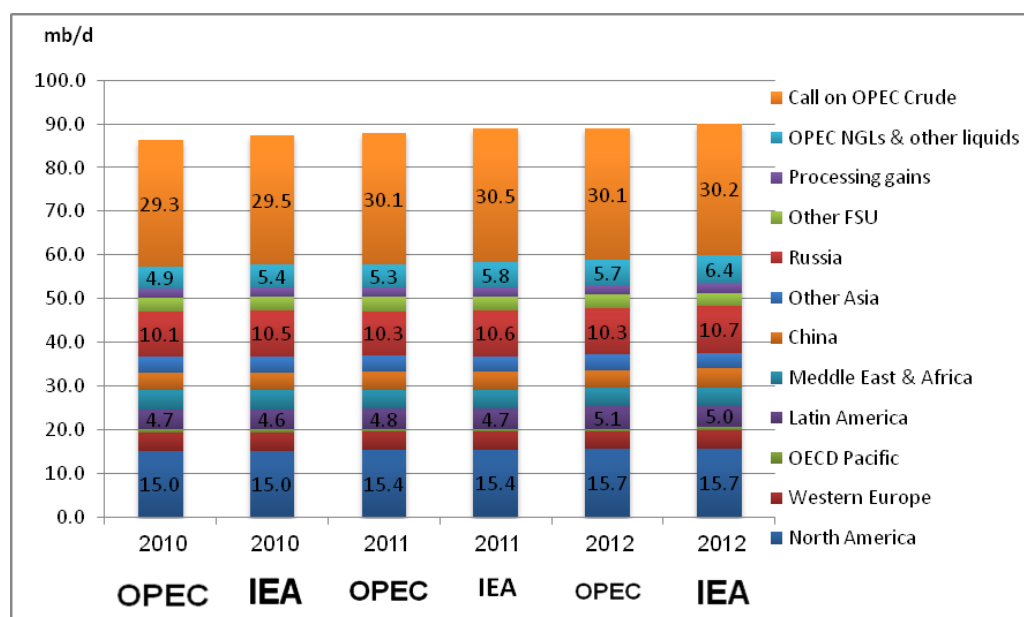
Figure (4): Revisions of non-OPEC supply growth projections for 2011



While a lot of the issues affecting non-OPEC supply in 2011 still remain, the peak maintenance period has now passed. Further, the overall prospects for non-OPEC supply in 2012 look healthier than 2011. Overall, a confluence of technical, geopolitical and structural

problems, which has weighed on non-OPEC supply this year, is not assumed to repeat in 2012. In this respect, both the IEA and OPEC reports forecasting a rise in non-OPEC supply for 2012. However, for 2012, the IEA is rather more optimistic than OPEC, with non-OPEC supply increasing by 1.0 mb/d according to the IEA report versus 0.7 mb/d in OPEC's report. Both reports point out that output growth remains concentrated in few a non-OPEC countries including Brazil, Russia, Azerbaijan, Kazakhstan, Colombia, Ghana, US and Canada. Elsewhere, new developments are relatively much smaller, Figure (5).

Figure (5): Short-term world oil supply



Biofuels are re- included in the countries and regions

The IEA report expects OPEC NGLs and non-conventional oil to average 5.8 mb/d in 2011 and 6.4 mb/d in 2012, representing growth of 0.5 mb/d for both years, a growth slightly higher than OPEC's figure. However the **absolute levels for 2011 and 2012 differ by around 0.5 and 0.7 mb/d respectively**, as the IEA report sees more OPEC NGLs and other liquids in 2009 and 2010.

In addition, there is around **0.3 mb/d difference in their non- OPEC supply figures of 2010 which add to the differences in 2011 and 2012**. This difference stems mainly from their **diverse views on the level of Russian production**. Adding this figure to the difference in the OPEC NGLs mentioned above, this will result in more **than 0.5 mb/d difference between the IEA and OPEC projections**. However, in general their forecasts for the demand for OPEC crude for 2012 are very similar, as both see that this level will help balance the oil markets next year and would also allow daily stocks to be replenished given that demand growth is expected to slow. For the whole of 2012, the IEA expects global demand for OPEC oil and/or stock change to be at 30.2 mb/d, while OPEC forecasts demand for OPEC crude at 30.1 mb/d.

On the supply side, both outlooks for 2012 are quite comfortable, and the incremental oil demand in 2012 will be met by the increase in non-OPEC supply and OPEC NGLs. In addition, there is sufficient spare capacity in place to offset any unforeseen production losses or increase in demand.

Indeed, OPEC spare capacity after reaching a 2011 low of 3.5 - 4.0 mb/d in June compared with over 5.0 mb/d prior to the crises in the MENA region in January, recovered again and currently stand around 4.0 and 5.0 mb/d according to IEA and OPEC estimate respectively, more than enough to offset any production losses.

2.2. Medium-Term Outlook

The IEA medium-term projections presented here are taken from IEA Medium-Term Oil Market update (MTOMR) published in December 2011 and from OPEC's World Oil Outlook 2011, published early November 2011. OPEC's mid-term projection is 2015 and this is the comparison year used in this paper. The IEA presently takes its medium-term projections out to 2016.

2.2.1. Oil Prices and Economic Growth

The oil price assumptions of both the IEA and OPEC over the medium term are somewhat different. The IEA medium-term update employs a crude oil price assumption that is some \$9 per barrel lower for 2016 than that assumed in their June 2011 medium-term-outlook, with nominal Brent crude falling from \$109/bbl in 2011 through to \$91/bbl in 2016, based on the prevailing futures strip. OPEC's WOO-2011 assumes that oil prices will remain in \$85-95/bbl range over the years to 2020 in nominal terms, which is \$10/bbl higher than in last year's outlook.

For economic growth, based on the IMF's September 2011 outlook, the IEA report assumes that the pattern of global economic growth shows slower output in the short-term (3.9% in 2011/2012) before giving way to relatively stronger performance for the global economy through the remainder of the forecast period (growing by an average of 4.6% annually during 2013-2016), and a reduction in oil use intensity of 3% annually.

OPEC's WOO-2011 assumes that the global economy grows by 3.9% in 2011, and then by an average of 3.9% per annum in the medium-term to 2015. However, it is assumed that decisive action is taken in a timely manner to make sure the global economy remains on the path of recovery. **The difference between the two reports over the medium term stems from their assumptions about the economic growth in non- OECD countries.** The IEA report continues to illustrate also an alternative demand case, based on lower underlying economic growth assumptions and slower efficiency gains; where economic growth averages some 3% on average from 2011-2016, versus 4.4% in the base case, and oil intensity diminishes by 2% per year instead of 3% in the base case.

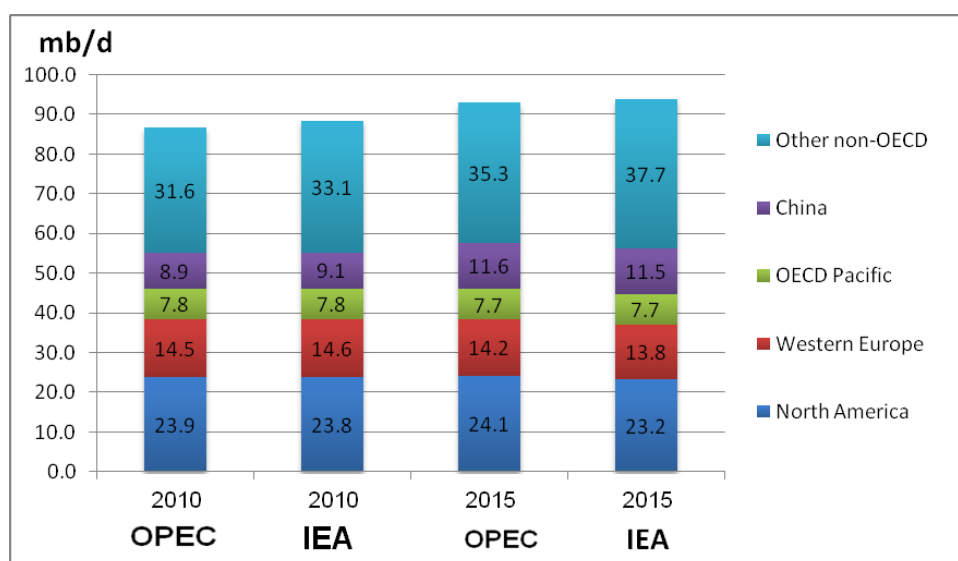
2.2.2. Oil Demand

Both the IEA and OPEC expect robust growth in global oil demand over the medium term. However, **the IEA global medium term oil demand projection is higher than the OPEC's figure by around 1.0 mb/d by 2015**, Figure (6). The higher demand figures by the IEA over the medium-term can be traced to the difference in the base year demand level mentioned earlier. But, in term of demand growth IEA medium term projection is lower than the OPEC's growth figure by more than 0.6 mb/d, despite their (IEA) higher assumptions for economic growth.

When the IEA replicated low GDP sensitivity for the oil demand projection in its model, the demand for crude oil in 2015 came in at about 92.0 mb/d.

The IEA expects global oil demand to average 93.8 mb/d by 2015, an annual growth close to 1.1 mb/d over the years to 2015 on average, while OPEC puts global oil consumption in 2015 at 92.9 mb/d, an annual average growth of just over 1.2 mb/d over the years to 2015. This year OPEC's WOO sees global oil demand 1.9 mb/d higher than in the previous WOO, as it cites a faster recovery from the global economic recession than it expected in the previous year's report. The biggest upwards demand growth revision to its assumption is for China.

Figure (6): Medium-term oil demand outlook



At the regional level, both the IEA and OPEC expect oil demand to be driven by non-OECD countries. However, the extent of the growth in non-OECD countries differs, creating a difference in the oil demand projections at the regional level. Figure (6) shows that **the IEA projection for demand in non-OECD countries in 2015 is 2.2 mb/d greater than OPEC's projection**, although some of this is due to differences in historical data. Last year the difference was 2.8 mb/d, and around one quarter of it was attributed to China alone; however, this year's outlooks show similar projections on China's demand.

For other non-OECD countries, comparison of the regional breakdown between specific non-OECD regions is difficult as the OPEC projection separates out OPEC demand, while IEA includes OPEC countries demand within the respective geographical region. The IEA report expects that the total non-OECD oil demand will overtake the demand for oil in the OECD countries by 2013, while OPEC's report shows that until 2015, the total non-OECD oil demand will overtake the demand for oil in the OECD countries.

When considering the OECD region, the **IEA expects oil demand in OECD countries to decline more steeply than OPEC's report estimates by 2015, with a 1.5 mb/d decline in IEA projections from 2010 to 2015 versus 0.1 mb/d or essentially will remain flat in the OPEC outlook.** Again, the biggest difference stems from the short-term growth, for 2011 and 2012. Within the OECD region, most of the difference in demand in 2015 comes from differences in the projections of demand from North America.

2.2.3. Oil Supply

The IEA and OPEC both projected high growth in the global oil supply over the medium term to meet the projected demand increase by 2015. However, their medium term global oil supply forecasts differ by around 0.8 mb/d by 2015 as the case in the oil demand, Figure (7).

Figure (7): Medium-term oil supply outlook

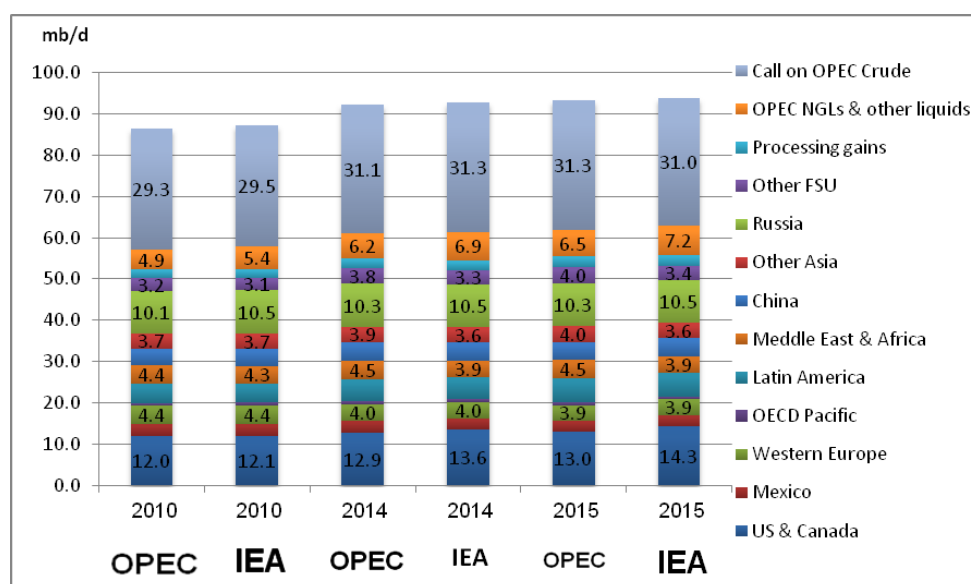


Figure (7) shows that **IEA and OPEC have almost similar projections when it comes to the growth in non-OPEC supply over the medium term**, with non-OPEC supply reaching 55.66 mb/d by 2015 according to the IEA projection versus 55.3 mb/d by OPEC. Both reports project the same growth in non-OPEC supply of around 3.04 mb/d by 2015, or around 0.6 mb/d per year from 2010 to 2015. The minor difference in absolute terms is due to the difference in non-OPEC supply figures used by IEA and OPEC for the base year, 2010.

On the regional level, the differences between IEA and OPEC projections by 2015 are substantial in some regions and small in others. For example, there is a deficit of around 1.3 mb/d between the OPEC's WOO and IEA's MTOMR projections for supply from US and Canada only, compared to an overall difference in supply projections for non-OPEC regions of 0.3 mb/d. On the other hand, OPEC's medium term projection for Middle East & Africa, other FSU and other Asia regions is around 1.6 mb/d higher than the IEA's medium term forecast for these regions.

The IEA report expects 2.12 mb/d growth from Canada and the US, 1.1 mb/d from Brazil and Colombia, and 0.85 mb/d from China, other FSU and processing gains, while it sees Mexico, Western Europe, Middle East & Africa and other Asia declining by 0.3, 0.5, 0.4 and 0.2 mb/d respectively over the medium term. The IEA report cites the mature field decline and/or investment uncertainty behind the declining region.

On the other hand, OPEC's report expects 1.0 mb/d growth over the period 2010-2015 from Canada and the US, another 1.0 mb/d from Latin America (mainly Brazil and Colombia), and 0.8 mb/d from other FSU. It also expects 1.0 mb/d growth coming from China, other Asia, Russia and processing gains. OPEC's report expects a 0.9 mb/d decline from Western Europe and Mexico.

The IEA expects OPEC NGLs and non-conventional to average 7.22 mb/d by 2015, representing growth of 1.9 mb/d. This growth is slightly higher than OPEC's figure of 1.6 mb/d, Figure (7). While the absolute levels for 2015 differ by some 0.7 mb/d, this is largely because the IEA reports more OPEC NGLs and other liquids in 2010.

Both the IEA and OPEC reports expect the call on OPEC crude to rise slowly over the medium term until 2015, from 30.3 and 29.3 mb/d in 2010 according to IEA and OPEC respectively, to just over 31 mb/d by 2015.

The IEA and OPEC are both expecting an increase in OPEC crude production capacity over the medium term until 2015, but with slightly different assessments of the level of capacity increase. The IEA expects OPEC crude capacity to increase by 2.1 mb/d, from 2010 to 2015 (from 35.7 mb/d to 37.8 mb/d) versus close to 4.0 mb/d by OPEC. **Consequently, OPEC foresees a steady increase in OPEC spare capacity over the medium term to reach close to 8.0 mb/d by 2015, not far from the IEA which expects the spare capacity to reach 6.8 mb/d by 2015.** According to the IEA report, Iraq will account for 80% of the increased capacity, followed by UAE and Angola.

Certainly, both reports foresee an easing of the world oil market in the medium term to 2015 with rising OPEC spare production capacity, OPEC NGLs and non-conventional, and non-OPEC supply.

3. Long Term Energy Outlook

This part will discuss main assumptions behind IEA and OPEC's outlooks including population growth, price patterns, economic growth, energy and environmental policies, and technological developments. The section also addresses issues related to non-conventional resources, second generation biofuels, peak oil (in supply and demand), investments, decline rate, oil intensity, energy efficiency, sources and quality of data, and several other issues.

The part will also discuss the energy demand growth in the OECD region; the regional shift in energy demand toward emerging markets (non-OECD region); the impact of energy and environmental policies on energy outlooks and the energy market, and finally, the implications of the future crude quality trends on the downstream sector.

The long-term projections from the IEA are taken from IEA's World Energy Outlook (WEO) and from OPEC's World Oil Outlook (WOO), both released in November 2011.

3.1. Basic Assumptions for the Outlooks

WEO 2011 maintained the **New Policies Scenario**, as the central scenario. This scenario takes into account recent government policy commitments that have already been announced by countries around the world, to tackle environmental and energy-security concerns, even where the specific measures to implement these commitments have yet to be announced. In addition to this scenario, the WEO presents two other scenarios, differentiated by the underlying assumptions about government policies. The first one, the **Current Policies Scenario**, which assumes no new policies are added to those in place as of mid-2011 and the second scenario, the **450 ppm Scenario**, which assumes implementation of the high-end of national pledges and stronger policies after 2020, to limit the concentration of greenhouse gases in the atmosphere to 450 ppm of CO₂ equivalent. However, the WEO-2011 emphasizes that none of the scenarios it presents should be interpreted as forecasts.

The **Reference Case** of the OPEC WOO-2011 is defined in a similar way as in the previous version of WOO. It retains the principal that only policies that are already in place influence supply and demand patterns. The two key policies that are already factored in are the EU package of measures for climate change and renewable objectives and the US Energy Independence and Security Act (EISA). The Reference Case also reflects measures contained in China's Five Year Plan for the period 2011–2015, though the WOO does not foresee these measures greatly affecting the Reference Case. In addition to the Reference Case, the WOO developed an **Accelerated Transportation Technology and Policy (ATTP) Scenario**. The ATTP scenario explores the potential impacts upon the call on OPEC crude of an alternative set of assumptions impacting the projected volumes required. Specifically, alternative rates of development and implementation of technologies in the transportation sector are assumed. OPEC's WOO also presents two other scenarios,

reflecting the uncertainties over economic growth, in the short, medium and long term.

3.1.1. Population Growth

IEA and OPEC outlooks use consistent demographic assumptions based on the United Nations, Department of Economic and Social Affairs, Population Division (UNPD). Both reports forecast that most of the population growth to 2035 will occur in developing countries, although the rate of expansion will gradually decline in some regions, and contracted in others. They also point to the higher proportions of populations in urban areas, with the notable exception of Africa. The rapid urbanization will have significant implications on demand for energy services. OPEC's WOO also emphasizes the importance of the changing age structure of populations, and the impact that will have on the growth of working age populations. In all scenarios world populations grow from an estimated 6.9 billion in 2010 to around 8.6 billion in 2035, an average rate of increase of 0.9% per year.

3.1.2. Oil Price assumptions

On projecting supply and demand an important assumption is “what will be the price of crude oil over the forecasting period”. Price assumptions do not constitute price forecasts as they are determined by a bottom-up approach of prices needed to generate sufficient investment in supply to meet projected demand over the projection period.

The price assumptions in the IEA WEO report are based on average IEA crude oil import price as a proxy for international oil price. In OPEC WOO, the price assumptions are based on the OPEC Reference Basket (ORB) crude oil price.

In the New Policies Scenario of the IEA WEO, oil prices are assumed to rise steadily to \$136/barrel (nominal term) in 2020 and \$212/barrel in 2035, in nominal terms, reflecting rising production costs. In addition, the IEA report assumes the price rises more rapidly in the Current Policies Scenario to \$247/barrel (nominal term) in 2035, reflecting increasing marginal costs as more supply is needed to balance higher level of demand, and more slowly in the 450 scenario to \$171/barrel (nominal term) in 2035 on lower demand. The IEA reaches these price assumptions by a process of iteration to balance the demand and supply models, which is guided by expert opinion. So price is in effect an input to both the demand and supply model.

The Reference Case of the OPEC WOO assumes a nominal price that remains in the range \$85-95/barrel over the years to 2020, reaching \$133/barrel by 2035, reflecting the behavior of prices since November 2010, the behavior of marginal costs, the impact of dollar exchange rate movements on recent prices and potential future developments, and signals from futures prices.

The price assumptions of both the IEA WEO 2011 and OPEC WOO 2011 have been increased slightly from last year. The IEA and OPEC outlooks form their oil price assumptions based on their expectations for marginal costs of oil supply among other considerations. However, they have diverse views on the level of these marginal costs which contributes among others to the differences in their long-term oil price assumptions.

3.1.3. Economic Growth

Economic growth is an important assumption in determining the supply and demand projections. There are some difficulties in comparing the GDP growth rates assumed by the IEA WEO and OPEC WOO. First and most importantly, there are differences in the regional definitions. Second, there are differences in the base year period. These difficulties were also highlighted during the first symposium.

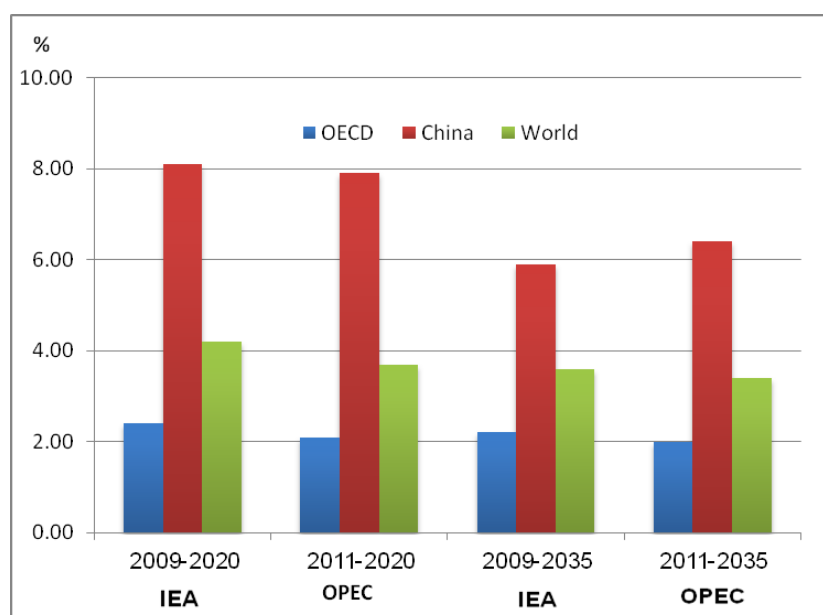
Figure (8) shows that the IEA's and OPEC's long-term expectations for world economic growth are broadly similar, although the IEA's is a little higher. The differences may be attributed to the difference in the base year.

The IEA WEO assumes that the world global economy grows on average by 4.2% per year over the period 2009-2020. In the longer term, the rate of growth is assumed to temper, as the emerging economies mature and their growth rates start to converge with those of the OECD economies. Global GDP growth is assumed to grow by an average of 3.6% per year over the period 2009-2035. Assumed growth is somewhat higher than in last year's Outlook, in part due to the lower 2009 base.

OPEC's WOO-2011 projections are broadly similar but with the greatest growth to be in China (6.4%). It assumes that the global economy will grow by 3.7 and 3.4% per year, over the periods 2011-2020 and 2011-2035 respectively.

In both outlooks, the developing countries as a group are assumed to continue to grow much more rapidly than the OECD countries, driving up their share of world GDP. However the OECD countries will retain their position as the wealthiest nations in terms of income per capita. In the short-, and medium-term both outlooks remain cautious about the sustainability of global economic recovery, and warned that risks have increased recently.

Figure (8): Long Term economic growth rates



3.1.4. Energy and Environmental Policies

The 2011 WEO maintained the **New Policies Scenario**, as the central scenario. This scenario takes into account broad policy commitments and plans that have already been announced by countries around the world, to tackle energy insecurity, climate change and local pollution, and other pressing energy-related challenges, even where the specific measures to implement these pledges have yet to be announced. Those pledges include renewable energy and energy-efficiency targets and support, programmes relating to nuclear phase-out or additions, national pledges to reduce greenhouse-gas emissions communicated officially under the Cancun Agreements and the initiatives taken by G-20 and APEC to phase out inefficient fossil-fuel subsidies that encourage wasteful consumption. In this regard, the scenario assumes that these pledges will be implemented in a relatively cautious manner, reflecting their non-binding character and, in many cases, the uncertainty shrouding how they are to be put into effect. According to the IEA the scenario intends to provide a benchmark to assess the achievements and limitations of recent developments in climate and energy policy.

In addition to this scenario, the WEO presents two other scenarios, differentiated by the underlying assumptions about government policies. The first one, the **Current Policies Scenario** (called the **Reference Scenario** prior to WEO 2010), which assumes no new policies are added to those in place as of mid-2011 and the second scenario, the **450 Scenario**. A number of the policy commitments and plans that were included in the New Policies Scenario in WEO 2010 have since been enacted so are now included in the Current Policies Scenario. These include, China's 12th Five Year Plan for the period 2011–2015; a new scheme in India, new EU directives and new appliance standards in the US. The **450 Scenario** assumes implementation of the high-end of national pledges and stronger

policies after 2020, to limit the concentration of greenhouse gases in the atmosphere to 450 ppm of CO₂ equivalent. However, the WEO-2011 emphasizes that none of the scenarios it presents should be interpreted as forecasts.

The WOO-2011 **Reference Case** is defined in a similar way as in the previous version of the WOO. It retains the principal that only policies that are already in place influence supply and demand patterns. The two key policies that are already factored in are the EU package of measures for climate change and renewable objectives and the US Energy Independence and Security Act (EISA). No change is anticipated for these two sets of policies in terms of how they might impact the Reference Case, as compared to the previous WOO. It also reflects measures contained in China's Five Year Plan for the period 2011–2015, though the WOO does not foresee these measures greatly affecting the Reference Case. In addition to the Reference Case, the WOO developed an **Accelerated Transportation Technology and Policy (ATTP) Scenario**.

The **ATTP Scenario** explores the potential impacts upon the call on OPEC crude of an alternative set of assumptions impacting the projected oil demand. Specifically, alternative rates of development and implementation of technologies in the transportation sector are assumed. This assumes higher efficiency improvements to internal combustion engines; an accelerated shift to hybrids, and in some parts of the world, electric vehicles; a more rapid penetration in some regions of natural gas in the transportation sector; and an accelerated move to regulate efficiencies in commercial vehicles. It also includes a more aggressive support for alternative fuels, in particular biofuels, CTLs, biomass-to-liquids, gas-to-liquids and compressed natural gas and the assumption that international marine bunker regulations lead to more efficient fuel use in this sector.

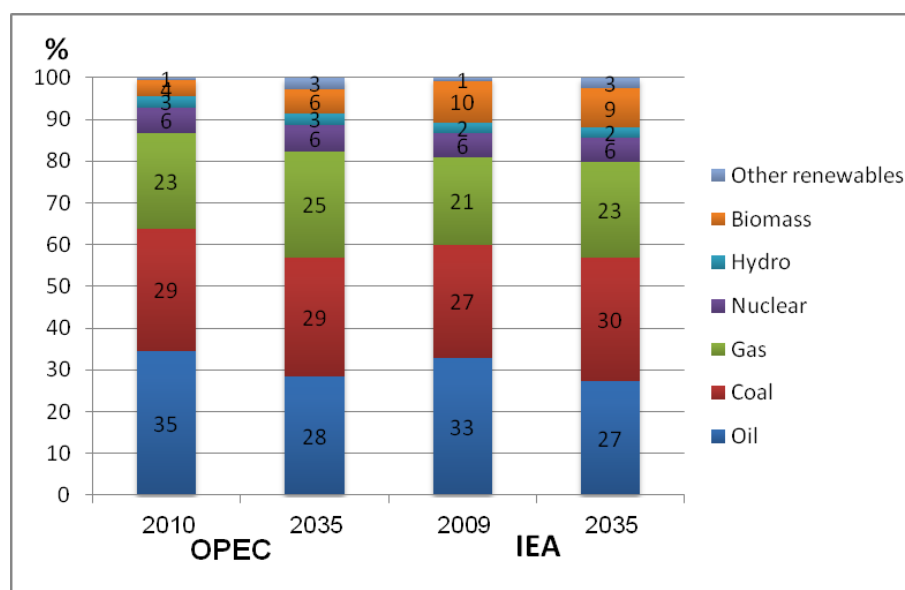
Energy and environmental policies are one of the key drivers for future energy demand and supply; however they are one of the most uncertain areas of the outlooks. The policy assumptions incorporated in the Current Policies Scenario of the IEA WEO-2011 are not exactly the same as those considered by OPEC's Reference Case. This difference in energy and environmental policy assumptions will create some ambiguity in the comparison between the outlooks and drive differences in the supply and demand projections. However, for the purpose of this report the IEA **Current Policies Scenario** and OPEC's **Reference Case** are mainly comparable.

3.2. Long Term Energy Demand Outlook

The IEA WEO sees that global primary energy demand continues to grow. In the Current Policies Scenario, global energy demand increases more quickly reaching 18,300 Mtoe in 2035, 51% higher than in 2009, and representing average growth of 1.6% per year. Non-OECD countries account for nearly 90% of the increase over the outlook period. Fossil fuels maintain a central role in the primary energy mix in the Current Policies Scenario, although their share declines slightly, from 81% in 2009 to 80% in 2035, Figure (9). In the Current Policies Scenario, coal demand grows the most in absolute terms and overtakes oil to capture the largest single share of energy mix before 2035 at nearly 30%.

Oil demand² increases by around 25% over the forecast period, though its share in total energy mix declines by 5 points from around 33% in 2009 to over 27% in 2035, Figure (10). Gas demand is up by 65% in 2035 compared to 2009, though it does not surpass that for coal. The share of nuclear power stays more or less flat over the projection period at around 6%. The use of modern renewable energy, including wind, solar, geothermal, marine, modern biomass and hydro, increased over the outlook period, its share in total primary energy demand reached 14.4% in 2035, Figure (9).

Figure (9): World primary energy fuel share



- IEA Current Policies Scenario.
- IEA biomass includes traditional and modern uses.

OPEC's Reference Case sees that global energy demand continues to increase, as economies expand, the global population grows and living conditions across the world improve. By 2035, world energy demand will be 51% higher than in 2010. In the future, developing countries will account for most of the demand increase, however energy use per capita in developing countries will remain well below that of the OECD countries in 2035. Fossil fuels maintain a prominent role, and though their share in the energy mix is expected to fall, it remains over 82% throughout the period to 2035. For most of the projection period, oil will remain the energy type with the largest share. However, by 2035 it will have been overtaken, in the Reference Case, by coal use, which will represent 29% of total energy, similar to today, while oil's share falls from 34% to 28%. The rate of expansion in natural gas use is expected to be up by 68% in 2035 compared to 2010, especially with the technological developments that have made economic the exploitation of unconventional resources. Gas use will rise at faster rates than either coal or oil, both in percentage terms and volumes, with its share rising from 23% to 25%. According to the

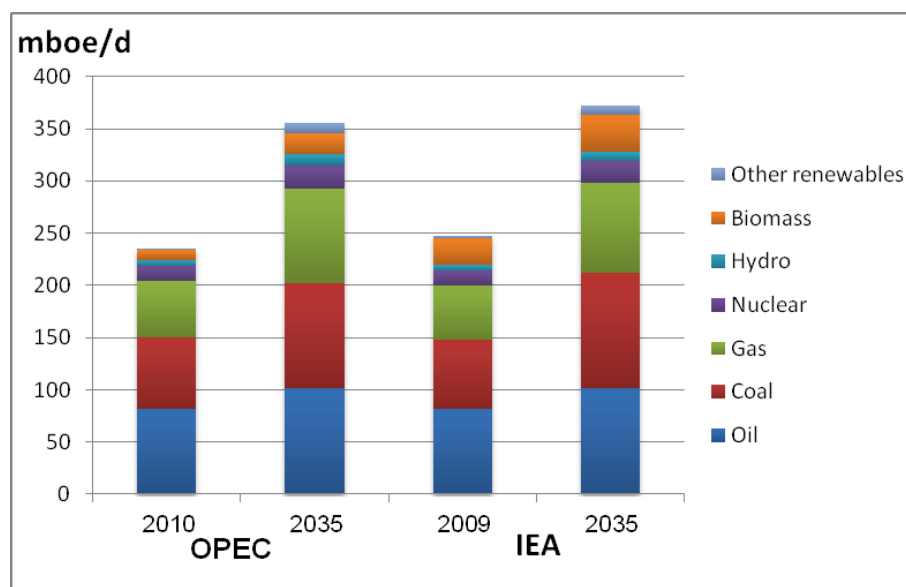
² Excludes biofuels demand, which is projected to rise from 1.3 mb/d (in energy-equivalent volumes of gasoline and diesel) in 2010 to 3.4 mb/d in 2035.

WOO 2011, the prospects for nuclear energy have been affected by events at Japan's Fukushima nuclear power plant in March this year. In the Reference Case, nuclear energy still expands at an average rate of 1.7% p.a., although its contribution has been revised down from earlier estimates. Biomass use expands rapidly, and its contribution to total supply is approaching that of nuclear by 2035, at around 6%. Renewable energy, other than hydro, rises the fastest of all energy forms, but since this starts from a low base, its share is still only 3% by 2035.

IEA WEO Current Policies Scenario and OPEC WOO Reference Case see that the global primary energy demand continues to grow in all energy sources. By 2035, both outlooks are very similar and forecast world energy demand will be more than 50% higher than today. Fossil fuels continue to be the most widely used fuel, and their resources are more than sufficient to meet the growth in demand, making over 80% of total energy consumption in 2035. In addition, the IEA WEO and OPEC WOO's **growth rates by fuel type are relatively comparable**, although OPEC Reference Case projects slightly faster growth in hydro, biomass and other renewable demand, while IEA Current Policies Scenario projects faster growth in oil and coal.

Both IEA and OPEC expect that oil will continue to be the single largest constituent of primary energy demand for most of the projection period, although its share as a proportion of total fuels will have fallen, to 28% from more than 34% in 2010 according to OPEC's report and to 27% from around 33% in 2009 according to the IEA WEO.

Figure (10): World primary energy demand



- a. IEA Current Policies Scenario.
- b. IEA biomass includes traditional and modern uses

Similar to last year's assessment, we are unable to make direct comparisons on regional/country levels between IEA and OPEC figures for oil demand, for several reasons:

- **Different treatment of biofuels and marine bunkers.** The IEA does not include biofuels in its WEO definition of oil, and consequently, reports biofuels separately, bunkers are only included as an aggregate, not at the regional level;
- **Differences in the regional breakdown.** WOO has an OPEC grouping, while the IEA WEO does not routinely publish its demand projection for OPEC as the OPEC Member countries are split across different WEO regions.

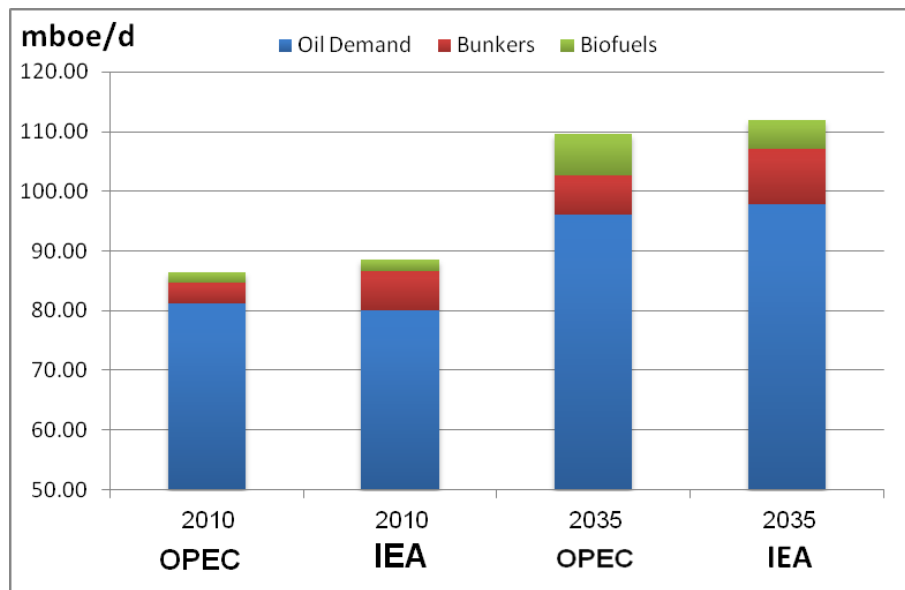
A comparison at a global level between the IEA Current Policies Scenario and OPEC Reference Case is presented in Figure (11). Over the forecast period IEA Current Policies Scenario and OPEC Reference Case sees similar growth in world liquids demand of around 0.9% p.a.. Both outlooks pointed out that the key to future demand growth is the transportation sector of non-OECD countries, notably China and India.

The IEA Current Policies Scenario long-term projection for world liquids demand (defined as world oil and NGLs production plus processing gains plus biofuels) in 2035 is 111.9 mb/d whereas OPEC's Reference Case projection is 109.7 mb/d, a difference of around 2.2 mb/d; this is mainly due to the higher base data by the IEA, which is around 1.7 mb/d higher than OPEC for the year 2010. Both outlooks see a decline in the OECD oil demand over the projection period and most increase in developing countries demand. However, they have different views on the biofuels and bunkers demand levels. For example, the IEA Current Policies Scenario sees biofuels demand reaches 4.7 mb/d (volumetric basis) by 2035, while OPEC's Reference Case sees Biofuels demand reaching 7.1 mb/d by 2035, a difference of more than 2 mb/d.

On the bunker demand the IEA Current Policies Scenario expects international marine and aviation fuels to reach 9.4 mb/d by 2035 comparing with marine bunker demand of 6.5 mb/d in OPEC's Reference Case, a difference of around 3 mb/d. However, adding OPEC's aviation oil demand to its marine bunker demand (marine and aviation fuels), then OPEC's figure reaches 13.5 mb/d by 2035. The main reason behind this difference lies in the fact that total aviation demand includes domestic flights. As such, this aggregate figure is therefore not comparable. This issue of methodology and definitions is an area which might need further consideration by the two organizations.

In addition to the oil demand in the Current Policies Scenario, the IEA projected oil demand under two other scenarios, differentiated by the underlying assumptions about government policies as highlighted earlier.

Figure (11): Global liquids demand



1. Includes biofuels (volumetric bases) and international marine and aviation fuels.
2. IEA Current Policies Scenario.

OPEC's WOO also presents three other scenarios for oil demand, reflecting the uncertainties over energy and environmental policies, technological developments, as well as economic growth and the implications these will have on the oil market in the future. The low growth scenario reflects the downside risks to demand stemming from these uncertainties over economic growth. The high growth scenario, considers the upside potential for economic growth, with an even swifter recovery from the recent economic downturn than that assumed in the Reference Case. This scenario also involves a more optimistic view over the long-term sustainable rates of GDP growth. Finally, the **ATTP Scenario** explores the potential impacts upon the call on OPEC crude of an alternative set of assumptions impacting the projected volumes required. Specifically, alternative rates of development and implementation of technologies in the transportation sector are assumed. By 2035, this scenario sees the call on OPEC crude 10 mb/d lower than the Reference Case.

Indeed, oil demand projection is based on various assumptions (such as economic growth, oil intensity, oil prices, energy policies, technology developments, etc). For example, the IEA long-term projection for world oil demand in 2035 is 105.5 mb/d under the New Policies Scenario, whereas OPEC's Reference Case projection is 109.7 mb/d, a difference of more than 4.0 mb/d. The divergent views in the underlining assumptions between the IEA New Policies Scenario and OPEC's Reference Case, especially those related to energy and environmental policies contribute to the differences in their oil demand projections.

Uncertainties related to energy and environmental policies constitute a significant obstacle for energy security both on the demand side and on the supply side.

3.2.1. Long-Term Supply Outlooks

The IEA and OPEC outlooks assumptions regarding the availability of resources and the size of the resource base are quite similar. The leading source of estimating ultimately recoverable resources of conventional crude oil and NGLs for both outlooks is the 2000 assessment by the US Geological Survey (USGS-2000).

According to OPEC WOO, the ultimately recoverable conventional resources- a category that includes initial proven and probable reserves from discovered fields, reserves growth and economically recoverable oil that has yet to be found amounts to 3.5 trillion barrels and the remaining resources as of the end of 2010 is around 2.5 trillion barrels.

IEA estimates now put remaining recoverable resources worldwide at nearly 5,500 billion barrels, with proven reserves amounting to about one-quarter of the total.

In addition, both outlooks emphasized that non-conventional oil resources are expected to make an increasingly important contribution to liquid supply. They indicate that significant non-conventional resources exist throughout the world. Major examples include kerogen oil and the oil sands of Alberta, Canada. However, the potential of future oil supplies from non-conventional sources faces many technical, environmental and commercial challenges.

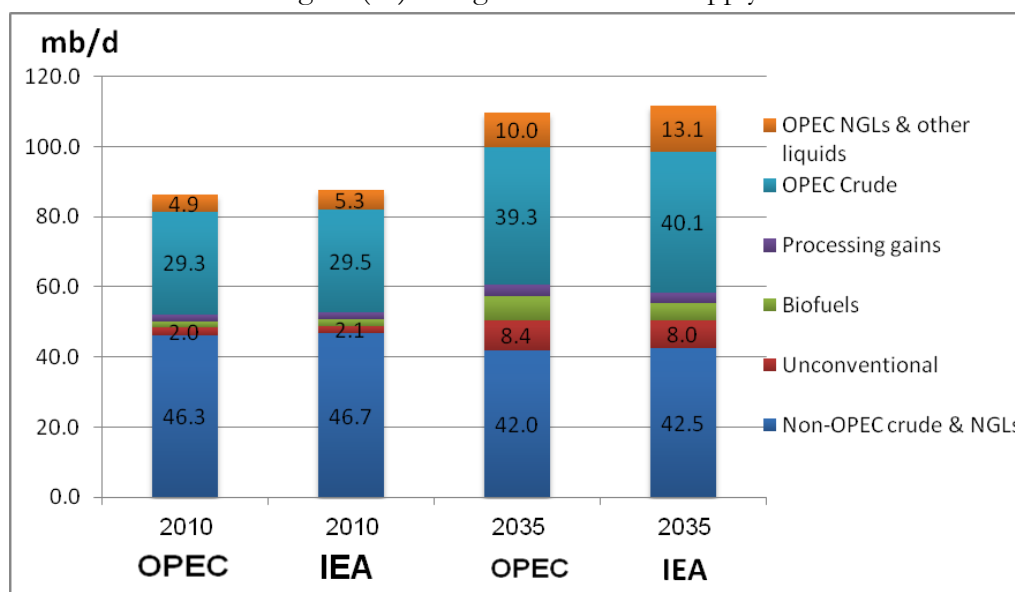
The IEA WEO projections take account of current field production profiles and future decline rates based on field characteristics, including size and physiographical situation. The IEA WEO mentions that by 2035, aggregate output from fields already in production in 2010 will drop from 69 mb/d to 22 mb/d by 2035, around 4.5% per year. OPEC current projections do not refer to any decline rate figures as well. However OPEC WOO-2009 stated that the production weighted average annual observed decline rate for non-OPEC is around 4.6% p.a., and this is higher than that in OPEC Member Countries. In addition, the IEA WEO oil supply balances the modeled WEO oil demand; the OPEC WOO does the same, but with around 0.2 mb/d allowance for stock building. **Differences in scenarios, in methodology, in the level and regional distribution of projected demand for crude, as well as in regional cost assumptions translate into differences in the level of projected investments that may be needed in producing fields and for additional capacity to meet demand by 2035. Moreover, the large differences in the projected demand for crude between the various scenarios translate into huge uncertainties in regard to what would be needed in terms of investments.**

A comparison between IEA's WEO supply projection in its Current Policies Scenarios and OPEC's WOO supply projection in its Reference Case appears in Figure (12). Both outlooks have been similarly adjusted for the purposes of consistency of the comparison. There are differences in expectations for total non-OPEC supply (defined as crude oil and NGLs production plus processing gains plus biofuels) between the two outlooks; IEA WEO Current Policies Scenarios sees non-OPEC supply increasing lower than the figures

in the OPEC's WOO Reference Case, reaching 58.4 mb/d by 2035, 2.1 mb/d lower than the OPEC WOO figure. In addition, there are some differences on the regional/country level.

The IEA WEO projects higher OPEC NGLs and other liquids (excluding Venezuela extra heavy oil) than OPEC's WOO does by around 3.1 mb/d for 2035. This will partially balance the lower projection of non-OPEC supply by the IEA WEO as mentioned above. For the call on OPEC crude oil in 2035 the estimates are fairly similar, 40.1 mb/d (including Venezuela extra-heavy) for IEA WEO versus 39.3 mb/d for OPEC WOO.

Figure (12): Long-term world oil supply



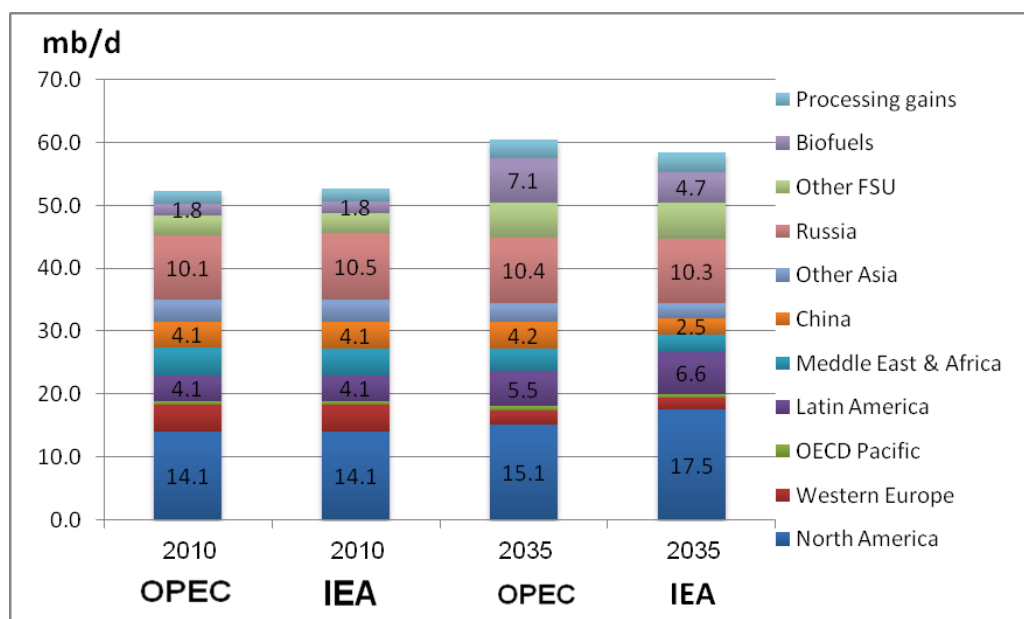
1. Biofuels (volumetric basis)
2. IEA Current Policies Scenario
3. OPEC crude includes Venezuela extra-heavy

To identify the differences within the non-OPEC regions between the two outlooks, Figure (13) presents a more detailed breakdown of supply from non-OPEC regions/countries, including biofuels.

As Figure (13) shows, there is a deficit of around 2.4 mb/d between the OPEC's WOO and IEA's WEO projections for supply from North America only, compared to an overall difference in supply projections for non-OPEC regions of 2.1 mb/d. On the other hand, OPEC's WOO Reference Case projection for Biofuels is around 2.4 mb/d (on a volume basis) higher than the IEA's WEO Current Policies Scenarios. There is also a difference of 1.7 mb/d in the projections for China alone between the two outlooks.

The regions where the IEA WEO projection is greater than OPEC's are North America, Latin America and other FSU. This region covers those areas (after accounting for Russia) defined by OPEC as "transition economies" and by the IEA as "Eastern Europe/Eurasia".

Figure (13): Long-term Non-OPEC Supply

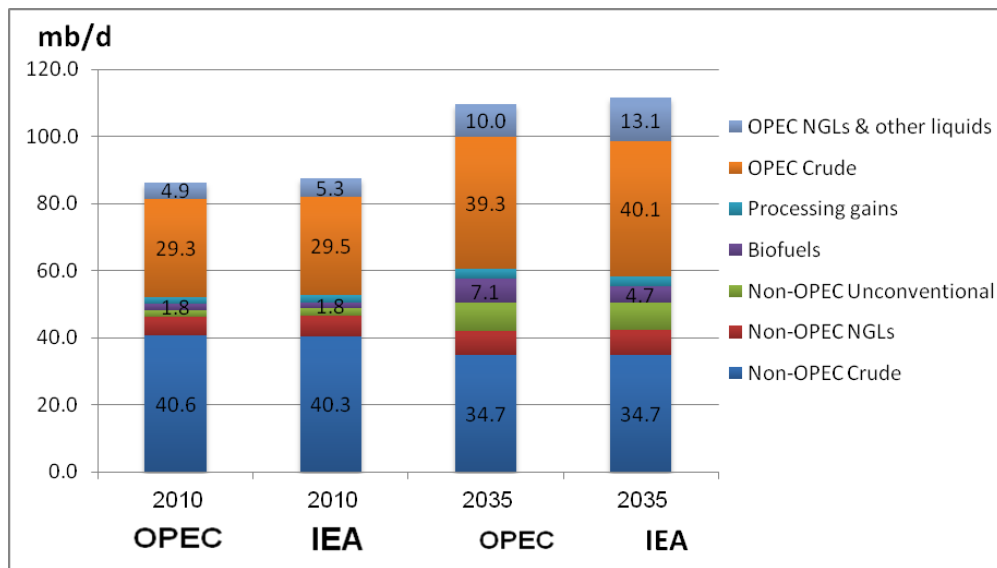


1. IEA Current Policies Scenario.
2. Region/country includes non-conventional and exclude biofuels.
3. Biofuels Volumetric basis.

All in all, the Non-OPEC supply as projected by the IEA WEO is thereby 2.1 mb/d lower than for the OPEC WOO figures. This is worth highlighting despite the fact that there are large differences in their oil price assumptions; OPEC assumes \$133/bbl (nominal) by 2035 versus \$247/bbl (nominal) by IEA

The oil supply projections are also available by oil type and this analysis attempts to further demonstrate where differences may lie. The IEA's and OPEC's projections by oil type are given in Figure (14). OPEC's WOO and the IEA WEO projects almost the same non-OPEC Crude, non-conventional oil and NGLs, and they have only 0.8 mb/d difference in their OPEC crude oil projections. However, **the IEA sees more NGLs and other liquids (mainly GTL) coming from OPEC member countries than OPEC does, the difference by 2035 is around 3.1 mb/d. On the other hand, OPEC WOO projects more Biofuels than IEA WEO does, the difference by 2035 is around 2.4 mb/d (on volume basis).**

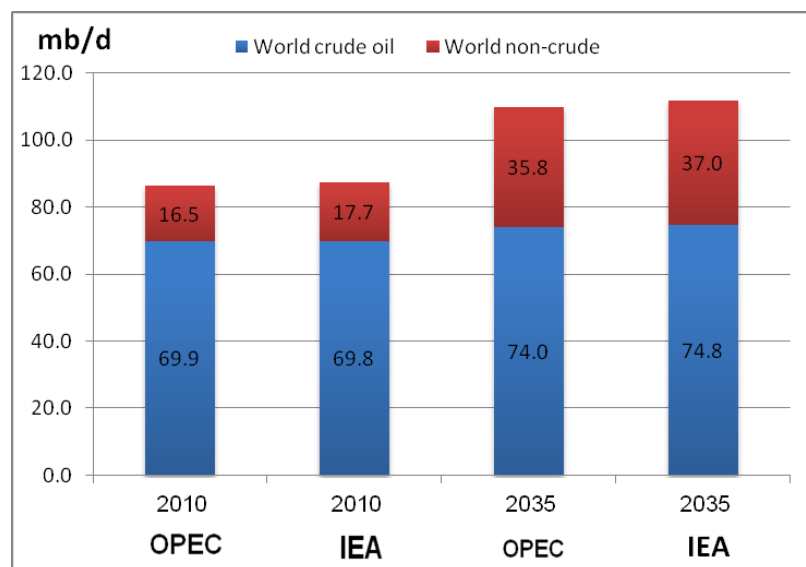
Figure (14): Long-term world oil Supply by region and type



IEA Current Policies Scenario
 Non-OPEC non-conventional includes oil sands,
 OPEC Crude includes Venezuela extra heavy oil

Both outlooks recognize that there will be a wide range of sources of oil to satisfy demand. In particular, they see non-crude liquids supply, from both OPEC and non-OPEC sources, such as non-conventional oil, condensate and NGLs and biofuels, more than doubled by 2035. Consequently, global conventional crude supply in 2035 is only 4.0 mb/d higher than 2010 level, Figure (15). On the other hand global non-crude supply in 2035 is more than 19.0 mb/b higher than 2010 level. By 2035 the demand for crude will reach 74.0 mb/d, according to OPEC's WOO and 74.8 mb/d (crude includes Venezuela extra-heavy) based on IEA WEO projection, a difference of only 0.8 mb/d.

Figure (15): Long-term world oil Supply by region and type



Crude includes Venezuela extra heavy oil

In addition to the oil supply in the Current Policies Scenario, the IEA projected oil supply under two other scenarios, New Policies and 450 Scenarios, differentiated by the underlying assumptions about government policies and oil prices. Under these scenarios, the **IEA WEO projects much lower global oil supply for both non-OPEC and OPEC regions**. Under the 450 Scenario, global oil demand peaks before 2020 at just below 90 mb/d and declines to 78 mb/d by the end of the projection period, over 8 mb/d, or almost 10%, below 2010 levels. In the 450 Scenario the demand for OPEC crude in 2035 is less than 2010 levels by more than 2 mb/d.

OPEC's WOO also presents three other scenarios as mentioned above, the lower growth scenario is assumed to be accompanied by oil prices that are lower than in the Reference Case, which could mean lower non-OPEC supply. However, under this scenario OPEC carries most of the burden resulting from the weakness in demand. In the higher growth scenario stronger growth in non-OPEC oil, both conventional and non-conventional, is projected associated with higher oil prices. In addition, the key supply response comes from OPEC. Finally, the ATTP Scenario sees OPEC crude production 10 mb/d lower than the Reference Case by 2035.

4. Remarks

This paper has identified the main differences between the IEA and OPEC's outlooks and reasons behind these differences, including areas in relation to definitions or presentation of the results.

The differences in the IEA and OPEC's projections for future energy demand especially those for oil demand can be attributed mainly to their energy and environmental policies assumptions. As these policies are one of the key drivers for the energy outlook, however they are at the same time one of the most uncertain areas for the outlooks.

Uncertainties related to energy and environmental policies constitute a significant obstacle for energy security.

For oil supply the primary difference in the IEA and OPEC's projections was over their views about non-OPEC supply. Significant differences were also seen in the oil price assumptions utilized by the IEA and OPEC.

Of course it should not be expected to reconcile the IEA and OPEC's assumptions and outlooks, but to improve clarity over how the assumptions differ and the reasoning behind these differences could prove worthwhile.

Uncertainty affecting the global economy in the short term associated with price volatility witnessed over the past years has fogged structural development making energy forecasting more difficult than ever.

In this respect, the background paper points to a number of areas where there is scope to discuss analytical issues among organisations– not necessarily to come to a common view, but to ensure a better understanding of each outlook. Examples included demand growth in some regions, such as China, India and the Middle East, impact of policies, marginal cost and price assumptions, ethane treatment, definition and availability of spare capacity, bunker fuels, biofuels, seasonality patterns in oil demand and supply, long term non-OPEC supply, processing gains, NGLs, and the links between GDP growth and oil demand.

The IEA-IEF-OPEC Symposium offers a timely opportunity for relevant energy stakeholders to discuss energy market trends (energy supply, demand and prices) and associated factors that influence these trends (environmental policies, economic conditions, technological development, etc.).