# FIFTH IEA IEF OPEC SYMPOSIUM ON ENERGY OUTLOOKS

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# INTRODUCTORY PAPER
# A COMPARISON OF RECENT IEA AND OPEC OUTLOOKS

International Energy Forum in partnership with Duke University

Duke UNIVERSITY | ENERGY INITIATIVE

This introductory paper was prepared by the IEF and Duke University in consultation with the IEA and OPEC.

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## Acknowledgements

This report was prepared by the **IEF** and the Duke University Energy Initiative, in consultation with the International Energy Agency and the Organization of the Petroleum Exporting Countries.

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## Acronyms and Abbreviations

| | |
|---|---|
| bbl | Barrel |
| CPS | Current Policies Scenario (IEA) |
| EOR | Enhanced Oil Recovery |
| FSU | Former Soviet Union |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gases |
| HEG | Higher Economic Growth Scenario (OPEC) |
| IEA | International Energy Agency |
| IEF | International Energy Forum |
| IMF | International Monetary Fund |
| kb/d | Thousand Barrels per Day |
| LEG | Lower Economic Growth Scenario (OPEC) |
| LSS | Liquid Supply Surge Scenario (OPEC) |
| LTO | Light Tight Oil |
| mb/d | Million Barrels per Day |
| mboe | Million Barrels of Oil Equivalent |
| mboe/d | Million Barrels of Oil Equivalent per Day |
| MOMR | Monthly Oil Market Report (OPEC) |
| mtoe | Million Tonnes of Oil Equivalent |
| MTOMR | Medium-term Oil Market Report (IEA) |
| NGLs | Natural Gas Liquids |
| OECD | Organisation for Economic Co-operation and Development |
| OMR | Oil Market Report (IEA) |
| OPEC | Organization of the Petroleum Exporting Countries |
| ORB | OPEC Reference Basket |
| ppm | Parts per Million |
| ROI | Return on Investment |
| R/P | Resources-to-Production |
| SPR | Strategic Petroleum Reserve |
| UN | United Nations |
| UPS | Upside Supply Scenario (OPEC) |
| URR | Ultimately Recoverable Resources |
| USGS | US Geological Survey |
| WEO | World Energy Outlook (IEA) |
| WOO | World Oil Outlook (OPEC) |

## 1. Key Observations

### 1.1 Data Harmonisation and Comparability of Outlooks

- **The joint IEA-IEF-OPEC Symposia on Energy Outlooks objective is to stimulate meaningful producer-consumer dialogue on possible energy futures.** Deepening collective understanding of underlying assumptions over short-, medium- and long-term projection periods, in particular on economic and demographic growth, as well as advancing alignment of baseline data, geographical groupings, data clusters and conversion factors contribute to enhanced comparability of outlooks.

- **Since the First IEA-IEF-OPEC Symposium on Energy Outlooks convened in January 2011 noteworthy progress has been made** in the alignment of projection periods over the short-, medium- and long-term and in the disaggregation of light-tight oil (LTO) and natural gas liquids (NGLs) from both regional and crude oil classifications[1]. Important differences, however, remain mainly in methods, fuel data and geographical classifications.

- **Differences in 2013 baseline historical data, upon which the IEA and OPEC outlooks are built, yield surprisingly high differentials.** Variations between IEA's and OPEC's world liquids demand and supply baseline data range from 1.6 mb/d for demand and 1.3 mb/d for supply. As a result the base year difference between the IEA's and OPEC's 2014, long-term outlooks for liquids demand surpasses 2 mb/d.

- **Dissimilarities in OPEC and IEA historical demand data by region have grown, and almost exclusively apply to non-OECD countries.** This mostly concerns non-OECD Asia, excluding China, the Former Soviet Union (FSU) and Africa. The IEA has revised its 2012 and 2013 baseline demand data upwards for many non-OECD countries, following the incorporation of new data sources and methodological changes in data collection and classification for oil products. Since IEA baseline demand data was already 1.1 mb/d higher than OPEC's past calculations, which were not subject to such changes, differentials have become larger.

- **Differences in IEA and OPEC historical supply data remain largely unchanged and primarily stem from non-OECD and OPEC supply.** The largest divergence resides in non-OECD supplies, most notably from Russia.

- **Issues of definition further contribute to a gap between the IEA's and OPEC's estimates of OPEC NGLs and unconventional supply.** While the IEA notes that NGLs and unconventional supply includes OPEC condensates, non-conventional sources and non-oil inputs, OPEC aggregates information on components differently.

1 WOO2014 does not use the term 'tight oil'. Instead OPEC refers to 'tight crude'. This paper refers to light tight oil (LTO) and tight oil, except when direct reference is made to OPEC classifications in WOO2014.

### 1.2 Recent Progress on Data Harmonisation and Comparability of Outlooks

- **OPEC has conducted a more comprehensive evaluation of unconventional oil plays in North America and incorporated this updated assessment into its World Oil Outlook (WOO) 2014.** This resulted in a higher estimate for supply growth potential from this region, and is now closer to the IEA's projection results.

- **OPEC has also redefined tight crude and unconventional NGLs in the WOO2014.** In the WOO2013, OPEC included a category called "tight NGLs" in the "tight crude" category rather than in the "NGLs" category. In the WOO2014, the term "tight NGLs" is abandoned. Instead, OPEC uses the term "unconventional NGLs," which are now included in the "NGLs" category. This makes OPEC's liquids categories more comparable to the IEA's.

- **Different treatment of biofuels meant that comparing regional non-OPEC supply forecasts between the IEA and OPEC was complex.** The IEA did not include biofuels in each region's total liquids supply as OPEC does. Since the last Symposium, the IEA's Medium Term Oil Market Report (MTOMR) and the monthly Oil Market Report (OMR) publish biofuels production by region separately (in table 5 and 5a for MTOMR, and table 17 of the OMR). This has enabled a direct comparison between IEA's and OPEC's liquids supply outlooks.

- **The IEA has improved its methodology for estimating historical non-OECD demand in its short-term Oil Market Report (OMR).** This however has also exposed larger differences in baseline demand data relative to OPEC. While advances to improve methods are made, outlook findings highlight that further dialogue on baselines is needed.

- **Gaps in IEA and OPEC short-term liquids demand outlooks have narrowed from 1.6 mb/d in 2013 to 1.3 mb/d in 2014 and to 1.0 mb/d in 2015.** Though identified differences in historical baseline data still impact projections, dialogue can sharpen focus on variations in perspective, such as the lower short-term demand growth estimate of IEA compared to OPEC.

### 1.3 IEA and OPEC Short-term Outlooks

- **Though OPEC and the IEA base their short-term GDP forecasts on different sources, both expect 2015 World GDP growth to exceed revised 2014 growth** by 50 and 40 basis points and reach 3.8% and 3.6%, respectively. IEA and OPEC short-term 2015 GDP forecasts are well aligned and pitched on the upside of expectations when compared to more conservative assessments from other sources.

- **The IEA lowered OECD demand projections more than growth projections for non-OECD nations.** Market factors played a larger role in downward revisions in 2Q2014 liquids demand than the methodological revisions of IEA for calculating historical demand in non-OECD countries, which may have artificially increased non-OECD historical demand data for 2012 and 2013.

- **The IEA and OPEC estimate liquids demand growth in 2014 to have been 0.6 mb/d and 0.9 mb/d, respectively, resulting in a 0.3 mb/d differential.** Though OPEC forecasts for 2014 liquids demand started lower, they were subject to fewer revisions than those of the IEA.

- **More bullish forecasts from OPEC and the IEA for liquids demand growth in 2015 amount to 0.9 mb/d and 1.2 mb/d, respectively,** which is 0.3 mb/d higher than forecasts of both organisations for 2014.

- **IEA estimates of 2014 demand growth in OECD Americas and China are more bearish than those of OPEC, as a result of the variance in short-term world liquids demand forecasts.** Though OPEC sees OECD Americas liquids demand increasing, the IEA shows negative liquids demand growth due to weak demand and increased vehicle efficiency.

- **The IEA's projection for China's liquids demand growth in 2014 is slightly lower than OPEC's 0.1 mb/d for 2014 and 2015.** Yet both organisations seem to acknowledge that China has entered a less oil-intensive development stage.

- **OPEC and IEA projections for non-OPEC supply growth started the year with a difference of 0.4 mb/d, then converged to roughly the same level by November 2014.** This trend was driven primarily by the availability of supply data. Both the IEA and OPEC have revised their projections for OECD supply upward and their projections for non-OECD supply downward.

- **IEA and OPEC project 2015 supply growth from non-OPEC countries to ease versus 2014, and expect supply growth in 2015 to be lower than that in 2014 by 0.6 mb/d and 0.3 mb/d,** respectively. This is largely as a consequence of a lower price environment.

- **Particularly for 2015 forecasts, OPEC projects stronger supply growth across OECD economies, but lower growth in Latin America than does the IEA.** Notwithstanding, a seemingly unchanged differential of 0.4 mb/d for non-OPEC supply masks some different perspectives on OECD and non-OECD supply growth between the organisations.

- **The difference between the IEA's and OPEC's estimates for 2014 OPEC supply is 0.8 mb/d and 0.6 mb/d for 2015, but these gaps are in fact more telling of differences in demand projections.** Variances between IEA and OPEC projections of OPEC supply largely reflect technical approaches rather than differences in supply perspectives.

### 1.4 IEA and OPEC Medium-term Outlooks

- **Price assumptions for OPEC and IEA medium-term outlooks differ** primarily because the IEA uses an "IEA Average Import Price" based on market information derived from the Brent futures price curve, while OPEC uses an "OPEC Reference Basket" (ORB) price derived from production-weighted average price of representative OPEC crudes driven by the cost estimates of marginal supply.

- **There is a growing differential between the IEA and OPEC price assumptions for the medium-term projection period, with IEA's oil price assumption being nearly US$20/bbl lower by the end of this decade.** However, the IEA's 2020 oil price assumptions in its long-term World Energy Outlook 2014 (WEO2014) are higher than OPEC's.

- **Neither OPEC nor the IEA had incorporated the recent oil price slide into the outlooks that are discussed in this paper,** but both have moderately lowered their expectations for short-term global economic growth, while maintaining projections for more rapid growth through to 2019.

- **The IEA projects an annual average growth of 1.3 mb/d in global liquids demand, reaching 100 mb/d by the end of 2019.** OPEC is slightly more conservative and projects the demand growth rate to be around 1.0 mb/d per year.

- **Leading differences between IEA and OPEC medium-term outlooks, similar to short-term projections, arise from non-OECD nations.** This is due to varying historical demand data and the IEA's more bullish view on non-OECD liquids demand growth. In regard to OECD liquids demand, the IEA and OPEC have almost identical declining projections.

- **OPEC and IEA highlight new milestones that show how global oil markets are transforming over the medium- and long-term.** The IEA suggests that non-OECD countries should have overtaken OECD nations in oil demand in 2014, while OPEC projects this will occur in 2015. Due to competition from other fuels, environmental concerns and energy efficiency gains, the IEA projects that non-OECD oil demand growth will markedly decelerate in the 2030s, a time when China's oil demand level is projected to plateau.

- **Comparison of the OPEC and IEA medium-term liquids demand outlooks for regions show most substantial differences appear in the Middle East, Africa and Latin America.** Direct comparison of these three regions remains challenging because the IEA and OPEC maintain different regional definitions.

- **IEA disaggregates medium-term liquids demand by sector. The transportation sector continues to dominate, accounting for more than half of demand over the medium term.** Liquids demand in the petrochemical sector will continue to grow fastest while demand in the residential and power sector will continue to decline. OPEC focuses on long-term trends in demand by sector, but does give projections for 2015 and 2020.

- **Both OPEC and IEA take a "bottom-up" approach of assessing field-level supply capabilities for each country.** However, they may take different upstream oil production projects into account and estimate different levels of productivity.

- **IEA and OPEC have distinct liquids classification systems that make comparison of projections less straight forward.** The two institutions continue to differ in their categorisation of certain types of unconventional oil.

- **Both OPEC and IEA expect the pace of non-OPEC production growth to decelerate in 2014.** Non-OPEC supply growth is likely to slow down further as a consequence of a substantially changed price environment that had not been fully taken into account at the time these assessments were made.

- **The IEA's projection for OECD Americas supply growth is slightly higher than OPEC's and contributes to a 0.5 mb/d projection difference by 2019 that can be attributed to diverging projections on Mexican supply potential.** OPEC is more bullish about supply growth from Latin America, leading to a 0.5 mb/d difference by the end of the projection period, but sees Mexican production levels decline from 2.9 mb/d in 2013 to 2.4 mb/d in 2019, unlike IEA which remains more bullish.

- **OPEC and IEA projections for non-OPEC supply are largely similar, and forecasts converge by the end of the projection periods.** This is despite technical differences such as a higher implied estimate by IEA of OPEC crude and a differential of 0.7 mb/d in historical data.

- **Despite last year's diverging projections for medium-term oil supply for the United States and Canada, both the IEA and OPEC project oil supplies to reach 18.3 mb/d by 2019.**

### 1.5 IEA and OPEC Long-term Outlooks

- **The IEA and OPEC long-term outlooks, while both extending to 2040, are based on 2012 and 2010, respectively.** To enhance comparability, this background paper uses 2012 as the baseline for liquids and 2010 for other fuels.

- **Only the IEA's Current Policy Scenario is compared with OPEC's Reference Case Scenario.** This is despite the fact that the latter scenario may now include policies that are not yet legally binding and that IEA's narrative on long-term outlooks centres around the New Policy Scenario, which takes into account policies that are not yet enacted.

- **Many challenges remain in comparing the IEA's and OPEC's long-term outlooks, due to the varied baseline data and assumptions made, yet overall assumptions on population and GDP growth are largely similar.**

- **Difficulties remain in comparing GDP growth rate assumptions for the same region or country between the IEA and OPEC.** The IEA uses 2012 while OPEC uses 2014 as the baseline to calculate compound average annual growth. The use of different time intervals over the outlook period further complicates comparison with OPEC.

- **OPEC and the IEA have similar growth rate projections for the world and OECD nations in both the medium- and the long-term, but the two organisations diverge greatly on China's long-term growth rate.** The IEA has a much lower estimate for China's growth rate (4.1%) relative to OPEC (5.3%) between 2021 and 2040. Nonetheless, both the IEA and OPEC project that China's total GDP in 2040 will exceed each of the three OECD sub-regions.

- **Gaps between the IEA and OPEC long-term oil price assumptions are largest when comparing the OPEC's Reference Case with IEA's Current Policies Scenario.** The latter has the highest oil price assumptions due to higher oil demand projections derived from its model. This leads to gaps of US$21/bbl and US$53/bbl relative to OPEC's Reference Case in 2020 and 2040, respectively.

- **OPEC projects a 60% increase in world total primary energy demand in 2040 relative to 2010, which is moderately higher than the IEA's projection of a 55% increase.** Overall, primary energy demand projections in OPEC's Reference Case are closest to the IEA's Current Policies Scenario.

- **The most notable differences between the OPEC's and IEA's long-term projections lies in the composition of the fossil fuel mix.** The IEA's projection for total natural gas supply in 2040 is 16 mboe/d lower than OPEC's, while its outlooks for oil and coal supply are both 7 mboe/d higher than OPEC's. The share of renewables is projected to increase from 13% in 2013 to 16% by 2040 in OPEC's Reference Case, and to 15% in the IEA's Current Policies Scenario

- **In both the IEA's Current Policies Scenario and OPEC's Reference Case, oil cedes its leading position in primary energy consumption to coal by 2040.** The IEA Current Policies Scenario projects the share of oil will decline from 32% in 2010 to 27% in 2040, while OPEC projects a drop from 32% to 24%.

- **Oil demand enjoys robust growth over long-term IEA and OPEC projection periods. However, both the IEA and OPEC estimate much slower annual demand growth after 2020, relative to this decade.** In the IEA's Current Policies Scenario, world liquids demand reaches 120.0 mb/d by 2040, 8.9 mb/d higher than OPEC's Reference Case projection of 111.1 mb/d.

- **OPEC and IEA both project that OECD countries will experience a decline in long-term oil demand, yet this decrease is expected to be more than offset by robust demand growth in non-OECD regions.** The centre of demand growth continues to shift to developing countries, with non-OECD nations' share of total oil demand increasing from roughly 50% to around 65% over the course of both outlooks.

- **For individual regions and nations, the IEA and OPEC share similar views on overarching trends.** The Middle East (including OPEC Countries) emerges as an important growth centre, with Middle East demand growth approaching that of China and India. The largest declines under both projections occur in OECD Americas, where more stringent fuel economy standards help reduce demand.

- **Notwithstanding its higher global liquids supply forecast in the Current Policies Scenario, the IEA's supply outlook for Europe and Eurasia is almost 3 mb/d lower than OPEC's forecasts.** This projected level of production is lower than current production levels, with the largest declines coming from Russia.

- **The IEA's forecasts compared to OPEC's are substantially more bullish for OECD Americas and OPEC NGLs/unconventionals.** OECD Americas boasts abundant unconventional resources, led by LTO in the United States and oil sands in Canada. This may be in part due to the considerably higher oil price assumptions in IEA's WEO2014 relative to OPEC's WOO2014, noting that their long-term supply projection methodologies remain very different.

- **OPEC's share of global supply rises from the current level of around 40% to roughly 45% by 2040 under the IEA's Current Policies Scenario and OPEC's Reference Case.** In another similarity, both project fairly steady production levels from non-OPEC conventional crude & NGLs supply, but the share of liquids from these sources falls substantially due to increasing total supplies. The IEA projects that these liquids will fall from 49% of total supply in 2013 to 34% in 2040, while OPEC projects a decline from 50% in 2013 to 40% in 2040.

## 2. Background and Introduction

The IEA and OPEC are two important players in the global energy dialogue. Each year, they guide decision-makers by providing a variety of energy data, projections and analyses. Both organisations track global energy market dynamics to produce short-, medium- and long-term energy outlooks, offering their insights into how the energy market may evolve.

In light of the importance of these outlooks and their influence on decisions taken by policymakers, corporate executives, investors and other stakeholders, the Joint Statement of the 22 June 2008 Jeddah Energy Meeting called for shared analyses of oil market trends and outlooks. Attachment II of the Cancún Ministerial Declaration (March 2010), which identifies specific areas for IEA-IEF-OPEC cooperation on numerous fronts, outlined the terms for trilateral collaboration with regard to energy outlooks and other areas. Attachment II recognised the IEF's role as a platform for sharing insights and exchanging views about energy market trends, and called for the three organisations to organise an annual Symposium on Energy Outlooks at the IEF Secretariat.

The IEA-IEF-OPEC Symposium on Energy Outlooks began in 2011 and has been held at the IEF Secretariat for four consecutive years. The past symposia convened both leadership and technical experts from all three organisations to discuss the potential for data harmonisation efforts that help make the IEA and OPEC Outlooks more directly comparable.

The IEA-IEF-OPEC Symposia on Energy Outlooks stimulate meaningful producer consumer dialogue by facilitating the comparison of different outlooks.

The Fifth IEA-IEF-OPEC Symposium on Energy Outlooks will be held on 23 March 2015, and is intended to further discussions on a better understanding of consensus and divergence between energy outlooks released by the IEA and OPEC. As with prior gatherings, the Fifth Symposium will also highlight where progress has been made on data harmonisation, and where additional enhancements are needed. The dialogue will be held among key market actors, policymakers and stakeholders from both the public and private sectors.

Attachment II of the Cancún Declaration calls for the IEF, in consultation with the IEA and OPEC, to produce an introductory paper to help frame discussions at the Symposium. This paper is prepared for the Fifth IEA-IEF-OPEC Symposium on Energy Outlooks for this purpose. The paper compares the IEA's and OPEC's short-, medium- and long-term energy outlooks published in 2014[2], with the following four objectives:

- To identify key similarities and divergences between the IEA's and OPEC's projections for energy demand and supply over various time horizons;
- To better understand the major differences between the IEA's and OPEC's historical data, assumptions, definitions and methodologies that contribute to their distinct views on energy outlooks;
- To highlight efforts that have been made to improve the comparability of the outlooks; and
- To mark areas that would benefit from further progress on harmonisation[3].

2 A major oil market shift occurred after the publication of the IEA's June 2014 MTOMR. This shift, among other issues, is taken into account in the IEA's MTOMR published in February 2015. The latter report, together with the IEA's OMRs and OPEC's MOMRs published in 2015, remain outside the scope of the comparative analysis.

3 Harmonisation efforts focus on deepening understanding of the baseline data, assumptions, conversion and other factors applied to enhance the comparability among different energy outlooks. Making the variety of insights that shape distinct energy outlooks more transparent informs and stimulates dialogue.

On the topic of harmonisation, the introductory paper published in January 2014 for the Fourth IEA-IEF-OPEC Symposium on Energy Outlooks identified opportunities to enhance the comparability of the outlooks between the IEA and OPEC.

- Differences in historical data, particularly in non-OECD demand and OPEC supply for natural gas liquids(NGLs) and unconventional liquids;
- Variations in geographical definitions;
- Categorisation of liquids supply;
- Unit conversion processes across million barrels per day (mb/d), million barrels of oil equivalent per day (mboe/d) and million tonnes of oil equivalent (mtoe);
- Differences of perceptions regarding unconventional oil production potential;
- Methods in forecasting medium- and long-term oil prices; and
- Long-term oil supply projection models.

During the past year, the IEA and OPEC have both made progress on several of the above-mentioned issues. For example, OPEC has conducted a more comprehensive evaluation of unconventional oil plays in North America and incorporated this updated assessment into its World Oil Outlook (WOO) 2014. This resulted in a higher estimate for supply growth potential from this region, and is now closer to the IEA's projection results. In addition, OPEC redefined tight crude and unconventional NGLs in WOO2014, which makes its liquids categories more comparable to the IEA's. For its part, the IEA has improved the methodology for estimating historical non-OECD demand in its short-term Oil Market Report (OMR), leading to larger discrepancies in baseline demand data relative to OPEC. Different treatment of biofuels meant that comparing regional non-OPEC supply forecasts between the IEA and OPEC was complex. Following the last Symposium, the IEA's Medium Term Oil Market Report (MTOMR) and the monthly Oil Market Report (OMR) now both present biofuels production by region separately. This has enabled a direct comparison between IEA's and OPEC's liquids supply outlooks. These efforts reflect the cooperation of the IEA and OPEC and the practice established to discuss and review their methods and approaches. More details regarding these changes will be provided below.

During the past year, the IEA and OPEC have both made progress to enable direct comparison between outlooks.

Section 2 examines differences in the 2013 historical base year data that sets the stage for the IEA and OPEC outlooks. Sections 3, 4, and 5 of this introductory paper compare the short-, medium- and long-term outlooks issued by the IEA and OPEC, respectively. Table 1 lists the publications used for comparison herein. On a related note, the IEA Medium Term Oil Market Report (MTOMR) was published in June 2014, which yields a five-month gap versus the release of its counterpart: OPEC's WOO2014. The last section concludes with main findings in this paper and expectations for future harmonisation efforts.

**Table 1. List of IEA and OPEC Outlooks Analysed in this Introductory Paper**

| | IEA | OPEC |
|---|---|---|
| **Short-term** | Oil Market Report (OMR), published December 2014 | Monthly Oil Market Report (MOMR), published December 2014 |
| **Medium-term** | Medium-Term Oil Market Report (MTOMR), published June 2014 | World Oil Outlook (WOO 2014), published November 2014 |
| **Long-term** | World Energy Outlook (WEO), published November 2014 | World Oil Outlook (WOO), published November 2014 |

Despite progress, differences in historical baseline data-sets that IEA and OPEC used to build their outlooks remains a significant issue.

## 3. Baseline 2013 Data

Despite the progress made to date, a number of issues on the outlooks harmonisation agenda remain. One significant issue is baseline historical data, upon which the various outlooks build their projections. **Table 2, Table 3,** and **Table 4** respectively provide comparisons of the IEA's and OPEC's base year (2013) demand, supply and stock change data, using the IEA's and OPEC's December OMR and MOMR, respectively. As Table 2 and Table 3 show, the differences in world liquids demand and supply baseline data are surprisingly high this year, diverging by 1.6 mb/d for demand and 1.3 mb/d for supply, larger than the differences we identified last year.

In last year's assessment, we also noted that the IEA has different base year data between its OMR and WEO reports. This issue remains, but the difference has been reduced from 0.8 mb/d to 0.3 mb/d – the IEA's estimate for liquids demand in 2013 is 91.8 mb/d in its December OMR and 92.1 mb/d in WEO2014.[4] OPEC has more consistent base year oil demand data in its WOO2014 and MOMR. As a result, the base year difference between the IEA and OPEC's long-term outlooks for liquids demand surpasses 2 mb/d. These differences shed light on the different methodologies used by the IEA and OPEC in demand calculation.

Historical differences between IEA and OPEC baseline data mostly arise from non-OECD countries.

**Table 2** also provides details on the IEA's and OPEC's estimates for regional baseline demand data. Similar to last year's assessment, the historical difference is almost completely due to non-OECD countries, particularly from non-OECD Asia excluding China, Former Soviet Union nations (FSU) and Africa.

The IEA has made large upward adjustments to its baseline data due to methodological changes in calculating non-OECD demand. Since the August 2014 OMR, the IEA Annual Statistical Supplement and Annual Energy Statistics were incorporated into oil demand estimates for non-OECD countries, adding to existing information sources (i.e. national statistics, JODI data and other reports). In addition, the IEA has developed new methods in data collection and classification for oil products, which the IEA suggests will improve demand assessments for non-OECD countries. As a result, many non-OECD countries' baseline demand data in both 2012 and 2013 have been revised upwards. Countries that have seen the largest upward revisions include India, Libya, Egypt and Russia. More details

4 For world oil demand, the figure reported in WEO2014 is 91.4 mb/d, which yields 92.1 mb/d after converting biofuels from an energy-equivalent basis to volumetric basis.

about these methodology changes can be found in the IEA's August 2014 OMR.

In contrast, OPEC's estimates for the world and non-OECD liquids demand in 2013 have not changed much during the past year. Since the IEA's baseline demand data was already 1.1 mb/d higher than OPEC's in last year's assessment, the IEA's upward revision for non-OECD demand further enlarges this IEA-OPEC difference.

### Table 2. Liquids Demand in 2013 (mb/d)

| | IEA | OPEC | DIFFERENCE (IEA - OPEC) |
|---|---|---|---|
| Total OECD | 46.1 | 46.0 | 0.1 |
| OECD Americas | 24.1 | 24.1 | 0.0 |
| OECD Europe | 13.6 | 13.6 | 0.0 |
| Asia Oceania | 8.3 | 8.3 | 0.0 |
| Total Non-OECD | 45.6 | 44.2 | 1.4 |
| Asia | 22.0 | 21.1 | 0.9 |
| China | 10.1 | 10.1 | 0.0 |
| Other non-OECD Asia | 11.9 | 11.1 | 0.8 |
| Middle East | 7.9 | 7.8 | 0.1 |
| Latin America | 6.6 | 6.5 | 0.1 |
| FSU | 4.7 | 4.5 | 0.2 |
| Europe | 0.6 | 0.6 | 0.0 |
| Africa | 3.8 | 3.6 | 0.2 |
| World | 91.8 | 90.2 | 1.6 |

***Table 2 data sources:*** *IEA Dec 2014 OMR, Table 1; OPEC Dec 2014 MOMR, Table 4.1 and 4.6.*

***Table 2 note:*** *Columns may not sum to total due to rounding.*

As for world oil supply, Table 3 shows that the IEA-OPEC difference in 2013 data primarily lies in non-OECD countries and in OPEC supply. The largest difference from the non-OECD regions stems from the FSU nations, in particular Russia. Since the last Symposium, the IEA has made efforts to account for and explain the discrepancies in FSU supplies. IEA includes Russian gas plant NGLs and supply source specific conversion factors that make up the bulk of the difference.

Comparing IEA's and OPEC's regional non-OPEC supply forecast is challenging because of their different treatment of biofuels.

Different treatment of biofuels meant that comparing regional non-OPEC supply forecasts between the IEA and OPEC was complex. Comparing regional non-OPEC supply forecasts between the IEA and OPEC was challenging because of the organisations' different treatment of biofuels. While OPEC includes biofuels in each region's total liquids supply, the IEA does not. Since the last Symposium, the IEA's Medium Term Oil Market Report (MTOMR) and the monthly Oil Market Report (OMR) have published biofuels production by region separately (in table 5 and 5a for MTOMR, and table 17 of the OMR). This has enabled a more

direct comparison between IEA's and OPEC's liquids supply outlooks. This paper refers to the IEA's MTOMR for regional biofuels supply data – both historical and forecast data – and adds those data to each region's oil supply data as featured in the IEA OMR.

There is a gap between OPEC's and IEA's estimates of OPEC NGLs and unconventionals supply due to the different definitions applied.

Regarding supply from OPEC countries, there is a notable gap between the IEA's and OPEC's estimates of OPEC NGLs and unconventionals supply. This large divergence may result from different definitions for this category. IEA reports in its OMR that NGLs and unconventionals supply includes OPEC condensates, oil from non-conventional sources (e.g. Venezuelan Orimulsion) and non-oil inputs to Saudi Arabian methyl tertiary butyl ether (MTBE), while OPEC provides more aggregated information of the components in this category. Compared to NGLs and unconventionals, the difference in OPEC crude estimates between the two institutions is more modest.

Due to the IEA's larger gap between oil supply and demand data, IEA reports a deeper decline in stock change than OPEC.

**Table 4** presents stock changes and other items that account for the difference between supply and demand data in the IEA and OPEC reports. Both the IEA and OPEC report data on commercial oil stock changes and strategic petroleum reserve (SPR) changes from reporting OECD countries. "Oil-on-water" is oil in floating storage and in water transit. The remainder of the gap between total supply and total demand is allocated to a "miscellaneous to balance" item, which covers both stock changes in non-OECD countries and other items. As Table 4 shows, the IEA reports a deeper decline in stock change than OPEC, due to the IEA's larger gap between oil supply and demand data. Since the IEA and OPEC have similar estimates about OECD stock and "Oil-on-water" items, the difference in total stock change is thus reflected in the constructed "miscellaneous to balance" item.

## Table 3. Liquids Supply in 2013 (mb/d)

| | IEA[a] | OPEC | DIFFERENCE (IEA - OPEC) |
|---|---|---|---|
| Total OECD | 22.1 | 22.2 | -0.1 |
| OECD Americas | 18.1 | 18.1 | 0.0 |
| OECD Europe | 3.5 | 3.6 | 0.0 |
| Asia Oceania | 0.5 | 0.5 | 0.0 |
| Total Non-OECD | 30.4 | 29.9 | 0.4 |
| Asia | 7.8 | 7.8 | 0.0 |
| China | 4.2 | 4.2 | 0.0 |
| Other non-OECD Asia | 3.6 | 3.6 | 0.0 |
| Middle East | 1.4 | 1.4 | 0.0 |
| Latin America | 4.8 | 4.8 | 0.0 |
| FSU | 13.9 | 13.4 | 0.5 |
| Europe | 0.1 | 0.1 | 0.0 |
| Africa | 2.3 | 2.4 | -0.1 |
| Processing gains | 2.2 | 2.1 | 0.1 |
| Total Non-OPEC | 54.7 | 54.2 | 0.5 |
| Total OPEC | 36.7 | 35.8 | 1.0 |
| OPEC crude | 30.5[b] | 30.2 | 0.3 |
| OPEC NGLs + unconventionals | 6.3 | 5.6 | 0.7 |
| World | 91.4 | 90.0 | 1.4 |

***Table 3 data sources:*** *IEA Dec 2014 OMR, Table 1; IEA MTOMR Table 5 and Table 5a; OPEC Dec 2014 MOMR, Table 5.1 and 10.3.*

***Table 3 notes:*** *Columns may not sum to total due to rounding.*

*IEA[a] Biofuels from IEA MTOMR 2014 are added to IEA regional oil supply data for comparability with OPEC estimates [b] IEA's "OPEC NGLs" includes condensates, oil from non-conventional sources (e.g. Venezuelan Orimulsion) and non-oil inputs to Saudi Arabian MTBE.*

### Table 4. Stock Change and Miscellaneous Items (2013-2012) (mb/d)

| | IEA | OPEC | DIFFERENCE (IEA - OPEC) |
|---|---|---|---|
| Reported OECD | -0.2 | -0.2 | 0.0 |
| Industry/commercial | -0.2 | -0.3 | 0.1 |
| Government/SPR | 0 | 0.1 | -0.1 |
| Oil-on-water | 0.1 | 0.1 | 0.0 |
| Miscellaneous to balance [a] | -0.3 | -0.1 | -0.2 |
| Total stock change & misc. | -0.4 | -0.2 | -0.2 |

***Table 4 data sources:*** *IEA Dec 2014 OMR, Table 1; OPEC Dec 2014 MOMR, Table 10.3.*

***Table 4 notes:*** *Columns may not sum to total due to rounding. Miscellaneous to balance[a]: is computed as the difference between total OPEC stock change/misc. and other reported stock changes.*

## 3.1 Short-term Energy Outlooks

Short-term oil market reports from the IEA and OPEC forecast energy demand and supply up to 18 months in the future based on regular monitoring of respectively, macroeconomic and energy market conditions, technology, and policy developments. Monthly oil market reports also include statistics and analyses of other topics, which we do not focus on in this paper, such as fluctuations in benchmark oil prices, oil stocks, movements in product markets, and trade flows. Both the IEA and OPEC capture market-moving events and offer in-depth analyses in their respective reports. In this section, we summarise and compare their perspectives on short-term macroeconomics, as well as oil demand and supply outlooks[5].

5 Though this introductory paper compares data from the December 2014 oil market reports, all 2014 monthly reports from both organisations were reviewed to assess how their views evolved throughout the year.

## 3.2 Economic Growth Assumptions

IEA short-term GDP forecasts are guided by IMF's projections. OPEC makes its own GDP projections based on a modelling approach.

The IEA and OPEC take different approaches for short-term GDP forecasts. The IEA primarily refers to the IMF's projections published in the World Economic Outlook and the World Economic Outlook Updates; occasionally, the IEA makes minor adjustments to the IMF forecasts in its OMRs. Unlike the IEA, OPEC has established its own GDP projection based on a modelling approach.

Both IEA's and OPEC's short-term GDP forecasts are pitched on the upside of analysts' expectations for 2015.

As in several recent years, 2014 economic performance in both developing and developed countries was lower than forecasted expectations. Both the IEA's and OPEC's 2014 economic growth estimates in the December 2014 monthly reports are lower than the forecasts made a year ago. The IMF has made downward adjustments to forecasted world GDP growth for four consecutive years, due to lingering problems from the global financial crisis in developed countries and a lower growth potential in developing countries. Nonetheless, both the IMF (used by IEA) and OPEC have confidence that the global recovery will continue. As Table 5 shows, the IMF and OPEC expect 2015 GDP growth to exceed 2014 growth by 50 and 40 basis points, respectively. The IMF's 3.8% world GDP growth rate forecast for 2015 is higher than the OPEC's estimate of 3.6%. This difference is not particularly significant when comparing a broader range of GDP forecasts. For example, the United Nations and World Bank have less optimistic views on short-term growth prospects, with 2015 GDP growth forecasts of 3.2%[6] and 3.4%[7] in their most recent economic outlook publications. These discrepancies in growth forecasting result from different perspectives on future growth along with differing methods for calculating GDP.

### Table 5. Short-term Global GDP Growth Assumptions

| | 2014 | 2015 |
|---|---|---|
| IEA (IMF) | 3.3% | 3.8% |
| OPEC | 3.2% | 3.6% |

***Table 5 data sources:*** *IMF World Economic Outlook Oct 2014, Table 1.1; OPEC Dec 2014 MOMR, Table 3.1.*

Some variations in major economies are worth noting. For example, OPEC's 2015 GDP growth forecasts for the United States and India (2.6% and 5.8%, respectively) are substantially lower than the IMF's estimates (3.1% and 6.4%, respectively), while OPEC's growth forecast for Japan (1.2%) is more optimistic than the IMF's (0.8%).

6 United Nations, World Economic Situation and Prospects Update (New York: United Nations, mid-2014), 1.

7 World Bank, Global Economic Prospects (Washington, DC: World Bank, June 2014), 4.

### 3.3 Short-term Liquids Demand

IEA revised downward forecast for 2014 global liquids demand growth from 1.3 mb/d to 0.6 mb/d over 2014.

Both the IEA and OPEC revise their short-term liquids demand forecasts monthly, based on market and policy movements, as well as comparison between actual data and changes in macroeconomic conditions. In addition, they sometimes revise the methodology of demand calculation for specific regions, which may also result in changes to demand forecasts. As Figure 1 illustrates, the IEA has consistently revised downward its forecasts for 2014 global liquids demand growth since July 2014, decreasing demand growth from 1.3 mb/d at the start of 2014 to 0.6 mb/d by December 2014.

The green dotted line and dash line in Figure 1 shows that this curtailment comes from both OECD and non-OECD regions. For several non-OECD countries, the IEA has revised its calculation method for historical demand, as mentioned in Section 2, leading to higher overall non-OECD historical demand data in both 2012 and 2013. This higher baseline demand data may artificially moderate the growth forecast for non-OECD countries. However, market factors played a larger role in the downward adjustment. For OECD regions, the 2Q14 liquids demand was unexpectedly weak, and the IMF lowered its expectations for 2014 global economic growth. The IEA lowered OECD demand projections more substantially than growth projections for non-OECD nations.

OPEC demand growth forecast started lower and were more stable compared to IEA.

In contrast, OPEC's forecasts for 2014 liquids demand growth started lower and were more stable compared to the IEA. In response to the lower-than-expected liquids demand, OPEC only cut the world total demand growth in 2014 by 0.2 mb/d in December, entirely from the OECD regions, as shown by the blue dash line. As of the December 2014 OMR and MOMR, the IEA and OPEC estimate demand growth in 2014 to be 0.6 mb/d and 0.9 mb/d respectively, resulting in a 0.3 mb/d differential.

**Figure 1. Revisions of 2014 World Liquids Demand Growth Estimates**

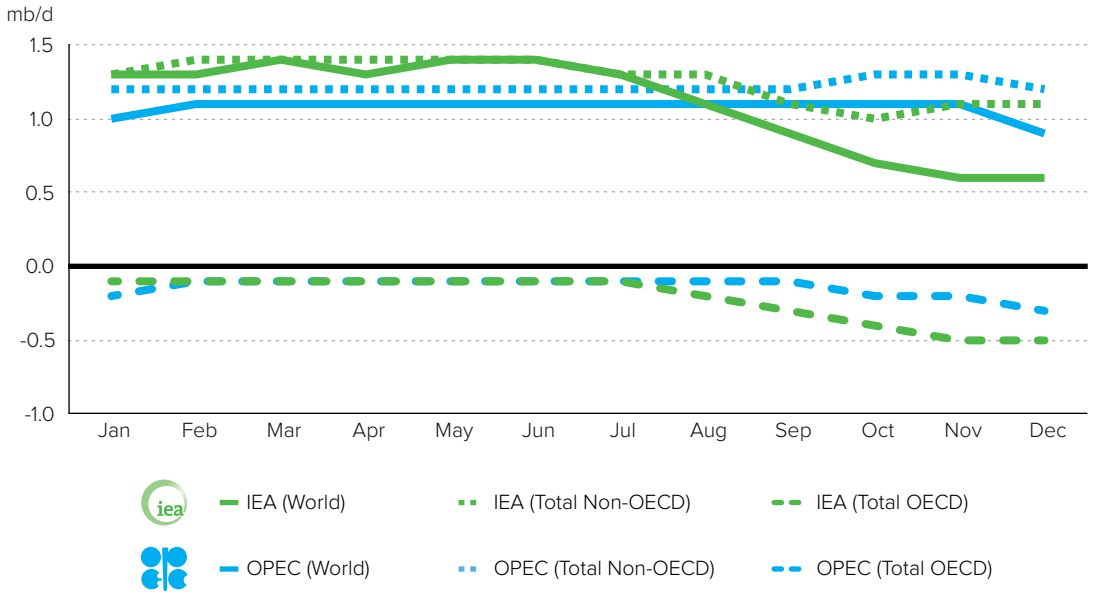



***Figure 1 data sources:*** *IEA Jan–Dec 2014 OMR, Table 1; OPEC Jan–Dec 2014 MOMR, Table 10.3.*

IEA and OPEC have more bullish demand growth forecast in 2015 estimated at 0.9 mb/d and 1.2 mb/d respectively.

Looking forward, both the IEA and OPEC have more bullish forecasts for demand growth in 2015, estimating 0.9 mb/d and 1.2 mb/d, respectively. And both projections are 0.3 mb/d higher than the growth estimates for 2014 – largely underpinned by more optimistic economic outlooks. Nonetheless, the IEA's demand growth forecast for 2015 is still 0.3 mb/d lower than OPEC's projection.

Divergent perspectives on liquids demand growth in 2014 and 2015, coupled with historical data differences, explain the gaps between the IEA's and OPEC's liquids demand projections for 2014 and 2015. As Figure 2 shows, the gap created by historical demand differences shrinks from 1.6 mb/d in 2013 to 1.3 mb/d in 2014 and to 1.0 mb/d in 2015. This reduced gap in total world liquids demand masks the IEA's lower projection for demand growth in both 2014 and 2015.

**Figure 2. Short-term World Liquids Demand: 2012-2014**

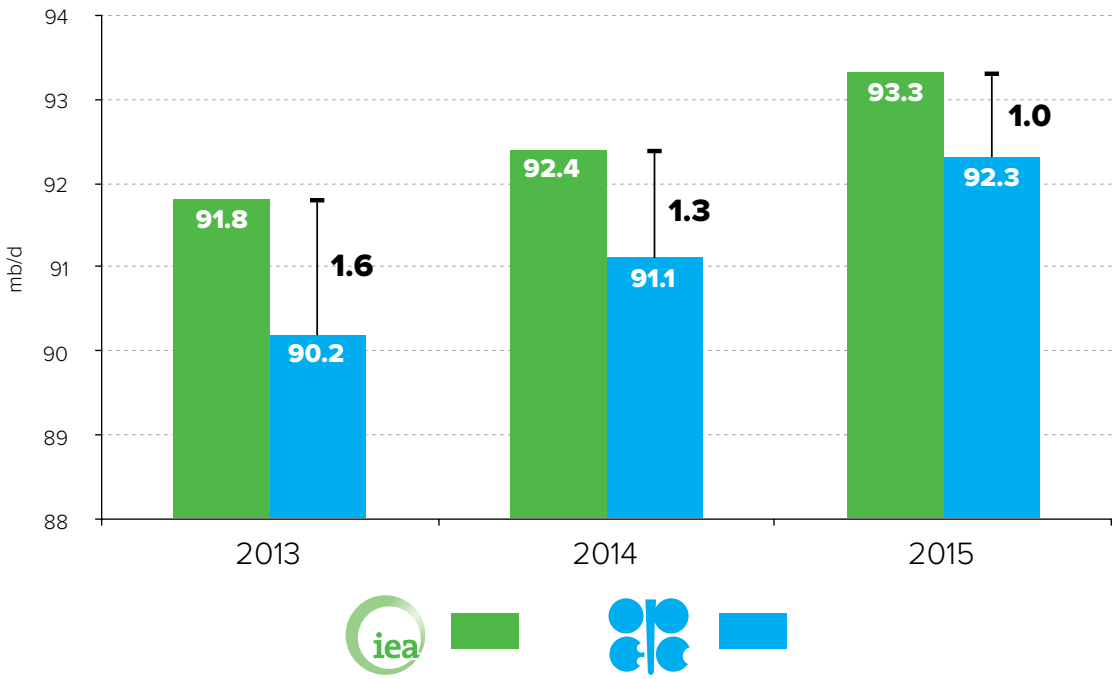



***Figure 2 data sources:*** *IEA Dec 2014 OMR, Table 1; OPEC Dec 2014 MOMR, Table 1.*

***Figure 2 note:*** *2013 is historical data and 2014/2015 are projections.*

OPEC's and IEA's regional liquids demand outlooks for 2014 and 2015 vary greatly in regions with large historical data differences.

The IEA's and OPEC's regional liquids demand outlooks for 2014 and 2015, as well as the projection differences between them, are summarised in **Table 6.** These short-term demand outlooks vary in regions that have large differences in historical data – particularly in non-OECD Asia excluding China **(see Table 2)**. This reinforces our view on the impact of historical differences on projections.

Different growth estimates for 2014 and 2015 further contribute to regional differences.

In addition, different growth estimates for 2014 and 2015 contribute to several regional discrepancies shown in **Table 6**. In particular, **Figure 3** shows that the IEA's estimates for demand growth in OECD Americas and China in 2014 are more bearish than OPEC's. The IEA believes that OECD Americas has experienced negative demand growth in 2014, while

Both outlooks show higher demand growth for North America liquids in 2015. However, OPEC is more upbeat than the IEA, which notes demand slowing on efficiency gains.

OPEC estimates an increase in the region. OPEC expects positive demand growth for the region for 2014, in line with EIA data, and that low prices will have a more pronounced effect on OECD America's oil consumption compared to other OECD regions. In the IEA's assessment, OECD Americas' annual demand growth is primarily affected by unexpectedly low oil deliveries in 2Q14. IEA also cites weak demand in this region due to increased vehicle efficiency. For other OECD countries, both the IEA and OPEC expect liquids demand to decline further in both 2014 and 2015.

Regarding non-OECD regions, both the IEA and OPEC believe they will continue to lead global demand growth, particularly non-OECD Asia, followed by the Middle East and Africa. The IEA's projection for China's liquids demand growth in 2014 is slightly lower than OPEC's, but they both acknowledge that China has entered a less oil-intensive development stage, and the country is transitioning towards a more service-oriented economy. Moreover, the IEA has lower projections for 2015 demand growth in other non-OECD nations—mainly the FSU region.

### Table 6. Short-term Liquids Demand Forecasts (mb/d)

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | IEA | OPEC | DIFFERENCE (IEA-OPEC) | IEA | OPEC | DIFFERENCE (IEA-OPEC) |
| Total OECD | 45.6 | 45.7 | -0.1 | 45.6 | 45.6 | 0.0 |
| OECD Americas | 24.0 | 24.2 | -0.1 | 24.1 | 24.3 | -0.2 |
| OECD Europe | 13.5 | 13.4 | 0.1 | 13.4 | 13.3 | 0.1 |
| Asia Oceania | 8.1 | 8.2 | -0.1 | 8.0 | 8.0 | 0.0 |
| Total Non-OECD | 46.7 | 45.4 | 1.3 | 47.7 | 46.6 | 1.1 |
| Asia | 22.4 | 21.7 | 0.7 | 23.1 | 22.3 | 0.9 |
| China | 10.3 | 10.4 | -0.1 | 10.6 | 10.7 | -0.1 |
| Other non-OECD Asia | 12.1 | 11.3 | 0.8 | 12.5 | 11.5 | 1.0 |
| Middle East | 8.1 | 8.1 | 0.0 | 8.3 | 8.4 | -0.1 |
| Latin America | 6.8 | 6.7 | 0.1 | 6.9 | 6.9 | 0.0 |
| FSU | 4.8 | 4.6 | 0.3 | 4.6 | 4.6 | 0.0 |
| Europe | 0.7 | 0.7 | 0.0 | 0.7 | 0.7 | 0.0 |
| Africa | 3.9 | 3.7 | 0.2 | 4.1 | 3.8 | 0.3 |
| World | 92.4 | 91.1 | 1.3 | 93.3 | 92.3 | 1.0 |

Both IEA and OPEC believe that non-OECD regions will continue to lead global demand growth, particularly non-OECD Asia.

***Table 6 data sources:*** *IEA Dec 2014 OMR, Table 1; OPEC Dec 2014 MOMR, Table 4.1 & Table 4.6*

***Table 6 note:*** *Columns may not sum to total due to rounding.*

## Figure 3. Short-term Liquids Demand Annual Growth

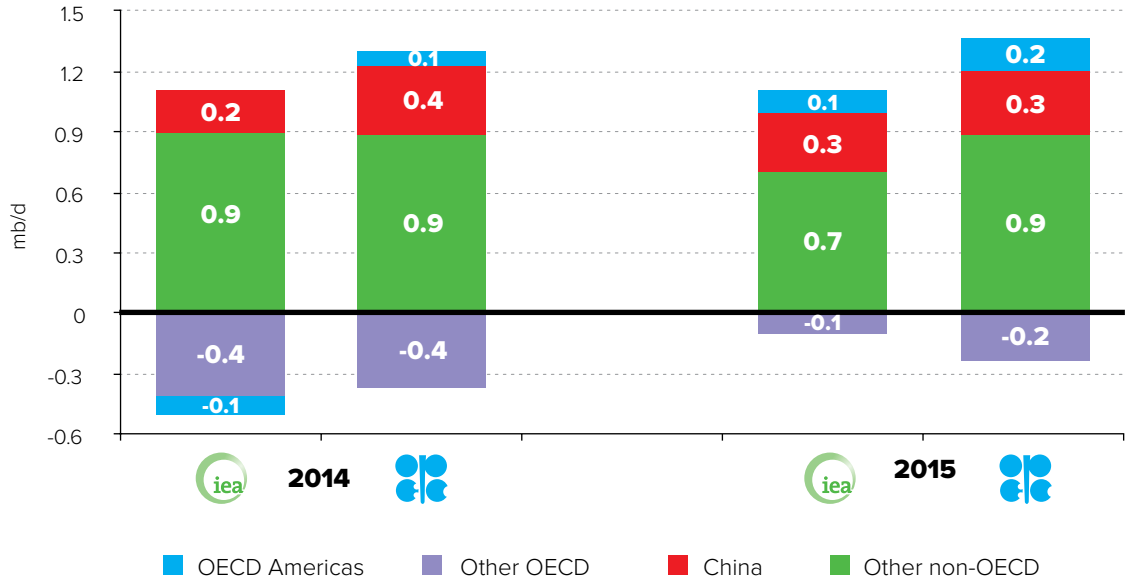



***Figure 3 data sources:*** *IEA Dec 2014 OMR, Table 1; OPEC Dec 2014 MOMR, Tables 4.1 and 4.2.*

## 3.4 Short-term Liquids Supply

IEA's and OPEC's short-term supply growth projections for non-OPEC countries have converged as more complete data-sets are now available.

As in their demand forecasts, the IEA and OPEC have evolving views regarding non-OPEC liquids supply growth in 2014. Figure 4 reveals two noteworthy trends. First, IEA and OPEC projections for total non-OPEC supply growth (shown as the solid lines) began the year with a difference of 0.4 mb/d, then converged to roughly the same level by November 2014. This trend was driven primarily by the availability of actual supply data. Second, both the IEA and OPEC have revised their projections for OECD supply (shown as the dash lines) upward and their projections for non-OECD supply (shown as the dotted lines) downward. Similar to 2013, the upward revisions made to OECD supply centre in the United States, particularly as light tight oil (LTO) growth in North Dakota and Texas, along with deepwater production from the Gulf of New Mexico, repeatedly exceed forecasts.

### Figure 4. Forecast Revisions of 2014 Non-OPEC Liquids Supply Growth

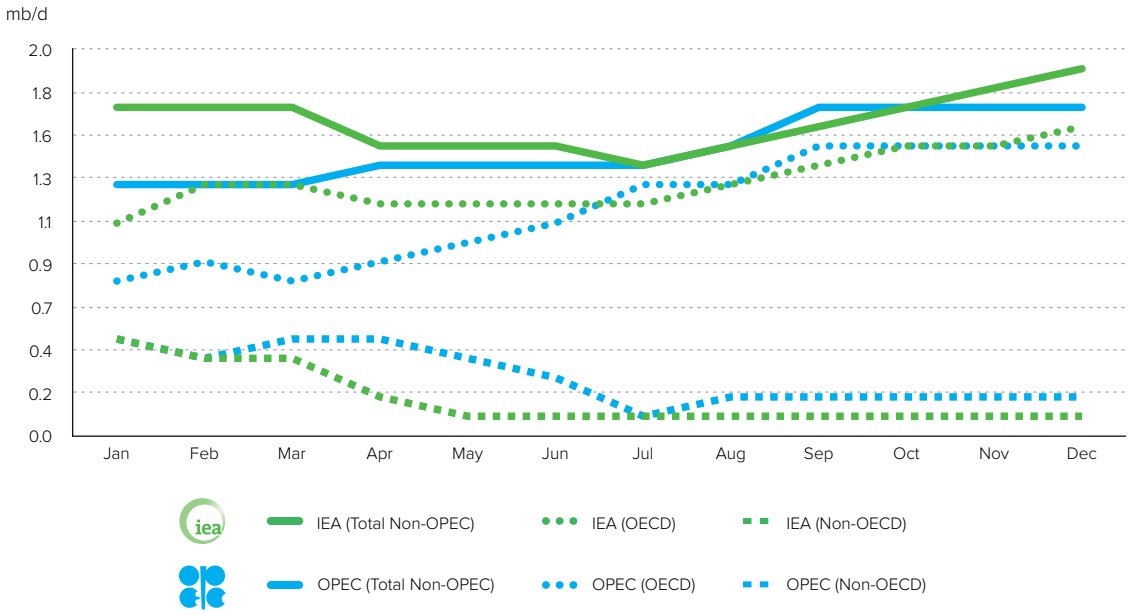



***Figure 4 data sources**: IEA Jan–Dec 2014 OMR, Table 1; OPEC Jan–Dec 2014 MOMR, Table 10.3.*

Both IEA and OPEC project supply growth in 2015 from non-OPEC countries to ease compared to 2015.

This growth in North American unconventional LTO supply is exceptional, and has continued through an oil price plunge in the second half of 2014. However, some experts believe that low oil prices are likely to reduce investment and moderate future production growth from North American unconventional plays. Partly for this reason, both the IEA and OPEC project supply growth in 2015 from non-OPEC countries to ease compared to 2014. As **Figure 5** indicates, non-OPEC liquids supply has been increasing sharply for the past several years, but supply growth in 2015 is expected to be lower than that in 2014 by 0.6 mb/d and 0.3 mb/d in the IEA's and OPEC's forecasts, respectively. Figure 5 also indicates that the IEA's and OPEC's views about overall non-OPEC supply growth are similar for the past and short-term outlooks.

**Figure 5. Short-term Non-OPEC Liquids Supply Annual Growth**

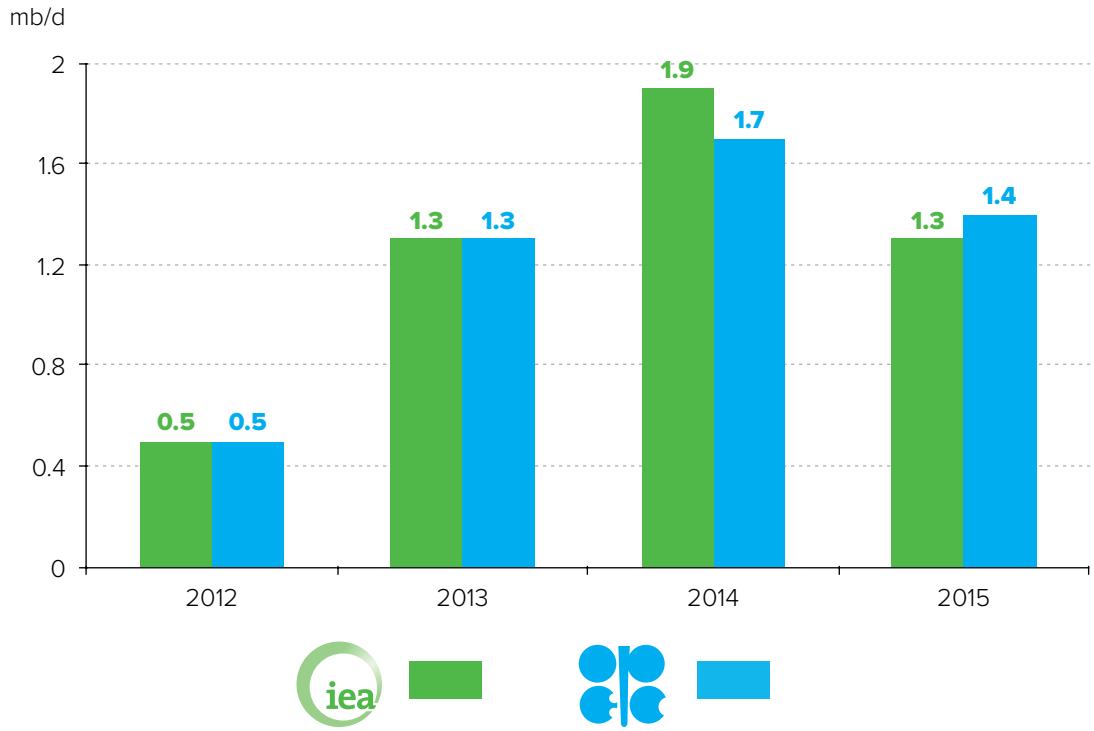



***Figure 4 data sources:*** *IEA Dec 2014 OMR, Table 1; OPEC Dec 2014 MOMR, Table 10.3.*

The largest differential in non-OPEC liquids supply outlooks resides in the FSU due to the difference in historical baseline data.

**Table 7** displays a detailed comparison of short-term liquids supply outlooks by region. The IEA-OPEC difference in overall non-OPEC supply outlooks is almost the same as the historical supply data difference **(see Table 3).** The largest differential in non-OPEC liquids supply outlooks still resides in the FSU, stemming almost completely from the difference in historical data.

However, the seemingly unchanged differential of 0.4 mb/d for non-OPEC supply masks some different perspectives on OECD and non-OECD supply growth. Particularly for 2015 forecasts, OPEC projects a stronger supply growth across OECD economies, but a lower growth in Latin America, compared to the IEA. **Figure 6** illustrates how the IEA's and OPEC's views on regional supply growth differ in 2014 and 2015.

Though neither IEA nor OPEC make projections for OPEC supply, the difference between the IEA's and OPEC's constructed estimates for OPEC supply is 0.8 mb/d for 2014 and 0.6 mb/d for 2015, slightly less than the 1.0 m/b historical difference identified in **Table 3**. This change also merits discussion. "OPEC crude" in **Table 3** is an estimate based on reported supply data from OPEC countries, whereas the **Table 7** item "Call on OPEC crude + stock ch. & misc" is a constructed item. This item is calculated by subtracting total non-OPEC supply as well as OPEC NGLs and unconventionals supply from world liquids demand projections, since neither the IEA nor OPEC projects OPEC crude supply in their oil market reports. Therefore, differences between IEA and OPEC in the "Call on OPEC crude + stock ch. & misc" item and "Total OPEC" item do not necessarily reflect different projections regarding OPEC crude; rather the differences could reveal their distinct projections of global liquids demand and non-OPEC crude supply.

## Table 7. Short-term Liquids Supply Forecasts (mb/d)

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | IEA[a] | OPEC | DIFFERENCE (IEA-OPEC) | IEA | OPEC | DIFFERENCE (IEA-OPEC) |
| Total OECD | 23.8 | 23.7 | 0.1 | 24.8 | 25.0 | -0.1 |
| OECD Americas | 19.7 | 19.7 | 0.0 | 20.7 | 20.9 | -0.1 |
| OECD Europe | 3.6 | 3.6 | 0.0 | 3.5 | 3.6 | -0.1 |
| Asia Oceania | 0.5 | 0.5 | 0.0 | 0.5 | 0.5 | 0.0 |
| Total Non-OECD | 30.4 | 30.1 | 0.3 | 30.7 | 30.2 | 0.6 |
| Asia | 7.8 | 7.8 | 0.0 | 7.8 | 7.8 | 0.0 |
| China | 4.2 | 4.2 | 0.0 | 4.2 | 4.3 | -0.1 |
| Other non-OECD Asia | 3.5 | 3.5 | 0.0 | 3.6 | 3.5 | 0.1 |
| Middle East | 1.3 | 1.3 | 0.0 | 1.3 | 1.4 | 0.0 |
| Latin America | 5.0 | 5.0 | 0.0 | 5.3 | 5.1 | 0.2 |
| FSU | 13.9 | 13.4 | 0.5 | 13.8 | 13.3 | 0.5 |
| Europe | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 |
| Africa | 2.3 | 2.4 | -0.1 | 2.3 | 2.4 | -0.1 |
| Processing gains | 2.2 | 2.2 | 0.0 | 2.2 | 2.2 | 0.0 |
| Total Non-OPEC c | 56.5 | 56.0 | 0.5 | 57.8 | 57.3 | 0.5 |
| Total OPEC | 36.0[c] | 35.2[c] | 0.8 | 35.5[c] | 35.0[c] | 0.5 |
| Call on OPEC crude + stock ch. & misc.[b] | 29.5 | 29.4 | 0.1 | 28.9 | 28.9 | 0.0 |
| OPEC NGLs + unconventionals | 6.4 | 5.8 | 0.6 | 6.7 | 5.9 | 0.8 |
| World Supply [c] | 92.5[c] | 91.1[c] | 1.4 | 93.4[c] | 92.1[c] | 1.3 |

***Table 7 data sources:*** *IEA Dec 2014 OMR, Table 1; IEA MTOMR, Table 5 & 5a; OPEC Dec 2014 MOMR, Table 5.1, 5.2, 10.3.*

***Table 7 notes:*** *Columns may not sum to total due to rounding. IEA[a]: Biofuels from IEA MTOMR 2014 are added to IEA regional oil supply data for comparability with OPEC estimates. Call on OPEC crude + stock ch. & misc[b]: Equals total liquids demand minus non-OPEC supply minus OPEC NGLs/unconventionals. Total OPEC and World Supply[c]: Estimates for total OPEC supply and world supply are constructed from other components because IEA and OPEC do not directly provide these forecasts in their reports.*

### Figure 6. Short-term Liquids Supply Net Annual Growth Forecasts

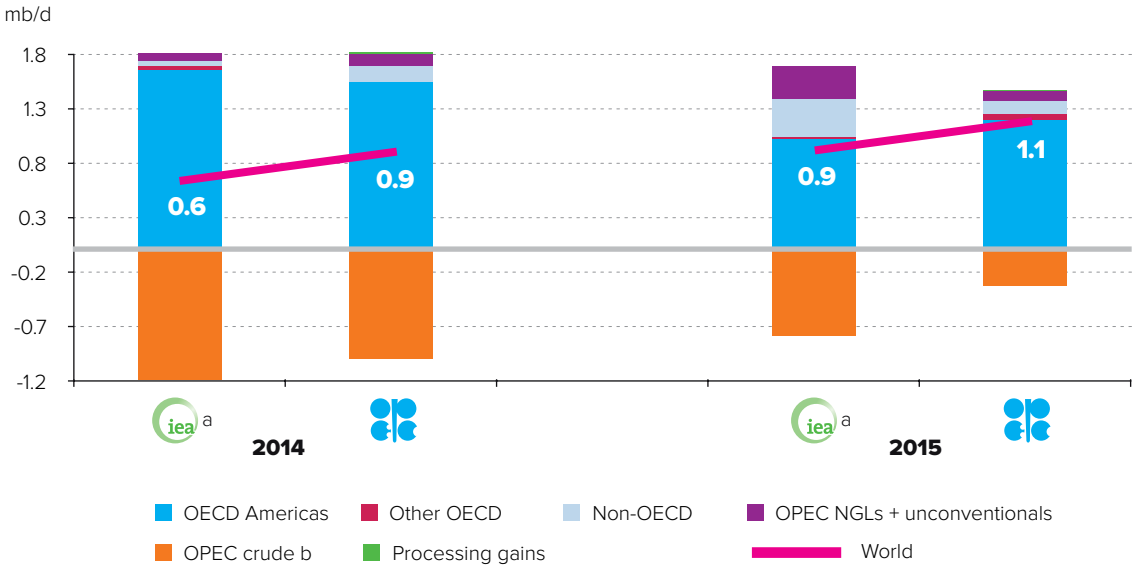



***Figure 6 data sources:*** *IEA Dec 2014 OMR, Table 1; IEA MTOMR 2014, Table 5 & 5a; OPEC Dec 2014 MOMR, Table 5.1, 5.2, 10.3.*

***Figure 6 note****: IEA[(a)]: Biofuels from IEA MTOMR 2014 are added to IEA regional oil supply data for comparability with OPEC estimates. OPEC crude[(b)]: IEA and OPEC do not forecast OPEC crude; this estimate is constructed as the "call on OPEC crude" including "stock change and miscellaneous".*

## 4. Medium-term Energy Outlooks

Both organisations make their medium-term projections through 2019, using 2013 as a base year.

Our comparison of medium-term outlooks analyses the IEA's Medium-term Oil Market Report (MTOMR) published in June 2014, and OPEC's World Oil Outlook (WOO) published in November 2014 **(Table 1)**. Both organisations make their medium-term projections through 2019, using 2013 as a base year. However, there is a five-month gap between publication dates of the two reports and, given the dynamic nature of market conditions this gap complicates the comparison of the projections. A major market shift occurred after the publication of the IEA's June 2014 MTOMR that is taken into account in the IEA MTOMR published in February 2015. Due to timing constraints in preparing this background paper, the latter report remains outside the scope of the comparative analysis.

### 4.1 Oil Price and Economic Growth Assumptions

#### 4.1.1 Oil Price

IEA and OPEC oil price assumptions use different price proxies and distinct approaches.

The price of oil is one of the primary factors influencing the projection of oil demand. The basis for IEA and OPEC oil price assumptions differs in two fundamental ways. First, the IEA and OPEC use different price proxies. In the WOO series, OPEC makes assumptions for an OPEC Reference Basket (ORB) price, which is a production-weighted average price of a number of representative OPEC crudes driven by the cost estimates of marginal supply. In contrast, the IEA uses an "IEA Average Import Price", which reflects the IEA's perspective on its member countries' future crude import prices. Second, oil price assumptions are derived through distinct approaches. OPEC's medium-term price assumptions mainly reflect its assumptions on the ORB price detailed above, while its longer-term price assumptions also take into account its estimation of the cost of supplying the marginal barrel. In contrast,

the IEA utilises market information – the Brent futures price curve – to derive its medium-term price assumptions. From the IEA's perspective, Brent futures prices reflect what market players will accept to pay in the future, which in turn shapes the medium-term demand and supply outlook. Neither approach is perfect. Oil prices are volatile in nature. The second half of 2014 saw a decline of crude oil futures price from above US$107/bbl to nearly US$60/bbl as of the time this report was written. Neither the IEA nor OPEC had incorporated the recent oil price slump into its medium-term forecasts.

Different methods for oil price assumptions have led to distinct medium term price outlooks.

The different methods for developing oil price assumptions have led to distinct medium-term price outlooks. In IEA's MTOMR, the nominal "IEA Average Import Price" is projected to decline from around US$107/bbl in 2014 to just above US$90/bbl in 2019. In contrast, the nominal ORB price in OPEC's WOO2014 is expected to average US$110/bbl over the period to 2020, which is similar to the assumption made in WOO2013. As **Figure 7** suggests, there is a growing differential between the two price assumptions throughout the medium-term projection period, with the gap reaching nearly US$20/bbl by the end of the decade.

### Figure 7. Medium-term Oil Price Assumptions (nominal US$)


***Figure 7 data sources:*** *Annual average ORB price from OPEC WOO2014 and history from www.opec.org/opec_web/en/data_graphs/40.htm?selectedTab=annually;*

*Annual average IEA import price from IEA MTOMR 2014 and Brent history from www.quandl.com/IMF-International-Monetary-Fund/POILBRE_USD-Crude-Oil-petroleum-Price-Dated-Brent.*

***Figure 7 notes:*** *Only historical prices through mid-2014 (at the time IEA and OPEC wrote their report) were included; IEA Average Import Price assumption is based on the Brent futures strip, adjusted slightly downward.*

Both OPEC and IEA have lowered their medium-term GDP growth expectations compared to 2013.

### 4.1.2 Economic Growth

Compared to the WOO2013 and MTOMR2013, both the IEA and OPEC have moderately lowered their expectations for medium-term global economic growth. While OPEC maintains its projection of accelerating growth through to 2019, the IEA expects global growth to level in 2016. The GDP growth assumptions for each year of the projection period are lower in OPEC's WOO2014 than those in the IEA's MTOMR2014. This difference could result from the fact that WOO2014 was published later than the MTOMR2014—which was probably completed under more optimistic macroeconomic expectations. In addition, the IEA uses the economic growth forecast published in the IMF's April World Economic Outlook as an input, whereas OPEC may have referred to both the IMF and other information sources **(Table 8).**

**Table 8. Medium-term Annual GDP Growth Assumptions**

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| OPEC | 3.1% | 3.4% | 3.6% | 3.7% | 3.8% | 3.8% |
| IEA | 3.5% | 3.8% | 3.9% | 3.9% | 3.9% | 3.8% |

***Table 8 data sources:*** *IEA MTOMR 2014, Table ES.1; OPEC WOO2014, Table 1.2. The IEA's forecast relies on IMF's April World Economic Outlook.*

Under both projections, OECD and non-OECD economies expand over the medium-term, though non-OECD nations continue to grow faster. However, downside risks exist in both OECD and non-OECD nations. For the OECD, legacy issues stemming from the global financial crisis continue to subdue the Eurozone's growth potential, and Japan's economic outlook remains uncertain. The OECD Americas region, led by the United States, enjoys a stronger recovery than other OECD regions. For non-OECD nations, economic growth in recent years has repeatedly been weaker than expected, as emerging economies such as China continue to mature. Finally, geopolitical risks related to Ukraine will affect economic growth in Russia and the FSU, with impacts potentially spilling over to energy and other commodities markets.

Both the IEA and OPEC expect robust medium-term growth in global liquids demand.

## 4.2 Medium-term Liquids Demand

### 4.2.1 Global and Regional Demand Growth

Similar to last year's assessment, both the IEA and OPEC expect robust medium-term growth in global liquids demand. As **Table 9** shows, the IEA projects an annual average growth of 1.3 mb/d in global liquids demand, reaching 100 mb/d by the end of 2019. OPEC is slightly more conservative and projects the demand growth rate to be around 1.0 mb/d per year. As illustrated by **Figure 8(a)**, the IEA's steeper demand growth trajectory, coupled with a higher baseline, leads to a 3.1 mb/d differential in world liquids demand projection by 2019 compared to OPEC's estimate. Figure 8(b) further shows that the leading differences arise from non-OECD nations, due to varying historical demand data and the IEA's more bullish view on non-OECD liquids demand growth. As to OECD liquids demand, the IEA and OPEC have almost identical declining projections. The two divergent trends of oil demand growth between OECD and non-OECD nations illustrate how global oil markets are transforming.

Leading differences arise from non-OECD nations, due to varying historical demand data and IEA's more bullish view on non-OECD liquids demand growth.

The IEA's MTOMR2014 suggests that non-OECD countries should have overtaken OECD nations in oil demand in 2014, while OPEC projects this will occur in 2015.

**Figure 8. Medium-term Liquids Demand**

The two divergent trends of oil demand growth between OECD and non-OECD nations illustrate how global oil markets are transforming.

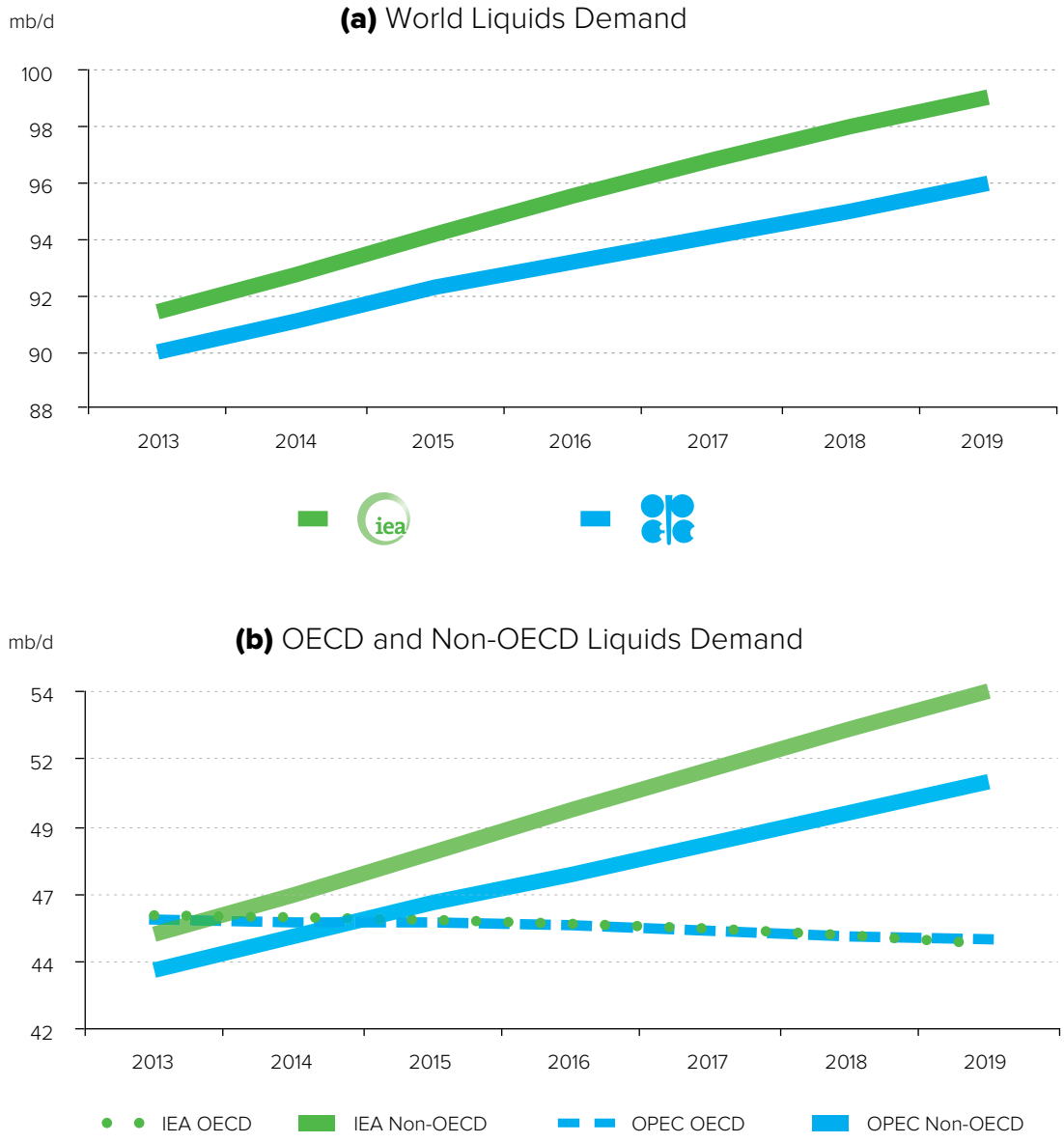



***Figure 8 data sources:*** *IEA MTOMR 2014, Table 2; OPEC WOO2014, Table 1.10.*

Direct comparison of Middle East, Africa and Latin America is challenging because of differences in how OPEC and IEA define regions.

**Table 9** presents a detailed comparison of the IEA and OPEC medium-term liquids demand outlooks for comparable regions. The most substantial differences between the projections appear in the Middle East, Africa and Latin America. However, direct comparison of these three regions is challenging because the IEA and OPEC have different regional definitions. In the WOO series, OPEC excludes its member countries from these regions and reports OPEC group liquids demand separately. The IEA does not make a similar distinction. To allow for comparison, we group together the Middle East, Africa and Latin America for regional demand projections.

### Table 9. Medium-term Liquids Demand Forecasts (mb/d)

| | 2019 | | Avg. annual growth (2013-2019) | | |
|---|---|---|---|---|---|
| | IEA | OPEC | IEA | OPEC | DIFFERENCE (IEA-OPEC) |
| Total OECD | 45.0 | 45.2 | -0.2 | -0.1 | -0.1 |
| OECD Americas | 23.6 | 24.1 | -0.1 | 0.0 | -0.1 |
| OECD Europe | 13.4 | 13.1 | 0.0 | -0.1 | 0.0 |
| Asia Oceania | 8.1 | 7.9 | -0.1 | -0.1 | 0.0 |
| Total Non-OECD | 54.0 | 50.8 | 1.4 | 1.1 | 0.3 |
| Asia | 26.1 | 25.2 | 0.7 | 0.7 | 0.0 |
| China | 12.3 | 12.2 | 0.4 | 0.4 | 0.0 |
| India | 4.0 | 4.6 | 0.1 | 0.2 | -0.1 |
| Other non-OECD Asia | 9.7 | 8.4 | 0.2 | 0.2 | 0.1 |
| Middle East, Africa & Latin America | 22.0 | 20.2 | 0.6 | 0.4 | 0.2 |
| Europe & Eurasia | 6.0 | 5.4 | 0.1 | 0.1 | 0.0 |
| World | 99.1 | 96.0 | 1.3 | 1.0 | 0.3 |

***Table 9 data sources:*** *IEA MTOMR 2014, Table 2; OPEC WOO2014, Table 1.10.*

***Table 9 notes:*** *Columns may not sum to total due to rounding.a OPEC calculates demand from OPEC member countries as a whole by excluding them from corresponding geographical region, which makes demand figures for Middle East, Africa and Latin America not comparable with IEA estimates. Therefore, in this report, Middle East, Africa and Latin America are grouped together for regional demand comparisons.*

### 4.2.2 Sectoral Demand

Both IEA and OPEC take a "bottom-up" approach of assessing field-level supply capabilities for each country.

The WOO2014 focuses on long-term trends in demand growth by sector. Though OPEC does give sectoral projections for the year 2015 and 2020 we highlight some of the IEA's medium-term perspectives on this issue. The transportation sector continues to dominate oil consumption, accounting for over half of total global demand over the medium-term. The petrochemical sector is the second largest oil-consuming sector globally. With higher projected industrial activity, petrochemicals oil demand growth is expected to grow faster than any other sector. The residential and power sectors will continue to see declining oil consumption, as other energy sources displace relatively expensive and polluting oil-based fuels. The rate of demand growth for the transportation sector is roughly the average growth rate of all demand sectors.

## 4.3 Medium-term Liquids Supply

### 4.3.1 Liquid Fuels Classification and Projection Methodology

For their medium-term liquids supply outlooks, both the IEA and OPEC take a "bottom-up" approach of assessing field-level supply capabilities for each country. However, they may take different upstream oil production projects into account and estimate different levels of productivity for each field. Differing supply projections between the IEA and OPEC could also result from their distinct oil price assumptions.

Understanding of the differences in the categorisation of liquids fuel by IEA and OPEC is necessary to compare projections fairly.

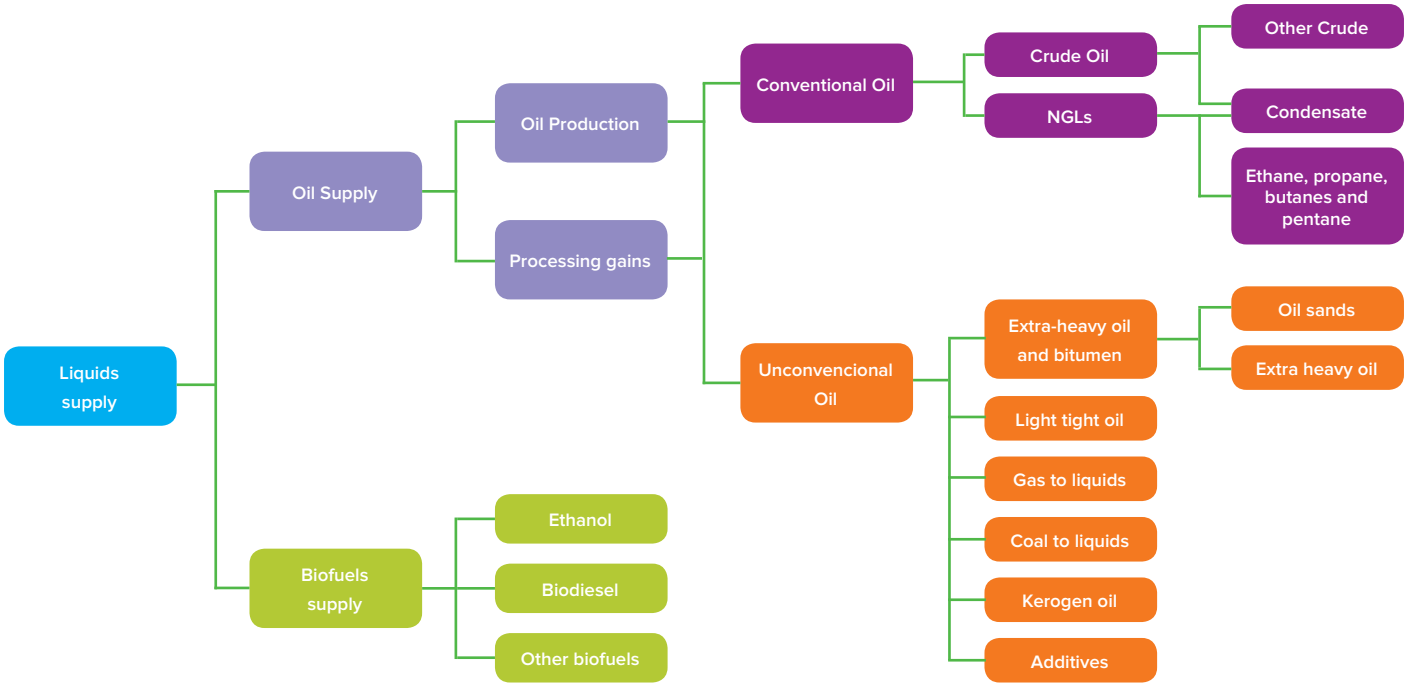
In addition, an understanding of the differences in the IEA's and OPEC's categorisation of liquid fuels is necessary for fair comparison of their projections. **Figure 9(a)** and **(b),** respectively, illustrate the IEA's and OPEC's distinct liquids classification systems.

First, the two institutions differ in their categorisation of certain types of unconventional oil. One recent change by OPEC is noteworthy. In the 2013 assessment, OPEC included a category called "tight NGLs" in the "tight crude" category rather than in the "NGLs" category. In WOO2014, the term "tight NGLs" is abandoned. Instead, OPEC uses the term "unconventional NGLs," defined as NGLs extracted from low-permeability formations with hydraulic fracturing technology, and is included in the "NGLs" category.

**Figure 9(a)** shows that the IEA groups together conventional crude oil, NGLs and condensate into one category, and "unconventional oil" into another. For OPEC, the equivalent of the IEA's "unconventional oil" group is "other liquids." However, OPEC excludes LTO and Venezuelan heavy oil from that category, treating them as crude oil. Additionally, OPEC and the IEA use different terms in their reports, such as "kerogen oil" in WEO2014 vs. "oil shale" and "tight crude" in WOO2014. Finally, OPEC categorises biofuels together with other unconventional non-crude supply sources, whereas the IEA treats biofuels distinctly from all other oil supply sources.

## Figure 9. Liquid Fuels Categorisation by the IEA and OPEC

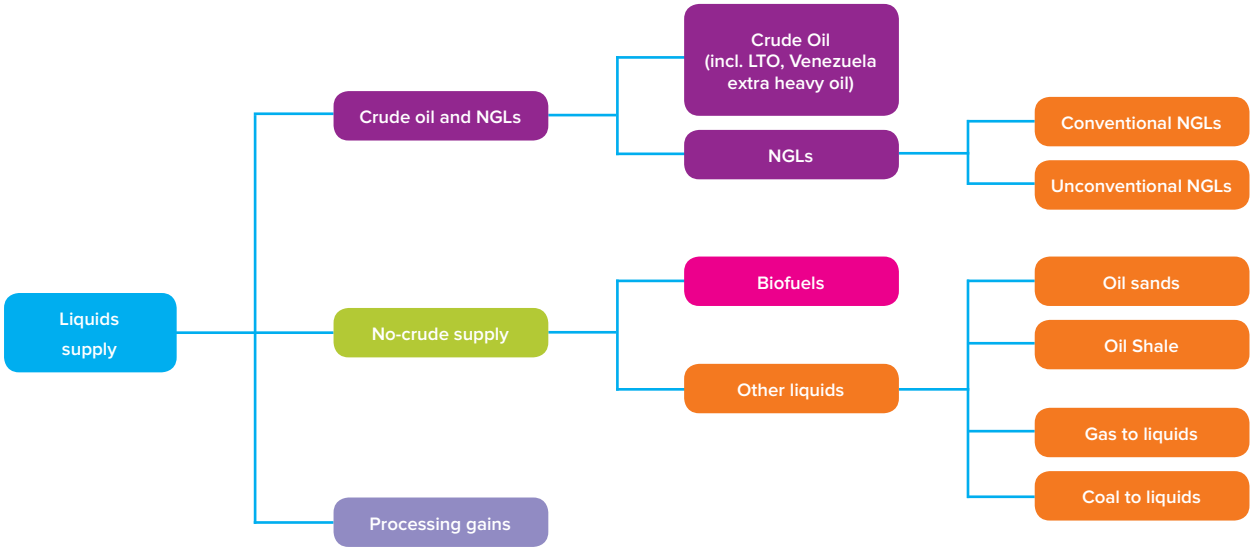
### (a) IEA Liquid Fuel Schematic




Source: IEA WEO2013, Figure 13.2

***Figure 9(a)*** *source: IEA WEO2013, Figure 13.2.*

### (b) OPEC Liquid Fuels Schematic




Source: Duke and IEF based on WOO2014

***Figure 9(b) source:*** *Duke and IEF based on WOO2014.*

***Figure 9(b) note:*** *WOO2014 does not use the term 'tight oil' and instead OPEC refers to 'tight crude'.*

Both OPEC and IEA expect supply growth from non-OPEC countries to continue outpacing OPEC supply growth in medium term projections.

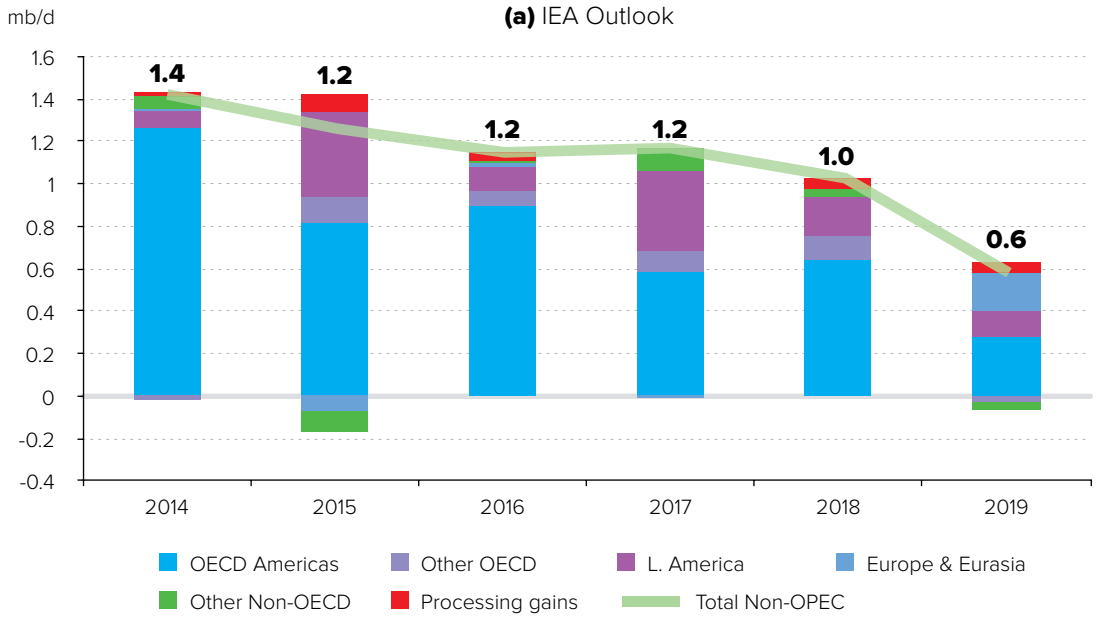
### 4.3.2 Global and Regional Liquids Supply

In both the IEA and OPEC medium-term projections, supply growth from non-OPEC countries continues to outpace the increase in OPEC supply. Although non-OPEC production is expected to grow further, both projections show the annual growth in production peaking in 2014. Production growth may be further reduced as lower oil prices slow investment in LTO production in the United States.

IEA foresees OECD Americas to lead supply growth throughout the projection period. OPEC forecast it to dominate during the first two years only.

The IEA and OPEC diverge on growth contributions from each region. Figure 10(a) and Figure 10(b) portray the IEA's and OPEC's respective medium-term non-OPEC supply growth outlooks. While the IEA foresees OECD Americas leading supply growth throughout the projection period, OPEC forecasts OECD Americas growth to dominate only during the first two years of the time horizon. Both predict that supply growth from OECD Americas will taper off over the projection period. In addition to North American supply, both the IEA and OPEC expect large liquids supply growth from Latin America. Brazil is likely to become the second largest source of non-OPEC supply growth, supported by deep-water and pre-salt production, as well as biofuels. Other countries including Argentina, Mexico and Kazakhstan are expected to contribute more in a later projection period.

**Figure 10. Medium-term Non-OPEC Liquids Supply Annual Growth**



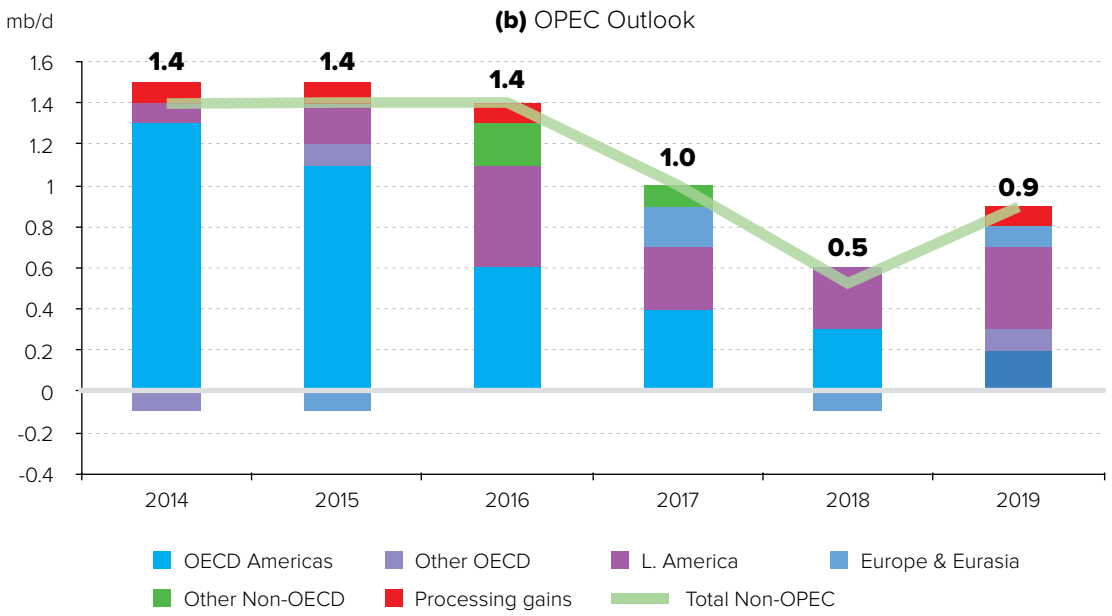



***Figure 10 data sources:*** *IEA MTOMR 2013, Table 3; IEA MTOMR 2014, Table 5 & 5a for biofuels; OPEC WOO2014, Table 1.12.*

***Figure 10 note:*** *Biofuels are added to IEA regional oil supply data for comparability with OPEC estimates.*

Table 10 provides a detailed regional comparison of medium-term liquids supply between the two outlooks. Their projections for non-OPEC supply are similar, but the IEA's projection for OECD Americas is slightly higher than OPEC's, contributing to a 0.5 mb/d projection difference by 2019. OPEC is more bullish about supply growth from Latin America. Smaller differences exist between the projections for Europe and Eurasia, non-OECD Asia excluding China, and OECD Asia Oceania.

Although projections for total non-OPEC supplies are similar, the IEA's higher overall demand forecast results in a greater estimate for the "OPEC crude" item in Table 10. This is because we construct this item by subtracting non-OPEC supply and OPEC NGLs supply from total world liquids demand. Finally, despite a 0.7 mb/d difference in historical data for OPEC NGLs and other unconventional oils (Table 3), the IEA and OPEC projections from these liquids sources are similar by the end of the projection period.

### Table 10. Medium-term Liquids Supply Forecasts (mb/d)

| | 2018 | | Avg. annual growth (2013-2019) | | |
|---|---|---|---|---|---|
| | IEA[b] | OPEC | IEA | OPEC | DIFFERENCE (IEA-OPEC) |
| Total OECD | 26.6 | 26.0 | 0.7 | 0.7 | 0.1 |
| OECD Americas | 22.3 | 21.8 | 0.7 | 0.6 | 0.1 |
| OECD Europe | 3.6 | 3.6 | 0.0 | 0.0 | 0.0 |
| Asia Oceania | 0.8 | 0.6 | 0.1 | 0.0 | 0.0 |
| Total Non-OECD | 31.9 | 32.1 | 0.3 | 0.4 | -0.1 |
| Asia | 7.7 | 8.0 | 0.0 | 0.0 | -0.1 |
| China | 4.4 | 4.4 | 0.0 | 0.0 | 0.0 |
| Other non-OECD Asia | 3.3 | 3.6 | -0.1 | 0.0 | -0.1 |
| Middle East & Africa | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 |
| Latin America | 6.1 | 6.6 | 0.2 | 0.3 | -0.1 |
| Europe & Eurasia | 14.1 | 13.7 | 0.0 | 0.0 | 0.0 |
| Processing Gains | 2.4 | 2.5 | 0.0 | 0.1 | 0.0 |
| Total Non-OPEC | 60.9 | 60.6 | 1.0 | 1.1 | 0.0 |
| Total OPEC | 35.8[c] | 35.6 | 0.2 | 0.0 | 0.3 |
| OPEC crude[a] | 31.0 | 28.7 | 0.1 | -0.3 | 0.3 |
| OPEC NGLs + unconventionals | 7.1 | 6.9 | 0.1 | 0.2 | -0.1 |
| World | 99.1[c] | 96.2 | 1.3 | 1.0 | 0.2 |

***Table 10 data sources:*** *IEA MTOMR 2014, Table 3; IEA MTOMR 2014, Table 5 & 5a; OPEC WOO2014, Table 1.12.*

***Table 10 notes:*** *Columns may not sum to total due to rounding. OPEC crude[a]: For IEA includes stock change and miscellaneous. IEA[b]: regional supply estimates include biofuels, based on IEA MTOMR 2014 Table 5 & 5a. [c]: Estimates for total OPEC supply and world supply are constructed from other components because IEA does not directly provide these forecasts in their reports.*

Last year a significant difference between the IEA's and OPEC's medium-term oil supply projections from the United States and Canada was highlighted. This year, their projections regarding this supply are rather similar, and they both made substantial upward adjustments to the supply forecasts for the two countries **(Figure 11).** Both estimate that oil supply from the two countries will reach 18.3 mb/d by 2019. The 0.5 mb/d difference in OECD Americas' production identified in **Figure 11** is primarily due to diverging projections for Mexico. While the IEA projects that Mexican production will remain steady at 2.9 mb/d, OPEC expects it to fall from 2.9 mb/d in 2013 to 2.4 mb/d in 2019. OPEC bases this outlook on the fact that production from Mexico's two largest complexes, Cantarell and Ku-Maloob-Zaap, has steadily declined in recent years. Despite accounting for recent energy sector reforms, OPEC predicts the declining trend to continue over the medium-term. The IEA, however, is more bullish about Mexico's production prospects, projecting a growth in production by 2016, due primarily to deep-water and LTO resources.

**Figure 11. Medium-term US and Canadian Oil Supply (excluding biofuels)**

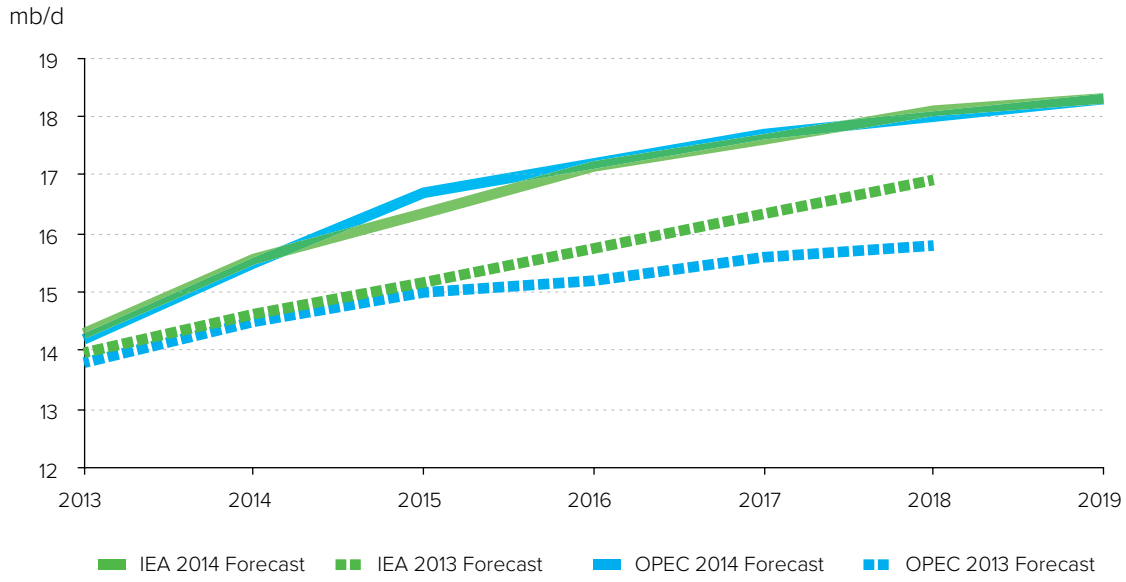



***Figure 11 data sources:*** *IEA MTOMR 2014; OPEC WOO2014, Table 1.12 & Table 3.5; IEA MTOMR 2013, Table 3 and Table on p.77 for biofuels; OPEC WOO2013, Table 1.10 and Table 3.4.*

***Figure 11 note:*** *Biofuels are excluded from OPEC's total liquids supply estimates for US & Canada.*

## 5. Long-term Energy Outlooks

IEA and OPEC now both extend long-term projections to 2040 but still depart from different historical baselines.

The long-term outlooks comparison in this paper evaluates the IEA's World Energy Outlook 2014 (WEO2014) and OPEC's World Oil Outlook 2014 (WOO2014), both released in November 2014. In these reports, the IEA and OPEC have made their first projections that now both extend through 2040. However, projections for fuels other than oil are based on different baseline years (2010 for OPEC and 2012 for IEA), creating inconsistencies when comparing the two reports in terms of growth over time. For greater comparability, this paper uses 2012 as the baseline year for liquids and 2010 for other fuels.

Another comparability challenge is related to units for primary energy demand: OPEC uses million barrels of oil equivalent per day (mboe/d) and the IEA uses million tons of oil equivalent (mtoe) per year. We convert IEA units of primary energy from mtoe per year to mboe/d by multiplying by 7.33 mboe/mtoe and dividing by 365 days per year.

### 5.1 Key Assumptions

#### 5.1.1 Scenarios

Both the IEA and OPEC conduct scenario analysis to address uncertainties through 2040. **Table 11** lists key assumptions for each scenario included in the WEO2014 and WOO2014. A more detailed comparison is provided in **Annex 1**, and a comparison of outlook results for each scenario is featured in **Annex 2.**

### Table 11. Long-term Scenario Key Assumptions

| IEA WEO Scenarios | OPEC WOO Scenarios |
|---|---|
| **Current Policies Scenario (CPS)**<br>Only considers policies that have been enacted as of mid-2014 | **Reference Case**<br>Only incorporates specific policies that have been enacted, but also accepts that the policy process will evolve over time |
| **New Policies Scenario (NPS)**<br>Considers both policies in place and commitments announced | **Economic Growth Scenarios (HEG / LEG)**<br>Assumes higher (HEG) or lower (LEG) economic growth rate than the Reference Case |
| **450-ppm Scenario**<br>Assumes policies are taken to limit the concentration of GHGs in the atmosphere to 450-ppm of CO2 equivalent | **Supply Scenarios (HIGHSUP / LOWSUP)**<br>Looks at possibility of higher (HIGHSUP) or lower (LOWSUP) non-OPEC supply than the Reference Case |

The IEA has maintained its three-scenario analysis – the New Policies Scenario, the Current Policies Scenario and the 450-ppm Scenario.

The IEA has maintained its three-scenario analysis – the New Policies Scenario, the Current Policies Scenario and the 450-ppm Scenario. The New Policies Scenario, the central scenario in the WEO series, considers both policies in place as well as proposals that have been put forward. The Current Policies Scenario is provided as a baseline scenario to show how the global energy market might evolve without further policies. Finally, the 450-ppm Scenario creates an energy path consistent with the trajectory towards a 450-ppm climate target, a level estimated to have a 50% chance of limiting global temperature increase to 2°C. All three scenarios share the same GDP and population assumptions, while variations in policy assumptions affect technological development and energy markets.

OPEC also employs scenario analysis in the WOO series. The WOO2014 continues to build on OPEC's World Energy Model (OWEM) for upstream liquids demand and supply projections.

OPEC also employs scenario analysis in the WOO series, and the WOO2014 continues to build on OPEC's World Energy Model (OWEM) for upstream liquids demand and supply projections. In the WOO series, the Reference Case is the main scenario. In previous WOO reports, the Reference Case only took enacted policies into account, without considering proposals that are not legally binding. In WOO2014, however, OPEC accepts that some proposals put forward in 2014 may have long-term consequences for the global energy market. They highlight several new energy proposals in WOO2014 – which are summarised in Section 4.1.5 – and examine their potential impacts over time. However, it seems that while OPEC may not incorporate specific prospective policy proposals into their model, they do allow for policy evolution over time. Because OPEC's Reference Case in WOO2014 is not strictly based on energy policies in place, it becomes more challenging to find a counterpart in IEA's WEO2014 for comparison.

OPEC examines two pairs of alternative scenarios in WOO2014. One pair varies in GDP growth assumptions and another pair varies in energy supply assumptions. The WOO2014 varies GDP assumptions by +10%/–15% relative to the Reference Case for its higher/lower economic growth scenarios, allowing for variations in different regions to account for special economic circumstances. The uncertainty is focussed on the medium term and alternative growth rates converge to the reference case in 2040. For its supply scenarios, the Upside Supply Scenario (HIGHSUP) focuses on more optimistic projections for LTO

and unconventional NGLs supply and the Downside Supply Scenario (LOWSUP) considers factors that may reduce both conventional and unconventional production. The LOWSUP is new to the WOO series.

Although OPEC's Reference Case may also look at proposals or commitments that are not legally enacted, we still compare it with the IEA's Current Policies Scenario in this report. Unless otherwise noted, the figures and tables in this section refer to these two scenarios.

### 5.1.2 Demography

Both the IEA and OPEC base their demographic assumptions primarily upon projections made by the United Nations Population Division (UNPD)

Among the numerous drivers that impact energy demand, population growth assumptions tend to be the most consistent between the IEA and OPEC. As in previous outlooks, both the IEA and OPEC base their demographic assumptions primarily upon projections made by the United Nations Population Division (UNPD). In the most recent UNPD report, the world population is projected to grow from an estimated 7.1 billion in 2013 to 9.0 billion by 2040 in the "medium-variant" scenario [8]. Note that the UN projections also include low-, high- and constant-fertility scenarios, in which world population projections in 2040 range from 8.3 to 9.8 billion.

Regarding regional population growth through 2040, the IEA and OPEC assume a 1.0% annual growth rate for non-OECD nations, and a 0.4% growth rate for OECD nations. Africa, Middle East and non-OECD Asia excluding China are expected to have the fastest growth rate. India is likely to overtake China as the world's most populous country around 2030, at roughly the same time Chinese population is projected to peak.

Urbanisation is projected to accelerate under both projections. The share of people living in cities grows from 53% in 2013 to 64% in 2040.

In addition to population growth assumptions, urbanisation is projected to accelerate under both projections, with the share of people living in cities growing from 53% in 2013 to 64% in 2040. Urbanisation occurs most rapidly in non-OECD Asia and Africa. Other crucial demographic factors that may impact energy consumption include age structure and global migration patterns. For example, energy demand projections will be higher if assuming a larger percentage of working-age population and more immigrants from non-OECD nations to OECD nations.

### 5.1.3 Economic Growth

The IEA and OPEC take similar approaches in deriving their GDP assumptions. For medium-term projections, they both use internal expertise in combination with economic forecasts published by the IMF, World Bank and other organisations. Their long-term projections, however, are based on assumptions about working population and productivity levels, key factors in determining economic growth rates. Because of differing assumptions on these issues, OPEC projects global annual growth of 3.5% through 2040, 0.1% higher than the IEA.

Although both the IEA and OPEC make GDP assumptions in Purchasing Power Parity (PPP) terms[9], several challenges exist when comparing GDP growth projections between the

8 United Nations Population Division (UNPD), World Population Prospects: The 2012 Revision (New York: United Nations, 2013).The "medium-variant" scenario assumes fertility rates in different countries to move towards a global average level.

9 The World Bank's International Comparison Program (ICP) released revised data for Purchasing Power Parity (PPP) in 2014. In this revision, emerging economies see large upward GDP adjustments, and China becomes the world's largest economy. Neither the IEA nor OPEC has incorporated this change into their reports.

It is difficult to compare IEA's and OPEC's GDP growth rate assumptions for the same region or country.

IEA and OPEC. First, they use different baseline years – the IEA uses 2012 while OPEC uses 2014 – to calculate compound average annual growth. Second, while the IEA provides projections for 2020-2030 and 2030-2040, OPEC only provides 2021-2040 growth rates. Third, regional breakdowns for GDP assumptions vary between WEO2014 and WOO2014. For these reasons, it would be difficult to compare GDP growth rate assumptions for the same region or country between the IEA and OPEC.

Through communications with the IEA WEO modelling team, the compound average annual GDP growth rates for the periods of 2014-2020 and 2021-2040 was recalculated, allowing for direct comparison with OPEC's data. **Figure 12** reveals that the IEA and OPEC have similar growth rate projections for the world and OECD nations in both medium- and long-term, but the two organisations diverge greatly on several countries' long-term growth rates.[10] For example, between 2021 and 2040, the IEA has a much lower estimate for China's annual growth rate (4.1%) relative to OPEC (5.3%), while the IEA is more bullish about Russia's growth rate (3.0%) than OPEC (2.3%). Nonetheless, both the IEA and OPEC project that China's total GDP in 2040 will exceed each of the three OECD sub-regions, and non-OECD Asia will surpass the entire OECD region in economic size. In terms of GDP per capita, however, OECD countries still dwarf other regions.

**Figure 12. Long-term GDP Growth Assumptions for Selected Regions**

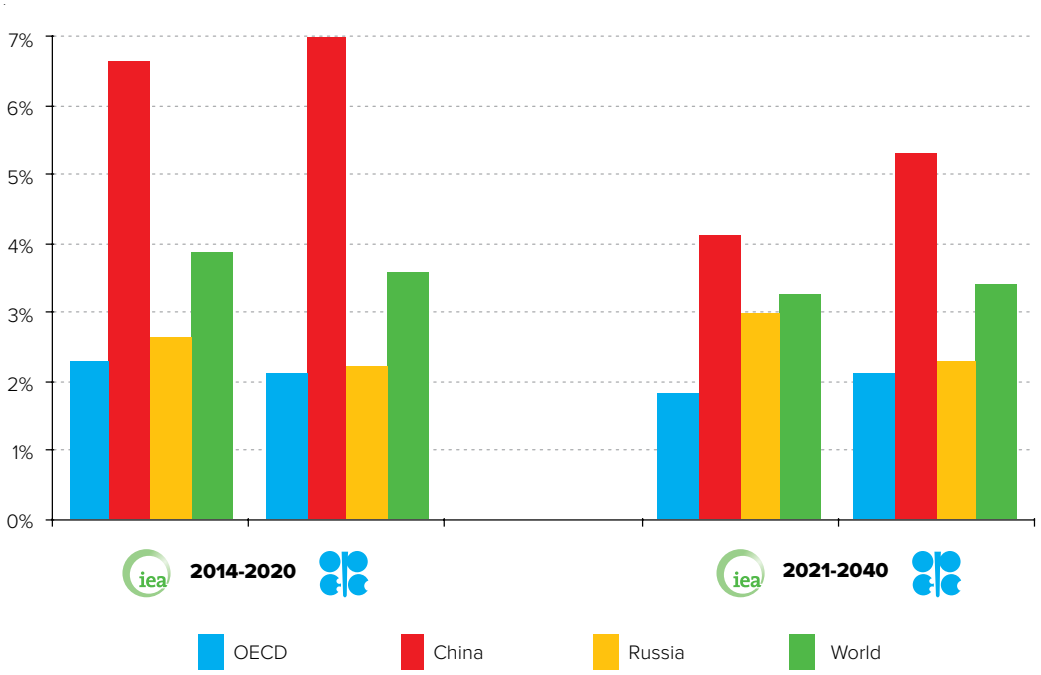



***Figure 12 data sources:*** *IEA WEO2014 Internal Data; OPEC WOO2014, Table 1.6.*

OPEC's long-term oil price assumptions are derived based on the cost of supplying the marginal barrel.

### 5.1.4 Oil Prices

OPEC's long-term oil price assumptions are derived based on its estimation of the cost of supplying the marginal barrel. The IEA WEO series take a different approach from its MTOMR series to derive long-term oil prices. Instead of referring to the Brent futures curve (which does not extend to 2040), the IEA's long-term price assumptions are based on the

10 We also compared the GDP growth rates assumptions for India and the differences are not large. The IEA and OPEC's GDP growth projections for India are respectively 6.7% and 6.4% during 2014-2020, and 6.1% and 5.9% during 2021-2040.

IEA's long-term price assumptions are based on IEA's supply and demand model and factor in market and policy assumptions.

equilibrium prices reached in a supply-demand model. Unlike OPEC, the IEA's equilibrium price factors in marginal cost assumptions, investment return requirements (12%)[11] and policy factors.

Even accounting for the differences described above, the gaps between the IEA's and OPEC's long-term oil price assumptions are still large. As shown in **Figure 13**, OPEC's oil price assumptions (in real 2013 US$) in the Reference Case are substantially lower than all but the 450-ppm Scenario in WEO2014. Among the IEA's three scenarios, the Current Policies Scenario has the highest oil price assumptions due to higher oil demand, leading to gaps of US$21/bbl and US$53/bbl relative to OPEC's Reference Case in 2020 and 2040, respectively.

Notwithstanding these differences in methods, gaps between IEA and OPEC price assumptions remain large.

**Figure 13. Long-Term Oil Price Assumptions (real 2013 US$)**

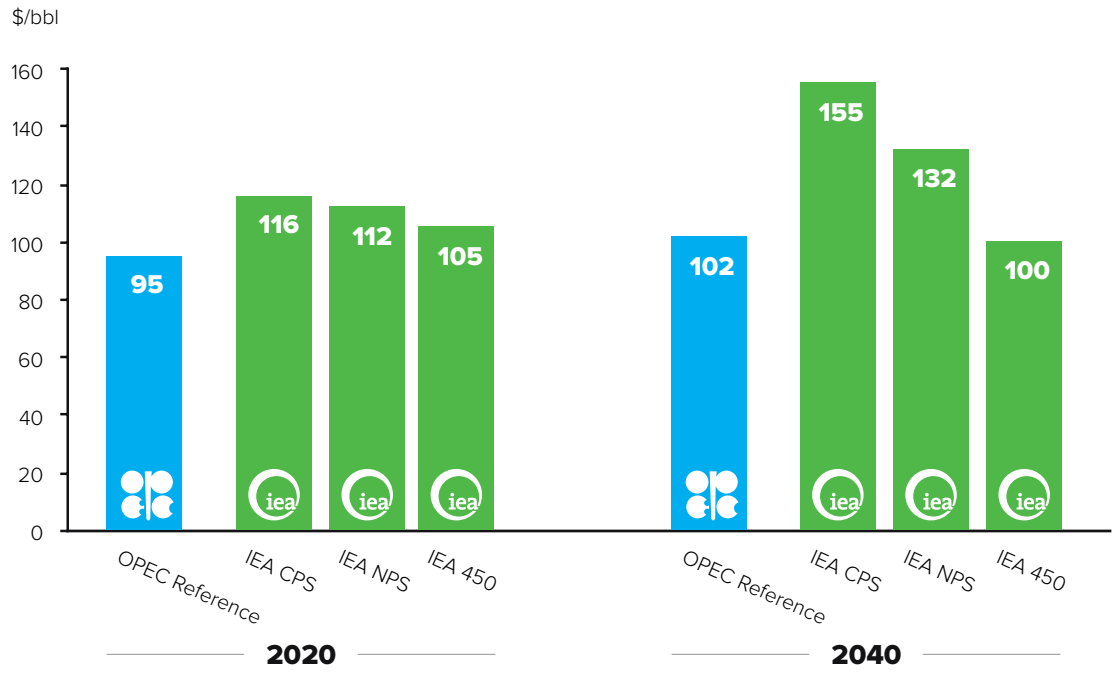



***Figure 13 Data Sources:*** *IEA WEO2014 Table 1.5; OPEC WOO2014 Table 1.1. CPS is the Current Polices Scenario and NPS is the New Policies Scenario.*

### 5.1.5 Energy and Environmental Policies

Each year, projections incorporate new policies enacted or proposed. Both the IEA and OPEC highlight a number of policies developed during the year in their reports. A comparison of policy updates between WOO2014 and WEO2014 is provided below. Note that in the WEO2014, the IEA highlights just the new proposals or commitments included in its 2014 New Policies Scenario. It does not explicitly describe what policy changes, if any, have been made to its 2014 Current Policies Scenario. Due to competition from other fuels, environmental concerns and energy efficiency gains, the IEA projects that non-OECD oil demand growth will markedly decelerate in the 2030s, a time when China's oil demand is projected to plateau.

11 IEA, World Energy Outlook 2013 (Paris: OECD/IEA, 2013), p.459.

OPEC shares a few proposals with the IEA's New Policy Scenario.

The comparison shows that OPEC shares a few common proposals with the IEA's New Policies Scenario in their policy highlights, including EU's new 2030 climate and energy targets, China's National Action Plan on Prevention and Control of Air Pollution, Japan's possibility of reactivating nuclear power plants, and India's fuel efficiency standards. Note that the policies highlighted in the IEA's New Policies Scenario are not legally adopted.

| | **IEA WEO2014:** Highlighted Policies | **OPEC WOO2014:** Highlighted Policies |
|---|---|---|
| | **Only for New Policies Scenario:** | |
|  | **CHINA:** National Action Plan on Prevention and Control of Air Pollution | National Action Plan on Prevention and Control of Air Pollution (2013 – 2017)<br>Energy-related policies in 12th Five-Year Plan<br>Local car sales control (car license limits) |
|  | **DUBAI:** New building codes | |
|  | **EU:** 2030 climate and energy targets announced by the European Commission | 2030 climate and energy targets announced by the European Commission<br>Amendment to biofuel target which restrict crop-based biofuels below 6% |
|  | **INDIA:** Corporate Average Fuel Consumption standards | Energy related policies in 12th and 13th Five-Year-Plans<br>Corporate Average Fuel Consumption standards |
|  | **JAPAN:** Strategic Energy Plan which includes reactivation of some nuclear power plants | Strategic Energy Plan which includes reactivation of some nuclear power plants |
|  | **MEXICO** | Energy Reform Bill introduced in December 2013 |
|  | **QATAR:** Efficiency standards for air conditioners | |
|  | **SAUDI ARABIA:** Fuel-economy labelling for new cars and for imported vehicles | |
|  | **SOUTH KOREA** | Second Basic Energy Plan 2014-2035 |
|  | **US:** Clean Power Plan with the aim of cutting power sector CO2 emissions 30% by 2030 relative to 2005 levels | Phase-2 CAFE standards for heavy-duty vehicles<br>Crude oil export ban retained |

## 5.2 Long-term Energy Demand

### 5.2.1 Primary Energy Consumption

Fossil fuels continue to dominate the primary energy mix. Oil, gas and coal take 80% of the total.

The fundamental trends of global energy consumption are similar to those presented last year. Global energy demand continues to grow through 2040 in the projections, but that growth is slower than in previous decades. Consumption growth is driven primarily by economic and population growth, with the majority of demand growth coming from developing countries. Fossil fuels continue to dominate the primary energy mix, with oil, gas and coal maintaining around 80% of the total share. As always, significant uncertainties remain regarding policy and technological development, which will play important roles in shaping the pace of demand growth as well as fuel mix composition. Overall, primary energy demand projections in OPEC's Reference Case are closest to the IEA's Current Policies Scenario. OPEC projects a 60% increase in world total primary energy demand in 2040 relative to 2010, which is moderately higher than the IEA's projection of a 55% increase. **Figure 14** provides a comparison of total expected primary energy supply by energy source. **Figure 15** presents the share of each fuel in the global energy mix in 2010, along with projections for 2040. The most notable difference between the projections lies in the composition of the fossil fuel mix. The IEA's projection for total natural gas supply in 2040 is 16 mboe/d lower than OPEC's, while its outlook for oil and coal supply are both 7 mboe/d higher than OPEC's.

Primary energy demand projections in OPEC's Reference Case are closest to the IEA's Current Policies Scenario.

The most notable difference between projections lies in the composition of the fossil fuel mix.

**Figure 14. World Primary Energy in 2010 and Outlook for 2040**

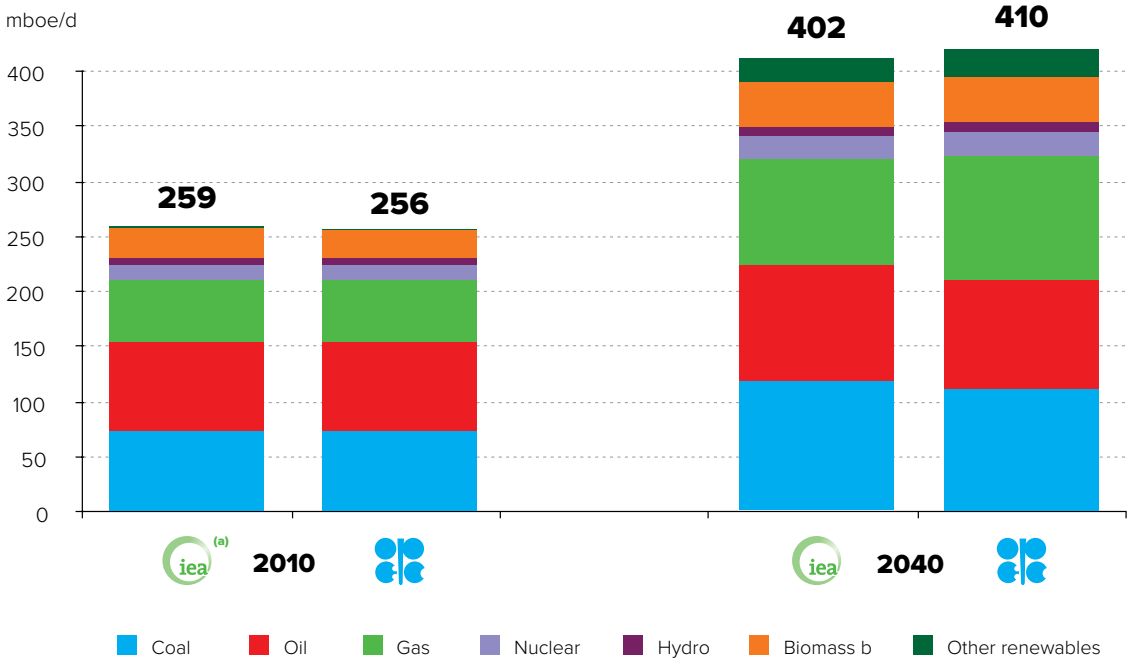



***Figure 14 data sources:*** *IEA WEO2014, Annex Table; Communication from IEA; OPEC WOO2014, Table 1.7.*

***Figure 14 notes:*** *a IEA's primary energy is converted from mtoe per year to mboe/d by multiplying by 7.33 mboe/mtoe and dividing by 365 days per year. b Biomass includes both traditional and modern biomass uses.*

**Figure 15. World Primary Energy Fuel Shares in 2010 and Outlook for 2040**

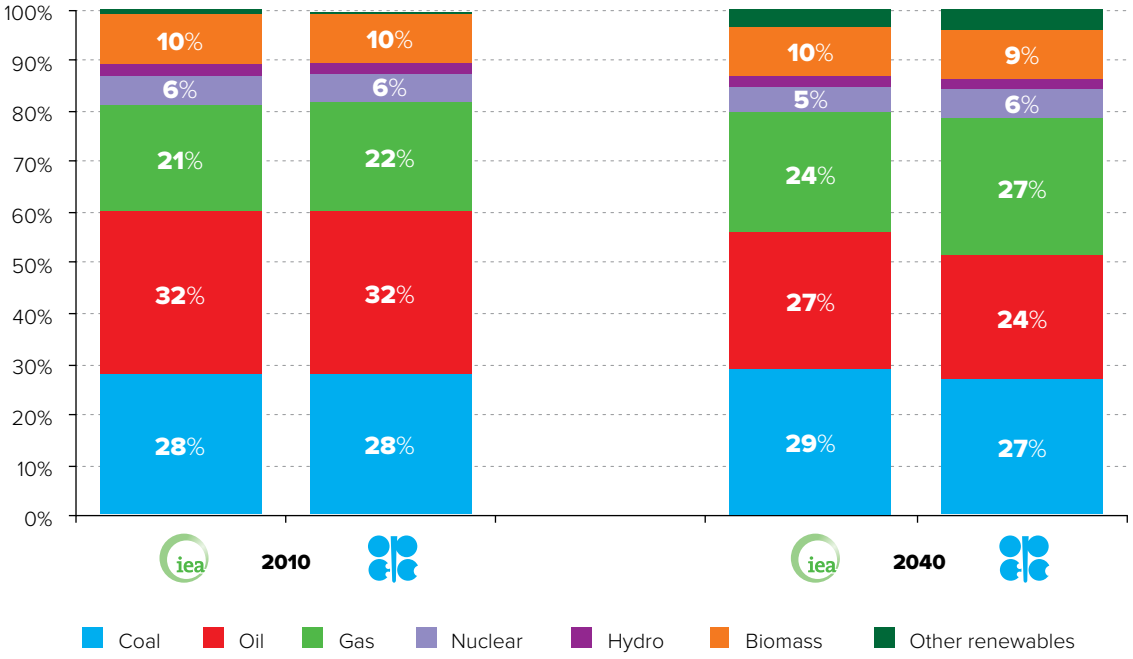



***Figure 15 data sources:*** *IEA WEO2014, Annex Table; Communication from IEA; OPEC WOO2014, Table 1.7.*

In both the IEA's Current Policies Scenario and OPEC's Reference Case, oil is expected to cede its leading position in primary energy consumption to coal by 2040. In the IEA's New Policies Scenario, however, oil maintains its position as the leading fuel. As **Figure 15** shows, the IEA Current Policies Scenario projects the share of oil will decline from 32% in 2010 to 27% in 2040, while OPEC sees a drop from 32% to 24%. In both the IEA's Current Policies Scenario and OPEC's Reference Case, the share of coal will remain steady throughout the projection period, while natural gas is set to grow the fastest among all fossil fuels with an increasing share in the fuel mix. In addition, renewables' share is projected to increase from 13% in 2013 to 16% by 2040 in OPEC's Reference Case, and to 15% and 19% in the IEA's Current Policies Scenario and New Policies Scenario respectively. Electricity is expected to grow faster than any other final form of energy worldwide.

It remains a challenge to compare oil demand between the WEO and WOO because of different regional definitions and fuel classifications.

### 5.2.2 Liquids Demand

Similar to last year's assessment, it remains a challenge to directly compare oil demand between the WEO and WOO reports. First, the IEA and OPEC maintain different regional definitions. As mentioned in Section 3, OPEC separates its member countries from their geographic regions and calculates OPEC oil demand as a distinct group. The IEA groups countries by geography and OECD membership status. Since OPEC member countries are found in the Middle East, Africa and Latin America, oil demand in these regions reported by OPEC is not comparable with the IEA's figures. This paper aggregates the Middle East, Africa and Latin America into one group to more directly compare oil demand projections.

Second, the IEA and OPEC diverge on their classification of biofuels. The IEA groups biofuels into the renewables category, and projects the demand of biofuels and oil separately. On the other hand, OPEC treats biofuels as a liquids category, and thus its projections for liquids demand includes biofuels demand as IEA does in its OMR and MTOMR. To adjust for

this difference, we aggregate the IEA's oil and biofuels demand for each region, making the numbers comparable with OPEC's.[12]

IEA and OPEC define bunker fuels differently and use different units in energy demand projections.

Third, the IEA and OPEC define bunker fuels differently. While the IEA reports international marine bunker and aviation fuel as a distinct "bunker" group – not attributable to any country or region – OPEC includes bunker and aviation fuel in each region's oil demand, just as it does with biofuels. In addition, OPEC does not differentiate between international and domestic aviation fuels. Aggregating total marine bunker and aviation fuel demand from the OPEC WOO2014 report leads to a much larger number than that reported under the "bunkers" category in the WEO2014. For this reason, we do not compare bunker and aviation fuels between the IEA and OPEC, although we do show "bunkers" as a category for the IEA's world oil demand projections.

Finally, the IEA and OPEC use different units in energy demand projections. Oil demand in the OPEC WOO2014 is presented in volumetric units "million barrels per day (mb/d)." However, since the WEO2014 includes fuels other than oil, the IEA standardises its reporting in energy-equivalent terms: "million tonnes oil equivalent (mtoe)." For comparability, we convert biofuels from mtoe to mb/d by multiplying by a factor of 0.033 mb/d per mtoe[13].

Incorporating the adjustments described above, **Table 12** presents a comparison of long-term world liquids demand projections using the IEA's Current Policies Scenario and OPEC's Reference Case. Although the share of oil is expected to decrease over time in the world primary energy portfolio, oil demand still enjoys robust growth over the projection period. In the IEA's Current Policies Scenario, world liquids demand reaches around 121 mb/d by 2040, roughly 10 mb/d higher than OPEC's Reference Case projection of 111 mb/d. However, the IEA's New Policies Scenario also projects world total liquids demand to be around 111 mb/d in 2040 **(Figure 16).**

Though oil demand is expected to grow over the projection period, the largest difference for oil demand in 2040 is 35.6 mb/d.

Of all the scenarios, the upper bound of demand projections comes from the IEA's Current Policies Scenario, and the lower bound from the IEA's 450-ppm Scenario. The difference between the highest and lowest projections for 2040 world liquids demand is 35.6 mb/d. By incorporating strict policies for greenhouse gas mitigation, the 450-ppm Scenario suggests that world liquids demand peaks around 2020, then gradually declines below 2013 levels by around 2035. OPEC's three projection trajectories stay in the middle of the range. Taking into account the historical gap at the beginning of the projections, OPEC's Reference Case projects slightly faster annual growth for liquids demand than the IEA's New Policies Scenario. **Figure 16** also suggests that demand growth will slow in the coming decades. Both the IEA and OPEC estimate much slower annual demand growth after 2020 relative to this decade.

12 For the IEA's central case, the New Policies Scenario, biofuels projections are presented in Chapter 7 and for the Current Policies Scenarios are available in "IEA World Energy Outlook 2014 Annex A Tables for Scenario Projections" (see WEO2014 p. 602).

13 The mtoe-to-mbd conversion factor of 0.033 is derived from a three-step calculation: first, we divide the IEA's world biofuels demand in oil-equivalent mb/d terms (presented in WEO2014 Table 3.1) by corresponding biofuels demand in mtoe (presented in WEO2014 Annex A tables), which generates an average conversion factor of 0.021 mboed/mtoe; second, we divide the IEA's world biofuels demand in volumetric mb/d terms (calculated from the IEA's MTOMR) by the demand in mboed to get an average mboed-to-mbd conversion factor of 1.544; finally, we multiply 0.021 mboed/mtoe by 1.544 mbd/mboed to arrive at 0.033 mbd/mtoe.

## Table 12. Long-term Liquids Demand Forecasts (mb/d)

| | 2040 | | Avg. annual growth (2013-2040) | | |
|---|---|---|---|---|---|
| | IEA Current Policies Scenario[a] | OPEC Reference Case | IEA | OPEC | Difference (IEA-OPEC) |
| Total OECD | 38.8 | 38.2 | -0.1 | -0.3 | 0.1 |
| OECD Americas | 22.8 | 20.6 | 0.0 | -0.1 | 0.1 |
| OECD Europe | 10.4 | 11.0 | -0.1 | -0.1 | 0.0 |
| Asia Oceania | 5.5 | 6.5 | -0.1 | -0.1 | 0.0 |
| Total Non-OECD | 71.6 | 72.9 | 1.1 | 1.1 | 0.0 |
| Asia | 37.9 | 41.0 | 0.7 | 0.7 | -0.1 |
| China | 17.7 | 18.8 | 0.3 | 0.3 | 0.0 |
| India | 10.8 | 9.8 | 0.3 | 0.2 | 0.0 |
| Other non OECD | 9.3 | 12.4 | 0.1 | 0.2 | -0.1 |
| Middle East, Africa & Latin America | 28.3 | 26.0 | 0.4 | 0.3 | 0.1 |
| Europe & Eurasia | 5.4 | 5.9 | 0.0 | 0.0 | 0.0 |
| Bunkers[b] | 10.4 | n/a | 0.1 | n/a | n/a |
| World | 120.8 | 111.1 | 1.1 | 0.8 | 0.3 |

***Table 12 data sources:*** *IEA WEO2014, Annex A Tables; OPEC WOO2014, Table 1.11.*

***Table 12 notes:*** *Columns may not sum to totals due to rounding. IEA Current Policies Scenario[a]: Biofuels from IEA WEO2014 Annex A are added to IEA regional oil demand data for comparability with OPEC estimates, after converting from mtoe to mb/d. Bunkers[b]: in the IEA WEO2014 include international marine bunkers and aviation fuels. In the OPEC WOO, all bunkers are within regional demand.*

## Figure 16. World Liquids Demand Projections in Various Scenarios

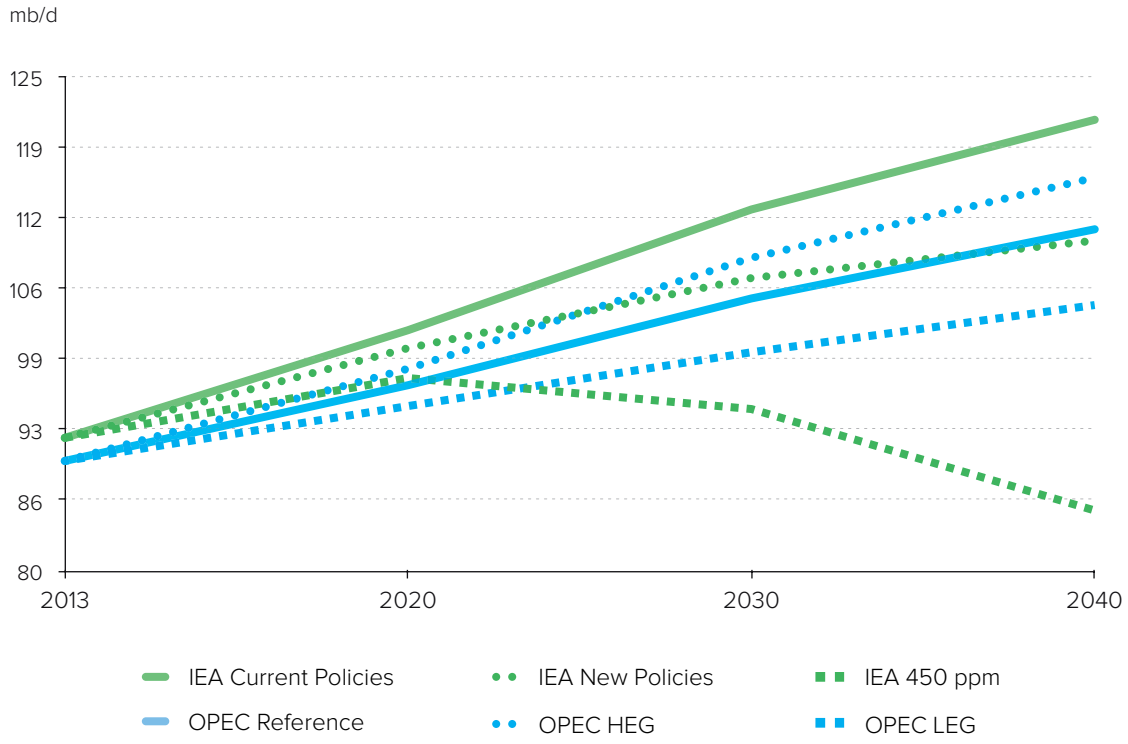



***Figure 16 data sources:*** *IEA WEO2014, Annex A Tables for Scenario Projections and Table 3.2; Communication from IEA; OPEC WOO2014, Table 1.11, Table 4.3, 4.5.*

***Figure 16 notes:*** *Biofuels from IEA WEO2014 Annex A are added to IEA regional oil demand data for comparability with OPEC estimates, after converting from mtoe to mb/d.*

The centre of demand continues to shift to developing countries, with the share of non-OECD countries' demand increasing from 50% to 65% by 2040.

Regarding regional demand, the IEA's Current Policies Scenario and OPEC's Reference Case make similar projections for OECD and non-OECD consumption patterns. Both project that OECD countries will experience a decline in long-term oil demand, yet this decrease is expected to be more than offset by robust demand growth in non-OECD regions. The centre of demand growth continues to shift to developing countries, with non-OECD nations' share of total oil demand increasing from roughly 50% to around 65% over the course of both outlooks **(Figure 17)**.

For individual regions and nations, the IEA and OPEC share similar views on overarching trends, with some moderate differences for certain regions and nations. For instance, both project that China will contribute most to oil demand growth over the projection period, followed by India. Due to rising demand in other non-OECD Asia nations as well, this region dominates global demand growth in both the IEA's and OPEC's projections. In addition, the Middle East (including OPEC countries) emerges as an important growth centre, with Middle East demand growth approaching that of China and India. The largest declines under both projections occur in OECD Americas, where more stringent fuel economy standards help reduce demand.

**Figure 17. OECD and Non-OECD Shares of Liquids Demand in 2013 and Outlook for 2040**

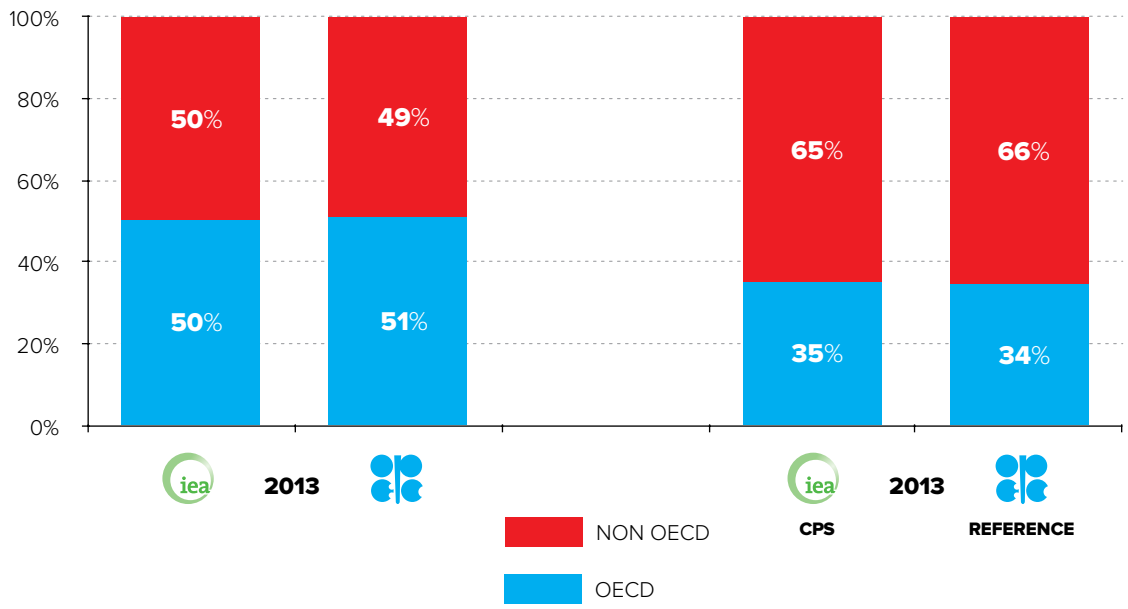



***Figure17 data sources:*** *IEA WEO2014, Annex A Tables for Scenario Projections & Table 3.2; OPEC WOO2014, Table 1.11.*

***Figure17 note:*** *a The "bunkers" group in the IEA's WEO report is excluded from calculation for OECD and non-OECD oil demand shares. b Biofuels from IEA WEO2014 Annex A are added to IEA regional oil demand data for comparability with OPEC estimates, after converting from mtoe to mb/d by multiplying by a factor of 0.033.*

IEA and OPEC perspectives on sectoral trends are overall consistent.

Perspectives on sectoral trends are consistent between the IEA and OPEC. Transportation and the petrochemicals industry are expected to remain the largest oil consumers and also contribute the majority of demand growth. Oil consumption for power generation is projected to decrease in all regions. As a result, shares of oil consumption in transport and petrochemical sectors will become larger.

## 5.3 Long-term Energy Supply

### 5.3.1 Mathematical Models

IEA's and OPEC's long-term supply methodologies are very different.

Section 3 mentioned that both the IEA and OPEC base their medium-term supply projections on bottom-up approaches. However, their long-term supply projection methodologies are very different.

In its WOO series, OPEC uses a resources-to-production (R/P) model to verify estimates of annual future oil production based on various variables including discovery rates, development cost, profitability and drilling footage. In this model, the focus is on estimating the remaining oil reserves of each country. OPEC primarily relies on U.S. Geological Survey (USGS) data updated in 2012 for country-level Ultimately Recoverable Resources (URR). The advantage of using R/P to verify estimates is its simplicity and ease of understanding.

OPEC uses a resources-to-production model in combination with other factors.

However, past research suggested methodological flaws in such models. For example, URR can be low due to the possible exclusion of new discoveries and underestimates of reserve growth[14].

However, OPEC notes that the largest concern in using an R/P model is the challenge of incorporating unconventional resources. OPEC finds its R/P model inappropriate in developing supply forecasts for LTO and unconventional NGLs, and therefore separates its supply forecasts for tight crude and unconventional NGLs from conventional liquids resources.

One methodological improvement from OPEC over last year is that the WOO2014 includes a more comprehensive examination of active unconventional plays in North America. This yields a more optimistic view on unconventional crude and NGLs supply relative to the WOO2013. For unconventional resources outside North America, OPEC takes a cautious approach. Non-OPEC unconventional supply from Russia and Argentina is included in OPEC's Reference Case projection, while those from China and Mexico are only considered to produce oil in the Upside Supply Scenario (HIGHSUP).

IEA uses a bottom-up country-by- country modelling approach for its long-term supply projection.

The IEA employs a bottom-up modelling approach for its long-term oil supply projection. Unlike in the MTOMR, however, the IEA takes a country-by-country approach instead of the field-by-field approach (though the first five years of the long-term projection employs field-by-field analysis). For the long-term projections, production in each country is derived by simulating the investment process, considering existing and potential resources, global oil demand, and a net present value (NPV) ranking of possible projects in that country.

Another important difference between the IEA's long-term supply forecast and its medium-term forecasts lies in the methodology for calculating OPEC supply. As shown in Table 10, OPEC crude is constructed by subtracting non-OPEC supplies and OPEC NGLs/unconventionals supply from total world oil demand in the MTOMR. In the long-term WEO model, however, supplies from OPEC countries are projected using the same methodology used for non-OPEC nations.

14 Adam R. Brandt, Review of mathematical models of future oil supply: Historical overview and synthesizing critique, Energy, Volume 35, Issue 9, September 2010, Pages 3958-3974, ISSN 0360-5442, http://dx.doi.org/10.1016/j.energy.2010.04.045.

IEA and OPEC use different liquid fuel classification systems that make comparison of outlooks difficult.

### 5.3.2 Liquids Supply

As Figure 9 in Section 3 illustrates, the IEA and OPEC use different classification systems for liquids fuels, presenting challenges when comparing long-term supply forecasts. Table 13 summarises long-term liquids supply outlooks for the IEA's Current Policies Scenario and OPEC's Reference Case. Many of the differences in this table can be attributed to divergent demand projections, but some other noteworthy points also emerge.

**Table 13. Long-term Liquids Supply (mb/d)**

| | 2035 | | Avg. annual growth (2012-2035) | | |
|---|---|---|---|---|---|
| | IEA Current Policies Scenarioa | OPEC Reference Case[a] | IEA Current Policies Scenario | OPEC Reference Case | Difference (IEA-OPEC) |
| OECD | 27.3 | 24.0 | 0.2 | 0.1 | 0.1 |
| Americas | 24.0 | 20.8 | 0.3 | 0.1 | 0.1 |
| Europe | 2.4 | 2.4 | 0.0 | 0.0 | 0.0 |
| Asia Oceania | 1.0 | 0.6 | 0.0 | 0.0 | 0.0 |
| Non-OECD | 30.9 | 30.8 | 0.0 | 0.1 | 0.0 |
| Asia | 6.6 | 6.2 | 0.0 | -0.1 | 0.0 |
| Middle East, Africa & Latin America | 10.8 | 9.3 | 0.1 | 0.0 | 0.1 |
| Europe & Eurasia | 13.5 | 16.4 | 0.0 | 0.1 | -0.1 |
| Processing Gains | 3.5 | 3.1 | 0.0 | 0.0 | 0.0 |
| World Biofuels supply | 5.6 | 4.0 | 0.1 | 0.1 | 0.1 |
| Total Non-OPEC | 67.3 | 61.9 | 0.5 | 0.3 | 0.2 |
| Total OPEC | 54.8 | 49.3 | 0.7 | 0.5 | 0.2 |
| OPEC crude[b] | 40.8 | 39.7 | 0.4 | 0.4 | 0.0 |
| OPEC NGLs + unconventionals | 13.9 | 9.7 | 0.3 | 0.1 | 0.1 |
| World Supply | 122.1 | 111.3 | 1.1 | 0.8 | 0.3 |

***Table 13 data sources:*** *IEA WEO2014, Annex A Tables, Table 14.1; Communication from IEA; OPEC WOO2014, Table 1.13, 3.8.*

***Table 13 notes:*** *Columns may not sum to totals due to rounding. OPEC Reference Case[a]: The IEA WEO does not include regional biofuels supply. Regional biofuels supply (OPEC WOO2014 Table 3.8) is therefore subtracted from each of OPEC's regional total liquids supply (OPEC WOO2014, Table 1.13) and only world biofuels supply is provided. OPEC crude[b]: Venezuela extra heavy oil is included in OPEC crude, consistent with OPEC classification.*

Notwithstanding its higher global liquids supply forecast in the Current Policies Scenario, the IEA's supply outlook for Europe and Eurasia is almost 3 mb/d lower than OPEC's forecasts. This projected level of production is lower than current production levels, with the largest decline coming from Russia under both the Current Policies and New Policies Scenarios.

Balancing out this difference in projections, the IEA's forecasts compared to OPEC's are substantially more bullish for OECD Americas and OPEC NGLs/unconventionals. OECD Americas boasts abundant unconventional resources, led by LTO in the United States and oil sands in Canada. Indeed, much of the incremental demand envisioned in the IEA's Current Policies Scenario will be fuelled by unconventional liquids. This may be in part due to the considerably higher oil price assumptions in IEA's WEO2014 relative to OPEC's WOO2014.

### A Continued Focus on LTO

The IEF-Duke 2014 background paper identified very different perspectives of the IEA and OPEC with regard to North American LTO production. Over all three projection periods, the IEA made more optimistic forecasts for LTO supply growth than OPEC. This year, however, we find similar growth forecasts for North America LTO over the short- and medium-terms (**Figure 6** and **Figure 11)**. Both the IEA and OPEC have revised their short- and medium-term forecasts upward as field production has repeatedly surpassed expectations; OPEC's revision was greater.

For long-term supply, the LTO production peak projected by the IEA is later than that projected by OPEC. OPEC projects LTO production in North America to peak at 4.4 mb/d just before 2020 and begin to fall, while the IEA projects production to taper off in the late 2020s after a long plateau around 6.5 mb/d under the New Policies Scenario. Based on new assessments of unconventional fields in the United States and Canada, OPEC's long-term LTO supply projections in WOO2014 are substantially higher than WOO2013. Nonetheless, discrepancies still exist. Both the IEA's Current Policies and New Policies Scenarios make much higher projections for both LTO and Canadian oil sands supply in 2040 than OPEC's Reference Case.

Both IEA and OPEC revised their short- and medium-term LTO forecasts upwards as production surpassed expectations.

As always, forecast differences are expected over a 26-year projection period. Key questions focus on how long the United States can sustain its LTO production and whether other regions can replicate North America's LTO success. Within the United States, these questions include whether technological advances can offset the depletion of "sweet spots," and how the 2014 oil price slide will affect LTO investment. Outside North America, OPEC projects limited production from Russia and Argentina, with total production of 0.7 mb/d by 2040. However, the IEA expects almost half of total tight oil production in 2040 to come from countries outside North America. They expect aggregate production from Russia and Argentina to exceed 1 mb/d in the New Policies Scenario by 2040. Following that are Mexico, China and the rest of the world, whose combined production is projected to reach around 1 mb/d by 2040.

Analysis of the IEA's and OPEC's views about the composition of world supply by fuel type, as shown in **Figure 18** and **Figure 19**, also yields notable points. As shown in **Figure 19**, OPEC's share of global supply rises from the current level of around 40% to roughly 45% by 2040 under the IEA's CPS and OPEC's Reference Case. In another similarity, both project fairly steady production levels from non-OPEC conventional crude and NGLs supply, but the share of liquids from these sources falls substantially due to increasing total supplies. The IEA projects that these liquids will fall from 49% of total supply in 2013 to 34% in 2040, while OPEC projects a decline from 50% in 2013 to 40% in 2040.

## Figure 18. Liquids Supply Sources in 2013 and Outlook for 2040

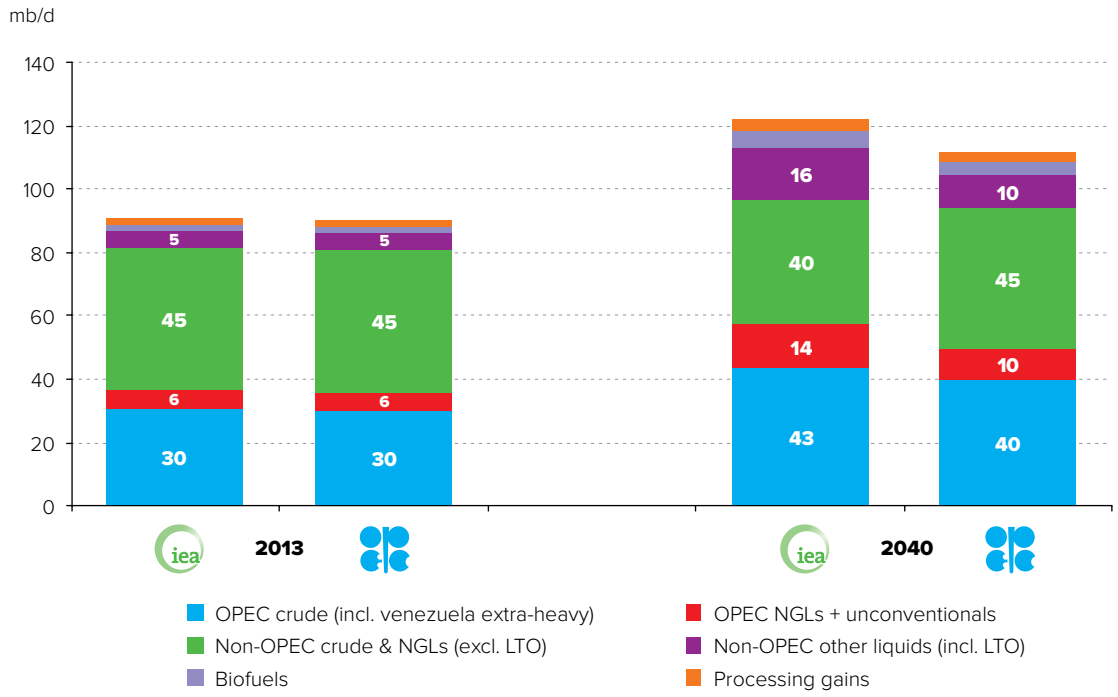



***Figure 18 data sources:*** *IEA WEO2014, Table 3.5; Communication from IEA; OPEC WOO2014, Tables 1.13 and 3.8.*

***Figure 18 note:*** *IEA biofuels from Table 3.5 in WEO2014 converted from energy-equivalent basis to volumetric mb/d by multiplying a factor of 1.544. See footnote 14.*

## Figure 19. Shares of Liquids Supply by Types in 2013 and Outlook for 2040

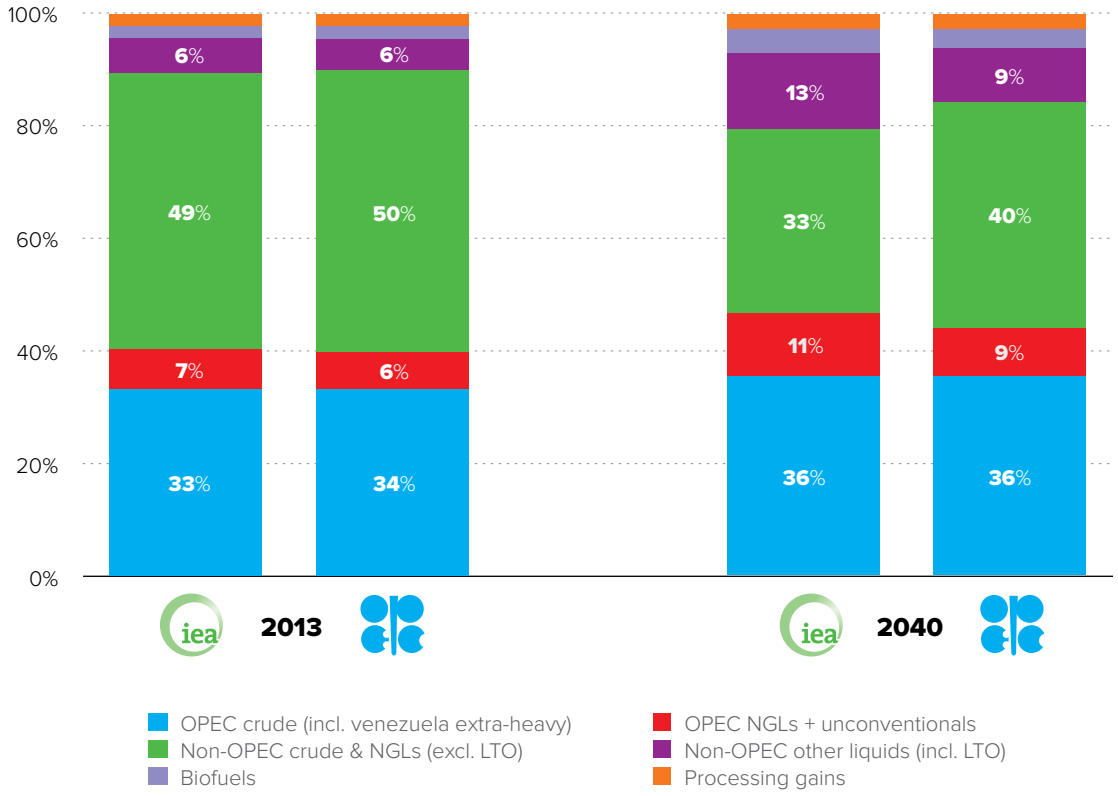



***Figure 19 data sources:*** *IEA WEO2014, Table 3.5; Communication from IEA; OPEC WOO2014, Tables 1.13 and 3.8.*

World supply outlooks are strongly affected by different scenario assumptions as Figure 20 illustrates.

Finally, **Figure 20** presents a comparison of world liquids supply forecasts from all WEO2014 and WOO2014 scenarios. This figure highlights how dramatically world supply outlooks can be affected by different scenario assumptions. The IEA primarily varies its assumptions across different policies by adjusting key energy and environmental policies. As a result, all types of liquids supply are affected. In the WOO2014, the key variable that drives differences in the scenarios is economic growth. OPEC projections show variation in OPEC crude supplies, while non-OPEC supplies and OPEC NGLs stay fairly constant across scenarios.

### Figure 20. 2040 Liquids Supply Outlook in Different Scenarios

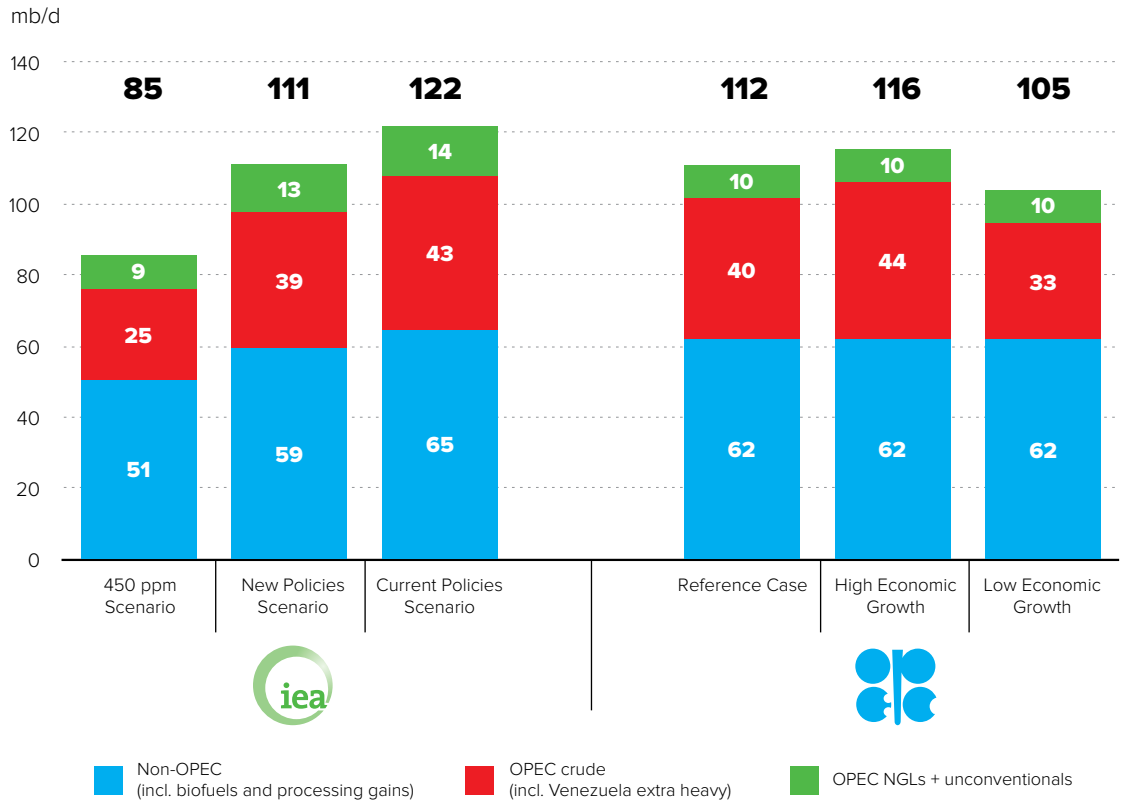



***Figure 20 data sources:*** *IEA WEO2014, Table 3.5; Communication from IEA; OPEC WOO2014, Table 4.3, 4.4,4.5 & 4.6.*

***Figure 20 notes:*** *IEA[a]: biofuels from Table 3.5 in WEO2014 are converted from energy-equivalent to volumetric basis by multiplying a factor of 1.544 (See footnote 14). OPEC[b]: WOO2014 does not report projections for processing gains in the LEG and HEG scenarios; it is assumed that processing gains in these scenarios are the same as the OPEC Reference Case.*

## 6. Final Observations

2014 was a turbulent year for global oil markets. Relatively stable oil prices above US$100/bbl since 2011 plunged to below US$60/bbl by the end of 2014, and continued to decline in early 2015. This price drop is attributable to a range of factors including weaker-than-expected oil demand from OECD and non-OECD nations, continued rapid growth from North American unconventional oil supplies, and resulting changes in global oil market expectations. While for some countries low oil prices stimulates economic growth, the drop in crude prices has triggered concerns in certain sectors, such as possible negative spill

over effects on financial markets, decreased investment in unconventional oil production, and weakened economic growth prospects in major oil-producing countries.

Notwithstanding these short-term uncertainties, some long-term fundamentals are fairly clear. Economic expansion and population growth will continue to boost global oil demand, with the majority of growth contributed by non-OECD nations, particularly non-OECD Asia, the Middle East and Africa. Despite international efforts to slow global climate change, oil in 2040 – along with other fossil fuels – appears likely to maintain a central position in the global fuel mix. However, as the major emerging economies mature, more efficient technologies are deployed and environmental concerns grow, global oil demand growth may be tempered.

The key questions for long-term oil supply are which nations and what types of oil production are likely to support demand growth. Non-OPEC supply from unconventional plays has increased sharply in recent years, but there is no consensus on when this supply may peak or begin to fall. To meet long-term demand growth, OPEC will continue to play a central role in global oil supply.

This introductory paper attempts to enhance understanding of views and methodologies from two widely acknowledged information providers, the IEA and OPEC, by comparing their outlooks over various time horizons. Various similarities and differences between their historical data, assumptions and projections are mentioned in this paper. Our objective is not to harmonise all assumptions or to eliminate differences in perspectives. Instead, the goal is to pursue higher-quality data and control for differences in convention in order to better inform stakeholders worldwide.

As a continuous effort, the Fifth IEA-IEF-OPEC Symposium on Energy Outlooks aims to provide an open platform to facilitate consumer-producer dialogue on global energy security. After a careful comparison of the IEA's and OPEC's multi-horizon outlooks, this paper has proposed the following issues for further discussion at the symposium:
Exploring differences in historical data, particularly in non-OECD demand, as well as FSU and OPEC NGLs/unconventionals supply;

- Understanding factors that underscore differences in medium- and long-term oil price assumptions;
- Advancing efforts to standardise liquids fuel supply categories;
- Adopting consistent approaches in classifying fuels at regional versus global levels (e.g. biofuels, bunkers);
- Understanding policy assumptions made in each long-term energy outlook;
- Harmonising baseline years in long-term energy projection models;
- Sharing viewpoints on oil supply forecast models, and analysing potential enhancement of long-term oil supply projection models, particularly with respect to unconventional resources; and
- Standardising unit conversion processes across mb/d, mboe/d, and mtoe.

## Annex 1: Long-term Outlook Assumptions

| | OPEC | | | IEA | | |
|---|---|---|---|---|---|---|
| **Variables** | **Reference Case** | **LEG** | **HEC** | **New Policies** | **Current Policies** | **450** |
| Global Economic Growth Rate (2014-2040) | 3.6% | 3.1% | 3.9% | 3.4% | same as New Policies | same as New Policies |
| Population, Billion | From 7.1 to 9.1 (2013-2040) | same as Reference Case | same as Reference Case | From 7.1 to 9.1 (2013-2040) | same as New Policies | same as New Policies |
| Oil Price Assumptions (in 2013 $) | $95/bbl by 2020; $102/bbl by 2040 | Same as Reference Case | Same as Reference Case | $112/bbl by 2020; $132/bbl by 2040 | $116/bbl by 2020; $155/bbl by 2040 | $105/bbl by 2020; $100/bbl by 2040 |
| Investment (2014-2040, in 2013 $) | $102/bbl by 2040 | same as Reference Case | same as Reference Case | $112/bbl by 2020; | Not specified | Not specified |
| Energy and Environmental Policies | $132/bbl by 2040 | $116/bbl by 2020; | same as Reference Case | Considers both policies in place and commitments announced | Only considers policies that have been enacted as of mid-2014 | Assumes policies to be taken to limit the concentration of GHGs in the atmosphere to 450-ppm of CO2 equivalent |
| Carbon Prices (in 2013 $) | Not specified | Not specified | Not specified | By 2040: $50/tonne in EU and Korea; $35/tonne in China; $24/tonne in Chile and South Africa | By 2040: $40/tonne in EU and Korea | By 2040: $140/tonne in OECD countries; $125/tonne in China, Russia, Brazil and South Africa |

## Annex 2: Long-term Outlook Results

| | OPEC | | | | IEA | | | |
|---|---|---|---|---|---|---|---|---|
| | Base Year | 2040 Scenario | | | Base Year | 2040 Scenario | | |
| | | Reference Case | LEG | HEG | | New Policies | Current Policies | 450-ppm |
| Global energy demand (mboe/d) [a] (2010-2040) | 256.4 | 410.1 | - | - | 260.3 | 369.4 | 404.6 | 315.6 |
| Global Oil Demand (mb/d) (2013-2040) | 90.0 | 111.1 | 104.2 | 115.8 | 92.1 | 110.1 | 121.1 | 85.5 |
| Non-OPEC Supply (mb/d) [b] (2013-2040) | 54.2 | 61.9 | 61.7 | 62.0 | 54.7 | 58.3 | 63.8 | 49.6 |
| OPEC Crude (mb/d) [c] (2013-2040) | 30.2 | 39.7 | 33.0 | 44.2 | 30.0 | 38.8 | 43.3 | 25.5 |
| OPEC NGLs and Other Liquids (mb/d) (2013-2040) | 5.7 | 9.7 | 9.5 | 9.6 | 6.7 | 10.7 | 11.4 | 7.6 |

***Annex 2 notes**:*

[a] *IEA primary energy is converted from mtoe per year to mboe/d by multiplying by 7.37 mboe/mtoe and dividing by 365 days per year.*

[b] *Include biofuels and processing gains.*

[c] *OPEC crude includes Venezuela extra-heavy oil.*

# FIFTH IEA IEF OPEC SYMPOSIUM ON ENERGY OUTLOOKS

**International Energy Forum** in partnership with **Duke University**

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