

SIXTH IEA IEF OPEC SYMPOSIUM ON ENERGY OUTLOOKS



 AN INTERNATIONAL ENERGY FORUM PUBLICATION

16 FEBRUARY 2016

INTRODUCTORY PAPER A COMPARISON OF RECENT IEA AND OPEC OUTLOOKS

International Energy Forum in partnership with Duke University

Duke | ENERGY INITIATIVE
UNIVERSITY



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



SIXTH IEA IEF OPEC SYMPOSIUM ON ENERGY OUTLOOKS

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.

Professor Richard G. Newell, Director of the Duke University Energy Initiative and Gendell Professor of Energy and Environmental Economics, served as Principal Researcher on the project. Xiaochen Sun, Research Analyst at the Duke University Energy Initiative, provided key research assistance and Benjamin Gibson, Assistant Director for Research Development, provided additional support at Duke.

The **IEF** would like to thank the **IEA** and **OPEC** for their constructive comments and insights into this document and the on-going dialogue that underpins the trilateral programme of work.

Table of Contents

Acronyms and Abbreviations	4
1. Key Observations	5
1.1 Overview	5
1.2 Recent Progress on Data Harmonisation and Comparability of Outlooks	5
1.3 Opportunities to Advance the Comparability of Outlooks	6
1.4 IEA and OPEC Short-Term Oil Outlooks	7
1.5 IEA and OPEC Medium-Term Oil Outlooks	8
1.6 IEA and OPEC Long-Term Energy Outlooks	9
1.7 Recent Trends	12
2. Background and Introduction	12
3. Baseline 2014 Data	14
4. Short-term Oil Outlooks	17
4.1 Economic Growth Assumptions	17
4.2 Short-term Liquids Demand	18
4.3 Short-term Liquids Supply	23
5. Medium-term Oil Outlooks	26
5.1 Oil Price and Economic Growth Assumptions	26
5.1.1 Oil Price	26
5.1.2 Economic Growth	28
5.2 Medium-term Liquids Demand	28
5.2.1 Global and Regional Demand Growth	28
5.2.2 Sectoral Demand	30
5.3 Medium-term Liquids Supply	31
5.3.1 Liquid Fuels Classification and Projection Methodology	31
5.3.2 Global and Regional Liquids Supply	33
6. Long-term Energy Outlooks	36
6.1 Key Assumptions	36
6.1.1 Scenarios	36
6.1.2 Demography	38
6.1.3 Economic growth	39
6.1.4 Oil Prices	40
6.1.5 Energy and Environmental Policies	41
6.2 Long-term Energy Demand	43
6.2.1 Primary Energy Consumption	43
6.2.2 Liquids Demand	44
6.3 Long-term Oil Supply	48
6.3.1 Mathematical Models	48
6.3.2 Liquids Supply	50
7. Final Remarks	54
Annex 1: Long-term Outlook Assumptions	56
Annex 2: Long-term Outlook Results	57

Acronyms and Abbreviations

bbbl	Barrel
CPS	Current Policies Scenario (IEA)
EOR	Enhanced Oil Recovery
FSU	Former Soviet Union
GDP	Gross Domestic Product
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)
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
NPV	Net Present Value
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
R/P	Resources-to-Production
SPR	Strategic Petroleum Reserve
UN	United Nations
UPS	Upside Supply Scenario (OPEC)
URR	Ultimately Recoverable Resources
USGS	U.S. Geological Survey
WEO	World Energy Outlook (IEA)
WOO	World Oil Outlook (OPEC)

1. Key Observations

1.1 Overview

- This document provides a **comparative analysis of the short-, medium-, and long-term energy outlooks** published by the IEA and OPEC in 2015.
- The exposition compares **estimates for world liquids fuel demand and supply** through the three time frames, along with their main regional and sectorial drivers. It also **includes comparisons of world primary energy consumption projections to 2040** by energy source and across three long-term scenarios, two from the IEA and one from OPEC.

1.2 Recent Progress on Data Harmonisation and Comparability of Outlooks

- During the past year, the IEA and OPEC have made **significant progress on data harmonisation** and improving the comparability of outlooks.
- For the first time both organisations use the **same baseline years across all oil demand projections** and **more directly compare geographical groups** for their long-term oil demand projections.
- For **long-term projections of primary energy demand the baseline year is now 2013** for both organisations.
- The **baseline year for projections of liquids fuel demand in the short-, medium-, and long-term is 2014**.
- OPEC and the IEA agreed to share and review more **historical baseline data** from 2008 to 2013 for the regions where apparent differences are largest: **Non-OECD Asia (excluding China), and the Former Soviet Union (FSU)**.
- **Regional assessments by the IEA and OPEC are more directly comparable** and help overcome their different regional classifications. In the WOO series, OPEC normally excludes its member countries from their geographical regions and reports OPEC group liquids demand separately. Since the IEA does not make a similar institutional distinction, OPEC has included a separate table that includes OPEC member country liquids demand data in the corresponding geographical regions.
- **Since last year biofuels production by region is published separately** in both the **IEA's Medium-Term Oil Market Report (MTOMR)** and the monthly **Oil Market Report (OMR)**, to enable a more direct comparison between the IEA's and OPEC's liquids supply outlooks.

1.3 Opportunities to Advance the Comparability of Outlooks

- **Differences in world liquids demand and supply baselines for 2014 of IEA and OPEC remain high**, diverging by 1.5 mb/d for demand and 1.3 mb/d for supply.
- IEA estimates **2014 world liquids demand** at 92.8 mb/d, whereas OPEC at 91.4 mb/d.
- For **2014 world liquids supply** IEA estimates 93.7 mb/d whereas OPEC estimates 92.4 mb/d.
- Regarding the supply from OPEC Member Countries, there is a 0.6 mb/d **gap between the IEA's and OPEC's estimates of OPEC NGLs and unconventional supply**. This divergence may result from different definitions for this category.
- The IEA and OPEC apply **distinct liquids classification systems** that differ in their categorisation of certain types of unconventional oil. In 2014 OPEC introduced the term “unconventional NGLs,” and included this in the “NGLs” category. IEA groups together conventional crude oil, NGLs (including conventional and unconventional supplies) and condensate into one category, and “unconventional oil” into another.
- Notwithstanding progress, the **categorisation of biofuels in medium-term reports is different**. OPEC puts biofuels together with other unconventional non-crude supply sources, whereas the IEA treats biofuels distinctly from all other oil supply sources. While OPEC includes biofuels in each region's total liquids supply, the IEA instead groups biofuels in a single world biofuels supply category.
- **Inconsistencies in units** for primary energy demand between the two organisations create further challenges in comparing the two reports. OPEC uses million barrels of oil equivalent per day (mboe/d), while the IEA uses million tons of oil equivalent (mtoe) per year for primary energy demand.
- Both organisations use **different definitions for apparently similar categories** e.g. “Kerogen oil” vs “Oil shale”, and “Tight oil” vs “Tight crude” or “Light Tight Oil”.
- The **basis for IEA and OPEC oil price assumptions differs** in two fundamental ways. First, IEA and OPEC use different price proxies. OPEC makes assumptions for an OPEC Reference Basket price. In contrast the IEA uses an IEA Average Import Price. Second, OPEC's long-term price assumptions focus on the estimated supply costs of the marginal barrel. The IEA uses market data from the Brent futures curve for the medium-term outlook and equilibrium prices reached in a supply demand model for the long-term outlook.
- While both OPEC and the IEA take a “bottom-up” approach of **assessing field-level supply capabilities** for their medium-term supply outlooks, they may take **different upstream oil production projects** into account and estimate different levels of field productivity resulting for instance from methodological differences that lead to distinct oil price assumptions.

- **OPEC's and IEA's mathematical models** for long-term supply projection methodologies are more distinct. The inherent uncertainties to which these methodologies are exposed contribute to **different long-term supply estimates from unconventional resources**.
- **OPEC uses a resources-to-production (R/P) model** to verify estimates of annual future oil production based on the U.S. Geological Survey data for country level estimates of Ultimately Recoverable Resources as well as variables including discovery rates, development cost, profitability and drilling footage.
- **IEA uses a bottom up approach** for long-term oil supply projections based on **a field-by-approach followed by a country-by-country approach** beyond the first five years of the long-term projection, modulating estimates by simulating the investment process, considering existing and potential resources, global oil demand and net present value rankings.
- This **contrasts with IEA's short-, and medium-term constructed supply assessments for OPEC supply** that subtract non-OPEC supplies, OPEC Natural Gas Liquids and unconventional from total world demand.
- IEA and OPEC use **different baseline years to calculate compound average annual economic growth**, despite overall comparable methods in deriving long-term GDP forecasts.

1.4 IEA and OPEC Short-Term Oil Outlooks

Liquids Demand

- OPEC and the IEA project **2015 world liquids demand** at 92.9 mb/d and 94.6 mb/d respectively, a difference in their estimates of 1.7 mb/d.
- Throughout 2015 both organisations revised upward their estimates for **world liquids demand growth**. The IEA increased it from 0.9 mb/d at the beginning of the year to 1.8 mb/d by December 2015; OPEC from 1.0 mb/d to 1.6 mb/d.
- The IEA and OPEC project **2016 world liquids demand** to reach 95.8 mb/d and 94.1 mb/d respectively, maintaining a difference of 1.7 mb/d in their estimates.
- They IEA and OPEC have similar but more conservative forecasts for **2016 world liquids demand growth**, estimating 1.2 mb/d and 1.3 mb/d respectively.
- The **2016 growth** projections of IEA and OPEC are 0.6 mb/d and 0.4 mb/d lower than their respective growth estimates for 2015.
- The gaps between the IEA's and OPEC's world liquids demand projections for 2015 and 2016 are **due to divergent perspectives on the regional drivers of world liquids demand growth in 2015 and differences in historical baseline data**. This baseline gap expanded from 1.5 mb/d in 2014 to 1.7 mb/d in 2015, and is forecast to remain around 1.7 mb/d in 2016.

- OPEC and the IEA **estimates for regional liquids demand in 2015 and 2016 vary in regions with large differences in historical data** – particularly in non-OECD Asia excluding China.

Liquids Supply

- The IEA and OPEC project **2015 world liquids supply** at 94.6 mb/d and 92.9 mb/d each, a difference of 1.7 mb/d.
- Both organisations have **evolving but similar views regarding 2015 non-OPEC liquids supply growth**. They adjusted non-OECD, non-OPEC supply upward during the course of 2015 due to higher-than-expected production levels in a number of non-OPEC suppliers, including the US and Brazil, as well as upward revisions made to historical data.
- The IEA and OPEC project **2016 world liquids supply** to reach 95.8 mb/d and 94.1 mb/d respectively, also a difference of 1.7 mb/d.
- Both organisations **views about overall non-OPEC world liquids supply growth are similar**, and they expect it to decline in 2016, after 2015 brought slower supply growth relative to 2014.
- IEA and OPEC estimate **annual non-OPEC liquid supply growth** decreasing by 1.1 mb/d and 1.2 mb/d respectively in 2015.
- The **non-OPEC liquids supply outlook shows the most significant difference** between OPEC's and IEA's short-term world liquids supply outlooks, even though it has narrowed from 0.8 mb/d to 0.6 md/d between 2015 and 2016.
- The **largest regional difference in supply still resides in the FSU**, stemming primarily from the difference in historical data. This gap in supply forecast has increased from 0.4 mb/d in 2015 to 0.5 in 2016.

1.5 IEA and OPEC Medium-Term Oil Outlooks

Liquids Demand

- The IEA and OPEC expect **2020 world liquids demand** to total 99.1 mb/d and 97 mb/d respectively.
- The IEA projects **world liquids demand growth** at an annual average of 1.1 mb/d reaching 99.1 mb/d in 2020. OPEC projects a slightly lower demand growth at an annual average of around 1.0 mb/d reaching 97.4 mb/d by 2020.
- **Differences in the IEA's and OPEC's medium term global liquids demand projections lead to a 1.7 mb/d gap in 2020** due to varying **historical demand data** and the different views on **non-OECD liquids demand growth**.

- IEA projects **non-OECD liquids demand** to grow by 1.2 mb/d, reaching 54 mb/d on the medium term. OPEC estimates show **non-OECD liquids demand** to grow yearly by 1.0 mb/d, rising to 51.8 in 2020.
- Both the IEA and OPEC note the **divergence in oil demand growth between OECD and non-OECD nations** to underscore the on-going transformation in global oil markets. OPEC suggests that oil demand in non-OECD nations surpassed that of OECD nations in 2015, while the IEA estimates this crossing point occurred about one year earlier.
- The IEA and OPEC medium-term **regional liquids demand outlooks shows that differences are largest in other non-OECD Asia outside of China, the Middle East, Africa, and Latin America.**

Liquids Supply

- The IEA projects **2020 world liquids supply growth** at an annual average of 1.0 mb/d to reach 99.1 mb/d in 2020. OPEC projects a slightly lower demand growth at around 0.9 mb/d per year reaching 97.6 mb/d by 2020.
- IEA and OPEC **differ on regional contributions to world liquids supply growth.** OPEC forecasts **OECD Americas supply** growth to taper off after 2015. The IEA's projection for **OECD Americas supply** is slightly higher than OPEC's and contributes to a 0.5 mb/d difference by 2020.
- In contrast, **OPEC is more bullish than IEA about regional liquids supply growth in the Middle East & Africa regions,** with an additional 0.6 mb/d projected by 2020.
- OPEC and the IEA also hold **different perspectives on liquids supply growth from Latin America. OPEC expects large liquids supply growth from this region,** especially approaching 2020, **while the IEA projects a gradual decline** in those countries as supply growth in Brazil may be hampered by low oil prices.
- OPEC and IEA **projections for medium-term liquids supply from the United States and Canada converge this year** reaching 18.9 mb/d and 18.7 mb/d by 2020 according to respective IEA and OPEC estimates. Both organisations made substantial upward adjustments to supply forecasts for both countries.
- The IEA and OPEC **projections from OPEC NGLs and other unconventional oils are similar by the end of the projection period despite a 0.6 mb/d difference in historical data.**

1.6 IEA and OPEC Long-Term Energy Outlooks

- IEA and OPEC prepare **25-year projections** for total primary energy demand and liquid fuel demand and supply out to 2040.
- **The central scenarios for each organisation are OPEC's Reference Case and IEA's New Policy Scenario.**

- **OPEC's High and Low Growth Scenarios** present alternative projections depending on world economic performance.
- **The IEA's Current Policies Scenario** provide a business as usual benchmark **and its 450-ppm Scenario** limits energy use to a level consistent with an expected mean global temperature increase of 2°C.

Primary Energy Demand

- Total primary energy demand in **OPEC's Reference Case** reaches 400 mboe/d and is close to the IEA's **Current Policies Scenario** of 397 mboe/d by 2040.
- This is significantly higher than the more tempered demand growth IEA projects in its **New Policy Scenario** – its central long-term outlook – where demand reaches 362 mboe/d in 2040.
- OPEC projects **2040 world total primary energy demand growth** of 49% relative to 2013, significantly above the 32% increase IEA projects by 2040 in its **New Policies Scenario**.

Energy Supply Mix

- Both the IEA and OPEC project **fossil fuels to dominate the primary energy mix in 2040**, with oil, gas and coal maintaining around 75-80% of the total share in all the scenarios, except in the **IEA 450-ppm scenario**.
- Both OPEC and the IEA project the **share of natural gas to grow the fastest among fossil fuels** with an increasing share in the fuel mix in every projection examined. Yearly growth rates of the IEA and OPEC at 1.4% and 2.4% lead to natural gas taking 24% and 28% of the energy mix by 2040 respectively.
- In all the IEA and OPEC long-term scenarios the **share of renewables, currently led by biomass, is projected to increase** from nearly 13% in 2013 to 16% by 2040. Most of this growth comes from renewable electricity such as wind, solar, and hydro.
- **Electricity** is expected to grow faster than any other final form of delivered energy worldwide.

Liquids Demand

- OPEC and IEA **long-term world liquids demand forecast show large differences** across scenarios.
- The **central scenarios** of both organisations for **world liquids demand** in 2040 are the closest to each other, with a difference of 200 kb/d. The IEA's **New Policies Scenario** estimate reaches 109.6 mb/d, while OPEC's **Reference Case** 109.8 mb/d by 2040.
- The IEA's **Current Policies Scenario** sees demand vary at 10 mb/d greater than the central scenarios reaching 120.3 mb/d in 2040.

- The IEA and OPEC **central scenarios estimate similar average annual long-term world liquids demand growth to 2040** of 0.6 mb/d and 0.7 per year respectively, though the share of oil in the world primary energy portfolio is expected to decrease. The IEA **Current Policies Scenario shows average annual long-term world liquids demand growth to 2040 at 1.1 mb/d**.
- OPEC and IEA share **similar views and perspectives on regional trends**. **China** will contribute most to oil demand growth over the projection period, followed by **India** and the **Middle East**. The largest relative declines occur in **OECD Americas**, where more stringent **fuel economy standards** reduce demand.
- Though all three of the IEA and OPEC scenarios compared project that **OECD countries will experience a decline in long-term oil demand**, this decrease is expected to be more than offset by demand growth in **non-OECD nations**, whose **share of total oil demand increases** from half to two-thirds over the course of all three outlooks.
- With respect to **sectoral trends**, both organisations expect **transportation to remain the largest oil consumer** and to contribute the majority of demand growth.

Liquids Supply

- OPEC and IEA **long-term world liquids supply projections follow long-term world liquids demand projections closely**, with similar growth assessments across compared scenarios.
- **OPEC's Reference Case long-term world liquids supply projection is also close to the IEA's New Policies Scenario**: 110.0 m/d vs. 109.6 mb/d by 2040 – a difference of 400 kb/d.
- This is **in contrast to IEA's projections in the Current Policies Scenario** that see long-term world liquids supply reaching 122.3 mb/d in 2040 – a difference of more than 12 mb/d relative to the abovementioned central scenarios.
- The IEA and OPEC **central scenarios estimate similar average annual long-term world liquids supply growth to 2040** to increase by 0.6 mb/d and 0.7 per year respectively, though the share of oil in the world primary energy portfolio is expected to decrease.
- The IEA Current Policies Scenario shows **average annual long-term world liquids supply growth** to 2040 at 1.1 mb/d.
- **In the three IEA and OPEC scenarios, OPEC's share of world liquids supply rises** from the current level of just under 40% to roughly 45% by 2040. **The non-OPEC share of world liquids supply falls** to 48% in the New Policies Scenario, 50% in the Current Policies Scenario and 52% in OPEC's Reference Case by 2040.

- In their **regional** assessments of **long-term world liquids supply growth**, OPEC's **Reference Case** shows stronger growth than IEA's **New Policies and Current Policies Scenarios** in supplies from **non-OECD Europe and Eurasia**. IEA is more reserved on **Russian** production but sees stronger growth in supply from **OPEC NGLs and unconventional**s than OPEC's estimates.

1.7 Recent Trends

- Neither the IEA nor OPEC had incorporated the **most recent oil price declines** into the forecasts reviewed in this paper. In a special section of the long-term energy outlook IEA discusses long-term global energy trends under a **Low Oil Price Scenario**, subject to **variations in key assumptions** (resilience of non-OPEC supplies, a commitment to protect market share by conventional oil producers, and lower near-term growth).
- **IEA's Low Oil Price Scenario's 2040 oil price assumption of US\$85/bbl** (in real 2014 US\$) is US\$43/bbl below that of its **New Policies Scenario**, US\$65\$/bbl below its **Current Policies Scenario**, and US\$19/bbl below **OPEC's Reference Case**.
- **Lower oil prices impact the global fuel mix**, with oil demand increasing to 100.2 mboe/d, which is 4.6 mboe/d higher than in the **New Policies Scenario**, 7.8 mboe/d below the **Current Policies Scenario** and just 0.4 mboe/d lower than OPEC's **Reference Case**.

2. Background and Introduction

The IEA and OPEC energy outlooks shape perceptions on energy trends and influence investment and policy decisions. Ministers have called for their shared analysis.

The International Energy Agency (IEA) and the Organization of Petroleum Exporting Countries (OPEC) track global energy market trends to produce short-, medium- and long-term energy outlooks. Their insights shape perceptions on how energy markets might evolve and influence important policy and investment decisions around the world.

In light of their influence, the Joint Statement of the Jeddah Energy Meeting (2008) called for shared analyses of the oil market trends and outlooks produced by the IEA and OPEC. The Cancun Ministerial Declaration (2010) recognised the IEF's role as a platform for sharing insights and exchanging views about energy market trends, and called for the IEA, IEF, and OPEC to organise an annual Symposium on Energy Outlooks at the IEF Secretariat.¹ The three organisations held their First Symposium in 2011 and have collaborated since then to advance understanding of the factors that drive energy supply and demand.

This paper compares the short-, medium- and long-term outlooks published by the IEA and OPEC in 2015

An introductory paper comparing the most recent outlooks prepared by the IEA and OPEC has accompanied each Symposium. This paper is for the Sixth Symposium and takes as reference the outlooks published by both organisations in 2015. As in previous editions, the objectives of this analysis are:

- To identify similarities and differences in estimates for short-, medium-, and long-term oil demand and supply;
- To contrast the long-term outlooks for primary energy demand and the global energy mix; and
- To better understand the methodologies, definitions, and assumptions behind these projections and outlooks.

¹ Attachment II of the Cancun Declaration identifies specific areas of collaboration through a trilateral Programme of Work.

Though the IEA and OPEC have made progress, there are opportunities to further advance the comparability of their outlooks.

An on-going challenge in the comparison of energy outlooks concerns the different use each organisation makes of historical data, definitions, and geographical classifications. The introductory paper of the Fifth Symposium identified opportunities to harmonise a number of variables:

- Baseline historical data, particularly in non-OECD demand, as well as FSU and OPEC;
- Baseline years in long-term energy projection models;
- NGLs/unconventionals supply;
- Medium-, and long-term oil price assumptions;
- Liquids fuel supply categories;
- Fuel classification at regional and global levels (e.g., biofuels, bunkers);
- Policy assumptions in long-term energy outlooks;
- Long-term oil-supply projection models, particularly with respect to unconventional resources; and
- Unit conversion processes across mb/d, mboe/d, and mtoe.

The IEA and OPEC use the same baseline years for long-term energy projections in this year's outlooks and agreed to share and review more historical baseline data.

During the last year the IEA and OPEC made progress on some of these areas. For example, they used the same baseline years for long-term energy projections in the outlooks published this year: 2013 for primary energy demand and 2014 for oil. In addition, they agreed to share and review more historical baseline data for the years 2008 to 2013 for the regions where apparent differences are largest: Non-OECD Asia (excluding China) and the Former Soviet Union (FSU). These efforts reflect the cooperation of the IEA and OPEC and the established practice of discussing and reviewing their methods and approaches.

Table 1 lists the publications used for comparison in this introductory paper. Note that the IEA Medium-Term Oil Market Report (MTOMR) was published in February 2015, ten months earlier than the release of OPEC's Medium-Term projections in WOO2015. Note that neither the IEA nor OPEC had incorporated the most recent oil price declines into the forecasts reviewed in this paper.

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

	IEA		OPEC	
Report type	Report name	Publication date	Report name	Publication date
Short-term	Oil Market Report (OMR)	Dec. 2015	Monthly Oil Market Report (MOMR)	Dec. 2015
Medium-term	Medium-Term Oil Market Report (MTOMR)	Feb. 2015	World Oil Outlook (WOO2015)	Dec. 2015
Long-term	World Energy Outlook (WEO)	Nov. 2015	World Oil Outlook (WOO2015)	Dec. 2015

3. Baseline 2014 Data

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

The harmonisation of the baseline historical data IEA and OPEC is a necessary step to enhance the comparability of their outlooks. **Table 2**, **Table 3**, and **Table 4** compare the IEA and OPEC base year (2014) demand, supply, and stock change data, respectively, using the IEA's December OMR and OPEC's December MOMR, which focus on the short-term outlook. Note that, unlike last year, the IEA and OPEC now have mutually consistent base year oil demand data in their short-term reports and long-term outlooks.

As shown in **Table 2** and **Table 3**, differences in world liquids demand and supply baselines remain high, diverging by 1.5 mb/d for demand and 1.3 mb/d for supply, slightly smaller than the differences identified last year. Specifically, IEA estimates 92.8 mb/d whereas OPEC estimates a lower 91.4 mb/d for 2014 world liquids demand, and IEA estimates 93.7 mb/d whereas OPEC estimates 92.4 mb/d for 2014 world liquids supply. Both organisations, therefore, estimated a net stock build during 2014 of about 1 mb/d.

Similar to last year's assessment, differences in historical baseline demand data are due to 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) and FSU nations.

Table 2. Liquids Demand in 2014 (mb/d)

	IEA	OPEC	Difference (IEA-OPEC)
Total OECD	45.7	45.7	0.0
OECD Americas	24.1	24.2	-0.1
OECD Europe	13.4	13.4	0.0
Asia Oceania	8.2	8.2	0.0
Total Non-OECD	47.1	45.6	1.5
Asia	22.6	21.9	0.7
China	10.6	10.5	0.1
Other non-OECD Asia	12	11.4	0.6
Middle East	8	8.1	-0.1
Latin America	6.8	6.6	0.2
FSU	4.9	4.5	0.4
Non-OECD Europe	0.7	0.7	0.0
Africa	4	3.8	0.2
World	92.8	91.4	1.5

Table 2 data sources: IEA OMR Dec 2015, Table 1; OPEC MOMR Dec 2015, Table 4.1, 4.6.

Table 2 note: Sums may not total due to rounding.

As for world liquids supply, **Table 3** shows that the IEA-OPEC difference in 2014 data lies primarily in non-OECD producers and in OPEC supply. The largest difference associated with non-OECD producers stems from FSU nations, in particular Russia.

Changes in the categorisation of biofuels facilitated comparison between IEA's and OPEC's liquids supply outlooks but differences in categorisation and definition remain.

Different treatment of biofuels means that comparing regional non-OPEC supply forecasts between the IEA and OPEC requires adjustments. While OPEC includes biofuels in each region's total liquids supply, the IEA does not include biofuels in each region's total liquids supply. Since the Fourth 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 the IEA's and OPEC's liquids supply outlooks. This paper uses the IEA's MTOMR regional biofuels supply data – both historical and forecast data – due to the MTOMR's more specific regional breakdown, and adds those data to each region's oil supply data as featured in the IEA OMR. We also compare MTOMR biofuels supply data with OMR data to ensure relative consistency.

A gap of 0.6 mb/d remains between IEA's and OPEC's estimates of OPEC Natural Gas Liquids and unconventional supply.

Regarding supply from OPEC Member Countries, there is a notable gap between the IEA's and OPEC's estimates of OPEC NGLs and unconvensionals supply. This large divergence may result from different definitions for this category. IEA reports in its OMR that NGLs and unconvensionals 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 less detail about the specific components of this category. Compared to NGLs and unconvensionals, the difference in OPEC crude oil supply estimates between the IEA and OPEC is more modest.

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 used in floating storage and 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, both organisations estimate a roughly 1 mb/d stock increase in 2014, although the IEA reports a somewhat smaller stock increase than OPEC. 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 2014 (mb/d)

	IEA ^(a)	OPEC	DIFFERENCE (IEA - OPEC)
Total OECD	24.2	24.2	0.0
OECD Americas	20.0	20.1	0.0
OECD Europe	3.6	3.6	0.0
Asia Oceania	0.5	0.5	0.0
Total Non-OECD	30.5	30.2	0.4
Non-OECD Asia	7.9	7.8	0.1
China	4.2	4.3	0.0
Other non-OECD Asia	3.6	3.5	0.2
Middle East	1.3	1.3	0.0
Latin America	5.0	5.0	0.0
FSU	13.9	13.6	0.4
Non-OECD Europe	0.1	0.1	0.0
Africa	2.3	2.4	-0.1
Processing gains	2.2	2.2	0.0
Total Non-OPEC	57.0	56.5	0.5
Total OPEC	36.6	35.9	0.8
OPEC crude	30.3	30.1	0.2
OPEC NGLs + unconventional	6.4	5.8	0.6
World	93.7	92.4	1.3

Table 3 data sources: IEA OMR Dec 2015, Table 1; IEA MTOMR 2015, Table 5, 5a; OPEC Dec 2015, Table 5.2, 10.3.

Table 3 notes: Sums may not total due to rounding.

IEA^(a) "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 (2014-2013) (mb/d)

	IEA	OPEC	DIFFERENCE (IEA - OPEC)
Reported OECD	0.4	0.4	0.0
Industry/commercial	0.4	0.4	0.0
Government/SPR	0	0.0	0.0
Oil-on-water	0	0.0	0.0
Miscellaneous to balance ^(a)	0.5	0.6	-0.1
Total stock change & misc.	0.9	1.1	-0.2

Table 4 data sources: IEA OMR Dec 2015, Table 1; OPEC MOMR Dec 2015, Table 10.3.

Table 4 notes: Sums may not total due to rounding.

OPEC miscellaneous to balance^(a): is computed as the difference between total OPEC stock change/misc. and other reported stock changes.

4. Short-term Oil 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 macroeconomic and energy market conditions, technology, and policy developments. Monthly oil market reports also include statistics and analyses of other topics that 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 outlooks².

4.1 Economic Growth Assumptions

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.

As in several recent years, 2015 economic performance in both developed and developing countries, with the primary exception of India, was generally lower than originally forecast. Both the IEA's and OPEC's 2015 economic growth estimates in the December 2015 monthly reports are lower than the forecasts made a year ago. The IMF has made downward adjustments to world GDP growth forecasts for five consecutive years, due to lingering problems from the global financial crisis in developed countries and slower growth in several large developing economies, notably Brazil, China, and Russia.

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

² Though this introductory paper compares data from the December 2015 oil market reports, reports from January to December in 2015 from both organisations were reviewed to assess how their views evolved throughout the year.

Both the IEA and OPEC forecasts show that economic growth will increase by 50 and 30 basis points to 3.6% and 3.4% in 2016 respectively.

India emerged as an exception to this trend in 2015 with higher than forecasted GDP growth. Nonetheless, both the IMF (used by IEA) and OPEC forecasts exhibit confidence that global economic growth will increase slightly in 2016. As **Table 5** shows, the IMF and OPEC expect 2016 GDP growth to exceed 2015 growth by 50 and 30 basis points, respectively. The IMF's 3.6% world GDP growth rate forecast for 2016 is slightly higher than OPEC's estimate of 3.4%. The United Nations and World Bank have the same optimistic views as the IMF on short-term growth prospects, with identical 2016 GDP growth forecasts of 3.6%^{3,4} in their most recent economic outlook publications. These discrepancies result from different perspectives on future growth along with differing methods for calculating GDP.

Table 5. Short-term Global GDP Growth Assumptions

	IEA (IMF)	OPEC
2015	3.1%	3.1%
2016	3.6%	3.4%

Table 5 data sources: IMF World Economic Outlook Oct 2015, Table 1.1; OPEC MOMR Dec 2015, Table 3.1.

Compared to IEA's GDP projections OPEC's 2016 GDP forecasts are lower for the US and Euro Area but higher for India and China.

Some variations in major economies are worth noting. For example, OPEC's 2016 GDP growth forecasts for the United States and Euro Area (2.5% and 1.5%, respectively) are slightly lower than the IMF's estimates (2.8% and 1.6%, respectively). In addition, OPEC's growth forecasts for China and India (6.4% and 7.6%, respectively) are slightly more optimistic than the IMF's (6.3% and 7.5%, respectively).

4.2 Short-term Liquids Demand

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 occasionally revise methodologies for calculating demand for specific regions, which may also result in changes to demand forecasts.

The IEA and OPEC revised their monthly year on year forecasts for annual demand growth, reaching 1.8 mb/d, and 1.6 mb/d in December 2015 respectively.

The **Figure 1** illustrates, the IEA and OPEC both steadily revised upward their forecasts for 2015 global liquids demand growth throughout the year. The IEA increased projected 2015 demand growth from 0.9 mb/d at the beginning of the year to 1.8 mb/d by December 2015, and OPEC increased its projected demand growth from 1.0 mb/d to 1.6 mb/d over the same period, resulting in a 0.2 mb/d growth differential by the end of the year. The dotted-, and dash lines in **Figure 1**, reflecting Non-OECD and OECD country assessments respectively, show that the increases for both the IEA and OPEC came primarily from OECD countries. The IEA's upward revisions were further supported by a small increase in the non-OECD region, while OPEC's overall increase was very slightly offset by a small decrease in the non-OECD region.

³ United Nations, World Economic Situation and Prospects 2016 (New York: United Nations, 2016), 2.

⁴ World Bank, Global Economic Prospects (Washington, DC: World Bank, June 2016), 4.

Figure 1. Monthly Revisions of Annual Estimates for 2015 World, OECD, and Non-OECD Liquids Demand Growth (mb/d)

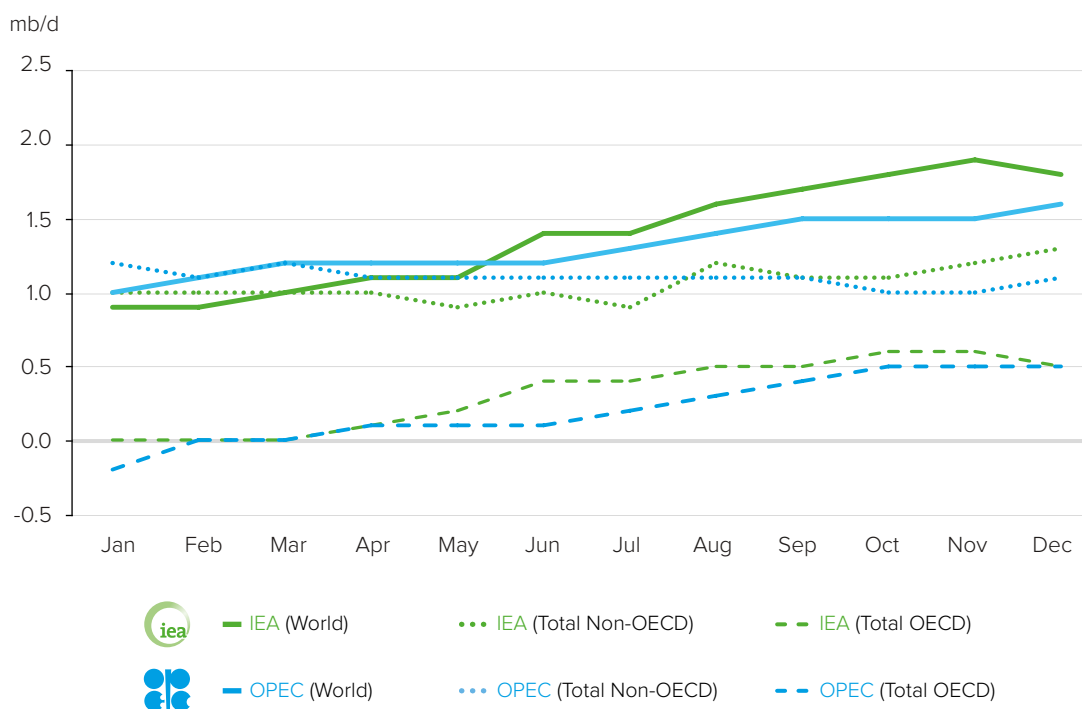


Figure 1 data sources: IEA OMR Jan–Dec 2015, Table 1; OPEC MOMR Jan–Dec 2015, Table 10.3. 2015 revisions are relative to 2014 data.

The IEA's and OPEC's latest demand growth projections converge on 1.2 mb/d for 2016. A slow down in demand growth relative to 2015.

Looking forward to 2016 in **Figure 2**, the IEA and OPEC have more conservative forecasts for 2016 demand growth, both estimating 1.2 mb/d. The 2016 growth projections of IEA and OPEC are 0.6 mb/d and 0.4 mb/d lower than their respective growth estimates for 2015.

Divergent perspectives on liquids demand growth in 2015, coupled with historical data differences, explain the gaps between the IEA's and OPEC's liquids demand projections for 2015 and 2016. As **Figure 2** shows, this gap expanded from 1.5 mb/d in 2014 to 1.7 mb/d in 2015, and is forecast to remain 1.7 mb/d in 2016.

Differences between the IEA's and OPEC's liquids demand growth increase from 1.5 mb/d to 1.7 mb/d in 2015 and 2016.

Figure 2. Short-term World Liquids Demand: 2014-2016 (mb/d)

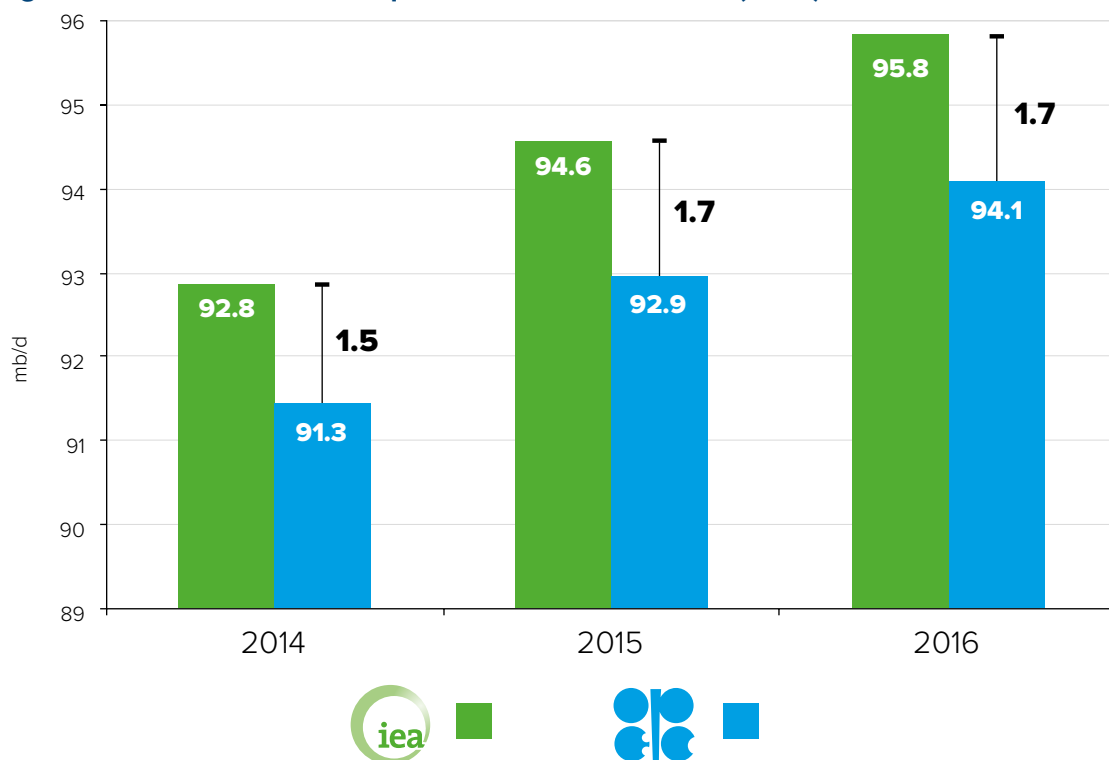


Figure 2 data sources: IEA OMR Dec 2015, Table 1; OPEC MOMR Dec 2015, Table 1.

Figure 2 note: 2014 are historical data and 2015/2016 are projections.

The IEA's and OPEC's regional liquids demand outlooks for 2015 and 2016, as well as the projection differences between them, are summarised in **Table 6**. These short-term demand outlooks vary greatly 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 differences in historical baseline data and the importance of ongoing collaboration on historical baseline data between the organisations.

Both IEA and OPEC see strong demand growth in India, largely driven by the transport sector, but less oil-intensive growth in China due to the transformation of its economy.

Both the IEA and OPEC believe non-OECD regions will continue to lead global demand growth, particularly non-OECD Asia, followed by the Middle East and Africa. Although not reflected explicitly in **Figure 3**, both organisations highlighted India, which is included in the other non-OECD category, as a key driver for the growth of oil demand. India stood out with high demand growth of 18%⁵ and a year-on-year increase of 0.6 mb/d⁶ as of October 2015 due in large part to continued growth in the transportation sector.

Nonetheless, different growth estimates for 2015 and 2016 contribute to several regional discrepancies shown in **Table 6**. In particular, the IEA has more bullish estimates about 2015 demand growth in China and OECD countries apart from OECD Americas than OPEC (**Figure 3**), although both organisations acknowledge that China has entered a less oil-intensive development stage due in part to its gradual transition toward a more service-oriented economy.

⁵ Data from IEA Dec OMR Page 12.

⁶ Data from OPEC Dec MOMR Page 38.

OPEC finds that non-OECD countries experienced higher demand growth in 2015 than the IEA.

In contrast, OPEC estimates that other non-OECD countries experienced slightly higher demand growth in 2015 than does the IEA. In 2016, OPEC expects higher demand than IEA in OECD Americas, and that sustained low prices will have a larger effect on the region's oil consumption. The IEA and OPEC forecast stable demand or continued growth for nearly all regions in 2016, with the most growth projected in Non-OECD Asia.

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

	2015			2016		
	IEA	OPEC	Difference (IEA-OPEC)	IEA	OPEC	Difference (IEA-OPEC)
Total OECD	46.2	46.2	0.0	46.2	46.4	-0.1
OECD Americas	24.4	24.5	-0.1	24.4	24.8	-0.4
OECD Europe	13.7	13.6	0.1	13.6	13.6	0.0
Asia Oceania	8.1	8.1	0.0	8.1	7.9	0.2
Total Non-OECD	48.4	46.7	1.7	49.6	47.8	1.8
Asia	23.8	22.6	1.2	24.6	23.2	1.4
China	11.3	10.8	0.5	11.6	11.1	0.5
Other non-OECD Asia	12.5	11.8	0.7	13.0	12.1	0.9
Middle East	8.2	8.3	-0.1	8.3	8.6	-0.3
Latin America	6.8	6.7	0.1	6.8	6.8	0.0
FSU	4.9	4.6	0.4	4.8	4.6	0.2
Non-OECD Europe	0.7	0.7	0.0	0.7	0.7	0.0
Africa	4.1	3.9	0.2	4.2	4.0	0.2
World	94.6	92.9	1.7	95.8	94.1	1.7

Table 6 data sources: IEA OMR Dec 2015, Table 1; OPEC MOMR Dec 2015, Table 4.1, 4.6.

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

Figure 3. Short-term Liquids Demand Annual Growth (mb/d)

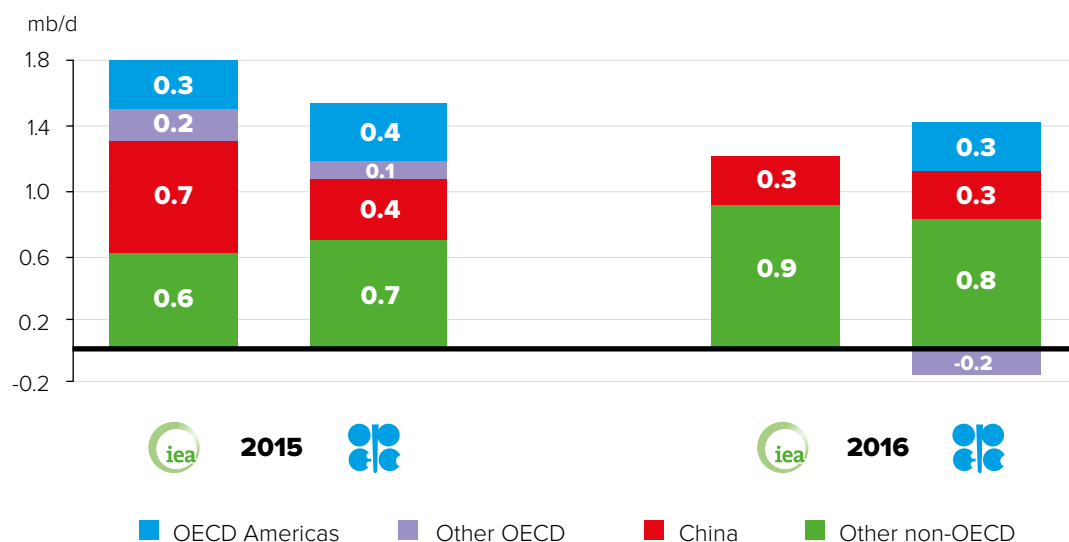


Figure 3 data sources: IEA OMR Dec 2015, Table 1; OPEC MOMR Dec 2015, Tables 4.1, 4.6.



**CELEBRATING 25 YEARS OF THE
PRODUCER-CONSUMER DIALOGUE**

4.3 Short-term Liquids Supply

Views regarding non-OPEC liquids supply have evolved due to sustained low oil prices and supply resiliency.

As in their demand forecasts, the IEA and OPEC have evolving views regarding non-OPEC liquids supply growth in 2015. **Figure 4** reveals that IEA's projection ended where it began after a dip during the year, whereas OPEC has revised its projection for OECD supply downward in 2015 due to sustained low oil prices. As a result, non-OPEC liquids supply estimates from the IEA were 0.4 mb/d lower than OPEC in January 2015, but 0.3 mb/d higher than OPEC by December 2015. Both organisations adjusted non-OECD, non-OPEC supply upward during the course of 2015 due to higher-than-expected production levels in a number of non-OPEC suppliers, including Brazil.

Figure 4. Monthly Revisions of Annual Estimates for 2015 Non-OPEC Liquids Supply Growth (mb/d)

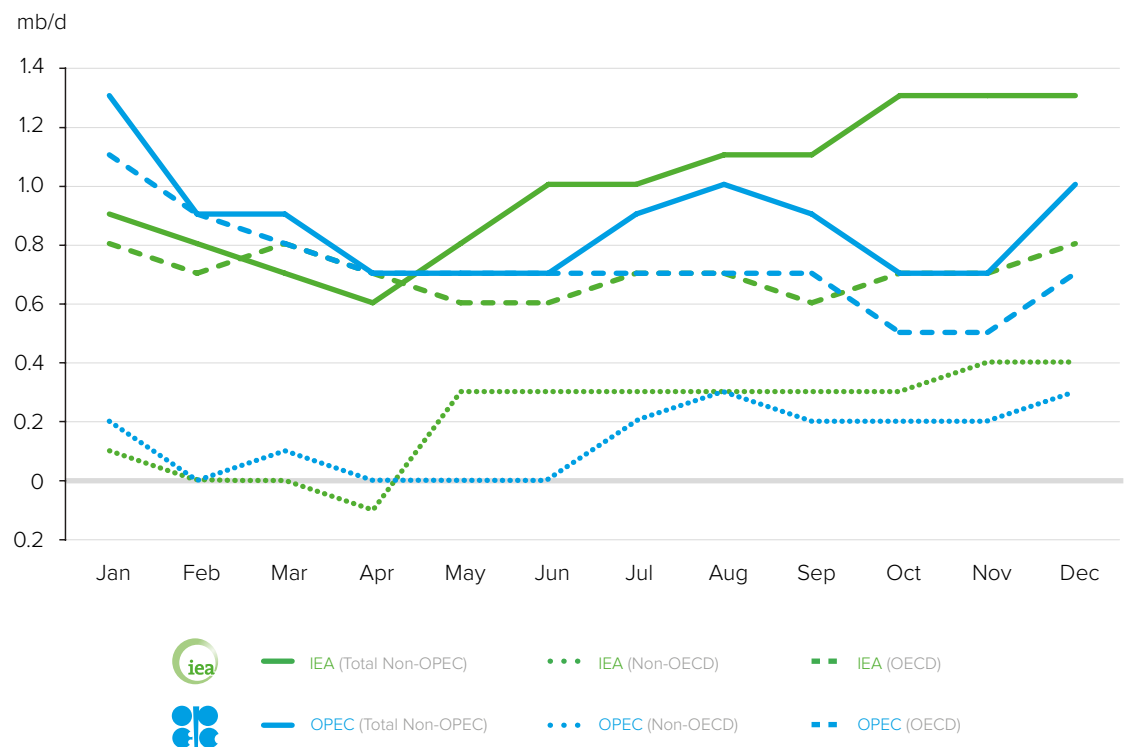


Figure 4 data sources: IEA OMR Jan-Dec2015, Table 1; OPEC MOMR Jan-Dec 2015, Table 10.3. 2015 revisions are relative to 2014 data.

Both IEA and OPEC project supply growth in 2016 from non-OPEC countries to ease further compared to preceding years.

Non-OPEC liquids supply had been increasing sharply for the past several years but, as **Figure 5** indicates, 2015 brought slower supply growth relative to 2014. Non-OPEC supplies are projected to fall in 2016. **Figure 5** also indicates that the IEA's and OPEC's views about overall non-OPEC supply trends remain similar for the short-term outlooks.

Figure 5. Short-term Non-OPEC Liquids Supply Annual Growth (mb/d)

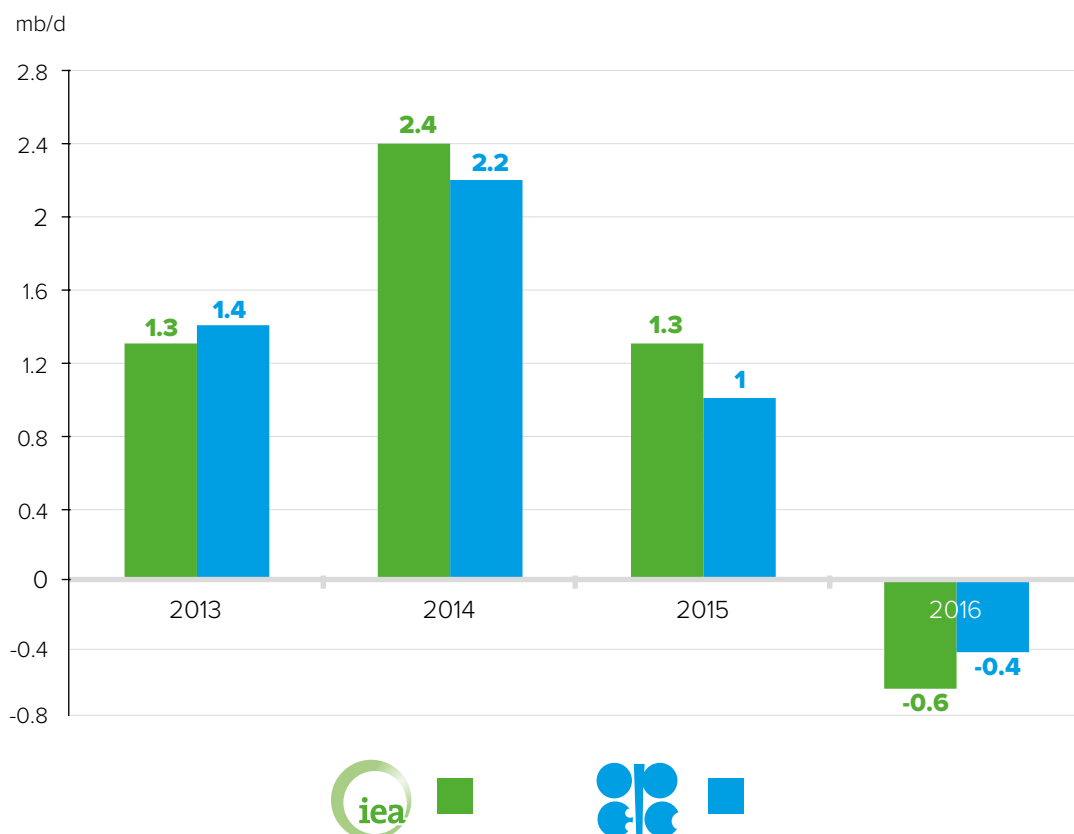


Figure 5 data sources: IEA OMR Dec 2015, Table 1; OPEC MOMR Dec 2015, Table 10.3.

The difference in overall non-OPEC supply outlooks follows historical supply data, whereby the largest differential resides with the FSU.

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 difference in historical supply data (see **Table 3**). The largest differential in non-OPEC liquids supply outlooks still resides in the FSU, stemming primarily from the difference in historical data.

The IEA-OPEC differential for 2016 non-OPEC supply is also unchanged from 2015, with the bulk of the difference attributable to non-OECD countries in both years. **Figure 6** illustrates how the IEA's and OPEC's regional supply growth estimates differ in 2015 and 2016.

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 0.9 mb/d for 2015 and 1.1 mb/d for 2016, slightly higher than the 0.8 mb/d historical difference identified in **Table 3**. This merits discussion. "OPEC crude" in **Table 3** is an estimate based on reported supply data from OPEC Member 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 the IEA and OPEC in the "Call on OPEC crude + stock ch. & misc" item and "Total OPEC" item do not directly reflect different views regarding OPEC crude supply; rather the differences could reveal their distinct projections of global liquids demand and non-OPEC crude supply. .

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

	2015			2016		
	IEA ^a	OPEC	Difference (IEA-OPEC)	IEA ^a	OPEC	Difference (IEA-OPEC)
Total OECD	25.1	24.9	0.2	24.6	24.7	-0.1
OECD Americas	20.9	20.7	0.1	20.5	20.6	-0.1
OECD Europe	3.7	3.7	0.0	3.5	3.6	-0.1
Asia Oceania	0.5	0.5	0.1	0.5	0.5	0.1
Total Non-OECD	31.0	30.4	0.6	30.8	30.3	0.5
Asia	8.1	7.9	0.2	8.0	8.0	0.0
China	4.3	4.4	0.0	4.4	4.4	0.0
Other non-OECD Asia	3.7	3.6	0.2	3.7	3.6	0.0
Middle East	1.2	1.3	0.0	1.2	1.2	0.0
Latin America	5.2	5.2	0.0	5.4	5.2	0.2
FSU	14.0	13.6	0.4	13.9	13.4	0.5
Non-OECD Europe	0.1	0.1	0.0	0.1	0.1	0.0
Africa	2.3	2.3	0.0	2.3	2.3	0.0
Processing gains	2.2	2.2	0.0	2.3	2.2	0.1
Total Non-OPEC	58.3	57.5	0.8	57.7	57.1	0.6
Total OPEC^(c)	36.3	35.4	0.9	38.1	37.0	1.1
Call on OPEC crude + stock ch. & misc. ^(b)	29.8	29.4	0.4	31.3	31.1	0.2
OPEC NGLs + unconventional	6.5	6.0	0.5	6.8	5.9	0.9
World Supply	94.6	92.9	1.7	95.8	94.1	1.7

Table 7 data sources: IEA OMR Dec 2015, Table 1; IEA MTOMR 2015, Table 5, 5a; OPEC MOMR Dec 2015, Table 5.2, 5.7, 10.3.

Table 7 notes: Columns may not sum to total due to rounding.

IEA^(a): Biofuels from IEA MTOMR 2015 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 (mb/d)

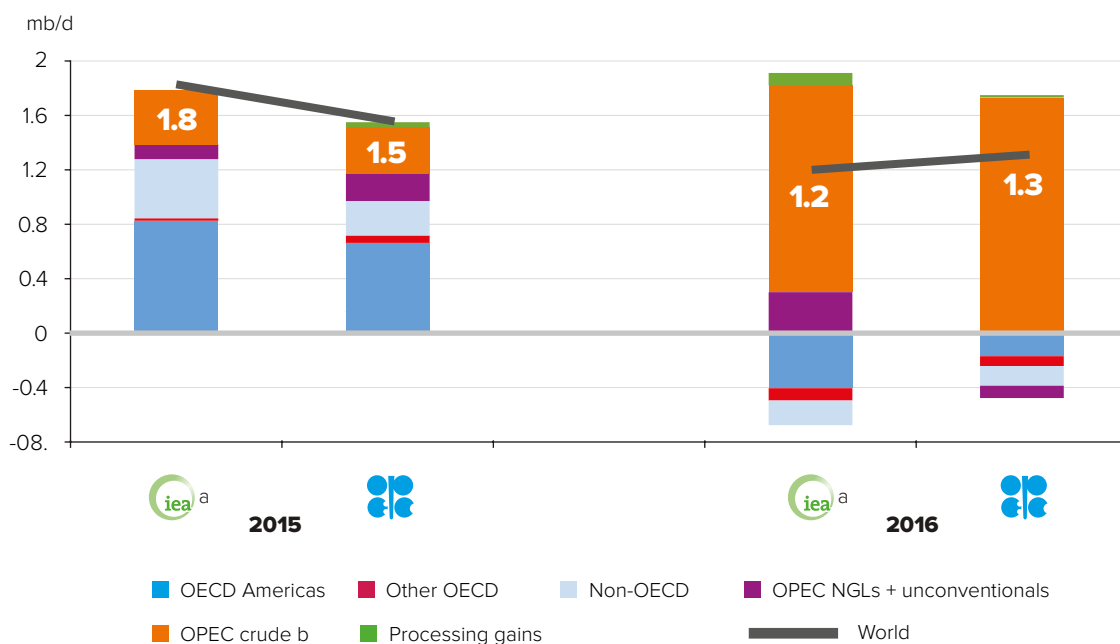


Figure 6 data sources: IEA OMR Dec 2015, Table 1; IEA MTRMR 2015, Table 5, 5a; OPEC MOMR Dec 2015, Table 5.2, 5.7, 10.3.

Figure 6 note: IEA^(a): Biofuels from IEA MTRMR 2015 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”.

5. Medium-term Oil Outlooks

Our comparison of medium-term outlooks analyses the IEA’s Medium-Term Oil Market Report (MTOMR) published in February 2015, and OPEC’s World Oil Outlook (WOO) published in December 2015 (**Table 1**). Both organisations make their medium-term projections through 2020, using 2014 as a base year. However, there is a ten-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.

5.1 Oil Price and Economic Growth Assumptions

5.1.1 Oil Price

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 differ 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.

The ten-month gap between publication dates of IEA’s and OPEC’s medium-term outlooks reports complicates their comparison.

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

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. Of course, neither approach is perfect, and oil prices are volatile in nature. The crude oil futures price declined from more than US\$107/bbl in mid-2014 to about US\$60/bbl by the end of 2014, and declined further in late 2015 to below US\$40/bbl at the time this report was written. Neither the IEA nor OPEC has incorporated the most recent oil price declines into its medium-term forecasts.

Different methods have led to distinct medium-term oil price outlooks. IEA and OPEC project oil prices to reach US\$73/bbl and US\$80/bbl by 2020 respectively.

The different methods for developing oil price assumptions have led to distinct medium-term price outlooks. In the IEA’s MTOMR, the nominal “IEA Average Import Price” is projected to decline from around US\$100/bbl in 2014 to just US\$55/bbl in 2015, followed by a slight increase to US\$73/bbl by 2020. The nominal ORB price in OPEC’s WOO2015 declines from US\$96/bbl in 2014 to US\$55/bbl in 2015, recovering to US\$80 in 2020—higher than IEA, but significantly lower than last year’s OPEC price projection of \$110/bbl in 2019. As **Figure 7** illustrates, the two price forecasts are similar through 2018.

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



Figure 7 data sources: Annual average ORB price from OPEC WOO2015 and history from http://www.opec.org/opec_web/en/data_graphs/40.htm?selectedTab=annually;

Annual average IEA import price from IEA MTOMR 2015 and Brent history from https://www.quandl.com/data/ODA/POILBRE_USD-Brent-Crude-Oil-Price

Figure 7 notes: ^(a) Only historical prices up to the time IEA and OPEC wrote their reports were included

^(b) IEA Average Import Price assumption is based on the Brent futures strip, gradually increasing from 2015 to 2020.

5.1.2 Economic Growth

IEA GDP growth projections tend to be slightly higher than those of OPEC but both organisations have moderated expectations.

Compared to the WOO2014 and MTOMR2014, both the IEA and OPEC have moderately lowered their expectations for medium-term global economic growth. While IEA maintains its projection of accelerating growth through 2020, OPEC expects steady global GDP growth from 2016 onward. The GDP growth assumptions in OPEC's WOO2015 are typically close to, or slightly lower than those in the IEA's MTOMR2015 (**Table 8**).

Table 8. Medium-term Annual GDP Growth Assumptions (%)

	2015	2016	2017	2018	2019	2020
OPEC	3.2	3.5	3.7	3.8	3.8	3.7
IEA	3.5	3.7	3.7	3.7	3.8	3.8

Table 8 data sources: IEA MTOMR 2015, Table ES.1; OPEC WOO2015, Table 1.1. IEA's forecast relies on IMF's April World Economic Outlook.

Though non-OECD economies may expand faster, both OECD and non-OECD regions are exposed to downside risk.

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 most non-OECD nations, economic growth in recent years has repeatedly been weaker than expected, as emerging major economies such as China continue to mature. Finally, geopolitical risks will continue to affect economic growth in Europe, the Middle East and other regions with impacts potentially spilling over to energy and other commodities markets.

5.2 Medium-term Liquids Demand

5.2.1 Global and Regional Demand Growth

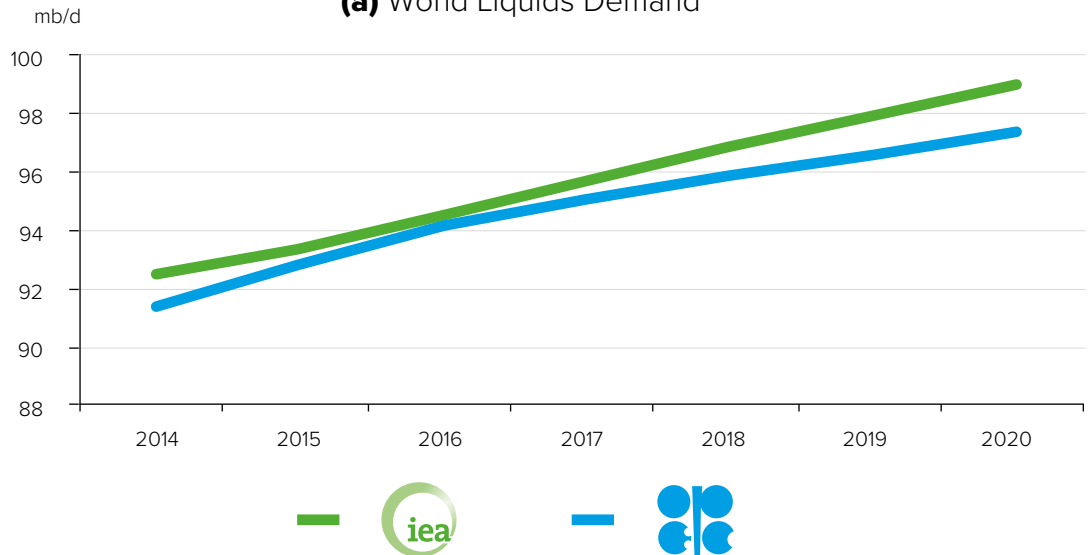
IEA estimates 2020 liquids demand to be 1.7mb/d higher than assessments by OPEC due to differences in historical data.

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 annual average growth of 1.1 mb/d in global liquids demand, reaching nearly 100 mb/d by the end of 2020. OPEC projects slightly lower demand growth rate at around 1.0 mb/d per year reaching 97 mb/d by 2020. As illustrated by **Figure 8^(a)**, the IEA's steeper demand growth trajectory, coupled with a higher baseline, leads to a 1.7 mb/d differential in world liquids demand projection by 2020 compared to OPEC's estimate. **Figure 8^(b)** shows that these differences arise largely from non-OECD nations, due to varying historical demand data and the IEA's more bullish view on non-OECD liquids demand growth.

Regarding OECD liquids demand, both the IEA and OPEC project modest declines, with the IEA projection being slightly lower due in part to differing baseline data. The divergence in oil demand growth between OECD and non-OECD nations reinforces how global oil markets are transforming. OPEC's WOO2015 suggests that oil demand from non-OECD countries surpassed that of OECD nations in 2015, while the IEA's MTOMR2015 estimates this crossing point occurred about one year earlier.

Figure 8. Medium-term Liquids Demand (mb/d)

(a) World Liquids Demand



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

(b) OECD and Non-OECD Liquids Demand

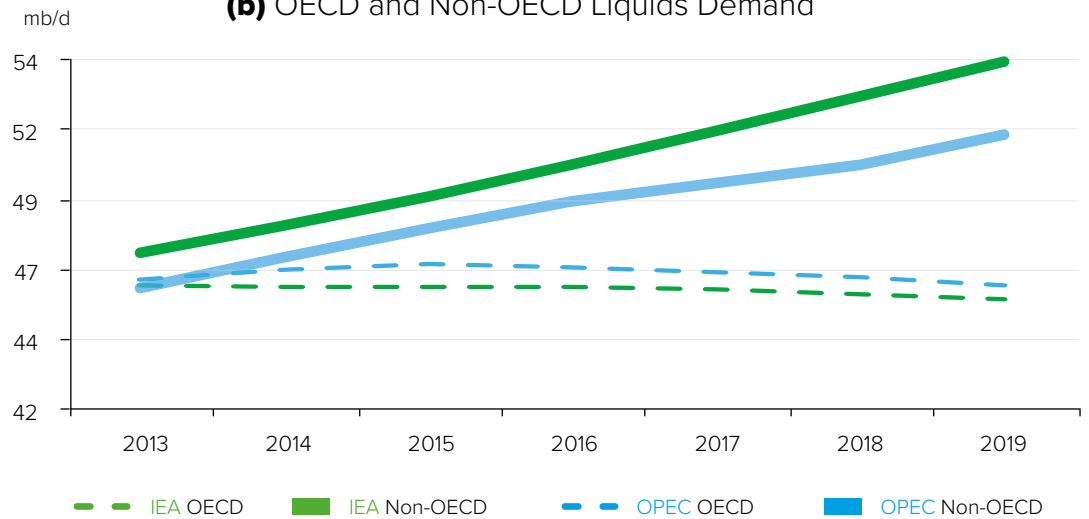


Figure 8 data sources: IEA MTOMR 2015, Table 2; OPEC WOO2015, Table 1.7.

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 other non-OECD Asia and the Middle East, Africa and Latin America. However, direct comparison of the latter three regions is challenging for medium-term forecasts because the IEA and OPEC have different regional definitions. In the WOO's medium-term projections, 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)

	2020		Avg. annual growth (2014-2020)		
	IEA	OPEC	IEA	OPEC	Difference (IEA-OPEC)
Total OECD	45.1	45.6	-0.1	0.0	-0.1
OECD Americas	24.4	24.6	0.1	0.1	0.0
OECD Europe	12.9	13.3	-0.1	0.0	-0.1
Asia Oceania	7.8	7.7	0.0	-0.1	0.0
Total Non-OECD	54.0	51.8	1.2	1.0	0.2
Asia	26.6	25.7	0.7	0.7	0.0
China	12.1	12.4	0.3	0.3	0.0
India	4.7	4.7	0.1	0.2	0.0
Other non-OECD Asia	9.8	8.6	0.3	0.2	0.1
^(a) Middle East, Africa & Latin America	21.7	20.6	0.5	0.3	0.1
Europe & Eurasia	5.7	5.5	0.0	0.1	0.0
World	99.1	97.4	1.1	1.0	0.1

Table 9 data sources: IEA MTOMR 2015, Table 2; OPEC WOO2015, Table 1.7.

Table 9 notes: Sums may not 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.

5.2.2 Sectoral Demand

The WOO2015 provides sectoral analysis for the year 2014 and projections for 2040, but does not include medium-term projections. Unlike in 2014, the IEA's MTOMR2015 does not include global sectoral analysis. Based on MTOMR2014, IEA expects the transportation sector will continue to dominate oil consumption, accounting for more than half of total global demand over the medium-term. The petrochemical sector will remain the second largest oil-consuming sector globally. 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 equal to the average growth rate of all demand sectors.

The transport sector will dominate consumption in the medium-term outlooks of both organisations.

5.3 Medium-term Liquids Supply

5.3.1 Liquid Fuels Classification and Projection Methodology

The IEA and OPEC take a “bottom-up” approach to assess medium-term supply potential. Productivity and oil price estimates make for different assessments.

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.

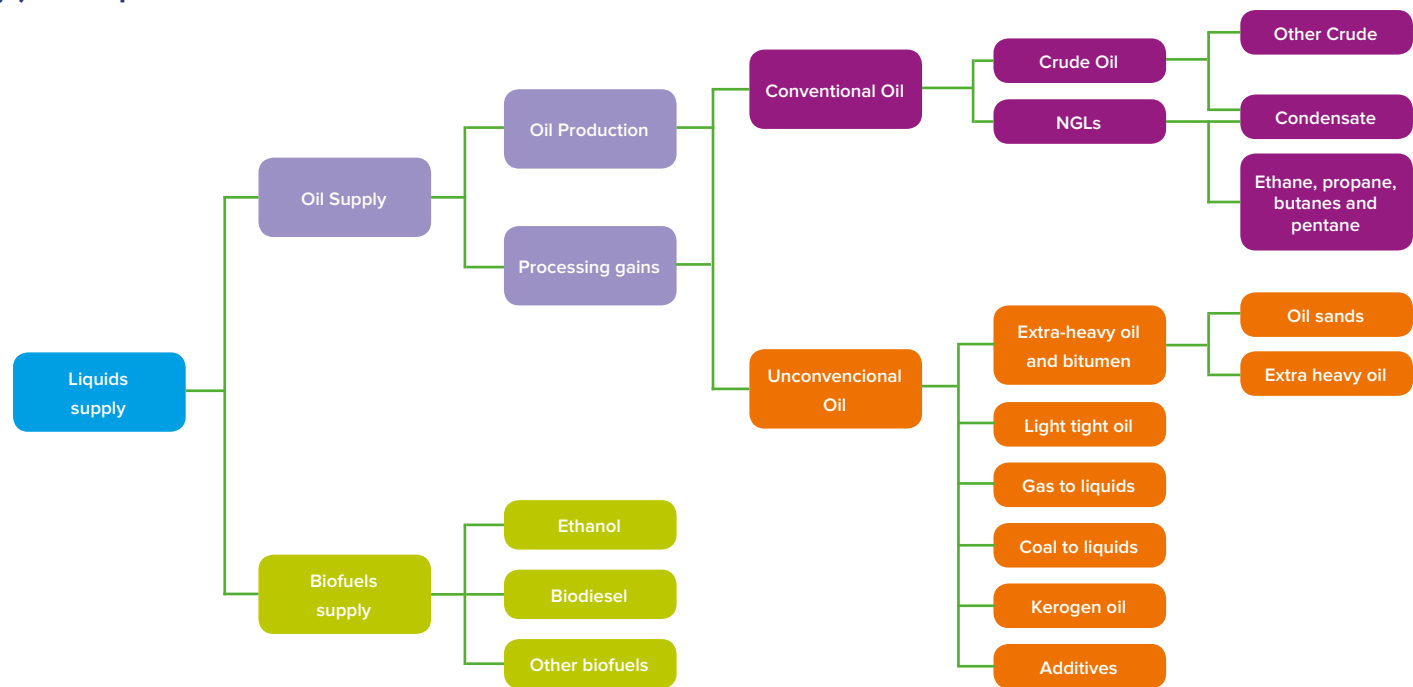
In addition, an understanding of the differences in the IEA’s and OPEC’s categorisation of liquid fuels is necessary for fair comparison of their projections. **Figure 9(a)** and **(b)**, respectively, illustrate the IEA’s and OPEC’s distinct liquids classification systems.

Distinct categorisation systems of liquid fuels further complicate direct comparison.

First, the two institutions differ in their categorisation of certain types of unconventional oil. One recent change by OPEC is noteworthy. In WOO2014, OPEC began using the term “unconventional NGLs,” defined as NGLs extracted from low-permeability formations with hydraulic fracturing technology, which is included in the “NGLs” category. **Figure 9(a)** shows that the IEA groups together conventional crude oil, NGLs (including conventional and unconventional supplies) 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 technical terms in their reports, such as “kerogen oil” in WEO2015 vs. “oil shale” in WOO2015. 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

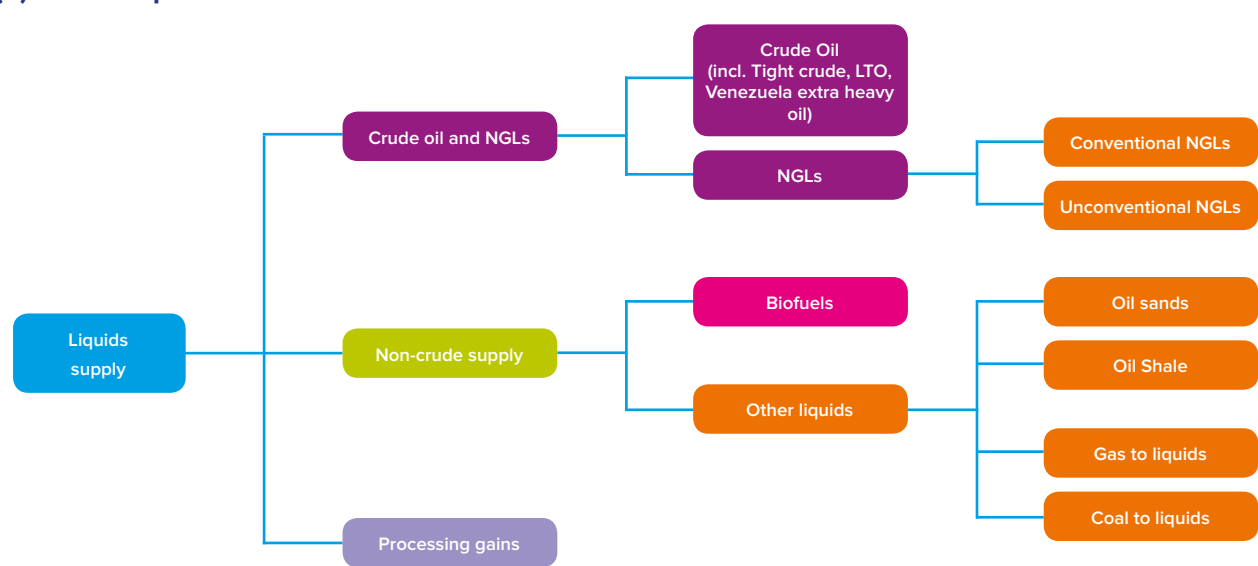


Source: IEA WEO2013, Figure 13.2

Figure 9(a) source: IEA WEO 2015, Figure C.1.

(a) IEA previously referred to “Tight oil” as “Light Tight Oil”.

(b) OPEC Liquid Fuels Schematic



Source: Duke and IEF based on WOO2014

Figure 9(b) source: Duke and IEF based on WOO2015

5.3.2 Global and Regional Liquids Supply

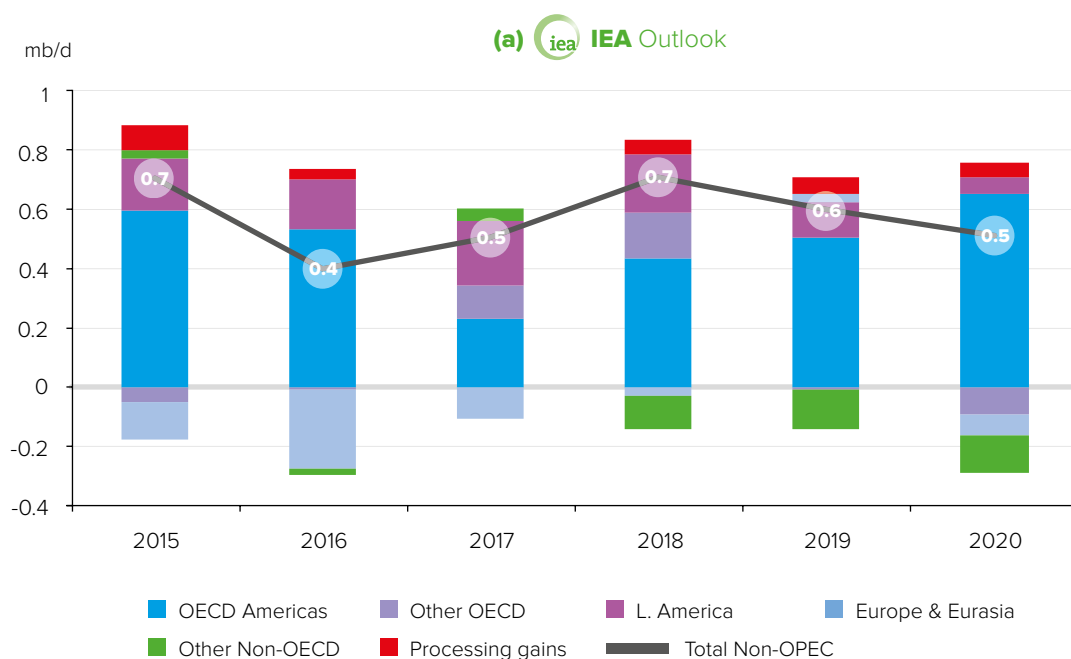
Though non-OPEC production will continue to grow both IEA and OPEC project a near term decrease in output.

OPEC is more moderate than the IEA on OECD Americas liquids supply, while the IEA is more reserved on the supply potential of Latin America.

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 a near-term decrease in growth, with a small rebound in 2018.

The IEA and OPEC diverge on regional contributions to supply growth. **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 taper off somewhat after 2015. In addition to North American supply, the IEA and OPEC hold somewhat different perspectives on liquids supply growth from Latin America. While OPEC expects large liquids supply growth from Latin America, especially approaching 2020, IEA projects a gradual decline in those countries. Although Brazil is still expected to become the second largest source of non-OPEC supply growth towards 2020, its growth may be hampered by low oil prices.

Figure 10. Medium-term Non-OPEC Liquids Supply Annual Growth (mb/d)



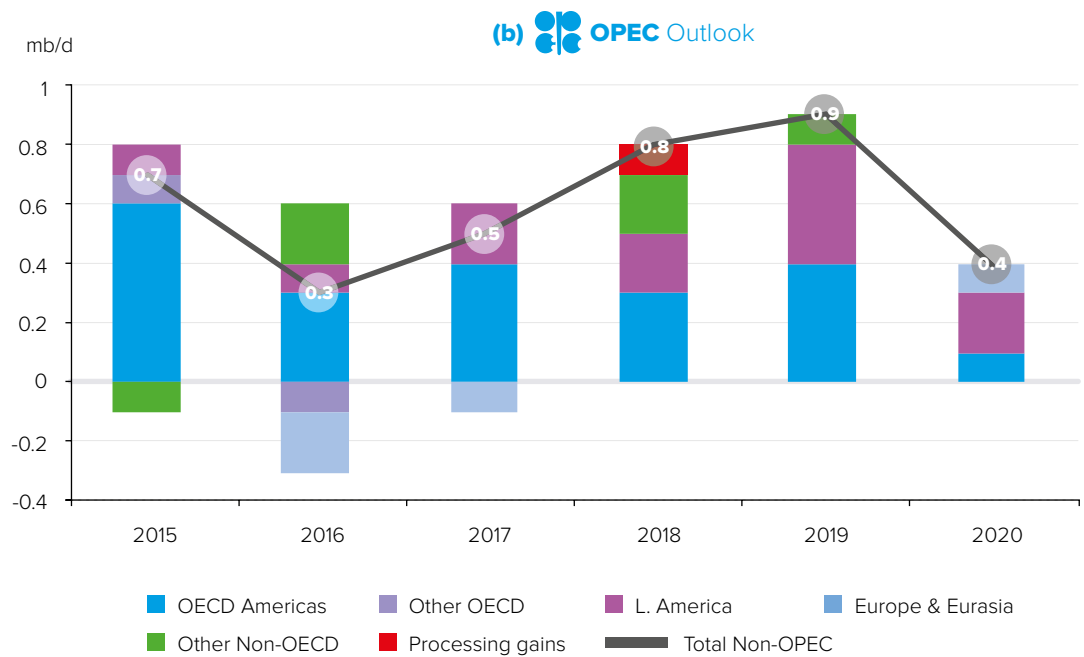


Figure 10 data sources: IEA MTOMR 2015, Table 2, Table 5, Table 5a; IEA MTRMR 2015, Table 39 for biofuels; Regional data from OPEC WOO2015, Table 1.9. Some totals may differ due to rounding.

Figure 10 notes: Other OECD is the sum of data from OECD Europe and Asia Oceania; Other Non-OECD is the sum of data from Middle East & Africa and Non-OECD Asia. 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 overall 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 difference by 2020. In contrast, OPEC is more bullish than IEA about supply growth in the Middle East & Africa regions, with an additional 0.6 mb/d projected by 2020. Smaller differences exist between the projections for OECD Europe, non-OECD Asia excluding China, and Latin America.

Despite a difference of 0.6Mb/d in estimates of OPEC Natural Gas Liquids and unconventional oils, IEA's and OPEC's projections align on the medium-term.

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 this item is constructed by subtracting non-OPEC supply and OPEC NGLs supply from total world liquids demand. Finally, despite a 0.6 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)

	2020		Avg. annual growth (2014-2020)		
	IEA ^(a)	OPEC	IEA	OPEC	DIFFERENCE (IEA-OPEC)
Total OECD	27.0	26.3	0.5	0.4	0.2
OECD Americas	22.8	22.2	0.5	0.4	0.1
OECD Europe	3.4	3.5	0.0	0.0	0.0
Asia Oceania	0.8	0.6	0.1	0.0	0.0
Total Non-OECD (Non-OPEC)	30.5	31.6	0.0	0.3	-0.2
Asia	7.8	8.0	0.0	0.0	0.0
China	4.4	4.4	0.0	0.0	0.0
Other non-OECD Asia	3.4	3.6	0.0	0.0	0.0
Middle East & Africa	3.3	3.9	-0.1	0.0	-0.1
Latin America	5.9	6.2	0.2	0.2	0.0
Europe & Eurasia	13.5	13.5	-0.1	0.0	-0.1
Processing Gains	2.5	2.3	0.0	0.0	0.0
Total Non-OPEC	60.0	60.2	0.6	0.6	0.0
Total OPEC	39.1^(c)	37.4	0.4	0.3	0.1
OPEC crude ^(a)	32.1	30.7	0.3	0.1	0.2
OPEC NGLs + unconventional	6.9	6.7	0.1	0.1	0.0
World	99.1^(c)	97.6	1.0	0.9	0.1

Table 10 data sources: IEA MTOMR 2015, Table 5, Table 5a; IEA MTRMR 2015, Table 39; OPEC WOO2015, Table 1.9.

Table 10 notes: Sums may not total due to rounding.

^(a)For IEA includes stock change and miscellaneous.

^(b)IEA regional supply estimates include biofuels, based on IEA MTRMR 2015 Table 39.

^(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.

This year IEA and OPEC assessments of oil supplies from the United States and Canada align.

Unlike 2013, when a significant difference emerged between the IEA's and OPEC's medium-term oil supply projections from the United States and Canada, this year's projections are rather similar. As in 2014, both the IEA and OPEC made substantial upward adjustments to supply forecasts for the two countries (**Figure 11**). Oil supply projections for the United States and Canada reach 18.9 mb/d from IEA and 18.7 mb/d from OPEC by 2020.

Figure 11. Medium-term US and Canadian Oil Supply (mb/d, excluding biofuels)

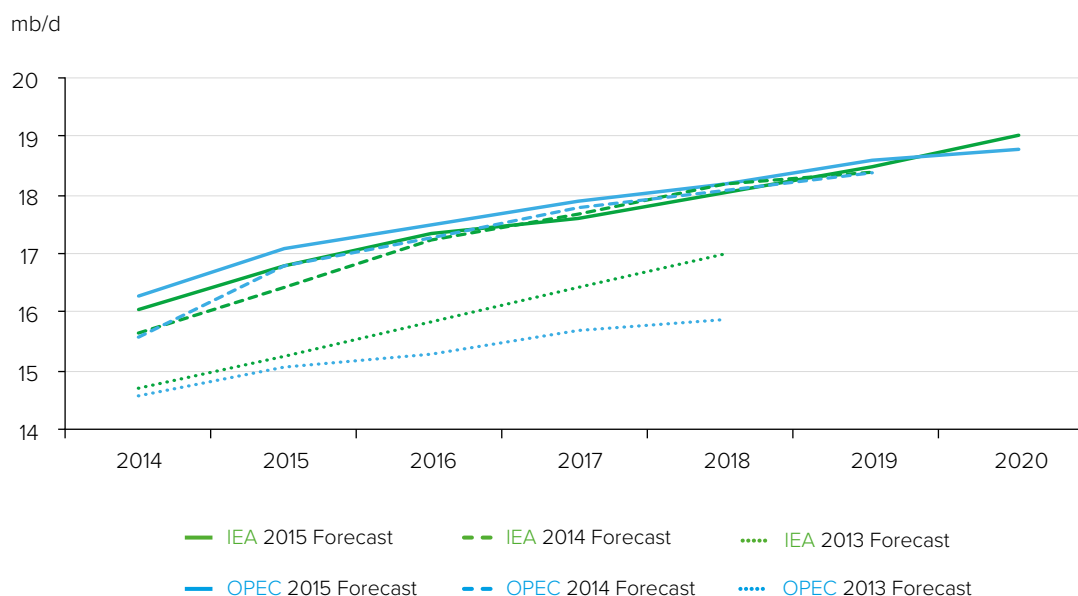


Figure 11 data sources: IEA MTOMR 2015 Table 3; OPEC WOO2015, Table 1.9 & Table 3.5; IEA MTOMR 2014, Table 3; OPEC WOO2014, Table 1.12 & Table 3.5; IEA MTOMR 2013, Table 3 & Table on p.77 for biofuels; OPEC WOO2013, Table 1.10 & Table 3.4.

Figure 11 note: Biofuels are excluded from OPEC's total liquids supply estimates for US & Canada. 2013 projections are available through 2018 only.

6. Long-term Energy Outlooks

IEA and OPEC make long-term projections to 2040 based on 2013 data for primary energy demand, and 2014 data for liquids demand.

The following comparison of long-term outlooks evaluates the IEA's World Energy Outlook 2015 (WEO2015) and OPEC's World Oil Outlook 2015 (WOO2015). In these reports, the IEA and OPEC have made projections extending through 2040, with both organisations using baseline years of 2013 for primary energy demand and 2014 for oil. However, the inconsistencies in units for primary energy demand between the two organisations create challenges in comparing the two reports. OPEC uses million barrels of oil equivalent per day (mboe/d), while the IEA uses million tons of oil equivalent (mtoe) per year. To address this issue, we convert the IEA's units of primary energy from mtoe per year to mboe/d by multiplying by 7.37⁷ mboe/mtoe and dividing that total by 365 days per year, yielding a conversion factor of 0.0202 mboe/d/mtoe.

6.1 Key Assumptions

6.1.1 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 WEO2015 and WOO2015. A more detailed comparison is provided in **Annex 1**, and a comparison of outlook results for each scenario is featured in **Annex 2**.

⁷ IEA, Oil Information 2015, IV.93.

Table 11. Long-term Scenario Key Assumptions

IEA WEO Scenarios	OPEC WOO Scenarios
Current Policies Scenario: Only considers policies that have been enacted as of mid-2015	Reference Case: Only considers specific policies that have been enacted, but also accepts that the policy process will evolve over time
New Policies Scenario: Considers both policies in place and commitments announced	Economic Growth Scenarios (HEG / LEG): Assumes a higher or lower economic growth rate than the Reference Case
450 Scenario: Assumes policies are taken to limit the concentration of GHGs in the atmosphere to 450 ppm of CO ₂ equivalent	Supply Scenarios (HIGHSUP / LOWSUP): Looks at possibility of higher or lower non-OPEC supply than the Reference Case

IEA and OPEC each base their projections on three distinct scenarios to modulate business as usual with alternative policies, growth- and emission rates.

The IEA has maintained its analysis of three core scenarios – 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 policies that have been announced. 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 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 by 2100. All three IEA scenarios share the same GDP and population assumptions, while variations in policy affect technological development and energy markets. In WEO2015, the IEA has also included a special section on a Low Oil Price Scenario, which is intended to illustrate the impact of persistently lower oil prices than those modelled in the New Policies Scenario. The Low Oil Price Scenario is not included in the comparative analyses of this paper, but is discussed separately in Section 5.3.2.

OPEC also employs scenario analysis in the WOO series, and the WOO2015 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 central scenario. As in WOO2014, this year OPEC not only considers enacted policies, but also accepts that some proposals put forward in 2015 may have long-term consequences for the global energy market. In WOO2015, OPEC highlights several new energy policies in the Energy Policy section of chapter 4 and examines their potential impacts over time. However, while OPEC does not incorporate specific prospective policy proposals into their model, they do allow for policy evolution over time. Because OPEC's Reference Case in WOO2015 is not strictly based on energy policies already in place, it becomes more challenging to find a single counterpart in IEA's WEO2015 for comparison.

To enlarge the comparison between IEA and OPEC scenarios this analysis compares OPEC's reference case with IEA's New-, and Current Policies Scenario.

OPEC examines two pairs of alternative scenarios in WOO2015. One pair adjusts GDP growth assumptions and another adjusts energy supply assumptions. The WOO2015 adjusts GDP assumptions by +10% relative to the Reference Case for its higher economic growth scenario (HEG) and by -15% for its lower economic growth scenario (LEG). The scenarios also allow for variation in different regions to account for region-specific economic circumstances. Under these scenarios, the largest variations are over the medium term, with HEG and LEG growth rates converging with 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.

Because OPEC's Reference Case considers both enacted policies and proposals or commitments that are not legally enacted, we compare it with both the IEA's Current Policies Scenario and the IEA's New Policies Scenario, which is new for this year's comparison paper.

6.1.2 Demography

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 7.3 billion people in 2015 to 9.7 billion by 2050 in the "medium-variant" scenario.⁸

IEA and OPEC use UNDP analysis for their demographic growth assumptions.

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 rates. 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 at about 1.4 billion.

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 63% 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 demographic assumptions include a larger percentage of working-age population and more immigrants from non-OECD nations to OECD nations.

⁸ United Nations Population Division (UNPD), World Population Prospects: The 2015 Revision (New York: United Nations, 2015). The "medium-variant" scenario assumes fertility rates in different countries to move towards a global average level.

6.1.3 Economic growth

Though IEA and OPEC use different assumptions and baselines to model long-term economic growth, their global estimates converge.

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. Although the IEA and OPEC use slightly different assumptions, both organisations project annual average global economic growth of 3.5% through 2040.

The IEA and OPEC both make GDP assumptions in Purchasing Power Parity (PPP) terms⁹. In addition, both organisations project GDP growth rates over the periods 2020-2030 and 2030-2040, facilitating direct comparisons over those time intervals. However, the two organisations use different baseline years – the IEA uses 2013 and OPEC uses 2014 – to calculate compound average annual growth.

IEA and OPEC however diverge on long-term growth rates for China and Russia.

Through communications with the IEA WEO modelling team, the compound average annual GDP growth rates for the periods of 2014-2020 was recalculated, allowing for direct comparison with OPEC's data. Figure 12 shows 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. For example, between 2030 and 2040, the IEA has a much lower estimate for China's annual growth rate (3.1%) relative to OPEC (4.2%), while the IEA is more bullish about Russia's growth rate (3.1%) than OPEC (2.1%).¹⁰ Nonetheless, both the IEA and OPEC project that China's total GDP in 2040 will exceed each of the three OECD sub-regions (OECD Americas, OECD Europe, and OECD Asia Oceania), 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 even in 2040.

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.

¹⁰ We also compared the GDP growth rates assumptions for India and the differences are not large. The GDP growth projections for India are 7.6% during 2014-2020 for both IEA and OPEC, 7.0% and 6.8% respectively during 2020-2030, and 5.3% and 5.9% respectively during 2030-2040.

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

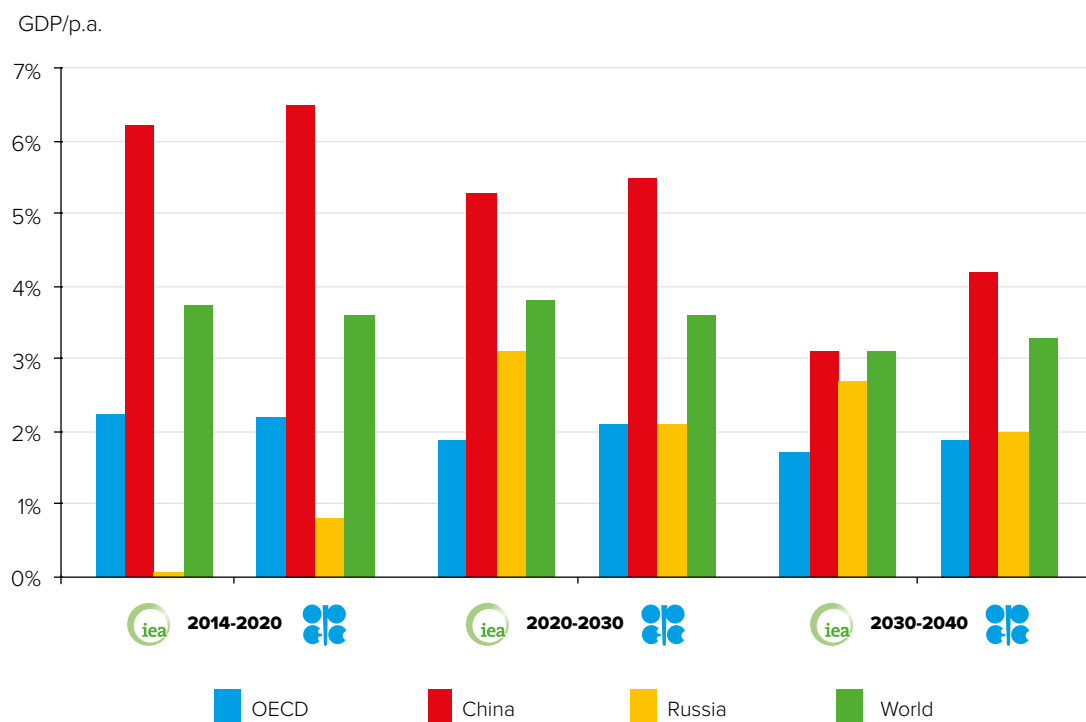


Figure 12 data sources: IEA WEO2015 Internal Data; OPEC WOO2015, Table 1.4.

6.1.4 Oil Prices

OPEC's long-term oil price assumptions are based on the cost of supplying the marginal barrel, while IEA oil price assumptions follow from the equilibrium found in supply-demand models.

The gaps between the IEA's and OPEC's long-term oil price assumptions remain large across compared scenarios.

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 takes 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 equilibrium prices reached in a supply-demand model. 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 2014 US\$) in the Reference Case are substantially lower than all but the 450-ppm Scenario in WEO2015. 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\$12/bbl and US\$55/bbl relative to OPEC's Reference Case in 2020 and 2040, respectively.

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

Figure 13. Long-Term Oil Price Assumptions (real 2014 US\$/bbl)

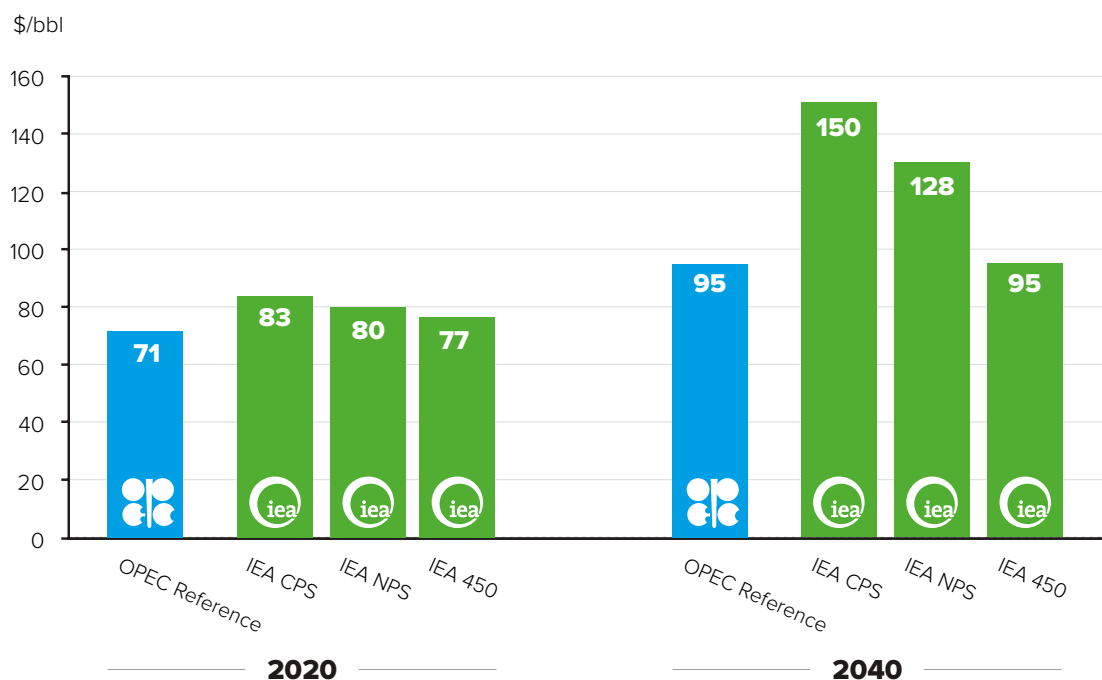


Figure 13 Data Sources: IEA WEO2015 Table 1.6; OPEC WOO2015 Figure 1.8.

6.1.5 Energy and Environmental Policies

The IEA does not describe what policy changes have been made for its most recent Current Policy Scenario. Some policies of the New Policy Scenario may not have been enacted.

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 WEO2015 and WOO2015 is provided below. Note that in the WEO2015, the IEA highlights just the proposals or commitments included in its 2015 New Policies Scenario. It does not explicitly describe what policy changes, if any, have been made to its 2015 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 level plateaus.

OPEC shares a few new policy proposals with the IEA's New Policies Scenario in its Reference Case.

In their policy highlights, OPEC shares a few proposals that are common with the IEA's New Policies Scenario, including China's National Action Plan on Prevention and Control of Air Pollution, the EU's 2030 Climate and Energy Package, India's fuel efficiency standards, and U.S. plans to regulate greenhouse gas emissions. Note that the policies highlighted in the IEA's New Policies Scenario have not necessarily been legally adopted.

	IEA WEO2015: Highlighted Policies	OPEC WOO2015: Highlighted Policies
	Only for New Policies Scenario	
	Brazil: Partial implementation of National Energy Efficiency Plan	2015-2019 Business and Management Plan
	China: National Action Plan on Prevention and Control of Air Pollution Implementation of specific energy-related measures of 12th Five-Year Plan	Energy Development Strategy Action Plan Elimination of the mineral resource compensation fee
	EU: 2030 Climate and Energy Package	European Energy Security Strategy 2030 Climate and Energy Package
	INDIA: Further implementation of the National Electric Mobility Mission Plan 2020	Corporate Average Fuel Consumption standards
	JAPAN	Energy Mix Plan
	MEXICO	Energy Reform Bill approved in December 2014
	RUSSIA	Amendment of Russian Energy Strategy 2035 (RES 2035)
	SOUTH KOREA	Emission trading system
	US: Clean Power Plan with the aim of cutting power sector CO2 emissions 32% by 2030 relative to 2005 levels CAFE standards	Phase-2 CAFE standards for heavy-duty vehicles Debate over crude oil export ban Climate Action Plan with commitment of reducing GHG emissions by 26%-28% by 2025 relative to 2005.
	INTERNATIONAL	UNFCCC Intended Nationally Determined Contributions

6.2 Long-term Energy Demand

6.2.1 Primary Energy Consumption

Primary energy demand increases to a similar level according to both organisations, but at a slower pace.

Total primary energy demand reaches 400 mboe/d in OPEC's Reference Case and is close to IEA's Current Policies Scenario estimate of 397 mboe/d.

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, and while the percentage rate of growth is slower, absolute levels of growth are similar to previous decades. Consumption growth is driven primarily by economic and population growth, with the majority of new demand coming from developing countries. Fossil fuels continue to dominate the primary energy mix, with oil, gas and coal maintaining around 75-80% of the total share in all the scenarios (except the IEA 450 ppm scenario). 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.

Total primary energy demand in OPEC's Reference Case is closest to the IEA's Current Policies Scenario. OPEC projects a 49% increase in world total primary energy demand in 2040 relative to 2013, which is moderately higher than the IEA's projection of a 45% increase in the Current Policies Scenario, and significantly higher than the 32% increase in IEA's New Policies Scenario. **Figure 14** provides a comparison of total expected primary energy supply by energy source. The most notable difference between the projections lies in the composition of the fossil fuel mix. The IEA's projection in the Current Policies Scenario for total natural gas supply in 2040 is 19 mboe/d lower than OPEC's, while its outlook for oil supply is 7 mboe/d higher, and for coal is 15 mboe/d higher than OPEC's. Under the IEA's New Policies Scenario, natural gas, oil, and coal consumption levels are all lower than OPEC's Reference Case projections.

Figure 14. World Primary Energy in 2013 and Outlook for 2040 (mboe/d)

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

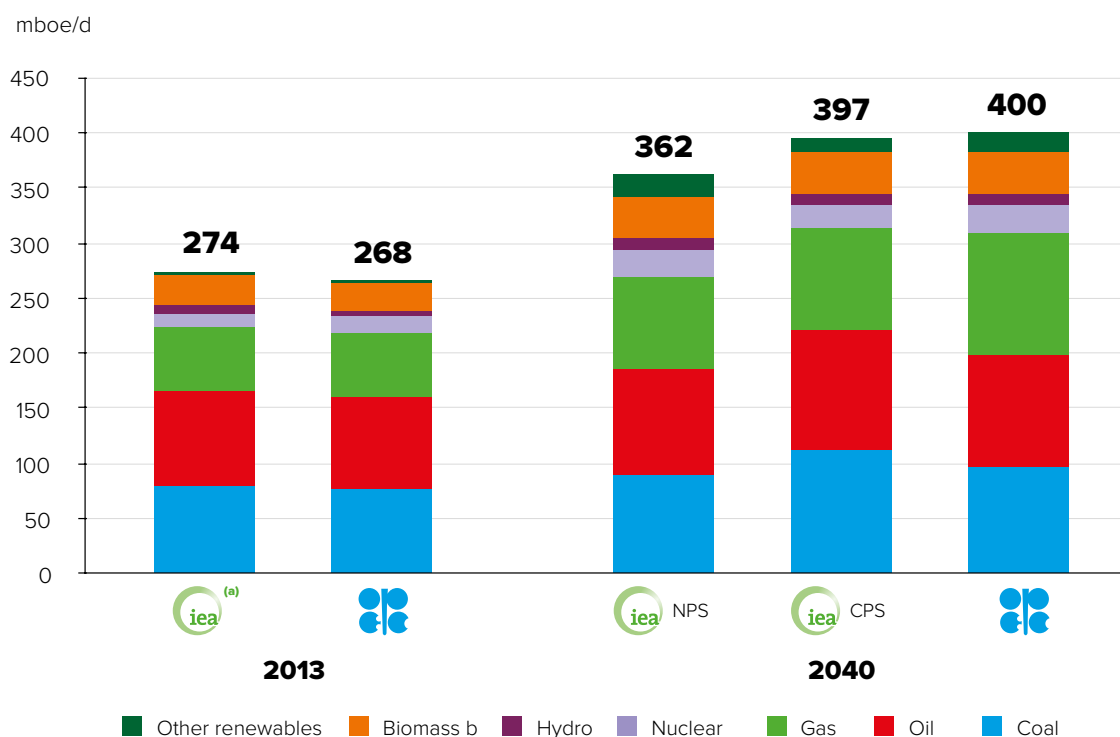


Figure 14 data sources: IEA WEO 2015, Annex Table; OPEC WOO2015, Table 1.5.

Figure 14 notes: ^(a)IEA primary energy is converted from mtoe per year to mboe/d by multiplying by 0.0202 mboed/mtoe.

IEA sees oil and coal as the leading fuel in its New-, and Current Policies Scenario respectively, while in OPEC's Reference case natural gas emerges as the leading primary energy source.

Figure 15 presents the share of each fuel in the global energy mix in 2013, along with projections for 2040. In the IEA's New Policies Scenario, while its share shrinks, oil is expected to maintain its position as the leading fuel in 2040. In the IEA's Current Policies Scenario for 2040, oil cedes its leading position in primary energy consumption to coal. In OPEC's Reference Case for 2040, natural gas emerges as the leading primary energy source. As **Figure 15** shows, the IEA projects the share of oil will decline from 31% in 2013 to 26% and 27% in 2040 in the New Policies Scenario and the Current Policies Scenario, respectively, while OPEC sees a drop from 32% to 25%. In the IEA's Current Policies Scenario, the share of coal remains steady during the projection period, while it drops from 28% to 25% in the OPEC Reference Case. Natural gas is set to grow the fastest among fossil fuels with an increasing share in the fuel mix in every projection examined here. The share of renewables, currently led by biomass, is projected to increase in all the scenarios from nearly 13% in 2013 to 15% under the IEA's Current Policies Scenario, 16% by 2040 in OPEC's Reference Case, and to 19% under the IEA's New Policies Scenario. Most of this growth comes from renewable electricity such as wind, solar, and hydro, and electricity is expected to grow faster than any other final form of delivered energy worldwide.

Figure 15. World Primary Energy Fuel Shares in 2013 and Outlook for 2040

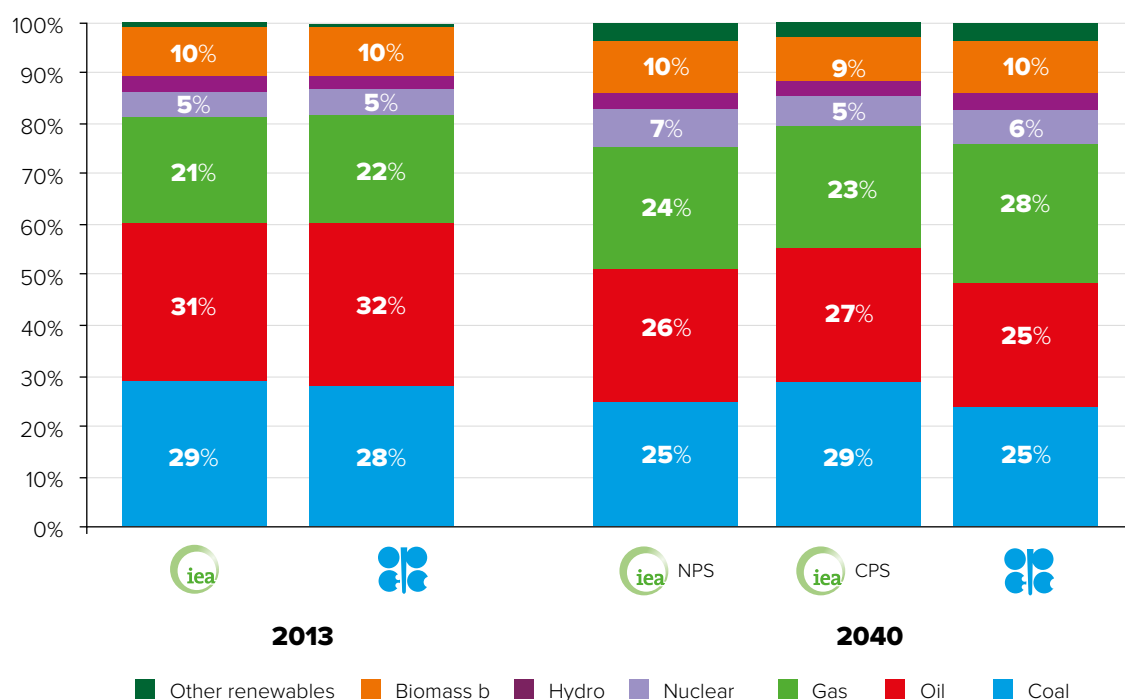


Figure 15 data sources: IEA WEO 2015, Annex Table; OPEC WOO2015, Table 1.5.

Figure 14 notes: ^(a)IEA primary energy is converted from mtoe per year to mboe/d by multiplying by 0.0202 mboe/d/mtoe.

6.2.2 Liquids Demand

Despite progress, it remains a challenge to compare liquids demand between the IEA and OPEC Outlooks.

Similar to last year's assessment, it remains a challenge to directly compare liquids demand between the WEO and WOO reports. First, the IEA and OPEC diverge on their classification of biofuels. The IEA groups biofuels into the renewables category, and projects demand for biofuels and oil separately. OPEC includes biofuels in the liquids category, as the IEA does in its OMR and MTOMR (but not the WEO). 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 We also must convert IEA biofuels data in energy equivalent units to volumetric units for comparison with OPEC.¹³

Second, 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 WOO2015 report leads to a much larger number than that reported under the “bunkers” category in the WEO2015. 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.

Third, although OPEC disaggregated its member countries demand data to improve direct comparison with IEA's outlook, an inconsistency still exists within the Middle East & Africa regions as reported in the two outlooks. While IEA reported Middle East and Africa regions separately, OPEC grouped them together as a single category. This paper aggregates the Middle East and Africa in WEO2015 to more directly compare oil demand projections between the two organizations.

Although the share of oil in the world energy portfolio is expected to decrease, the level of oil demand remains robust.

Incorporating the adjustments described above, **Table 12** presents a comparison of long-term world liquids demand projections using the IEA's New Policies Scenario, Current Policies Scenario and OPEC's Reference Case. Although the share of oil in the world primary energy portfolio is expected to decrease, the level of oil demand still enjoys robust growth over the projection period. In both IEA's New Policies Scenario and OPEC's Reference Case, world liquids demand reaches around 110 mb/d by 2040. In IEA's Current Policies Scenario, 2040 world liquids demand is roughly 10 mb/d higher at 120 mb/d (**Figure 16**).

The difference between the highest (IEA Current Policies Scenario) and lowest (IEA 450 Scenario) projections for 2040 world liquids demand is 34.3mb/d. By incorporating ambitious policies for greenhouse gas mitigation, the 450 Scenario projects that world liquids demand would peak around 2020, then gradually decline below 2014 levels by around 2032. Taking into account the historical gap in the base year 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 slower annual demand growth after 2030 relative to 2014-2030 under all scenarios except IEA's Current Policies Scenario and OPEC's Low Economic Growth Scenario.

12 For the IEA's New Policies Scenario, biofuels projections are presented in Chapter 9 and for the Current Policies Scenarios are available in “IEA World Energy Outlook 2015 Annex A Tables for Scenario Projections” (see WEO2015 p. 580).

13 We use a conversion factor of 0.032 mbd/mtoe for biofuels. This overall conversion factor is computed by first deriving a factor of 1.463 mbd/mboed for converting ethanol in energy-equivalent barrels to volumetric barrels (we divide IEA's world biofuels demand in volumetric mbd terms (from IEA's MTOMR) by the demand in mboed). We then multiply 1.463 mbd/mboed by 0.022 mboed/mtoe (we divide IEA's world biofuels demand in oil-equivalent mb/d terms (presented in WEO2015 Table 3.1) by corresponding biofuels demand in mtoe (presented in WEO2015 Annex A tables) to arrive at an overall conversion factor of 0.032 mbd/mtoe. This conversion factor differs slightly from the one we use from primary energy demand, as described in Section 5.

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

	2040			Avg. annual growth (2013-2040)			Difference (IEA-OPEC)	
	IEA NPS ^(a)	IEA CPS	OPEC Reference Case	IEA NPS	IEA CPS	OPEC Reference Case	NPS	CPS
Total OECD	33.1	37.2	37.8	-0.3	-0.2	-0.3	0.0	0.1
OECD Americas	19.4	22.1	20.2	-0.1	0.0	-0.2	0.0	0.1
OECD Europe	8.7	10.0	11.3	-0.1	-0.1	-0.1	0.0	0.0
Asia Oceania	4.9	5.1	6.3	-0.1	-0.1	-0.1	0.0	0.0
Total Non-OECD	66.5	72.7	71.9	0.9	1.1	1.0	-0.1	0.1
Asia	35.7	39.1	39.9	0.6	0.7	0.7	-0.1	0.0
China	16.1	17.9	18.0	0.2	0.3	0.3	-0.1	0.0
India	10.1	10.8	9.6	0.2	0.3	0.2	0.0	0.0
Other non-OECD Asia	9.6	10.4	12.3	0.1	0.1	0.2	-0.1	0.0
Latin America	8.2	8.7	8.9	0.1	0.1	0.1	0.0	0.0
Middle East & Africa	17.3	19.5	17.3	0.2	0.3	0.2	0.0	0.1
Europe & Eurasia	5.3	5.4	5.8	0.0	0.0	0.0	0.0	0.0
Bunkers ^(b)	10.0	10.4	n/a	0.1	0.1	n/a	n/a	n/a
World	109.6	120.3	109.8	0.6	1.1	0.7	-0.1	0.3

Table 12 data sources: IEA WEO 2015, Annex A Tables; OPEC WOO2015, Table 1.8a.

Table 12 notes: Sums may not total due to rounding.

^(a) Biofuels from IEA WEO 2015 Annex A are added to IEA regional oil demand data for comparability with OPEC estimates, after converting from mtoe to mb/d.

^(b) Bunkers in the IEA WEO 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 (mb/d)

The difference of 34.3 mb/d between the highest and lowest projections for oil demand in 2040 reflects the inherent uncertainties of long-term projections.

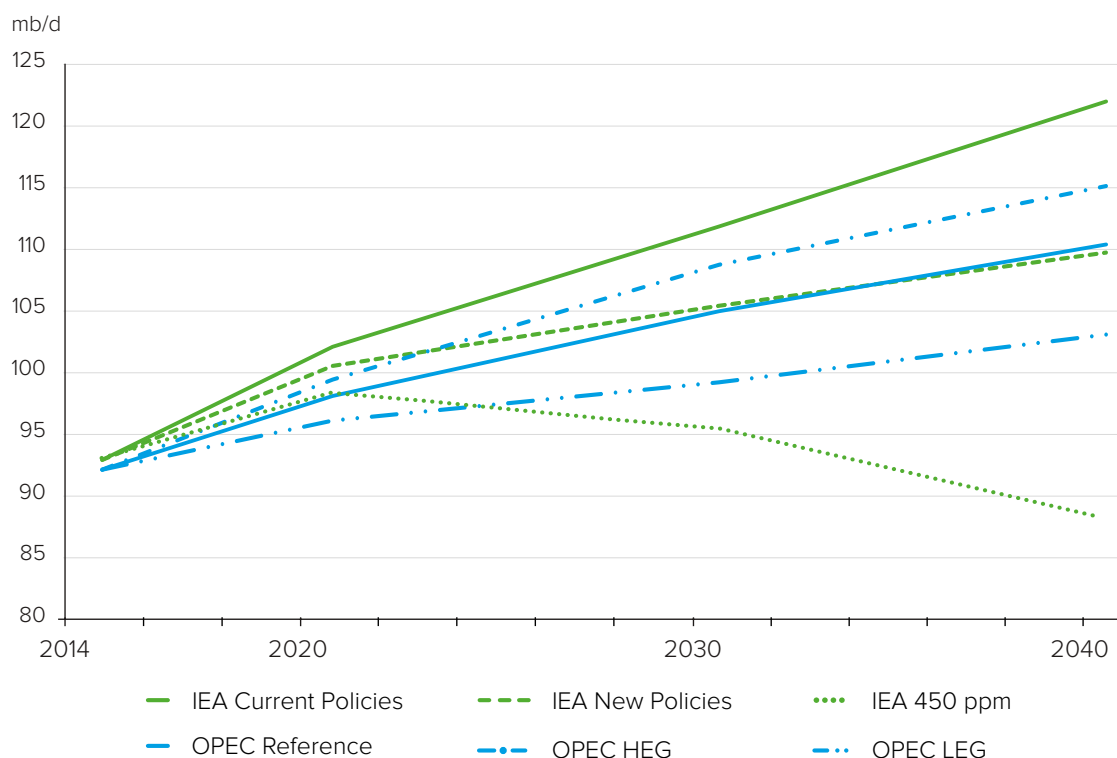


Figure 16 data sources: IEA WEO 2015, Annex A Tables for Scenario Projections and Table 3.1; OPEC WOO2015, Table 1.8, 4.3, 4.5.

Figure 16 notes: Biofuels from IEA WEO 2015 Annex A are added to IEA regional oil demand data for comparability with OPEC estimates, after converting from mtoe to mb/d.

The projected decrease in long-term oil demand in the OECD is more than offset by demand growth in the OECD region taking two-thirds of total demand in 2040.

Regarding demand growth among countries at different stages of development, the IEA's New Policies Scenario, Current Policies Scenario and OPEC's Reference Case make similar projections for OECD and non-OECD consumption patterns. All three project that OECD nations 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 nations. The centre of demand growth continues to shift to developing countries, with non-OECD nations' share of total oil demand increasing from half to two-thirds over the course of all three outlooks (**Figure 17**).

The Middle East and Africa emerge as new oil demand growth centres alongside China and India.

For specific regions and nations, the IEA and OPEC share similar views on overarching trends of oil demand, with some moderate differences. 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, this region dominates global demand growth in both the IEA's and OPEC's projections. In addition, the Middle East and Africa category (including OPEC Member Countries) emerge as an important growth centre, with Middle East demand growth trailing that of China and India. The largest relative declines under both projections occur in OECD Americas, where more stringent fuel economy standards for light- and heavy-duty vehicles lead to reduced demand.

Figure 17. OECD and Non-OECD Shares of Liquids Demand in 2014 and Outlook for 2040

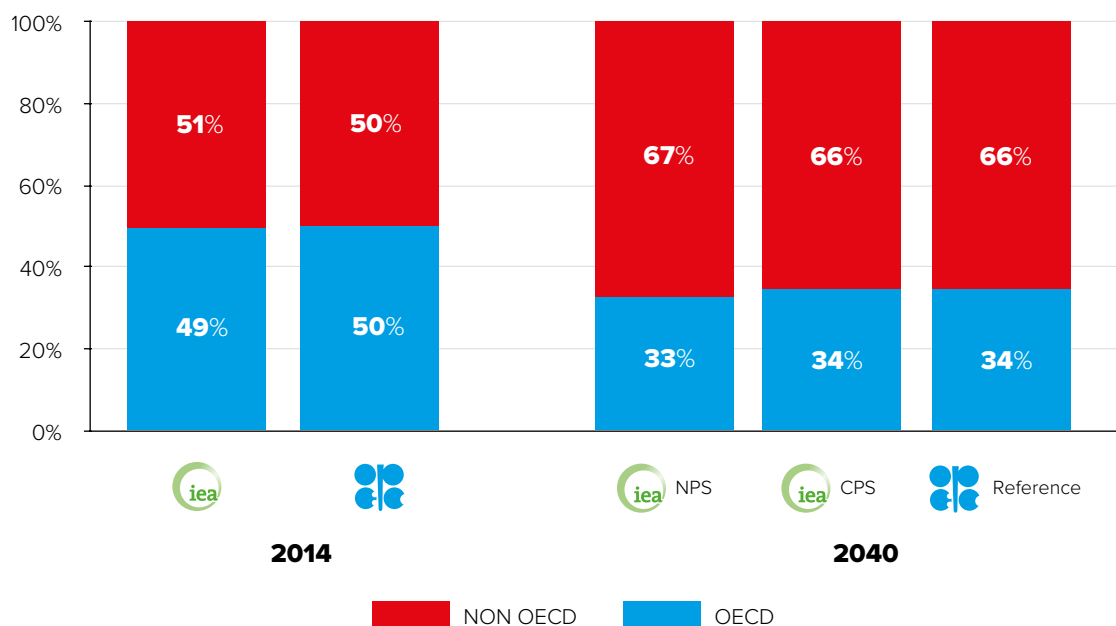


Figure17 data sources: IEA WEO 2015, Annex A Tables for Scenario Projections and Table 3.1; OPEC WOO2015, Table 1.8.

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 WEO 2015 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 0.032.

Sectoral perspectives of the IEA’s and OPEC’s long-term demand outlooks converge on the transport sector.

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.

6.3 Long-term Oil Supply

6.3.1 Mathematical Models

The IEA and OPEC use distinct methods to project long-term supply. These are each more exposed to uncertainty and judgement calls.

In Section 3, we noted that both the IEA and OPEC base their medium-term supply projections on bottom-up approaches. However, their long-term supply projection methodologies are more distinct.

In its WOO series, OPEC uses a resources-to-production (R/P) model to verify estimates of annual future oil production based on variables including discovery rates, development cost, profitability and drilling footage. In this model, the focus is on estimating the economic accessibility of oil resources in each country. OPEC primarily relies on U.S. Geological Survey (USGS) data (updated most recently in 2012) for country-level estimates of Ultimately Recoverable Resources (URR). The advantage of using R/P to verify estimates is its simplicity and ease of understanding. However, URR estimates are subject to substantial uncertainty, and past research has identified cases where URR estimates may be low due to the possible exclusion of new discoveries and underestimates of reserve growth¹⁴. In addition, unanticipated technological advancements may substantially affect the economic viability of known resources.

Distinct methods complicate accounting for supply growth from unconventional resources.

Indeed, OPEC notes that the largest concern in using an R/P model is the challenge of incorporating unconventional resources. OPEC finds its 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.

Like last year, the WOO2015 includes a detailed assessment of active unconventional plays in North America, yielding a relatively optimistic view on unconventional crude and NGLs supply. For unconventional resources outside North America, OPEC continues to take a cautious approach. Non-OPEC unconventional supply from Russia and Argentina is again included in OPEC's Reference Case projection, while those from China and Mexico are only projected to produce oil in the Upside Supply Scenario (HIGHSUP).

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.

In the long-term outlook, the IEA projects supplies from OPEC Member Countries with the same methodology as for non-OPEC countries.

Another important difference between the IEA's long-term supply forecast and its medium-term forecast 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 Member 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 synthesising 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.

6.3.2 Liquids Supply

Table 13 summarises long-term liquids supply outlooks for the IEA's New Policies and Current Policies Scenarios and OPEC's Reference Case. A number of the differences in this table can be attributed to differences in total supply and demand projections, but some noteworthy points also emerge. First, OPEC is substantially more bullish on production from non-OECD Europe and Eurasia, projecting 2040 production to be 2.4 mb/d and 1.0 mb/d higher than the IEA New Policies and Current Policies Scenarios, respectively. The IEA projects production from this region to be lower than current levels, with the largest decline coming from Russia. Another substantial difference, both IEA scenarios show supply from OPEC NGLs and unconventional to be substantially higher than OPEC's estimates.

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

	2040			Avg. annual growth (2014 - 2040)			Difference (IEA-OPEC)	
	IEA NPS	IEA CPS	OPEC Reference Case ^(a)	IEA NPS	IEA CPS	OPEC Reference Case	IEA NPS - OPEC	IEA CPS - OPEC
Total OECD	24.1	28.2	24.0	0.1	0.2	0.0	0.0	0.2
OECD Americas	21.0	24.7	21.1	0.1	0.2	0.1	0.0	0.1
OECD Europe	2.2	2.4	2.4	0.0	0.0	0.0	0.0	0.0
Asia Oceania	0.9	1.1	0.6	0.0	0.0	0.0	0.0	0.0
Total Non-OECD (Non-OPEC)	27.2	31.0	29.0	-0.1	0.0	0.0	-0.1	0.0
Non-OECD Asia	5.9	7.1	5.9	-0.1	0.0	-0.1	0.0	0.0
Middle East, Africa & Latin America	9.1	10.3	8.7	0.0	0.1	0.0	0.0	0.1
Europe & Eurasia	12.2	13.6	14.6	-0.1	0.0	0.0	-0.1	-0.1
Processing Gains	3.0	3.4	3.0	0.0	0.0	0.0	0.0	0.0
World Biofuels supply	6.1	5.3	3.7	0.2	0.1	0.1	0.1	0.1
Total Non-OPEC	60.4	67.8	59.7	0.1	0.4	0.1	0.0	0.3
Total OPEC	49.2	54.5	50.2	0.5	0.7	0.6	-0.1	0.1
OPEC crude ^(b)	36.6	41.0	40.7	0.3	0.4	0.4	-0.2	0.0
OPEC NGLs+ unconventional	12.5	13.5	9.5	0.2	0.3	0.1	0.1	0.1
World Supply	109.6	122.3	110.0	0.6	1.1	0.7	-0.1	0.4

Table 13 data sources: IEA WEO 2015, Annex A Tables, and internal communication; OPEC WOO2015, Table 1.10, 3.8.

Table 13 notes: Sums may not total due to rounding.

^(a)The IEA WEO does not include regional biofuels supply. Regional biofuels supply (OPEC WOO2015 Table 3.8) is therefore subtracted from each of OPEC's regional total liquids supply (OPEC WOO2015, Table 1.10) and only world biofuels supply is provided.

IEA projects that lower economic growth estimates will temper oil demand growth in the transport sector.

Low Oil Price Scenario

In WEO2015, the IEA includes a special section that forecasts long-term global energy trends under a Low Oil Price Scenario, in which prices stabilize within a range of US\$50-US\$60/bbl into the 2020s before ultimately rising to US\$85/bbl by 2040. This scenario starts with IEA's New Policies Scenario, and then changes several key assumptions that could hold oil prices lower, including greater resilience of production from non-OPEC supply sources; a sustained commitment by OPEC to prioritize market share; and lower near-term economic growth. IEA's Low Oil Price Scenario's 2040 oil price assumption of US\$85/bbl is US\$43/bbl below that of IEA's New Policies Scenario, US\$65/bbl below IEA's Current Policies Scenario, and US\$19/bbl below OPEC's Reference Case.

Under IEA's Low Oil Price Scenario, global primary energy demand in 2040 is 0.5% lower than in the New Policies Scenario because the energy demand stimulation of lower prices is more than offset by slower assumed economic growth. Lower oil prices impact the global fuel mix more substantially, with oil demand increasing to 100.2 mboe/d, which is 4.6 mboe/d higher than IEA's New Policies Scenario, 7.8 mboe/d below the Current Policies Scenario, and just 0.4 mboe/d lower than OPEC's Reference Case. Coal cedes the most ground in the Low Oil Price Scenario, with a decrease of 3.4 mboe/d (or 3.8%) relative to the New Policies Scenario due in part to lower electricity demand driven by lower economic growth. The projected uptake rate of renewable energy sources in IEA's Low Oil Price Scenario remains nearly unchanged from the IEA's New Policies Scenario.

As one would expect, the sectoral impacts of the Low Oil Price Scenario are most significant in transport, where lower oil prices contribute to higher demand growth relative to the New Policies Scenario, but the expansion is tempered by the lower economic growth assumption. The transport-related demand increase is greatest in the United States, where low prices have a more pronounced effect on relative fuel costs due to lower fuel taxes relative to other OECD countries.

From a regional economic perspective, net oil importers are likely to fare well under IEA's Low Oil Price Scenario. An open question with respect to low oil prices is how far they can fall and how long they can remain there before various oil resources, such as Canadian oil sands, Arctic resources, or U.S. tight oil deposits, can no longer be profitably exploited over the long-term. Under IEA's Low Oil Prices Scenario, for example, the share of conventional crude in global oil production is projected to be 70% in 2040 compared with 66% under IEA's New Policies Scenario.

Recall from Figure 9 (Section 3) that the IEA and OPEC use different classification systems for liquids fuels, presenting challenges when comparing long-term supply forecasts. 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. **Figure 18** shows that all three scenarios project increasing OPEC liquids supply, and roughly stable non-OPEC liquids supply. Consequently, **Figure 19** shows how OPEC's share of global supply rises from the current level of just under 40% to roughly 45% by 2040 under the IEA's New Policies Scenario, Current Policies Scenario, and OPEC's Reference Case. Likewise, the share of liquids from non-OPEC nations falls substantially in all the scenarios, to 50% by 2040 (including processing gains). In another similarity, both project conventional non-OPEC supplies to decline, while other non-OPEC liquids including LTO increase.

Both the IEA and OPEC show OPEC Member Countries share of liquids supply increase against stable non-OPEC supply.

Figure 18. Liquids Supply Sources in 2014 and Outlook for 2040 (mb/d)

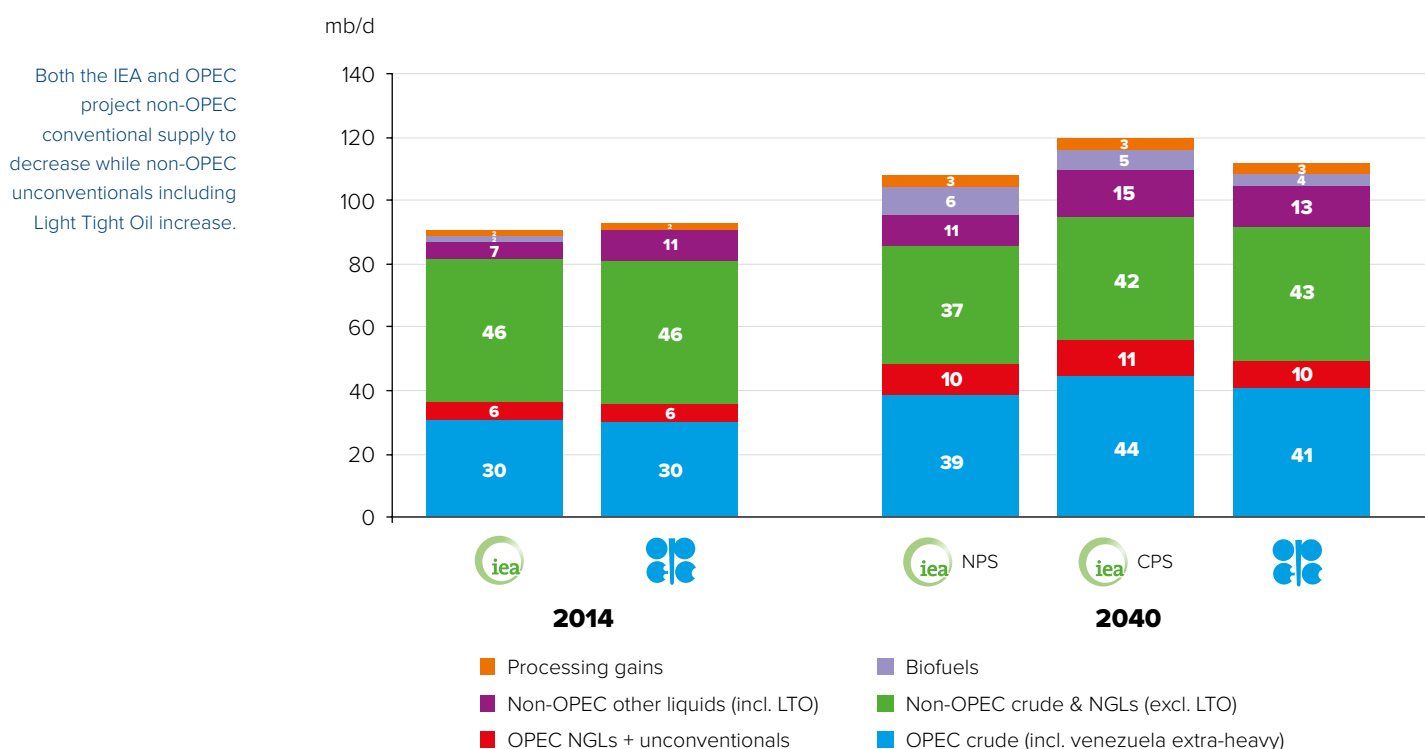


Figure 18 data sources: Communication from IEA; IEA WEO2015 Table 3.7; OPEC WOO2015, Table 1.10, 3.8.

Figure 18 note: IEA biofuels from communication with IEA, converted from energy-equivalent basis to volumetric mb/d by multiplying a factor of 1.463.

Figure 19. Shares of Liquids Supply by Types in 2014 and Outlook for 2040

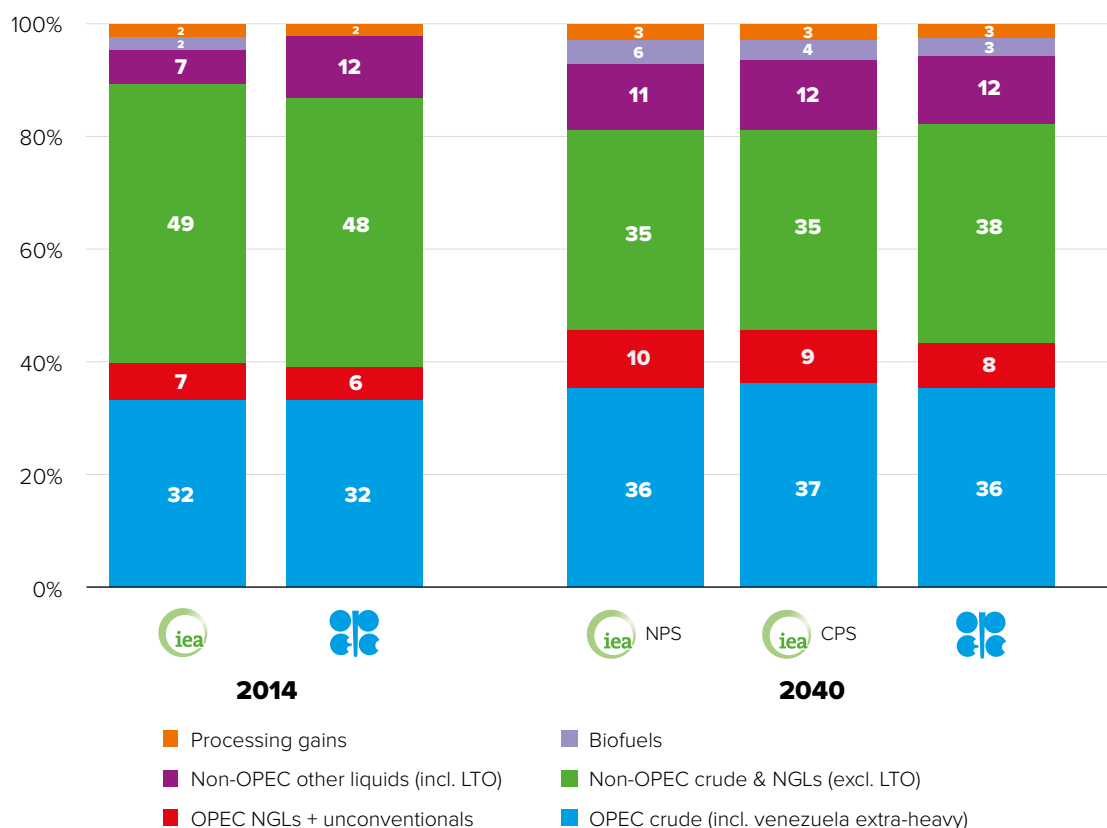


Figure 19 data sources: Communication from IEA; IEA WEO2015 Table 3.7; OPEC WOO2015, Table 1.10, 3.8.

Figure 19 note: IEA biofuels from communication with IEA, converted from energy-equivalent basis to volumetric mb/d by multiplying a factor of 1.463.

Finally, **Figure 20** presents a comparison of world liquids supply forecasts from all core WEO2015 and WOO2015 scenarios. This figure highlights how dramatically world supply outlooks can be affected by different scenario assumptions. The IEA primarily varies its assumptions by adjusting key energy and environmental policies, affecting all types of liquids supply. In the WOO2015, 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 (mb/d)

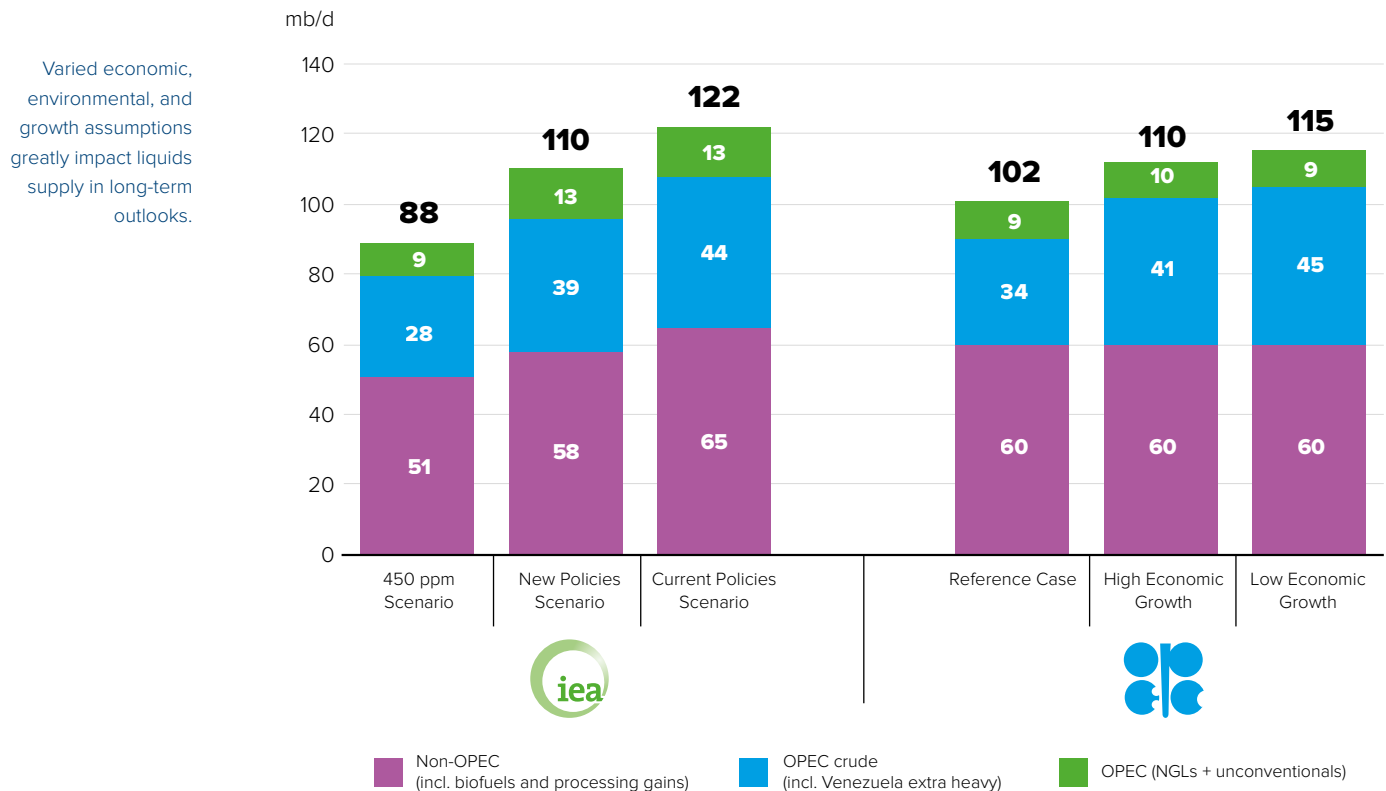


Figure 20 data sources: Communication from IEA; IEA WEO2015 Table 3.7; OPEC WOO2015, Table 4.3, 4.4, 4.5, 4.6.

Figure 20 notes:

IEA^(a): biofuels are converted from energy-equivalent basis by multiplying a factor of 1.463.

OPEC^(b): WOO 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.

7. Final Remarks

Despite a rise in short-term uncertainties some long-term fundamentals remain clear: oil alongside other fossil fuels retains a central position in the energy mix but demand will be more moderate over most projection periods.

2015 was a turbulent year for global oil markets. After falling by almost half from about \$110/bbl in the second half of 2014, oil prices levelled off at around US\$60/bbl in the first half of 2015. Prices then plunged further to below US\$40/bbl by the end of 2015. This extended period of low prices is attributable to a range of factors including continued development of North American unconventional oil supplies, growing OPEC supply levels, weaker-than-expected demand from OECD and non-OECD nations, and resulting changes in global oil market expectations. While for some countries low oil prices support economic growth, the precipitous drop in crude prices has triggered concerns elsewhere, including negative spill-over effects on financial markets, decreased investment in unconventional oil production, and weakened economic growth prospects and heightened risk of fiscal and political stresses in some 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. Unless policies or technologies change significantly more than currently expected, and 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 major emerging economies mature, more efficient technologies are deployed, and environmental concerns grow, global oil demand growth rates will likely be tempered. Supply, on the other hand, has been robust.

The key questions for long-term oil supply are which nations and what types of oil production are likely to supplant production declines from existing projects and support demand growth. Non-OPEC supply from unconventional plays has increased sharply in recent years, and the industry has made efficiency gains to cope with lower oil prices, though it is unclear how sustained low prices will affect these supplies and how high prices would need to get to support a rebound. Nonetheless, to meet long-term demand, OPEC Member Countries will likely continue to play a central and even increasing role in global oil supply.

This introductory paper seeks to enhance understanding of views and methodologies from two widely acknowledged information providers, the IEA and OPEC, by comparing their outlooks over corresponding time horizons. Various similarities and differences between their historical data, assumptions and projections are described 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.

To facilitate and inform the producer-consumer dialogue more opportunities exist to make outlooks more comparable and robust.

As a continuous effort, the Sixth 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 proposes the following issues for further discussion at the symposium:

- Ongoing analysis of 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;
- 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	HEG	New Policies	Current Policies	450-ppm
Global Economic Growth Rate (2014-2040)	3.5%	3.1%	3.7%	3.5%	same as New Policies	same as New Policies
Population, Billion (2015)	From 7.3 to 9.7 (2015-2050)	same as Reference Case	same as Reference Case	From 7.3 to 9.7 (2015-2050)	same as New Policies	same as New Policies
Oil Price Assumptions (in 2014\$)	\$71/bbl by 2020; \$95/bbl by 2040	same as Reference Case	same as Reference Case	\$83/bbl by 2020; \$150/bbl by 2040	\$80/bbl by 2020; \$128/bbl by 2040	\$77/bbl by 2020; \$95/bbl by 2040
Investment (2015-2040 in 2014\$)	Upstream: \$7.2 trillion; Midstream and downstream: \$2.7 trillion	Not specified	Not specified	Upstream: \$12.6 trillion; Midstream and downstream: \$2.8 trillion	Not specified	Not specified
Energy and Environmental Policies	Primarily considers policies that have been enacted, but also acknowledges potential impacts from policy proposals	same as Reference Case	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 2014\$)	Not specified	Not specified	Not specified	By 2040: \$50/tonne in EU and Korea; \$35/tonne in China; \$24/tonne in South Africa; \$20/tonne in Chile	By 2040: \$40/tonne in EU and Korea	By 2040: \$140/tonne in US, Canada, EU, Japan, Korea, Australia and New Zealand; \$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) (2013-2040)	267.7	399.6	-	-	273.8	362.1	396.6	306.8
Global Oil Demand (mb/d) (2014-2040)	91.3	109.8	102.4	114.6	92.1	109.1	121.5	87.3
Non-OPEC Supply (mb/d) ^(b) (2014-2040)	58.8	62.7	59.5	59.9	56.8	58.2	65.2	51.2
OPEC Crude (mb/d) ^(c) (2014-2040)	30	40.7	33.5	45.4	30.3	38.9	43.7	27.7
OPEC NGLs and Other Liquids (mb/d) (2014-2040)	6	10	9	9	6	13	13	9

Annex 2 notes:

^(a) IEA primary energy is converted from mtoe per year to mboe/d by multiplying by a factor of 0.0202 mboed/mtoe.

^(b) Include biofuels and processing gains.

^(c) OPEC crude includes Venezuela extra-heavy oil.



SIXTH IEA IEF OPEC SYMPOSIUM ON ENERGY OUTLOOKS



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

