11 IEA IEF OPEC Symposium on Energy Outlooks

IEF RESOURCES for the FUTURE

IEF RFF Outlooks Comparison Report

This report was prepared by the International Energy Forum in collaboration with Resources for the Future

11TH IEA IEF OPEC SYMPOSIUM ON ENERGY OUTLOOKS

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Acronyms and Abbreviations

bbl	Barrel
CCE	Circular Carbon Economy (G20)
CPS	Current Policies Scenario (IEA)
CTLs	Coal to Liquids
EIA	U.S. Energy Information Administration
DRS	Delayed Recovery Scenario (IEA)
EOR	Enhanced Oil Recovery
FSU	Former Soviet Union
GDP	Gross Domestic Product
GECF	Gas Exporting Countries Forum
GHG	Greenhouse gas
GTLs	Gas to Liquids
IEA	International Energy Agency
IEF	International Energy Forum
IMF	International Monetary Fund
IRENA	International Renewable Energy Agency
kb/d	Thousand Barrels per Day
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
MTBE	Methyl Tertiary Butyl Ether
NDC	Nationally Determined Contribution (UN)
NGLs	Natural Gas Liquids
NPV	Net Present Value
NZE2050	Net Zero Emissions by 2050 Scenario (IEA)
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
SDS	Sustainable Development Scenario (IEA)
SEforAll	United Nations Sustainable Energy For All (UN)
SPR	Strategic Petroleum Reserve
STEPS	Stated Energy Policy Scenario (IEA)
UN	United Nations
URR	Ultimately Recoverable Resources
USGS	U.S. Geological Survey
WEO	World Energy Outlook (IEA)
WOO	World Oil Outlook (OPEC)

1. Key Observations

The key observations summarise the detailed discussion of energy outlooks that follows in the chapters below to inform dialogue at the 11th Session of the IEA-IEF-OPEC Symposium on Energy Outlooks hosted virtually by the IEF on 17 February 2021.

The COVID-19 pandemic impact on energy demand and supply balances is unparalleled in the history of energy markets. Restrictions imposed on the world economy caused a systemic shock that most severely struck short-range trends in liquids supply, demand, and stock changes as sweeping revisions show. The production adjustments that OPEC and Non-OPEC producers agreed to under the 2016 Vienna Declaration, and the wider support obtained at the extraordinary G20 Energy Ministers Meeting that the Presidency of Saudi Arabia convened early April 2020, cushioned the blow COVID-19 dealt energy markets as subsequent data series underscore.

The structural energy policy and market shifts that COVID-19 brings shall influence future energy supply and demand modelled in long-term scenarios greatly as well. A swift and inclusive global economic recovery depends on how various public health, macroeconomic, and other variables will reinforce domestic and international energy policy, sustainable development, and climate goals. This not only adds an additional layer of complexity over the energy outlooks that this report compares, but also makes dialogue on the evolution of energy markets even more relevant than before.

The G20 Energy Ministers meeting in September 2020 invited the IEF to take forward the work of the G20 Energy Focus Group on more comprehensive data coverage and analysis in cooperation with the IEA, OPEC, and other international and regional organisations under the G20 Presidency of Italy in 2021.

Mindful of the above developments and the exceptional circumstances in which the 11th IEA-IEF-OPEC Symposium on Energy Outlooks convenes, the IEF has invited the Gas Exporting Countries Forum (GECF) the International Renewable Energy Agency (IRENA), and United Nations (UN) to join.

In addition to the comparative analysis of short-, medium, and long-term energy outlooks that OPEC and the IEA published in 2020, this report places the long-term outlooks of these key producer and consumer organisations in the context of those that other key stakeholders issued last year.

IEA and OPEC Short-Term Oil Outlooks

Economic contraction and recovery

For 2020, the IEA and OPEC projected a global GDP contraction of 4.1% and 4.2%, respectively, in their forecasts published in December 2020. This is in stark contrasts to their previous growth estimates of 3.4% and 3.0% given just a year earlier. For 2021, both organisations projected a resumption of global growth. The IEA projected a growth rate of 5.2%, while OPEC projected more modest growth of 4.4%.

The IEA largely estimates higher economic growth in 2021, compared to OPEC, for most regions. Though there is substantial regional variation, China stands out as the only major economy to retain some growth in 2020 and regain robust growth over 2021. The IEA estimates an increase in China's GDP of 7.8% and OPEC of 6.9% in 2021. Both the IEA and OPEC project India had a steep economic

contraction of 8.4% and 9.2% in 2020, respectively. However, the IEA projects notably higher growth of 9.3% in 2021 compared to the OPEC estimate of 6.8% for India during the same time.

Liquids Demand

Between January and December this year, estimates for global 2020 liquids demand by the IEA and OPEC fell by 10.0 mb/d and 11.0 mb/d, respectively, to reach 91.2 and 90.0 mb/d, respectively.

Estimates for both OECD and non-OECD nations saw drastic revisions to negative demand growth in April. Overall, OPEC continued to slightly revise down its estimates of global oil demand from April to December. The IEA estimates for the OECD made a sharp downward revision in April, followed by a modest recovery in May and broadly remained at that level for the rest of the year.

Non-OECD nation estimates followed a more gradual decline over the first five months. Throughout the year and despite sweeping revisions in April, both organisations projected that non-OECD nations would continue to have more modest declines as compared to the OECD for 2020.

In 2021, both organisations project a significant demand growth recovery of roughly 6 mb/d when the IEA and OPEC estimate liquids demand will reach 96.9 mb/d and 95.9 mb/d, respectively. However, OPEC expects the contraction in 2020 to be more severe and the recovery in 2021 to remain further below world liquids demand levels observed in 2019 than the IEA.

Demand is notably higher in the IEA's forecast for many non-OECD regions. The IEA is also more bullish on demand growth in the OECD for both 2020 and 2021. OPEC, on the other hand, projects a sharper decline in many regions in 2020 but also estimates a mildly greater recovery in the non-OECD region in 2021.

Liquids Supply

2020 annual supply growth estimates were also abruptly revised downward from March to April and May. Non-OPEC supply growth projections from both organisations fell by around 5.3 mb/d in just two months. Data of the IEA and OPEC shows that world liquids supply reached 91.2 mb/d and 90.0 mb/d in 2020.

Supply forecasts for 2020 by both organizations reached their lowest point in May and were then revised slightly upward over the remainder of 2020. Both the IEA and OPEC projected that the OECD would see less negative growth by the end of the year compared to non-OECD non-OPEC producers. Non-OPEC liquids supplies suffered a steep contraction in 2020 estimated at –2.6 mb/d and –2.5 mb/d by the IEA and OPEC, respectively.

For 2021, data of the IEA and OPEC indicates world liquids supply reaches 96.9 mb/d and 95.9 mb/d. In their December 2020 reports, they estimated Non-OPEC liquids supply in 2021 to increase by 0.5 mb/d and 0.8 mb/d in 2021, respectively. However, substantial differences were noted in the OECD. The IEA projected a decrease of -0.1 mb/d in OECD supplies, while OPEC projected a 0.6 mb/d increase from 2020 to 2021, mostly from growth forecast in OECD Americas. This pointed at differing assumptions on US tight oil supply resilience, among other factors.

Notable differences also emerged for non-OECD Europe and FSU, which OPEC now summarizes under the grouping "Eurasia". The IEA projected 0.3 mb/d and 0.6 mb/d in additional supplies relative to OPEC in 2020 and 2021, respectively.

IEA and OPEC Medium-Term Oil Outlooks

Growth Projections

Both organisations make their medium-term projections through 2025, using 2019 as a base year. The eight-month gap between publication dates, and the excessive volatility witnessed in that time interval make the comparison both more complex and instructive. Apart from 2021, the IEA's GDP assumptions are higher than OPEC's. Like OPEC, however, the IEA's GDP assumptions have declined substantially. Overall, the IEA estimates average annual growth globally of 3.3% and OPEC of 2.3% from 2019 to 2025. The IEA and OPEC growth estimates reach 3.6% and 3.4% in 2025.

Liquids Demand

The IEA and OPEC expect 2025 world liquids demand to reach 105.7 mb/d and 103.7 mb/d, respectively. COVID-19 turns down average annual growth estimates between 2019 and 2025 to 1.0 and 0.7 mb/d for the IEA and OPEC. The IEA now estimates 1.5 mb/d and OPEC 2.2 mb/d lower demand in 2024 compared to last year's reports. These figures mark a significant decrease in projections compared to last year.

Demand growth remains strongly anchored in non-OECD nations. While OPEC projections show a significant demand decrease from 2019 levels of 4.9 and 4.0 mb/d for OECD and non-OECD countries for 2020, their later forecasting follows a similar trend to IEA estimates. OPEC expects non-OECD liquids demand growth to average 0.8 mb/d per annum by 2025, while the IEA projects growth of 0.9 mb/d. OPEC projects total OECD liquids demand to decline from 47.9 mb/d in 2019 to 46.8 mb/d by 2025. The IEA projects total OECD liquids demand to increase slightly from 47.6 mb/d to 47.7 mb/d over the same period.

The IEA estimates 1.1 mb/d more liquids demand in China in 2025 compared to OPEC. The IEA and OPEC project the same level of demand growth in India despite the IEA's more bullish projection for India's GDP growth.

OPEC provides sectoral oil demand projections for 2019 through to 2025. Road transport is the largest source of cumulative growth at 1.9 mb/d. But road transport demand shrinks between 2019 and 2020 from 44.4 to 40.1 mb/d, respectively, before recovering to 46.3 mb/d in 2025. Similarly, aviation demand nearly halves from 6.7 mb/d in 2019 to 3.5 mb/d in 2020 before recovering to 7.1 mb/d in 2025. The petrochemicals sector shows notable growth over the period by a total of 1.1 mb/d from 2019 to 2025.

The IEA places emphasis on shifting transport fuel demand because of electric vehicle (EV) and fuel standard policies. Fuel efficiency is expected to reduce gasoline and diesel growth significantly by 2025. The IEA also projects strong growth in demand for liquefied petroleum gases (LPG), ethane, and naphtha feedstocks which grows by an average of 0.5 mb/d annually, roughly half of oil product growth.

Liquids Supply

For the full projection period of 2020 and 2025, OPEC projects cumulative net non-OPEC supply growth of 5.7 mb/d, while the IEA projects supply growth of 4.5 mb/d in this category. The IEA and OPEC see medium-term liquids supply reach 105.7 mb/d and 103.9 mb/d in 2025, respectively.

In the pre-pandemic IEA projections, OECD Americas, particularly the United States, were expected to account for 67% of cumulative non-OPEC growth over the medium term, while OPEC's later publication attributes a substantially smaller proportion of 28% of cumulative growth to the region.

Where the IEA predicted growth of 1.3 mb/d for OECD Americas in 2020, OPEC estimates OECD Americas supply to contract by 1.8 mb/d in that year. OPEC projects 27.4 mb/d from OECD Americas in 2025, while the IEA estimates production for the region to reach 28.9 mb/d that year. OPEC's forecasting for OECD America constitutes a downward revision from previous growth estimates and breaks a trend of upward revisions to US tight oil supplies. However, both organisations expect that most liquid supply growth from the OECD Americas will continue to originate from U.S. tight oil.

Both the IEA and OPEC maintain similar predictions for the second largest supply growth contributor of Latin America over the period of 2020 to 2025. The IEA estimates cumulative growth of 1.6 mb/d (36% of total) and OPEC of 2.2 mb/d (39% of total). These gains are driven by new offshore Brazilian and Guyanese production. OPEC projects substantially greater supply from Latin America (8.2 mb/d compared with 7.2 mb/d for the IEA) and Non-OECD Europe and Eurasia (15.2 mb/d compared with 14.6 mb/d for the IEA).

OPEC also projects considerably more supply growth from OECD Europe than the IEA. It estimates growth of 0.8 mb/d compared to the IEA's estimate of 0.0 mb/d for OECD Europe. OPEC estimates of 4.5 mb/d in 2025 for OECD Europe maintain last year's estimate of the same value for 2024, whereas the IEA estimate lower levels of production in the region compared to last year at 3.8 mb/d.

In total, the IEA forecasts 69.4 mb/d in liquids supply from non-OPEC nations in 2025, while OPEC estimates 70.7 mb/d; a 1.2 mb/d difference. The IEA's projections imply supply from OPEC member nations of 36.3 mb/d, 3.1 mb/d higher than the assessments by OPEC. By 2025 the IEA projects that OPEC provides 34% of global liquids, compared with an estimate of 32% from OPEC.

The largest discrepancy in annual growth estimates exists for aggregated non-OECD nations, with OPEC projections averaging 0.3 mb/d higher annually than those of the IEA. Differences in medium-term supply projections largely reflect different assumptions about technologies and oil prices between the IEA and OPEC.

IEA and OPEC Long-Term Energy Outlooks

Growth Projections

The IEA assumes average annual GDP growth of 3.0% in the Stated Energy Policy Scenario (STEPS) and 2.6% in the Delayed Recovery Scenario (DRS) from 2019 to 2040, compared with OPEC's assumption of 2.9% from 2019 through to 2045 in the OPEC Reference scenario. These figures reflect large downward revisions from last year's assumptions, when the IEA and OPEC assumed annual average growth rates of 3.4% and 3.3%, respectively, from 2018 to 2040.

Primary Energy Demand

Fossil fuels continue to dominate the primary energy mix, with oil, natural gas, and coal providing 73% under IEA STEPS and 74% under OPEC's Reference scenario in 2040. This share declines to 56% under the IEA SDS, 55% under OPEC's Scenario A, and 58% under Scenario B. These show two pathways for alignment with the long-term goals of the Paris Agreement that are driven by market signals and technology solutions, respectively.

In 2019, fossil fuels accounted for 81% of the primary energy mix.

Total primary energy demand grows under the main scenarios considered, increasing by 0.8% per year on average for the IEA STEPS and by 0.9 under OPEC's Reference case from 2019 through 2040. In last year's projections, both scenarios projected long term demand growth of 1.0% annually. Under the IEA Sustainable Development Scenario (SDS), global energy demand declines by an average of 0.5% per year, considerably faster than last year's SDS projection of 0.3%. In OPEC's Scenario A, global demand declines by 0.2% per year, but grows by 1.0% under Scenario B. Last year, OPEC's Below 2°C scenario envisioned declines of 0.4% per year.

Projections for total primary energy supply by energy source, highlight several differences. OPEC's Reference Case projects coal demand to decline by 4 mboe/d from 2019 to 2040, while IEA's STEPS projects a decline of 9 mboe/d. Oil consumption grows by 9 mboe/d for OPEC's Reference Case and by 6 mboe/d under IEA STEPS. Both scenarios project natural gas demand to grow by 20 mboe/d through 2040.

Under all Paris-aligned scenarios global coal demand falls by 50 mboe/d or more, but differences emerge between the scenarios on the future of oil and natural gas. Under the IEA's SDS, oil and natural gas demand decline by 31 and 8 mboe/d, respectively. Under OPEC's Scenario A, oil falls by 15 mboe/d and natural gas declines by 11 mboe/d. However, under OPEC's Scenario B, where carbon capture, use, and storage play an enhanced role, oil and gas consumption respectively rise by 18 and 14 mboe/d through 2040.

Under all scenarios, nuclear, hydro, and other renewables grow considerably over the next two decades. Nuclear energy rises from 2019 to 2040 by 3, 6, and 8 mboe/d under the IEA STEPS, OPEC Reference, and IEA SDS, while hydropower grows by 3 to 4 mboe/d under these scenarios. Other renewables, led by wind and solar, grow by 21 and 22 mboe/d under OPEC's Reference Case and IEA STEPS, respectively, and by 42 mboe/d under the IEA SDS.

Energy mix shares

In all five scenarios examined, oil maintains its position as the leading primary energy source globally. Though its share shrinks in each, demand volume rises in four of the five scenarios. In OPEC's Reference Case and IEA STEPS, the share of oil falls from 31% in 2019 to 28%, and to 23% in IEA's SDS. OPEC's two alternative scenarios show oil falling to 28% under Scenario A and 30% under Scenario B.

Natural gas' share of the global energy mix increases under central scenarios, growing from 23% in 2019 to 25% in OPEC's Reference and IEA's STEPS. Under the Paris-aligned scenarios, natural gas' share remains flat in IEA's SDS, and declines to 20% and 22% in OPEC's Scenarios A and B, respectively.

Coal's share of the mix declines substantially under all scenarios, falling from 26% to 27% of global primary energy supply in 2019 to 19% under IEA STEPS and 21% under OPEC's Reference scenarios. This decline is accelerated under the IEA's SDS, where coal falls to 10% by 2040, and shrinks further to 7% and 5% under OPEC's Scenarios A and B, respectively.

The share of renewables, which is currently dominated by biomass, is projected to increase in all scenarios from 14% in 2019 to 20% in OPEC's Reference Case, 22% under IEA STEPS, and 36% under the IEA's SDS. Virtually all of this growth comes from renewable electricity such as wind, solar, and hydro. OPEC's Sensitivity scenarios do not provide fuel-specific data for non-fossil fuels.

Liquids Supply

The difference between the highest (IEA STEPS) and lowest (IEA SDS) projections for 2040 world liquids demand is 35 mb/d. Last year the difference between the IEA STEPS and lowest IEA SDS projections for 2040 world liquids demand stood at 29 mb/d. This difference highlights the growing "gap" between the greenhouse gas emissions goals articulated in the 2015 Paris climate agreement and those likely to occur under current and announced policies.

To bridge this apparent "gap", energy ministers and market stakeholders from producer and consumer countries have launched efforts to scale up investment in clean energy technology deployment and research and development. These include various net-zero GHG emissions strategies such as the European Unions' Green Deal and the Circular Carbon Economy Platform that the G20 endorsed in September 2020.

The IEA's STEPS projects 111.0 mb/d in supplies in 2040, compared with 109.3 for OPEC's Reference Case. Under the IEA's SPS, global supplies decline to 76.2 mb/d by 2040. Each of these projections are lower than those made in 2019, reflecting in part updated expectations about global economic growth following the COVID-19 pandemic.

The most notable difference is between projections for OECD and non-OECD supplies. IEA's STEPS projects supply from OECD Americas to be 3.0 mb/d higher than under OPEC's Reference Case by 2040, and total OECD supplies to be 2.5 mb/d higher than OPEC's projection. An even larger difference emerges from the non-OECD region, where OPEC projects supplies in 2040 to be 7.1 mb/d higher than IEA's STEPS.

Under IEA STEPS, US tight crude production increases from 7.7 mb/d in 2019 to 10.7 mb/d by 2030, before falling to 9.6 mb/d by 2040. Under OPEC's Reference Case, US tight crude drops to 6.9 mb/d in 2020, then recovers to a peak of 10.3 mb/d in the late 2020s, then declining to 8.1 mb/d by 2040. Tight liquids production also grows in Canada, Argentina, and Russia, but majority of supplies emerge from the United States, led by the Permian basin region.

IEA and OPEC Outlooks Placed in the Wider Context

Total Primary Energy Demand

Primary energy demand grows in central scenarios through 2040: by 19% in IEA STEPS, 18% in Equinor's Rivalry and GECF's Reference Case Scenario (RCS), 17% in OPEC's Reference Scenario, 14% in IRENA's Planned Energy Scenario (PES), 10% in GECF's CMS, and 9% in Equinor's Reform Scenario. With the exemption of the GECF Carbon Mitigation Scenario (CMS), all alternative scenarios project that global energy demand in 2040 will be below 2019 levels, reflecting a major change in the historical relationship between economic growth and energy demand growth. The GECF's CMS scenario investigates the role of natural gas in reducing emissions through available carbon mitigation technologies and policy support that take account of national commitments and challenges.

Under the Paris-aligned scenarios, total primary energy consumption declines considerably through 2040, falling by 6% under IRENA's Transforming Energy scenario (TES) and by 8% under Equinor's Rebalance scenario, compared with a 10% reduction under the IEA SDS. BP's two Paris-aligned scenarios also show considerable declines. Total primary energy consumption (which, for BP, excludes non-marketed biomass) falls by 6% under the Rapid Transition scenario and by 14% under the Net Zero scenario.

Wide variation is also apparent in different scenarios for natural gas. Under central scenarios through to 2040, natural gas consumption increases by 29% and 30% for IEA and OPEC respectively, compared with 34% for IRENA's Planned Energy and GECF Reference Case Scenario, 26% for BP's BAU, and 19% for Equinor's Reform Scenario.

In various alternative scenarios, natural gas use increases by 37% in GECF's CMS, by 9% in BP's Rapid Transition scenario and in Equinor's Rebalance scenario by 1%. However, natural gas use declines considerable in IEA's SDS (-12%), BP's Net Zero scenario (-27%), and IRENA's Transforming Energy scenario (-21%).

Natural gas demand growth assessments range from 34% to 19% in central scenarios and are even wider in alternative scenarios that show natural gas demand will grow by 37% or decline by 27% to 2040. This reflects that policy and technology pathways that affect natural gas demand in both central and alternative scenarios are far from certain. Assumptions on the role of natural gas in energy sector transformations vary widely.

In all scenarios other than Equinor's Rivalry, global coal demand falls, ranging from a reduction of 4% under OPEC's Reference Case to a roughly two-thirds decline in the IEA SDS, BP Rapid Transition, and IRENA's Transforming Energy scenarios.

Liquids Demand

Liquids demand grows by 11% in the GECF RCS, 10% for both IEA STEPS and OPEC Reference Case but falls by 2% under BP's BAU, 3% under IRENA's Planned Energy Scenario, and 8% under Equinor's Reform.

Paris-aligned scenarios show global liquids demand falling by 26% for the IEA SDS, 27% for BP's Rapid Transition, 38% in Equinor's Rebalance scenario and 42% in IRENA's Transforming Energy Scenario. This demand falls by 5% in the GECF's CMS.

In volumetric terms, central scenarios from the IEA and OPEC see liquids growth reaching roughly 110 mboe/d by 2040, with lower levels envisioned in Paris-aligned scenarios. The GECF RCS shows liquid demands reach 111 mboe/d in 2040. Other organisations' and market stakeholders' scenarios, however, show lower liquids demand in 2040. BP's BAU scenario projects 98 mboe/d, IRENA's Planned Energy scenario and GECF's CMS each project 97 mboe/d, and Equinor's Reform scenario projects 92 mboe/d.

Paris-aligned scenarios show further declines. In the IEA SDS, liquids demand falls to 74 mboe/d, while BP's Rapid Transition and Net Zero scenarios project liquids demand of 73 and 57 mboe/d, respectively, in 2040. In IRENA's Transforming Energy scenario liquids demand declines to 58 mboe/d, and Equinor's Rebalance scenario shows liquid demand to fall to 62 mboe/d by 2040. Equinor's Rivalry scenario stands out with the highest projected liquids demand of 112 mboe/d in 2040.

Renewables and Nuclear Growth

The fastest growing energy source in these scenarios is renewable energy (including hydropower). Central scenarios show renewable shares grow from 2019 to 2040 by 46% in OPEC's Reference, 72% in GECF RCS, 78% in IEA's STEPS, 86% in IRENA's Planned Energy, and 84% in Equinor's Reform scenario.

For Paris-aligned scenarios, growth is even more robust. Renewables increase by 219% in IRENA's Transforming Energy 119% in IEA's SDS, 114% in Equinor's Rebalance scenario, and 99% in GECF's CMS. Finally, BP's projections for renewables—which exclude non-marketed biomass—show growth of 179%, 343%, and 509% under the BAU, Rapid Transition, and Net Zero scenarios, respectively.

Nuclear energy adds to the energy mix in all scenarios, with growth from 2019 to 2040 ranging from as low as 1% (IRENA's Transforming Energy scenario) to 85% under BP's Net Zero scenario. IEA STEPS and OPEC Reference project nuclear energy growth of 23% and 42%, respectively. Most Paris-aligned scenarios project more rapid growth, such as 55% for IEA SDS, 65% for BP's Rapid Transition, and 63% for Equinor's Rebalance scenario. Only the GECF shows nuclear growing more rapidly in the RCS than in the CMS by 23% and 17 % respectively. The GECF CMS focuses on the possibilities that greater market penetration of natural gas in partnership with renewables offers to reduce emissions.

2. Background and Introduction

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

Considering 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.

IEF Energy Ministers, gathered at the 15th International Energy Forum (Algiers, September 2016), acknowledged the renewed encouragement from the G20 Energy Ministers Meetings (Beijing, June 2016) to continue this fruitful collaboration to further understand energy outlooks. The G20 Energy Ministers meeting virtually on 27-28 September 2020 in Riyadh Saudi Arabia agreed to collaborate in encouraging dialogue to help mobilise public and private investment in various energy sectors, including innovative technologies and quality infrastructure in line with national circumstances, to enhance energy security and invited the IEA, IEF, IRENA, OPEC and the GECF to further consider this matter in their work program. G20 Ministers also invited the IEF to take forward the work of the G20 Energy Focus Group on more comprehensive data coverage and analysis in cooperation with the IEA, OPEC, and other international and regional organisations under the G20 Presidency of Italy in 2021. An introductory paper comparing the most recent outlooks prepared by the IEA and OPEC has accompanied each Symposium. This paper is for the Eleventh Symposium and takes as reference the outlooks published by both organisations in 2020. 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.

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 Tenth Symposium identified opportunities to harmonise a number of variables:

(i) Better align regional groupings. OPEC and IEA differ in their reporting of OECD and non-OECD status, as well as their groupings of nations in the Middle East and Africa.

(ii) Align baseline years for long-term outlooks. This year, the two organisations used the same base year (2019), enhancing the comparability of these outlooks.

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

(iii) Enhance consistency in the classification of liquid fuels at regional and global levels. There are issues with maritime and aviation fuels, bunkers, units as well as biofuels and product classifications.

(iv) Continue dialogue at the expert level on assumptions and methodologies to deepen understanding of the impact that different price assumptions and different views on the evolution of policy, technology, and economic growth have on longer term oil supply and demand balances, particularly as this relates to the role of unconventional production and other energy sources.

(v) Better align historical baseline data, particularly for non-OECD nations. This year, differences were particularly noteworthy for demand in non-OECD Asia and Latin America, and supply in OPEC and non-OECD Europe and Eurasia. Yet, reported total world oil demand volumes from both agencies are in general aligned.

(vi) Increase consistency in choice of units for primary energy demand. OPEC continues to use million barrels of oil equivalent per day (mboe/d), while the IEA predominately uses million tons of oil equivalent (mtoe).

(vii) Better align the publication dates of the medium-term oil market outlooks by the IEA and OPEC. In 2020, they were separated by an 8-month interval during which the global economy and oil market experienced dramatic changes due to the impacts of the COVID-19 pandemic.

Table 1 lists the publications used for comparison in this introductory paper. Note that the IEA Medium-Term Oil 2020 report was published in March 2020, eight months earlier than the release of OPEC's Medium-Term projections in its 2020 World Oil Outlook (WOO2020). As we discuss in detail in Section 4, this gap results in very large differences in the outlook for the global economy and oil markets due to the intervening effects of Covid-19.

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

	IEA	OPEC
Short-term	Oil Market Report (OMR), published December 2020	Monthly Oil Market Report (MOMR), published December 2020
Medium-term	Oil 2019, published March 2020	World Oil Outlook (WOO 2020), published October 2020
Long-term	World Energy Outlook (WEO 2020), published October 2020	World Oil Outlook (WOO 2020), published October 2020

3. Baseline 2019 Liquids Data

The harmonisation of baseline historical data between the IEA and OPEC is a necessary step to enhance the comparability of their outlooks. **Table 2**, **Table 3**, and **Table 4** compare IEA and OPEC base year (2019) demand, supply, and stock change data, respectively, primarily using the IEA's December OMR and OPEC's December MOMR, both the last short-term outlooks published in 2020. Note that as an outcome of the collaborative work on historical baseline data, the IEA and OPEC have mutually consistent base year oil demand data in their reports.

As shown in **Table 2** and **Table 3**, differences in world liquids demand and supply baselines remain within the interval ±1mb/d, diverging by 0.3 mb/d for demand and 0.8 mb/d for supply. These differences are smaller than those found in previous years. For example, last year's comparative analysis found differences of 0.5 mb/d in demand and 1.2 mb/d in supply.

Table 2 provides details on the IEA's and OPEC's estimates for 2019 baseline liquids demand data by region. Globally, the IEA estimates liquids demand of 100.0 mb/d, 0.3 mb/d higher than OPEC. Similar to previous year's assessment, the historical difference is mostly attributable to non-OECD nations, particularly from Asia, where the IEA and OPEC diverge by 0.8 mb/d, 0.4 mb/d half of which is attributable to China. There are differences in demand estimates for Latin America (0.4 mb/d) and Africa (0.2 mb/d), with smaller differences (roughly 0.1 mb/d) stemming from OECD Europe, the Middle East, and non-OECD Europe and Eurasia.

Table 2. Liquids Demand in 2019 (mb/d)

	IEA	OPEC	DIFFERENCE (IEA - OPEC)
Total OECD	**47.7**	**47.7**	**0.0**
OECD Americas	25.65	25.70	-0.05
OECD Europe	14.25	14.25	0.00
Asia Oceania	7.8	7.8	0.0
Total Non-OECD	**52.3**	**52.0**	**0.3**
Asia	28.0	27.2	0.8
China	13.7	13.3	0.4
Other non-OECD Asia	14.3	13.9	0.4
Middle East	8.3	8.2	0.1
Latin America	6.2	6.6	-0.4
Non-OECD Europe and Eurasia	5.5	5.6	-0.1
Africa	4.28	4.45	-0.17
World	**100.04**	**99.76**	**0.27**

Table 2 data sources: IEA OMR Dec 2020, Table 1; OPEC MOMR Dec 2020, Table 4 - 1, 4 - 2.

Table 2 note: Numbers rounded to nearest significant digit except when additional decimal points are needed to clarity. Sums may not total due to rounding.

As for world liquids supply, **Table 3** shows a number of differences. Globally, the IEA estimates liquids supply at 100.6 mb/d, 0.8 mb/d higher than OPEC. In the OECD, the IEA and OPEC differ by 0.1 mb/d, with this divergence attributable to OECD Americas. Outside of the OECD, we observe a difference of 0.3 mb/d for non-OECD Europe and Eurasia, equal to the difference seen in last year's report, and differences of 0.1 mb/d for both China and Latin America. For OPEC crude, the IEA and OPEC differ by 0.2 mb/d, an increase from a difference of 0.0 mb/d last year. For OPEC NGLs and unconventionals, the two organisations also differ by 0.2 mb/d, down from 0.7 mb/d last year.

Note that IEA and OPEC treat NGLs and unconventionals differently. IEA reports in its OMR glossary that NGLs and unconventionals supply includes OPEC condensates, oil from non-conventional sources (e.g., Venezuelan Orimulsion, oil shales, CTLs, GTLs) and other sources of supply (e.g., blending components such as MTBE), while OPEC provides less detail about the specific components of this category.

Different treatment of biofuels means that comparing regional non-OPEC supply forecasts between the IEA and OPEC still requires adjustments. While OPEC includes biofuels in each region's total liquids supply, the IEA only includes global biofuels supply separately. This paper adds these IEA regional biofuels data – both historical and forecast data – to each region's oil supply data.

Table 3. Liquids Supply in 2019 (mb/d)

	IEA[a]	OPEC	DIFFERENCE (IEA - OPEC)
Total OECD	**30.1**	**30.0**	**0.1**
OECD Americas	25.8	25.8	0.1
OECD Europe	3.7	3.7	0.0
Asia Oceania	0.5	0.5	0.0
Total Non-OECD	**33.2**	**32.9**	**0.3**
Asia	7.6	7.6	0.0
China	4.0	4.1	-0.1
Other non-OECD Asia	3.6	3.5	0.0
Middle East	3.2	3.2	0.0
Latin America	6.2	6.1	0.1
Non-OECD Europe and Eurasia	14.8	14.5	0.3
Africa	1.5	1.5	0.0
Processing gains	2.4	2.3	0.1
Total Non-OPEC	**65.6**	**65.2**	**0.4**
Total OPEC [b]	**34.9**	**34.6**	**0.3**
OPEC crude	29.5	29.3	0.2
OPEC NGLs + unconventionals	5.4	5.3	0.2
World	**100.6**	**99.8**	**0.8**

Table 3 data sources: IEA OMR Dec 2020, Table 1; IEA Oil 2020, Tables 5, 5a; OPEC MOMR Dec 2020, Tables 5-1 and 5-2.

Table 3 notes: Numbers rounded to one decimal point, and sums may not total due to rounding. IEA liquids supply calculated by summing IEA oil and IEA biofuel estimates. IEA[a] "OPEC NGLs" includes condensates, oil from non-conventional sources (e.g. Venezuelan Orimulsion) and non-oil inputs (e.g. to Saudi Arabian MTBE). [b] Total OPEC equals OPEC crude plus OPEC NGLs/unconventionals.

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 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, the IEA estimates a stock build in 2019 with growth of 0.5 mb/d, while OPEC estimates near zero growth. The bulk of this difference is attributable to the "miscellaneous to balance" item. 2019 data shows a reduction in "miscellaneous to balance" when compared to 2018 data, indicating greater data transparency.

Table 4. 2019 Stock Change and Miscellaneous Items (mb/d)

	IEA	OPEC	DIFFERENCE (IEA - OPEC)
Reported OECD	0.0	0.0	0.0
Industry/commercial	0.0	0.0	0.0
Government/SPR	0.0	0.0	0.0
Oil-on-water	0.1	-0.1	0.2
Miscellaneous to balance [a]	0.4	0.1	0.3
Total stock change & misc.	0.5	0.0	0.5

Table 4 data sources: IEA OMR Dec 2020, Table 1; OPEC MOMR Dec 2020, Table 11 - 1.

Table 4 notes: Numbers rounded to one decimal place. 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 oil demand and supply up to 18 months into 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 the IEA's and OPEC's perspectives on short-term macroeconomics, as well as oil demand and supply outlooks.[2]

4.1 Economic Growth Assumptions

The IEA and OPEC take different approaches for short-term GDP forecasts. In 2020 the IEA transitioned from use of IMF's projections published in the World Economic Outlook and the World Economic Outlook Updates to projections prepared by Oxford Economics. OPEC has established its own GDP projections by its own methodology.

2 Though this introductory paper compares data from the December 2020 oil market reports, reports from January to December in 2020 from both organisations were reviewed to assess how their views evolved throughout the year.

Both the IEA and OPEC estimates for global economic growth have been revised sharply downward relative to estimates made in late 2019 to reflect impacts of the COVID-19 pandemic. For 2020, the IEA and OPEC estimated global GDP contraction of 4.1% and 4.2%, respectively in the December issues of their reports.[3] This starkly contrasts with their previous growth estimates of 3.4% and 3.0%, respectively, from just a year earlier. For 2021, both organisations project a resumption of global growth. The IEA projected a growth rate of 5.2% while OPEC projects growth of 4.4% in its December MOMR. As **Table 5** shows, there is substantial regional variation across major economies. China stands out as being the only country of this group projected to have positive growth for 2020, as well has high growth over 2021. Here the IEA estimated an increase of 7.8% and OPEC of 6.9%. Both the IEA and OPEC projected India to see a steep economic contraction of –8.4% and –9.2% in 2020, respectively. However, the IEA projected notably higher growth of 9.3% in 2021 compared to the OPEC estimate of 6.8% for India that year. The IEA largely estimated higher growth in 2021 compared to OPEC for most regions, excluding Japan, where the IEA projected growth of 2.7% and OPEC 2.8% in 2021.

Table 5. Short-term GDP Growth Assumptions

	2020			2021		
	IEA	OPEC	DIFFERENCE (IEA-OPEC)	IEA	OPEC	DIFFERENCE (IEA-OPEC)
World	-4.1%	-4.2%	0.1%	5.2%	4.4%	0.8%
US	-3.4%	-3.6%	0.2%	4.3%	3.4%	0.9%
China	1.7%	2.0%	-0.3%	7.8%	6.9%	0.9%
EU	-7.5%	-7.3%	-0.2%	4.7%	3.7%	1.0%
Japan	-5.4%	-5.2%	-0.2%	2.7%	2.8%	-0.1%
India	-8.4%	-9.2%	0.8%	9.3%	6.8%	2.5%
Brazil	-4.6%	-5.8%	1.2%	4.5%	2.4%	2.1%

Table 5 data sources: Table 1.1; OPEC MOMR Dec 2020, Table 3 – 1, IEA GDP assumptions provided via internal communication, based on analysis from Oxford Economics.

Note 1: The IEA provides estimates for the European Union, while OPEC uses the Euro-zone grouping.

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.

2020 saw widespread economic impacts caused by the COVID-19 pandemic, and as **Figure 1** illustrates, the IEA and OPEC both saw major revisions to their global liquids demand growth estimates between March and April that set a persistent trend of liquids demand contraction through to the end of 2020.

3 While the IEA left its negative GDP growth assessment for 2020 unchanged at 4.1%, OPEC has increased its GDP estimate for 2020 from a contraction of 4.2% to 4.1% in its January Monthly Oil Market Report.

Between January and December, global estimates for 2020 by the IEA and OPEC fell by 10.0 mb/d and 11.0 mb/d, respectively.

Figure 1 indicates changes in projected growth rates for the world (solid line), OECD (dashed lines), and non-OECD (dotted lines). Estimates for OECD and non-OECD nations alike saw a drastic revision to negative demand growth in April. OPEC consistently revised its estimates downward from January to May. The IEA estimates for the OECD made a sharp downward revision in April, followed by a stronger recovery before aligning with OPEC estimates in September. Non-OECD nation estimates followed a more gradual decline over the first five months. Throughout the year and despite the major revisions in April, both organisations projected that non-OECD nations would continue to have higher growth as compared to the OECD for 2020.

Figure 1. Monthly Revisions of Annual Estimates for 2020 World, OECD, and Non-OECD Liquids Demand Growth

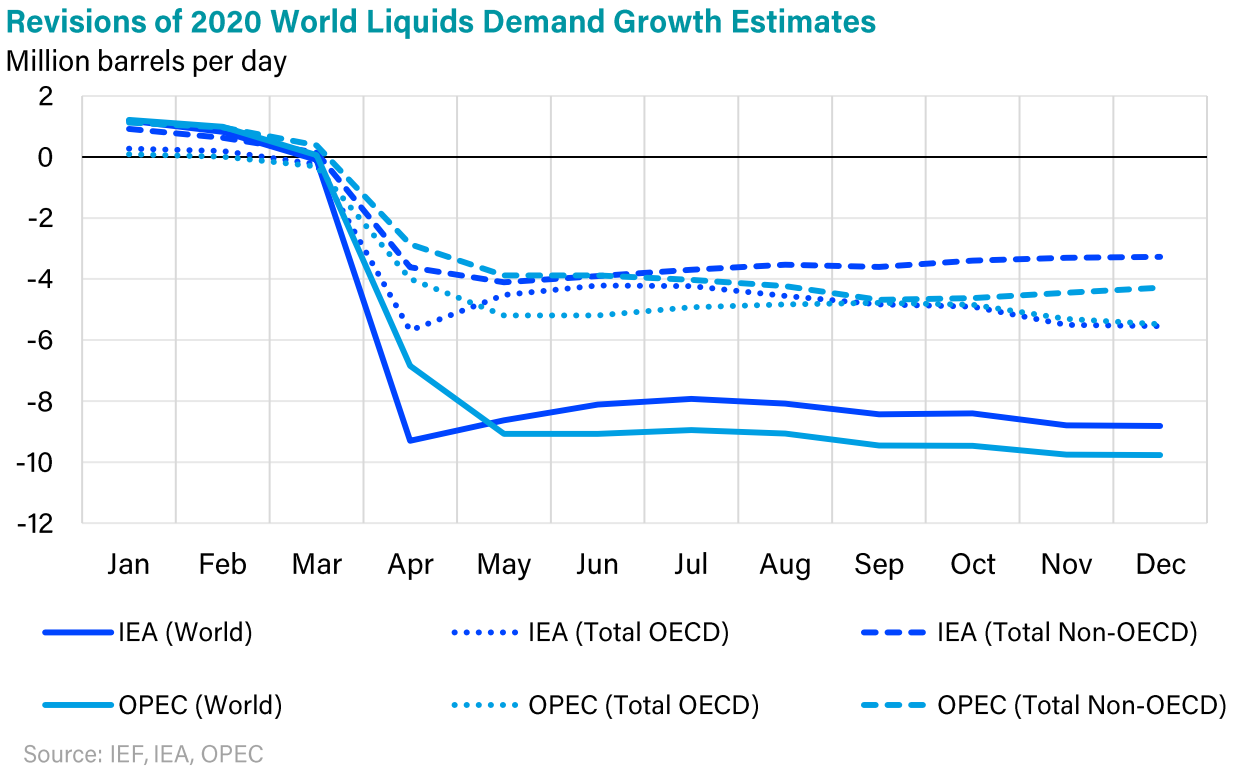
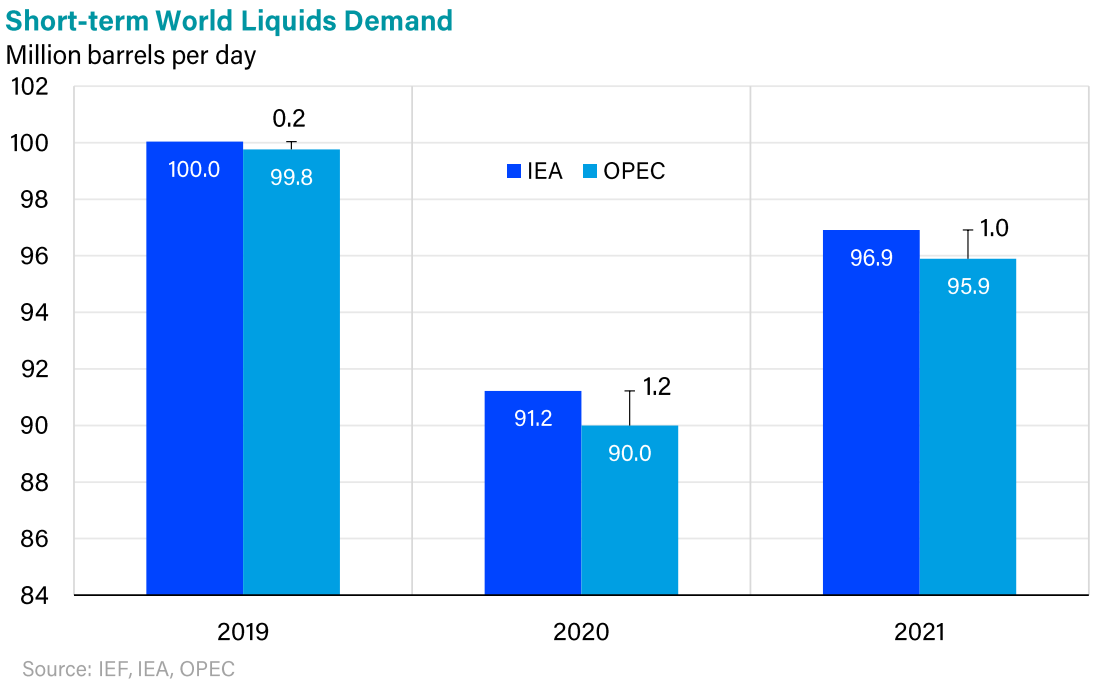


Figure 1 data sources: IEA OMR Jan–Dec 2020, Table 1; OPEC MOMR Jan–Dec 2020, Table 11 - 1..

Looking forward in **Figure 2**, both organisations estimated that global liquids demand had shrunk by nearly 10 mb/d in 2020. In 2021, both organisations project a significant demand growth recovery of roughly 6 mb/d. For these three years, OPEC estimates are consistently lower than those of the IEA. OPEC expects the contraction in 2020 to be more severe and the recovery in 2021 to remain further below world liquids demand observed in 2019.

Figure 2. Short-term World Liquids Demand: 2019-2021



Source: IEF, IEA, OPEC

Figure 2 data sources: IEA OMR Dec 2020, Table 1; OPEC MOMR Dec 2020, Table 11 - 1.

Figure 2 note: 2019 are historical data and 2020/2021 are projections. Sums in data callouts may not total due to rounding.

The IEA's and OPEC's regional liquids demand outlooks for 2020 and 2021 as published in the December reports, as well as the differences between them, are summarised in **Table 6**. These short-term demand outlooks have historically varied most widely in regions that have large differences in historical data – particularly in non-OECD regions including China, other non-OECD Asian nations, and the Middle East (see **Table 2**). In previous years such as 2015, differences between baseline liquids demand varied by as much as 1.7 mb/d[4]. Over subsequent years these differences have become smaller, in part an outcome of the joint analysis of discrepancies in historical baseline data that both organisations pursue on the IEF platform. Though 2020 projections show large differences, these reflect the elevated uncertainty related to impact of the COVID-19 pandemic on liquids demand.

Between 2020 and 2021, both the IEA and OPEC believe non-OECD regions will continue to lead global demand growth, particularly China and other non-OECD Asia. Further, as can be seen in **Figure 3**, both the IEA and OPEC project the 2021 recovery in China and other non-OECD Asia to offset significantly more of their respective 2020 demand reductions as compared to other regions. The IEA and OPEC estimate non-OECD countries to lose –3.3 mb/d and –4.3 in demand from 2019 to 2020, while projecting demand increases of 2.9 mb/d and 3.3 mb/d from 2020 to 2021 respectively. The IEA and OPEC both project OECD demand to fall by 5.5 mb/d from 2019 to 2020 but estimate OECD demand to increase by 2.8 mb/d and 2.6 mb/d between 2020 and 2021, respectively; this amounts to a recovery of roughly half the demand lost in 2020. Despite this commonality, a variety of regional differences appear in **Table 6** and are additionally highlighted in **Figure 3**. Demand is notably higher

4 See Table 2 from the Introductory Paper to the 7th IEA-IEF-OPEC Symposium, published in February 2017.

in the IEA's forecast for many non-OECD regions due to differences in historical baselines, which are in part a reflection of data constraints resulting from the COVID-19 pandemic. The IEA is also more bullish on demand growth in the OECD for both 2020 and 2021. OPEC, on the other hand, projects a sharper decline in many regions in 2020 while also estimating a mildly greater recovery in the non-OECD region in 2021.

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

	2020			2021		
	IEA	OPEC	DIFFERENCE (IEA-OPEC)	OPEC	OPEC	DIFFERENCE (IEA-OPEC)
Total OECD	**42.2**	**42.3**	**-0.1**	**44.9**	**44.9**	**0.1**
OECD Americas	22.6	22.9	-0.3	24.2	24.5	-0.2
OECD Europe	12.4	12.3	0.1	13.3	13.0	0.3
Asia Oceania	7.1	7.1	0.0	7.4	7.4	0.0
Total Non-OECD	**49.1**	**47.7**	**1.3**	**52.0**	**51.0**	**0.9**
Asia	26.7	25.2	1.6	28.5	27.3	1.3
China	13.8	12.8	1.0	14.7	13.9	0.8
Other non-OECD Asia	12.9	12.3	0.6	13.9	13.4	0.5
Middle East	7.6	7.6	0.1	7.9	7.9	0.0
Latin America	5.5	6.0	-0.5	5.9	6.3	-0.4
Non-OECD Europe and Eurasia	5.3	4.9	0.3	5.5	5.3	0.2
Africa	3.9	4.1	-0.2	4.1	4.2	-0.1
World	**91.2**	**90.0**	**1.2**	**96.9**	**95.9**	**1.0**

Table 6 data sources: IEA OMR Dec 2020, Table 1; OPEC MOMR Dec 2020, Table 4 - 1, 4 - 2.

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

Figure 3. Short-term Liquids Demand Annual Growth

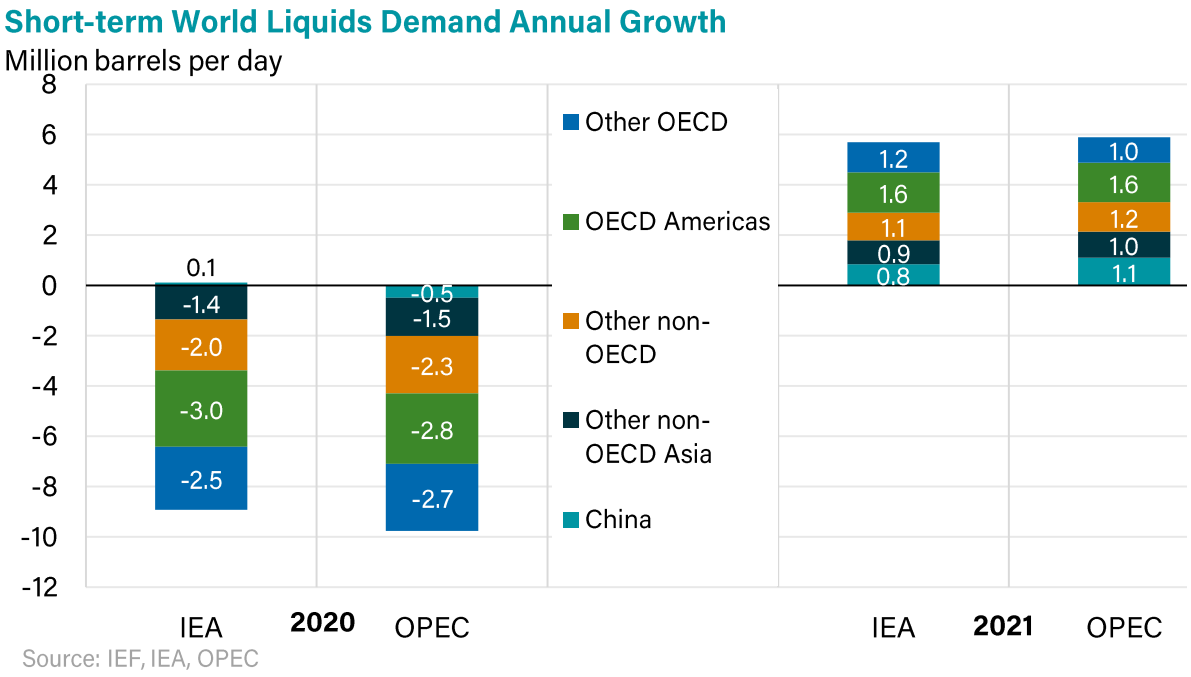
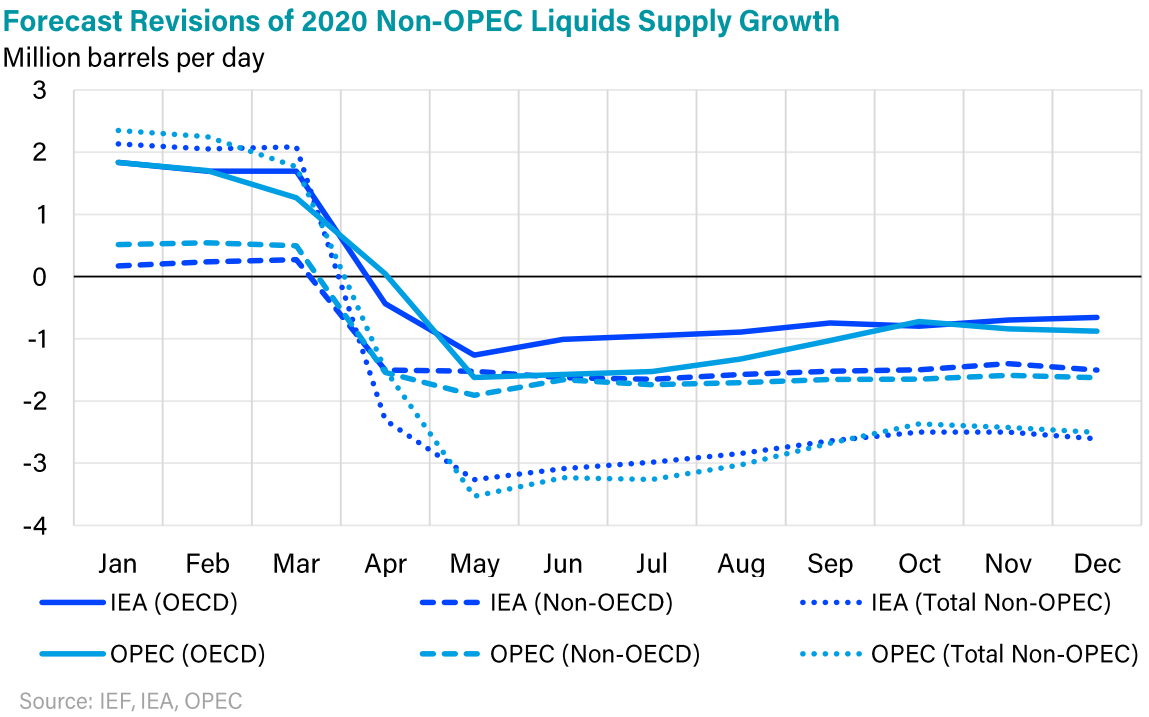


Figure 3 data sources: IEA OMR Dec 2020, Table 1; OPEC MOMR Dec 2020, Tables 4 - 1, 4 - 2.

4.3 Short-term Liquids Supply

Changes in short-term projections for global non-OPEC liquids supply over 2020 by the IEA and OPEC followed a similar trend to those of liquids demand. As **Figure 4** reveals, annual supply growth estimates were abruptly revised downward from March to April, with non-OPEC supply growth projections from both organisations falling by 5.3 mb/d in just two months. Supply forecasts for the year reached their lowest point in May and were then revised slightly upward over the remainder of 2020. Both the IEA and OPEC projected that the OECD would see less negative growth by the end of the year as compared to non-OECD non-OPEC producers.

Figure 4. Monthly Revisions of Annual Estimates for 2020 Non-OPEC Liquids Supply Growth



Source: IEF, IEA, OPEC

Figure 4 data sources: IEA OMR Jan-Dec 2020, Table 1; OPEC MOMR Jan-Dec 2020, Table 11 - 1.

Following robust growth in 2018 and 2019, Non-OPEC liquids supplies suffered a steep contraction in 2020 and are projected to only modestly recover in 2021. As **Figure 5** indicates, non-OPEC liquids supply growth is projected to have decreased in 2020 by –2.6 mb/d and –2.5 mb/d by the IEA and OPEC, respectively. In 2021, differences in supply estimates, as published in the December reports, arise with the IEA and OPEC estimating Non-OPEC liquid supply to increase by 0.5 mb/d and 0.8 mb/d, respectively.

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

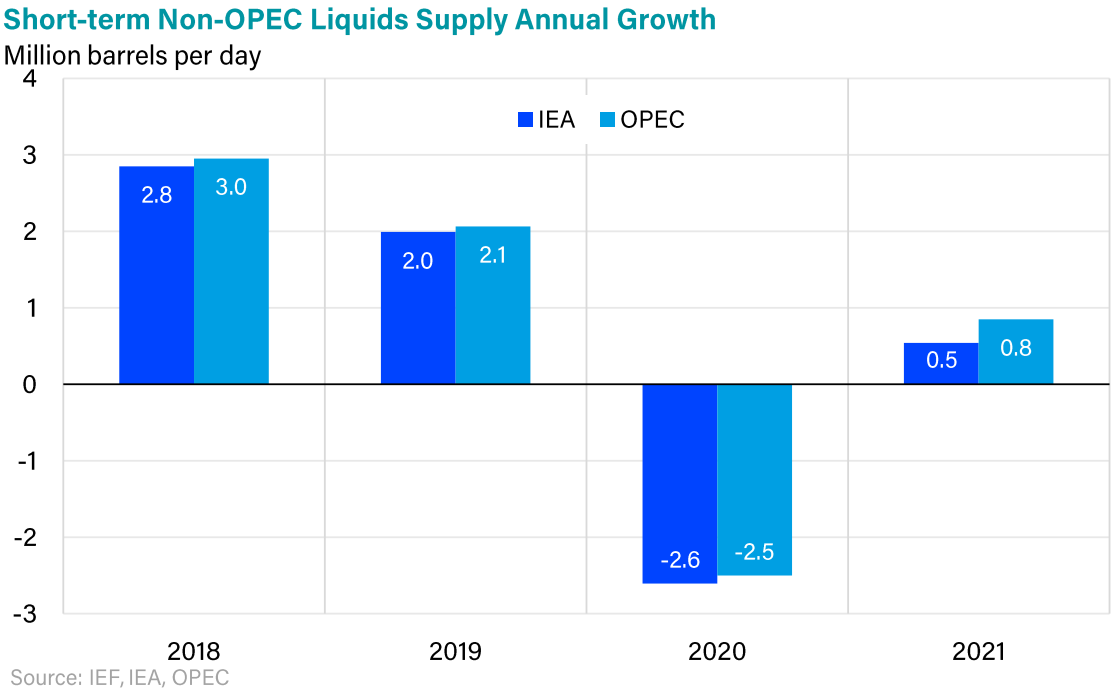


Figure 5 data sources: IEA OMR Dec 2020, Table 1; OPEC MOMR Dec 2020, Table 11 - 1

Table 7 provides a detailed comparison of short-term liquids supply outlooks by region. While projections for the annual rate of growth of non-OPEC liquids supply are largely similar between the IEA and OPEC, as shown in **Figure 5**, that growth builds upon differing baseline data, as shown in Table 3. Substantial differences were seen in the OECD, with the IEA projecting a decrease of -0.1 mb/d in supplies from 2020 to 2021, while OPEC projected a 0.7 mb/d increase during the same period, mostly from changes in OECD Americas. Notable differences also emerged for non-OECD Europe and Eurasia, with the IEA projecting 0.3 and 0.6 mb/d in additional supplies relative to OPEC in 2020 and 2021, respectively.

Variations emerged between the two estimates for OPEC supply as well. The IEA projects OPEC to supply an additional 0.9 mb/d in 2020 and 1.0 mb/d in 2021 over OPEC's forecasts for demand for OPEC supplies. Looking at the composition of these supplies, the IEA projects 0.1 mb/d more OPEC NGLs and unconventionals than does OPEC for both 2020 and 2021.

Neither the IEA nor OPEC make projections for short-term OPEC crude, but the difference between their constructed estimates for demand for OPEC crude has grown from 0.3 mb/d in 2019 (the baseline year) to 0.8 mb/d in 2020 and 0.9 mb/d in 2021. This merits further 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 changes & miscellaneous" 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 production in their monthly oil market reports. Therefore, differences between the IEA and OPEC in the "Call on OPEC crude + stock changes & miscellaneous" item and "Total OPEC" item do not directly reflect different views regarding OPEC crude supply; rather the differences reveal their distinct projections of global liquids demand and non-OPEC crude supply.

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

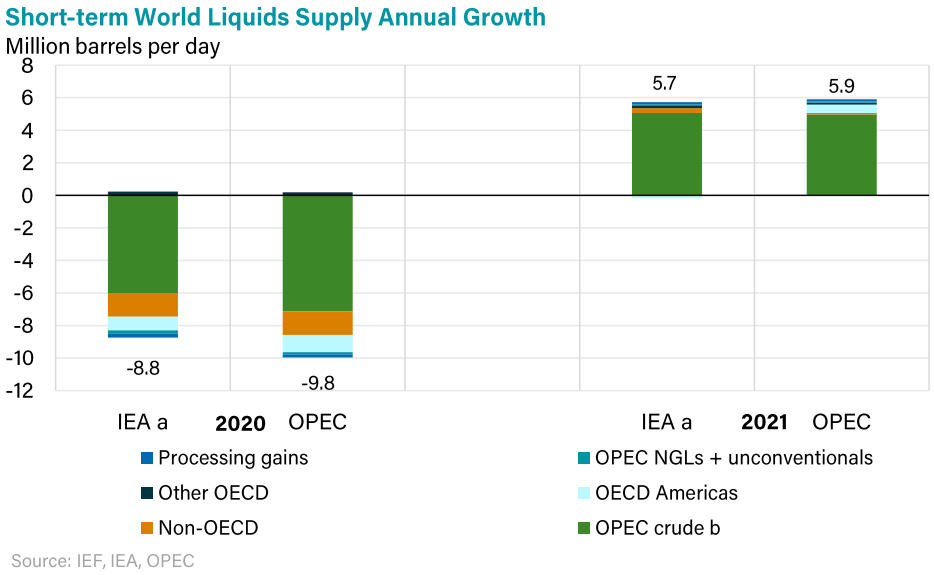
	2020			2021		
	IEA	OPEC	DIFFERENCE (IEA-OPEC)	IEA	OPEC	DIFFERENCE (IEA-OPEC)
Total OECD	**29.5**	**29.1**	**0.3**	**29.4**	**29.8**	**-0.3**
OECD Americas	25.0	24.7	0.3	24.8	25.2	-0.4
OECD Europe	3.9	3.9	0.0	4.0	4.0	0.0
Asia Oceania	0.6	0.5	0.0	0.6	0.5	0.1
Total Non-OECD	**31.7**	**31.5**	**0.3**	**32.0**	**31.6**	**0.5**
Asia	7.4	7.5	0.0	7.4	7.4	0.0
China	4.1	4.2	-0.1	4.1	4.2	-0.1
Other non-OECD Asia	3.4	3.3	0.1	3.3	3.3	0.1
Middle East	3.1	3.2	0.0	3.2	3.2	0.0
Latin America	6.1	6.1	0.1	6.4	6.4	0.0
Non-OECD Europe and Eurasia	13.6	13.3	0.3	13.7	13.1	0.6
Africa	1.4	1.5	-0.1	1.3	1.4	-0.1
Processing gains	2.1	2.1	0.0	2.3	2.2	0.1
Total Non-OPEC	**63.0**	**62.7**	**0.3**	**63.5**	**63.5**	**0.0**
Total OPEC [a]	**28.2**	**27.3**	**0.9**	**33.4**	**32.4**	**1.0**
Call on OPEC crude + stock ch. & misc.[b]	23.0	22.2	0.8	28.0	27.2	0.9
OPEC NGLs + unconventionals	5.2	5.1	0.1	5.3	5.2	0.1
World Supply [c]	**91.2**	**90.0**	**1.2**	**96.9**	**95.9**	**1.0**

Table 7 data sources: IEA OMR Dec 2020, Table 1; IEA Oil 2020, Table 5 & 5a; OPEC MOMR Dec 2020, Table 5 - 2, 5 - 3, 11 - 1.

Table 7 notes: Numbers rounded to nearest significant digit. IEA[a]: Biofuels from IEA Oil 2020 are added to IEA regional oil supply data for comparability with OPEC estimates. Call on OPEC crude + stock ch. & misc[b]: 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. Total OPEC and World Supply[c]: Equals total liquids demand minus non-OPEC supply minus OPEC NGLs/unconventionals.

Figure 6 illustrates how the IEA's and OPEC's regional supply growth estimates differ in 2020 and 2021 and highlights the central role of supply growth in the OECD Americas region, along with a change in "call" on OPEC.

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



Source: IEF, IEA, OPEC

Figure 6 data sources: IEA OMR Dec 2020, Table 1; IEA Oil 2020, Table 5, 5a; OPEC MOMR Dec 2020, Table 5 - 1, 5 - 2, 11 - 1.

Figure 6 note: IEA[(a)]: Biofuels from the IEA Oil 2020 report 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 assesses the IEA's Oil 2020 published in March 2020, and OPEC's World Oil Outlook (WOO) published in October 2020 (**Table 1**). Both organisations make their medium-term projections through 2025, using 2019 as a base year. However, there is an eight-month interval between publication dates of the two reports, and given the dynamic nature of market conditions, this gap complicates the comparison of the projections. The significance of this gap was highlighted this year by the widespread economic effects of the COVID-19 pandemic.

5.1 Oil Price and Economic Growth Assumptions

5.1.1 Oil Price

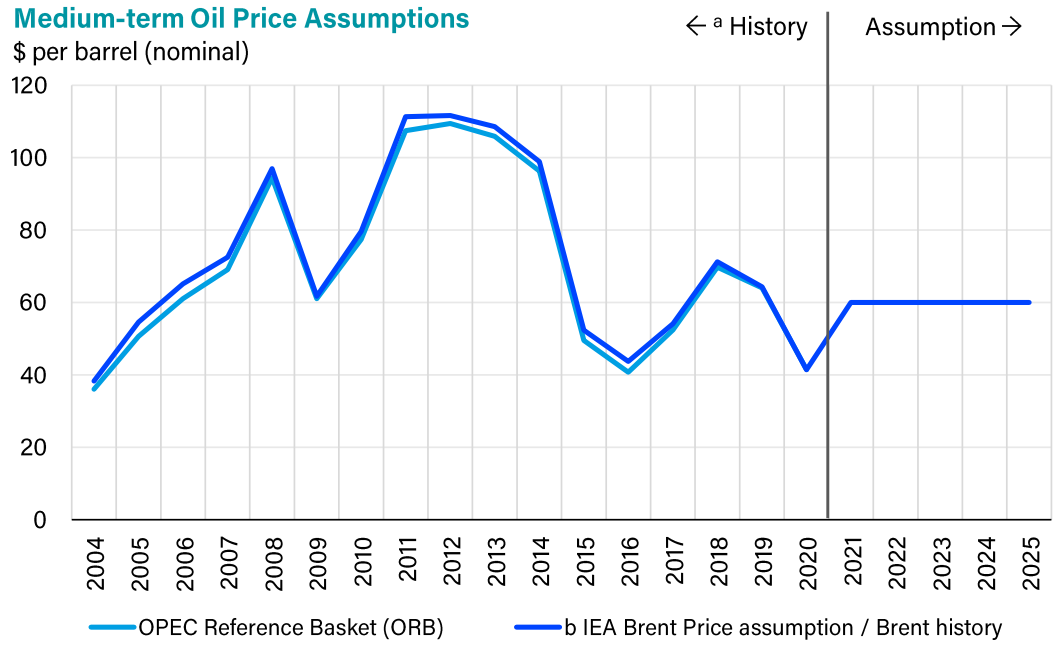
The price of oil is one of the primary factors influencing the projections of oil demand. OPEC last published its oil price assumptions for the medium and long-term in the 2016 WOO, preventing detailed comparison between the IEA and OPEC.

When considering historical and future prices, 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 several representative OPEC crudes driven by the cost estimates of marginal supply. The IEA uses an "IEA Average Import Price," which reflects the IEA's perspective on its member countries' future crude import prices.

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. In previous years, OPEC's medium-term price assumptions mainly reflected its assumptions on the ORB price detailed above, while its longer-term price assumptions have also taken into account its estimates of the cost of supplying the marginal barrel.

Figure 7 illustrates a drop in Brent oil prices from an average of US$64/bbl in 2019 to $41/bbl in 2020. However, in their modelling within the Oil 2020 report, the IEA assumes a constant price of $60/bbl from 2019 through 2025. Note that OPEC no longer publishes medium- or long-term oil price assumptions in the WOO.

Figure 7. Oil Price History and Medium-Term IEA Assumptions (nominal US$)



Source: IEF, IEA, OPEC

Figure 7 data sources: Historical OPEC ORB price from https://www.opec.org/opecweb/en/data_graphs/40.htm

Historical Brent price from US EIA at https://www.eia.gov/opendata/qb.php?category=1039852&sdid=STEO.BREPUUS.A.

Figure 7 notes: IEA[(a)]: Only historical prices up to the time IEA and OPEC released their reports were included. [(b)]: IEA Brent Price assumption is based on the Brent futures strip.

5.1.2 Economic Growth

As shown in **Table 8**, the IEA revised its medium-term economic assumptions downward, while OPEC revised 2020 estimates downward and 2021 upward, relative to their respective 2019 outlook. OPEC, whose report was published in October 2020, assumes GDP growth that reflects COVID-19 impacts and goes negative for 2020 to –3.7% before reversing to reach 4.7% in 2021. OPEC expects global growth to gradually strengthen after the initial COVID-19 recovery in 2021, reaching 3.4% by 2025. The IEA's GDP assumptions are higher than OPEC's, partly due to the 8-month gap between publications of Oil2020 and WOO2020 and partially because the IEA released their report in March, before the full impacts of COVID-19 were realized. Like OPEC, however, the IEA's GDP assumptions have declined substantially despite being early into the global pandemic. In 2019, the IEA (based on the IMF) projected 2020 growth of 3.6%, compared with 2.4% in IEA Oil 2020. Over the next several years, the IEA assumes relatively steady GDP growth of 3.3% to 3.6% between 2021 and 2025, roughly on par with their assumptions of 3.6% growth from 2021 through 2023 used in IEA Oil 2019.

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

	2020	2021	2022	2023	2024	2025
OPEC	-3.7	4.7	3.1	3.2	3.3	3.4
IEA	2.4	3.3	3.6	3.6	3.6	3.6

Table 8 data sources: IEA Oil 2020, Table 1.3; OPEC WOO 2020, Table 1.4. IEA's forecast relies on IMF, OECD, and IEA information.

Under both projections, OECD and non-OECD economies expand over the medium-term, though the OPEC estimates reflect widespread reductions in GDP growth in 2020 before converging to levels comparable to IEA assumptions for 2025. Further differences in projections exist among some key countries, shown in **Figure 8**. For example, the OPEC assumptions for GDP growth in China are substantially higher than the world more broadly, with China falling to 1.3% growth in 2020 as compared to –2.5%, -4.5%, and –3.7% assumed for India, Russia, and the world, respectively. While largely recovering from the contraction in 2020, OPEC projections lie modestly lower than those of the IEA for the four regions present in **Figure 8**. The IEA projects China to average 5.7% GDP growth annually from 2019 to 2025, only slightly greater than OPEC's estimates of 4.9% average annual growth for the country over the same period. Overall, the IEA estimates average annual growth globally of 3.3% and OPEC of 2.3% from 2019 to 2025.

Figure 8. Regional GDP growth assumptions

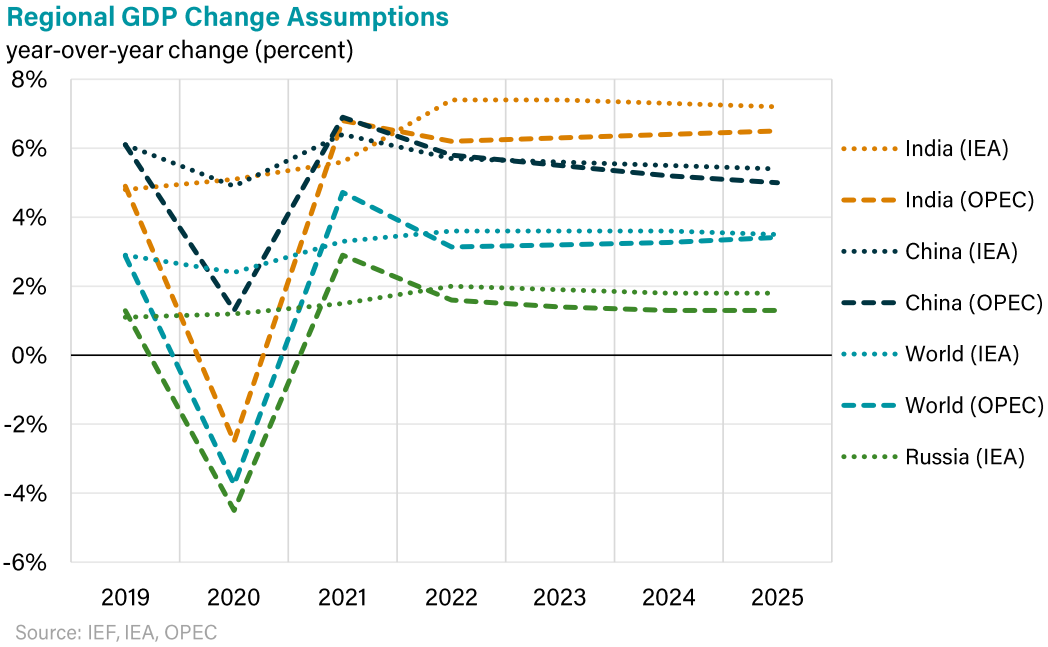


Figure 8 data sources: IEA Oil 2020, Table 1.3; OPEC WOO 2020, Table 1.4. IEA's forecast relies on IMF, OECD, and IEA information.

5.2 Medium-term Liquids Demand

5.2.1 Global and Regional Demand Growth

Both organisations' medium-term outlooks project relatively strong medium-term growth in global liquids demand, though OPEC's projection, incorporates more actual COVID-19 impacts, are naturally more bearish. Liquids demand in the baseline year of 2019 is 99.7 mb/d for OPEC and 100.0 mb/d for the IEA, a difference of 0.3 mb/d, slightly smaller than the baseline difference of 0.5 mb/d observed in last year's report.

As **Figure 9a** illustrates and **Table 9** shows in detail, OPEC's greater incorporation of the effects of COVID-19 contributes to the steep drop in 2020 global liquids demand estimates, 9.2 mb/d lower than the IEA. By 2025, demand under the IEA's projections reaches 105.7 mb/d, compared with 103.7 mb/d for OPEC, reflecting average annual growth between 2019 and 2025 estimated at 1.0 and 0.7 mb/d for the IEA and OPEC, respectively. These figures mark a significant decrease in projections compared to last year, with the IEA now estimating 1.5 mb/d and OPEC 2.2 mb/d lower demand in 2024 compared to last year's reports.

As in other recent years, demand growth is centred squarely in non-OECD nations. While OPEC projections in **Figure 9b** reflect a significant decrease in demand for 2020, of 4.9 and 4.0 mb/d for OECD and non-OECD countries from 2019 levels, their later forecasting follows a similar trend to IEA estimates. OPEC expects non-OECD liquids demand growth to average 0.8 mb/d per annum, while the IEA projects growth of 0.9 mb/d. By 2025, OPEC projects total OECD liquids demand to decline from 47.9 mb/d in 2019 to 46.8 mb/d, while the IEA projects total OECD liquids demand increasing slightly from 47.6 mb/d to 47.7 mb/d.

Figure 9. Medium-term Liquids Demand

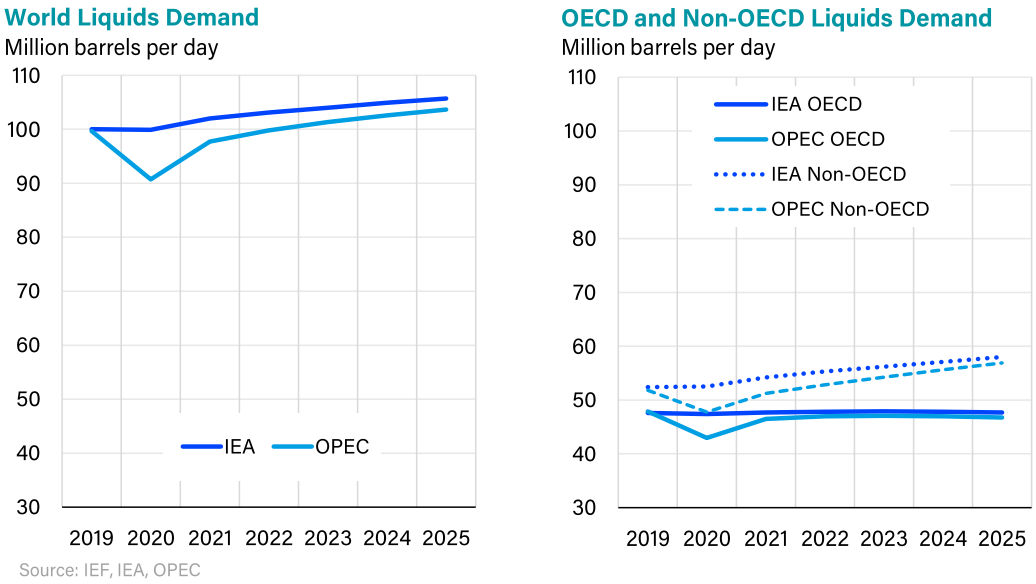


Figure 9 data sources: IEA Oil 2020, Table 2; OPEC WOO 2020, Table 3.1..

Table 9 presents a detailed comparison of the IEA and OPEC medium-term liquids demand outlooks for comparable regions. Modest differences arise in projected 2025 demand, with OPEC's projections generally lower than the IEA for most regions, particularly. OPEC's lower estimates can be partially attributed to their later publication date that allowed more time to incorporate COVID-19 effects, though as **Figure 9** illustrated, OPEC projects a rapid realignment with previous trends despite the large contraction in 2020.

When looking at specific regions, we can see that the IEA project 0.2 mb/d greater annual growth per year over OPEC forecasts for the OECD from 2019 to 2025, with OPEC predicting a slight reduction in OECD demand over the period. Of non-OECD nations, the IEA estimates 1.1 mb/d more liquids demand in China in 2025 compared to OPEC. Interestingly, the IEA and OPEC project the same level of demand growth in India despite the IEA's more bullish projection for India's GDP growth. Comparison of non-OECD regions is complicated by the fact that, in the WOO medium-term projections, OPEC excludes its member countries from regional groupings and publishes OPEC liquids demand separately. The IEA does not make a similar distinction. To allow for comparison across the regions where OPEC members are located, we group together the Middle East, Africa and Latin America for regional demand projections, which allows for the inclusion of all OPEC members into this category.

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

	2025		Avg. annual growth (2019-2025)		
	IEA	OPEC	IEA	OPEC	DIFFERENCE (IEA-OPEC)
Total OECD	**47.7**	**46.8**	**0.02**	**-0.19**	**0.20**
OECD Americas	25.7	25.7	0.02	0.02	0.00
OECD Europe	14.0	13.7	-0.02	-0.11	0.09
Asia Oceania	8.0	7.4	0.02	-0.09	0.11
Total Non-OECD	**58.0**	**56.9**	**0.93**	**0.85**	**0.08**
Asia	32.0	30.2	0.68	0.54	0.14
China	15.5	14.4	0.30	0.23	0.07
India	6.0	5.8	0.17	0.17	0.00
Other non-OECD Asia	10.5	9.9	0.22	0.15	0.07
Middle East, Africa & Latin America [a]	20.1	20.9	0.18	0.27	-0.09
Europe & Eurasia	5.9	5.8	0.07	0.10	-0.04
World	**105.7**	**103.7**	**0.95**	**0.66**	**0.29**

Table 9 data sources: IEA Oil 2020, Table 2; OPEC WOO2020, Table 3.1.

Table 9 notes: Numbers rounded to nearest significant digit. OPEC[a]: OPEC calculates demand from OPEC member countries as a whole by excluding them from the corresponding geographical region. To allow for comparison across the regions where OPEC members are located, we group together the Middle East, Africa, and Latin America for regional demand projections, which allows for the inclusion of all OPEC members into this category.

5.2.2 Sectoral Demand

The WOO2020 provides sectoral oil demand projections for 2019 through 2025, with road transport being identified as the largest source of cumulative growth at 1.9 mb/d. Road transport demand shrinks between 2019 and 2020 from 44.4 to 40.1 mb/d, respectively, before recovering to 46.3 mb/d in 2025. Similarly, aviation demand nearly halves from 6.7 mb/d in 2019 to 3.5 mb/d in 2020 before recovering to 7.1 mb/d in 2025. The petrochemicals sector also sees notable growth over the period by a total of 1.1 mb/d from 2019 to 2025.

The IEA's medium-term Oil 2020 report does not include detailed global sectoral data, but instead focuses on the composition of liquids demands through different products. The 2020 report discusses some key shifts in oil market dynamics, with a particular focus on shifting transport fuel demand which is changing rapidly as a result of electric vehicle (EV) and fuel standard policy. Fuel efficiency is expected to reduce gasoline and diesel growth significantly by 2025. The Oil 2020 report also details strong growth in demand for liquefied petroleum gases (LPG), ethane, and naphtha feedstocks which grows by an average of 0.5 mb/d annually, roughly half of oil product growth.

Both organisations take note of the 2020 changes in fuel specifications from the International Marine Organization (IMO) which took effect at the beginning of the year, which was expected to reduce

demand for high sulphur fuel oil (HSFO), currently accounting for roughly 75% of bunker fuel demand. The IEA estimated HSFO demand to fall by 1.8 mb/d in 2020, but that some demand would return by 2025 as more ships are equipped with scrubbers. OPEC assert that HSFO demand fell considerably in the marine bunkers sector alone as a result of the IMO rules, though effects of COVID-19 have largely overshadowed these impacts on the refining industry and product pricing.

5.3 Medium-term Liquids Supply

5.3.1 Liquid Fuels Classification and Projection Methodology

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

In addition, an understanding of the differences in the IEA's and OPEC's categorisation of liquid fuels is necessary to enhance comparison of their projections. **Figure 10(a)** and **(b)**, respectively, illustrate the IEA's and OPEC's distinct liquids classification systems.

First, the two institutions differ in their categorisation of certain types of unconventional oil supplies. **Figure 10(a)** shows that the IEA groups together conventional crude oil, NGLs (including conventional and unconventional supplies) and condensate into one category, and "unconventional oil," including tight oil, into another. OPEC, as shown in **Figure 10(b)** accounts for tight crude in its "crude oil" category and distinguishes between conventional and unconventional NGLs. It groups other unconventional liquids such as oil sands and oil shale into its "non-crude supply" category.

Figure 10. Liquid Fuels Categorisation by the IEA and OPEC

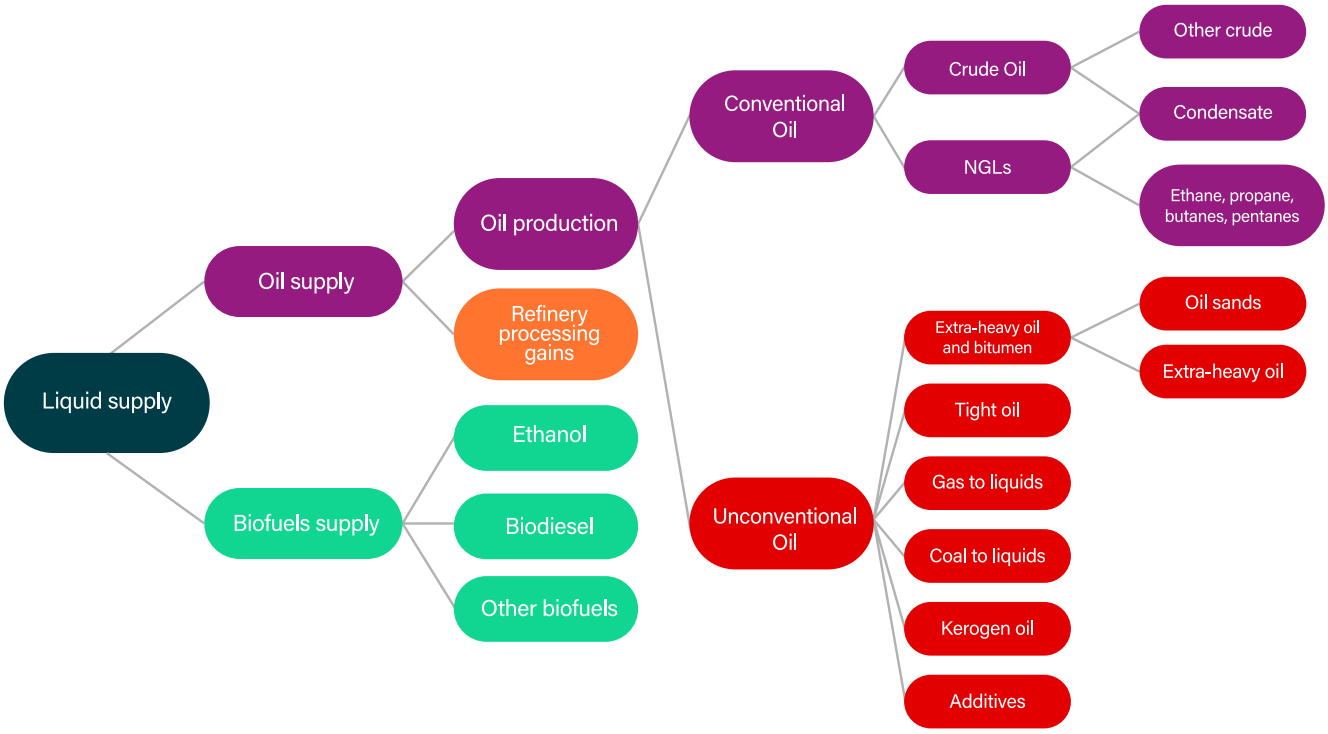


Figure 10(a) source: Resources for the Future and IEF based on IEA WEO 2020 and internal communication.

IEA[a]: IEA previously referred to "tight oil" as "light tight oil".

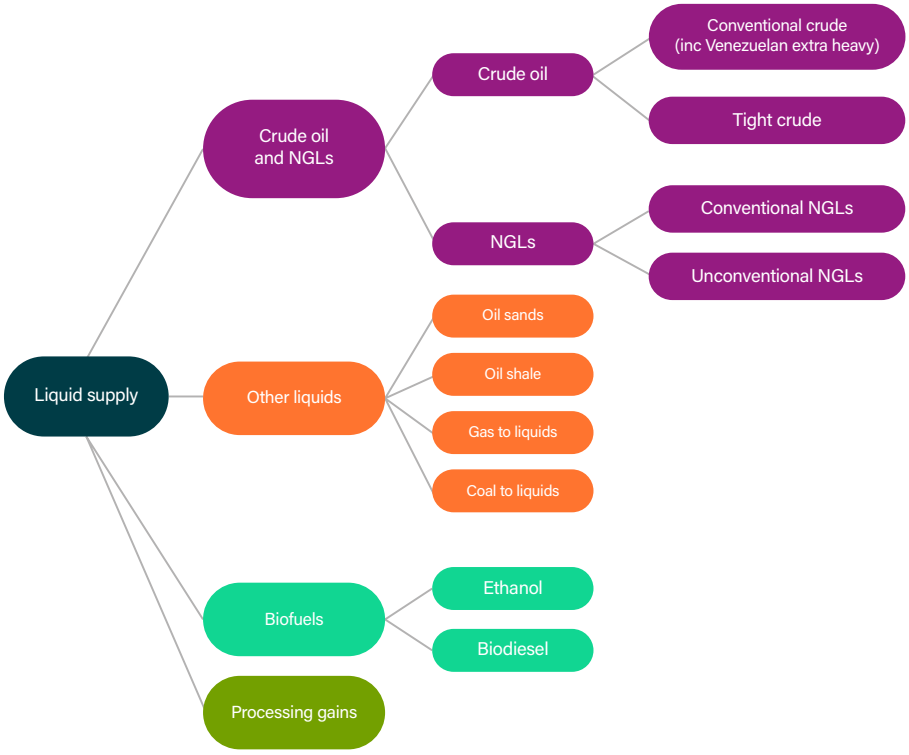


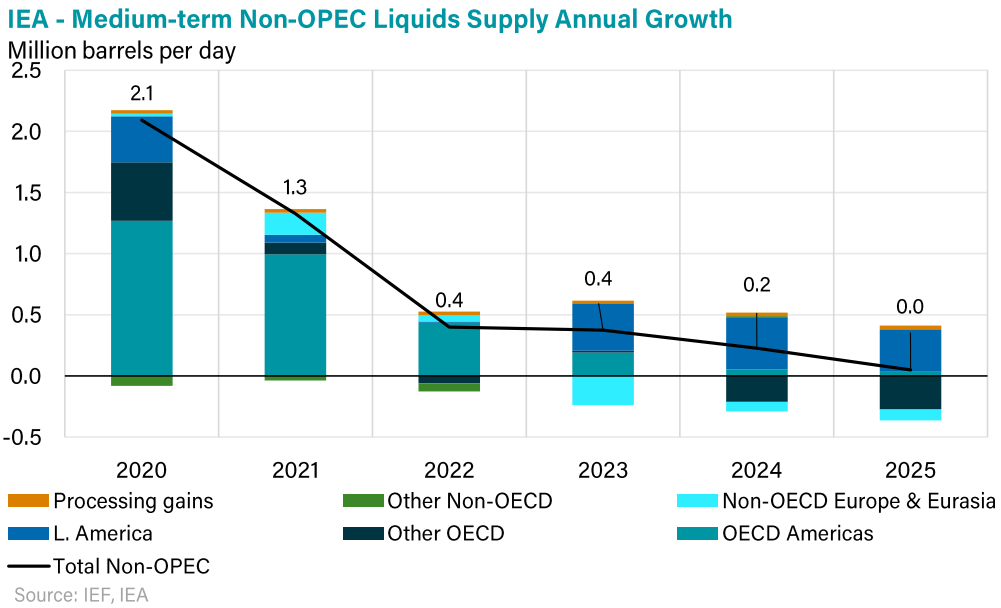
Figure 10(b) source: Resources for the Future and IEF based on WOO2020 and internal communication.

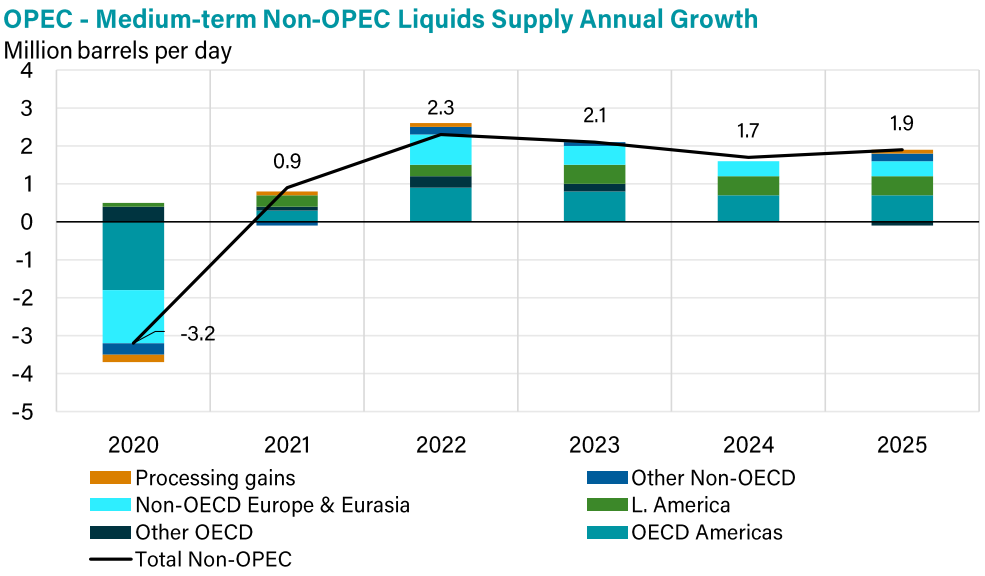
5.3.2 Global and Regional Liquids Supply

OPEC and the IEA projections offer contrasting pictures of estimated non-OPEC supply growth in the near term, while both foresee slower growth from 2022 to 2025 (**Figure 11(a)** and **Figure 11(b)**). Having not fully incorporated COVID-19 effects, the IEA projected robust non-OPEC supply growth in 2020 and 2021, while the later OPEC report projects negative growth for much of the world and severely dampened growth in 2021. From 2022 to 2025, OPEC's projections are generally higher than those from the IEA, which projects less than 0.5 mb/d in annual net growth in these years. For the full projection period of 2020 and 2025, OPEC projects cumulative net non-OPEC supply growth of 5.7 mb/d, while the IEA projects cumulative supply growth of 4.5 mb/d.

In the pre-pandemic IEA projections, OECD Americas, particularly the United States, were expected to account for 67% of cumulative non-OPEC growth over the medium term, while OPEC's later publication would attribute a substantially smaller proportion of 28% of cumulative growth to the region. Where the IEA predicted growth of 1.3 mb/d for OECD Americas in 2020, OPEC estimates contraction of 1.8 mb/d. Both the IEA and OPEC maintained similar predictions for the second largest supply growth contributor of Latin America over the period of 2020 to 2025, with the IEA estimating cumulative growth of 1.6 mb/d (36% of total) and OPEC of 2.2 mb/d (39% of total). These gains are driven by new offshore Brazilian and Guyanese production. OPEC projects considerably more supply growth from OECD Europe than the IEA, with OPEC estimating growth of 0.8 mb/d to the IEA's estimate of 0.0 mb/d. Both the IEA and OPEC estimate a contraction in supply from non-OECD Asia of 0.3 mb/d from 2020 to 2025.

Figure 11. Medium-term Non-OPEC Liquids Supply Annual Growth





Source: IEF, OPEC

Figure 11 data sources: IEA Oil 2020, Table 3, Table 5, Table 5a; OPEC WOO 2020, Table 4.1. Sums may differ due to rounding.

Figure 11 note: 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.

Table 10 provides a detailed regional comparison of medium-term liquids supply between the two outlooks. Compared to the IEA's projections for March 2020, the later OPEC figures have both higher and lower estimates varying from region to region. Of significance, OPEC projects 27.4 mb/d from OECD Americas in 2025, while the IEA sees production for the region of 28.9 mb/d. OPEC's forecasting for OECD America constitutes a downward revision from previous growth estimates and breaks a trend of upward revisions to US tight oil supplies that persisted in recent years. On the other hand, OPEC estimates of 4.5 mb/d in 2025 for OECD Europe maintain last year's estimate of the same value for 2024, whereas the IEA estimate lower levels of production in the region compared to last year at 3.8 mb/d. Similarly, OPEC projects substantially greater supply from Latin America (8.2 mb/d compared with 7.2 mb/d for the IEA) and Non-OECD Europe and Eurasia (15.2 mb/d compared with 14.6 mb/d for the IEA).

In total, the IEA forecasts 69.4 mb/d in liquids supply from non-OPEC nations in 2025, while OPEC estimates 70.7 mb/d, a 1.2 mb/d difference. The IEA's projections imply supply from OPEC member nations of 36.3 mb/d, 3.1 mb/d higher than the assessments by OPEC. Overall, the IEA's estimates generated earlier into the COVID-19 pandemic as well as their stronger estimates for global demand helps to pull in a larger volume of supplies, with the IEA projecting total global supplies of 105.7 mb/d and OPEC projecting 103.9 mb/d in 2025. In that year, the IEA projects that OPEC provides 34% of global liquids, compared with an estimate of 32% from OPEC.

Despite significant differences in projected regional growth in the years between 2020 and 2025, average annual growth over the period remains close between both organisations' regional forecasts. The largest discrepancy in annual growth estimates exists for aggregated non-OECD nations, with OPEC projections averaging 0.3 mb/d greater annually than the IEA.

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

	2025		Avg. annual growth (2019-2025)		
	IEA[b]	OPEC	IEA	OPEC	DIFFERENCE (IEA-OPEC)
Total OECD	33.1	32.5	0.5	0.4	0.1
OECD Americas	28.9	27.4	0.5	0.3	0.2
OECD Europe	3.8	4.5	0.0	0.1	-0.1
Asia Oceania	0.5	0.6	0.0	0.0	0.0
Total Non-OECD	**33.8**	**35.9**	**0.2**	**0.5**	**-0.3**
Asia	7.1	7.3	-0.1	0.0	0.0
China	4.1	4.1	0.0	0.0	0.0
Other non-OECD Asia	3.1	3.2	-0.1	0.0	0.0
Middle East & Africa	4.9	5.1	0.0	0.1	0.0
Latin America	7.2	8.2	0.3	0.4	-0.1
Europe & Eurasia	14.6	15.2	0.0	0.1	-0.2
Processing Gains	2.5	2.4	0.0	0.0	0.0
Total Non-OPEC	**69.4**	**70.7**	**0.7**	**0.9**	**-0.2**
Total OPEC	**36.3**	**33.2**	**0.1**	**-0.1**	**0.2**
OPEC crude [a]	30.6		0.1		
OPEC NGLs + unconventionals	5.7		0.0		
World	**105.7**	**103.9**	**0.9**	**0.8**	**0.0**

Table 10 data sources: IEA Oil 2020, Tables 3, 5, and 5a; OPEC WOO2020, Table 4.1.

Table 10 notes: Numbers rounded to nearest significant digit. OPEC crude[a]: For IEA includes stock change and miscellaneous. OPEC also includes stock change in medium-term and long-term projections. IEA regional supply estimates include biofuels, based on IEA Oil 2020 Tables 5 and 5a. IEA[b]: Estimates for total OPEC supply and world supply are constructed from other components because IEA does not directly provide these forecasts in their reports.

As noted above, and unlike previous years as is evident in **Figure 12**, projections for medium-term oil supply by the IEA and OPEC differ substantially as a result of the unmatched episode of energy market volatility in the eight months between their publication. While short-term supply estimates by OPEC reflect impacts of COVID-19, the difference in projected supply by the end of the forecast period shrinks to only 1.5 mb/d in 2025. These medium-term supply projections also reflect different assumptions about technologies and oil prices between the IEA and OPEC. For both organisations, most of this forecasted growth continues to come from U.S. tight oil.

Figure 12. Medium-term US and Canadian Oil Supply (excluding biofuels)

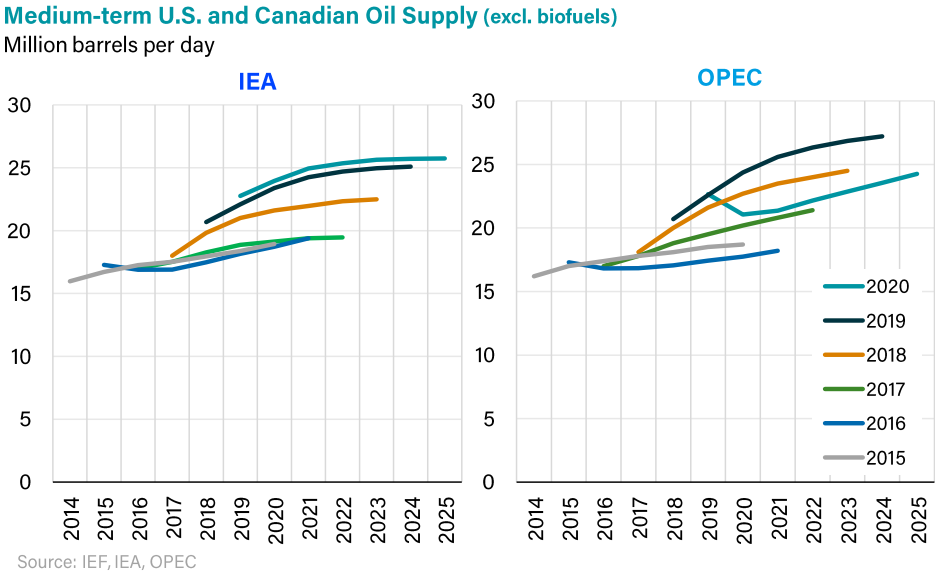


Figure 12 data sources: IEA Oil 2020 Table 3; OPEC WOO 2020 Tables 4.1 and 4.2, Figure 4.7. IEA Oil 2019 Table 3; OPEC WOO 2019 Tables 4.1 and 4.2, Figure 4.7; IEA Oil 2018 Table 3; OPEC WOO 2018 Tables 4.5 and 4.10; IEA Oil 2017 Table 3; OPEC WOO2017, Table 4.1; IEA MTOMR 2016 Table 3; OPEC WOO2016, Table 4.1

6. Long-term Energy Outlooks

The following comparison of long-term outlooks evaluates the IEA's World Energy Outlook 2020 (WEO2020) and OPEC's World Oil Outlook 2020 (WOO2020). In these reports, the IEA makes projections extending through to 2040, and OPEC makes projections through 2045. Unlike some previous years, these long-term outlooks base their projections on the common baseline year of 2019, facilitating comparison.

Differences between the IEA and OPEC in their choice of units for primary energy demand create some challenges in making comparisons. OPEC uses million barrels of oil equivalent per day (mboe/d), while the IEA uses million tons of oil equivalent (mtoe) for primary energy projections (the IEA also publishes fuel-specific volumetric data for certain measures). Where necessary, we convert the IEA's units of primary energy from mtoe per year to mboe/d by multiplying by 7.37[5] mboe/mtoe and dividing that total by 365 days per year, yielding a conversion factor of 0.0202 mboed/mtoe.

A more substantial challenge in comparing long-term outlooks arises from differences in regional groupings between the IEA and OPEC. While OPEC reports its main regional results in terms of OECD status (i.e., OECD Americas, OECD Europe, non-OECD Asia, etc.), and the IEA publishes aggregate projections for the broader OECD and non-OECD categories, since 2018 it no longer groups regions according to OECD status in its main results and Annex tables. The IEA has graciously provided additional data with these regional groupings for this report to enhance comparability.

5 IEA, Oil Information 2015, IV.93. In WEO2019 (p. 618), the IEA notes that there is no standard conversion factor from boe to toe, with common factors ranging from 7.15 to 7.40. Exact factors depend on the type of oil. Per internal communication, OPEC uses a factor of 7.33, which would result in a conversion factor of 0.02008.

6.1 Key Assumptions

6.1.1 Scenarios and sensitivity cases

In the WEO2020, the IEA has taken a different approach to its scenario design, reflecting the deep uncertainty surrounding the future of energy in the context of a continuing global pandemic and the policy and market shifts it may create. Because of these uncertainties, the IEA does not publish a Current Policies Scenario that reflects current pathway dependency or the baseline in scenario modelling. Instead, the IEA focuses on the Stated Policies Scenario (STEPS) and the Sustainable Development Scenario (SDS). It also provides projections for certain policy measures under two new scenarios: the Delayed Recovery Scenario (DRS) and the Net Zero Emissions by 2050 (NZE2050) scenario (which includes a limited amount of data through year 2030). As in previous years, OPEC focuses on a single Reference Case, and provides a range of sensitivity analyses to address uncertainties through to 2040. **Table 11** lists key assumptions for the scenarios included in the WEO2020 and WOO2020. A more detailed comparison is provided in **Annex 1**, and a comparison of key outlook results for each scenario is featured in **Annex 2**.

Table 11. Long-term Scenario Key Assumptions

IEA WEO Scenarios	OPEC WOO Scenarios
Stated Policies Scenario (STEPS) Considers both policies in place and announced targets	**Reference Case** Considers policies that have been enacted as well as viable evolution of these policies guided by announced targets
Sustainable Development Scenario (SDS) Ensures universal energy access by 2030; sharply reduces air pollution; aligns with Paris Agreement goals to limit global warming "well below 2°C"	**Scenario A** A global carbon price covering industrial and power sectors; focus on energy efficiency improvements; transport sector emissions reductions; aligns with Paris Agreement goals to limit global warming "well below 2°C"
Delayed Recovery Scenario (DRS) Same policies as STEPS, but a prolonged pandemic creates greater economic and social impacts. Global energy demand does not recover to pre-pandemic levels until 2025	**Scenario B** Coal declines rapidly; nuclear and CCUS are deployed at scale; bioenergy with CCS comes online at scale this century; aligns with long-term Paris Agreement goals to limit global warming "well below 2°C"
Net Zero by 2050 Scenario (NZE2050) Lays out additional measures that would need to be adopted over the next 10 years to put the world on track to reach net zero emissions by mid-Century	

As we noted in last year's report, the IEA renamed its central scenario in 2019, replacing the New Policies Scenario (NPS) with the Stated Policies Scenario (STEPS). As discussed in the introduction section in WEO2019, the name change is intended to enhance the notion that the central projection is not a "forecast," but rather a reflection of energy and climate policies that have been announced by governments. This point is reinforced in the WEO2020.

Like last year, the STEPS considers both policies in place as well as policies and commitments that have been announced. It also includes assumptions about the continued evolution of technologies, including cost reductions associated with increased deployment and "learning-by-doing." The SDS creates an energy path consistent with the United Nations' Sustainable Development Goals, and projects that carbon dioxide emissions from fossil fuel consumption will decline through 2040 consistent with the long-term temperature goals outlined in the 2015 Paris climate agreement. These two IEA scenarios, along with the NZE2050 scenario, share the same GDP and population assumptions, while variations in policy affect technological development and demand-supply patterns on energy markets.

In the DRS, the IEA considers a scenario where economic growth, energy demand, energy access, and energy-related emissions are well below those envisioned in STEPS. In the NZE2050, the IEA lays out energy system changes that go beyond those seen in the SDS to achieve net zero greenhouse gas emissions by 2050.

OPEC employs a more limited set of sensitivity analysis to examine specific issues in the WOO2020, building upon its World Energy Model (OWEM) for upstream liquids demand and supply projections. In the WOO series, the Reference Case is the central scenario. The Reference Case not only considers enacted policies, but also accepts that the policy process evolves over time, with regional policy assumptions highlighted in Chapter 7, and sensitivity cases outlined in Chapter 8 of WOO2020. Because OPEC's Reference Case is not strictly based on energy policies already in place, it is challenging to find a single counterpart in IEA's WEO2020 for comparison. As a result, we focus on a comparison between the WOO2020 Reference Case and the IEA's STEPS and SDS, selectively providing other scenarios and sensitivity cases for additional context.

OPEC examines several sensitivity cases for specific topics in WOO2020. The first, Scenario A, reflects an energy pathway compatible with limiting global average temperature rise to 2°C above pre-industrial levels by 2100. In Scenario A, global energy demand is roughly 22% lower in 2040 than under the Reference Case, with a higher share of renewables in the energy mix. Scenario B, which includes a larger role for fossil energy along with CCUS and nuclear energy technologies, is also compatible with the 2°C target, but global energy demand is only 2% lower than the Reference Case by 2040. OPEC also includes alternative scenarios for global GDP growth and Non-OPEC liquids production through the projection period.

6.1.2 Demography

As in previous outlooks, both the IEA and OPEC base their demographic assumptions primarily upon projections made by the Population Division of the United Nations Department of Economic and Social Affairs. However, the organisations differ slightly in their baseline 2019 population estimates. OPEC assumes a world population of 7,711 million while the IEA assumes a world population of 7,672 million in 2019. Both the IEA and OPEC assume annual population growth rates of roughly 0.9% from 2019 through 2040.

For both outlooks, the largest population growth comes from developing countries. For OPEC, the non-OECD region grows by 1.1% p.a., while the OECD experiences annual growth of roughly 0.25% p.a. For the IEA, the most rapid population growth rates are seen in Africa (2.8% p.a.) and the Middle East (1.5% p.a.). OPEC did not publish specific population growth assumptions for Africa in 2020.

In addition to population growth assumptions, urbanisation continues to accelerate under both projections, with the share of people living in cities growing from 56% in 2019 to 64% in 2040. This trend occurs most rapidly in Africa and non-OECD Asia. In China, the urbanisation rate accelerates particularly fast from 55% in 2015 to 76% by 2040. 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.

6.1.3 Economic Growth

The IEA and OPEC take similar approaches in deriving GDP assumptions. For medium-term projections, 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. The IEA and OPEC both use 2019 as a base year and make GDP assumptions in Purchasing Power Parity (PPP) terms[6] , though the IEA also publishes its assumptions in Market Exchange Rate (MER) terms. One notable difference is that OPEC's projection period in the WOO2020 extends through to 2045, while the IEA's projections extend through to 2040 in the WEO2020.

The IEA assumes average annual GDP growth of 3.0% in STEPS and 2.6% in the DRS from 2019 to 2040, compared with OPEC's assumption of 2.9% from 2019 through 2045. These figures reflect large downward revisions from last year's assumptions, when the IEA and OPEC assumed annual average growth rates of 3.4% and 3.3%, respectively, from 2018 to 2040. Notably, OPEC's extended outlook horizon to 2045 also contributes to its lower annual average growth rate because growth is slower toward the end of the projection period. Under the IEA's SDS and NZE2050 scenarios, GDP growth assumptions are equal to those seen in STEPS.

Figure 13 illustrates annual average growth over each projection period globally and in key regions, highlighting the downward revisions that have been caused by the effects of COVID-19. As noted above, comparisons between regions are complicated by different regional groupings and by OPEC's separation of its member countries into a distinct "OPEC" category. Still, some comparisons are instructive. For example, OPEC assumes growth of 3.9% per year in China, down from 4.6% last year, while the IEA's growth assumptions for China fell from 4.3% to 4.0% in STEPS and stand at 3.6% in the DRS. In India, OPEC assumes growth of 5.6% (down from 6.3% in 2019), while the IEA assumes 5.4% under STEPS (down from 6.4% in 2019) and 4.9% under the DRS. Downward revisions for economic growth in the OECD Americas and OECD Europe region are more modest, ranging from no change to a reduction of 0.2%.

6 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. Both organisations have incorporated this change into their reports.

Figure 13. Annual Average GDP Growth Assumptions for Selected Regions in 2019 and 2020

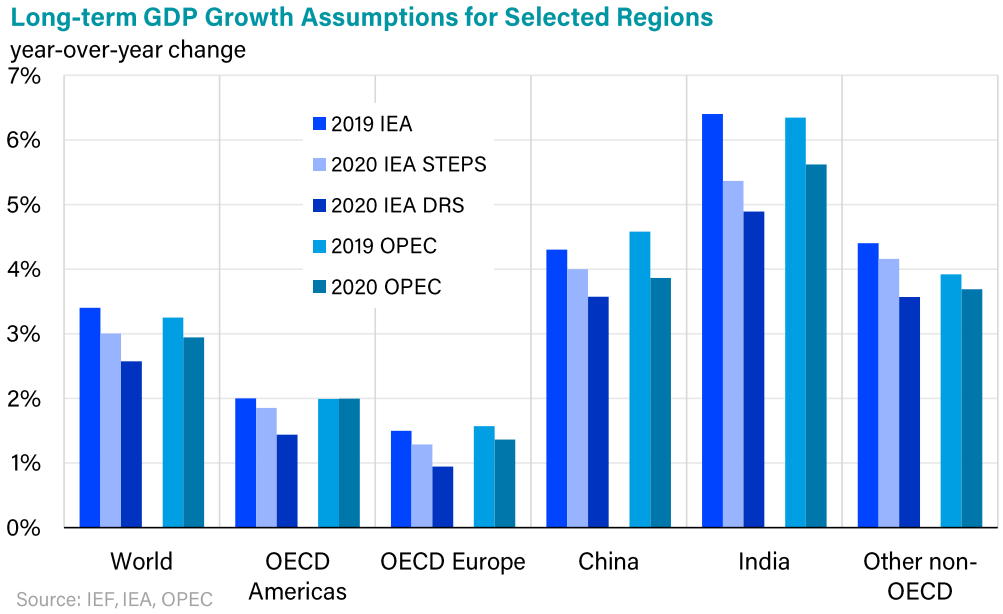


Figure 13 data sources: *IEA WEO 2020 Table 2.1; OPEC WOO2020 Table 1.5.*

Figure 13 notes: *the IEA's 2020 assumptions and all 2019 assumptions extend from 2019 through 2040, while OPEC's 2020 assumptions extend from 2019 through 2045, , which results in a lower annual average growth rate because growth is slower near the end of the projection period. Because the IEA and OPEC's regional classifications differ, we construct the following regional classifications to allow for intercomparison: OECD Americas is North America for IEA, and OECD Americas for OPEC; OECD Europe is the European Union for IEA, and OECD Europe for OPEC, Other non-OECD Asia is Southeast Asia for IEA, and Other non-OECD Asia for OPEC.*

6.1.4 Oil Prices

The IEA WEO series takes a different approach from medium-term scenarios to derive 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, and country-specific policy and risk factors. As stated above, OPEC last published its medium- and long-term oil price assumption in WOO2016.

As shown in **Figure 14**, the IEA's future price assumptions have been revised downward considerably this year, reflecting lower levels of future demand due to the lower economic growth assumptions shown in **Figure 13**. Under STEPS, oil prices rise from roughly $41/bbl in 2020 to $85/bbl by 2040, down from last year's 2040 oil price assumption of $105 under STEPS. Under the DRS and SDS, oil prices rise more slowly due to reduced demand, reaching $72/bbl and $53/bbl respectively in 2040. In 2019, the IEA's STEPS assumed a 2040 oil price of $60. Note that the IEA did not publish a Current Policies Scenario (CPS) in the WEO2020.

Figure 14. Long-Term Oil Price Assumptions in 2040

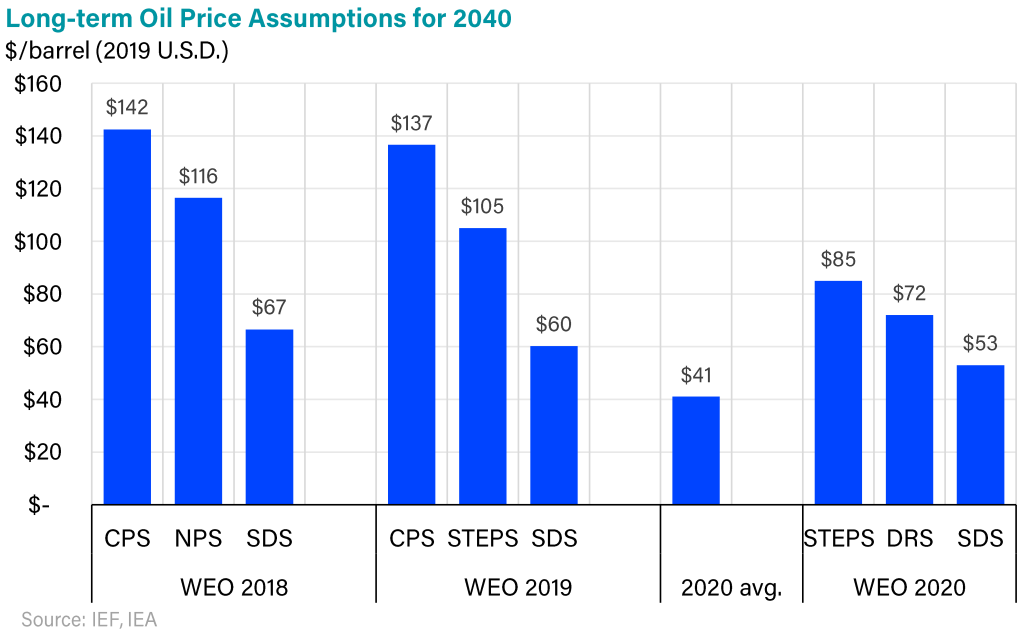


Figure 14 Data Sources: IEA WEO 2018 and 2019 Table B.4, IEA WEO 2020 Annex Tables. US EIA for 2020 average Brent price.

Figure 14 notes: OPEC has not published medium- or long-term oil price assumptions since WOO2016.

6.1.5 Energy and Climate Policies

Each year, projections incorporate new policies, enacted, or proposed. Since the announcement of the 2015 Paris Climate Agreement, policies related to climate change have received prominent attention. For the most part, these policies have remained in place or have strengthened since 2015. One notable exception was the United States, which formally withdrew from the agreement in late 2020 and had relaxed or eliminated a suite of federal climate policies during the 2017-2020 period. However, the new US Biden Administration re-joined the Paris Agreement upon taking office and many policies are likely to be re-instated and enhanced in 2021 or thereafter.

Most nations appear committed to pursuing their NDCs through various domestic policies, and major economies such as China, the United States, the European Union, Japan, the Republic of Korea have announced goals of achieving net-zero greenhouse gas emissions by 2050 or 2060. In WEO2020, the IEA highlights various changes in national and subnational policies in major energy consuming nations, laying out key policy assumptions in its introduction and providing details in Annex B, including details on carbon pricing, air pollution, transport policies, and energy efficiency standards.

In WOO2020, OPEC dedicates Chapter 7 to policy issues with a focus on climate change trends and policies, along with an overview of the concept of the Circular Carbon Economy that G20 Energy Ministers endorsed in 2020. It describes policies related to road transportation, the power sector, and more for the United States, the EU, China, and India, and several other regions.

6.2 Long-term Energy Demand

6.2.1 Primary Energy Consumption

Despite the effects of COVID-19 on the global economy near-term energy demand-supply balances, public policies, and energy technology, the central projections from both the IEA and OPEC see global energy demand rising through 2040. Although the percentage rate of growth is slower, absolute levels of growth are similar to previous decades. Consumption growth is driven primarily by an expanding population and economy, with the majority of new demand coming from developing countries, particularly in Asia. Fossil fuels continue to dominate the primary energy mix, with oil, natural gas, and coal providing 73% under IEA STEPS and 74% under OPEC's Reference scenario in 2040. This share declines to 56% under the IEA SDS, 55% under OPEC's Scenario A, and 58% under Scenario B, both of which are compatible with the long-term goals of the Paris agreement. In 2019, fossil fuels accounted for 81% of the primary energy mix.

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 the composition of the fuel mix.

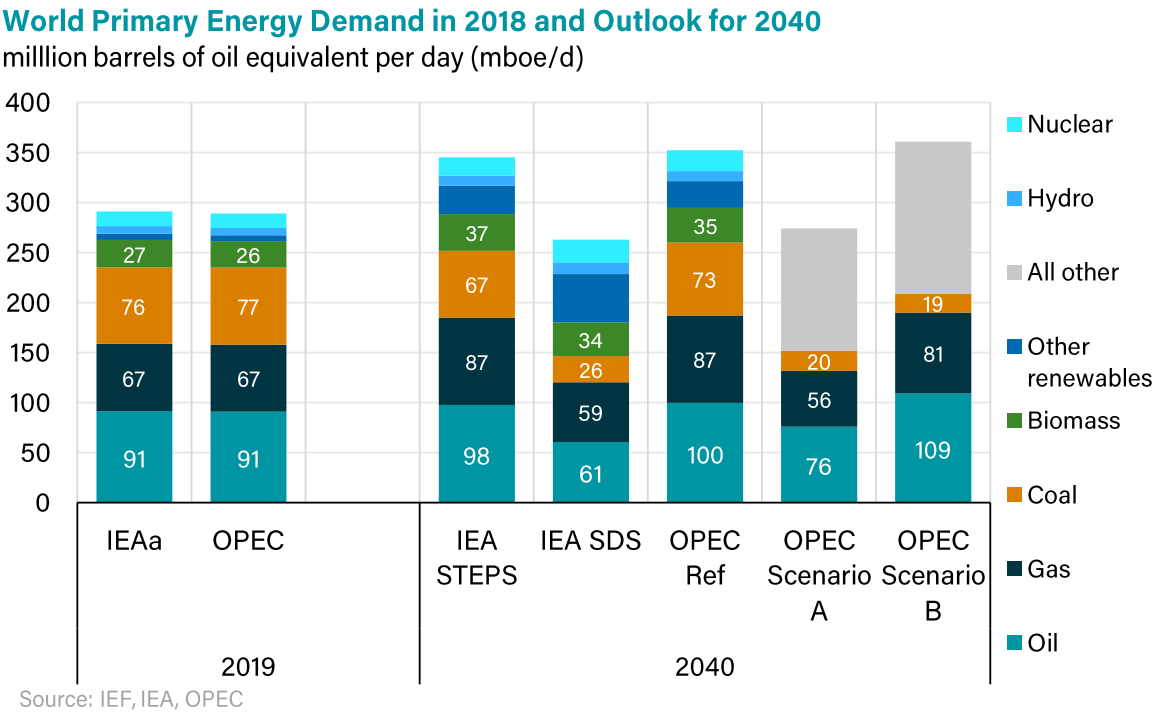
Total primary energy demand grows under 3 of the 5 scenarios considered here, increasing by 0.8% per year on average for the IEA STEPS and by 0.9% under OPEC's Reference case from 2019 through 2040. In last year's projections, both of these scenarios projected long term demand growth of 1.0% annually. Under the IEA SDS, global energy demand declines by an average of 0.5% per year, considerably faster than last year's SDS projection of 0.3%. In OPEC's Scenario A, global demand declines by 0.2% per year, but grows by 1.0% under Scenario B. Last year, OPEC's Below 2°C scenario envisioned declines of 0.4% per year.

Figure 15 provides a comparison of projections for total primary energy supply by energy source, highlighting a number of differences. OPEC's Reference Case projects coal demand to decline by 4 mboe/d from 2019 to 2040, while IEA's STEPS projects a decline of 9 mboe/d. Oil consumption grows by 9 mboe/d for OPEC's Reference Case and by 6 mboe/d under IEA STEPS. Both scenarios project natural gas demand to grow by 20 mboe/d through 2040.

Under all Paris-aligned scenarios (the IEA's SDS and OPEC's Scenarios A and B), global coal demand falls by 50 mboe/d or more, but differences emerge between the scenarios on the future of oil and natural gas. Under the IEA's SDS, oil and natural gas demand decline by 31 and 8 mboe/d, respectively. Under OPEC's Scenario A, oil falls by 15 mboe/d and natural gas declines by 11 mboe/d. However, under OPEC's Scenario B, where carbon capture, use, and storage plays an enhanced role, oil and gas consumption respectively rise by 18 and 14 mboe/d through 2040.

Under all scenarios, nuclear, hydro, and other renewables grow considerably over the next two decades. Nuclear energy rises from 2019 to 2040 by 3, 6, and 8 mboe/d under the IEA STEPS, OPEC Reference, and IEA SDS, while hydropower grows by 3 to 4 mboe/d under these scenarios. Other renewables, led by wind and solar, grow by 21 and 22 mboe/d under OPEC's Reference Case and IEA STEPS, respectively, and by 42 mboe/d under the IEA SDS.

Figure 15. World Primary Energy in 2019 and Outlook for 2040



Source: IEF, IEA, OPEC

Figure 15 data sources: IEA WEO 2020, Annex Tables; OPEC WOO2020, Table 2.1 for Reference Case and Internal communication for Scenarios A and B.

Figure 15 notes: [a] IEA primary energy is converted from mtoe per year to mboe/d by multiplying by 0.0202 mboed/mtoe. OPEC Sensitivity Scenarios do not provide fuel-specific data for non-fossil fuels.

Figure 16 presents the share of each fuel in the global energy mix in 2019 along with projections for 2040. In every one of the 5 scenarios examined here, oil maintains its position as the leading primary energy source globally, though its share shrinks. In OPEC's Reference Case and IEA STEPS, oil falls from 31% in 2019 to 28%, and to 23% in IEA's SDS. OPEC's two alternative scenarios show oil falling to 28% under Scenario A and 30% under Scenario B.

Natural gas' share of the global energy mix increases under central scenarios, growing from 23% in 2019 to 25% in OPEC's Reference and IEA's STEPS. Under the Paris-aligned scenarios, natural gas' share remains flat in IEA's SDS, and declines to 20% and 22% in OPEC's Scenarios A and B, respectively.

Coal's share of the mix declines substantially under all scenarios, falling from 26% to 27% of global primary energy supply in 2019 to 19% under IEA STEPS and 21% under OPEC's Reference scenarios. This decline is accelerated under the IEA's SDS, where coal falls to 10% by 2040, and shrinks further to 7% and 5% under OPEC's Scenarios A and B, respectively.

The share of renewables, which is currently dominated by biomass, is projected to increase in all scenarios from 14% in 2019 to 20% in OPEC's Reference Case, 22% under IEA STEPS, and 36% under the IEA's SDS. Virtually all of this growth comes from renewable electricity such as wind, solar, and hydro. OPEC's Sensitivity scenarios do not provide fuel-specific data for non-fossil fuels.

Figure 16. World Primary Energy Fuel Sharesin 2019 and Outlook for 2040

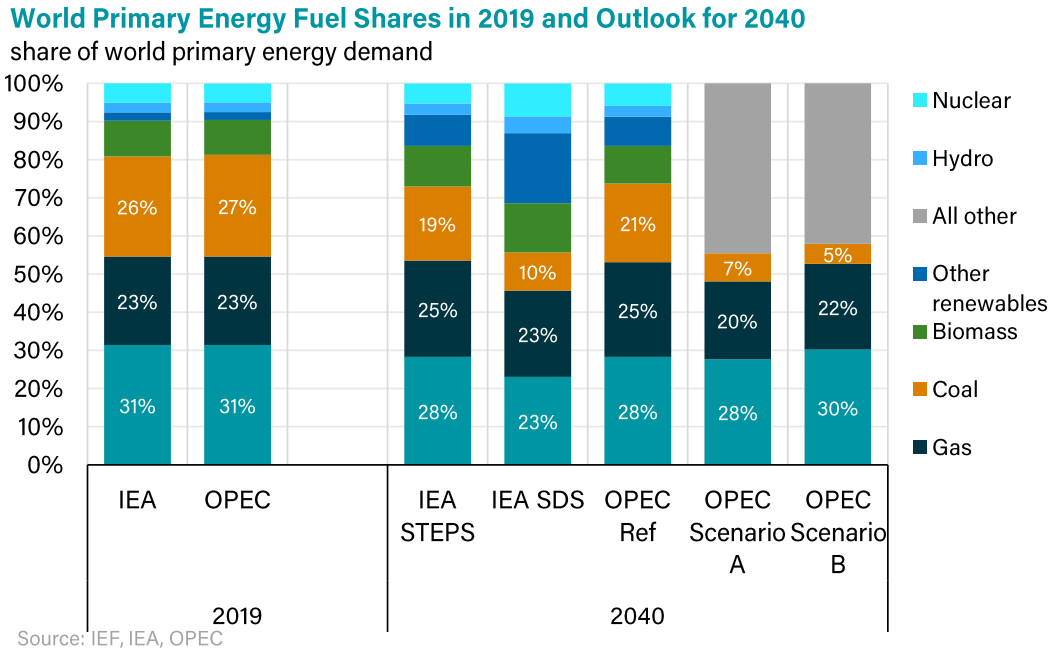


Figure 16 data sources: See Figure 15. Sums in the data callouts may not total due to rounding. OPEC Sensitivity scenarios do not provide fuel-specific data for non-fossil fuels.

6.2.2 Liquids Demand

Several differences between the IEA and OPEC create challenges in directly comparing long-term liquids demand projections.

As in previous years, the IEA and OPEC diverge on their classification of biofuels. First, 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 short- and medium-term outlooks (but not in 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.[7] Secondly, in some cases, we also must convert IEA biofuels data from energy equivalent units (mboed) to volumetric units (mb/d) for comparison with OPEC[8].

Third, the IEA and OPEC define bunker fuels differently. While the IEA reports international marine bunker and aviation fuel as a distinct "bunker" group – not attributable to any country or region – OPEC includes bunker and aviation fuel in each region's oil demand, just as it does with biofuels. In addition, OPEC does not differentiate between international and domestic aviation fuels. 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.

7 These regional biofuels projections were provided via internal communication with and the IEA and supplemented with data from the WEO2020 Annex Tables.

8 The IEA has provided, via internal communication, biofuels demand data by OECD status, in energy-equivalent units (mboed). We convert from these energy-equivalents to physical units (mb/d) using a factor of 0.7397. This factor is derived from the IEA's medium term Oil2020 report, which reports 2019 global biofuels demand of 2.8 mb/d (physical units), and IEA's WEO, which reports 2019 global biofuels demand of 2.1 mboe/d (energy equivalent units).

Fourth, 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 the IEA reported the Middle East and Africa regions separately, OPEC groups them together as a single category. This paper aggregates the Middle East and Africa in WEO2020 to compare oil demand projections between the two organisations more directly.

Incorporating the adjustments described above, **Table 12** presents a comparison of long-term world liquids demand projections using the major scenarios from WEO2020 and WOO2020. Notably, we are unable to harmonise regional bunker fuels, which contributes to OPEC's higher projections than the IEA's for most regions.

Although the share of liquids in the world primary energy mix is expected to decrease, the level of demand still grows over the projection period under central scenarios. In IEA's STEPS and OPEC's Reference Case, world liquids demand reaches 110.0 mb/d and 109.3 mb/d, respectively, by 2040. In the IEA's SDS, 2040 world liquids demand shrinks to 76.2 mb/d. In terms of average annual growth rates, OPEC's Reference Case projects liquids demand growth of 0.5 mb/d, roughly equal to IEA's STEPS projection, and considerably higher than the IEA SDS, in which global liquids demand shrinks by 1.6 mb/d annually through to 2040

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

	2040			Growth p.a. (2019-2040)			Difference (IEA-OPEC)	
	IEA SDS	IEA STEPS[a]	OPEC Ref.	IEA SDS	IEA STEPS	OPEC Ref.	SDS	STEPS
Total OECD	**22.9**	**35.8**	**38.0**	**-1.0**	**-0.4**	**-0.5**	**-0.6**	**0.1**
OECD Americas	14.3	21.9	21.2	-0.5	-0.1	-0.2	-0.3	0.1
OECD Europe	4.8	8.4	11.1	-0.4	-0.2	-0.2	-0.2	-0.1
Asia Oceania	3.8	5.5	5.8	-0.2	-0.1	-0.1	-0.1	0.0
Total Non-OECD	**45.3**	**63.3**	**71.2**	**-0.1**	**0.7**	**0.9**	**-1.0**	**-0.2**
Asia	22.9	33.7	39.0	-0.1	0.4	0.6	-0.7	-0.2
China	9.8	14.6	16.7	-0.2	0.1	0.2	-0.3	-0.1
India	6.1	9.0	9.9	0.1	0.2	0.2	-0.2	-0.1
Other non-OECD Asia	7.1	10.1	12.4	0.0	0.1	0.2	-0.2	0.0
Latin America	5.4	7.2	7.6	0.0	0.1	0.1	-0.1	0.0
Middle East & Africa	13.0	17.0	6.9	0.1	0.3	0.1	-0.1	0.1
Europe & Eurasia	4.0	5.3	6.1	0.0	0.0	0.0	-0.1	0.0
Bunkers [b]	8.0	11.9	n/a	0.0	0.2	n/a	n/a	n/a
World	76.2	111.0	109.3	-1.2	0.5	0.5	-1.6	0.0

Table 12 data sources: Internal communication from the IEA; IEA WEO2020 Annex Tables, IEA Oil2020 Tables 5 and 5a. OPEC WOO2020, Table 3.2.

Table 12 notes: OPEC regional estimates exclude OPEC member nations. IEA 2019 data are preliminary. Numbers rounded to one decimal point. IEA and OPEC regional classifications differ. IEA oil demand figures that align with OPEC's regional classification system were provided via internal communication. IEA Current Policies Scenario[a]: Biofuels demand from IEA WEO 2020 (provided via internal communication) are added to IEA regional oil demand data for comparability with OPEC estimates. All biofuels data are included in volumetric terms, converted from energy-equivalent terms using a factor of0.7397 (see footnote 7). Bunkers[b]: Global bunkers in the IEA WEO include international marine bunkers and aviation fuels. In the OPEC WOO, all bunkers are included within regional demand.

The difference between the highest (IEA STEPS) and lowest (IEA NZE2050) projections for 2030 world liquids demand is 43 mb/d. This gap would almost certainly be larger in 2040, but liquids demand estimates under the IEA's NZE2050 scenario for 2040 are not available.

The difference between the highest (IEA STEPS) and lowest (IEA SDS) projections for 2040 world liquids demand is 35 mb/d. Last year the difference between the IEA STEPS and lowest IEA SDS projections for 2040 world liquids demand stood at 29 mb/d.

Both differences highlight the growing "gap" between the greenhouse gas emissions goals articulated in the 2015 Paris climate agreement and those likely to occur under current and announced policies.

To bridge this apparent "gap" energy ministers from producer and consumer countries encourage concerted efforts to scale up investment in clean energy technology deployment and research and development. These include net-zero GHG emissions strategies such as the European Unions' Green Deal and the Circular Carbon Economy Platform that the G20 endorsed in September 2020.

Figure 17 also suggests that liquids demand growth will slow considerably in the coming decades. From 2019 through to 2025, the IEA STEPS projects demand to grow by 3.1 mb/d compared with growth of 4.0 mb/d under OPEC's Reference scenario. By 2040, IEA STEPS projects somewhat higher global liquids demand of 111.0 mb/d and OPEC's Reference projecting 109.3 mb/d. Under the IEA's SDS, demand falls by 2.2 mb/d through to 2025, then continues to decline through the projection period. For the IEA's NZE2050, which only includes projections through 2030, demand declines by 36 mb/d through the projection period.

Relative to 2019 levels, global liquids demand in 2040 is 10.3 mb/d higher under the IEA's STEPS and 24.5 mb/d lower under the SDS. Under the NZE2050 scenario, global liquids demand falls 40% below STEPS by 2030. For OPEC's, demand is 9.6 mb/d higher under the Reference case by 2040

Figure 17. World Liquids Demand Projections in Various Scenarios

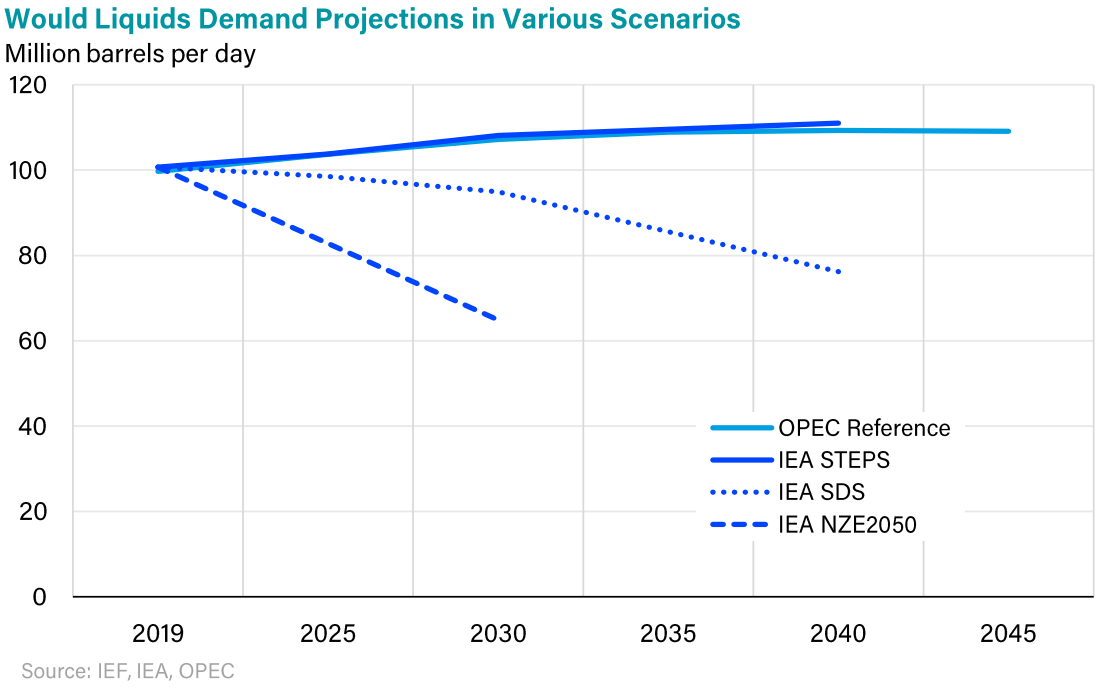
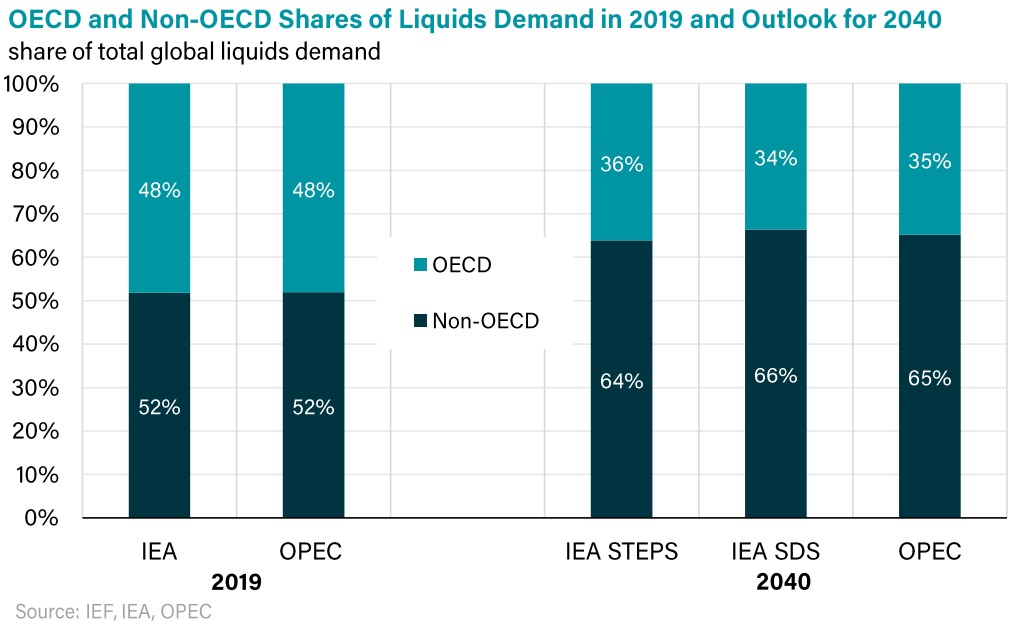


Figure 17 data sources: IEA WEO 2020, Annex Tables, Figure 4.5 for NZE2050; OPEC WOO 2020, Table 3.2.

Projections for the share of liquids demand from aggregate OECD and non-OECD groups are similar across all scenarios. All agree that OECD nations will experience a decline in oil demand in absolute and relative terms, yet this decrease is expected to be more than offset by robust demand growth in non-OECD nations, except for the IEA's SDS. The centre of demand growth continues to shift to developing countries. Non-OECD nations' share of global liquids demand will increase from 52% to between 64% and 66% by 2040 (**Figure 18**). As noted above, the IEA provides bunker fuels data separately from regional demand, while OPEC includes bunkers within each regional grouping.

Figure 18. OECD and Non-OECD Shares of Liquids Demand in 2019 and Outlook for 2040



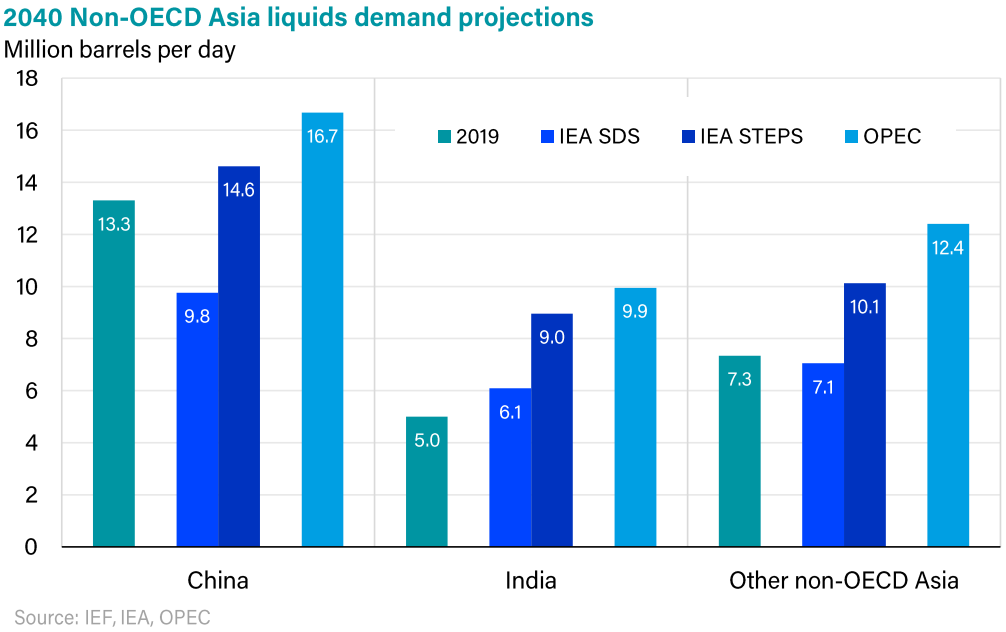
Source: IEF, IEA, OPEC

Figure 18 data sources: IEA WEO 2020, Annex Tables and internal communication; OPEC WOO 2020, Table 3.2.

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 2020 (provided via internal communication) are added to IEA regional oil demand data for comparability with OPEC estimates.

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 non-OECD Asia will lead consumption growth over the forecast period. **Figure 18a** shows projected oil demand for China, India, and other non-OECD Asia in 2040. However, direct comparisons between regions are challenging because OPEC includes bunker fuels within these regional estimates, while the IEA does not.

Figure 18a. Non-OECD Asia oil demand in 2040



Source: IEF, IEA, OPEC

Figure 18a data sources: : IEA WEO 2020, Annex A Tables, with biofuels demand data provided via internal communication; OPEC WOO 2020, Tables 3.2.

Figure 18a note: Regional demand projections from OPEC WOO 2020 include bunker fuels, while the IEA does not.

Perspectives on sectoral trends are broadly consistent between the IEA and OPEC. Transportation and the petrochemicals industry are expected to remain the largest oil consumers and 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 grow.

6.3 Long-term Oil Supply

6.3.1 Mathematical Models

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 and 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), supplemented by regional updates and other sources. 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 growth[9]. In addition, elevated risk levels and market volatility

9 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.

that the COVID-19 crisis brings as well as unanticipated technological advancements and policy shifts substantially affect the economic viability of known resources.

Like the previous years, the WOO2020 includes a detailed assessment of active tight oil plays in the United States (Section 4.5.2), along with analyses of sensitivity cases for US tight oil production (Section 8.4). The WOO2020 also updates its estimates for tight oil supplies outside of the U.S. (Section 4.5.1), estimating growth of 0.4 mb/d from Russia, 0.3 mb/d for Argentina from 2019 to 2045, 0.1 mb/d in additional supplies from Canada, and 0.1 mb/d from all other countries. Each of these estimates are downward revisions from last year's projections.

The IEA employs a bottom-up modelling approach for its long-term oil supply projection. Unlike in the IEA medium-term Oil 2020, however, the IEA largely 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 most countries 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.

However, the IEA in 2016 began estimating U.S. tight oil production on a play-by-play basis, and in the WEO2020 estimates production from 23 plays or sub-plays. In a new development, this year's WEO estimates production using upwardly revised ultimately recoverable resource (URR) estimates from both the US Geological Survey (USGS) and the US Energy Information Administration (US EIA), whereas in previous years, their projections had been based solely on URR estimates from the US EIA. These estimates endogenously incorporate a certain level of learning, which affects production costs over time. The IEA also examines a range of factors that could affect US tight oil supply, with a focus on investment levels, highlighted in Figure 7.5 in the WEO2020.

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 IEA's Oil2020. In the long-term WEO model, however, supplies from OPEC Member Countries are projected using the same methodology used for non-OPEC nations.

6.3.2 Liquids Supply

Direct comparison of liquids supplies between the IEA and OPEC is challenging. As in previous years, OPEC includes biofuels supplies within its regional liquids supply estimates, while the IEA does not. OPEC also publishes region-specific biofuels production data, allowing us to adjust OPEC data to match the IEA's regional liquids supply projections (which exclude biofuels). One additional challenge is that, like last year, OPEC did not publish data on the composition of OPEC supplies (i.e., OPEC crude and OPEC NGLs + unconventionals) in the WOO2020.

Table 13 summarises the available data regarding long-term liquids supply outlooks in the major scenarios. The IEA's STEPS projects 111.0 mb/d in supplies in 2040, compared with 109.5 for OPEC's Reference Case. Under the IEA's SPS, global supplies decline to 76.2 mb/d by 2040. Each of these projections are lower than those made in 2019, reflecting in part updated expectations about global economic growth following the COVID-19 pandemic.

Despite these similar estimates for global supplies under central scenarios, considerable differences emerge regarding regional supplies. Perhaps the most notable difference is between projections for OECD and non-OECD supplies. IEA's STEPS projects supply from OECD Americas to be 3.0 mb/d higher than under OPEC's Reference Case by 2040, and total OECD supplies to be 2.5 mb/d higher than OPEC's projection. An even larger difference emerges from the non-OECD region, where OPEC projects supplies in 2040 to be 4.3 mb/d higher than IEA's STEPS.

Interestingly, these differences are larger than the differences between the two scenarios on OPEC supplies, where OPEC projects supply to be 2.6 mb/d higher than the IEA's STEPS by 2040. Non-OPEC oil supply in 2040 is similar between IEA's STEPS and OPEC, with IEA projecting 0.6 mb/d higher oil supplies. A larger difference emerges in outlook for biofuels, which IEA STEPS projects 6.9 mb/d by 2040, compared to 3.5 mb/d for OPEC. Under the IEA SDS, supplies from all regions are far below either OPEC's or IEA's STEPS projections, though global biofuels supplies are 3.2 mb/d higher under SDS than STEPS.

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

	2040			Growth p.a. (2019-2040)			Difference (IEA-OPEC)	
	IEA SDS	IEA STEPS	OPEC Ref.[a]	IEA SDS	IEA STEPS	OPEC Ref.	IEA SDS	IEA STEPS
Total OECD	**21.6**	**30.0**	**27.5**	**-0.3**	**0.1**	**0.0**	**-0.3**	**0.1**
OECD Americas	19.9	27.3	24.3	-0.2	0.1	0.0	-0.2	0.1
OECD Europe	1.3	1.9	2.8	-0.1	-0.1	0.0	-0.1	0.0
Asia Oceania	0.4	0.7	0.4	0.0	0.0	0.0	0.0	0.0
Total Non-OECD	**42.7**	**71.3**	**75.6**	**-1.1**	**0.2**	**0.5**	**-1.6**	**-0.3**
Non-OECD Asia	3.1	5.0	5.7	-0.2	-0.1	-0.1	-0.1	0.0
Middle East, Africa & Latin America	31.6	52.9	54.4	-0.6	0.4	2.1	-2.7	-1.7
Europe & Eurasia	8.1	13.4	15.5	-0.3	-0.1	0.0	-0.4	-0.1
Processing Gains	1.8	2.8	2.8	0.0	0.0	0.0	-0.1	0.0
World Biofuels	10.0	6.9	3.5	0.3	0.2	0.0	0.3	0.2
Total Non-OPEC [b]	**40.0**	**61.8**	**61.2**	**-0.9**	**0.1**	**-0.3**	**-0.6**	**0.4**
Total OPEC	**24.4**	**39.5**	**41.9**	**-0.5**	**0.2**	**0.4**	**-0.9**	**-0.2**
OPEC crude [c]	18.7	31.7	nd	-0.5	0.1	nd		
OPEC NGLs+unconventionals	5.7	7.8	nd	0.0	0.1	nd		
World Liquids Supply	**76.2**	**111.0**	**109.5**	**-1.4**	**0.3**	**0.23**	**-1.7**	**0.1**

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

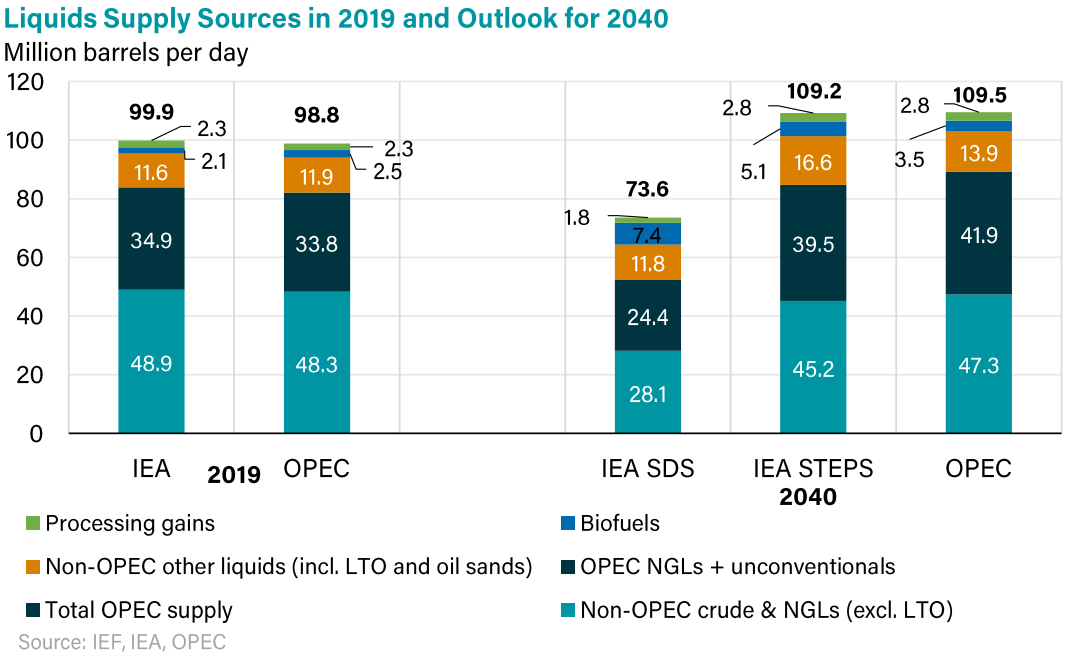
a: Both sources include oil supply plus biofuels demand by region. Neither outlook provides biofuels supply by OECD regional groupings.

b: "OPEC crude" category includes Venezuelan extra heavy oil.

OPEC and the IEA differ in their projections for global unconventional supplies. Despite the effects of the pandemic and uncertainty over finances for US tight oil producers, both organisations project continued growth in US tight crude supplies. Under IEA STEPS, US tight crude production increases from 7.7 mb/d in 2019 to 10.7 mb/d by 2030, before falling to 9.6 mb/d by 2040. Under OPEC's Reference Case, US tight crude drops to 6.9 mb/d in 2020, then recovers to a peak of 10.3 mb/d in the late 2020s, then declining to 8.1 mb/d by 2040. Tight liquids production also grows in Canada, Argentina, and Russia, but the large majority of supplies emerge from the United States, led by the Permian basin region.

Recall from **Figure 10** (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 19** and **Figure 20**, also yields notable points. **Figure 19** shows that central scenarios project increasing liquids supply both from OPEC and non-OPEC sources, with the majority of growth coming from non-crude liquids such as tight oil and unconventionals. **Figure 20** shows OPEC's share of global supply growing under both central scenarios, increasing from 35% to 36% under IEA STEPS, and rising from 34% to 38% under OPEC's Reference Case.

Figure 19. Liquids Supply Sources in 2019 and Outlook for 2040

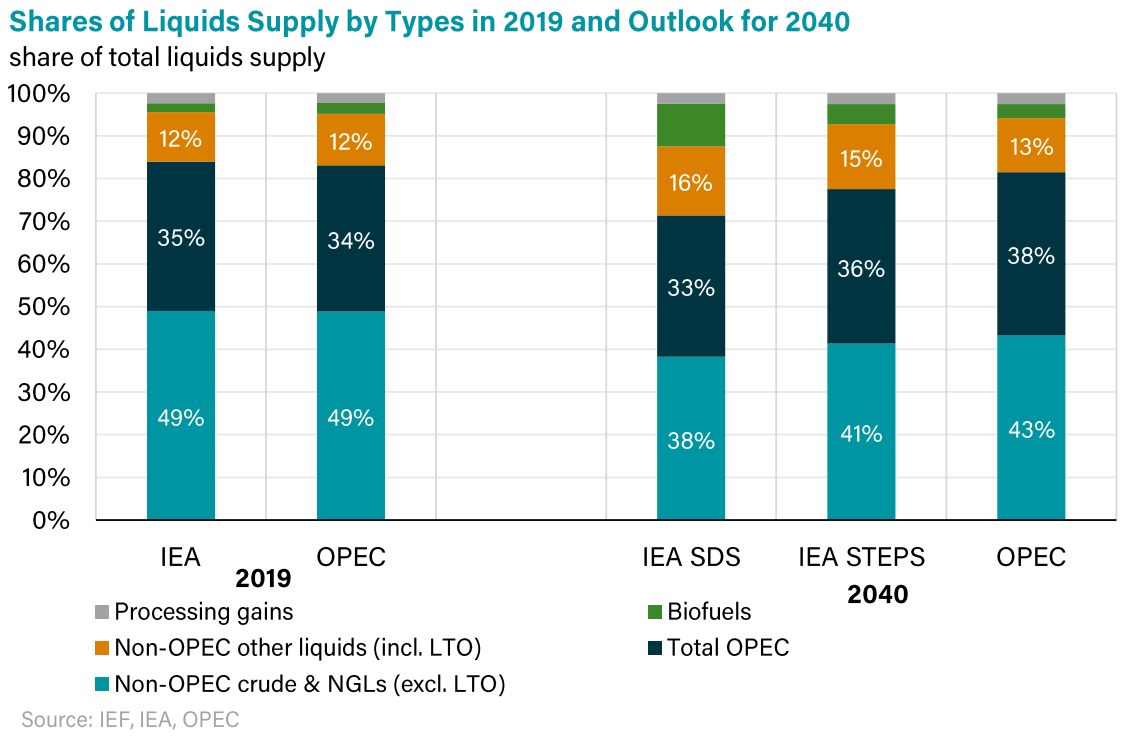


Source: IEF, IEA, OPEC

Figure 19 data sources: IEA WEO2020 Annex Tables for STEPS and internal communities for SDS; OPEC WOO2020, Table 4.2 through 4.18.

Figure 19 note: IEA 2019 data are preliminary.

Figure 20. Shares of Liquids Supply by Types in 2019 and Outlook for 2040



Source: IEF, IEA, OPEC

Figure 20 data sources and notes: See Figure 19. Sums in the data callouts may not total due to rounding. IEA 2019 data are preliminary.

Finally, **Figure 21** presents a comparison of world liquids supply forecasts from the two central scenarios. This figure highlights how dramatically world supply outlooks can be affected by different scenario assumptions. The IEA's SDS demonstrates far lower liquids supplies than any of the other with OPEC and non-OPEC production roughly 38% and 32% lower than the IEA STEPS, respectively.

Figure 21. 2040 Liquids Supply Outlook in Different Scenarios (mb/d)

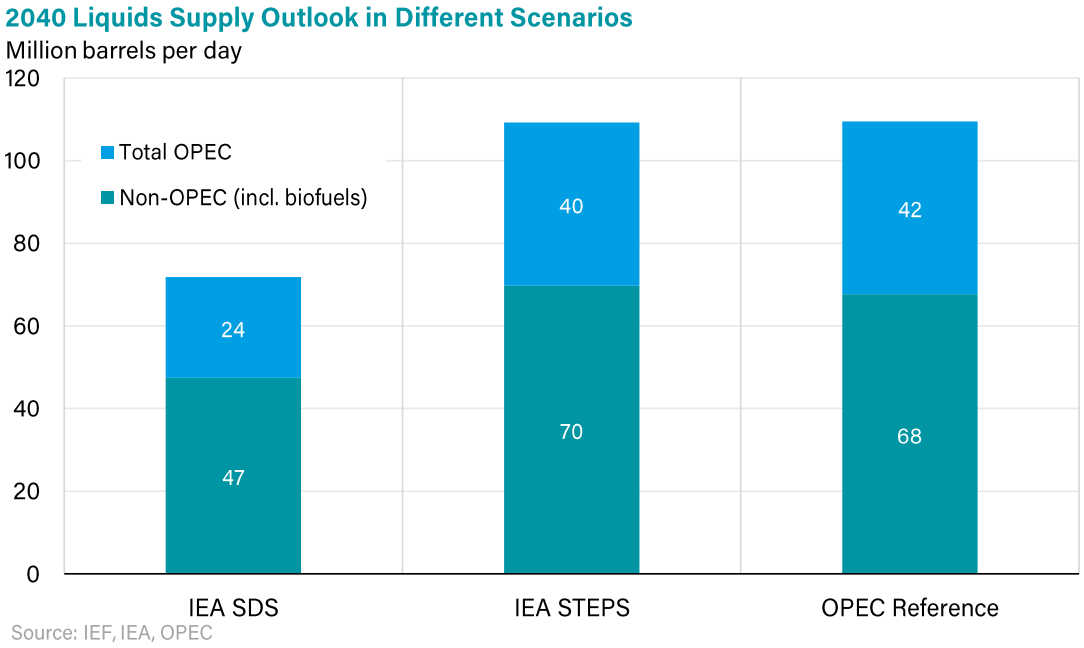


Figure 21 data sources: IEA WEO2020 Annex Tables. OPEC WOO2020 Table 4.3.

Figure 21 notes: OPEC did not publish details on the composition of OPEC supplies (e.g., NGLs and unconventionals) in WOO2020. Processing gains are not included in this figure.

7. Additional context: IEA and OPEC scenarios alongside other outlooks

Although this report focuses on comparing data and projections from the IEA and OPEC, it is also useful to consider how they compare with other organisations that produce long-term energy outlooks. These include energy companies such as BP and Equinor, along with intergovernmental organisations such as the International Renewable Energy Agency (IRENA) and the Gas Exporting Forum (GECF). This section provides a comparison of these outlooks.

7.1 Scenarios

In its Energy Outlook 2020, BP focuses on three scenarios: (i) Business as Usual (BAU), which assumes that technologies, policies, and social preferences evolve similarly to the last decade and that CO2 emissions peak in the 2020s but decline slowly; (ii) Rapid Transition, which includes substantial increases in carbon pricing other sector-specific policies that reduce CO2 emissions by 70% by 2050; and (iii) Net Zero, which—like the IEA's NZE2050 scenario—assumes policy measures that reduce CO2 emissions by more than 95% by 2050.

We focus on two scenarios from IRENA's 2020 Global Renewables Outlook: (i) Planned Energy Scenario, which projects future trends based on policies and announcements as of 2019, including Nationally Determined Contributions on emissions reductions; and (ii) Transforming Energy Scenario, which directs the energy system on a path consistent with the long-term Paris Agreement goals of

keeping global temperature rise "well below 2° Celsius" within this Century.

We also include relevant data from the GECF's Reference Case Scenario (RCS), and Carbon Mitigation Scenario (CMS) of the 2020 edition of the Global Gas Outlook 2050 to complete the comparison. The RCS accounts for existing policies and announced ambitions to reduce emissions and rapidly deploy new technologies such as electric vehicles but assumes that some of these targets will be missed. The CMS focuses on the possibilities greater market penetration of natural gas in partnership with renewables offers to reduce emissions. Under this scenario renewables and natural gas displace coal and oil more rapidly, and the deployment of energy efficiency, residential and commercial electrification, and hydrogen is expanded.

Finally, we include three scenarios from Equinor's Energy Perspectives 2020: (i) Rivalry, which assumes that climate policies are not major priorities for most nations, and that a variety of factors lead to slower economic growth, greater protectionism, and less international cooperation; (ii) Reform, which assumes that global efforts to address climate change strengthen, but that not all long-term targets are achieved; and (iii) Rebalance, which assumes policies that are consistent with the long-term Paris Agreement goals noted above.

7.2 Liquids demand

Figure 22 illustrates how each scenario envisions the evolution of global liquids demand through 2040. As noted above (see **Figure 17**), central scenarios from the IEA and OPEC see liquids growth reaching roughly 110 mboe/d by 2040, with lower levels envisioned in Paris-aligned scenarios. The GECF RCS shows liquid demands reach 111 mboe/d in 2040. Other organisations' and market stakeholders' scenarios, however, show lower liquids demand in 2040. BP's BAU scenario projects 98 mboe/d, IRENA's Planned Energy Scenario and GECF's CMS each project 97 mboe/d, and Equinor's Reform scenario projects 92 mboe/d.

Paris-aligned scenarios from these organisations show further declines, with BP's Rapid Transition and Net Zero scenarios projecting liquids demand of 73 and 57 mboe/d, respectively, in 2040. In IRENA's Transforming Energy Scenario liquids demand declines to 58 mboe/d, and Equinor's Rebalance scenario shows liquid demand to fall to 62 mboe/d by 2040. Equinor's Rivalry scenario stands out with the highest projected liquids demand of 112 mboe/d in 2040.

By 2040, the gap between the highest scenario (Equinor Rivalry) and lowest scenario (BP Net Zero) is roughly 55 mb/d. Note that in **Figure 22**, the grey shaded area represents the range of implied liquids demand from 2020 through 2025, as most outlooks do not provide projections during this period.

As **Figure 23** discussed further below reflects, liquids demand grows by 11% in the GECF RCS, 10% for both IEA STEPS and OPEC Reference Case but falls by 2% under BP's BAU, 3% under IRENA's Planned Energy Scenario, and 8% under Equinor's Reform. Paris-aligned scenarios show global liquids demand falling by 5% under GECF CMS, 26% for the IEA SDS, 27% for BP's Rapid Transition, 38% in Equinor's Rebalance scenario and 42% in IRENA's Transforming Energy Scenario.

Figure 22. Liquids Demand Scenarios Through 2040

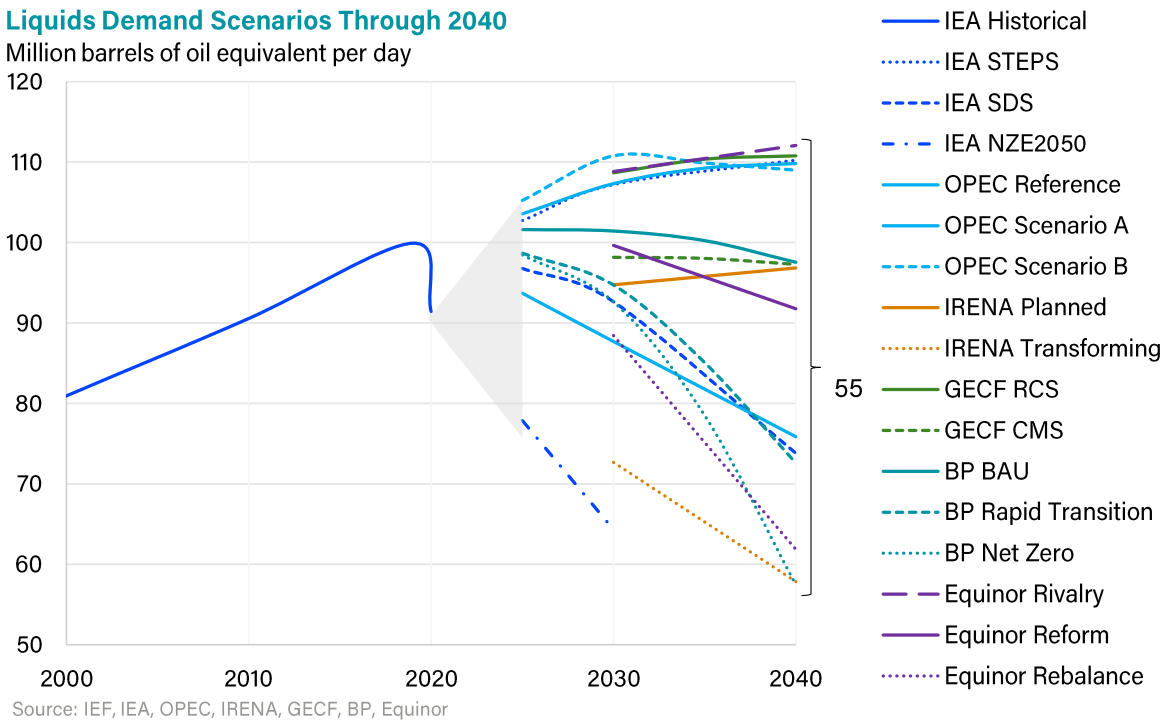


Figure 22 data sources: IEA WEO2020 Annex Tables for STEPS and SDS and Figure 4.5 for NZE2050, OPEC WOO2020 Table 3.2, BP Energy Outlook 2020 Summary Tables, IRENA Global Renewables Outlook 2020 and 2020 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2020 Data Appendix. Because most outlooks do not provide projections from 2020 through 2025, the grey shaded area represents the range of implied liquids demand during this period.

7.3 Primary Energy Mix

Projections for the global primary energy mix also vary between different scenarios from these organisations. In central scenarios, total primary energy growth from 2019 through to 2040 is more in the IEA STEPS (+19%), GECF RCS (18%), or OPEC Reference (+17%) than for IRENA (+14%) and Equinor (+9%). BP's BAU scenario projects growth of 13% through 2040, but this figure is not directly comparable because it excludes non-marketed biomass energy.

With the exemption of the GECF's CMS that shows primary energy demand to grow by 10%, all alternative scenarios project that global energy demand in 2040 will be below 2019 levels, reflecting a major change in the historical relationship between economic growth and energy demand growth.

Under these Paris-aligned scenarios, total primary energy consumption declines considerably through 2040, falling by 6% under IRENA's Transforming Energy scenario and by 8% under Equinor's Rebalance scenario, compared with a 10% reduction under the IEA SDS. BP's two Paris-aligned scenarios also show considerable declines. Total primary energy consumption falls by 6% under the Rapid Transition scenario and by 14% under the Net Zero scenario (these reductions are compared with BP's baseline 2018 data which excludes non-marketed biomass).

Equinor's Rivalry scenario shows primary energy demand growth of 18% through 2040, like the GECF's

RCS (+18) and similar to the IEA's STEPS (+19%) and OPEC's Reference (+17%) scenarios.

In all scenarios other than Equinor's Rivalry, global coal demand falls, ranging from a reduction of 4% under OPEC's Reference Case to a roughly two-thirds decline in the IEA SDS, BP Rapid Transition, and IRENA's Transforming Energy scenarios.

Wide variation is also apparent in different scenarios for natural gas, particularly in Paris-aligned scenarios. Under central scenarios through to 2040, natural gas consumption increases by 29% and 30% for IEA and OPEC respectively, compared with 34% for IRENA's Planned Energy Scenario and GECF Reference Case Scenario, 26% for BP's BAU, and 19% for Equinor's Reform scenario.

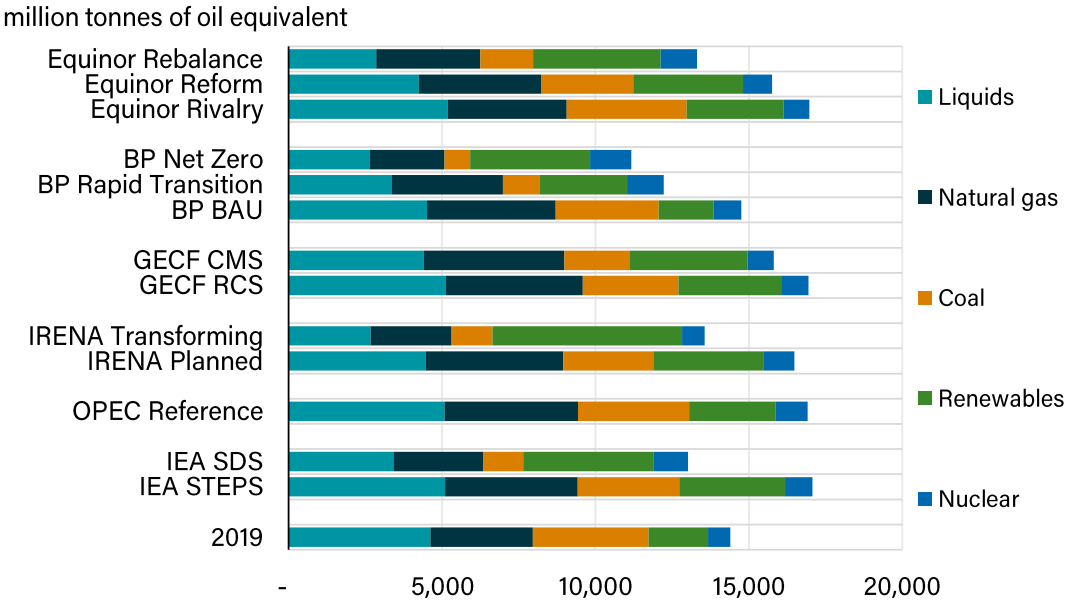
In Paris-aligned scenarios, natural gas use increases by 37% in GECF's CMS, by 9% in BP's Rapid Transition scenario and in Equinor's Rebalance scenario by 1%. However, natural gas use declines considerable in IEA's SDS (-12%), BP's Net Zero scenario (-27%), and IRENA's Transforming Energy Scenario (-21%).

The fastest growing energy source in percentage terms and, in some cases, absolute terms, in these scenarios is renewable energy (including hydropower). Central scenarios show renewable shares grow from 2019 to 2040 by 46% in OPEC's Reference, 72% in GECF RCS, 78% in IEA's STEPS, 86% in IRENA's Planned Energy Scenario, and 84% in Equinor's Reform scenario.

For Paris-aligned scenarios, growth is even more robust. Renewables increase by 219% in IRENA's Transforming Energy 119% in IEA's SDS, 114% in Equinor's Rebalance scenario, and 99% in GECF's CMS. Finally, BP's projections for renewables—which exclude non-marketed biomass—show growth of 179%, 343%, and 509% under the BAU, Rapid Transition, and Net Zero scenarios, respectively.

Nuclear energy adds to the energy mix in all scenarios, with growth from 2019 to 2040 ranging from as low as 1% (IRENA's Transforming Energy scenario) to 85% under BP's Net Zero scenario. IEA STEPS and OPEC Reference project nuclear energy growth of 23% and 42%, respectively. Most Paris-aligned scenarios project more rapid growth, such as 55% for IEA SDS, 65% for BP's Rapid Transition, and 63% for Equinor's Rebalance scenario. Only the GECF shows nuclear growing more rapidly in the RCS than in the CMS by 23% and 17 % respectively.

Figure 23. Primary Energy Demand in 2019 and 2040 Scenarios



Source: IEF, IEA, OPEC, BP, Equinor, IRENA, GECF

Figure 23 data sources: IEA WEO2020 Annex Tables, OPEC WOO2020 Table 2.1, BP Energy Outlook 2020 Summary Tables, IRENA Global Renewables Outlook 2020 and 2020 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2020 Data Appendix.

Figure 23 notes: "Renewables" include hydro, biomass, and other renewables such as wind, solar, and geothermal. BP data excludes non-marketed "traditional" biomass.

7.3 Carbon pricing and emissions

Carbon pricing policies are one of the most powerful and prevalent tools that governments have used to reduce carbon dioxide emissions. These policies can incentivize the development and deployment of new technologies, including energy efficiency, renewable energy, carbon capture, use, and storage (CCUS), hydrogen, and other approaches to reduce emissions.

Under the IEA STEPS, carbon prices rise slowly through 2040, reaching more than $50 per tonne (in 2019 US dollars) in the EU and Republic of Korea, $38 in Canada, $35 in China, $24 in South Africa, and $20 in Chile. By 2040, global carbon dioxide emissions under this scenario are roughly flat. Under the SDS, substantially higher carbon prices of $140 in advanced economies and $125 in select developing economies lead to global CO2 emissions falling by 56% from 2019 through 2040.

IRENA's scenarios do not explicitly reference carbon pricing policies, but they do provide estimates of the cost of emissions reductions. Under the Transforming Energy scenario, IRENA's modelling suggests that reducing emissions 47% below 2019 levels would cost $34 per tonne on average. They also estimate that reaching net zero carbon dioxide emissions by 2060 would cost $100 per tonne, and that reaching zero emissions (i.e., no negative emissions from land use, CCUS, or other technologies) by 2060 would cost $156 per tonne.

GECF's carbon pricing assumptions are not available at the time of this writing for the 2020 outlook.

However, in its 2019 Global Gas Outlook, carbon prices in the EU ETS reach roughly $85 per tonne by 2050 under the RCS and $170 under the CMS. In China, carbon prices are roughly $25 and $50 per tonne under the RCS and CMS, respectively; while prices in Japan and the Republic of Korea respectively grow to roughly $40 and $70 per tonne under the RCS and CMS, respectively. In the United States, carbon prices reach roughly $30 and $40 per tonne by 2050, respectively, under the RCS and CMS.

BP's three scenarios each project declining carbon dioxide emissions and rising carbon prices, with considerable variation across scenarios. In the BAU scenario, carbon prices reach $65 per tonne in developed economies and $35 per tonne in developing economies by 2050, leading to global emissions reductions of just 2% by 2040. Under both the Rapid Transition and Net Zero scenarios, prices rise to $250 and $175 per tonne by 2050 in developed and developing economies, respectively. In Rapid Transition, global emissions fall by 50% by 2040, and by 71% in Net Zero, as additional policies and shifting consumer preferences drive emissions reductions that exceed those achieved under a carbon price alone.

Although Equinor's carbon price assumptions are not stated in its Energy Perspectives 2020, its three scenarios suggest large differences in climate policy and associated carbon prices. In its Rivalry scenario, global emissions grow by 10% from 2018 through 2040, but decline by 9% under the Reform scenario, and by 44% under the Rebalance scenario.

8. Final Remarks

The Covid-19 pandemic has altered daily life and global economic conditions in profound and unexpected ways. As a result, global oil markets experienced one of their most challenging and volatile years in 2020. Demand contracted at historically unprecedented rates during the first half of the year, and recovery has been slow and unevenly distributed around the world. OPEC members, in collaboration with several non-OPEC countries, reacted to these developments by adjusting production to help balance global markets.

Looking ahead to 2021, much remains unknown. Although vaccines to protect against the pandemic have been developed and manufactured at remarkable speed, the pace and scale of vaccine distribution, particularly to the developing world, remains uncertain. Although some nations—notably China—have returned to relatively strong economic growth rates, economic recovery across most of the world remains highly uncertain. These uncertainties are reflected in some of the scenarios produced by the IEA and OPEC, particularly IEA's Delayed Recovery Scenario (DRS).

Over the longer term, considerable uncertainties once again arise. Under central scenarios, both the IEA (STEPS) and OPEC (Reference scenario) project continued growth in demand for liquid fuels, although the rate of growth is slower than observed in previous years. Under these scenarios, OPEC's share of global liquids supplies increases through to 2040, while the share of supplies from non-OPEC nations declines modestly. Production from OECD Americas, led by tight oil from the United States, remains a major source under these scenarios.

However, alternative scenarios such as the IEA's SDS and NZE2050, along with OPEC's Scenario A, envision a world in which demand for all fossil fuels, including oil and other liquids, decline considerably over the next 10 to 20 years. These scenarios, along with other "Paris-aligned" scenarios produced by

organizations such as BP, IRENA, and Equinor, project that global energy demand in 2040 will be below 2019 levels, reflecting a major change in the historical relationship between economic growth and energy demand growth. These scenarios assume rapid growth of renewables, energy efficiency, nuclear, electric vehicles, carbon capture and storage, and other technologies, which entail numerous technological, political, and socioeconomic challenges.

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 insight and control for differences in convention in order to better inform stakeholders worldwide.

As a continuous effort, the Eleventh 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:

- Advancing efforts to standardise regional classifications across long-term outlooks;
- Advancing efforts to increase comparability of medium- and long-term oil price assumptions;
- Advancing efforts to increase comparability and transparency of liquids supplies, particularly concerning biofuels and the composition of OPEC liquids supplies;
- Ongoing analysis of differences in historical data, particularly in non-OECD demand, as well as Russian, Eurasian, and OPEC liquids supply;
- 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**	**STEPS**	**SDS**
Global Economic Growth Rate	2.9% (2019-2045)	3.0% (2019-2040)	Same as STEPS
Population, Billions	2019: 7.7; 2040: 9.2	2019: 7.7; 2040: 9.2	Same as STEPS
Oil Price Assumptions (2040 in 2019$)	Not specified	$85/bbl	$53/bbl
Average annual oil and gas investment (in billions, 2019$)	(2019-2045, oil only) Upstream: $379 Transport: $47 Downstream: $57	(2020-2040, oil and gas) Upstream: $625 Transport: $179 Downstream: $41	(2020-2040, oil and gas) Upstream: $427 Transport: $127 Downstream: $24
Energy and Environmental Policies	Takes into account enacted policies in most countries and announced targets. However, not all announced targets are incorporated.	Considers both policies in place and announced intentions.	Universal energy access by 2030; fully aligned with Paris Agreement's climate targets; dramatically reduces air pollution from energy.
Carbon prices (per tonne in 2019$)	Not specified	2040: $38 in Canada; $20 in Chile; $35 in China; $52 in EU; $52 in Korea; $24 in S. Africa	2040: $140 in Advanced Economies; $125 in select developing economies

Annex 2: Long-term Outlook Results

	OPEC		IEA		
				2040	
	2019	2040 Reference Case	2019	Stated Policies	Sustainable Development
Global energy demand (mboe/d)[a]	289.1	352.3	291.0	3.0% (2019-2040)	Same as STEPS
Global Liquids Demand (mb/d)	99.7	109.3	100.0	2019: 7.7; 2040: 9.2	Same as STEPS
Non-OPEC Supply (mb/d) [b]	65	67.6	64.9	$85/bbl	$53/bbl
Total OPEC Supply (mb/d)[c]	33.8	41.9	34.9	(2020-2040, oil and gas) Upstream: $625 Transport: $179 Downstream: $41	(2020-2040, oil and gas) Upstream: $427 Transport: $127 Downstream: $24
OPEC Crude (mb/d)[d]	-	-	28.9	Considers both policies in place and announced intentions.	Universal energy access by 2030; fully aligned with Paris Agreement's climate targets; dramatically reduces air pollution from energy.
OPEC NGLs and Other Liquids (mb/d)	-	-	6.0	2040: $38 in Canada; $20 in Chile; $35 in China; $52 in EU; $52 in Korea; $24 in S. Africa	2040: $140 in Advanced Economies; $125 in select developing economies

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] Includes biofuels and processing gains. [c] OPEC did not publish the composition of OPEC liquids supply (e.g., crude, NGLs, other unconventionals) in WOO2020.

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