Short-Term Energy Outlook Liquid Fuels Supply Forecasts

The U.S. Energy Information Administration (EIA), the statistical and analytical agency within the
U.S. Department of Energy (DOE), prepared this report. By law, our data, analyses, and forecasts are
independent of approval by any other officer or employee of the U.S. Government. The views in this
report do not represent those of DOE or any other federal agencies.

Table of Contents

1. Introduction

In the *Short-Term Energy Outlook* (STEO), our forecast for international (excluding United States) monthly liquid fuels supply is a component of the Global Short-Term Oil Model (GSTOM). Our data published in the *International Energy Statistics* (IES) database provide the underlying historical baseline for the STEO supply forecast in the GSTOM for each country and liquid fuels stream.

Our forecasts include all OPEC and non-OPEC liquid fuels producers. Our forecasting methodologies among countries vary; Sections 3 and 4 outline the methodologies in detail. We forecast the crude oil, condensate, hydrocarbon gas liquids (HGL), biofuels, coal-to-liquids (CTL), and gas-to-liquids (GTL) supply of each non-OPEC country as appropriate, subject to data availability. For non-OPEC oil producers, we publish a forecast for total liquid fuels of each country as appropriate, and for OPEC oil producers, we only publish a forecast of the group's total crude oil production and total production of non-crude oil liquid fuels.

Some countries supply small volumes of petroleum or other liquid fuels that we do not explicitly forecast using the methods described in this report. For these countries, we use econometric equations to forecast existing historical production trends into the future. These methods are most often employed for HGL, CTL, GTL, and biofuels streams. For larger volumes (over 25,000 barrels per day), we validate forecast output with forecasts from trade press, company announcements, and Global Agricultural Information Network (GAIN) reports from the U.S. Department of Agriculture's (USDA) Foreign Agricultural Service.

Section 6 describes our assessment of crude oil and other liquid fuels disruptions and how we adjust the liquid fuels forecast for these disruptions.

2. Terminology

In STEO, we reference different streams of liquid fuels, including:

- *Crude oil* (excluding lease condensate): A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. This measurement of crude oil excludes certain hydrocarbons such as lease condensate and natural gasoline that are recovered as liquid fuels from natural gas wells in lease or field separation facilities and are later mixed into the crude oil stream. Depending on the characteristics of the stream, crude oil may also include:

    - Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casinghead) gas in lease separators. These hydrocarbons are subsequently comingled with the crude oil stream without being separately measured.

    - Small amounts of hydrocarbons produced with the oil, such as sulfur and various metals

- *Condensate*: Light liquid hydrocarbons recovered from lease separators or field facilities at associated and non-associated[1] natural gas wells. Condensate is mostly pentanes and heavier hydrocarbons, and it normally enters the crude oil stream after production.

- *Hydrocarbon gas liquids*: A group of hydrocarbons including ethane, propane, normal butane, isobutane, and natural gasoline, and their associated olefins, including ethylene, propylene, butylene, and isobutylene. As marketed products, HGL represents all natural gas liquids (NGL) and olefins. We report production of HGL from refineries (liquefied refinery gas, or LRG) and natural gas plants (natural gas plant liquids, or NGPL). This category excludes liquefied natural gas (LNG).

- *Total liquids or total liquid fuels.* Includes crude oil, condensate, natural gas liquids, biofuels, coal-to-liquids, gas-to-liquids, and refinery processing gain.

3. Sources

Where available, STEO uses historical liquid fuels data from our IES database. For total liquid fuels production, the most recent historical data point in the IES database is lagged by three months. The IES database presents crude oil and condensate production together as one line item, which makes STEO the only EIA publication where OPEC crude oil production is broken out separately. For the three months between the last IES historical data point and the beginning of the forecast, STEO uses a range of data sources along with forecasting to generate data.

Unlike the data series we forecast in the U.S. Short-Term Energy Model (USSTEM), which are almost entirely generated using econometric equations, the output of GSTOM is mainly based on analysts' assessment of decline rates, investments, and oil project developments. We rely on the sources listed in Appendix A to help generate these assessments and forecasts.

4. Non-OPEC Liquid Fuels Supply

In general, the methodology we use to forecast oil production is fairly consistent across non-OPEC producers. For crude oil, condensate, and HGLs, we assess the productivity of the associated resources based on historical data and trend analysis via regression or analyst judgement to estimate production from existing projects. In addition, we regularly track new projects or investments for expanded production growth at existing projects, and we assess them for inclusion in our production forecast. Our assessments of the timing and volumes of these projects come from the sources listed in Appendix A, and we develop our own assessment of associated initial production rates for these projects. We base these assessments on variables such as geopolitical factors, oil market trends, capital investment, and insight from industry trade press and company quarterly reporting. Although generally consistent, how we forecast non-OPEC liquid fuels varies by region.

---

[1] Associated natural gas is natural gas obtained from wells that primarily produce crude oil. Non-associated natural gas is natural gas obtained from wells that primarily produce natural gas (as opposed to crude oil).

Our biofuels forecast largely relies on historical data from GAIN reports from the USDA's Foreign Agricultural Service, which are adjusted based on market assessments and analyst judgement in the STEO forecast period for each country. We derive these assessments by tracking historical market trends, analyzing biofuels trade data, and tracking related government policies. Biofuels production forecasts are largely driven and derived from existing production capacity available to meet government biofuel policy targets.

We base our forecast for coal-to-liquids (CTL) and gas-to-liquids (GTL) on historical data and an accounting of all new plants coming online during the forecast period. We also reflect government policies in our forecast because these policies can significantly affect CTL and GTL totals; for example, we track the Chinese government's expansive and frequently changing policy, plans, and announcements related to CTL and GTL. In general, our refinery processing gain forecast is a simple regression based on historical data for the relationship between refinery inputs and refinery production, which represents refinery gain. We adjust the regression-based output for any expected refinery capacity additions not captured by the model.

Table 1 presents a summary of the fuels and data included in the international STEO supply forecast by region and country.

Table 1. Summary of fuels and data in the *Short-Term Energy Outlook*'s international supply forecast

	Crude oil (including condensate)	Crude oil only	Condensate	HGL	Biofuels	CTL and GTL	Select individual fields	Total liquid fuels only	Known or estimated planned maintenance	Ramp-up, plateau, and decline rates
Europe and FSU										
Norway		X	X	X			X		X	X
United Kingdom		X	X	X			X		X	X
Denmark	X							X	X	X
Russia	X								X	X
Azerbaijan		X	X						X	X
Kazakhstan		X	X						X	X
Americas										
Argentina		X	X		X				X	X
Bolivia								X		X
Brazil		X	X		X				X	X
Chile								X		X
Peru								X		X
Trinidad and Tobago		X	X			X				X
Colombia					X				X	X
Cuba					X					X
Suriname		X								X

	Crude oil (including condensate)	Crude oil only	Condensate	HGL	Biofuels	CTL and GTL	Select individual fields	Total liquid fuels only	Known or estimated planned maintenance	Ramp-up, plateau, and decline rates
Barbados		X			X					X
Belize		X								X
Guatemala		X			X					X
Guyana		X								X
Mexico					X				X	X
Canada		X	X	X	X		X		X	X
Asia										
China	X			X		X	X		X	X
India	X			X			X		X	X
Australia		X	X	X	X		X		X	X
Brunei	X			X	X				X	X
Indonesia	X			X	X	X	X		X	X
Malaysia	X			X	X		X		X	X
Pakistan	X			X					X	X
Thailand	X			X	X				X	X
Vietnam	X			X	X		X		X	X
Africa and Middle East										
Qatar		X	X	X					X	X
Egypt								X		X
Tunisia								X		X
Oman								X		X
Sudan and South Sudan	X						X		X	X
Cameroon	X								X	X
Chad	X								X	X
Niger	X								X	X
Uganda	X								X	X
Cote d'Ivoire	X								X	X

Data source: U.S. Energy Information Administration
Note: FSU = Former Soviet Union, HGL = hydrocarbon gas liquids, CTL = coal-to-liquids, and GTL = gas-to-liquids.

North America

We base our Canada oil sands forecast on aggregate capacity of individual oil sands projects and planned greenfield or capacity expansions. We apply a growth rate to each of these oil sands projects, and this growth rate comes from estimated regressions based on recent official government statistics or company calculations or estimates. We do not apply a decline rate for oil sands production because oil sands production, once started, remains relatively stable. The forecast reflects the closure of bitumen mining operations (when they are announced) because these mining operations directly affect the oil

sands production. The forecast also reflects planned maintenance, either based on announced plans or historical spring and fall turnaround seasons.

Europe and Eurasia

We track and forecast crude oil supply (including condensate) for select companies and subsidiaries to generate a liquid fuels outlook for Russia. We assume growth or decline rates for each company or subsidiary based on past performance and announced new projects. We derive these rates from STEO analyst judgement and estimated trends derived from recent government, company, and third-party data sources. We adjust the company and subsidiary-based forecast for planned maintenance, which we estimate based on historical patterns in the absence of company-announced scheduled maintenance. In addition to planned maintenance, we adjust the modeled forecast based on our assessment of Russia's compliance with OPEC+ output targets in coordination with other participating countries. More recently, our forecast reflects sanctions and import bans imposed on Russia's exports following its full-scale invasion of Ukraine.

Asia and Oceania

The China National Offshore Oil Corporation (CNOOC), China's offshore oil producer, reports historical data and expectations of production for the next year, and we use those reports to forecast annual growth for China's offshore fields in the Bohai Bay and South China Sea. For China's older fields, we apply an annual growth or decline rate for each field, and we base these rates on historical trends and announced plans by the government and the national oil companies. We also apply average seasonal factors to account for typical maintenance and monthly differences in production.

Our CTL production forecast for China reflects recent market trends in line with levels targeted in government policy, and we base it on an adjustment to historical data for new plants that are scheduled to begin operations. Our methanol-to-liquids forecasts come from an Argus-led study, commissioned by EIA, and we incorporate data on methanol that was converted to gasoline, diesel, and liquefied petroleum gas into the total forecast methanol volume.

We adjust Malaysia's and Brunei's oil and liquid fuels production from official government statistics for the OPEC+ production targets.

Middle East and North Africa

We forecast only crude oil supply for Sudan and South Sudan because we assume that these two countries only produce crude oil. We adjust the historical data for new field production (based on industry and trade press reports and market research) that will come online in the forecast period and a decline rate extrapolated from recent production trend data for aggregate production. In addition, we adjust the forecast to reflect reported and planned maintenance.

5. OPEC Liquid Fuels Supply

Middle East and North Africa

Our estimates of crude oil production and forecasts for the countries in the Middle East and North Africa rely on a variety of sources because accurate, current field-level production information for most of the

countries is not available on a regular basis. We also lack reliable government-reported historical statistics for our forecast.

To estimate the historical crude oil production (excluding condensates) for Algeria, Libya, Iran, Iraq, Kuwait, Saudi Arabia, and the United Arab Emirates, we account for all outlets for this crude oil, including exports, storage, direct use, and volumes sent to domestic refineries. We use data from a number of commercial data providers and energy consulting firms to estimate each of these volumes. For example, data from tanker tracking services account for the net volumes of crude oil that are exported.

We base our forecasts for Algeria, Libya, Iran, Iraq, Kuwait, Saudi Arabia, and the United Arab Emirates on estimates of forecast effective capacity levels, production disruptions in these countries, the countries' production targets, and factors that could affect compliance with these targets. These factors could include internal revenue needs that may drive up production despite the OPEC+ agreement, as well as the countries' ability and willingness to decrease production. In addition, our forecast reflects risk factors when appropriate.

We base our estimates of current and forecast production capacities on data from a variety of sources, including energy consultancies, trade press, and industry analysts. Our production estimates and forecasts, along with our disruptions estimates, reflect OPEC+ production targets. However, we derive our estimates and forecasts independently by expert judgment. We base our judgment on likely compliance with OPEC+ targets mainly on our assessment of and forecast of global oil market balances.

Sub-Saharan Africa

We estimate historical and forecast data for total liquid fuels production in Angola, Congo, Equatorial Guinea, Gabon, and Nigeria. We base historical data on third-party market research, refinery run estimates, crude oil tanker liftings data, and analyst judgment. We estimate an implied production for crude oil, condensates, and HGLs. We also use available government data when estimating historical production.

We base our forecast on the historical estimates (which we adjust for new field development), modeled ramp-up phases based on STEO analyst judgement and historical trends, and plateau phases for crude oil production at fields that are individually modeled. We aggregate the forecasts for fields that are not individually modeled and add the forecasts for these fields to generate a total crude oil forecast. We also apply a decline rate to aggregate crude oil production that we periodically adjust as new data become available. When appropriate, we adjust the production data for disruptions and planned maintenance.

Crude oil production and forecasts for Nigeria do not include volumes from the Akpo and Agbami streams because we include these volumes in the condensate totals. As a result, our total production estimate and forecast may differ from other sources.

South America

We estimate Venezuela's historical monthly crude oil production based on industry and trade press reports, tanker tracking data, and analyst judgment. The historical data serve as a basis for our forecast.

We derive the production forecast by applying a decline rate extrapolated from historical production trends and the most recent production estimate, and we adjust for any other factors that affect output, including outages at production or export facilities, sanctions, electric power shortages, or lack of human resources.

Non-crude oil liquid fuels

We base our estimates of condensates, natural gas liquids, refinery gains, and other liquid fuels production on information and data from a number of sources, including energy consultancies, trade press, and the International Energy Agency. We forecast production of OPEC non-crude oil liquid fuels, which tend to be associated with the production and consumption of crude oil, by adjusting current production of these liquid fuels to reflect changes in the forecast production and consumption of crude oil in the STEO. Natural gas liquids forecasts are based on our assessment of each country's natural gas production, which we derive from third-party sources (Appendix A).

6. Disruptions

We define disruptions as unplanned production outages. For OPEC producers, we only track estimated outages for crude oil. For non-OPEC producers, we track outages for all liquid fuels, including crude oil. These estimates exclude planned maintenance as well as production cuts made as part of OPEC+ production agreements.

We calculate disruptions as the difference between estimated effective production capacity (production that could be reached within one year) and estimated production. These outage estimates can differ from those measured against other capacity types, such as nameplate capacity (the capacity that was originally installed, but may no longer be attainable) or production before the disruption.

We exclude the OPEC+ production cuts from the disruption calculation, and we consider the difference between effective capacity and production resulting from those OPEC+ cuts as surplus production capacity. However, when actual disruptions occur in countries that are actively participating in the OPEC+ agreement, we estimate the effects of these disruptions by taking the difference between the most recent (pre-disruption) production and the current production.

We do not publish a disruptions forecast in the STEO. However, our liquid fuels supply forecast reflects an assumption that ongoing disruptions will continue unless otherwise verified.

Appendix A: Third-Party Data Sources

- Agency for Strategic planning and reforms of the Republic of Kazakhstan, Bureau of National statistics, Publications, Monthly editions, Socio-Economic Development of the Republic of Kazakhstan, Industrial production statistics
- Argentina: Ministry of Economy
- Argus News Service

- Australia's Department of Industry, Science, Energy and Resources, Australian Petroleum Statistics reports
- BP Azerbaijan, Business update
- BP's Statistical Review of World Energy
- Brazil National Agency for Petroleum, Natural Gas and Biofuels (ANP)
- Cameroon's SNH, National Hydrocarbons Corporation
- Canada Energy Regulator (CER)
- Central Bank of Malaysia, Monthly Highlights and Statistics
- China's National Bureau of Statistics (NBS), Energy Section
- Clipperdata, Inc
- CNOOC, Results and Presentations Section
- Colombia National Agency of Hydrocarbons (ANH)
- Danish Energy Agency, Monthly energy statistics, Oil supply
- Ecuador Central Bank
- Egypt's Petroleum and Mineral Wealth Ministry
- Energy Intelligence
- FACTS Global Energy Services
- Fitch Ratings Industry Reports
- General Statistics Office of Viet Nam
- Ghana's Ministry of Finance
- Global Trade Tracker
- Guyana Department of Energy
- IHS Markit
- India's Ministry of Petroleum and Natural Gas, monthly production report
- International Energy Agency, Oil Monthly Report
- IPD Latin America
- Joint Organization Data Initiative (JODI)
- Mexico National Hydrocarbons Commission (CNH)
- Middle East Economic Survey (MEES)
- Ministry of Energy of Russian Federation, Statistics, Crude Oil, Production (including gas condensate)
- Newsbase
- Nigeria's NNPC, DPR
- Norwegian Petroleum Directorate (NPD), Fact Pages, Saleable Production, Monthly—by field
- Norwegian Petroleum Directorate (NPD), Production figures
- Oman's Ministry of Energy and Minerals
- Oxford Economics Industry Reports, Country Briefings
- Peru: Ministry of Energy and Mines
- Petroleos Mexicanos, S.A. (PEMEX)
- Reuters
- Rystad Energy
- S&P Platts Global Oil Service
- State Bank of Pakistan, Statistical Bulletin

- Statistics Canada (StatCan)
- Statistics Tunisia
- Thailand's Ministry of Energy's Energy Policy and Planning Office
- The Ministry of Energy of the Republic of Azerbaijan, News
- Trinidad and Tobago: Ministry of Energy and Energy Industries
- Tullow (Ghana)
- United Kingdom, Department for Business, Energy & Industrial Strategy (BEIS), Energy Trends, National Statistics, Energy Trends: UK oil and oil products, indigenous production, refinery receipts, imports and exports (ET 3.10 - monthly)
- United Kingdom, Oil and Gas Authority Open Data, PPRS Spatial Dashboard, Field Production Data
- USDA Global Agricultural Information Network (GAIN)
- Vitol (Ghana)
- Yacimientos Petrolíferos Fiscales Bolivianos (YPFB)