

Annual report | 21 Jan 2020

Long-term energy market outlook

The Long-term energy market outlook contains our forecasts on how the international energy market will develop through 2040. We analyse how key contributing sectors will evolve over the next two decades, and provide region- and fuel type-specific breakdowns on the ways in which market fundamentals will change during this period. We also deliver a comprehensive analysis of how the oil, gas, coal, renewables and nuclear markets will evolve over the coming decades based on current trends and likely future policy decisions.

Now in its second year, the Long-term service has evolved to include country-by-country demand data through 2040. The report also features much more detail on natural gas, a thorough outline of developments in oil refining, a deep dive into the future of the petrochemical industry and coverage of the cross-commodity hydrogen market.

The data included with this year's Long-term service cover both supply and demand for all energy sources and oil products, on a country-by-country basis; price forecast for crude, oil products and natural gas; as well as annual vehicle fleet forecasts, refining, economic and population data. The service now also includes electricity generation mix by country and hydrogen demand

Drawing from our comprehensive datasets, the Long-term outlook delivers in-depth analyses and data-driven forecasts to 2040 that will help drive trading opportunities, corporate strategy and investment decisions.



Analysis

Data

Consultancy

Events

LEADING ANALYSIS

Over the next two decades, the global energy market will face some of the most comprehensive challenges it has ever endured. Regulations and market drivers to push countries toward more carbon-neutral energy approaches will transform the way producers develop and deliver energy commodities by 2040.

An estimated 140 million people per year will join the global middle class through 2040 (compared with roughly 100 million per year seen since 2000), which will trigger a dramatic evolution in energy demand. The overwhelming majority of these gains will take place in Asia, Africa and the Middle East (which will more than offset structural declines expected in Europe and North America), and infrastructure in these regions will have to develop accordingly.

As the world increasingly switches to electricity-based modes of power supply (notably in road transportation, agriculture, buildings and industry), global demand for primary energy—oil, coal, natural gas, renewables and nuclear—will evolve correspondingly.

Energy suppliers and producers are also becoming increasingly aware of the need to ‘go green’ as companies strive to improve their environmental, social and governance (ESG) ratings.

The 2020 edition of the Long-term energy market outlook contains detailed supply, demand and price forecasts for each primary energy source (oil, gas, renewables, nuclear and coal) coupled with an in-depth analysis of both the power sector and hydrogen. A country-by-country, sector-by-sector and year-by-year analysis gives a comprehensive overview out to 2040.

Key highlights from the Long-term outlook include:

- The energy transition will build through 2040 from both a fuel and regional perspective. Energy use will remain interlinked with both population and economic growth, but the energy mix’s composition will evolve as low-carbon alternatives generally become cheaper through 2040.
- We forecast strong but decelerating global economic growth through 2040, averaging 3.1% over the forecast period, and this momentum underpins our forecasts of generally rising energy demand.
- The world’s population is set to top 9 billion by 2040 (Asia will reach 5 billion inhabitants, China 1.4 billion and Africa 2 billion).
- The global population of middle-class individuals (those with daily incomes of between \$10 and \$100) is set to expand by 140 million people each year, which will greatly stimulate energy demand.
- Underpinned by these macroeconomic and demographic assumptions, global primary energy use will expand by 4.5 btoe between 2018 and 2040, an average gain of 1.3% each year. Renewable energy will dominate this growth, both in absolute and percentage terms, as we see renewable energy demand expanding by 2.3 btoe between 2018 and 2040 (3.8% per annum).
- The power sector will dominate global primary energy demand growth, adding 2.4 btoe over 2018–2040 and underpinning most of the strong gains we project for both renewables and natural gas.
- The Long-term outlook for oil will flip from a liquids surplus over 2020–2022 to small net deficits through most of the rest of the 2020s, a legacy of years of underinvestment in upstream projects.
- Our refining analysis shows that if all upcoming refinery projects that we designate as ‘likely’ were to enter service on time, crude demand will exceed conventional crude supply by nearly 17 mb/d in 2023.
- Oil prices will plateau in the late 2020s as the refining mismatch eases and as oil demand growth slows. It will then decline through the 2030s as demand progressively weakens after peaking in the mid-2030s.
- Global oil products demand will grow by approximately 10 mb/d over 2018–2040, an average gain of 0.4% each year, with demand peaking in the mid-2030s. The petrochemicals and aviation sectors will respectively contribute 7.1 mb/d and 3.0 mb/d of oil demand growth over 2018–2040, whereas road transport will grow through the early 2030s but start declining thereafter.

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- Emerging markets will dominate oil demand growth, while structural declines will hit North American and European demand over 2018–2040.
 - Electric vehicles will increasingly curb the pace of crude oil demand growth in our forecast, albeit to a lesser degree than curbs from ‘normal’ vehicle efficiency gains. By 2040, electric vehicles will remove an additional 8.3 mb/d of oil demand over levels we expect to result from normal efficiency gains.
 - Long-term oil supply forecasts show that conventional supplies, which continue to make up the lion’s share of global oil production, will decline by an average of 2% per year.
 - To replace conventional declines of 15 mb/d over 2025–2040, the industry must develop more than 500 billion barrels of ‘yet-to-be-found’ resources.
 - OPEC’s liquids supply is forecast to rise by 6 mb/d between 2025 and 2040.
 - The global natural gas market will continue to grow, especially in Asia, but there are headwinds to its long-term viability.
 - We project global gas production to see a CAGR of 1.7% through 2040.
 - Global final energy demand will increasingly shift toward electricity by 2040, and we forecast global electricity use to expand by 2.5% on average each year.
 - Low-carbon energy sources—including nuclear, biomass, wind, solar and hydro—will rapidly expand through our forecast period.
 - Coal consumption in power will peak in 2030 and then fall as China and India will increasingly rely on renewable and nuclear energy thereafter.

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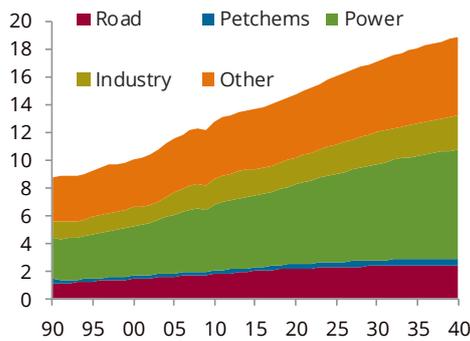
Sample pages from report

In our long-term timeframe, **Latin American** economies will generally experience economic growth (averaging 2.3% per year through 2040) that is below the global average due to a lack of structural reforms. Our long-term models show most **Middle Eastern** economies resuming their relatively strong growth prospects after 2025 due to the prospect of higher hydrocarbon prices (see **Oil**) and increased diversification.

Primary energy demand by sector

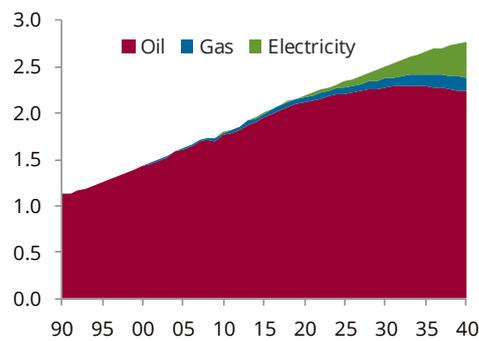
The power sector dominates primary energy demand growth through the long-term forecast—contributing 54% of the total gain between 2018–40 or 2.4 btoe—growth which underpins most of the strong gains we project for both renewables (see **Electricity**) and natural gas (see **Gas**). Other significant growth contributors include transportation—road (adding a net 0.26 btoe between 2018–40), marine (+0.07 btoe) and aviation (+0.15 btoe)—industry (+0.5 btoe), petrochemicals (+0.4 btoe) and the buildings sector (+0.4 btoe, combining residential and services/commercial building use).

Fig 19: Primary energy demand by sector, btoe



Source: IEA, Energy Aspects

Fig 20: Road transport demand, btoe



Source: IEA, Energy Aspects

Our models show the total contribution to global primary energy demand growth from road transport at approximately 0.26 btoe between 2018–40 (an average gain of 0.5% each year), an increase that has been curbed since the **last incarnation of this report** (+0.38 btoe) on both higher EV assumptions and presumed vehicle efficiency gains. While our road transportation model previously showed that the global EV penetration for PLDV sales would rise to 38% by 2040, we now see a higher near-50% 2040 estimate. This rise in future EV sales—a consequence of a ratcheting up in efforts to achieve carbon neutrality in the EU by 2050 and in California by 2045—along with more stringent vehicle efficiency standards essentially trims 0.12 btoe from our road transportation primary energy demand forecast for 2040. It should be noted that this is not energy lost but rather energy captured elsewhere, as the electricity component of road transport demand (which is not directly part of primary energy demand) is captured indirectly through its impact on the power sector (see **Electricity**).

Relatively subdued road transport growth attributable to sharp uptick in EV sales

It should be noted that this is not energy lost but rather energy captured elsewhere, as the electricity component of road transport demand (which is not directly part of primary energy demand) is captured indirectly through its impact on the power sector (see **Electricity**).

Road transport

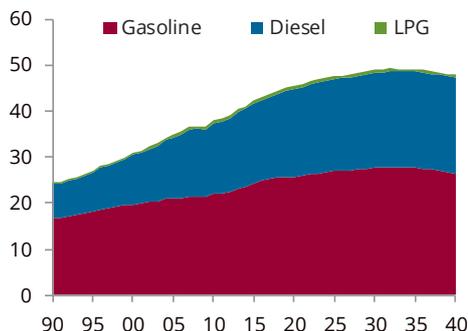
The road transport sector accounted for roughly 45% of global oil product demand in 2018, or around 45 mb/d worldwide. Gasoline took the prevailing market share, at 57% of road oil use in 2018, due to its status as the primary fuel of choice for both passenger light duty vehicles (PLDVs; particularly in China and the US) and two-wheelers. Diesel accounted for 41% of road oil demand in 2018, with this being the principal fuel choice for buses and commercial vehicles (CVs). The negligible remaining market share was attributable to LPG (concentrated in South Korea, Turkey, Poland, Italy and Mexico) in 2018.

Our road transport model shows a further gain in total road oil use of approximately 3.3 mb/d between 2018 and 2040, equivalent to an anaemic average expansion of 0.3% each year as road transport oil demand will peak in the early 2030s. Oil

Despite peaking in early 2030s, road adds 3.3 mb/d to oil demand, 2018–2040

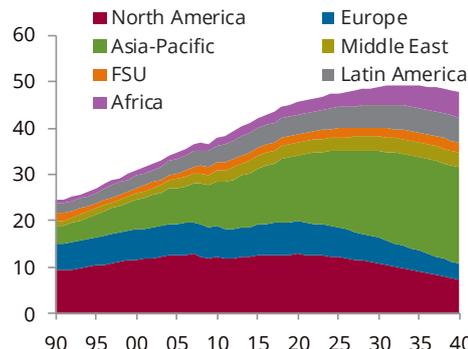
demand from the road transport sector will continue edging higher through until the early 2030s as the oil-specific fleet of internal combustion engine (ICE) PLDVs continues to expand through 2034 (before falling thereafter), with the oil-specific ICE PLDV fleet increasing by 122 million units between 2018 and 2040.

Fig 47: Road transport oil demand, by product, mb/d



Source: Energy Aspects

Fig 48: Road transport oil demand, by region, mb/d



Source: Energy Aspects

The upward trajectory in road oil use would have been steeper had it not been for the big increases that our models show regarding alternatively fuelled vehicle adoption. After efficiency gains (see **Efficiencies – the silent killer of road transport demand**), the two greatest fleet-specific threats to road oil use are electric vehicles (EVs), which largely hurt gasoline demand (through PLDVs), and gas-powered vehicles, which push prospective diesel demand downward because of their more widespread adoption in freight markets. Accordingly, our models show EVs theoretically reducing oil demand by 2.7 mb/d by 2030, and by 8.3 mb/d by 2040, significantly lower than the demand ‘hit’ incurred if no widespread EV adoption occurs and our models only account for normal vehicle efficiency gains. Both estimates have been raised since the previous incarnation of this report—in which we estimated prospective EV demand hits of 2.5 mb/d and 7.5 mb/d—as we have raised our projected EV sales numbers (particularly in Europe and Asia).

Overview

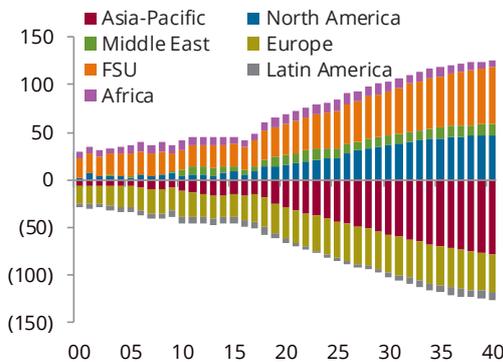
The global natural gas market will continue to grow, but there are headwinds to its long-term viability. With an estimated resource base of 7,000 tcf (196 tcm, 169 ttoe) and current production of 367 bcf/d (3.80 tcm/y, 3.28 ttoe)—creating an annual depletion rate of 2%—the global gas resource is large enough to sustain production increases. Gas is in relatively early stages of depletion, and its low carbon content compared to coal and oil suggests that it will be the last fossil fuel to be replaced by renewables as more countries adopt carbon-neutral policies. However, the future is not without challenges.

Gas will be the last fossil fuel to be replaced by renewables

Global gas demand growth will mainly take place in Asia, with the big developing countries like China and India retaining enormous scope to replace coal with cleaner gas in both power and industry. We expect Asian demand to rise by 82.8 bcf/d (856 bcm/y, 737 mtoe) over the forecast period and to grow from 21% of the global market to 29%. With Asian gas production expected to grow to 81 bcf/d (830 bcm/y, 714 mtoe) over the forecast period, the region as a whole may experience a supply shortfall of as much as 80.2 bcf/d (830 bcm/y, 716 mtoe).

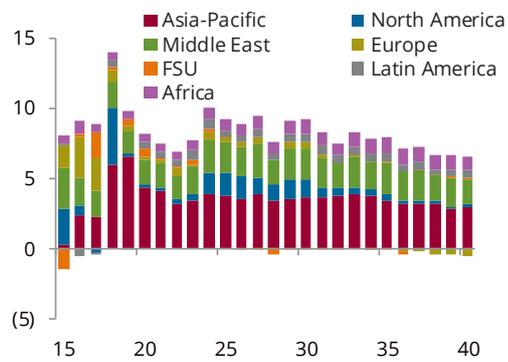
Much of the supply growth is focused in North America, Russia and the Middle East, and there will be a huge push to invest in gas infrastructure—either in pipelines or LNG liquefaction and regasification facilities—to move gas from production to consumption centres. The above three regions currently have gas supply surpluses around 41.1 bcf/d (493 bcm/y, 425 mtoe), but large investments in infrastructure will be required to overcome transportation bottlenecks if gas is to play the requisite role in the Asian demand markets.

Fig 189: Regional gas balance, bcf/d



Source: Energy Aspects

Fig 190: Gas demand growth by region, bcf/d



Source: Energy Aspects

Although meeting future global gas demand will require much investment, environmental concerns may increasingly slow demand growth toward the end of our forecast period. In the EU, a commitment to zero net carbon emissions by 2050 would imply that by 2040, the region will not burn much unabated gas and will instead electrify many sectors and meet that demand with low-carbon generation. As such, gas supply will need to be coupled with abatement measures like the

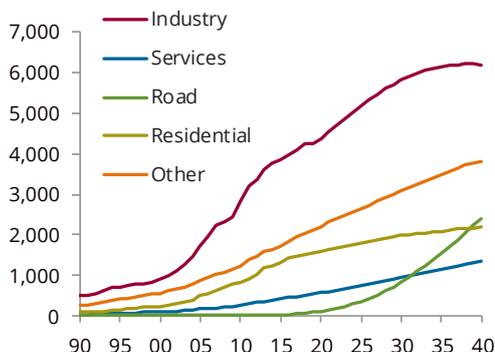
have electricity in end-use sectors reaching 30% of final energy demand (the official target is 27%) in 2020 due to a substitution in industrial demand. To date, the

Chinese electricity in end-user sectors to rise to 30% in line with 13th 5-year plan

industrial sector has been a focal point in China’s decarbonisation efforts as industry accounts for roughly half of the country’s power use and more than 70% of carbon emissions. China is on track to reach its five-year plan target, having reduced small-scale coal burning by electrifying industrial processes and agricultural production. Projects have included replacing privately-owned coal

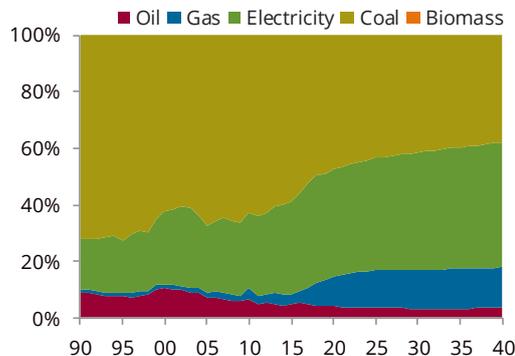
power plants, which supply industry, with cleaner alternatives such as hydropower, wind and solar, as well as more efficient coal plants. Oil rigs have switched to running on electricity instead of oil. While electrification of industrial processes is set to expand massively through the forecast period, growing by 42% between 2020–40, improved energy efficiency will impact growth.

Fig 281: China electricity demand per sector, TWh



Source: Energy Aspects

Fig 282: China industrial demand, mtoe



Source: Energy Aspects

With a conservative substitution in industry from traditional to electric furnaces or heat pumps, we see growth of the market share of electricity from 38% in 2018 to 42% in 2030. The amount of displaced coal and total energy needs create incremental demand of 1,700 TWh. In the medium term, we also see robust gains in the buildings sector. Increasingly, electric air conditioning is now used for cooling or heating in commercial buildings and urban areas, using heat pumps to draw waste heat from sewage, as well as water and ground source heat pumps. Indeed, air conditioning units are on the rise in China even if utilisation rates are lower than in developed economies. In the near term, the government’s efforts to phase out coal-fired boilers for residential users will be met by a combination of electrification and gasification. But since the shift to winter heating provision in northern China during cold winters caused power shortages—as the grids were not resilient enough to manage the load—natural gas is seen as a better substitute for coal in regions with sufficient supplies. Moreover, China will need to iron out numerous regulatory quirks on the local level in order to encourage further electrification using renewables. Currently, it is against the law for households and businesses investing in small-scale solar installations to sell unused power to others, while distributed solar projects struggle to access bank loans. Over time, we expect the technical and regulatory challenges to be resolved, leading residential demand to grow by 46% over the

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