Long term oil demand outlook

Vitol

Content

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As a physical trader of energy, Vitol has long monitored and forecast demand for crude oil and products.

In the context of an evolving energy mix, here we highlight some of our current thinking given the information we have at present.

We are mindful that some key influencing factors may change and our future outlook be adjusted accordingly.

Executive summary

This report outlines our view on future oil demand and the factors that may affect it. We take into account current sectoral trends including factors we think are likely to influence the availability and adoption of sustainable solutions.

We look over a 15-year horizon to 2040 because this ties in roughly with technological cycles and broadly matches vehicle fleet turnover patterns. Beyond 15 years, it is harder to anticipate how influencing factors will evolve, leading to higher levels of uncertainty.

To 2040, there is likely no global reduction in overall oil consumption. Declining demand from the middle of next decade only reverses the year-on-year increase in oil use over the next few years. Demand in 2040, is expected to be on a par with today.

Gasoline and gasoil demand is moderating and is anticipated to fall as the electrification of road transport continues and gasoil use in other sectors declines.

The outlook for these road transport fuels – at around half the barrel – is shaping the global oil demand trajectory.

In the absence of any disruptive technologies over the forecast horizon, jet fuel and LPG demand (for residential and commercial use and petrochemical feedstocks) are expected to continue to rise.

If, however, adoption of electric vehicles[1] (EVs) stalls, and targets were to be pushed back by just 5 years, road transport fuel demand could be 2-3 million bpd higher in 2040 than current projections.

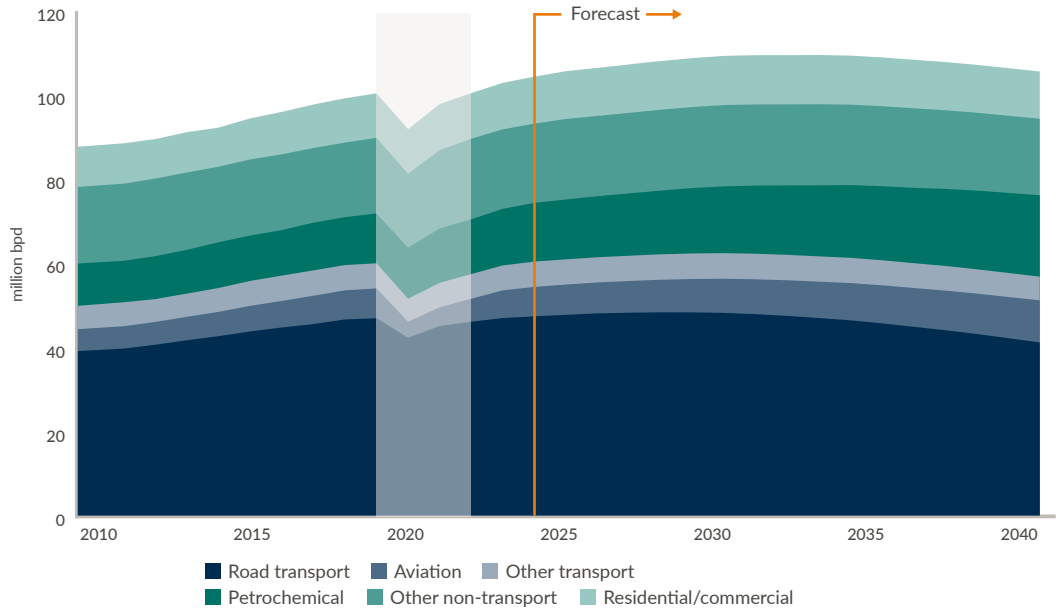
[1] Electric vehicles refer to units powered entirely by batteries – battery electric vehicles (BEVs)

1. Outlook to 2040

Ambition globally to limit climate change is driving efforts to reduce oil consumption and lower CO_2 emissions. However, population expansion, economic growth and urbanisation continues to increase demand for transport, plastics, chemicals and energy, and hence oil. The availability of sustainable solutions and the cost of adopting these will determine how decarbonisation will transpire over the next 15 years.

Demand change by sector over outlook

The demand outlook is likely to be a tale of two halves; road transport fuels are in decline whilst other sectors continue to increase



Shaded section indicates timing of COVID-19 pandemic

Global oil demand will likely continue to rise. At its height – expected at the end of this decade – demand could reach almost 110 million bpd, and is likely to remain at this level until it begins to decline from the middle of the next decade. By 2040, it is anticipated to recede to current levels of around 105 million bpd.

It is likely to be a tale of two halves during which the profile of the barrel is expected to change. The dominance of road transport fuels is anticipated to decline, whilst demand growth is expected to be driven by petroleum products used in the production of plastics and fuel for residential activities and aviation.

Oil fuels for road transport – principally gasoline and diesel – dominate demand at 45% of the barrel and the outlook for these fuels underpins the overall forecast. The adoption of EVs – primarily passenger cars and a portion of light commercial vehicles (LCVs) – represents the main decarbonisation solution at tailpipe and available at a scale that could moderate oil demand. Declining gasoil demand within the residential sector – as consumers adopt sustainable heating solutions – is also expected to contribute to falling consumption. By 2040, total gasoline and gasoil demand (in all categories) is anticipated to fall to represent less than half of the barrel.

The expected outlook for most of the remainder of the barrel is one of rising demand and no disruptive technologies that could reasonably reduce reliance on oil products at scale.

Rising populations, incomes and urbanisation is increasing demand globally for plastics, and in developing economies for fuels used in residential and small-scale commercial activities. It is anticipated that naphtha and LPG will consequently increase in relative importance over the outlook, to represent a quarter of the barrel by 2040 – up from a fifth today.

As people become wealthier and fly more, petroleum-derived jet fuel demand is expected to increase to represent 10% of the demand barrel by 2040, from 7% today. The adoption of sustainable aviation fuel (SAF) will likely increase over the forecast period as mandates come into effect, but is unlikely to be high enough to change a rising trend for petroleum-derived jet fuel demand.

Report aims and considerations

Structured by sector, each section sets out the outlook and highlights the influencing factors that could shape product demand, as well as potential risks to these projections. We discuss the available technologies but highlight that decarbonisation solutions come with a cost and will require ancillary investments in technology, labour and infrastructure. Someone must bear this cost.

Some regions are better placed to achieve decarbonisation; the cost of transition and impact on economic activity may dictate the pace of change, particularly in developing economies, where underlying oil demand is rising.

Policy will also be crucial in shaping behaviour and business decisions. The cost – both monetary and non-monetary – will be determined by policies, incentives and subsidies to reduce oil consumption. These are expected to heavily influence the pace of transition and give rise to regional disparities.

Key assumptions:

- Societies will keep their commitment to climate change abatement, but not at a cost that makes the them significantly poorer financially
- Certain countries will still value growth over the transition, but where feasible will adopt leapfrog technologies
- The policy frameworks we see today – including the less binding carbon neutrality commitments – will largely define the characteristics of investment decisions and the shape of the energy transition in distinct markets
- We do not see any new, disruptive, commercial technologies that impact oil demand within the 2040 forecast horizon, hence electrification of transportation and heating, combined with efficiency improvements are the key decarbonisation solutions

Unless otherwise referenced, all numbers are Vitol's own.

2. Road transport

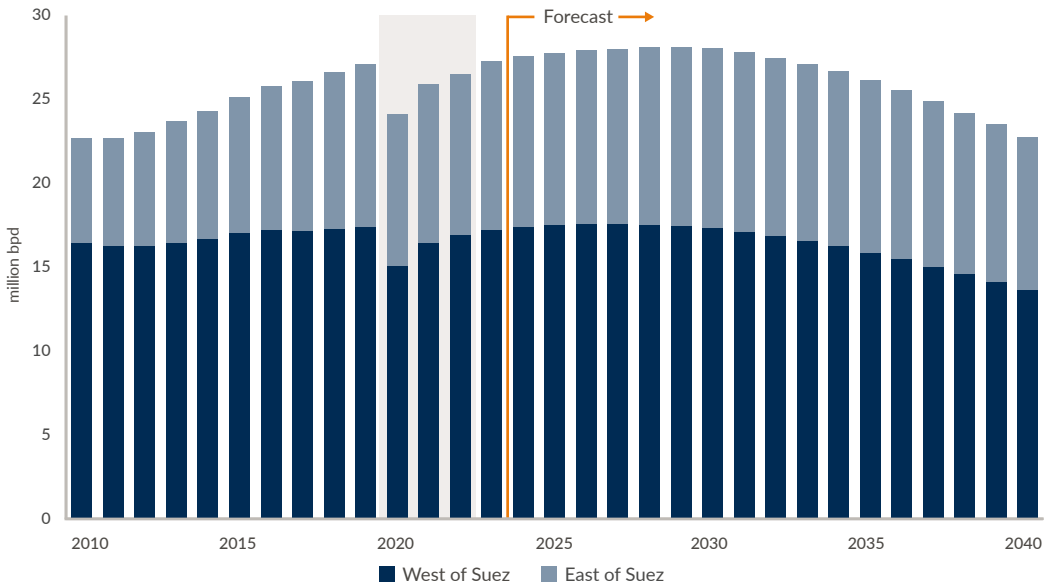
Road transport fuels drive much of today's oil demand, accounting for 45% of the barrel. They will remain a large portion of consumption, but their share is anticipated to decline to just under 40% of the barrel by 2040.

Key to this shift is the increasing availability of EVs which, for the first time, may support the expansion of road transport mobility, without a corresponding rise in the demand for petroleum fuels.

2.1. Gasoline

Global gasoline demand

Demand is expected to peak shortly due to electrification of passenger vehicles



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Global consumption of gasoline is expected to begin to decline shortly. Demand is anticipated to broadly flatline in coming years before falling steeply from 2030 onwards, with net gasoline use expected to fall by 4.5 million bpd against current levels by 2040.

Europe, China and the US represent over half of current global gasoline demand. Consumption from these regions is not expected to rise further, with demand either falling, or remaining flat before shortly entering decline, in line with the pace of electrification and efficiency gains in their car fleets.

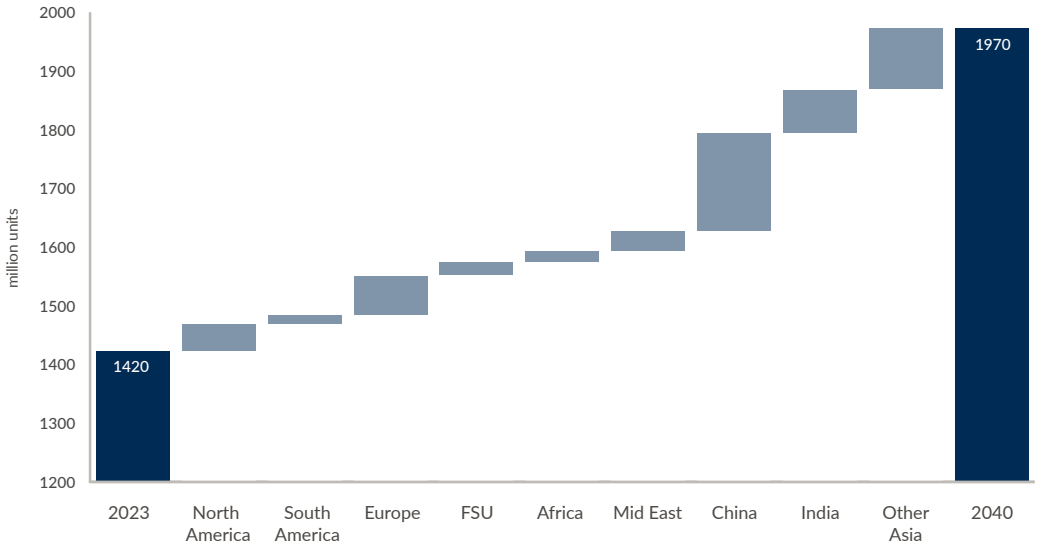
In China, significant progress in EV adoption means that gasoline demand has likely peaked, and could now decline to reach 2.3 million bpd by 2040.

In the US, gasoline demand is anticipated to remain broadly flat over the next few years. Before the end of the decade, consumption is expected to enter into decline, falling to 6.3 million bpd by 2040. In Europe, where gasoline consumption has been growing again due to the de-dieselisation of the car fleet, demand is anticipated to remain broadly flat at around 2 million bpd until 2030. From there it is expected to begin to decline and could reach 1.6 million bpd by 2040.

These regions are largely anticipated to remain market leaders in the adoption of EVs, assuming policy implementation remains supportive; and will provide a blueprint (of both successes and learnings) as the rest of the world electrifies its road transport.

Increase in total car fleet by region over forecast period

The global car fleet is expected to grow, supporting passenger road fuel demand over the forecast period



Former Soviet Union (FSU)

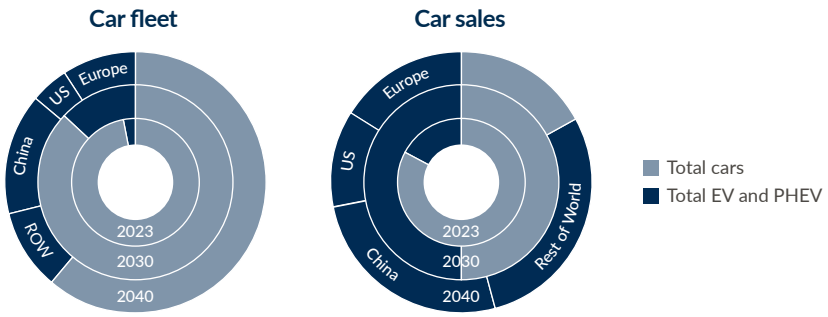
By 2040, it is anticipated that gasoline demand in the EU, US and China will be roughly 5 million bpd lower than current levels. These markets will likely still account for a high proportion of gasoline demand – around 44% of global consumption by the end of the forecast compared to 55% today. Indeed, in 2040, the US is expected to remain the single biggest market for gasoline.

This highlights the challenge in reducing the proportion of internal combustion engine (ICE) vehicles in global fleets. By 2040, the total global car fleet is expected to increase by 550 million units to around 2 billion, with EVs and PHEVs still only likely to represent at most 38%[2] of this figure despite rising global sales.

EV and plug-in hybrid electric vehicle (PHEV) adoption: sales and proportion of total fleet

EVs and PHEVs could represent at most 38% of global car fleets in 2040

China, US and Europe will lead in EV and PHEV adoption



Gasoline demand in other regions has varying outlooks. Some countries, like Russia, will likely follow main markets with demand declining by 2030 or soon after. In other regions, including Africa and the majority of developing Asian economies, gasoline demand is expected to continue to rise into the next decade, increasing by almost 1.8 million bpd by 2040 as their car fleets grow. At this point, these regions could represent almost a quarter of global demand, up from 14% today, while African demand is expected to peak after 2040.

Despite continued growth in global road transportation, the increasing availability of EVs and PHEVs for individual and commercial use is transforming the road transport market.

Electric cars are now able to deliver similar functionality at close to the cost of an ICE car. This, in addition to investment in infrastructure and consumer incentives is critical in supporting the electrification of transport.

However, key markets are now entering a new phase as they move beyond early adopters to focus on mainstream consumers. This has shifted market dynamics – as evidenced by the recent slowing pace of global sales of EVs, which have also been accompanied by stronger than previously anticipated PHEV sales, thus sustaining demand for gasoline. Limited information regarding the driving patterns of PHEV users has led to uncertainty over the proportion of battery vs. gasoline mileage and their true efficiency and emission savings.

[2] Forecast based on regulation, consumer behaviour, technology improvements and stated ambitions by OEMs

These latest sales trends suggest that mainstream consumers, less concerned with environmental credentials, will be less willing to bear the cost of transition; not just financial, but of convenience and driving experience.

Original equipment manufacturers (OEMs) will need to improve the specification and driving experience of their EV offerings at a price which remains competitive against ICE models. The current ranges in the lower-cost category outside China, and of sport utility vehicles (SUV) EVs remain under-represented in many regions. Increasing the options in these categories may support wider adoption; indeed, the popularity of SUVs – 45% of global car sales in 2023 – could present a significant opportunity to increase the ubiquity (and impact) of EVs.

Mainstream consumers are also more likely to choose EVs if the cost of ownership offsets the perceived inconvenience such as: higher insurance premiums due to the fragility of batteries and increased maintenance costs, as a result of faster wear and tear. This also impacts their resale value in the secondary market. In some regions, variability in charging costs has, at certain times surpassed pump prices, while charging inconvenience and range anxiety also remain a challenge. Improving access to both faster chargers and to cost-effective slower charging solutions will be key.

Incentives – of cost and convenience – that both encourage the use of EVs and discourage the use of ICE vehicles, will likely be prioritised in maturing and nascent markets. These might include; access to low-emission zones; priority lanes for EVs; waiving of parking fees or parking priority for EVs, (or conversely parking restrictions for ICE vehicles). Government incentives for drivers to scrap older ICE models, and replace them with EVs could also be a potential solution to address the large legacy fleet of ICE vehicles which is expected to increase over the forecast horizon reaching around 1.2 billion units by 2040.

However, the cost of subsidies, incentives and tax breaks to encourage electrification may constrain the pace of adoption in many regions. Governments are likely to be cautious in how aggressively they pursue targets that restrict ICE vehicle use to the detriment of economic activity. Where EV markets are maturing, removal of support will need to be carefully balanced in order to maintain progress.

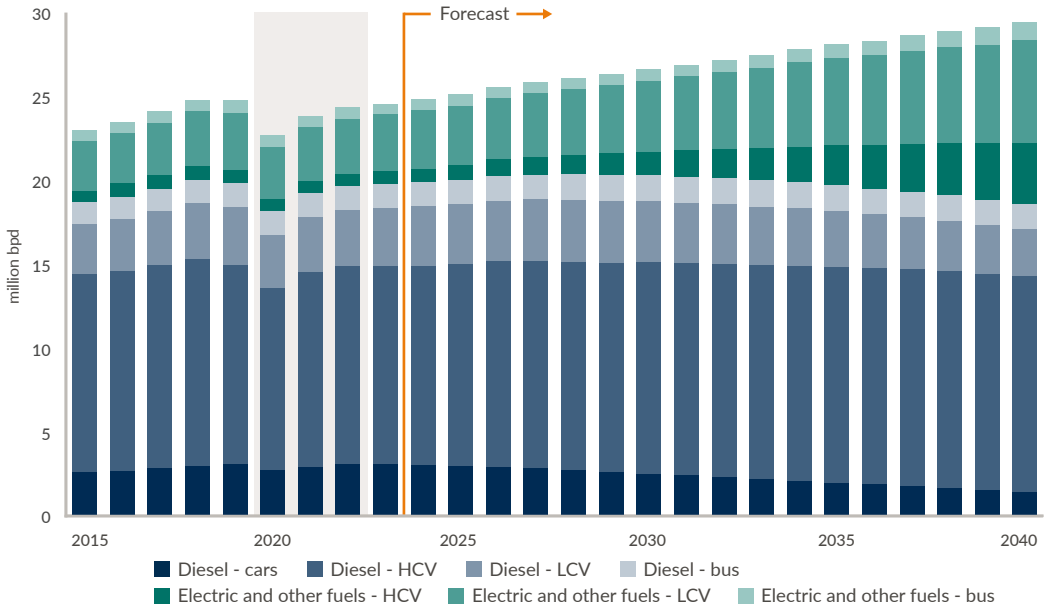
China is roads ahead. Government intervention has highly incentivised EV production and adoption; sales of both EVs and PHEVs now account for around half of all cars purchased. Chinese OEMs are also producing surplus to export – an opportunity for EV fleets to grow in some developing markets. Latest data suggest that increasing EV exports from China are already boosting sales of these vehicles in some countries, including Brazil and the Philippines.

Battery-swapping is a leapfrog charging innovation particularly for two- and three-wheeled vehicles. In emerging economies where this segment predominates, it could accelerate the electrification of road transport. It offers a lower lifetime cost per vehicle, a charging solution where infrastructure or home charging is lacking, and time efficiency compared to traditional charging infrastructure where it exists. Widespread access could also lower the day-to-day running costs of these vehicles against petroleum alternatives, further spurring adoption.

2.2. Diesel

Diesel equivalent demand by transport type

As the use of other fuels by commercial vehicles increases, diesel demand is expected to stagnate before declines begin to gather pace from 2035



Shaded section indicates timing of COVID-19 pandemic
Electric vehicle use in barrel of oil equivalent

Diesel demand from the transport sector is anticipated to increase marginally over coming years before plateauing and reversing by 2030. The initial pace of decline is expected to be slow compared to gasoline, but begins to gather pace from 2035 onwards, with global consumption falling by over 1 million bpd to just under 19 million bpd by 2040.

The expected reduction in diesel consumption reflects progress in electrification of the light commercial vehicle (LCV) and bus segments. However, it will likely be constrained by limited success in electrification or adoption of transitional fuels by a growing heavy commercial vehicle (HCV) sector. This sector currently accounts for 70% of road diesel consumption, with the fleet expected to increase by over 30% to 314 million units by 2040.

Battery technology is unlikely to be sufficiently developed for electrification to present a commercially viable option for the HCV category in the medium term. The larger and heavier batteries required for HCVs reduce payload capacity, while charging requirements make electric HCVs less competitive than diesel in long-haul road transportation by impacting range and refuelling time.

The HCV sector is at a fork in the road of its decarbonisation journey; it may adopt an alternative solution like LNG or bioLNG, or wait for electrification to become more commercially viable. This could also apply to other segments like long range coach fleets.

Main options – benefits and challenges:

Option 1 **Adopt no/low carbon fuels like LNG or bioLNG**	LNG and bioLNG offer an immediate solution to reduce or negate emissions and lower diesel use, and can be integrated with existing network infrastructure. However, limited local distribution and high cost of investment in vehicles remain limiting factors. In addition, the investment cycle of these vehicles could hinder adoption if the result is multiple fleet fuel requirements within depots, which would increase operational and maintenance costs.
Option 2 **Continue to use diesel vehicles until an alternative solution, most likely a battery, becomes more commercially viable**	Fuel cell technology is not expected to offer a commercial solution much before 2040. Rather, battery technology presents an alternative which may soon be viable for HCV electrification. There has already been significant advancement in battery technology but there is still some way to go to make it commercially viable at scale. Businesses may decide that waiting is a better commercial decision than adopting LNG or bioLNG. To electrify the HCV sector fully, significant investment to develop charging infrastructure will be required.

The electrification of LCVs – like last mile delivery vehicles – is expected to be important in reducing diesel demand over the outlook. From a lower base today, the electrification of these fleets is likely to reach a similar market share to cars by 2040.

Centralised decision-making will accelerate the pace of adoption for some commercial vehicles, particularly those following a back-to-base model, which do not rely on external charging infrastructure. The infrastructure for most commercial vans is similar to passenger cars; where this is in place uptake is likely to be higher.

While the bus segment is a small sector for global diesel demand, there will likely be success in the electrification of urban bus systems – expedited due to centralised decision-making. Given that the cost of electric buses compared to ICE equivalents is often lower, this is likely to occur even in locations where low-carbon transport solutions have not been prioritised.

CASE STUDY

VG Mobility

Accelerating electrification of transport fleets across the Americas

A Vitol-owned company, VG Mobility provides e-mobility solutions across the Americas, including electric fleet provision, charging infrastructure, depot design and construction, and asset management.

It is optimally placed to support municipal transport providers with their decarbonisation goals and enable the wholesale shift to electromobility. Currently VG Mobility's portfolio includes projects across Latin America with over 1,500 buses, transporting more than 3 million passengers a month and saving over 1,160 tons CO_2 each month.

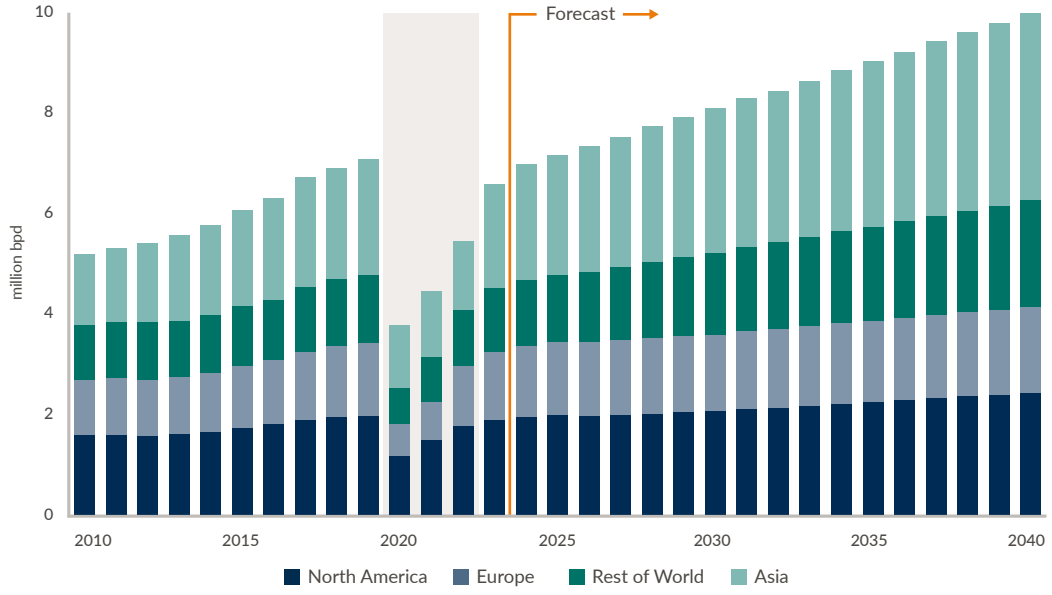
3. Aviation

Rising incomes and investment in the aviation industry are expected to drive continued expansion of the sector.

Hydrogen-powered and electric planes are technologies unlikely to be available on a commercial basis for decades. In contrast, sustainable aviation fuel (SAF) – fuel made from non-petroleum sources – is already available within the industry and represents a technology that has the long-term potential to partially replace demand for petroleum-derived jet fuel.

Jet fuel demand

Jet fuel demand is expected to continue to grow to 2040



Rest of World includes South America, Africa, Former Soviet Union (FSU) and Middle East
Shaded section indicates timing of COVID-19 pandemic
Jet fuel only includes kerosene-based fuel

Jet fuel represents a small portion of overall crude oil demand but both absolute levels of demand, and the proportion of the barrel it represents is anticipated to continue to increase to 2040. Peak demand for petroleum-derived jet fuel, even as SAF usage gains prominence from its non-existent base, is not expected before 2040.

By the end of the forecast period, annual jet fuel consumption is expected to increase by over 3 million bpd from current levels due to an approximate doubling of global passenger numbers. This is as a result of demand recovery from the impact of the COVID-19 pandemic and continued growth in international travel. The proportion of jet fuel within the barrel will likely rise to 10% (from 7% today), with demand moderated in North America and Europe where SAF adoption will also be highest over the next 15 years.

Mandates to increase the adoption of SAF as a solution to decarbonise the sector will likely raise the cost of international travel. If adopted in emerging economies, this could disproportionately impact aviation activity, where consumers may be less able to absorb higher prices.

In 2023, SAF represented just 0.2% of total jet fuel for the aviation sector. [3] SAF made primarily from crop and plant feedstocks (bio-SAF) and waste cooking oil dominate the nascent SAF market today, whilst researchers continue to explore the viability of ethanol-to-jet and synthetic/e-fuels.

SAF has been adopted at low levels by commercial airlines to improve green credentials, but constrained supply and resulting high cost – roughly three times that of petroleum jet fuel [4] – is limiting greater adoption. Hence the EU ReFuelEU legislation to mandate SAF adoption within the aviation sector. From 2025, SAF must represent 2% of fuel supplied, increasing to 6% in 2030, 20% in 2035 and then 70% by 2050. [5] However, not all regions will be willing to mandate high levels of SAF adoption when the likely outcome is increased costs which limit international travel and negatively impact aviation industries.

For SAF to play a significant role in the decarbonisation of the aviation sector, three things need to happen; legally binding mandates which ensure an investment market for SAF; the use of retired refinery infrastructure repurposed for SAF production; and the upscaling of crop and plant feedstocks and supply from waste cooking oils.

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[3] IATA (2024)

[4] based on 2022-2024 average ratio of Argus SAF FOB ARA Range (Class II) against Platt Jet ARA CIF CGS

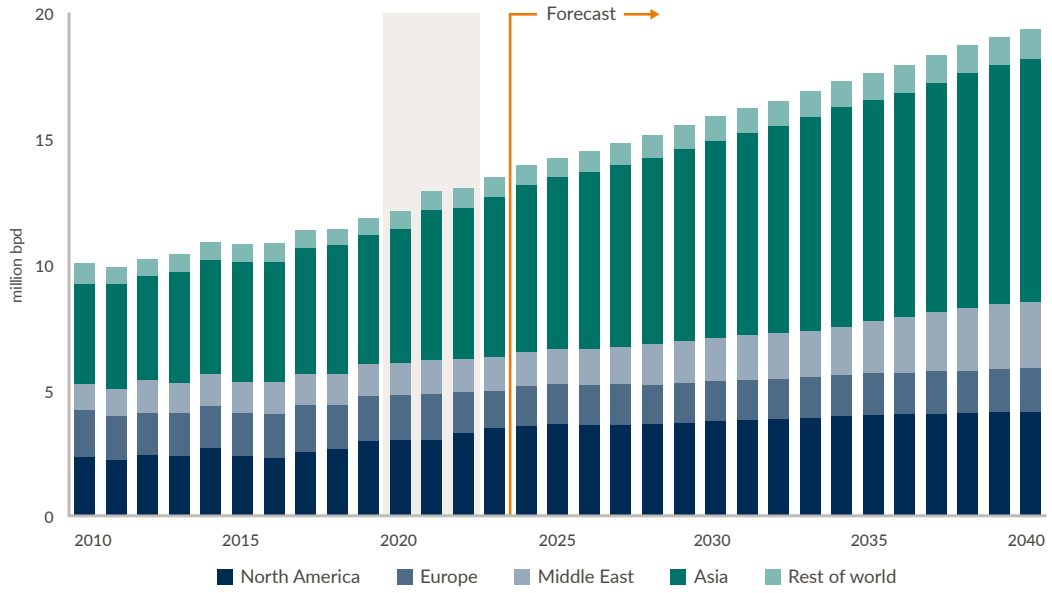
[5] Regulation (EU) 2023/2405

4. Petrochemical

Petroleum feedstock demand for the petrochemical sector is expected to increase to 2040. Rising populations and incomes in developing economies are driving ever greater demand for plastics, but there is limited scope for sustainable technologies to play a role in the market for the foreseeable future.

Petrochemical feedstock demand by region

Petrochemical feedstock demand is expected to continue to grow and will become an increasingly important part of the barrel



Rest of World includes South America, Africa and FSU
Shaded section indicates timing of COVID-19 pandemic
Petrochemical feedstock includes ethane, propane, butane and other liquids. Coal and methanol are not included.

By 2040, petrochemical feedstock demand is expected to represent a fifth of the demand barrel, rising by just under 6 million bpd from current levels.

It is anticipated that petrochemical feedstock demand will rise significantly in Asia by over 3 million bpd to account for 45% of global feedstock consumption. It is also expected to rise in North America and the Middle East, with just under 2 million bpd of additional demand from these regions by 2040. New investment for petrochemical facilities has been highest in these three regions with projects strategically located to capture cheap feedstock and market share. Asia in particular, has various large projects soon to come online which will increase overall capacity significantly.

The use of plastics is embedded in almost every aspect of modern life; it has transformed consumption and supported economic activity; playing a key role in progress, from advances in communication technology through to medical innovation. The drive to reduce consumption of this useful and ubiquitous material is based largely on the desire to limit its environmental impact, both its emissions from the use of petroleum-based feedstock, and also the challenge of its disposal.

Progress in recycling technology will increase capacity, but not to the scale required to significantly impact petrochemical feedstock demand before 2040, when recycled plastics will most likely still represent a relatively small share of total plastic use at an expected 14% of the market.

The market for bio-based plastics is expected to continue to lag behind; although supply has increased, they still represented less than 1% of plastics produced in 2022. [6] Higher costs of production, quality concerns, challenges in the supply of biological feedstocks and timeframes to upscale production are likely to limit their adoption over the forecast horizon.

Despite the biodegradability of certain bio-based plastics, most present the same disposal challenge as conventional plastics. Somewhat counterintuitively, the adoption of bio-based plastics increases the complexity and cost of sorting which could negatively impact recycling.

Although small, higher-income consumers choosing sustainable substitutes may drive some reduction in demand for petroleum-derived plastics. However, health concerns, particularly as the effects of micro-plastics are better understood, could result in a global consumer shift especially within the food and drink industry.

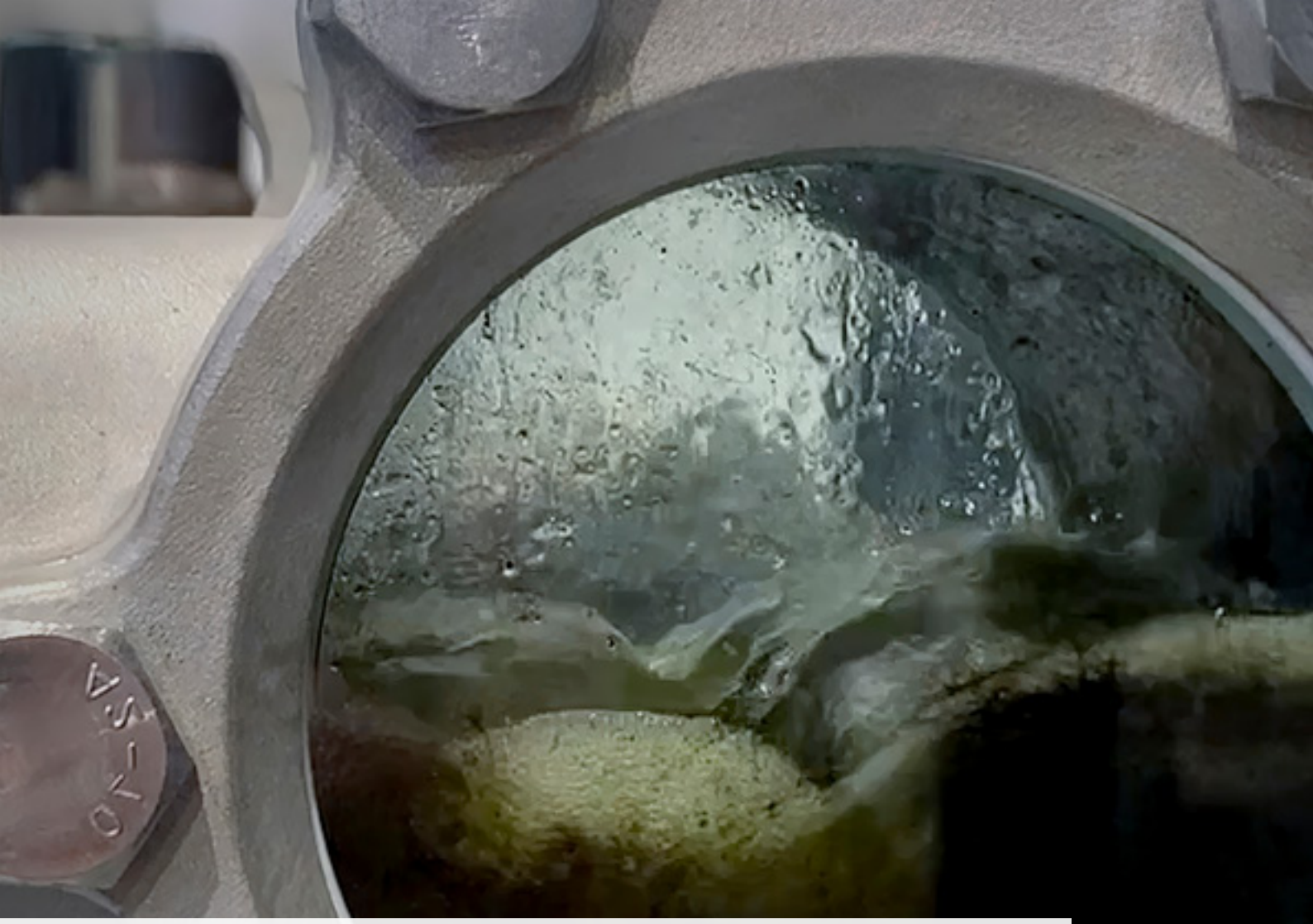
The overriding trend within the petrochemical sector is anticipated to be increasing demand from developing economies. Rising incomes will support a growing market for goods and services that improve living standards and for technology that promotes economic opportunity. Consumers in these regions are expected to largely prioritise cost over sustainability; only when alternative solutions are available at cost parity and at scale, is adoption likely to accelerate.

Definitions:[7]

Bio-based plastics: plastics made entirely or partially from biological feedstocks. Not necessarily biodegradable.

[6] EEA (2024)

[7] European Commission (2022)



CASE STUDY

WPU

Creating a circular plastics system

Vitol has recently acquired WPU Waste Plastic Upcycling, a company which upcycles end-of-life plastic waste to oil.

Using batch pyrolysis technology, the end product is used as a petrochemical feedstock in the production of recycled plastics. Chemical recycling is a critical pathway for the EU to achieve its circular plastics targets by 2030 and beyond. It also has the potential to be used in the road transport fuel and SAF markets.

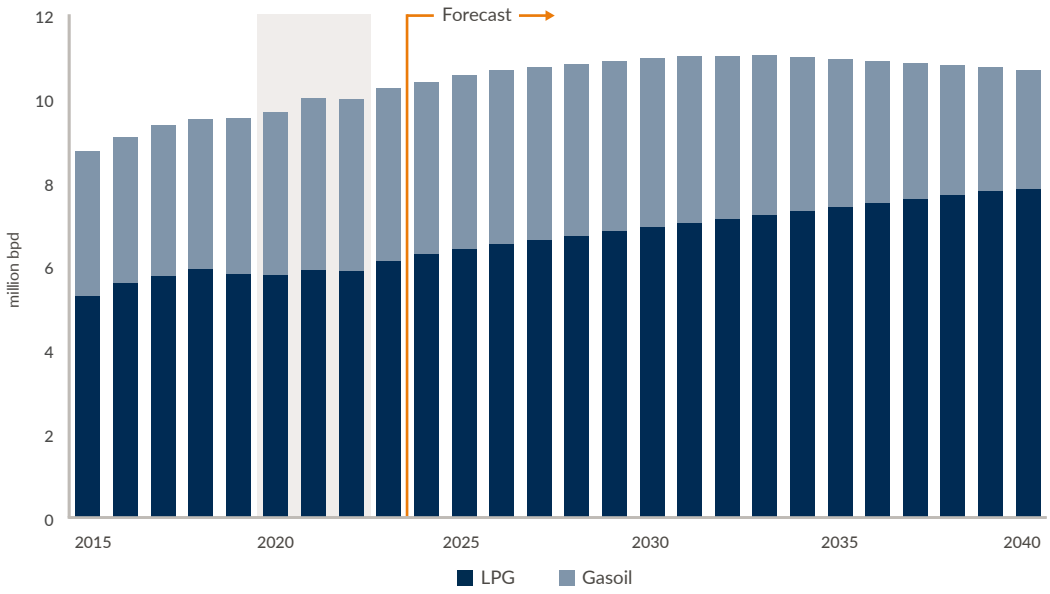
Based in Denmark, WPU has an operational commercial plant capable of recycling 25,000 tonnes of waste plastic a year – the equivalent of approximately five hundred million plastic bottles. Plans for a second plant with improved efficiency and capacity are underway.

5. Residential

Gasoil as a heating fuel is anticipated to decline in advanced economies due to the increasing availability of sustainable solutions. Whereas in developing economies, increasing use of LPG in place of solid fuels is expected to support economic activity and improved health outcomes.

Residential gasoil and LPG demand split

Growth in demand for LPG will likely offset decline in gasoil on a global basis

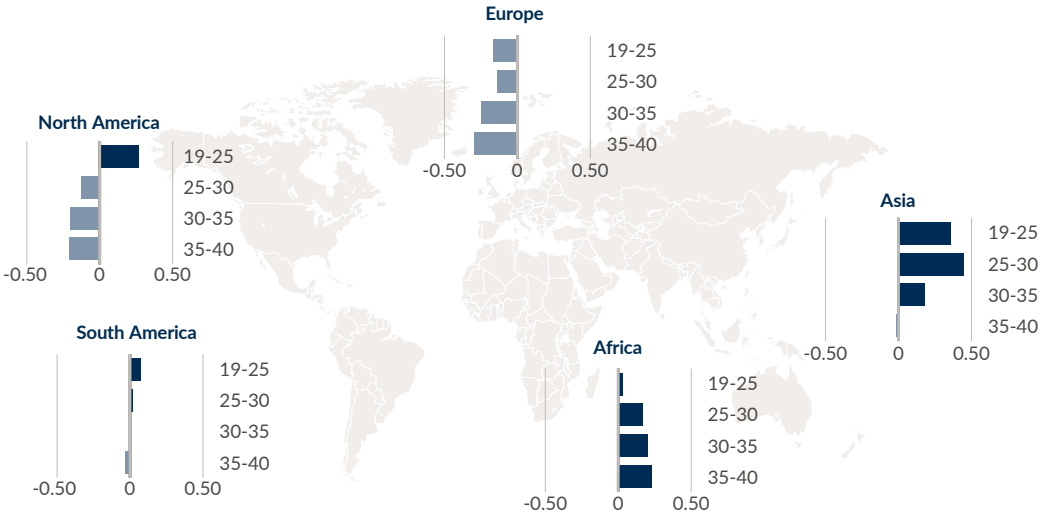


Shaded section indicates timing of COVID-19 pandemic

At the sector level, total consumption of oil products for residential and commercial use is expected to remain largely unchanged, but this masks the likelihood of growing LPG demand and declining gasoil consumption.

Global consumption of LPG as a fuel source could rise by 1.7 million bpd by 2040. On that basis, by the end of the outlook, LPG would represent 70% of the sector's oil product demand – up from around 50% today. Gasoil consumption, in contrast, is anticipated to fall by over 1 million bpd compared to today, with just under 3 million bpd of remaining demand by 2040.

Residential gasoil and LPG demand by region
Demand for residential fuels is expected to shift to developing economies
Asia and Africa are anticipated to lead demand for residential and commercial use



Change in million bpd

In 2040, Asia is likely to remain the largest user of oil for residential and commercial use, representing over half of sectoral demand. Africa is expected to rise in importance – by the end of the outlook, it could double to represent 11% of global consumption.

Gasoil

Solar panels and heat pumps are now available as a viable option for domestic use. In tandem, thermal efficiency in buildings has improved with advances in insulation and building design. As a result, in advanced economies the use of gasoil as a heating fuel is expected to decline significantly over the next fifteen years.

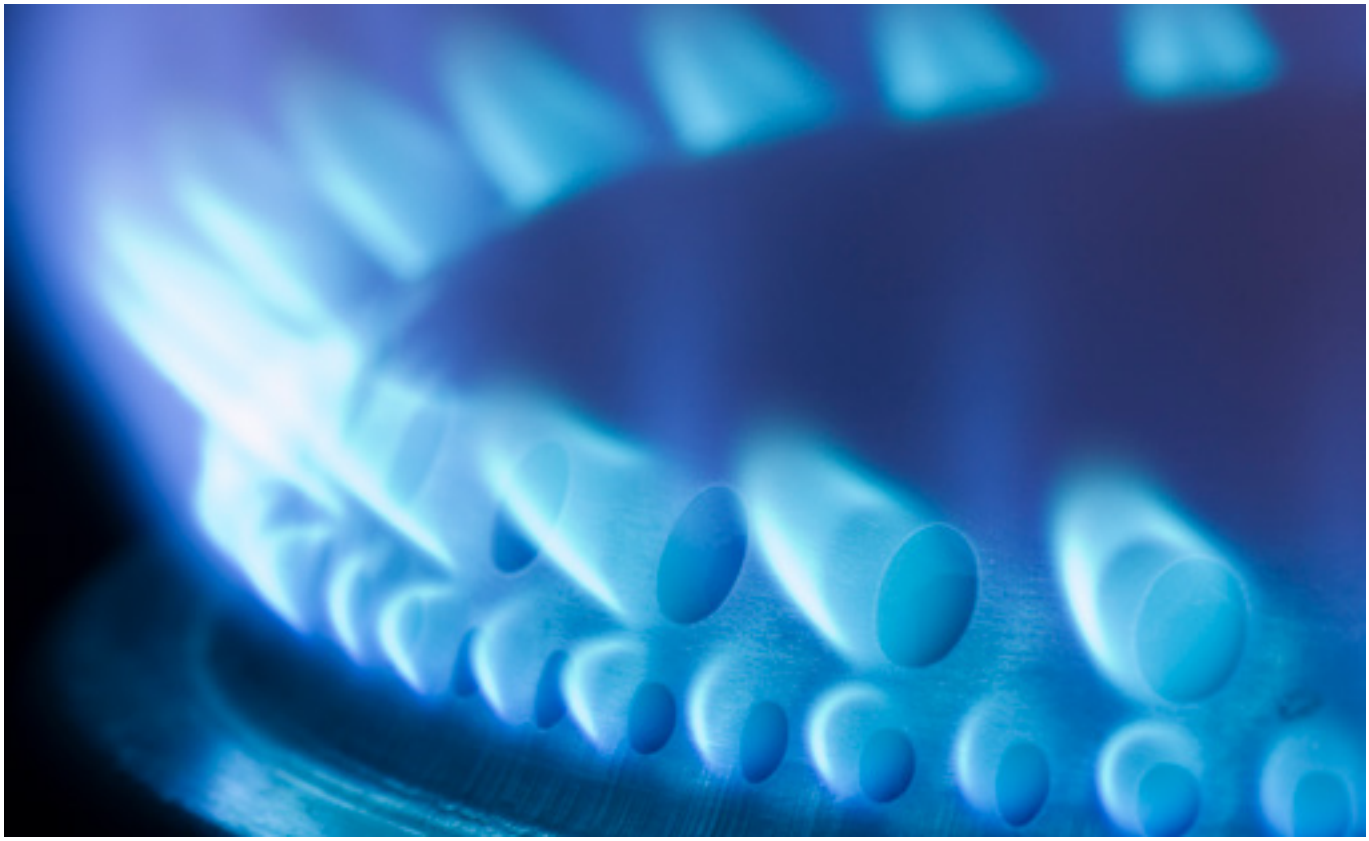
Governments could accelerate the pace of transition through more stringent building standards plus greater use of incentives and subsidies (although gains are limited by the small remaining size of the market).

LPG

In developing markets, growing rural and urban populations are increasing demand for fuel to support domestic activities. Even in urban areas, power networks are often inadequate, leading consumers to source alternative fuels. LPG, provides a flexible and accessible source of fuel for domestic and small-scale commercial activities (such as lighting and cooking).

In both urban and rural areas, where LPG replaces the use of highly polluting solid fuels, it has the potential to improve health outcomes for the 2+ billion people across middle- and low-income countries who continue to be exposed to household air pollution through cooking with these fuels.[8]

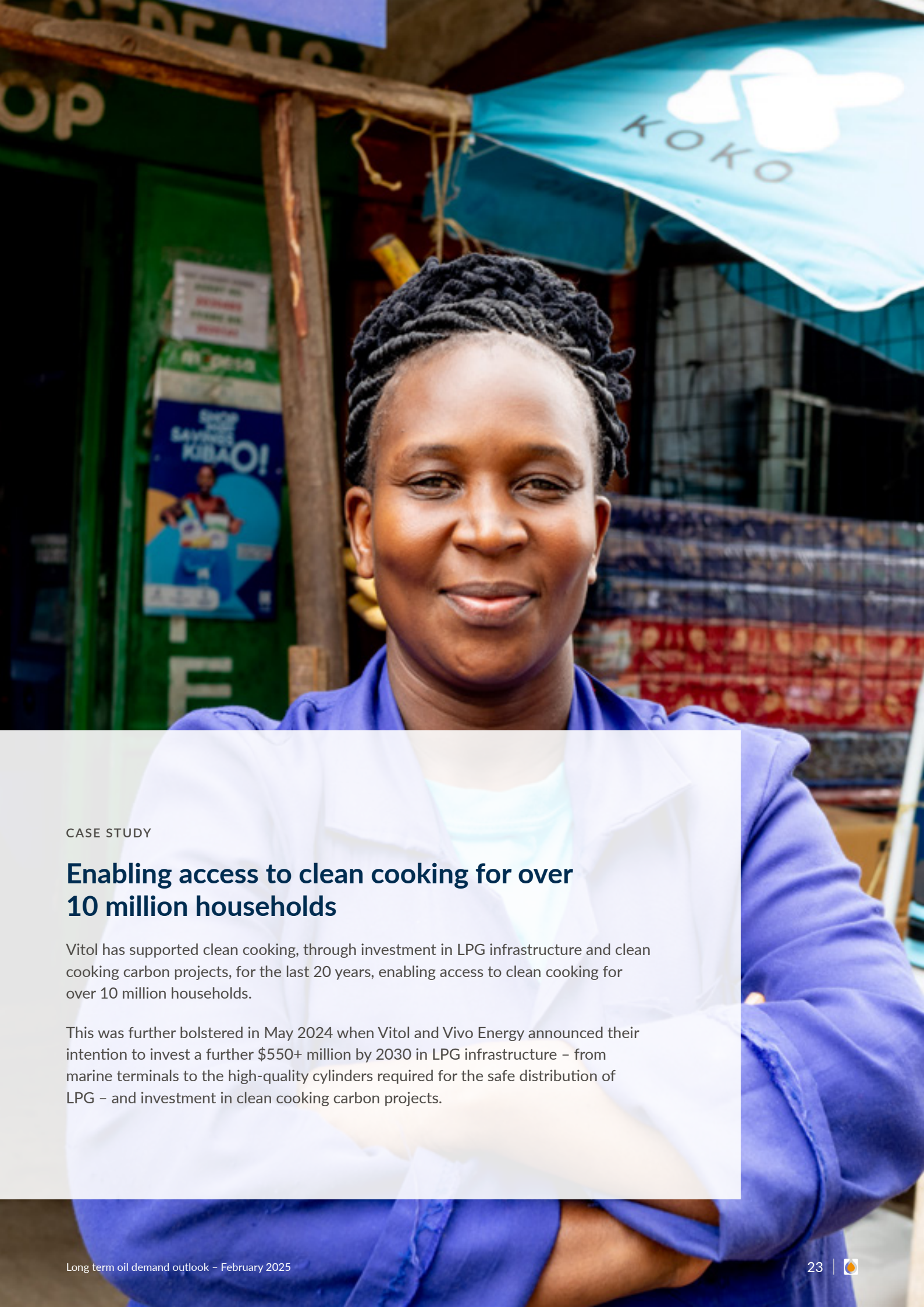
[8] WHO (2024)



With relatively low investment in infrastructure, LPG provides a fuel which can be efficiently and widely distributed. Investment and policies encouraging the adoption of LPG could give rise to regional divergences, with most rapid adoption occurring where investment in LPG infrastructure is greatest.

Over the next 15 years, the high cost and long timeframes involved in investment in power grid infrastructure and natural gas networks will likely mean that many urban and rural households in developing economies will remain off-grid. LPG presents the key transitional solution which can be adopted widely in developing economies today.

Even as new solutions for residential and commercial use become available, demand is expected to persist, as established LPG infrastructure will ensure it remains a competitive fuel option for many household activities.



CASE STUDY

Enabling access to clean cooking for over 10 million households

Vitol has supported clean cooking, through investment in LPG infrastructure and clean cooking carbon projects, for the last 20 years, enabling access to clean cooking for over 10 million households.

This was further bolstered in May 2024 when Vitol and Vivo Energy announced their intention to invest a further $550+ million by 2030 in LPG infrastructure – from marine terminals to the high-quality cylinders required for the safe distribution of LPG – and investment in clean cooking carbon projects.

Vitol

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