equinor

2025

Energy Perspectives

Global macroeconomic and energy market outlook

Welcome to Equinor's Energy Perspectives 2025

Long-term forecasts of the development in global energy markets are normally very difficult. As this year's Energy Perspectives report is published, the task is even more complex, as global markets and geopolitics are undergoing massive shifts with unpredictable consequences in both the shorter and longer term. Political priorities affecting global energy markets are shifting further away from decarbonisation towards energy affordability and security of energy supply. On top of this, it is nearly impossible to gauge the short-term impact of trade conflicts and new rules in the geopolitics game.

A global energy transition roughly in line with the ambitions of the Paris Agreement has become severely delayed and more fragmented, and global greenhouse emissions continued to increase last year. Despite numerous positive developments, the macroeconomic, political and geopolitical realities are characterised by lack of trust, cooperation and burden sharing, that are slowing down the pace of change foreseen in the Paris Agreement. A reversal of this development will take time, and its success is by no means guaranteed. With short-termism and local and regional priorities dominating policy-making, necessary global changes in the direction of truly sustainable development, balancing the different concerns in the energy trilemma, will be further delayed.

Energy Perspectives 2025 presents four scenarios for the future world economy, international energy markets and energy-related greenhouse gas emissions. The scenarios are designed to illustrate how divergent drivers in the energy trilemma (energy security, affordability and decarbonisation) affect long-term developments. The scenarios are not predictions, but possible contrasting pathways, providing a platform for debate, strategic planning and decision making.

The three forecasting scenarios, *Walls*, *Plazas* and *Silos*, aim to highlight the large gap between the relatively slow, incremental changes that characterise the energy transition today, and the radical and rapid changes needed to move the world onto a path aligned with the 1.5°C ambition of the Paris Agreement as in the normative *Bridges* backcast scenario.

The insights and analysis provided by Energy Perspectives help us navigate short-term uncertainties without losing sight of long-term trends

Anders Opedal
President and CEO

The geopolitical landscape and trade conflicts clearly illustrate that the global cooperation needed for a Paris-aligned energy transition is not present

Eirik Wærness
Senior vice president and Chief economist

Key insights from Energy Perspectives 2025

Energy Perspectives presents four scenarios for economic and energy market development

Walls builds on historical energy market trends and assumes climate action slowly accelerates.

Plazas explores a world where open trade and cross-border investment enable higher economic growth, more consumption, and affordable energy.

Silos considers a fragmented world where restricted global trade and a lack of collaboration hinder growth and shape consumption around energy security concerns.

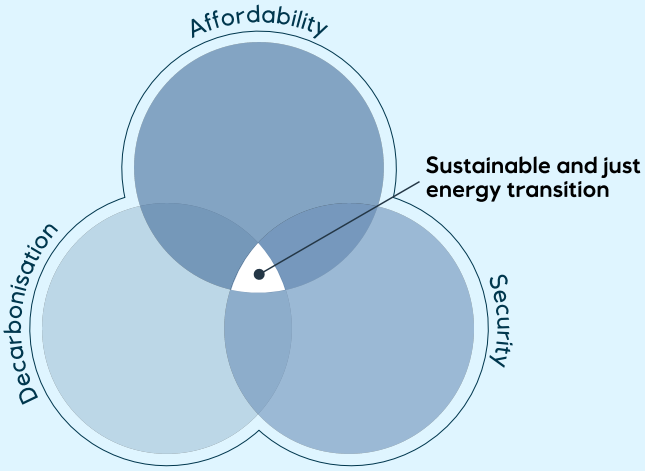
*Bridges EP23** is a normative backcast scenario that demonstrates the immense change needed to stay within the 1.5°C carbon budget.

*The *Bridges* scenario as outlined in the 2023 outlook.

Competing priorities are influencing policy makers' approach to economic, climate and energy policies

Geopolitical tensions, wars and economic development are drawing focus away from energy transition goals.

Decarbonisation faces increasing scrutiny as a policy consideration if viewed as a challenge for energy security or affordability.



The balance of priorities within the energy trilemma will influence global GDP, energy demand, energy mix and ultimately, emissions

In *Walls*, the world looks to balance energy security and affordability without disregarding decarbonisation.

In *Plazas*, economic growth is supported by unrestricted global trade, investment and collaboration, which increase consumption at the expense of decarbonisation.

In *Silos*, energy security dominates policymaking as global trade and collaboration fragment into regional alliances.

Scenario outcomes in 2050 compared to 2022 levels

	Walls	Plazas	Silos
Total primary energy demand	+5%	+19%	-5%
Net emissions	-35%	-16%	-34%
GDP CAGR	2.1%	2.3%	1.7%

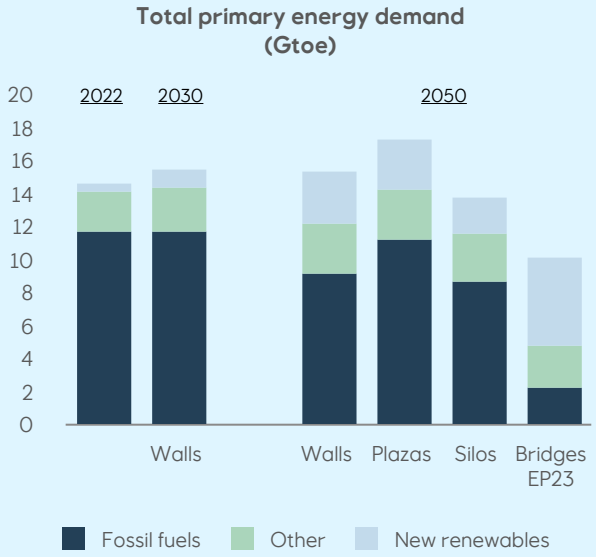
Source: Equinor

Total primary energy demand is impacted by both economic growth and a changing energy mix

In *Walls*, despite a growing global population and economy, primary energy demand plateaus in the late 2030s as electrification and a shift away from fossil fuels increase end-to-end energy efficiency.

By 2050, the increased consumption and slower transition in *Plazas* drive primary energy demand higher than in *Walls*. In *Silos*, lower growth and restricted consumption reduce energy demand in 2050 compared to 2022 levels.

Source: IEA (history), Equinor (projections)



Peak demand for fossil fuels arrives towards the end of the 2020s in *Walls* and *Silos*, but comes later in *Plazas*

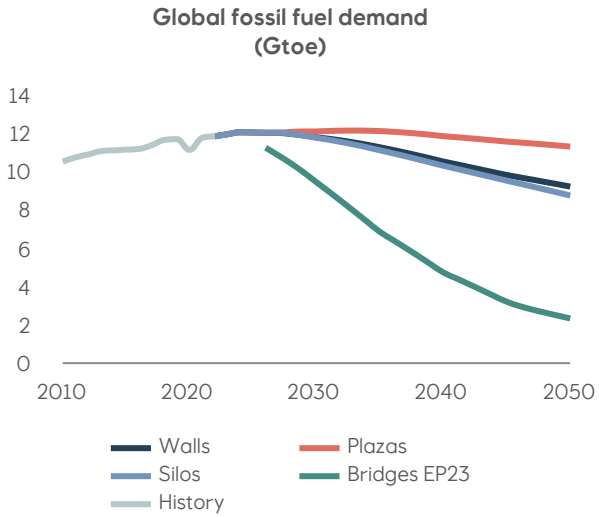
In *Walls*, total fossil fuel demand starts to level off in the mid-2020s, followed by a slight downward trajectory.

In *Plazas*, increased economic activity drives prolonged fossil fuel demand, which peaks in 2033 before a very slow decline.

In *Silos*, demand is impacted by low growth but supported by reduced global trade in clean technology.

In *Bridges EP23*, all fossil fuels see rapid decline.

Source: IEA (history), Equinor (projections)



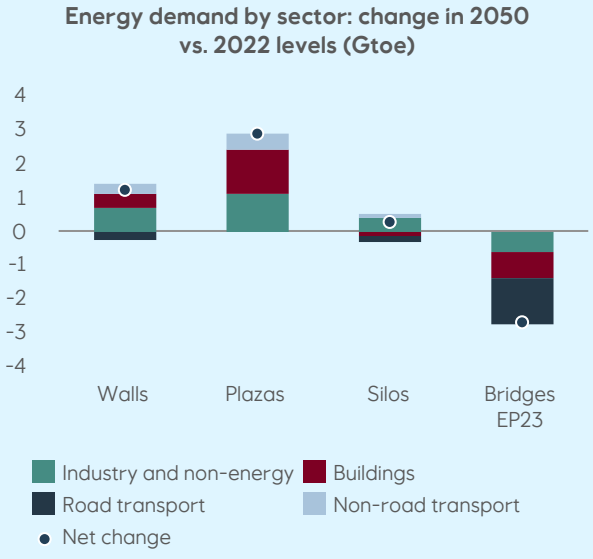
Sectoral demand changes reflect the interplay between growth and efficiency improvements

In *Walls*, demand in most sectors increases in line with the growing population and economy, but efficiency gains achieved through electric vehicle (EV) uptake reduce road transport energy demand.

In *Plazas*, the efficiency gains from EV uptake keep road transport demand in 2050 at 2022 levels. In other sectors, efficiency improvements are not sufficient to offset growing demand due to strong economic growth.

In *Silos*, cost-focused behavioural changes and efficiencies lead to a reduction in buildings and road transport demand out to 2050.

Source: IEA (history), Equinor (projections)



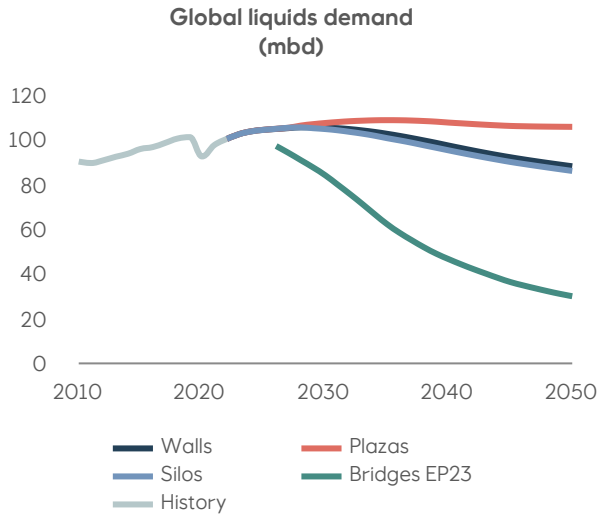
Liquids demand is weakened by EVs but supported by petrochemical and non-road transport sectors

In *Walls*, EVs increasingly replace internal combustion vehicles, causing demand to soften. However, petrochemicals and non-road transport see increasing demand, driven by a lack of alternatives. As a result, total liquids demand peaks at 105 mbd in 2028 before softening.

In *Plazas*, higher demand for travel and consumer products increases liquids demand and pushes the peak over 108 mbd in 2035,

Silos follows a similar trajectory to *Walls*, peaking at 105 mbd in 2028, as the effects of a slower transition to EVs are offset by lower overall demand.

Source: IEA (history), Equinor (projections)



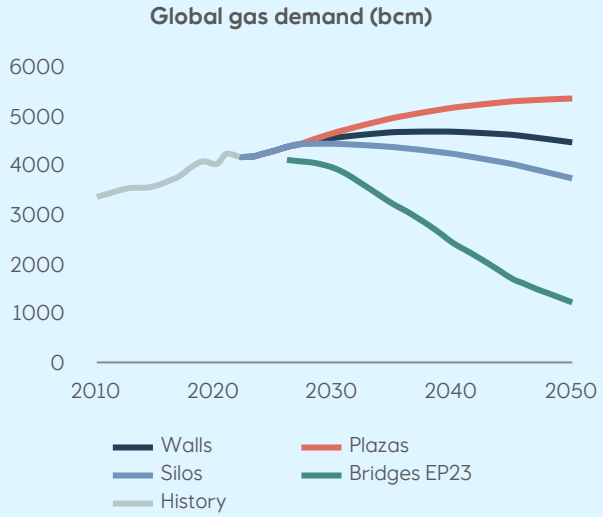
Global gas demand is highly sensitive to trade restrictions and energy interdependence

Walls sees peak gas demand in 2038 as electrification and renewables moderate the world's reliance on gas.

In *Plazas*, unrestricted gas supply and diluted climate targets push peak gas demand beyond 2050.

In *Silos*, global gas demand peaks in 2029 as gas importers reduce their dependence on other regions and growth stalls.

Source: IEA (history), Equinor (projections)

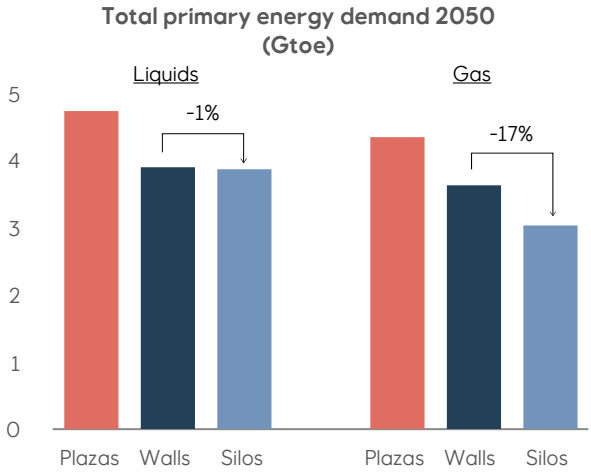


While gas and liquids are both traded globally, gas demand is more sensitive as it is impacted by electricity demand and can be more easily substituted with other energy sources

Liquids demand in *Silos* is similar to *Walls* despite lower economic growth, as slower uptake of EVs and clean transport fuels support liquids demand.

In contrast, gas demand is 17% lower in *Silos* than *Walls* by 2050 due to reduced total energy use, lower electricity demand, and increase fuel switching to viable alternatives.

Source: Equinor



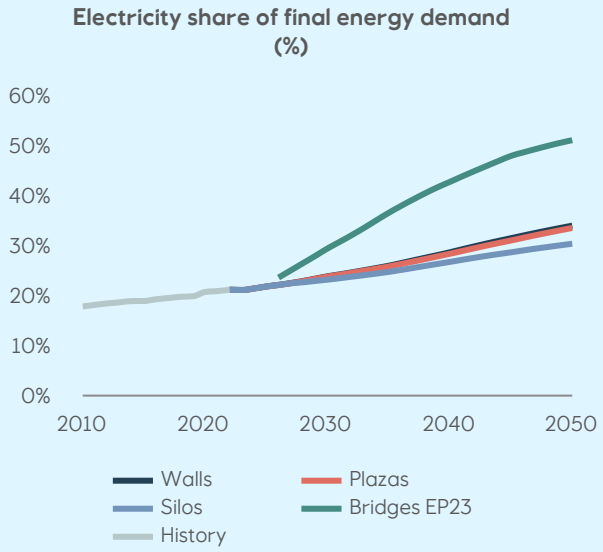
Electricity will meet a higher share of final energy demand

In *Walls*, electrification sees steady acceleration towards 2050, increasing its share by half.

Plazas follows a similar trend, with increased economic activity driving demand for both electricity and other energy carriers.

In *Silos*, restrictions on the trade of EVs and renewable technologies slow the increase in electricity demand and the availability of cheap electricity, leading to a slower rate of electrification.

Source: IEA (history), Equinor (projections)

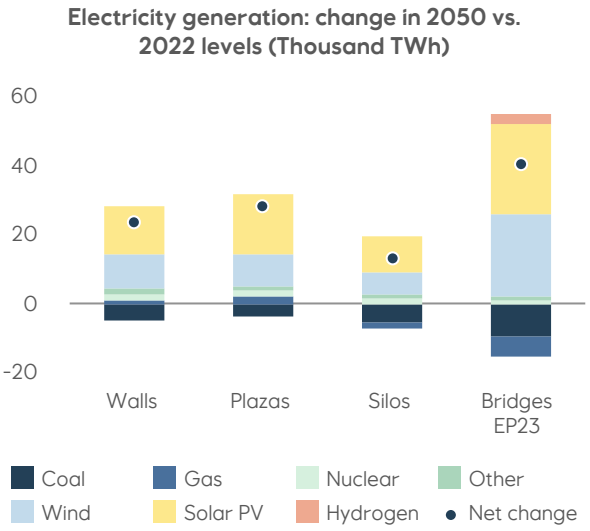


The key enabler of the energy transition is growth in decarbonised electricity, strongly linked to investment and policy

Low-carbon electricity production will increase in all scenarios, but to varying degree.

Solar and wind can provide cheap electricity, but their costs and share of generation will depend on trade restrictions, climate policy, and the wider investment environment.

Source: IEA (history), Equinor (projections)



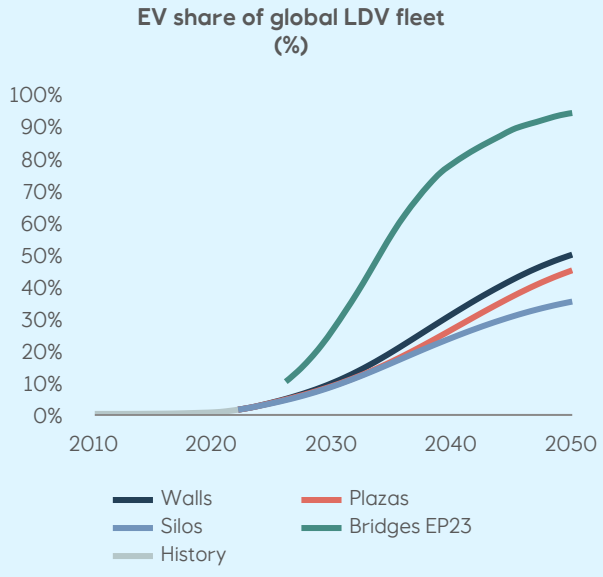
Electric vehicles become increasingly affordable and available

In *Walls*, policies including subsidies and emission standards encourage the adoption of EVs, especially amongst light duty vehicles (LDVs).

In *Plazas*, policy incentives are diluted, but higher consumer spending and unrestricted trade support EV uptake.

In *Silos*, EV uptake is delayed due to lower consumer spending, limited policy support, and restricted trade.

Source: IEA (history), Equinor (projections)



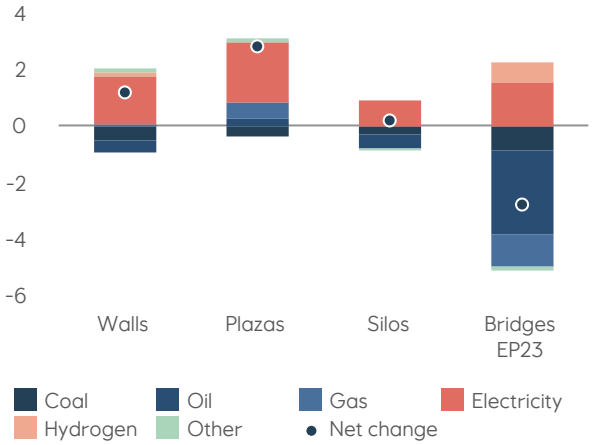
In *Plazas* and *Silos*, the energy transition progresses where it aligns with affordability or energy security priorities

In *Plazas* and *Silos*, incidental decarbonisation occurs, as using renewable energy to drive increased electrification can provide both value for money and energy independence for some end uses.

Climate policy can increase the speed of transition and encourage decarbonisation across all sectors.

Source: IEA (history), Equinor (projections)

Energy demand by energy carrier: change in 2050 vs. 2022 levels (Gtoe)



Energy-related net emissions are reduced in all scenarios by 2050 compared to 2022

Regardless of climate policy ambitions, demand for coal is projected to fall in every scenario, driven by the affordability of renewable energy sources, which can provide additional advantages over coal such as decreased import reliance and improved air quality.

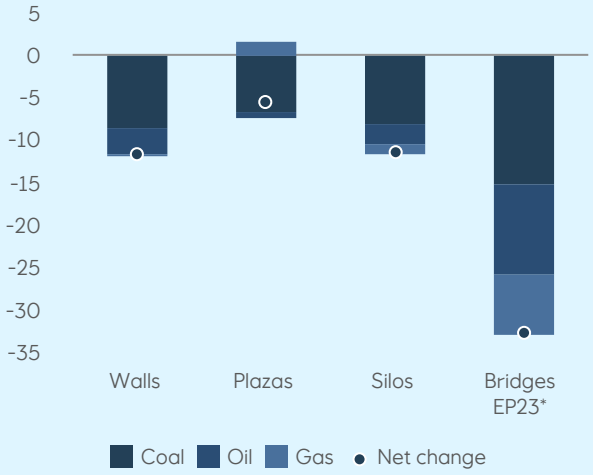
The cost-driven transition to EVs reduces emissions from oil in all scenarios. *Plazas* has higher oil demand overall, but a greater share comes from the petrochemical sector, which has a lower emissions intensity than the road sector.

In 2050, gas demand and its corresponding emissions are higher in *Plazas* and lower in *Silos* versus *Walls*, in line with the level of demand and trade openness.

*Excluding carbon removal from nature-based solutions, direct air capture, and bioenergy with carbon capture and storage.

Source: IEA (history), Equinor (projections)

Energy-related net emissions: change in 2050 vs. 2022 levels (Gt CO_2 eq.)



Carbon capture and storage (CCS) deployment stagnates in *Plazas* and *Silos*

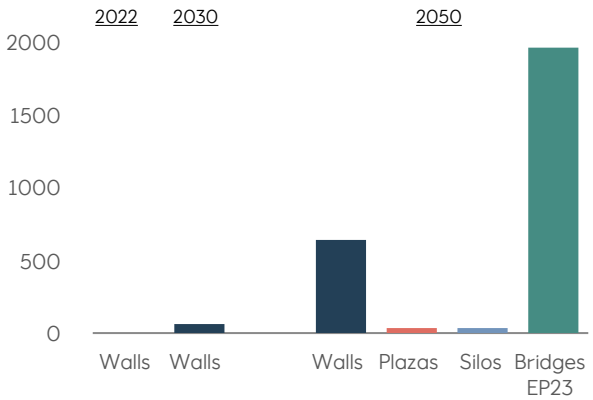
CCS enables decarbonisation but increases costs, only providing a competitive advantage when emission reductions are inherently valued.

Accordingly, CCS is not prioritised in *Plazas* and *Silos*, where decarbonisation is not a main policy focus. In *Walls*, CCS accounts for 644 million tonnes of CO_2 in 2050, compared to 1,965 million tonnes in *Bridges EP23**.

*Excluding nature-based solutions, direct air capture and bioenergy with CCS. Total carbon capture and removal in *Bridges EP23* is 6,264 million tonnes.

Source: IEA (history), Equinor (projections)

Annual carbon capture and storage of energy-related emissions (Mt CO_2)

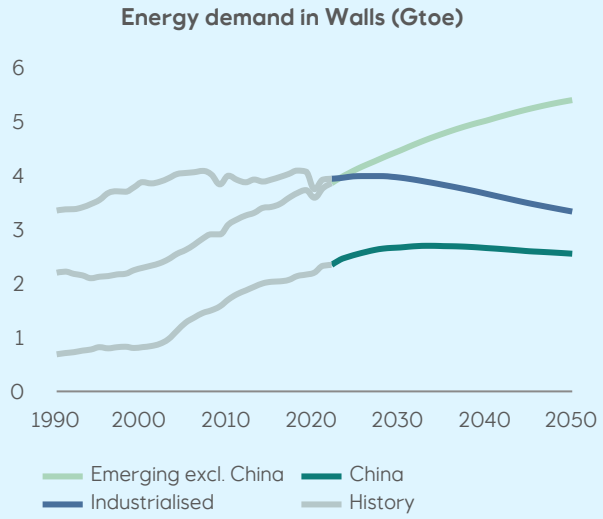


Energy demand in emerging regions excluding China overtakes use in industrialised regions in this decade

Emerging regions excluding China will be the biggest contributors to global energy demand out to 2050, overtaking the combined demand of industrialised regions.

This change is driven by increasing population and high economic growth in emerging regions, while industrialised regions will experience a population plateau, continued deindustrialisation, and a faster transition to more efficient energy technology.

Source: IEA (history), Equinor (projections)

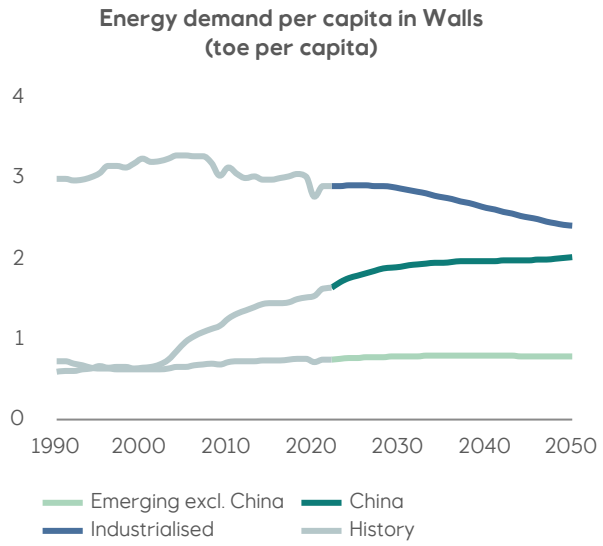


Energy demand per capita in emerging regions excluding China remains much lower than in industrialised regions

The increased energy use in emerging regions excluding China is spread over an increasing population, which limits energy per capita growth even though the total final demand exceeds the use in industrialised regions. This reflects the continued disparity in living standards between industrialised and emerging economies.

As China's population starts to decrease out to 2050, its energy use per capita starts to approach that of industrialised regions.

Source: IEA (history), Equinor (projections), UN (population)



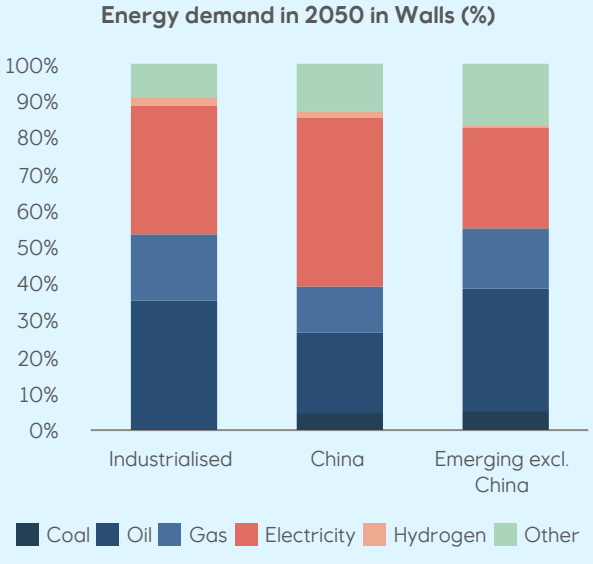
China is expected to lead the world in electrification. Fossil fuel demand remains significant across regions

China's dominance in producing cost-effective clean energy technology allows it to produce cheap electricity, reduce dependence on fossil fuel imports, and consequently decarbonise its energy supply.

In *Walls*, industrialised regions maintain climate ambitions, experience a stronger coal phase-down and a higher share of electricity and clean transport fuels than emerging regions excluding China.

Emerging regions excluding China prioritise growth and development, and remain with a lower share of electrification beyond 2050.

Source: Equinor



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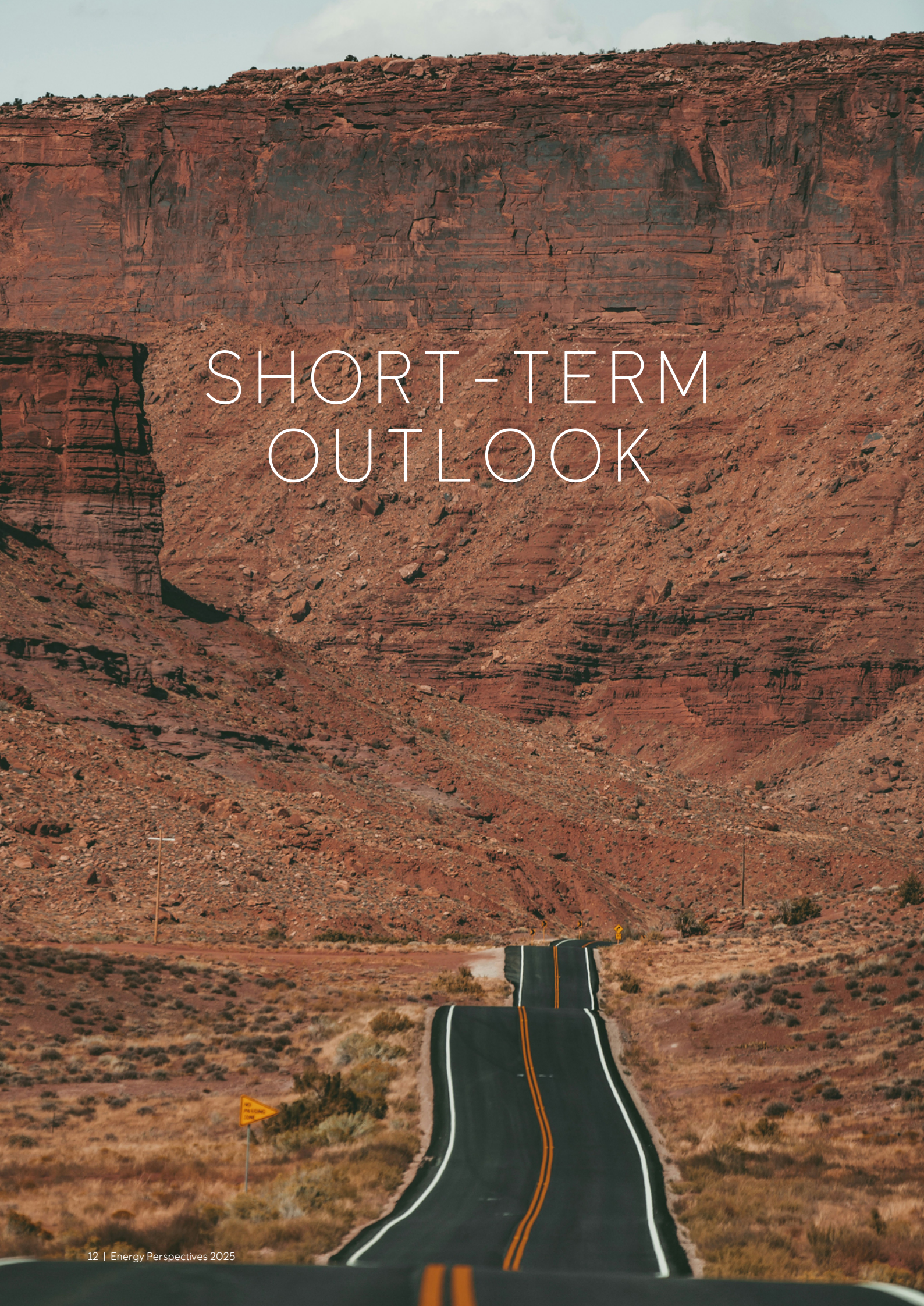


SHORT-TERM OUTLOOK

Geopolitics is shaping trade and energy markets

In 2025, energy markets will be impacted by intense geopolitical competition and shifts in global power dynamics. The erosion of economic collaboration will further add to market volatility. Also, the policies of the new US administration will play a significant role in fuelling the uncertainty these markets will experience.

Geopolitical risks will dominate the short-term outlook, reinforcing a sense that the global order is experiencing a fragile and uncertain transition. President Trump's disruptive instincts and willingness to challenge long-standing US foreign policy norms will feed this uncertainty, further increasing the range of possible outcomes. In this context, protectionism and national security will dominate policymakers' priorities, alongside urgent increases in defence spending in this new era of hard power. This focus will further limit the space for global cooperation.

The EU will prioritise improving its economic competitiveness and defence integration. While climate targets will remain, there will be less emphasis on decarbonisation, particularly where state subsidies are needed to progress energy transition projects. EU manufacturing is already under severe pressure from high energy prices, exacerbated by the ongoing conflict in Ukraine and rising global trade barriers. The bloc's competitiveness will likely be further undermined by the new US administration's trade and security policies and potential reactions from China.

Faced with US tariffs, the EU will initially seek to negotiate with the US but is also prepared to retaliate if talks fail. As global tariffs escalate, the EU will aim to diversify its geopolitical partnerships through strengthened relations with multi-aligned powers like India. Any weakening of the US' security commitment to Europe will push European countries to increase defence spending, likely at the expense of decarbonisation investment and welfare. There is a risk that European populist parties, which are hostile to more defence spending, will gain popularity if policymakers fail to strike the right balance. The EU's growing competitiveness concerns will push the European Commission to embark on a deregulatory agenda, including on some climate regulations.

The US "energy dominance" strategy marks a significant shift away from decarbonisation efforts, impacting energy markets and geopolitics in 2025. Given the growth potential of global LNG markets, US exports, already a powerhouse, are set to play a greater role as a bargaining chip during trade negotiations. US allies are facing growing pressure to increase US LNG imports to offset threats of tariffs.

The US diplomatic behaviour – outreach to Russia and closer ties to Saudi Arabia – underscores a shift to a more resource-driven mindset where energy market primacy and bilateral negotiations are leveraged to overcome perceived constraints of a multilateral order.

Competition between the US and China will remain an enduring geopolitical dynamic, and a risk factor for businesses. In the immediate term, trade issues will dominate relations, but fundamental differences entail that the relationship will face longer-term instability. Both China and the US will use their economic policy to further their strategic interests. This trend will be echoed in policies worldwide, risking deeper trade fragmentation and greater supply chain complexity and disruptions.

The US administration's staunchly unilateralist approach to foreign policy is likely to drive further multilateral engagement among emerging economies. While multilateral forums, such as BRICS+[1], have been steadily expanding, starkly divergent goals among members will continue to limit cohesion and effective decision making. Nevertheless, the number of multi-aligned powers adept at leveraging strategic resources is growing.

Countries across Latin America, Africa and Southeast Asia have proved able to navigate between great powers, thereby securing a diverse range of investment sources. Efforts by the EU and others to de-risk supply chains and diversify import and export markets will offer emerging economies further opportunities for case-by-case international alignment. Yet, the US' "America First" agenda will place some of these multi-aligned strategies under closer scrutiny, potentially exposing them to economic backlash.

Great power competition also creates opportunities for rising middle powers to adopt a more assertive, and at times, more destabilising foreign and security policy. In Africa, this dynamic materialises in fierce competition for control over vital commodities and key infrastructure. In addition, non-state actors may capitalise on the resulting instability to strengthen their territorial control and challenge failed or failing states.

[1] An expanding intergovernmental organisation including Brazil, Russia, India, China, South Africa and others.

The global economy

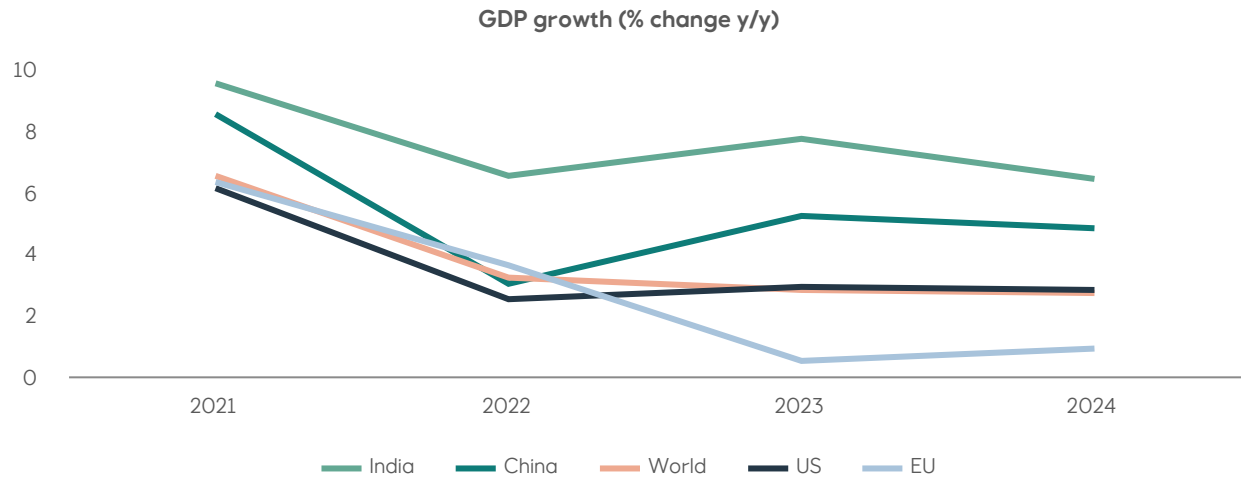
Global growth is expected to continue to stabilise, although at a subdued level, with divergent paths and near-term risks biased to the downside due to policy uncertainty[2].

After a sequence of shocks, the global economy stabilised in 2024 and clocked a GDP growth of 2.7% y/y. Around two-thirds of the growth contribution came from emerging markets. The US grew briskly at 2.8% y/y while Europe delivered subpar expansion at 0.8%. Following the sharp increase in food and energy prices observed in 2022, global inflation has gradually fallen towards 4% in 2024, and moved closer to central banks' targets in the developed world. In response, several key central banks have lowered their policy interest rates. Unemployment has remained low in most economies, weathering the quickest rate hike cycle in decades.

While global economic momentum persisted at the beginning of 2025, the rise in protectionist measures—triggered by the Trump administration's shift in trade policy—has the potential to significantly affect economic growth. The effects are likely to differ across countries, depending on trade and financial linkages, as well as policy responses to trade measures. Open economies like the EU countries and Norway are vulnerable to tariffs and other trade restrictions. Protectionist policies have been implemented despite agreement on the part of most mainstream economists that the world economy benefits from free trade. It is often argued that free trade maximises trading partners' comparative advantage, increases economic efficiency, and reduces consumer prices.

In the US, economic growth is forecast to moderate to an average of 2.0% over the next four years as consumption eases. Solid labour productivity is expected, on the back of business investment within software and computer services. The EU looks to be a growth laggard at 1.4% annually for 2025-2028. Europeans grapple with financial constraints due to debt and competing spending needs, although there is room for some additional public spending in selected areas. In addition, they face problems including stagnating productivity, insufficient innovation, high energy costs, and poor demographics. Private consumption should be a driver for economic activity due to increased purchasing power. The ongoing slowdown of the Chinese economy is likely to continue and lead to an estimated 4% average growth from 2025 to 2028. The economic landscape is hampered by high investment-driven manufacturing overcapacity, a weak property market, subdued consumption and a high debt burden. Nevertheless, China will presumably contribute around one-third of overall global growth. Robust performance is anticipated in India, aided by consumption and investment growth.

The global economy is expected to expand at an average of 2.6% per year from 2025-2028, which will be somewhat weaker than the 3.0% average growth over the last 15 years. In the near term, the balance of risks to the outlook is skewed to the downside. The main worry is the potential widespread impact of tariffs and disruptions to trade and investment. Other concerns are potential escalation of geopolitical tensions and financial markets vulnerability related to the pace of monetary policy easing. Upside risks are more relaxed fiscal policy, more public investment, and business deregulation.



[2] Text finalised end of March 2025

Source: Oxford Economics Limited 2025

Higher cost of financing challenges the energy transition

The era of cheap money seen in the last decade has ended. Higher interest rates shift the direction of capital flows and strain state finances, challenging the deployment of technologies and infrastructure crucial to long-term climate goals.

The global shift in macroeconomic and financial conditions over recent years threatens the necessary deployment of capital to reach long-term climate objectives. Financial markets forward pricing and economic forecasters, such as the IMF (2024), convey expectations that real interest rates will stay materially higher than the low rates seen after the Global Financial Crisis in 2008-2009. Higher interest rates and cost inflation, together with the European energy crisis, have significantly contributed to:

- Integrated oil and gas companies scaling down their decarbonisation ambitions..
- A larger share of green energy and low carbon projects announced in previous years not yet passing final investment decision.
- IEA (2024) reporting growth in energy transition investment at a three-year low in 2024.

The energy transition implies moving towards an energy system that is less dependent on fossil fuels to operate. However, low-emission technologies typically require greater and longer capital commitments than technologies reliant on fossil fuels.

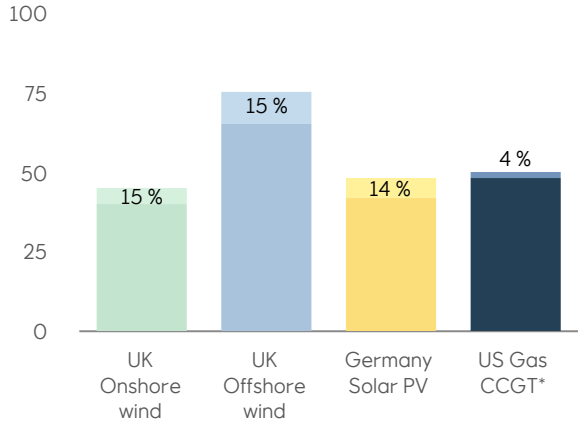
With greater capital intensity comes higher sensitivity to changes in the cost of capital. As financiers increasingly prefer investment with higher and more reliable returns on their capital, the energy transition now stands to lose some of its momentum,

Among low carbon technologies, investment in assets with lower technological and market maturity, such as CCS and hydrogen, will be disproportionately hit. As such, higher borrowing costs slow the deployment of nascent technologies which might be crucial to reaching long-term climate goals in 2050.

Meanwhile, more mature renewables technologies, such as onshore wind and solar, are more resilient due to their lower costs, which reduces risk and lowers premiums on financing.

The profitability of fossil-based electricity generation technologies is largely dependent on fuel prices. While capital commitments are large in absolute terms, capital expenditures are small relative to spending on fuel. Elevated coal and gas prices have contributed to a sharp slowdown in investment in fossil fuel electricity generation in recent years.

Interest rates impact on the levelised cost of electricity (LCOE, USD)



* Combined cycle gas turbine

Shaded area illustrates the effect of a three-percentage point interest rate increase on LCOE. Source: Equinor estimates

Governments are crucial enablers for the energy transition in correcting market failures and supporting innovation and infrastructure development. However, rising debt levels are leaving state budgets vulnerable to higher borrowing costs, leaving less fiscal room for discretionary spending. With a changed geopolitical landscape, fiscal room is further limited by weaker GDP growth, competing policy priorities aimed at cost-of-living challenges and military spending.

Fiscal pressures are already evident in delayed or scaled-back renewable energy initiatives across the globe. The challenges are particularly evident in emerging markets (EMs), where debt servicing costs increased by 26% from 2021 to 2023 (UNCTAD, 2024). Higher borrowing rates thus limit the breadth and inclusivity of the energy transition, leaving EMs more reliant on fossil fuels. Currently, over 30 countries are yet to register a large-scale renewable investment project according to UNCTAD (2024).

Under a changed macroeconomic landscape, a successful energy transition will require prudent and efficient policymaking, as well as a substantially lower geopolitical conflict level to foster increased global collaboration.

Commodities

Liquids

Oil prices will remain volatile due to geopolitical and economic uncertainty.

Non-OPEC+ liquids supply is expected to outpace global demand growth in the short term, creating an oversupplied market. However, US policies and their possible impact on the global economy create significant uncertainties for the liquids market outlook, including cost impacts and additional sanctions removing supply from the market. The OPEC+ group has announced it will start to unwind some of its voluntary production cuts but retain most of the cuts currently in place, with the focus continuing to remain on supporting prices. The Russia-Ukraine war continues to add uncertainty and volatility to liquids markets.

Gas

LNG takes over.

The global gas market has been tightening since last summer due to a combination of factors, including record temperature fluctuations globally linked to El Niño and La Niña effects, and an end to Russian piped flows via Ukraine to Europe. The summer will be difficult for those responsible for refilling gas storage in Europe, but 2026 will bring a wealth of new LNG volumes, which will soften the market balances.

Electricity

On a path to decarbonisation, but too slow for the 1.5°C ambition.

Global electricity demand continues to rise in the coming years, driven by economic growth, increased adoption and use of air conditioning, growth in demand from data centres and digital services, and increasing adoption of EVs. Annual growth from 2022 to 2028 varies by region; 5.0% for India and Southeast Asia combined, 1.3% in North America and 1.3% in the European Union. The fossil fuel share of generation will decline as renewables expand, though penetration rates differ by region. In 2028 solar and wind will comprise 40% of EU's generation mix but only 22% of North America's. Price volatility will likely increase due to fluctuating commodity prices and a growing share of weather-dependent renewable generation.

Hydrogen

Hydrogen seeks a role in the energy transition.

Hydrogen is seen as necessary for nations aiming to make deeper cuts in carbon dioxide emissions. Global annual hydrogen consumption stands at 100 million metric tonnes, with 98% produced from unabated hydrocarbons and a mere 2% from clean sources. Its primary uses include refining, ammonia, methanol, and fertiliser production. The initial step would be to decarbonise existing use in industrial feedstocks, followed by use of low-carbon hydrogen in high-temperature heating processes. Policy support and creation of hydrogen production hubs is essential for expanding hydrogen's role as a clean fuel.

THE SCENARIOS

The scenarios

Energy Perspectives 2025 explores the dimensions of the energy trilemma and introduces two new scenarios: *Silos* and *Plazas*.

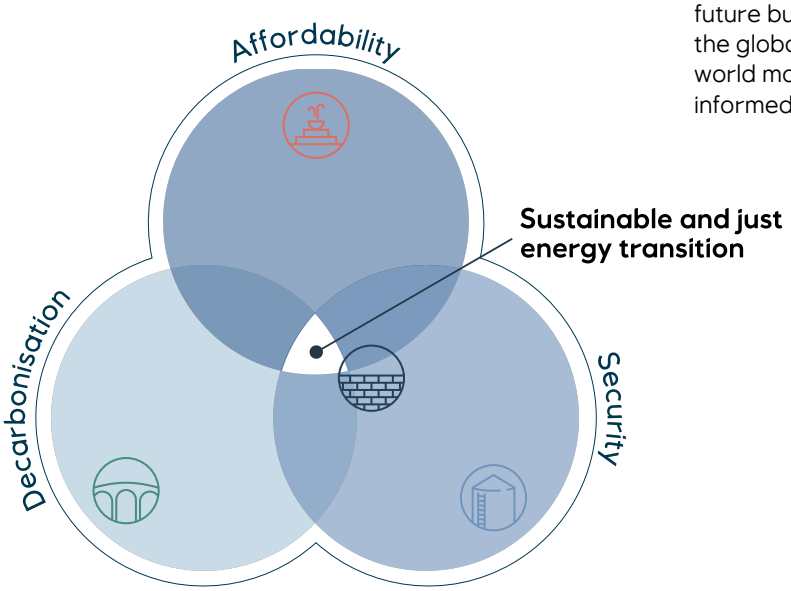
The energy landscape is shaped by unprecedented uncertainty. Geopolitical fragmentation has intensified, with shifting alliances, economic nationalism, and rising tensions impacting global trade and energy markets. Some governments are placing greater emphasis on security, increasing defence budgets and strengthening economic resilience, which in some cases may come at the expense of long-term climate ambitions. At the same time, cost of living remains a pressing concern, with volatile energy prices placing affordability at the forefront of political agendas. These forces create a complex and often contradictory policy environment, where investments in clean energy must compete with short-term security and economic priorities.

Navigating this uncertainty requires confronting the energy trilemma: the challenge of delivering energy that balances security, affordability and decarbonisation. These dimensions are deeply interconnected, yet often in tension with one another:

Security of Supply: Energy supply is always available, robust against geopolitical instability and supply chain disruptions.

Affordability: Consumers' needs for energy services can be met without compromising their ability to meet other basic needs.

Decarbonisation: Energy services are provided and used in a way that does not disadvantage future generations.



This year's Energy Perspectives presents four scenarios, each illustrating alternative pathways for navigating the energy trilemma. These scenarios differ notably in the pace and nature of the energy transition, shaped by factors such as policy choices, geopolitical developments and technological adoption. While some scenarios highlight rapid transitions driven by strong global cooperation and innovation, others explore slower transition pathways shaped either by geopolitical fragmentation or by economic interests that delay structural change.

The four scenarios reflect different ways these dynamics might evolve, highlighting the critical uncertainties and trade-offs that will define the future of the global energy system:

- ***Silos*** **-** a world built around focus on energy **security** and resilience
- ***Plazas*** - a future shaped by growth, open competition and **affordability**
- ***Bridges EP23*** - a transformative path driven by **decarbonisation** and cooperation
- ***Walls*** - the current trajectory, building on today's energy markets and policy and technology trends

Three of the scenarios are exploratory, illustrating different plausible futures based on divergent assumptions beyond 2027, while *Bridges EP23* is a normative backcast aligned with the 1.5°C climate ambition.

Energy Perspectives is not an attempt to predict the future but rather to illustrate possible pathways for the global energy system based on the choices the world makes, providing a platform for debate and informed decision-making.

Walls

Walls represents barriers that stand in the way of deep and rapid change in the global energy system.

Walls have long been built to protect us against danger, disease, and disaster. But walls do more than shield. They confine, draw boundaries, and limit movement.

Walls protect, but they also divide.

The *Walls* scenario captures a world caught between accelerating technological change and a shifting geo-economic landscape defined by growing competition, mounting market distortions, deepening fragmentation and rising polarisation; all of which complicate long-term systemic transformation.

Clean energy technologies are scaling, investments are rising, and some sectors are undergoing rapid transformation. But the pace is uneven, across both technologies and regions. Governments compete over supply chains, subsidies, and strategic technologies, often prioritising domestic resilience over international cooperation. At the same time, critical infrastructure faces delays, capital costs remain high, and institutional inertia slows system-wide change.

While global emissions decline, driven by reductions in some key regions and sectors, the overall pace remains too slow to meet the ambitions of the Paris Agreement. The global pathway bends, but not enough. Mismatched policies, uneven ambitions, and a lack of trust between nations make it difficult to coordinate action at the speed and scale required. The result is an energy transition that is real, but insufficient, delayed by structural barriers and diverted by competing priorities.

Walls outlines one possible future – rooted in today's realities and shaped by the tensions already playing out across politics, markets, and society. It is a scenario of real, measurable progress: clean energy expands, technology advances, and emissions begin to fall. But without deeper cooperation, institutional reform, and broader alignment, the pace of change remains uneven, and the full potential of the transition is left unrealised. The barriers in this scenario may not stop progress, but they do shape its direction, speed, distribution, and ultimately, its impact.

Bridges

Bridges signifies connections, cooperation and the momentum needed for a rapid energy transition.

A bridge spans and connects what separates us – land, rivers, borders or ideas. It creates new pathways, allowing people and systems to move where they could not before. Bridges are open structures. In the energy transition they symbolise cooperation, integration, and moving in the same direction.

Bridges connect and enable.

The *Bridges EP23* scenario is a normative backcast scenario, constrained by an energy-related carbon budget of 445 Gt CO_2, compliant with a 50% probability of no more than a 1.5°C temperature rise all the way to the end of the century[3].

It describes a world where climate action becomes the organising principle of global development. Geopolitical stability and renewed multilateralism allow for coordinated policy, shared technology, and open, rules-based markets.

Fossil fuels are phased out rapidly and equitably. Clean energy systems scale fast, efficiency improves across sectors, and behavioural change plays a vital role. The transformation is deep and system-wide, reshaping how economies function and how people live. By 2030, momentum is unmistakable. By mid-century, the energy system has been fundamentally restructured.

But time has run out. *Bridges EP23* was developed in 2023, and each year of delayed action makes it harder to achieve. Another year of record emissions means that *Bridges EP23* is no longer within the original carbon budget. Additional carbon emission reductions or removals of around 5 Gt would be required, starting from today to 2050, in order for *Bridges EP23* to align with the 1.5°C carbon budget.

Bridges EP23 is a benchmark against which actual and outlook developments can be compared.

[3] The IPCC's 6th Assessment Report puts the CO_2 budget for the 2020-2050 period at 500 Gt. This budget is to be shared between emissions in energy, industrial uses like cement, and agriculture. In this analysis, a budget of 445 Gt is allocated to emissions for energy purposes.

Plazas

Plazas illustrates a world where rising consumption and economic growth take precedence over climate ambition.

Plazas are vibrant market places buzzing with economic activity, symbolising a world where competitiveness drives affordability and rising living standards. Historically, plazas have served as open gathering places, hubs of trade, exchange, and communal life.

Plazas thrive, though habits persist.

Plazas is a scenario of economic opportunity – built on growth, open trade, and short-term pragmatism. In response to the cost-of-living crisis, political focus turns decisively towards affordability and competitiveness. Energy prices fall as new supply finds its way to the market, cost-efficient sources are prioritised, market design is optimised, and energy taxation is reduced. Governments support business competitiveness through deregulation, solution-driven policy, trade based on specialisation and robust global supply chains. Emerging markets benefit from industrial investment and knowledge transfer, capitalising on large, low-cost labour forces to become key players in global production. As price pressures ease over time, global consumption rises faster than in other scenarios. Increased economic activity and productivity broaden the tax base, giving governments greater fiscal space to support income equality policies. The improved economic outlook gains momentum throughout the outlook period, as pragmatism and global cooperation continue to reinforce each other.

Global geopolitics moves away from escalating rivalry towards open competition. While tensions between major powers persist, the emphasis shifts toward industrial efficiency and supply chain resilience. From the late 2020s, the global trading order is revitalised through stable regional blocs and a more functional multilateral framework, with institutions like the World Trade Organization (WTO) regaining relevance. Strategic investment in cost-saving technologies and critical mineral processing outside China help mitigate geopolitical risk. Shared vulnerabilities such as energy bottlenecks and maritime choke points trigger a series of positive-sum responses: targeted coordination to ease pressure, improve infrastructure and enable cross-border energy flows.

Proven low-cost technologies dominate the energy transition in *Plazas*. Renewables continue to expand, especially solar and wind, where they offer the clearest economic benefits. Electrification advances steadily, driven by falling technology costs and supportive market conditions. But with affordability as the guiding principle, climate ambition takes a back seat to immediate gains. High consumption and growing demand, especially in emerging economies, delay the phase-out of fossil fuels. While decarbonisation does occur, it is uneven, and reducing total emissions proves difficult. Efficiency improvements and adaptation efforts gain some political traction, but the pace of structural transformation is limited.

Plazas combines economic strength and geopolitical stability with a cost-driven energy transition. Growth is sustained through open markets, investment, and proven technologies, while global institutions adapt to support a more functional trading system. But delayed decarbonisation and rising demand visualise the longer-term risks of an energy policy strategy driven by affordability over decarbonisation.

Silos

Silos represents a fragmented world, hindering the unified action needed for an accelerated energy transition.

Silos emerged as structures of preservation, built to store essential resources such as grain, seeds or other supplies in times of scarcity. While silos safeguard valuable assets, they also isolate them, creating barriers that hinder collaboration, efficiency, and adaptability.

Silos preserve, but isolate.

Persistent geopolitical tensions and unchecked strategic rivalries define *Silos*. Increased isolationism and reduced commitment to alliances and free trade weakens global institutions and fractures long-standing partnerships. The collapse of institutions like the WTO gives way to regional trade blocs, resource nationalism, and protectionist policies. Strategic rivalry between major powers pressures others to choose sides, deepening global fragmentation. This fragmentation extends to financial markets, which increasingly align along geopolitical lines. Domestic polarisation grows, fuelling political instability as governments struggle to manage rising demands for protectionism and growing distrust in foreign investment and global governance.

In this divided world, energy security becomes the dominant policy priority. Governments seek self-reliance in critical sectors – from energy and digital infrastructure to industrial manufacturing and critical materials. Public spending shifts toward defence and domestic resilience, crowding out investments in infrastructure, innovation, and climate action. Renewables are valued for their role as resilient home-grown energy sources, but growth is constrained by limited access to components, capital and international expertise. Energy systems adapt to local constraints, with investments directed toward reliable, established technologies that reduce exposure to geopolitical risks and global supply chains. Disrupted technology flows and restricted innovation hinder efficiency improvements and delay system transformation. Climate goals fade into the background as energy independence becomes the central concern.

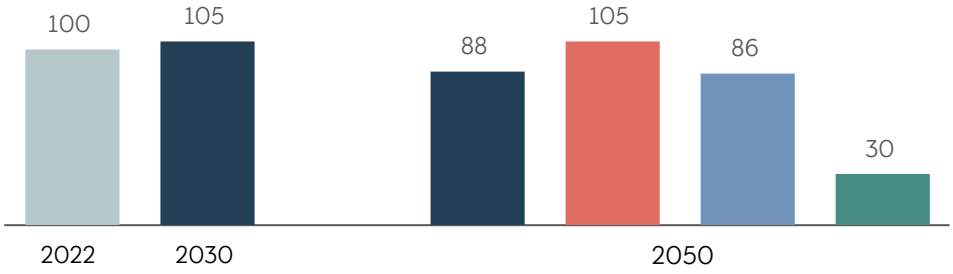
Without the benefits of open trade, global specialisation, and comparative advantages, productivity growth slows, and economic activity weakens. Higher energy prices, reduced access to goods, and growing uncertainty depress demand. Households and businesses adapt through lower energy use, but decarbonisation stalls. The lack of trust between regions limits knowledge sharing, joint innovation, and coordinated climate strategies. In this world, the energy transition continues unevenly, but without global alignment, it is slower, more costly, and less effective.

Silos captures a world defined by fragmentation, distrust, and strategic competition. It shows how the breakdown of cooperation reshapes energy systems, not through inaction, but through disconnection. Energy security is prioritised, but at the cost of innovation, integration, and long-term transformation.

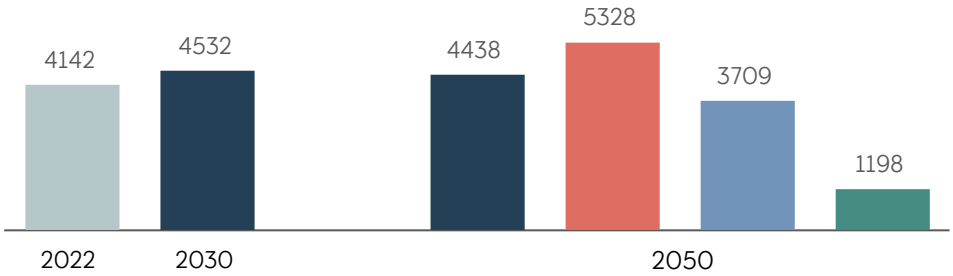
LONG-TERM OUTLOOK

The energy world in 2030 and 2050

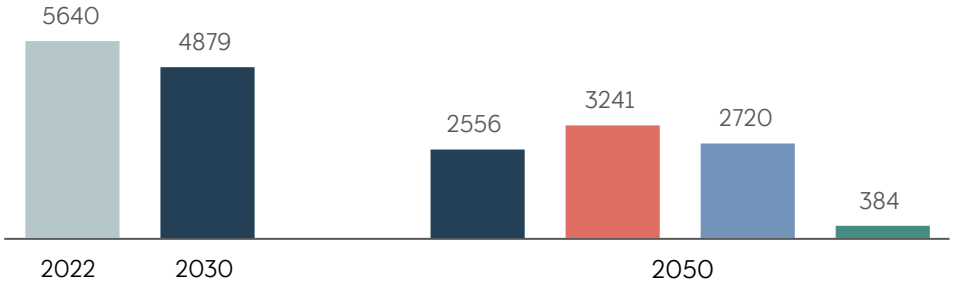
Global liquids demand
mbd



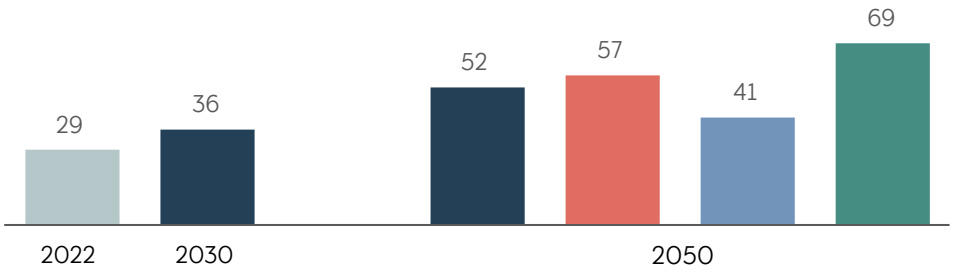
Global gas demand
bcm



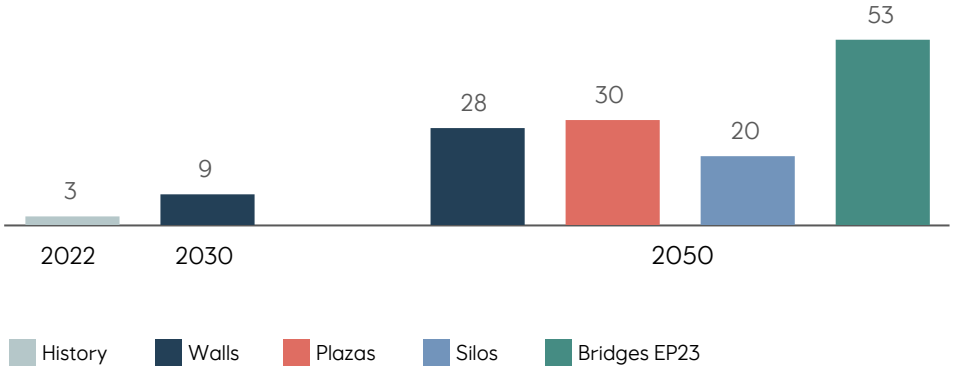
Global coal demand
Mtce



Global electricity demand*
PWh



Global wind & solar electricity supply*
PWh



* Includes demand/supply for both grid and hydrogen production. PWh = 1000 TWh

Source: IEA (history), Equinor (projections)

Global economy: Declining long-term growth prospects

The long-term economic growth prospects are dimmed as a structural growth slowdown takes hold. Several of the forces that have powered growth and prosperity over the last decades have weakened, with global growth expected to be lower than the historical average in all four scenarios.

Over the last years, global economies have been hit by a series of shocks. States experience rising public debt and the need for tough fiscal prioritisation, while households face cost-of-living challenges due to persistently high inflation and interest rates, stemming from policy responses to adverse crises. The near-term global outlook is gloomier on the back of the current heightened geopolitical tension, spreading protectionism and a more disruptive trade policy. More protectionism is an ineffective solution to global challenges.

The almost overlapping crises over the last years are also impacting the outlook for long-term growth. If the current trend of structural slowdown persists, it is likely that the global rate of potential growth will continue to decline. The recent shocks have added to the structural challenges, and now almost all forces that drove economic progress the last three decades are in retreat. Reviving global growth is possible through policies to grow the labour supply, increase productivity and provide incentives for investment. The policy mix required must be based on strengthening global cooperation, which unfortunately is faltering and has experienced severe setbacks over the recent years.

Changes in global demographics are key to long-term growth and can have profound implications for economic performance. Population growth is uneven, with some regions experiencing rapid growth, while others are in slight decline. Furthermore, the global population is ageing, a shift primarily driven by lower fertility rates and increased life expectancy. An ageing population with a growing dependency ratio will impede overall productivity and place a potential strain on public finances.

The pace and impact of technological developments are likely to increase over the next decades. While revolutionary technology breakthroughs are, by nature, hard to predict, it is assumed that the focus on and use of artificial intelligence (AI) will grow and gradually fuel productivity gains.

In addition, advancements in biotech and the pharmaceutical industry can support growth by lowering healthcare costs, increasing labour market participation, and enhancing productivity.

Global economic expansion continues throughout the period across the scenarios, mainly driven by growth in emerging economies. The fading favourable impact of the structural factors and globalisation result in projected growth lower than historically observed for all scenarios.

In ***Walls***, the global economy grows on average by 2.0% per year in 2025-2050. The lower growth trajectory than historically observed is mainly explained by weaker demographics, slower productivity development, and a diminishing catch-up potential for emerging economies.

In ***Plazas***, a more benign environment with focus on competitiveness leads to arenas of collaboration and increased trade. Transfer of wealth and investment directed towards emerging economies reduce the economic gap. Affordability is prioritised, and long-term economic impact of climate change is not. Global growth is at a 2.3% annual average in 2025-2050.

In ***Silos***, economic growth is impacted negatively by escalating geopolitical rivalry, and the global growth rate is 1.7% on average annually in 2025-2050. Trade becomes more fragmented, and more resources are channelled towards defence and security of supply. Climate initiatives are scaled down due to lack of capital and reluctance to invest under uncertain circumstances, as countries are focused on security of supply concerns.

In ***Bridges EP23***, consumers, primarily in industrialised regions, face significantly higher carbon costs to curb the use of fossil fuels and to finance a rapid energy transition. Investments and transfer of technology are directed towards emerging economies. The global economy grows 2.1% on average annually in the period 2025-2050, with the highest growth towards the end of the period.

The global liquids market

Liquids demand declines as the energy transition advances in *Walls* and *Bridges EP23*, and as growth softens in *Silos*. Only *Plazas* sees growth. Nevertheless, the long-term role of liquids in petrochemicals remains unrivalled and provides resilience in all scenarios.

In *Walls*, liquids demand is expected to peak at 105 mbd by the end of this decade, followed by a decrease to 88 million barrels per day by 2050. This is largely driven by progress in decarbonising the transportation sector, where fuel efficiency, uptake of EVs and low or zero carbon liquid fuels lead to reductions in liquids demand.

The petrochemical sector will see continued global demand growth, underpinned by increased plastics consumption from a growing middle class. Aviation will also see significant growth, but a growing proportion of fuel supply will be from non-fossil fuel-based sustainable aviation fuel.

Industrialised economies and China drive the global decrease in demand towards 2050, as they focus on efficiencies and transitions to cost-competitive and cleaner fuel types. This results in a combined decrease of 25% between 2025 and 2050. In contrast, rapid development of Africa, India and the Middle East results in continued demand growth.

Oil production will decline in many regions as existing assets deplete and investment declines, particularly in Europe, CIS, and Asia. US shale production is expected to peak in the 2030s but will remain a vital supply source, with OPEC likely addressing any shortfalls.

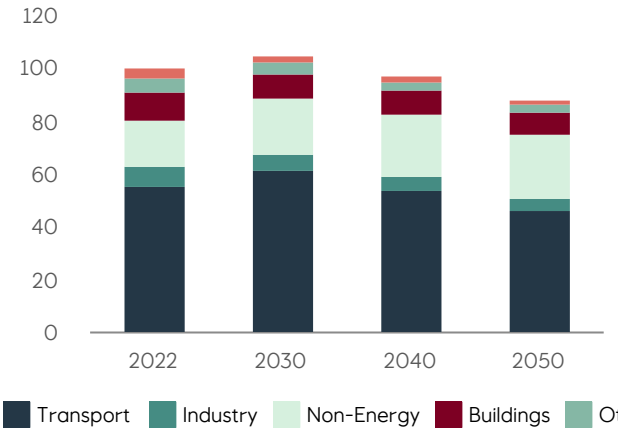
In *Bridges EP23*, liquids demand must peak immediately. The energy transition drives the liquids demand projection to 2050 with policies, technology and behavioural changes all contributing to a reduction in liquids demand of 70 mbd (70%) between 2025 and 2050.

The road transport sector sees the most significant decrease in liquids demand as LDV internal combustion engines are rapidly replaced by EVs, and diesel engine trucks are replaced predominantly by electric and hybrid vehicles. Hydrogen vehicles are also introduced but play a small role in this sector due to costs.

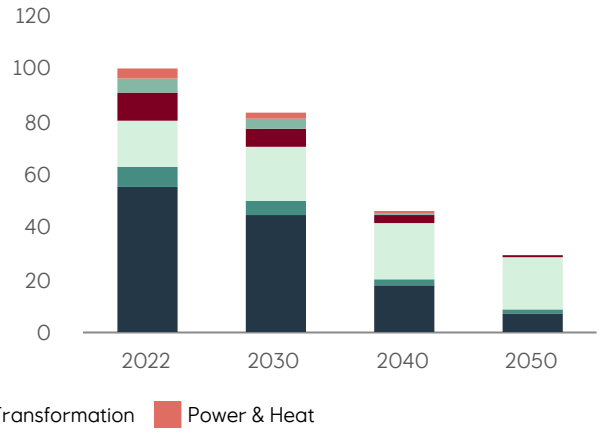
Despite total liquids demand declining, liquids demand continues to increase towards 2050 in several regions including China and the Middle East. The continued growth in both regions is driven primarily by demand from the petrochemical sector, which is the only sector to see liquids demand growth past 2025.

The sector changes are reflected in the demand for specific oil products, with gasoil and gasoline rapidly declining from 2025 onwards, whilst refinery-based petrochemical feedstock demand continues to rise until 2030.

Walls - Global Liquids demand by sector (mbd)



Bridges EP23 - Global Liquids demand by sector (mbd)



Source: IEA (history), Equinor (projections)

In *Plazas*, overall growth remains high, driving a gradual increase in liquids demand from almost 105 mbd in 2025 to a plateau just below 110 mbd in the 2030s, before softening slightly by 2050. However, the global total masks significant differences and trends across sectors and geographies.

At a sectoral level, the non-energy sector sees the greatest overall uplift, with global demand rising almost 45% between 2025 and 2050, driven largely by petrochemicals and the consumption of plastics. In addition, increased spending, coupled with a decline in recycling due to the lack of robust decarbonisation policies, propel demand in this sector across borders.

In the absence of substitutes, liquids demand from the non-road transport sector also enjoy global support. Gains of roughly 40% from 2025 to 2050 are driven by increased shipping (trade) and aviation (travel) as living standards improve across the world.

However, the trade and investment consistent with the overall development in *Plazas* does not evolve evenly across the globe. Emerging economies experience the most substantial growth in liquids demand as their middle-class populations boom and enjoy improved standards of living. In contrast, most industrialised economies see demand dampen with increasing efficiencies and electrification.

Likewise, liquids demand from road transport varies substantially by region. Industrialised economies and China transition to EVs, which drives a reduction in liquids demand. In contrast, emerging economies see growth in all vehicle types, providing support to the liquids market out to 2050 and beyond.

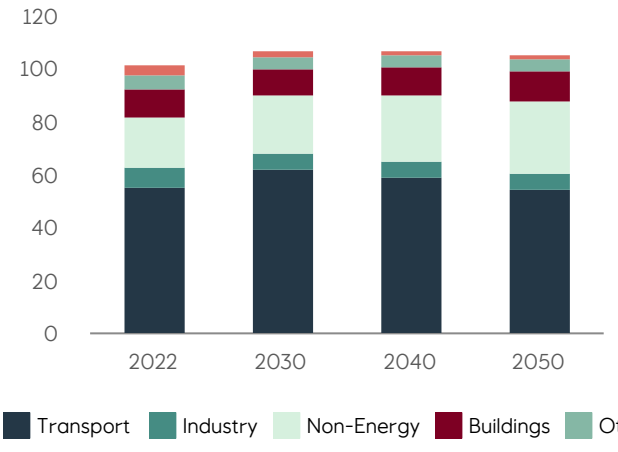
In *Silos*, liquids demand plateaus at 105 mbd before the end of the decade, and then steadily decreases almost 20% by 2050, Liquids demand softens as a result of the muted economic growth and energy security concerns that weigh down and encourage regions and sectors to switch to more secure, cost effective alternatives where available.

Emerging economies see growth, but not as much as seen in other scenarios, due to the lack of investment and development. India's demand grows by a modest 25% and Africa's by just 15% from 2025 to 2050. Meanwhile, industrialised economies see demand decrease, mainly due to poorer economic outlooks.

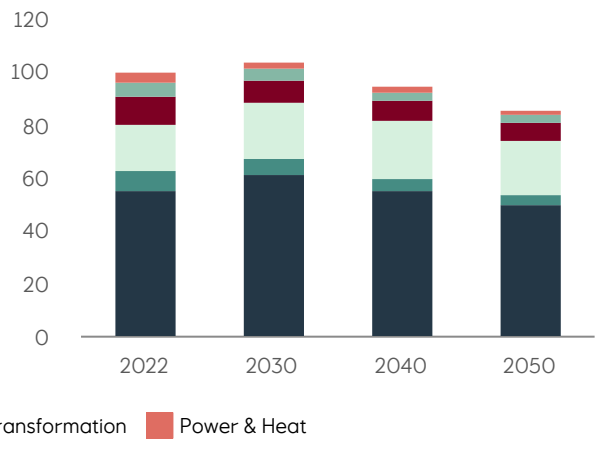
Nearly all sectors experience downwards pressure between 2025 and 2050, due to lower economic activity and cost focused behavioural changes. Road transport remains the largest demand sector, accounting for over 40% of demand by 2050. Demand in this sector also sees modest growth until 2030. The underlying cause is slowed penetration of EV's arising from fractured trade, decreased investment, and a reliance on older fleets.

Despite the reduced spending and consumption in this scenario, a lack of viable alternatives for plastics provide support from the petrochemical sector throughout the time period considered. Demand in this sector therefore remains almost constant towards 2050, hovering just above 20 mbd.

Plazas - Global liquids demand by sector (mbd)



Silos - Global liquids demand by sector (mbd)



Transport | Industry | Non-Energy | Buildings | Other Transformation | Power & Heat

Source: IEA (history), Equinor (projections)

The global gas market

Gas is sensitive to the pace of the energy transition and global trade; flourishing in *Walls* and *Plazas*, yet pushed out in favour of lower carbon alternatives in *Bridges EP23*, whilst *Silos* highlights the impacts of a fractured world on this globally traded commodity.

In *Walls*, gas demand grows by nearly 10% (~380 bcm) from 2025 to its peak demand around 2040. After 2040, however, demand is ultimately dampened as decarbonisation intensifies. Gas plays an important role in the global energy transition by helping to phase out coal and balance electricity systems with growing shares of intermittent renewables.

Asia is the key driver behind demand growth from 2025 to 2040 (~280 bcm). This is due to increased demand from the industry and electricity sectors, as well as coal-to-gas switching in response to clean air concerns and carbon neutrality pledges.

Gas demand in Europe declines, driven by electrification, renewables build-out and increased energy efficiencies. By 2050, current demand will be cut nearly in half. Declining gas use in the heating of buildings will be the single most important reduction factor, followed by decarbonisation of the electricity and industry sectors.

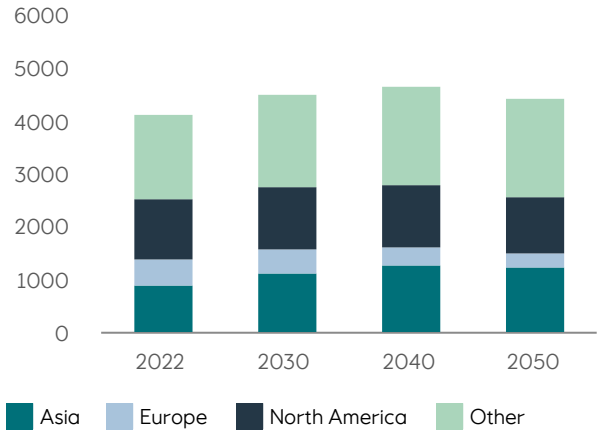
North American gas demand peaks in 2030 and declines by ~150 bcm to 2050 from the 2030 level. The Inflation Reduction Act (IRA) has a negative push on gas demand in electricity, industry, and heating. However, the effect has been dampened by increased gas-to-power demand to support rapidly expanding AI centres and improved support for thermal electricity under the new administration.

In *Bridges EP23*, global gas demand peaks in 2025 and subsequently declines by more than 70% (~3,000 bcm) towards 2050 due to a rapid shift towards an all-encompassing energy transition. The uptake of renewables and hence the phase-out of fossil fuels occurs so quickly that the role of gas as a transition fuel is limited.

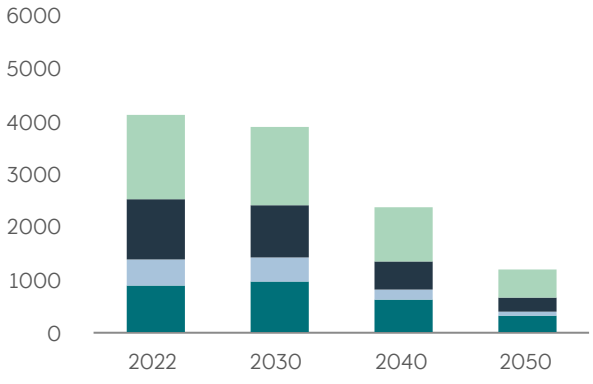
The change in gas demand is most significant in the industrialised regions, which see a 79% drop from 2025 to 2050 compared to 64% in the emerging regions including China. The global demand reduction will accelerate after 2030, affecting all flows and trade (pipe, LNG and domestic) plus all investments in gas exploration, production, infrastructure, and usage.

Power & heat represents the largest gas demand sector until the late 2040s when it is overtaken by the petrochemical sector. Hydrogen production and the petrochemical sector are the only areas to see gas demand growth beyond 2025. Gas demand in hydrogen production peaks in the early 2040s before slightly declining towards 2050, as enough capacity is built in renewables to make green hydrogen the preferred choice.

Walls - Global gas demand by region (bcm)



Bridges EP23 - Global gas demand by region (bcm)



Source: IEA (history), Equinor (projections)

In *Plazas*, gas demand sees significant growth across all sectors and regions, buoyed by a positive economic outlook, increased investment, reduced geopolitical risks, and, importantly, the open and optimised trade of cost-effective resources. Global demand is projected to rise by approximately 1,050 bcm, or 25%, between 2025 and 2050, reaching over 5,300 bcm by the end of this period, with no indication of reaching a plateau.

The electricity sector continues to dominate global gas demand, expected to account for nearly 40% of total demand by 2050. This sector is also where gas sees its most substantial growth, of almost 400 bcm from 2025 to 2050, as this commodity expands its role as a traditional energy provider and as growing intermittency support to renewables.

Other notable sectors are residential and industry. These also see meaningful growth, of over 20% and 15%, respectively, between 2025 and 2050, driven by rising standards of living and an uptick in manufacturing in response to growth.

Regional dynamics reveal a clear distinction between importing and exporting nations. While all regions in *Plazas* consume more gas than in any other scenario, demand in importing regions are inherently more sensitive to fluctuations in global gas prices. This sensitivity leads to a reactive market, with importing regions responding positively to the open markets of *Plazas*, seeing growth of nearly 40% between 2025 and 2050. In contrast, increased gas demand in exporting regions is more closely tied to economic growth rather than trade dynamics, and sees more steady growth of almost 15% in the same time frame.

In *Silos*, gas demand is down across all sectors and regions. Global demand quickly peaks at roughly 4,400 bcm before the end of the decade, decreasing to 3,710 bcm by 2050.

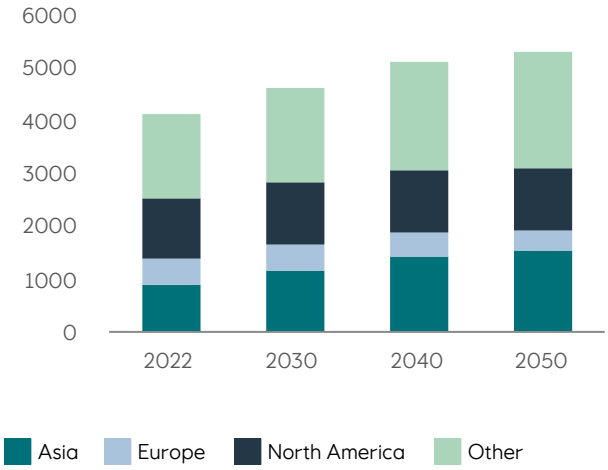
Gas therefore provides an insight into the downward pressures that can affect a globally traded commodity in a fractured world. In the case of gas, this downward pressure is exacerbated by lower growth and fuel switching to less volatile and more secure domestic alternatives, e.g. coal.

Export regions like the Middle East are more protected from the effects of fractured global markets, and in such regions, demand is resilient, remaining almost constant from 2025 to 2050. Heavily import-dependent regions such as Europe diversify where possible and, in addition, modify behaviour to adapt to higher prices. Consequently, demand falls by more than 50% during the same time frame. However, demand in North America drops by nearly 25% in the same timeframe, despite its domestic gas reserves. This shift reflects the fall in gas-intensive electricity demand, as economic pressures weigh down in this region.

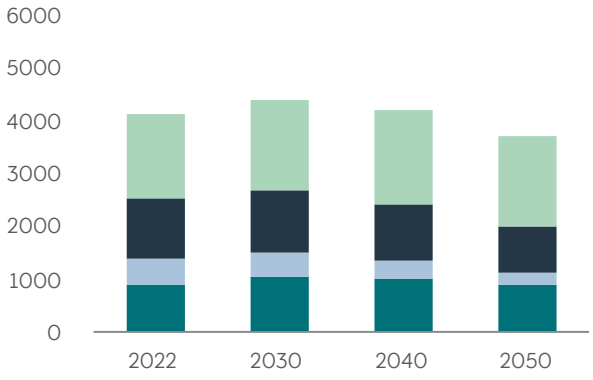
On a sectoral level, power & heat, the largest demand sector for gas, sees the most significant decrease in *Silos*, Energy security concerns weigh heavily in this sector, encouraging shifts to more secure generation types, prompting the loss of just over 400 bcm globally from 2025 to 2050.

Ultimately, higher costs, increased volatility and security concerns impact this globally sensitive commodity in an economically weakened landscape.

Plazas - Global gas demand by region (bcm)



Silos - Global gas demand by region (bcm)



Source: IEA (history), Equinor (projections)

Gas remains a transition fuel in Europe

Gas demand in the EU27+UK countries is expected to maintain its downward trajectory, however, the fuel remains an important provider of energy as Europe phases out more polluting alternatives.

Europe represents nearly 10% of the global gas market, with around 384 bcm being consumed in the EU27+UK countries in 2024. Although the residential and commercial sectors are the largest gas consumers in Europe (40%), gas-to-power (30%) and industry (24%) are also significant demand sectors (S&P Global Commodity Insights, ©2025 by S&P Global Inc).

The extreme price increases triggered by the war in Ukraine have had a profound impact on gas demand in Europe. The combination of halted Russian supplies and mild temperatures resulted in a demand reduction of around 17% in 2024, compared to the pre-crisis (2017-2021) average (S&P Global Commodity Insights, ©2025 by S&P Global Inc). Looking ahead, the energy transition and EU policy unpredictability result in uncertainty for residual demand and thus also for key suppliers to Europe, such as producers on the Norwegian Continental Shelf.

Electrification is a priority in the EU, with ambitious heat pump installation goals in the residential and commercial sectors. Countries such as France and Italy have seen faster heat pump penetration than countries such as Germany or the UK. However, the phase-out of gas boilers and switch to heat pumps, combined with efficiency and insulation measures, are leading to a decreasing trend in gas demand.

Gas plays a crucial role as a flexible electricity provider within the expanding electricity sector, particularly in countries with growing levels of renewable electricity generation and/or countries working to phase out coal or lignite generation, like Germany and Poland. As such, the demand for gas in electricity generation sees some variability across Europe. Indeed, it is anticipated that the rise of heat pumps, EVs, and data centres will further drive electricity demand, and with it, gas as the flexible provider.

For the industrial sector in Europe fuel costs and the overall economic development influence gas consumption. Electrification and efficiency measures have been observed, but driven mainly by a desire to reduce price exposure and not necessarily linked to climate initiatives. A full recovery in the industrial sector is not expected, but market prices and political support could represent a further upside for gas.

Finally, it is currently estimated that Europe consumes a very small volume of gas (15 bcm in 2024) for unabated hydrogen production in the industrial sector (S&P Global Commodity Insights, ©2025 by S&P Global Inc). This new demand sector is emerging with the energy transition efforts: low carbon hydrogen, which includes CCS. However, projects are currently being delayed due to multiple factors: costs, complexity, lack of demand, security of supply focus and industrial decline.

In conclusion, gas remains an important source of energy to Europe. Even though a full demand recovery to pre-crisis levels is not expected, especially in the industrial sector, gas is still a cleaner fossil fuel alternative which will support Europe in achieving its 2050 climate ambitions.

The global electricity market

Electricity demand grows, driven by decarbonisation and improving living standards in emerging economies, enabled by cost-competitive, easily deployable solar and wind. Even so, investments and trade are crucial and underpin widespread progress.

In *Walls*, global electricity demand is expected to increase significantly, adding over 18,000 TWh between 2025 and 2050, accounting for over 30% of total final energy demand. India will see the largest growth, doubling by 2040 and nearly tripling by 2050. Industrialised economies see steady growth (1.2% annually in the EU and 1.3% in North America, respectively), driven by EV adoption, electrification of heating and cooling, and data centres.

The industrial sector will account for nearly 40% of total demand by 2050, led by China. In the residential sector, China and North America will maintain high demand, while India and Africa will rapidly grow to become the second largest regions for residential demand by 2050, collectively matching China's 40% share of global residential consumption. EU's residential demand will grow steadily at 2.9% annually, balanced by efficiencies and behavioural changes. Transportation demand increases nearly 18 times by 2050, mainly driven by growth in China, EU, and North America.

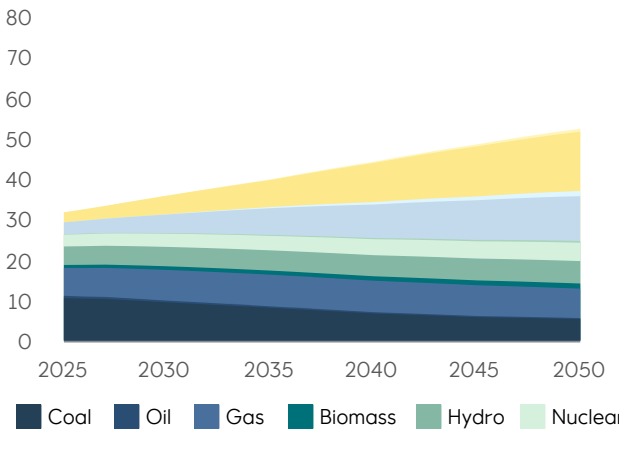
Electricity generation shifts away from fossil fuels to renewables, particularly solar and wind. The fossil fuel share of the electricity generation mix will drop from ~60% in 2025 to 25% in 2050, while solar and wind will rise from 17% to over 50%. Industrialised regions will require market reforms to attract investment to enhance and create more resilient grid infrastructure for the growing share of renewable energy.

In *Bridges EP23*, electricity demand more than doubles (grows ~38,000 TWh) between 2025-2050, and by 2050 electricity constitutes half the total final energy demand. All regions electrify quickly in the mid term. India sees the largest growth in electricity demand over the outlook period, followed by Africa. Indeed, global electricity demand continues to grow throughout the outlook period, despite efficiency gains and behavioural changes in order to drive down fossil fuels .

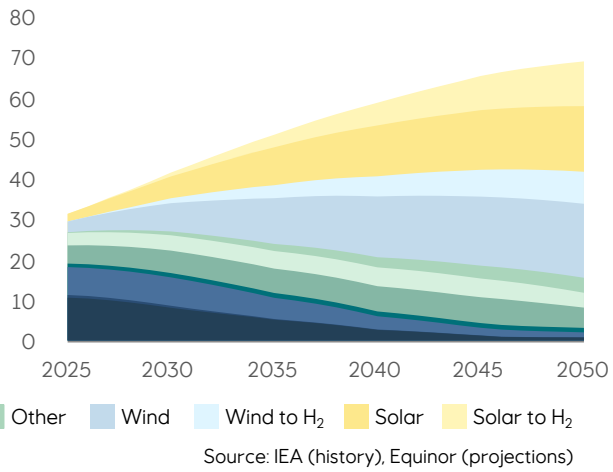
Green hydrogen production, industry and residential are the highest electricity demand sectors in 2050, accounting for 28%, 20% and 17% of total demand, respectively. Demand in industry and hydrogen production is completely dominated by China throughout the period. The residential sector sees persistent high demand in China and North America, but demand in India and Africa grows rapidly, making them the highest residential demand regions by 2050.

Electricity demand in the transport sector increases nearly six times from 2025 to 2050. This is spearheaded by China and North America. Electricity generation sees a shift away from fossil fuels towards renewables, from almost 60% fossil fuel share in 2025 to 3% in 2050. Solar and wind make up nearly 80% of the electricity generation fuel mix in 2050.

Walls - Electricity generation mix (Thousand TWh)



Bridges EP23 - Electricity generation mix (Thousand TWh)



Source: IEA (history), Equinor (projections)

In *Plazas*, global electricity demand increases at a robust rate, adding more than 25,000 TWh between 2025 and 2050, reaching over 55,000 TWh in 2050 with no plateau or peak in sight. The underlying drivers are economic development, digitalisation, and expanding access.

Emerging economies see the largest gains in electrification; India leads the way with nearly a 400% increase from 2025 to 2050, followed closely by Africa and China. These three regions together account for over 50% of the growth seen in *Plazas* over this period, adding nearly 15,000 TWh between them. Such significant growth is driven by rapidly expanding populations enjoying improved living standards, supported by increased investment providing access to affordable electricity. Industrialised economies, with ageing populations, existing infrastructure and a focus on efficiencies, also see robust growth, but not at a rate that can rival that in emerging economies. For example, North America and the EU each see growth rates of nearly 40%, over the same time frame.

Solar PV emerges as a competitive and easily deployable solution to meet rising demand, especially in emerging economies. The take up of solar-generated electricity benefits from mini-grids, which are advantageous in rural areas and avoid the need for costly infrastructure. In addition, the abundance of sunlight in countries situated at lower latitudes or near the equator makes solar energy an efficient choice. By 2050, solar energy is projected to account for over 30% of total generation. Onshore wind also plays a significant role in advancing electrification, supported by an increased capital investment in projects. In contrast, due to their higher costs, growth of nuclear and offshore wind generation is restrained in a landscape that prioritises affordability.

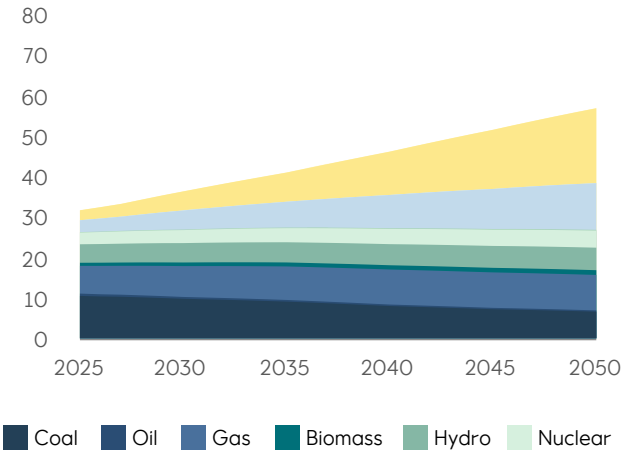
In *Silos*, electricity demand continues its steady growth, adding almost 10,000 TWh between 2025 and 2050. However, the rate of growth is muted compared to other scenarios.

Modest growth in all regions and sectors is underpinned by the globally pervasive trends of softer economic outlooks, cost-focused behavioural changes, reluctance to invest in capital-intensive infrastructure projects and competition from more secure, lower cost energy alternatives.

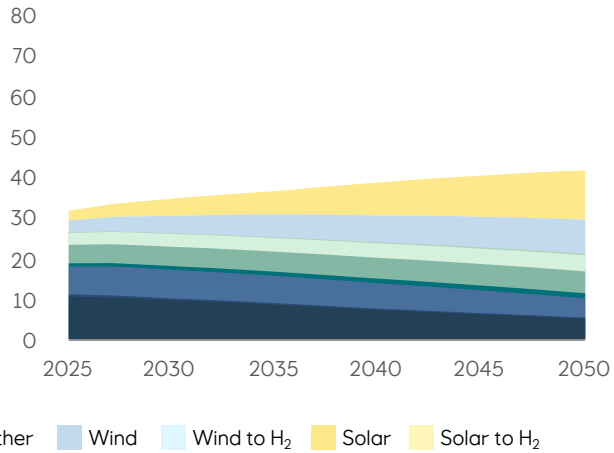
Road is the only sector to experience a significant increase, growing almost by a factor of 13 between 2025 and 2025. Nearly all this growth occurs in China, which makes up 48% of the global EV fleet by 2050, as domestically produced EVs and renewable electricity make this the most cost-effective and secure form of transport.

Global energy security concerns also shape the generation mix for electricity, as higher interest rates and defence spending leave less funds for investment in new technologies and grids. As such, fossil fuels remain incumbent in regions with domestic availability and therefore still account for a quarter of the generation mix worldwide by 2050, whilst other regions turn towards renewable sources as a means of securing sufficient generation. Solar generation increases nearly five-fold from 2025 to 2050, and wind increases almost three-fold in the same time frame. Geothermal, although a small contributor, also increases three-fold toward 2050. On the other hand, industrialised economies such as Europe and Other Asia-Pacific, with access to technology and more capital investment for larger projects, diversify with nuclear generation. Consequently, nuclear grows ~40% towards mid-century.

Plazas - Electricity generation mix (Thousand TWh)



Silos - Electricity generation mix (Thousand TWh)



Source: IEA (history), Equinor (projections)

Data centres: Local effects, global consequences

Towards 2030, electricity demand from data centres is expected to increase across all regions, however, the effects remain largely local.

The electricity consumption by data centres is projected to grow significantly over the next decade, largely fuelled by our growing reliance on digital applications that require large storage spaces, robust computing power, and sophisticated data processing. While today's data centres predominantly serve the needs of data storage and cloud computing, the rise of AI stands to revolutionise this domain. As AI cements its role in our digital ecosystem, data centres are likely to become a key driver for growth in electricity demand.

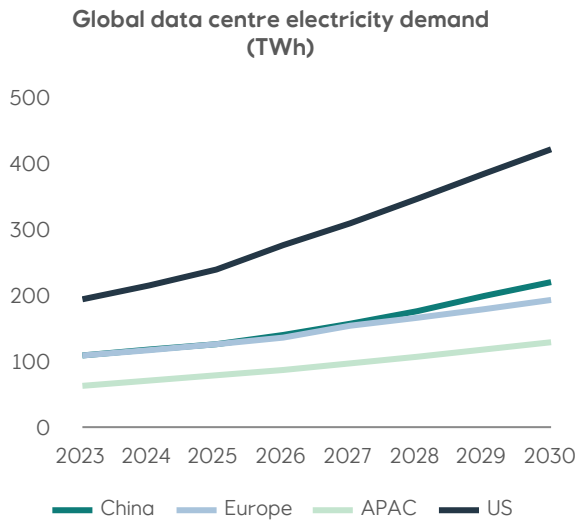
The US is the world's largest data centre market. Based on Equinor analysis, electricity demand from US data centres is expected to double by the end of 2030, growing from approximately 5 to 10 per cent of the country's total electricity consumption. Virginia is the data centre capital of the US, currently responsible for over a quarter of the electricity consumed by data centres nationally. A large portion of global internet traffic passes through Northern Virginia's Data Center Alley, a cluster of data centres close to Washington DC.

Electricity consumption by data centres in Europe is also expected to increase significantly, albeit at a slower pace than in the US. Compared to the 100% growth in the US market, the European market is forecast to grow by 60% over the next six years. Data centres in Germany, Europe's largest market, use roughly half the electricity of Virginia, highlighting the sheer scale of the data centre market in the US. The Asia-Pacific (APAC) market is expected to have a similar growth trend to Europe, but the market is smaller. Compared to its large population, China's data centre market can be considered small. However, due to significant government investment, its electricity use by data centres is expected to surpass Europe's by 2030.

Due to the concentrated nature of data centre markets, elevated electricity demand in some areas is creating electricity shortages, transmission bottlenecks, and grid connection queues. This has led to increased government pressure on data centres to improve energy efficiency and restrictions on new projects in some areas such as the Netherlands and Ireland.

As companies look to avoid grid connection queues, data centres are pursuing long-term, reliable electricity supplies, with behind-the-meter generation becoming an attractive solution. Furthermore, as companies face increasing pressure to reach sustainability targets, there is an increasing focus on obtaining electricity from nuclear and renewable sources through power purchase agreements (PPAs). The intermittent nature of solar and wind means that there will be a continuing need for flexible electricity generation, possibly leading to an increased demand for gas-to-power as well as a delay in coal phase-out in certain areas.

In conclusion, the data centre industry is expected to grow significantly by the end of 2030, largely driven by the uptake of AI. Currently, challenges related to data centres are mainly seen on a local scale, but as the industry grows, they are likely to become more widespread. However, AI technologies can improve energy efficiencies in data centres, which can help mitigate challenges related to the industry's growth.



Source: Equinor estimates

The global hydrogen market

The role of clean hydrogen as an energy carrier is limited by high costs, and without climate incentives, hydrogen fails to take off in *Plazas* and *Silos*. Decarbonisation policies create opportunities for both hydrogen and its derivatives to develop as flexible and sustainable fuel sources in *Bridges EP23,* and to a much lesser extent also in *Walls*.

In *Walls*, clean hydrogen in final energy use grows from zero today to almost 200 Mtoe in 2050. This growth comes from decarbonisation efforts which create new use cases in industry and transport, with some utilisation in electricity. In *Walls*, clean hydrogen demand for energy remains in a niche category at 2% of final energy demand, due to high costs, infrastructure needs, and competition for renewables.

Net zero targets drive Europe's hydrogen appetite, but demand in *Walls* falls well short of ambitions on energy security and affordability grounds. Imports to Europe are crucial as domestic production faces economic constraints. North America can lead the clean hydrogen economy with low natural gas prices and export opportunities. Industrial Asia Pacific has a use case for hydrogen in electricity generation to decarbonise a young thermal plant fleet. China shows promise to become a self-sufficient consumer of clean hydrogen, leveraging its renewables potential and feeding increasing demand for hydrogen derivatives in transport and industrial uses.

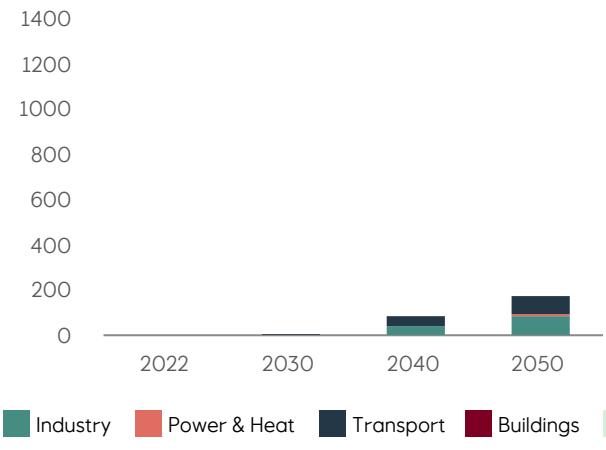
Towards 2050, hard to abate sectors are expected to lead the growth in clean hydrogen, evenly distributed between industrial processes and hydrogen derivatives in shipping. Electricity sector demand remains at a niche level due to high costs.

In *Bridges EP23*, the share of hydrogen in total final energy use rapidly increases, reaching nearly 10% in 2050, driven by a need to remove the remaining emissions from dispatchable gas electricity generation.

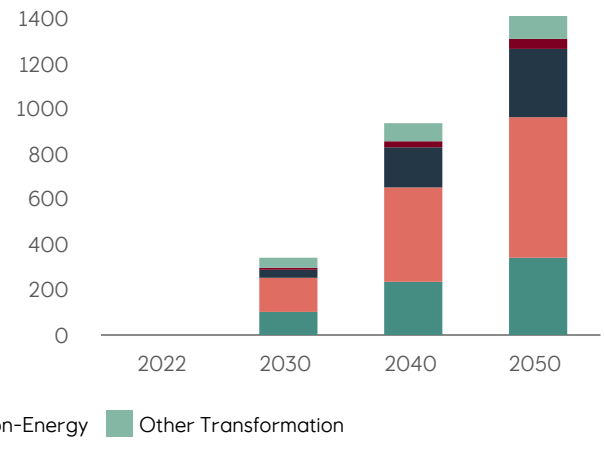
Obstacles to the roll-out of hydrogen are being overcome in *Bridges EP23*. Strong government support provides confidence in market growth in several regions, including Africa and the Middle East. Green hydrogen production dominates, and energy costs are coming down due to more projects being developed. Most sectors adapt to the use of hydrogen, led by the early movers, i.e., refineries and fertiliser and methanol production.

In *Bridges EP23*, China sees the fastest growth in demand in the mid term, accounting for ~40% of the global use in 2030. China remains the largest consumer in 2050, but its share of total demand will be reduced to 20%. More than 40% of demand in 2050 comes from electricity, followed by industry at nearly 25%. The share of green hydrogen production increases rapidly and, by the early 2030s, will be more than 50% of production. The green hydrogen share exceeds 80% by 2050.

Walls - Global hydrogen demand by sector (Mtoe)



Bridges EP23 - Global hydrogen demand by sector (Mtoe)



Source: IEA (history), Equinor (projections)

Key figures

		2022	2050		2022-50 growth per year (%), CAGR	
	Units		Walls	Bridges EP23	Walls	Bridges EP23
Global GDP	2015-USD trillion	90.3	160.8	158.0	2.1	2.0
North America, Europe, Industrial Asia Pacific	2015-USD trillion	54.1	78.8	74.7	1.3	1.2
China	2015-USD trillion	16.5	35.3	37.0	2.8	2.9
Rest of World	2015-USD trillion	19.6	46.7	46.3	3.1	3.1
Global energy intensity - Indexed to 2022		100	58.9	39.7	-1.9	-3.2
Global population	billion	8.02	9.66	9.69	0.7	0.7
Global primary energy demand	Gtoe	14.6	15.3	10.1	0.2	-1.3
Coal	Gtoe	3.9	1.8	0.3	-2.8	-9.1
Oil	Gtoe	4.4	3.7	1.0	-0.6	-5.1
Gas	Gtoe	3.4	3.6	1.0	0.2	-4.3
Nuclear	Gtoe	0.7	1.2	1.0	2.0	1.2
New renewables	Gtoe	0.5	3.1	5.3	7.0	9.1
Oil ex biofuels	mbd	96.7	82.4	24.3	-0.6	-4.8
Gas	bcm	4,142	4,438	1,197	0.2	-4.3
Global energy-related CO_2 emissions	billion tonnes	33.8	22.0	1.1	-1.5	-11.6
North America	billion tonnes	5.7	3.0	0.2	-2.3	-11.8
Europe	billion tonnes	3.6	1.2	0.0	-3.8	-17.1
China	billion tonnes	10.7	4.7	0.1	-2.9	-16.2
India	billion tonnes	2.6	3.1	0.1	0.7	-10.2
World CO_2 emissions from fossil fuel use removed by CCUS	million tonnes	15	641	1,964	14.3	19.0
World CO_2 emissions removed from atmosphere	million tonnes	0	3	4,300		
Global light duty vehicles (LDVs) fleet	million	1,469	1,904	1,368	0.9	-0.3
LDVs oil demand	Mtoe	1,205	689	29	-2.0	-12.5
LDVs biofuel demand	Mtoe	64	44	1	-1.3	-14.9
LDVs electricity demand	Mtoe	5	230	292	14.6	15.6

Source: IEA (history), Oxford Economics Limited 2025 (history), UN (history and projections), Equinor (projections)

		2022	2050		2022-50 growth per year (%), CAGR	
	Units		Plazas	Silos	Plazas	Silos
Global GDP	2015-USD trillion	90.3	172.0	145.8	2.3	1.7
North America, Europe, Industrial Asia Pacific	2015-USD trillion	54.1	81.9	73.2	1.5	1.1
China	2015-USD trillion	16.5	37.9	31.2	3.0	2.3
Rest of World	2015-USD trillion	19.6	52.1	41.4	3.5	2.7
Global energy intensity - Indexed to 2022		100	62.4	58.7	-1.7	-1.9
Global population	billion	8.02	9.66	9.66	0.7	0.7
Global primary energy demand	Gtoe	14.6	17.4	13.9	0.6	-0.2
Coal	Gtoe	3.9	2.3	1.9	-2.0	-2.6
Oil	Gtoe	4.4	4.6	3.8	0.1	-0.6
Gas	Gtoe	3.4	4.4	3.0	0.9	-0.4
Nuclear	Gtoe	0.7	1.1	1.1	1.7	1.5
New renewables	Gtoe	0.5	3.1	2.2	7.0	5.8
Oil ex biofuels	mbd	96.7	101.4	82.1	0.2	-0.6
Gas	bcm	4,142	5,328	3,709	0.9	-0.4
Global energy-related CO_2 emissions	billion tonnes	33.8	28.3	22.3	-0.6	-1.5
North America	billion tonnes	5.7	4.2	3.6	-1.0	-1.6
Europe	billion tonnes	3.6	2.0	1.8	-2.1	-2.5
China	billion tonnes	10.7	6.2	4.2	-1.9	-3.3
India	billion tonnes	2.6	3.5	3.0	1.1	0.5
World CO_2 emissions from fossil fuel use removed by CCUS	million tonnes	15	42	39	3.8	3.4
World CO_2 emissions removed from atmosphere	million tonnes	0	0	0		
Global light duty vehicles (LDVs) fleet	million	1,469	2,103	1,784	1.3	0.7
LDVs oil demand	Mtoe	1,205	841	859	-1.3	-1.2
LDVs biofuel demand	Mtoe	64	54	49	-0.6	-1.0
LDVs electricity demand	Mtoe	5	223	144	14.5	12.7

Source: IEA (history), Oxford Economics Limited 2025 (history), UN (history and projections), Equinor (projections)

Units

Coal	Mtce	million tonnes of coal equivalent
Oil	mbd	million barrels per day
Gas	bcm	billion cubic metre
Electricity	TWh	terawatt-hour
	PWh	petawatt-hour
Energy	Mt	million tonnes
	Gt	gigatonnes
	toe	tonnes of oil equivalent
	Gtoe	giga tonnes of oil equivalent
	Mtoe	million tonnes of oil equivalent
Carbon	Gt CO_2	gigatonnes of carbon dioxide
	Mt CO_2	megatonnes of carbon dioxide

Only units used in the report are listed

Definitions

Energy demand and consumption
History: 1990-2022
Projection: 2023-2050

Regions
There are 12 regions modelled.
Industrialised: European Union, Industrialised Asia Pacific, North America, Other Europe.
Emerging: Africa, China, CIS (Commonwealth of Independent States), India, Middle East, Other Americas, Other Asia Pacific, Southeast Asia.

Sectors
There are eight sectors modelled.
Industry, residential, other stationary, transport, non-energy, power & heat, hydrogen, other transformation.

Commodities
Electricity demand and electricity generation include both grid demand and electricity demand for hydrogen production.
Liquids refers to oil and biofuels.

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