Beyond the energy transition

Reimagining Energy Scenarios for an Evolving World

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Credits

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S&P Global
Commodity Insights

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Introduction

In 2025, S&P Global Commodity Insights reimagined our long-term energy and climate scenarios to address the complexities of modern energy markets. The traditional framework of the "energy transition" is no longer sufficient to capture the sometimes contradictory trends in fossil fuel demand and renewable energy growth, as well as the fragmentation and complexities of international geopolitical relationships and trade. This rethinking has led to the development of three new scenarios—Adaptation, Fracture, and Renaissance—alongside updates to the CI Base Case and Net-Zero 2050 outlook.

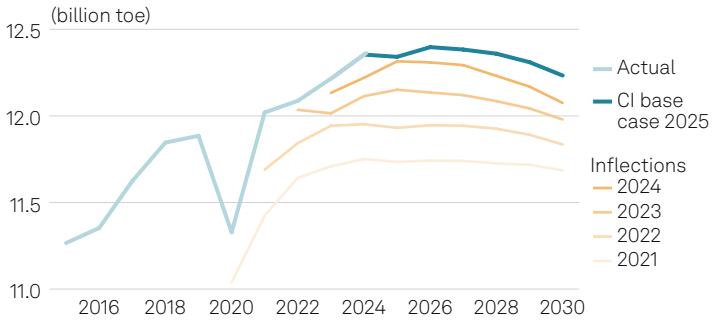
The new scenarios highlight governance and technological progress as critical drivers of future energy pathways and emphasize the need for strategic planning to navigate a volatile world where contradictory trends can and will coexist. Thinking beyond the energy transition requires energy market players to prepare for high-risk, low-probability events and the potential for continued geopolitical upheaval.

To learn more or to request a demo, visit spglobal.com/new-energy-scenarios.

Global and regional energy dynamics have become increasingly complex

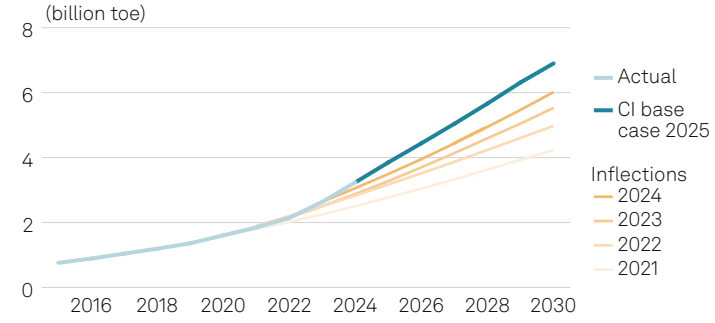
In 2025, we have fundamentally reimagined our suite of long-term energy and climate scenarios.

Global fossil fuel demand



Source: S&P Global Commodity Insights

Global non-hydro renewable capacity



Source: S&P Global Commodity Insights

The decision to reimagine our scenarios was driven by the recognition that 'the energy transition' had become a far too narrow framework to explain the dynamics of modern energy markets. Depending on perspective, the same data could (and have been) interpreted as the energy transition accelerating, or grinding to a halt. Beyond energy, the 2020s have proved so far to be a decade of instability and change, but in 2025 the world has experienced a marked increase in volatility, and notably, a fragmentation of international relationships and trade that is unprecedented in modern times. Deepening our analysis – thinking beyond the overly simplified energy transition – is therefore essential to capture the energy market risks of today and to reimagine plausible pathways to the future.

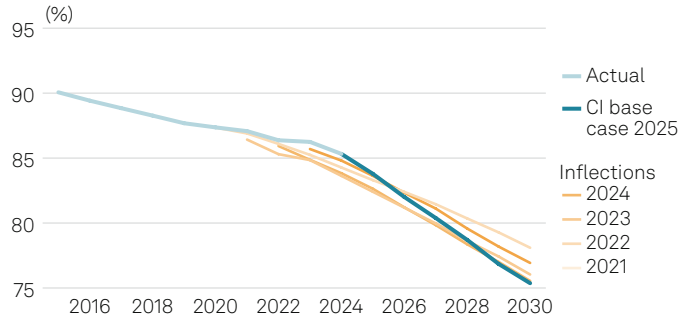
Since 2020, expectations for the post-COVID-19 recovery in global energy demand have confounded expectations. Global fossil fuel demand has rebounded faster than expected, but renewable capacity and generation growth have also exceeded forecasts. By 2024, global fossil fuel demand was approximately 5% higher than the value predicted for the same year in 2021, but renewable power capacity (excluding hydro) had reached a level 22% above what was predicted in 2021. Such conflicting trends have led to simultaneous and opposite conclusions: the energy transition has stalled, and the energy transition is racing ahead.

Regional trends in the evolution of energy demand since 2020 have proved similarly diverse. Looking specifically at the fossil fuel share of primary energy demand, some markets are moving more quickly than expected; others more slowly, but for all, year-on-year volatility is notable.

The share of fossil fuels in China's energy mix has been falling for some years (albeit from very high levels), but since 2020 this rate of decline has slowed and fossil fuels have demonstrated themselves to be more resilient than expected – even with a huge contemporaneous uplift in renewable power capacity and generation. The fossil fuel share of India's energy mix fell far more than expected in 2020 and the rebound took almost two years to fully materialize, but when it did arrive it was stronger than initially forecast. In the US and the EU the fossil fuel share

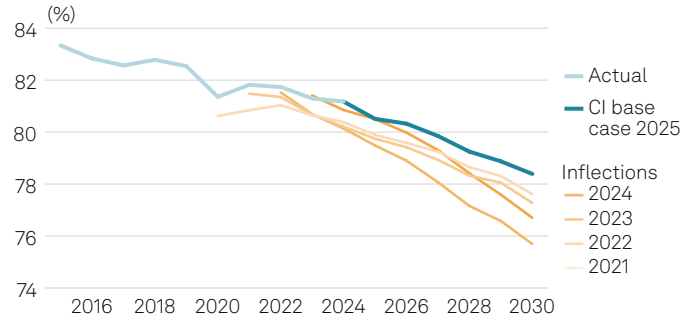
of total energy demand has been in decline for some years but fell very sharply during COVID as transportation and industrial demand collapsed. A rebound was forecast in both regions and this proved to be the case, but subsequently the two regions have diverged. Both have broadly returned to trend but in the US the rate of decline of fossil fuels has slowed in comparison to the historical average, while in the EU it has accelerated – and significantly faster than forecast – largely as a result of the Ukraine conflict and the region's subsequent goal to maximize its energy independence through decarbonization.

China: Fossil fuel share of total primary energy demand



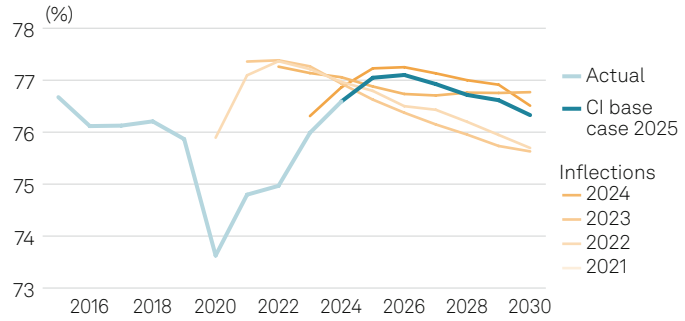
Source: S&P Global Commodity Insights

US: Fossil fuel share of total primary energy demand



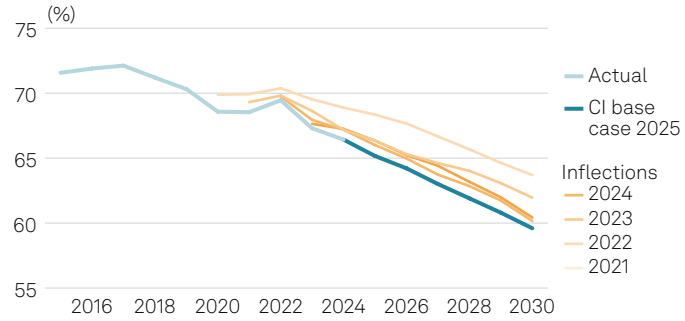
Source: S&P Global Commodity Insights

India: Fossil fuel share of total primary energy demand



Source: S&P Global Commodity Insights

EU: Fossil fuel share of total primary energy demand



Source: S&P Global Commodity Insights

A new approach is required

The process of deepening the S&P Global Commodity Insights scenarios suite began with an extensive series of research conversations and interviews, held in fourth quarter 2024 and first quarter 2025.

By the end of this process, we had collected over 400 questions about the future from colleagues and clients. Our aim was to use the answers to these questions to shape a brand-new set of scenarios that were narratively and thematically distinct from our 2024 and earlier outlooks.

Close analysis of the 400 questions revealed 40 critical uncertainties ranging across four thematic topics: governance; technological progress; the future of emerging markets and developing economies (EMDEs); and great power diplomacy.

We deemed governance and technological progress to be the primary drivers of the new scenario narratives, with the future of EMDEs and great power diplomacy as secondary drivers. Governance, after all, is fundamental: How the body politic manages its affairs has a bearing on everything else.

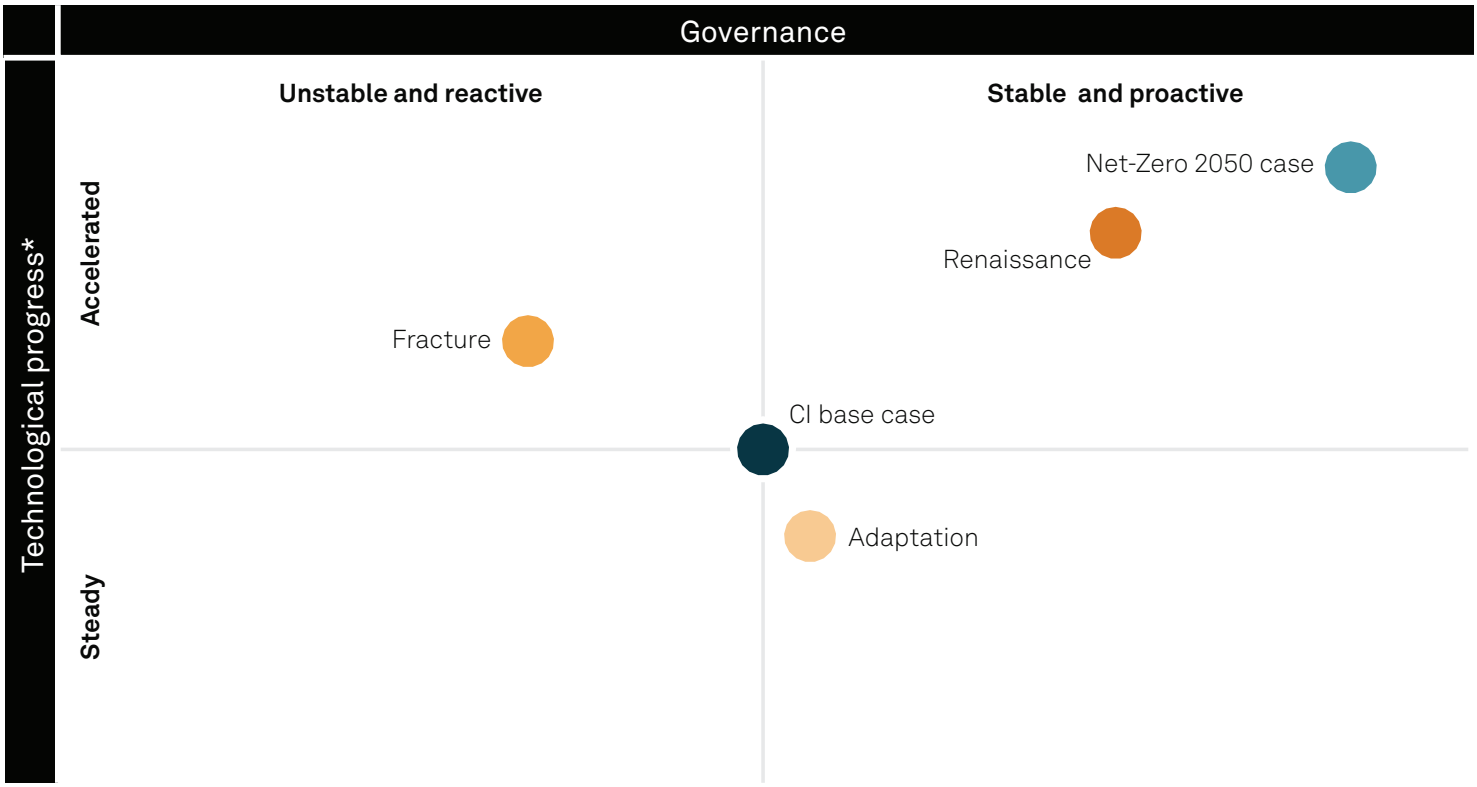
While in the past, technology would have also been a dependent driver underneath governance, the world has reached a stage where technological development is becoming independent of wider governance and, in many cases, is actively ahead (AI and social media are examples).

The future trajectories of EMDE growth and great power diplomacy are functions of or are dependent on developments in the governance and technology spaces. It is, for example, difficult to imagine a world where EMDE growth accelerates ahead of trend without good or effective governance in place.

These secondary drivers do not, therefore, define the new scenarios, but they are important in adding additional dimensions and narrative elements.

Three new scenarios emerged from a 2x2 matrix built around the drivers of governance and technological progress. The locations on the matrix of the new scenarios – Adaptation, Fracture and Renaissance – plus the CI Base Case and the Net-Zero 2050 case, are shown in Figure 1, next page.

Governance and technological progress are the primary driving forces of the new suite of scenarios



* From 2024 levels.
Unstable and reactive: volatile politics; disorderly policymaking and change implementation. Stable and proactive: engaged citizenry; orderly policymaking and change implementation.
Accelerated: significant advancements; disruptive technologies; new energy models emerge. Steady: moderate advancements; technical barriers; gradual evolution in energy.

Source: S&P Global Commodity Insights

Introducing Adaptation, Fracture and Renaissance

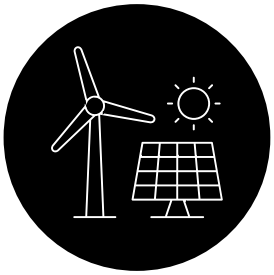
Adaptation, Fracture and Renaissance are our brand new scenarios.

They sit alongside our updated CI Base Case (the evolution of the 'Inflections' scenario from 2024 and prior years) and the Net-Zero 2050 case, which is an update of the Multitech Mitigation (MTM) outlook from 2024 and prior years.

Adaptation

Balancing fossil-fuel-powered economic growth against heightened global warming. The Adaptation scenario outlines a shift in global priorities, in which nations focus on economic growth and resilience-building in response to the challenges posed by climate change.

As the ambition to limit global warming to 1.5 degrees C becomes increasingly unattainable, countries pivot toward strategies that emphasize adaptation to climate change via stronger, more resilient economies, over emissions mitigation. This pragmatic focus on economic growth underpins robust energy consumption and resilient demand for fossil fuels, especially oil and gas, through the long term. Adaptation, therefore, positions the benefits of a faster-growing global economy in the near to medium term against the risks of accelerated climate change in the longer term.



Fracture

Accelerated technological progress in a weak policy and governance environment. The Fracture scenario presents a world characterized by rapid technological advancements but also complex governance issues and significant shifts in global energy dynamics as some markets decarbonize very rapidly, while others lag behind.

The combination of poor governance and accelerated technological progress has profound implications for geopolitics and economics, as well as environmental issues such as climate change, creating a complex and often difficult future for energy markets and society at large.

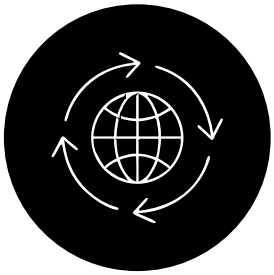
Renaissance

Emerging markets play a key role in driving a late but accelerated energy transition. The Renaissance scenario anticipates a world that sees significant change in global economic and political relationships, alliances, and leadership, stemming from the end of the post-World War II global order dominated by the US.

Reaction to these changes leads to profound shifts in the global balance of power. A more multipolar geopolitical landscape develops that is marked by a faster-than-expected rise of key EMDEs. These countries play a significant role in driving strong global economic growth and a more accelerated uptake of clean energy technology across the world.

CI Base Case 2025

The Commodity Insights base case view of the energy future. The 2025 iteration of the CI Base Case describes a world attempting to manage the instability and uncertainty of the early to mid-2020s and facilitate an energy transition that conclusively pivots the global energy system away from fossil fuels, while still meeting the growing needs of developed and emerging economies alike.



Net-Zero 2050

Based on its analysis of the NZ 2050 case outlook, the Commodity Insights team has determined that the steps and pace of change required to meet the 2050 net-zero global emissions would require radical, highly implausible actions to be taken across the world in all sectors, both within energy and outside of it, making the outlook unrealistic from an economic, political and practical standpoint.

Commodity Insights Energy and Climate Scenarios and net-zero case: Key metrics

	Global GDP CAGR (%, 023–60)	2050 TPED (%, change vs 2024)	2060 Fossil fuel (%, TPED)	GHG emissions (%, change vs 2024)	Global temp. (°C, change by 2100)
CI base case 2025	2.4	+17	52	-31	2.5
Adaptation	2.8	+32	64	+1	3.2
Fracture	2.0	+3	53	-29	2.5
Renaissance	2.8	-3	32	-71	1.9
Net-Zero 2050	2.7	-18	15	-107	1.5

GHG: greenhouse gas, TPED: Total Primary Energy Demand S&P Global Commodity Insights considers a country or region to have effectively reached "net-zero" emissions once GHG emissions have fallen to less than 1% of their 2022 level and remain at that level over the course of a year.

Source: S&P Global Commodity Insights

Energy and GHG emissions trends

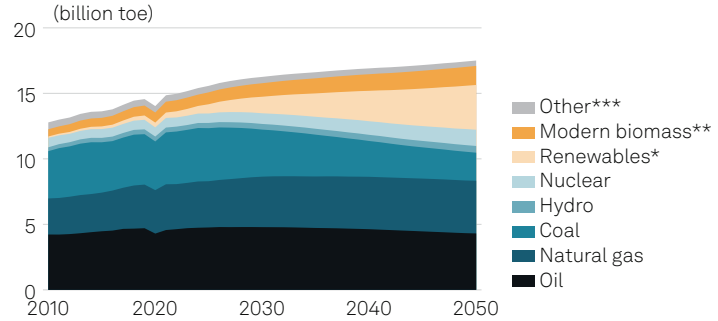
Across all scenarios (CI Base Case, Adaptation, Fracture, and Renaissance), fossil fuels remain pivotal and cleantech deployment advances, but there are specific differences between each outlook.

Under the CI Base Case, renewable energy supply expands multifold between 2024 and 2060. Coal is pushed out of the power sector while global oil demand is eroded – but only slowly – by a steadily-growing fleet of EVs and improving fuel efficiency of internal combustion engines.

In Adaptation, the progress of technological development is slower than in other scenarios (though it does not go into reverse), meaning that cleantech penetration is unable to simultaneously meet total incremental demand growth and erode legacy fossil fuel consumption. Adaptation is the 'energy addition' scenario, where fossil fuels maintain the majority share of global primary energy demand even in 2060.

Technological development in both Fracture and Renaissance is faster than in the CI Base Case, but the difference between the two scenarios lies in the implementation and deployment of that technology. In Fracture, poor governance means that the implementation of emerging technologies is often disorganized

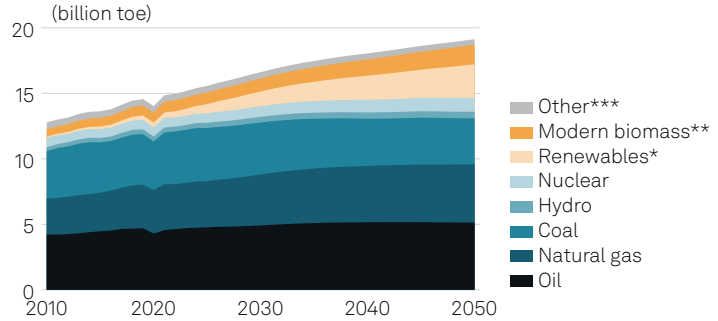
CI Base Case: Total global primary energy demand by fuel



*Includes solar, wind, geothermal, and ocean energy.
**Includes biofuels and biomass (industry, electricity, district heat, and refining).
***Includes solid waste, traditional biomass, ambient heat, net trade of electricity, or heat

Source: S&P Global Commodity Insights, International Energy Agency

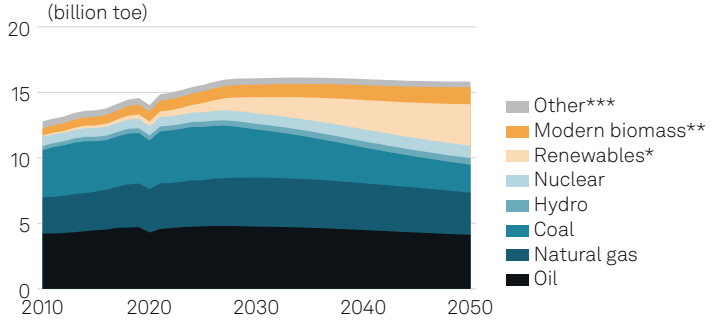
Adaptation: Total global primary energy demand by fuel



*Includes solar, wind, geothermal, and ocean energy.
**Includes biofuels and biomass (industry, electricity, district heat, and refining).
***Includes solid waste, traditional biomass, ambient heat, net trade of electricity, or heat

Source: S&P Global Commodity Insights, International Energy Agency

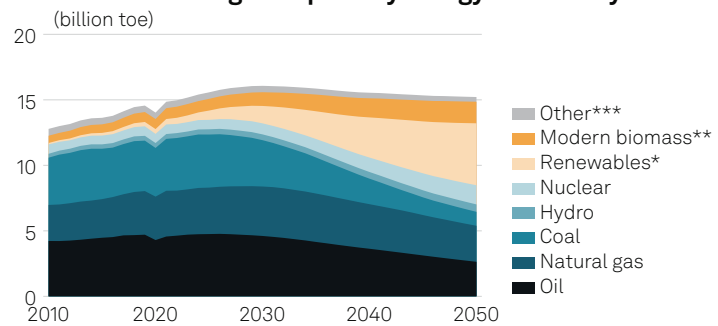
Fracture: Total global primary energy demand by fuel



*Includes solar, wind, geothermal, and ocean energy.
**Includes biofuels and biomass (industry, electricity, district heat, and refining).
***Includes solid waste, traditional biomass, ambient heat, net trade of electricity, or heat

Source: S&P Global Commodity Insights, International Energy Agency

Renaissance: Total global primary energy demand by fuel



*Includes solar, wind, geothermal, and ocean energy.
**Includes biofuels and biomass (industry, electricity, district heat, and refining).
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Source: S&P Global Commodity Insights, International Energy Agency

and chaotic, leading to a patchwork of competing solutions. This lack of cohesion in technology deployment results in inefficiencies and overbuilding, hindering the potential for an accelerated global energy transition. In Renaissance, the combination of effective governance and accelerated technology development means that by 2040, coal, oil, and even gas demand are in decline, with the world's energy needs increasingly met by rapidly growing clean energy solutions.

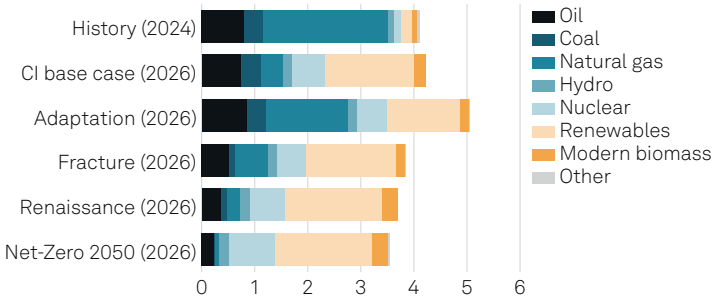
The regional diversity of primary energy demand trends illustrates the complexity of the 2025 suite of scenarios. Both within and across the outlooks, some markets transition more quickly, while others lag. China's global dominance of cleantech manufacturing is pronounced across all outlooks, as is its strategic imperative to reduce dependence on imported energy and build its influence on the global stage. Here, the energy transition is accelerated across all outlooks, though the resilience of fossil fuels (i.e., which fuels survive for longest) does vary depending on the specific framework of each scenario.

In India, there is a stark divide between the CI Base Case and Adaptation scenarios on one side, and Fracture and Renaissance on the other. For the CI Base Case and Adaptation outlooks, fossil fuels (and coal in particular) underpin India's long-term energy demand growth. In Fracture, the easy and cheap availability of clean energy technology erodes fossil fuel demand, but the imperfect implementation issues mentioned above (and a weaker economic outlook vs. the base case) do act as a constraint on overall energy demand growth. Only in Renaissance does India see an accelerated energy transition away from fossil fuels over the long term.

The developed markets of the US and the European Union follow divergent paths. In the Fracture scenario, domestic political choices mean the US cedes leadership on clean energy technology development to China, while also locking out Chinese imports. The result is a continued strong presence for fossil fuels in the US energy system – a trend seen also in the Adaptation scenario. In the Renaissance scenario, US policy eventually pivots back towards decarbonization as a strategic goal, setting the conditions for a long-term transition away from fossil fuels.

China total primary energy demand by fuel, 2024 and 2026

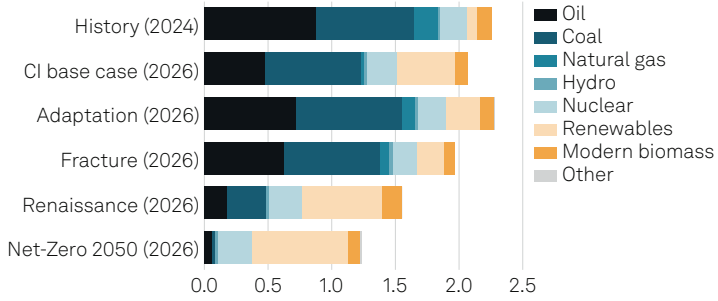
(billion toe)



Source: S&P Global Commodity Insights

US total primary energy demand by fuel, 2024 and 2026

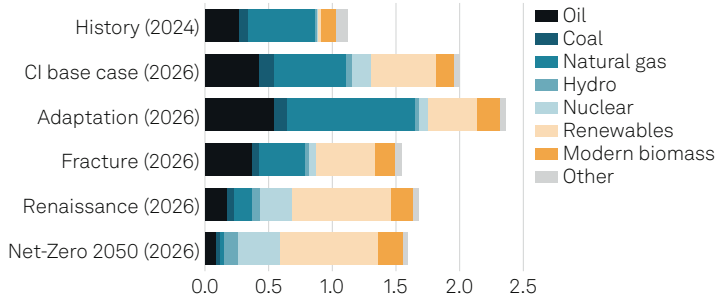
(billion toe)



Source: S&P Global Commodity Insights

India total primary energy demand by fuel, 2024 and 2026

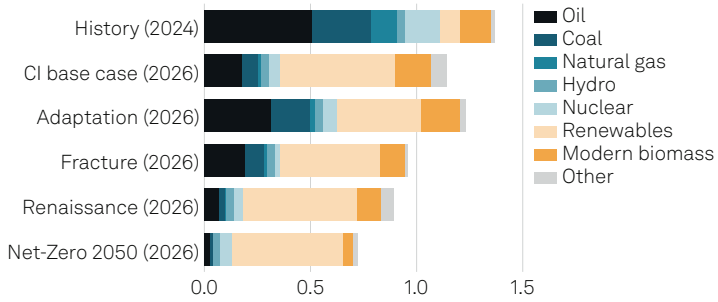
(billion toe)



Source: S&P Global Commodity Insights

EU total primary energy demand by fuel, 2024 and 2026

(billion toe)

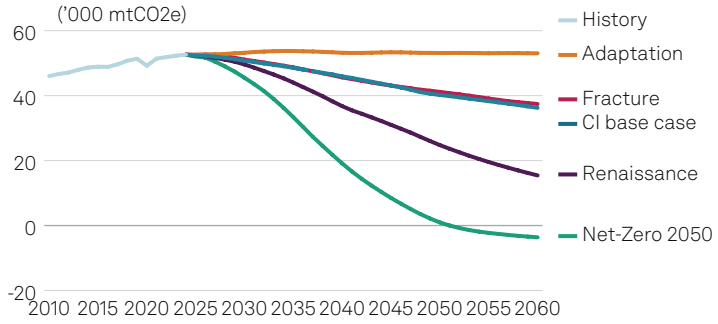


Source: S&P Global Commodity Insights

In the EU, long-term decarbonization is expected regardless of outlook, but under the Adaptation and Fracture scenarios, the political will to adhere to goals such as the region's Paris Agreement Nationally Determined Contribution (NDC) or reaching net-zero GHG emissions by 2050 falls by the wayside. This is not to say that decarbonization drops completely off the European policy agenda, but in Fracture and Adaptation, other imperatives, such as economic growth and addressing the high cost of energy, come more to the fore. Renaissance posits a scenario under which Europe's decarbonization and clean energy technology policy goals are largely (though not entirely) met, and it is this outlook which features the most significant move away from fossil fuels.

The differing speeds of the energy transition across key markets is reflected in their GHG emissions trajectories. China's GHG emissions are expected to decline in all outlooks, though in Adaptation this decline is far slower than in the other scenarios. India's GHG emissions are expected to rise until the late 2040s under the CI Base case, after which they will enter a slow decline. By contrast, India's GHG emissions in the Adaptation scenario continue growing until 2060, and likely beyond. In the US and the EU, GHG emissions are also expected to fall over the long term, but in both markets the

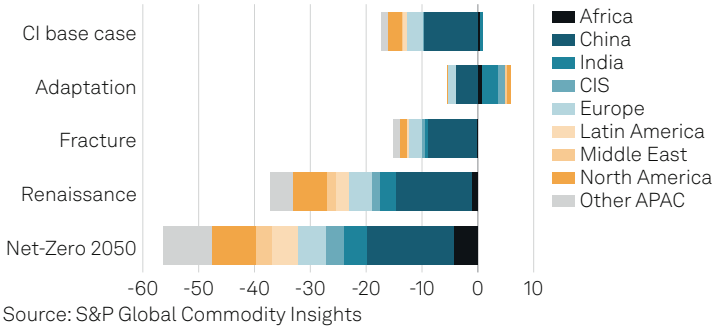
Global GHG emissions by scenario



Source: S&P Global Commodity Insights

Global GHG emissions change by region

('000 mtCO2e)



Source: S&P Global Commodity Insights

rate of decline under Fracture and Adaptation is tempered in comparison to the CI Base Case. In both markets GHG emissions fall most rapidly in the Renaissance scenario; under this outlook both the US and EU could approach net-zero emissions by 2060.

Globally, the 2025 scenarios show GHG emissions as stable to declining, but all outlooks except Renaissance and the Net-Zero 2050 case imply warming of well above 2 degrees C by 2050. Managing the consequences of a changing and warming climate is an inescapable truth regardless of outlook.

Predetermined elements common to all outlooks

The research conversations that shaped the 2025 scenarios also revealed a number of other fixed or predetermined elements – outcomes that were considered to be overwhelmingly likely to occur, regardless of outlook.

1.5 °C

warming threshold is no longer possible

Demographics are pointing to slower global population growth and falling populations in some countries, such as China. Given that population size is intimately linked to energy demand, this demographic trend will inevitably push the trajectory of global energy demand growth to slow over the coming decades. In addition, regional population growth is typically expected in areas (such as sub-Saharan Africa) that currently have very low energy demand on a per-capita basis.

Power demand will grow in relative and absolute terms. This phenomenon is independent of underlying demand trends: electricity demand will grow in the Organisation for Economic Co-operation and Development (OECD) countries and China, even as we expect total energy demand to slow and eventually fall. Electricity demand will also grow in the non-OECD excluding China, where we expect total energy demand to increase. All sectors (transport, industry and residential and commercial) will experience increased electrification as a share of end-use demand, in all regions.

The rise of China from the 1990s to 2020s will not be repeated. This occurred during a moment in history during which a very large, centrally-planned government was able to capitalize on liberalized global trade rules to industrialize its own economy and effectively de-industrialize the West. Now, international trade is rapidly moving back from globalization, and no other large economy (or group of economies) is governed in the same centrally planned fashion as China. Furthermore, with economic and energy demand growth slowing in developed economies and China — and industrial overcapacity in China itself — it is not clear where the opportunity for a further round of de-industrialization would occur. Effective re-industrialization of the West to 1990s levels is considered implausible for cost reasons.

Limiting global warming to 1.5 degrees above pre-industrial levels is no longer possible. Atmospheric concentrations of GHGs indicate that the breaching of the 1.5-degree-C warming threshold will be sustained even with a sudden and rapid drop in emissions from today's levels. Past, current and future anthropogenic activity (including GHG emissions, water and air pollution, etc.) will continue to negatively impact the global climate and natural environment for at least 50 years hence.

Strategic implications of thinking beyond the energy transition

> Our scenarios are not forecasts; instead they describe possible pathways to the future for the global energy sector, bounded by what we consider plausible outcomes.

In 2025, the superabundance of energy market risk factors demanded a new approach to scenario development.

Technological development, and the structure and process by which the body politic of nations, states and societies use values, policies, systems and institutions to manage economic, political and social affairs – i.e. governance – are the key trends to watch. How these trends evolve will reshape the world. The 2025 scenarios show that almost unconstrained technological development can occur in a world where governance norms are under threat. Similarly, the scenarios illustrate that governance frameworks may be organised, pragmatic and responsible, but this is not a guarantee that technology will advance at the pace required to drive an energy transition that is fast enough to mitigate the threat of global climate change. This outcome is of course possible, but it will require technology to deliver, and a renaissance in global geopolitical cooperation.

The 2025 suite of scenarios describe a landscape of possibilities, at the centre of which is the CI Base Case. As the central view in our suite of scenarios, the CI Base Case reflects elements from each of our alternative outlooks of Adaptation, Fracture and Renaissance. But where the alternative scenarios are provided as plausible boundaries to the evolution of geopolitics, macroeconomics and energy markets over the coming decades, the CI Base Case is more dynamic, and as a result may at times (and in future updates) reflect more or less of the themes and outcomes of each of the alternative scenarios, depending on how future events play out.

Thinking beyond the energy transition means strategic planning for a world in which high risk, low probability events could become the norm. Energy market players should be prepared for futures that can accommodate the evolution of entirely opposing trends – at the same time. Market volatility, contradictory data and an almost unprecedented upheaval in global geopolitical norms will ensure that the legacy of the 2020s will be felt for decades to come.

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Conclusion

The reimagined Energy & Climate Scenarios for 2025 reflect the intricate and multifaceted nature of today's energy landscape. By moving beyond the narrow confines of the traditional energy transition framework, we gain a clearer understanding of the diverse pathways that lie ahead. The scenarios – Adaptation, Fracture and Renaissance – highlight the critical interplay between governance technological

advancement, emphasising that the future of energy markets will be shaped by complex and powerful forces.

As we navigate this terrain, it is essential for stakeholders to remain agile and informed, and prepared to respond to futures characterised by volatility and uncertainty. The insights derived from these scenarios will serve as a vital tool for strategic planning, enabling decisionmakers to anticipate and adapt to the evolving dynamics of the global energy system.

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