Taking Stock 2026: US Energy and Emissions Outlook

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Authors:
Hannah Kolus
Ben King
Parker Case
Michael Gaffney
Nathan Pastorek
Anna van Brummen
Nathan Wiens

Contents

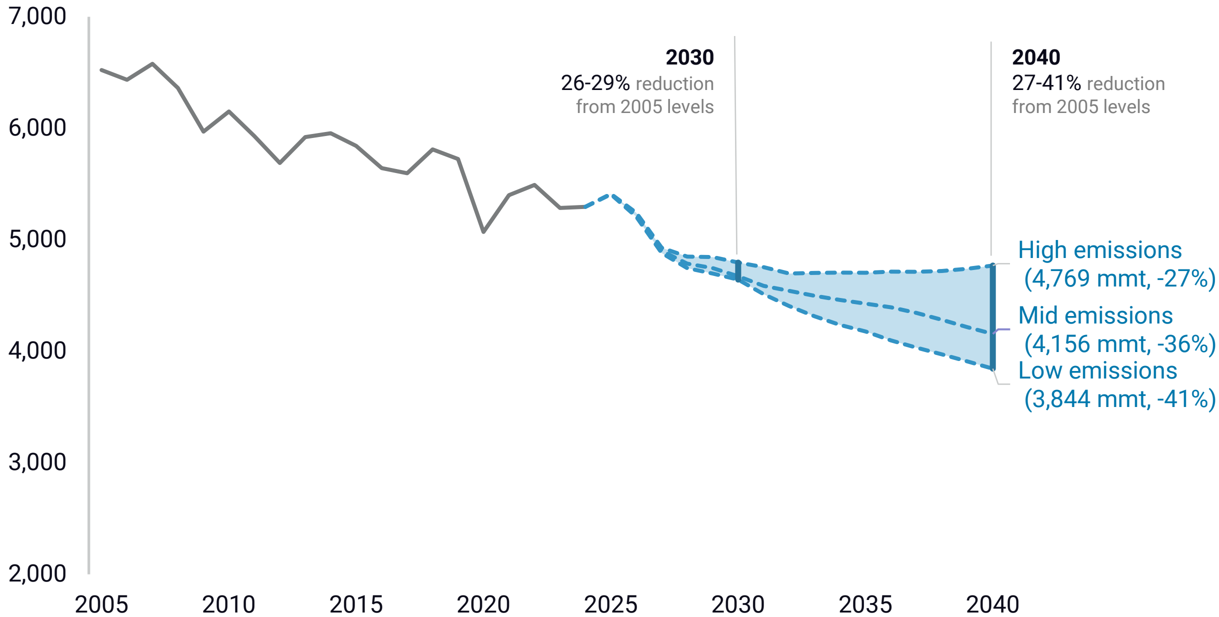
Executive summary

Taking Stock is Rhodium Group's annual independent projection of the future trajectory of the US energy system and greenhouse gas (GHG) emissions under all current federal and state policy. We estimate this trajectory using a range of inputs for key variables to reflect uncertainty in how the system will evolve over time. The largest drivers of uncertainty are the prices of fossil fuels, the evolution of clean technology costs over time, and the pace of growth of the US economy. We combine these variables to create low and high-emissions scenarios, representing our judgment on how these "atmospheric" factors could combine to yield the lowest and highest pathways for GHG emissions, as well as a mid-emissions scenario that represents more moderate outcomes on these variables.

FIGURE ES1

US greenhouse gas emissions under current policy

Net million metric tons (mmt) of CO2-equivalent ($CO2_e$)



Source: Rhodium Group

Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in liquified natural gas (LNG) export capacity.

In this year's report, we find that the US is on track to reduce GHG emissions by 27-41% below 2005 levels in 2040, considering all relevant federal and state policies on the books as of June 2026. These emissions outcomes represent divergent futures after the late 2020s. In the high-emissions scenario, the emissions reductions that have characterized the last 20 years slow through the early 2030s before reversing direction altogether, with growing emissions through most of that decade. In the low-emissions case, the economic competitiveness of clean technologies relative to fossil incumbents, alongside an imperative for "speed-to-power" for large loads, continues—and accelerates—GHG emission declines through 2040.

Under the hood of these economy-wide findings, key sectoral shifts are the drivers of long-term emissions outcomes:

- The power sector has taken on increased salience beyond energy analysts in recent months, and for good reason. Surging electricity demand, driven increasingly by new AI data centers, is running into a power grid that has seen flat load growth for the better part of three decades. This is all happening against a backdrop of shifting policy, as the most impactful parts of the clean electricity tax credits are set to phase out over the next few years. As a result, new clean generation on the grid surges through the late 2020s across all scenarios, but natural gas and renewables compete for dominance thereafter. In the low-emissions scenario, the US sustains continued near-record growth for renewables through 2040. In the high-emissions case, clean capacity additions slow to a trickle in the 2030s while large amounts of new natural gas meet surging demand. The result is 2040 power sector emissions that are 48% lower than 2025 in the low-emissions case but only 24% lower in the high-emissions case.

- In the transportation sector, emissions decline by 12-22% in 2040 compared to 2025. Sustained growth in the passenger electric vehicle (EV) fleet drives down economy-wide motor gasoline consumption, with the biggest impacts occurring when EVs are more cost-competitive with gasoline incumbents in the low and mid-emissions scenarios.

- The outcome for industrial emissions hinges on two main factors: emissions associated with the production, processing, and transportation of oil and gas, and underlying economic growth. With higher oil and gas production and faster macroeconomic growth in the high-emissions scenario, emissions increase by 15% in 2040 compared to 2025. Lower oil and gas production (while still quite robust, especially natural gas production) and slower economic growth lead to a 4% decline in industrial emissions in the low-emissions case over the same window.

- Global trade dynamics increasingly affect US oil and gas production, a trend underscored by ongoing uncertainty in these markets caused by the war with Iran and associated disruptions to shipping in the Strait of Hormuz. Here again we see a divergence between scenarios. Plentiful subsurface resource and relatively low prices increase the share of crude oil that is exported in the mid- and high-emissions scenarios, and we project increased production levels accordingly. Decreasing domestic demand and high prices lead to lower oil and gas production in the low-emissions scenario. Natural gas is more resilient across scenarios, with liquified natural gas (LNG) exports increasing by 94-148% in 2040 relative to today's levels. Domestic consumption of gas is flat-to-down across these scenarios in 2040, so the 1-44% increase in US gas production is mostly driven by this export dynamic.

Though we try to capture as much uncertainty as we can in our model inputs, still other factors may push the energy system beyond the bounds we contemplate in this report. Expectations for data center growth continue to trend upward, but are subject to the dual threats of public backlash and a potential popping of the bubble. The US could unlock still more growth of the grid to meet the associated electricity demand through permitting reform and effective cost allocation, or energy affordability threats could become even more connected with data centers in the public consciousness. The war in Iran may end soon—or not—with longer-term implications for global oil and gas markets.

CHAPTER 1

Energy on the front page

In a year that certainly doesn't lack for eventful news, it's telling that major themes related to the US and global energy systems have broken containment from conversations among energy analysts into front-page news. A growing share of the public is tracking the explosive growth in electricity demand coming from the build-out of data centers (and developing strong feelings on the subject). They know the role that public utility commissioners play in setting electricity rates. And they now know that 20% of the world's oil transits the Strait of Hormuz.

These topics are all interconnected and exacerbated by escalating uncertainty that has become a persistent feature of the US energy system and US policymaking more broadly. And, alongside updating our expectations for key drivers of energy system evolution like technology costs and macroeconomic expectations, these are also important topics that we tackle in this year's Taking Stock report.

Data center expectations continue to grow but more barriers are on the horizon

Expectations for near-term and future data center demand growth continue to rise. This demand outlook is largely driven by increasing interest and investment in AI, which has become more deeply embedded in the US economy since this time last year. We have revised our data center demand assumptions upward accordingly, reflecting an 11% increase from Taking Stock 2025 in 2040. But uncertainty persists in our (and others') projections: the gap between the lowest and highest analyst expectations for total data center electricity demand in 2030 (just over three years from now) is more than the total electricity consumption of the states of California and Florida combined.

As data center demand expectations grow, the barriers to data center expansion become more acute and urgent. Rapid access to reliable power remains a major challenge for data center developers. While connecting new loads to the grid is ideal in terms of cost and reliability, building out new grid capacity and the infrastructure required to serve large loads takes a long time—too long for some data center developers who are instead exploring temporary or even permanent behind-the-meter gas generation that can be deployed more quickly. This potentially speedier solution worsens GHG emissions and local air pollution, which is one reason why local opposition to data center development has exploded over the last year and become another major barrier facing developers.

The ever-looming threat of a potential AI bubble bursting further increases the uncertainty of data center demand projections, with ripple effect consequences on grid planning and electricity prices.

Affordable energy takes root as a significant political concern

Another factor driving data center opposition is the fear that the electricity-intensive facilities will drive up electricity prices for residential customers. Affordability for consumers has been a front and center topic since 2021 when inflation first began to surge in the post-Covid recovery, but concerns were largely focused on housing prices, rental prices, and the cost of groceries. Over the last year, affordable energy has gained national attention and emerged as a serious political issue.

Nationwide average real electricity prices increased in 2025, outrunning the pace of inflation and reversing a decade-long downward trend. In some regions (most notoriously in PJM), rapidly increasing demand from data centers contributed to these sudden price hikes, but the factors causing high prices varied across the country. Some drivers of high prices show no signs of improving in the near future. For instance, high inflation in critical energy equipment (e.g., transformers) coupled with an aging grid—or a grid increasingly impacted by natural disasters like wildfires—that requires equipment upgrades, replacement, and expansion suggests that high electricity prices may be here to stay. In Taking Stock 2026, we calibrate the transmission and distribution (T&D) components of electricity prices to reflect recent inflationary pressure and trends towards increased equipment upgrades or replacement.

As we unpacked in a report earlier this year, higher demand *can* reduce electricity prices by spreading fixed costs over a larger customer base, but this relationship breaks down if new capacity can't be deployed quickly enough to meet the step changes in load resulting from a data center coming online. With affordability top of mind, many state and local governments have begun taking steps aimed at limiting the impacts of data centers on ratepayers. These actions range from proposals to change rate structures (e.g., such that costs associated with serving large loads are allocated exclusively to those large loads), all the way to data center moratoriums. Many of these policies are still under development or are quite recent, so we largely do not reflect them in this year's report.

Global energy market turmoil

The Iran war has magnified affordability concerns by driving up world oil prices. The on-again, off-again closure of the Strait of Hormuz has more substantial impacts for other countries globally that are more exposed to direct imports that run through the Strait, including fuel shortages and surging natural gas prices. In the US, the war is showing up largely at the pump: at the time of writing, retail motor gasoline prices are $0.74 (23%) higher than at this time last year, while retail diesel prices are up $1.04 (27%). Domestic natural gas prices, meanwhile, are effectively flat from a year ago and have generally been running under 2025 levels. While the US is far more exposed to global oil market dynamics, even with record levels of liquified natural gas (LNG) exports, it remains largely insulated—though we discuss the extent to which this could change later in the report.

There is no clarity as to when normal shipment volumes will resume or when (or even if) prices will return to pre-conflict baselines. In our analysis, we include the impact of the war on oil prices in 2026 as well as a more extended impact on refined petroleum product prices over the next few years.

Surging clean energy demand against a steadier policy backdrop

After a tumultuous first year of the second Trump administration, the federal energy policy landscape remains largely the same as a year ago. The changes made to the tax code by the FY2025 budget reconciliation bill (often called the "One Big Beautiful Bill Act") have entered their implementation phase, with the IRS issuing guidance on interpreting new prohibited foreign entity and commence construction requirements. On the regulatory front, the Environmental Protection Agency (EPA) finalized its repeal of GHG emissions standards for vehicles and continued to advance its rollback of GHG and other pollution standards for power plants. And, as we began to explore in last year's Taking Stock report, there is still considerable uncertainty around the issuance of federal permits and other actions for new renewable generators. We unpack the full suite of federal and state policies we model in the Technical Appendix to this year's report.

Against this backdrop, 2025 was a record year for energy storage installations on the grid and the second-best year for new utility-scale solar builds. New clean generating capacity met more than three-quarters of new load added to the grid in 2025. What's more, as we unpack in greater detail later in this report, we're poised to see record levels of solar and storage deployment in 2026 and 2027 as well, alongside double-digit gigawatts of new onshore wind coming online. A combination of rushing to claim expiring tax credits alongside the urgent need for more capacity on the grid has helped accelerate this surge in new clean generator installations.

These same technologies are also being battered by other headwinds, which are impactful today and will take on increasing importance in the years ahead. Interconnection queues remain massive, and it's exceptionally difficult to build big transmission lines. We took a closer look at these factors this year and updated costs accordingly. Supply chains remain backlogged, especially for critical grid infrastructure equipment. And an increasing share of counties have laws on the books to restrict wind and solar development. As costs continue to decline for these technologies, these other barriers are likely to increasingly serve as the bottlenecks to increased deployment.

In this year's Taking Stock, we work to bring all of these threads together and estimate where the US energy system and associated GHG emissions will head through 2040. In Chapter 2, we unpack our methodology and key inputs to our modeling. In Chapter 3, we dive deeper into key sectoral trends and outcomes. Finally, in Chapter 4, we discuss what's on the horizon for the US energy system.

CHAPTER 2

Bounding uncertainty in projections

We project the energy system and emissions impacts of current policies under a range of possible future trajectories for energy markets, technology, and the economy. Critically, we do not produce probabilistic forecasts but rather determine a range of possible outcomes using a combination of testing and modeler judgment. The ranges we report represent distinct emissions pathways rather than confidence intervals on a central estimate.

We provide emissions and energy system projections for three main current policy scenarios:

- Our **high-emissions scenario** provides a reasonable upper bound on US emissions through 2040, combining the lowest projections of oil and gas prices with the most conservative cost declines for a range of clean technologies (including clean power, EVs, industrial decarbonization technologies, and direct air capture) and faster economic growth than the latest Congressional Budget Office (CBO) projections through 2040. This scenario also includes a broader range of planned LNG export facility additions.
- Our **low-emissions scenario** provides a reasonable lower bound on US emissions through 2040, effectively the inverse scenario of our high emissions pathway. It combines the highest projections of oil and gas prices with the most aggressive cost declines and performance improvements for clean technologies. It also assumes economic growth aligned with the latest CBO projections and the completion of LNG export capacity currently under construction or in the commissioning stage per the latest Energy Information Administration (EIA) data.
- Our **mid-emissions scenario** adopts more moderate trajectories for some of these factors. It assumes continued cost declines for clean technologies, but less aggressive declines than in our low-emissions scenario, and sees oil and gas prices that roughly split the difference between prices in the low and high-emissions scenarios. It also assumes economic growth aligned with the latest CBO projections and planned LNG export capacity consistent with the latest EIA data on facilities under construction or in the commissioning stage.

FEDERAL POLICY ENVIRONMENT

We generally reflect current, "on-the-books" policy as of June 2026 in this year's Taking Stock report. That includes the repeal of EPA's GHG standards for model year 2027 and later light-, medium-, and heavy-duty vehicles, which was finalized in February 2026. It also includes changes to EPA's hydrofluorocarbon regulations, finalized this May, that effectively delay standards by 2-6 years. This July, EPA is expected to finalize the repeal of GHG standards for power plants and propose sweeping changes to the methane standards for oil and gas operations. We assume both sets of standards are repealed in Taking Stock. Though these policies aren't yet finalized and will likely face court challenges, the administration has prioritized these deregulatory actions, and the courts have generally allowed them. As a result, we expect the finalized rules to hew very closely to a complete rollback and believe it is appropriate to discuss energy system and climate trends accordingly.

TECHNOLOGY COSTS AND CONSTRAINTS

This year, the second year running without an Annual Technology Baseline (ATB) from the National Laboratory of the Rockies (NLR), we take a new approach to technology cost projections. We derived our own clean technology cost pathways for solar and onshore wind starting from the most recent estimates of current costs from NLR and generally assuming similar cost declines to NLR's 2024 ATB. Our utility-scale storage costs come from a 2025 literature review compiled by NLR. We updated our nuclear cost assumptions to reflect recent research out of MIT (advanced nuclear) and Energy Futures Finances Forum (small modular reactors). Finally, we updated the geothermal resource base and capital costs, including expanding potential resources to near-field and deep enhanced geothermal systems (EGS) based on data from a recent Princeton study.

To reflect the gas turbine supply crunch and resulting cost pressures, we constrained the build-out of gas capacity through 2029 and doubled the capital costs for all gas generators through 2030 (this results in capital costs that range from $2,000-$2,500/kW in 2025 dollars through 2030). We assume that gas turbine manufacturing capacity expands in response to this supply crunch enough to ease prices after 2030.

It's challenging to capture the impacts of non-cost barriers like the interconnection queue and slow transmission expansion with precision using an economy-wide energy model. We represent these barriers by increasing grid connection costs for solar and wind, since solar and wind are more likely than other technologies to require transmission expansion and upgrades to link quality resources with demand centers.

DATA CENTER DEMAND GROWTH

We reflect the same data center demand pathway across all scenarios, derived from a literature review of the most recent data center demand projections. We include regional representation of data center demand growth that's informed by the Electric Power Research Institute's report on state-level data center demand projections. New this year, we provide our state-level projections of demand growth by sector, including data centers, in data dashboards within ClimateDeck, Rhodium's free interactive data platform.

IRAN WAR REPRESENTATION

To capture the impacts of the Iran war, we calibrate the 2026 Brent oil price to EIA's June Short-Term Energy Outlook projection ($95/barrel). We perform the same price calibration for key refined petroleum products like motor gasoline, diesel, and jet fuel. Short-term elevated domestic oil prices have a lasting upwards impact on oil and gas production levels. Oil and gas production increases by up to 5-10% (+3-4 quads) in the near term relative to a scenario without the global oil price shock, and production impacts shrink to zero by 2040. Higher oil and gas production levels in turn lower wholesale natural gas prices. The Henry Hub spot price declines by 20% in the near-term compared to a scenario without the global oil price shock.

We provide greater details on the policies, constituent inputs of these scenarios, and our modeling environment in the Technical Appendix to this report.

Using RHG-NEMS

We use RHG-NEMS to quantify energy sector and emissions outcomes. RHG-NEMS is Rhodium Group's modified version of the National Energy Modeling System (NEMS), a model developed by the EIA to produce their AEOs. Rhodium Group maintains a version of NEMS that we modify from the EIA base version. As we do each year with base NEMS, in addition to changing many key inputs (as described above) and bringing the current policy representation up to date as of June 2026, we also vary key assumptions and algorithms in the model based on research and recent real-world observations.

We expand this version of NEMS to include all sectors of the US economy and coverage for all six greenhouse gases targeted for reduction under the Kyoto Protocol. We continue to use the latest land use, land use change, and forestry (LULUCF) projections from the US Fifth Biennial Report. Consistent with EPA's annual Inventory of Greenhouse Gas Emissions and Sinks and United Nations Framework Convention on Climate Change (UNFCCC) requirements, we use 100-year global warming potential (GWP) values from the IPCC Fifth Assessment Report (AR5). Finally, we downscale this data to provide state-level results for key metrics.

CHAPTER 3

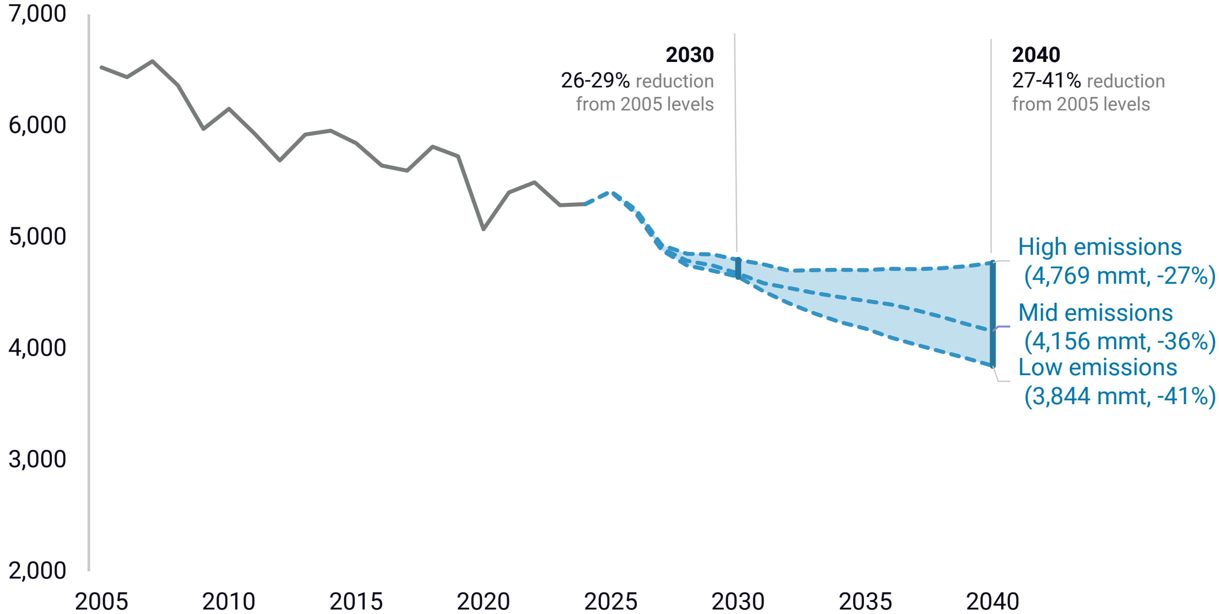
Emissions outlook and key sectoral trends

The US is on track to emit 3.8-4.8 gigatons (Gt) of net GHG emissions in 2040, representing a 27-41% reduction in emissions from 2005 levels and a 12-29% reduction from 2025 levels (Figure 1). Across all scenarios, emissions decline substantially from 2025 to 2027 as unprecedented levels of planned clean energy investments come online in time to claim federal tax credits. After federal tax credits expire for most clean investments, scenarios diverge.

FIGURE 1

US greenhouse gas emissions under current policy

Net million metric tons (mmt) of CO2-equivalent ($CO2_e$)



Source: Rhodium Group

Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

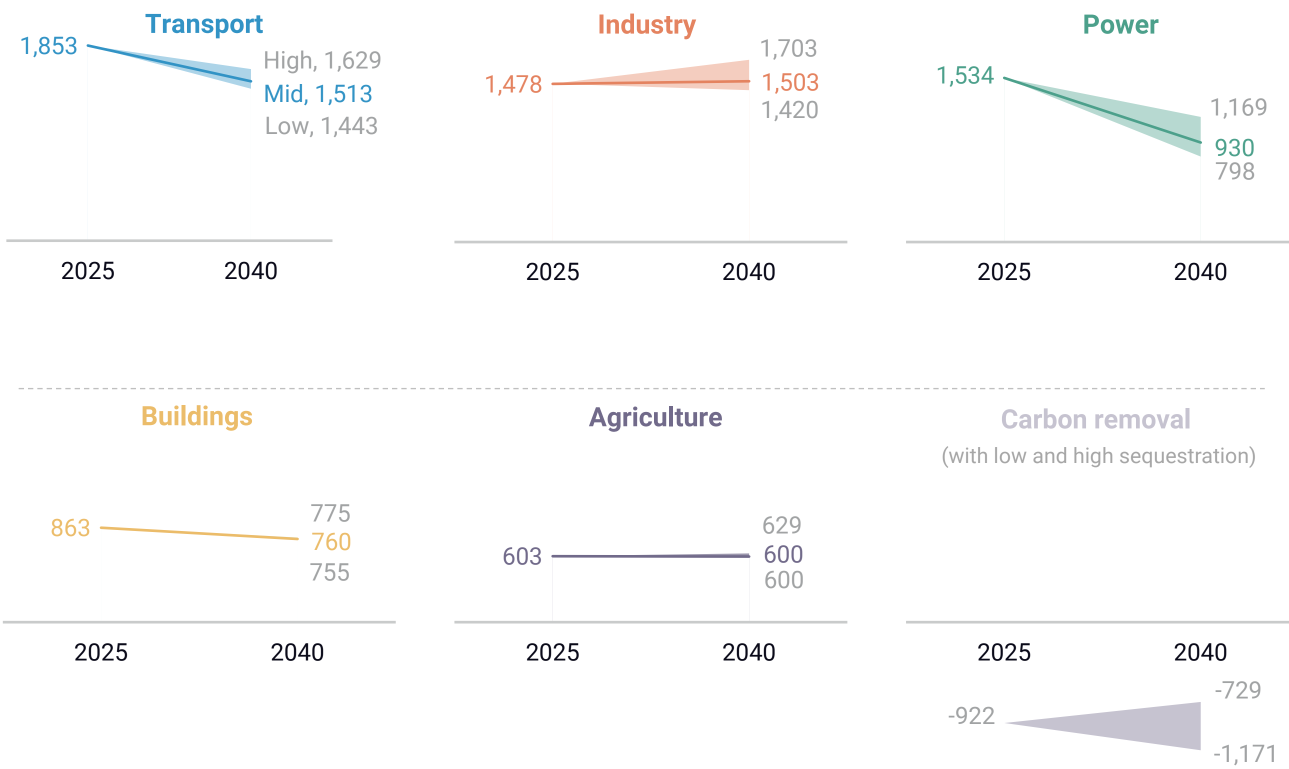
In the high-emissions scenario, emissions are relatively flat from 2028 to 2040, declining at an average rate of 0.3% per year over this timeframe. This is just a third of the rate of historical US emissions reductions from 2005 through 2025 (-0.8%). However, this average obscures the modest emissions increases that begin in 2036 and extend through the end of the projection period.

The pace of decarbonization accelerates in the mid and low-emissions scenarios. From 2028 through 2040, emissions fall by 1.3% and 1.8% on average in the mid and low-emissions scenarios, respectively. This represents doubling the pace of emissions reductions relative to historical levels in the low case and achieving 50% faster reductions in the mid case.

Power, transport, and carbon removal sectors contribute the most emissions reductions

Emissions decline across all scenarios in the power, transport, and carbon removal sectors, but the level of emissions reductions varies meaningfully by scenario (Figure 2). In the power sector, emissions drop by nearly half from 2025 to 2040 in the low-emissions scenario, while the high-emissions scenario sees a 25% reduction. Behind the power sector, the transport sector sees the next fastest pace of reductions, with emissions declining by 12-22% from 2025 to 2040. Building sector emissions decline modestly through 2040. Agricultural emissions remain flat in the mid and low cases, while higher macroeconomic activity drives a small emissions increase in the high case. The evolution of industrial emissions depends on the scenario, largely driven by oil and gas production levels. We unpack the energy system and economic trends underpinning these sectoral outcomes in the remainder of this chapter.

FIGURE 2
US greenhouse gas emissions under current policy
Net mmt $CO2_e$



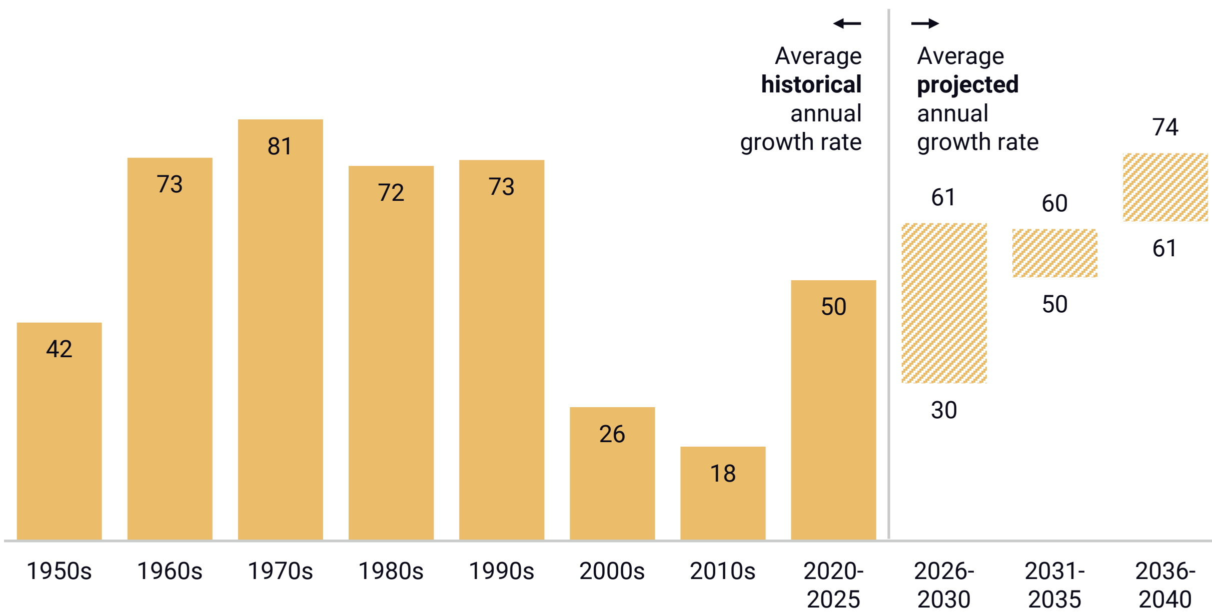
Source: Rhodium Group
Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

Carbon removal sector outcomes depend largely on assumptions around the carbon sink associated with land use, land use change, and forestry (LULUCF), with smaller impacts from the deployment of direct air capture (DAC) and point-source carbon capture on biogenic emissions at ethanol production facilities. Throughout this report, we report results using the high LULUCF pathway from the Fifth US Biennial Report. Under the report's low LULUCF pathway, the carbon sink weakens to the point that the sector contributes to increasing net emissions from 2025 to 2040. Though economy-wide emissions still fall over this period under the low LULUCF pathway, reductions are more modest, and US emissions decline by 21-35% from 2005 levels in 2040. Users can toggle between the low and high LULUCF pathways on ClimateDeck to further investigate this assumption's impact.

Power sector continues to decarbonize despite surging demand

We project that electricity demand will accelerate over the next fifteen years, growing faster than it has since the turn of the century (Figure 3). This upwards trend is already evident in historical data. From 2000 to 2023, demand increased annually by 20 terawatt-hours (TWh) on average, with growth rates generally declining over time—that's less than a third of the average growth rates that characterized the preceding 40 years. The pace of demand growth in the 2020s so far is more than double the recent historical rate, rising to 50 TWh due to surging demand in 2024 and 2025. We project that demand growth will continue to increase over the next fifteen years, reaching 61-74 TWh per year on average by the end of that period. Put another way, our projected increases in demand mark a step change from where the US power grid has been over the past quarter century and a return to the higher growth rates that characterized the late 1900s.

FIGURE 3
Evolution of electricity demand since the 1950s
Average annual terawatt-hours



Source: EIA Monthly Energy Review, Rhodium Group
Note: Ranges for future projections correspond to emissions scenarios with the lowest and highest growth rates in each 5-year period.

These growth rates are particularly sensitive to assumptions around electricity consumption at data centers. Our projections reflect substantial increases in power demand from data centers—doubling by 2032 and more than tripling in 2040 relative to 2025 levels. Data centers account for 62-77% of gross electricity demand growth in 2030 and 59-66% in 2040 (Figure 4). In these scenarios, data centers make up 17% of total US electricity demand in 2040.

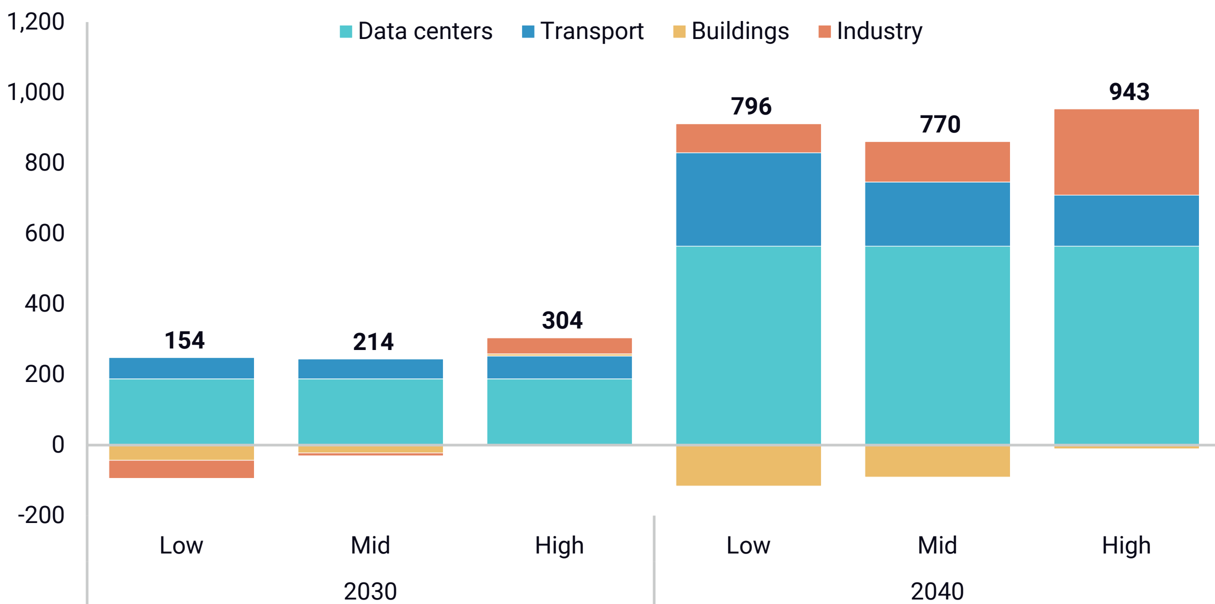
There is considerable uncertainty around this outcome, as we unpacked in Chapter 1. We use a single assumed demand growth path for data centers to enable comparison across our emissions scenarios, because wider variation in data center demand could potentially swamp the impact of other factors. As we discussed in a recent note, data center growth can act as an accelerant for existing trends on the grid. If demand grows more slowly, our projections could be overstating future grid demand; if exponential growth for AI and associated power demand comes to fruition, we could be understating grid impacts.

Currently, access to electricity is one of the major factors driving (or limiting) the growth of data centers. While we represent some frictions to grid capacity additions, an economy-wide energy system model isn't the best tool for characterizing the regionally granular decisions that underpin specific grid interconnection requests. We assume power demand is met, subject to some broad assumptions around the build-out of new generating capacity. In practice, the ability for that capacity to come online may limit data center demand growth. Data center developers are also exploring behind-the-meter solutions to meet demand, which fall outside the power grid-level modeling we're discussing.

FIGURE 4

Sources of electricity demand growth from 2025 levels in 2030 and 2040

Terawatt-hours



Source: Rhodium Group

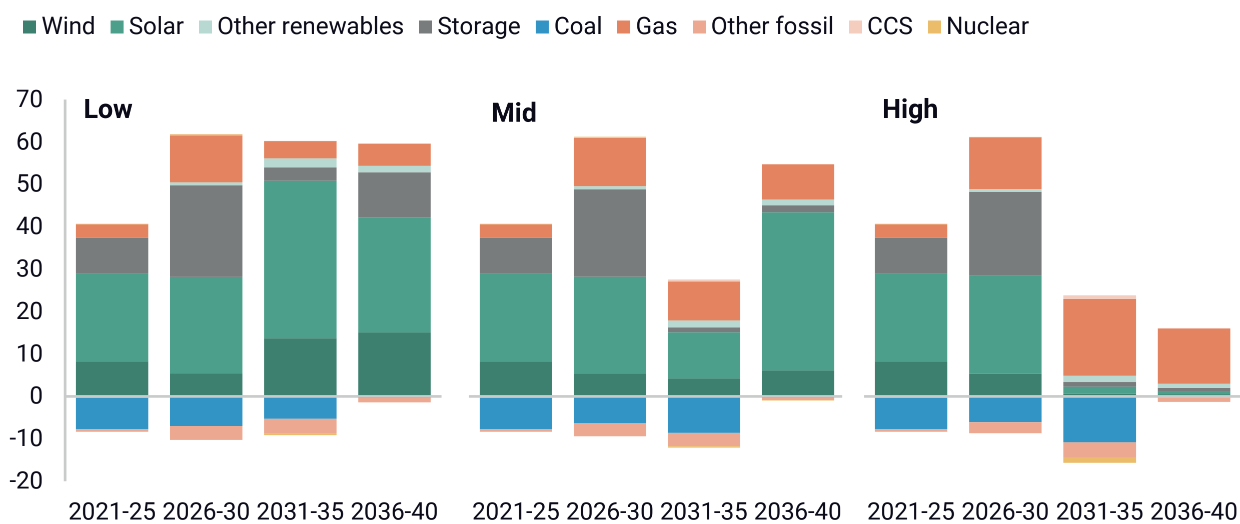
Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

Beyond data centers, other sectors also see meaningful changes in demand through 2040 (Figure 4). Increasing penetration of electric vehicles (EVs) makes transportation the second biggest driver of demand growth in the low and mid-emissions scenarios, which both assume more aggressive EV battery cost declines than the high scenario. In the high case, elevated levels of industrial activity drive a quarter of demand growth from 2025 to 2040. Electricity demand in the buildings sector (excluding data centers) decreases by up to 5% from 2025 to 2040 as appliances like heat pumps and water heaters gain efficiency. Build-out of distributed solar also moderates grid sales to buildings, as buildings meet more of their demand with their own generation. In 2040, distributed generation for own use in the buildings sector doubles relative to 2025 levels, though this supply is still a small fraction of total buildings demand. Taken together, all these factors increase total US electricity demand by 19-23% in 2040 compared to 2025.

GAS AND RENEWABLES COMPETE FOR DOMINANCE

Despite the substantial growth in demand from 2025 to 2040, power sector emissions decrease by 24-48% over that time period. Technology costs and natural gas prices influence capacity additions and retirement decisions, driving major differences in emissions between scenarios after 2030. Up until 2030, however, capacity changes look nearly identical across all three scenarios (Figure 5). A historic influx of renewables comes online during this period, despite the regulatory and non-cost barriers we discussed in Chapter 1, to claim federal tax credits before they expire. 48-50 gigawatts (GW) of solar, wind, and storage are deployed each year on average through 2030, in line with 2025's record of 50 GW. Solar and storage each achieve historic deployment years over this period, while wind falls short of setting a new record. Net gas additions reach 11-12 GW per year, tripling annual average additions from 2021-2025, but remain partially constrained by the gas turbine supply crunch. Coal continues to retire at a similar pace (6-7 GW per year) to the last five years, despite the sudden surge in capacity additions. However, the remaining coal runs about 10-40% less frequently than the previous five years, indicating that some capacity stays online to provide reliability. By 2030, power sector emissions decline by 22-27% from 2025 levels.

FIGURE 5
Average annual net capacity change (additions less retirements)
Gigawatts



Source: Rhodium Group
Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

After 2030, the grid's trajectory diverges significantly across scenarios. Sustained emissions reductions continue in the mid and low-emissions cases, while emissions increase by 4% from 2030 to 2040 in the high case. Emissions pathways are primarily determined by the composition of capacity additions that fill in behind retiring coal or deploy to meet increasing demand. In the low-emissions scenario, high natural gas prices and low-cost clean technologies increase the average pace of renewable additions to 53 GW per year from 2030 to 2040, while average gas additions fall to 5 GW per year. This is the only scenario that sees consistently high levels of storage additions, which deploys alongside sustained renewable build-out to capture variable renewable generation that would otherwise be curtailed. In the high-emissions scenario, cheap natural gas and high-cost clean technologies drive a preference for gas capacity, and average gas additions climb to 16 GW annually from 2030 to 2040. On the other hand, renewable deployment drops off dramatically, adding just 3 GW on average to the grid each year. In this scenario, gas prices are low enough that a handful of nuclear plants become uneconomic and retire. In all scenarios, the expiration of the zero-emission nuclear power credit after 2032 leads to the retirement of 2 GW of nuclear capacity by 2040, but an additional 5 GW retires in the high case.

With more moderate gas prices and clean technology costs, the mid-emissions scenario sees higher competition between gas and renewable technologies. Because of this dynamic, capacity additions are more sensitive to small shifts in prices, which results in meaningfully different deployment outcomes in the first five years of the 2030s versus the last five years. While average annual gas additions are similar between these two periods (9 GW per year), the pace of average renewable additions falls to 16 GW per year from 2031 to 2035 before jumping back up to 45 GW per year from 2036 to 2040. Average gas prices increase by $1.15 in the late 2030s, making it less economic to run existing gas generators and creating an opening for more renewables to come online. At the same time, renewable costs continue to decline over this period, shifting the economics further in their favor.

COAL CONTINUES TO RECEDE, NEW CLEAN FIRM GROWS SLOWLY

We project that 34-79 GW of coal capacity will remain operational in 2040, a 51-79% decline from 2025 levels. Coal dynamics play out counterintuitively: the low-emissions scenario preserves the highest levels of coal capacity while the high-emissions scenario retires the most coal capacity. Wholesale natural gas prices average $2.20/MMBtu lower in our high scenario than in our low scenario, incentivizing new natural gas builds to replace existing, less efficient coal plants. In the low-emissions scenario, higher natural gas prices make gas less competitive with coal as the marginal generator, resulting in the fewest coal retirements. In this case, coal accounts for over 40% of power sector emissions in 2040.

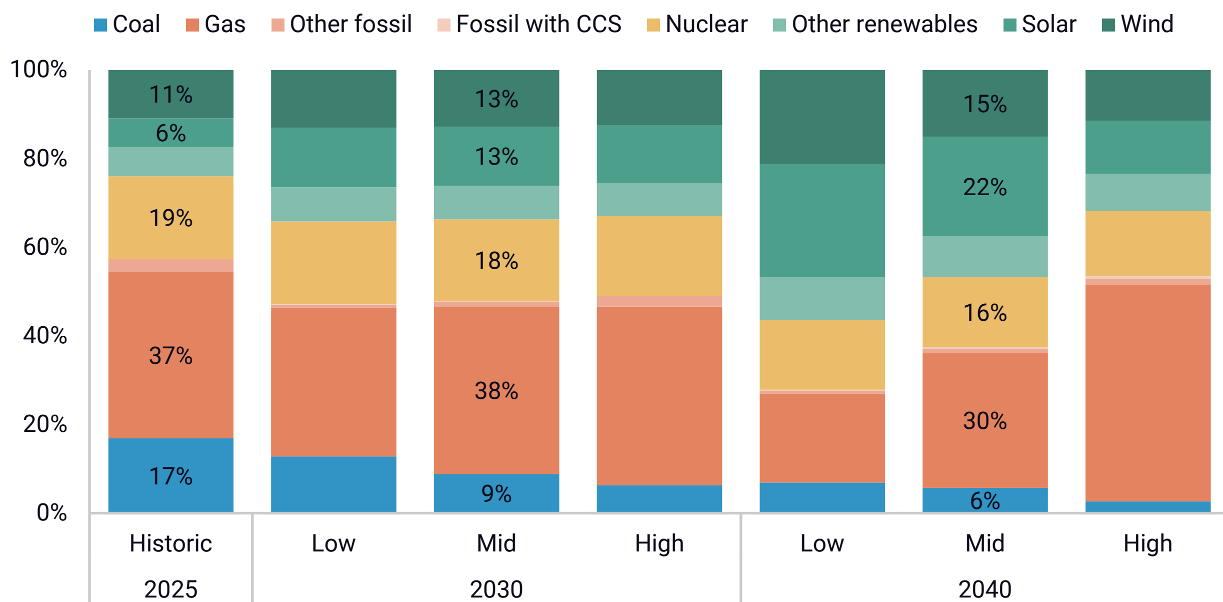
Nuclear technologies remain too expensive to build economically in any scenario, though we represent planned uprates and restarts. There are a handful of new nuclear projects actively underway and even more planned, but these projects remain in the early stages of development, and we don't include them in our modeling. Once these projects achieve a level of development that lends more certainty to their online dates, we will integrate them into our projections. More broadly, while economic deployment drives our model's decisions, economic competitiveness likely isn't the primary factor driving nuclear investment decisions. Interest in nuclear development, in particular from the Trump administration, which recently announced a $17.5 billion loan program for long-lead nuclear reactor components, may help catalyze domestic nuclear deployment in the coming decades before the technology becomes cost-competitive.

We find that enhanced geothermal systems (EGS), another promising emerging clean technology, are cost-competitive in some regions. In our projections, geothermal begins to scale in the early 2030s and reaches 13-19 GW of cumulative additions by 2040.

FIGURE 6

Power sector generation shares by fuel type

Percent of total generation



Source: Rhodium Group

Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

As a result of these capacity changes, zero-emitting resources account for 51-53% of generation in 2030 and 47-72% of generation in 2040, up from 43% today (Figure 6). Notably, zero-emitting generation shares decline from 2030 to 2040 in the high case, as demand growth is met primarily with new gas capacity, and low gas prices drive nuclear retirements. While gas makes up 37% of total generation today, it powers half of US electricity in 2040 in this scenario. The mid and low scenarios utilize a more diverse grid, with a stronger mix of renewable and clean firm generation shares. Though nuclear generation decreases slightly in these scenarios, clean firm generation rises and clean firm shares remain stable over time due to ramping geothermal generation.

ELECTRICITY PRICES CONTINUE TO OUTPACE INFLATION, BUT REGIONAL DIFFERENCES PERSIST

These changes to the power system result in continued growth in the price of electricity. The average price of electricity is 3-10% higher in real terms in 2040 compared to 2025, so growth in power prices continues to outpace inflation. In terms of what consumers see, this is a 39-48% increase in electricity prices.

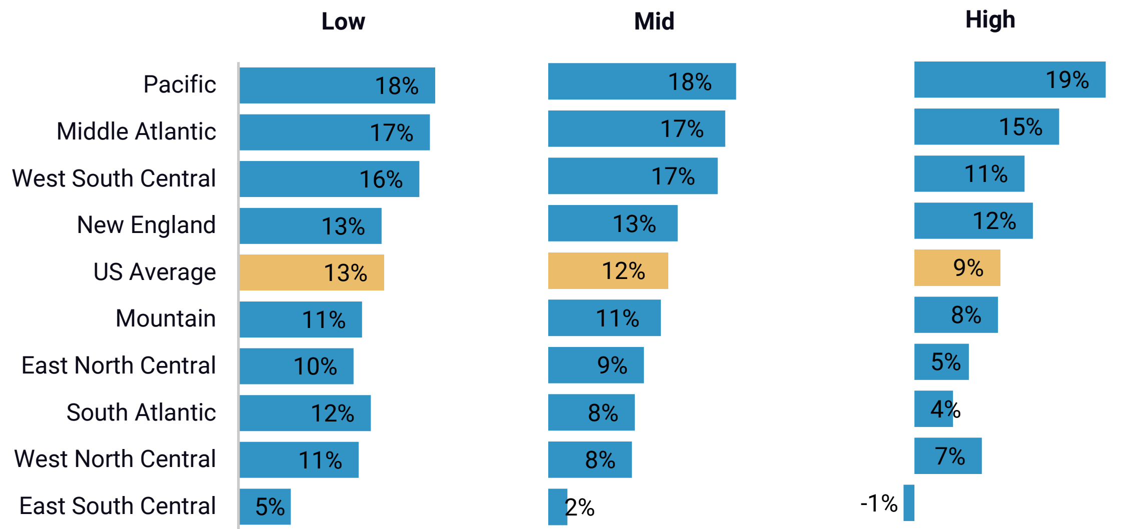
Price increases are the largest for residential customers, who see real increases of 1.4-2.2 cents per kilowatt-hour (kWh) in 2040 compared to 2025—a 9-13% increase (Figure 7). There is considerable regional variation in these outcomes. In general, the Pacific, Middle Atlantic, the West South Central (i.e., Texas, Louisiana, Oklahoma, and Arkansas), and New

England see the largest impacts. These are parts of the country that have either seen large increases historically, in large part due to transmission and distribution spending, or where we anticipate the largest concentrations of new data center load.

FIGURE 7

Change in real residential electricity prices, 2025-2040

Percent



Source: Rhodium Group

Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

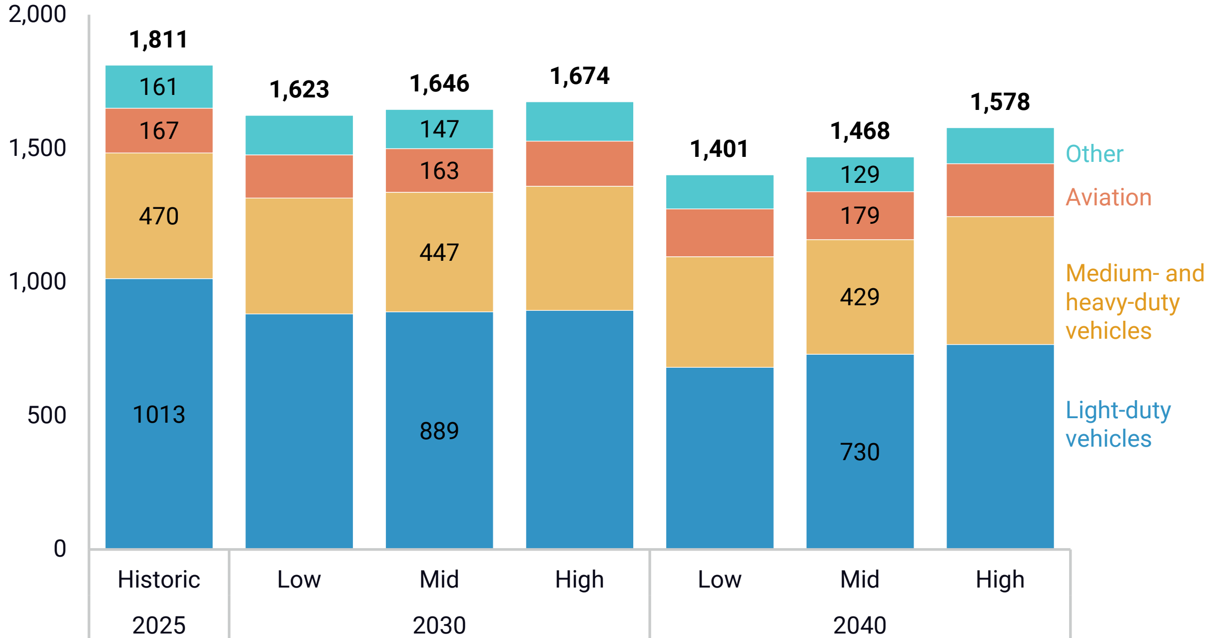
Continued electrification drives transport sector decarbonization

The transportation sector experiences the largest decline in emissions behind power, with emissions decreasing by 12-22% from 2025 to 2040. The lion's share of decarbonization comes from light-duty vehicles (LDVs), the single largest emitting mode of transportation (Figure 8). Despite the expiration of federal EV tax credits, zero-emitting vehicle (ZEV) sales shares continue to rise in our projections, reaching 19-43% in 2040—double to quadruple today's ZEV sales shares. In 2040, ZEVs comprise 13-22% of LDVs on the road, up from 3% today. Stock turnover also plays a role in lowering emissions, as new internal combustion engine (ICE) vehicles have higher fuel economy on average than older ICE vehicles.

Medium- and heavy-duty vehicles (MDVs and HDVs) see modest emissions reductions in the mid and low cases and flat emissions in the high case. MDVs and HDVs face a higher ZEV premium compared to LDVs, and there's little appetite to purchase MDV and HDV ZEVs without policy drivers to push adoption. In our projections, MDV and HDV ZEV sales reach 1% in 2040. Fuel economy improvements reduce emissions in the mid and low scenarios. Stronger macroeconomic activity in the high-emissions case drives higher levels of freight-ton miles, and fuel economy improvements help curb emissions growth.

Aviation contributes a smaller but growing share of transport emissions as demand for air travel grows over time. A stronger economy boosts both travel demand and freight demand, leading to greater emissions upticks in the high-emissions scenario.

FIGURE 8
Transportation emissions by mode
Net mmt $CO2_e$



Source: Rhodium Group
Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity. The "Other" category includes emissions from buses, recreational boating, shipping, military activity, lubricants, mobile combustion, MVAC, rail, non-energy use of fuels, and transport emissions from Puerto Rico and Guam. These totals do not include emissions from natural gas pipelines, which are accounted for within the transport sector in Figure 2.

Industrial emissions diverge depending on fossil production and economic fundamentals

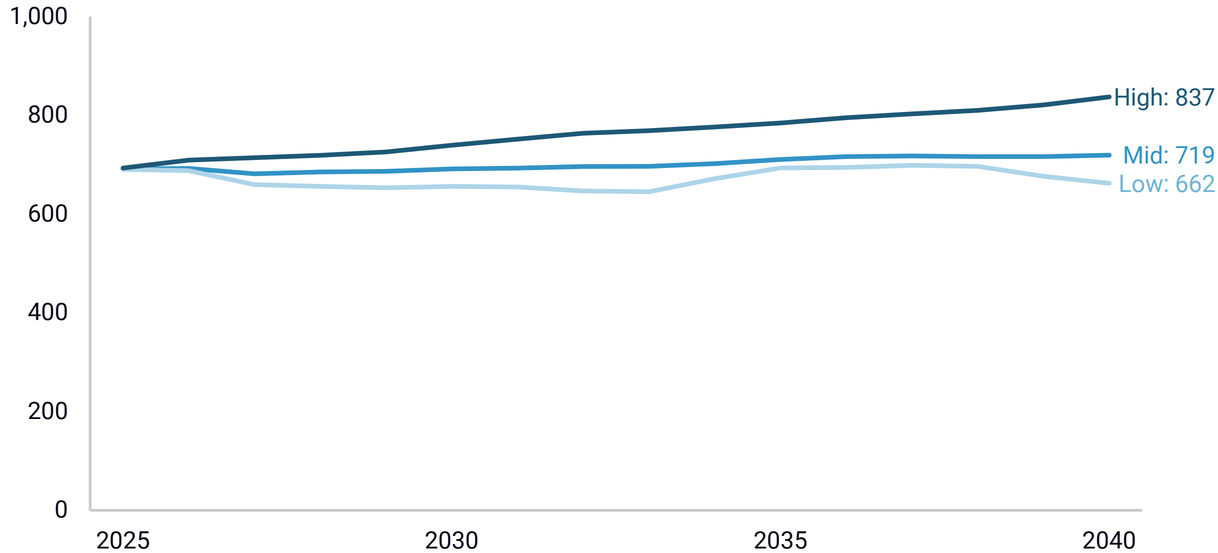
Emissions from manufacturing, oil and gas production, processing, and transportation, and other industrial sources like mining are generally flat in the low and mid-emissions cases, with a 4% decrease and 1% increase over 2025 levels in 2040, respectively. Industrial emissions increase by 15% in the high-emissions scenario in 2040 compared to 2025, marking a shift in the sector's largely flat emissions profile over the previous 15 years.

Two main factors drive the divergence between these scenarios. First, emissions from the oil and gas sector make up just under half of total industrial emissions, so the overall production of these fuels has a meaningful influence on total industrial emissions. We unpack oil and gas dynamics in the next section; in short, the US surges in oil and gas extraction over the coming years in the high-emissions scenario, sees more modest growth in the mid-emissions scenario, and sees declines in oil production (though sustained levels of gas production) in the low-emissions scenario by 2040. These high-level outcomes are reflected in associated emissions profiles (Figure 9).

FIGURE 9

GHG emissions from oil and gas production, processing, and transportation

Net mmt $CO2_e$

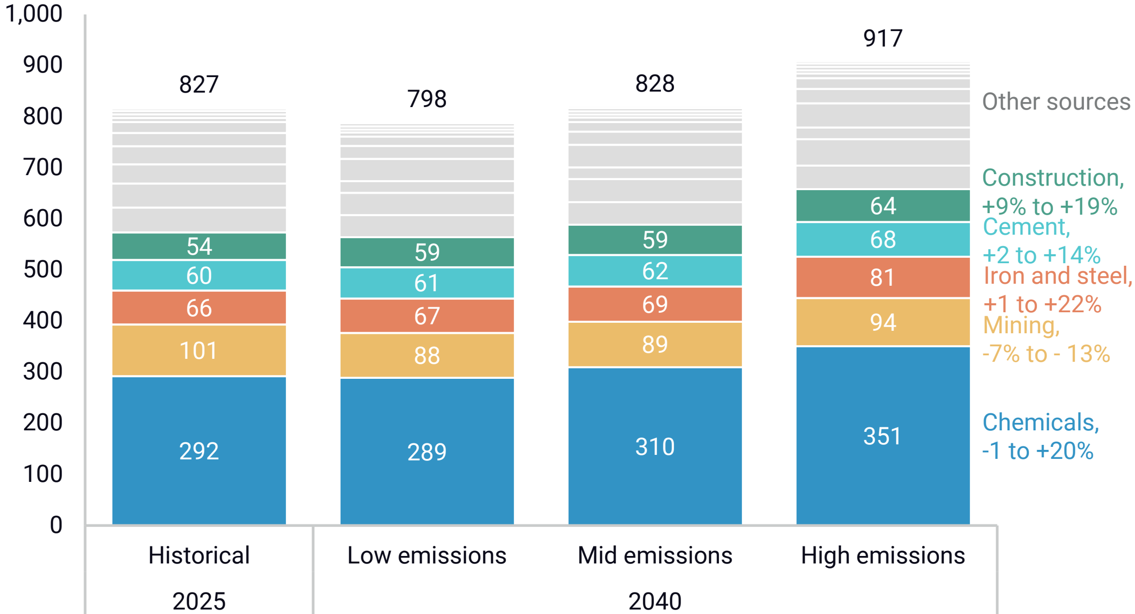


Source: Rhodium Group

Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

Second, industrial output (as measured by the value of shipments) grows more quickly in the high macroeconomic scenario that underpins our high-emissions scenario. GHG emissions and industrial output have historically moved in parallel: more output results in higher emissions. We see a gradual decoupling of this trend over the next 15 years, with fewer GHGs emitted per dollar of shipment produced across all three scenarios, reflecting a decline in coal consumption in industry as well as subtle shifts in the overall makeup of the industrial sector. Still, industrial output in the high-emissions case grows faster than this decoupling, resulting in higher non-oil and gas industrial emissions in 2040 relative to 2025 in the high-emissions case (Figure 10). The chemicals sector is particularly sensitive to both this underlying economic growth and the availability of low-cost natural gas as a critical fuel and feedstock input. The sector sees the highest absolute and second-highest relative growth in 2040 compared to 2025 among all major-emitting subsectors.

FIGURE 10
Industrial sector emissions from non-oil and gas sources
Net mmt $CO2_e$



Source: Rhodium Group
Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

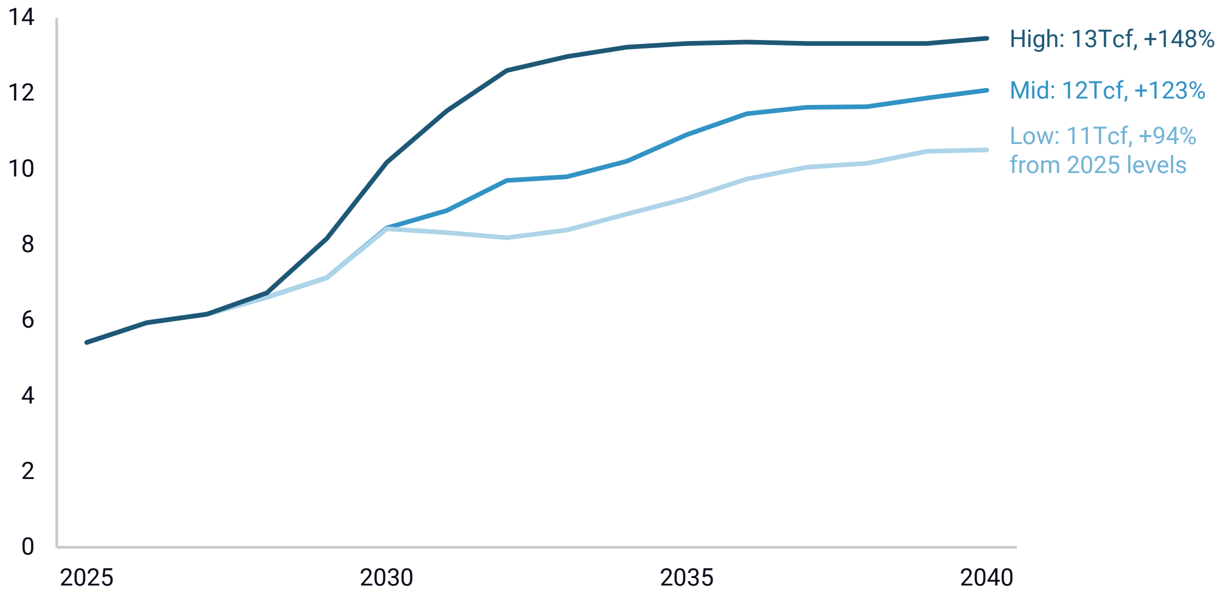
Oil and gas trade dynamics drive domestic production

We spent considerable time in last year's Taking Stock report unpacking the increasing share of US-produced oil and gas that is exported and the impact that dynamic has on production levels. Those dynamics largely persist in this year's update; as a result, we feature fewer graphics in the text of this year's Taking Stock, but we've created a new dashboard on ClimateDeck with all the data we usually report.

In short, domestic production of crude oil and other liquid fuels increases by 6% and 43% in the mid and high-emissions cases in 2040 compared to 2025, driven largely by a 34-55% increase in exports of these fuels. Elevated global prices from the war in Iran help drive near-term boosts in crude production as American oil is more economically competitive in these higher price scenarios, but the impact of this boost largely disappears by the mid-2030s. Domestic consumption is flat in the mid-emissions case and up a modest 3% in the high-emissions case. Because the highest cost of production makes exports less competitive in the low-emissions case, exports drop 14% and production drops 13% compared to today.

Natural gas dynamics are also similar to what we described last year but turned up a notch. The most notable shift occurs in liquified natural gas (LNG) exports, where export levels are 21-24% higher in 2040 compared to last year's report, and up 94-148% compared to today (Figure 11). These new higher levels are a function of more LNG export facilities being announced and commencing construction over the last year, but also due to model changes better reflecting global gas markets. This is particularly salient now, post-Hormuz closure, in an era when gas importers may be looking to diversify their supply beyond Qatar, which is likely to face a security premium on their gas in addition to a multi-year constraint on their ability to reach full export levels even once the Strait opens as it rebuilds a major LNG export facility damaged during the war.

FIGURE 11
Liquified natural gas exports
Trillion cubic feet (Tcf)



Source: Rhodium Group
Note: The high, mid, and low ranges reflect uncertainty around future fossil fuel prices, economic growth, clean energy technology costs, and growth in LNG export capacity.

CHAPTER 4

What's on the horizon?

We've provided a largely national look at trends in this report, but RHG-NEMS also produces state-level estimates for GHG emissions and key energy sector outcomes. Through ClimateDeck, Rhodium's free data platform, users can explore these results for each of our three main emissions scenarios using interactive charts, maps, and tables, and download the underlying data for further exploration. ClimateDeck includes filtering tools that allow users to examine results by sector or by gas, and a broader collection of data, making it possible to analyze questions not answered by this report. To access ClimateDeck, which also features Rhodium's global emissions data and clean investment tracking, visit the platform and sign up for an account.

TABLE 1

US GHG emissions under emissions scenarios

Million metric tons of CO_2-e

Gas	2005	2025	2030	2035	2040
Carbon dioxide	6,114	5,034	4,436 to 4,545	4,105 to 4,528	3,842 to 4,633
Methane	796	691	657 to 695	646 to 712	652 to 743
Nitrous oxide	424	397	384 to 387	382 to 387	379 to 389
HFCs	124	197	190 to 191	141	124
Other F-Gases	31	14	15	16	17
Gross GHG emissions	7,488	6,334	5,683 to 5,833	5,289 to 5,783	5,015 to 5,906
Carbon removal*	-965	-922	-1,037 to -1,042	-1,079 to -1,111	-1,136 to -1,171
Net GHG emissions	6,523	5,412	4,642 to 4,796	4,178 to 4,704	3,844 to 4,769
Change from 2005	0%	-17%	-26% to -29%	-28% to -36%	-27% to -41%

Source: Rhodium Group. Columns represent the minimum and maximum annual net US emissions given likely energy market, policy, and carbon removal outcomes. *Includes Land Use, Land Use Change, and Forestry (LULUCF) from the high sequestration scenario and carbon capture and sequestration.

Key questions that will continue to drive energy system change

We estimate outcomes for the energy system and emissions based on current policy and the best available information. Energy markets and policy are always dynamic, but that's particularly the case right now. We've explicitly captured some uncertainty in our emissions scenarios, and we've pointed out places where uncertainty exists that we haven't captured: will data center growth sustain at the expected pace? Will policymakers propose novel approaches to containing the growth of electricity prices? Will there be a return-to-normal once hostilities with Iran more fully abate?

Uncertainty looms large over permitting reform as well, one energy policy topic du jour in Washington DC. There is current bipartisan, bicameral interest in passing some version of federal permitting reform that will accelerate our ability to build out crucial US energy infrastructure, including transmission lines, gas pipelines, and new generating capacity. Speeding up transmission expansion would improve reliability, mitigate congestion, and expand the sites available to develop clean energy projects and connect them to the grid economically. Reducing the time required to build out new capacity would alleviate some of the uncertainty facing large loads waiting to connect to the grid or actively weighing their options for obtaining electricity. Building out energy infrastructure should ease pressure on electricity prices by increasing energy supply and the mobility of that supply. We will continue to monitor permitting reform developments in the coming weeks and months.

In the wake of the closure of the Strait of Hormuz, we've already seen some global responses to the crisis that center domestic energy security. Countries like Pakistan and Vietnam that have seen major growth in technologies like solar and electric vehicles have seen those investments pay meaningful dividends in the current supply-constrained environment. How those shifts continue to evolve will have implications for future US oil and gas production.

About Rhodium Group

Rhodium Group is an independent research provider with deep expertise in policy and economic analysis. We help decision-makers in both the public and private sectors navigate global challenges through objective, original, and data-driven research and insights. Our key areas of expertise are China's economy and policy dynamics, and global climate change and energy systems. More information is available at www.rhg.com.

About the Authors

Hannah Kolus is a Senior Analyst with Rhodium Group's Energy & Climate practice. Hannah leads US energy system modeling focused on the impacts of policy and evolving energy markets, particularly in the power sector. Hannah maintains Rhodium Group's modified version of the National Energy Modeling System (RHG-NEMS). Before joining Rhodium, Hannah worked with global land models and output at the Jet Propulsion Laboratory and researched historical climate at Northern Arizona University.

Ben King is a Director with Rhodium Group's Energy & Climate practice. Ben leads research projects focused on the effects of policy and economic changes to the US energy system, particularly in the power and industrial sectors. Prior to joining Rhodium, Ben was an analyst in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), where he worked on demand-side efficiency analysis and electricity market policy. Ben also served as Deputy Chief of Staff in EERE and developed clean energy policy resources for cities and states at the U.S. Environmental Protection Agency.

Parker Case is a Research Analyst with Rhodium's Energy & Climate practice. Parker analyzes the US energy system using RHG-NEMS. Before joining Rhodium, he worked on chemistry-climate modeling as a research scientist at the University of Maryland and NASA's Goddard Space Flight Center. He holds a PhD in atmospheric and oceanic sciences from the University of Colorado Boulder and a Bachelor's degree in earth science.

Michael Gaffney is Research Analyst with Rhodium Group's Energy & Climate practice. Michael joined Rhodium from the UC San Diego School of Global Policy and Strategy (GPS), where he conducted research on electric vehicle charging behavior and policy in California. Prior to graduate school, he worked as a Senior Associate at TDC, a Boston-based nonprofit management consulting firm.

Nathan Pastorek is a Research Analyst with Rhodium Group's Energy & Climate practice. Nathan works on research projects relating to emerging clean technologies and decarbonization. Before joining Rhodium, Nathan worked for KeyLogic Systems and was primarily focused on economic and geologic modeling for carbon capture and storage scenarios using models from the National Energy Technology Laboratory (NETL).

Anna van Brummen is a Research Analyst with Rhodium Group's Energy & Climate practice, focusing on US energy markets and policy. Anna assesses the impacts of energy policy using a national energy modeling framework. Prior to joining Rhodium, Anna worked with a California environmental consulting company to bring air quality data and other environmental quality assessments to local communities.

Nathan Wiens is a Research Analyst with Rhodium's Energy & Climate practice. Nathan analyzes the US energy system using RHG-NEMS. Before joining Rhodium, Nathan worked on energy modeling at Pacific Northwest National Lab's Joint Global Change Research Institute. He holds a Bachelor's degree in Systems Engineering from the University of Virginia.

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Disclosures

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