America's Better Pathway

Charting the Affordability, Health, and Emissions Benefits of a Clean Energy Transition

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UNIVERSITY OF MARYLAND
SCHOOL OF PUBLIC POLICY
CENTER FOR GLOBAL SUSTAINABILITY

AMERICA IS ALL IN

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Summary for Policymakers

A better pathway for the United States is within reach. This pathway accelerates a remarkable ongoing transition already happening thanks to leadership from governors, mayors, and others committed to America's clean energy future. And, this pathway can power our economy with domestic energy that is more secure, affordable, quicker to deploy, and clean. In doing so, it can deliver better health, energy, and emissions outcomes—providing an immediate, available route to lowering household energy costs.

State, city, and other subnational leaders are already forging ahead, advancing the clean energy transition across the United States through a diverse set of policy actions. At the same time, clean energy has become increasingly cost-competitive, offering a practical solution to the nation's evolving energy needs and further accelerating the transition. Last year, over 90% of new electricity capacity deployed in the United States was clean; solar and wind energy reached nearly 20% of the generation mix and surpassed coal for the first time.[1] This momentum comes as rising energy costs, exposure to fossil fuel price volatility, and rapidly growing electricity demand from emerging sources reshape national and global policy agendas.

In this context, clean energy policies and related actions are increasingly recognized as a key solution to address broader societal priorities in the United States, including energy affordability and security, health, and climate change. Solar and wind energy, especially when paired with battery storage, offer low-cost, secure, and rapidly deployable options to meet rising electricity demand while insulating U.S. households from volatile fossil fuel prices. Investments in clean technologies can also improve air quality and reduce mortality associated with harmful air pollution, while accelerating reductions in GHG emissions that lead to climate change.

This analysis details how America's *Better Pathway* can deliver real and significant benefits to people across the entire country—across our diverse geographical areas, political contexts, and urban and rural communities. To do this, the report quantifies the affordability, health, and emissions outcomes across two scenarios: a *Current Pathway,* which reflects a continuation of existing policies and trends, including federal policy rollbacks and subnational policies, and a *Better Pathway*, which accelerates the clean energy transition through additional subnational policies and market drivers. Enhanced subnational policies in the *Better Pathway* scenario drive greater renewable energy development, improve energy efficiency, and promote electrification across sectors.

This report finds that:

- **Accelerating the clean energy transition through the *Better Pathway* produces a quadruple benefit for America.** This includes:
  - **Delivering substantial energy cost savings for Americans.** On average, U.S. households would save over $7,800 cumulatively over the next decade with nearly $1,000 of savings per household per year by 2035 under the *Better Pathway*, compared to the *Current Pathway*.
  - **Improving air quality and saving American lives.** Nationally, the *Better Pathway* results in nearly 76,000 fewer air quality-related premature deaths cumulatively over the next decade, with 5,000 fewer deaths per year by 2035, compared to the *Current Pathway*.
  - **Reducing greenhouse gas emissions.** The *Better Pathway* projects a 38%–46% reduction in greenhouse gas emissions by 2035 compared to 2005 levels, versus 22%–32% under

the *Current Pathway*. Subnational actions under the *Better Pathway*, including state and city policies, can build on and accelerate the downward trend in U.S. GHG emissions (currently 19% below 2005 levels).

  - **Alleviating pressure on American electricity demand.** At a time of rapidly increasing burden on the U.S. electricity grid due to data centers and other emerging sources, the *Better Pathway* results in electricity demand growth that is 15% lower in 2035 compared to the *Current Pathway*, thanks to energy efficiency measures. This reduction is achieved even with greater electrification through electric vehicles and heat pumps under the *Better Pathway*, freeing more power to meet the needs of our communities and economy.

- **These benefits are broadly shared across regions and local geographies.** All states included in this analysis experience lower household energy costs and fewer air quality-related premature deaths under the *Better Pathway* in 2035. Household energy costs decrease by 13%–27% ($460–$1,379) and premature deaths due to ambient fine particulate matter ($PM_{2.5}$) decline by 1%–21% across states in 2035, compared to the *Current Pathway.*
- **California and Texas illustrate different state-level policy approaches and market drivers that shape the clean energy transition.** In California, the *Better Pathway* results in a $929 reduction in household energy costs and approximately 320 fewer premature deaths associated with ambient $PM_{2.5}$ in 2035, reflecting broad, economy-wide transformations. In Texas, the *Better Pathway* results in an $885 reduction in household energy costs and approximately 330 fewer deaths in 2035. The clean energy transition in Texas is slower, reflecting less ambitious and comprehensive policies, but still achieves large-scale clean energy deployment, driven by greater reliance on market forces and the declining costs of clean energy technologies.
- **Case studies across the United States demonstrate how states, counties, and cities are already implementing policies to bring tangible benefits to their communities.** Recent examples include expanded access to renewable energy, virtual power plants, building energy efficiency programs, transit-oriented development, incentives and investments in EVs, and more.

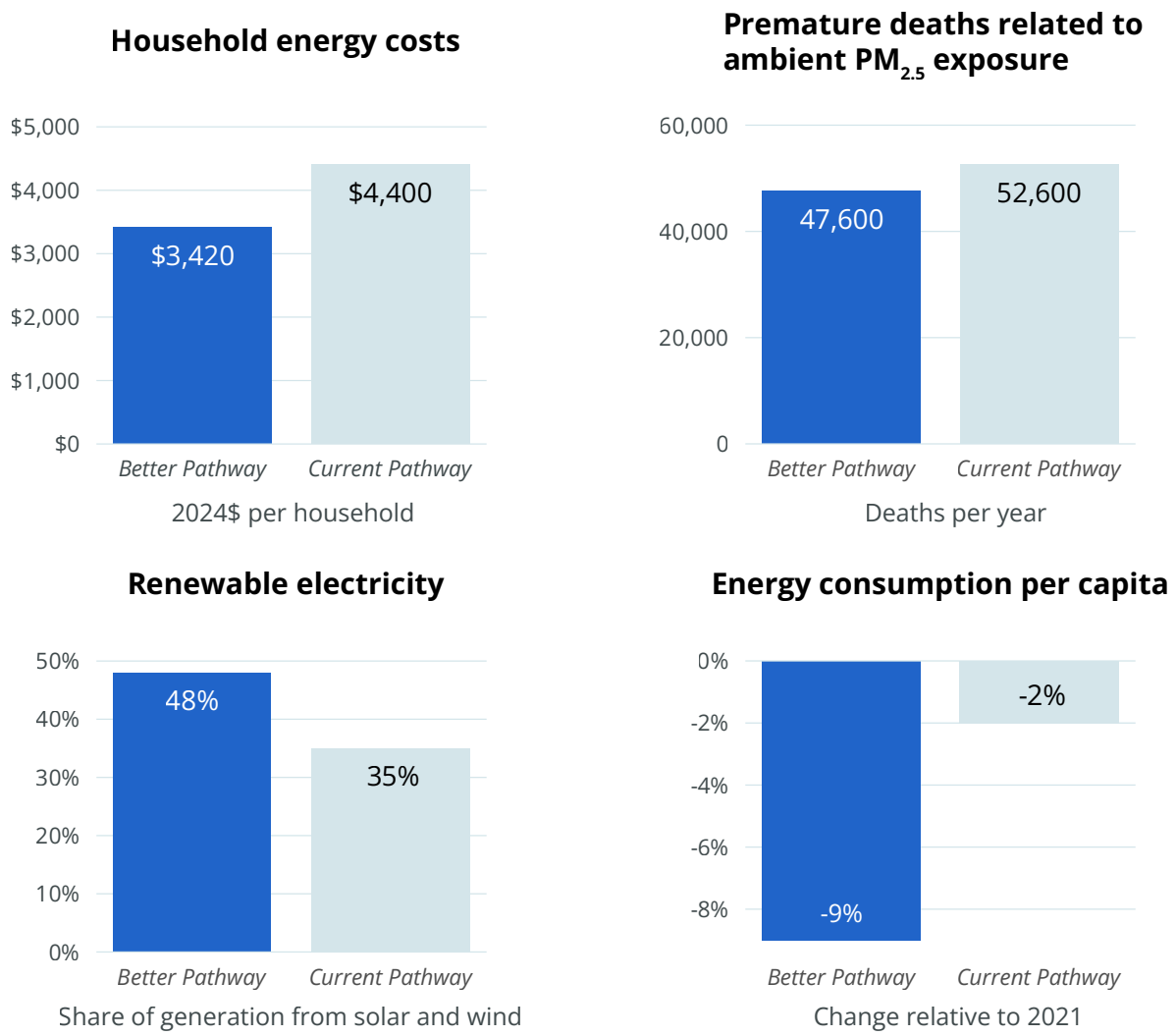


Figure 1. National outcomes for affordability, health, and the energy transition in 2035 under the *Better Pathway* and *Current Pathway* scenarios.

Introduction

America has a better pathway ahead. This pathway accelerates a remarkable ongoing transition already happening thanks to leadership from governors, mayors, and others committed to a clean energy future. This pathway can power our economy with domestic energy that is more secure, affordable, quicker to deploy, and clean. In doing so, it can deliver better health, energy, and emissions outcomes—and provide an immediate, available route to lowering household energy costs. As we forge this pathway together, we can deliver practical solutions that benefit people in every part of the country, from small towns to big cities, and in doing so, make meaningful improvements that address the concerns discussed every day at kitchen tables across our country.

This better pathway is within reach just as people across the country face increasing pressures on their pocketbooks and livelihoods. High and volatile fossil fuel prices, along with growing electricity demand, are driving up energy costs for households and the economy as a whole—as well as exposing major vulnerabilities in U.S. energy security stemming from high dependence on fossil fuels. The ongoing war with Iran, which has interrupted the global flow of crude oil and liquefied natural gas, has underscored to the world and the United States the economic and security risks of fossil fuel dependence.[2,3] At the same time, these challenges highlight the broader energy security and affordability benefits of clean energy technologies that use domestic resources.

States, cities, and local governments are leading through challenges

Energy affordability has become a salient political issue, with household incomes failing to keep pace with residential electricity prices.[4] Electricity bills increased nearly 7% in 2025, double the rate of inflation.[5] A surge in new data centers and associated load growth has further focused attention on energy affordability and security concerns. By 2030, data centers are projected to comprise 9%–17% of total U.S. electricity demand.[6,7] Seventy percent of voters now oppose the construction of a data center in their area, with many citing higher utility bills as their reason for opposition.[8] In response, states and cities are increasingly prioritizing protections for residential ratepayers and measures to maintain grid reliability.[9,10,11]

Meanwhile, the U.S. federal government has continued to withdraw support for clean energy deployment while prioritizing fossil fuel expansion. Notably, a rule was finalized in February 2026 to rescind the Endangerment Finding, which provided the basis for federal greenhouse gas (GHG) emissions regulations. This rule has directly repealed federal GHG emissions standards for motor vehicles, though repealing the underlying basis for other regulations will require additional action.[12] Other recent federal actions include cutting funds for clean energy projects, rescinding clean energy tax credits through the 2025 reconciliation bill, requiring coal plants to operate beyond planned retirement dates, and repealing or delaying building energy efficiency and electrification requirements.[13–18] Although many of these actions are facing legal challenges, and some have been overturned through the courts—such as the administration's initial offshore wind permitting pause—other restrictions and delays have limited the practical effect of those court decisions.[19,20]

Despite a lack of federal support, the clean energy transition is accelerating across the United States. In 2025, renewable energy comprised more than 90% of new capacity and reached nearly 20% of the generation mix, surpassing coal for the first time.[21] This trend is expected to continue through 2026.[22] States, cities, and other subnational actors continue to use their existing authorities to drive actions that address a linked set of issues across energy security and affordability, health, and climate change.

Colorado and New Mexico are among the states that have adopted some of the nation's strongest rules to cut oil and gas pollution.[23–25] California's Cap-and-Invest Program was recently extended through 2045 and includes key reforms such as the use of program revenue for household energy bill savings.[26] States are also rapidly advancing balcony solar legislation: Following Utah's passage of the first law in 2025, nine other states have enacted similar measures, and legislation is currently under consideration in 24 states.[27] In Virginia, lawmakers enacted a suite of clean energy policies in 2026 framed around community benefits, including measures to promote virtual power plants,[28] prioritize siting on existing transmission infrastructure,[29] and expedite solar permitting.[30]

At the city level, New York City implemented a congestion pricing program in 2025 that has already generated substantial air quality and economic benefits for the city.[31,32] Boise, Idaho, is expanding its geothermal system to supply affordable heating for up to 300 multifamily housing units in the city, saving participating households up to 80% on their utility bills.[33] Philadelphia, Pennsylvania, is bringing critical energy-saving upgrades to 14 city facilities, which are expected to generate more than $1.5 million in utility savings each year and create an estimated 300 jobs while reducing GHG emissions.[34] Sun Prairie is the first Wisconsin city to attain 100% renewable electricity for municipal operations, through a combination of city-installed solar photovoltaic (PV) systems that produce over 750 MWh of clean electricity annually and renewable energy blocks from Wisconsin Public Power Inc.[35]

Accelerating the ongoing clean energy transition is a means of addressing broader societal issues beyond climate change, including energy security, affordability, and health. Renewable energy deployment, for example, can reduce energy costs for U.S. households and insulate them from the price volatility inherent in fossil fuel markets.[36,37] It can also help manage rising electricity demand from data centers, electric vehicles (EVs) and heat pumps. Solar, wind and storage remain among the cheapest sources of new generation, with costs falling rapidly in recent years.[38] These technologies can be deployed more quickly than natural gas, particularly given the current backlog of new gas turbines.[39,38] Additionally, accelerating clean energy deployment can improve air quality and reduce premature deaths associated with exposure to $PM_{2.5}$, ozone, SO_2, and NO_x from fossil fuel power plants, internal combustion engine vehicles, and other sources of combustion.[40]

Accelerating improvement with America's *Better Pathway*

Against this backdrop of challenges and opportunities, this report illustrates a *Better Pathway* scenario that accelerates the clean energy transition through a diverse set of subnational policies, alongside market forces such as evolving technology costs, fossil fuel prices, and data center load growth. The report assesses the affordability, health, and emissions benefits associated with this *Better Pathway* through the year 2035, and compares them with those under current policies and trends (labeled the *Current Pathway* scenario). Importantly, this scenario does not assume additional federal action and should therefore not be interpreted as a maximum-ambition climate pathway for the United States.

Methodology

Overview of approach

This study provides a structured and transparent analysis of policies adopted or considered in the United States today and how those policies would impact societal outcomes, including affordability, health, and emissions.

Two different policy scenarios are constructed across all economic sectors: a *Current Pathway* scenario representing the current trajectory based on existing policies and trends, and a *Better Pathway* scenario representing enhanced policy adoption. Both scenarios incorporate a diverse set of policies at the national and state levels alongside key market forces. Outcomes related to affordability, health, and emissions are assessed to better understand the potential impacts of the enhanced pathway.

Methodologically, a multi-step approach is taken to construct the scenarios and assess the associated outcomes. First, the scenarios are developed with input from the key stakeholders to inform scenario design and policy implementation assumptions. Then, the scenarios are modeled using an integrated modeling framework that couples a field-leading integrated assessment model (IAM) with an air quality and health impacts model. The IAM has representation of all 50 U.S. states and the District of Columbia, and is used to project GHG emissions, energy system transitions, and household energy expenditures under each scenario. The model uses 2021 as its base year and projects outcomes through 2035, with all costs reported in 2024 dollars. The IAM outputs are then used as inputs to the health impacts model, which estimates air pollution concentrations and associated health impacts under each scenario for the lower 48 states and Washington, D.C.

This report describes the national- and state-level results on affordability and health impacts, as well as national emissions and energy outcomes. To illustrate how the *Better Pathway* may unfold across diverse domestic policy contexts, the report examines results from California and Texas in greater detail. Additionally, it presents case studies that demonstrate how subnational actors are already taking policy actions to advance the clean energy transition while delivering broad benefits to their communities.

Scenario design

Under both the *Current Pathway* and the *Better Pathway* scenarios, modeled policies address a linked set of broad societal issues, including climate change, energy security and affordability, and health. Modeled market forces include changing technology costs, fossil fuel prices, and data center load growth. Table 1 presents an overview of scenario elements in both scenarios.

The *Current Pathway* scenario models key federal and state-level energy and climate laws and regulations as of August 2026. This includes changes to the Inflation Reduction Act (IRA) under the One Big Beautiful Bill Act and federal cancellations and freezes of IRA and Bipartisan Infrastructure Law funding.[18,41,42] Federal repeals of major power plant, vehicle, and oil and gas methane regulations, as well as the revocation of California's Clean Air Act waivers related to Advanced Clean Cars II and Advanced Clean Trucks, are assumed to take effect, though many are being challenged in court.[43–46] Additionally, only half of planned coal power plant retirements are assumed to occur due to recent federal executive orders and investments in coal plants.[17,47] At the state level, some of the most ambitious existing policy actions are represented, including renewable portfolio standards in 24 states and building energy efficiency standards in 27 states.

The *Better Pathway* scenario expands upon ongoing state action, assuming broader adoption of existing policies and more ambitious policy measures that reduce GHG emissions. Motivated by diverse objectives such as climate change, energy security and affordability, and health, modeled policies include those that increase renewable energy deployment, improve energy efficiency, and promote electrification. Additionally, a health target is modeled. This aggregate target limits the damages related to ozone and fine particulate matter ($PM_{2.5}$) after 2025, and serves as a proxy for state-level ambition to improve air quality. While actions from cities and other subnational actors are not explicitly modeled in this analysis, they will be critical for supporting and implementing the modeled state-level actions. No new federal action is assumed; federal policy is the same in both scenarios through 2035. Lower costs for EVs and renewable energy technologies are assumed, reflecting additional investment in the clean energy transition.

To contextualize these scenarios within current global and national trends, assumptions around fossil fuels and data centers were held constant across scenarios. Both scenarios include high fossil fuel prices (based on the U.S. Energy Information Administration's (EIA's) Annual Energy Outlook (AEO) 2026[48]) and a medium case for data center load growth (based on Electric Power Research Institute's (EPRI's) 2026 report[6]).

Table 1. Scenario elements in the *Current Pathway* and *Better Pathway* scenarios.

Dimension	Category	*Current Pathway*	*Better Pathway*
Policy	**Federal policies**	Existing climate and energy policies in place as of August 2026.	
	State-level policies	Existing renewable portfolio standards, building energy efficiency policies, interregional cap and trade policies (in place as of August 2026).	States adopt enhanced actions across renewable energy deployment, energy efficiency, and electrification, among other actions that reduce GHG emissions. An aggregate health target limits damages related to $PM_{2.5}$ and ozone, ensuring they do not worsen relative to 2025 levels.
Market forces	**Technology costs**	Costs for EVs and renewable energy continue based on current trends.	Costs for EVs and renewable energy decline further as a result of increased deployment and investment in these technologies.
	Fossil fuel prices	High fossil fuel prices from EIA's AEO 2026 are used to reflect the recent reality of global fossil fuel markets.	
	Data center load growth	Total electricity demand from data centers is calibrated to the medium scenario from EPRI's 2026 report through 2030. These projections are extrapolated to reach 758 TWh by 2035.	

Modeling state-level policies

In addition to federal policies, the *Better Pathway* scenario models enhanced state-level policies that reduce GHG emissions (Table 2). These policies are motivated by a range of objectives, including climate, energy affordability, and energy security. For modeling purposes, policies are classified into two categories—*emissions-focused policies* and *multi-objective policies.*

Policies historically motivated primarily by emissions reductions are classified as *emissions-focused policies* in the scenario design, recognizing that they may also advance other societal objectives.

Enhanced emissions-focused policies under the *Better Pathway* scenario span multiple sectors, including renewable portfolio standards, clean fuel standards, zero-emission appliance standards, and oil and gas methane regulations. Policy assumptions are specified based on a state tiering system. Tier 1 states adopt the most ambitious policies; Tier 2 states adopt less ambitious policies over a longer time frame; and Tier 3 states adopt the least ambitious or no policies. See *Technical Appendix* for a list of the sector-specific tiers and further details on the underlying policy assumptions.

Policies increasingly driven by objectives beyond emissions reductions, including energy affordability and security, are classified as *multi-objective policies*. On the supply side, policies such as permitting reform, transmission expansion, and grid utilization can lower electricity costs and help meet growing electricity demand by facilitating renewable energy deployment. On the demand side, policies such as building energy efficiency measures can reduce household utility bills by lowering energy consumption and associated fuel costs. Similarly, policies to reduce vehicle miles traveled (VMT) can lower household transportation costs by reducing fuel use.

Multi-objective policies can provide an alternative pathway to accelerate the clean energy transition, supporting more ambitious outcomes than would result from emissions-focused policies alone. Policy assumptions reflect the potential for policies addressing salient issues, such as energy affordability and security, to gain broader adoption. See *Technical Appendix* for detailed policy assumptions.

Table 2. Enhanced state-level policies modeled under the *Better Pathway* scenario.

Sector	Primary Policy Motivation	Modeled Policy
Electricity	Emissions-focused	Renewable portfolio standards
	Multi-objective	Permitting reform, transmission expansion, grid utilization
Transportation	Emissions-focused	Clean fuel standard
	Emissions-focused	EV incentives (tax credits, rebates, etc.)
	Emissions-focused	Transit and school bus electrification targets
	Multi-objective	Vehicle miles traveled reduction policies
Buildings	Multi-objective	Energy efficiency policies
	Emissions-focused	Zero-emission appliance standards
	Emissions-focused	Zero-emission construction standards
Industry	Emissions-focused	Cement CCS targets
Methane	Emissions-focused	Methane regulations and policies
Hydrofluorocarbons (HFCs)	Emissions-focused	Significant New Alternatives Policy (SNAP) and Refrigerant Management Programs (RMP)
Land use, land-use change and forestry (LULUCF)	Emissions-focused	Policies related to wildfire mitigation, tree planting, conservation

Impacts on household energy expenditures

Energy affordability has become a central component of the broader affordability discussion in the United States. Electricity prices have been rising faster than inflation, particularly for residential households,[49] while recent geopolitical events have underscored the volatility of fossil fuels, including spikes in natural gas and gasoline prices.[50] These trends contribute to the growing energy affordability crisis: In 2024, 33% of households faced challenges in meeting their energy needs, up from 27% in 2020.[51,52] Natural gas prices, transmission and distribution infrastructure, and load growth are the key drivers projected to have the greatest impact on electricity prices in the near term.[49]

Direct household energy costs are a primary indicator of energy affordability.[53] In this analysis, residential utility bills for electricity, gas, and other heating fuels, as well as fuel costs associated with gasoline and electricity used for personal vehicles, are evaluated at the national and state levels. This metric does not include upfront capital costs or monthly non-energy operating costs (e.g., upgrading to more efficient appliances, purchasing an EV, investments in EV charging infrastructure), which should also be accounted for in future work to better contextualize the affordability impacts on U.S. households.

National outcomes

Model projections are compared to 2021, which is the model's base year; all years after 2021 are projected years. Costs are reported in constant 2024 dollars.

In 2021, U.S. households spent an average of $5,161 on energy. Gasoline accounted for 46% ($2,391) of the total energy cost, electricity 43% ($2,221), and natural gas 8% ($416). While electricity prices have risen in recent years, household energy costs decline in the future under both scenarios. Some of these changes occur endogenously within the model, reflecting stock turnover and market forces, such as the replacement of older appliances with more efficient models and the gradual increase in vehicle electrification.

Under the *Current Pathway*, average U.S. household energy costs decline by 14% from 2021 levels to $4,404 in 2035. This decrease occurs largely because of greater EV adoption, which lowers gasoline expenditures, and greater renewable energy integration, which lowers electricity costs (Figure 2). In the 27 states with existing energy efficiency measures, efficiency improvements also lower electricity and gas costs. In 2035, electricity accounts for 47% ($2,074) of total energy expenditures, followed by gasoline at 39% ($1,721), and gas at 11% ($494).

Under the *Better Pathway*, average household energy costs fall by 33% from 2021 levels to $3,422 in 2035. This represents a 22% ($981) reduction compared with the *Current Pathway* in 2035 (Figure 2), with most of the difference driven by electricity costs. In 2035, gasoline accounts for 44% ($1,507) of total energy expenditures, followed by electricity at 43% ($1,467), and gas at 10% ($354). Cumulatively, the *Better Pathway* reduces household energy costs by $7,833 over the next decade relative to the *Current Pathway*. These savings reflect modeled energy efficiency and electrification measures, alongside policies that accelerate renewable energy deployment, supported by lower renewable energy technology costs.

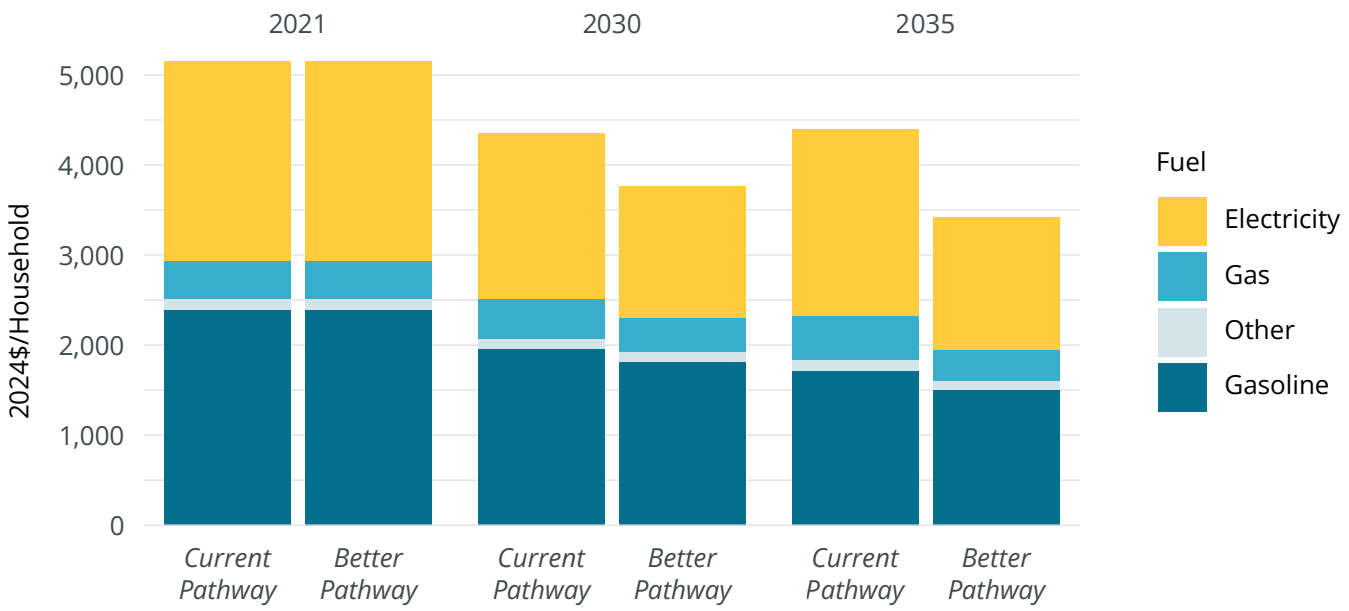


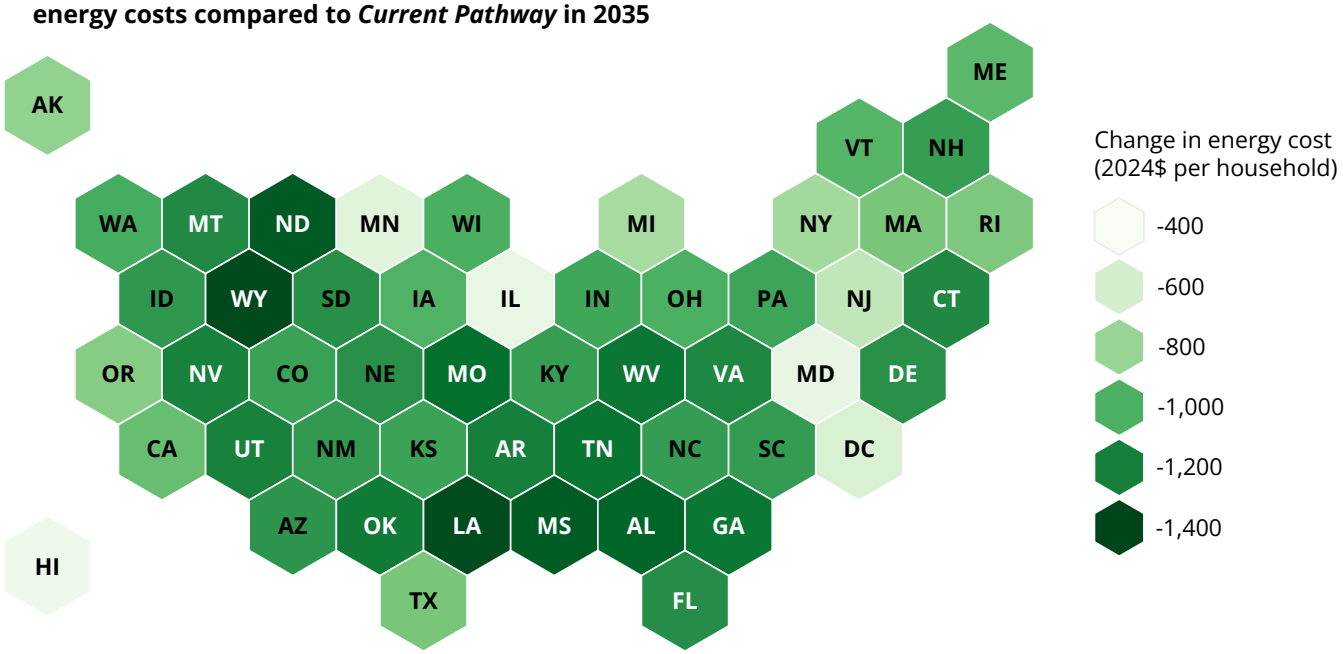
Figure 2. Average U.S. household energy costs by fuel under the *Current Pathway* and *Better Pathway* scenarios, in units of 2024 dollars per household.

State-level outcomes

All states experience lower household energy costs under the *Better Pathway* scenario in 2035 compared with the *Current Pathway* scenario (Figure 3a). Household energy costs decline by 13% to 27% ($460 to $1,379) in 2035 depending on the state.

Differences across states are explained by variation in energy consumption, energy prices, and trade dynamics within and across grid regions. Existing state-level policies included in the *Current Pathway* scenario also influence the differences between scenarios. For example, states like Wyoming and Oklahoma have some of the largest energy cost savings under the *Better Pathway* compared to the *Current Pathway* in 2035 (Figure 3a). This is partly because both states do not have existing clean energy policies under the *Current Pathway* scenario, resulting in a larger difference between scenarios. However, when compared with 2021 levels, both states rank among those with the lowest energy cost savings under the *Better Pathway* (Figure 3b).

a. *Better Pathway:* Change in average state-level household energy costs compared to *Current Pathway* in 2035



b. *Better Pathway:* Change in average state-level household energy costs, 2021 to 2035

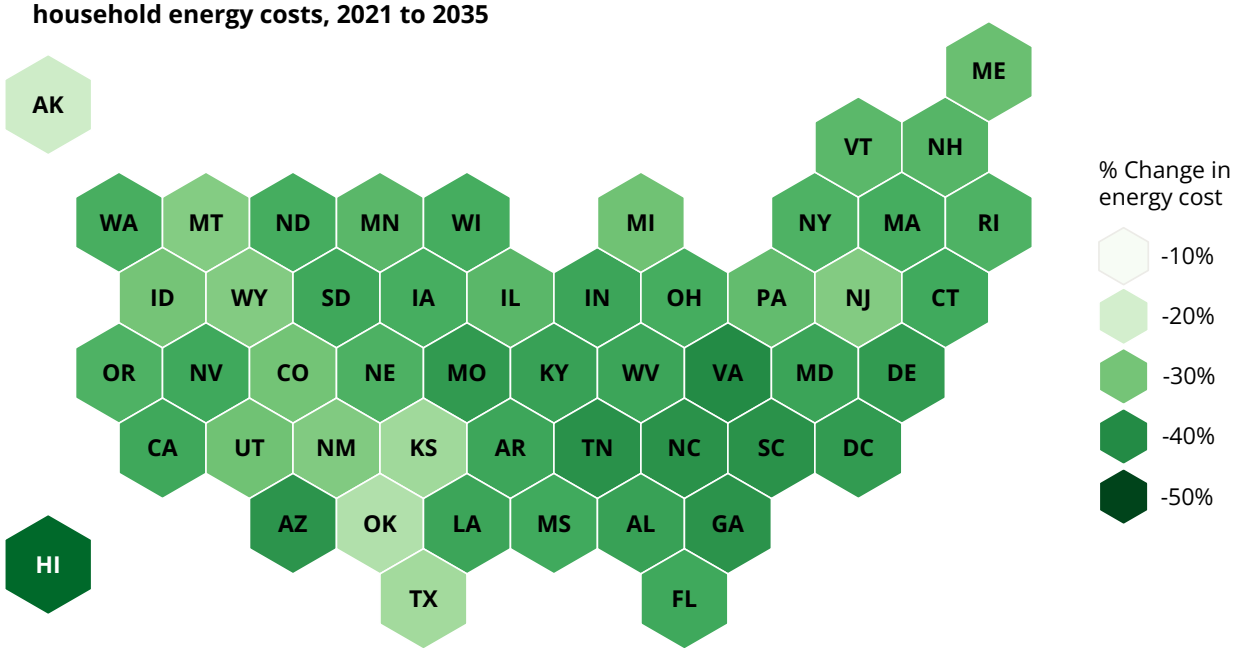


Figure 3. Changes in average state-level affordability outcomes under the *Better Pathway* scenario in 2035. Panel (a) shows the change in household energy cost, in units of 2024 dollars per household, relative to the *Current Pathway*. Panel (b) shows the percentage change in household energy costs relative to 2021 levels.

Air quality and health impacts

Air pollution related to ambient fine particulate matter ($PM_{2.5}$) continues to pose a serious health threat in the United States. $PM_{2.5}$ can either be directly emitted or formed through atmospheric chemical reactions involving precursor gases including nitrogen oxides (NO_x) and sulfur dioxide (SO_2). Fossil fuel combustion is a primary source of these pollutants. Other sources of direct $PM_{2.5}$ emissions and $PM_{2.5}$ precursors include wildfires and agriculture; however, this section focuses on emissions related to fossil fuel and biomass combustion.

Reducing the health burden of air pollution requires addressing sources across economic sectors. A number of health impacts are associated with $PM_{2.5}$, including cardiovascular and respiratory diseases, stroke, and premature death.[54] Furthermore, $PM_{2.5}$ exposure disproportionately affects communities that live near pollution sources like coal-fired power plants and industrial facilities.[55,56] The industrial sector is a major source of SO_2, NO_x, and $PM_{2.5}$, through activities such as oil refining, cement production, and fossil combustion in industrial boilers and process heaters. Coal combustion in the electricity sector contributes significantly to SO_2 and NO_x emissions, while gasoline and diesel combustion in the transportation sector is a major NO_x emitter. Wood combustion for heating in residential and commercial buildings is also a significant source of $PM_{2.5}$ emissions in many parts of the country.[57,58]

The *Better Pathway* scenario includes an aggregate health target that limits damages from premature mortality related to $PM_{2.5}$ and ozone (O_3) to 2025 levels through 2035. This constraint serves as a proxy for state-level ambition to improve air quality and influences the affordability, health, and emissions outcomes in this analysis. To more closely examine the air quality impacts under the *Current Pathway* and the *Better Pathway*, this air quality and health analysis focuses on $PM_{2.5}$, which tends to dominate air quality-related health impacts.[59]

National air quality and health outcomes

The *Better Pathway* scenario leads to improved air quality and fewer premature $PM_{2.5}$-related deaths compared to the *Current Pathway* scenario. National NO_x emissions are reduced by 11%, SO_2 by 26%, and primary $PM_{2.5}$ by 13% in 2035 under the *Better Pathway* (Figure 4a). These reductions are driven by policies and market forces under the *Better Pathway*, including the national health target. See *Technical Appendix* for details on the impacts of the health target.

The industrial sector accounts for 63% of the NO_x reductions and half of the primary $PM_{2.5}$ reductions, while the electricity sector drives 79% of the SO_2 reductions. Compared to the other sectors, the transportation sector plays a more limited role in reducing air pollutant emissions due to emissions limits for internal combustion engine vehicles.

These changes are associated with approximately 5,000, or 10%, fewer premature deaths attributable to ambient $PM_{2.5}$ exposure in 2035 than under the *Current Pathway* (Figure 4b). Cumulatively, the *Better Pathway* results in 75,600 fewer deaths by 2035 relative to the *Current Pathway*.

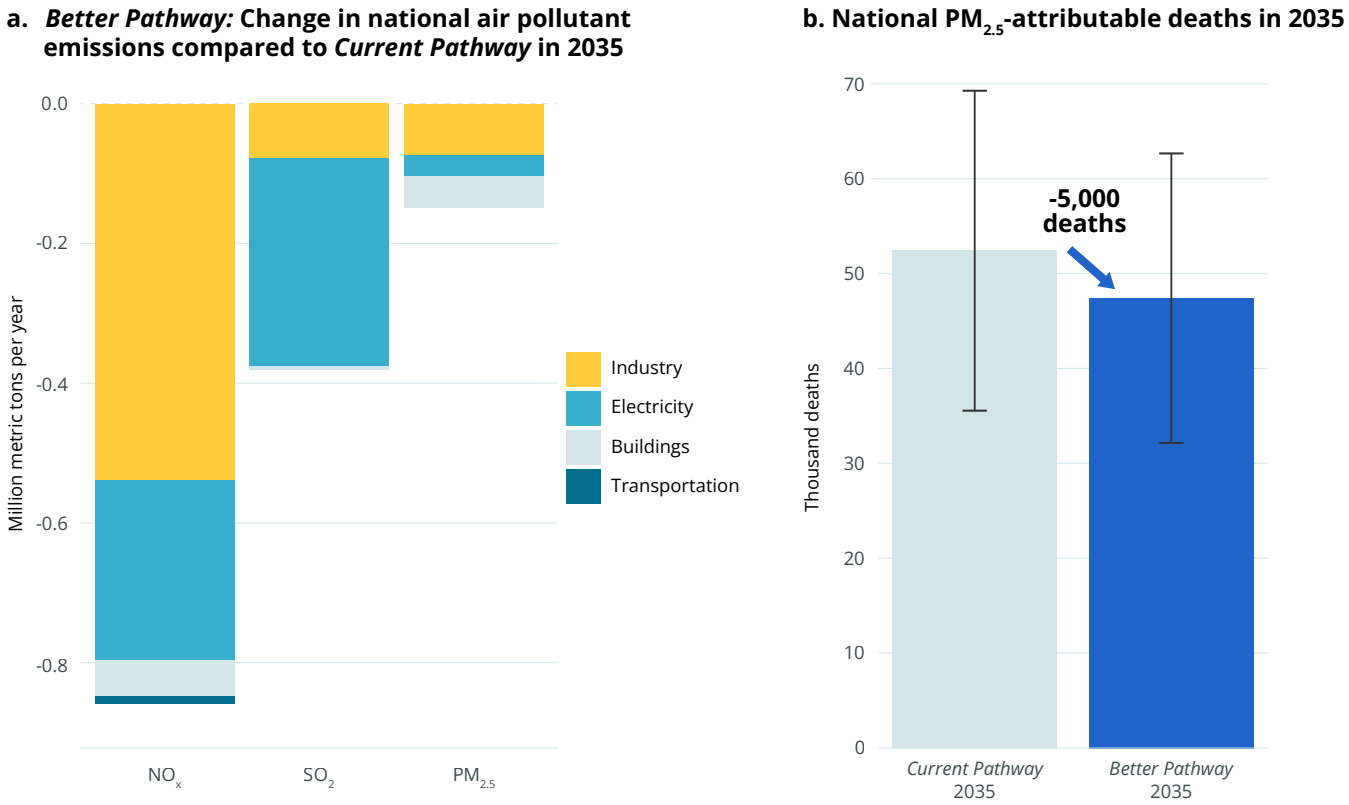


Figure 4. Changes in national air pollutant emissions and health damages under the *Better Pathway* scenario, relative to the *Current Pathway* scenario, in 2035. Panel (a) shows changes in national $PM_{2.5}$, SO_2, and NO_x emissions, in units of million metric tons per year. Panel (b) shows national premature deaths attributable to $PM_{2.5}$ exposure in 2035. Given uncertainties in the $PM_{2.5}$-mortality relationship, the error bars correspond to 95% confidence intervals in the concentration-response function used to estimate the health impacts.[60] Under these intervals, deaths in 2035 range from approximately 35,500 to 69,200 under the *Current Pathway* scenario (with a central estimate of 52,600) and from approximately 32,100 to 62,600 under the *Better Pathway* scenario (with a central estimate of 47,600).

State-level air quality and health outcomes

All lower 48 states experience air quality improvements and fewer premature deaths in 2035 under the *Better Pathway* scenario. However, the magnitude of these benefits varies across states. Reductions in $PM_{2.5}$ concentrations and $PM_{2.5}$-attributable deaths range from 1% to 21% across states (Figure 5). These differences reflect several factors: the sources of pollution in each state, such as coal-fired generation, industrial fuel use, and biomass heating; where those emissions occur relative to population centers; and baseline mortality rates.

The largest improvements in annual average $PM_{2.5}$ concentrations and associated deaths are found across the eastern United States, including Delaware (21%), West Virginia (20%), Maryland (18%), Pennsylvania (18%), New Jersey (16%), and New York (15%) (Figure 5b). In West Virginia, these benefits are driven primarily by reduced coal-fired electricity generation under the *Better Pathway,* which substantially lowers SO_2 and NO_x emissions in the state. The large relative reduction in premature deaths reflects the state's reliance on coal power and lack of clean energy policies. In Delaware and Maryland, the reductions are primarily driven by changes in the industrial sector, where diesel and

fuel oil consumption decline, rather than by changes in the electricity sector. In Maryland, increased electrification also reduces biomass use for heating, further contributing to emissions reductions in the state.

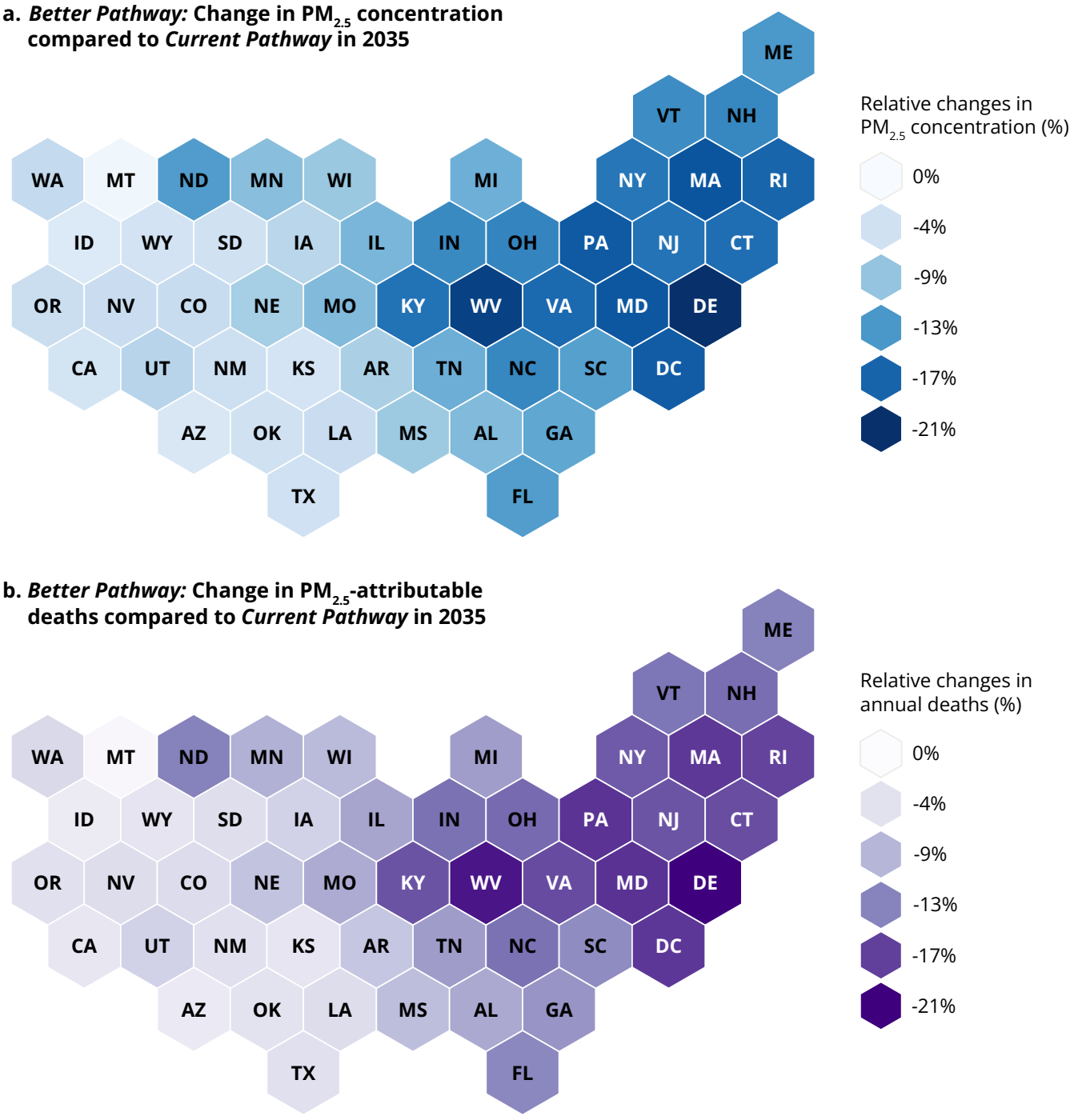


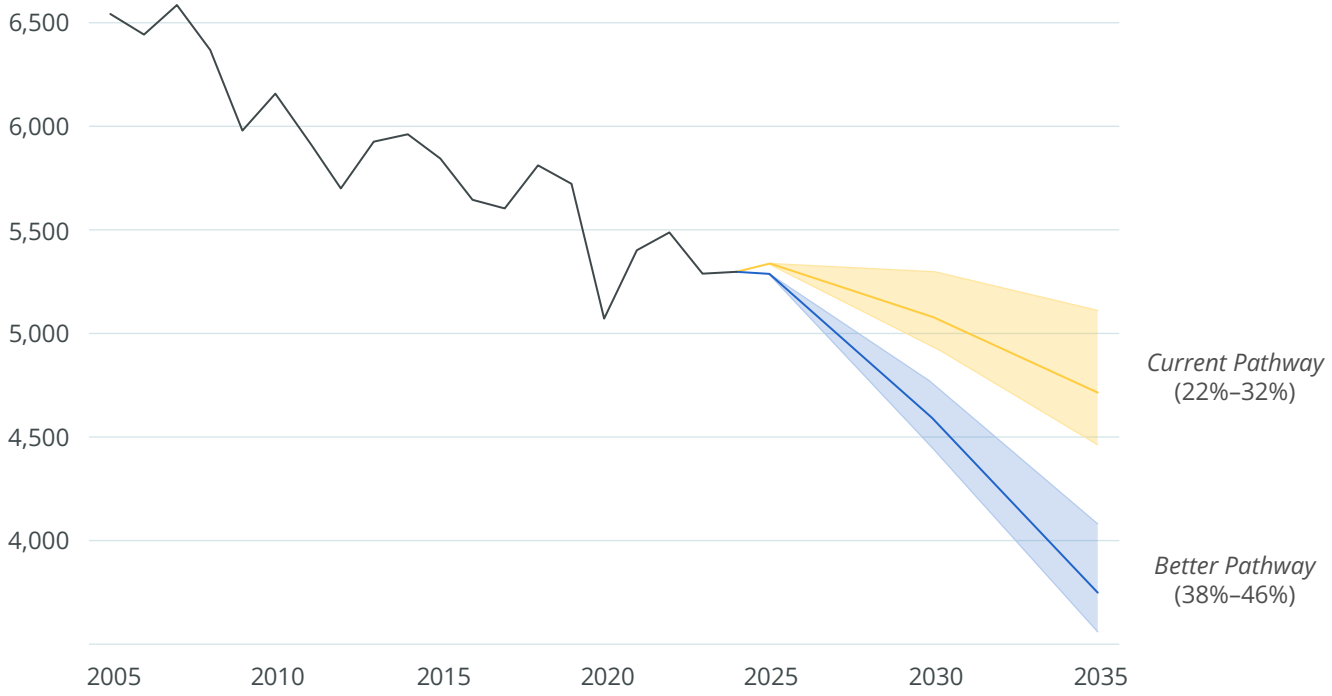
Figure 5. Changes in state-level air quality and health outcomes under the *Better Pathway* scenario, relative to the *Current Pathway* scenario, in 2035. Panel (a) shows relative changes in $PM_{2.5}$ concentration in 2035, relative to the *Current Pathway*. Panel (b) shows relative changes in annual $PM_{2.5}$-related deaths in 2035, relative to the *Current Pathway*. See *Technical Appendix* for a sensitivity analysis on the health target.

Emissions outcomes and energy system transition

As of 2024, the United States had reduced its GHG emissions by 19% from 2005 levels, primarily a result of reduced coal consumption and improvements in energy efficiency.[61] This study finds that by 2035, emissions fall by 42% relative to 2005 levels (3,750 $MMTCO_2e$) under the *Better Pathway*, with a range of 38%–46%. This compares to 28% (4,716 $MMTCO_2e$) under the *Current Pathway,* with a range of 22%–32% (Figure 6a). The ranges represent different assumptions around how key drivers evolve in the future, including economic growth, fossil fuel prices, technology costs, and data center load growth. See *Technical Appendix* for additional information on the sensitivity analyses.

Under the two core scenarios, the emissions difference in 2035 (966 $MMTCO_2e$) is primarily driven by the electricity sector (54%), followed by industry (12%), buildings (11%), and methane (10%) (Figure 6b). While the 100-year global warming potential (GWP) is used in country-level emissions accounting by convention, methane is much more potent over a shorter time frame. Sectoral emissions reductions in 2035 are therefore also evaluated using methane's 20-year global GWP. When evaluated this way, methane becomes the second largest contributor (26%) to the difference in 2035 emissions between scenarios, after electricity (45%). See *Technical Appendix* for additional detail on the implications of using different GWPs for methane.

a. Net greenhouse gas emissions ($MMTCO_2e$)



b. Emissions by sector in 2035 ($MMTCO_2e$)

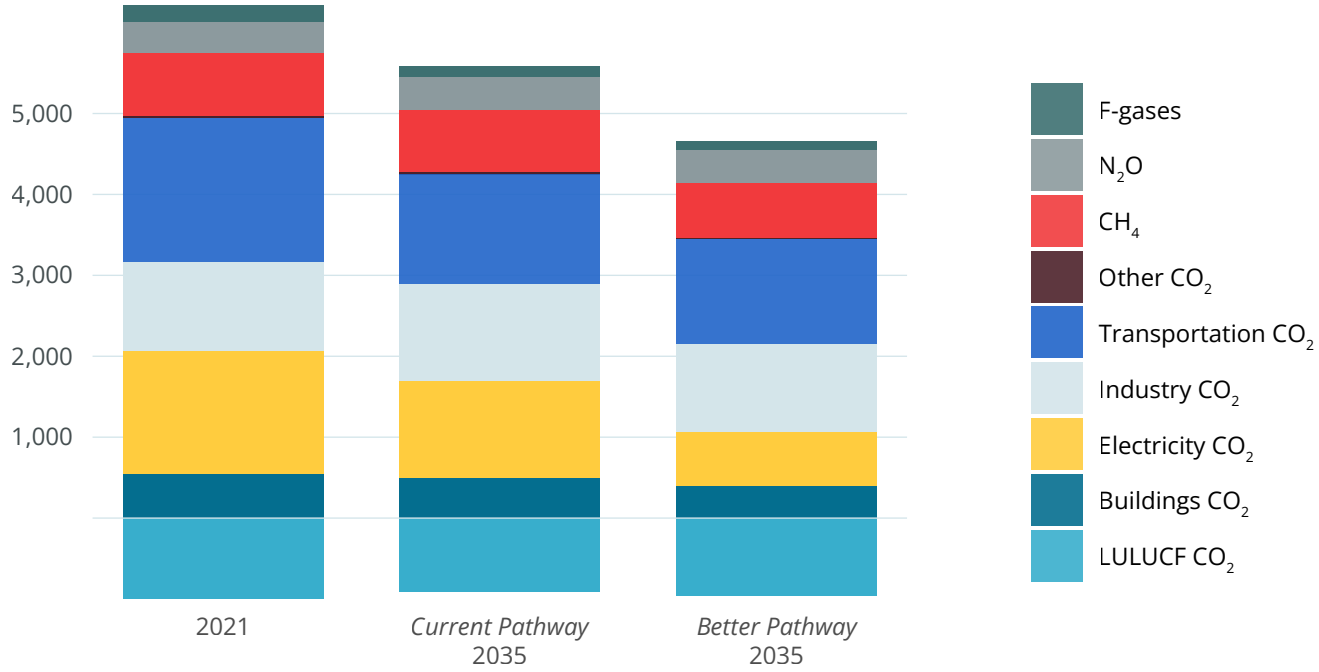


Figure 6. Greenhouse gas (GHG) emissions under the *Better Pathway* and *Current Pathway* scenarios. Panel (a) shows historical net GHG emissions through 2024 based on the latest GHG inventory, which uses the 100-year global warming potential to convert non-CO_2 gases into CO_2 equivalents.[62] The *Better Pathway* scenario achieves a 42% emissions reduction below 2005 levels by 2035 in the central case, with a sensitivity range of 38%–46%. The *Current Pathway* scenario reaches 28% emissions reductions in 2035 in the central case, with a sensitivity range of 22%–32%. The sensitivity range is based on assumptions of future socioeconomic growth, technology costs, fossil fuel prices, and data center demand. Panel (b) breaks down GHG emissions by sector in 2021 and under the two scenarios in 2035. LULUCF CO_2 emissions are negative in both scenarios because forests and other land absorb more carbon emissions from the atmosphere than they release in the United States.

Under the *Better Pathway* and *Current Pathway* scenarios, energy consumption declines as a result of electrification and energy efficiency improvements, reaching a 9% and 2% per capita reduction from 2021 levels, respectively. Electricity demand increases by 30% (1,185 TWh) under the *Better Pathway* scenario and 36% (1,400 TWh) under the *Current Pathway* scenario (Figure 7). Data centers are the largest contributors to this growth, accounting for 54% and 64% of total demand growth under the *Better Pathway* and *Current Pathway* scenarios, respectively.

Under the *Better Pathway* scenario, electricity demand from the transportation and industrial sectors accounts for 24% and 22% of demand growth by 2035, respectively. In contrast, electricity demand in the buildings sector declines by 5% from 2021 levels by 2035, reflecting the impact of modeled energy efficiency measures. Under the *Current Pathway* scenario, electricity demand growth is more modest in transportation and industry, accounting for 15% and 13% of demand growth by 2035, respectively. Meanwhile, the buildings sector plays a more prominent role, with electricity demand contributing to 32% of demand growth by 2035.

Change in electricity demand

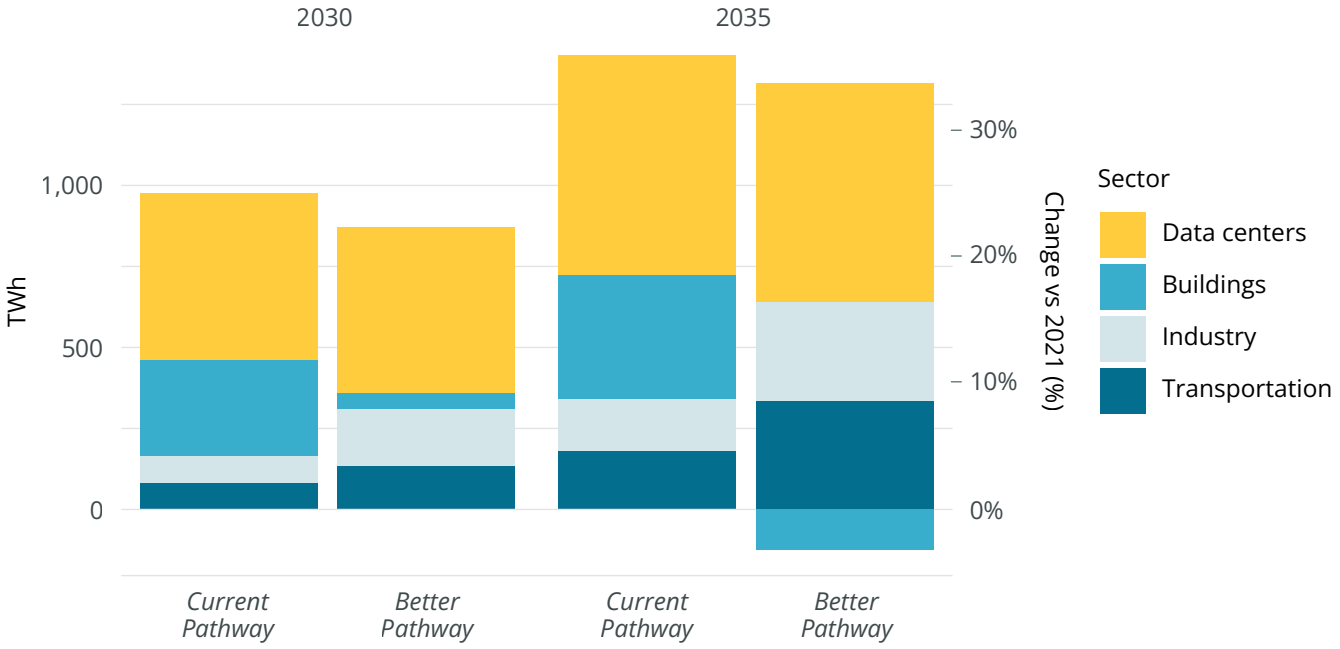


Figure 7. Electricity demand growth by sector in 2030 and 2035, from 2021 levels, under the *Better Pathway* and the *Current Pathway* scenarios. For comparison, 2021 U.S. electricity demand was 3,913 TWh.

To meet projected electricity demand, renewable generation increases under both scenarios. By 2035, solar and wind account for 48% (2,602 TWh) of the generation mix under the *Better Pathway* scenario and 35% (2,012 TWh) under the *Current Pathway* scenario, up from 13% (534 TWh) in 2021 (Figure 8). The higher share of renewable generation under the *Better Pathway* reflects enhanced state-level clean energy policies like renewable portfolio standards, as well as lower technology costs.

Natural gas generation remains relatively stable under the *Better Pathway* scenario, declining by less than 1% between 2021 and 2035 to 1,527 TWh in 2035. In contrast, natural gas generation increases by 30% under the *Current Pathway,* reaching 2,003 TWh by 2035. However, growth remains somewhat constrained even under the *Current Pathway* due to high fossil fuel prices and state-level clean energy policies.

Coal generation declines more sharply under the *Better Pathway* scenario, driven by market forces and state-level clean energy policies that accelerate coal plant retirements. Coal's share of total generation falls from 23% (982 TWh) in 2021 to 3% (152 TWh) in 2035 under the *Better Pathway* scenario. Under the *Current Pathway* scenario, coal generation declines more slowly, accounting for 9% (523 TWh) of total generation.

Electricity generation

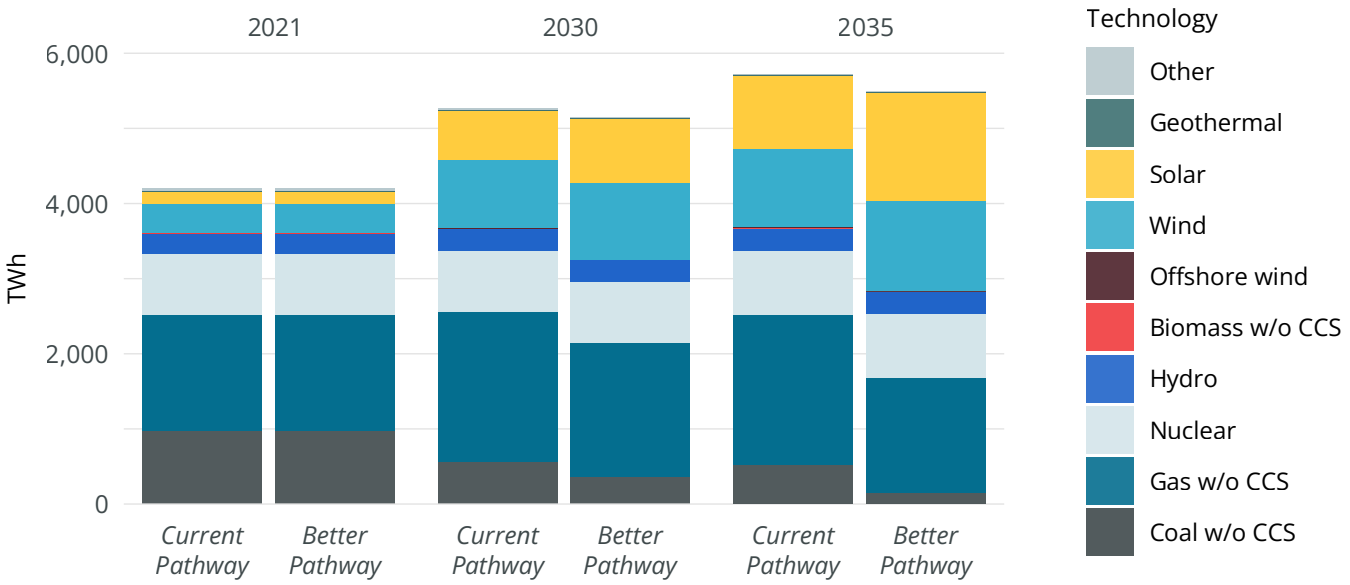


Figure 8. Electricity generation mix by technology in 2021, 2030, and 2035 under the *Better Pathway* and the *Current Pathway* scenarios.

Beyond the electricity sector, energy transformations also occur across other economic sectors under the *Better Pathway* (Figure 9). Notably, passenger EV sales account for 59% of sales by 2035, compared with 30% in the *Current Pathway*. The *Better Pathway* also sees higher levels of electrification in the industrial and buildings sectors. Industrial electrification increases to 17%, compared to 15% under the *Current Pathway*, while the share of electric hot water and heating appliances reaches 26% by 2035, compared to 22% under the *Current Pathway*.

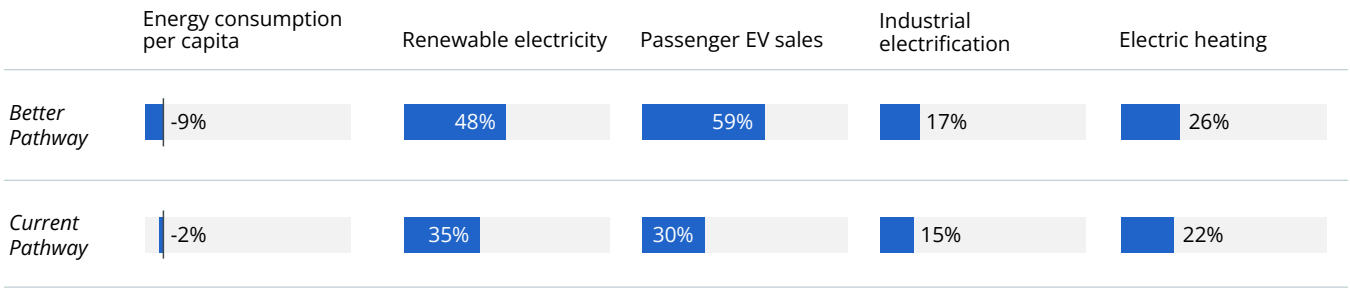


Figure 9. Energy transition metrics in 2035 under the *Better Pathway* and the *Current Pathway* scenarios. Changes in energy consumption per capita are relative to 2021 levels. Renewable electricity refers to the share of generation from solar and wind resources. Passenger EV sales refers to the electric share of new cars and SUVs. Industrial electrification refers to the share of electricity used in industrial processes (not including feedstocks). Electric heating refers to the share of electric appliances used in residential and commercial buildings.

Diverse drivers of the clean energy transition

States are advancing the clean energy transition through different combinations of policy levers and market forces, shaping the affordability, health, and emissions outcomes observed across states in this analysis. This section examines California and Texas as case studies, illustrating how differences in starting points, policy contexts, and market conditions can shape the benefits of the clean energy transition.

California's clean energy transition is world-leading due to its long-term, structured, and systematic mix of policy, innovation, economics, and market structure. The regional grid operator, CAISO, promotes low-cost sources like solar and wind,[63] and the state's cap and invest program creates incentives for polluters to decarbonize.[64] The state has established ambitious GHG reduction targets, with goals of a 40% reduction by 2030 and an 85% reduction by 2045 relative to 1990 levels.[65] To support these goals, California has enacted an array of high-ambition climate policies across the electricity, transport, and buildings sectors, among others. In the electricity sector, the state mandates a 100% zero-carbon target by 2045, with an interim goal of 60% renewable by 2030.[66] This target has contributed to a 52% share of generation from wind and solar technologies through the first half of 2026, up from 21% in the first half of 2016.[67] California's success in the transition is a result of integrating many complex pieces, including strong state, county, city, and other policies, which demonstrate the value of structured approaches like the ones envisioned in this report's *Better Pathway* scenario.

Texas provides a different example. Although Texas has not been supporting the clean energy transition through an integrated policy strategy, it illustrates an alternate approach driven through infrastructure- and market-oriented strategies. In Texas, transmission infrastructure policy as well as economic and technological factors have been driving clean energy deployment. However, policies that enable grid infrastructure like the Competitive Renewable Energy Zones (CREZ) set up by 2005 legislation, coupled with energy-first market forces and abundant solar and wind resources, helped drive the growth in renewable energy deployment across the state.[68] Texas recently surpassed California in renewable energy deployment, with over 75 GW of installed capacity from solar and wind energy.[69,70] However, Texas continues to rely heavily on natural gas and coal for electricity generation, highlighting the importance of policy in disincentivizing polluting power generation. Additionally, in sectors like transportation and buildings, the transition to clean energy has been less pronounced, highlighting how factors that drive clean energy deployment in one sector may not have similar effects across the broader economy.

Benefits in California and Texas under the *Better Pathway*

Under the *Better Pathway*, both California and Texas experience lower household energy costs and fewer deaths associated with $PM_{2.5}$ pollution in 2035 relative to the *Current Pathway*. However, the drivers of these benefits differ. In California, more ambitious policies support a broader transition across the economy, including a higher share of renewable electricity and greater electrification in end-use sectors. In Texas, the clean energy transition is slower, reflecting less ambitious and comprehensive modeled policies, though the state still achieves large-scale clean energy deployment due to its greater reliance on market forces combined with declining clean energy technology costs. These differences show how the clean energy transition unfolds under different state contexts, and highlights the role of policy in accelerating it further.

Household energy expenditures

In California, average households spent $4,419 on energy in 2021, with gasoline contributing significantly (59%), followed by electricity (29%) and gas (10%). Under the *Better Pathway*, energy costs fall to $2,855 per household in 2035. This represents a 24% ($929) reduction relative to the *Current Pathway.* The share of expenditures from electricity increases to 33% due to additional heat pump installations and EV purchases. With fewer internal combustion engine cars on the road, the share from gasoline decreases to 53% of total energy costs. Gas contributes to 12% of energy costs.

In Texas, average households spent $5,117 on energy in 2021, primarily from gasoline (52%) and electricity (44%), and a much smaller share from gas (2%). Under the *Better Pathway*, energy costs fall to $3,848 in 2035. This represents an 18% ($885) reduction relative to the *Current Pathway* in 2035. Electricity makes up half of total household energy costs in 2035, while gasoline remains a significant contributor at 46%.

Air quality and health

Under the *Better Pathway,* California sees a 4% improvement in $PM_{2.5}$ concentration and approximately 320 (3.9%) fewer deaths in 2035, compared to the *Current Pathway*. Lower air pollution levels in the state primarily result from increased electrification, which decreases the use of refined liquids in the industrial sector and biomass in residential heating.

Under the *Better Pathway,* Texas experiences a 4.5% decline in $PM_{2.5}$ concentration and approximately 330 (4.6%) fewer deaths in 2035. These improvements are mainly attributed to a decline in coal-fired power generation, accounting for 46% of SO_2 emissions reductions, 32% of NO_x reductions, and 31% of $PM_{2.5}$ reductions.

Electricity generation and demand

Under the *Better Pathway*, both states undergo significant electricity demand growth from data centers and end-use electrification, though this is partially offset by enhanced building energy efficiency measures and vehicle miles traveled reduction measures. To meet this new demand, both states expand renewable energy deployment.

California's electricity demand growth under the *Better Pathway* (48 TWh) is mostly driven by transport electrification (accounting for 63% of demand growth), followed by industry (20%) and data centers (17%) (Figure 10a). Some of this growth is offset by building energy efficiency measures, with electricity demand from buildings falling by 5% from 2021 levels (11 TWh). California's grid mix changes significantly under the *Better Pathway* due to enhanced state-level policies that retire natural gas power plants and promote renewable energy (Figure 10b). The share of solar and wind energy increases from 32% in 2021 to 60% in 2035, compared to 50% under the *Current Pathway*. Meanwhile, gas generation falls from 40% in 2021 to 14% of total generation in 2035, compared with 25% under the *Current Pathway.*

In Texas, electricity demand grows by 177 TWh from 2021 levels under the *Better Pathway*, nearly four times that of California. This growth is driven mainly by increasing data center load (accounting for 55% of the growth), followed by industry (22%), transportation (20%), and buildings (3%) (Figure 10a). Texas' generation mix changes more modestly compared to California. Despite favorable economics for new solar and wind energy, the transition is relatively slow because of existing fossil fuel power plants (Figure 10b). The generation share from solar and wind energy increases from 24% in 2021

to 39% in 2035 under the *Better Pathway,* compared to 37% under the *Current Pathway.* Coal and gas generation account for around half of the generation mix in 2035 under both scenarios, down from 67% in 2021.

Overall, these results underscore how different state policy contexts and market forces can shape the clean energy transition. The slower transition to renewable energy generation in Texas under the *Better Pathway,* relative to the *Current Pathway,* also highlights the role of policy in accelerating the transition beyond what might occur under existing trends and policies.

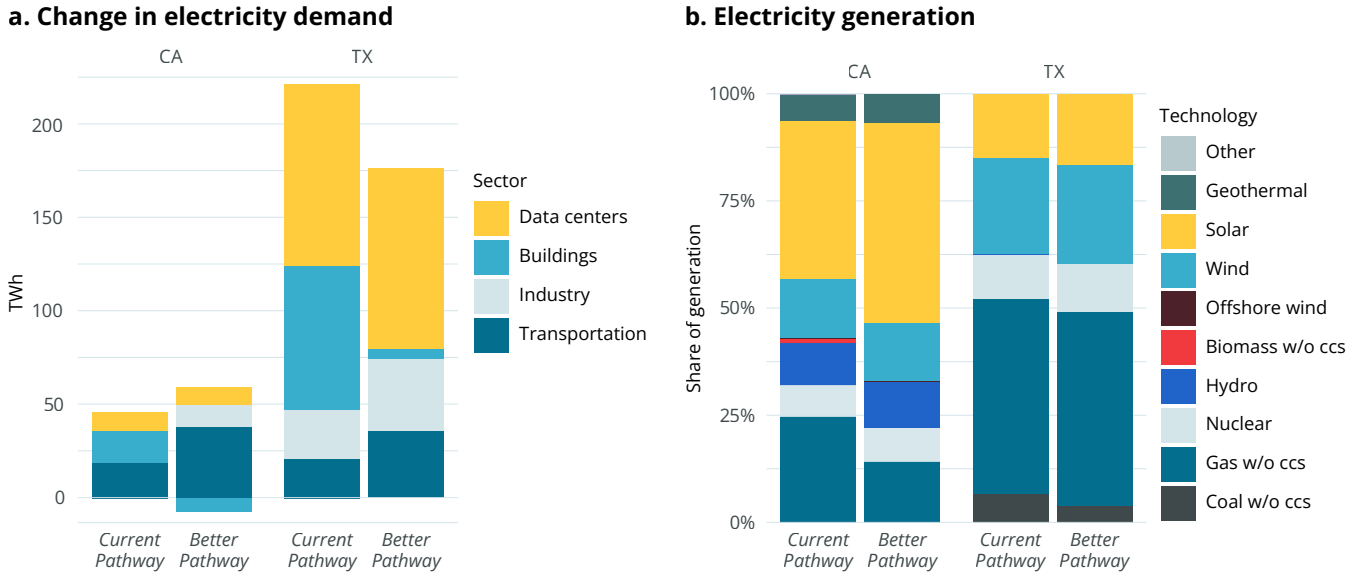


Figure 10. Electricity demand growth and generation mix in California and Texas in 2035 under the *Current Pathway* and the *Better Pathway* scenarios. Panel (a) shows electricity demand growth by sector in 2035, relative to 2021 levels. For context, 2021 electricity demand was at 264 TWh in California and 448 TWh in Texas. Panel (b) shows the share of electricity generation by technology in 2035.

Delivering local benefits through clean energy policies

States, cities, and other communities are already using a range of policy levers to implement some of the actions modeled under the *Better Pathway*. For example, subnational actors are passing laws and implementing programs aimed at improving demand response, expanding access to renewable energy systems, increasing building energy efficiency, improving transit-oriented development, reducing vehicle miles traveled, and shifting toward EVs. These policies are bringing tangible benefits to residents by reducing energy bills, improving air quality, creating jobs, and building a more resilient grid.

Expanding access to renewable energy

States and cities are expanding consumer access to renewable energy through balcony solar, consumer financing, bulk purchasing, and regional coordination. These actions can diversify local power supply, reduce household energy burdens, and improve grid reliability while accelerating the clean energy transition.[71]

Utah's House Bill 340 created the first policy in the nation legalizing balcony solar in May 2025.[72] This law removes many of the costs and logistical barriers by allowing customers to buy and self-install qualifying plug-in systems without undergoing the conventional utility-approval process or signing an interconnection agreement.[72] Since its enactment, Utah's legislation has been emulated by nine other states, the most recent being New Jersey and California, which both enacted balcony solar laws in September 2026.[73,74] California-based analysis estimates that balcony solar can supply roughly 14% of an average apartment's electricity use, saving consumers about $250 per year.[75]

Innovative financing policies can relieve financial strain related to solar procurement while improving grid flexibility. In North Carolina, House Bill 589, passed in 2017, allows third parties to lease qualifying on-site solar systems, making rooftop solar more accessible to households that cannot afford the upfront costs of installation while supporting local installers and solar businesses. A typical six kilowatt solar lease is expected to yield household savings of about $15 per month.[76] When paired with battery storage, leased solar can also qualify customers for bill credits and enhance the utility's distributed battery capacity, helping to manage peak demand.[77] Though new rooftop installations fell by about two-thirds statewide following the repeal of federal tax credits, the industry is experiencing renewed sales through lease-based solar and battery offerings.[77]

Solar United Neighbors' (SUN's) Switch Together program is using group purchasing and cross-sector partnerships across 100 states and localities to scale residential solar adoption. By pooling household demand and coordinating local outreach, contractor selection, and enrollment, Switch Together reduces the transaction costs and complexity of installing solar, heat pumps, battery storage, and EV chargers.[78] SUN's group purchasing model has proven successful in states like Virginia, which used SUN's model language to enact their 2025 Community Energy Act. Virginia recently announced a partnership with SUN to expand residential solar access across the state, which is estimated to save participating households approximately $2,200 a year on electricity.[79,80] SUN has also partnered with cities like Columbus, Ohio, to administer the distribution of city-purchased solar and battery storage for 17 households in neighborhoods most affected by blackouts, leveraging existing program data to ensure that a broad spread of income-qualified residents were identified to participate.[79] By allowing individuals, businesses, nonprofits, and subnational governments to operate as a coordinated solar market, the Switch Together program provides a replicable route from individual rooftop projects to regional distributed energy systems, supporting a more decentralized, resilient electricity system.

Piloting virtual power plants

In communities across the country, distributed energy systems such as smart thermostats, EVs and chargers, rooftop solar panels, batteries, and heat pumps are generating, storing, and managing electricity locally. The digital aggregation of these resources by utilities or other third-party operators into one coordinated power system creates a virtual power plant (VPP). VPPs function similarly to physical power plants, but are not limited to a physical site or boundary, allowing them to span neighborhoods or entire utility regions. These systems can provide cost-effective grid relief, coordinating existing small-scale resources to help meet peak demand and reducing reliance on utility-scale generation and infrastructure.[81] According to the U.S. Department of Energy in 2023, tripling national VPP capacity by 2030 could help manage 10–20% of peak load, saving $10 billion annually due to reduced grid costs.[81]

In Sonoma County and Mendocino County, California, Sonoma Clean Power (SCP) serves as a local community choice aggregator. In that role, SCP is currently launching the first phase of its Virtual Power Plant Approaches for Demand Flexibility (VPP-FLEX) program for up to 1,000 income-qualifying customers.[82] Participants are provided with free smart thermostats and professional installation, and are enrolled in SCP rewards. Additionally, VPP-FLEX connects potential program participants with local organizations providing enrollment aid and multilingual assistance.[83] Beyond the household level, this program allows SCP to reduce wholesale power costs while enhancing grid security, with a 4 MW reduction in peak demand expected by 2029.[83] The VPP program is replicable for public power providers and utilities more broadly, who can follow this same model of combined financial incentives, free equipment installation, and intentional participant engagement.

VPP operators are increasingly integrating bidirectional EV charging, a two-way power flow that allows electricity stored in EV batteries to power homes, other appliances, or the grid.[84] Bidirectional charging benefits EV owners by compensating them for the energy they send back into the grid, while providing utilities with a dispatchable backup energy source to improve grid flexibility and help meet peak demand.[84] At the same time, bidirectional EV charging can help states meet their clean energy targets: GridLab found that registering 10% of California's EVs in vehicle-to-grid charging over the next 10 years could meet 30% of the state's storage procurement target.[85]

School districts across the nation have begun to demonstrate how bidirectional EV charging for electric buses can provide economic, health, and grid stabilization benefits. Cajon Valley Union School District, located in San Diego County, California, received a grant through the California Energy Commission (CEC) which allowed them to procure one electric bus and the associated charging infrastructure to be used as part of their growing electric fleet. After being placed into service in 2024, the electric bus was evaluated over a 12-month period, with the CEC documenting both air quality improvements and an estimated lifetime savings of $2,800 per bus.[86] Similarly, Cherry Creek School District, located in Denver, Colorado, is currently procuring six electric buses and a charging garage with the aim of reducing operational costs long-term, given their lower maintenance and fuel costs compared with diesel buses. This initiative was funded by Xcel Energy's bus electrification program, and in return, Xcel Energy will benefit from the power sent back to the grid and improved demand response capability.[87] [86]

Promoting building energy efficiency

Although building energy efficiency measures have been implemented for decades, they are increasingly relevant as policymakers seek to manage rising electricity demand, reduce energy costs, and advance the clean energy transition.

Building Energy Performance Standards (BEPS) are a powerful tool to minimize the rebound effect, whereby consumers increase energy use following cost-saving efficiency improvements.[88] These standards originated in cities and continue to be led by cities across the country, including Boston, Massachusetts; Washington, D.C.; New York City, New York; St. Louis, Missouri; and Seattle, Washington. Boston received Electric Innovation Initiative's 2026 Policy Innovation Award for its Building Emissions Reduction and Disclosure Ordinance,[89] a city policy targeting net-zero emissions from covered buildings by 2050 through annual energy and water reporting requirements and progressively stringent emissions standards based on building use type.[90] Meanwhile, St. Louis is pioneering innovative building performance standards in the Midwest through two ordinances that require annual reporting and enforce increasingly strict energy efficiency targets.[91] St. Louis's performance targets are developed with consultation from a Building Energy Improvement Board that includes members from various local stakeholders, including utilities, affordable housing owners and tenants, labor representatives, technical building design professionals, and environmental nonprofits.[92]

Similar policies have been adopted in states and counties. Under Maryland's BEPS of 2022, large buildings (≥35,000 sqft) in the state are required to submit annual benchmark reports detailing energy use and energy intensity, and to meet net-zero direct emissions by 2040.[93] Montgomery County, Maryland, established a more ambitious BEPS, covering buildings ≥25,000 sqft.[94] By 2039, the county's program is expected to nearly halve gas use and reduce annual GHG emissions from commercial buildings by 19%, while saving building owners nearly $2 billion on energy costs.[95]

In Texas, commercial and industrial building energy efficiency efforts are supported by Texas Property Assessed Clean Energy (TX-PACE), a financing mechanism that covers the upfront costs of energy and water efficiency improvements. The program offers funding for a range of building types and project categories, including for retrofits, redevelopment, refinance, and new construction. Participating businesses then repay the financing over time through property taxes. In 2025, projects spanned property types including retail, hospitality, industry, non-profit, multi-family housing, and parking garages.[96] Since enabling legislation was passed in 2013,[97] which authorized local governments to establish PACE programs, adoption has increased in recent years. To date, PACE financing has been used to fund 115 projects, creating over 10,700 jobs in Texas. These projects save building owners 148 million gallons of water and 91 million kWh of energy annually while reducing GHG emissions by 52 $ktCO_2$ annually.[98] By lowering costs associated with building energy efficiency improvements, TX-PACE helps businesses lower energy and water use while reducing emissions.

Reducing vehicle miles traveled and transitioning to EVs

States, cities, and counties that support EVs and manage vehicle miles traveled can cut fuel and maintenance costs while improving air quality and supporting the clean energy transition.[99] Such policies include financial incentives for EVs, investments in active and public modes of transit, and transit-oriented development.

Transit-oriented development and urban planning are powerful tools that cities and counties can utilize to bring benefits to their residents while reducing emissions. In Mecklenburg County, North Carolina, a $19.4 billion plan known as "Meck Connect" was approved in 2024 to improve public transportation and roadway infrastructure.[100] Funded through a one-cent addition to sales taxes over the course of thirty years,[100] this plan will increase sidewalk and crosswalk infrastructure, boost bus service by 50%, build 43 new miles of rail, and add 18 new microtransit zones where on-demand public transit can be requested by passengers at any time. Meck Connect is also expected to bolster local economic growth by making employment more accessible; 83% of residents will be located within a 10-minute walk of a microtransit zone, bus or rail station, putting them within reach of 96% of county employment locations.[101,102] Similar programs have been implemented in other localities around the country, including in Chattanooga, Tennessee, where a housing fund coupled with zoning reform are helping to make the city more walkable and affordable.[103,104]

States and cities are also delivering benefits by making the switch to EVs and e-bikes through innovative policies. In Colorado, to reduce EV costs and counteract the impact of federal tax credit rollbacks, the state enacted legislation doubling the state tax credit for new and used EVs for the 2027 and 2028 tax seasons. Coloradans can now receive up to $12,250 off the purchase of a new EV through this tax credit alone.[105] In Massachusetts, the Metropolitan Area Planning Council launched a new "CommunityEV" electric carshare program in July 2026, serving Boston, Chelsea, Framingham, and Quincy.[106] Though EV expansion is a key tool for reducing the state's emissions, EVs are often unaffordable for low-income residents, and uptake therefore remains skewed toward higher income households.[107] CommunityEV promotes equitable clean mobility by placing stations near urban centers and public housing facilities and by providing discounted rates for low-income residents, expanding carsharing to those who previously lacked access.

Meanwhile, the city of Atlanta, Georgia, is working to advance both transit equity and the clean energy transition through their E-Bike Rebate Program, which provides residents up to $1,600 for the purchase of e-bikes, with 75% of funds reserved for individuals at or below 80% of the median income. The program is also designed to benefit the local economy; rebates can only be redeemed at eligible bike shops, which are exclusively locally owned small businesses. By 2024, the program generated $1.2 million in revenue at local bike shops, while rebate recipients reported a 40% reduction in car use for their commute, effectively reducing vehicle miles traveled and associated congestion.[108]

Conclusion

Taking a *Better Pathway* for the United States would accelerate the ongoing transition toward an energy system that is more secure, affordable, quickly deployable, and clean. This pathway can deliver greater affordability benefits, improved health impacts, and lower GHG emissions. In 2035, average household energy costs would fall by $981, approximately 5,000 premature deaths associated with air pollution would be avoided, and GHG emissions would decrease by 20% compared with the *Current Pathway*. These benefits are particularly important as households and communities face growing pressures on pocketbooks and livelihoods, rising energy demand, and the economic and security risks associated with continued dependence on fossil fuels.

Critically, the benefits of a clean energy transition extend across regions of the country. Under the *Better Pathway*, all states included in the analysis experience lower household energy costs and fewer premature deaths in 2035, with household energy costs declining by 13%–27% ($460–$1,379) and premature deaths declining by 1%–21%. These benefits emerge across diverse state policy contexts and market conditions, as illustrated by the experiences of California and Texas. Case studies from across the country further demonstrate how subnational leaders are already taking steps to advance this pathway and create tangible benefits for their communities, through expanding clean energy access, promoting DERs and VPPs, enhancing energy efficiency, redesigning transit infrastructure, and incentivizing EV adoption.

The *Better Pathway* in this analysis is designed to show how the clean energy transition can be accelerated; thus, it should not be interpreted as a pathway that maximizes the broader benefits related to affordability and health. While some tradeoffs between individual clean energy policies and societal benefits exist, our intent in this study is to assess the net benefits under a comprehensive, economy-wide clean energy transition that is rooted in subnational action. Similarly, our scenario is not a maximum-ambition climate pathway for the United States, which would also require additional federal action. Our analysis assumes a stable federal baseline in both scenarios, and does not reflect enhanced federal ambition. The findings from this study can nevertheless provide important context for developing a longer-term, high-ambition pathway in future work.

The indicators included in this analysis represent only a subset of the potential impacts of a clean energy transition. They are intended to illustrate the broader effects of the transition, but are by no means exhaustive. For example, while household energy costs are included in this analysis, upfront capital costs and maintenance costs related to purchasing household appliances and EVs are not. Jobs are also not considered in the modeling for this analysis, though they are a critical indicator of household and economic impact. Including these indicators in future analyses would help us better understand affordability and economic growth under the *Better Pathway*.

In addition, while a suite of plausible clean energy policies is modeled in the *Better Pathway*, real-world implementation may present challenges. For instance, recent federal policy rollbacks have applied additional pressure on state budgets and their ability to support climate programs. Additionally, the modeled target to improve health outcomes by limiting $PM_{2.5}$- and ozone-related damages to 2025 levels is aspirational; states do not currently have policy mechanisms in place to enact such a target, and existing air quality regulations generally focus on concentration rather than health outcomes. Industrial policy is another area for further development, both in policy implementation and modeling. State-level policies remain limited, participation in existing programs is often voluntary, and accurately representing these policies can be challenging given model resolution and data availability.

Nevertheless, a *Better Pathway* remains within reach. The approach detailed here is one contribution to a larger conversation about how state-level action can shape the future for the United States. Leaders from cities, states, counties, tribal governments and other subnational governments are already taking action, as are many businesses, investors, non-governmental organizations, communities of faith, and others. As these non-federal actors respond to affordability pressures and rising energy demand, advancing the clean energy transition offers an opportunity to address these challenges while delivering broad benefits for households and communities. Accelerating this transition can reduce household energy costs, improve health outcomes, and build a more climate-friendly future—all while powering a new and vibrant economy and laying the foundation for a more secure and resilient American future.

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Technical Appendix

America's Better Pathway

Charting the Affordability, Health, and Emissions Benefits of a Clean Energy Transition

NOVEMBER 2026

UNIVERSITY OF MARYLAND
SCHOOL OF PUBLIC POLICY
CENTER FOR GLOBAL SUSTAINABILITY

AMERICA IS ALL IN

Authors

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1. Overview of Modeling Approach

Building on previous CGS analyses,[1–3] this study uses an innovative, integrated approach to examine the impacts of federal and state-level policy actions on affordability, health, and emissions outcomes in the United States through 2035. In a collaborative effort with a Princeton University research team, this approach couples GCAM-USA-CGS, a field-leading, integrated assessment model with 50-state resolution in the United States, with InMAP and BenMAP, an air quality and health impacts model.

First, two policy scenarios, the *Current Pathway* scenario and the *Better Pathway* scenario, are developed with input from key stakeholders. The policy scenarios are then modeled in GCAM-USA-CGS, which provides national and state-level emissions and energy-related outputs. These outputs are used as inputs in InMAP and BenMAP to simulate air pollutant concentrations and quantify health damages.

GCAM-USA-CGS: Our analysis uses a version of the open-source Global Change Analysis Model (GCAM) to estimate the aggregate impact of federal and non-federal climate policies and actions on economy-wide emissions reductions in the United States. GCAM is a technology-rich integrated assessment model with international and state-level detail that simulates the evolution and interactions among energy, industry, buildings, transportation, agriculture, water, and climate systems. Specifically, we use GCAM-USA, a 50-state version of GCAM. We refer to the version of GCAM-USA used in this study as GCAM-USA-CGS, which is based on the open-source release of GCAM-USA 8.8.[4] GCAM-USA-CGS has been updated for the purposes of this study to reflect changes such as data center load growth, fossil fuel price trajectories, population and GDP growth, coal power plant retirement schedules, and power plant efficiencies.

InMAP and BenMAP: To estimate the air quality and health impacts of emissions across the contiguous U.S. in greater detail, we use a spatially explicit modeling framework combining downscaled emissions with the Intervention Model for Air Pollution,[5] a reduced-complexity, national-scale air quality model. State-level emissions projected by GCAM-USA-CGS are downscaled to a 12-km grid using spatial patterns from the 2017 National Emissions Inventory (NEI). InMAP then simulates annual average concentrations of both primary and secondary $PM_{2.5}$ (including sulfate, nitrate, and ammonium), solving a steady-state version of the reaction-advection-diffusion equation. This approach captures pollutant transport by wind, atmospheric diffusion, and chemical transformation. Simulated $PM_{2.5}$ concentrations are then used in EPA's Environmental Benefits Mapping and Analysis Program – Community Edition to estimate state-level premature deaths due to long-term $PM_{2.5}$ exposure,[6] using established concentration-response functions such as those from Pope et al.[7]

2. Modeled scenarios

2.1 Core scenarios

The *Current Pathway* scenario models key federal and state-level energy and climate laws and regulations as of August 2026. This includes changes to the Inflation Reduction Act (IRA) under the One Big Beautiful Bill Act and federal cancellations and freezes of IRA and Bipartisan Infrastructure Law funding.[8–10] Federal repeals of major power plant, vehicle, and oil and gas methane regulations, as well as the revocation of California's Clean Air Act waivers related to Advanced Clean Cars II and Advanced Clean Trucks, are assumed to take effect, though many are being challenged in court.[11–14] Additionally, only half of planned coal power plant retirements are assumed to occur due to recent federal executive orders and investments in coal plants.[15,16] At the state level, some of the most ambitious existing policy actions are represented, including renewable portfolio standards in 24 states and building energy efficiency standards in 27 states.

The *Better Pathway* scenario expands upon ongoing state action, assuming broader adoption as well as enhanced policies motivated by climate, energy, and affordability. These policies are explained in detail in the following section. Additionally, the scenario includes a health target that limits health damages related to ozone and fine particulate matter ($PM_{2.5}$). No new federal action is assumed; federal policy is the same in both scenarios through 2035. Lower costs for EVs and renewable energy technologies are also assumed, reflecting additional investment in the clean energy transition.

The modeled policy scenarios build on previously developed methodology for aggregating non-federal actions to the state level for implementation in GCAM-USA-CGS.[2,3,17–19] Detailed modeling assumptions for policy representation in GCAM-USA-CGS are shown in Sections 2.3 and 2.4.

2.2 Core model assumptions

The results of this study depend on many assumptions about how the U.S. and the world might evolve in the future. Both the *Current Pathway* and *Better Pathway* scenarios share the same core assumptions across socioeconomic growth, fossil fuel prices, and data center electricity demand; technology cost assumptions differ across scenarios (Table S1).

Our core assumptions draw from a set of data sources that are referenced in other parts of this appendix, for example, U.S. Energy Information Administration's (EIA's) Annual Energy Outlook (AEO),[20] National Laboratory of the Rockies' (NLR's) Annual Technology Baseline (ATB),[21] Electric Power Research Institute (EPRI), [22] and Argonne National Laboratory.[23]

2.2.1 Fossil fuel prices and technology costs

For both scenarios, high fossil fuel price estimates from EIA's AEO 2026 are assumed, with the goal of reflecting recent trends and the recent reality of fossil fuel markets.

The *Current Pathway* scenario uses moderate technology cost projections based on current trends. The *Better Pathway* scenario uses lower costs for clean energy technologies to reflect additional investments and deployment of these technologies, driven by market signals from state-level clean energy policies.

2.2.2 Data centers

Both scenarios use the same assumptions for data center load growth, based on the medium scenario from EPRI's 2026 study.[22] In their study, EPRI uses information on the development stages of data centers to create a set of future growth scenarios through 2030, each with different assumptions about completed projects by 2030. The medium growth scenario assumes that all data center projects under construction, 75% of those in advanced planning, and 10% in early planning are fully operational by 2030. We extrapolated future projections beyond 2030 for all states using a logistic growth function.

We note that only future electricity demand associated with data centers is taken from EPRI's study; we do not make assumptions about the generation sources used to meet this demand or the policy environment for data centers. Our modeling assumes grid-connected sources of electricity meet growing data center demand, and does not account for behind-the-meter electricity generating units.[24–27] Data centers with behind-the-meter combustion power plants (e.g., natural gas, bioenergy, waste-to-energy) have the potential to negatively impact air quality and human health, along with emissions.[28–30]

We also note that uncertainty remains around the electricity demands associated with data centers, including how technology and efficiency rates will improve in the future. The projections used in this study rely heavily on current assumptions about trends in data center technology and demand.

Table S1. Core modeling assumptions in GCAM-USA-CGS

Drivers	*Current Pathway* scenario	*Better Pathway* scenario
Economic Growth	Overall gross domestic product (GDP) increases by 1.88% per year on average from 2025 to 2035, based on EIA's AEO 2026 Counterfactual Baseline case.[20]	
Population Growth	Population grows by 0.37% per year on average from 2025 to 2035, based on EIA's AEO 2026 Counterfactual Baseline case.[20]	
Fuel Prices	Gas price is assumed to increase at an average rate of 9.58% per year from 2025 to 2035, which is consistent with EIA's AEO 2026 Low Oil and Gas Supply case.[20] Oil price is assumed to increase at an average rate of 2.93% per year from 2025 to 2035, which is consistent with EIA's AEO 2026 Low Oil and Gas Supply case.[20]	
Technology Costs	Electricity technology costs are updated with NLR's ATB 2024 Moderate Scenario assumptions.[21] Capital costs for renewable energy technologies decline by 1.7%–5.4% on average per year from 2025 to 2035. Motor vehicle technology costs are based on Argonne National Laboratory's low technology progress scenarios.[23] Capital costs for electric cars and SUVs decline by 0.1%–0.3% on average per year from 2025 to 2035.	Electricity technology costs are updated with NLR's ATB 2024 Advanced Scenario assumptions.[21] Capital costs for renewable energy technologies decline by 2.4%–7.4% per year from 2025 through 2035. Motor vehicle technology costs are based on Argonne National Laboratory's advanced technology progress scenarios.[23] Capital costs for electric cars and SUVs decline by 2.3%–2.4% on average per year from 2025 to 2035.
Data Center Electricity Demand	State-level data center electricity demand is based on the medium scenario from EPRI's 2026 study.[22] Projections from 2030–2035 are logistically extrapolated from the medium scenario. National data center electricity demand reaches 596 TWh by 2030 and 758 TWh by 2035.	

2.2.3 Offshore wind constraints

Due to substantial barriers to deployment, including pauses on project leasing, increased regulatory uncertainty, and market volatility,[31] the amount of offshore wind coming online by 2035 is limited to fully permitted projects. Those without existing permits are assumed to be unavailable until after 2035.[32]

2.2.4 Natural gas supply chain limitations

As a result of recent supply chain constraints, major companies have announced delivery backlogs for natural gas turbines, with GE and GE Vernova stating that gas turbines would not be delivered until late 2028 at the earliest.[33] To account for the impact of this natural gas turbine supply chain limitation, we assume that new natural gas capacity cannot exceed 64 GW between model years 2025 and 2030, as reported by the U.S. Energy Information Administration's May 2026 generator data.[34] In both policy scenarios, new capacity for natural gas is below 64 GW in model years 2030 and 2035, and therefore an explicit constraint was not modeled.

2.3 Policy representation in the *Current Pathway* scenario

This section presents modeled federal and state-level policies under the *Current Pathway* scenario in Tables S2 and S3, which summarize each policy's sector, policy type, the specific provision of the policy (where relevant), and modeling assumptions. This analysis reflects policies and actions in effect as of August 2026; those introduced or modified afterward are excluded.

2.3.1 Federal policy assumptions

Modeled federal policies under the *Current Pathway* scenario include the rolled back energy and climate provisions from the IRA and BIL under the One Big Beautiful Bill Act, along with rollbacks on federal regulations for fossil fuel-fired power plants, tailpipe emissions, and oil and gas methane. Detailed assumptions are described in Table S2.

Table S2. Federal policy assumptions by sector under the *Current Pathway* scenario

Sector	Policy Type	Provision/Policy	Modeling Assumption
Electricity	IRA	Sections 13701 and 13702: New clean electricity PTC and ITC	Rolled back after 2025
		Section 13302: Residential clean energy credit	Rolled back after 2025
		Section 13015: PTC for existing nuclear	No change, continues through 2033
		Section 50144: Energy infrastructure reinvestment financing	Rolled back after 2025
		Section 13104 – 45Q: Extension of credits for captured CO_2	Rolled back after 2025 due to uncertainty around termination of the greenhouse gas reporting program, which would make this credit difficult to claim.[35]

Sector	Policy Type	Provision/Policy	Modeling Assumption
Electricity	Regulations	CAA section 111(b) Standards for New Stationary Combustion Turbines	Rolled back after 2025
		CAA section 111(d) Emission Guidelines for Existing Fossil Fuel-Fired Sources	Rolled back after 2025
Transpor-tation	IRA	Section 13401 – 30D: Clean vehicle credit	Rolled back after 2025
		Section 13404: Alternative refueling property credit	Rolled back after 2026
		Section 13403 – 45W: Commercial clean vehicle credit	Rolled back after 2025
		Section 45Z: Clean fuel production credit	Extended through 2030
	BIL	Sections 11401 and 11403: Grants from charging and fueling infrastructure, Carbon reduction program, and National Electric Vehicle Formula Program	Rolled back after 2025
		Sections 11115 and 11403: Congestion mitigation and air quality improvement program, and Carbon reduction program	Rolled back after 2025
		Sections 71101 and 30018: Clean school bus program and Grants for buses and bus facilities	Rolled back after 2025
	Regulations	CAFE standards for LDVs	Rolled back after 2025
		GHG emissions standards for freight trucks	Rolled back 2025
Buildings	IRA	Section 13303: Energy efficient commercial building deduction	Rolled back after 2026
		Sections 13301 – 25C, 13304, and 50121: Energy efficient home improvement credit, Energy efficient home credit, and Home energy efficiency credit	Rolled back after 2025
		Section 51022: High-efficiency home rebate program	Rolled back after 2026

Sector	Policy Type	Provision/Policy	Modeling Assumption
Industry	IRA	Section 13104 – 45Q: Extension of credits for captured CO_2	Rolled back after 2025 due to termination of the greenhouse gas reporting program, which would make this credit difficult to claim.[35]
		Section 13204 – 45V: Production credit for clean hydrogen	Rolled back after 2027
		Section 13501 – 48C: Manufacturing investment tax credit for advanced energy projects	Rolled back after 2025
		Section 50161: Advanced industrial facilities deployment program	Rolled back after 2025
Methane	IRA	Section 60113: Methane emissions reduction program	Rolled back after 2025
	Regulations	EPA standards for oil and gas methane	Rolled back after 2025
Other	American Innovation and Manufacturing (AIM) Act	Hydrofluorocarbon (HFC) phasedown	National HFC phasedown is implemented consistent with the American Innovation and Manufacturing (AIM) Act.
	IRA and BIL	Land use, land-use change and forestry (LULUCF)	Rolled back after 2025, using the 'Absent Climate-Smart Policies' scenario from a previous CGS report on lands.[36]

2.3.2 State-level policy assumptions

Existing state-level policies are assumed to continue under the *Current Pathway* scenario, including renewable portfolio standards, energy efficiency resource standards, and methane regulations. Due to removal of California's waivers for Advanced Clean Cars II and Advanced Clean Trucks under the Clean Air Act, EV sales mandates and targets are not modeled. Detailed assumptions are described in Table S3.

Table S3. Non-federal policy assumptions by sector under *Current Pathway*

Sector	Policy	Modeling Assumption
Electricity	Renewable portfolio standards (RPS)	State-level RPS in 24 states are modeled.
	Cap and trade	The Regional Greenhouse Gas Initiative (RGGI) is modeled as a 55% reduction in power sector emissions below 2021 levels by 2035 in participating states.
	Coal phase-out	Half of scheduled retirements of coal-fired capacity are modeled through 2035 to reflect recent orders to delay retirement dates.[15]
Buildings	Energy efficiency resource standards (EERS)	State-level EERS in 27 states are modeled by reducing state-level building service demands.
Methane	Methane incentives and regulations	Non-federal actors are incentivized to reduce methane emissions reductions achievable at a cost of \$0/tCO_2e or below on the EPA's MAC curves.[37]

2.4 Policy representation in the *Better Pathway* scenario

2.4.1 Federal policy assumptions

The *Better Pathway* scenario uses the same federal assumptions as those listed under *Current Pathway* in Table S2.

2.4.2 State-level policy assumptions

The *Better Pathway* scenario incorporates enhanced state-level policies that reduce GHG emissions while addressing broader societal issues, including affordability, energy security, health, and climate change. This section describes the state-tiering framework used to establish future policy ambition, distinguishes emissions-focused policies from multi-objective policies, and summarizes all modeled policies. Table S4 identifies each policy, its policy area, primary policy motivation, and modeling assumptions, with actions differentiated by tier.

State tiering system

To account for varying levels of policy adoption across states, we categorize states into three tiers based on their propensity to adopt high-ambition climate policies. Tier 1 states are climate leaders with the most ambitious policies; Tier 2 states are follower states, with some policies in place but moving more slowly than Tier 1 states; and Tier 3 states have limited or no policies. State tiers are determined based on state climate policy ambition, progress in emissions reductions, local climate policies, and climate commitments. The methodology for the sectoral tiering framework is further described in a previous CGS report (2025) and Ordonez-Olazabal et al. (2026).[2,38]

The full list of states categorized into Tier 1, Tier 2, and Tier 3 is listed below. States with strong policies in one area but not in other areas may be categorized under Tier 2 or 3, given that policies are

evaluated comprehensively within each sector. Additionally, states that are improving climate-related outcomes as a result of market forces and other non-policy drivers (e.g., high shares of renewable energy in Texas) may not necessarily be categorized as a Tier 1 or 2 state, given our methodology's focus on policy drivers.

Electricity

- **Tier 1 states:** California, Colorado, the District of Columbia, Illinois, Hawaii, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Mexico, New Jersey, New York, Oregon, and Washington
- **Tier 2 states**: Arizona, Connecticut, Delaware, New Hampshire, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, Wisconsin
- **Tier 3 states:** Alabama, Alaska, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, Tennessee, Texas, Utah, West Virginia, and Wyoming

Buildings

- **Tier 1 states:** California, Colorado, Connecticut, the District of Columbia, Illinois, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont, and Washington
- **Tier 2 states**: Delaware, Hawaii, Louisiana, Michigan, Minnesota, Nevada, New Hampshire, New Mexico, North Carolina, Pennsylvania, Texas, Virginia, Wisconsin
- **Tier 3 states:** Alabama, Alaska, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Mississippi, Missouri, Montana, Nebraska, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Utah, West Virginia, and Wyoming

Transportation

- **Tier 1 states:** California, Colorado, Connecticut, the District of Columbia, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Washington
- **Tier 2 states**: Delaware, Hawaii, Illinois, Maine, Michigan, Minnesota, Nevada, New Mexico, Pennsylvania, Vermont, and Virginia
- **Tier 3 states:** Alabama, Alaska, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, New Hampshire, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, West Virginia, Wisconsin, and Wyoming

Industry

- **Tier 1 states:** California, Colorado, Maryland, Massachusetts, New York, Oregon, Washington
- **Tier 2 states**: Connecticut, Hawaii, Illinois, Maine, Nevada, New Jersey, New Mexico, North Carolina, Pennsylvania, Rhode Island, Vermont, and Virginia
- **Tier 3 states:** Alabama, Alaska, Arizona, Arkansas, Delaware, District of Columbia, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, West Virginia, Wisconsin, and Wyoming

Land use

- **Tier 1 states:** California, Colorado, Maryland, New Mexico, New York, Washington
- **Tier 2 states**: Connecticut, Delaware, District of Columbia, Hawaii, Illinois, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, North Carolina, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, and Wisconsin
- **Tier 3 states:** Alabama, Alaska, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Mississippi, Missouri, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Virginia, West Virginia, and Wyoming

Economy-wide tiers

- **Tier 1 states:** California, Colorado, the District of Columbia, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Washington
- **Tier 2 states**: Connecticut, Delaware, Hawaii, Illinois, Maine, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Pennsylvania, Vermont, and Virginia
- **Tier 3 states:** Alabama, Alaska, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, West Virginia, Wisconsin, and Wyoming

Emissions-focused policies

Policies motivated primarily by emissions reductions and climate change are classified as *emissions-focused policies* in the scenario design, recognizing that they may also advance other societal objectives.

Modeled emissions-focused policies include renewable portfolio standards, clean fuel standards, zero-emission appliance standards, cement CCS targets, and oil and gas methane regulations, among others. With the California waiver removed, states lose the ability to set their own vehicle emissions standards to mandate EV sales. In place of this, we assume that clean fuel standards, which currently exist in five states,[39] become the primary policy mechanism to drive EV adoption at the state level.

Policy assumptions are specified based on the state tiering system described in the section above. Tier 1 states are assumed to adopt the most ambitious actions across sectors based upon existing or proposed policies. Tier 2 states are assumed to adopt similar policies but with a less stringent target and/or timeline. Tier 3 states are assumed to have no or limited policy uptake. Detailed assumptions are described in Table S4.

Multi-objective policies

Policies increasingly driven by objectives beyond emissions, including energy affordability and security, are classified as *multi-objective policies.* For modeling purposes, these policies were selected based on their potential for broader adoption, as indicated by key trends from our subnational policy collection and consultation with stakeholders. However, we recognize that this approach may not capture all policies that can deliver broader societal benefits.

Multi-objective policies are embedded within different policy areas under the *Better Pathway* scenario, including renewable energy deployment, building energy efficiency, and vehicle miles traveled (VMT)

reductions. In renewable energy deployment, multi-objective policies provide an alternative pathway to accelerate the clean energy transition: They support more ambitious outcomes than those that would result from emissions-focused policies alone, especially in Tier 3 states. In building energy efficiency and vehicle miles traveled reductions, they serve as the primary mechanism for accelerating the clean energy transition. Detailed assumptions are described below and in Table S4.

Renewable energy deployment

In the electricity sector, multi-objective policies such as permitting reform, transmission expansion, and grid utilization can lower electricity costs and help manage rising demand by maximizing existing grid infrastructure and supporting the deployment of low-cost, renewable energy technologies.

Permitting reform, such as Washington's HB 1812,[40] New Jersey's Cross-Agency Permitting Team,[41] and the recently legislated smart solar permitting platforms in Connecticut[42] and Virginia,[43] aims to expedite project approvals to streamline renewable energy deployment. Similarly, policies that expand transmission, such as Iowa's authorization of transmission co-location along roads, interstates, and highways,[44] Virginia's underground transmission line pilot program expansion,[45] and the Western Governors' Association multi-state task force to update regional transmission lines,[46] can speed up renewable energy deployment and clear interconnection queues. When more transmission is paired with grid utilization policies, such as those recently passed in Virginia,[47] more renewable energy can be delivered from remote areas to population centers.

Under the *Better Pathway* scenario, these multi-objective policies are assumed to support the implementation of the already ambitious renewable portfolio standards (RPS) in Tier 1 and Tier 2 states. In the less ambitious Tier 3 states, permitting reform, transmission expansion, and grid utilization provide an alternative pathway for the clean energy transition, bringing up the renewable share of generation in Tier 3 states to 30% by 2035.

Building energy efficiency improvements

In the buildings sector, energy efficiency policies are classified as multi-objective. Improving energy efficiency is a key lever for reducing GHG emissions and accelerating the clean energy transition. At the same time, reducing energy consumption can lower energy bills and improve energy security for households and businesses.

Policies to improve building energy efficiency range from building standards and energy codes (e.g. building performance standards[48], energy efficiency resource standards[49]) to financial support (e.g. Property Assessed Clean Energy financing[50], green banks[51]) to electric rate design, which provides incentives to encourage energy efficiency and shift usage away from peak demand hours.[52]

In the *Better Pathway* scenario, building energy efficiency is assumed to improve by 3% annually between 2030 and 2035 in all states. This reflects the assumption that building energy efficiency policies, which already exist in over half of U.S. states, have potential for broader adoption because of their ability to address energy affordability and grid reliability objectives.

Vehicle miles traveled reductions

In the transportation sector, reducing vehicle miles traveled is a critical component of a clean energy transition. Efforts to reduce driving from single-occupancy vehicles and support public transit and active modes of transportation can also bring affordability, economic, and health benefits.[53] For example,

multi-modal transportation projects and transit-oriented development can increase accessibility, safety, and amenities associated with different neighborhoods. Furthermore, measures that reduce VMT can also lead to savings related to gas, car maintenance, and insurance, which is particularly relevant given ongoing concerns with affordability.[54]

Four states already have VMT reduction targets, with goals as early as 2030 and long-term goals to 2050.[55–57] Additionally, four states are actively considering adopting such a policy.[54] Through sustainable planning practices and housing reform, cities across the United States are also implementing policies to promote alternative modes of transportation and transit-oriented development. For example, Mecklenburg County, NC, is implementing the Meck Connect initiative to provide long-term funding for expanded rail, bus, microtransit, and multimodal transportation infrastructure.[58]

In the *Better Pathway* scenario, average annual vehicle miles traveled between 2030 and 2035 are assumed to decline by 1.25%, 0.75%, and 0.25% in Tier 1, 2, and 3 states, respectively. These assumptions reflect the potential for broader adoption of VMT reduction policies due to their affordability and other societal benefits, while accounting for their limited adoption levels at present.

Table S4. Modeled state-level policies in the *Better Pathway* scenario, broken out by sector, policy area, primary policy motivation, and modeling assumptions with actions differentiated by tier.

Sector	Policy Area	Primary Policy Motivation	Policy	Modeling Assumption
Electricity	Renewable energy deployment	Emissions-focused	Renewable portfolio standards, Clean electricity standards	**Tier 1 states** achieve a minimum of 65% renewable electricity by 2035. Coal phases out by 2030. **Tier 2 states** achieve a minimum of 50% renewable electricity by 2035. Coal phases out by 2035. **Tier 3 states** achieve a minimum of 30% renewable electricity by 2035. Coal phases out by 2040.
		Multi-objective	Policies that address permitting reform, grid utilization, transmission buildout, and more.	
Transportation	Light-duty vehicle electrification	Emissions-focused	Clean fuel standard	**Tier 1 states** reduce CO_2 intensities by 20% below 2021 levels in 2030 and by 50% in 2035. **Tier 2 states** reduce CO_2 intensities for vehicles by 10% below 2021 levels in 2030 and by 25% in 2035.
		Emissions-focused	EV incentives (e.g. tax credits, rebates)	**Tier 1 states** offer a $3,500 incentive for new EVs in 2030 and 2035. **Tier 2 states** offer a $2,000 incentive for new EVs in 2030 and 2035. **Tier 3 states** offer a $1,000 incentive for new EVs in 2030 and 2035.

Sector	Policy Area	Primary Policy Motivation	Policy	Modeling Assumption
Transport	Medium/heavy duty vehicle electrification	Emissions-focused	EV Incentives (tax credits, rebates, etc.)	**Tier 1 states** offer a $60,000 incentive for new electric heavy-duty freight trucks and $7,500 for electric medium- and light-duty freight trucks in 2030 and 2035. **Tier 2 states** offer a $40,000 incentive for new electric heavy-duty freight trucks and $6,500 for new electric medium- and light-duty freight trucks in 2030 and 2035. **Tier 3 states** offer a $20,000 incentive for new electric heavy-duty freight trucks and $5,500 for new electric medium- and light-duty freight trucks in 2030 and 2035.
	Bus electrification	Emissions-focused	Transit and school bus electrification targets	**Tier 1 states** achieve 100% electrification of new bus sales in 2030. **Tier 2 states** achieve 100% electrification of new bus sales in 2035. **Tier 3 states** achieve 100% electrification of new bus sales in 2040.
	Vehicle miles traveled (VMT) reductions	Multi-objective	Policies that encourage more multifamily development, transit-oriented development, and investments in public and active modes of transportation and infrastructure	**Tier 1 states** reduce VMT per capita annually by 1% through 2030; 1.25% by 2035. **Tier 2 states** reduce VMT per capita annually by 0.5% through 2030; 0.75% by 2035. **Tier 3 states** reduce VMT per capita by 0.1% through 2030; 0.25% by 2035.

Sector	Policy Area	Primary Policy Motivation	Policy	Modeling Assumption
Buildings	Energy efficiency	Multi-objective	Energy efficiency policies including regulations, financial incentives, electricity rate design	**Tier 1, 2 and 3 states** reach 2.5% annual efficiency savings by 2030 and 3% by 2035
	Building electrification	Emissions-focused	Zero-emission appliance standards, heat pump incentives	**Tier 1 states** achieve 100% electric heating and water heating sales by 2035 **Tier 2 states** achieve 100% electric heating and water heating sales by 2040
		Emissions-focused	Zero-emission construction standards, energy codes that heavily incentivize all-electric buildings	**Tier 1 and 2 states** achieve 100% new electric construction by 2035
Industry	Carbon Capture and Storage (CCS)	Emissions-focused	Cement CCS targets	**Tier 1 states** install CCS capability for 40% of cement produced by 2035 **Tier 2 states** install CCS capability for 20% of cement produced by 2035 **Tier 3 states** install CCS capability for 10% of cement produced by 2035
Methane	Oil and gas	Emissions-focused	Oil and gas methane regulations	**Tier 1 states** achieve all reductions available at a cost of \$60/tCO_2e by 2035 under EPA's MAC curve[37] **Tier 2 states** achieve all reductions available at a cost of \$30/tCO_2e in 2035 under EPA's MAC curve **Tier 3 states** achieve all reductions available at a cost of \$0/tCO_2e under EPA's MAC curve
	Agriculture	Emissions-focused	Agricultural methane policies	**Tier 1, 2, and 3 states** achieve reductions available at a cost of \$0/tCO_2e by 2035 under EPA's MAC curve[37]

Sector	Policy Area	Primary Policy Motivation	Policy	Modeling Assumption
Methane	Waste	Emissions-focused	Landfill waste & waste diversion policies	**Tier 1 states** achieve emissions reductions available at a cost of $60/tCO$_2$e by 2035 under EPA's MAC curve.[37] They also achieve a 60% reduction in landfill waste relative to baseline in 2035. **Tier 2 states** achieve emissions reductions available at a cost of $40/tCO$_2$e by 2035 under EPA's MAC curve. They also achieve a 40% reduction in landfill waste relative to baseline in 2035. **Tier 3 states** achieve emissions reductions available at a cost of $20/tCO$_2$e by 2035 under EPA's MAC curve. They also achieve a 20% reduction in landfill waste relative to baseline in 2035.
Other	Hydrofluorocarbons (HFCs)	Emissions-focused	Significant New Alternatives Policy (SNAP) and Refrigerant Management Programs (RMP)	**Tier 1 and 2 states** adopt SNAP and RMP programs to mitigate emissions from HFCs.
	Land use, land-use change and forestry (LULUCF)	Emissions-focused	Expanded policies for wildfire mitigation, tree planting, conservation and healthy soils	Negative emissions from LULUCF are assumed to remain constant at 2024 levels due to state-level actions related to wildfire mitigation, tree planting, conservation, and healthy soils.

Health target

GCAM-USA-CGS includes ozone and fine particulate matter health damage factors for NO_x, SO_2, and direct $PM_{2.5}$ that were developed by the U.S. EPA using the CO-Benefits Risk Assessment (COBRA) tool.[59] For each policy scenario, the model produces annual estimates of the costs associated with air pollutant-related premature mortality. Annual air quality-related health benefits can then be calculated by comparing these costs from one scenario to another. With this representation, we are also able to introduce policy constraints that limit these damages through time.

This approach is used within the *Better Pathway* scenario to model an aspirational health target that constrains total annual mortality-related health damages from O_3 and ambient $PM_{2.5}$ to 2025 levels through 2035. The constraint effectively improves air pollution levels given that the damage constraint is held constant while population and dollar-per-life valuations are increasing through time.

We note that the constrained damage values are estimated using factors derived from a different tool (COBRA) than the more detailed modeling used to estimate and compare the air quality (InMAP) and health impacts (BenMAP) of the *Current Pathway* and *Better Pathway* scenarios. Furthermore, the constraint includes both O_3 and $PM_{2.5}$-related damages, while the more detailed analysis focuses on $PM_{2.5}$, which tends to produce greater air quality-related health damages from premature mortality compared to O_3.[60] See Section 5.1 for a sensitivity analysis on the impacts of the health target.

3. Model overview

3.1 GCAM-USA-CGS

We use version 8.8 of the open-source Global Change Analysis Model (GCAM) to model the energy and emissions impacts of federal and state-level policies as well as the changing energy system in the United States.[4] GCAM is an integrated assessment model (IAM) that represents the dynamics of the energy, land, water, climate, and socioeconomic system across 32 geopolitical regions (of which the United States is one), 235 water basins and 284 land regions. GCAM tracks emissions and sinks of carbon dioxide (CO_2), 16 other GHGs, and several air pollutants.

The country-specific version we use in this analysis (GCAM-USA) provides state-level resolution for sector-specific energy inputs and outputs. We make additional adjustments to the release version of GCAM-USA 8.8 to more accurately reflect up-to-date values and trends for certain assumptions, including future data center load growth, fossil fuel price trajectories, population and GDP growth, coal power plant retirement schedules, and power plant efficiencies. We refer to the modified version of GCAM used for this report as GCAM-USA-CGS.

GCAM-USA further disaggregates the U.S. energy system into 50 states and the District of Columbia while maintaining the same level of detail as GCAM for water and land sectors. While the primary production of fossil resources is still modeled at the aggregate U.S. level, most other aspects of the energy system including renewable primary energy sources, transformation processes like refining and generation and end-use demands from buildings, transport and industry sectors are modeled at the individual state level with allowances for inter-state trade (Figure S1).

The energy system in GCAM-USA represents depletable primary energy sources including coal, gas, oil, and uranium, in addition to renewable resources including biomass, hydropower, solar, wind, and geothermal. Energy transformation processes like oil refining and electricity generation convert these resources into energy carriers such as liquid fuels and electricity. These energy carriers are used to deliver energy services to state-level end users in the buildings, transportation, and industrial sectors. The electric power sector includes representation of a range of electricity generation technologies, including those fueled by fossil fuels and bioenergy (with and without CCS), renewables, and nuclear. The refining sector includes representation of both oil refining and biomass refining technologies (with and without CCS).

As a market equilibrium model, GCAM solves for equilibrium in each period by balancing supply and demand for resources in a range of different markets from regional electricity sectors to land uses based on their prices and other relevant information. GCAM operates in 5-year increments, and each model period is directly informed by the period preceding it. In version 8.8, 2021 is the final historical calibration year. Since 2025 is not a calibrated year, the modeled results do not perfectly match historical values. Most technologies are vintaged, with existing stocks carried over from one period to the next to mimic real-world technology retirements.

3.2 InMAP and BenMAP

To evaluate air pollution levels and related health impacts across the contiguous U.S. for the study's two scenarios, we combine projections from GCAM-USA-CGS with a reduced-complexity air quality model (Intervention Model for Air Pollution[5]) and a health impact assessment tool (EPA's Environmental

Benefits Mapping and Analysis Program – Community Edition[6]). This modeling framework is consistent with approaches used in our previous studies.[61]

First, we spatially downscale state-level air pollutant emissions from GCAM-USA-CGS to a 12 km × 12 km grid using spatial allocation factors derived from 2017 National Emissions Inventory (NEI) for sectors such as power, transportation, industry, and buildings. We assume that these spatial patterns remain constant from 2015 to 2035. To isolate the effects of domestic changes, emissions for areas outside the contiguous U.S., such as Canada and Mexico, are held constant at 2017 levels.

We then use InMAP, a reduced-complexity air quality model, to simulate annual average ambient concentrations of fine particulate matter ($PM_{2.5}$). These ambient concentrations are comprised of both directly-emitted $PM_{2.5}$ and secondary $PM_{2.5}$, which is formed in the atmospheric reactions with precursors that include SO_2, NO_x, NH_3, and VOCs. InMAP uses steady-state atmospheric transport and chemistry equations to simulate the effects of wind transport, atmospheric mixing, and chemical transformations. Meteorological inputs are derived from WRF-Chem simulations for the year 2005. InMAP runs at variable spatial resolutions from 1 km in urban areas to 48 km in rural regions and includes 29 vertical layers, with the lowest layer representing near-surface concentrations. While InMAP simplifies some physical and chemical processes, it has been validated for its ability to capture large-scale pollution trends and is frequently used in energy and climate policy research due to its efficiency (Figure S1).

To estimate health impacts, the $PM_{2.5}$ concentrations from InMAP are input into BenMAP-CE (v1.5.8), a U.S. EPA-developed tool that quantifies health effects from changes in air pollution. We estimate county-level exposure using population-weighted averages when multiple InMAP grid cells overlap a county, and assign uniform concentrations when grid cells are larger than county boundaries (Figure S1).

Our primary health outcome is premature mortality from long-term $PM_{2.5}$ exposure, calculated using the log-linear exposure-response function from Pope et al.[62] These health assessments assume fixed population demographics and baseline mortality rates over time. While this limits the model's ability to account for future demographic changes or behavioral adaptation, it allows for consistent, comparative evaluation of policy-driven air quality changes.

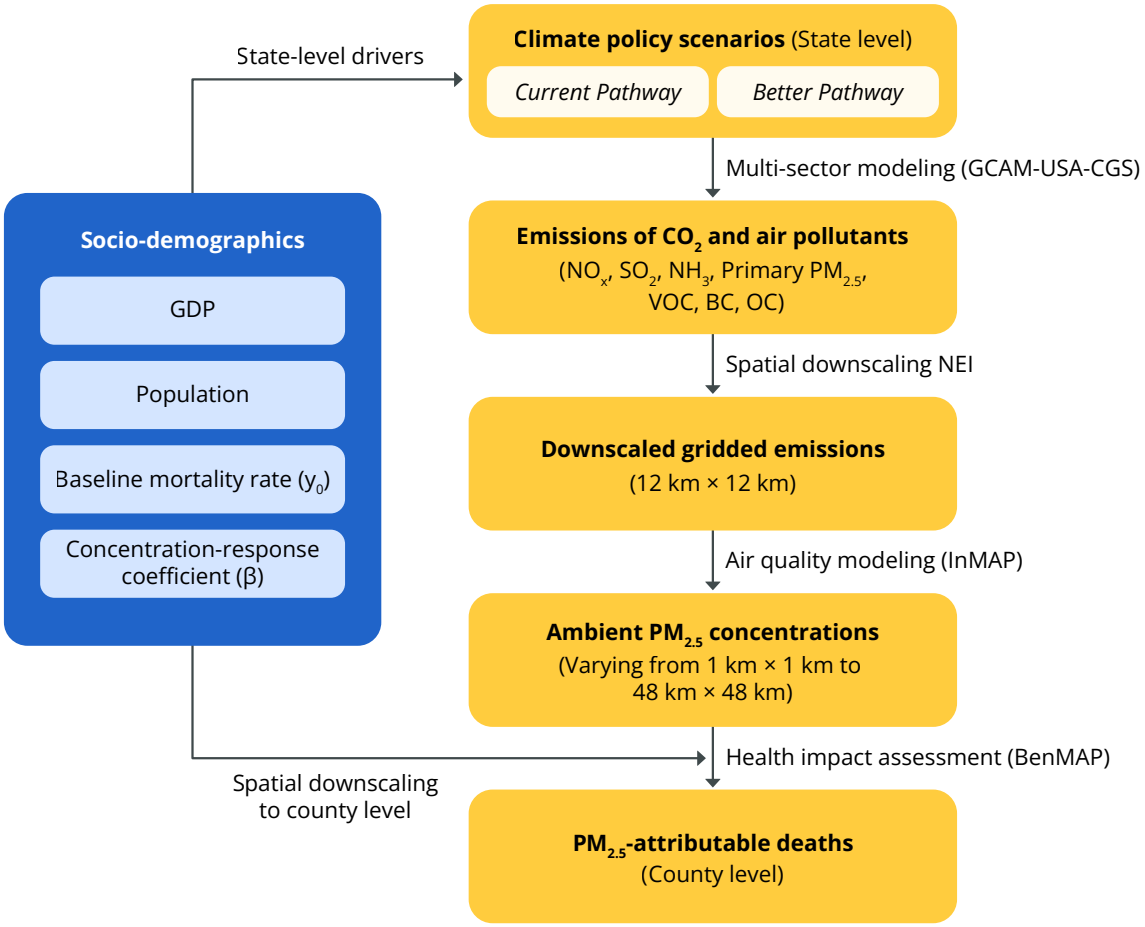


Figure S1. Integrated modeling method used for this study that couples GCAM-USA-CGS with InMAP and BenMAP.

4. GHG emissions results

4.1 Emissions reductions by sector

In the core *Current Pathway* scenario, economy-wide GHG emissions reductions reach 28% below 2005 levels by 2035. In the core *Better Pathway* scenario, emissions reductions reach 42% by 2035. A sector-by-sector breakdown of the GHG emissions results is shown in Table S5.

Table S5. Emissions results by sector, in units of million metric tons CO_2 equivalents ($MMTCO_2e$). Methane's AR5 100-year GWP of 28 is used in this table.

Sector/Gas	Emissions 2005 ($MMTCO_2e$)	Emissions 2021 ($MMTCO_2e$)	Emissions 2035 ($MMTCO_2e$)		Change relative from 2005 to 2035 (%)	
			Current Pathway	*Better Pathway*	*Current Pathway*	*Better Pathway*
Electricity CO_2	2,413	1,553	1,201	676	-50%	-72%
Transport CO_2	1,864	1,778	1,373	1,319	-26%	-29%
Industry CO_2	1,190	1,098	1,203	1,089	1%	-8%
Buildings CO_2	587	548	507	399	-13%	-32%
Other CO_2	71	40	36	30	-50%	-58%
CH_4	858	782	774	674	-10%	-21%
N_2O	436	408	418	413	-4%	-5%
F-Gases	156	200	120	115	-23%	-26%
Land sink	-1,037	-1,006	-916	-966	11%	7%
Net GHG Total	**6,539**	**5,401**	**4,717**	**3,750**	**-28%**	**-42%**

4.2 Comparison with other studies

Other recent studies have also assessed the impact of current policies on U.S. net GHG emissions trajectories. Rhodium Group's 2026 analysis projects that under current policy U.S. emissions will decline by 28–36% by 2035 relative to 2005 levels.[63] Similarly, ZERO Lab's Rapid Energy Policy Evaluation and Analysis Toolkit (REPEAT) estimates a 25% reduction in 2035 under a policy scenario that incorporates the final version of The One Big Beautiful Bill Act (OBBBA).[64] For comparison, the *Current Pathway* scenario in this report projects a 28% reduction in GHG emissions by 2035, which falls within this range. Differences in emissions outcomes can be attributed to differences in modeled policies and underlying modeling assumptions.

4.3 Global Warming Potential

In country-level emissions accounting, the 100-year global warming potential (GWP) for non-CO_2 gases is used to calculate GHG emissions in terms of CO_2 equivalents by convention. However, methane is much more potent over a shorter time frame. As such, in addition to using methane's 100-year GWP of 28, we also evaluate emissions reductions in 2035 using methane's 20-year global GWP of 84. When evaluated this way, methane becomes the second largest contributor (26%) to the difference in 2035 emissions between scenarios, after electricity (45%) (Figure S2). This highlights how using GWP 100 can obscure the critical role that methane mitigation can play in limiting near-term global warming.

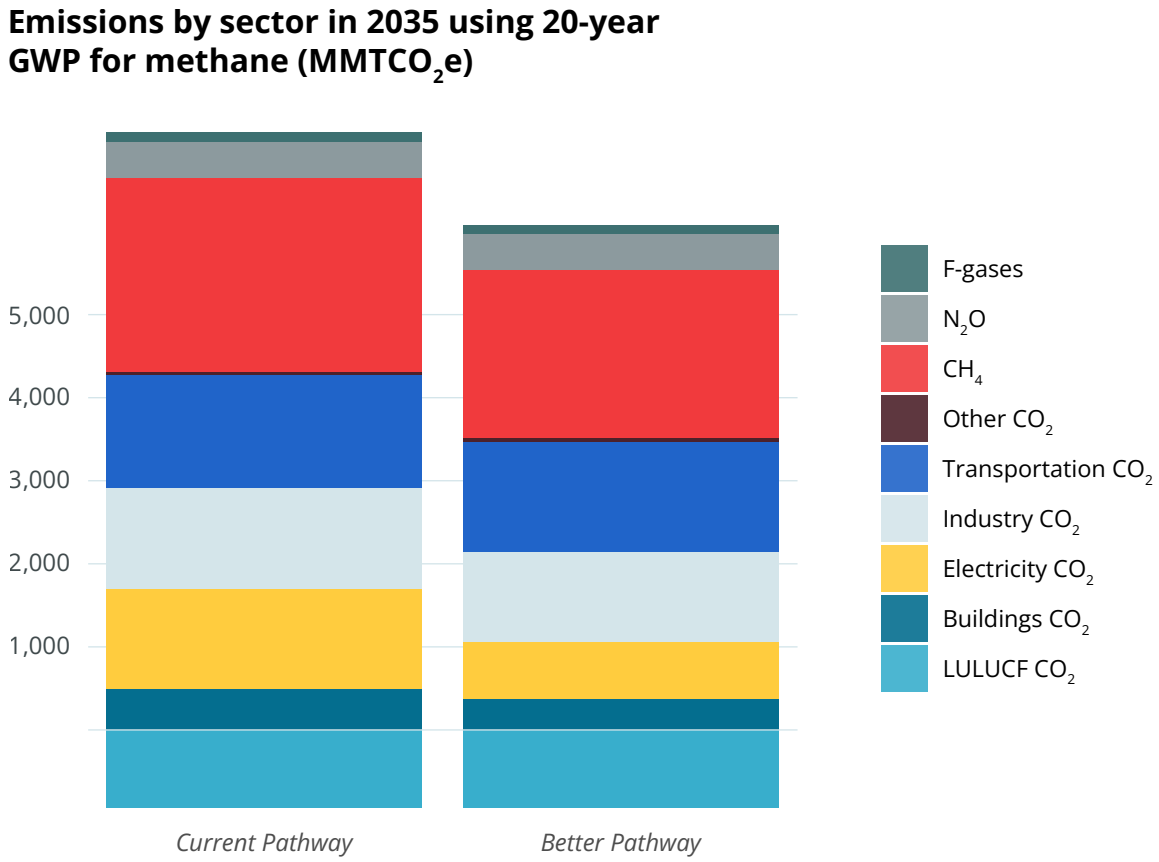


Figure S2. GHG emissions by sector in 2035 under the *Current Pathway* and the *Better Pathway* using the 20-year GWP for methane.

5. Sensitivity analyses

The *Current Pathway* and *Better Pathway* scenarios include a diverse set of policies and market drivers. We conducted a set of sensitivity analyses in order to disaggregate the impacts of key drivers of the health and emissions outcomes, including the health target, socioeconomic growth, fossil fuel prices, technology costs, and data center demand growth. The original *Current Pathway* and *Better Pathway* scenarios are the core scenarios about which the sensitivities are explored.

5.1 Health target

To examine the role of the health target on the health outcomes in the *Better Pathway* scenario, an alternative scenario without the constraint (*Better Pathway without health target*) was developed. The *Better Pathway without health target* scenario also leads to improved air quality and fewer premature $PM_{2.5}$-related deaths in 2035 compared to the *Current Pathway* scenario, but the health benefits are smaller than those achieved under the core *Better Pathway* scenario. Because the health target is aspirational and not currently a part of U.S. policies, these results suggest that combining more ambitious health objectives into climate and energy policy could help achieve greater health outcomes, particularly those related to industrial sector emissions.

The health target constrains national health damages to 2025 levels (around $189 billion) through 2035 under the core *Better Pathway* scenario (Figure S3). In contrast, damages increase to $228 billion in 2035 under the *Better Pathway without health target* scenario, only about $4 billion less than health damages under the *Current Pathway* (around $232 billion in 2035). Health damages are driven by factors such as population growth and increasing valuation of life (which are held constant across the scenarios), in addition to the policies and market forces modeled in the scenarios. These results suggest that the health target has a relatively larger impact on health damages compared to modeled policies and market forces in the *Better Pathway* scenario.

Air pollution damages by scenario

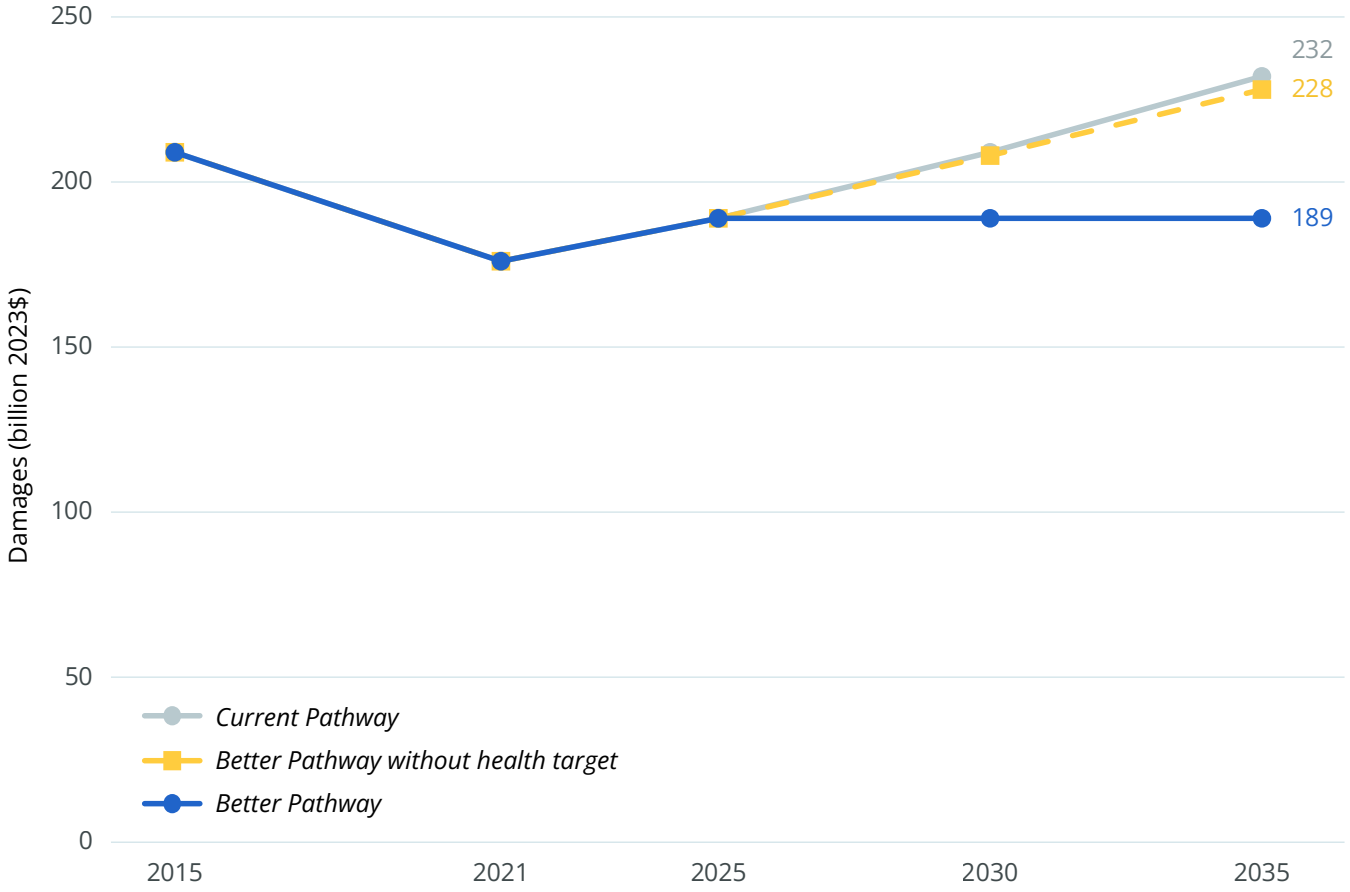


Figure S3. Health damages associated with premature mortality from exposure to O_3 and ambient $PM_{2.5}$ through 2035 across the *Current Pathway*, *Better Pathway without health target*, and *Better Pathway* scenarios.

Under the *Better Pathway without health target* scenario, national NO_x, SO_2, and $PM_{2.5}$ emissions are reduced by 4%, 22%, and 3% in 2035, respectively (Figure S4a). These changes are associated with a 5% reduction in $PM_{2.5}$ pollution and approximately 2,400, or 5%, fewer premature deaths attributable to ambient $PM_{2.5}$ exposure in 2035 than under the *Current Pathway* (Figure S4b). These improvements in $PM_{2.5}$ concentration and associated deaths, roughly half of those under the core *Better Pathway* scenario, reflect the combined effects of technology costs and modeled policies that do not explicitly target health outcomes.

The industrial sector plays a much smaller role in air quality improvement under the *Better Pathway without health target* scenario compared to the core scenario. Industrial NO_x emissions reductions fall by nearly 95%, from 0.54 to 0.03 million metric tons; SO_2 emissions reductions decrease by over 60%, from 0.08 to 0.03 million metric tons; $PM_{2.5}$ reductions decline from 0.07 to almost zero. This finding suggests that the health target plays a key role in mitigating emissions from the industrial sector.

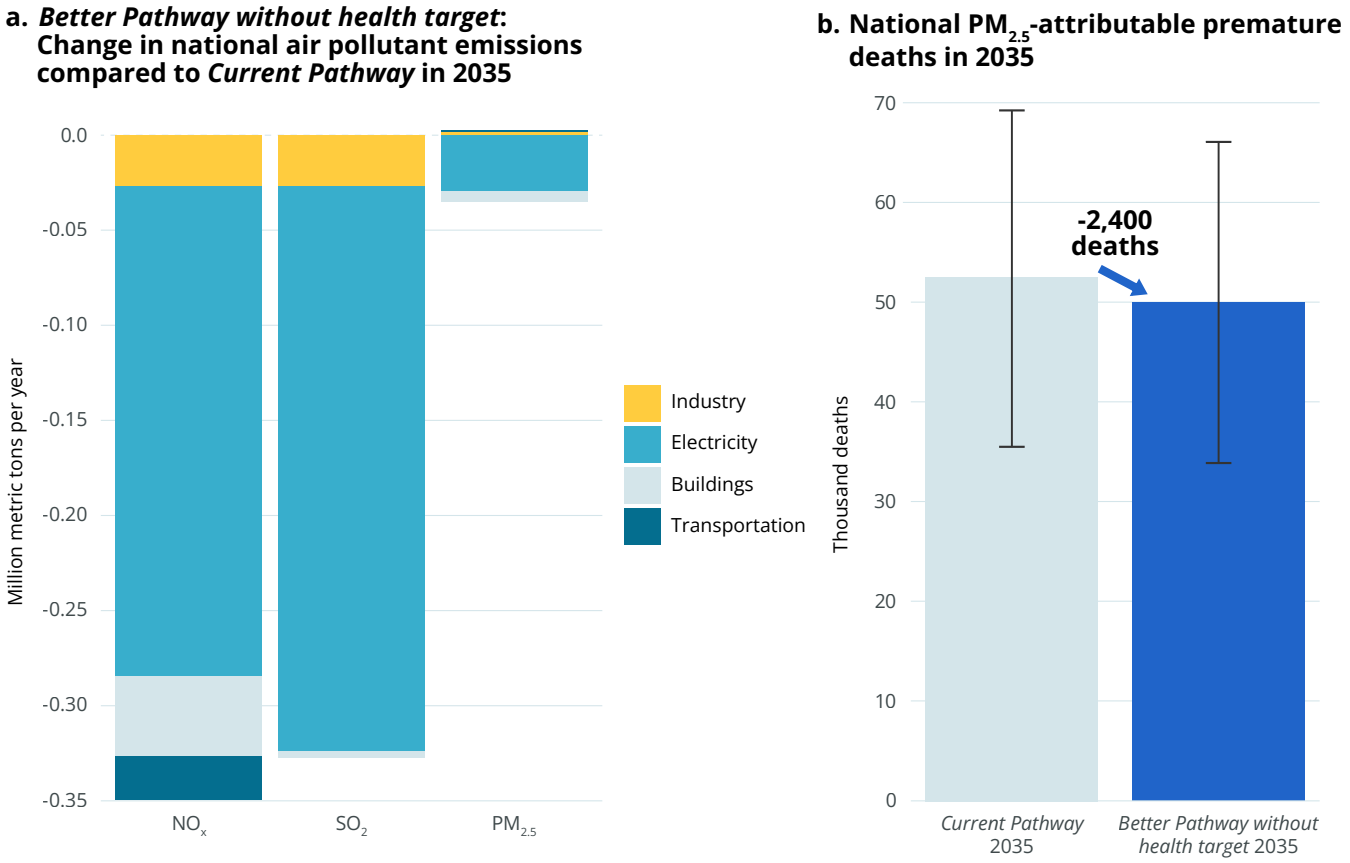
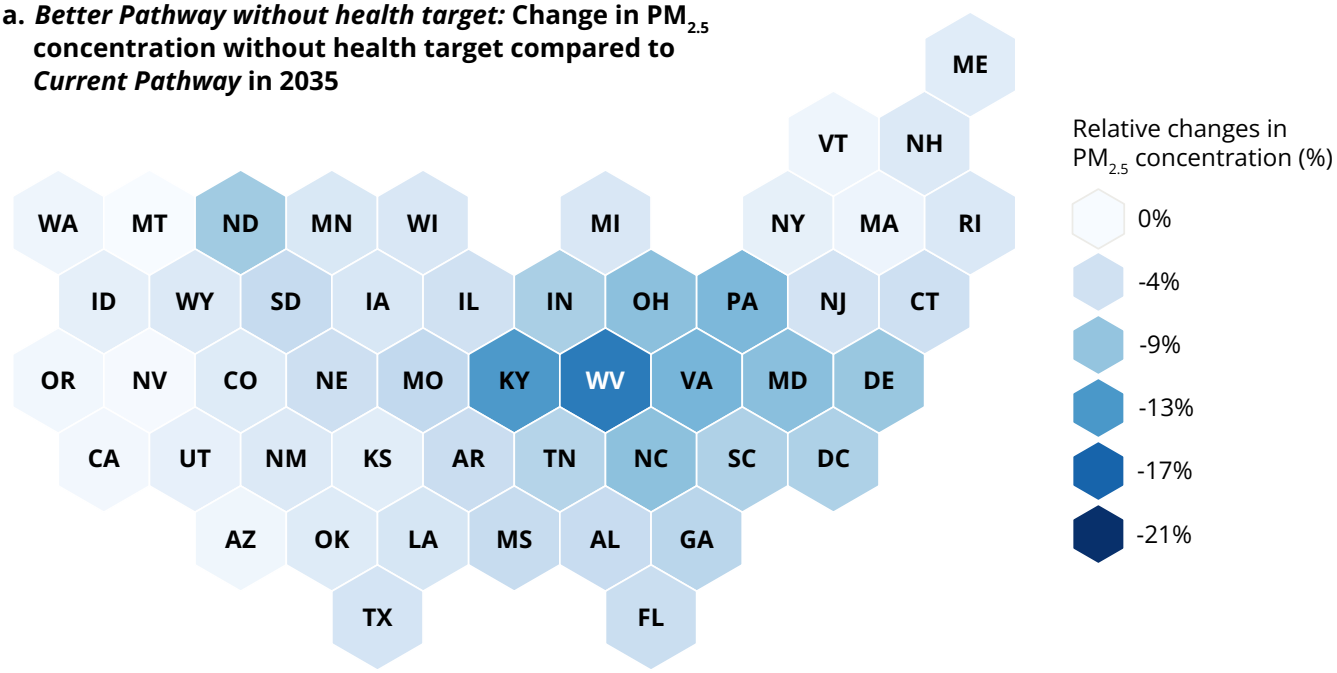


Figure S4. Changes in national air pollutant emissions and health damages under the *Better Pathway without health target* scenario in 2035. Panel (a) depicts changes in annual $PM_{2.5}$, SO_2, and NO_x emissions under the *Better Pathway without health target* scenario relative to the *Current Pathway* in 2035. Panel (b) shows the national premature deaths attributable to $PM_{2.5}$ exposure in 2035. Under 95% confidence intervals, the *Current Pathway* experiences 35,500 to 69,200 deaths (with a central estimate of 52,600) and the *Better Pathway without health target* experiences 33,900 to 66,100 deaths (with a central estimate of 50,200).

Under the *Better Pathway without health targ*et scenario, benefits in 2035 are concentrated in the Ohio Valley and the Mid-Atlantic, including West Virginia (15.2%), Kentucky (12.6%), Virginia (10.1%), and Pennsylvania (9.8%), largely driven by the transition from coal to other fuels in the power sector (Figure S5). While the spatial pattern of health benefits is similar to that under the core scenario, the magnitude of benefits in some of the densely populated states like New York, New Jersey, Massachusetts, and California is lower. For example, California sees 70 avoided premature deaths in 2035 under the *Better Pathway without health target* scenario, compared to 320 under the core *Better Pathway* scenario.

a. *Better Pathway without health target:* Change in $PM_{2.5}$ concentration without health target compared to *Current Pathway* in 2035



b. *Better Pathway without health target:* Change in $PM_{2.5}$-attributable deaths compared to *Current Pathway* in 2035

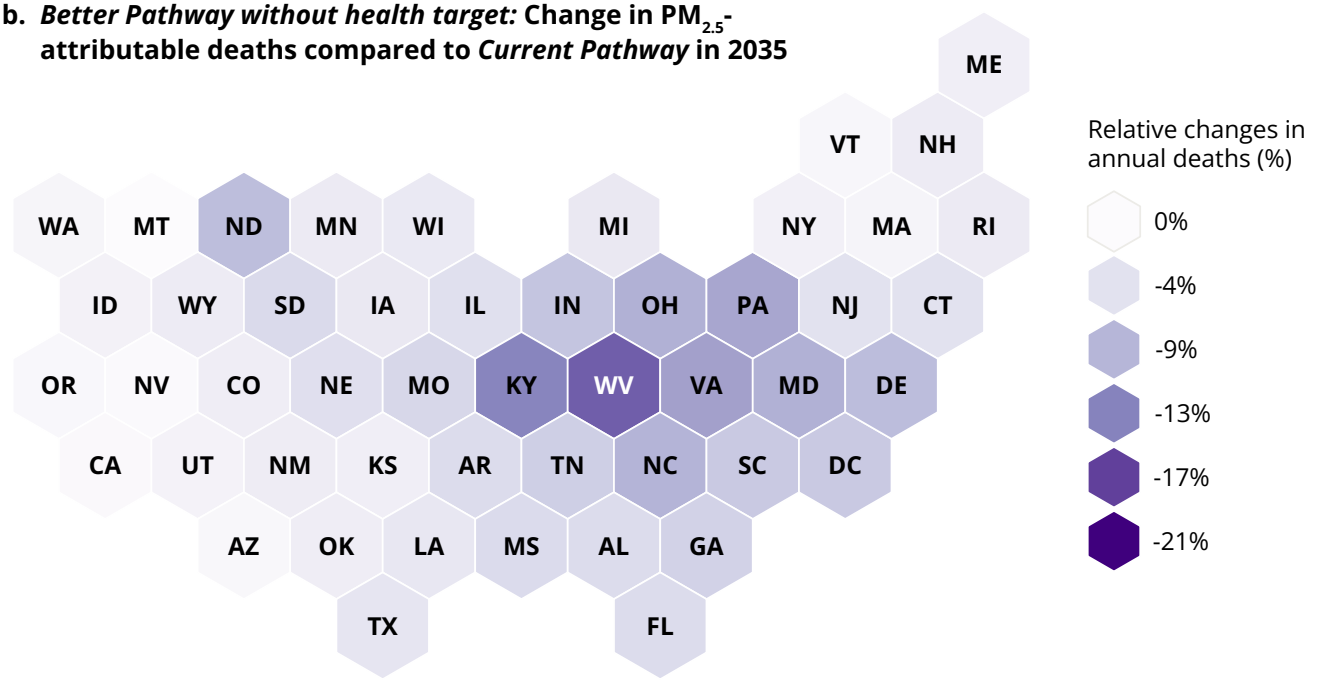


Figure S5. State-level air quality and health outcomes under the *Better Pathway without health target* scenario in 2035. Panel (a) shows relative changes in $PM_{2.5}$ concentration. Panel (b) shows relative changes in annual deaths in 2035 under the *Better Pathway without health target* scenario, compared to the *Current Pathway*.

5.2 Key drivers of GHG emissions

The core *Current Pathway* and *Better Pathway* scenarios reduce GHG emissions by 28% and 42% below 2005 levels by 2035, respectively. Additional sensitivity scenarios were developed to explore how assumptions around key drivers influence these outcomes, creating an aggregated range of 22%–32% for the *Current Pathway* and 38%–46% for the *Better Pathway* (Figure S6). The assumptions applied in each sensitivity scenario are specified in Tables S6–S8.

First, varying assumptions around fossil fuel prices and technology costs produces a sensitivity range of 25%–30% emissions reductions in 2035 for the *Current Pathway*, and 40%–44% for the *Better Pathway*. Building on the market force assumptions, the sensitivity analysis is then expanded to include variations on data center demand, expanding the ranges to 24%–30% for the *Current Pathway*, and 39%–44% for the *Better Pathway.* Finally, variations in socioeconomic growth are incorporated alongside the preceding drivers, further expanding the range to 22%–32% for the *Current Pathway*, and 38%–46% for the *Better Pathway*. For the *Better Pathway*, an additional sensitivity assesses the effects of removing the health target. Emissions reductions remain at 42% below 2005 levels in 2035 when the health target is removed. While the health target leads to substantial differences in air quality and associated deaths (see Section 5.1), it has limited effects on GHG emissions.

We note that beyond the initial set of sensitivities, each successive set of sensitivities should be interpreted as potential outcomes under a combination of drivers rather than the isolated effect of any individual driver. Across different driver assumptions, the 2035 emissions range between the *Current Pathway* (22%–32%) and the *Better Pathway* (38%–46%) are still significantly different. This suggests that the policies modeled in the *Better Pathway* scenario produce meaningful GHG emissions reductions even under different assumptions around key socioeconomic and market drivers.

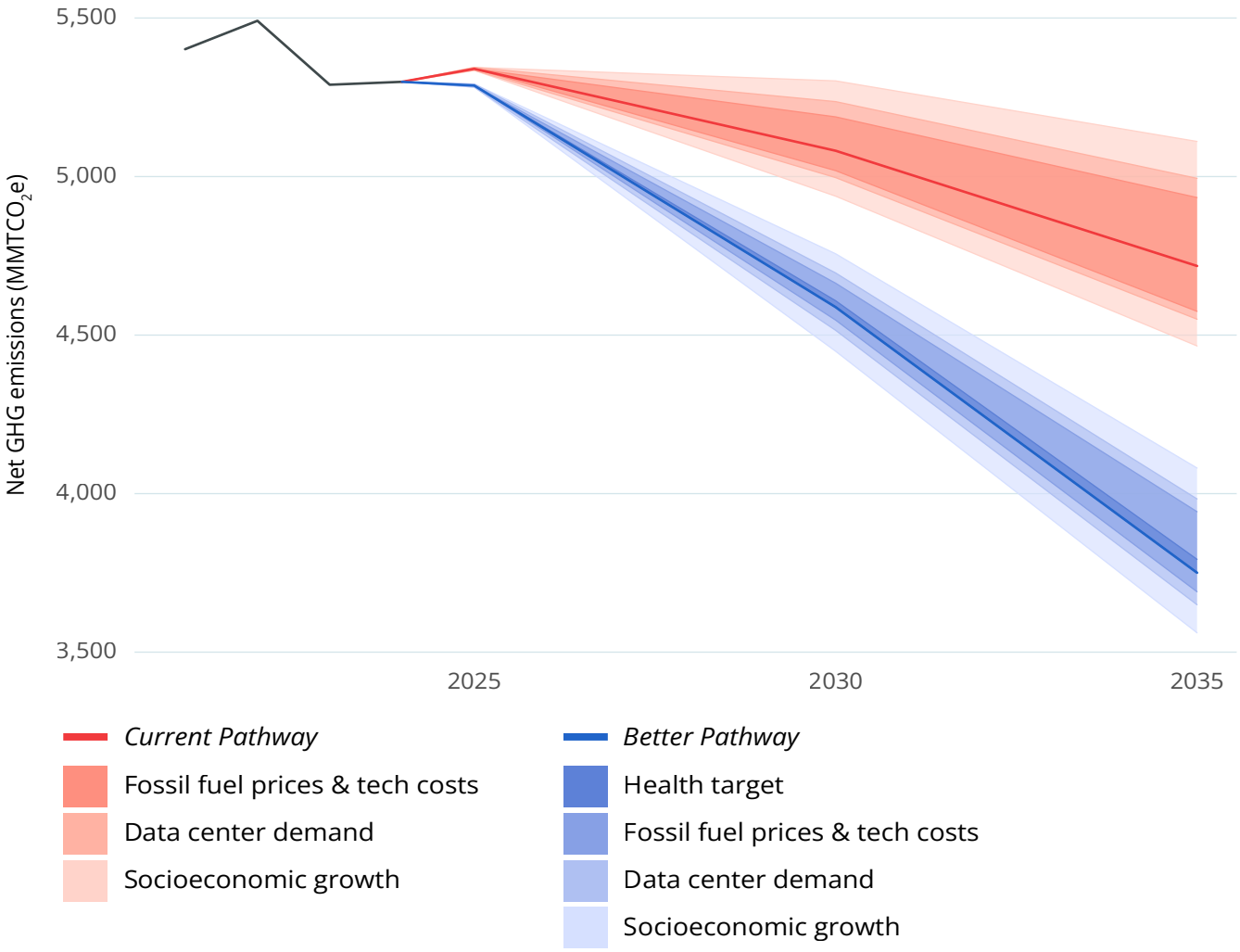


Figure S6. Net greenhouse gas emissions under the *Current Pathway* and *Better Pathway* scenarios through 2035 with sensitivity ranges. Historical GHG emissions are shown through 2024. The core *Current Pathway* and *Better Pathway* scenarios are shown by the red and blue lines, respectively. The shaded bands show the sensitivity ranges around key drivers. The bands are nested, from darkest to lightest, with each successive band adding new assumptions to the preceding band. The modeled sensitivities include a health target (only in the *Better Pathway* scenario), fossil fuel prices, technology costs, data center demand, and socioeconomic growth.

Table S6. Scenario design for sensitivity scenarios under the *Current Pathway*. The • symbol represents core scenario assumptions. The ↑ symbol represents a high variation of the core scenario assumptions. The ↓ symbol represents a low variation of the core scenario assumptions.

Scenario	Scenario Assumptions				Emissions Reductions (2005 to 2035)
	Fossil Fuel Price	Data Center Demand	Clean Energy Technology Costs	GDP & Population	
Socioeconomic growth (Low)	↑	↓	↓	↓	32%
Data center demand (Low)	↑	↓	↓	•	30%
Fossil fuel price (High) & Technology costs (Low)	↑	•	↓	•	30%
Core	•	•	•	•	28%
Fossil fuel price (Low) & Technology costs (High)	↓	•	•	•	25%
Data center demand (High)	↓	↑	•	•	24%
Socioeconomic growth (High)	↓	↑	•	↑	22%

Table S7. Scenario design for sensitivity scenarios under the *Better Pathway*. The • symbol represents core scenario assumptions. The ↑ symbol represents a high variation of the core scenario assumptions. The ↓ symbol represents a low variation of the core scenario assumptions. The - symbol indicates that the driver is absent in the scenario.

Scenario	Scenario Assumptions					Emissions Reductions (2005 to 2035)
	Fossil Fuel Price	Data Center Demand	Health Target	Clean Energy Technology Costs	GDP & Population	
Socioeconomic growth (Low)	↑	↓	•	•	↓	46%
Data center demand (Low)	↑	↓	•	•	•	44%
Fossil fuel price (High) & Technology costs (Low)	↑	•	•	•	•	44%
Core	•	•	•	•	•	42%
No health target	•	•	-	•	•	42%
Fossil fuel price (Low) & Technology costs (High)	↓	•	-	↑	•	40%
Data center demand (High)	↓	↑	-	↑	•	39%
Socioeconomic growth (High)	↓	↑	-	↑	↑	38%

Table S8. Detailed descriptions for modeling assumptions under low and high variations of key drivers.

Driver	Variation	Description
Fossil Fuel Price	Low	Price trajectories are based on the AEO 2026 High Oil and Gas Supply Scenario.[20] Oil prices increase at an average rate of 0.9% per year from 2025 to 2035. Gas prices increase at an average rate of 3.9% per year from 2025 to 2035.
	High	Price trajectories are based on the AEO 2026 Low Oil and Gas Supply Scenario, anchored to the 2026 price shocks.[20] Oil prices increase at an average rate of 4.3% per year from 2025 to 2035. Gas prices increase at an average rate of 10.3% per year from 2025 to 2035.
Data Center Demand	Low	National data center electricity demand reaches 384 TWh by 2030 and 445 TWh by 2035, consistent with the low scenario from EPRI's 2026 study.[22]
	High	National data center electricity demand reaches 794 TWh by 2030 and 1048 TWh by 2035, consistent with the high scenario from EPRI's 2026 study.[22]
GDP & Population	Low	Socioeconomic trajectories are based on the AEO 2026 Low Economic Growth scenario.[20] Population grows at an average rate of 0.21% per year from 2025 through 2035. GDP grows at an average rate of 1.36% per year from 2025 through 2035.
	High	Socioeconomic trajectories are based on the AEO 2026 High Economic Growth scenario.[20] Population grows at an average rate of 0.53% per year from 2025 through 2035. GDP grows at an average rate of 2.37% per year from 2025 through 2035.
Technology Costs	Low	Same as the core modeling assumption under the *Better Pathway* scenario (Table S1).
	High	Same as the core modeling assumption under the *Current Pathway* scenario (Table S1).
Health Target	Present/ Absent	An aggregate target limits health damages related to $PM_{2.5}$ and ozone, ensuring that they do not worsen relative to 2025 levels. See Section 2.4.2 for modeling details.

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