



AN “ALL-IN” PATHWAY TO 2030:

# Transportation Sector Emissions Reduction Potential

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## Key Findings



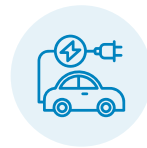
Through an “All-In” climate strategy integrating legislative initiatives from Congress, regulatory and other actions from the Executive Branch, and enhanced policy leadership from non-federal actors, the United States can deliver its ambitious climate target (NDC) of 50-52% reductions by 2030 relative to 2005 levels.



Under this strategy, emissions reductions from the transportation sector—the country’s largest source of emissions—would contribute one-fifth of the economy-wide emissions reductions needed. Through the remainder of the decade, emissions from the transportation sector could feasibly decrease emissions by 34% by 2030—a more ambitious level than usually identified.



Currently adopted policy measures account for 19%—or nearly 350 million tons of CO<sub>2</sub> (MtCO<sub>2</sub>)—of the emissions reductions needed. These measures include existing federal fuel economy and emissions standards, state and local policies and incentives, market force projections, and Congress’s recently passed Infrastructure Investment and Jobs Act (IIJA).



IIJA’s transportation decarbonization measures alone can reduce emissions by 12 MtCO<sub>2</sub>. Climate-aligned implementation of these policies can leverage wider deployment of charging infrastructure, renewed R&D into alternative fuels, and support the accelerated adoption of zero-emission vehicles (ZEVs) as they become price competitive in the market.



States, cities, businesses, and others have already shown significant ability to drive down transportation reductions and can reduce emissions by an additional 5%—or 92 MtCO<sub>2</sub>—through policy opportunities including ZEV mandates, municipal fleet targets, improving mobility options, and reducing vehicle miles traveled.



Congressional action currently being considered could cut 55 MtCO<sub>2</sub> of emissions through tax credits and other incentives. Cost-effective regulatory policies and other federal actions could cut an additional 120 MtCO<sub>2</sub>—combined, representing 10% or 175 MtCO<sub>2</sub> in reductions.

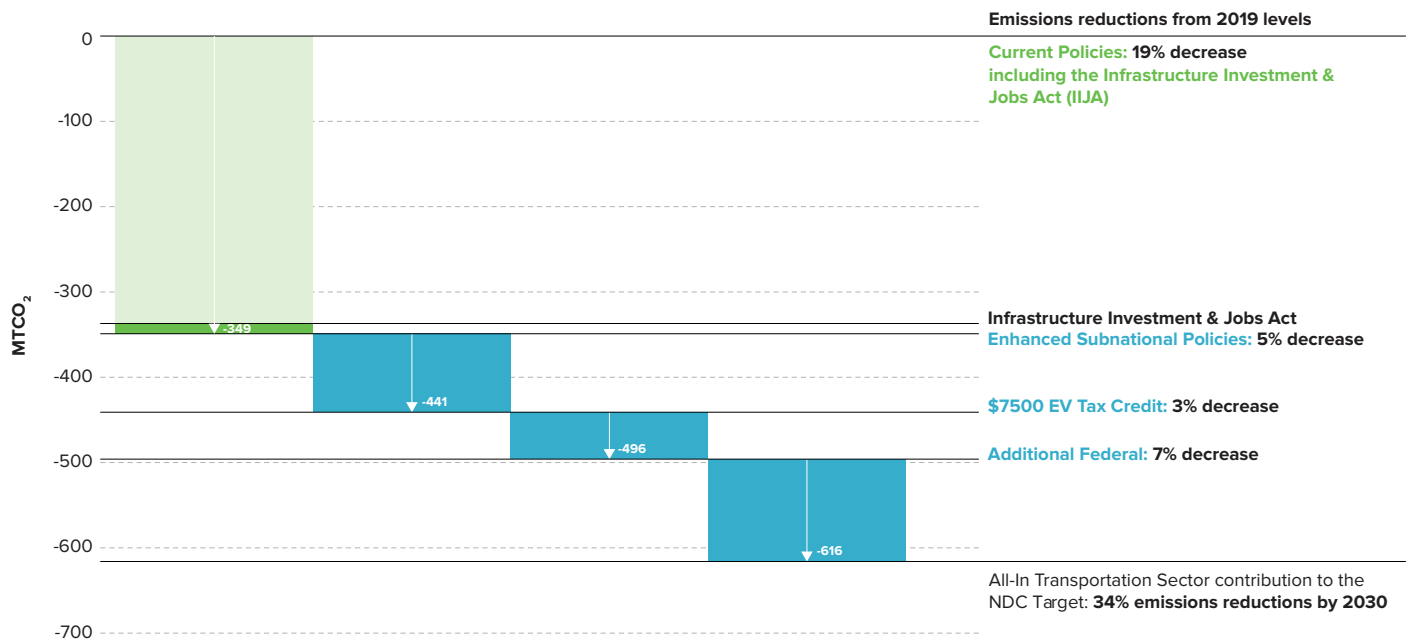
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# The U.S. Transportation Landscape

FIGURE 1 | "All-In" 2030 transportation emissions reductions by major policy area from 2019 levels



## The All-In emissions reductions scenario integrates existing action with what is possible in the form of new emissions reductions from non-federal actors, Congress, and the Executive Branch.

**A rapid and low-carbon transformation of the transportation sector in the United States holds the key to delivering on multiple goals:** enhancing economic mobility, improving health, expanding environmental justice and equity, reducing global oil dependence in a time of deep concerns about energy security, and delivering on ambitious and necessary climate goals. The United States has committed to an ambitious climate target of slashing emissions in half by 2030—setting the country on a path toward keeping global climate goals within reach.

The transportation sector—now the biggest single source of greenhouse gas emissions in the U.S.—is one of the key linchpins in reaching these climate goals. Achieving the nationally determined contribution (NDC) will be challenging but remains within reach through a combination of additional Congressional actions; mandates, and incentives driven by bottom-up leadership—states, cities, businesses, civil society, tribal groups, healthcare, and cultural institutions, universities, and more—and renewed comprehensive regulatory and other actions from the federal government<sup>6,7</sup>.

In September 2021, *America Is All In* released a comprehensive analysis offering an "All-In" pathway for the U.S. to take economy-wide climate action. The report highlighted the importance of combining federal and non-federal action to increase ambition, unlock critical opportunities for policy leadership, and broaden the scope of U.S. climate action<sup>8</sup>. Notably, the transportation sector plays a crucial role in this transformation through the accelerated deployment of electric light-duty vehicles, buses, and freight trucks.

Less than a year later, states, cities, and businesses have enhanced their commitments toward cleaner and more fuel-efficient vehicles, and Congress has passed the Infrastructure Investment and Jobs Act (IIJA), which focuses heavily on transportation infrastructure. Still, key questions remain about how close these current policies can get the U.S. to the NDC and what new policy approaches can cement the necessary reductions pathway.

The analysis presented in this report demonstrates how an All-In pathway can deliver reductions in the transportation sector, representing nearly 20%—or one-fifth—of the emissions needed to achieve the U.S. NDC of 50-52% emissions reductions by 2030 from 2005 levels. This pathway builds on reductions already underway—driven by years of consistent and robust action from non-federal actors—combined with actions on vehicle efficiency and new investment in charging stations and other areas authorized by Congress in IIJA. Additional measures from federal agencies and Congress can accelerate the deployment of electric vehicles (EVs), enhance electricity decarbonization, and extend reductions beyond 2030.

**An All-In strategy to achieve the NDC within the transportation sector could deliver an aggregate reduction of roughly 600 MtCO<sub>2</sub>e—36% below 2005 levels and 34% below 2019 levels. Importantly, this analysis underscores that continued federal regulatory actions and legislation from Congress—including, for example, climate provisions similar to those in the Build Back Better package—will be essential to delivering the emissions reductions needed.**

## Impact of Existing and Potential Expanded Policies for Transportation

To examine the impacts of the Infrastructure Investment and Jobs Act (IIJA) on the transportation sector, we modeled two scenarios in this study:

### The IIJA scenario

Here we implement significant climate-related policies in the transportation sector from IIJA, including infrastructure investments for passenger cars, buses, and freight trucks (Table 1). In addition, we implement the power sector investments that heavily influence the indirect emissions from EVs. While we recognize that these investments could be spent in ways that increase emissions, such as on streets and highways, we assume that state and local governments will implement all applicable funding toward EV charging infrastructure or electrification. These IIJA-specific policies are layered on top of current transportation sector measures, including recently updated Corporate Average Fuel Economy (CAFE) standards, state and local EV incentives, and projected market forces.

### The “All-In” scenario

Here we include a suite of federal and non-federal policies across all sectors to reach the 50-52% emissions reductions needed to meet the NDC (Table 1), including enhanced CAFE standards, 100% fleet electrification for all buses, the extension of the \$7500+ federal EV tax credit, federal scrappage program for old and inefficient vehicles, zero-emission vehicle (ZEV) mandates and fleet targets for medium- and heavy-duty vehicles (MDVs, HDVs), along with measures that improve mobility options and reduce vehicle miles traveled, such as urban planning, low- and zero-emissions zones, and decongestion pricing.

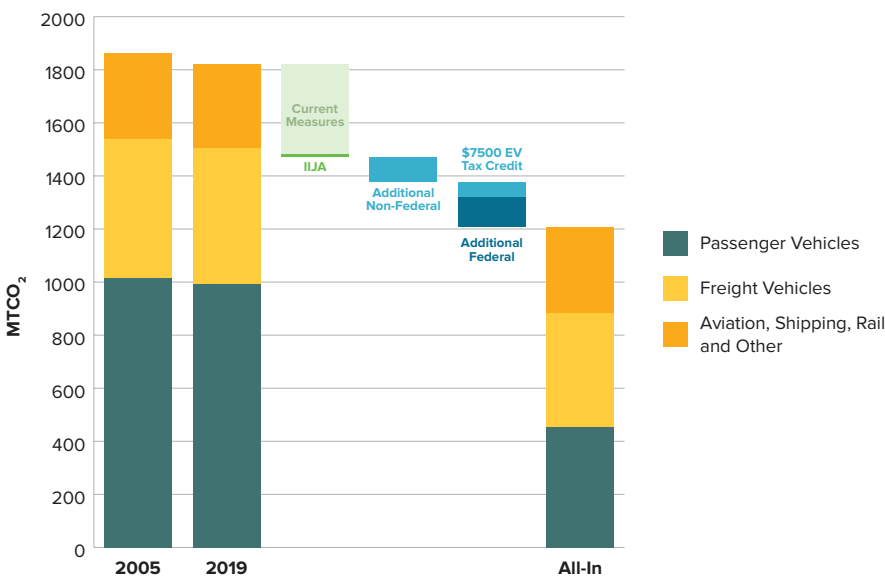
**TABLE 1** | Transportation sector policies modeled in the IIJA scenario and the All-In scenario

Modeled transportation sector policies	IIJA scenario	All-In scenario
Fuel economy/emissions standards	Efficiency improvement rates from recently updated CAFE standards are modeled so that nationally, fuel efficiency reaches 166gCO <sub>2</sub> /mi for new passenger cars and 219gCO <sub>2</sub> /mi for new SUVs by 2030.	Efficiency improvement rates from CAFE standards accelerate so that nationally, fuel efficiency reaches 143gCO <sub>2</sub> /mi for new passenger cars and 193gCO <sub>2</sub> /mi for new SUVs by 2030.
LDV electrification	Large state-, utility-, and district-level EV incentives included in the Alternative Fuels Data Center are modeled, equivalent to \$826 per vehicle.  <b>IIJA investment:</b> \$10.7 billion is invested in LDV charging infrastructure, equivalent to \$802 per vehicle.	Federal EV tax credit is extended through 2030 at \$7,500 minimum with no sunset.
LDV retirement	No new retirement policies	Sustained federal scrappage program accelerates retirement of older, less efficient vehicles.

MDV/HDV electrification	<p><b>IJJA investment:</b> \$4.24 billion is invested in MDV/HDV charging infrastructure, equivalent to \$9,211 per vehicle.</p>	<p>Federal and state sales targets and incentives drive ZEV sales to 50% of MDV market and 30% of HDV market by 2030 (consistent with CA Advanced Clean Trucks Rule and 15-state MOU commitment).</p>
Bus electrification	<p><b>IJJA investment:</b> \$5 billion is invested in school bus electrification, equivalent to \$25,000 per vehicle; \$2.6 billion is invested in transit bus electrification, equivalent to \$29,167 per vehicle.</p>	<p>Federal, state and city-level procurement drives national ZEV sales rate for new buses to 100% by 2030.</p>
Vehicle miles traveled (VMT) reduction	No new reduction policies	<p>Federal investment, and state and local planning lead to annual average per capita VMT reductions ranging from 0.5% to 1% in all states from 2025-2030 (consistent with current ambition in leading states).</p>

Overall results from the policies in each scenario are shown in Figure 2 below. Under the IJJA scenario, transportation emissions fall by 349 MtCO<sub>2</sub> from 2019 levels, which is 19% in emissions reductions. Only 12 MtCO<sub>2</sub> of these emissions can be attributed to IJJA. Current measures, which include existing fuel economy and emissions standards at the state and federal level, non-federal incentives, and market force projections, account for the remaining reductions.

**FIGURE 2** | Emissions reductions from the transportation sector in 2030 contribute roughly 600 MtCO<sub>2</sub> to achieving the NDC target based on an "All-In" scenario, through actions from non-federal actors, Congress, and the Executive Branch



IJJA is just one element of the Biden administration's plans to address climate change, and as such, it was never meant to be the sole contributor to delivering the 2030 U.S. NDC. A recent study by the Georgetown Climate Center<sup>9</sup> finds that the IJJA could either decrease or increase emissions depending on implementation, while Princeton University Zero Lab's study shows that IJJA falls short of meeting the NDC. This analysis confirms that IJJA does not alone deliver reductions consistent with meeting the NDC. However, the NDC is within reach if IJJA is supplemented by aggressive and rapid action from federal actors and climate-focused implementation by non-federal actors.

## Delivering on the NDC with Additional Actions

While investments from IJJA could represent a first step toward the U.S. climate goals, the emissions reductions needed would be many times larger than those achieved by IJJA alone. Aggressive and rapid action from both federal and non-federal actors is necessary to meet the NDC, including:

**Additional Congressional actions:** The \$7500+ EV credit, similar to what was included in the Build Back Better Act, further increases transportation emissions reductions by 55 MtCO<sub>2</sub>, leading to total reductions of 27% relative to 2019 levels.

**Non-federal actions:** Non-federal ZEV mandates, municipal fleet targets, and measures that can improve mobility options and reduce vehicle miles traveled can further reduce transportation emissions by 92 MtCO<sub>2</sub>, bringing reductions to 24% relative to 2019 levels.

**Federal regulation:** Regulation of MDVs and HDVs, scrappage programs for older, inefficient vehicles, and a more stringent CAFE standard can further reduce emissions by 120 MtCO<sub>2</sub> relative to 2019 levels. This translates into transportation emissions reductions of 34% by 2030, which achieves the U.S. NDC.

Our All-In scenario shows that 97% of the total transportation emissions reductions relative to 2019 need to occur in cars and freight trucks, with the remaining reductions coming from buses, shipping, and aviation (Table 2).

**TABLE 2 | Emissions broken down by transportation mode**

Transportation mode	2005 emissions	2019 emissions	IIJA 2030 emissions	All-In 2030 emissions
Passenger vehicles	1015	995	647	453
Freight vehicles	525	513	441	432
Aviation, rail, shipping, and other	321	313	382	323
<b>Total</b>	<b>1861</b>	<b>1821</b>	<b>1471</b>	<b>1208</b>

**Corrigendum footnote:** Table 2 has been updated from the original report to reflect consistent categorization of passenger and freight vehicles. In the current categorization, 26% of light-duty trucks are assumed to be used for freight purposes and the rest are used for passenger transport.

Accelerated EV deployment and accelerated retirement of internal combustion engine (ICE) cars will be critical for meeting the NDC, and these are elements lacking in IIJA alone.

**Accelerated electrification:** While EV sales for passenger vehicles (i.e. cars and buses) and freight trucks grow under the IIJA scenario, they fall short of the levels needed to meet the NDC. The All-In scenario offers a pathway for faster and deeper electrification. Of new passenger vehicle sales, only 23% are expected to be EVs by 2030 in the IIJA scenario, compared to 47% in the All-In scenario. Of new freight truck sales, less than 1% are expected to be EVs in the IIJA scenario, compared to 26% in the All-In scenario (Figure 3).

**Accelerated retirement:** Additionally, the retirement of old and inefficient vehicles reaches 71% in the IIJA scenario, compared to nearly 90% required to meet the All-In targets by 2030 (Figure 3).

**FIGURE 3 | New passenger EV sales reach 23% and 47% under IIJA and All-In scenarios, respectively. New freight EV sales are less than 1% and 26% under IIJA and All-In scenarios, respectively.**

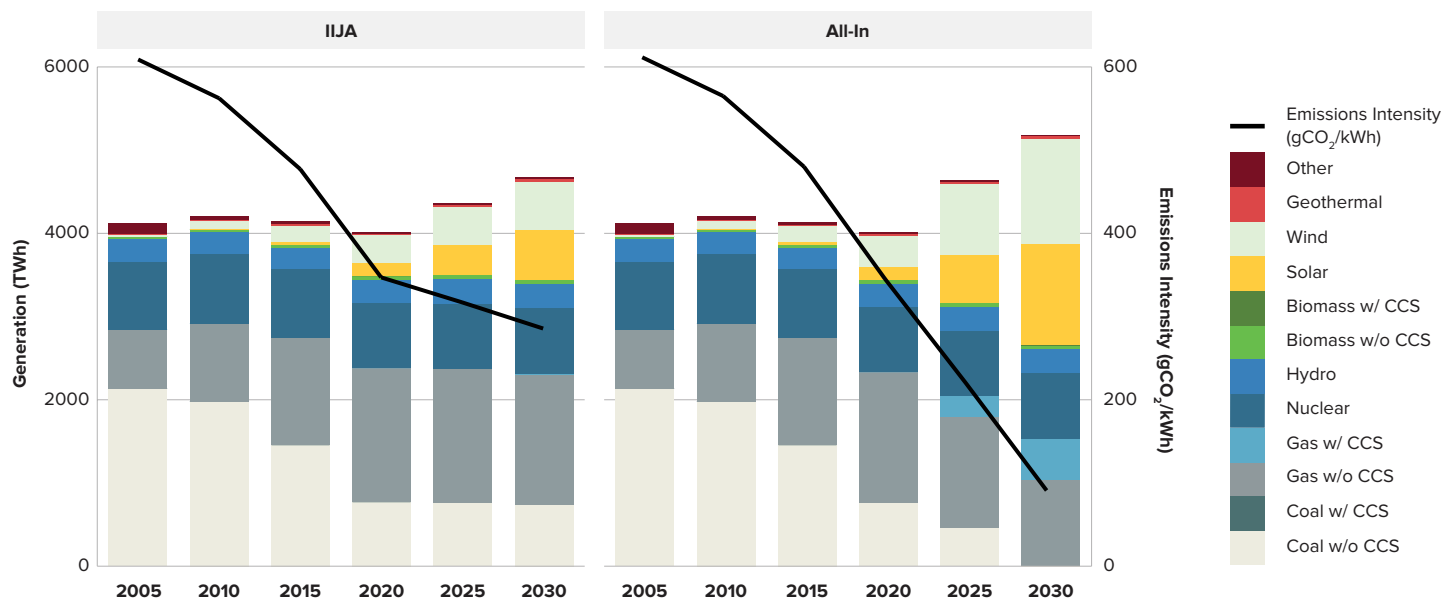


**Faster decarbonization of the power sector:** Since EVs are fueled by electricity, they have upstream emissions in the power sector. Therefore, the electric grid must also become cleaner more quickly to maximize the indirect emissions reductions from charging EVs. IIJA alone is insufficient to accelerate the retirement of coal and gas power plants and, correspondingly, lead to a rapid increase in clean electricity. Nearly 80% of the generation mix in 2030 must be carbon-free to meet the ambitious All-In target.

In the IIJA scenario, power sector emissions intensity decreases from 342 gCO<sub>2</sub>/kWh in 2020 to 288 gCO<sub>2</sub>/kWh in 2030. In contrast, the emissions intensity in the All-in scenario is 89 gCO<sub>2</sub>/kWh by 2030 (Figure 4).

Given that electric cars are expected to consume 90 TWh of electricity in 2030 under the IIJA scenario, 26 MtCO<sub>2</sub> are indirectly emitted upstream at the level of emissions intensity in the IIJA scenario. At the All-In scenario's level of emissions intensity, this level of electricity consumption results in only 8 MtCO<sub>2</sub> of indirect emissions. A cleaner power grid can therefore yield 18 MtCO<sub>2</sub> of additional indirect emission reductions from electric cars at IIJA's level of electrification and even more reductions with more ambitious electrification.

**FIGURE 4** | Electricity generation and emissions intensity in IIJA and All-In scenarios



In the All-In scenario, where the generation mix is close to 80% clean by 2030, emissions intensity in the power sector reaches 89 gCO<sub>2</sub>/kWh by 2030. In the IIJA scenario, where the generation mix is 51% clean, power sector emissions intensity is at 288 gCO<sub>2</sub>/kWh.

**Enhanced federal and bottom-up actions:** Additional non-federal and federal actions targeted at ZEV deployment, ICE retirement, and grid decarbonization will be crucial for meeting the NDC. However, once these incentives are put into place and make ZEVs price competitive, wider deployment of charging infrastructure and R&D into alternative fuels would help accelerate consumer adoption of ZEVs.

## Discussion

For the transportation sector, as well as for the economy as a whole, an all-of-society approach leveraging contributions from the federal government—both Congress and the Executive Branch—alongside actions from states, cities, businesses, civil society, and more will be critical to delivering sufficiently high levels of emissions reductions to achieve the overall U.S. NDC. While recent federal measures will enable new actions to drive down reductions—including enhanced vehicle fuel economy actions from EPA and significant new infrastructure investment from Congress—it is clear that though necessary, these actions alone are insufficient on their own to deliver the levels of reduction needed.

A broader strategy must therefore include additional actions from all-of-society. As key implementers, non-federal actors have innovated from the bottom-up over the past five years and cemented the transition to a clean economy.

Key actions and examples for further reductions include:

- **Investing in the deployment of charging infrastructure:** States and cities can pass updated building codes requiring new and renovated buildings to include multi-use charging infrastructure, including ZEVs.
- **Continuing to decarbonize electricity as rapidly as possible:** States, cities, and businesses can use federal funding to support the electrification of all public vehicles, such as EPA’s Clean School Bus Program, which plans to award \$5 billion to deploy electric school buses, nationwide<sup>10</sup>.
- **Accelerating research and development in alternative fuels technology:** The private sector can partner to move the capital needed for innovation in alternative fuels. For example, United Airlines has made strides in deploying sustainable aviation fuel<sup>11</sup>.
- **Identifying a role for local land-use and infrastructure planning in decision-making:** States can increase the number of site hosts and expand accessibility. For example, in West Virginia, all ten state park lodges have EV charging stations, and Washington’s rapid charging stations help extend bus services to rural areas<sup>12</sup>.

For all of these aspects, non-federal actors have innovated at the ground level over the past five years and in doing so have activated an accelerated transition to a clean economy. And for the transportation sector, it is clear that just as Congress and the Executive Branch must continue to press forward as rapidly as possible, innovation and implementation from the bottom-up must unlock the rapid decarbonization needed for the U.S. to achieve its 2030 climate, economic, and energy security goals.

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## Endnotes

- 1 Center for Global Sustainability, University of Maryland
  - 2 World Resources Institute at the time of analysis
  - 3 World Resources Institute
  - 4 New York City Energy Efficiency Corporation; Rocky Mountain Institute at the time of analysis
  - 5 Corresponding author
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