Evaluating the Biden Presidential Campaign's Transportation Policies

Prepared for API

November 13th, 2020

Outline

- Federal EV tax credit extension
- Scrapping older vehicles
- Fleet vehicle purchases
- EV charging station investments
- ZEV buses goal

- The policies listed above are selected from a number of proposed policies described in the Joe Biden campaign's clean energy plan.
  - Additional policies may be pursued, such as a national LCFS.

Caveats on Interpreting the Results

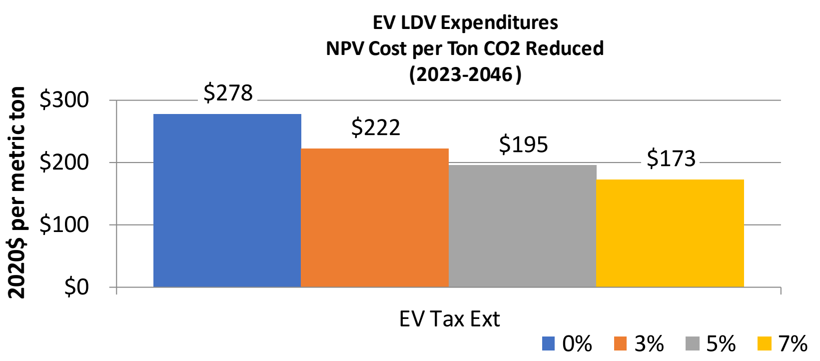
- There are uncertainties around consumer behavior and the scale of impact around these policies.

- The individual policy effects on CO_2 emissions were found to be small and therefore minor changes in assumptions can have a large impact on the cost of abatement and CO_2 emissions.

- This being stated we believe the results presented here are directionally correct.

Federal EV Tax Credit Extension Overview

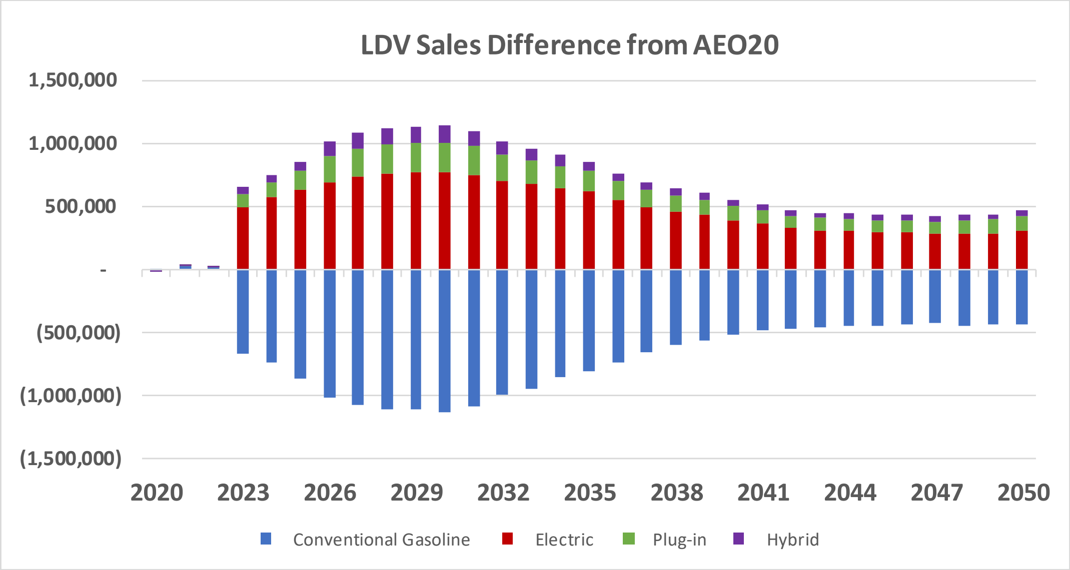
NPV Cost per Ton CO_2 (2020$ per metric ton) For years 2023-2046				
	Discount Rate			
	0%	**3%**	**5%**	**7%**
EV Tax Ext	$278	$222	$195	$173
NPV Costs (2020$ billions, diff from Ev Ext				
EV Tax Ext	$84	$68	$59	$52
NPV Costs (2020$ billions)				
AEO20	$5	$5	$5	$5
EV Tax Ext	$90	$73	$64	$57
Cumulative CO_2 Reductions (million metric tons, diff from Ref)				
	Transportation CO2 Emissions			
EV Tax Ext	304			
Cumulative CO_2 Emissions (million metric tons)				
	Transportation CO2 Emissions			
AEO20	40,544			
EV Tax Ext	40,240			



- Accelerate the adoption of zero-emissions vehicles paired with direct consumer rebates.
- <u>By the numbers</u>
  - $ 84 billion cost over 23 years.
  - 304 MMT Less CO2 emissions.
  - $278 per ton.
  - 0.75% reduction in transportation sector CO2 emissions.

Takeaways: Federal EV Tax Credit Extension

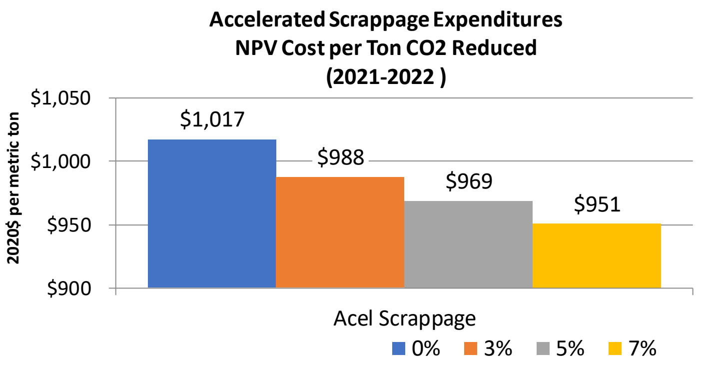
- Implementation assumes lifting of EV tax subsidy cap to 600,000 per manufacturer and tax credit is fully phased out on a calendar basis by 2046.
- EV sales are 11% higher during the duration of the tax credit and 40% higher overall than in the AEO2020.
- The EV tax credit extension is accompanied by a policy that maintains the projected improvements in fuel economy for new conventional LDVs.



Scrapping Older Vehicles Overview

NPV Cost per Ton CO2 (2020$ per metric For years 2021-2022				
	Discount Rate			
	0%	3%	5%	7%
Acel Scrappage	$1,017	$988	$969	$951
NPV Costs (2020$ billions, diff from Ev Ext				
Acel Scrappage	$3	$3	$3	$3
NPV Costs (2020$ billions)				
AEO20	$0	$0	$0	$0
Acel Scrappage	$3	$3	$3	$3

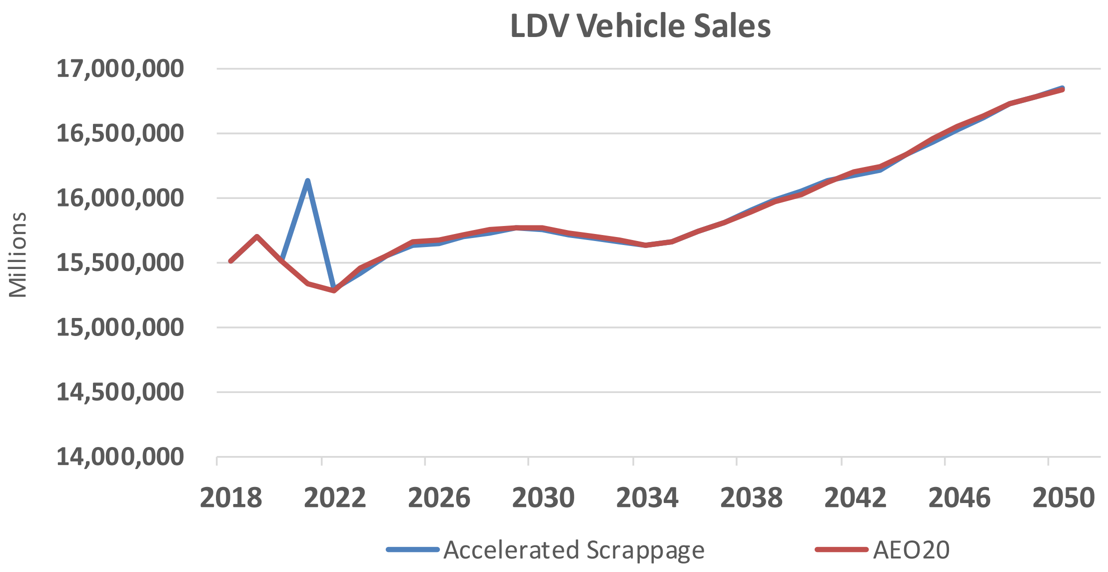
Cumulative CO_2 Reductions (million metric tons, diff from Ref)	
	Transportation CO2 Emissions
Acel Scrappage	3.3
Cumulative CO_2 Emissions (million metric tons)	
	Transportation CO2 Emissions
AEO20	3,687
Acel Scrappage	3,683



- Consumers provided with rebates to swap older, less-efficient, vehicles for newer made vehicles.
- <u>By the numbers</u>
  - $ 3.3 billion cost over 1 years.
  - 3.3 MMT less CO2 emissions.
  - $1,017 per ton.
  - Reduction of 0.10% in transportation sector CO2 emissions over the period.

Takeaways: Scrapping Older Vehicles

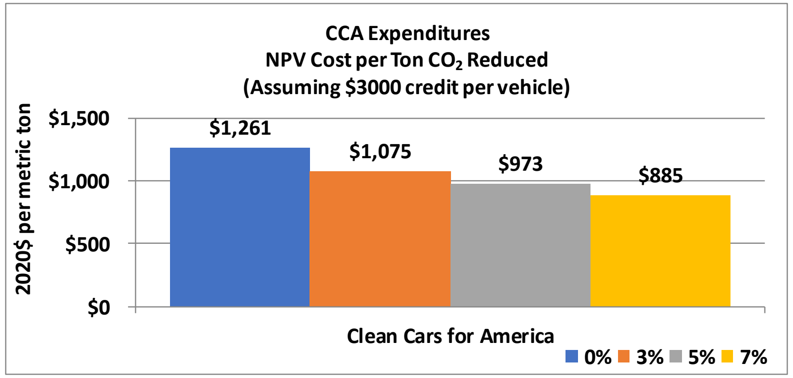
- Implementation in API-NEMS modeled after the previous "Cash for Clunkers" program and assumes a 5% increase in sales in 2021.
- Fuel economy improves by 0.24 mpg over the forecast period which helps drive emissions reductions.
- The implicit assumption is that the scrappage approach moves forward only a few years when older vehicles would be taken off the road.

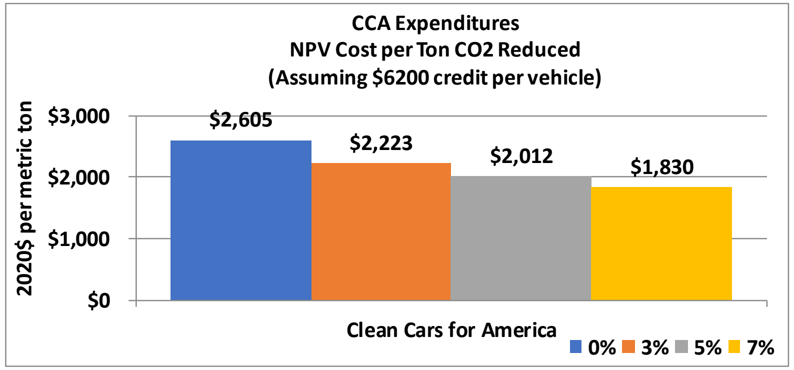


Alternative Approach: "Clean Cars for America" Policy

- Consumers provided with rebates in order to swap 63 million gasoline powered cars with ZEV Vehicles.
- Policy, as stated, to last for 10 years with $392 billion allocated in funding with the goal of replacing ~25% of the fleet.
- The emissions impact of replacing 63 million conventional vehicles with EVs and PHEVs from 2021-2030 estimated from the use of NEMS assumptions.

- <u>By the numbers</u>
  - $ 189 -392 billion cost over 10 years.
  - 150 MMT less CO2 emissions over 10 years.
  - $ 1,261-$2,605 per ton.
  - Reduction of 0.9% in transportation sector CO2 emissions over the period.





ZEV Government Fleet Vehicles Overview

NPV Cost per Ton CO2 (2020$ per metric ton) **For years 2020-2050**

Fleet Policy	Discount Rate			
	0%	3%	5%	7%
Fleet Policy	$2,626	$1,638	$1,242	$967

NPV Costs (2017$ billions, diff from Ev Ext

Fleet Policy	$88	$55	$42	$32

NPV Costs (2017$ billions)

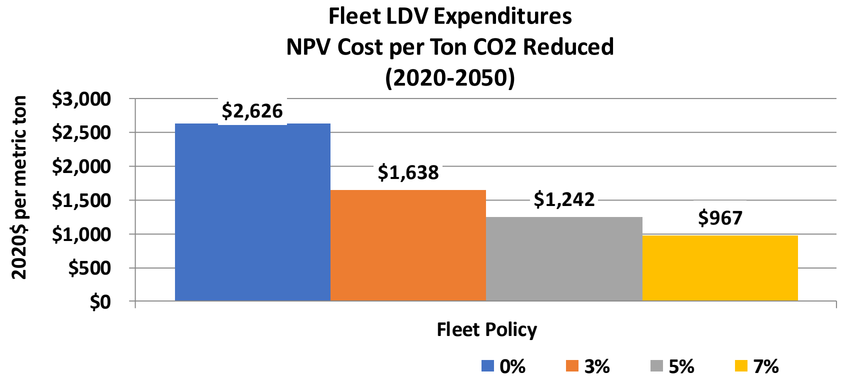
AEO20	$3,519	$2,243	$1,736	$1,386
Fleet Policy	$3,607	$2,298	$1,777	$1,418

Cumulative CO_2 Reductions (million metric tons, diff from Ref)

	Transportation CO2 Emissions
Fleet Policy	33

Cumulative CO_2 Emissions (million metric tons)

	Transportation CO2 Emissions
AEO20	52,947
Fleet Policy	52,914

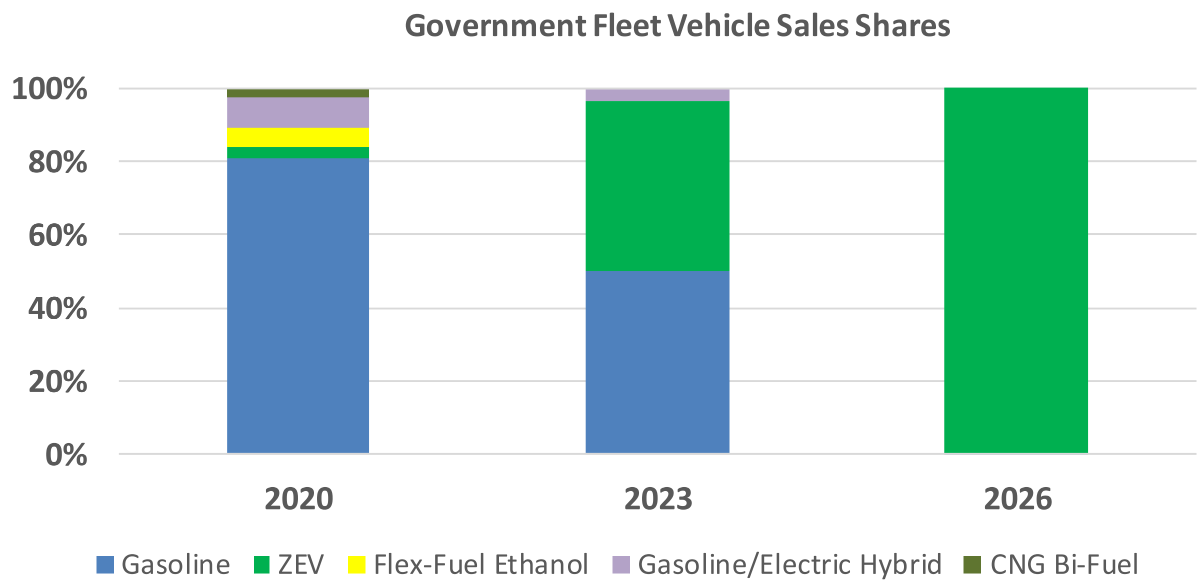


- Federal commitment to purchase clean vehicles for government fleets through an upgrade of three million vehicles in these fleets.

- <u>By the numbers</u>
  - $88 billion cost over 30 years.
  - 33 MMT less CO2 emissions.
  - $2,626 per ton.
  - Reduction of 0.06% in transportation sector CO2 emissions.

Takeaways: ZEV Government Fleet Vehicle Purchases

- Conventional vehicles purchases are phased out by 2025 and 100% of sales are ZEV by 2026.
- The stock of government fleet vehicles reach 3 million ZEVs by 2035.
- Fleet energy consumption declines by 4% due to the increased penetration of ZEVs.



Takeaways: EV Charging Station Investments

- Rapid build out of charging stations in AEO2020 assumes fueling availability parity with gasoline by the early 2020's. Thus additional EV stations would have **no impact** on increasing the number of EV sales or decreasing emissions.
- Cost estimate assumes the 500,000 stations would either be representative of the current historical shares of L2 and L3 charging stations. Or that all newly built stations would be L3 chargers.
- The range of costs is driven by the ultimate mix of stations that are built.

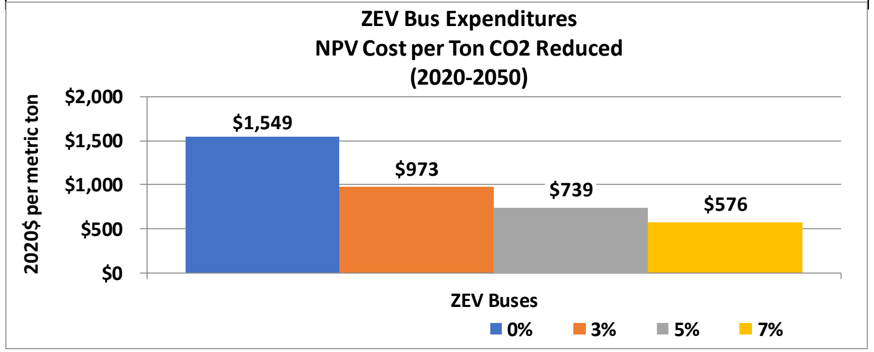
- By the numbers
  - $ 7-23 billion for build out of 500,000 chargers.
  - Potentially, zero impact on sales and emissions.

Charging level	Cost	Voltage	Typical power	range miles per charging hour	Location
Level 1	--	120 V AC	1.2–1.4 kW AC	3–4 miles	Primarily home and some workplace
Level 2	$7,073	208 V – 240 V AC	3.3–6.6 kW AC	10–20 miles	Home, workplace, and public
DC fast	$54,373	400 V – 1,000 V DC	50 kW or more	150–1,000 miles	Public, frequently intercity

Note: Costs represent direct cost of charging equipment. Does not include utility infrastructure upgrades needed.

ZEV Buses Policy Overview

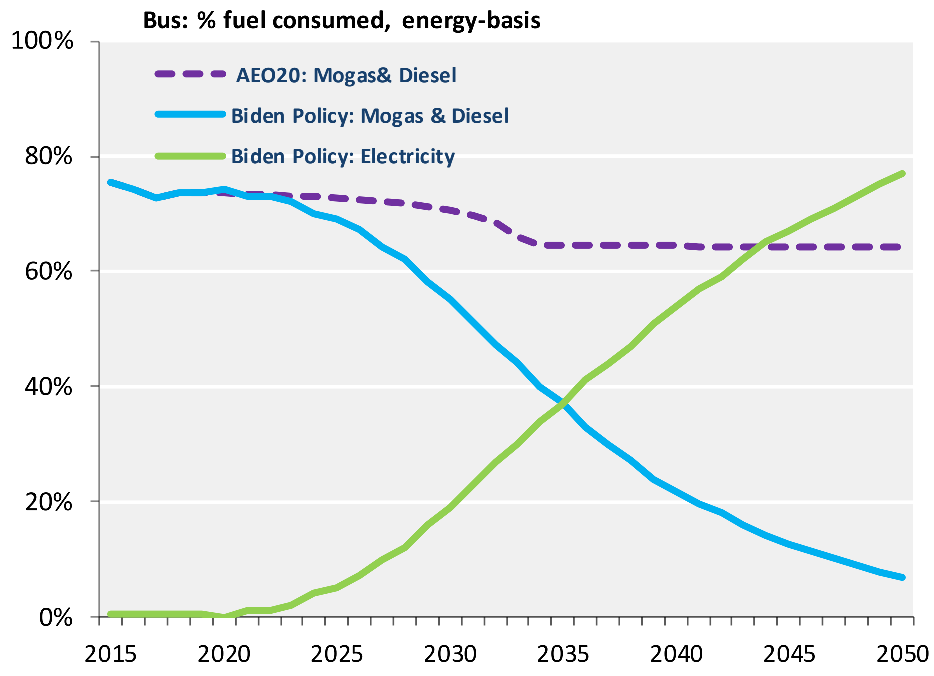
NPV Cost per Ton CO2 (2020$ per metric ton)				For years 2020-2050
	Discount Rate			
	0%	3%	5%	7%
ZEV Buses	$1,549	$973	$739	$576
NPV Costs (2020$ billions, diff from Ev Ext				
ZEV Buses	$175	$110	$83	$65
NPV Costs (2020$ billions)				
AEO20	$0	$0	$0	$0
ZEV Buses	$175	$110	$83	$65
Cumulative CO_2 Reductions (million metric tons, diff from Ref)				
	Economy-Wide			
ZEV Buses	113			
Cumulative CO_2 Emissions (million metric tons)				
	Transportation CO2 Emissions			
AEO20	52,947			
ZEV Buses	52,834			



- All buses sold will be zero-emissions by 2030.
- <u>By the numbers</u>
  - $175 billion cost over 30 years.
  - 113 MMT less CO2 emissions.
  - $1,549 per ton.
  - Reduction of 0.21% in transportation sector CO2 emissions.

Takeaways: ZEV Buses Goal

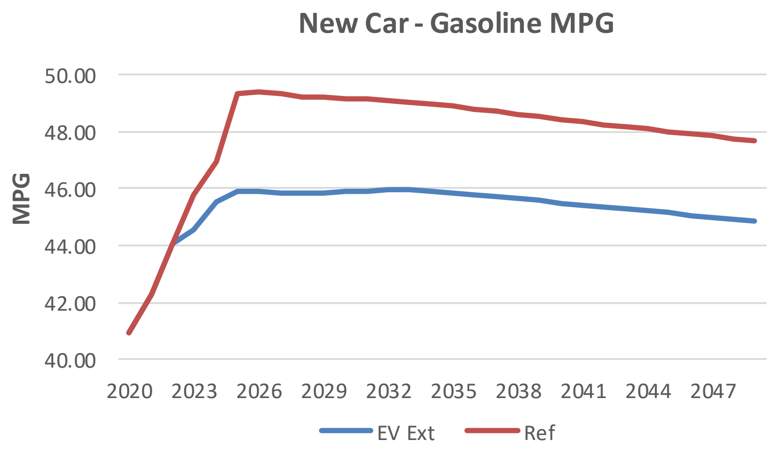
- Implemented for API-NEMS using a stock model to determine the change in the fuel share over time based on sales of electric buses.
- The analysis estimates that by 2050 electricity makes up ~80% of the fuel share consumed by buses.
- The cost differential of an electric bus compared to a diesel bus declines from $407,000 in 2020 to $200,000 in 2030.

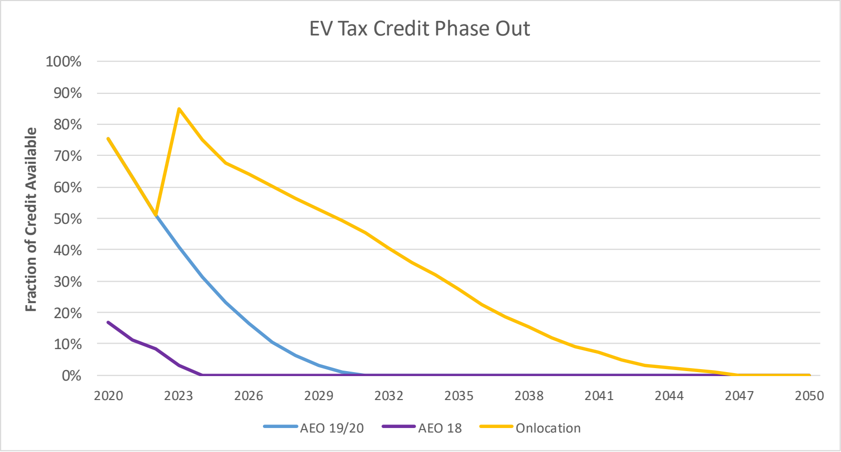


Appendix

Policy: Federal EV Tax Credit Extension

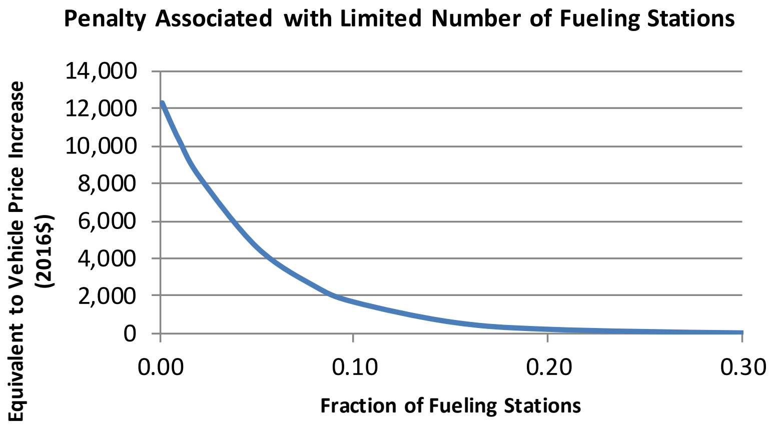
- Results:
  - New conventional vehicle MPG begins decline at the start of the EV tax credit and is an average of 6% lower than the AEO20 by 2050.
  - The falling conventional vehicle fuel economy also drives fuel economy lower for PHEV’s and Hybrids.
  - If the CAFE standard assumption used instead the Trump’s administrations SAFE rule, a less stringent standard, we would get higher marginal CO_2 emissions impact from the policy.
    - Directional impact of the SAFE rule as Reference case

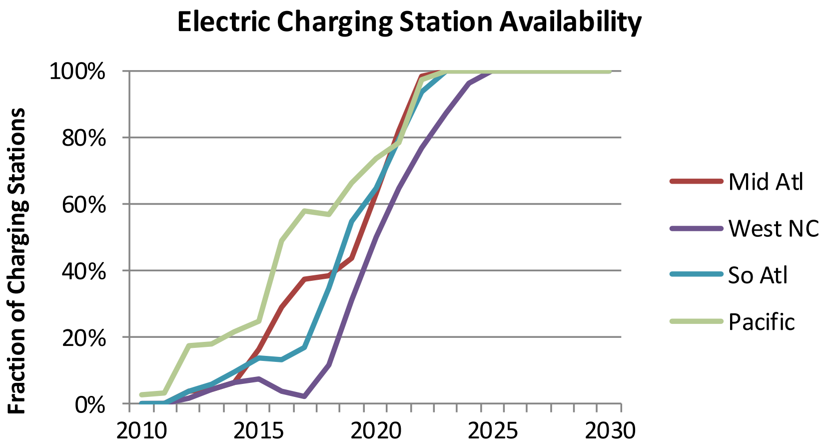




Policy: EV Charging Stations

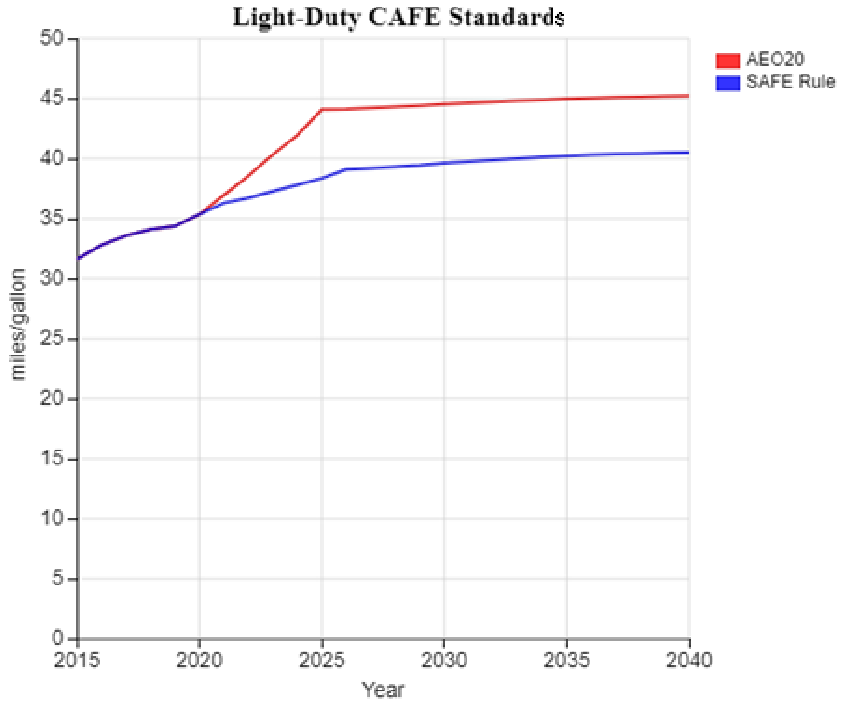
- Results:
  - EV charging stations builds are tied to vehicles sales in the model and is a variable in the consumer choice logit for how consumers are deciding on what vehicles to purchase.
  - In the AEO20 there is rapid build out of charging stations, so the consumer preference penalty is moot.
  - There is a steep penalty associated with a low number of charging stations. The model does not track the cost of building out charging stations or who is paying.





Reference Case Assumption: CAFE Standards

- **AEO20 Reference Case**: Increase in MPG by 5 percent per year above Model Year (MY) 2020 for MYs 2021-2025.
  - The standard correspond to approximately a fleet-wide CAFE equivalent of 44 miles per gallon by MY 2025.
- **SAFE CAFE Rule**: Increase in MPG by 1.5 percent per year above Model Year (MY) 2020 levels for MYs 2021-2026.
  - The standards correspond to approximately a fleet-wide CAFE equivalent of 39 miles per gallon by MY 2026.
- **SAFE Rule Effects**:
  - Results in 3.4% higher conventional vehicles sales and 2% higher conventional stock than the AEO 2020
  - Transportation motor gasoline consumption Is 3.6% higher than in the AEO 2020.
  - Cumulative transportation CO2 emissions under a SAFE rule scenario would be 1,512 MMT higher than in the AEO20 which would cause the effect of the transportation policies outlined to have a greater marginal impact on the volume of CO2 reductions.



About API-NEMS

- OnLocation's modeling and policy analysis was developed for API with the National Energy Modeling System (API- NEMS), the same modeling software used to build EIA's Annual Energy Outlook (AEO). The Reference Case referred to throughout is from the AEO 2020. Results are based on assumptions, laws and regulations that were in place in 2020.
- As with any model, the economic relationships here are a simplification of reality. Yet, even with these limitations, models are essential to make quantitative projections about the future.