

Transportation & Climate Initiative

Reference Case Results Webinar

August 8, 2019



**TRANSPORTATION &
CLIMATE INITIATIVE**

Of the Northeast and Mid-Atlantic States

The “Reference Case”

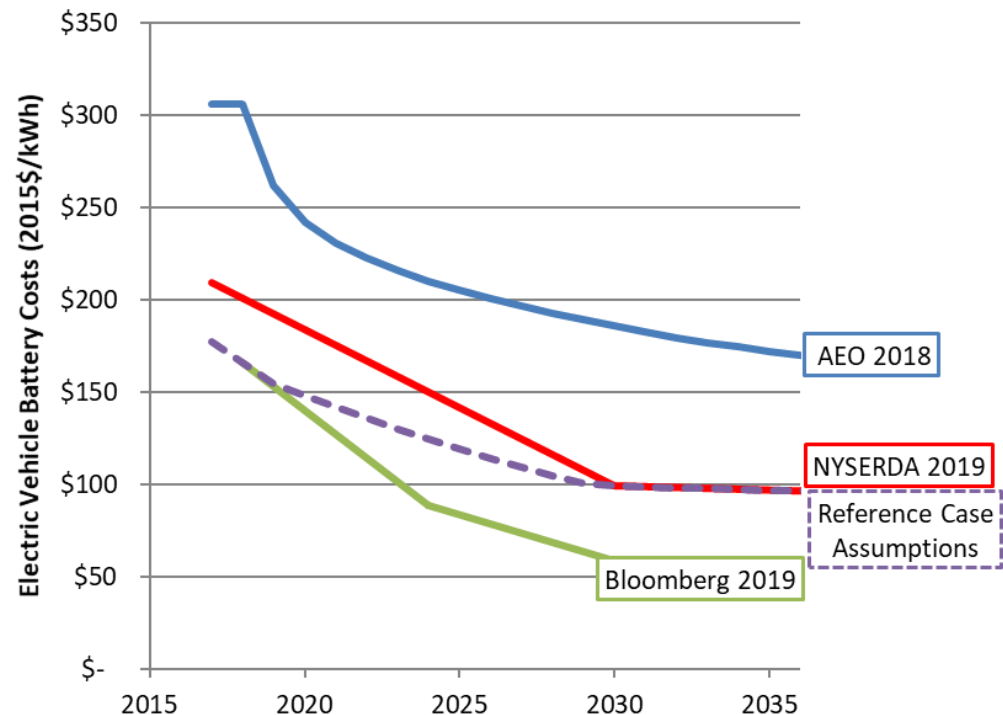
- The TCI analysis process begins with a Reference Case, which estimates emissions, fuel use, and other aspects of the transportation system **in the absence of any TCI "cap and invest" program.**
- The states proposed assumptions for the reference case via webinar on May 23, and have incorporated input received.
- Potential program options will be evaluated in Policy Scenarios that apply a carbon cap and investments to this reference case.

Recap of Last Webinar

- May 23 webinar explored assumptions for transportation modeling:
<https://www.transportationandclimate.org/webinar-reference-case-assumptions-policy-program-design>
- We received input on:
 - Electric Vehicle (EV) battery costs
 - EV model introduction years
 - Vehicle Miles Traveled (VMT) projections
 - Federal fuel economy and vehicle emission standards
- All submissions received are posted online at:
<https://www.transportationandclimate.org/tci-regional-policy-design-stakeholder-submissions>

Electric Vehicle Costs

- The states identified alternatives to built-in assumptions from the Energy Information Administration (EIA's AEO 2018), including NYSERDA analysis.
- Some stakeholders suggested using latest Bloomberg projections.
- The TCI reference case takes a hybrid approach:
 1. Begin at Bloomberg
 2. Converge to NYSERDA
- Non-battery costs also adjusted to hybrid NYSERDA and ICCT/UBS estimates.



SOURCES:

NYSERDA: <https://www.nysERDA.ny.gov/-/media/Files/Publications/Research/Transportation/19-07-Benefit-Cost-Analysis-EV-Deployment-NYS.pdf>

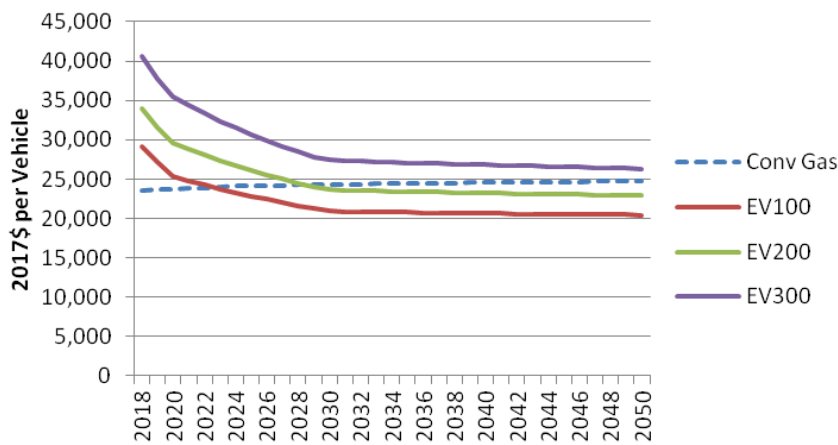
Bloomberg New Energy Finance: <https://about.bnef.com/electric-vehicle-outlook/>

International Council on Clean Transportation (ICCT): https://www.theicct.org/sites/default/files/publications/EV_cost_2020_2030_20190401.pdf

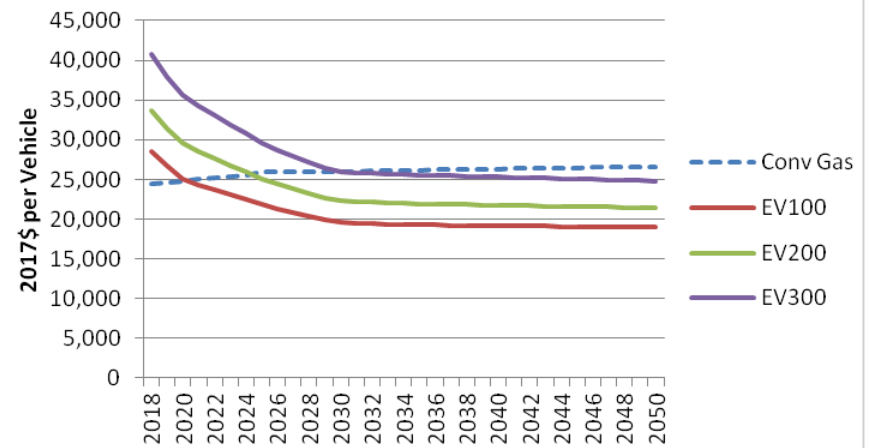
Light-Duty Vehicle Purchase Prices

- With the TCI battery and revised incremental non-battery costs, the mid-size car EV 100 and EV 200 prices fall below the conventional gasoline vehicle price by 2030. EV 300 prices remain slightly above the cost of conventional cars.
- For small SUVs, EVs of all ranges become less expensive than conventional vehicles by 2030.

Price of Midsize Cars



Price of Small Utility



Vehicle Introduction Years

- New vehicle types are assumed to be introduced over time, but not all are available in every size class.

Adjusted vehicle introduction year assumptions:

	CARS						LIGHT TRUCKS					
	2 Seater Cars	Mini Cars	Subcom Cars	Compact Cars	Midsize Cars	Large Cars	Compact Pickups	Std Compact Pickups	Std Compact Vans	Std Compact Vans	Std SUVs	Std SUVs
Turbo DI Diesel	2051	2051	2010	1990	2004	2007	2007	1995	2010	1990	2010	1995
Flex-Fuel Ethanol	2013	2015	2011	2009	2003	1993	1999	2002	1998	2003	2007	2002
Gasoline/Electric Hybrid	2015	2041	2011	1999	2005	2009	2017	2011	2016	2018	2008	2005
Diesel/Electric Hybrid	2051	2051	2040	2030	2030	2030	2051	2026	2030	2030	2030	2030
Plug-In Hybrid (10 mile)	2015	2051	2025	2014	2012	2014	2051	2051	2018	2019	2016	2019
Plug-In Hybrid (40 mile)	2020	2051	2018	2011	2014	2015	2019	2020	2020	2051	2018	2020
Electric Vehicle - 100 mile	2014	2015	1995	2011	2011	2051	2051	2051	2018	2019	2018	2051
Electric Vehicle - 200 mile	1995	2051	2020	2018	2018	2013	2019	2021	2020	2022	2016	2020
Electric Vehicle - 300 mile	2020	2051	2020	2020	2015	2012	2051	2021	2051	2051	2016	2016
CNG Bi-Fuel	2051	2051	2051	1990	2051	2000	2051	1990	2051	1990	2051	2051
Dedicated CNG	2051	2051	2051	1990	2051	1990	2051	1990	2051	1990	2051	2051
Hydrogen Fuel Cell	2051	2051	2012	2020	2012	2012	2051	2051	2015	2051	2015	2025

- The states sought input on availability of PHEV and EV light truck availability; updated introduction years (in green) based on latest manufacturer offerings.

Vehicle Miles Traveled (VMT)

- Total VMT for TCI region - Includes cars, light-duty trucks, commercial light trucks (CLT), and freight trucks.
- VMT growth calibrated to state projections.
- Light-Duty Vehicles (LDVs) and CLTs account for 93% of total VMT; freight trucks 7%.
- LDV grows by 8% from 2022 through 2032.
- Freight truck VMT grows by 10% from 2022 through 2032.

Fuel Economy Standards

- Corporate Average Fuel Economy (CAFE) standards are scheduled to improve through 2025.
- In August 2018, the U.S. EPA and NHTSA proposed freezing standards for LDVs at 2020 levels from 2021-2026.
- The states have assumed that the current standards take effect as scheduled through 2025.
- Some stakeholders suggested assuming continued improvement after 2025; the states have identified that as an assumption to explore in *Sensitivity Analysis* later.

Sensitivity Analysis

- The states will explore the impact of alternate assumptions in Sensitivity Analysis later in the process.
- High priority assumptions to vary:
 - More expensive vs less expensive EVs
 - CAFE rollback vs CAFE extension
- Input welcome on other assumption changes to explore.

Reference Case Results

- OnLocation will present results from the TCI Reference Case.
- The states are focusing attention on results through 2032, but the model runs through 2050.
- Policy Scenarios would reflect hypothetical caps that take effect in 2022; results through 2032 would capture subsequent decade.



Reference Case Webinar

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OnLocation Inc.

August 8, 2019

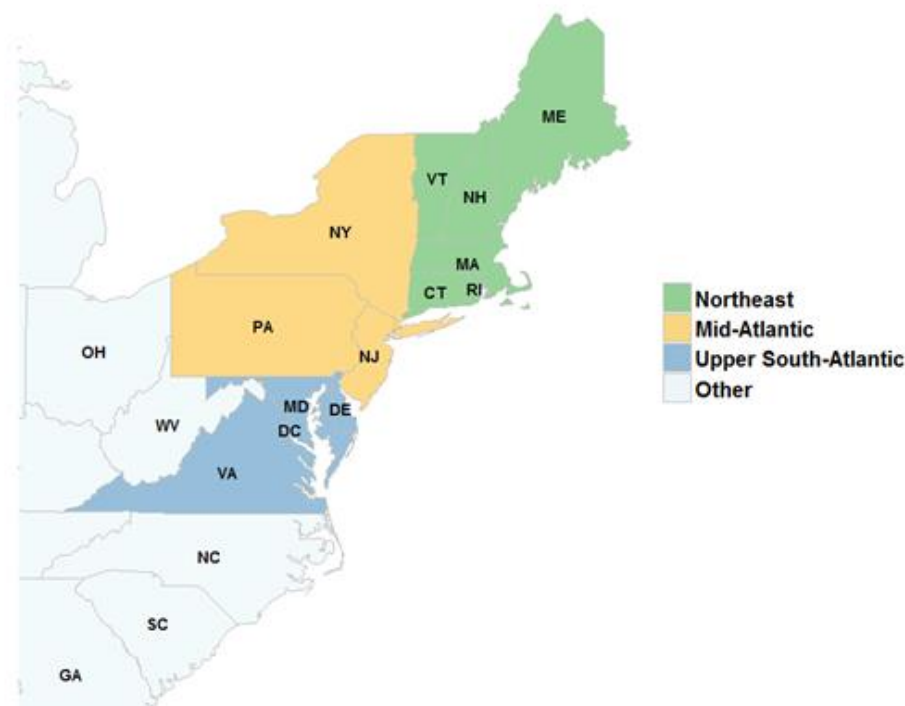


Overview of NEMS

- The National Energy Modeling System (NEMS) is an integrated energy model that includes energy supply and production by fuel type, energy consumption by end-use sector, electricity production, and petroleum refining.
- NEMS was developed by the Energy Information Administration (EIA) – an independent agency within the Department of Energy.
 - Used by EIA for its Annual Energy Outlook (AEO) projections, as well as Congressional and other agency requests.
 - Also used extensively outside of EIA (NGOs, private sector, etc).
- NEMS provides annual results through 2050 with significant detail by fuel and sector.

TCI Region

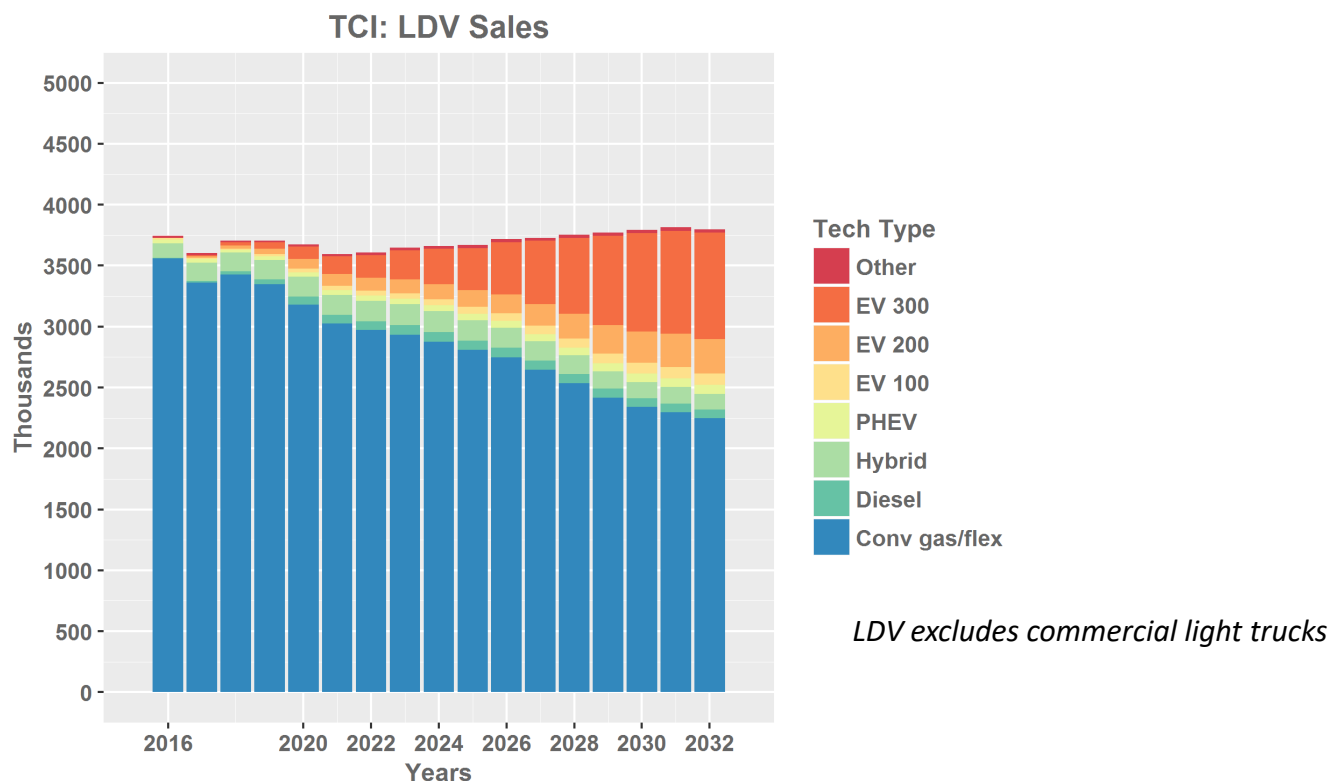
- In the TCI-NEMS* modeling for this study, the TCI region is represented by 3 regions: Northeast, Mid-Atlantic and Upper South Atlantic.



** For this analysis, we have split the South Atlantic Census Division into 2 subregions and renamed the model TCI-NEMS*

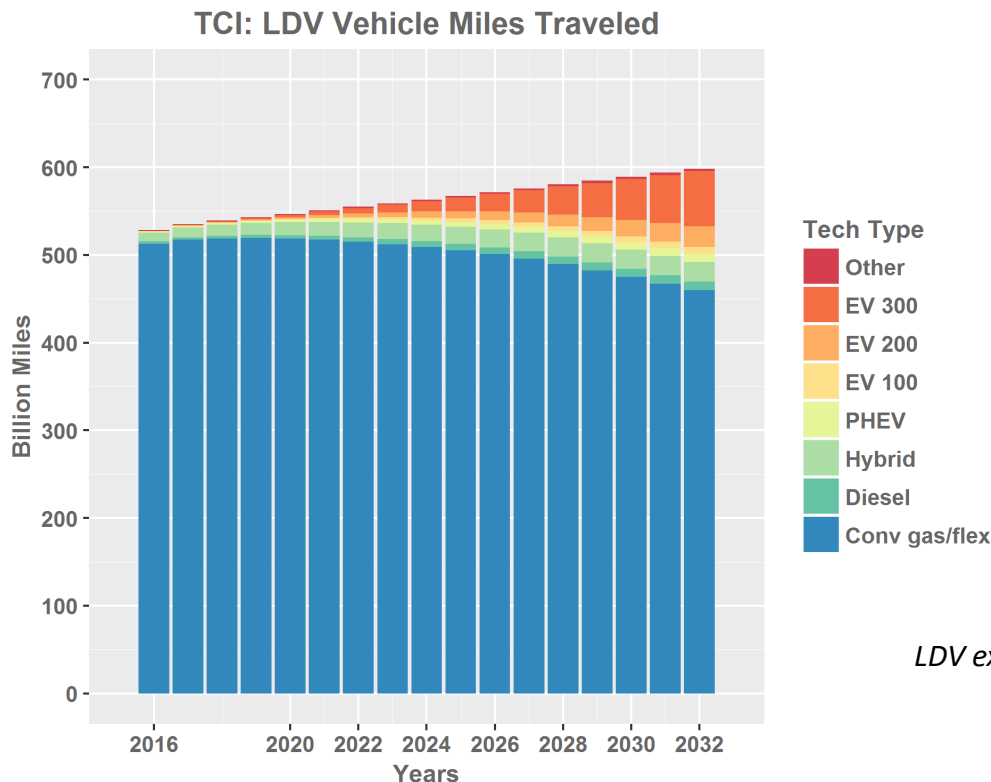
Light-Duty Vehicle Sales by Technology Type

- EV sales gain share in both car and light truck markets.
 - By 2032, EVs comprise roughly one-third of LDV sales.



Light-Duty Vehicle VMT

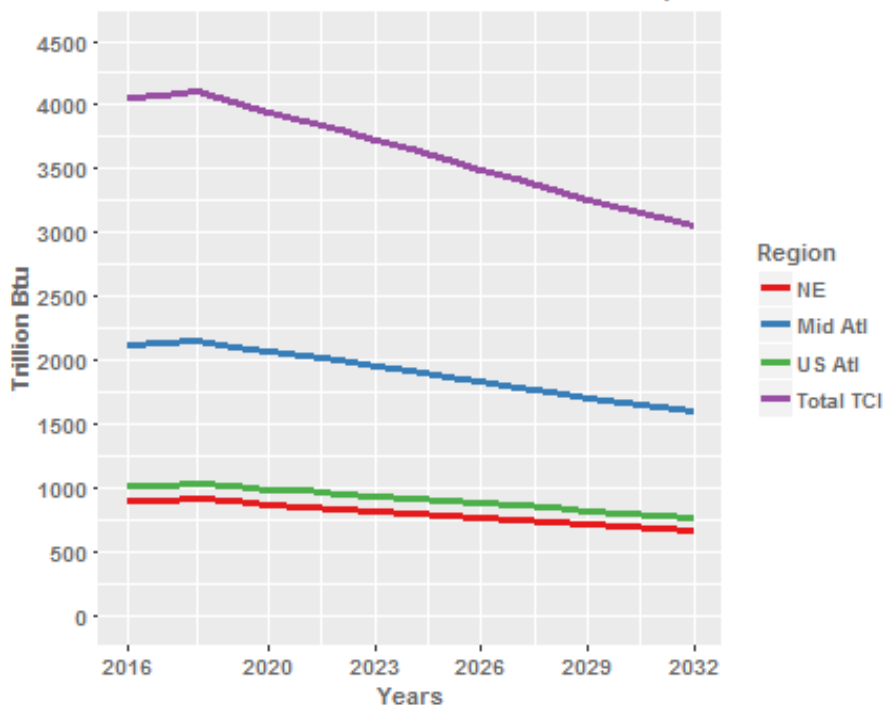
- As sales of EVs increase and vehicle stocks rise, EVs make up a larger share of total VMT in the region with a share of 16% in 2032.



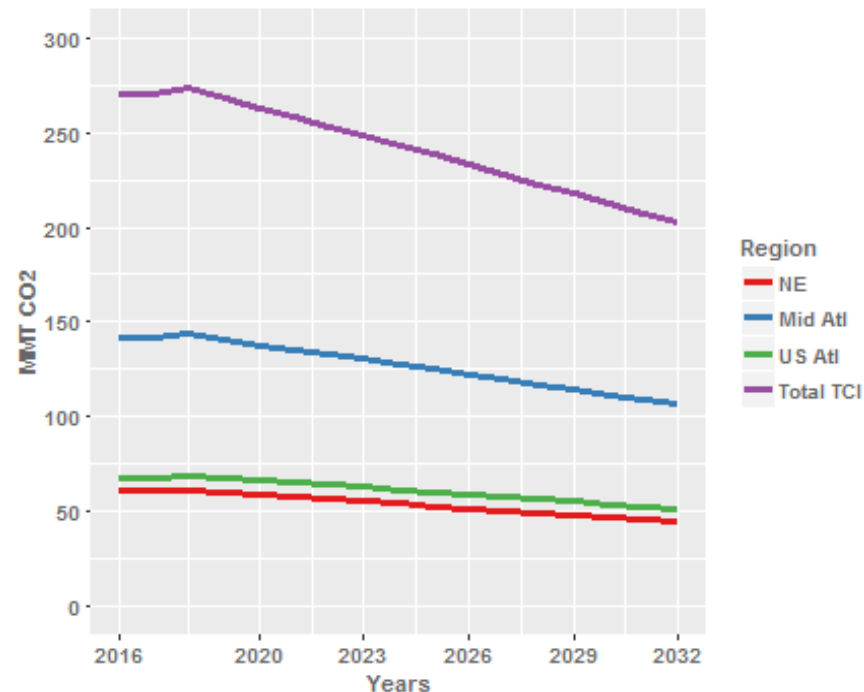
Total Motor Gasoline and On-Road Diesel Consumption and CO2 Emissions

- Total gasoline and diesel consumption and CO₂ emissions both fall by roughly 20% from 2022 through 2032 as a result of increased fuel economy in light and heavy-duty vehicles and increased LDV EV shares.

Combined Gasoline and Diesel Consumption

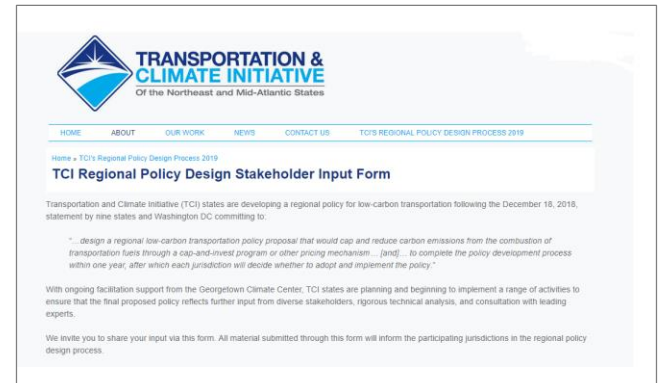


Combined Gasoline and Diesel CO2 Emissions



Next Steps

- Potential program options will be evaluated in "Policy Scenarios" that apply a cap and investments to this reference case.
- Input welcome - please submit written input to:
<https://www.transportationandclimate.org/main-menu/tci-regional-policy-design-stakeholder-input-form>
- THANK YOU!



Appendix – Other Assumptions

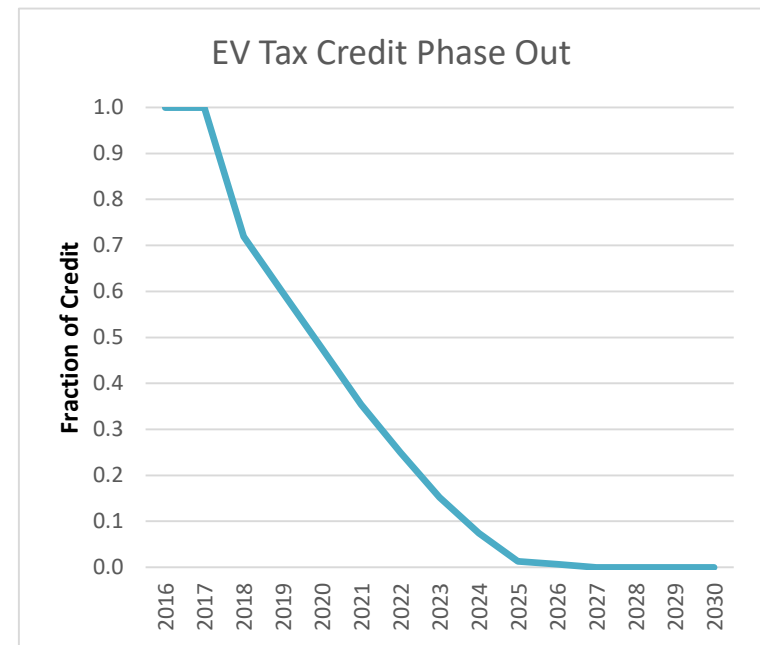
Electricity Sector & RGGI

The states have adjusted the 2018 Annual Energy Outlook (AEO 2018) assumptions to reflect assumptions from latest NJDEP modeling of RGGI:

- Firm Builds & Retirements
(<https://www.state.nj.us/dep/aqes/rggi.html>)
- State Offshore Wind Goals & Procurements (8,480MW by 2030)
- State Renewable and Clean Energy Programs
- State Energy Efficiency Programs
- National Renewable Energy Laboratory (NREL) Renewable Energy Cost Projections (2018 Annual Technology Baseline)

Federal EV Tax Credit

- The states have incorporated OnLocation's estimates for federal tax credit phase-out into the Reference Case.
- The Federal government offers tax credits of up to \$7,500 for the purchase of electric vehicles.
- The tax credit eligibility and phase-out are tied to individual vehicle manufacturers and the phase-out begins when cumulative sales of qualified vehicles reach 200,000.
 - Because NEMS does not track vehicle sales by manufacturer, the credits are assumed to phase-out over time.
 - The AEO2018 phase-out rate appeared out-of-date, so OnLocation has modified it based on projections of manufacturers EV sales expectations.



ZEV Mandates & State EV Incentives

- The AEO 2018 Reference Case includes Zero Emission Vehicle (ZEV) mandates for California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont.
- The requirement for sales of ZEVs starts at 4.5% of total sales for model year 2018 and increases to 22% for model year 2025. After 2025, requirements remain at 22%.
- TCI states currently provide a range of incentives for clean vehicles that meet the ZEV mandate requirements -- electric vehicles, plug-in hybrid electric vehicles, and fuel cell vehicles.
- The states have incorporated representations of the ZEV mandate and states' current EV subsidies into the Reference Case.

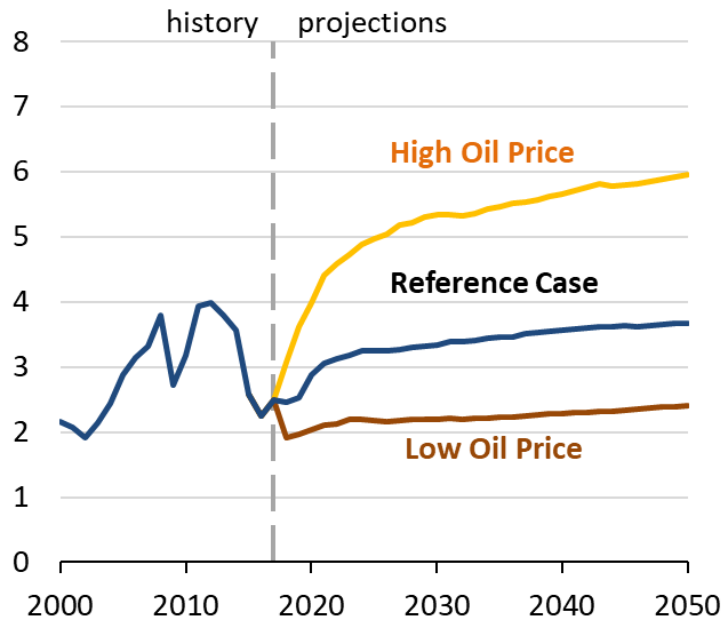
Fuel Prices

- The states have incorporated the AEO 2018 Reference Case assumptions for oil and natural gas prices.
- In the AEO 2018 Reference Case, gasoline and diesel prices rise by 1.2% and 1.3% annually, respectively, from 2017 through 2050.

Motor gasoline retail prices

2017 dollars per gallon

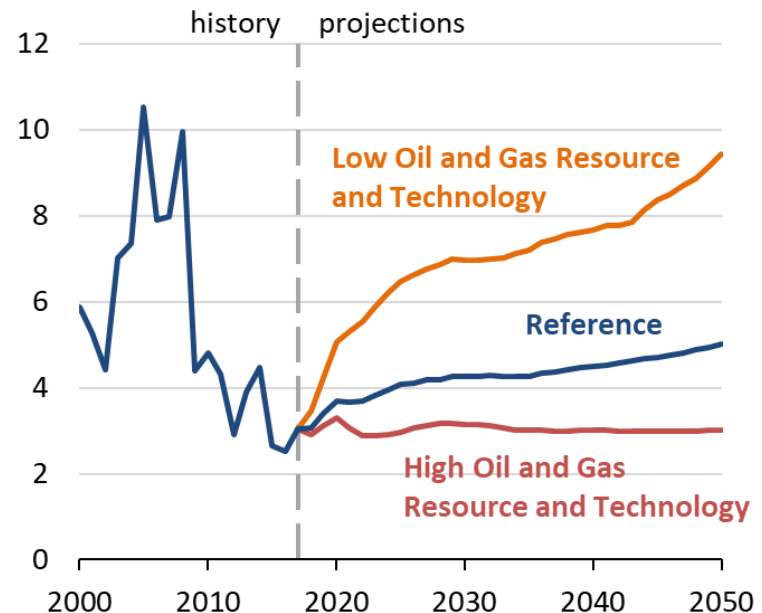
2017



Natural gas spot price at Henry Hub

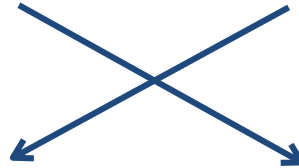
2017 dollars per million British thermal units

2017



How does the **CAP** affect the transportation sector (& others)?

How do the **INVEST**ments affect the transportation sector?



What are the impacts from the program?
(economic impacts, public health)

Who bears those impacts?



CAP

INVEST

NEMS

- Energy system model
- Effect of cap & other policies on transportation energy use & GHGs
- Interactions with other sectors (e.g. electrification)

OnLocation

Allowance
Proceeds

Investment
Impacts

Investment Strategy Tool

- VMT changes due to certain low-carbon transportation investment strategies

Cambridge Systematics

Capital
Costs,
Fuel
Savings,
etc.

Co-
Pollutant
Emissions

Active
Transportation

Other
Costs

REMI

- Net impacts on GDP, income, jobs

Cambridge Systematics

Health Impacts Model

- Health co-benefits of air pollution reductions

Harvard School of Public Health

Incidence Model

- Distribution of costs & benefits to different populations/ groups

Impacts: Emissions, Economy & Health, and how Distributed