Maryland
Department of the Environment

GGRA Modeling Update

This presentation does not represent any state policy positions nor does it represent a proposed state climate plan. This is a scenario specified by the MWG. It is one of several to be used to guide the state in developing a climate plan. These materials are informational only and should not be used for any other purpose.

November 13, 2018

Energy+Environmental Economics

Maryland Pathways
Policy Scenario 3: Carbon Price Scenario

November 13th, 2018

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Policy Scenario 3 Measures

- **Philosophy: Carbon Pricing Program in addition to complementary policy**
- **Includes:**
  - All measures from Policy Scenario 1 (see next slide)
  - Escalating carbon price, translating into direct and indirect impacts in Maryland
    - Direct impacts to energy consumption based on higher fuel prices
    - Indirect impacts based on revenue being used for mitigation programs in Maryland

Reminder: Policy Scenario 1 Measures

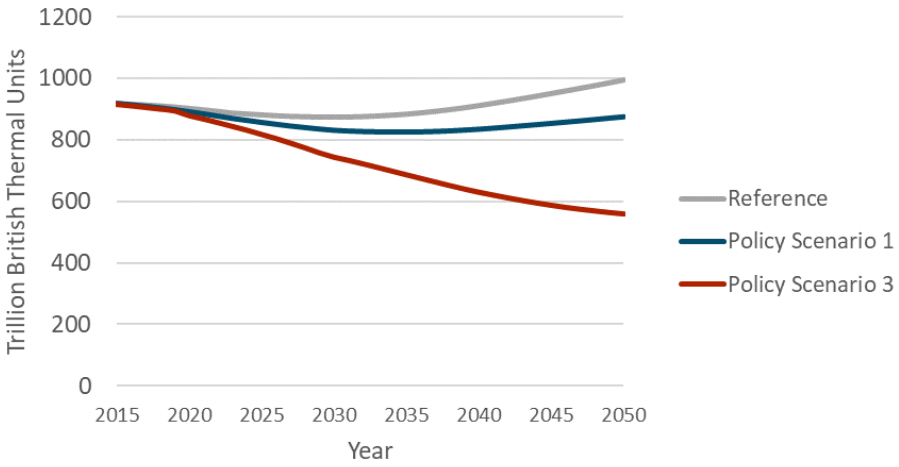
- **Philosophy: Continuation or Extension of current programs**
- **Includes:**
  - Continued effort for energy efficiency in buildings
  - Additional ZEV sales for light-duty transit
  - Reduction in vehicle-miles traveled and other MDOT measures
  - 50% RPS by 2030 (HB1435/SB0732)
  - Smart Growth (75% compact development goal)
  - Additional acreage in forest management and healthy soils conservation practices

How does a carbon price affect Maryland?

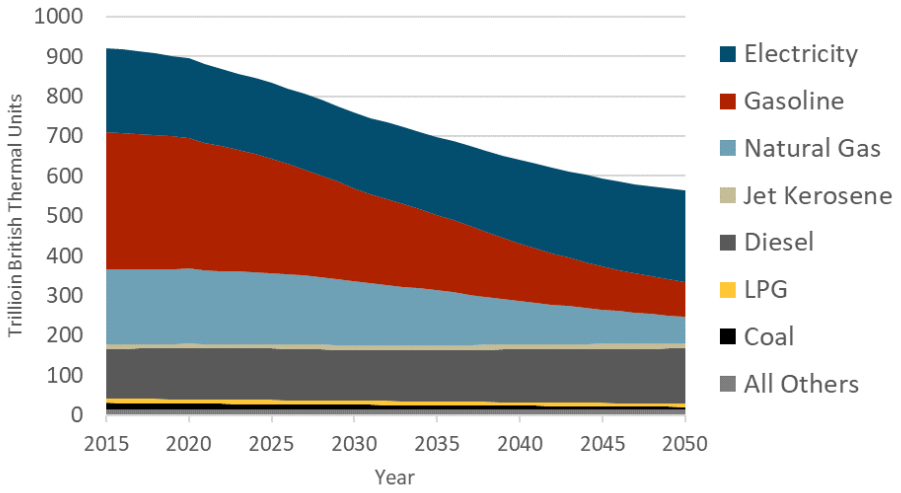
- **Direct Impact – price response in energy demand**
  - Reduced energy consumption due to higher fuel costs
  - Increased investment in energy-efficient equipment
- **Direct Impact – price response in electric supply**
  - Early retirement of coal and oil combustion turbine power plants
  - Increased electricity imports and solar generation
- **Indirect Impact – revenue funding mitigation programs, including:**
  - Additional 200,000 EVs on the road by 2030,
  - 50% electric bus fleet in 2030,
  - Transit capacity expansion,
  - Expanded bike and pedestrian system development

Policy Scenario 3 Measures
Price response reflected in energy consumption

Total Energy Consumption by Scenario



Total Energy Consumption by Fuel Policy Scenario 3



- PS3 has significant reduction in energy consumption due to carbon price effects:
  - 9% reduction in 2030 and 35% in 2050 relative to PS1

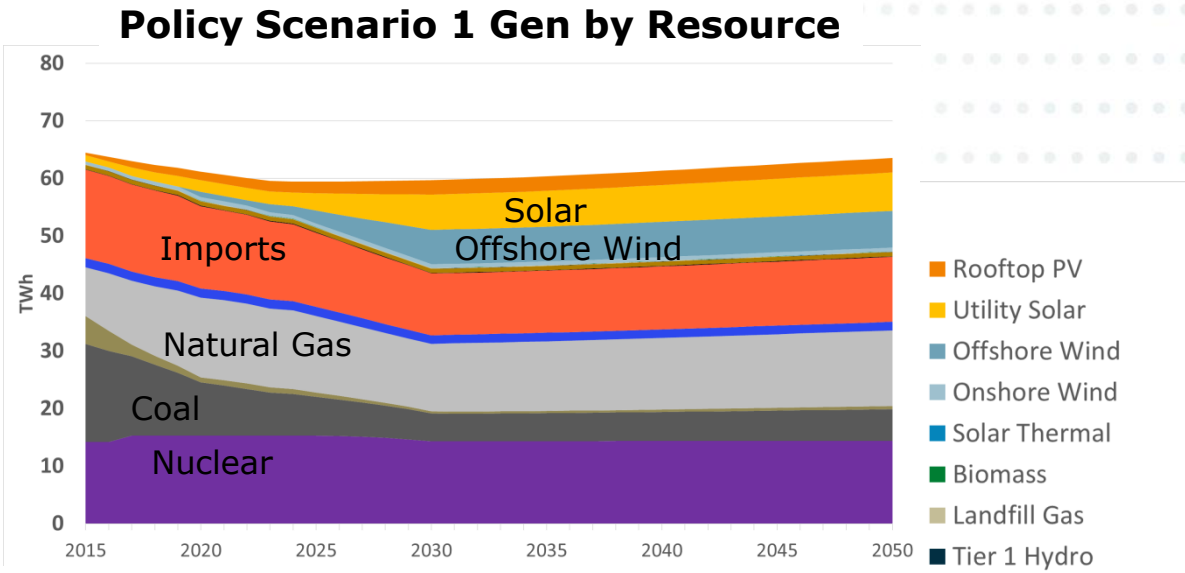
- Gasoline consumption is impacted the most by carbon price and mitigation spending, followed by natural gas.

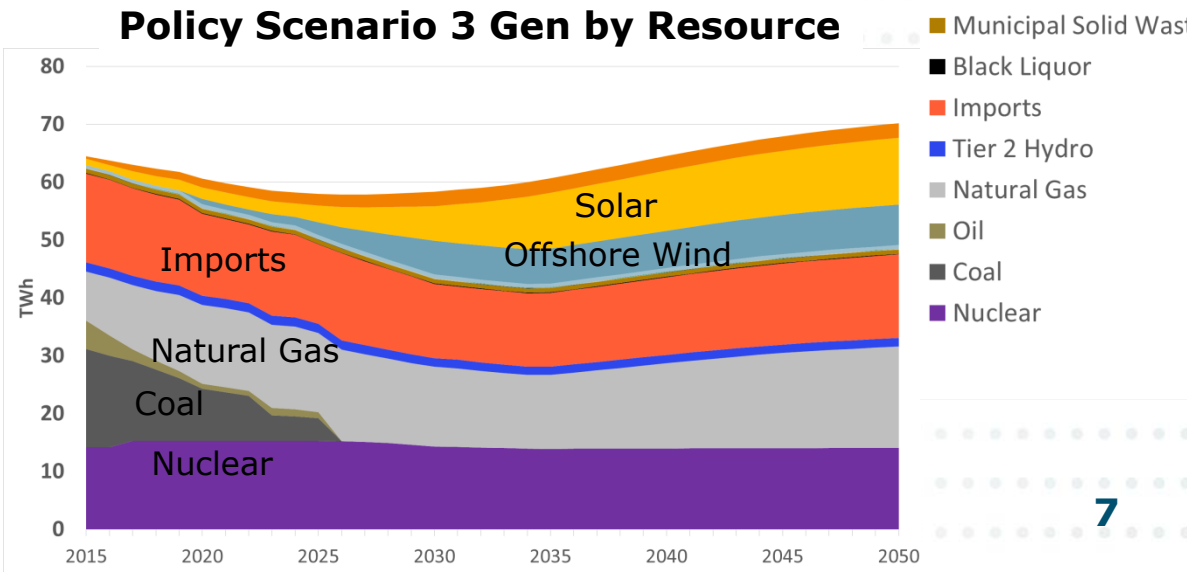
Policy Scenario 3 Measures
Price response reflected in electric supply

50% RPS by 2030 (HB1435/SB0732)

- 25% RPS in 2020, 50% RPS in 2030, with solar (14.5%) and offshore wind (10%) carveouts
- Coal and Oil CT resources are phased out as carbon price increases
- In-state solar penetration increases post-2030 to 20%
  - Consistent with PJM modeling on ability of system to handle 30% intermittent resources

Coal and Oil CTs start to ramp down at ~$30/MWh





Policy Scenario 3 Measures
Revenue funds additional transportation actions

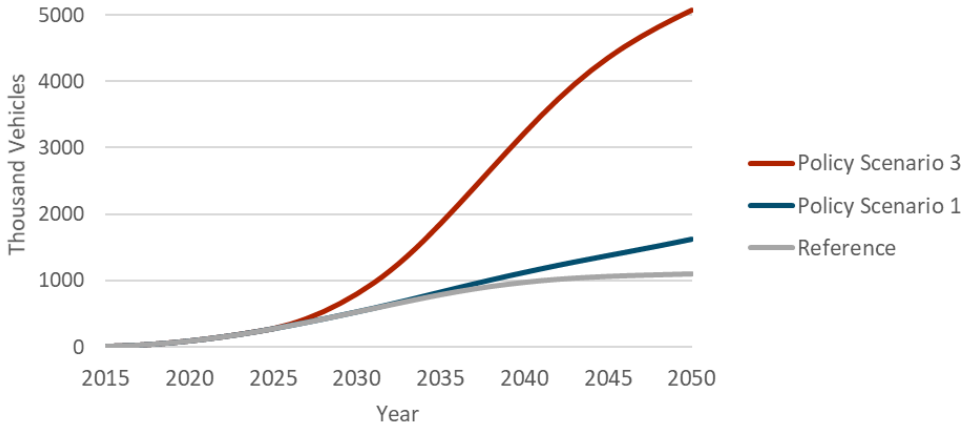
Increased Sales of ZEVs

- New sales of EVs and PHEVs gradually increase to 50% by 2030 and 100% by 2050
- 270,000 ZEVs by 2025, 800,000 ZEVs by 2030, 5,000,000 ZEVs by 2050

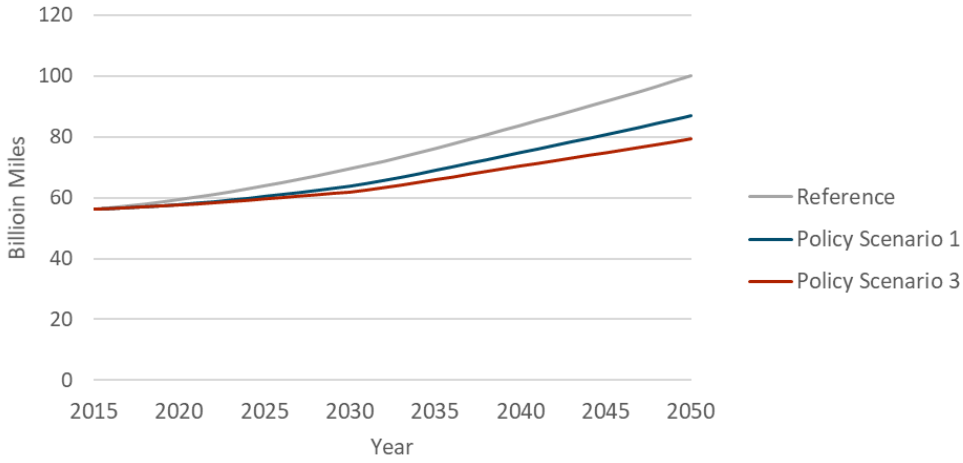
Reduction in VMT

- Reduction of annual LDV vehicle-miles traveled by 3% relative to Policy Scenario 1 in 2030 and 9% in 2050

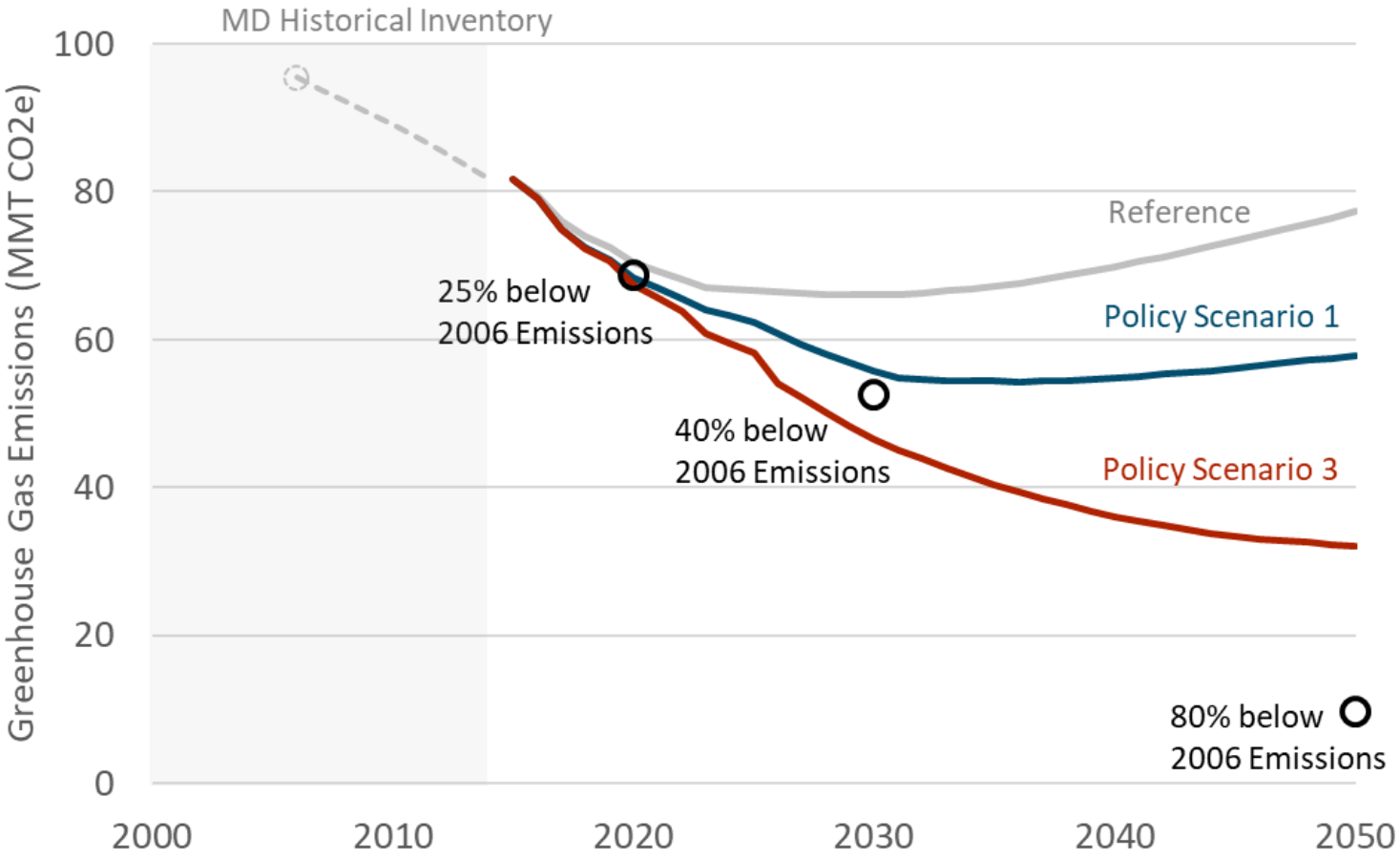
ZEV Stock (LDAs and LDTs)



VMT by Scenario



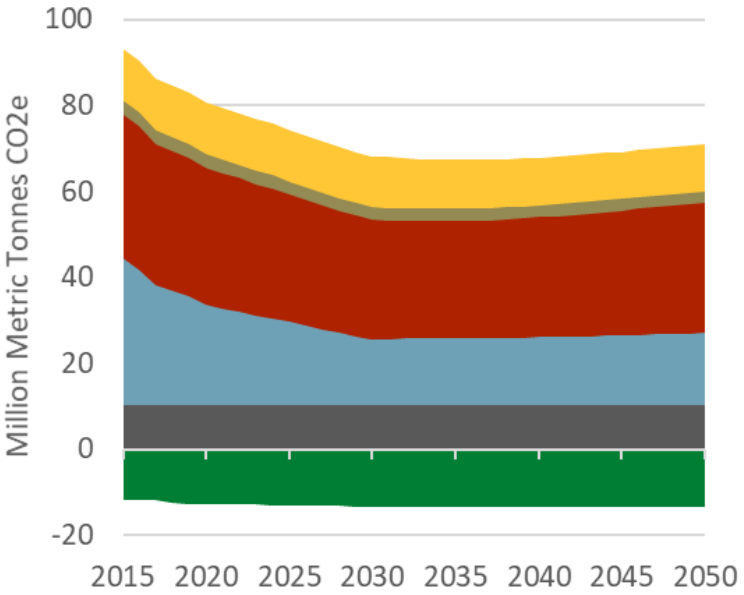
Total Net GHG Emissions by Scenario



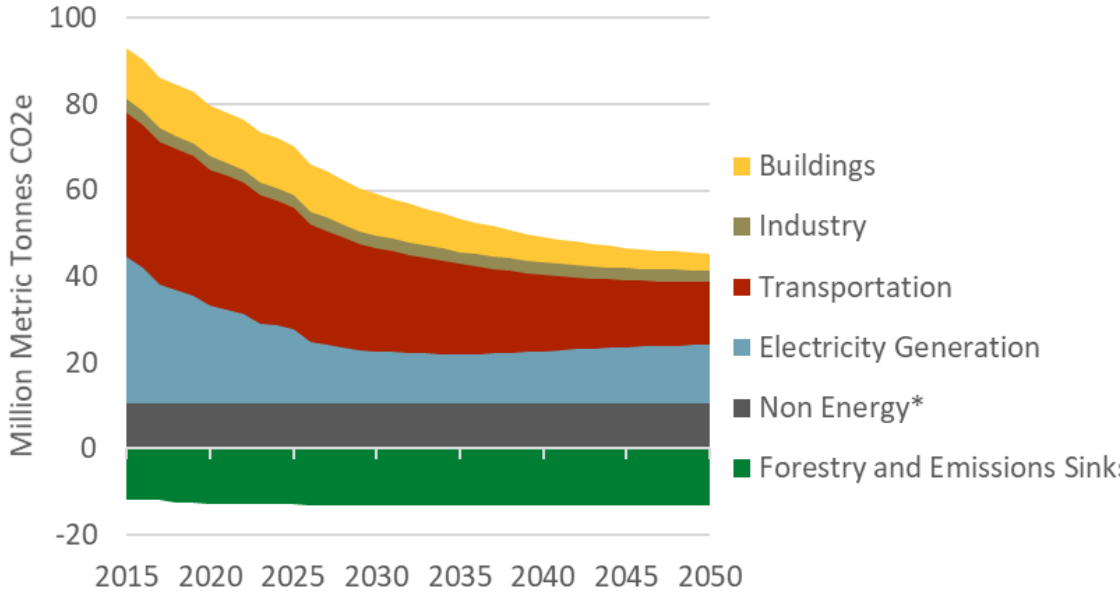
PS3 Gap in 2020: -1.3 MMT (overachieved goal)
PS3 Gap in 2030: -6.0 MMT (overachieved goal)
PS3 Gap in 2050: 22.4 MMT

Total GHG Emissions by Sector

Policy Scenario 1



Policy Scenario 3



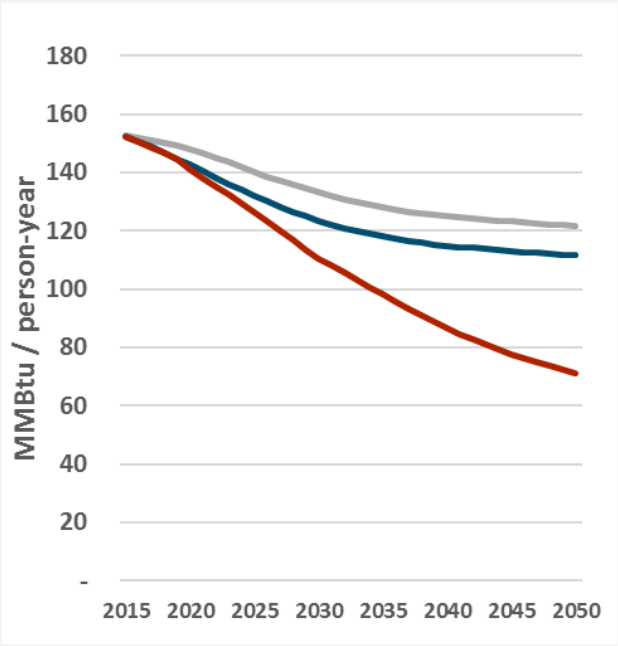
- The Transportation sector in Policy Scenario 3 has the largest reduction in GHG emissions of 15.8 MMT CO2 relative to PS1 by 2050 from switching to ZEVs and VMT reductions

- Residential and commercial buildings reduce 6.9 MMT in PS3 below PS1 levels in 2050, driven by higher equipment efficiency and electrification
- Emissions associated with new electric demand are captured in "Electricity Generation" – which is reduced 2.9 MMT

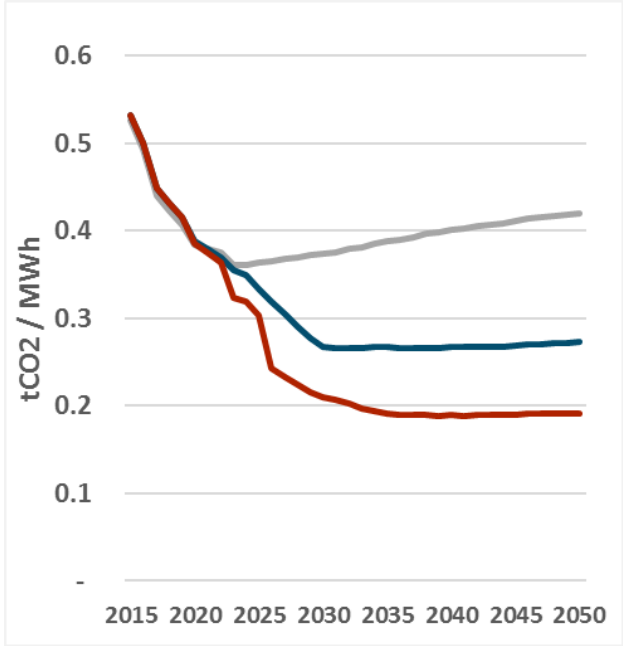
*Non Energy includes Agriculture, Waste Management, Industrial Processes and Fossil Fuel Industry emissions

Key Metrics: 3 Pillars of Decarbonization

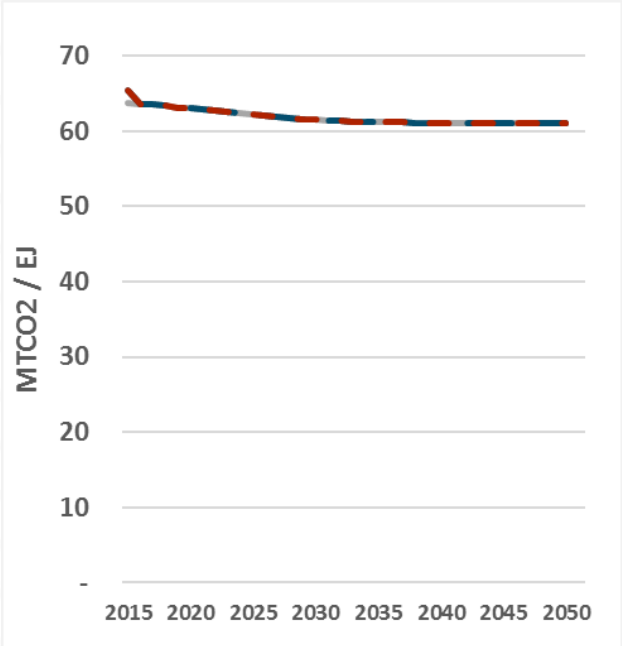
(1) Energy Efficiency
[Energy Consumption per person]



(2) Clean Electricity
[Metric ton/MWh]



(3) Clean Liquid and Gaseous Fuels
[Million Metric tonnes / EJ]



Reference Scenario
Policy Scenario 1
Policy Scenario 3

Energy+Environmental Economics

Thank You!

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Appendix

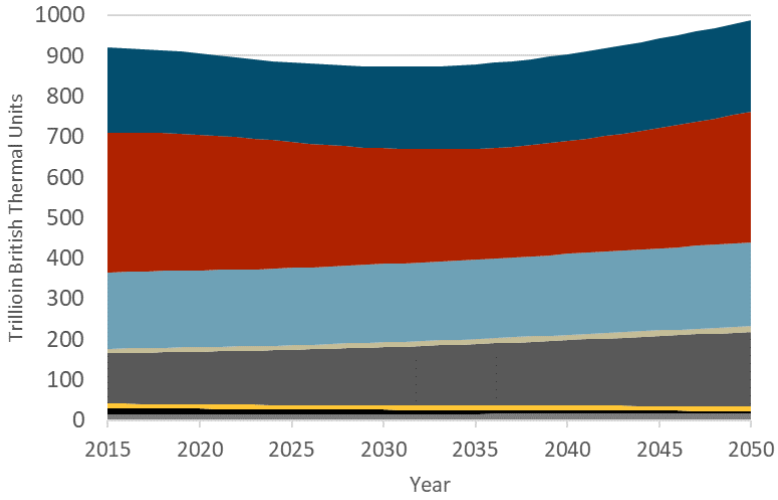
Modeled programs and measures assumed to receive funding from carbon pricing program

+ Indirect Impact – revenue funding mitigation programs:

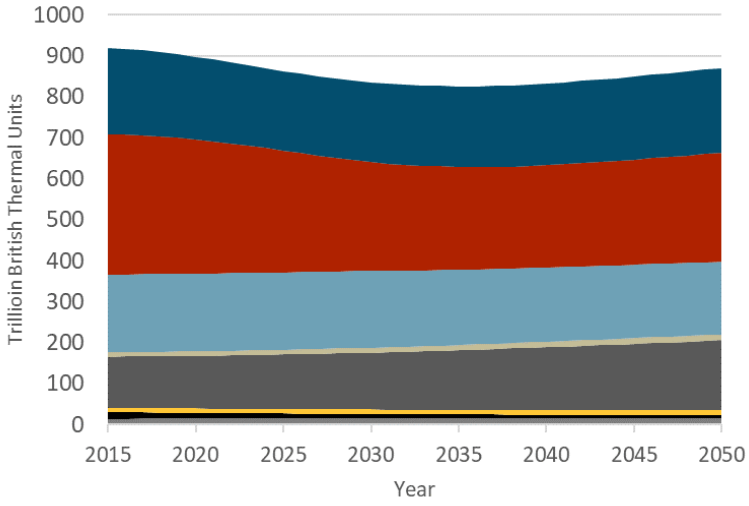
- Additional 200k EV by 2030,
- 50% EV Transit Bus Fleet in 2030,
- Transit capacity expansion,
- Expanded bike/pedestrian system development,
- Truck stop electrification
- Expanded Transportation Demand Management (TDM) strategies, including telecommute and non-work policies
- MARC (Maryland's commuter rail system) growth and investment plan
- Zero-emission trucks and truck corridors

Energy Consumption by Fuel and Scenario

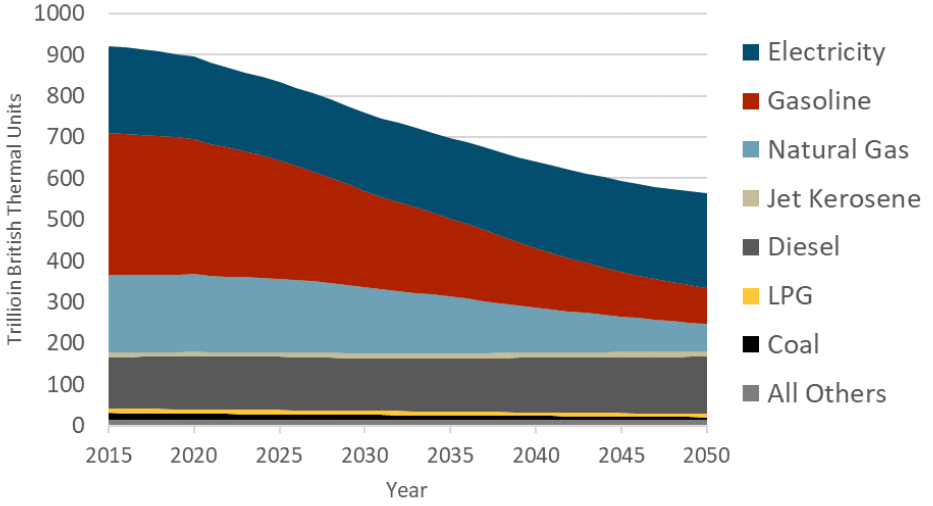
Reference



Policy Scenario 1



Policy Scenario 3

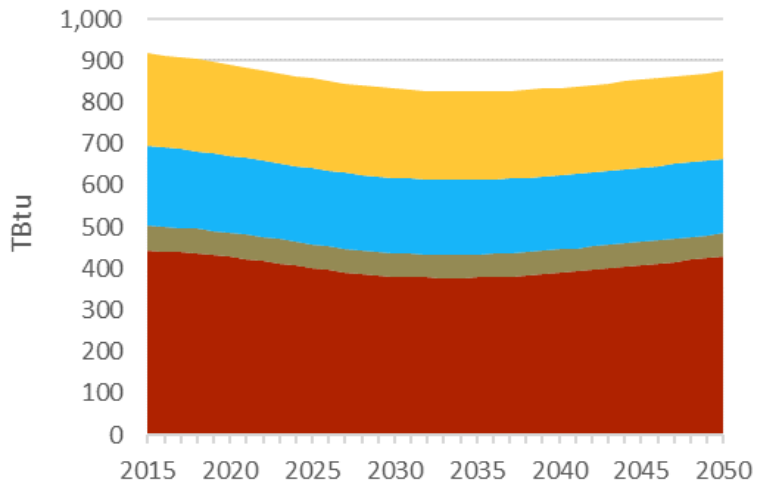


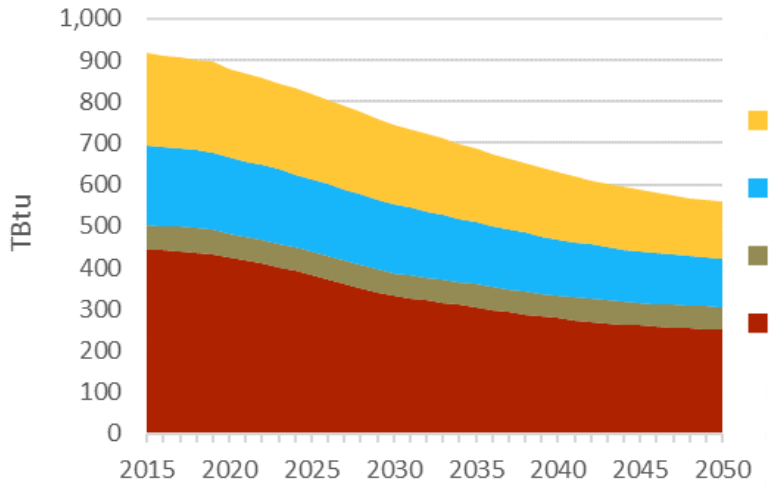
Energy Consumption by Sector
Policy Scenario 1 vs. Policy Scenario 3

Policy Scenario 1

Policy Scenario 3

All Fuels





Electricity