Maryland
Department of the Environment

40-by-30 Modeling

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Mitigation Working Group Meeting

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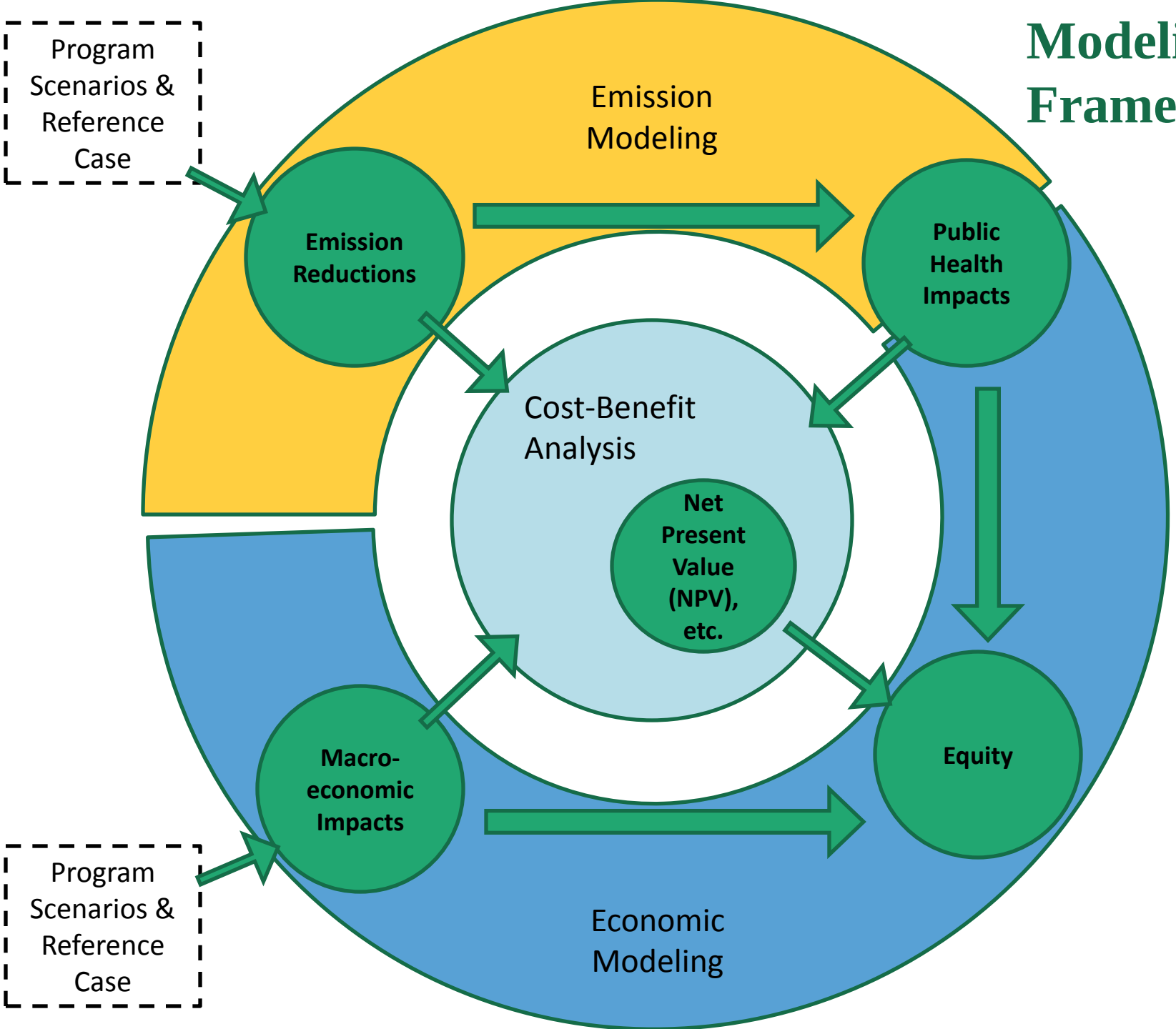
40-by-30 Modeling Update

- Modeling Framework
- PATHWAYS Model Overview
- Business-As-Usual Case
- Timeline

Modeling Framework



Emissions Model: PATHWAYS

- E3's PATHWAYS model
  - Used by CA & NY for 2030 goal planning
- Representation of energy consuming stock across economic sectors
  - Captures emissions from most inventory categories, but not all

Energy Demand in PATHWAYS

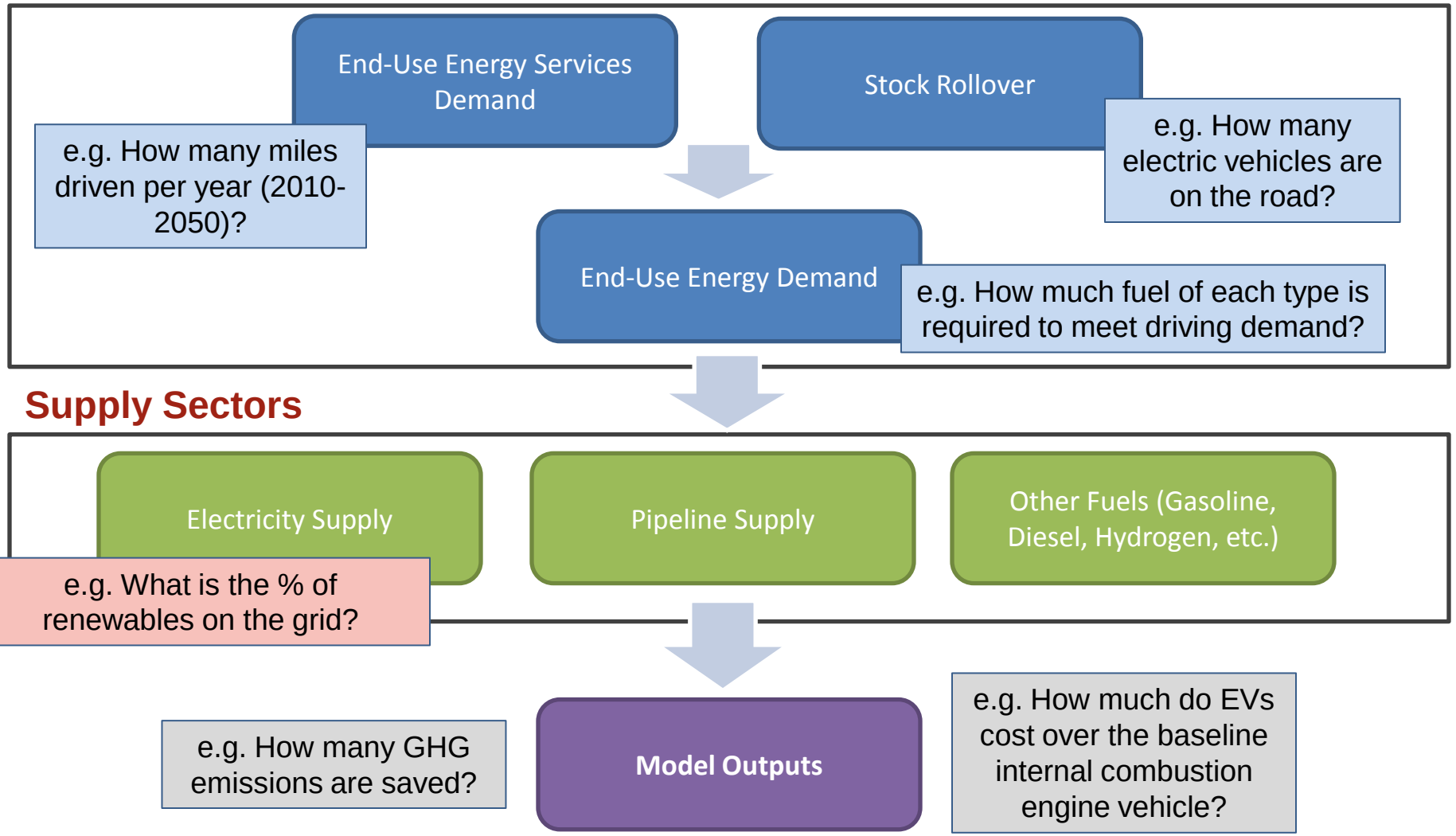
Residential	Commercial	Transportation
12 subsectors, including: • Water Heating • Air Conditioning • Cooking	**10** subsectors, including: • Refrigeration • Ventilation • Office Equipment	**12** modes of transport, including: • Cars, Trucks, Buses • Passenger Rail • Aviation

Industrial	Non-Fuel, Non-Energy GHGs	Forestry, Land use change
• Sector-Level Energy Demand Only	• Sector-Level GHGs Only, with reduction measures by GHG type consistent with MDE inventory categories (e.g. non-CO2 emissions from agriculture, methane from waste and manure, F-gases, etc.)	• Not currently explicitly modeled

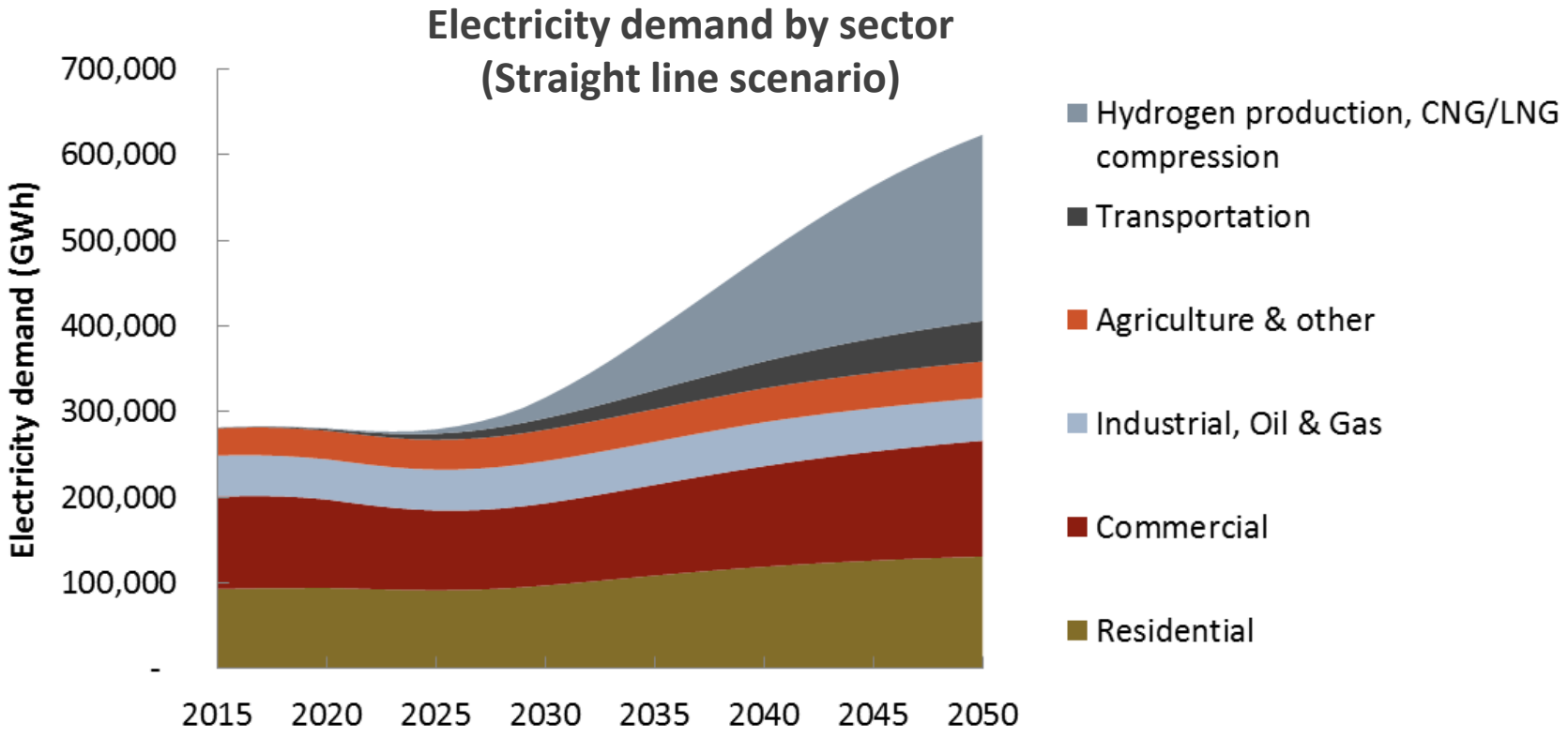
Energy Supply in PATHWAYS

Electricity	Combined Heat & Power	Pipeline Gas	Liquid fuels	Other fossil fuels
• Nuclear • Hydro • Coal • Geothermal • Wind • Solar PV • Solar thermal • Natural Gas • Biomass • Specified imports (various types) • Unspecified imports	• Waste heat	• Natural Gas • Hydrogen • Power to Gas • Biogas	• Diesel • Gasoline • Renewable Diesel • Renewable Gasoline • Hydrogen • Kerosene-Jet Fuel	• Coke • Refinery and Process Gas • Fuel Oil • Kerosene • LPG

PATHWAYS Energy Modeling Framework



Example PATHWAYS Outputs



2015 Energy Principals outputs, subject to change in CARB Scoping Plan

(Example from California Scoping Plan)

Business as Usual (BAU) Case

- Projects emissions to 2030 (& 2050) under all policies currently on the books
  - (Note this is not a “no policy” reference case)
- All major programs together
  - Interactions automatically captured
  - (Note this will not produce program-level reduction estimates)
- Primary Question: How much work do we have to do to reach 40-by-30?

Major Programs (Preliminary)

Modeled in PATHWAYS	NOT in PATHWAYS
1. RGGI	1. All Agriculture
2. EmPOWER	2. All Forestry/Sinks
3. RPS	3. Landfill Methane
4. Grid of the Future?	4. Waste Reduction / Materials Management
5. Clean Cars	5. Non-energy Land Use impacts
6. Public Transportation	
7. Other transportation?	
8. Land Use / Smart Growth	
9. Green Buildings	

Timeline

Remainder of 2017: Build database and run BAU

Early 2018: Present BAU results, construct policy scenarios

Mid-2018: Run policy scenarios

Late 2018: Present policy scenarios, draft Plan

Macroeconomic impact modeling (REMI) and non-energy GHG analysis will occur concurrently & iteratively; Public Health impact afterward.