

**DOCKETED**

|                         |                                                                                             |
|-------------------------|---------------------------------------------------------------------------------------------|
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| <b>Project Title:</b>   | Business Meeting Agendas, Transcripts, Minutes, and Public Comments                         |
| <b>TN #:</b>            | 246747                                                                                      |
| <b>Document Title:</b>  | Presentation Item 1 - California Energy Policy Simulator - October 24 2022 Business Meeting |
| <b>Description:</b>     | N/A                                                                                         |
| <b>Filer:</b>           | Dorothy Murimi                                                                              |
| <b>Organization:</b>    | California Energy Commission                                                                |
| <b>Submitter Role:</b>  | Commission Staff                                                                            |
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| <b>Docketed Date:</b>   | 10/24/2022                                                                                  |



# GETTING CALIFORNIA ON TRACK FOR 2030 AND 2045 CLIMATE TARGETS

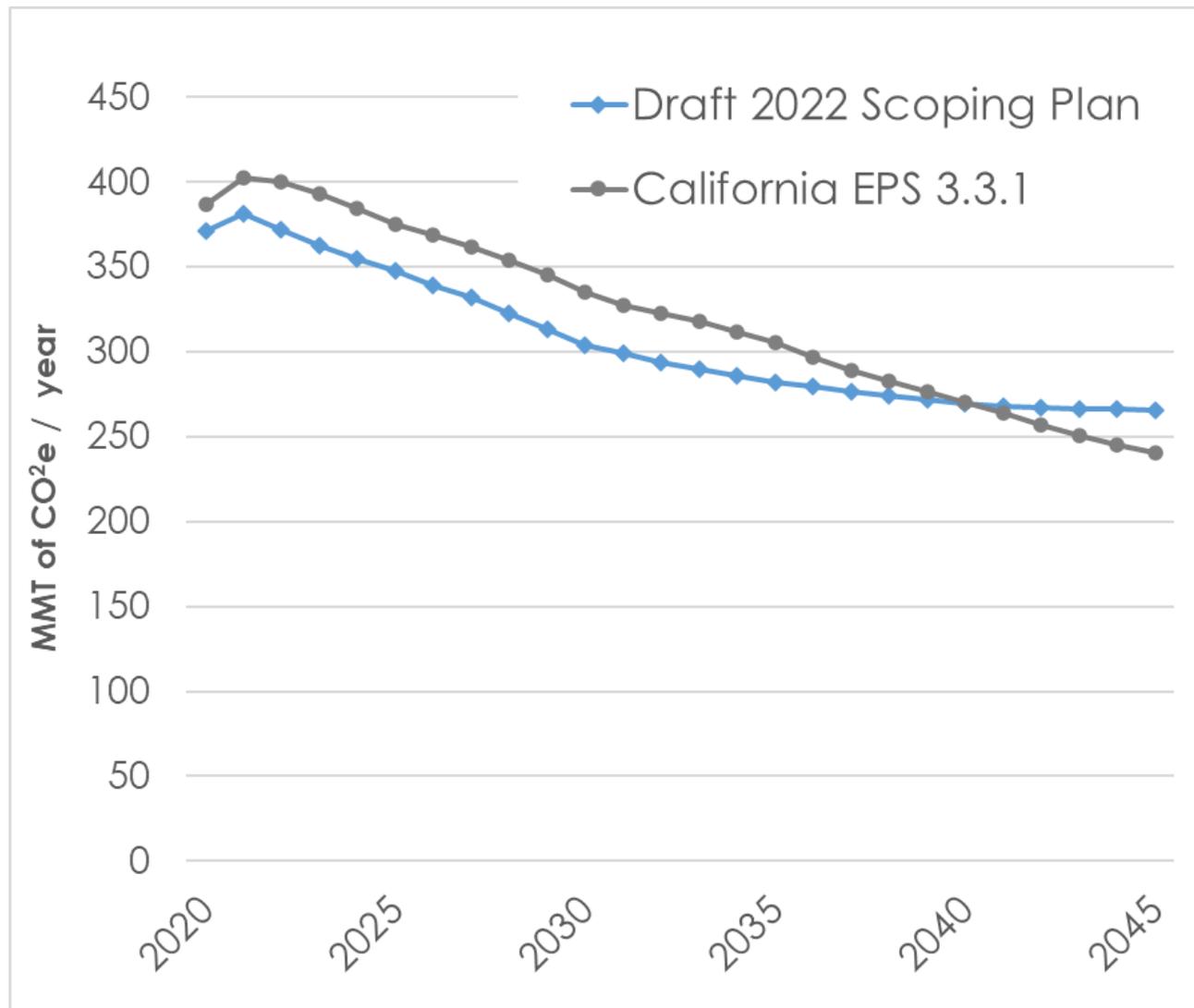
ENERGY  
INNOVATION   
POLICY & TECHNOLOGY LLC

Anand Gopal  
California Energy Commission  
October 24, 2022

# California Energy Policy Simulator 3.3.1

- June 2022 release
- Model calibration based on authoritative sources, prioritizing data from official sources.
- For example, energy and emissions inputs draw on
  - *State emissions inventory*
  - *Integrated Energy Policy Report*
  - *2022 Scoping Plan*

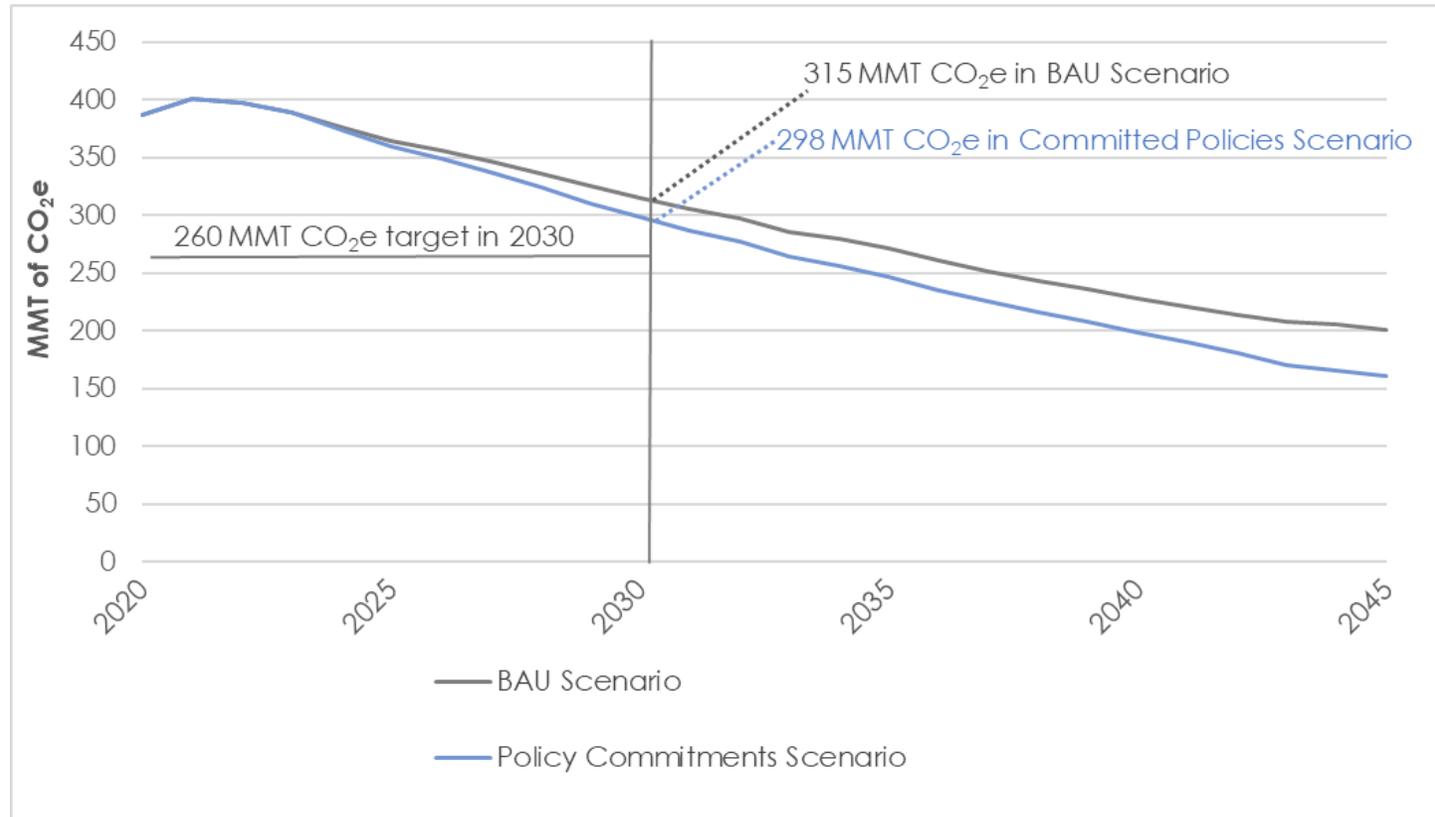
## California EPS and 2022 Scoping Plan Business-as-Usual Comparison



## 3 Policy Scenarios

- **BAU** captures the effect of settled policies
- **Committed Policies** adds executive orders or specific proposals not established in law or regulation.
- **Deeper Decarbonization** selects the most cost-effective policies to meet 2030 and 2045 targets while delivering public health and jobs benefits.

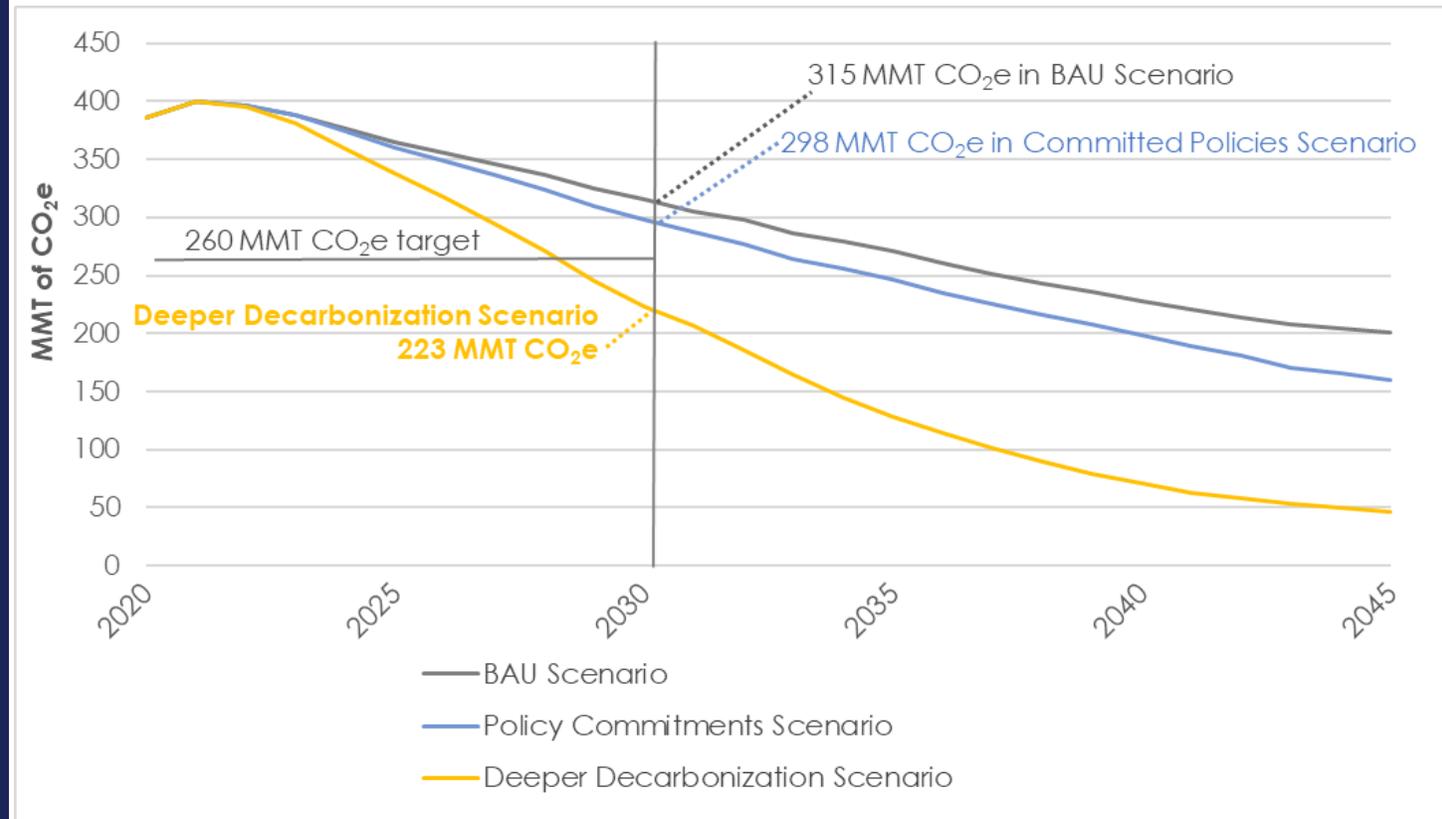
Committed Policies Scenario results in 2030 emissions 40 MMT CO<sub>2</sub>e above target



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Deeper Decarbonization Scenario lowers emissions 37 MMT CO<sub>2</sub>e below 2030 target (equivalent to 48% below 1990 emissions)



# California EPS 3.3.1 Identifies Policies with Greatest Decarbonization Potential

| Policy                                                | Description                                                                                                                                  |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Industrial fuel switching (electrification +hydrogen) | Industrial fuel use shifted to electricity, primarily, as well as to hydrogen                                                                |
| Building electrification                              | By 2030, electrification of 100% of building energy components sold for new construction and existing buildings                              |
| Zero emission vehicles                                | By 2030, 100% ZEVs in new sales by 2030 for most road vehicles,<br>By 2030, 100% ZEVs in new heavy duty tractor-trailer freight trucks sales |
| Clean energy standard                                 | 2030 as share of demand: 94% clean, 87% renewable<br>2030 as share of generation: 77% clean, 71% renewable                                   |

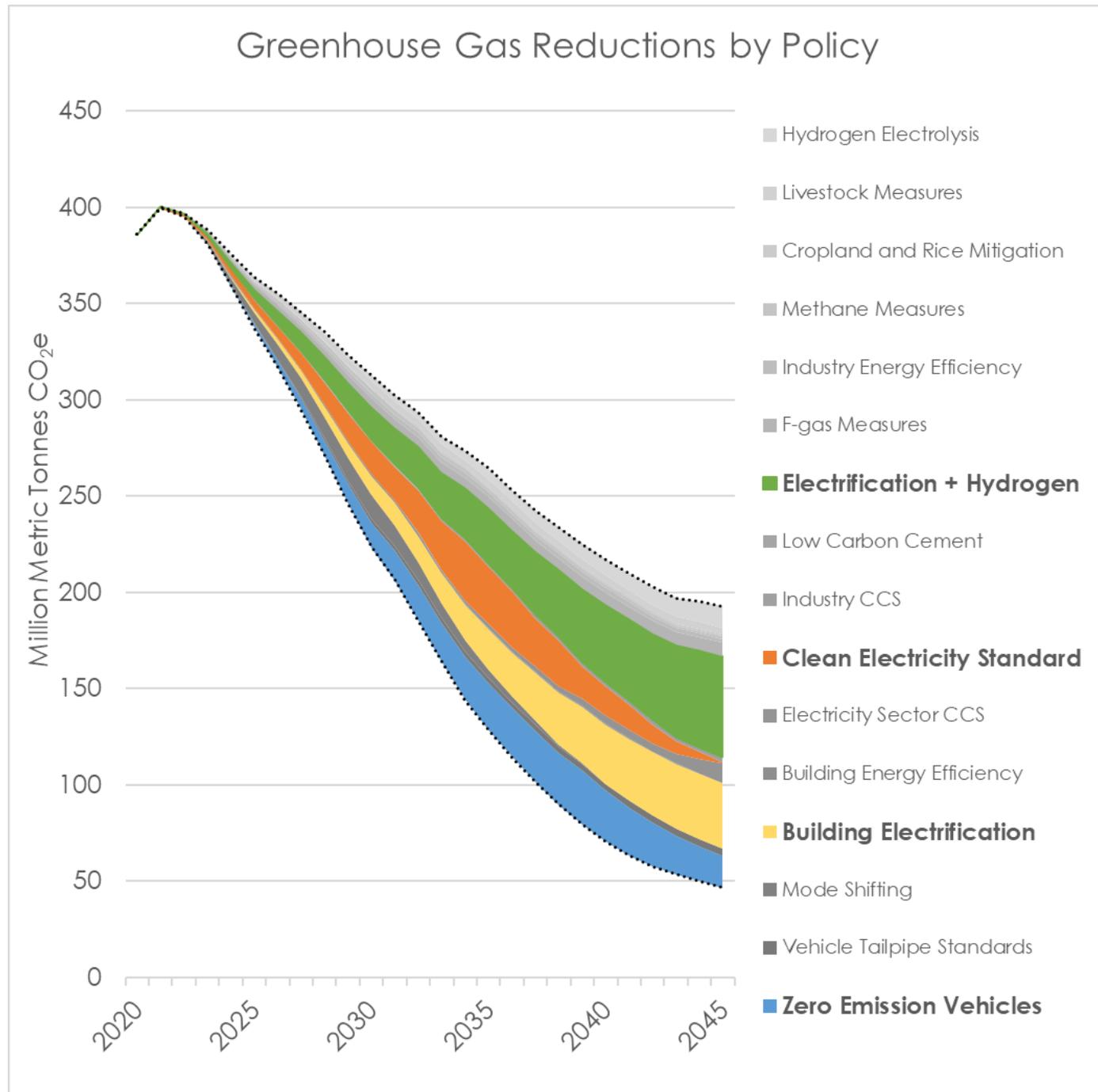
# Highest Impact Options California EPS 3.3.1 Identifies

| Policy                                                | Emissions reductions <sup>1</sup>                          | Cost effectiveness <sup>2</sup>                  |
|-------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|
| Industrial fuel switching (electrification +hydrogen) | 30 MMT / year                                              | \$310 / tonne                                    |
| Building electrification                              | 19 MMT / year                                              | -\$28 / tonne                                    |
| Zero emission vehicles                                | 15 MMT / year                                              | -\$610 / tonne                                   |
| Clean energy standard                                 | 11 MMT / year                                              | -\$54 / tonne                                    |
|                                                       | <sup>1</sup> Average annual emissions reductions 2024-2050 | <sup>2</sup> Average net present value 2024-2050 |

## Wedge Diagram Shows Annual Reductions Due to Individual Policies in Deeper Decarbonization Scenario

### Spotlighting Highest Impact Policies

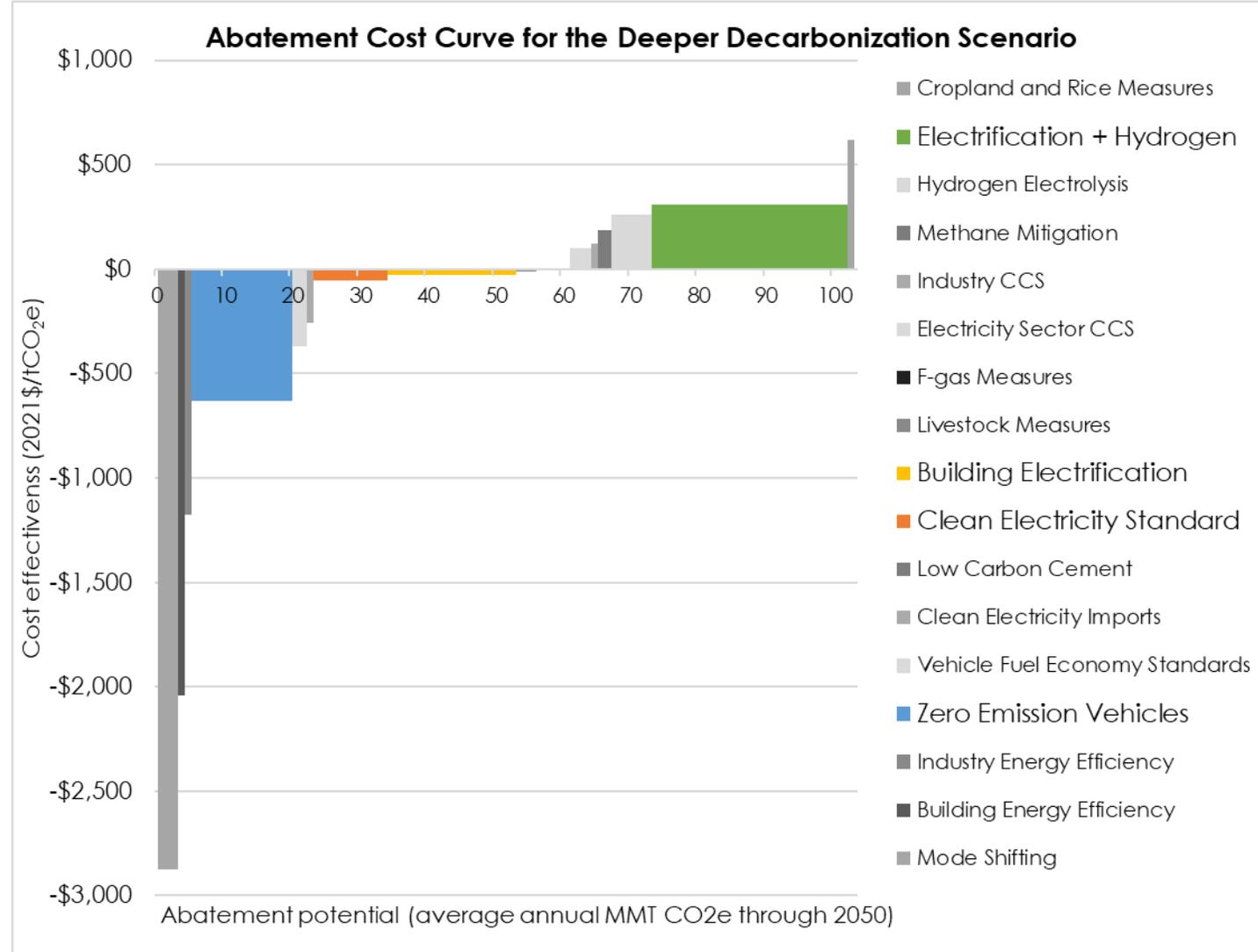
- **Industry Fuel Switching: Electrification + Hydrogen**
- **Clean Electricity Standard**
- **Building Electrification**
- **Zero Emission Vehicles**



# Abatement Cost Curve for Deeper Decarbonization Scenario

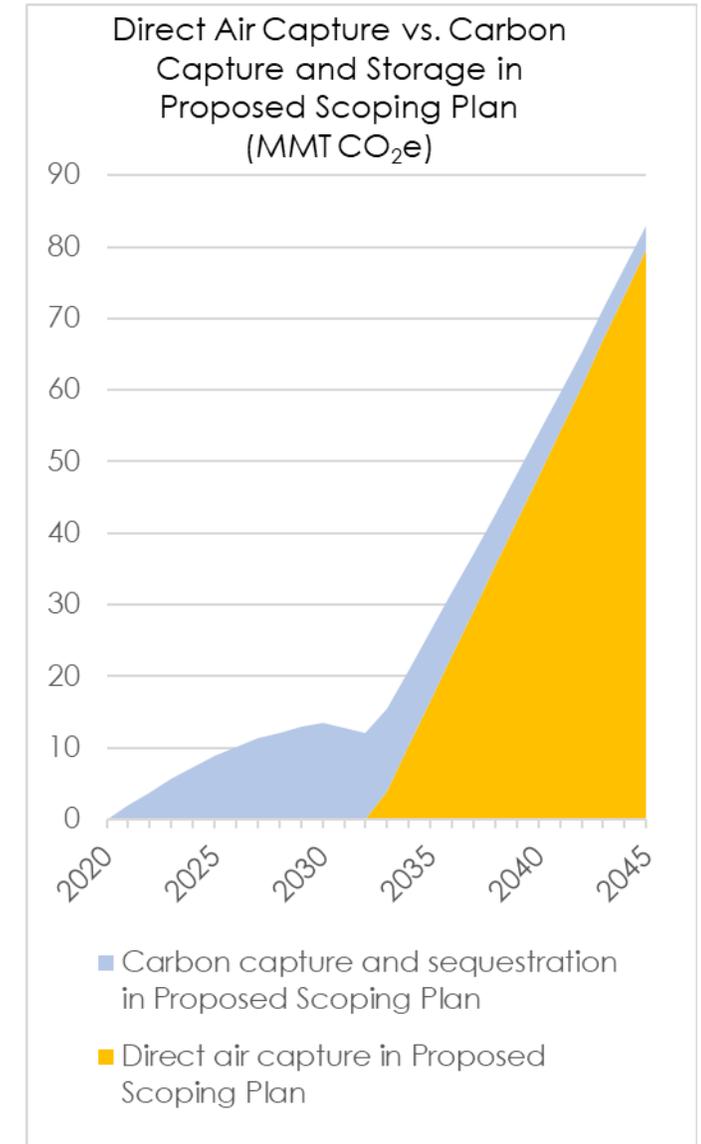
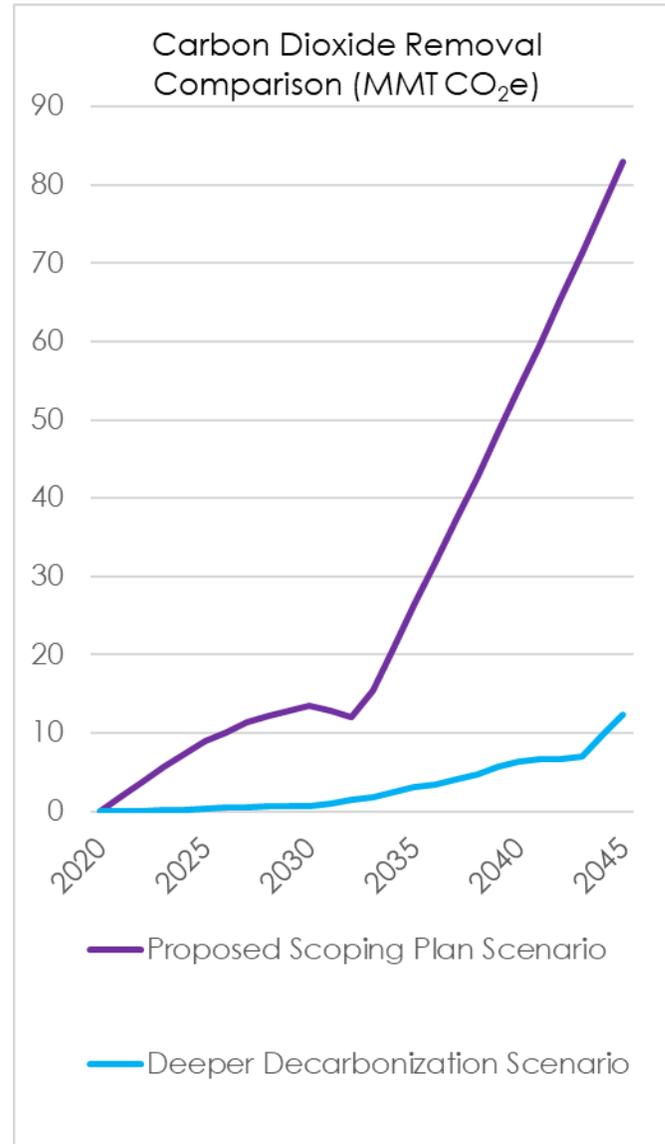
## Spotlighting Highest Impact Policies

- **Industry Fuel Switching:**  
**Electrification + Hydrogen**  
*Net positive cost*
- **Clean Electricity Standard**  
*Net negative cost*
- **Building Electrification**  
*Net negative cost*
- **Zero Emission Vehicles**  
*Net negative cost*



# Carbon Dioxide Removal in Scenarios

- Significant in Proposed Scoping Plan reductions, including direct air capture.
- Smaller role in Deeper Decarbonization scenario, including only carbon capture and sequestration



# Direct Air Capture will need an enormous amount of clean electricity

- Direct Air Capture in the Alt 3 2045 Scenario is 80 MMTCO<sub>2e</sub>
- Estimated electricity to sequester that much carbon would be equivalent to 9% of total electricity demand in CA's 2045 business as usual scenario
- CA is better off using new clean electricity to serve end uses in vehicles and homes, making people's lives better, particularly in environmental justice communities





Thank you

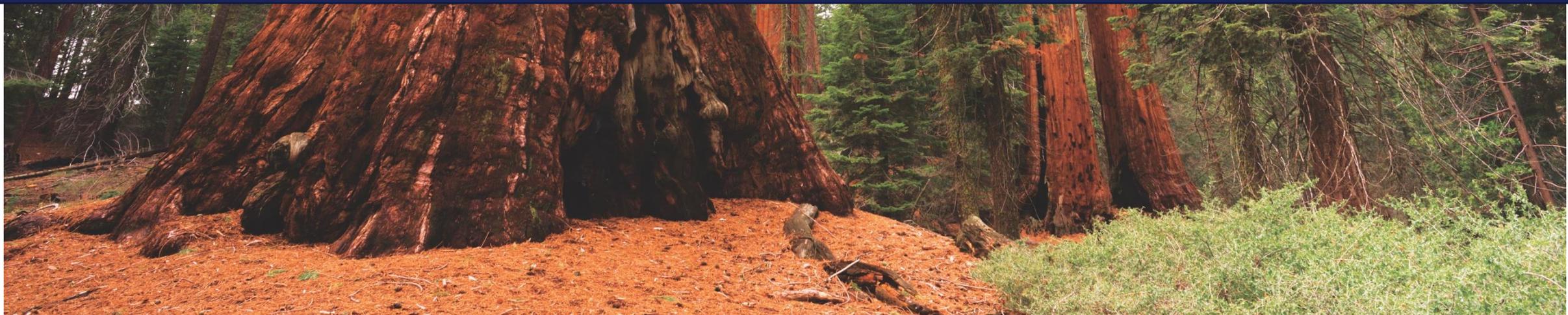
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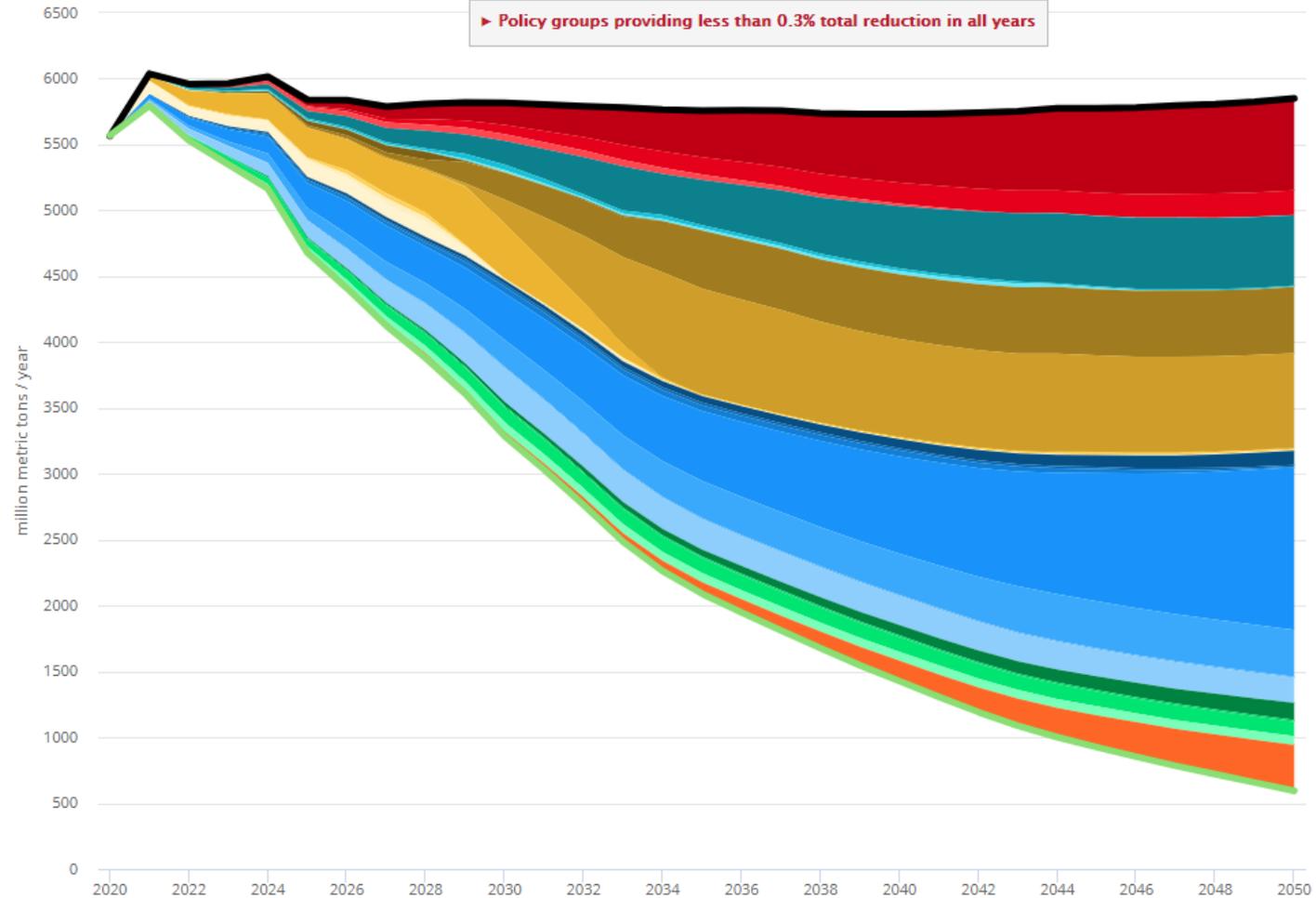
# Energy Policy Simulator Introduction

- An open source, peer-reviewed, system dynamics energy policy model evaluating.
- Enables policymakers to rapidly compare emissions, economic, and public health impacts of multiple decarbonization pathways.
- Available for 19 countries.
- California model URL:  
<https://california.energypolicy.solutions>

OUTPUT GRAPH SELECTOR

Effects by Policy: CO2e Wedge Diagrams

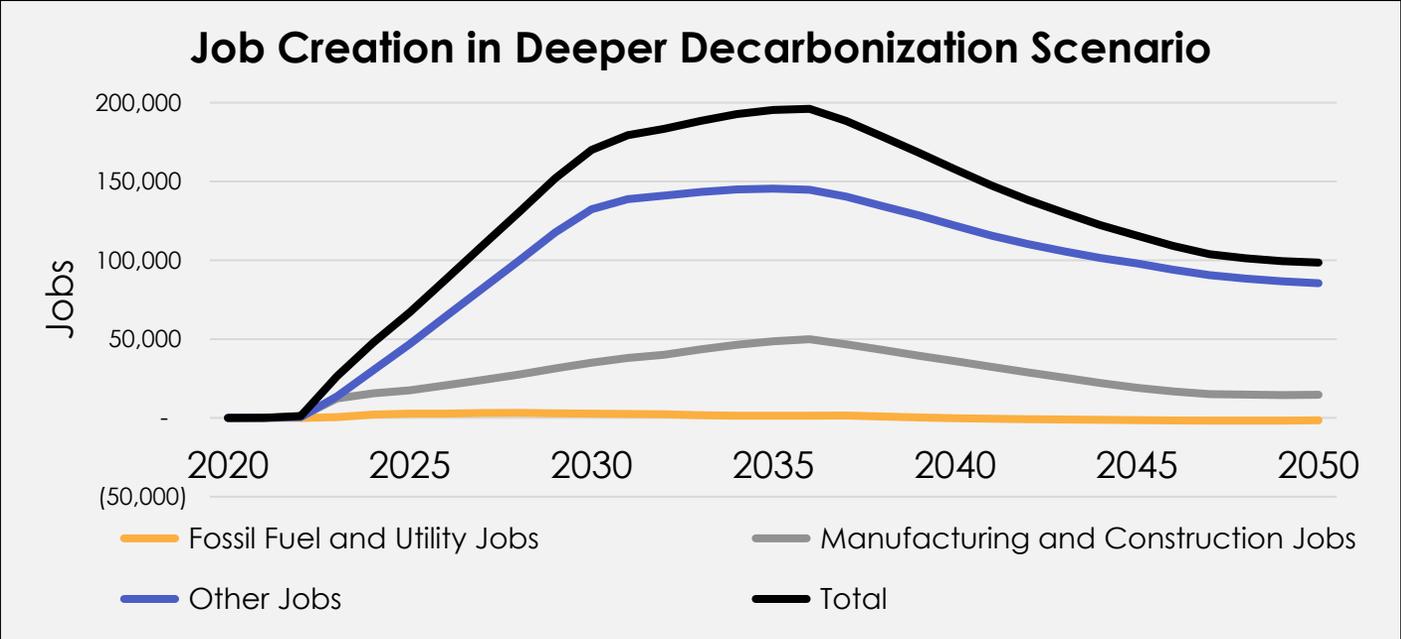
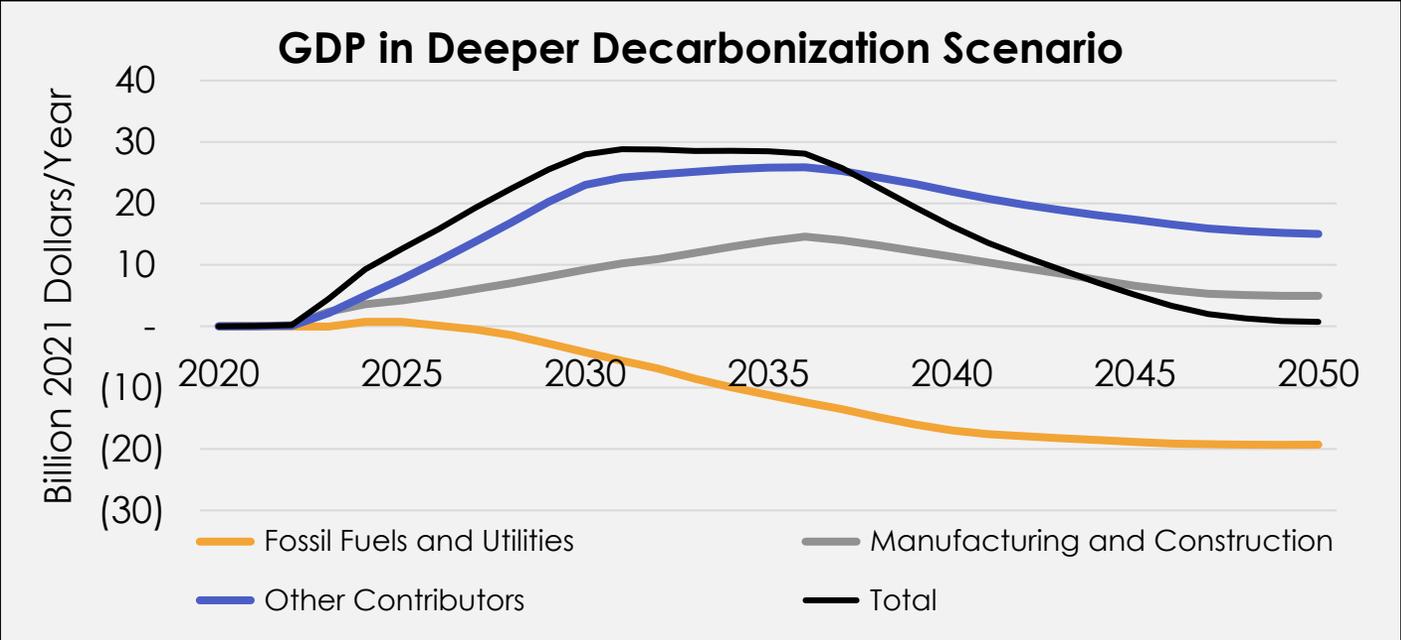
Total



- EV Sales Standard
- Building Component Electrification
- Ban New Power Plants
- Demand Response
- Increase Transmission
- Subsidy for Electricity Production
- Industry Energy Efficiency Standards
- Material Efficiency, Longevity, & Re-Use
- Cropland and Rice Measures
- Hydrogen Electrolysis
- NDC Pathway
- Vehicle Fuel Economy Standards
- Building Energy Efficiency Standards
- Electricity Sector CCS
- Early Retirement of Power Plants
- Non BAU Mandated Capacity Construction
- Industry CCS
- Electrification + Hydrogen
- Methane Capture and Destruction
- Improved Forest Management
- Mode Shifting
- Increased Retrofitting
- Clean Electricity Standard
- Grid-Scale Electricity Storage
- Subsidy for Capacity Construction
- Cement Clinker Substitution
- F-gas Measures
- Afforestation and Reforestation
- Livestock Measures
- Business as Usual

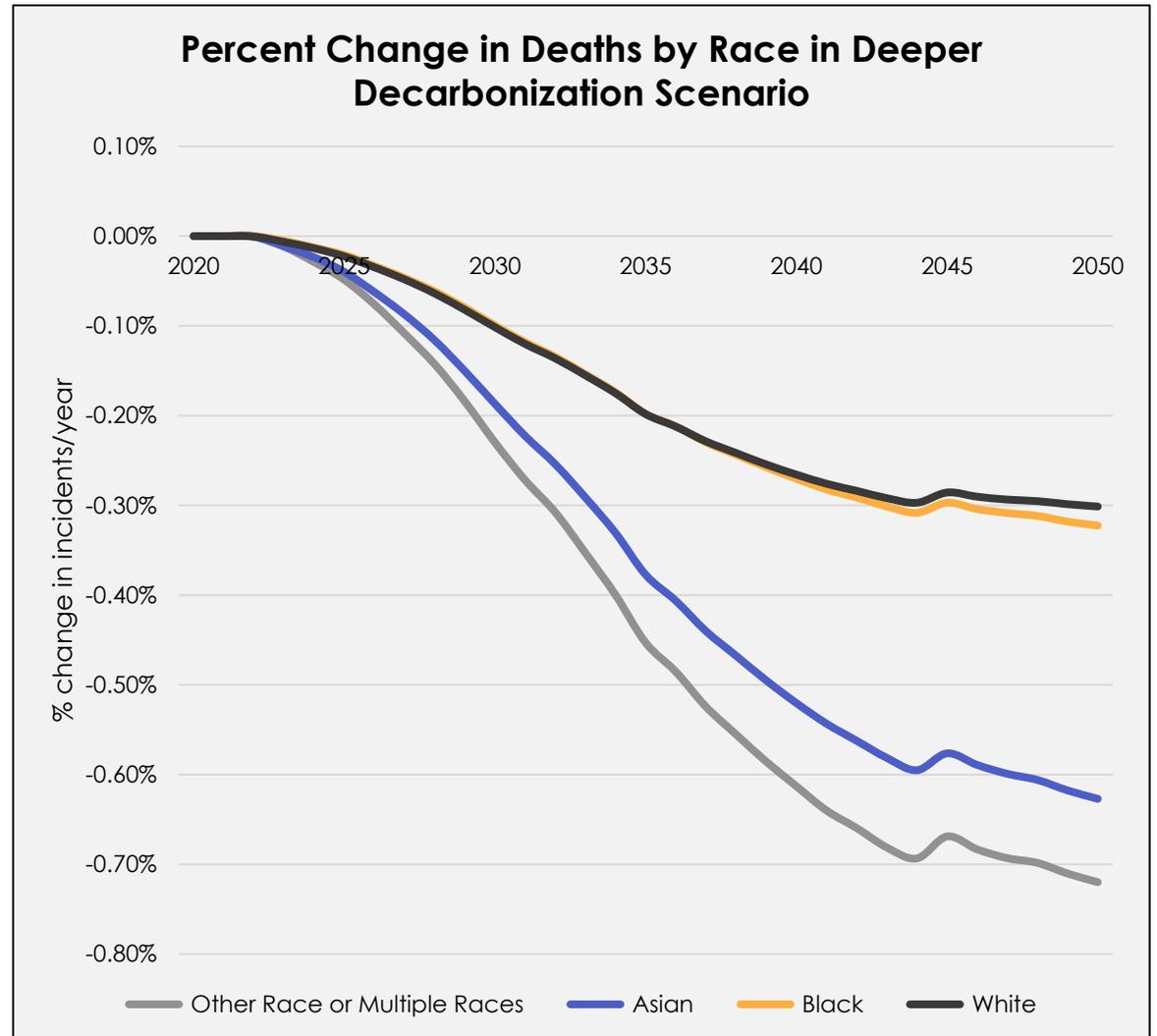
# Jobs and GDP

- Significant, positive economic benefits
- Both total jobs and GDP are net positive in 2030



## Health Benefits

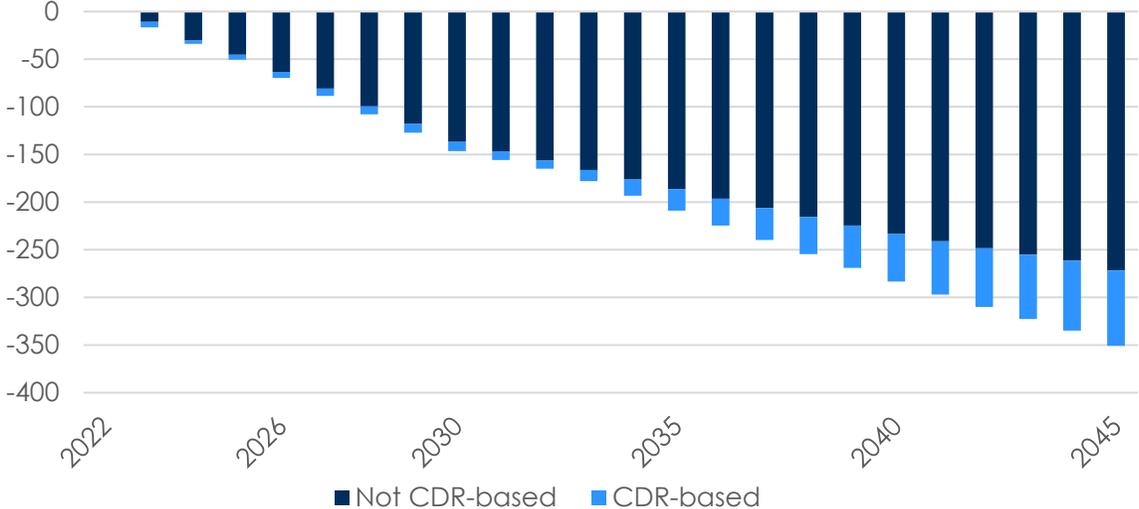
- Avoids approximately 1,300 premature deaths due to air pollution in 2030 and 3,900 deaths in 2045
- Prevents 26,000 asthma attacks in 2030 and 77,000 asthma attacks in 2045
- Benefits are greatest among communities of color



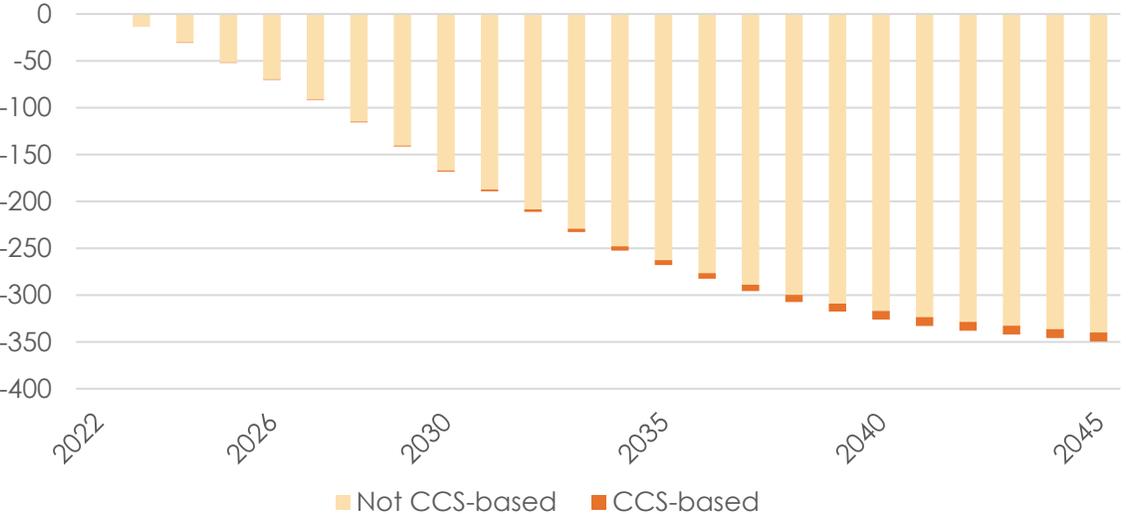
# Carbon Capture's Role in Scenarios

- Significant part of Proposed Scoping Plan
- Included, but less significant part of Deeper Decarbonization Scenario

Proposed Scoping Plan Scenario Emissions Reductions (MMT of CO<sub>2</sub>e)



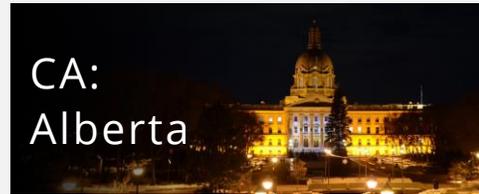
Deeper Decarbonization Scenario Emission Reductions (MMT of CO<sub>2</sub>e)



# Data Sources

| Sector                                    | Source                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Electricity</b>                        | <ul style="list-style-type: none"> <li>• For capacity and generation: EIA's <a href="#">Form 923</a> and EIA's <a href="#">Form 860</a></li> <li>• E3, <a href="#">RESOLVE</a> modeling for California Public Utilities Commission's 2022 long-term planning process.</li> <li>• For imports/exports: EIA's State Electricity Profiles <a href="#">Table 10</a></li> </ul>                                                                |
| <b>Building Energy Use</b>                | <ul style="list-style-type: none"> <li>• California Energy Commission, Integrated Energy Policy Report</li> <li>• California Energy Commission, <a href="#">Building Decarbonization Assessment</a></li> <li>• CARB 2022 Pathways <a href="#">Modeling</a></li> <li>• National Renewable Energy Laboratory, Electrification Futures: <a href="#">End-Use Electric Technology Cost and Performance Projections Through 2050</a></li> </ul> |
| <b>Industrial Energy Use</b>              | <ul style="list-style-type: none"> <li>• California Pathways <a href="#">Modeling</a></li> <li>• California Energy Commission, <a href="#">Integrated Energy Policy Report</a></li> <li>• Plant-level fuel combustion data in <a href="#">CARB GHG Inventory</a></li> <li>• EIA <a href="#">Form 860</a> - Schedule 2, Plant Data, or Combined Heat and Power</li> </ul>                                                                  |
| <b>Industrial Process Emissions</b>       | <ul style="list-style-type: none"> <li>• CARB 2022 Pathways <a href="#">Modeling</a></li> </ul>                                                                                                                                                                                                                                                                                                                                           |
| <b>Agriculture, Land Use And Forestry</b> | <ul style="list-style-type: none"> <li>• CARB Wildfire Emission <a href="#">Estimates for 2020</a> &amp; <a href="#">other studies</a></li> <li>• The Nature Conservancy report, <a href="#">Natural Climate Solutions for the U.S.</a></li> </ul>                                                                                                                                                                                        |
| <b>Transportation</b>                     | <ul style="list-style-type: none"> <li>• CARB, EMFAC emissions and fleet <a href="#">database</a></li> </ul>                                                                                                                                                                                                                                                                                                                              |

# Existing Energy Policy Simulator Models



(54% of global GHG emissions)

# External Reviewers, Advisers, And contributors

## National Labs



## Universities



## Global Partners

