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<tr>
<th><strong>Docket Number:</strong></th>
<th>22-BUSMTG-01</th>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Business Meeting Agendas, Transcripts, Minutes, and Public Comments</td>
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<td><strong>TN #:</strong></td>
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<tr>
<td><strong>Document Title:</strong></td>
<td>ITEM 2-Information Item on California Air Resources Board (CARB) Draft 2022 Climate Change Scoping Plan</td>
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<tr>
<td><strong>Description:</strong></td>
<td>N/A</td>
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<tr>
<td><strong>Filer:</strong></td>
<td>Dorothy Murimi</td>
</tr>
<tr>
<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
</tr>
<tr>
<td><strong>Submitter Role:</strong></td>
<td>Commission Staff</td>
</tr>
<tr>
<td><strong>Submission Date:</strong></td>
<td>5/23/2022 5:24:48 PM</td>
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<td><strong>Docketed Date:</strong></td>
<td>5/23/2022</td>
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Draft 2022 Scoping Plan

MAY 2022
AB 32 Climate Change Scoping Plan Statutory Requirements

- Scoping Plan(s) are action plans for CA to meet statewide GHG reduction targets
  - Scoping Plan(s) outline a suite of climate policies to address emissions across all sectors
  - Required to be updated at least every 5 years
  - 2017 SP (most recent) – cost-effective and technologically feasible path to achieve the 2030 target
- Provide direct GHG emissions reductions and air quality benefits
- Minimize emissions “leakage” – increase to non-CA GHG emissions
  - Ensure high-road jobs remain
- Facilitate sub-national and national collaboration
  - Develop exportable programs for partners to adopt
- Support cost-effective and flexible compliance
California’s Climate Policy Framework

- Legislation and Executive Orders: total GHGs (AB 32/SB 32) or sector targets (SB 1383/SB 100), etc.

- AB 32 Scoping Plan: Actionable plan across all sectors

- Action: Regulations & Incentives: Advanced Clean Cars, Climate change investments, etc.

- Projects: Examples: building compost facilities, digesters, renewables, energy infrastructure, etc.
Incorporation of EJ Advisory Committee Recommendations

- The EJAC met over dozen times since early last summer to help inform this Draft 2022 Scoping Plan
- Developed over 200 recommendations
- Incorporation of feedback into the Draft 2022 Scoping Plan Document
  - Modeling input incorporated into the design of the scenarios
  - Additional evaluation of phasing out refinery operations by 2045
  - 5 dozen references to EJAC Draft Recommendations in the Draft Scoping Plan
  - Categorizes recommendations that could not be incorporated into the Draft Scoping Plan as well as a process for following up
## AB 32 Sources Scenarios Overview

<table>
<thead>
<tr>
<th>Year</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>2035</td>
<td>Alternative 1: Nearly complete phaseout of combustion, limited reliance on engineered carbon removal, restricted applications for biomass derived fuels, and ambitious innovation in electric technology and aggressive consumer adoption trends (e.g. electric aviation adoption and 100% electrification by 2035).</td>
</tr>
<tr>
<td>2035</td>
<td>Alternative 2: Use full suite of technology options, including engineered carbon removal</td>
</tr>
<tr>
<td>2045</td>
<td>Alternative 3: Use a broad portfolio of existing and emerging fossil fuel alternatives and alignment with statutes and Executive Orders (staff is recommending this scenario)</td>
</tr>
<tr>
<td>2045</td>
<td>Alternative 4: Use existing and emerging technologies, slower rate of clean technology and fuel deployment and consumer adoption.</td>
</tr>
</tbody>
</table>
What Carbon Neutrality Means

Continue to reduce emissions from sources in the AB 32 GHG Inventory

Emissions and sequestration from natural and working lands

Technological Carbon Dioxide Removal

\[ \text{GHG} \pm \text{CO}_2 - \text{Carbon Neutral} \]
<table>
<thead>
<tr>
<th></th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Metrics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Annual Build Rates</strong></td>
<td>Solar: 10GW</td>
<td>Solar: 5GW</td>
<td>Solar: 7GW</td>
<td>Solar: 6GW</td>
</tr>
<tr>
<td>Historic Max Builds:</td>
<td>Battery: 5GW</td>
<td>Battery: 3GW</td>
<td>Battery: 2GW</td>
<td>Battery: 2GW</td>
</tr>
<tr>
<td>Solar: 2.7GW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery: 0.3GW</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Vehicle Early Retirements</strong></td>
<td>LDV: 16M 5-16 yr. old</td>
<td>LDV: 0</td>
<td>LDV: 0</td>
<td>LDV: 0</td>
</tr>
<tr>
<td>US-wide Cash for Clunkers</td>
<td>MHDV: 1.4M 5-16 yr. old</td>
<td>MHDV: 0</td>
<td>MHDV: 0.6M 10-20 yr. old</td>
<td>MHDV: 0.6M 10-20 yr. old</td>
</tr>
<tr>
<td>$3B and 690k vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Residential Early Retirements</strong></td>
<td>7M electric homes.</td>
<td>7M electric homes.</td>
<td>7M electric homes.</td>
<td>7M electric homes.</td>
</tr>
<tr>
<td></td>
<td>Appliances 5-16 yr old</td>
<td>Appliances 5-16 yr old</td>
<td>Appliances 5-16 yr old</td>
<td>Appliances 5-16 yr old</td>
</tr>
<tr>
<td>Total CA Capacity:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Solar: 83GW</td>
<td></td>
<td></td>
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<tr>
<td><strong>Petroleum Refining Remaining</strong></td>
<td>2035: 0%</td>
<td>2035: 25%</td>
<td>2035: 33%</td>
<td>2035: 39%</td>
</tr>
<tr>
<td>2045: 0%</td>
<td>2045: 8%</td>
<td>2045: 13%</td>
<td>2045: 18%</td>
<td></td>
</tr>
<tr>
<td><strong>Total CCS Needs</strong></td>
<td>2035: &lt;1MMT</td>
<td>2035: 8MMT</td>
<td>2035: 10MMT</td>
<td>2035: 11MMT</td>
</tr>
<tr>
<td>Industrial &amp; Refining</td>
<td>2045: &lt;1MMT</td>
<td>2045: 2.4MMT</td>
<td>2045: 4MMT</td>
<td>2045: 5MMT</td>
</tr>
<tr>
<td><strong>Residual Emissions</strong></td>
<td>2035: 30MMT</td>
<td>2035: 123MMT</td>
<td>2035: 0MMT</td>
<td>2035: 0MMT</td>
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<tr>
<td>Current global DAC 0.01 MT/year</td>
<td>2045: 22MMT</td>
<td>2045: 60MMT</td>
<td>2045: 80MMT</td>
<td>2045: 99MMT</td>
</tr>
</tbody>
</table>
Scenario Emissions Modeling

Emissions shown after CCS, before CDR
Combustion Fuels Transition

- **20% Carbon Intensity Reduction**: 2030
  - Transportation
  - Targeted H2 use
  - H2 used in key sectors
  - Combustion phase outs

- **20% Carbon Intensity Reduction**: 2035
  - Transportation

- **20% Carbon Intensity Reduction**: 2045
  - Transportation

- **Biofuels used for Sustainable Aviation Fuel** then BECCS H2
- Increasing H2 pipeline blend up to 7%

**Graph Details**
- **2020**: Natural Gas (Electric Gen) > Other > Natural Gas > Liquid Petroleum Fuels > Liquid Biofuels > Biomethane
- **2035**: Natural Gas (Electric Gen) > Other > Natural Gas > Liquid Petroleum Fuels > Liquid Biofuels > Biomethane
- **2045**: Natural Gas (Electric Gen) > Other > Natural Gas > Liquid Petroleum Fuels > Liquid Biofuels > Biomethane
Loads by Scenario

- Electric loads increase by 30-80% relative to today by 2035 and 60-90% by 2045
- Loads for direct air capture and hydrogen production are assumed to be provided by off-grid renewables, and are not included in this graphic
- Other transportation includes all non-LDVs and reflects electrification of things like passenger and freight rail, aviation, and ocean-going vessels (OGVs)
Cumulative New Resource Capacity Build in 2045

In Alt 1, builds ~62 GW of battery storage and ~30 GW of hydrogen fuel cells as clean firm capacity.

Alt 1 builds ~124 GW of solar, compared to ~26 GW in the BAU.

Alts 2 through 4 are similar in 2045 due to SB100 goal, while in Alt 1 the model builds significantly more clean energy resources to meet the 0 MMT, no combustion target.

In Alt 3 scenario, model builds ~90 GW of solar and ~40 GW of batteries to meet SB100 retail sales target. All gas remains online and ~10 GW of new gas is built.
Direct Cost by Scenario, 2035 and 2045

Costs from PATHWAYS in a single year relative to the growing California

- **Alternative 1 (2035):** $130 Billion
- **Alternative 2 (2035):** $106 Billion
- **Alternative 3 (2035):** $18 Billion
- **Alternative 4 (2035):** $23 Billion
- **Alternative 1 (2045):** $59 Billion
- **Alternative 2 (2045):** $34 Billion
- **Alternative 3 (2045):** $27 Billion
- **Alternative 4 (2045):** $30 Billion
Employment by Scenario Including CDR, 2035 and 2045

Impact from IMPLAN in a single year relative to California employment that grows from 23.5 million in 2021 to 27.7 million in 2045

Initial results from PATHWAYS costs assuming CDR is liquid solvent DAC technology powered by off-grid solar relative to BAU. Jobs are defined in IMPLAN as an annual average that accounts for seasonality and follows the same definition used by the BLS and BLS. Percentage change is relative to CDR-0.0% and BAU employment forecasts.
Gross State Product by Scenario Including CDR, 2035 and 2045

Impact from IMPLAN in a single year relative to the California economy that grows from $3.2 trillion in 2021 to $5.1 trillion in 2045

Initial results from PATHWAYS costs assuming CDR is liquid solvent DAC technology powered by off-grid solar relative to BAU. IMPLAN reports value added which is equivalent to an industry’s contribution to Gross State Product or GSP. Percentage change is relative to CARB 2035 and 2045 Gross State Product forecasts.
Emissions Modeling

Scenarios achieve large reductions in emissions due to shifts to zero pollutant emission fuels and reductions in energy consumption

- Reductions in total NO\textsubscript{x} from the Reference scenario range from 89% in Alt 1 to 58% in Alt 4

![Graph showing Total NO\textsubscript{x} Emissions and Reductions in Emissions in 2045](image)

*ROG: Reactive Organic Gases*
The implementation of the Scoping Plan scenarios achieves notable public health benefits relative to the Reference Scenario.

- Total combined benefits range from $8.3 billion in Alt 4 to $15.9 billion in Alt 1 in Improvements in winter PM$_{2.5}$ provide significant benefits.

*Represents the mean value reported by BenMAP
2022 Scoping Plan Update Schedule

Building Blocks to Scoping Plan
SB 100, AB 74 Reports Complete

2021
Q1
Q2
Q3
Q4
Reconvene EJAC
Initiate Scoping Plan
EJAC Meeting
Board Meeting (update)

2022
Q1
Q2
Q3
Q4
Draft Scoping Plan
Board-EJAC Joint Mtg. June 2022
2 Board Meetings (update)
Board Meeting (1 of 2)
June 2022

EJAC Meetings and Community Meetings (ongoing)
June 2021 – Fall 2022
Scoping Plan Workshops (ongoing)
June 2021 – Late Summer 2022

Release Final Scoping Plan
Board-EJAC Joint Mtg. Fall 2022
Board Meeting (2 of 2)
Late Fall 2022