2022 Scoping Plan Update – Draft Scenario Inputs Technical Workshop

SEPTEMBER 30, 2021

Today's Workshop Objectives

- Introduce draft carbon neutral scenario assumptions
  - Propose four alternatives
  - Reflect existing statute, Governor's direction, State Agency plans
  - Reflect feedback from stakeholders in oral and written comments from previous workshops
- Receive feedback on draft scenario assumptions before finalizing a set to be used for scenario modeling
- Draft scenarios are for evaluation purposes at this time and not meant to inform any current regulatory activities at CARB
- Iterative process to refine modeling scenario inputs

Transparency on Oral Comment Process

- Dedicated time for EJ Advisory Committee Members after the conclusion of presentation
- During general comment period:
  - CARB staff will periodically announce approximate number of hands raised
  - No ceding of time to others
  - Any EJ Advisory Committee Members should use the dedicated time after presentations to make any comments to ensure they are heard
  - Please do not email us directly to ask that we give you priority
- Goal to post agendas for workshops at least 48 hours in advance

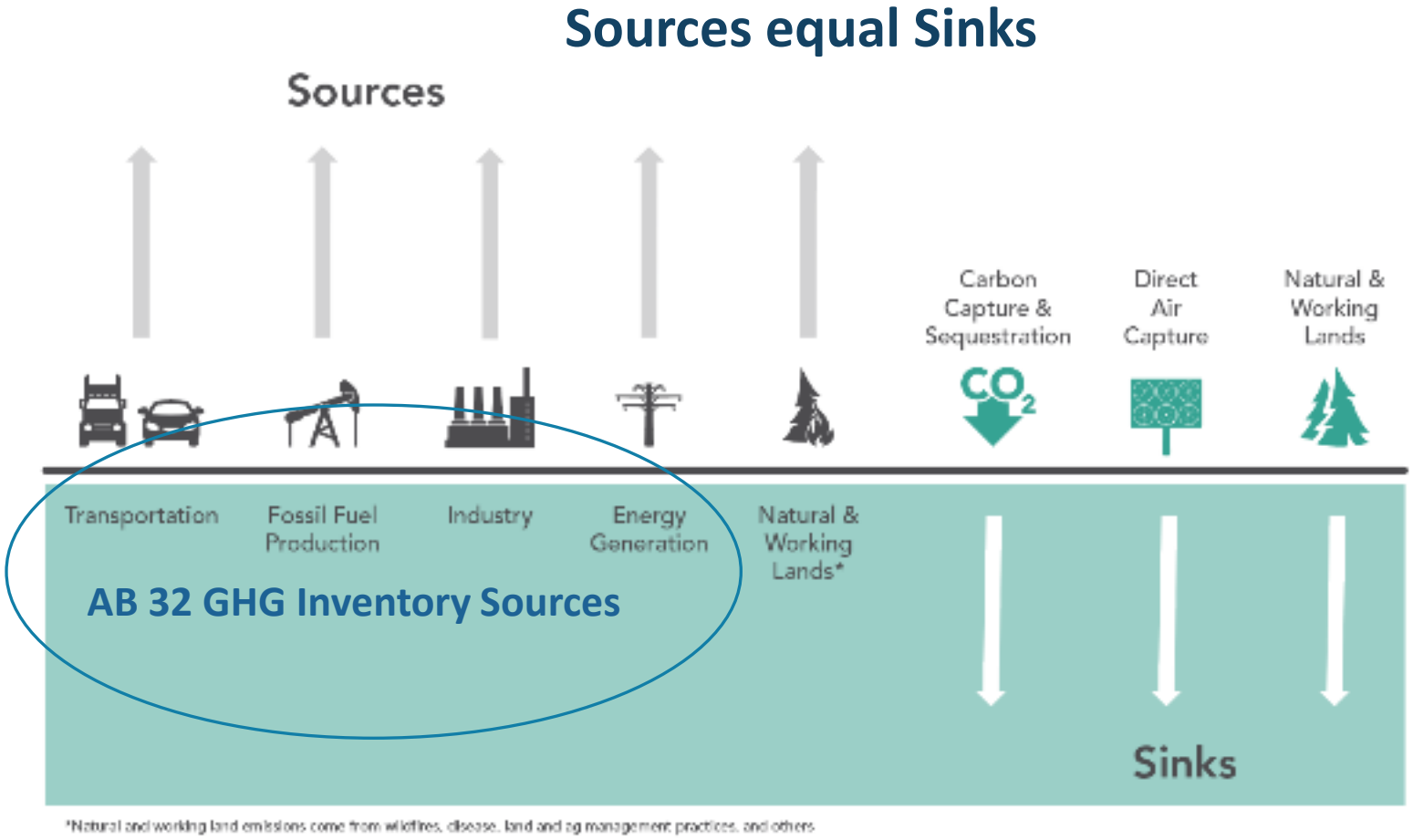
Public Participation

- Staff Presentation
- Questions and Feedback
  - Use the "**Raise Hand**" function in the GoToWebinar toolbar, which should be located to the right of your screen as shown
  - When staff call your name, please "**Unmute**" yourself by clicking the red button, and proceed to introduce yourself
- Written comments can be submitted following the workshop: Scoping Plan Meetings & Workshops
- Comment closing date October 22, 2021 (11:59 pm)

Draft Scenario Modeling Timeline

- September 30 – CARB workshop on draft scenario assumptions
  - Informed by stakeholder comments and initial EJ Advisory Committee Input
- October 22 – Comments due on 9/30 workshop
  - Requesting comments from all stakeholders, including EJ Advisory Committee
- Last week October – CARB workshop on revised draft scenarios
  - Scenarios revised based on comments received by October 22
  - CARB staff to take any further input during the workshop
- First week November – CARB provides draft scenario inputs to contractor to model scenarios.
  - Modeling emissions, health, and economics will take multiple months

Science-based Target: Achieve Carbon Neutrality (CO_2e) Mid-Century



- Continue to reduce emissions from sources in AB 32 GHG Inventory
- Reduce emissions and increase sequestration in Natural and Working Lands
- Maximize all sinks with goal of achieving net negative

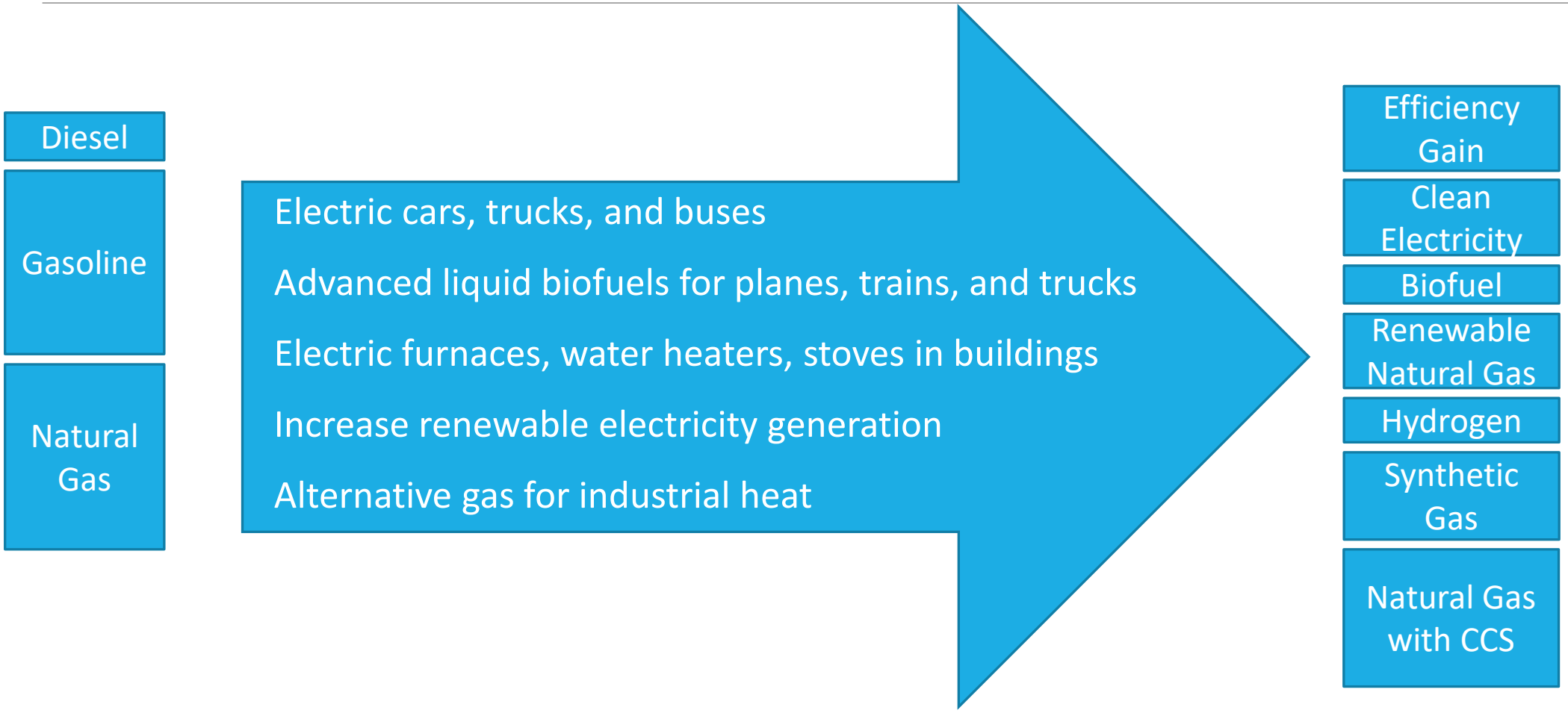
Modeling Approach

- Assess progress toward 2030 target
- Develop carbon neutral scenarios for 2035 and 2045 based on alternative fuels and technologies to reduce fossil fuel consumption (e.g., end-use sector outcomes)
- Estimate need for carbon removal to achieve carbon neutrality
  - Estimate any remaining GHG emissions in energy and industrial sectors
    - Separate effort to develop Natural and Working Land sequestration potential and targets
- Quantify air quality, health, and economic impacts for each scenario
- Based on alternative scenarios evaluated, identify a single Scoping Plan scenario

Sample of Commenters from Recent Workshops- Not Exhaustive

- Energy Futures Initiative
- California Environmental Justice Alliance
- Southern California Edison
- California Independent Petroleum Assn.
- Comite Civico Del Valle, Inc.
- Clean Air Task Force
- Bioenergy Assn. of California
- National Biodiesel Board
- Move LA
- 350 Humboldt
- California Manufacturers & Technology Assn.
- Physicians for Social Responsibility Los Angeles
- Independent Energy Producers Assn.
- Growth Energy
- Earthjustice
- Coalition for Renewable Natural Gas
- California Assn. of Sanitation Agencies
- Green Hydrogen Coalition
- Central Valley Asthma Coalition
- Dairy Cares
- California Publicly Owned Utilities
- Environmental Defense Fund
- Center for Biological Diversity
- Asian Pacific Environmental Network
- Leadership Council for Justice and Accountability
- California Hydrogen Business Council
- California Compost Coalition
- 350 Ventura County
- Western States Petroleum Assn.
- California Farm Bureau
- Coalition of Environmental Justice Groups
- Coalition for Sustainable Cement Manufacturing & Environment

Transition from Fossil Fuel to Alternatives



Draft Scenario Overview

- Alternative 1: Achieve carbon neutrality by 2035, with complete phaseout of combustion and no reliance on engineered carbon removal.
- Alternative 2: Achieve carbon neutrality by 2035, with full suite of technology options, including engineered carbon removal.
- Alternative 3: Achieve carbon neutrality by 2045, utilizing a broad portfolio of existing and emerging fossil fuel alternatives and achievement of Executive Order N-79-20.
- Alternative 4: Achieve carbon neutrality by 2045, utilizing existing and emerging technologies, in line with recent agency reports (AB 74 carbon neutrality in transportation, SB 100 zero-carbon electricity grid).

Carbon Neutrality by 2035

Alternative 1	Alternative 2
Accelerate emission reductions to exceed 2030 target to ~45%	Accelerate emission reductions to exceed 2030 target to ~55%
No combustion of any fuel including fossil, biomass-based fuels, or hydrogen	Allows for all options of current and emerging fuels to be utilized, but with focus to reduce fossil fuel combustion
Hard to decarbonize sectors – cement, aviation, etc.- with no non-combustion options would be phased out in California, may need to import goods to meet demand	Broad portfolio of zero carbon technologies including CCS, hydrogen, renewables, biomass-based fuels. Hard to decarbonize sectors would have options to operate
Early retirement of vehicles, gas appliances, industrial equipment in 2035 to eliminate fossil fuel emissions through buy-back programs	Emphasize transportation sector emission reduction through widespread electrification to reduce demand and corresponding reduction in petroleum supply
Without carbon dioxide removal to compensate for non-combustion emissions (short lived climate pollutants), carbon neutrality may not be achieved	Carbon dioxide removal deployed in 2035 to compensate for remaining economy-wide fossil fuel and non-combustion emissions (short lived climate pollutants)

Carbon Neutrality by 2045

Alternative 3	Alternative 4
Meet 2030 target	Meet 2030 target
Aggressively implement existing and emerging fossil fuel alternatives to reduce emission in excess of 80% below 1990 levels by 2050 target	Based on existing statute and state agency plans, implement existing and some emerging fossil fuel alternatives along path to 80% below 1990 levels by 2050 target
Broad portfolio of zero carbon technologies including CCS, hydrogen, renewables, biomass-based fuels	Broad portfolio of zero carbon technologies including CCS, hydrogen, renewables, biomass-based fuels
Emphasize transportation sector emission reduction through widespread electrification to reduce demand and corresponding reduction in petroleum supply	Retain some transportation fossil fuel use and technology and reduce demand and corresponding reduction in supply
Carbon dioxide removal deployed in 2045 to compensate for remaining fossil fuel and non-combustion emissions (short lived climate pollutants)	Carbon dioxide removal deployed in 2045 to compensate for remaining fossil fuel and non-combustion emissions (short lived climate pollutants)

Stakeholder Feedback

- Do we need to consider different scenarios?
- Which modeling inputs would you change in a given scenario?
- Are there technology or fuel options not presented that should be considered in the modeling? If so, please provide sufficient background to understand the technology or fuels, including any public health or cost information.

Non-Combustion Methane Emissions

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
• No additional landfill or dairy digester methane capture. Maximize deployment of alternative manure management strategies. Enteric strategy deployed before 2030. • Divert 75% of organic waste from landfills by 2025 • Oil and gas methane emissions are nearly eliminated when combustion phased out	• Rapidly increase landfill and dairy digester methane capture. Some alternative manure management deployed for smaller dairies. Enteric strategy deployed before 2030. • Divert 75% of organic waste from landfills by 2025 • Oil and gas fugitive methane emissions reduced 50% by 2030 and further reductions as infrastructure components retire in line with reduced natural gas demand
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
• Increase landfill and dairy digester methane capture. Some alternative manure management deployed for smaller dairies. Enteric strategy deployed in 2030. • Divert 55% of organic waste from landfills by 2025 and 75% by 2030 • Oil and gas fugitive methane emissions reduced 50% by 2030 and further reductions as infrastructure components retire in line with reduced natural gas demand	• Increase landfill and dairy digester methane capture. Limited alternative manure management deployed. Enteric strategy deployed in 2030. • Divert 55% of organic waste from landfills by 2025 and 75% by 2030 • Oil and gas fugitive methane emissions reduced 45% by 2030 and further reductions as infrastructure components retire in line with reduced natural gas demand

Industry (Manufacturing, Construction, and Agriculture)

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
Chemicals and Allied Products; Pulp and Paper: • Electrify 50% of boilers by 2030; • Electrify 100% of boilers and process heat by 2035; • Electrify 100% of other energy demand by 2030 **Stone, Clay, Glass & Cement**: • Facilities close because non-combustion alternative not available	**Chemicals and Allied Products; Pulp and Paper**: • Electrify 50% of boilers by 2030 and 100% of boilers by 2035; • Hydrogen for 25% of process heat by 2035 trending to 100% by 2045; • Electrify 100% of other energy demand by 2035 **Stone, Clay, Glass & Cement**: • CCS on large facilities by 2030 and on all facilities by 2045
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
Chemicals and Allied Products; Pulp and Paper: • Electrify 0% of boilers by 2030 and 100% of boilers by 2045; • Hydrogen for 25% of process heat by 2035 trending to 100% by 2045; • Electrify 100% of other energy demand by 2045 **Stone, Clay, Glass & Cement**: • CCS on large facilities by 2030 and on all facilities by 2045	**Chemicals and Allied Products; Pulp and Paper**: • Electrify 0% of boilers by 2030 and 10% of boilers by 2045; • Hydrogen for 0% of process heat by 2035 trending to 10% by 2045; • Electrify 0% of other energy demand by 2045 **Stone, Clay, Glass & Cement**: • CCS on large facilities by 2030 and on all facilities by 2045

Vehicle Miles Traveled (VMT)

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
• VMT per capita reduced 15% below 2019 levels by 2030 and 20% below 2019 levels by 2035	• VMT per capita reduced 12% below 2019 levels by 2030 and 22% below 2019 levels by 2045
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
• VMT per capita reduced 12% below 2019 levels by 2030 and 22% below 2019 levels by 2045	• VMT per capita reduced 10% below 2019 levels by 2030 and 15% below 2019 levels by 2045

Vehicle Fleet Electrification

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
Light Duty ZEVs: • 100% of LDV sales are ZEV by 2025; no Plug-in Hybrid Electric Vehicle (PHEV) sales after 2030 • Only ZEVs on road by 2035; no PHEVs on road by 2035 **Truck ZEVs**: • 100% of MD/HDV sales are ZEV by 2030 • Only ZEVs on road by 2035; no PHEVs on road by 2035	**Light Duty ZEVs**: • 100% of LDV sales are ZEV by 2030; • No PHEV sales after 2035 **Truck ZEVs**: • 100% of MD/HDV sales are ZEV by 2030; • Only ZEVs on road by 2045; no PHEVs on road by 2045
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
Light Duty ZEVs: • Executive Order N-79-20: 100% of LDV sales are ZEV by 2035 **Truck ZEVs**: • 100% of MD/HDV sales are ZEV by 2035	**Light Duty ZEVs**: • AB 74 ITS Report: 100% of LDV sales are ZEV by 2040 **Truck ZEVs**: • AB 74 ITS Report: 100% of MD/HDV sales are ZEV by 2040

Biofuels

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
• No biofuels consumption by 2035 • 25% of aviation fuel demand is met by electricity (batteries) or hydrogen (fuel cells) in 2030 and 50% in 2035 • 50% of aviation fuel demand not met in 2035 because non-combustion alternative not available	• Biomass supply used to produce conventional and advanced biofuels as well as hydrogen • 25% of aviation fuel demand is met by electricity (batteries) or hydrogen (fuel cells) in 2045
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
• Biomass supply used to produce conventional and advanced biofuels as well as hydrogen • 10% of aviation fuel demand is met by electricity (batteries) or hydrogen (fuel cells) in 2045	• Biomass supply used to produce conventional and advanced biofuels as well as hydrogen • 0% of aviation fuel demand is met by electricity (batteries) or hydrogen (fuel cells) in 2045

Petroleum Fuels

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
Oil and Gas Extraction: • Phase out operations by 2035 **Petroleum Refining**: • Phase out production by 2035	**Oil and Gas Extraction**: • Phase out operations by 2035 **Petroleum Refining**: • CCS on large facilities by 2030; • Production reduced in line with petroleum demand
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
Oil and Gas Extraction: • Phase out operations by 2045 **Petroleum Refining**: • CCS on large facilities by 2030; • Production reduced in line with petroleum demand	**Oil and Gas Extraction**: • Reduce operations in line with petroleum demand **Petroleum Refining**: • CCS on large facilities by 2030; • Production reduced in line with petroleum demand

Carbon Free Electricity Grid

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
• Sector GHG target of 23 MMTCO2e in 2030 and 0 MMTCO2e in 2035 • Total load coverage • Excludes combustion-based generation resources regardless of fuel; hydrogen fuel cells provide firm capacity	• Sector GHG target of 30 MMTCO2e in 2030 and 0 MMTCO2e in 2035 • Total load coverage • Includes Renewables Portfolio Standard (RPS)-eligible and zero-carbon generation resources
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
• Sector GHG target of 30 MMTCO2e in 2030 and 0 MMTCO2e in 2045 • Total load coverage • Same generation resources as Alternative 2	• Sector GHG target of 30 MMTCO2e in 2030 and 24 MMTCO2e in 2045 • Retail sales load coverage • Same generation resources as Alternative 2

Residential and Commercial Building Decarbonization

Alternative 1 - Carbon Neutrality by 2035	Alternative 2 - Carbon Neutrality by 2035
Existing Residential Buildings: • 80% of appliance sales are electric by 2025 and 100% are electric by 2030 • All buildings retrofitted to electric appliances by 2035 **Existing Commercial Buildings**: • 80% of appliances sales are electric by 2025 and 100% are electric by 2030 • All buildings retrofitted to electric appliances by 2035	**Existing Residential Buildings**: • 80% of appliance sales are electric by 2030 and 100% are electric by 2035 • Appliances are replaced at end of life **Existing Commercial Buildings**: • 80% of appliance sales are electric by 2030 and 100% are electric by 2045 • Appliances are replaced at end of life
Alternative 3 - Carbon Neutrality by 2045	**Alternative 4 - Carbon Neutrality by 2045**
Existing Residential Buildings: • 80% of appliance sales are electric by 2030 and 100% are electric by 2035 • Appliances are replaced at end of life **Existing Commercial Buildings**: • 80% of appliance sales are electric by 2030 and 100% are electric by 2045 • Appliances are replaced at end of life	**Existing Residential Buildings**: • 75% of appliance sales are electric by 2030 and 100% are electric by 2035 • Appliances are replaced at end of life **Existing Commercial Buildings**: • 75% of appliance sales are electric by 2030 and 100% are electric by 2045 • Appliances are replaced at end of life

Public Participation

- Today:
  - Environmental Justice Advisory Committee Members (up to 15 minutes)
  - Public (up to 90 minutes)
- Questions and Feedback
  - Use the “Raise Hand” function in the GoToWebinar toolbar, which should be located to the right of your screen as shown
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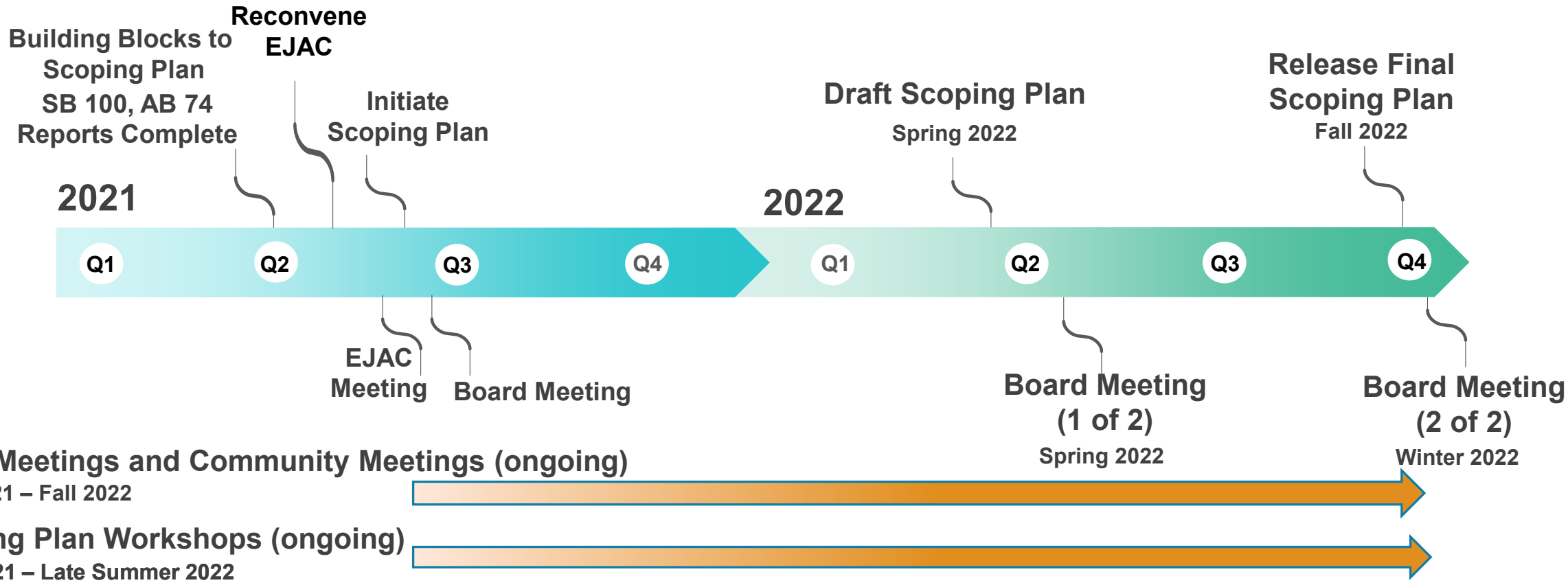
2022 Scoping Plan Update Schedule



Closing – Staying Engaged

- Written comments
  - https://www.arb.ca.gov/lispub/comm2/bcsubform.php?listname=sp22-inputs-ws&comm_period=1
  - **Comment closing date October 22, 2021 (11:59 pm)**
- Additional resources
  - www.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan
  - Workshops, EJ Advisory Committee Meetings, supporting materials, Board Meetings