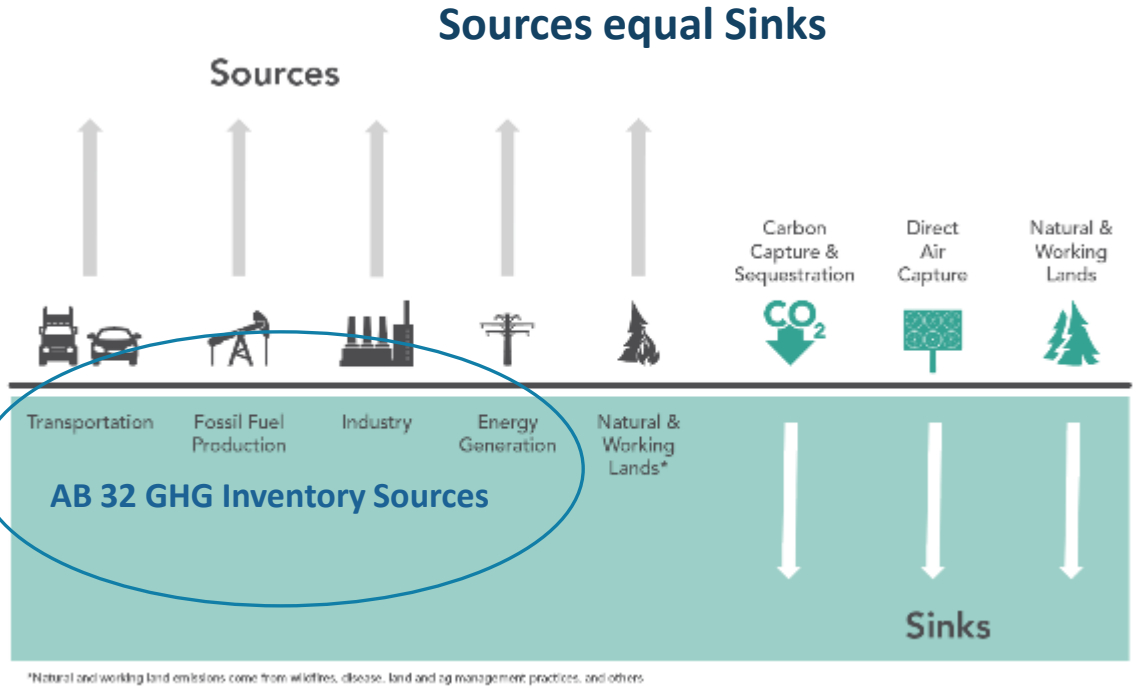
2022 Scoping Plan Update – Short-Lived Climate Pollutants Workshop

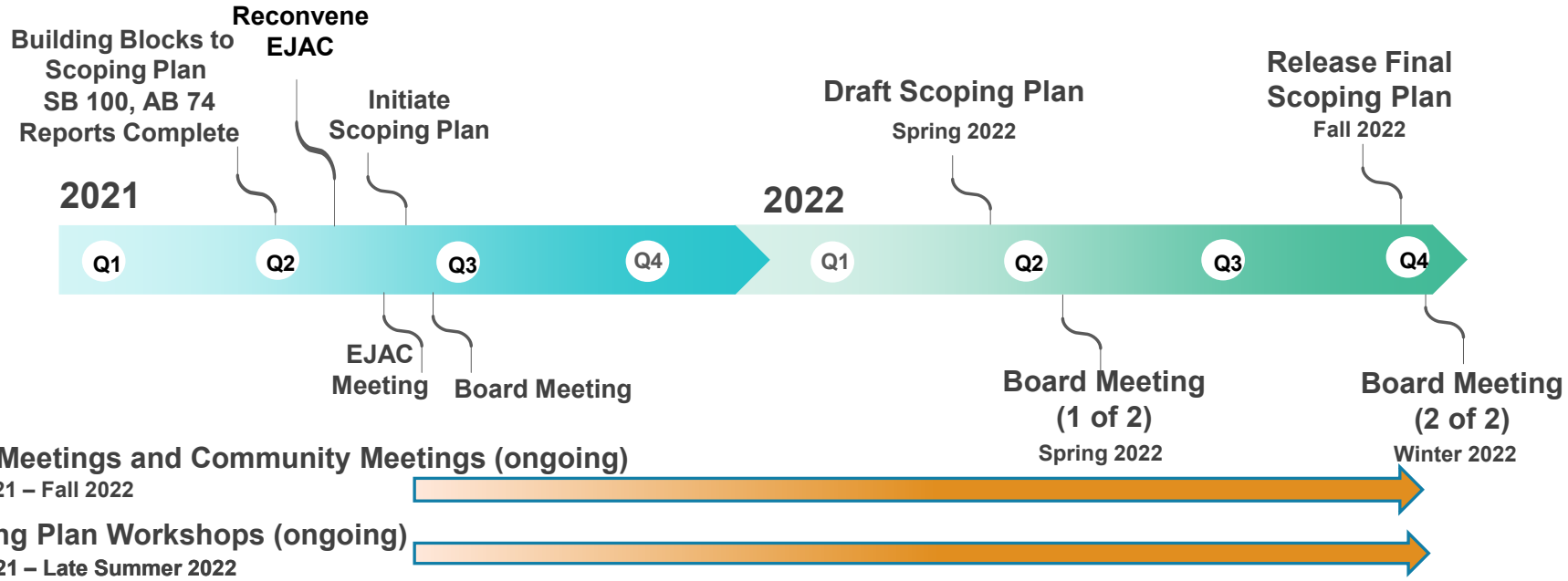
SEPTEMBER 8TH, 2021

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

2022 Scoping Plan Update Schedule



Transparency on Oral Comment Process

- Dedicated time for EJ Advisory Committee Members for each major workshop segment and after the conclusion of presentations
- 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 September 22, 2021 (11:59 pm)

Today's Workshop Objectives

- Provide status update on progress towards the current targets
- Solicit feedback on additional reduction opportunities in support of carbon neutrality
  - Pace of reductions and actions to reduce SLCP emissions beyond current targets
  - Energy and non-energy pathways that promote SLCP reductions
- Discuss options for modeling SLCP scenarios for Scoping Plan
- Receive feedback on barriers to reducing SLCPs in support of carbon neutrality by 2035 or 2045

Reminder – Relevant SLCP Questions from past scenarios concepts workshop

- **Timeline:** 2030 target in SB 32: 40% below 1990 levels
  - **Increase ambition in 2030?**
  - **Achieve Carbon Neutrality in 2045, 2035, or other year?**
- **Methane/RNG:** How should we use biogas captured from dairies and landfills - electricity generation, industrial heat, transportation fuel, other?
- **Solid biomass:** How should we best utilize solid biomass waste? Should biomass play a role in producing energy?

Workshop Agenda (Part 1)

1. **Workshop Overview**
2. Oil and Gas Emissions
3. Black Carbon
4. Hydrofluorocarbons (HFCs)
5. EJAC and Public Comments
6. 10-minute break

Workshop Agenda (Part 2)

1. Dairy and Livestock
2. Landfills, Organic Waste, and Renewable Natural Gas
3. EJAC and Public Comments
4. Closing

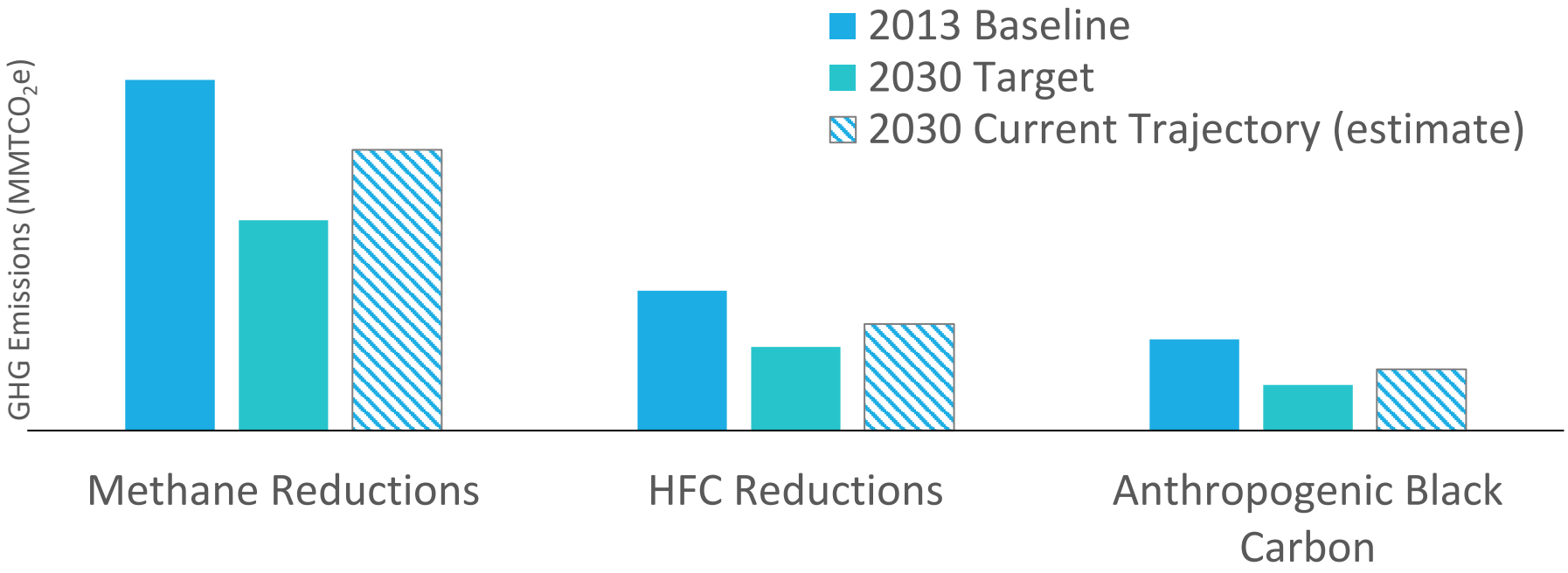
Overview – Short-Lived Climate Pollutants

- SLCPs are potent climate forcing gases with relatively short atmospheric lifetimes
  - Methane
    - Dairy & Livestock
    - Landfill Organic Waste
    - Oil & Gas
  - Hydrofluorocarbons (HFC)
  - Black carbon

Short-Lived Climate Pollutants Policy Framework

- Senate Bill 1383 (Lara, 2016) requires CARB to adopt and begin implementing the Short-Lived Climate Pollutant (SLCP) Reduction Strategy
- In 2017, CARB approved and began implementing the comprehensive SLCP Reduction Strategy to reduce statewide emissions to below 2013 levels by 2030 for:
  - methane by 40 percent
  - hydrofluorocarbon gases by 40 percent, and
  - anthropogenic black carbon by 50 percent

SB 1383 2030 emissions reduction targets may require more aggressive action



Feedback on targets and actions to further reduce emissions, and mechanisms to get there

Policy Objective	Action	Mechanism Pathway
A goal for when SLCPs might be reduced and by how much	On-the-ground activity that alters what is done compared to the business-as-usual case	A portfolio of levers that California can use to elicit the desired changes in reduction strategies (legislation, incentives, regulation, etc.)
• e.g., Reduce methane by 40% relative 2013 levels by 2030	• Increase composting of food rather than landfilling • Use feed additives for dairy operations to reduce enteric emissions • Use of mass timber products for new home construction	• Fund build-out of new compost and anaerobic digestion facilities, etc. • A clean product standard that creates a market for compost, mass timber, low-carbon dairy products, etc. • Cap on methane emissions allowed at facility; etc.

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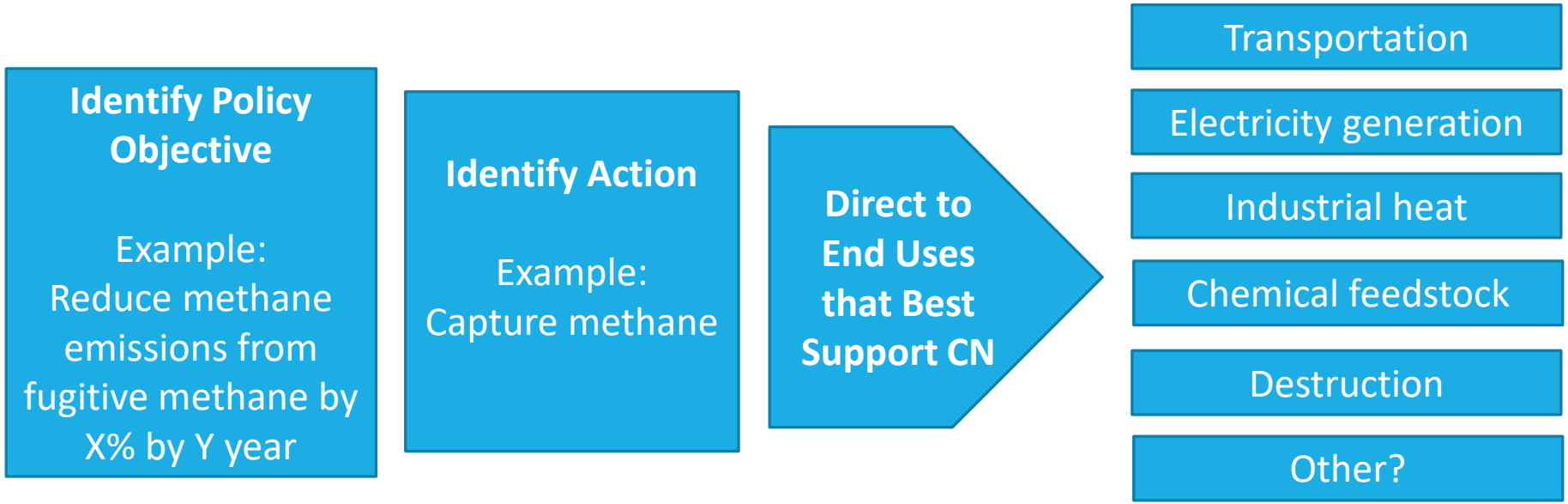
Example: SLCP Policy Objectives and Actions Affect Other Sectors



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6. Public Comments
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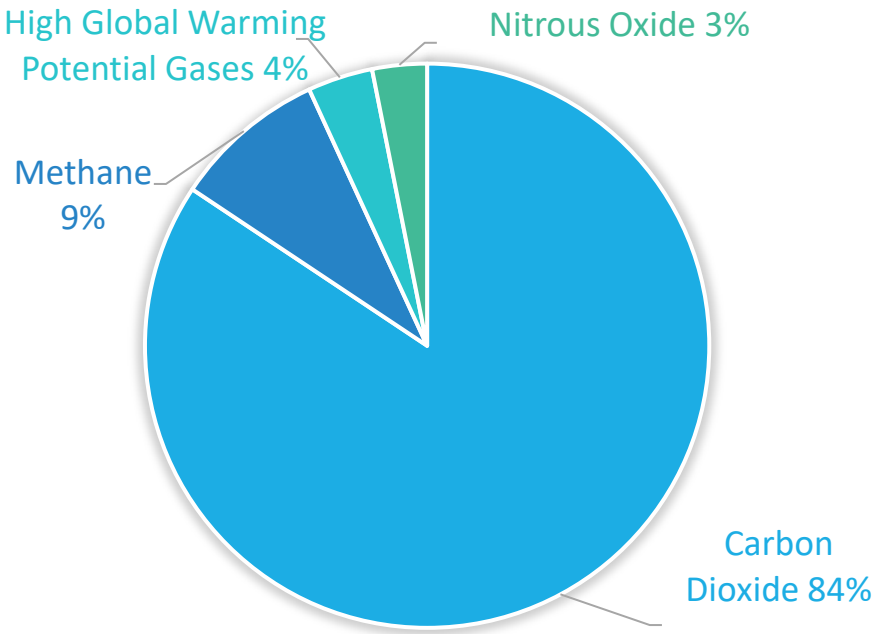
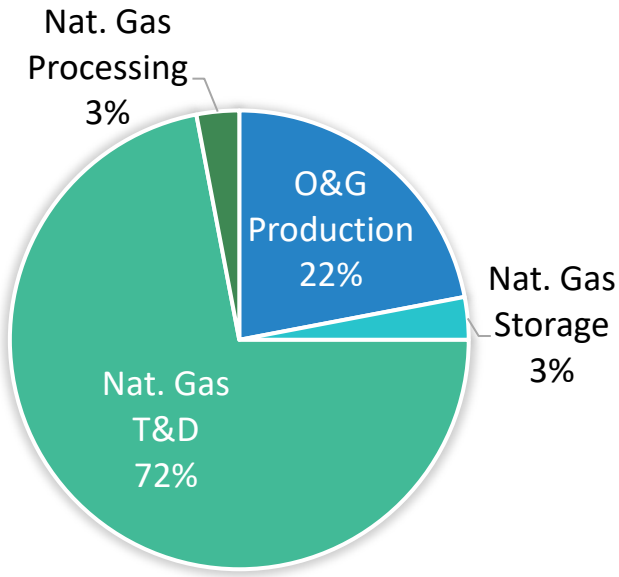
Methane Emissions in California (2013)



Fugitive Methane from Oil and Gas Systems

- In 2018, California's oil and gas systems were responsible for approx. 6 $MMTCO_2e$ (100-yr GWP)
- California has an extensive oil and gas industry that contributes to fugitive methane emissions, including:
  - Oil and gas production
  - Natural gas processing and storage
  - Natural gas transmission and distribution



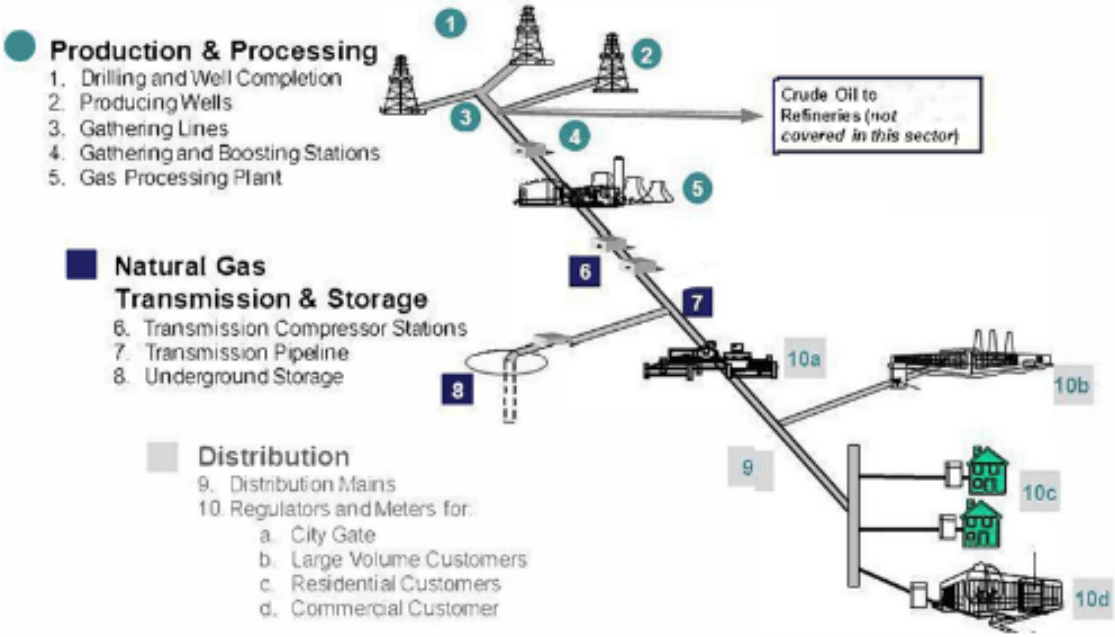
Oil and Gas Methane Emissions Reduction Programs

GHG Emission Standards for Crude Oil and Natural Gas Facilities
(Oil and Gas Methane Regulation, 2017)

Decision (D.17-06-015, June 2017)
(Natural Gas Leak Abatement Program)

Natural Gas System

Natural gas systems encompass wells, gas gathering and processing facilities, storage, and transmission and distribution pipelines..



Source: Adapted from American Gas Association and EPA Natural Gas STAR Program

SLCP Emissions Reduction Targets for Oil and Gas Sector

- SLCP Reduction Strategy established goals of reducing fugitive methane from oil and gas sector by:
  - 40% by 2025 (below 2013 levels)
  - 45% by 2030 (below 2013 levels)

Progress Towards Emissions Reduction Targets for Oil and Gas Sector

Oil and Gas Methane Regulation

- Estimated to result in emissions reduction of 0.5 MMTCO$_2$e/yr (100-yr GWP)
- Anticipated to achieve approximately 36% reduction in production and processing fugitive methane by 2025 (4% short of SLCP target)

Natural Gas Leak Abatement Program

- Gas utilities appear to be making progress toward reduction targets
- CPUC and CARB are currently assessing reductions achieved

Upcoming Scenario Modeling and Cross-Sector Relationships

Scenario modeling will evaluate how fugitive methane from oil and gas sources will change based on:

- The Governor's directive to phase out in-state oil and gas production by 2045 or sooner
- Changes in natural gas demand
- RNG utilization in existing fossil gas infrastructure

Key Questions

- What additional strategies should we prioritize now to further reduce fugitive methane emissions from the oil and gas sector?
- As the volume of fossil gas in the State's infrastructure decreases, should the existing infrastructure be repurposed, if so, how?
- How can we ensure that fugitive emissions from repurposed infrastructure are mitigated?

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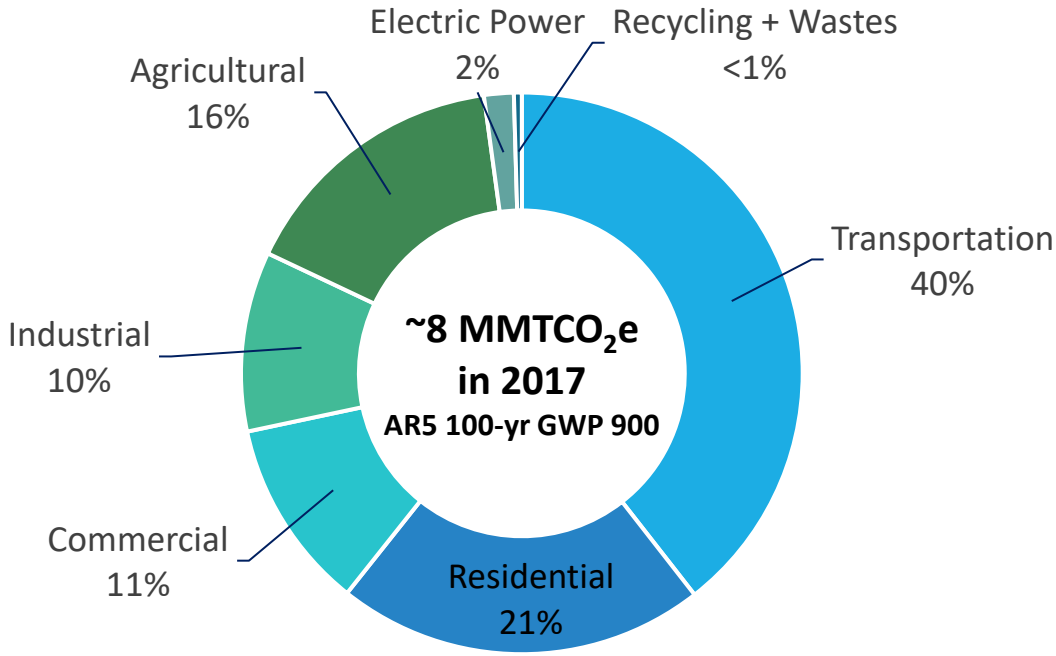
Black Carbon Climate Impact

- Black Carbon traps heat in the atmosphere
  - It has a shorter lifespan than other GHG emissions, but is a more powerful warming agent than CO_2
  - One ton of BC has a warming effect equal to 900 tons of CO_2 over a 100-year period, and 3,200 tons over 20 years (IPCC-AR5)
- SB 1383 directs CARB to reduce Anthropogenic Black Carbon Emissions 50% from 2013 levels by 2030
- Black Carbon is not an AB 32 gas, and is not included in the AB 32 GHG Inventory



Sources of Anthropogenic Black Carbon

Black carbon (BC) inventory is calculated using existing $PM_{2.5}$ emission inventories combined with speciation profiles that define fraction of $PM_{2.5}$ that is BC



Anthropogenic Black Carbon Emissions Reduction – Key Actions

Reduce Combustion Emissions from the Transportation sector

- Regulations and incentives for on-road and off-road engines and fleets
- Clean fuels regulations and incentive

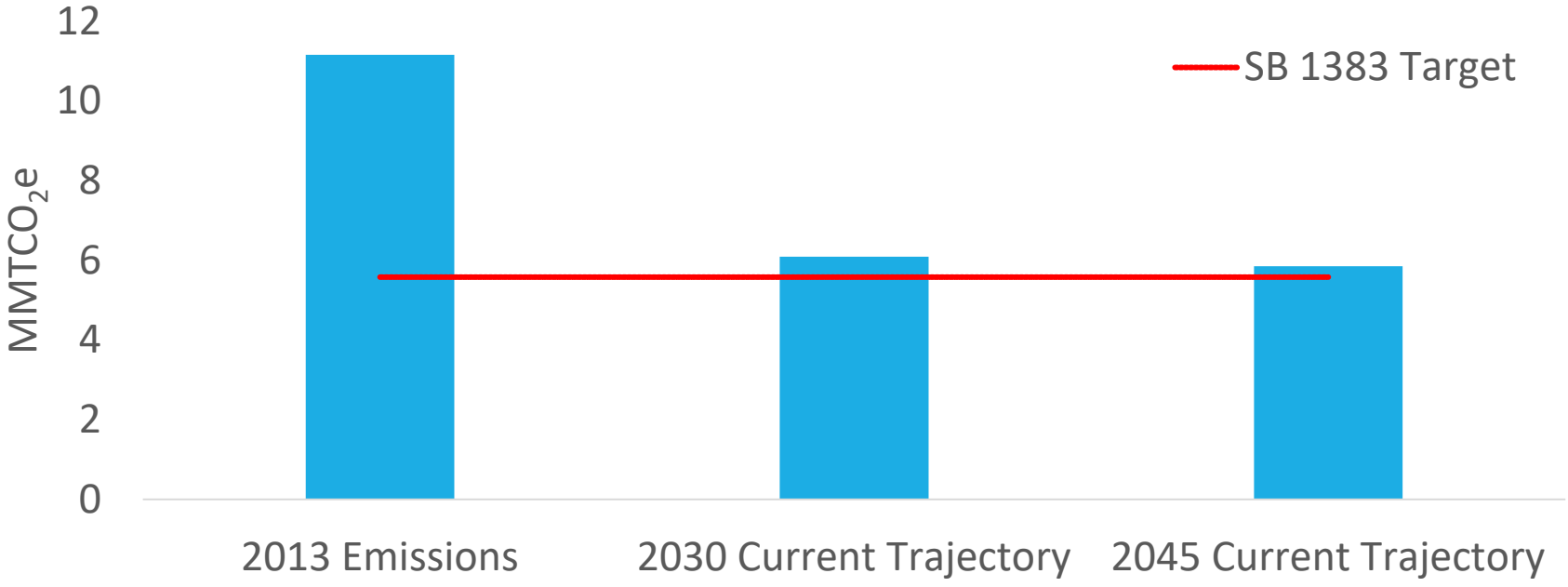
Reduce Residential Woodsmoke emissions

- Federal, State, and local incentive programs to reduce wood burning

Reduce Commercial and Industrial emissions

- Local stationary source air quality requirements
- State GHG reduction programs, which also have co-pollutant reductions

Black Carbon Reductions are not on track to hit SB 1383 2030 reduction target



Additional Analysis/Questions

- What will an updated inventory for anthropogenic black carbon emissions in California show?
- What will the effect of various climate and energy policies (e.g., ZEV EO, SB 100, building decarbonization) be on future anthropogenic black carbon emissions?
- What amount of residential woodsmoke and black carbon reductions should we expect from the various Federal, State, and Local programs?

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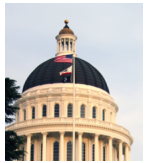
Hydrofluorocarbons (HFCs) are potent Short-Lived Climate Pollutants

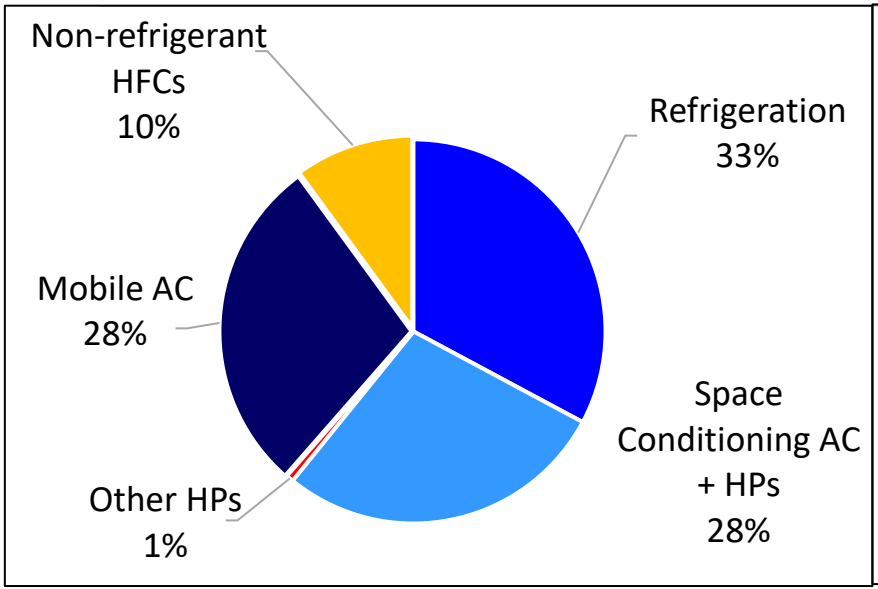
- Commonly used for cooling and insulating houses and vehicles, keeping food cold and safe, propellants for medical and other devices
- As climate change worsens, need for cooling increases
- Common HFCs used today have very high global warming potential (GWP) values

  For example: 1 lb. of most common home AC (GWP 2,088) = 2,088 lbs. of CO_2

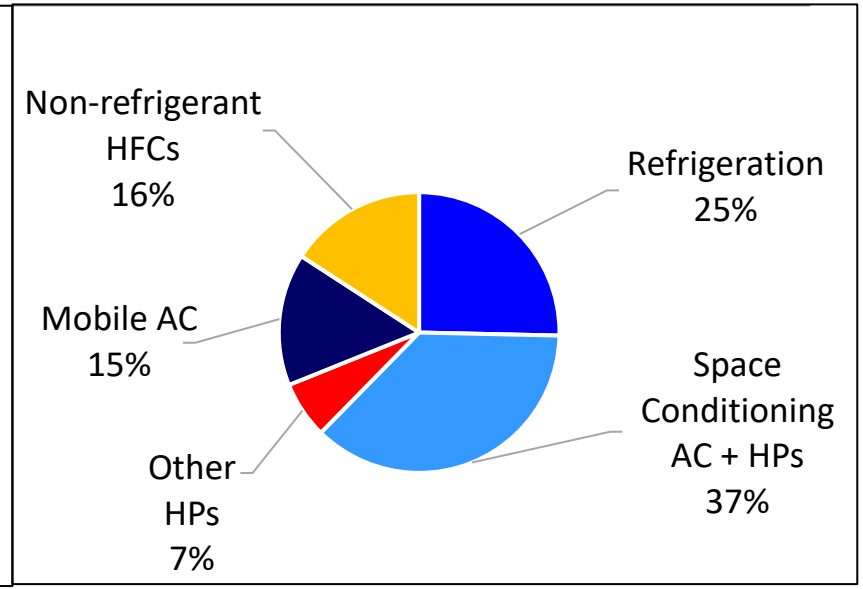


SB 1383 requires CARB to reduce HFC emissions 40% below 2013 levels by 2030

Sources of HFCs in California
(with current and proposed regulations in place)



2019

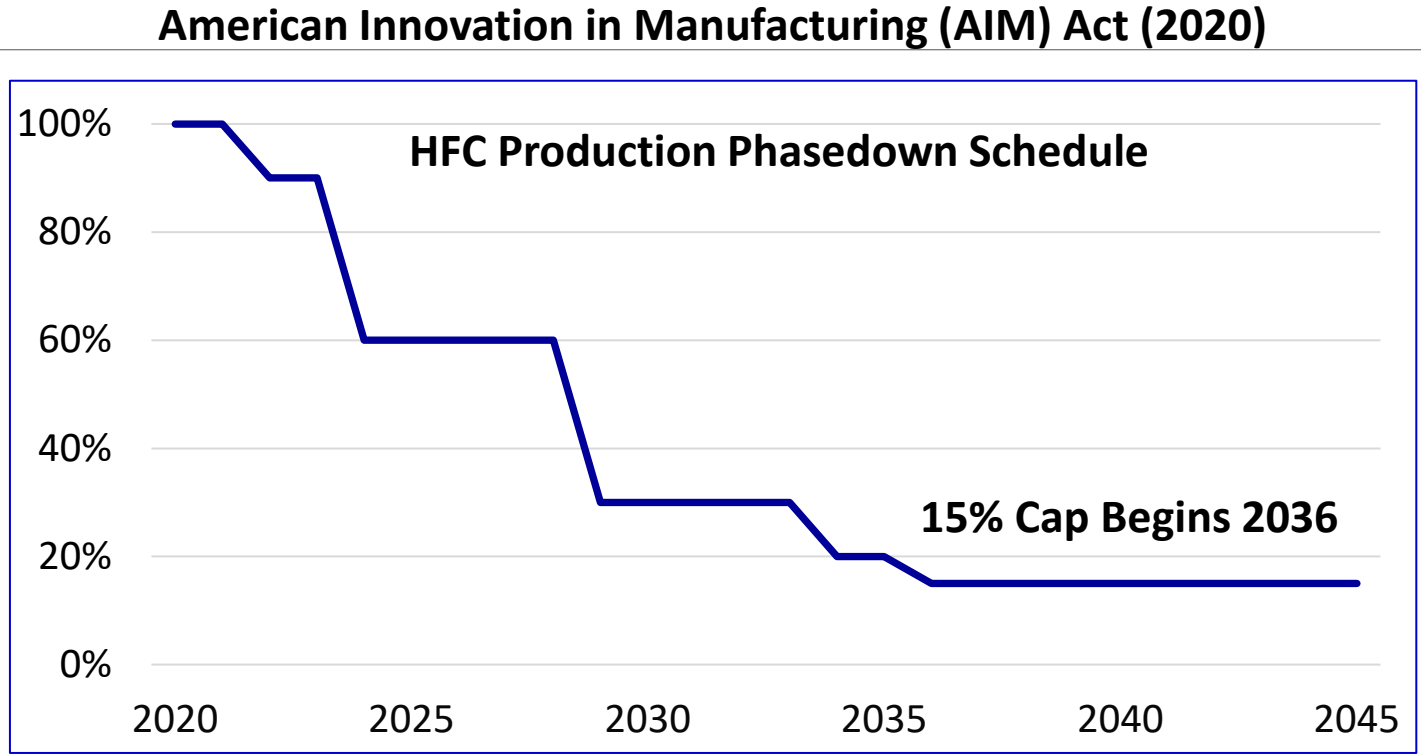


2030

What has CA done to reduce HFC emissions?

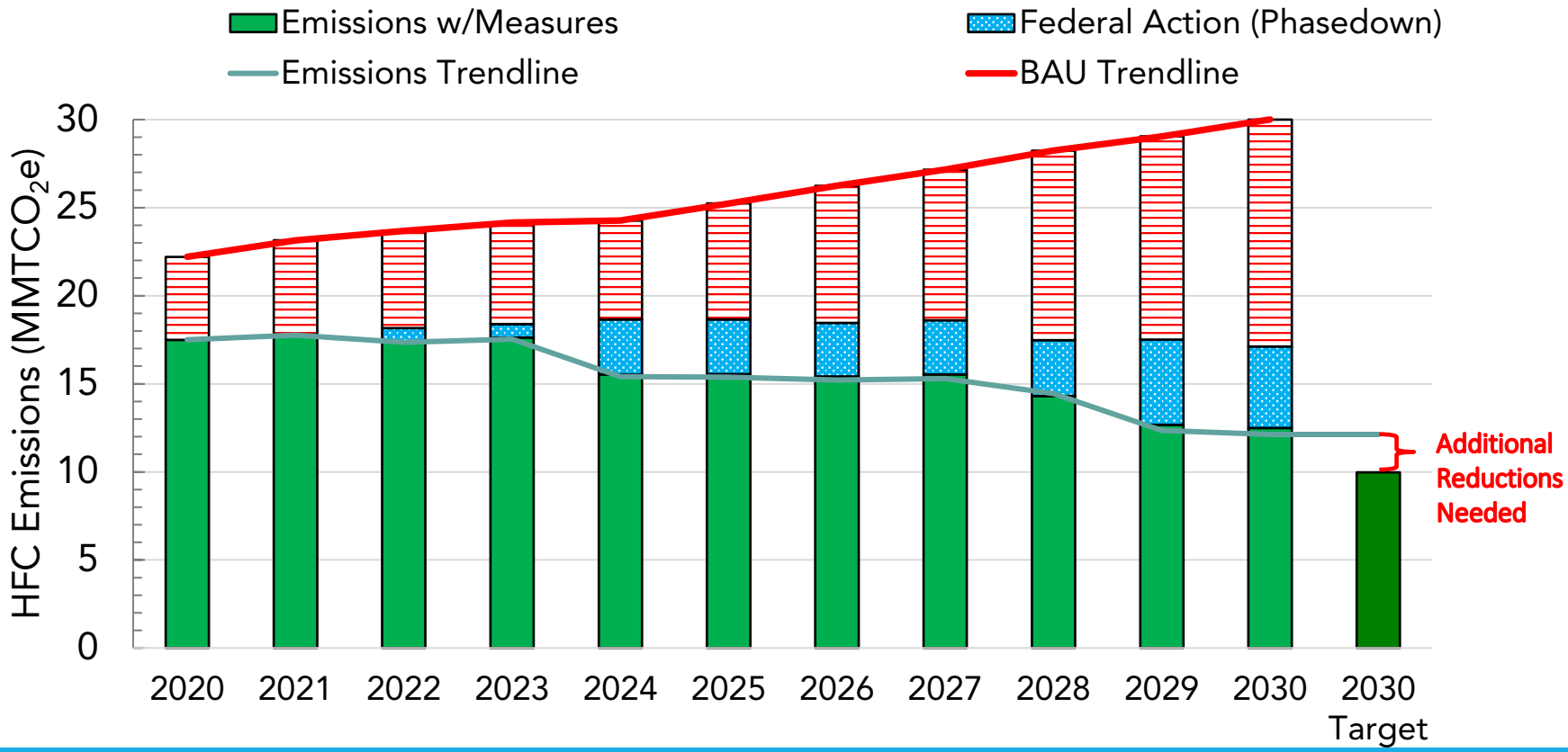
Regulations Adopted under AB 32	• **Refrigerant Management Program** • **Motor Vehicle AC** • **Consumer product aerosol propellants** • **Semiconductor Manufacturing**
California SNAP (2018)	• **Prohibitions on high-GWP refrigerants for stationary refrigeration, foams, chillers, vending machines, aerosols**
GWP Prohibitions for AC and Refrigeration (2020)	• **Refrigerants with GWP < 150 for refrigeration, company-wide targets, effective 2022** • **Refrigerants with GWP > 750 for AC, effective 2023/2025/2026** • **Refrigerant reclaim and re-use program (R4 Program)**

National Action on HFCs



Source: U.S. EPA 2021

Progress to Meet 2030 HFC Target

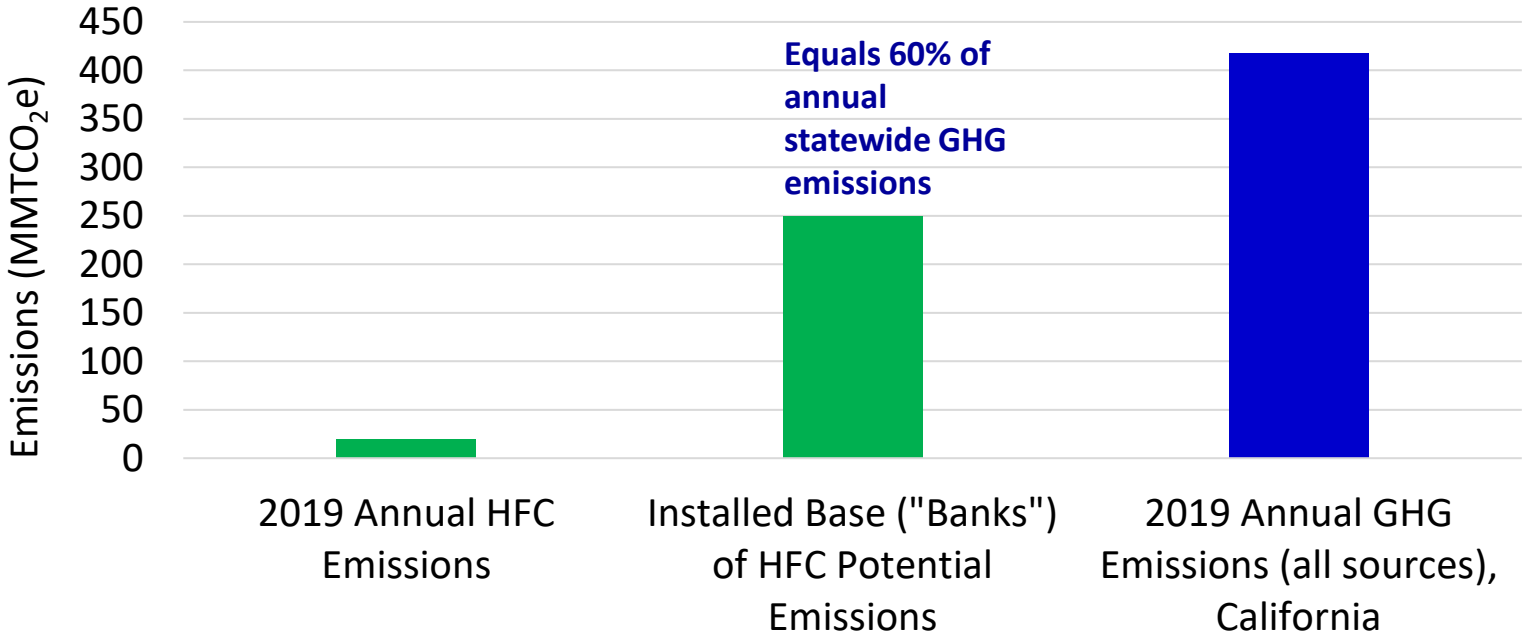


Unique Challenges of Reducing HFCs

- Dispersed sources of AC and refrigeration in millions of homes and office buildings, and thousands of grocery stores
- Limited/no drop-in replacements for refrigerants already in equipment
- Phasedown in HFC production does not result in immediate emissions reductions due to long equipment lifetimes

~14 million households

What are the Potential Emissions from HFCs in Existing Equipment?

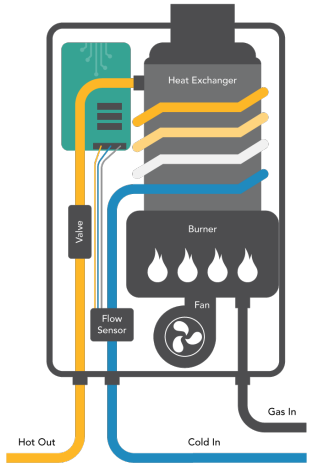


Reducing HFCs is Critical for Carbon Neutrality

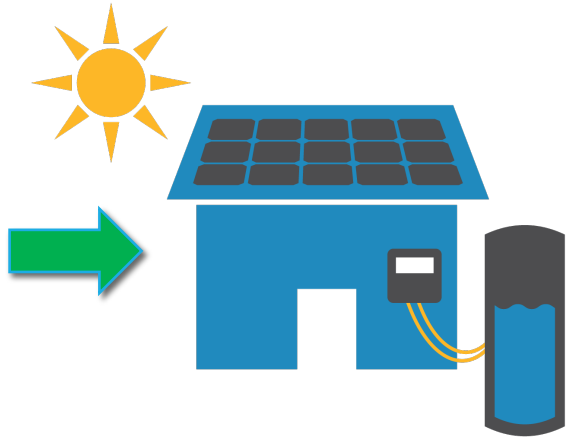
- By 2045, HFCs could be one of the largest remaining GHG sources
- HFC reductions integral for achieving state's long-term climate goals

HFCs trends with Building Electrification

- Building electrification has many benefits
- However, new HFC sources are added: adoption of heat pumps is expected to increase HFC use in space conditioning, water heating, clothes drying, and pool and spa heaters



Uses Fossil Gas



Uses Refrigerants

Additional Action Needed to Reduce HFCs

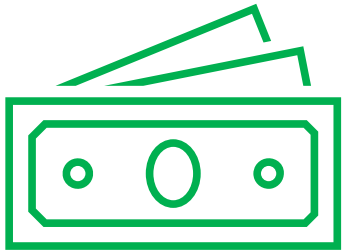
- GWP limits for new sources like heat pumps
- Tighten GWP limits on existing sources
- Enhance recovery, reclaim and reuse
- Other?

Regulations

- Overcome barriers for ultra-low-GWP technologies
- Partner to maximize incentives, broaden the reach
- Assist low-income and disadvantaged communities

Incentives

Incentives are Critical for Meeting Climate Goals



CARB's SLCP Strategy (2017) identified incentives as an important strategy

SB 1013 (2018) established first statewide incentive program

Cap-and-Trade Auction Proceeds DRAFT Investment Plan for 2022-2023 to 2024-2025 identifies HFC reduction as an investment priority

Going forward, interagency coordination needed for building electrification incentives to ensure transition to low-GWP alternatives

Coordination with CA Agencies and Utilities

SB 1013 (2018) directed interagency coordination on HFCs

- AB 3232 building assessment
- 2022 Building codes
- Research & Development
- SB 1477

- SB 1477
- Incorporating refrigerants in existing energy programs

- California Building Codes

Utilities – Southern California Edison, LA Dept. of Water & Power, and others

Key Questions

- What additional strategies could be used to further reduce HFC emissions?
- How should we address existing banks of HFC emissions?
- How should we preserve building electrification benefits with respect to HFC refrigerants?

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5. **EJAC and Public Comments**
6. 10-minute break

Kevin Hamilton

Central California Asthma Collaborative

Public Participation

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  - Environmental Justice Advisory Committee Members (up to 15 minutes)
  - Public (up to 30 minutes)
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Short Break

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   - California Department of Food and Agriculture: Amrith Gunasekara, Science Advisor to Secretary Karen Ross
   - CARB: Qian Mitloehner, Short-Lived Climate Pollutant Policy Section
   - Michael Boccadoro, West Coast Advisors
   - EJAC presentation: J Jordan, Leadership Counsel for Justice & Accountability
2. Landfills, Organic Waste, and Renewable Natural Gas
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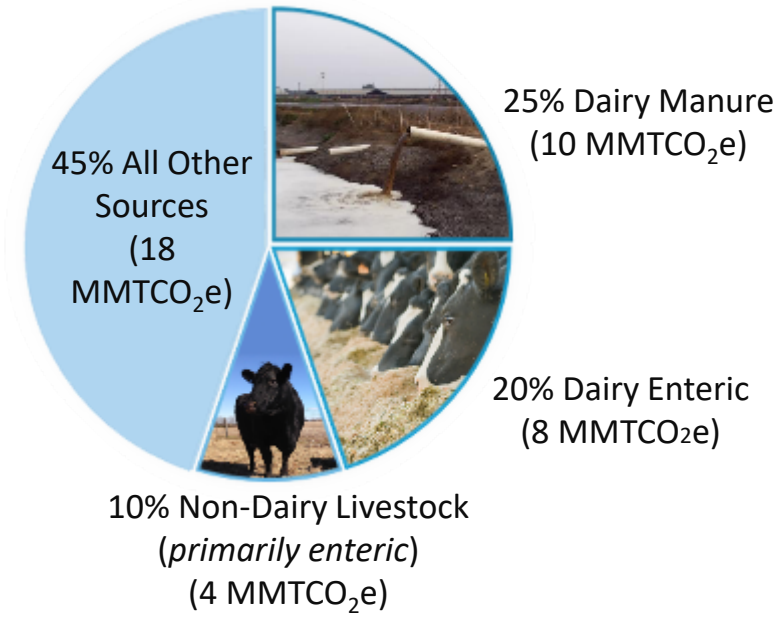
2013 Dairy and Livestock Methane Emissions

- Senate Bill (SB) 1383 baseline year
- Dairy and livestock methane comprises 55% of the annual methane emissions
  - 10 $MMTCO_2e$ from manure management
  - 12 $MMTCO_2e$ from enteric fermentation

2013 Methane Emissions



Methane Mitigation Strategies

- Manure management strategies
  - Anaerobic digesters
  - Alternative manure management practices
- Enteric mitigation strategies
- Selective breeding and Diet modification
- Feed additives
  - Benefits
    - Pay-as-you-go emissions reductions
    - Potentially cost effective for producers
    - Ease of adoption
  - Challenges
    - Safety and consumer acceptance
    - Lack of financial incentives
    - Few options are commercially available

Methane Emissions through 2030 – Projection Assumptions

Population change

- Linear annual decrease of 0.5% projected 2013-2030
- Plateaus beyond 2030

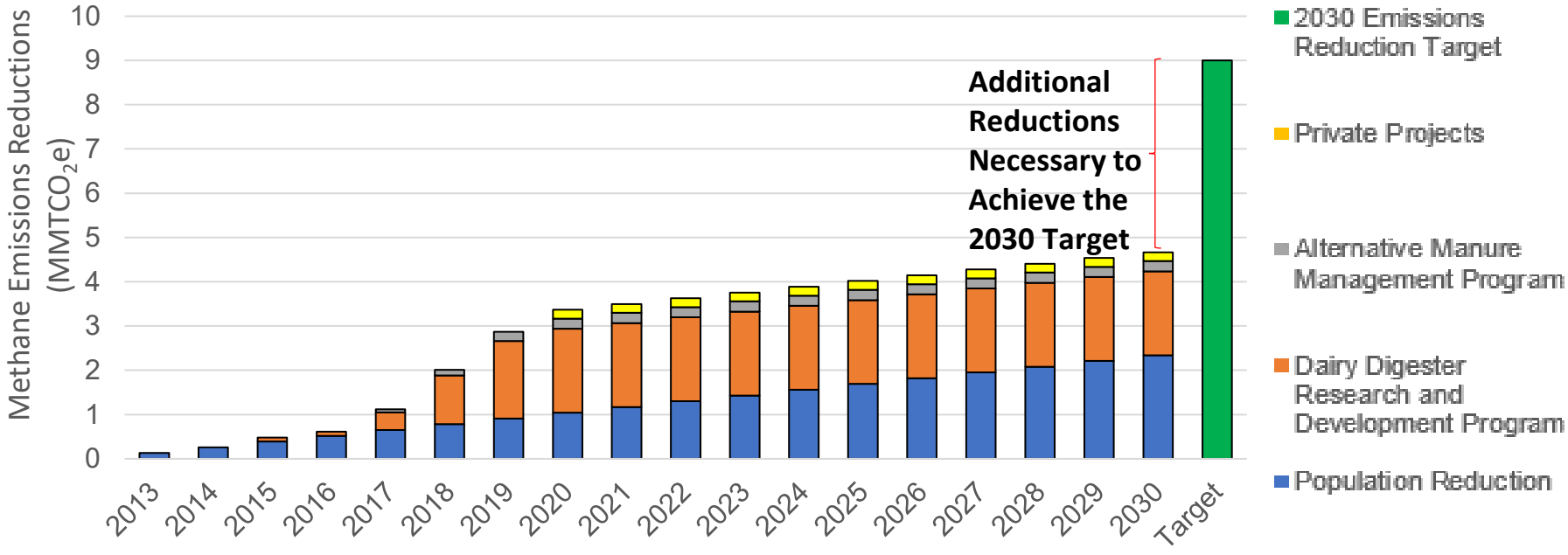
Manure management strategies

- CCI-funded projects to date: ~2.0 $MMTCO_2e$
- Privately funded projects: ~0.2 $MMTCO_2e$
- 125 digesters and 155 alternative manure management projects
- No significant additional investment beyond 2022

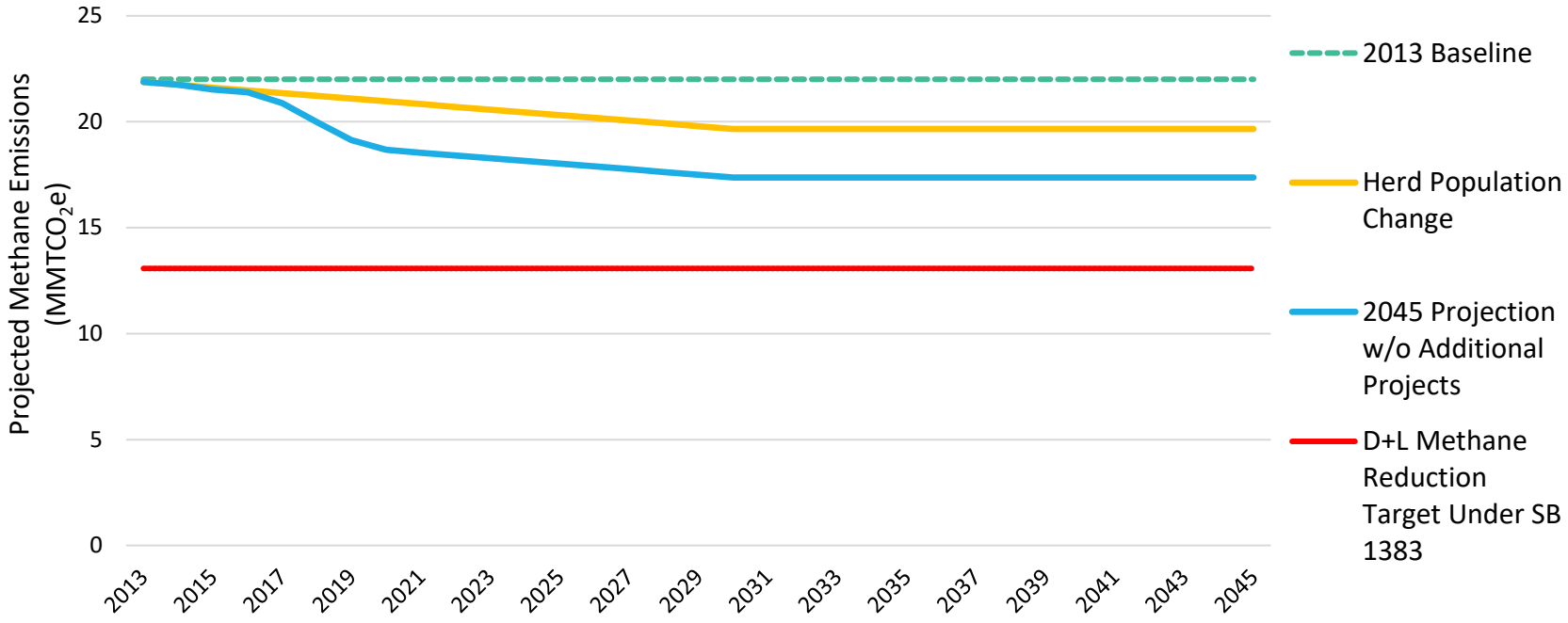
Enteric strategies

- No implementation of enteric methane reduction strategies

Methane Emissions Projection – Progress toward 2030 SB 1383 Target



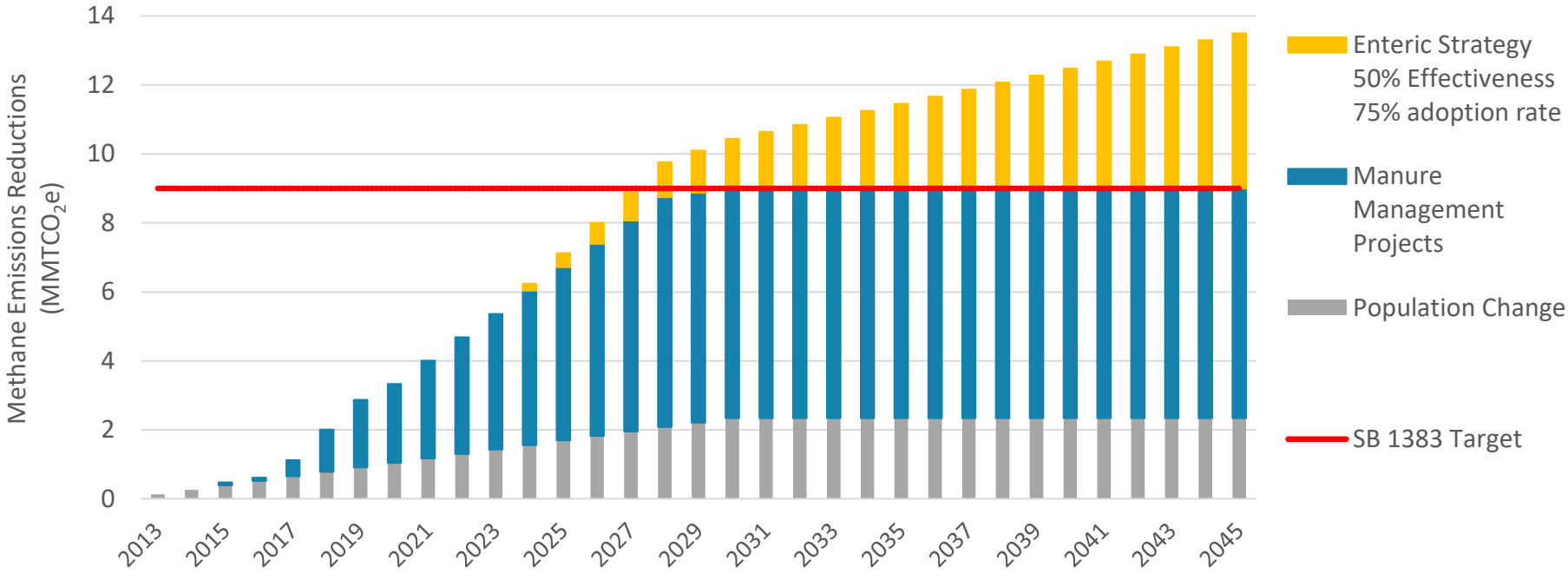
Dairy/Livestock methane through 2045 – Without additional projects



Key Questions for Modeling Additional Reductions

Animal population change	Manure management strategies	Enteric strategies	Other strategies
• Should we anticipate a continued decline in animal population? If so, how much?	• How many additional manure management projects should we anticipate? • How much funding might be available?	• What will the GHG reduction potential of enteric strategies be? • How widely will these be adopted and when?	• Are there other strategies for reducing California dairy/livestock methane that we're missing?

Illustrative Example – Potential Methane Reductions from Dairy and Livestock



Key Questions

- What additional strategies could further reduce methane emissions from the dairy and livestock sector?
- What amount of methane reductions pre- and post-2030 should we expect from the dairy and livestock sector?
- What strategies will best support adoption of enteric methane emission reduction strategies?
- What are reasonable assumptions about effectiveness and adoption rates for enteric strategies?
- What are reasonable assumptions about in-State animal population change?
- To what extent should we prioritize or account for non-GHG outcomes of emissions reduction projects?

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   - RNG Coalition: Sam Wade
   - CPUC: Karin Sung
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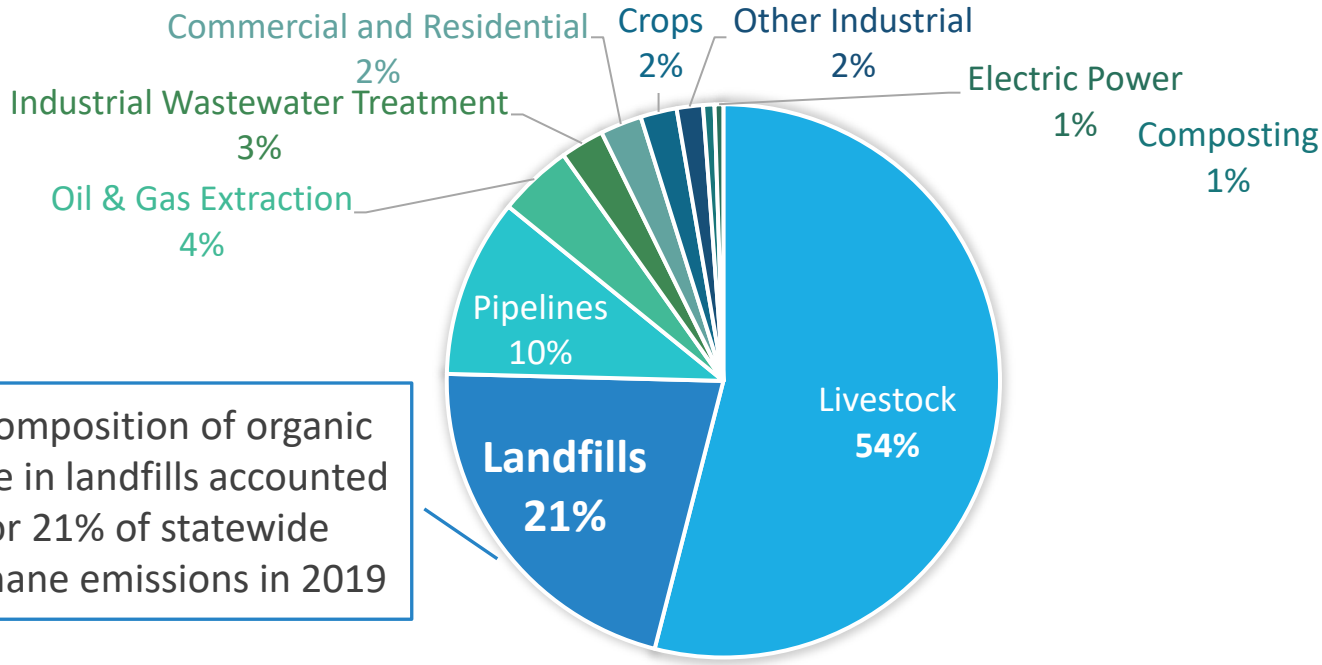
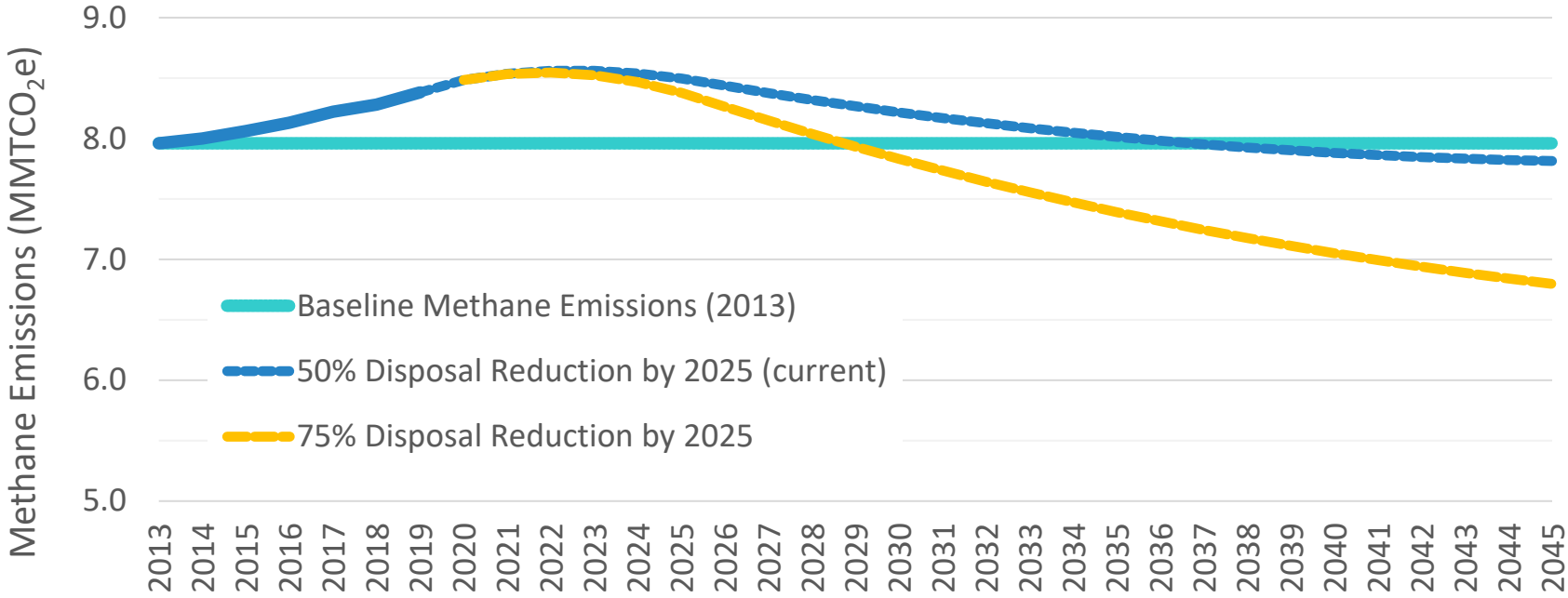
Landfills are a leading source of methane emissions



Decomposition of organic waste in landfills accounted for 21% of statewide methane emissions in 2019

Source: California Methane Inventory for 2000-2019 by Scoping Plan Category

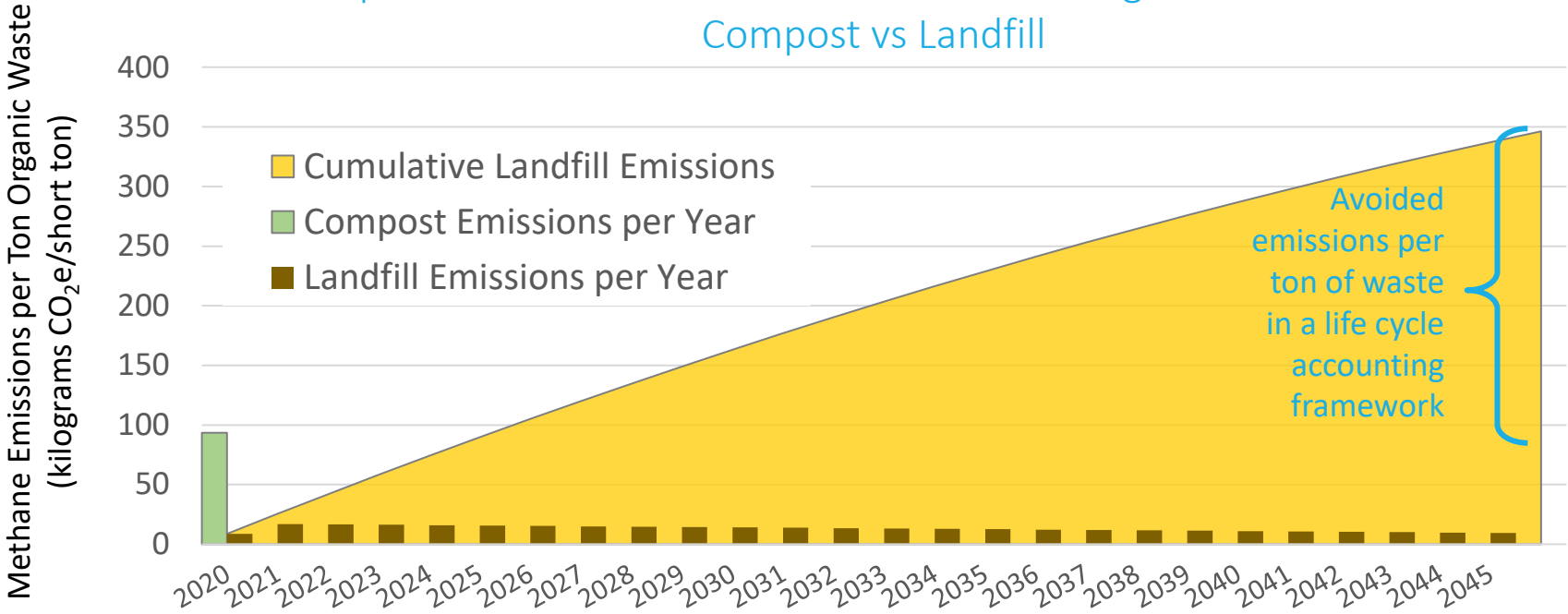
Landfill methane through 2045 – The difference diversion makes



2025 Disposal Reduction estimated from: CalRecycle, 2020 Analysis of the Progress Toward the SB 1383 Waste Reduction Goals

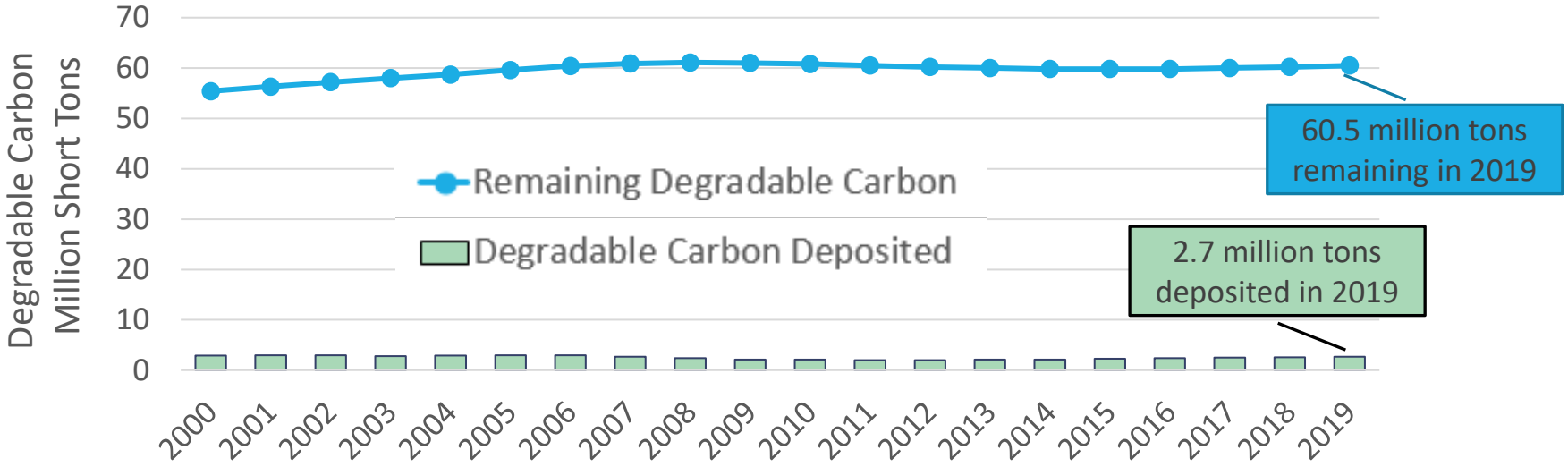
Emission benefits of diversion accrue over the long lifetime of waste degradation

Example: Methane emissions from one ton of organic waste in 2020: Compost vs Landfill



Previously-disposed organic waste leads to continued emissions

Phasing out landfilling of organic waste will not <u>immediately</u> eliminate landfill emissions; waste in place will continue to generate significant methane for decades



Source: California Greenhouse Gas Emission Inventory for 2000-2019

CARB's efforts to reduce methane emissions from landfills

- The Landfill Methane Regulation was adopted as a discrete early action measure under AB 32; in effect since 2010
  - Established stringent statewide standards and requires extensive monitoring to ensure gas collection and control systems are maintained and operated to minimize methane emissions; estimated to capture at least 75% of landfill gas
- Ongoing methane research is expected to help:
  1. Identify new technologies and practices that can reliably improve collection efficiency and reduce fugitive emissions;
  2. Inform quantification of facility-scale methane emissions and variability; and
  3. Quickly pinpoint large methane point sources to help operators identify and mitigate leaks.

For more information see CARB's Methane Research Program

Key Questions

- What are suitable post-2030 targets given the magnitude of future methane emissions from organic waste already in place at landfills?
- What additional strategies should be prioritized to further reduce methane emissions from the waste sector? E.g.,
  - Deployment of new monitoring technologies to identify, quantify, track, and respond to methane leaks; Improve landfill operations and cover practices to control fugitive emissions
  - Edible food rescue programs and other waste prevention efforts; best management practices to minimize emissions at organics recycling facilities; expand markets for bioproducts

Workshop Agenda (Part 2)

1. Dairy and Livestock Methane
2. **Landfills, Organic Waste, and Renewable Natural Gas**
   - CalRecycle: Clark Williams
   - CARB: Anthy Alexiades, Short-Lived Climate Pollutants Policy Section
   - RNG Coalition: Sam Wade
   - CPUC: Karin Sung
   - EJAC presentation: Kevin Hamilton, Central California Asthma Collaborative
3. EJAC and Public Comments

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Kevin Hamilton

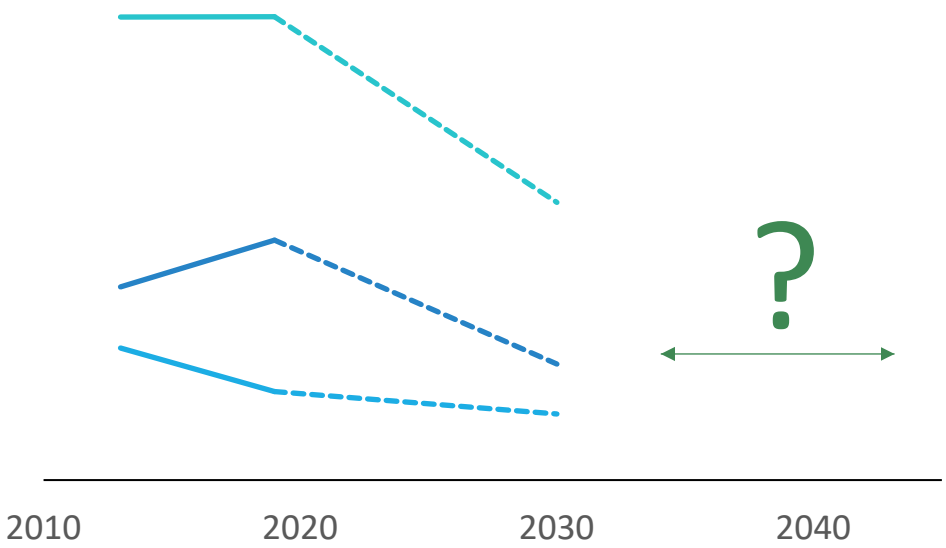
Central California Asthma Collaborative

Public Participation

- Today:
  - Environmental Justice Advisory Committee Members (up to 15 minutes)
  - Public (up to 30 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
  - When staff calls your name, please “Unmute” yourself by clicking the red button, and proceed to introduce yourself

Conclusions for Workshop

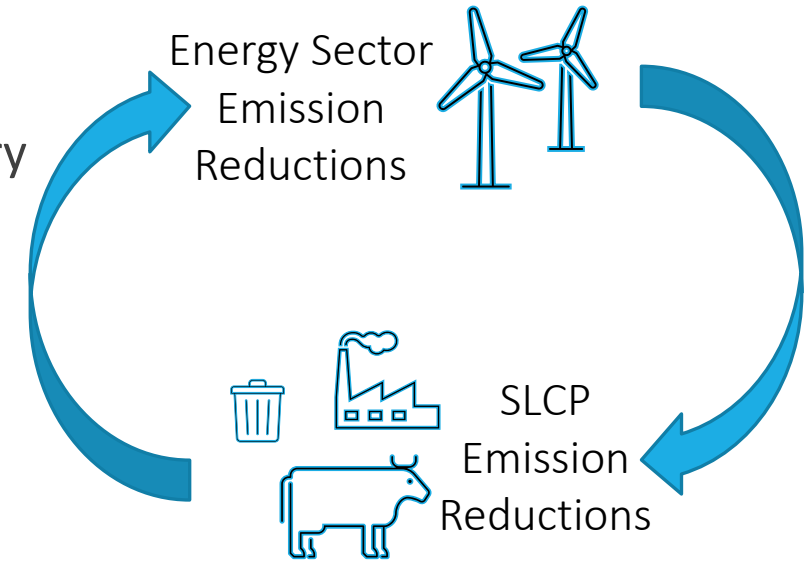
What targets are reasonable after 2030?



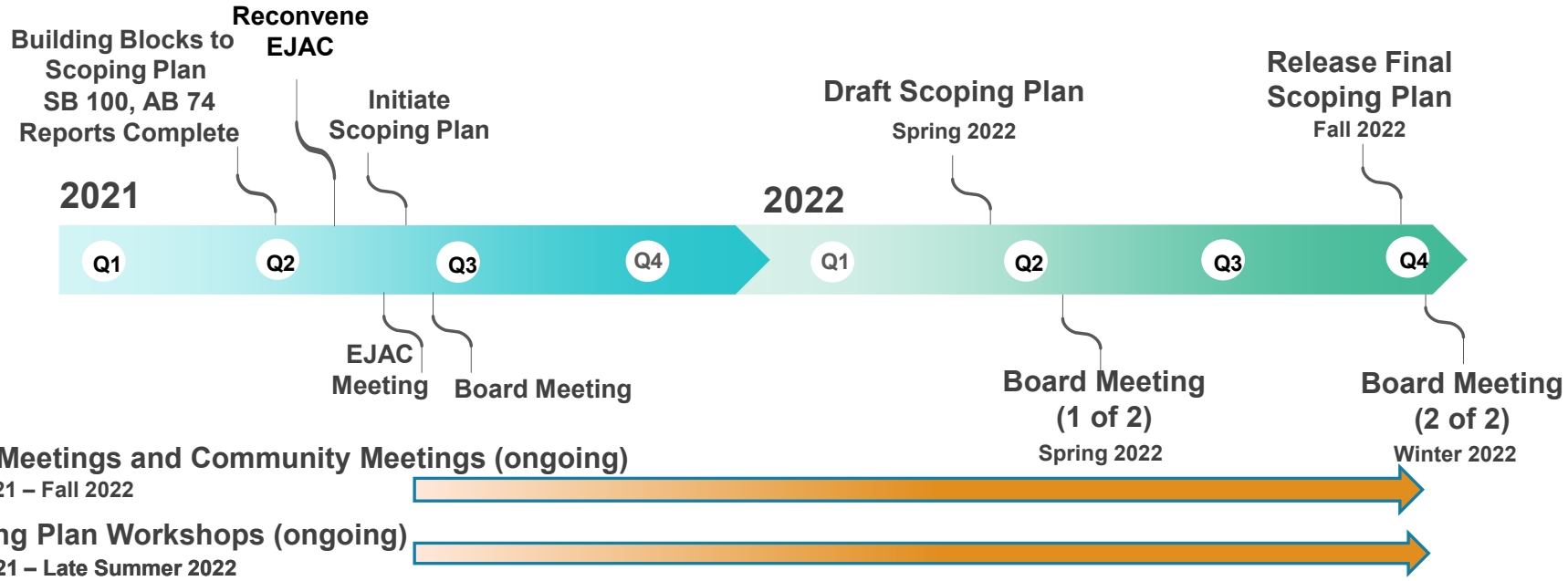
SB 1383 has set targets for SLCPs through 2030, but additional feedback is needed to inform target setting beyond 2030, and the set of actions that can help achieve these targets.

Statewide emission reductions and the role of SLCPs

- Additional actions may be necessary to ensure SLCP reductions meet SB 1383 Targets
- New targets for 2030 may be necessary to align reductions with 2035 or 2045 carbon neutrality goals
- Actions that reduce SLCP emissions may impact emission reductions for other sectors, and vice versa
  - Residual SLCPs impacts the need for carbon dioxide removal



2022 Scoping Plan Update Schedule



Closing – Staying Engaged

- Written comments
  - Scoping Plan Meetings & Workshops
  - Comment closing date September 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