

Appendix C:

Technical Methodology for Calculating the 2035 and 2045 Emission Reduction Goals

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1 Introduction

This appendix describes the methodology used to calculate the economy-wide near-term (2035) and long-term (2045) greenhouse gas (GHG) reduction goals used in the San Diego Regional Climate Action Roadmap (Roadmap). These regional goals are voluntary and were developed to align with California statewide 2030 and 2045 GHG reduction goals. Actual GHG reductions will depend on future policies, actions, technology, and funding.

Rounding is used for the final values within the equations throughout this appendix. Values are not rounded in the intermediary steps in any calculation. Because of rounding, numbers may not add up to the totals provided and percentages may not reflect the absolute figure.

2 California Statewide Targets

California has statewide GHG reduction targets to:

- Reduce anthropogenic emissions to 40% below 1990 levels by 2030, as directed by California Senate Bill 32 (Pavley, 2016) (SB 32), and;
- Reduce anthropogenic emissions to 85% below 1990 levels and achieve carbon neutrality by 2045, as directed by California Assembly Bill 1279 (Muratsuchi, 2022) (AB 1279).

3 Approach to Align Regional GHG Reduction Goals with State Laws

California's statewide GHG reduction targets established in SB 32 and AB 1279 are expressed relative to 1990 emission levels. Because the San Diego region does not have a 1990 GHG emissions inventory, the Roadmap instead uses 2022 as its base year and the 2022 San Diego Regional GHG Inventory for goal setting. To align with statewide targets, proportional goal reduction percentages for the Roadmap were developed by comparing the statewide numeric emissions limits relative to the 2022 statewide emissions level (the latest statewide 2022 GHG inventory). This conversion allows the Roadmap's regional goals to align with statewide targets while using 2022 as a base year.

In 2022, California emitted 371 MMT CO₂e.¹ The statewide 2030 numeric emissions limit established by SB 32 is 260 MMT CO₂e (40% below 1990 levels).² By applying Equation 1 below, the statewide 2030 emissions limit of 260 MMT CO₂e is determined to be equivalent to 30% below the 2022 statewide emissions level.

Equation 1: Statewide 2030 Reduction Percentage in Relation to 2022 Emissions Level

$$\begin{aligned} & \text{2030 Reduction Percentage in relation to 2022 Emissions Level} \\ &= \frac{\text{2030 GHG Limits per SB32} - \text{2022 Emissions}}{\text{2022 Emissions}} = \frac{260 \text{ MMT CO}_2\text{e} - 371 \text{ MMT CO}_2\text{e}}{371 \text{ MMT CO}_2\text{e}} \\ &= -0.2994 \text{ or (30\% reduction)} \end{aligned}$$

¹ "California Greenhouse Gas Emissions from 2000-2022: Trends of Emissions and Other Indicators," (CARB, 2024), https://ww2.arb.ca.gov/sites/default/files/2024-09/nc-2000_2022_ghg_inventory_trends.pdf

² "California Greenhouse Gas Emissions from 2000-2022: Trends of Emissions and Other Indicators," (CARB, 2024), Figure 1. Annual Statewide GHG Emissions and GHG Limits. https://ww2.arb.ca.gov/sites/default/files/2024-09/nc-2000_2022_ghg_inventory_trends.pdf

The statewide 2045 numeric emissions limit is not given in AB 1279. Instead, it is calculated based on 85% below the 1990 level of 431 MMT CO₂e, which equals 65 MMT CO₂e.³ Equation 2 below shows that 65 MMT CO₂e is equivalent to 83% below the statewide 2022 GHG emissions level.

Equation 2: Statewide 2045 Reduction Percentage in Relation to 2022 Emissions Level

$$\begin{aligned} \text{2045 Reduction Percentage in relation to 2022 Emissions Level} &= \frac{\text{2045 GHG Limits} - \text{2022 Emissions}}{\text{2022 Emissions}} \\ &= \frac{\text{1990 GHG Level} * (1 - 85\%) - \text{2022 Emissions}}{\text{2022 Emissions}} \\ &= \frac{431 \text{ MMT CO}_2\text{e} * (1 - 85\%) - 371 \text{ MMT CO}_2\text{e}}{371 \text{ MMT CO}_2\text{e}} = -0.8258 \text{ or } (83\% \text{ reduction}) \end{aligned}$$

4 Approach to Determining the 2035 and 2045 Reduction Percentage and Emissions Limits for the Roadmap

Because the Roadmap uses 2035 as its near-term goal year while the state uses 2030 and 2045, it is necessary to linearly interpolate the near-term reduction percentage between 2030 and 2045 for 2035. Equation 3 below shows the result is equivalent to 47% below 2022 level by 2035.

Equation 3: 2035 Reduction Percentage in Relation to 2022 Emissions Level

$$\begin{aligned} \text{2035 Reduction Percentage in relation to 2022 Emissions Level} &= \frac{\text{2045 Reduction Percentage} - \text{2030 Reduction Percentage}}{\text{2045} - \text{2030}} * (\text{2035} - \text{2030}) \\ &+ \text{2030 Reduction Percentage} = \frac{0.8258 - 0.2994}{2045 - 2030} * (\text{2035} - \text{2030}) + 0.2994 \\ &= 0.4748 \text{ or } (47\% \text{ reduction}) \end{aligned}$$

The statewide 2045 reduction percentage of 83% is applied directly for the region as the Roadmap's 2045 long-term goal.

Using the numeric emissions level of the San Diego Regional 2022 GHG Inventory of 22.2 MMT CO₂e, the equivalent 2035 numeric limit is 11.8 MMT CO₂e and the equivalent 2045 numeric limit is 3.8 MMT CO₂e, as calculated in Equation 4 and Equation 5.

Equation 4: Roadmap 2035 Near-Term GHG Reduction Goal

$$\begin{aligned} \text{Roadmap 2035 Emissions Goal} &= (1 - \text{2035 Reduction Percentage}) * \text{2022 Emissions Level} \\ &= (1 - 47\%) * 22.2 \text{ MMT CO}_2\text{e} = 11.8 \text{ MMT CO}_2\text{e} \end{aligned}$$

Equation 5: Roadmap 2045 Long-Term GHG Reduction Goal

$$\begin{aligned} \text{Roadmap 2045 Emissions Goal} &= (1 - \text{2045 Reduction Percentage}) * \text{2022 Emissions Level} \\ &= (1 - 83\%) * 22.2 \text{ MMT CO}_2\text{e} = 3.8 \text{ MMT CO}_2\text{e} \end{aligned}$$

³ 1990 emissions level is from "GHG 1990 Emissions Level & 2020 Limit," (CARB), <https://ww2.arb.ca.gov/ghg-2020-limit>.

As a result of the above calculations, the Roadmap seeks to reduce regional anthropogenic emissions to levels that are equivalent to:

- 47% below 2022 levels by 2035 or 11.8 MMT CO₂e (aligned with California legislative goals in SB 32 and AB 1279), and;
- 83% below 2022 levels by 2045 or 3.8 MMT CO₂e (aligned with California legislative goals in SB 32 and AB 1279).