

DOCKETED

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Building Decarbonization Assessment Baseline



Nicholas Janusch, PhD
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Demand Analysis Office
California Energy Commission



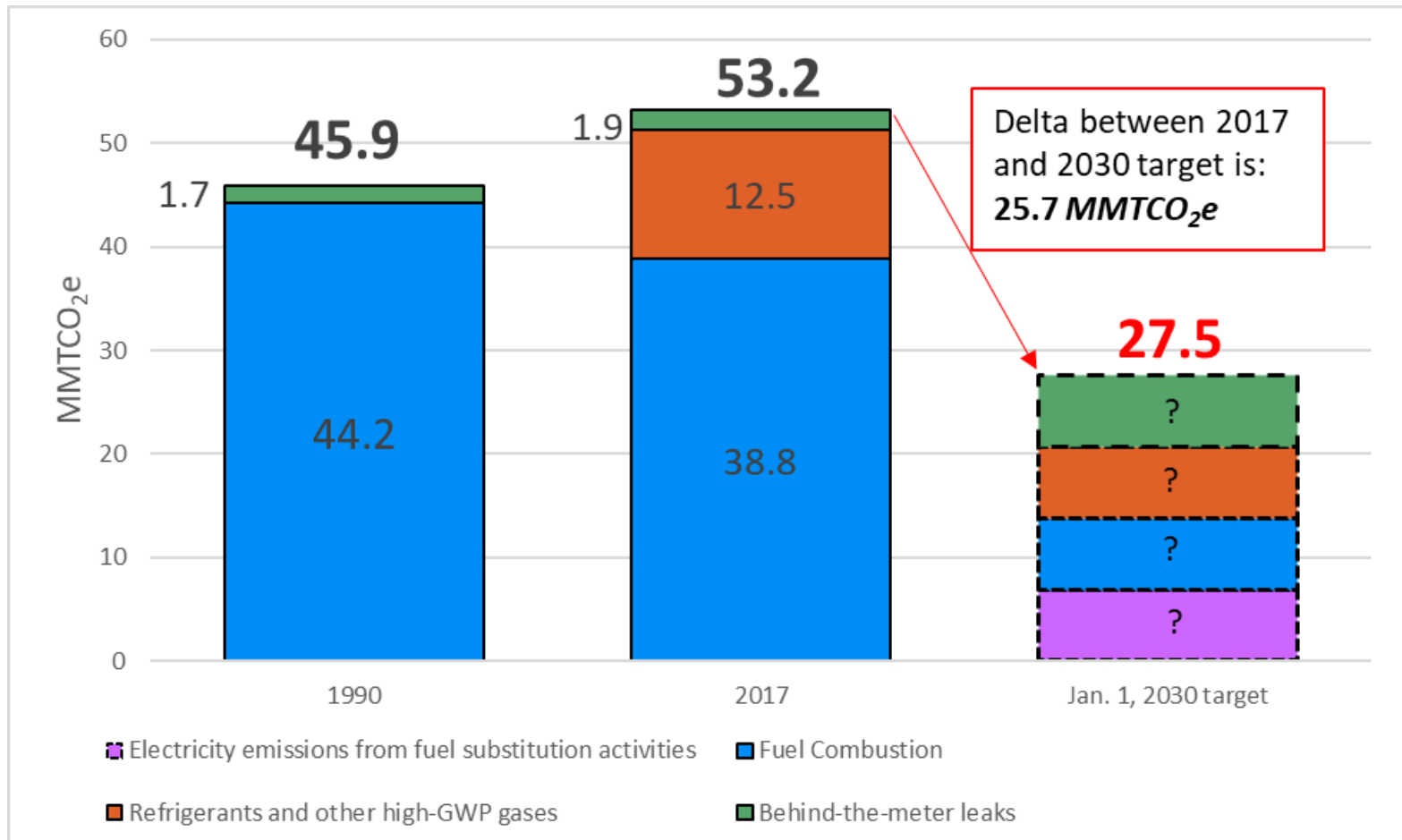
Overview of baseline

Type or source of emissions	Reported for buildings in CARB inventory?	In CEC AB 3232 baseline?
<i>Core building emissions</i>		
✓ Fuel combustion (natural gas and other fuels)	Yes	Yes
✓ Refrigerants and other high global warming potential (high-GWP) gases	Some; not for 1990 & not for ozone-depleting substances (ODS)	Yes ; only ODS substitutes
<i>Methane emissions from natural gas infrastructure leaks</i>		
• Production	No	No
• Transmission and distribution	No	No
• Meter	No	No
✓ Behind-the-meter leaks ("post-meter natural gas leaks")	Residential; not for 1990 & pending for commercial sector	Yes
<i>Electricity emissions</i>		
• Count in 1990 baseline	No	No
✓ Account for incremental emissions from the increased loads from fuel substitution activities	--	Yes



1990 GHG baseline: 45.9 MMTCO₂e

2030 GHG 40% reduction target: 27.5 MMTCO₂e





Core building emissions: fuel combustion

- Reported in CARB GHG inventory for residential and commercial sectors from 1990-2017
- Emissions have **decreased** since 1990
- Residential and Commercial natural gas consumption forecasted to **increase** 2.2 percent from 2017 to 2030.
- Staff expects that these emissions must decrease significantly more than 40% from 1990 levels.

CARB GHG Inventory	MMTCO ₂ e	
	1990	2017
<u>Total Fuel Combustion</u>	44.18	38.81
Natural gas	38.83	35.36
Other fuels	5.35	3.45
<i><u>Residential Fuel Combustion</u></i>	<i>29.74</i>	<i>25.11</i>
<i>Natural gas</i>	<i>27.74</i>	<i>23.62</i>
<i>Other fuels</i>	<i>2.00</i>	<i>1.49</i>
<i><u>Commercial Fuel Combustion</u></i>	<i>14.44</i>	<i>13.70</i>
<i>Natural gas</i>	<i>11.08</i>	<i>11.75</i>
<i>Other fuels</i>	<i>3.35</i>	<i>1.95</i>



Core building emissions: Refrigerants and other high-GWP gases

- **Not all high-GWP gases reported in GHG inventory**
 - Ozone-depleting substances (ODS) are **not included** in GHG inventory
 - ODS Substitutes reported for residential and commercial buildings for 2000-2017
 - Results in a negligible 1990 baseline value, 0.01 MMTCO₂e
- **Substantial increase in ODS substitutes** since 1987 Montreal Protocol, but total emissions (ODS + ODS Substitutes) have decreased
- New sources of hydrofluorocarbons (“HFCs”) would be added in heat pumps for space heating, water heating, and clothes drying.
- According to CARB staff, **HFC emissions are expected to increase significantly**

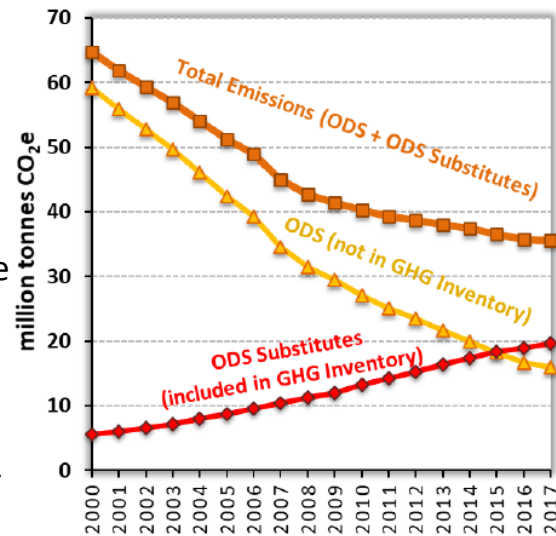


Figure 17a. Trends in ODS and ODS Substitutes Emissions. This figure presents the trends in emissions from ODS Substitutes, ODS, and their sum (“Total Emissions”). ODS Substitutes emissions are specified in IPCC Guidelines and AB 32 and are included in the inventory. ODS are also GHGs, but are tracked separately outside of the inventory.

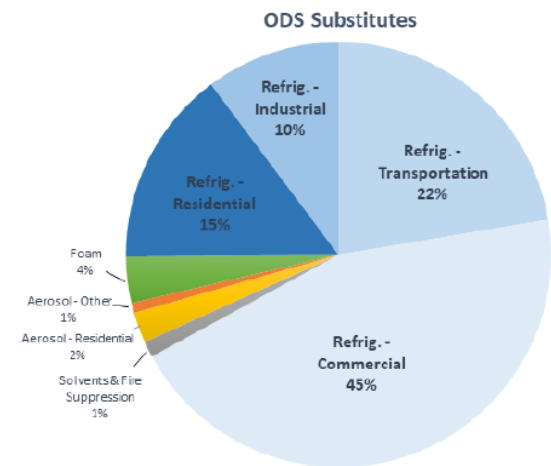


Figure 17b. ODS Substitutes Emissions by Category. This figure presents the breakdown of ODS substitutes emissions by product type and sector category in 2017. Refrigerants (“Refrig.”) used in various sectors make up the majority of ODS substitutes emissions.



Methane emissions from natural gas infrastructure leaks

- Leaks that occur at following sources:
 - Production
 - Transmission and distribution
 - Meter
 - **Behind-the-meter (included for residential buildings in recent update to CARB GHG inventory)**
- Some contention of whether to exclude or to have a non-zero attribution of these emissions for residential and commercial buildings
- Staff open to updating the baseline with consultation with CARB and CPUC and discussion at a staff workshop



Electricity Emissions

The handling of electricity emissions is the most contentious issue when deciding an AB 3232 baseline. Can be summarized into three concerns:

1. Handling of GHG emissions from the increased electricity loads from fuel substitution activities
2. The impact of Senate Bill 100 and 2045 carbon neutral mandate on the feasibility of obtaining the 2030 target
3. How will the Assessment handle the GHG reduction potential of flexible demand strategies and other demand-side management strategies



Electricity Emissions

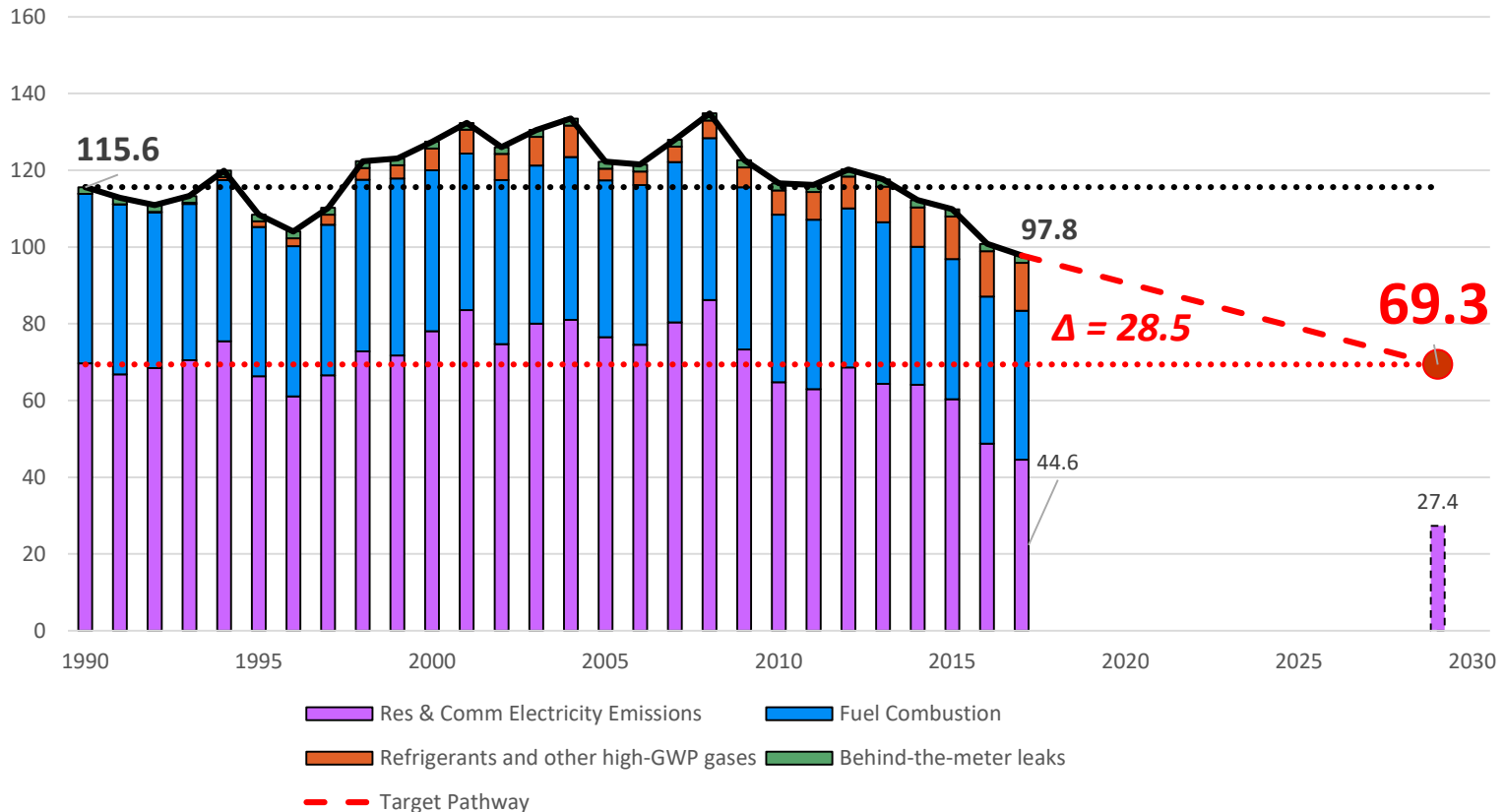
1. Electricity generation emissions must be accounted for in some way
 - Account for incremental emissions from the increased electric loads from fuel substitution activities
2. If electricity emissions are included in 1990, staff estimates that we will likely reach the 2030 target without much effort from buildings (~11.2 MMTCO₂e abatement remains)
 - Although counterintuitive, not including electricity generation emissions in the 1990 baseline results in a more aggressive target. CARB staff recommended not including GHG emissions in 1990 baseline. The Assessment will inform CEC's SB 100 work of achieving 2045 target.
3. The abatement cost analysis will capture GHG reduction potential of all strategies, including the full scope of flexible demand and demand-side management strategies.
 - Not all GHG reduction potential strategies will be assessed compared to the baseline; however, they will be assessed as part of the GHG emissions abatement cost curve analysis which will compare *ALL* "statewide greenhouse gas emissions reduction strategies."



Electricity Emissions:

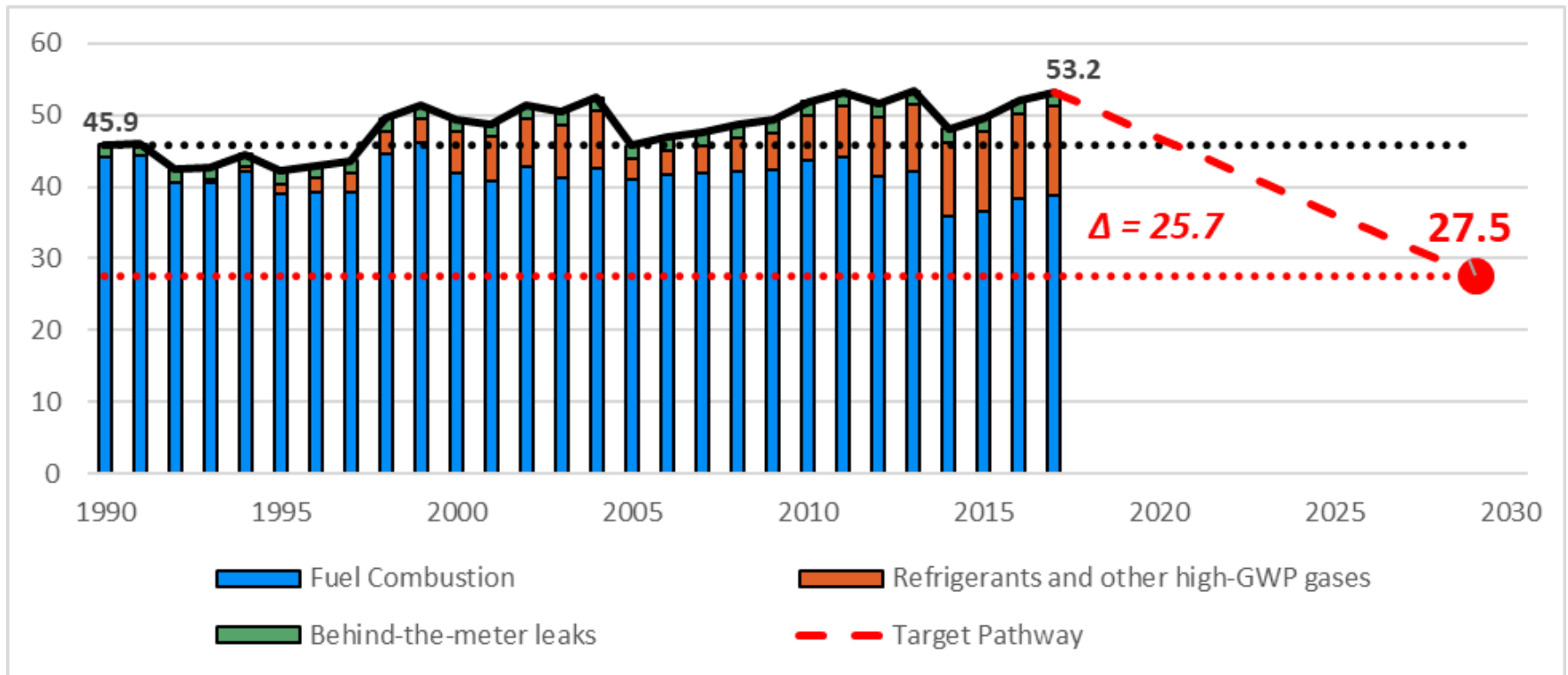
1990-2017 time series with electric generation emissions

GHG emissions by emissions category (1990-2017) and 2030 target -- including electricity generation emissions attributed to residential and commercial buildings (million tonnes of CO2 equivalent---MMTCO2e)





Building Decarbonization Assessment Baseline 1990-2017 time series

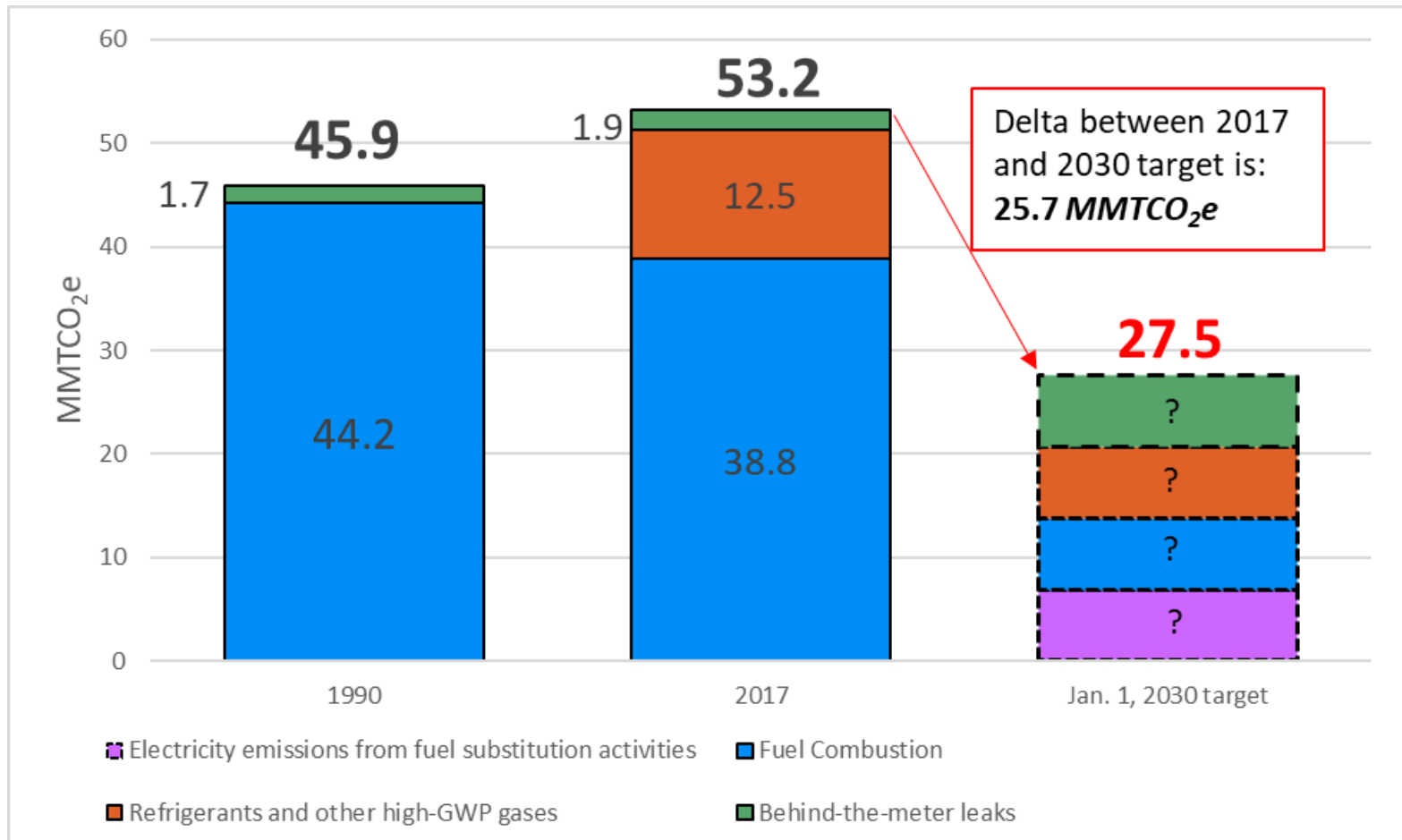


Note: Not illustrated are the incremental emissions from the increased loads from fuel substitution activities



Recap:

1990 GHG baseline: 45.9 MMTCO₂e
2030 GHG 40% reduction target: 27.5 MMTCO₂e

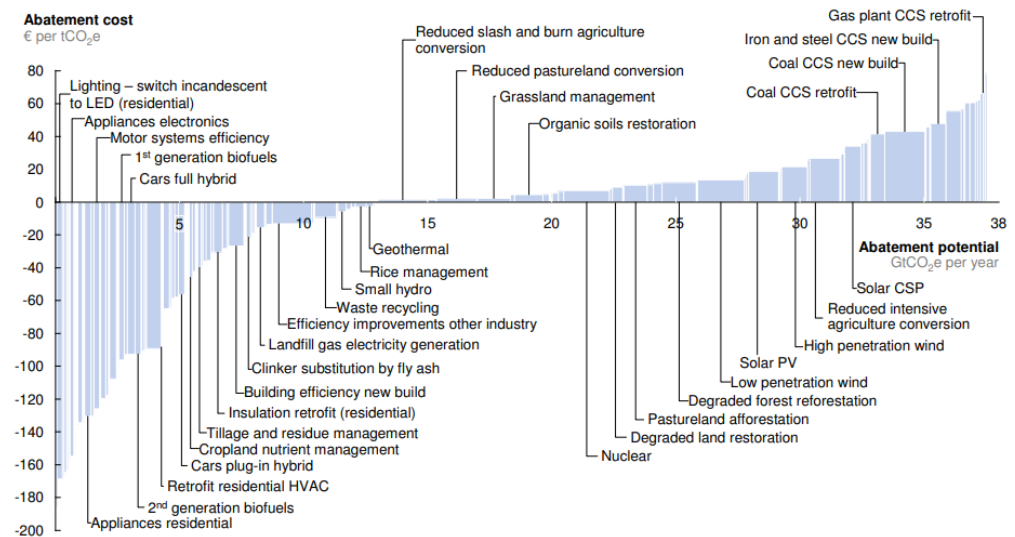




What is a marginal abatement cost curve?

- A **marginal abatement cost curve** plots out the marginal costs of achieving a cumulative level of emissions abatement in order from the lowest- to highest-cost technology or measure
- Staff will generate multiple marginal abatement cost curves using different scopes
 - Baseline
 - Buildings sector
 - Across economic sectors

V2.1 Global GHG abatement cost curve beyond BAU – 2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO₂e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.1

Source: McKinsey & Co. 2010. (p. 8).

<https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Impact%20of%20the%20financial%20crisis%20on%20carbon%20economics%20Version%202021/Impact%20of%20the%20financial%20crisis%20on%20carbon%20economics%20Version%202021.ashx>



Conclusion

- Baseline selection was difficult and complex
- Baseline is flexible, staff will update baseline based on consultation from CARB and CPUC and discussion at a staff workshop
- Although counterintuitive, staff recommends this baseline approach because it focuses attention for the buildings sector to decarbonize
- The projected growth of *refrigerants and other high-GWP gases* and the need for significant reduction in *fuel combustion* emissions will be key drivers in this Assessment



Public Process

- **19-DECARB-01 proceeding docket**
 - Subscribe to list serves: Existing Buildings, Climate Change, Natural Gas**
- **Submit and view comments**
- **Comment period closes December 19**

Contact:

Heriberto Rosales

916-654-4879

Heriberto.Rosales@energy.ca.gov

Nicholas.Janusch@energy.ca.gov

Nicholas Janusch, Ph.D.

916-651-9080

