

## Greenhouse Gas Reduction Fund Program: Proposed Highest Priority Projects Through Year 2030

The Greenhouse Gas Reduction Fund Program provides funds in three categories: Transportation and Sustainable Communities, Clean Energy and Energy Efficiency, and Natural Resources and Waste Management. Thirty-five percent of the investments from these funds are required to go to disadvantaged communities. To date \$16,716,000 has been allocated.

Going forward it will be critical that the cap-and-trade program is designed in such a way to produce higher and higher revenues for the Greenhouse Gas Reduction Fund Program. Not just because high revenues will hopefully reflect the gradual moving of the floor toward a price of carbon that is currently considered realistic -- \$50 to \$100 per ton rather than \$18 -- but because there are extraordinarily important programs that require assured funding.

### Short-Lived Climate Pollutants Deserve Assured and Generous Funding

Although it was clear 6 years ago as well,<sup>1</sup> there is now a consensus that short-lived climate pollutants, particularly HFCs and other high GWP gases and methane, offer opportunities we cannot afford to pass by. We will cite only a few authoritative sources, but many others could be brought to bear.

In March 2021, an all-star group of climate scientists and policy-makers, led by Daniel Kammen the head of the UC Berkeley Renewable and Appropriate Energy Laboratory and a lead author of the Intergovernmental Panel on Climate Change reports, published a call for California to radically pick up the pace of its climate mitigation actions called: *Accelerating the timeline for climate action in California*.<sup>2</sup> While most of the paper argues for reducing CO<sub>2</sub> emissions much faster, a significant second step calls for very rapid elimination of short-lived climate pollutants.

“The second lever involves drastic reductions in super pollutants that are short-lived—black carbon, methane, tropospheric ozone, and hydrofluorocarbons (HFCs). These super pollutants are about 30 to 2000 times more potent than CO<sub>2</sub> in trapping infrared heat. Black carbon is soot emitted by mostly diesel engines and lives in the air for a week; its heat-trapping power is 2000 times that of CO<sub>2</sub>. HFCs used as refrigerants are also about 2000 times more potent. Collectively these super pollutants are responsible for about 40% of warming globally. Reducing methane emissions by half, reducing soot

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<sup>1</sup> The original SLCP report in 2017 says: “Deploying existing technologies and resource management strategies globally to reduce SLCP emissions can cut the expected rate of global warming in half and keep average warming below the dangerous 2°C threshold at least through 2050. We can slow sea level rise significantly, reduce disruption of historic rainfall patterns, and boost agricultural productivity by reducing crop losses to air pollution. Cutting global SLCP emissions immediately will slow climate feedback mechanisms in the Arctic and elsewhere that would otherwise further accelerate global warming and make climate change far more difficult to solve and far more costly to live with—as more resources would be required for disaster relief, conflict management, and adaptation. Most importantly, we can dramatically reduce global air pollution, saving millions of lives each year.” [https://ww2.arb.ca.gov/sites/default/files/2020-07/final\\_SLCP\\_strategy.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf)

<sup>2</sup> <https://arxiv.org/abs/2103.07801>

emissions by 80% with soot-free vehicles such as electric vehicles, replacing currently used HFCs with zero- to low-warming potential refrigerants, and decreasing sources of methane emissions such as leaks from natural gas pipes, food, and other landfilled organic waste, if implemented now, *can cut the rate of warming over the next 2 to 3 decades by half* [our emphasis].”

## HFCs

- Emission of HFC refrigerants into the atmosphere, along with other short-lived climate pollutants, will cause 30% of the warming between now and 2050.<sup>3</sup> HFCs are the fastest growing source of greenhouse gas emissions, doubling every 5-7 years.<sup>4</sup>
- Costs for mitigating HFC emissions are far less than costs for mitigating CO<sub>2</sub><sup>5</sup>, so should not be a barrier to mitigation to the extent technically possible.
- Although there are international agreements that cover HFCs, “Research suggest that almost 40% of their emissions by 2050 will fall outside the scope of international agreements such as the Paris Accord, Montreal Protocol and Kigali Amendment.”<sup>6</sup>

## METHANE

The UN global methane assessment<sup>7</sup> concludes:

- More than half of global methane emissions stem from human activities in three sectors: fossil fuels (35 per cent of human-caused emissions), waste (20 per cent) and agriculture (40 per cent).
- Currently available measures could reduce emissions from these major sectors by approximately 180 Mt/yr, or as much as 45 per cent, by 2030. This is a cost-effective step required to achieve the United Nations Framework Convention on Climate Change (UNFCCC) 1.5° C target.

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<sup>3</sup> Daniel M Kammen, Teenie Matlock, Manuel Pastor, David Pellow, Veerabhadran Ramanathan, Tom Steyer, Leah Stokes, Feliz Ventura, *Accelerating the timeline for climate action in California, March 2021*, <https://arxiv.org/abs/2103.07801>

<sup>4</sup> Benjamin K. Sovacool, Steve Griffiths, Jinsoo Kim, Morgan Bazilian, Climate change and industrial F-gases: A critical and systematic review of developments, sociotechnical systems and policy options for reducing synthetic greenhouse gas emissions, *Renewable and Sustainable Energy Reviews*, Volume 141, 2021, 110759, ISSN 1364-0321, <https://doi.org/10.1016/j.rser.2021.110759>.)

<sup>5</sup> In general, non-CO<sub>2</sub> warming emissions are considerably cheaper to implement than mitigating CO<sub>2</sub> itself. “The Contribution of Non-CO<sub>2</sub> Greenhouse Gas Mitigation to Achieving Long-Term Temperature Goals, *Journal: Energies*, : 2017, ISSN: 1996-1073”

<sup>6</sup> Sovacool, op cit.

<sup>7</sup> United Nations Environment Programme and Climate and Clean Air Coalition (2021). *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions*. Nairobi: United Nations Environment Programme. The report lists many concrete benefits of ozone reduction besides a like a 0.3C reduction in warming: “a 45 per cent reduction would prevent 260 000 premature deaths, 775 000 asthma-related hospital visits, 73 billion hours of lost labor from extreme heat, and 25 million tonnes of crop losses annually.”

A 2021 paper by Ocko and colleagues states<sup>8</sup>:

Overall, strategies exist to cut global methane emissions from human activities in half within the next ten years and half of these strategies currently incur no net cost. Pursuing all mitigation measures now could slow the global-mean rate of near-term decadal warming by around 30%, avoid a quarter of a degree centigrade of additional global-mean warming by midcentury, and set ourselves on a path to avoid more than half a degree centigrade by end of century. On the other hand, slow implementation of these measures may result in an additional tenth of a degree of global-mean warming by midcentury and 5% faster warming rate (relative to fast action)... [G]iven that fast methane action can considerably limit climate damages in the near-term, it is urgent to scale up efforts and take advantage of this achievable and affordable opportunity as we simultaneously reduce carbon dioxide emissions.

### Federal and California Actions on HFCs and Methane

The federal government has in recent months began a large scale response to both HFCs and methane. The AIM Act, passed late in 2020, will phase out HFCs on a schedule designed to eliminate 85% manufacture or importation by 2036. The US has also taken the lead in getting 105 countries to sign a new treaty to reduce methane by 30% by 2030. Five federal agencies are working on methane rules, including the EPA for oil and gas leaks and the Department of Agriculture for manure-generated methane. We are also joining the International Methane Emissions Observatory for global surveillance of methane emissions.

California established a policy of reducing both types of greenhouse gas by 40% by 2030 [SB 1383 \(Lara, Chapter 395, Statutes of 2016\)](#). Recent reports from CARB have made it clear that we are not on track to attain either goal, despite groundbreaking HFC regulations that will become effective January 1, 2022 and the expenditure of \$289 million for agricultural methane abatement from the Greenhouse Gas Reduction Fund Program as well as additional resources from other funding sources. In the 2021-22 budget and additional \$85 million was allocated to manure management projects.

While these federal and state actions show the broad recognition that attends mitigation of HFC and methane emissions, they don't come close to achieving the degree to which it is technically feasible to reduce SLCP emissions by 2030.

### Why HFCs and Methane Need Greenhouse Gas Reduction Fund Program Support

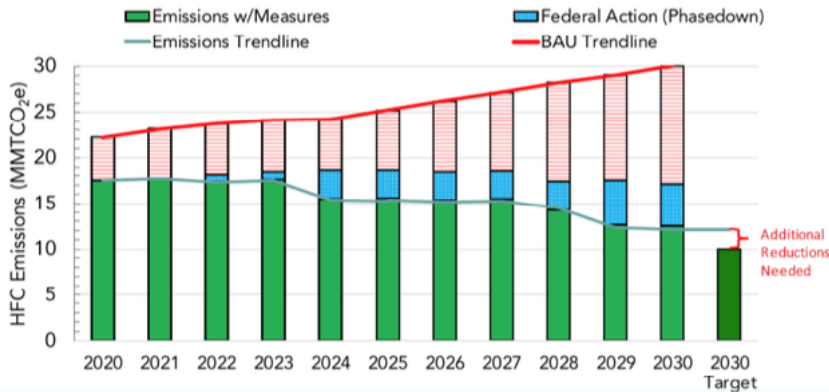
#### HFCs

There are a number of abatement measures for HFCs which have already been implemented by CARB. However, even with the new federal regulations we will come up short on the 2030 goal and by 2045 a large part of the unmitigated greenhouse gases will be HFCs.

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<sup>8</sup> Ilissa B Ocko *et al* 2021 *Environ. Res. Lett.* **16** 054042

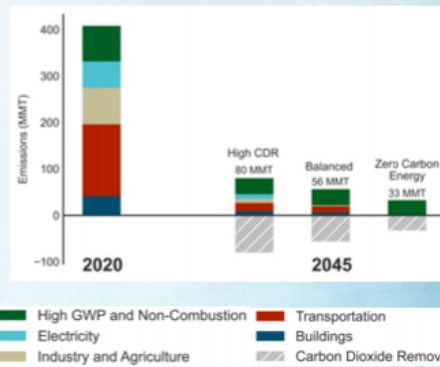
## Progress to Meet 2030 HFC Target



## Reducing HFCs is Critical for Carbon Neutrality

- By 2045, HFCs among the largest remaining GHG sources
- HFC reductions integral for achieving state's long-term climate goals
- HFC emissions expected to increase with building electrification through adoption of heat pump technologies

Greenhouse Gas Emissions by Sector in 2020 and 2045

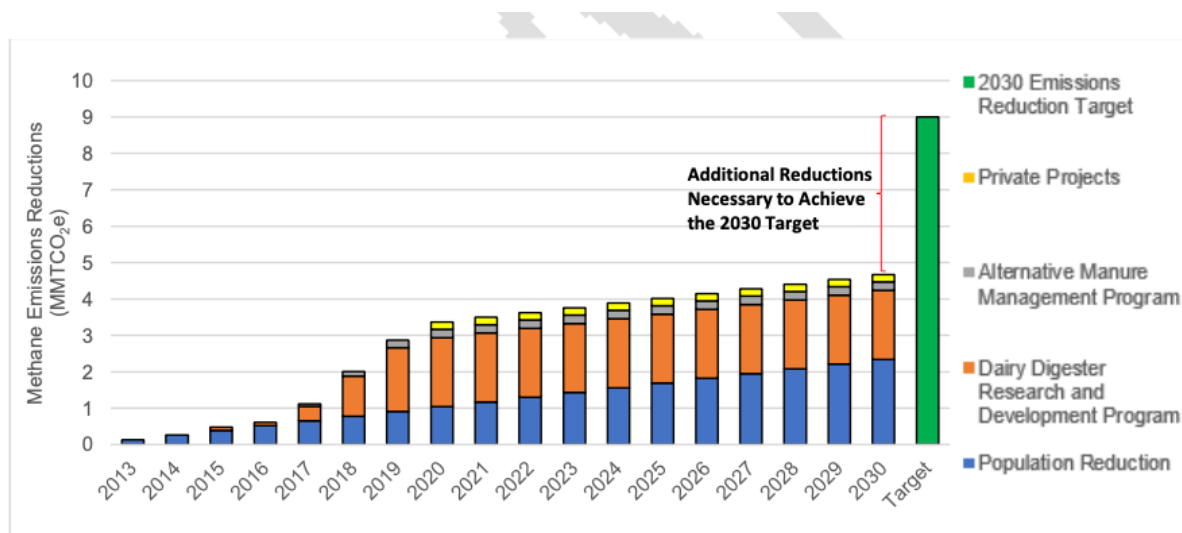


[Source: Energy and Environmental Economics, Inc., 2020, Achieving Carbon Neutrality in California.]

There are a variety of possible additional ways to mitigate HFC release. The most critical, though, has to do with supermarkets. Because the construction of very low global warming potential (GWP) refrigerant systems is very different from HFC systems, a basic remodeling must be done. New CARB regulations require new stores to be very low GWP, but in order to avoid requiring complete remodels CARB's standards won't reduce the average in the 4000 stores below GWP of 1,450, and that may be optimistic.

METHANE

Our focus is on methane generated by the decomposition of manure.<sup>9</sup> In June of 2021 CARB issue a draft report on progress toward the 40% goal with respect to dairies and cattle.<sup>10</sup> The graph below is from that report and shows that considerably more effort will be needed to reach even the 40% goal.

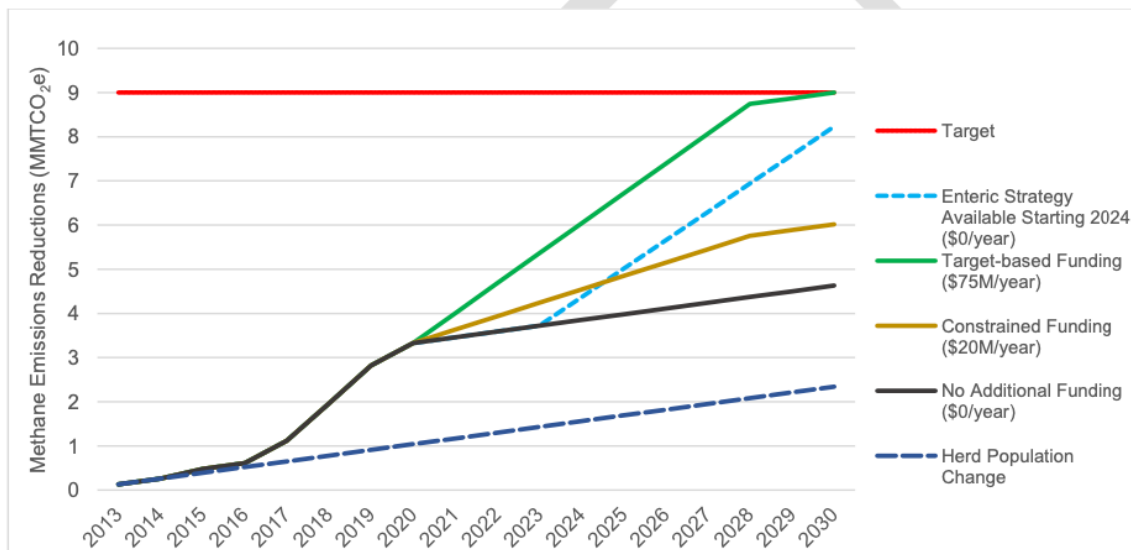


**Figure ES-1.** Projected Annual Methane Emissions Reductions through 2030 without Additional Funding beyond FY 2020-21

The report projects a number of possible scenarios, along with their minimal costs. See the “Figure 6” on the next page.

<sup>9</sup> There are several major sources of methane in California. We do not address leaks from oil and gas facilities or public utility pipelines as there are a variety of mechanisms available to abate these sources. We do not address methane from landfills as that situation is still developing and legislative objectives have yet to go into effect. Finally we do not address enteric methane from cattle as none of the highly effective feed additives are as yet commercially available.

<sup>10</sup> <https://ww2.arb.ca.gov/resources/documents/draft-2030-d-l-ch4-analysis>



**Figure 6. Projected Annual California Dairy and Livestock Sector Methane Emissions Reductions through 2030<sup>43</sup>**

### Proposed Funding from the Greenhouse Gas Reduction Fund Program

Priority for both refrigerants and manure management are described in the Draft Final Cap-and-Trade Auction Proceeds Fourth Investment Plan: Fiscal Years 2022-23 through 2024-25. However, the opportunity to actually reduce (not just slow) warming, makes it imperative that they receive high priority and in amounts adequate to achieve or exceed current state objectives.

### HFCs

There are approximately 4,000 supermarkets in California. Each remodel to install very low GWP refrigeration equipment costs approximately \$500,000. So that would be a total of two billion dollars. However, there are existing sources of funding (small) and the CPUC will be bringing other sources on line in 2024. So something less than that amount would be necessary. CARB should provide the GGRFP estimates of what it would take to completely switch the supermarkets in CA to very low GWP refrigeration systems by 2030. What is crucial is that there is an assured source of funding that is proportionate to the task. The stakes are very high and the window of opportunity limited.

### Methane

The costs in the “Figure 6” above do not account for the larger expenditures necessary to minimize air pollution from digesters. The CARB report estimates \$3.7 billion as the cost for digesters and approximately \$1 billion for alternative manure management projects. This is to achieve the 40% goal: we need it to be higher. Again, CARB has a good handle on how to time and allocate public incentive funds to meet the SB 1383 goal. THE GGRFP has, as noted above, already contributed \$289 million to manure generated methane abatement, and \$85 million was in the current budget. But the needed funds beyond these amounts are considerable. Again, the very high stakes make it important to prioritize achieving and exceeding current state goals.



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