Methane is a climate super-pollutant that is 80 times more powerful than carbon dioxide over a 20-year period. Given its potency and short life, experts believe that reducing methane emissions is the highest-yield action that governments and businesses can take to curb near-term warming.

In the US, livestock are responsible for over one third of anthropogenic methane emissions; in California, this number is over 50 percent, largely due to the state's dairy sector, whose 1.7 million cattle produce nearly 20 percent of all US milk. State leaders have taken first-in-the-nation steps to address livestock emissions, but much work remains to achieve 2030 targets. A new report from CLEE and UCLA's Emmett Institute identifies several key strategies to drive progress toward these targets while prioritizing environmental and public health. (RSVP here for our Nov. 10 webinar.)

Livestock methane emissions stem from two oxygen-free (anaerobic) environments: the gut of animals, which produces enteric emissions in the form of burps; and liquid pools where manure is stored. (Worldwide, enteric emissions represent the majority of livestock methane, but in California the balance is closer to 50-50 due to the high prevalence of liquid manure storage at large-scale dairy operations.)

These two emissions sources call for two distinct sets of emissions reduction strategies. For manure emissions, the strategies include anaerobic dairy digesters that capture methane to generate energy or convert it into offsite fuels; and alternative manure management strategies that introduce oxygen into the waste storage process or filtering the waste through an ecosystem of hungry earthworms. For enteric emissions, the strategies include feed additives, diet modifications, vaccines, and breeding techniques that alter the chemistry of digestion to reduce methane generation.

Broadly speaking, manure strategies are well established and their emissions reduction potential is fairly clear; enteric strategies are in the earlier stages of development with some open questions around efficacy, productivity, and animal health. In combination, these strategies can substantially reduce methane emissions from livestock that produce milk and meat for consumers. But implementing them in a fashion that achieves climate targets while promoting environmental health and justice, protecting animal health, and supporting a sustainable industry presents a thorny policy challenge.

California has pioneered a policy approach to addressing livestock methane, including first-of-its kind legislation requiring utilities to get a portion of their electricity from agricultural bioenergy sources (SB 1122, Rubio, Chapter 612, Statutes of 2012); a state plan for methane and other short-lived climate pollutants (SB 605 Lara, Chapter 523, Statutes of

2014); and, most importantly, a statutory target to reduce methane emissions 40 percent below 2013 levels by 2030, in part through a focus on livestock methane (SB 1383, Lara, Chapter 396, Statutes of 2016).

In addition, the state has provided significant direct funding for manure emissions reduction projects through the Dairy Digester Research and Development Program (DDRDP) and the Alternative Manure Management Program (AMMP), along with financial incentives for dairy digesters through the state's Low-Carbon Fuel Standard program for transportation fuels.

The result, according to the California Air Resources Board, has been a methane emissions reduction of over 3 million metric tons of CO_2 equivalent since 2013. But the state is only on track to achieve about half of the 9 million metric ton reduction needed to achieve the 2030 target.

At the same time, dairy digesters—the leading emissions reduction strategy to date—are highly controversial. Neighboring communities and environmental justice advocates have serious concerns around the air and water quality impacts of large-scale, concentrated dairy operations—impacts that they argue are exacerbated by incentives for digesters. Industry leaders counter that facility concentration is driven by industry-wide economics rather than by digesters, and that digesters reduce certain air quality impacts compared to uncontrolled facilities.

State program leaders point out that the DDRDP and AMMP programs have provided some of the most cost-effective GHG emissions reductions of the entire Greenhouse Gas Reduction Fund portfolio. Meanwhile, enteric emissions strategies—including recently approved red seaweed feed additives—are promising, but not uniformly well studied or available for commercial use, in part due to the challenges of measuring emissions from animals and in safely and consistently applying diet and other modifications.

This spring, CLEE and UCLA convened a group of agency, industry, academic, and environmental justice experts to discuss policy solutions to accelerate state climate progress while addressing health and environmental concerns. The resulting report, *Ahead of the Herd*, identifies a number of strategies including:

- Creating an interagency one-stop shop for greenhouse gas, air quality, water quality, and other data reporting and technical assistance
- Updating the Low-Carbon Fuel Standard to better assess the full life-cycle impacts and additionality of digester projects, support environmental health protections, and increase certainty for operators

- Accelerating approval of and increasing financial support for new enteric emission reduction strategies

Download the report here.

Please join us on November 10 for a webinar to discuss the report and promising strategies to reduce livestock methane emissions, featuring California Department of Food and Agriculture Secretary Karen Ross, Ermias Kebreab of UC Davis, and Albert Straus of Straus Family Creamery. RSVP here.