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Methane, Cows, and Climate Change:
California Dairy's Path to Climate Neutrality

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Executive Summary

Leading climate scientists are now recognizing that holding methane emissions stable will also stabilize this greenhouse gases' powerful impact, and reducing methane emissions can actually offset some of the far more damaging impacts of carbon dioxide (CO_2) and nitrous oxide (N_2O). This whitepaper fully explores that research and its practical implications for the nation's leading dairy state, California. Key takeaways include:

- **Understanding important differences in how various greenhouse gases (GHGs) impact climate change is critical as policymakers establish climate objectives and specific initiatives to achieve them.**
- **The amount of methane contributed by California milk production is less today than in 2008. This means more methane is being broken down in the atmosphere each year than is being created by the state's dairy farms, leading to lower overall atmospheric concentrations and less warming.**
- **At the current rate, methane reduction efforts will allow California's dairy farms to offset any remaining CO_2 and nitrous oxide (N_2O) emissions and reach climate neutrality sometime in the near future.**

California continues to lead the nation and the world in implementing policies to reduce GHG emissions and climate impacts. The state has established ambitious goals for reducing total GHG emissions. Ultimately, California is working toward a goal of "net-zero" carbon emissions by 2045. As these efforts continue, it is also important to improve our understanding of how methane and other GHGs contribute to climate impacts, as we seek to limit additional global warming.

A closer look at methane—and its atmospheric lifetime—reveals how effective methane stabilization and reduction efforts are in limiting additional climate warming. Through the continued reduction of methane emissions and other GHG emissions, California's dairy farms can relatively quickly achieve "climate neutrality," or the point at which operations are no longer contributing to additional warming.

Global Warming Potential of Methane

Each GHG has a unique heat trapping ability, known as its global warming potential (GWP). Understanding how emissions impact temperature; however, requires consideration of not just the GWP, but also how long each type of GHG will last in the atmosphere (atmospheric lifetime). Leading climate scientists are now recognizing that because of its short lifespan, reducing methane emissions can quickly stabilize the climate impact and begin to offset the long-lasting impacts of CO_2.

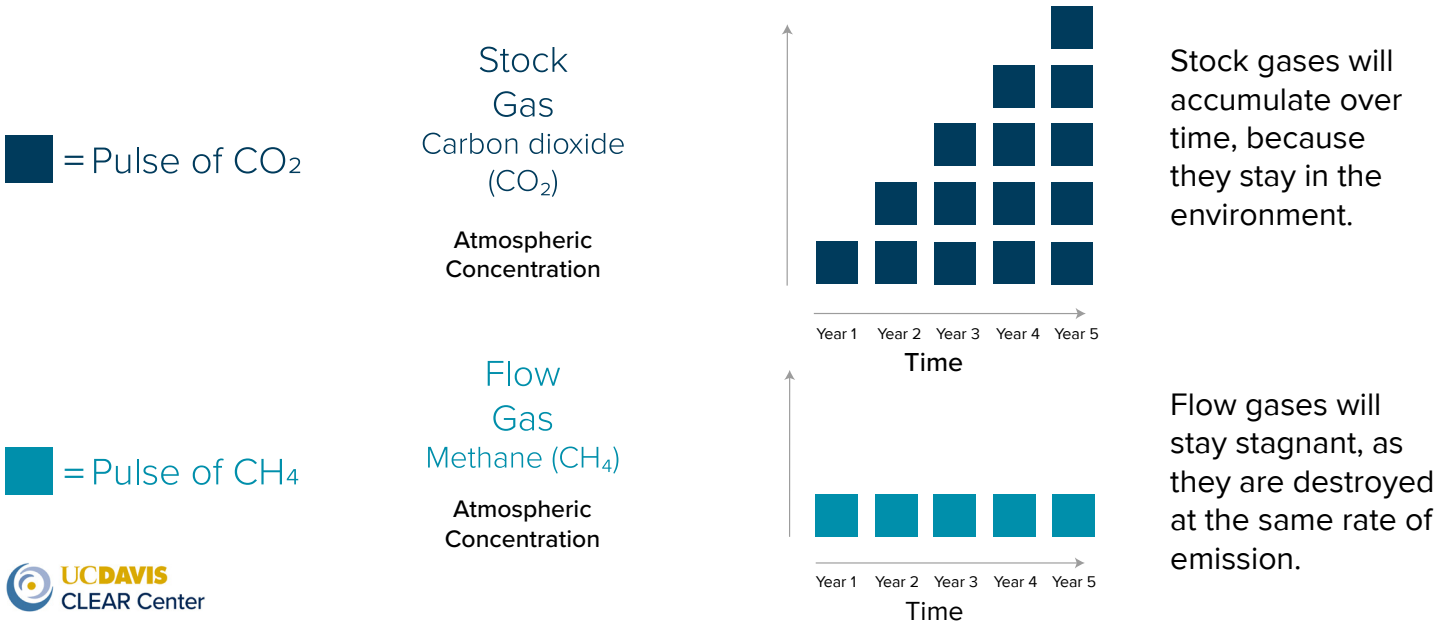

Figure 7. Based on research by Myles R. Allen, Keith P. Shine, Jan S. Fuglestvedt, Richard J. Millar, Michelle Cain, David J. Frame & Adrian H. Macey. Read more here: https://rdcu.be/b1t7S

Methane is classified as a short-lived climate pollutant (SLCP), with emissions breaking down after an average of 12 years (Farlie, Lynch, 2019). These methane emissions do not accumulate, which means that when a steady rate of methane is released—as emitted by a constant number of dairy cows, for example—the amount of methane in the atmosphere (concentration) stays at a constant level and does not increase. As a result, when a steady amount of methane is emitted, no additional warming occurs (Frame et al., 2018).

This does not mean that methane should be ignored, as emitting additional methane to the atmosphere will result in significant additional warming. But, because of its short-lived atmospheric lifetime, a fall in methane emissions has climate cooling effects (Cain, 2018).

Climate Neutral Dairy – Achievable in California's Near Future

California's dairy farms are doing their part to meet these climate goals. The number of milk cows raised in California reached a peak in 2008 and has since declined by more than 7 percent (CDFA, 2017). As a result, the amount of methane contributed by California milk production is less today than in 2008. This means more methane is being broken down in the atmosphere each year than is being created by the state's dairy farms, and as a result, less warming is occuring.

California's dairy farms are also taking important, voluntary steps to further reduce methane emissions by installing anaerobic digesters designed to capture methane and converting it into vehicle fuels, or through other projects like compost pack barns and solid separators, which are designed to reduce methane production on farms. A total of 213 dairy methane reduction projects have been incentivized with state funds to date (CDFA, 2019). As further reductions are achieved, they will offset some of the remaining CO_2 and other gases contributed by dairy production.

The continued adoption of these methane reduction projects—and other climate-smart practices—will allow the state's dairy sector to achieve climate neutrality, and possibly global cooling effects, in the near future.

For other dairy regions, achieving California's level of production efficiency (more milk with fewer cows) may be a critical first step to begin to stabilize regional and global methane emissions in the dairy sector and begin to achieve global climate neutrality for dairy.