September 22, 2021
To: CA Air Resources Board
From: Muriel Strand, P.E.
Re: 2022 Scoping Plan Update – Short-Lived Climate Pollutants Workshop

This workshop was a great, tuition-free crash course in SLCPs, a topic that's been on the edge of my radar for a year or 2 now. Then I did some homework, reviewing the recording with a pause button, as well as catching up with the 2017 SLCP Strategy. I didn't see a 2021 draft Strategy, so it's hard to be sure what data and results staff have gathered from research projects in the interim. Possibly some of my ideas and suggestions have already been incorporated and/or mentioned by others; if so I clearly support them.

The short time horizon of the SLCPs increases the danger of applying bandaid solutions, rather than the radical recalibration of our unsustainable, fossil-fuel lifestyles that would be wise. At the same time, it's undeniable that various existing statutes and precedents are blocking that recalibration. Proposition 218, passed in 1996, is an example. According to the Sacramento city attorney, it prevents the city from charging for waste/recycling disposal by actual weight or volume rather than per capita, blocking an effective market signal to consumers. Fossil fuel subsidies ($600 billion/year in the US, according to the IMF), sugar subsidies, mining subsidies, etc., among many others also accumulate to confuse and derail accurate market signals. There's also the fact that almost all of our built environment has been designed for and built with fossil fuels and the resources they have made possible.

Biomethane

The Strategy to reduce methane emissions tries to apply the standard engineering and technological mentality to sources of both fossil methane and biomethane. I believe using typical technological methods to reduce biomethane is generally and inevitably more expensive over the long term than using biological methods to avoid most of it in the first place. Conversely, standard engineered piping is a good fit for all methane leaks in existing methane operations, whether fossil fuel processes or landfill collection systems. Further, the control of diverse orphan sources such as abandoned wells probably deserves a case-by-case analysis and tailored engineering designs.

It appears to me that most of these anaerobic biomethane emissions are direct symptoms of the unhealthy disruption and disconnection of various natural biological and ecological cycles and of the natural ecological circular economy of carbon, nitrogen, water, manure, etc. So the first solution to consider is reconnecting them. Since these cycles generally operate for 'free,' that is, mostly powered by direct and indirect solar energy traveling along biological paths, this approach promises to minimize costs by avoiding a number of process steps, such as putting manure in lagoons then adding on various technological bandaids to enable a fossil-fuel-economy dairy industry to limp along while leaning on subsidies.

The idea of building miles of new gas distribution lines for renewable natural gas (RNG) from anaerobic digestion of manure slurries is an example of using standard technology for a biological source. Yet it seems that there's no analysis of a scenario of a 100% pasture-based dairy to compare.

Notably, the idea that "[p]asture systems also limit the ability to manage manure as a valuable organic waste resource," (p.66), overlooks manure's role as valuable nutrient for the pasture that ruminants in turn find most nutritious. It seems that grasslands and ruminants have co-evolved together for eons. Two excellent resources for analyzing pasture-based systems in our Mediterranean climate are:
Holistic Management: A Commonsense Revolution to Restore Our Environment, by Allan Savory
https://savory.shop/products/holistic-management-a-commonsense-revolution-to-restore-our-environment?_ga=2.109037770.916218485.1632169813-1759190697.1628355094
Nourishment: What Animals Can Teach Us about Rediscovering Our Nutritional Wisdom, by Fred Provenza
https://www.chelseagreen.com/product/nourishment/

While biomethane from landfills and sewage digestion facilities are also symptoms of disrupted natural cycles, many, perhaps most, are located near urban areas and have likely already installed standard gas collection and piping systems. There is no good reason to remove these systems, until installation of urban composting privies and waste reduction successes make them obsolete.

Biochar's Amazing Potential
One mention was made of biochar during the workshop; it deserves more discussion. Biochar's potential beneficial synergies are substantial. Made by pyrolysis processes, it yields primarily black carbon microscopic lattice, and 'syngas,' a usable fuel that's mostly CO and CH4. Bladders can be used to hold and transport humanscale quantities from small biochar projects, while large projects can support more standard engineered piping systems. The microscopic lattice offers stable sequestration for decades to centuries, as well as high-surface-area condos for healthy soil microbiota. Reportedly, soil amended with properly prepared biochar supports vigorous plant growth and even more ongoing carbon sequestration. A truly virtuous cycle.

I recommend the recent book, "Burn: Using Fire to Cool the Earth" by Albert Bates and Kathleen Draper. I was deeply impressed by the variety and detail of information about biochar and its many possible applications that are all described in the book.

Composting is obviously another key process for managing leftover vegetation and food waste of all kinds, and aerobic composting avoids substantial biomethane emissions. Turning woody debris into mulch yields another useful product, although chipping and grinding consumer substantial energy. Decentralizing both composting and farming shortens supply chains, which tends to reduce waste. Field tests have shown that allegedly compostable plastic is far more stable and impervious than paper and woody debris.

Black Carbon
It's not clear to me that concerns about black carbon emissions from woodstoves in relatively isolated rural homes are logical. It is clear to me that it's almost impossible to live in a rural area without driving all over the place. How does black carbon from vehicle exhaust, often diesel, compare to black carbon from woodstoves? As well, many rural homes have diesel generators for appliances requiring more power than PVs can provide.

Refrigeration and HFCs
Considering that ammonia is not a climate pollutant, and also has thermodynamic properties particularly suitable as a refrigerant, perhaps a research project into the possibility of an industrial ammonia refrigeration facility would be helpful. Historically, such facilities produced ice blocks that were distributed to residential iceboxes. What scale of such facility might fit into our current urban systems and displace some HFC use?

Shrinking supply chains and relocalizing horticultural production can be expected to reduce refrigeration needs. After all, homo sapiens survived and thrived for hundreds of thousands of years without refrigerators and freezers.

Envisioning the Future
Envisioning a complete integrated interactive design of urban and rural biological processes and cycles, including specific details, allows analysis and modeling to unpack the synergistic benefits of biological solutions. While fossil fuel engineering economies of scale often favor larger systems, biological economics of scale favor fractally nested and integrated systems. When analysis is based on the individual sources—manure, landfills, etc.—these biological synergies go uncounted. And evolution has I am certain developed many such synergies.

At the same time, it's certainly true that precise and repeatable quantification of biological measures, such as soil carbon concentrations or the chemical composition of manure slurry, is more challenging than that of most physical measures, due to significant variability of actual biological quantities and flows in spacetime. This reality makes analysis of natural phenomena, such as carbon sequestration in healthy soils, forests and grasslands, less precise, but it should not be allowed to sabotage or delay support for their potential to pull carbon from the atmosphere, nor to delay phasing out unhealthy projects such as CAFOs. Policy makers must protect constructive climate investments from being crowded out by technical testing and administrative costs.

The detailed design of our envisioned ecologically rational future is the key measure. They say 'you get what you measure,' so measures that are purely quantitative will be incomplete at best, misleading at worse. Beyond that, measurements in dollars of costs and benefits should always be calibrated by parallel pricing of the kwhr and GHGs embedded in those costs and benefits, along with the dollar prices of goods and services. Quantification of kwhr is not the same application of math as quantification of goods and

services by dollars. One measure of the problematic relationship between money and energy is the fact that humanpower is several hundred times more expensive than fossil fuel energy. As well, a 5% discount rate is too high. The truly sustainable discount rate is zero; the future is as valuable as the present.

Environmental Justice and California Leadership

Implementing integrated, biological replacements for fossil technology is I believe the very best way for California to offer leadership by example to the rest of the US and the world. After all, the strategy of grafting our fossil fuel lifestyle onto PVs and windmills just cannot scale up globally: https://www.youtube.com/watch?v=TFyTSiCXWEE

This is also an effective strategy for true environmental justice. My comments pursuant to the recent workshop on investment of cap & trade funds discuss in detail several basic considerations pertaining to investing in sustainable and high-quality jobs, so I incorporate them here by reference: https://www.arb.ca.gov/lists/com-attach/9-4thinvestmentplan-ws-VDVWIlMwWFQGYwRo.pdf

Along with misplaced allegiance to overgeneralized and ungrounded monetary indicators like GDP, one hears regular concerns about economic competitiveness. The subtext usually seems to be about competing with other nations. This is also misplaced; we need to compete with ourselves to transform our economy into one that puts ecology and the working class first.

However, mention during the workshop of local Climate Action Plans (CAPs), with the expectation that they will result in strong local actions to supplement state research and GHG reduction policies and regulations, seems overly optimistic. State and federal leadership so far has been about finding ways to maintain our fossil fuel lifestyles by pasting on bandaids like electrification without first reviewing a complete menu of lifestyles. So I suspect that most local jurisdictions are simply taking that cue.

Thank you for the opportunity to comment.