

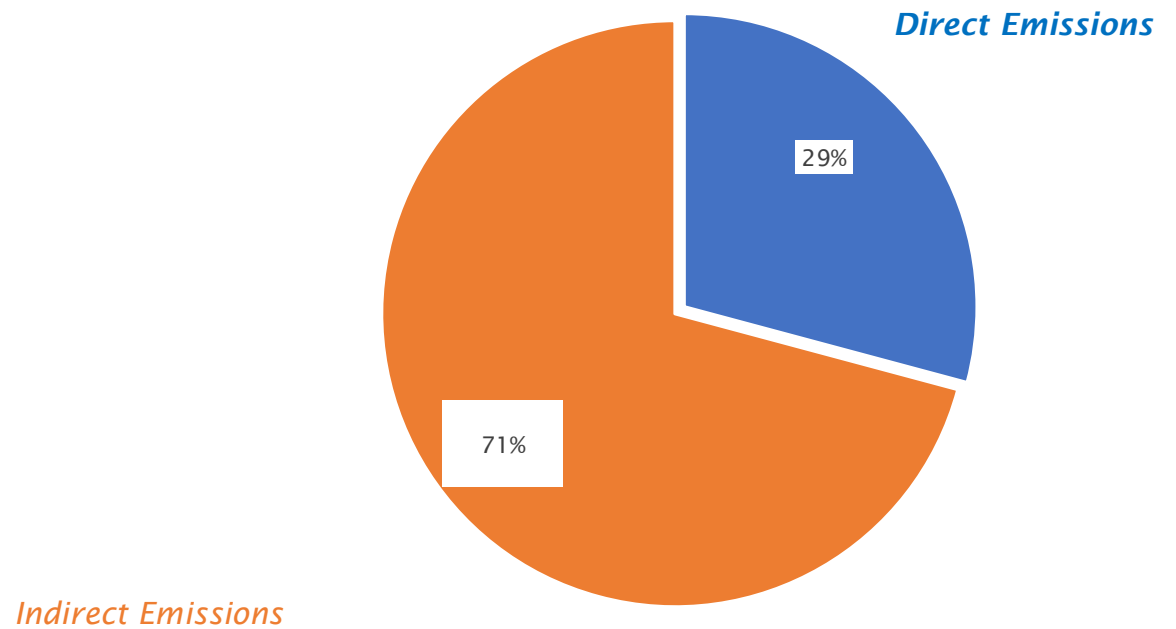
# CONTEXT



# Consumption Based Emissions Inventory

## PETALUMA HOUSEHOLD GHG (2015)

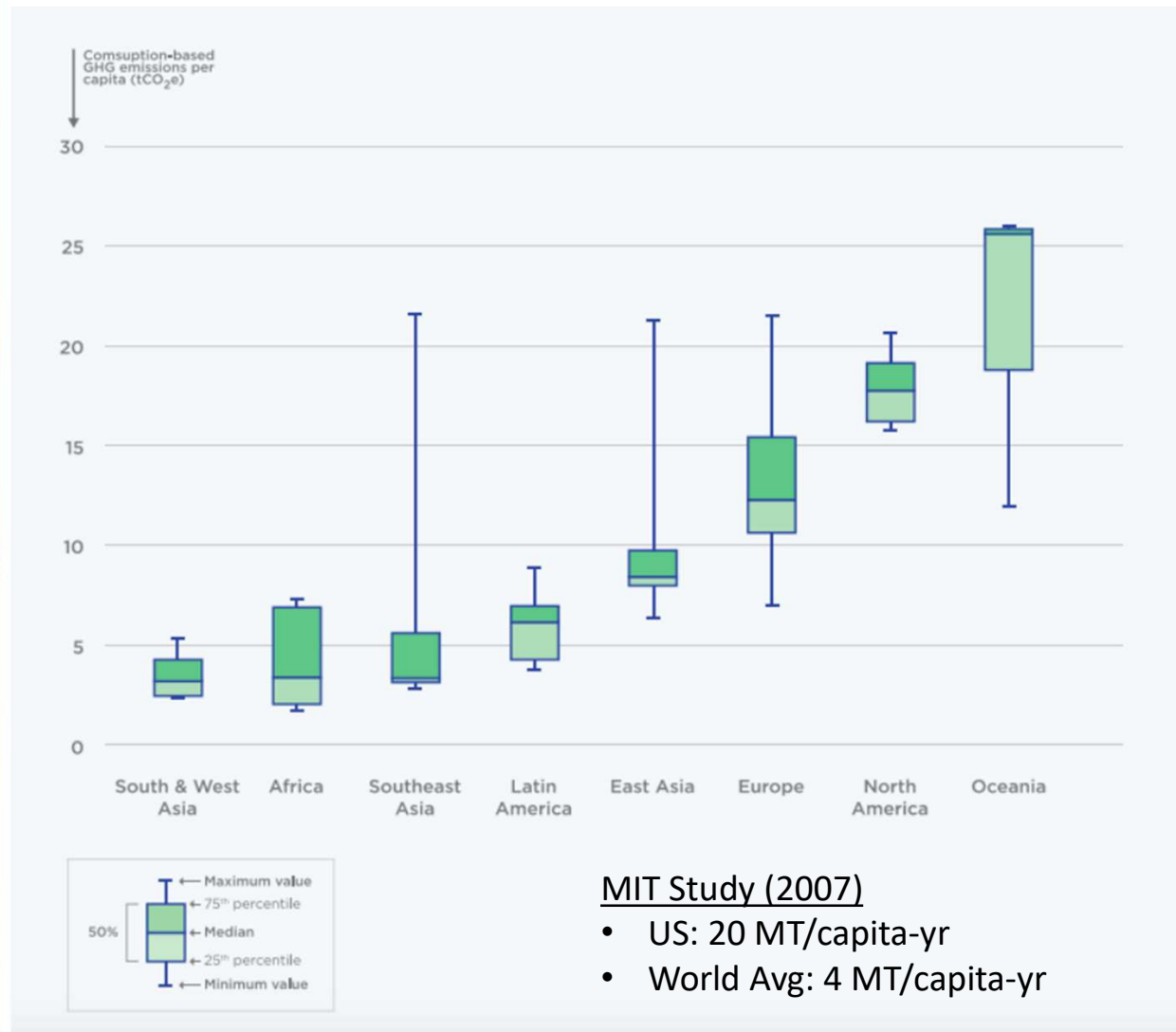
~1,209,000 MT eCO<sub>2</sub>



*Energy and Resources Group, UC Berkeley*

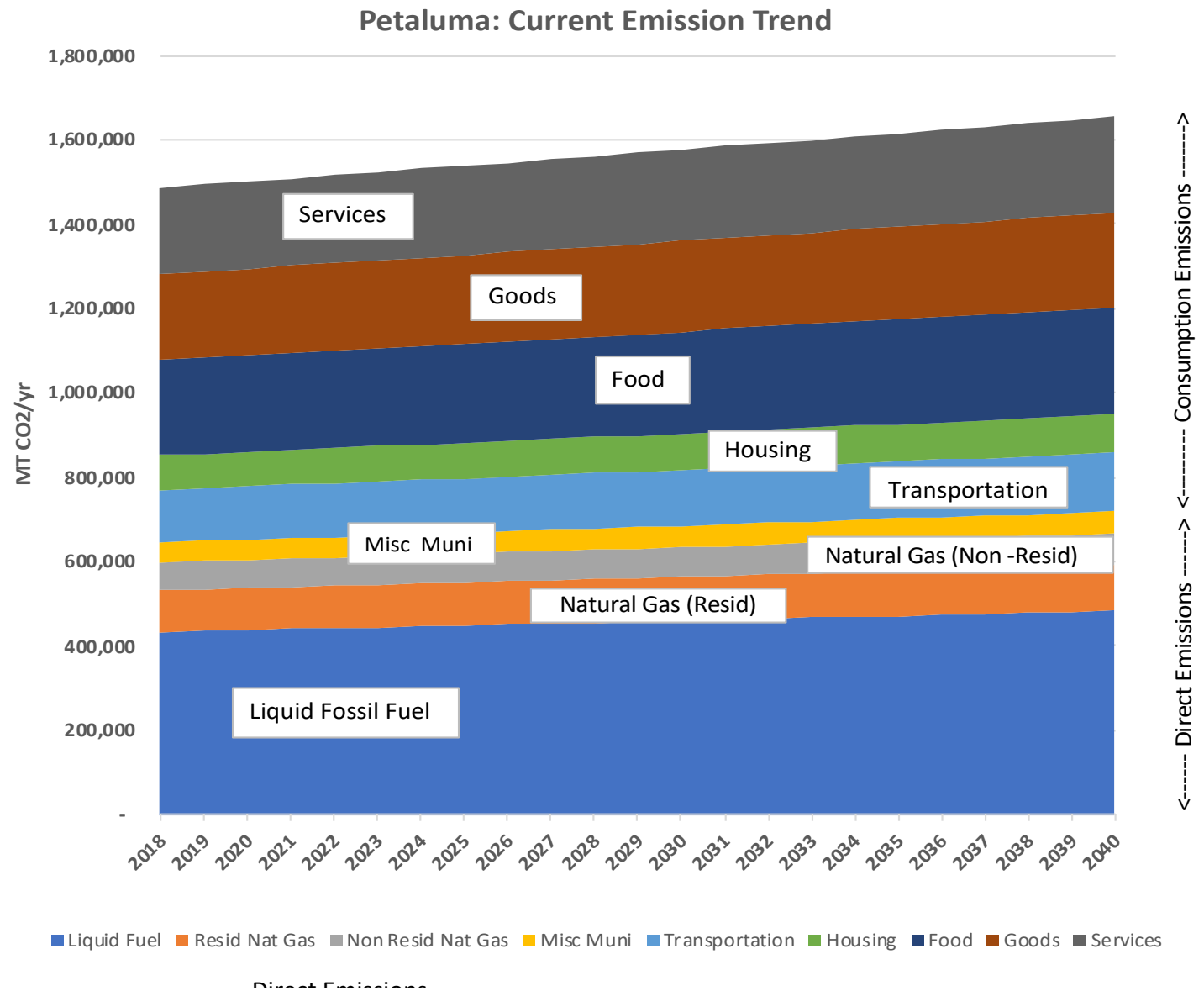
# Consumption Based Emissions Inventory

Regional variation of per-capita consumption-based GHG emissions

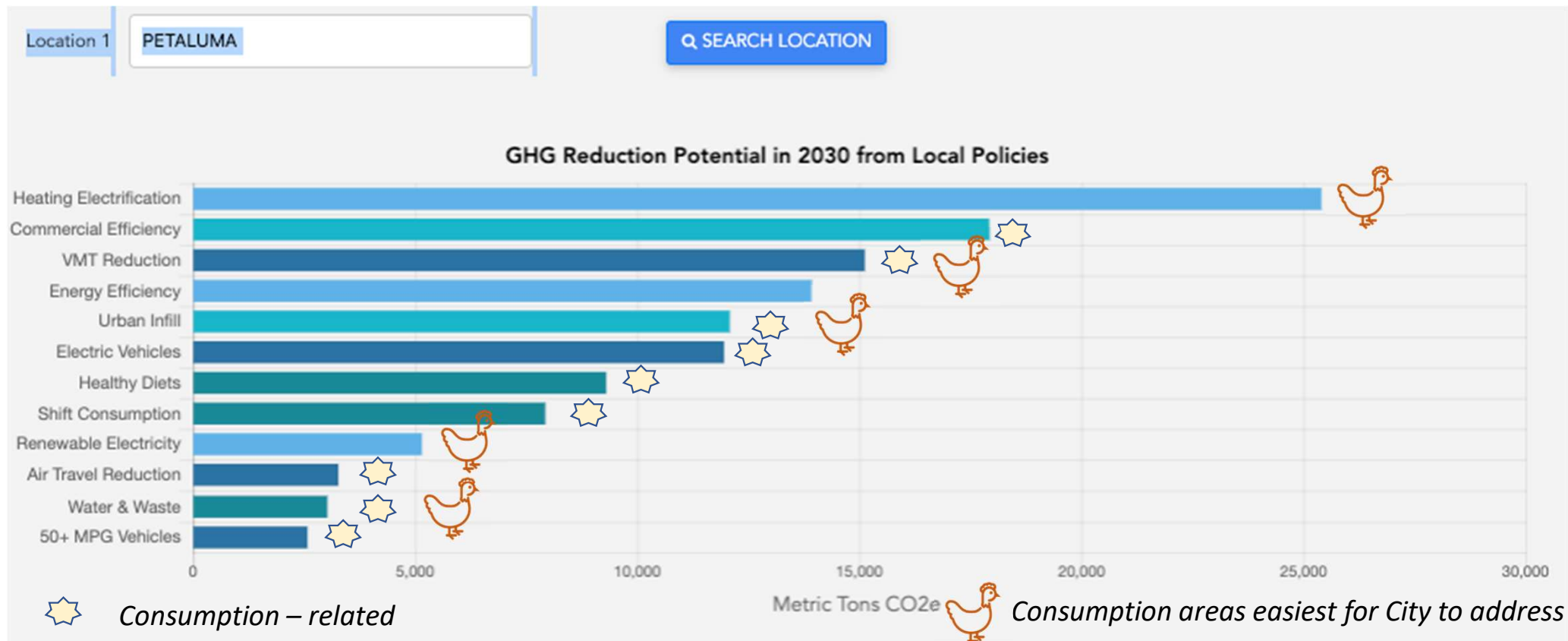


2015)		
eCO <sub>2</sub> per capita		
il	Consumption Only	Total
1,597	2.1	6.9
1,734	2.1	3.2
1,032	3.8	3.8
1,688	3.3	3.3
1,137	3.4	3.4
1,402	(0.2)	
1,892	(1.5)	
1,785	14	20.4
100%		
1,340		

# Citywide Emissions: Direct plus Household Consumption Emissions

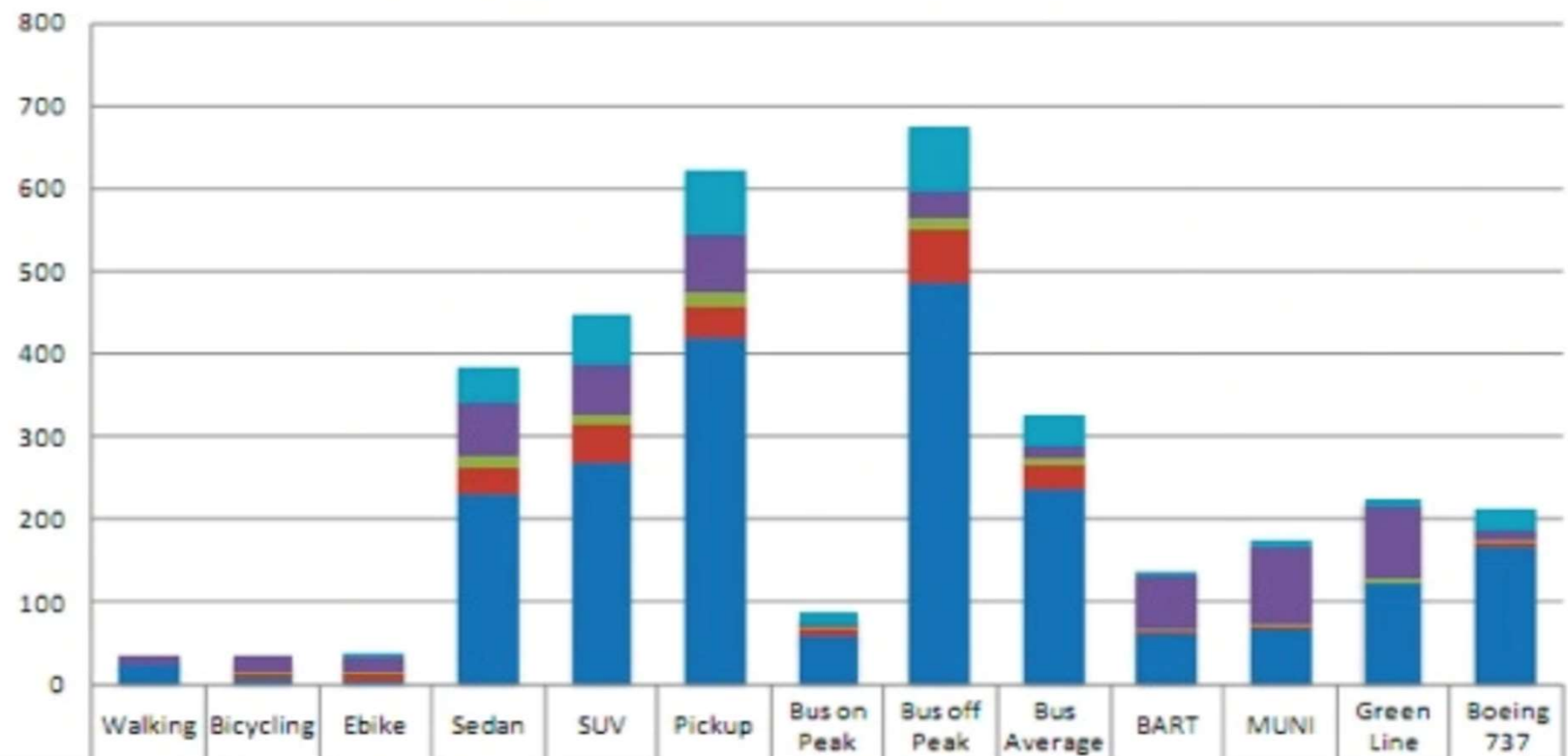


# EMISSION REDUCTION POTENTIAL



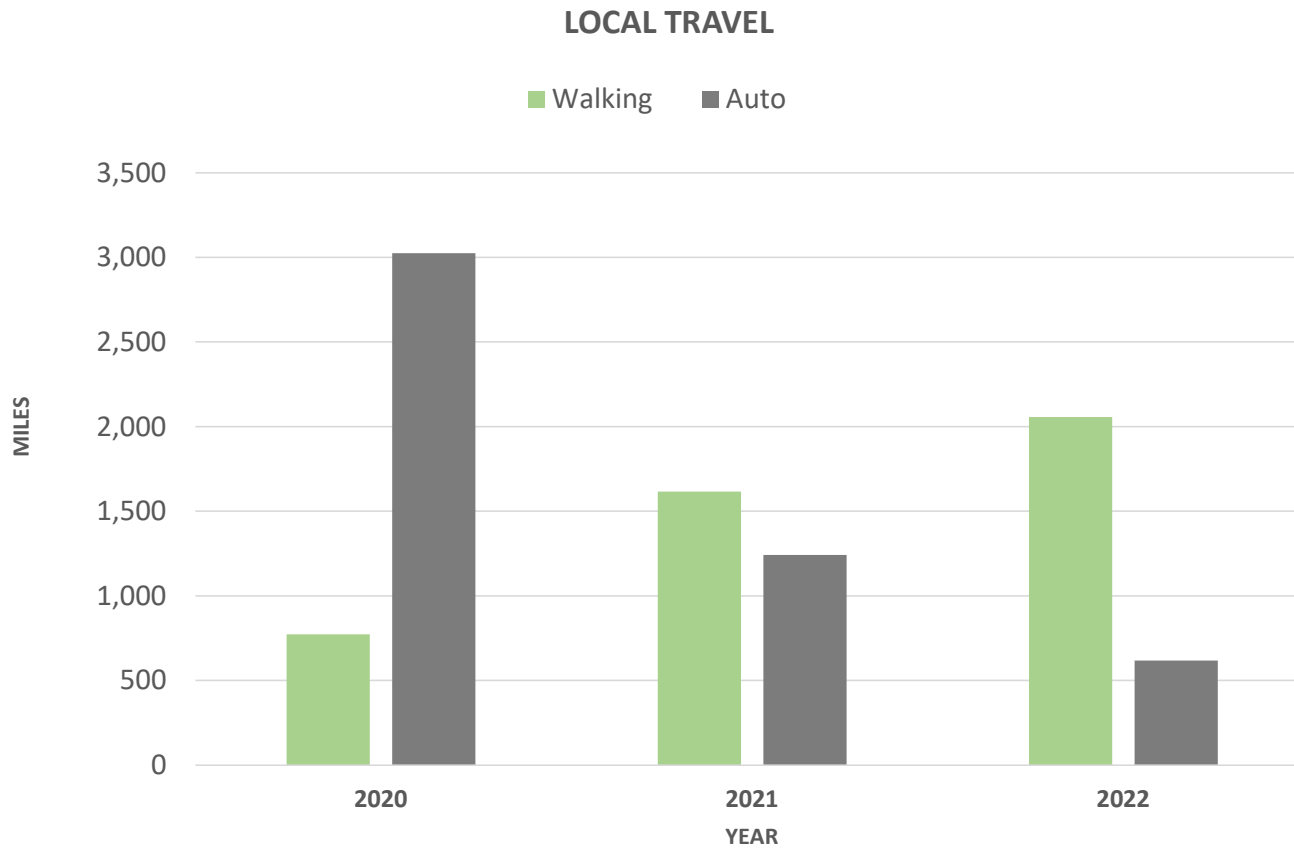
Results generated by the California Local Government Climate Policy Tool (@ <https://coolclimate.berkeley.edu/ca-scenarios/>)

## Greenhouse gas emissions in kg GGE/PMT



	Walking	Bicycling	Ebike	Sedan	SUV	Pickup	Bus on Peak	Bus off Peak	Bus Average	BART	MUNI	Green Line	Boeing 737
Total	33	33	33	382	446	619	85	674	326	136	173	224	210
Fuel Production	0	0	0.33	39	58	74	10	77	36	3	4	8	23
Infrastructure	9	17	17	65	59	71	4	34	16	64	94	87	11
Maintenance	0	1	1	15	14	17	1	12	6	2	4	4	4
Manufacturing	0	8	11	34	45	38	8	66	31	2	2	1	4
Operation	24	7	4	230	270	420	61	486	237	64	69	123	168

# Active Transportation: Continuing Experiment



# Addressing Consumption Emissions

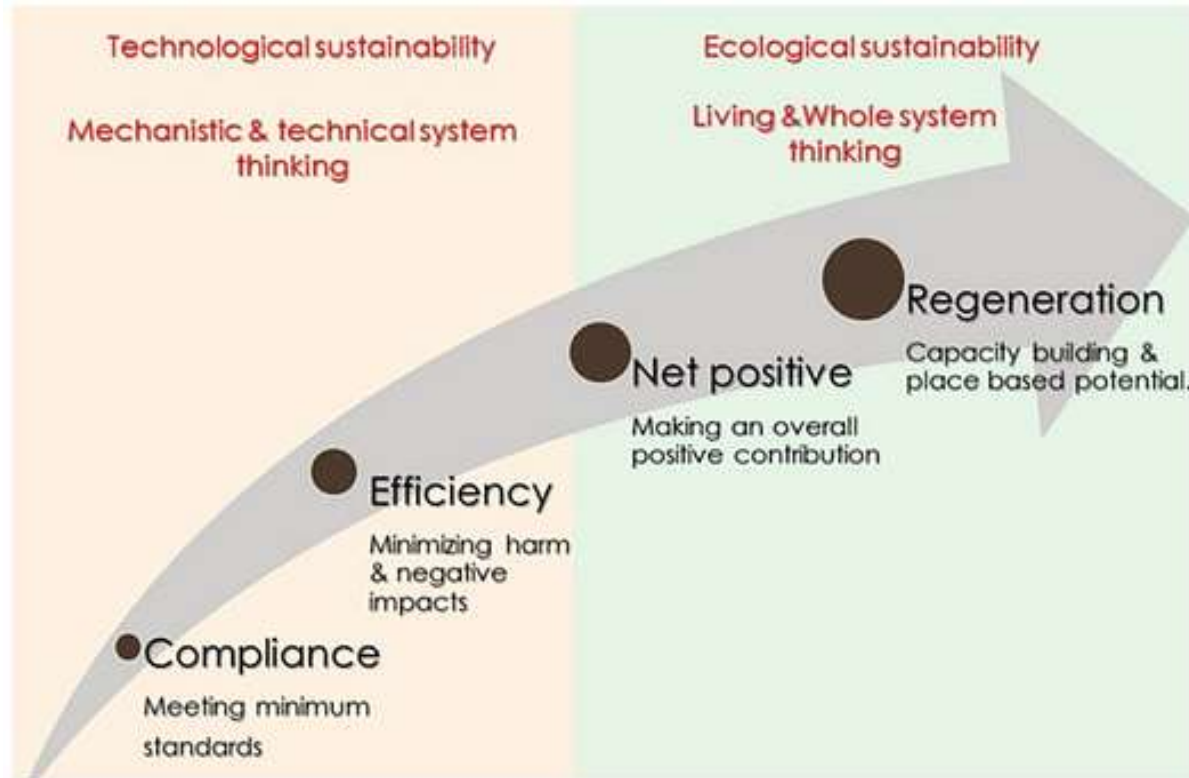
## Primary Pathways

1. Produce Goods and Services Beneficial to Abundance of Life on Earth
  - a. Business design evolves to contribute to the regeneration of whole systems – human and the rest of life - that support the restoration of life with replenished capacity.
2. Consumer Behavior
  - a. Consumers select good and services that are regenerative, long lived, and may be reused or cleanly recycled;
  - b. Governmental assistance provided to offer dependable and appropriate guidance about how well various goods and services support equity and ecological values; and
  - c. Faith communities, educational systems, and industrial/financial leaders support a comprehensive shift in cultural values to support this transformation



# Addressing Consumption Emissions: Source

Business design must evolve from mere compliance with current regulations (allowing degradation of natural systems) to contribute to the regeneration of whole systems that support the restoration of life with replenished capacity.



## Leadership

### Current

- Amsterdam
- PACE
  - (w/ The World Resources Institute)
- SF, Portland

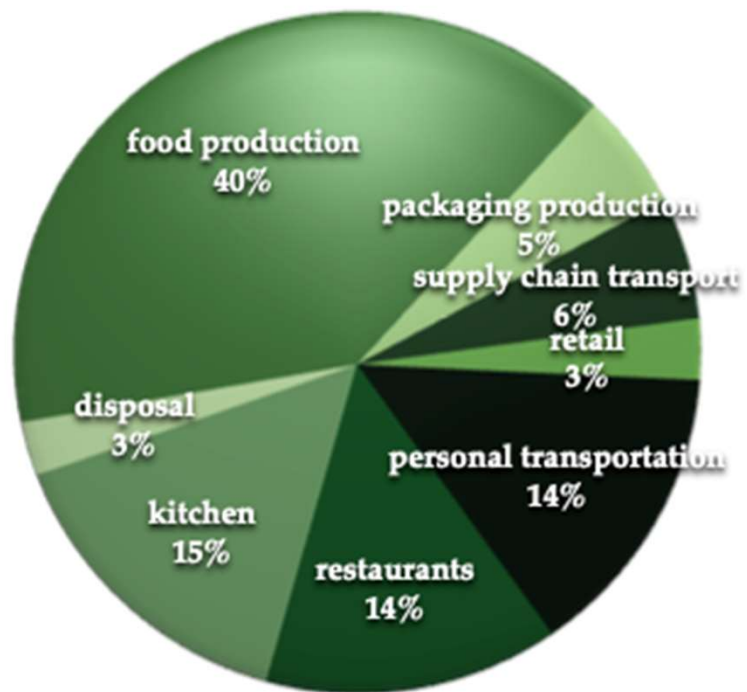
### Emerging Guidance

- Deep Transformation Network (Broad View)
- Regenerative Organic Alliance (Agriculture)

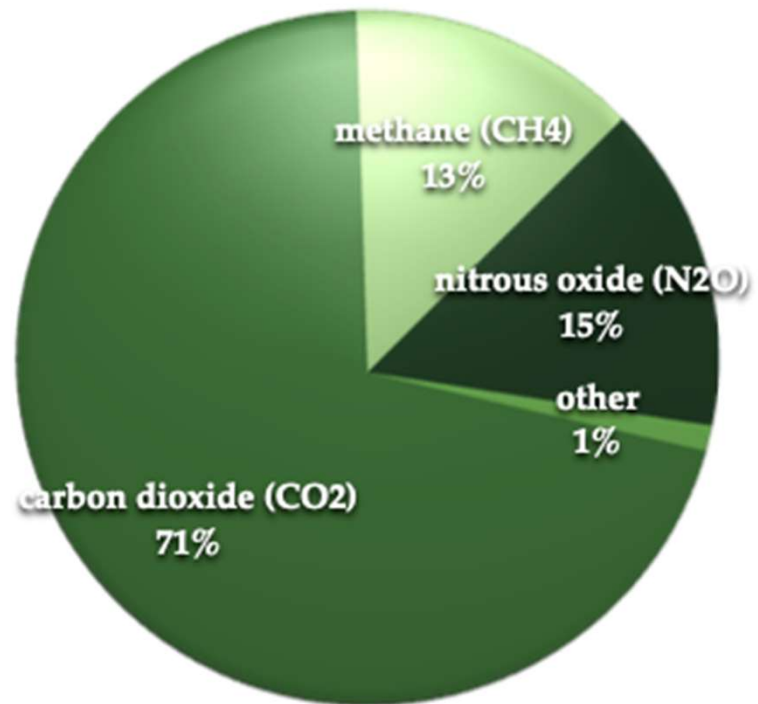
# Consumption Emissions: Food

- Largest of Household Consumption Emission Categories
- The current food system doesn't work. Industrial farming has turned agriculture into a substantial source of greenhouse gas emissions and pollution; and is driving biodiversity loss.
- Items from [THE AMERICAN CARBON FOOTPRINT](#) follow

# Food

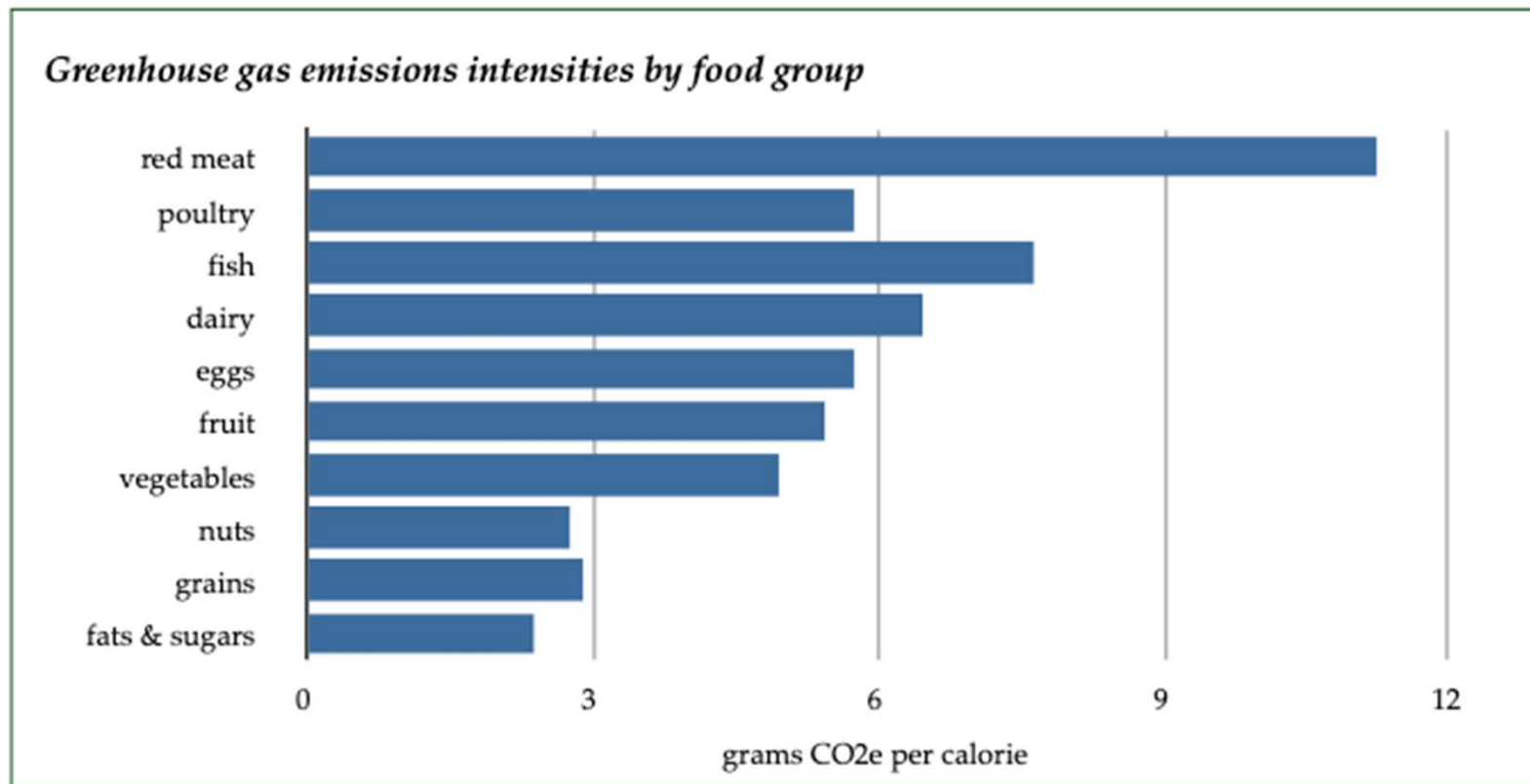


*Breakdown by life cycle phase*



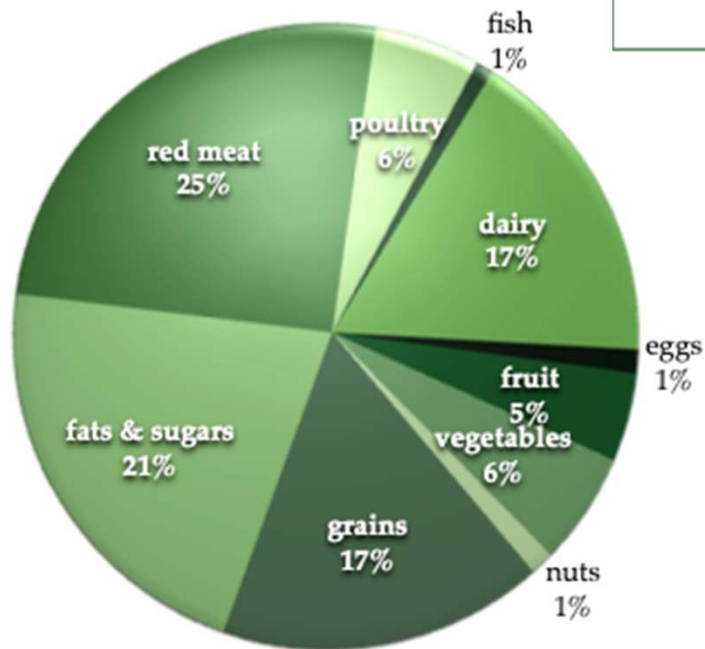
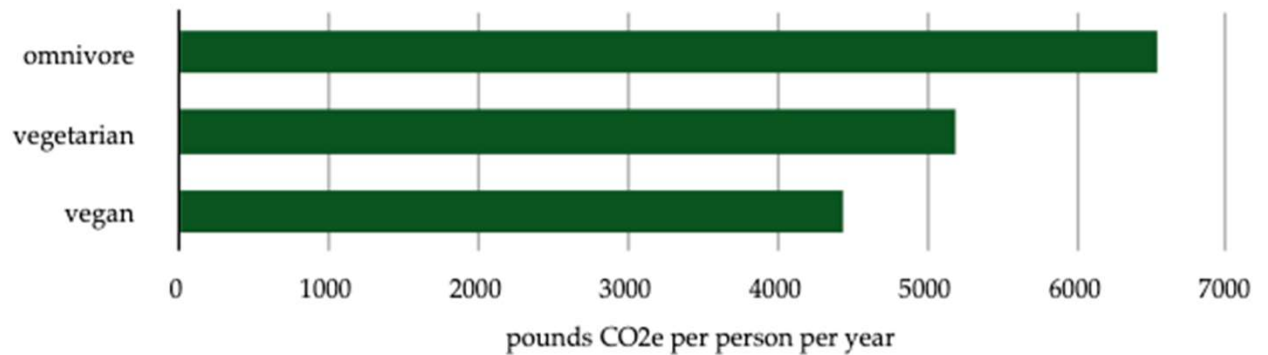
*Breakdown by greenhouse gas*

# Food



# Food

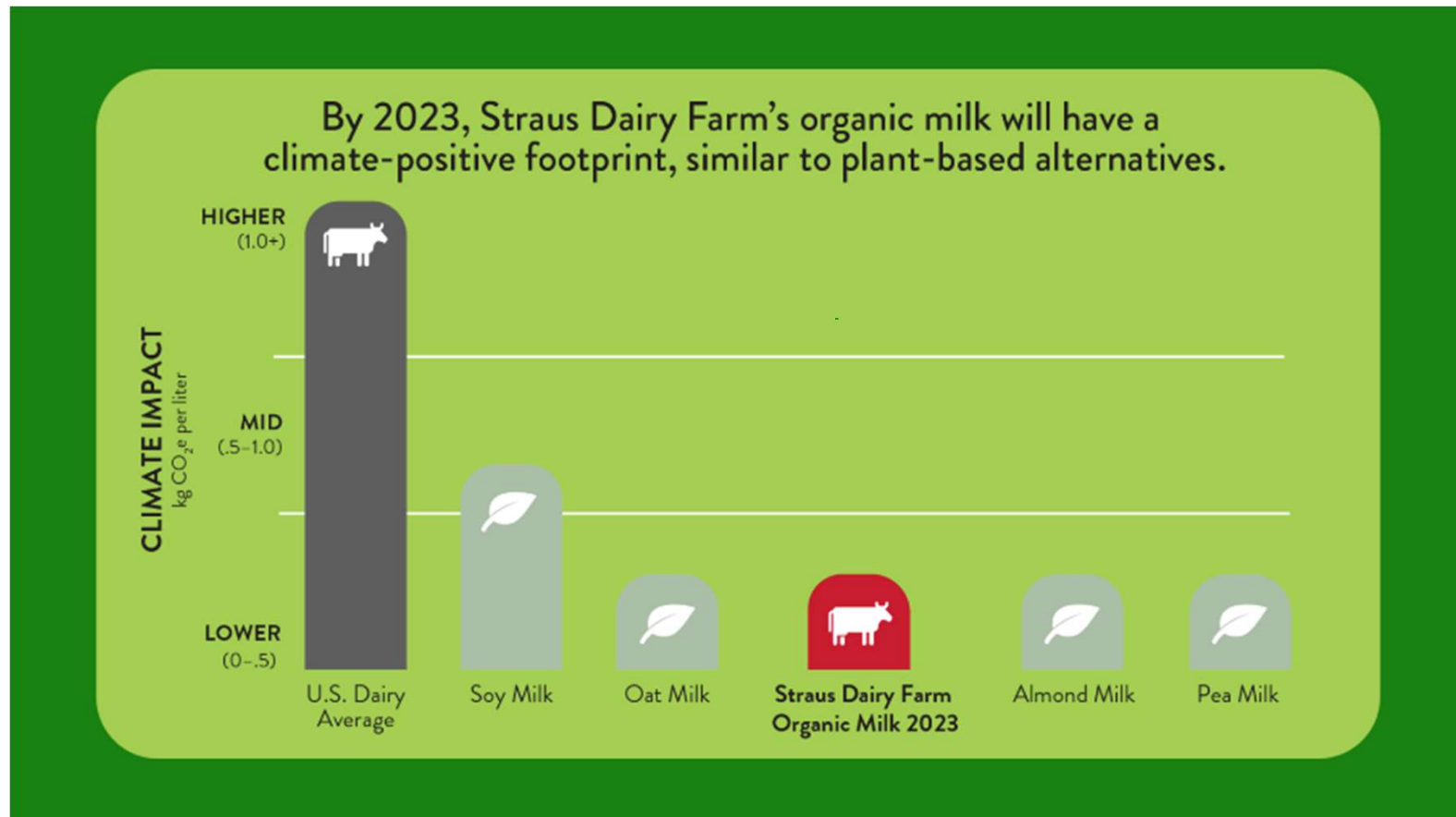
*Embodied food emissions for three diet classes*



*Breakdown by food group*

*How may guidance change if Food is produced with a deep desire to reduce Ecological Impact? As with a local dairy?*

# Food: Emerging Possibilities (Dairy)



# Food: Straus Dairy Innovations (to date)



Carbon farming  
regenerates the soil and  
enhances carbon  
sequestration



Organic farming is essential to  
building a resilient food system



Methane digester converts cow  
manure into renewable energy



Red seaweed supplements in  
cow feed reduce enteric  
methane emissions (cow burps)



Electric farm equipment  
eliminates fossil fuels

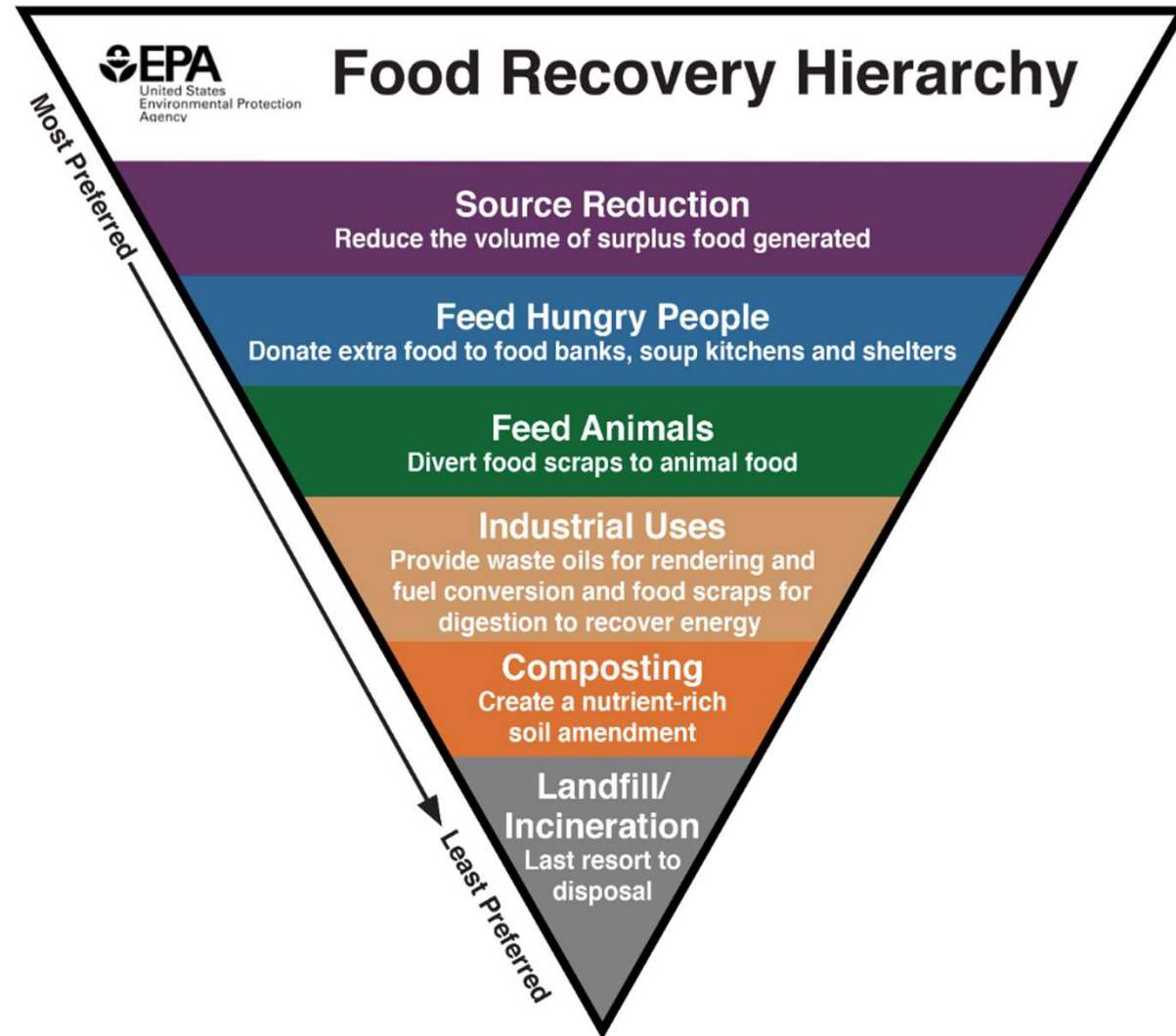
## Food: End-of-Life Issues

**A third of all food in the U.S.  
gets wasted. Fixing that could  
help fight climate change.**

The carbon footprint of food waste is  
greater than that of the airline industry.



# Food Waste Mangement



# Food: Waste Processing Concept

- Process w/ Anerobic Digestion (ideally thermophilic; designed for High Solids feedstock; zero methane emissions)
- Outputs:
  - Compost for soil health / carbon sequestration
  - Biomethane for clean energy:
    - Plant Operation
    - Convert to DiMethyl Ether for easy transport (or direct use in diesel engines)
    - Deliver to SMART fueling location(s); convert to green hydrogen
    - Electrify SMART trains via hydrogen processed in fuel cells
- Regenerative Step: as demand builds, recreate brown kelp forests offshore to renew habitat; harvest some to digest for more soil amendment and green energy

# PETALUMA CLIMATE ACTION

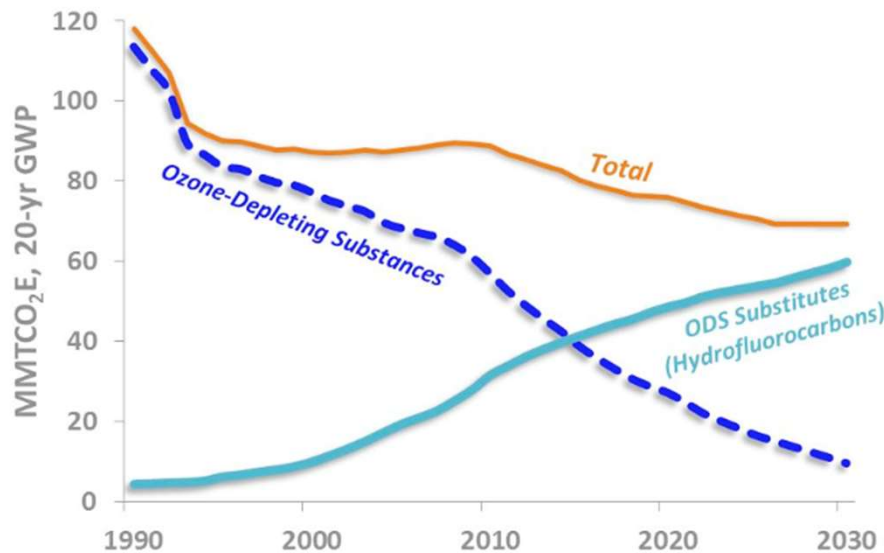
## Refrigerants

*Petaluma: Early Leadership with Consequential Results*



# Guidance (California Air Resources Board)

**Figure 6: Emission Trends of ODS and ODS substitutes (hydrofluorocarbons) – (as ODS are phased out, HFCs increase).\***



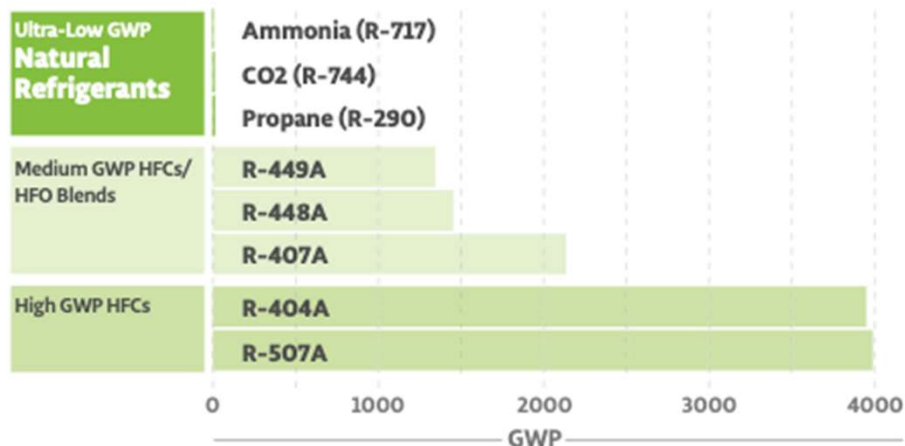
\* Further analysis is needed to reflect the impact of the Kigali Amendment on HFC emission reductions in California

- Hydrofluorocarbons (HFCs; or High GWP “F” gases) are the fastest-growing source of GHG emissions both globally and in California.
- Accelerate the transition to low-GWP refrigerants and more energy efficient refrigeration systems (ARB SLCP Strategy: 40% reduction 2013-2030)

# Guidance



**Classified as Short-Lived Climate Pollutants (SLCPs), HFCs have a disproportionate impact on warming in the near term, making their mitigation significantly more urgent than other GHGs.**



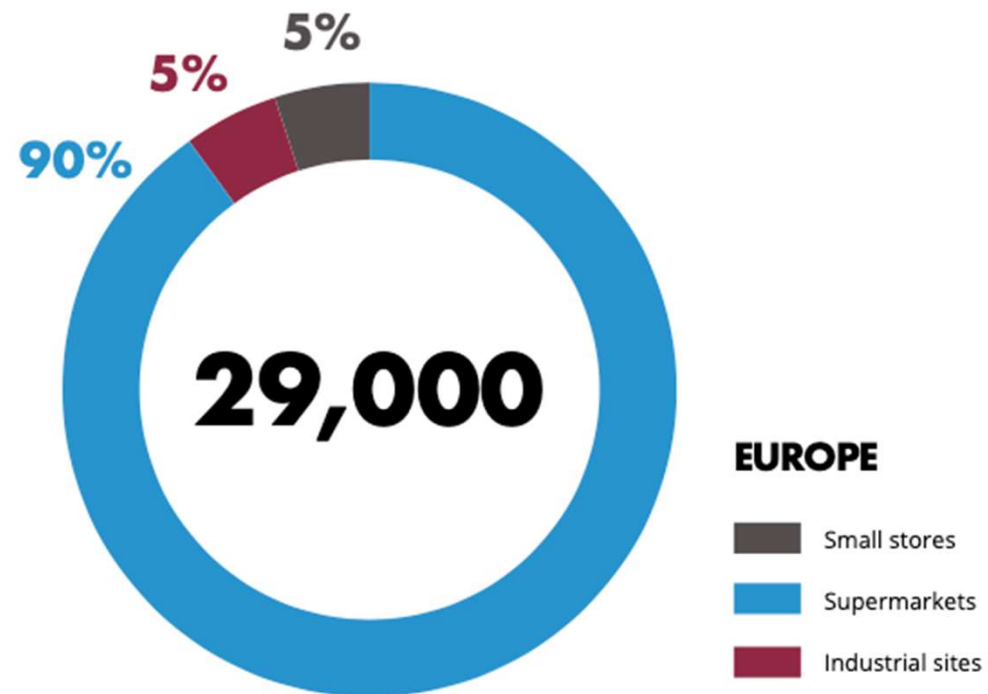
**Natural refrigerants are the climate-friendly solution to mitigate supermarket HFC (Hydrofluorocarbons) emissions**

Natural refrigerants, such as CO<sub>2</sub>, Ammonia, and Propane, have zero or near-zero global warming potential (GWP) and are considered technically viable, safe, and climate-friendly alternatives to “Super Pollutant” HFCs. Due to their long history of use and negligible environmental impact, natural refrigerants are considered “future-proof” from both a regulatory and environmental standpoint.

## Notes....

- CO<sub>2</sub> is the safest of the Natural Refrigerants
- HFOs (Hydrofluoroolefins) produce environmentally harmful trifluoroacetic acid

## Guidance: Market for CO2 Systems



## **Petaluma Leadership:**

*Find Grant support to Electrify a Petaluma Supermarket and convert to CO2 refrigerant, thus bypassing decades of operation (and leakage) of refrigerants with high GWP (possibly also flammable or environmentally harmful). Apply results to leverage legislation to support follow-on work throughout Petaluma and the rest of California.*



# PETALUMA CLIMATE ACTION

Consumption Emissions


*Concluding Thoughts*





# Our Calling: Cultural Transformation

*Thomas Berry*



"The human is neither an addendum nor an intrusion into the universe. We are quintessentially integral with the universe."

Our actions are bringing to an end to the Cenozoic Era. Berry believes next will be the Ecozoic, when Humans become mutually beneficial to all of life.

Indigenous people have demonstrated such reverence. Diné woman Lyla June relates this in her profound Ted Talk (via link provided below), as she explains we are a Keystone Species with the power, and 3,000 years of experience, to knit all the pieces together.