A hand is shown holding a globe of the Earth. The globe is split vertically down the middle. The left half is a vibrant, healthy Earth with green continents and blue oceans, set against a bright blue sky with white clouds. The right half is a scorched, red and orange Earth, appearing as if it has been consumed by fire, with a dark, skeletal tree on top. The background of the entire image is a composite of these two scenes, with the hand holding the globe in the center.

CLIMATE CHANGE

Impacts for Carlisle

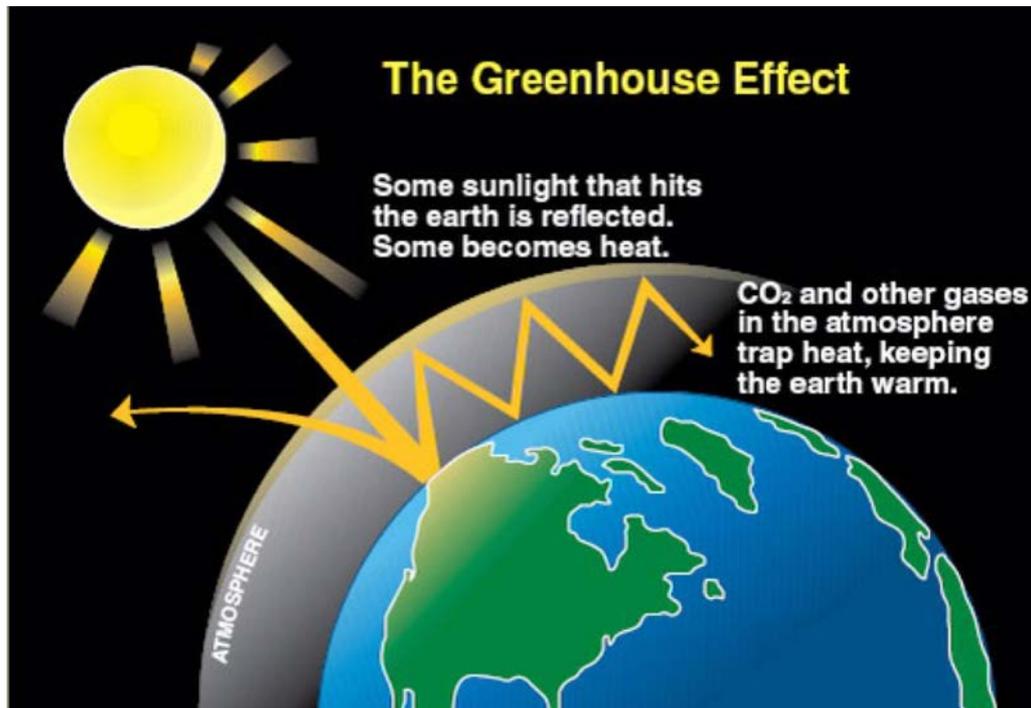
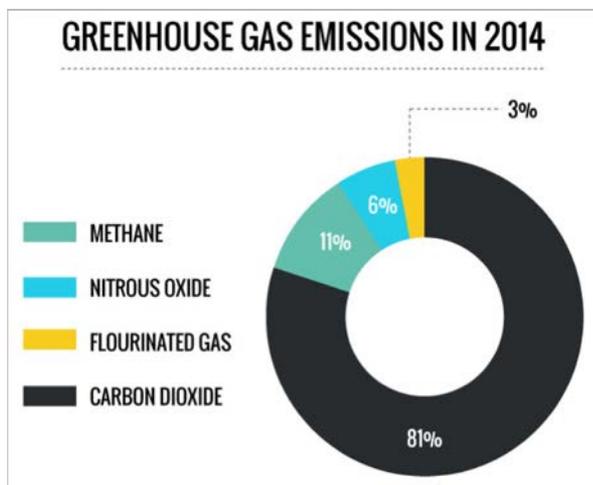
Wednesday February 27th

Presenters:

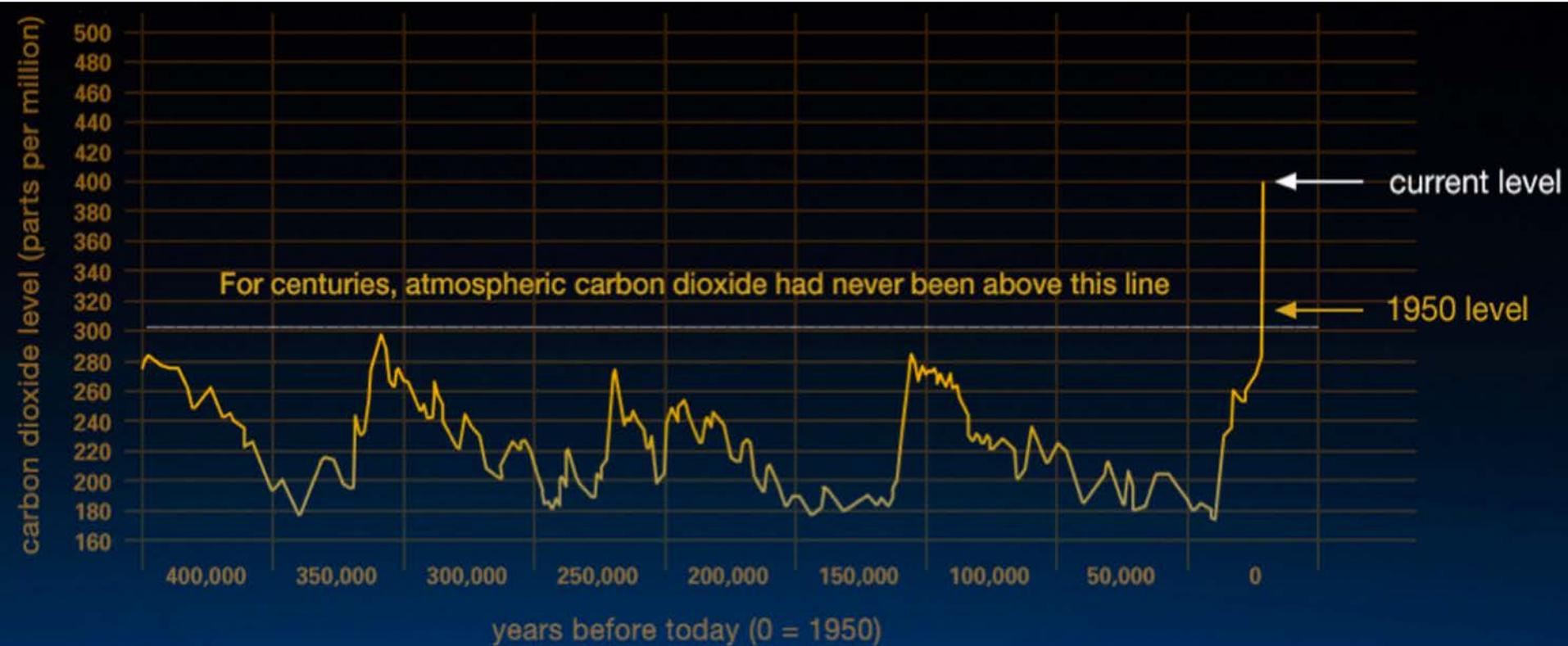
Kierthan Lathrop, Peter Richardson,
Karsten DeMay, Ella White & David White

What Causes Climate Change?

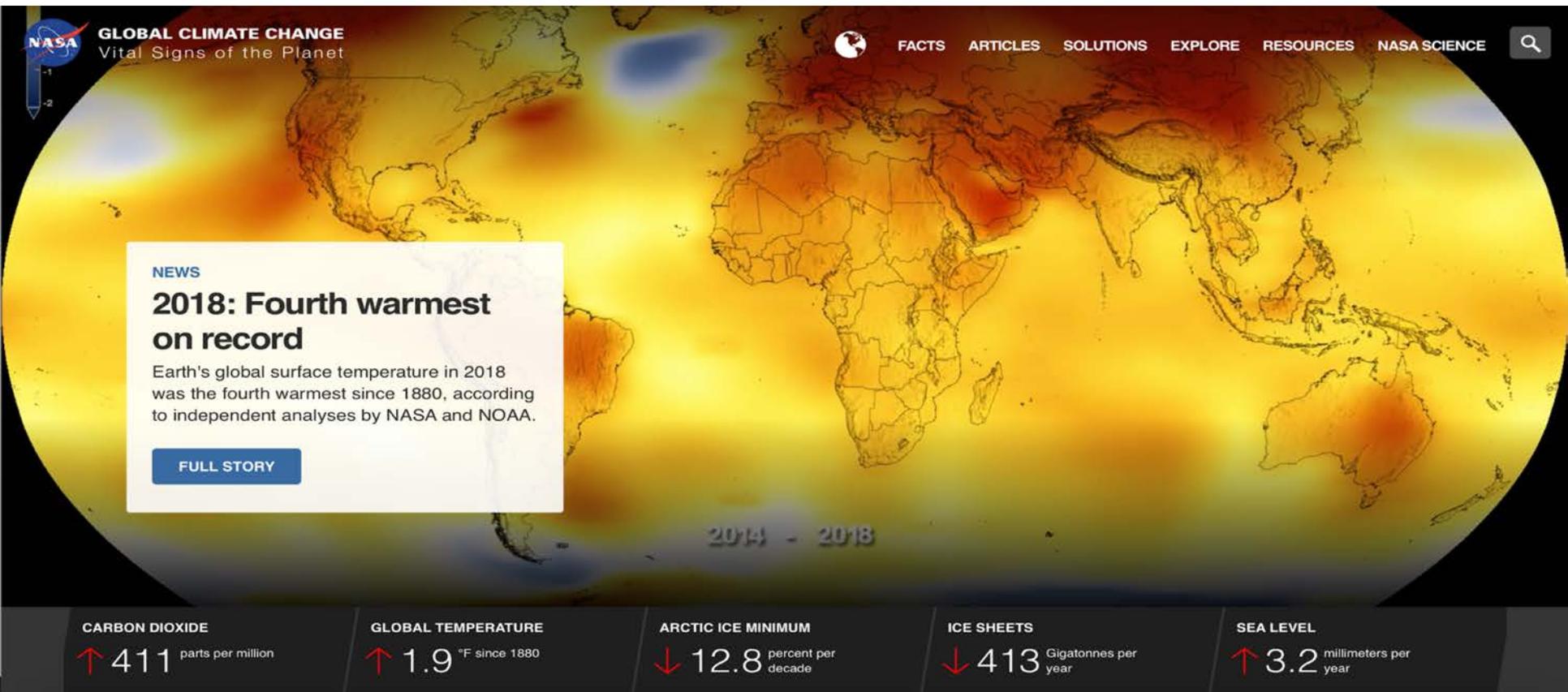
- Greenhouse gases trap solar radiation and warm the atmosphere
- Feedback loop - The warmer earth gets, the more H2O vapor



Atmospheric CO₂ has risen sharply since 1950



CO₂ and Global Warming Facts



Source: <https://climate.nasa.gov>

Global Impacts: What can we observe today?

- Rising sea levels - melting polar ice
 - Coastal flooding (5-8 inch sea level rise since 1900)
- Polarized weather
 - Extreme hot and cold weather
 - Very hot and dry wildfire seasons
- More destructive severe weather (hurricanes, tornadoes, etc)
- Damage to marine ecosystems - ocean acidification
 - Rapid coral decay
- Animal migrations, more invasive species-
- Civil war and mass migration because of scarcity of resources (water, food) caused by drought (Syria, Honduras, and Somalia)



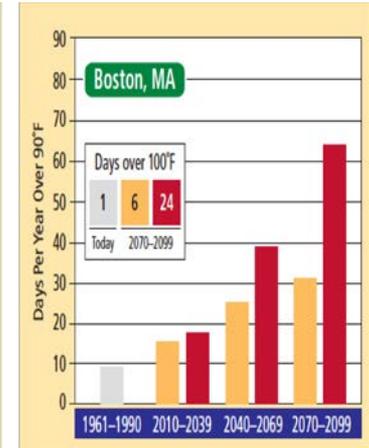
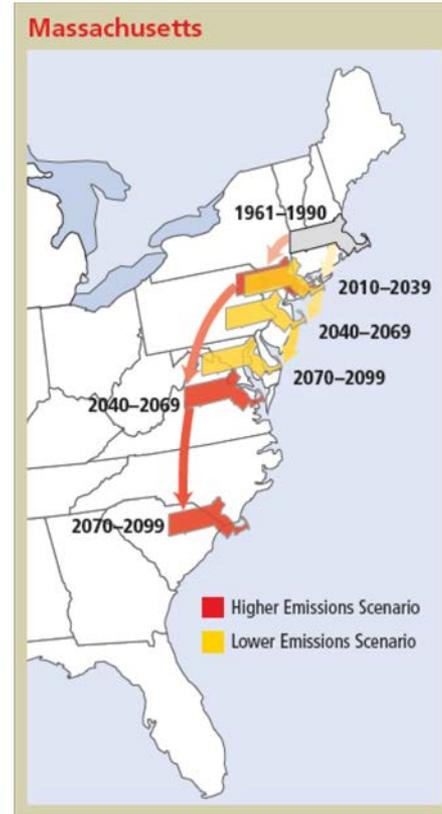
Global Impacts: What lies ahead in this Century



- IPCC forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century.
- More extreme weather will occur more often
- Complete flooding of many island nations - sea level rise additional 1 to 4 feet by 2100
- Loss of wildlife habitat, extinction of many arctic/island species
- Catastrophic loss of coral life
- More war and global unrest and mass migration

Local Impacts: What Can Carlisle Expect?

- Increase in precipitation
 - 10% increase in rainfall since 1900 (EPA.gov)
 - Increase of extreme weather events
- Increase in temperature
 - From 2-8° F increase in next 50 years
- Flooding and drought will happen more frequently
- Changes to biodiversity
 - Loss of biodiversity - climate sensitive plants and wildlife
 - Increase of invasive species and disease-carrying insects
- Economic and social impacts of national disasters, displacement and mass migration



Climate Change Mitigation & Adaptation

- **Mitigation** - The actions we can take to reduce the severity of climate change
- **Adaptation** - The process of adapting to the changes that will occur
- We need to do both



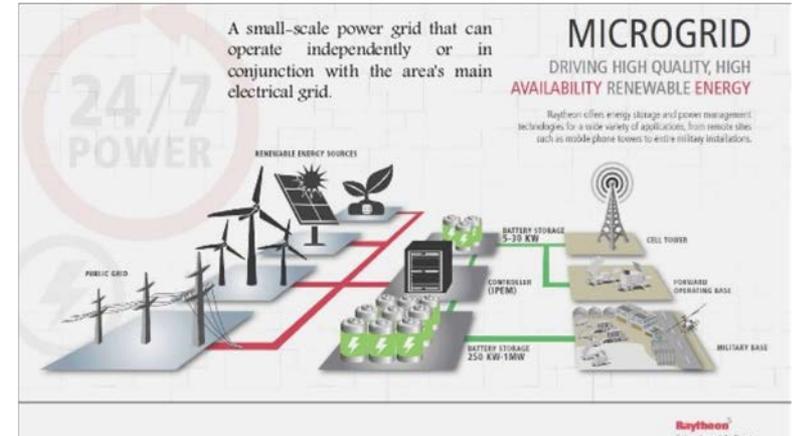
Top Six Mitigation Strategies

1. Refrigerant Management
 - a. HFC's are 1,000-9,000x worse than CO₂
 - b. Possible reduction of global warming of 1° F
2. Onshore Wind Turbines
- 3. Food Waste Reduction**
 - a. A third of food produced is wasted
 - b. Accounts for 8% of global emissions
- 4. Plant-Rich Diet**
 - a. Meat/dairy production accounts for 20% of global emissions
 - b. Changing to vegetarian diets can reduce food related global emissions by 63%
5. Restoring Tropical Forests
6. Educating Girls/Family Planning



Adaptation Strategies

- Addressing Sea Level Rise and Storm Surge
 - with new infrastructure (built and landscape)
 - or by relocating coastal communities
- **Preparing for Extreme Weather - Flooding/Drought/Power Outages**
 - Retrofit homes for new climate (air conditioning for hotter summers, power backup for frequent outages, upgraded drainage systems for flood events)
 - Water and energy resilience strategies to survive drought and mass power outages
- Preparing for Global Food Insecurity



Carlisle Co2 Emissions - Preliminary Analysis CETF

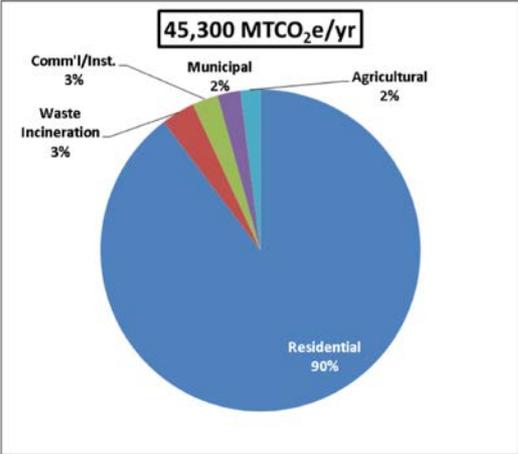
- The Carlisle Energy Task Force is working on an analysis of Carlisle's emissions

Sustainable Carlisle—10/10/2019 Presentation to JCC

4

Residential Emissions

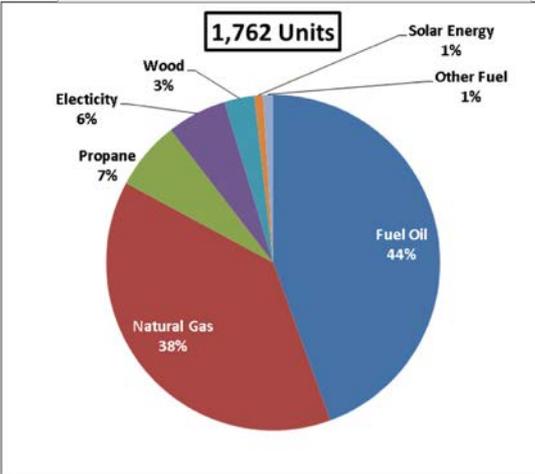
2017 Carlisle Emissions ¹



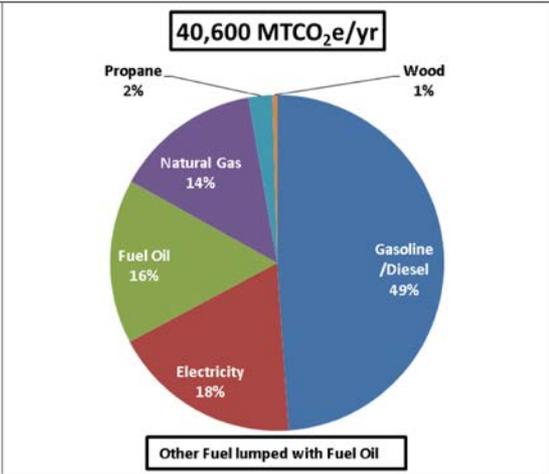
1) Includes vehicles; excludes indirect emissions associated with purchased goods and services

PRELIMINARY DATA

2016 Occupied Housing Units by Primary Heating Fuel



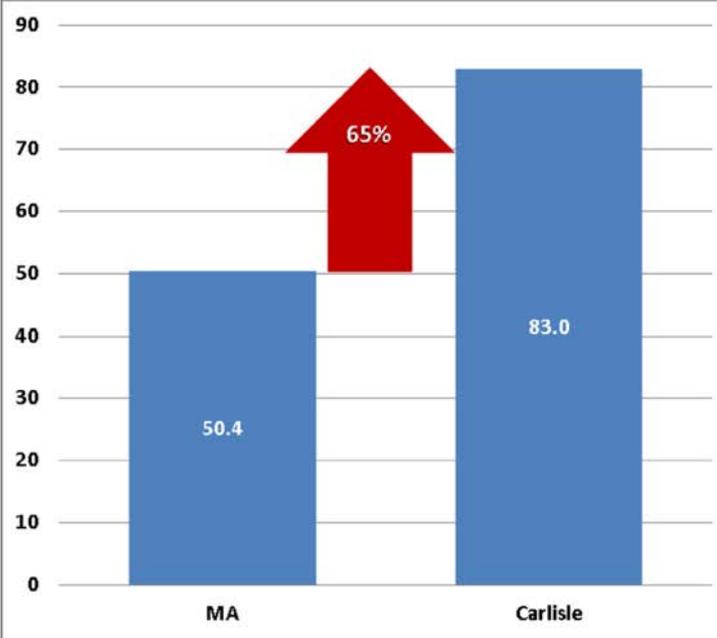
2017 Residential Emissions by Fuel Type, Including Vehicles



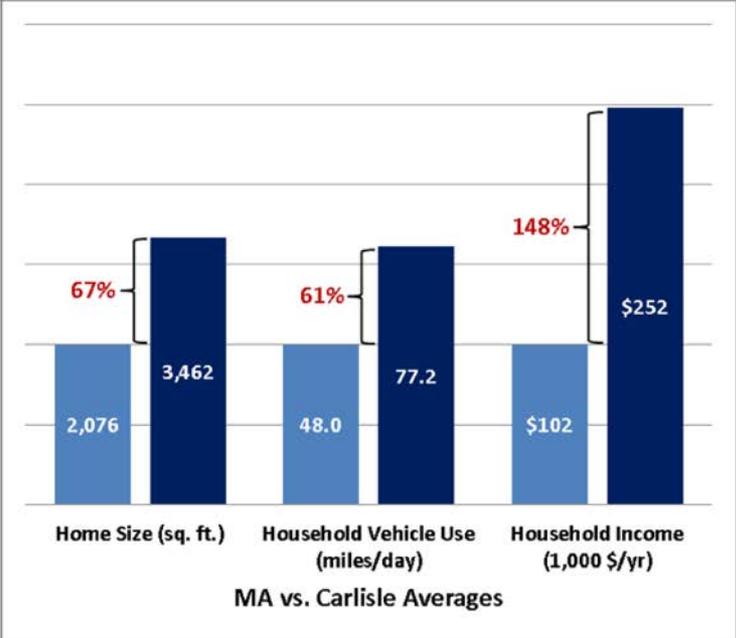
PRELIMINARY DATA

MA/Carlisle Comparison - Preliminary Analysis CETF

Per-Household Direct and Indirect Emissions (MTCO₂e/yr.)



Other Metrics

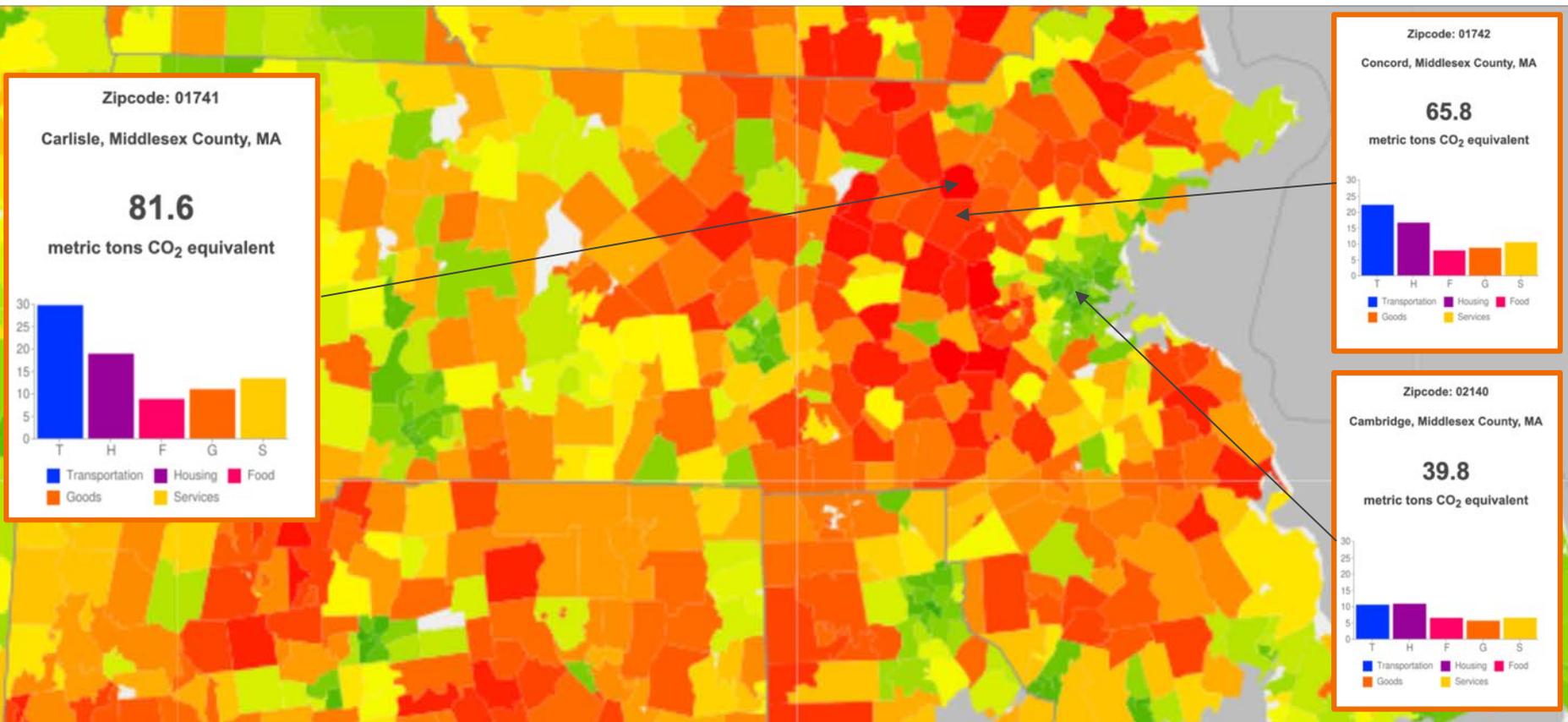


PRELIMINARY DATA FOR HOME SIZE

International Targets for CO₂e reductions

- Intergovernmental Panel on Climate Change (IPCC 2018 report)
 - To keep global warming to 1.5° C, global CO₂ emissions should decline by 45% from 2010 levels by 2030 (SPM15C1)
 - Net zero emissions of carbon dioxide must be reached by 2050
- The Union of Concerned Scientists
 - To keep global warming below 2° C, the US must reduce carbon emissions by approximately 8% per year to get to at least 80% below 2000 levels by 2050

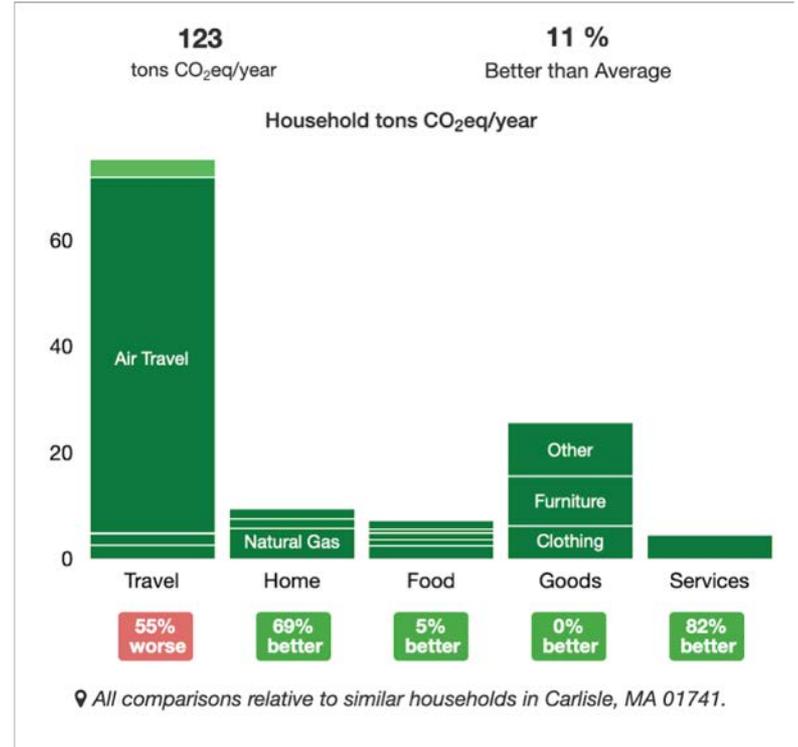
Cool Climate - Comparisons of Household CO₂e



Cool Climate - Karsten

Air travel is my family's biggest CO₂e footprint - 150K/year

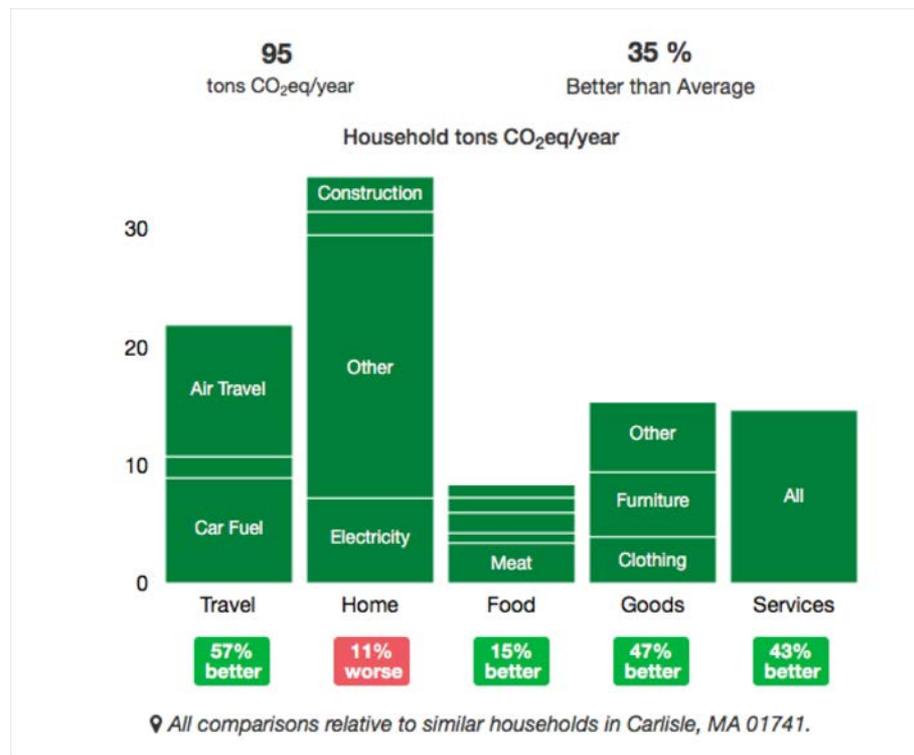
Both my parents travel for work and my family is spread out in California and Norway



Cool Climate - Kierthan

My family is 57% better than average with travel

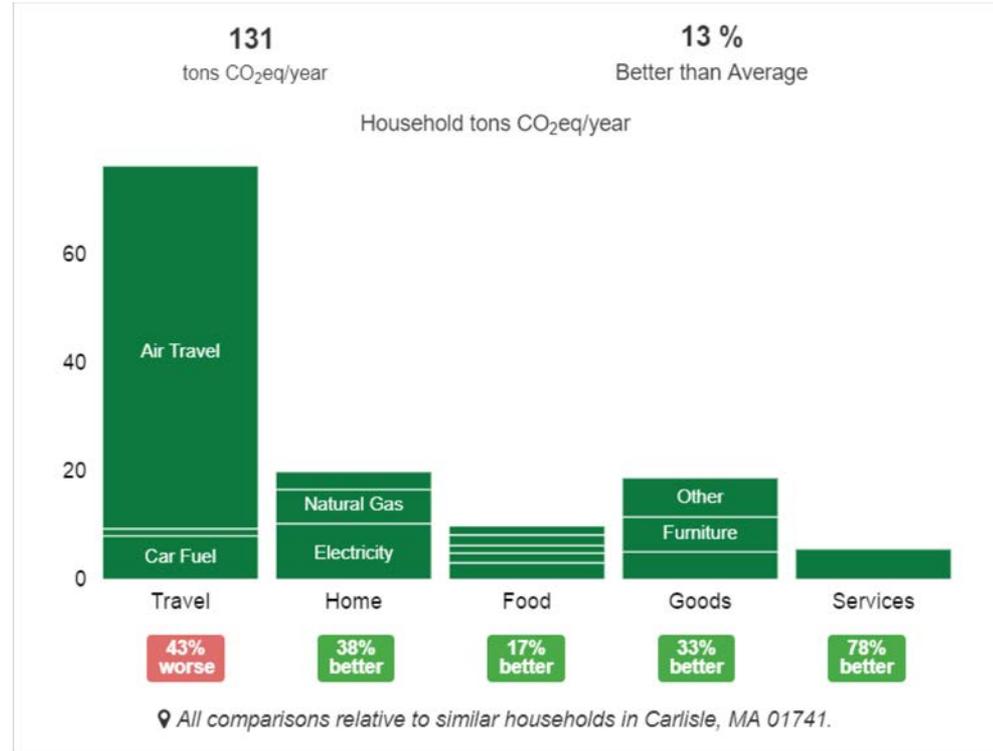
- Yet we own 3 cars and drive them regularly
- We burn oil to heat our house



Cool Climate - Peter

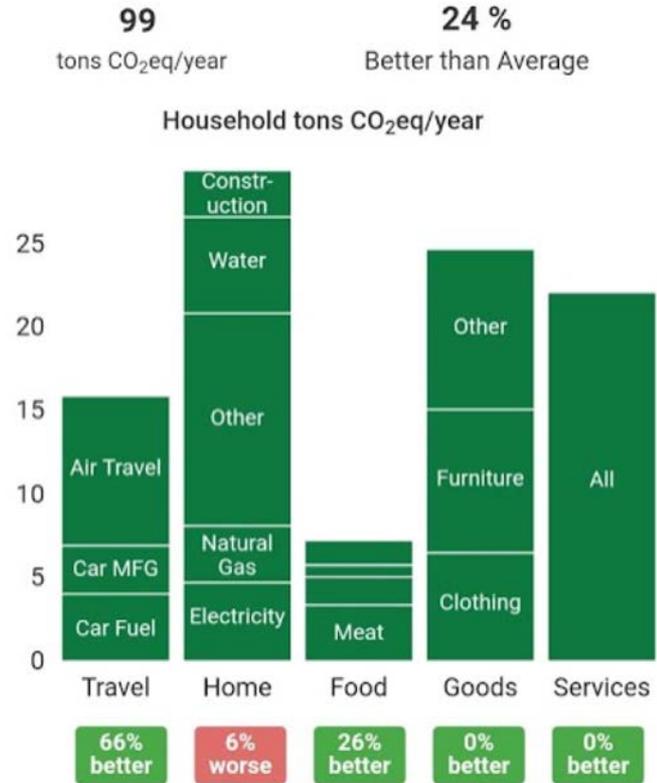
My family's greatest CO₂ footprint is a result of frequent air travel - 43% worse than average.

- My parents fly internationally regularly for work
- We all fly multiple times per year domestically



Cool Climate - David & Ella

- The area that we were the greatest amount below average was travel despite the fact that our family tends to travel quite regularly.
 - It is likely this is true because my mother works from home, and my father bikes to work during the summer months.
 - Our family doesn't tend to fly that often, so that could explain the relatively small air travel numbers



📍 All comparisons relative to similar households in Carlisle, MA 01741.

How Can the Master Plan Address Climate Change?



A hand is shown holding a globe of the Earth. The globe is split vertically. The left side is a vibrant, healthy Earth with blue oceans, green continents, and a single green tree on top. The background is a bright blue sky with white clouds and a few birds flying. The right side is a scorched, fiery Earth with a black, dead tree on top. The background is a dark, orange-red sky with lightning bolts and a landscape of cracked, dry earth. The text "Thank you" is written in white across the center of the globe.

Thank you

More info about the master plan process at: www.carlisleplan.org