



# Climate Change and Housing Cooperative

Climate change, its impacts and how housing cooperatives can help improve the situation and their bottom line.

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# What is Climate Change?

## What is climate change and weather?

Climate Change - is a measure of the average pattern of weather over long periods.



Weather – a natural phenomenon that changes daily.



# What is Climate Change?

Climate is always changing! Why?



## Nature

*Volcanic activity pushes heat and gases into the air*



## The Sun

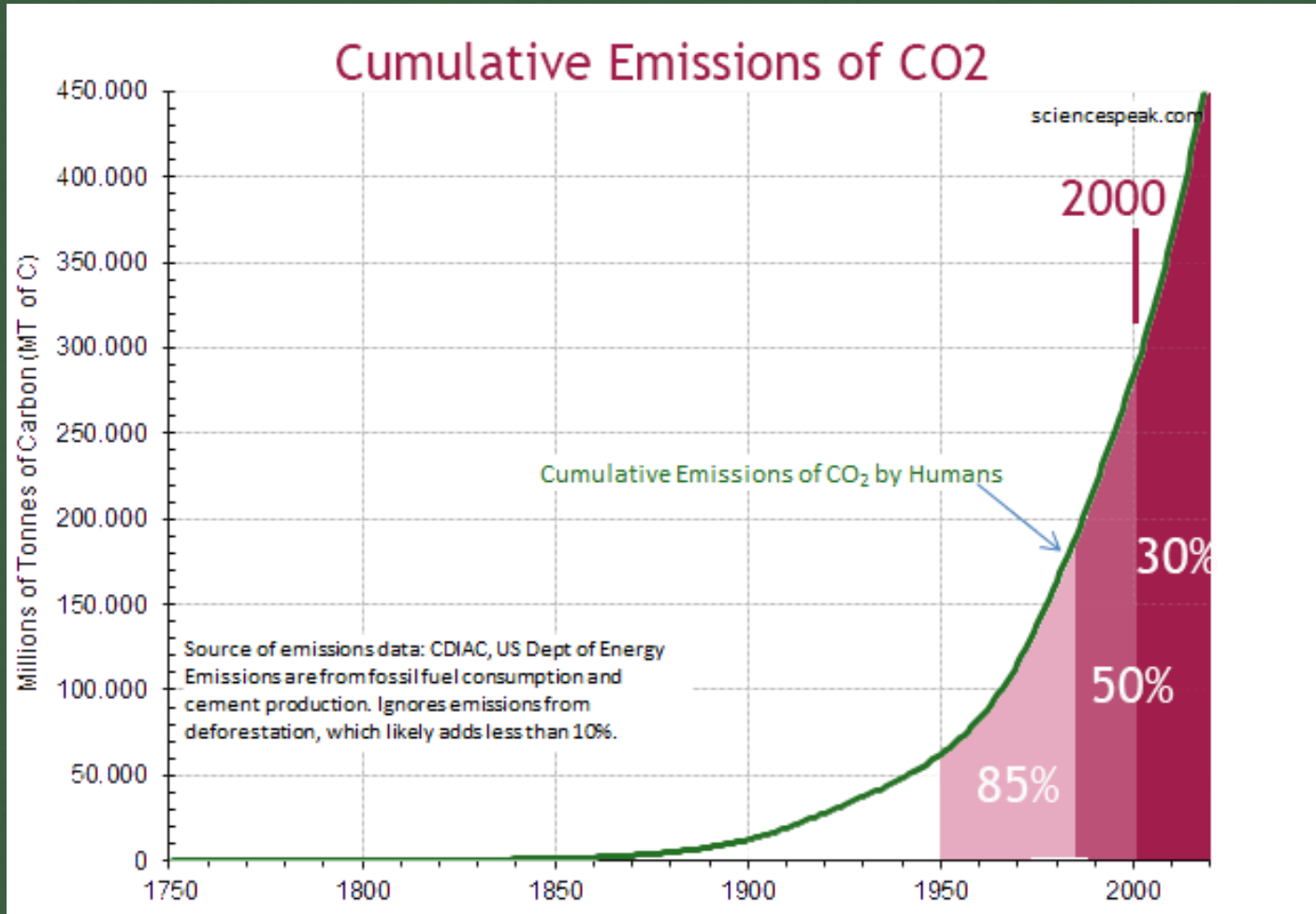
*Changes in the sun's energy reaching the Earth*



## Humans

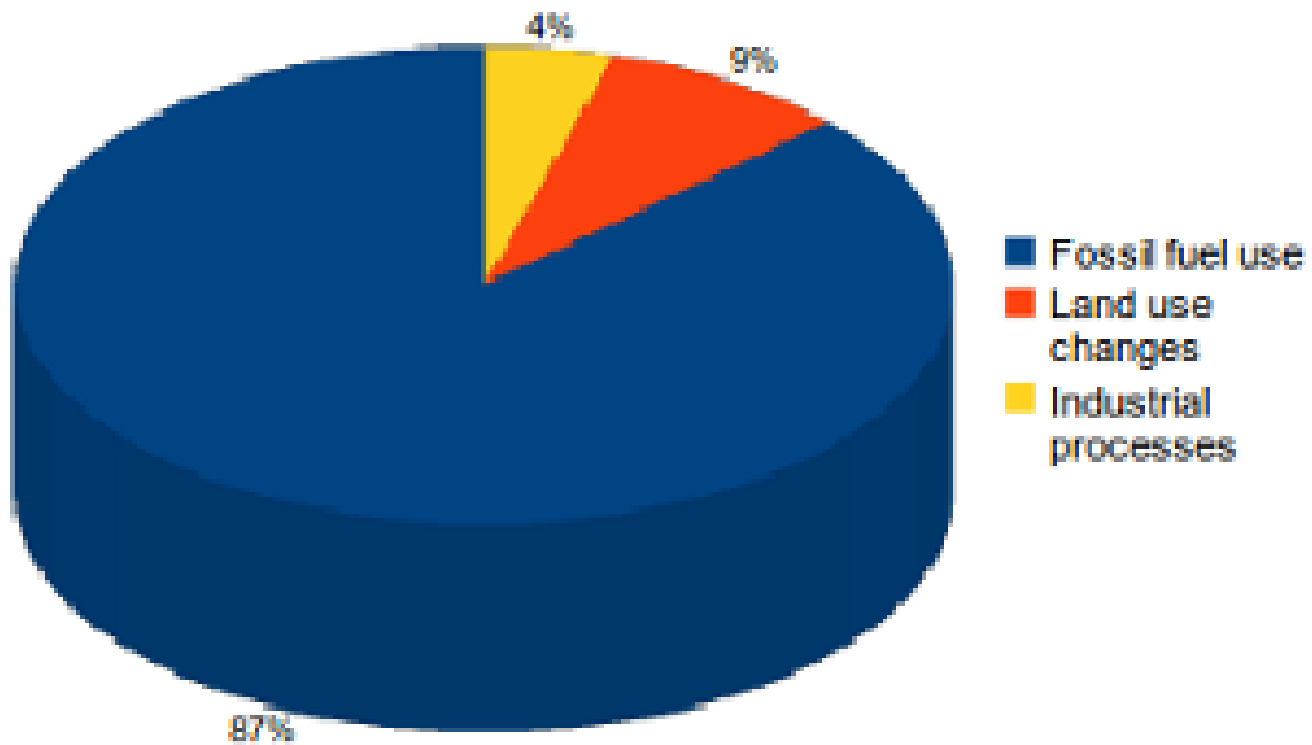
*Human activities like driving cars, generating electricity and running factories release create a greenhouse effect.*

# Human activity and Climate Change?



# Human activity and Climate Change?

Human sources of carbon dioxide



# Impact of Climate Change

The planet is in a dire state

**+1.1°C**

Current global temperature anomaly vs. pre-industrial averages

**-68%**

Decline in animal population sizes since 1970 according to WWF *Living Planet Report*

**8M**

People displaced by flooding per year

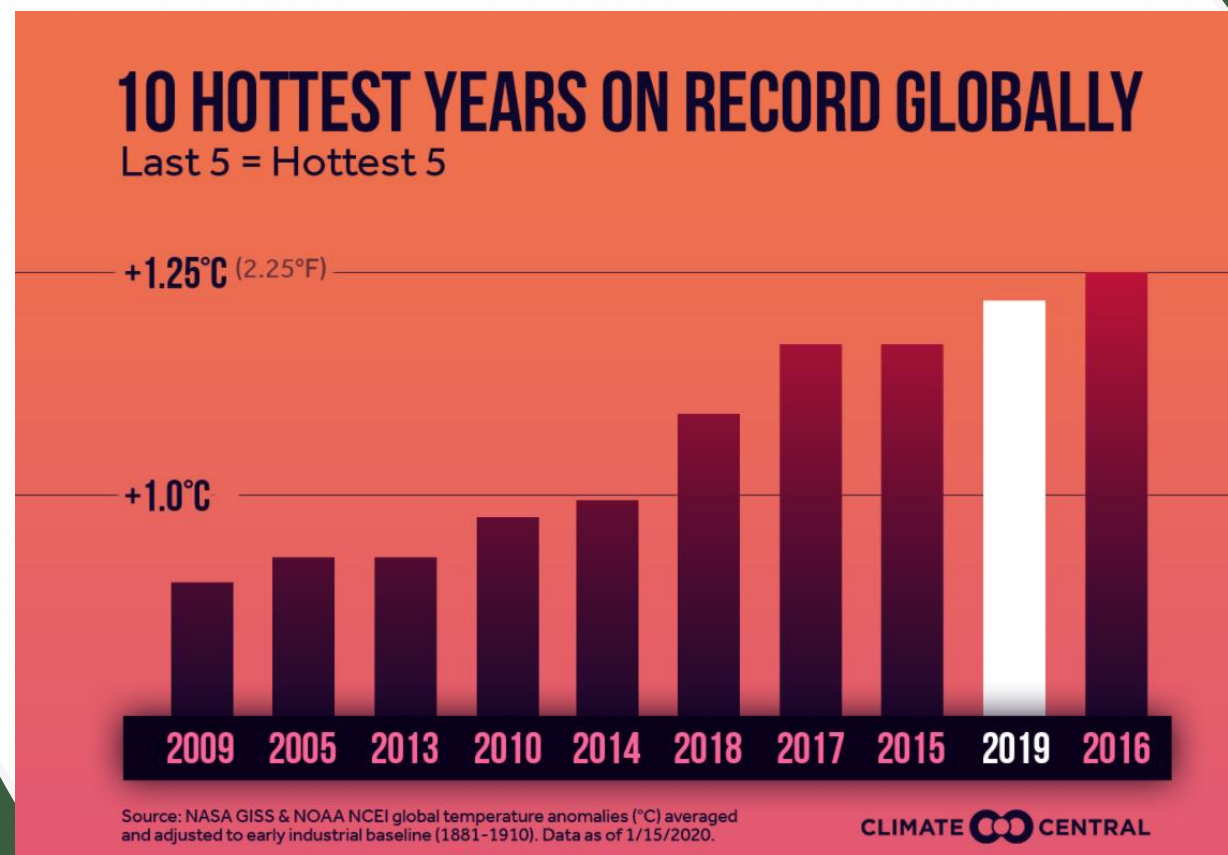
**-25%**

Loss in GDP/capita by 2100 on current climate trajectory

**11M**

Metric tons of plastic flowing into the ocean every year

# Impact of Climate Change



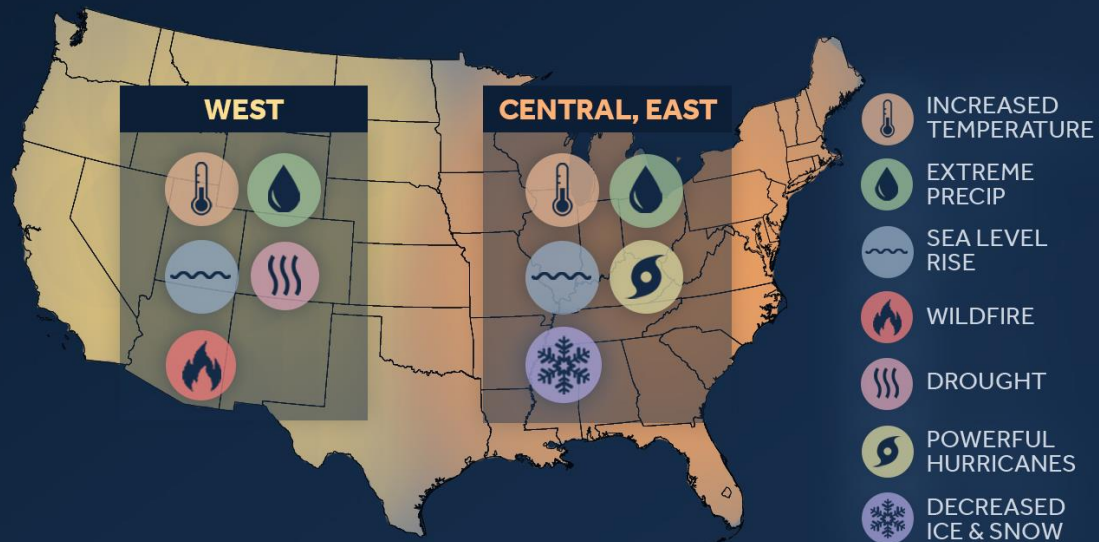
# Impacts of Climate Change



# Impact of Climate Change

## U.S. CLIMATE IMPACTS

FUTURE SEVERITY DEPENDS ON CHOICES TODAY



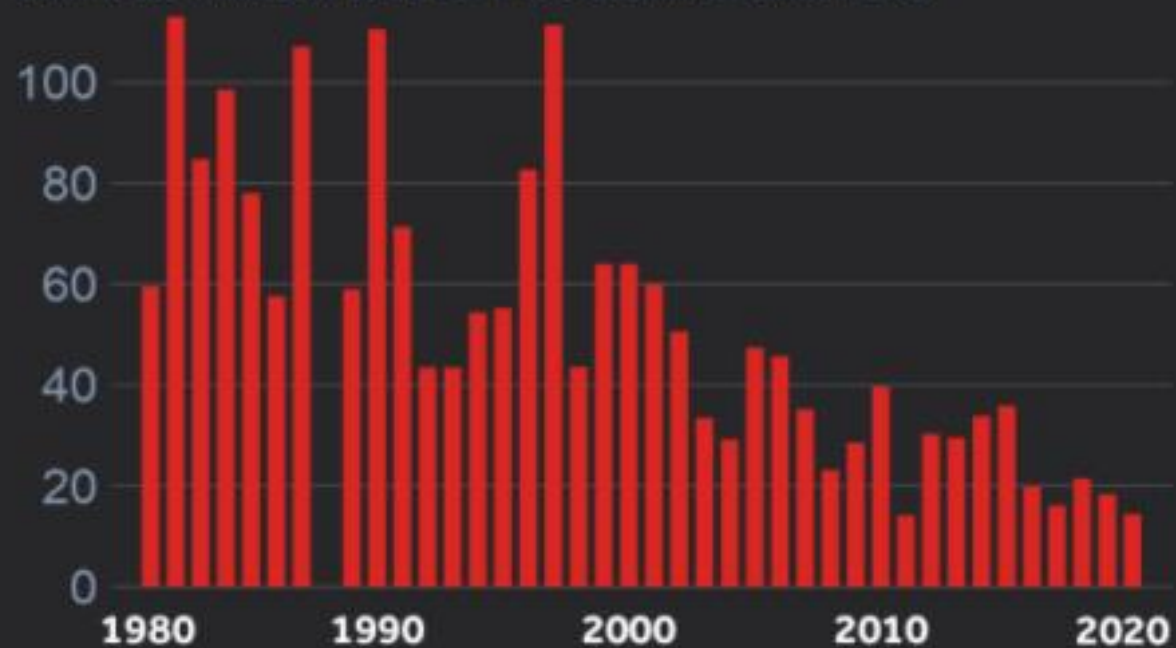
Summary of U.S. Impacts. Based on Table 12.8  
Source: IPCC AR6 WG1

CLIMATE CENTRAL

# Impact of Climate Change

## MORE FREQUENT DISASTERS

DAYS BETWEEN BILLION DOLLAR DISASTERS

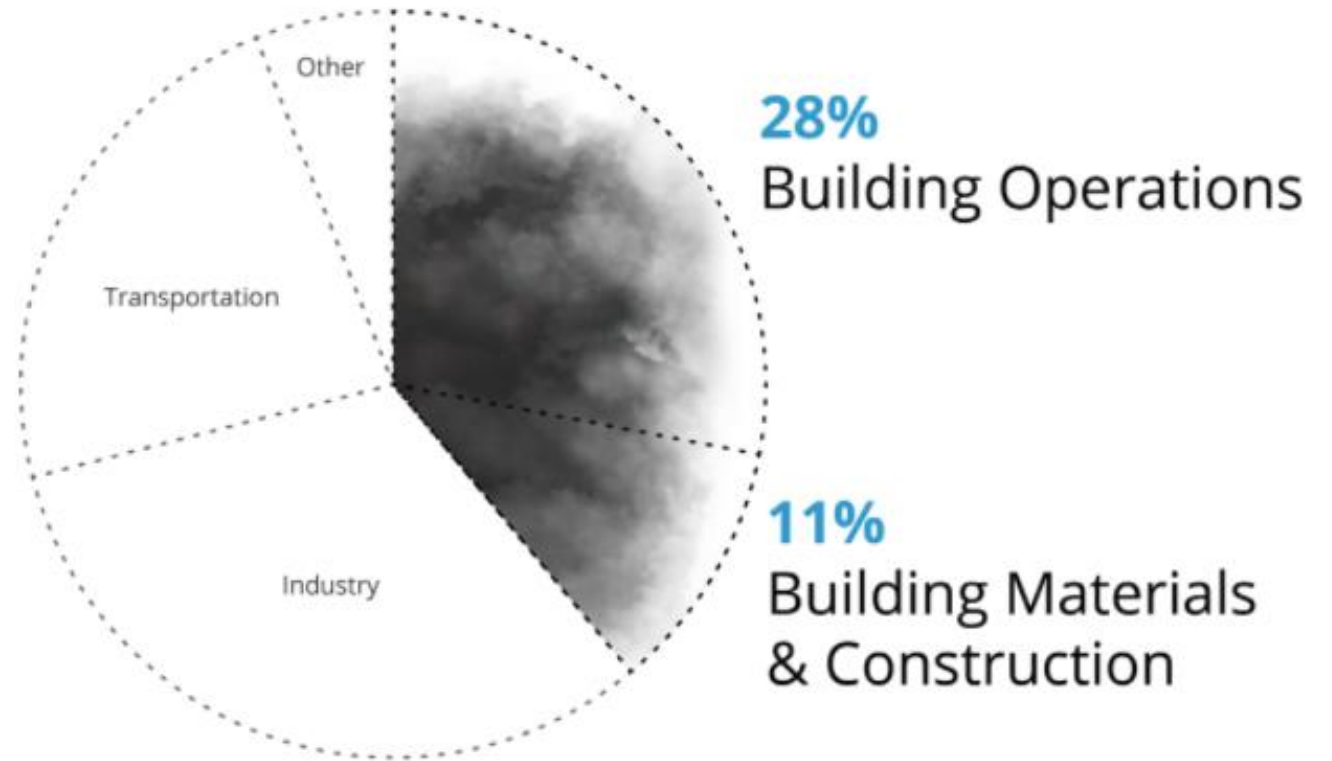


Note: Number of days between billion-dollar disasters in a calendar year.  
No disasters occurred in 1987 and only one in 1988.  
Source: NOAA/NCEI

CLIMATE  CENTRAL

# What role do Cooperatives Play?

Annual Global CO<sub>2</sub> Emissions



# What role to Cooperatives Play?

## IMPACTS OF U.S. BUILDINGS ON RESOURCES

**40%** primary energy use\*

**72%** electricity consumption\*

**39%** CO<sub>2</sub> emissions\*

**13.6%** potable water consumption\*

# FUTURE TEMPERATURES

FUTURE CLIMATE DEPENDS ON CHOICES TODAY



Global surface temperature anomaly relative to 1950-1900  
High warming scenario: SSP3-7, Low warming scenario from SSP1-2.6.  
Source: IPCC AR6 WG1

# How do we fix this - The answer is getting to Net Zero (Carbon Free)

- The term “net zero” means that any greenhouse gas emissions released are balanced by an equal amount being taken out of the atmosphere.
- The Paris Climate Agreement created goals to limit the increase in global temperatures to well below 2.0°C (3.6°F) above pre-industrial levels, and to aim to curb the temperature increase to 1.5°C (2.7°F). To do this, global greenhouse gas emissions need to be cut in half by 2030, and reach “net zero” by mid-century for the 1.5°C degree target.
- Core areas of the U.S. economy—transportation, electricity, industry, agriculture, and commercial and residential buildings—need to undergo major transformation in order to get to net zero.
- Most of the pathways to keeping global temperature increases below 2°C—and every pathway to stopping at 1.5°C—incorporates absorbing carbon emissions from the atmosphere through carbon capture and storage, or sequestration.

# The Path to Net Zero (Carbon Free)

While modeling and projections may incorporate different inputs and show different outcomes, all these projects highlight the same core areas of our economy that need to undergo major transformation in order to get to net zero:

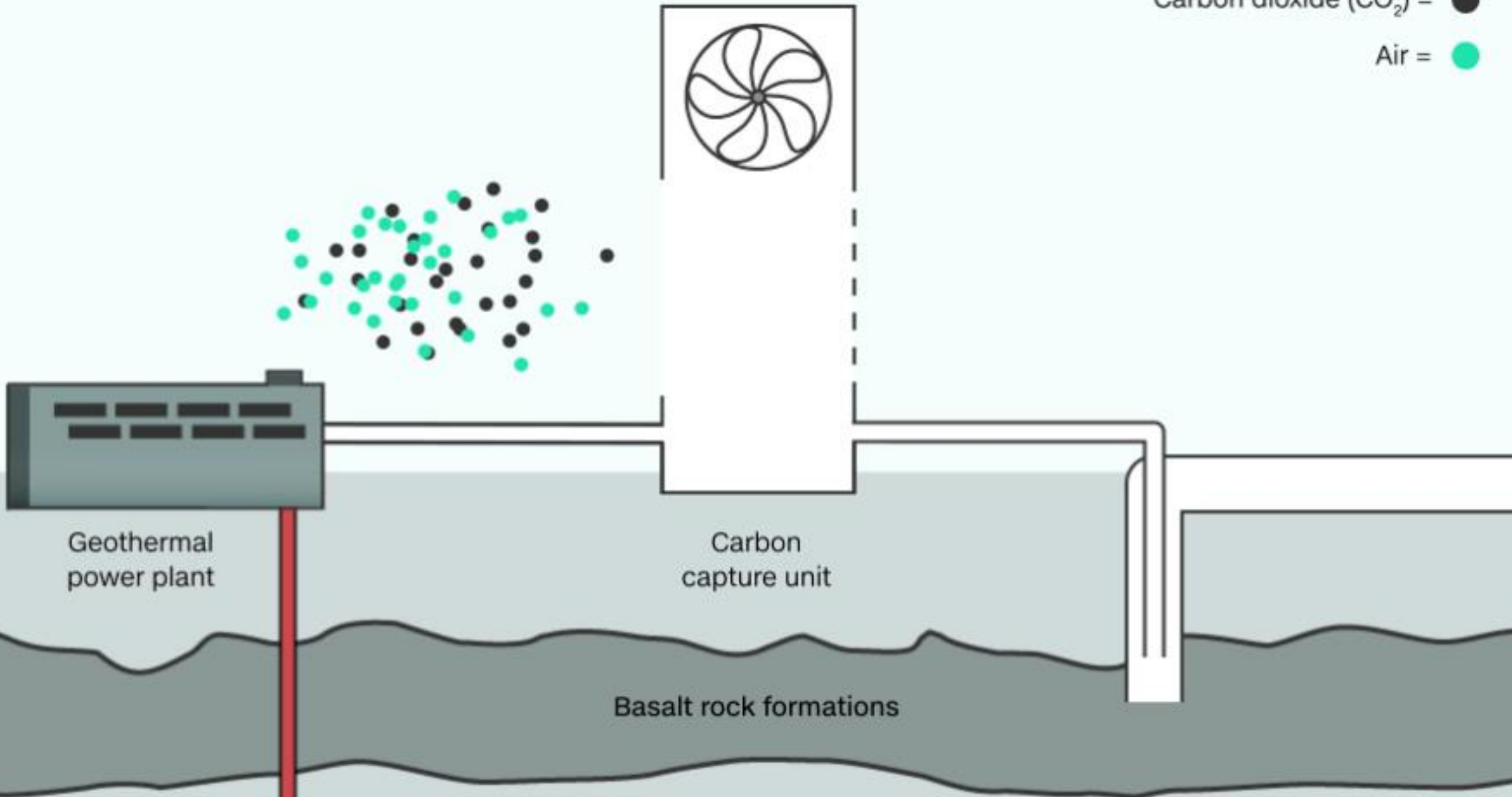
- Creating carbon-free electricity
- Electrifying transportation
- Adopting energy efficiency measures and electrifying our buildings
- Decarbonizing industry and manufacturing
- Transforming our farming and food habits
- In addition, most pathways to Net Zero also include the removal of Carbon Dioxide from the atmosphere at scale, which presents some challenges



climeworks

Carbon dioxide (CO<sub>2</sub>) = ●

Air = ●

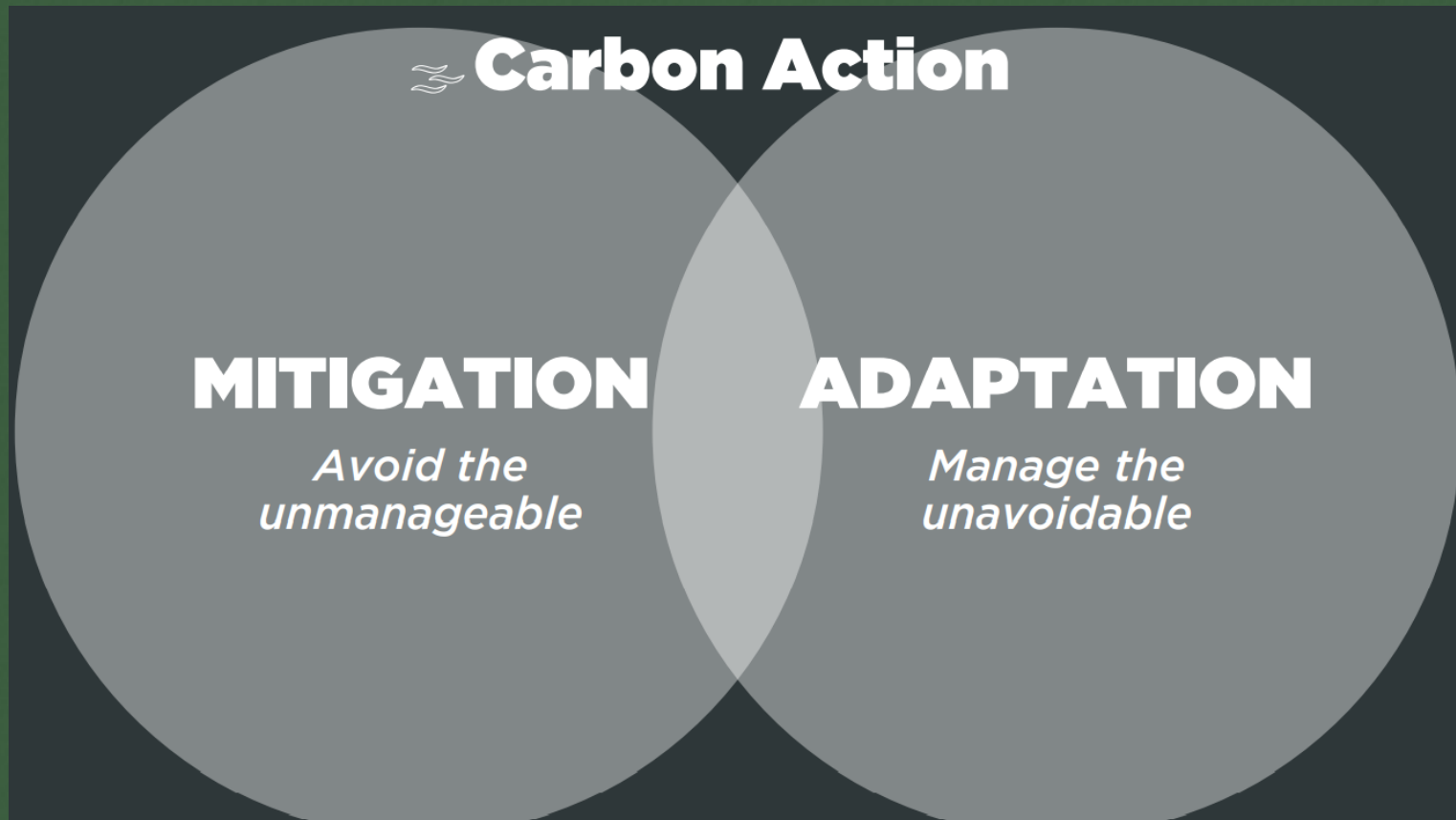


Geothermal power plant

Carbon capture unit

Basalt rock formations

# What can Cooperatives Do?



# Mitigation Measures

Cooperative housing that is undergoing any type of significant rehab should focus on the following related to sustainability:

- Decarbonization
- Electrification
- HVAC
- Domestic Hot Water
- Building Envelope – including insulation, windows, thermal bridges, façade issues
- Energy efficient appliances/Lighting
- Water Use Management

# Adaptation Measures

Measures cooperatives can undertake include:

- Disaster planning
- Fiscal planning related to future environmental concerns
- Risk Evaluation
- Storm Water Management
- Heat island and landscaping evaluation to prevent erosion
- Back up power sources
- Planning for the next pandemic/health crisis

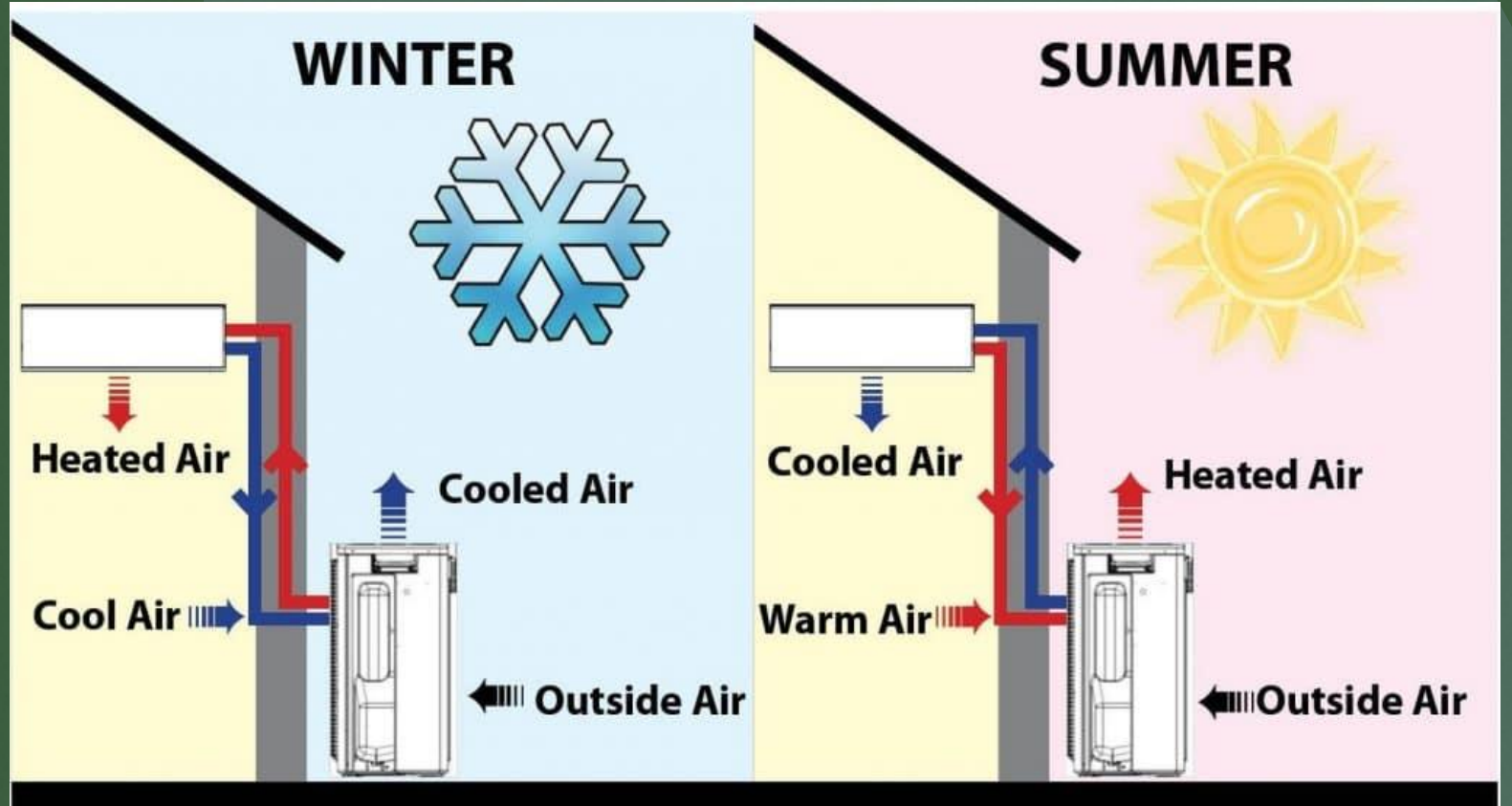
# Tools for Decarbonization – Heat Pumps

Heat pumps offer an energy-efficient alternative to furnaces and air conditioners for all climates. Like your refrigerator, heat pumps use electricity to transfer heat from a cool space to a warm space, making the cool space cooler and the warm space warmer. During the heating season, heat pumps move heat from the cool outdoors into your warm house. During the cooling season, heat pumps move heat from your house into the outdoors. Because they transfer heat rather than generate heat, heat pumps can efficiently provide comfortable temperatures for your home.

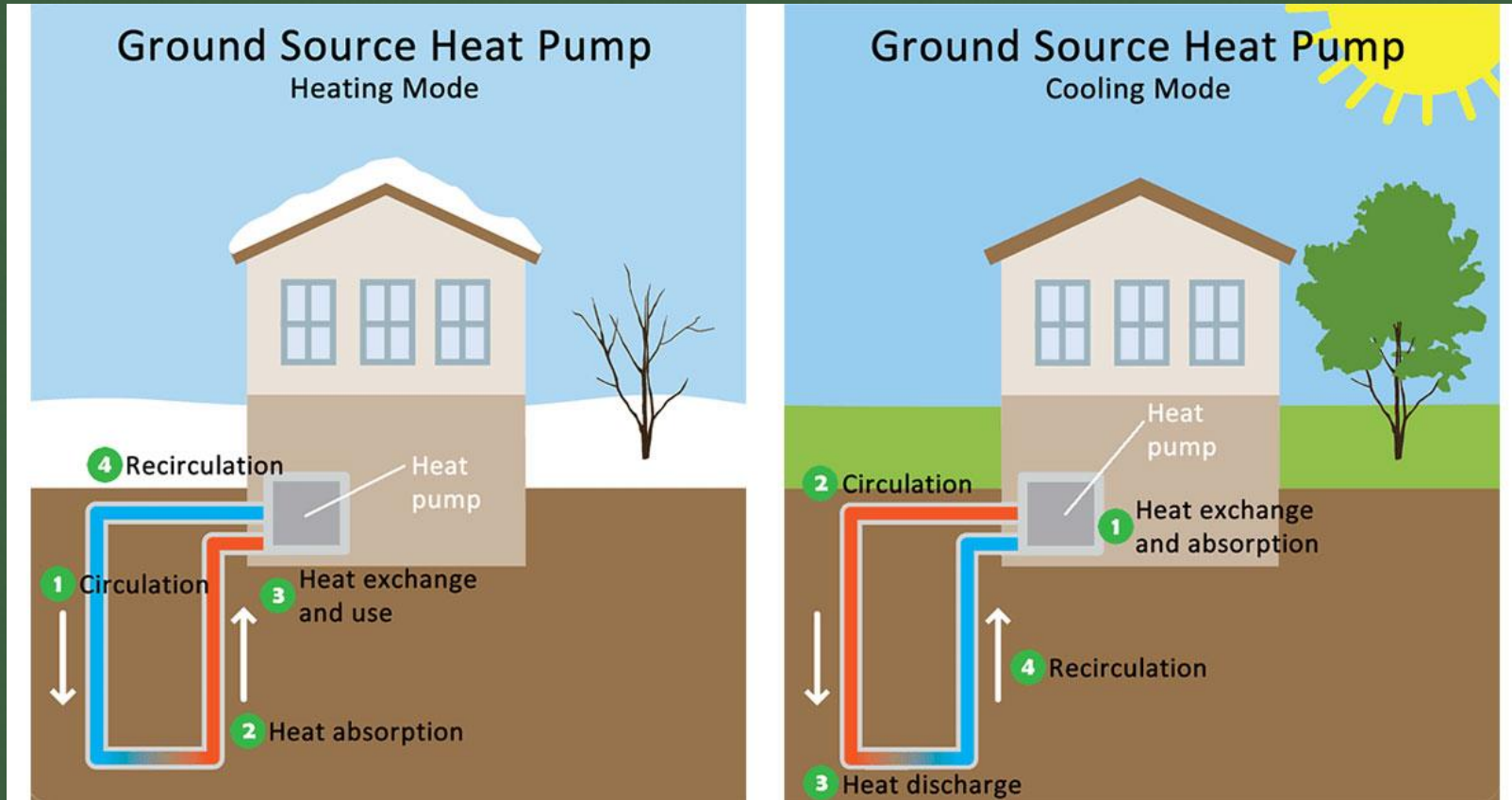
# Heat Pumps



# Air Source Heat Pumps

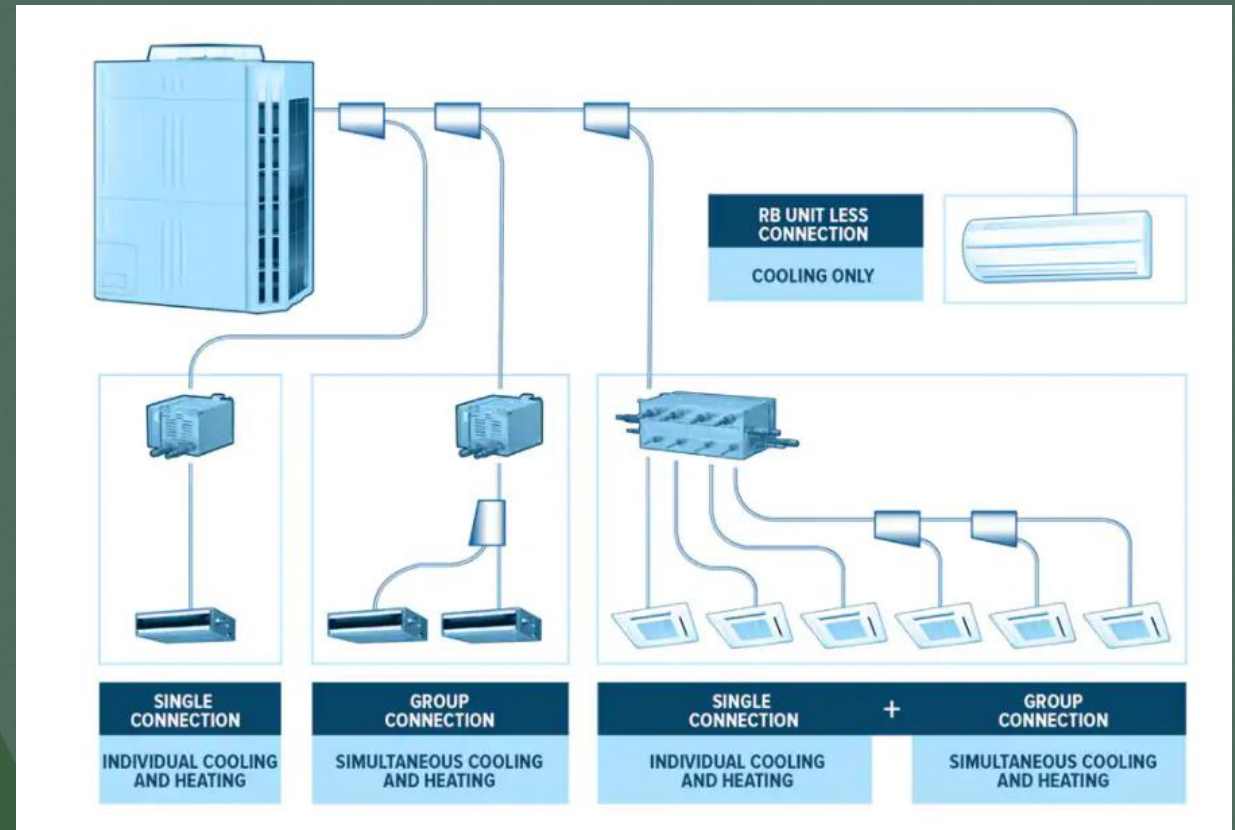


# Geothermal Heat Pump



# VRF Systems

The simplest explanation of VRF is to describe it as a large-scale ductless HVAC system that can perform at a high capacity and is extremely efficient. The specific design of a VRF system varies based on application. In general, VRF technology provides the ability for multiple indoor units or zones to operate on the same system. VRF systems can either be a heat pump system or a heat recovery system, which provides simultaneous heating and cooling.





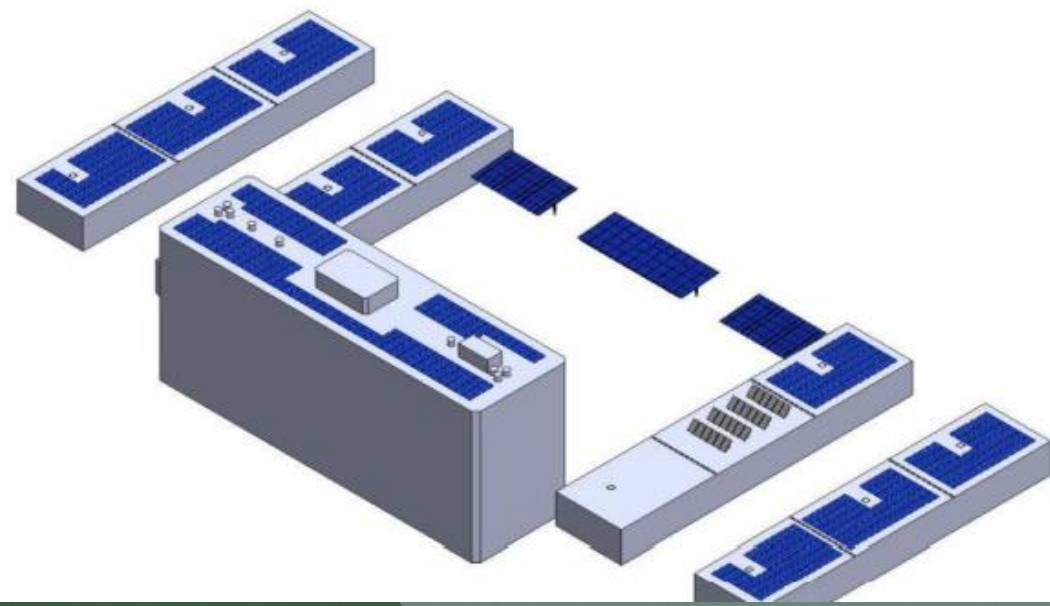
# Solar Power

## Garden Apartments with Pitched Roofs



Solar Power

## Highrises and Townhomes with Flat Roofs



# Solar Power – Carports and Canopies

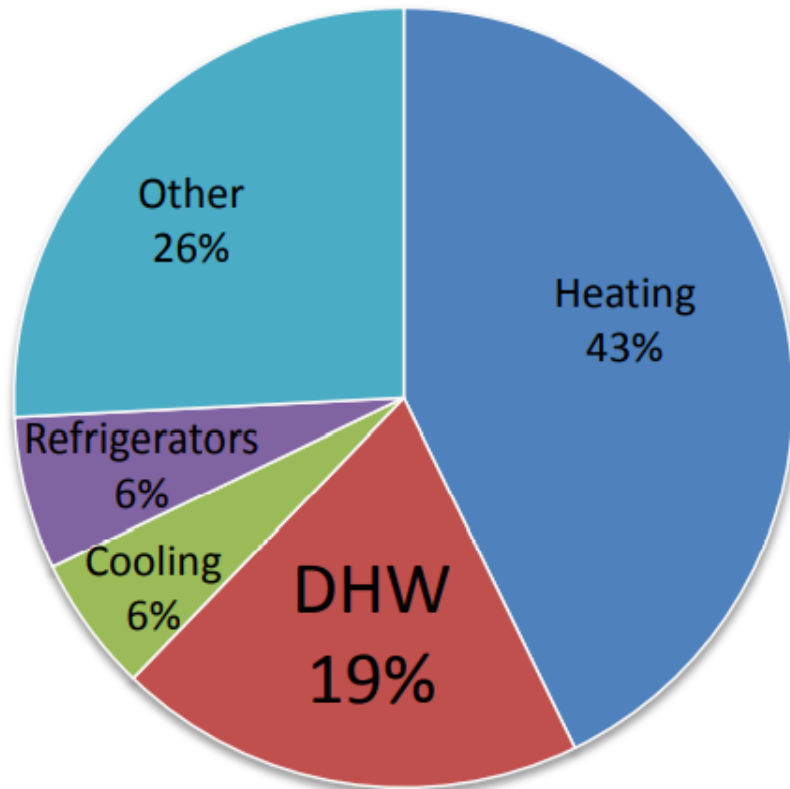


# Community Solar

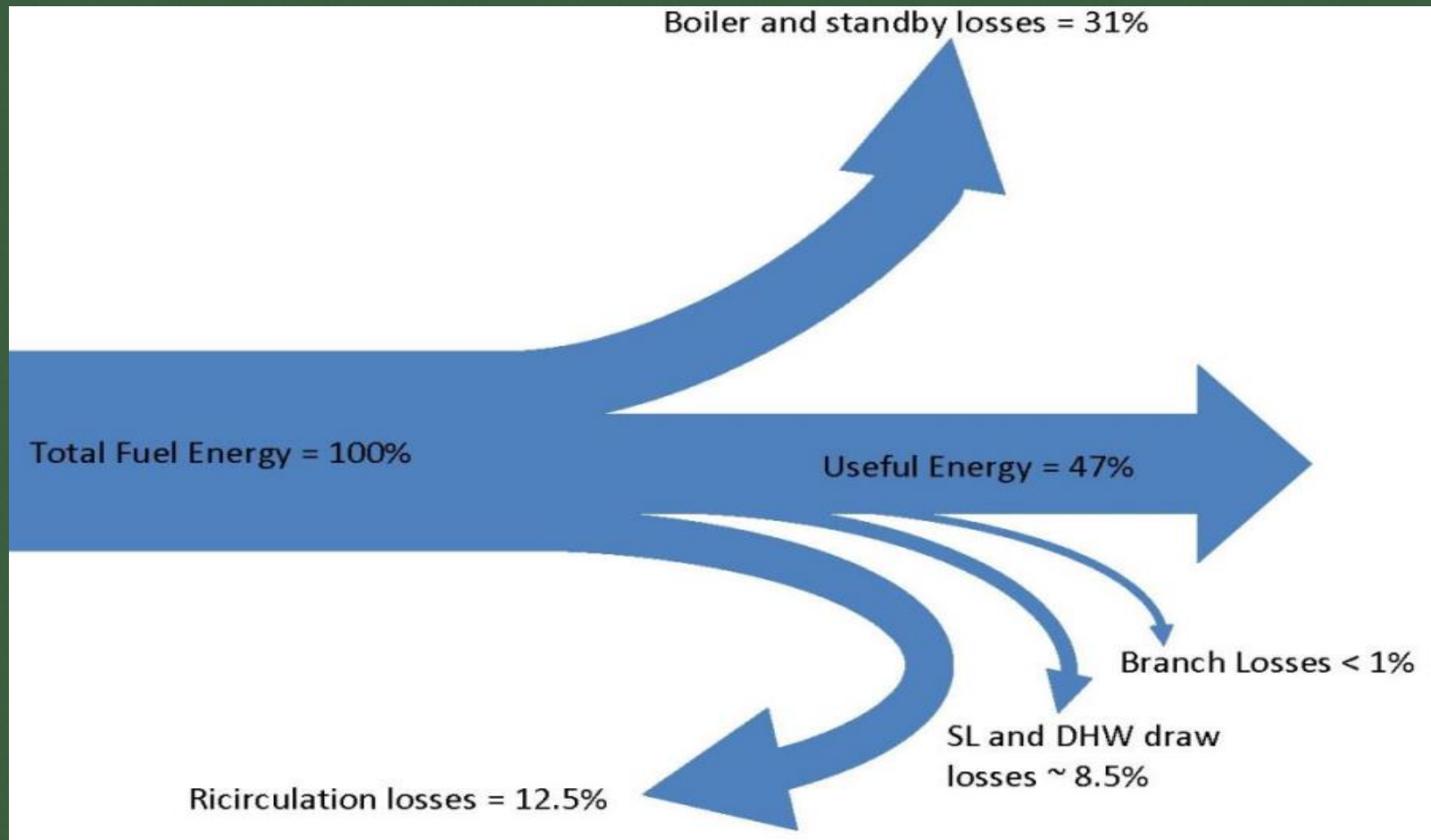


# Domestic Hot Water

**Average Site Energy End Use for Multifamily (5+ Units) Buildings**



# Typical Energy Use – Domestic Hot Water – Central Boiler



# Central Boiler System

- Recirculating domestic hot water (DHW) systems are common in commercial and multifamily buildings
- Recirculation pumps often run 24x7 - increasing energy consumption because the pipes radiate heat continuously, even during periods when there is no demand for hot water.

# Considerations for Central Domestic Hot Water

- Replace with high efficiency electric hot water boilers
- Retrofit circulation pump with automatic control system so boiler and pump run less often.

# Types of Circulation Control

Timer Control - Turns pump on and off according to a time schedule. Off-peak hot water use wastes water

Temperature Control - Automatically turns pump on and off based on temperature (usually 120°F) via a sensor on the return line. Less pump electricity, but keeps the distribution loop hot to maintain 120°F even when there is no demand.

Temperature Modulation Control - Modulates DHW supply temperature according to a daily schedule. Energy savings can be achieved via lower distribution losses, but pump runs continuously.

Demand + Temperature Modulation Control - Uses two pieces of information; Real-time user demand (detects flow) and Return water temperature (pump cuts in below 100°F). The pump only runs if both conditions above are satisfied or the pump has not run for five hours

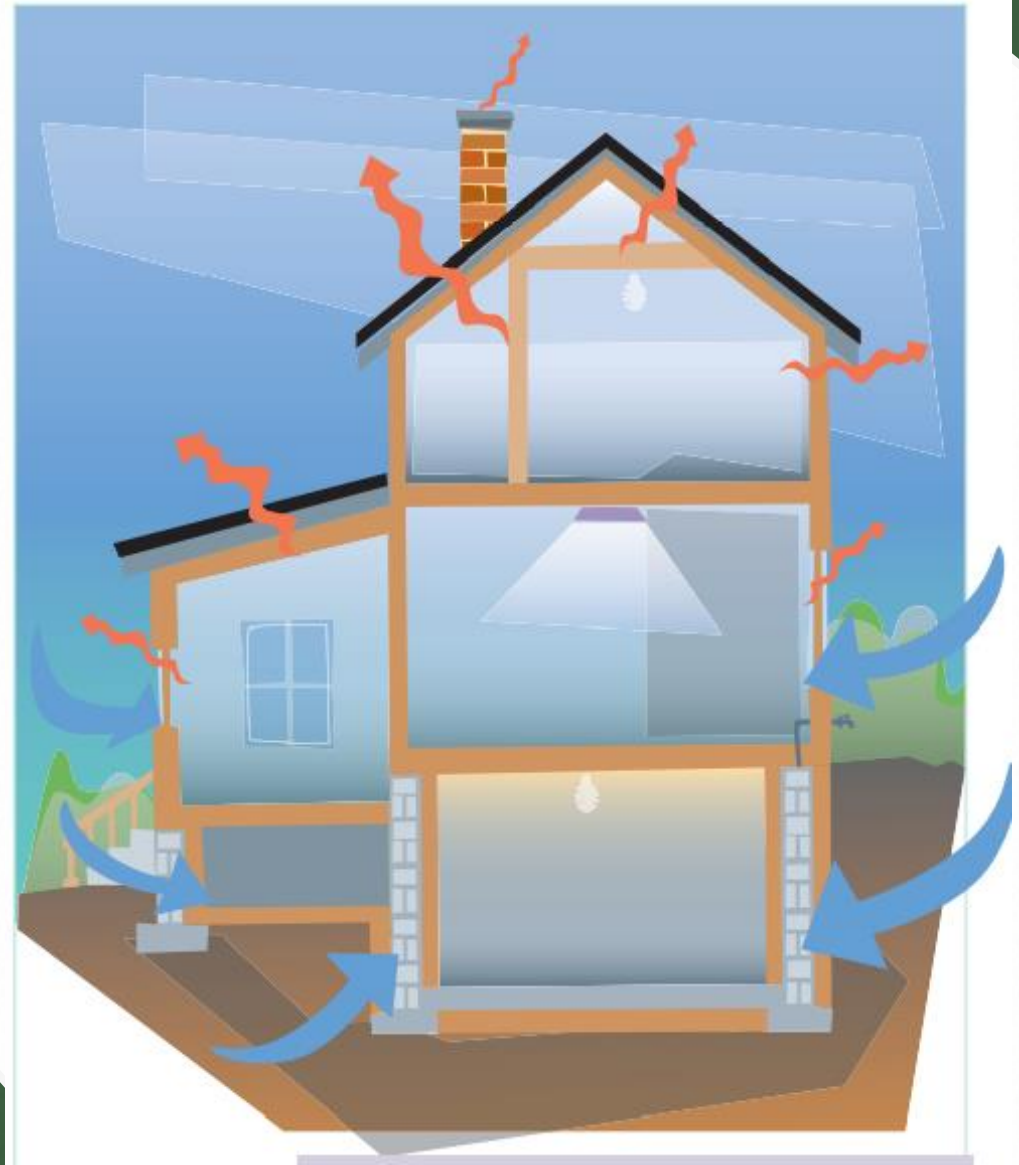
# Individual Unit Hot Water Heater

- Hot water on demand – no running out of hot water during multiple showers.
- Take up less space in a utility closet allowing for more storage space.
- Lower risk of leaking
- Safer
- Longer lifespan compared to tank reservoir
- Enables water heating to be off-set with renewable energy systems
- Tank less water heaters to be powered by electricity. These types of water heaters were found to be 22 percent more energy efficient on average than the gas-fired storage tank models

# Tankless Hot Water



# Building Envelope



# Building Envelope is composed of:

Walls,  
cladding

Roofs

Windows

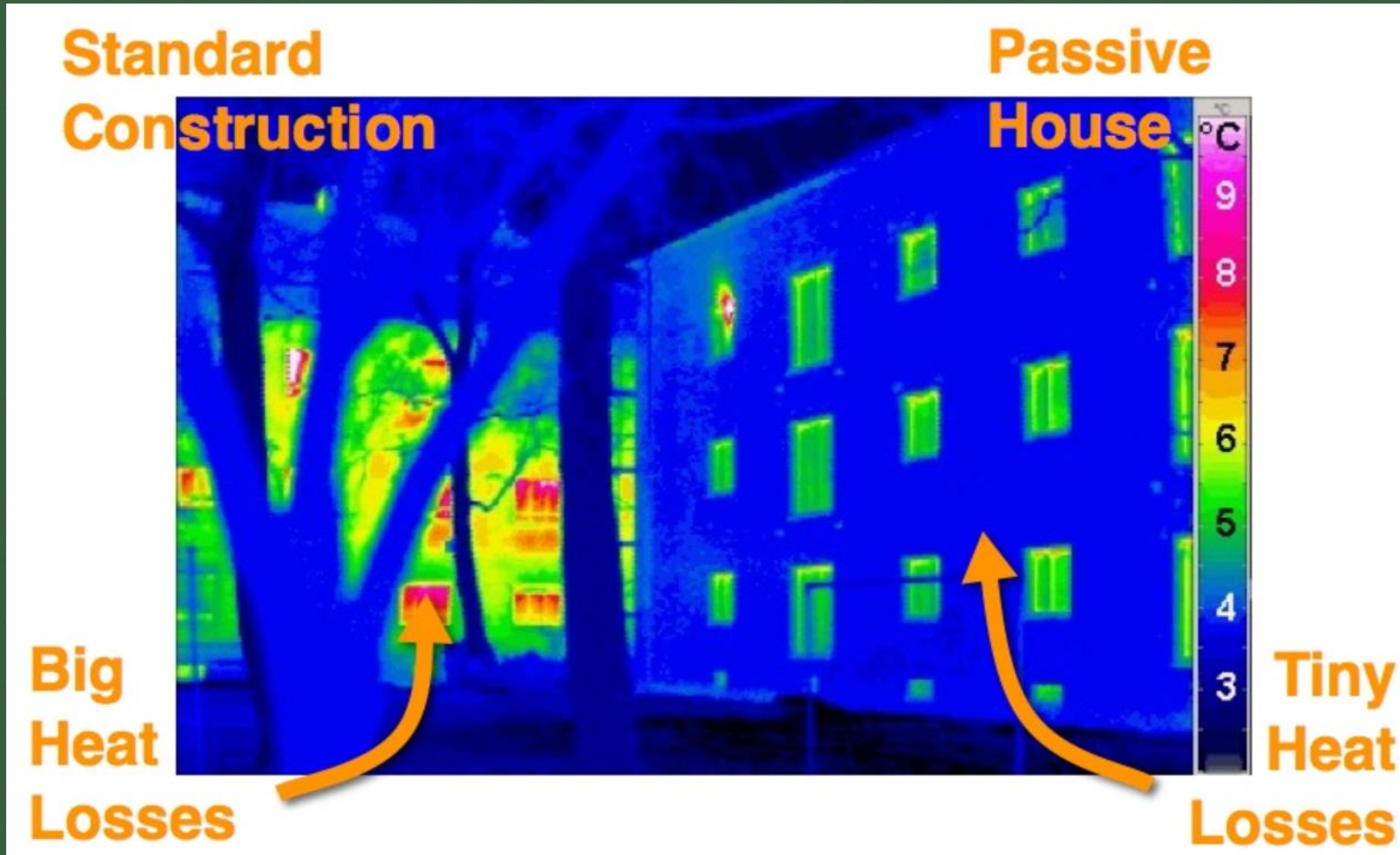
Doors

Skylights

Other  
openings

Insulation

# Before and After Renovation






# Lighting

Energy efficient lighting is necessary to:

- To reduce electricity consumption, thereby reduces the electricity bills
- To save electricity rather than wasting in terms of losses
- To lower greenhouse emissions because conventional lamps cause CO<sub>2</sub> emissions
- To achieve peak load reduction

# Energy Efficient Lighting

## Comparison Chart LED Lights vs. Incandescent Light Bulbs vs. CFLs

Energy Efficiency & Energy Costs	 Light Emitting Diodes (LEDs)	 Incandescent Light Bulbs	 Compact Fluorescents (CFLs)
Life Span (average)	50,000 hours	1,200 hours	8,000 hours
Watts of electricity used (equivalent to 60 watt bulb).  LEDs use less power (watts) per unit of light generated (lumens). LEDs help reduce greenhouse gas emissions from power plants and lower electric bills	6 - 8 watts	60 watts	13-15 watts
Kilo-watts of Electricity used (30 Incandescent Bulbs per year equivalent)	329 KWh/yr.	3285 KWh/yr.	767 KWh/yr.
Annual Operating Cost (30 Incandescent Bulbs per year equivalent)	\$32.85/year	\$328.59/year	\$76.65/year

# Lighting Changes to make

1

Switch to LED lighting in common areas, encourage members to use LED lighting (Many states have grant programs for switching to LED lighting)

2

Switch Outdoor Lighting to HID lamps (High Intensity Discharge). HID lights can save between 75% and 90% on lighting costs

3

Use Dimmers on Hallways and Stairwells

4

Use occupancy sensors in common areas

# Stove Replacement

Gas stoves contribute to the release of greenhouse gases and can be dangerous. They also release harmful gasses, creating poor interior air quality.

- Replace with high efficiency electric stoves
- To save even, consider adopting induction stove technology

# Induction Stove

Induction stoves, like microwaves, seemingly work by magic. The technology creates a magnetic field that directly heats iron in pans. The heat comes from within the pan itself rather than heating the space under the pan like a traditional stove

- Efficiency – Energy transfer is around 84% with Induction, traditional electric and gas are 74% or lower.
- Speed and control – Induction matches and exceeds gas in control and speed of change. It also out-performs gas on low settings
- Safety – Since the pan heats instead of the surface directly, it is not as hot as electric or gas. It also turns off within 10 seconds if a pan is not detected.

# Other Issues

- Carbon Trading and Carbon Caps
- Thermal Storage
- EV Charging Stations
- Electric – Real Time/Time of Use
- Venting and Conveyance

# Carbon Trade and Carbon Caps

- Carbon trade is the **buying and selling of credits that permit a company or other entity to emit a certain amount of carbon dioxide**. The carbon credits and the carbon trade are authorized by governments with the goal of gradually reducing overall carbon emissions and mitigating its contribution to climate change.
- Carbon Cap is a government limit on an industry or economy on the amount of carbon that industry or economy can release into the atmosphere.

# Thermal Storage

- Thermal energy storage (AKA heat storage) covers all the different ways of storing energy, so it can be used for heating or hot water when it's needed.
- Usage examples are the balancing of energy demand between daytime and nighttime, storing summer heat for winter heating, or winter cold for summer air conditioning (Seasonal thermal energy storage).
- Storage media include water or ice-slush tanks, masses of native earth or bedrock accessed with heat exchangers by means of boreholes, deep aquifers contained between impermeable strata; shallow, lined pits filled with gravel and water and insulated at the top
- Storage media also include Heat Batteries which can be hung on the wall.

# EV Charging Stations

Most car manufacturers will be going full electric in line-up by 2035

Domestic automakers are making the commitment to full electric by 2030

Having EV charging will be a great marketing tool

EV are becoming price competitive and have lower maintenance expense than gas powered cars

# Time of Use vs Real Time

There are Time of Use plans for electricity (TOU plans) vs Real Time plans.

You can subscribe to a TOU plan for energy use that will charge you less money for using electricity for off-peak hours

One example of TOU plans is that utility companies will charge you less to charge your electric car between midnight and 7 AM then during the day.

Check with your utility provider to see if they offer TOU plans