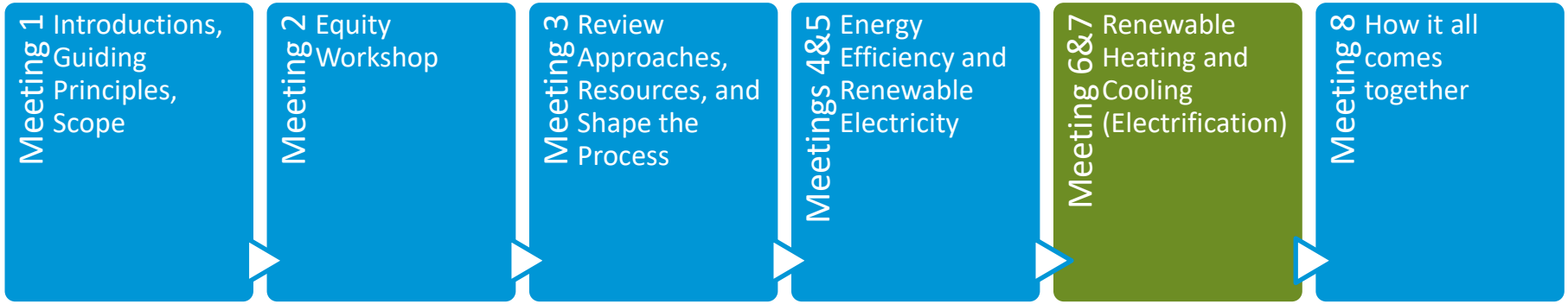




# Energize Denver Task Force

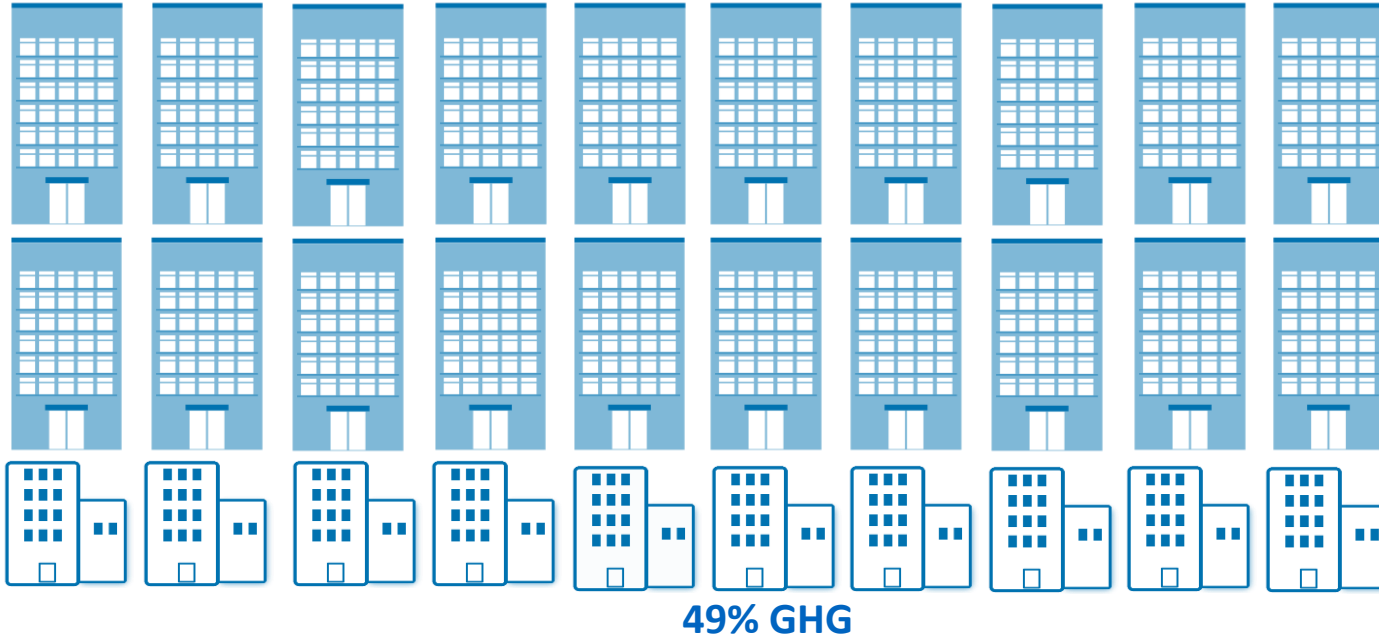
Prep-briefing for Meeting 6, 6-8-2021

# Task Force Draft Schedule



Workgroups:  
Equity Workgroup  
Workforce Workgroup  
Climate Solutions Workgroup

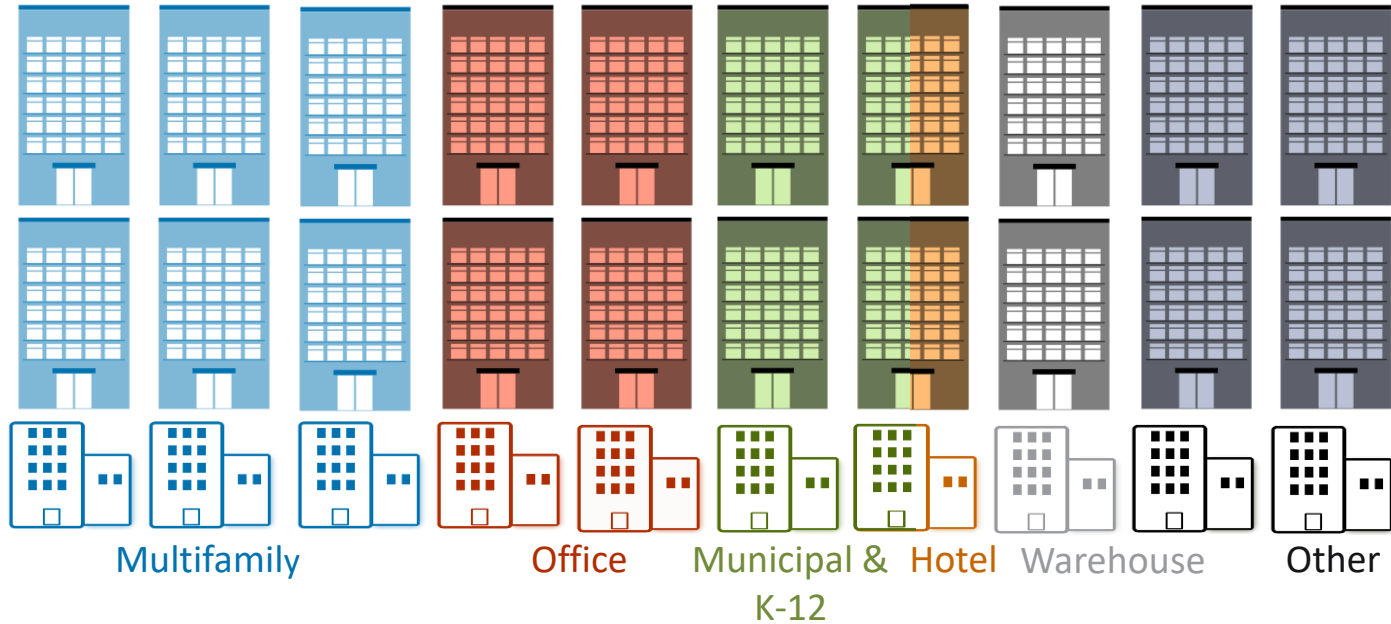
# Commercial and Multifamily Buildings Account for 49% of Denver's GHG Emissions



- >25,000 sq ft:
- 82% of square footage
  - **3,000** buildings

- <25,000 sq ft:
- 18% of square footage
  - **14,000** buildings

# Building Types and Sizes



# Net Zero Energy

Highly Energy  
Efficient

Renewable  
Energy

Demand  
Flexible

All-Electric

# Supports Needed

## City needs:

- Resources
- Staff



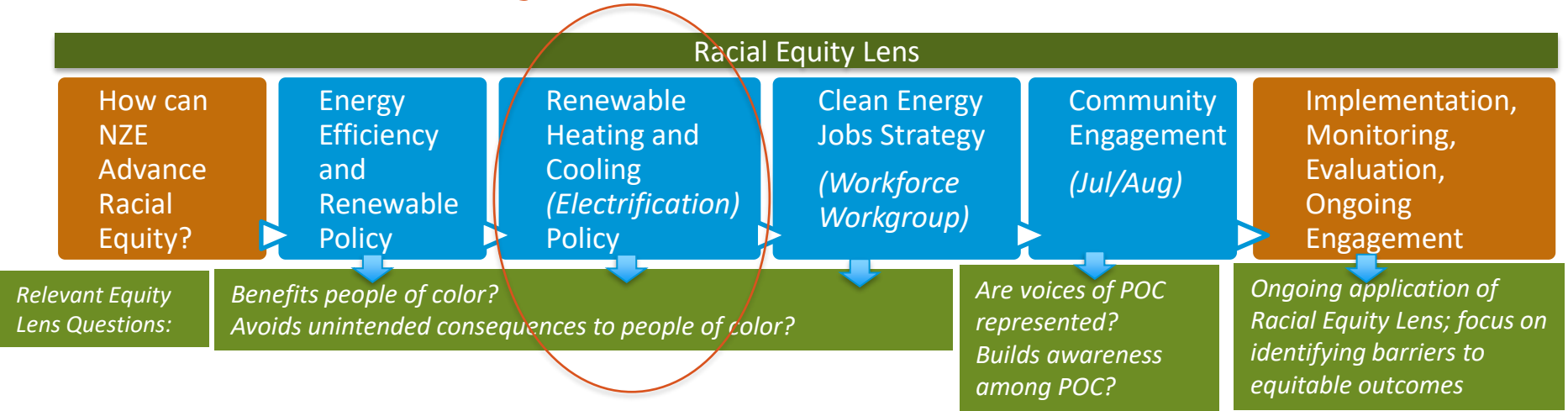
## Community needs:

- Workforce Training
- Outreach and Education
- Financing
- Advocacy
- Education
- Programs

# Racial Equity

Roadmap, Supports, Incentives, & Index

# Racial Equity Roadmap



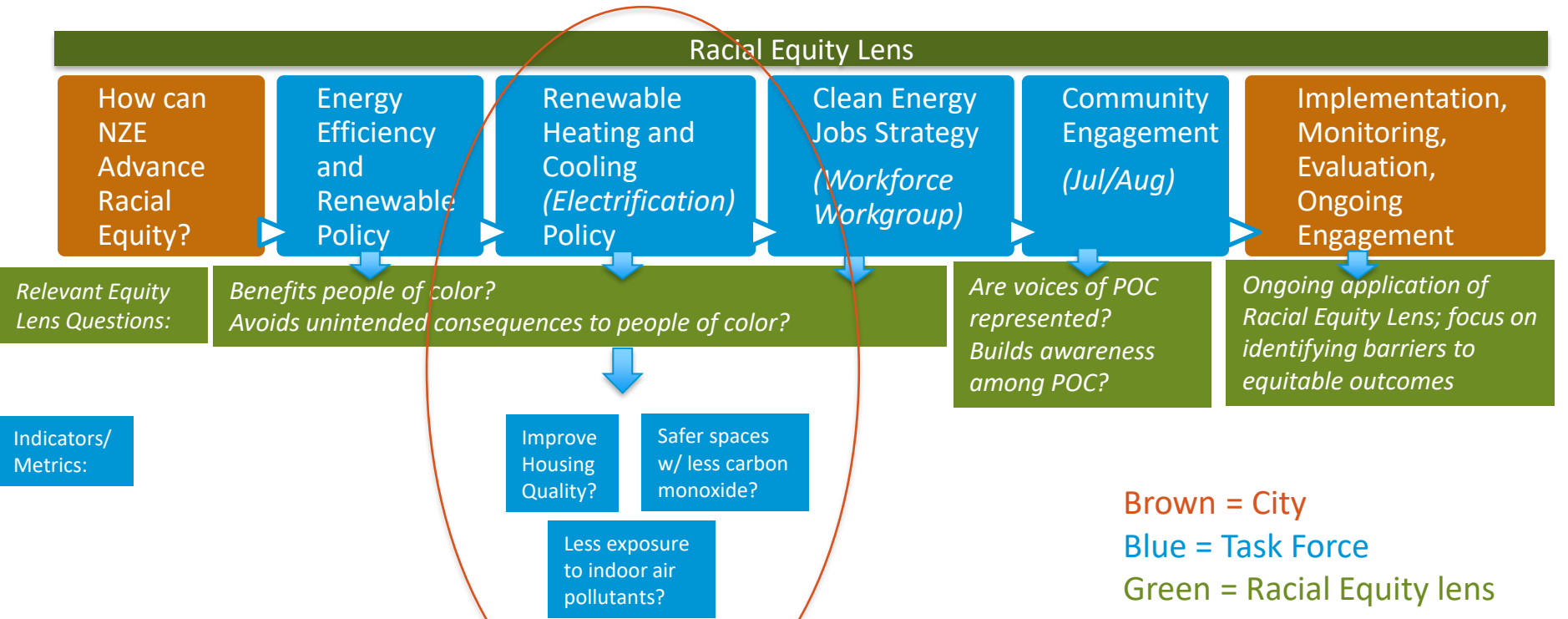
Brown = City

Blue = Task Force

Green = Racial Equity lens



# Racial Equity Roadmap



# Improved Building and Housing Quality

- Improved building and housing **quality**
- Improved **ventilation**
- Improved **thermal comfort**

# Improving Safety

Equipment in Denver fails carbon monoxide tests in:

- 30% of Denver's income-qualified homes
- Compared to 5% of market rate homes

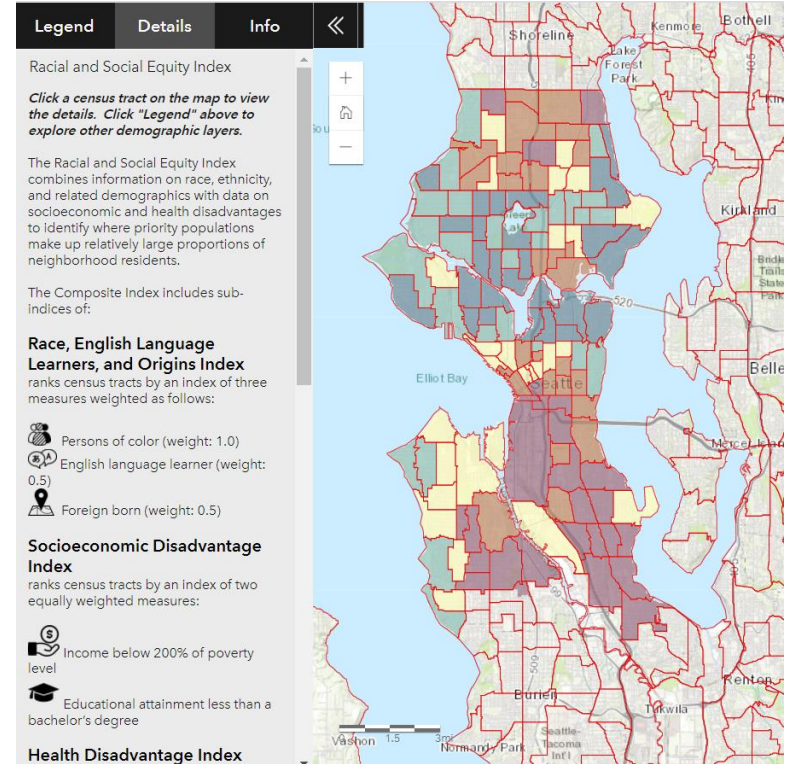
# Decreasing Indoor Air Pollutants

Lowering exposure to indoor air pollutants:

- Residents of homes with gas appliances have **nearly 3x the rate of asthma**
- Compared to homes with electric appliances

# Racial Equity Index

- Use weighted social equity indicators to develop an index score that can be used to identify under resourced buildings at the census tract level
- Example: Seattle's Racial and Social Equity Index
- Greenlink Equity Map (GEM)
  - Indicators
  - Weighting



<https://seattlecitygis.maps.arcgis.com/apps/Minimalist/index.html?appid=764b5d8988574644b61e644e9fbe30d1>

# GEM Indicators

## Demographics

- Racial Composition

## Health

- Asthma
- Health Insurance Stress

## Housing

- Eviction Rates
- Households with High Living Costs
- Household Living Cost Burden
- Renter or Owner
- Housing Type (single or multi)

## Technology

- Lack of Internet Access

## Income

- Income Stress

## Utility Burden

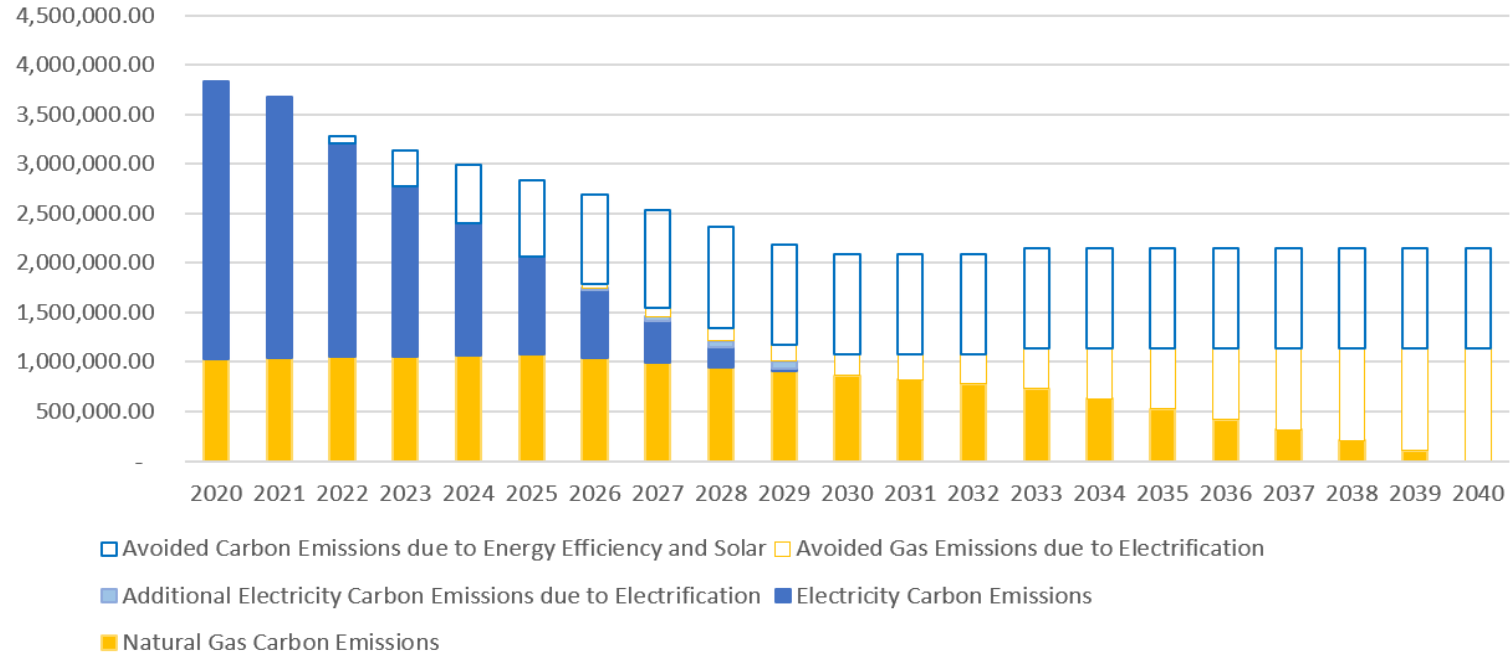
- Neighborhood Average
- Electricity, Gas, & Water Burden
- Households with Above Average, High, or Severe Energy Burden

# Renewable Heating and Cooling (Electrification)

*Energize Denver Renewable Heating and Cooling Plan:  
Existing Building and Home Electrification*

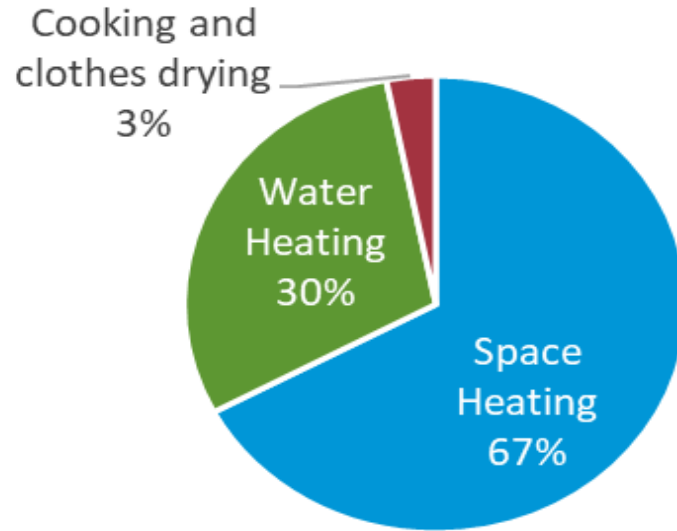
*June 2021*

# Goal of the Task Force





# Gas Use in Buildings



# High Impact Climate Benefits

- Methane, the primary component of natural gas, is released when we use gas and causes 80 times the amount of climate change as standard carbon dioxide emissions.
- As the grid moves to 100% renewable power, electric renewable heating and cooling is the clear path to reducing these emissions generated by homes and buildings.

## Zero Emission Electricity is Coming



# Heat Pumps

- Heat pumps move heat instead of creating it achieving 200-300% efficiency
- 100% efficiency is based on a source that creates heat



# Improved Equity and Safety

- In 30% of low-income homes in Denver today, gas equipment fails carbon monoxide tests, compared to less than 5% of market rate homes.



# Lower Exposure to Indoor Air Pollutants

- Residents of homes with gas appliances have nearly three times the rate of asthma compared to homes with electric appliances.



# Better Outcomes, Same Cost

- When a furnace, A/C compressor, or hot water heater fails, most homes and buildings can replace it with an electric equivalent with a similar cost for both installation and operation, as they would pay with a new gas system.



# Increases Grid Utilization

- Denver's electric system is already built to withstand high air conditioning load during the summer, therefore winter heating needs can shift to renewable electricity without significant infrastructure build-out.



# Proven, Reliable Technology

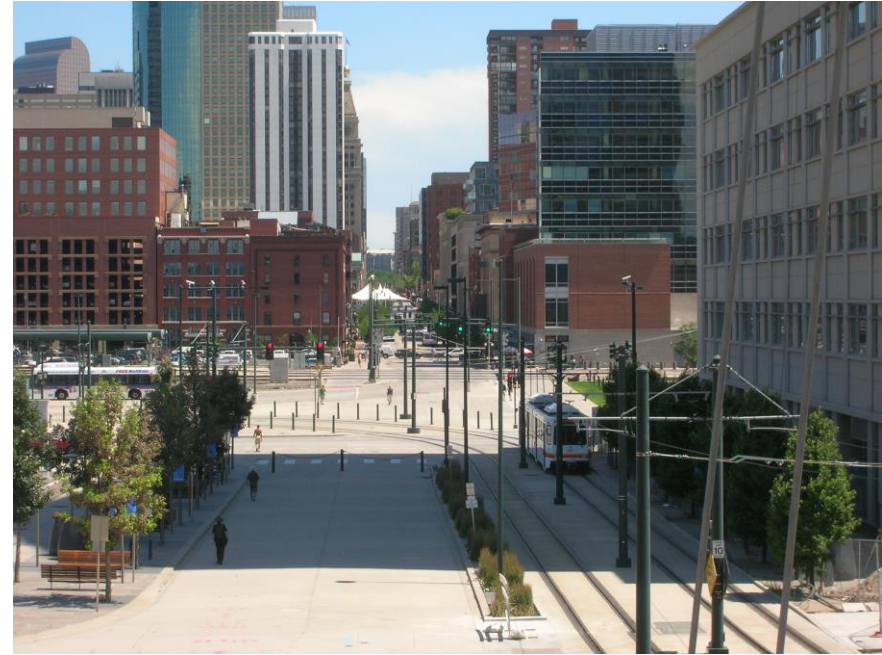
- Heat pumps have been in use since the 1800s in American refrigerators.
- And, for decades to heat homes and buildings Asia and Europe.





# Denver has an opportunity to lead

- Cities and businesses around the world are rapidly adapting to the new energy landscape.
- A delay in action could weaken Denver's economic position and add tremendous costs if we try and "catch up" later to our total conversion goals.



# Non-fossil gas alternatives

Biogas - limited supply (5-10%)

Hydrogen – can be blended with gas up to 7% of pipeline mix (requires excess renewables)

Synthetic gas – to meet EDTF climate goals would be 4x cost of fossil gas

## End to end efficiency

	Syn-gas	Heat pump
Generation	64%	100%
	↓	↓
Distribution	98%	95%
	↓	↓
End use	90%	250%
	=	=
Total efficiency	56%	235%



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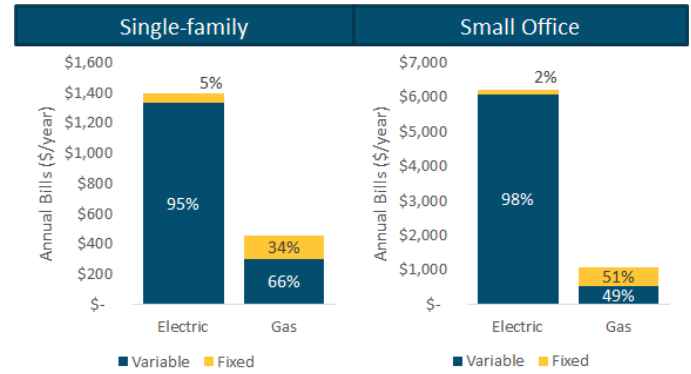
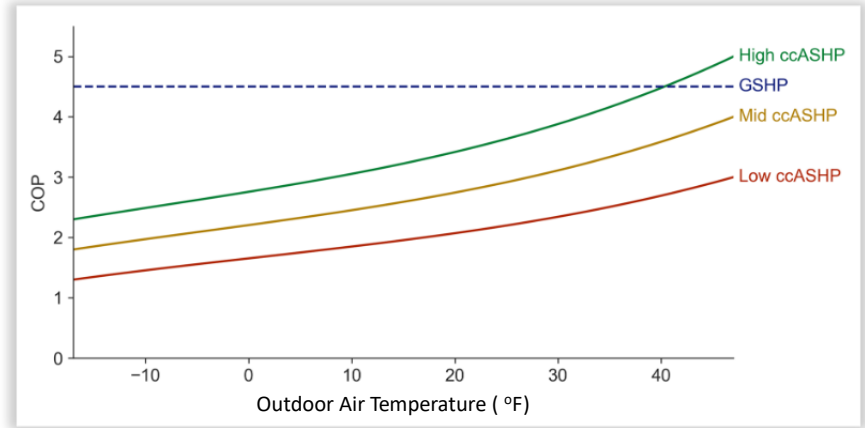
# Electrification Typologies

# Key considerations

Heat pump efficiency increases with outdoor temperature

Either natural gas or electric resistance can kick in to support heat pump

Avoiding electric resistance saves on both capital and operating costs

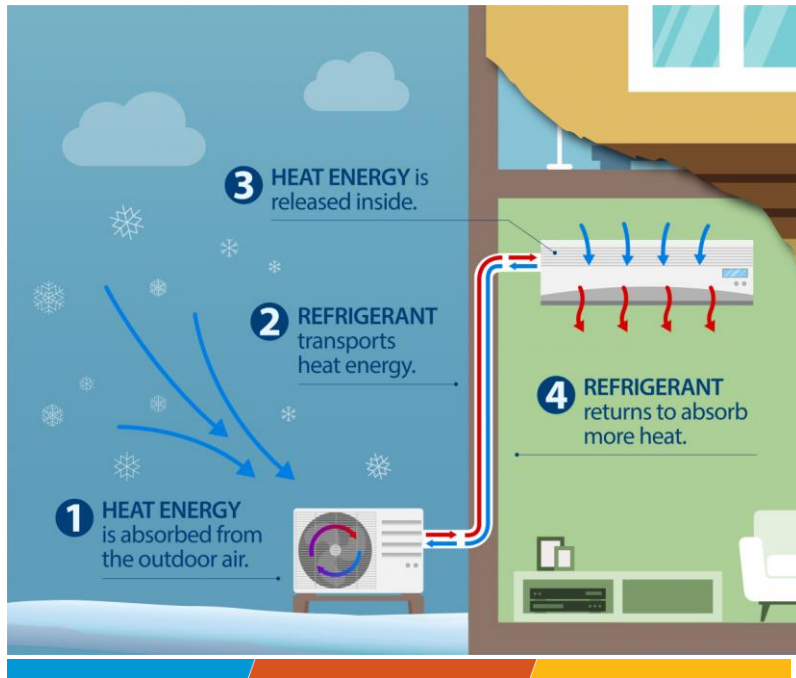


# Space Heating

# Space Heating Typologies

70% of Commercial and Multifamily buildings have one of these typologies:

- Typology 1: Furnace (18% commercial)
- Typology 2: Rooftop Unit (37% commercial)
- Typology 3: Packaged terminal air conditioning unit (3%)
- Typology 4: Boiler (12%)



## Space Heating Typology 1: Furnace

14% Commercial, 48% of Denver's multifamily square footage

Small commercial spaces or multifamily buildings can utilize either a **ducted** or **ductless** heat pump in place of a furnace, and benefit from either **full** electrification or **partial** electrification packages

# Space Heating Typology 1: Furnace

	Partial Electrification		Full Electrification	
	Ducted (<20F gas backup)	Mini-split (<15F gas backup)	Ducted	Mini-split
Installation Cost relative to like-for-like	5%-18%	0-8.5%	35%-60%	15-30%
Energy Bills	0%	-4.5%	5%	5%
Gas reduction	70%	82%	100%	100%
EUI reduction	24%		30%	





Space Heating Typology 2: RTUs  
37% Commercial square footage

Medium sized commercial spaces can swap out their Rooftop units (RTUs) for either fully electrified heat pump models or heat pump based models that contain a gas furnace that can serve heating below 15 degrees F

# Space Heating Typology 2: RTUs

	Partial Electrification	Full Electrification
Installation Cost relative to like-for-like	0-12%	50-72%
Energy Bills	0%	-5%
Gas reduction	81% @ 15F	100%
EUI reduction	24%	30%



Common in hotels, and multifamily buildings, PTACs (packaged terminal air conditioners) provide both heating and cooling at the terminal unit. PTHP (packaged terminal heat pumps) can serve both heating and cooling needs more efficiently

**Space Heating Typology 3: PTACs**  
3% Commercial, 21% of Denver's multifamily square footage

# Space Heating Typology 3: PTACs

	Partial Electrification	Full Electrification
Installation Cost relative to like-for-like	78%	98%
Energy Bills	-10%	12%
Gas reduction	58% @ 15F	100%
EUI reduction	21%	24%

Large commercial buildings utilize a centralized heating and cooling system with a dedicated chiller and boiler. Existing gas boilers can be replaced with electric boilers,



**Space Heating Typology 4: Boilers**  
12% of Denver's commercial square  
footage

# Space Heating Typology 4: Boilers

	Full Electrification
Installation Cost relative to like-for-like	66%
Energy Bills	19%
Gas reduction	100%
EUI reduction	24%

# Water Heating

# Water Heating Typologies

- Typology 1: Individual system with tank. (96% of single family and multi-family residences)
- Typology 2: Central system with tank. (84% of commercial space)
- Typology 3: Gas point of use system. (39% of commercial space)





Small commercial spaces or some multifamily buildings can benefit from a heat pump water heater to replace their existing gas water heater

### Water Heating Typology 1: Individual System with Tank

14% Commercial, 48% of Denver's multifamily square footage

# Water Heating Typology 1: Individual System with Tank

	Full Electrification
Installation Cost relative to like-for-like	0-48%
Energy Bills	1%
Gas reduction	100%



A large central system can be electrified using a central tanked HPWH with additional electric resistance heating elements to satisfy periods of increased hot water demand

## Water Heating Typology 2: Central System with Tank

84% Commercial, 96% of Denver's multifamily square footage

# Water Heating Typology 2: Central System with Tank

	Full Electrification
Installation Cost relative to like-for-like	7-20%
Energy Bills	4%
Gas reduction	100%



Some buildings do not pipe domestic hot water through the building like other building typologies, and instead rely on point-of-use tankless water heating.

**Water Heating Typology 3: Point of Use**  
39% of Denver's Commercial square  
footage

# Water Heating Typology 3: Point of Use

	Full Electrification
Installation Cost relative to like-for-like	30-45%
Energy Bills	5%
Gas reduction	100%

# Electrification Considerations

- Permit for equipment replacement
- Fully electric – both primary & backup heat provided by electricity
- Partial electric – primary heating provided by electricity with possible gas backup (for very cold days)

# Denver Policy Option

Renewable Heating, Cooling, & Water Heating (Electrification)



# Option 1: Full Electrification

*Very Ambitious Policy*

Full Electrification (significant incentives needed)

2023, Mandatory electrification at 2040

Building Heating Typology: 1, 2, 3, & 4

- Gas Furnace or Split AC with Gas Furnace
- RTU with AC and Gas Heat
- PTAC with Gas Heat
- Boiler

Water Heating Typology: 1, 2, & 3

- Individual System w/ Tank
- Central System w/ Tank
- Gas Point of Use System

# Option 2: Partial Electrification with Capital Cost Parity

*More Ambitious Policy*

Capital cost parity (incentives needed)

Operating cost increase of 1-5% for water heating (with upfront incentive to cover this)

2023, End of life replacements

Building Heating Typology: 1, 2, & 3

- Gas Furnace or Split AC with Gas Furnace
- RTU with AC and Gas Heat
- PTAC with Gas Heat

Water Heating Typology: 1, 2, & 3

- Individual System w/ Tank
- Central System w/ Tank
- Gas Point of Use System

# Option 3: Partial Electrification with Capital & Operational Cost Parity

*Least Ambitious Policy*

Capital & operational cost parity

2023 end of life replacements

Building Heating Typology: 1 & 2

- Gas Furnace or Split AC with Gas Furnace
- RTU with AC and Gas Heat

Water Heating Typology: None

# Considerations for the Task Force

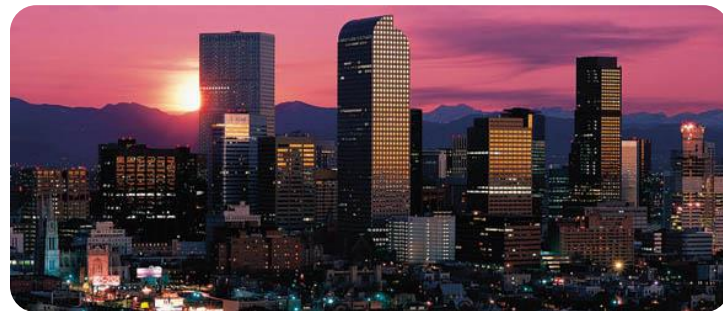
- What **supports/incentives** will help buildings comply so POC see the benefits first?
- How to avoid negative outcomes and unintended consequences for POC?

# Green Buildings Ordinance

# Green Buildings Ordinance

Buildings of 25,000 square feet or more:

1. New buildings
2. Existing buildings – only if recovering/replacing roof
  - Early enrollment into Energy Program
  - At roof replacement
3. Additions
  - 25,000–49,999 sq. ft.
  - ≥ 50,000 sq. ft. or more



# Green Building Ordinance: Compliance Options for EXISTING BUILDINGS



At Roof Replacement: Cool Roof Required\* plus ONE of the Following Options:



## Green Roof / Green Space

Anywhere on building or zone lot

Green area equivalent to the least of:

- 2% of floor area of the building
- 18% of the total roof area
- Available roof space

## Pay for Offsite Green

Payment to Green Building Fund of:

- \$50.00 per square foot of green space coverage required but not provided



## Solar

Anywhere on building or zone lot

Onsite solar or other renewable equivalent to the least of:

- 5% of the floor area
- 42% of the total roof area
- An area equal to an amount required to provide 100% of building electricity use



## Certification

One of the following:

- LEED Certification, minimum silver
- Enterprise Green Communities certification
- National Green Building Standard ICC/ASHRAE 700
- Equivalent certification approved by the building official



## Energy Program

Enroll in a flexible energy program that includes various energy efficiency and renewable options designed to achieve similar greenhouse gas emission reductions as the on-site solar option.

- Comply with one of many pathways in the Energy Program within 5 years.
- Can enroll early to “bank” efficiency projects for next roof replacement

\* If the roof is a character-defining roof, CPD may allow alternative roof materials

# Energy Program: Compliance Options for Existing Buildings



At Roof Replacement: Cool Roof Required\* plus ONE of the Following Options:



## ENERGY STAR Score

Score of 85 or higher

- Maintained annually
- Energize Denver Benchmarking Map for recent data at [energizedenver.org](http://energizedenver.org)



## EUI Improvement

Annual weather normalized site EUI

Buildings 25,000 - 49,000 gross floor area (GSF):

- 10% EUI improvement
- Buildings 50,000 GSF or larger:
- 15% EUI improvement

## EUI + Offsite Solar

Buildings 25,000 - 49,000 GSF

- 5% EUI improvement
- Offsite solar equiv. to 10% of building energy use

Buildings 50,000 GSF or larger

- 7.5% EUI improvement
- Offsite solar equiv. to 15% of building energy use



## Onsite / Offsite Solar

Anywhere on building or zone lot, or off-site

Onsite solar or other renewable equiv. to your choice of:

- 5% of the floor area
- 42% of the total roof area
- 100% of annual average electricity used at the building

**OR**

Offsite solar equiv. to:

- 100% of building electricity use



## Green Building Certification

One of the following:

- LEED Certification, minimum silver
- Enterprise Green Communities certification
- National Green Building Standard ICC/ASHRAE 700
- Equivalent certification approved by the building official

\* If the roof is a character-defining roof, CPD may allow alternative roof materials





# Initial Community Engagement on Policy Options

July 19<sup>th</sup>- July 30<sup>th</sup>

# Purpose and Target Audience

- Build initial community **awareness** about the Task Force's work and proposed policies.
- Collect **input** on policy options to shape final Task Force recommendations.

# Proposed Approach

## City Proposed Role

- 2 public **webinars** (1 technical, 1 less technical)
- Open **survey** July 19<sup>th</sup>-July 30<sup>th</sup>
- **Promote** webinars and surveys through:
  - CASR newsletters (~10k people) and CPD lists
  - Human Rights and Community Partnerships (HRCP) Commissions (African American, American Indian, Asian American Pacific Islander, Latino Commission, People with Disabilities, etc)
- Develop **materials** to support Task Force members in offering custom briefings as desired

## Task Force Proposed Role

- **Promote** webinars/surveys
- **Convene** discussions and townhalls among constituencies as desired
- Review and **incorporate** input
- *What else would you need?*