



SF Environment

Our home. Our city. Our planet.

A Department of the City and County of San Francisco

Building Decarbonization and Climate Action

Barry Hooper | June 30, 2022



Agenda

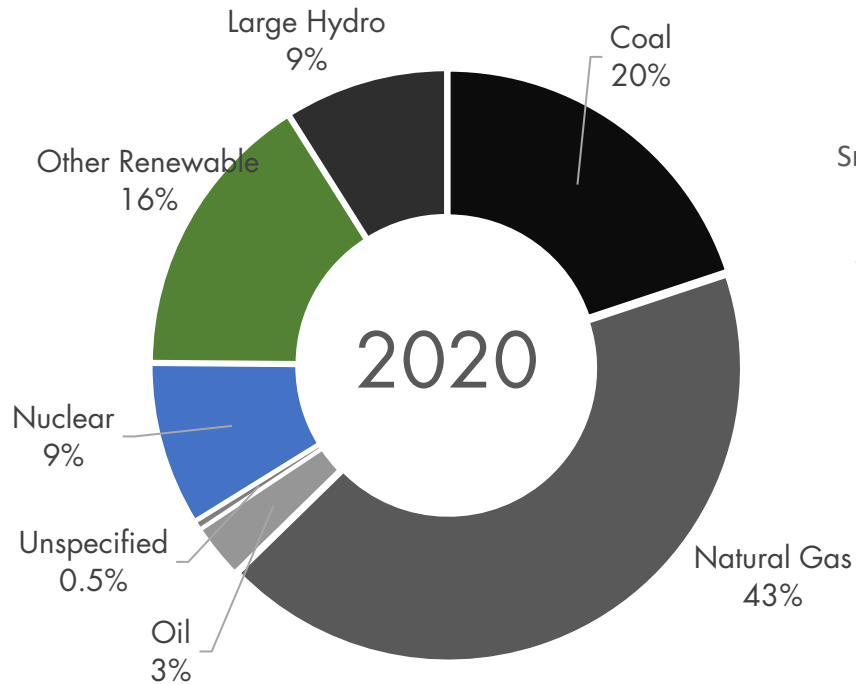


1. Why All-Electric is essential to San Francisco
2. Stakeholder process
3. Building decarbonization in the 2021 Climate Action Plan
4. What's working

The electric grid in SF is a few years ahead



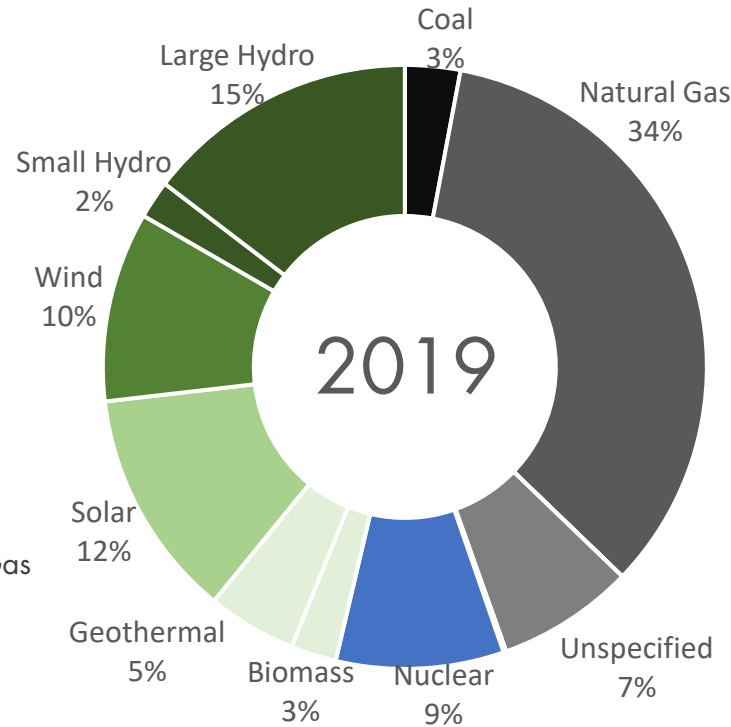
United States
Electricity Sources



Renewable: 25%

Source: [eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php](https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php)

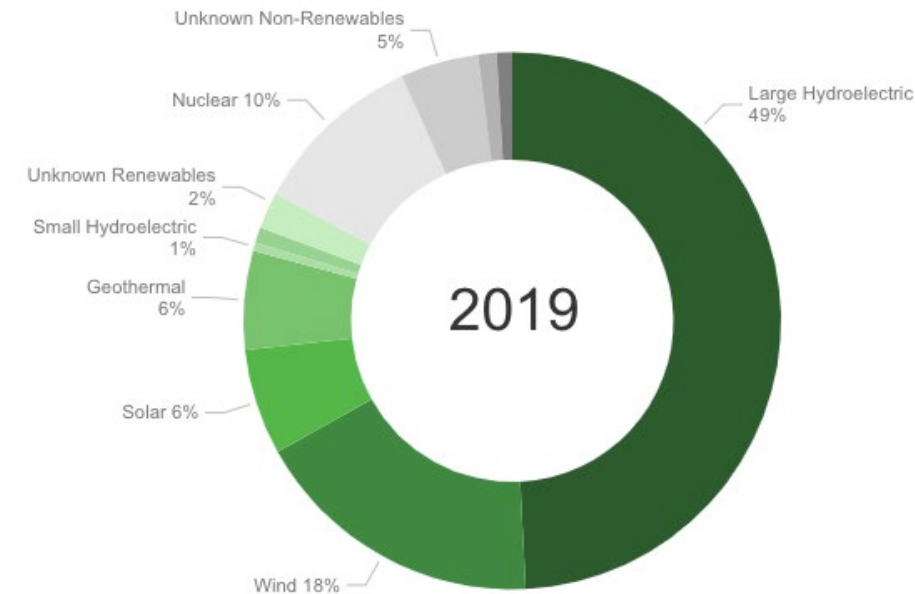
California 2019
(In-State and Imports)



Renewable: 46%

Source: CEC (2021) *Energy Almanac 2019*.
San Francisco considers large hydroelectric generation as "renewable" for GHG impact estimation.

San Francisco Electricity Sources
(All Load Serving Entities)



Renewable: 83%

Source: SFE (2021) sfenvironment.org/sf-climate-dashboard

Fossil gas impacts . . .



Health



Safety

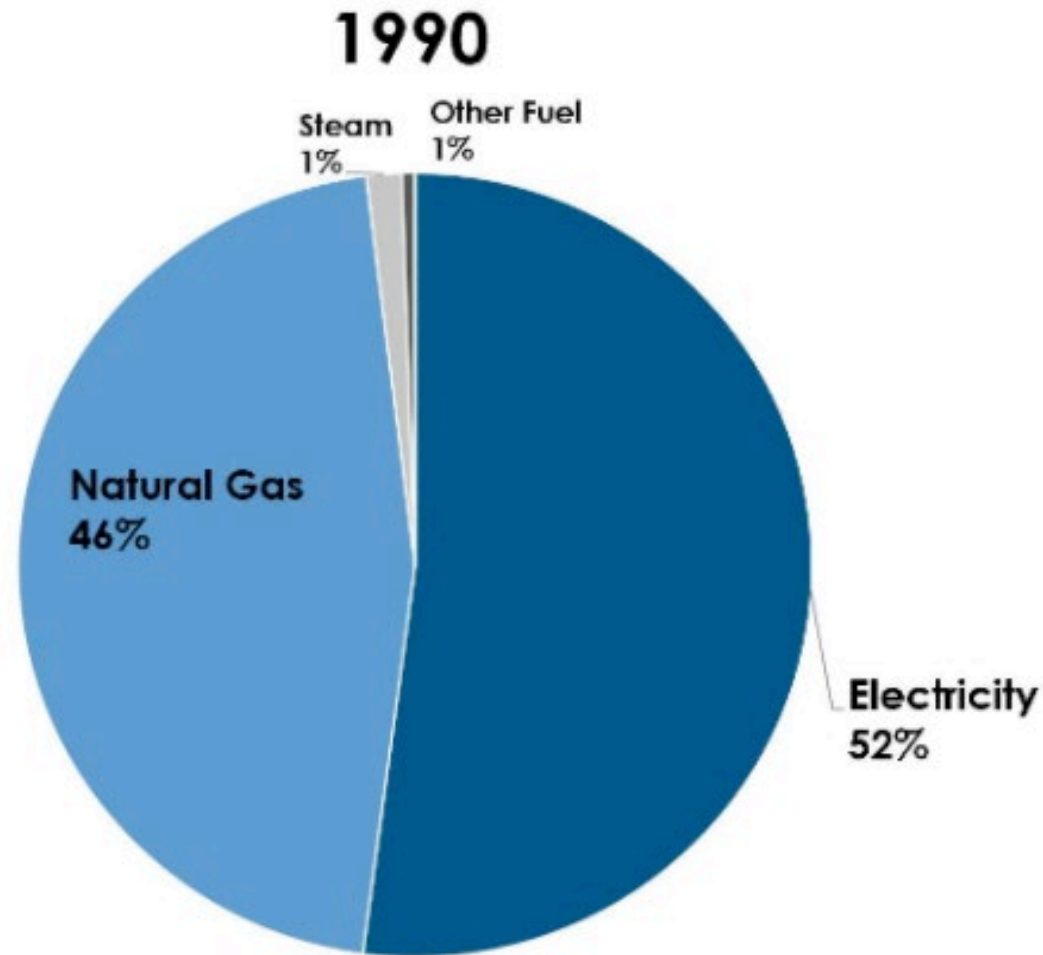


Resilience

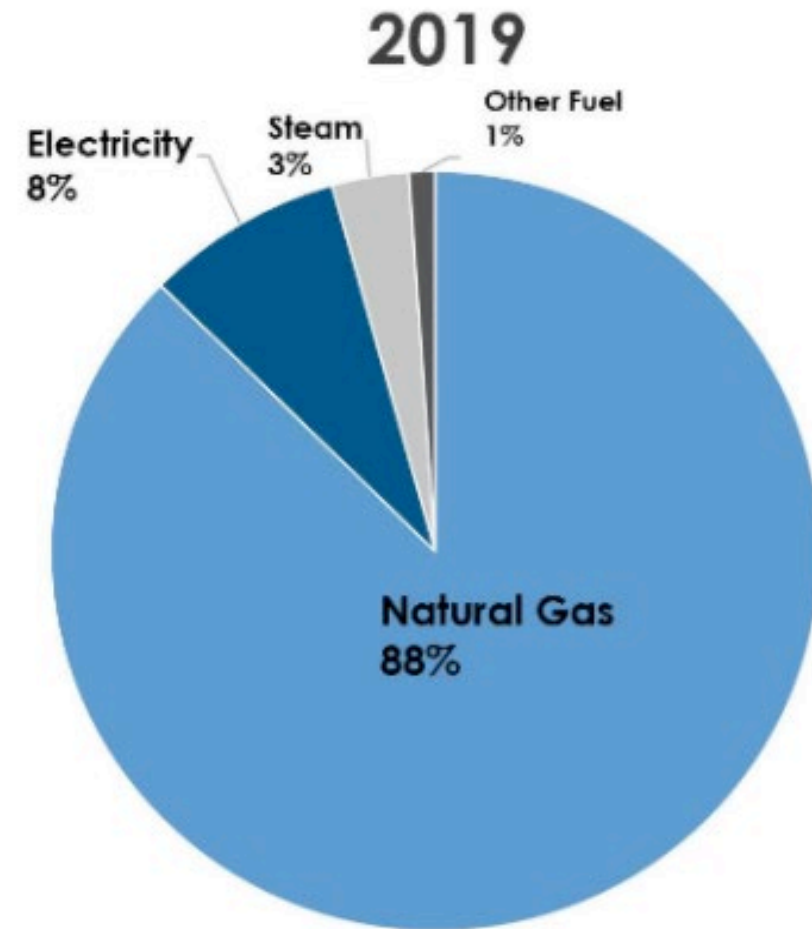


Equity

Emissions from San Francisco Buildings

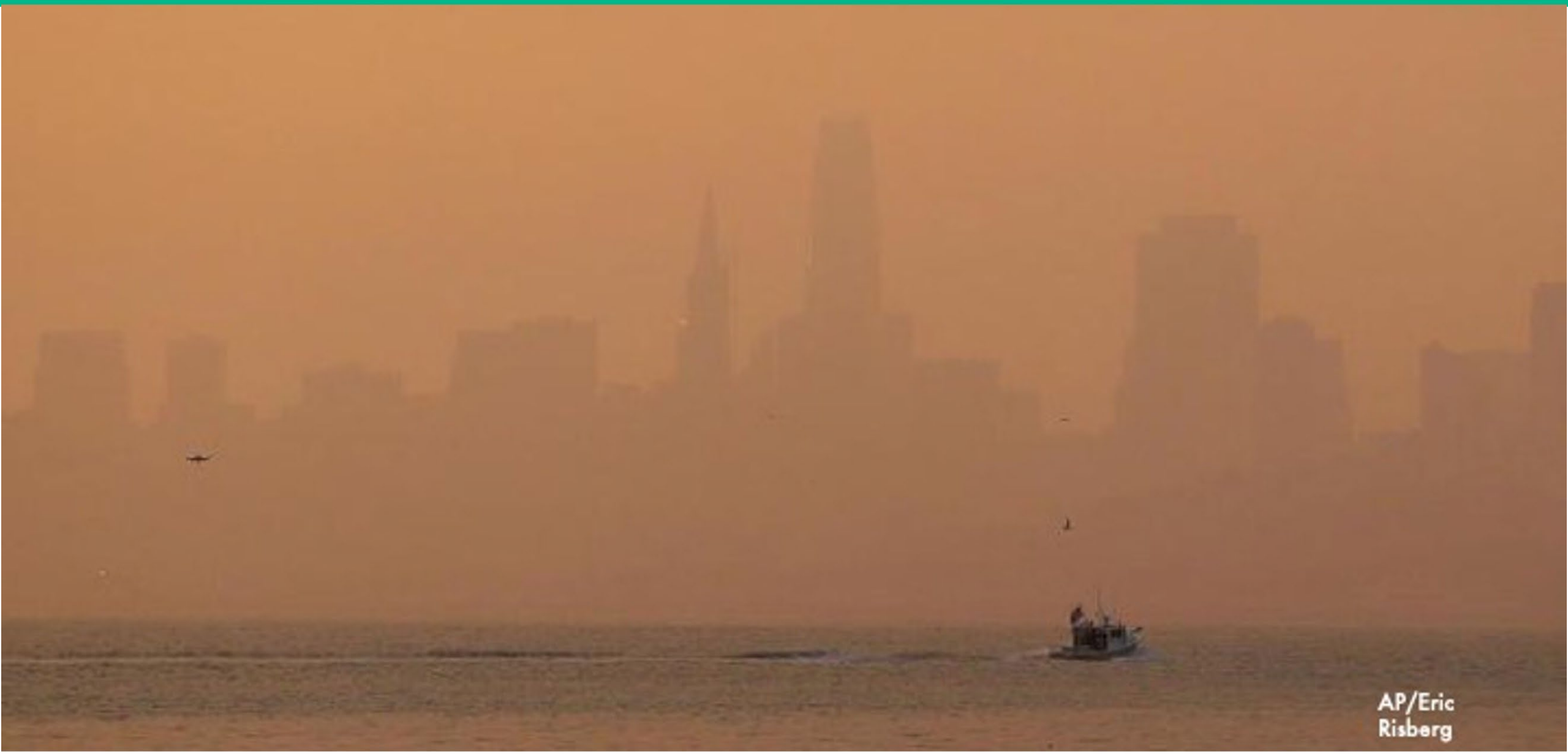


Total Building Emissions:
4.4 Million mtCO₂e



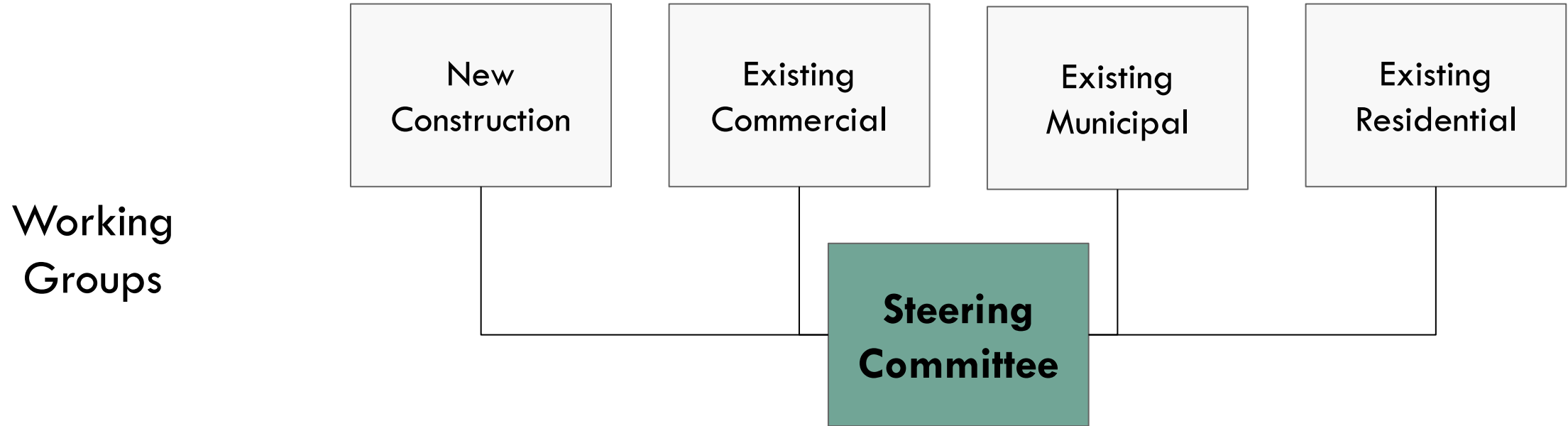
Total Building Emissions:
1.9 Million mtCO₂e

Climate change impacts us today

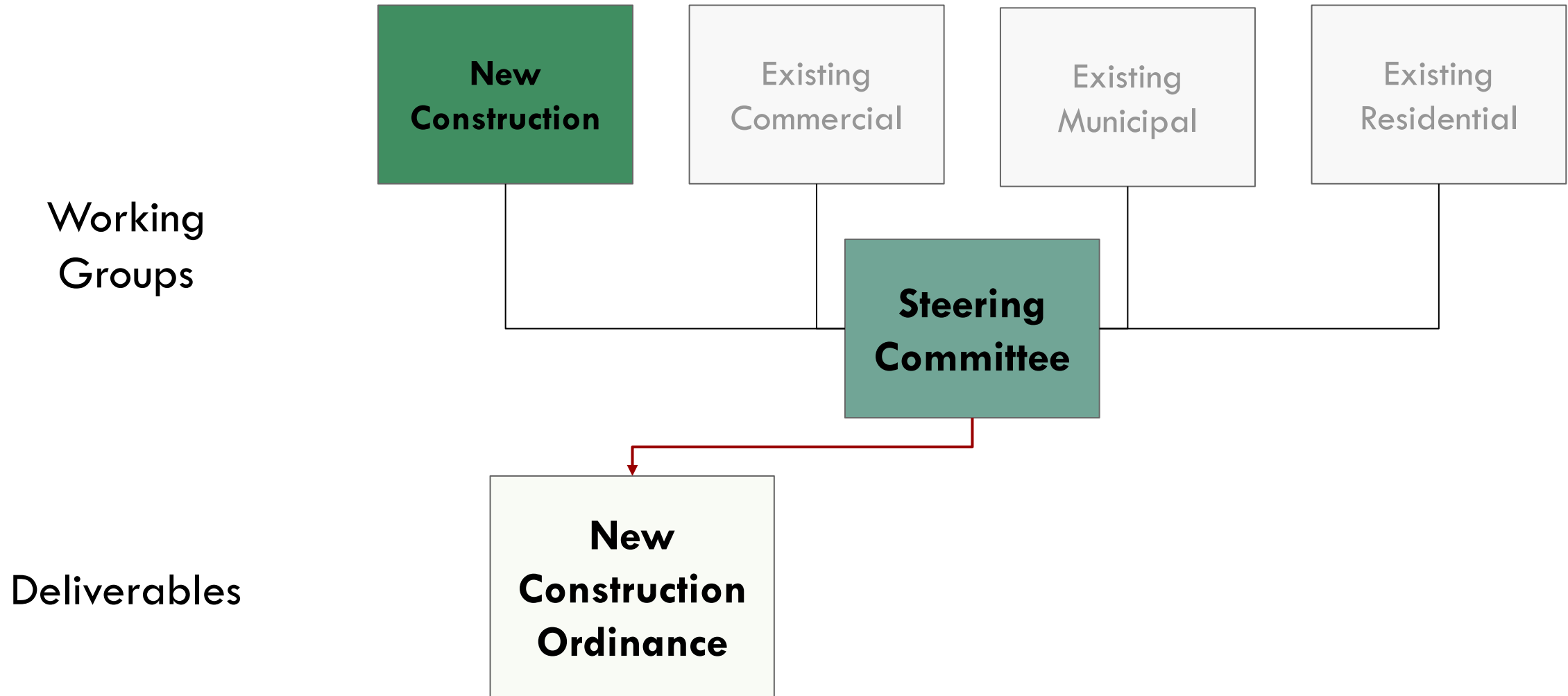


AP/Eric
Risberg

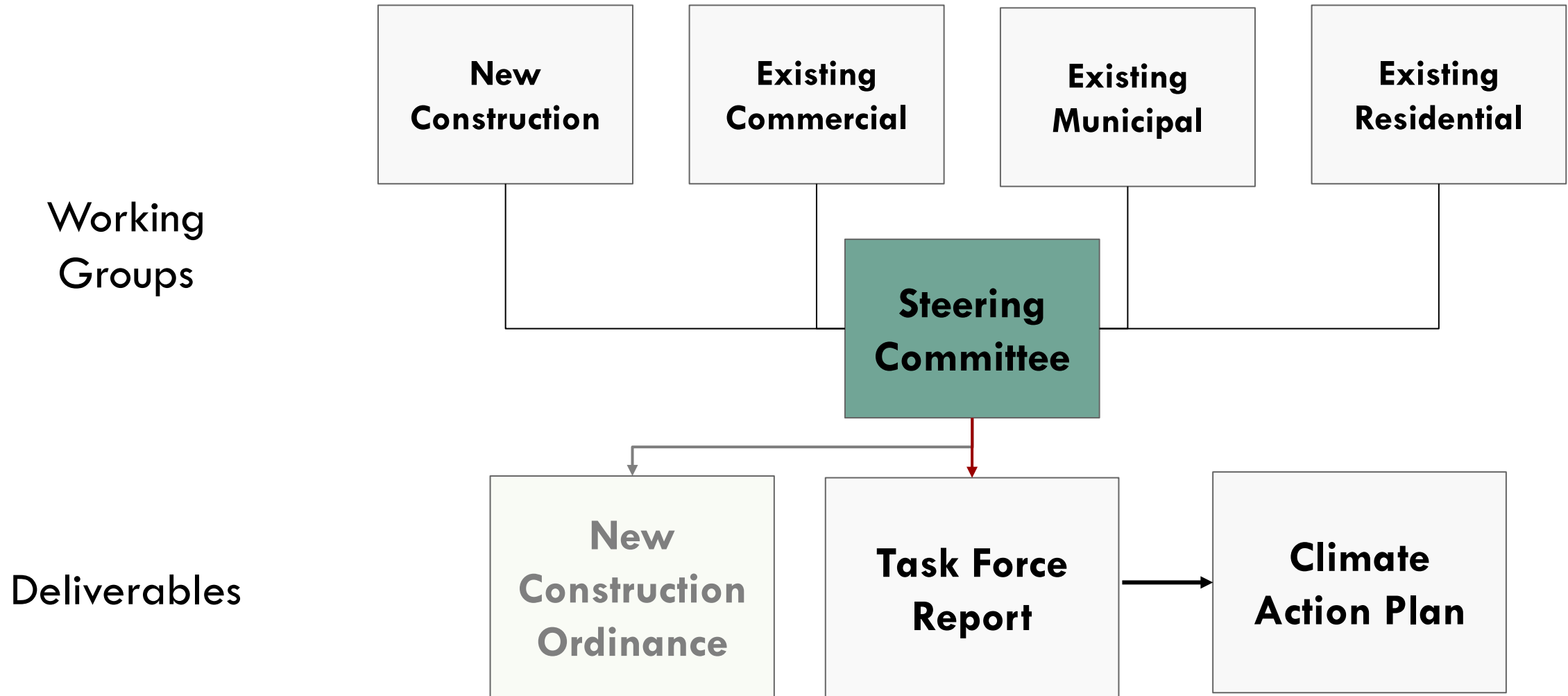
Zero Emission Buildings Taskforce



Zero Emission Buildings Taskforce



Zero Emission Buildings Taskforce



Zero Emission Buildings Taskforce



How can San Francisco:

- Establish long-term partnerships and build trust
- Identify opportunities for City engagement and action



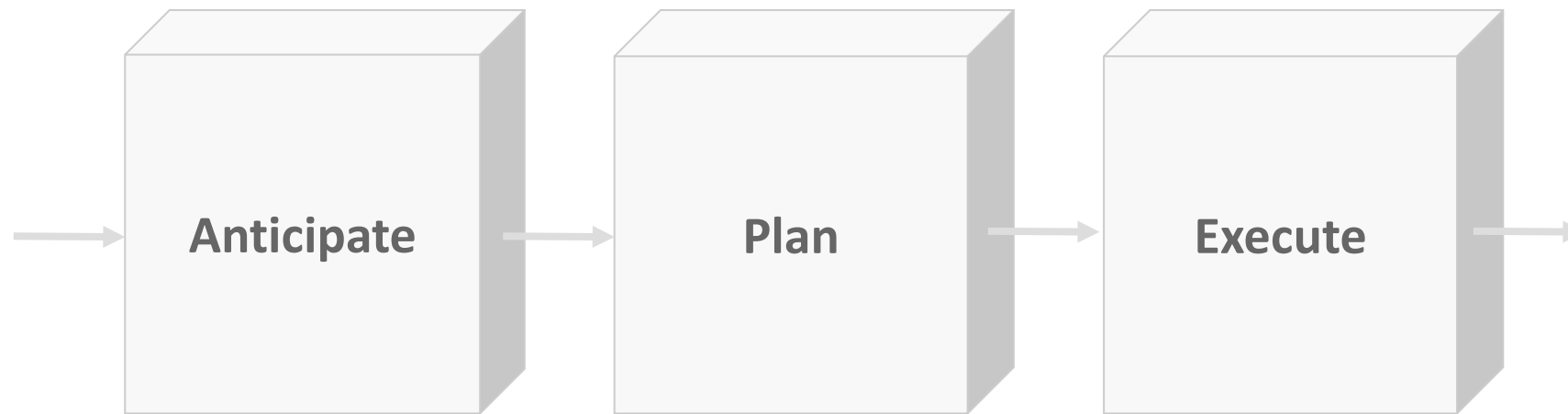
Cross-cutting findings



Timing



Decarbonization plans must sync with real estate cycles



Opportunities
Triggers
Needs

Engineering
Procurement
Logistics

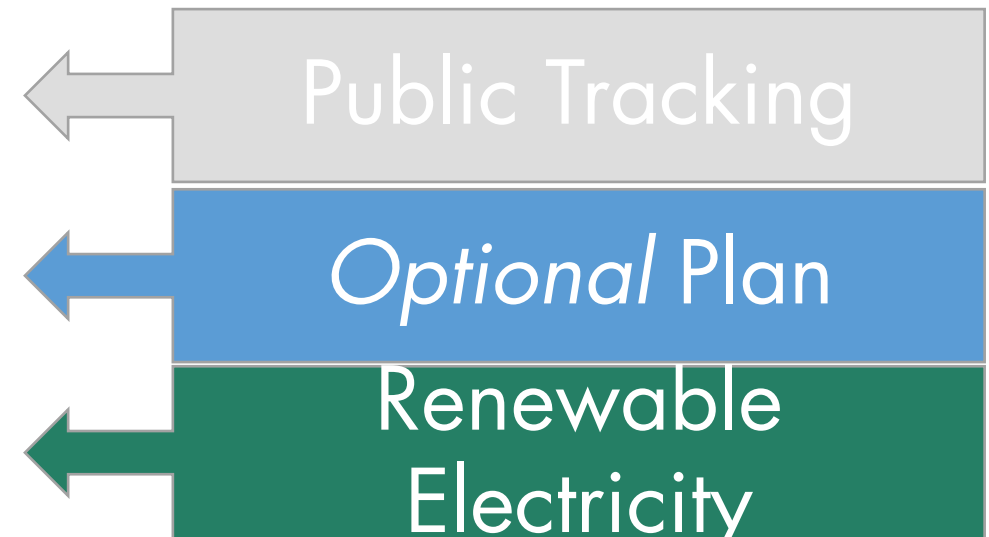
Resourcing

The City must **support** **planning** and **eliminate missed opportunities** for decarbonization.

Current Law



- All-Electric New Construction
 - All sizes, all occupancies
- Existing Commercial Buildings:
 - Every year: Disclose energy use publicly
 - Every 5 years:
 - Audit energy efficiency, or
 - Prepare a plan for decarbonization
 - Subscribe to 100% renewable electricity*



* Mandatory for all buildings >500,000 sq feet by Dec 31, 2022.

SAN FRANCISCO CLIMATE ACTION PLAN 2021

sfenvironment.org/climateplan



Climate Action Plan – Highlighted strategies



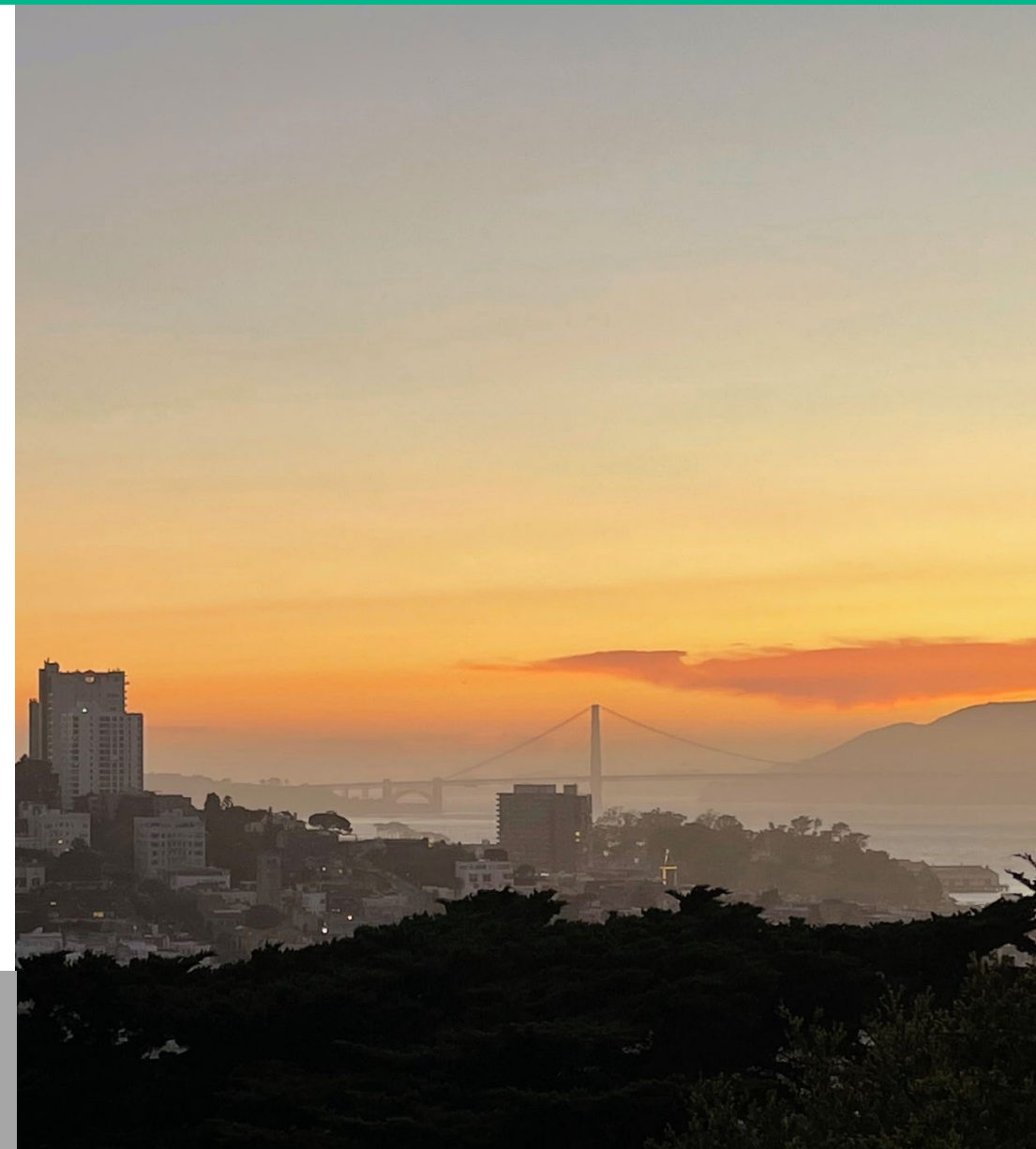
ENERGY SUPPLY

- Supply 100% Greenhouse-gas free electricity citywide

BUILDING OPERATIONS

- Eliminate fossil fuel use in new construction and existing buildings
- Expand the decarbonization workforce; target support to disadvantaged workers
- Low-GWP refrigerants

Strategies set direction



Climate Action Plan



Example action for large commercial

BUILDING OPERATIONS

Action 02-7:

Adopt building performance policy requiring large commercial buildings to:

- (1) transition to efficient and all-electric equipment no later than 2035,
- (2) in 2025 begin regular disclosure of progress toward goal, and
- (3) allow payment of annual fees in lieu of electrification, which must be invested in decarbonization of low-income and affordable housing.

Actions outline subsequent work



Decarbonization framework



FOR LARGE COMMERCIAL, LEVERAGE EXISTING POLICIES

- 100% Renewable Electricity
- Public Tracking - Build upon benchmarking

NEW

- Require a Plan for Decarbonization
- Require decarbonization by 2035 and regular reporting of progress
- **Flexibility:** Invest fees in decarbonization of low-income and affordable housing



The future is here: all-electric education, office, labs



Claire Lilienthal Elementary School
BUILT - SFUSD, Lionakis



270 Brannan - Office
BUILT - Pfau Long Architecture



Pier 70 Building 12
CONSTRUCTION - Point Energy Innovations



Lick Wilmerding High School
BUILT - EHDD, Integral Group



Sacred Heart Academic & Arts
BUILT - WRNS, Interface, Integral Group



LBNL Genomics Laboratory
CONSTRUCTION - Smith Group/JRR and Integral Group

The future is here: all-electric government



Southeast Community Center
CONSTRUCTION - SFPUC, SFPW



Golden Gate Park Golf Course Clubhouse
DESIGN - RPD, SFPW



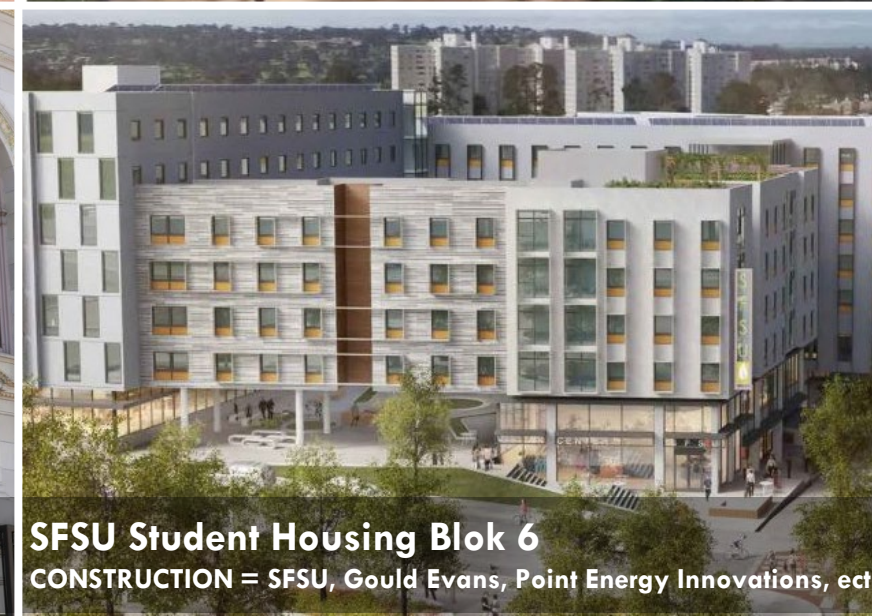
Consolidated Admin Facility
BUILT - SFO, Integral Group



Alameda Creek Watershed Center
CONSTRUCTION - SFPUC, SFPW



Mission Branch Library (Major Renovation)
DESIGN - SFPL, SFPW



SFSU Student Housing Blok 6
CONSTRUCTION = SFSU, Gould Evans, Point Energy Innovations, ect

Thank You



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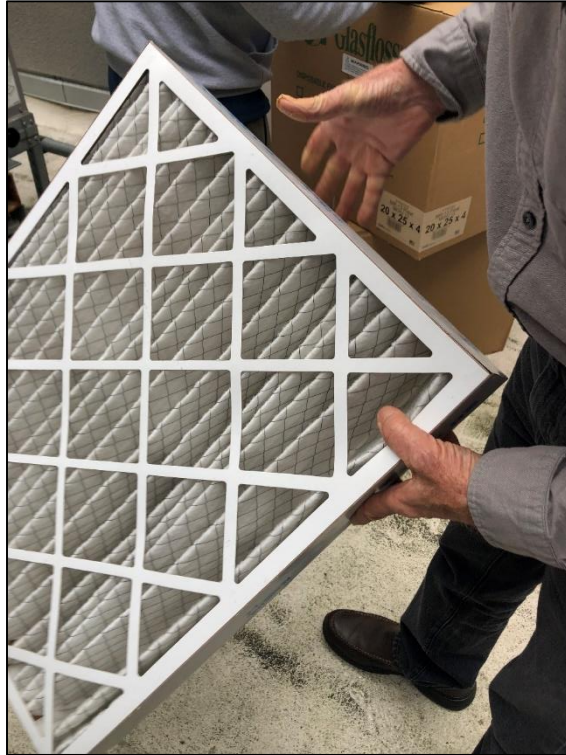
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SPUR Energy Audit 2021 - How and when should the SPUR building be decarbonised?



Energy audit carried out in Dec. 2021



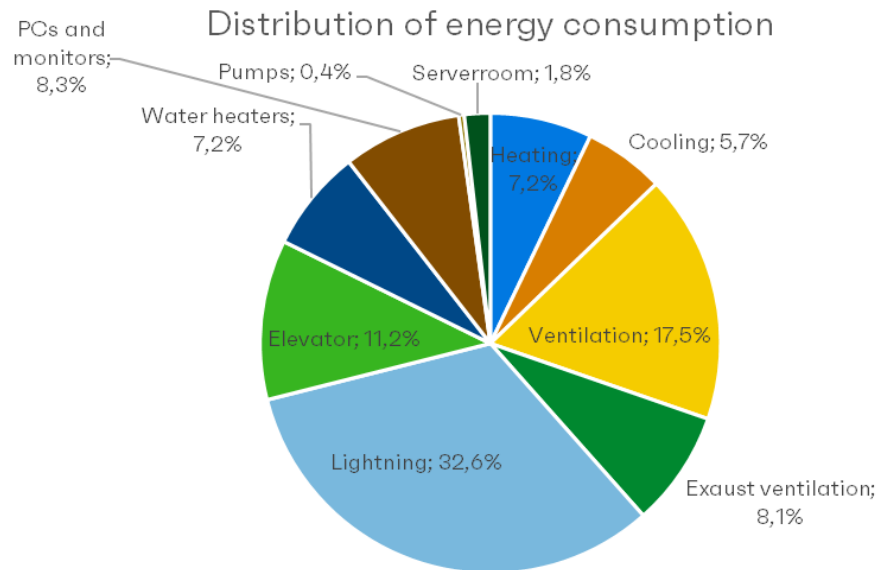
Distribution of the energy consumption

Electricity consumption for:

- Lighting (basement, staircases)
- Ventilation of the workspace, meeting room and exhibition space
- Ventilation from toilets
- Cooling of the workspace, meeting room and exhibition space
- Lifts
- Water heaters (2 large water tanks and direct water heaters at the toilets)
- Pumps
- IT and server, PC's, coffee machines and others

Gas consumption for:

- Heating



Ventilation, heating and cooling

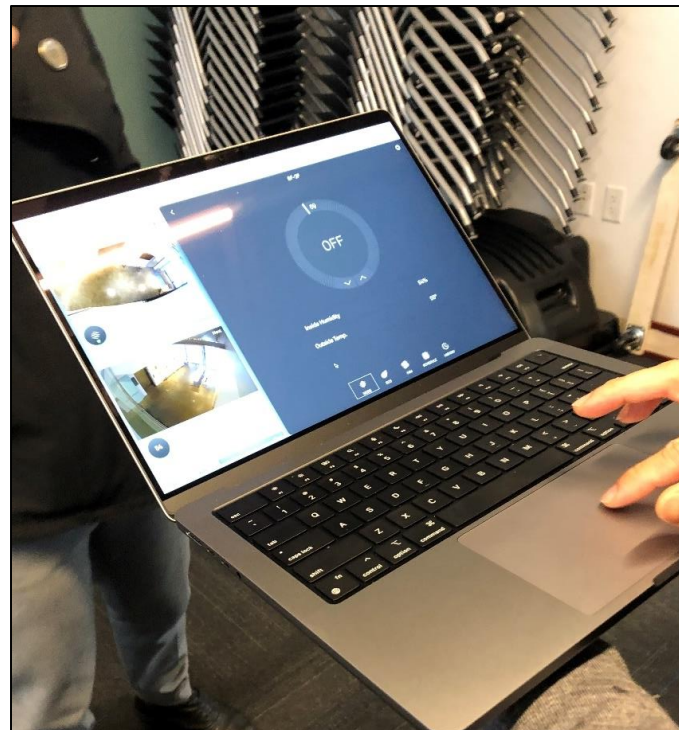


Four Gas heated
Rooftop Units from 2009,
estimated remaining life
time approx. 10 years.



Can be replaced with
RTU with heat pumps

Control system for heating, ventilation and cooling - what is controlling what?



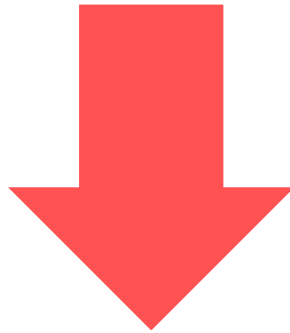
Exhaust ventilation



*Exhaust ventilation from toilets running
24 hours/day*



Replace with
more efficient
ventilator

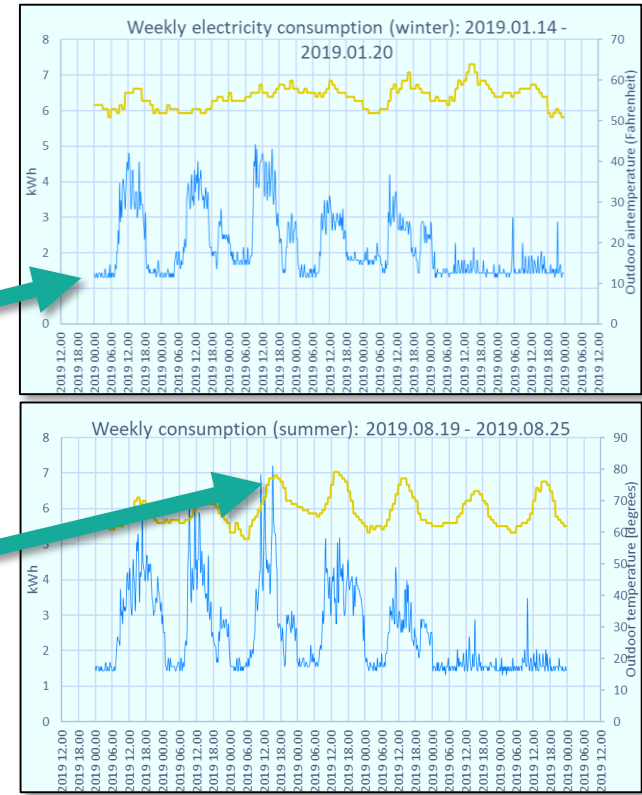


Reduce
operation time

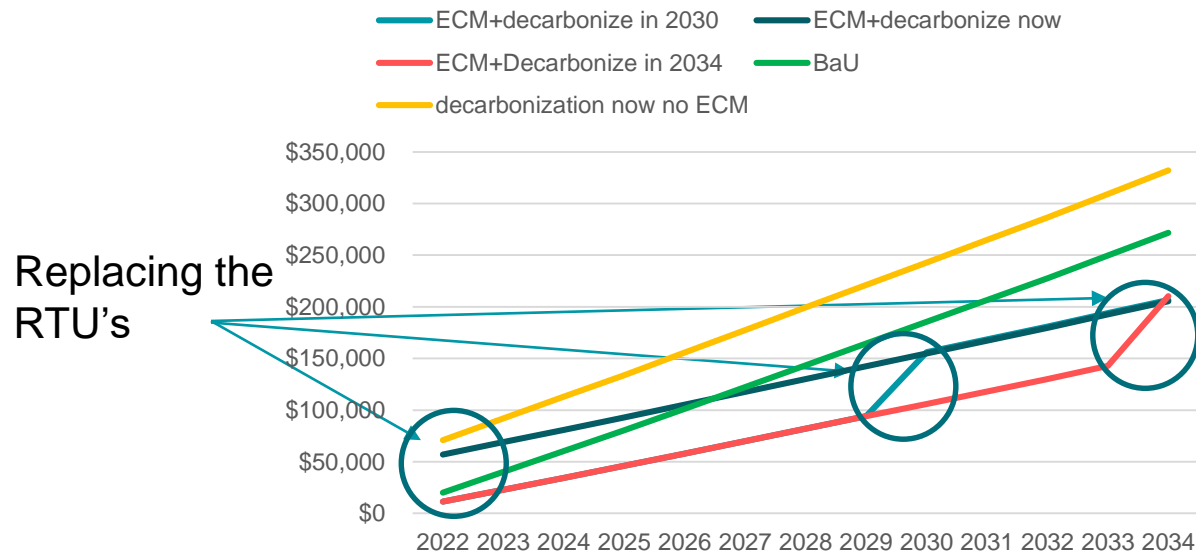
Our Findings

Electricity consumption, winter
Baseload is about 1.5 kWh –
what is this?

Electricity consumption summer
cooling is needed



Accumulated cost if ECM are carried out



Conclusions

There are possibilities for energy savings (even for a highly efficient building):

- Recirculation of air
- Better control of ventilation and cooling according to occupancy (sensors)

The heat consumption is very low (mild climate and a very energy efficient building) therefore it is not a feasible solution now, but...

Gas prices are expected to rise in the future

Decarbonization is possible **now** by replacing the RTU with units with heat pumps

The challenge is buildings where the RTU's need to be replaced now and will be replaced with gas units



Thank you!

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Decarbonizing the SPUR Urban Center

6/22/2022



Ideas + Action
for a Better City



Agenda

- 1. Introductions**
- 2. SPUR's Motives**
- 3. Recommendations**
 - a. Vision
 - b. Short-Term Tasks
 - c. Long-Term Tasks

SPUR's Motives

Understand how we can comply with regulations and align our energy use with our values.

Create a platform for public education on how to decarbonize commercial buildings.



Urban Center Was a Relatively Easy Test Case for Decarbonization

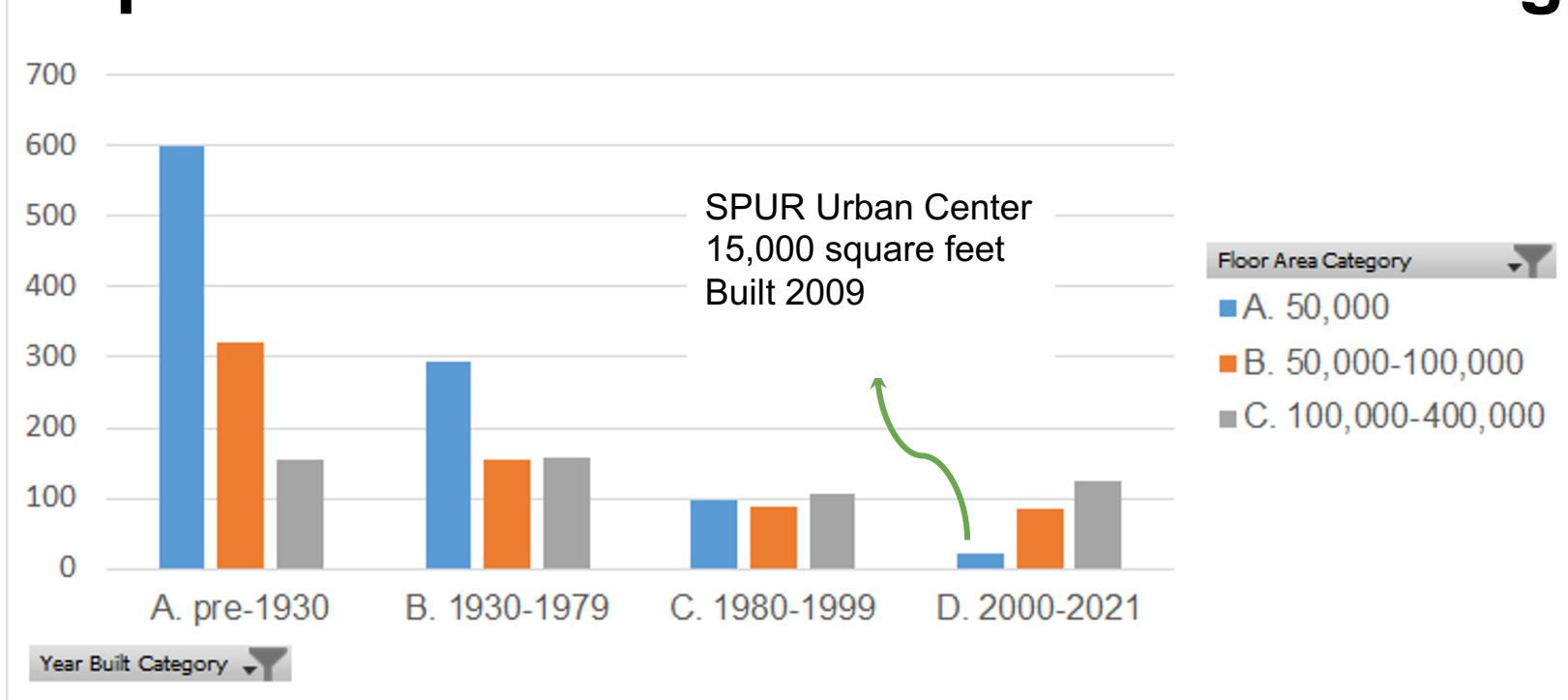
LEED Silver Certified

Mostly uses electricity; very little gas

**Average Monthly Energy Bill:
\$1000 for electricity, \$22 for gas**



Urban Center is Relatively New & Small Compared to Other SF Commercial Buildings



Recommendations

Overall Vision: Reduce, Then Eliminate Operating Emissions

Short term: Reduce energy use.

Long term: Replace HVAC units with highly efficient heat-pumps to eliminate use of natural gas onsite.

Why is reducing energy use part of a decarbonization strategy?

Short-term reductions in energy use have three major benefits:

- 1. Reduce ongoing energy bills
- 1. Be a good electrical grid citizen
- 1. Reduce heating demand, allowing SPUR to purchase smaller, less expensive heat pumps

SPUR's decarbonization roadmap

Fiscally Conservative, Forward-Thinking

- 1. Reduce present use of energy with efficiency and conservation measures.**
- 2. When the HVAC units reach their end of life (approximately 2032), replace them with highly efficient electric heat pumps.**

Lessons Learned

It's not going to be difficult.

No anticipated electrical service or panel upgrade.

It's a no-lose proposition

Marginal upfront costs are modest.

Will be cost-effective after 2030.

Planning ahead is key.

Questions?

Short-Term Tasks

Ventilation:

- The ventilation wasn't responding to CO₂ levels in the rooms as intended; repair this system.
- The control of the heating and cooling set points should be improved.
- Heating and cooling can be optimized by changing fans, motors and filters in HVAC units, and minimizing heat loss through the entrance door and windows.
- Consider reducing recirculating air when occupancy is low if and when COVID risk has greatly reduced.

Short-Term Tasks, Continued

Hot water:

Replace the electric water heater tanks on the 3rd floor and basement with instant demand heaters. If dishwashers are able to heat their water, as it appears, instant heaters will only be required for kitchen sinks. Instant demand heaters are already installed in the restrooms.

Lighting:

Replace remaining fluorescent lighting with LEDs in the staircases and basement. Add daylight control as well as movement control in rooms that lack it.

Long-Term Task

Replace the HVAC RTUs no later than the end of life time with high efficiency heat pump HVAC RTUs.

If the end of life of the roofing material coincides with end of life of the HVAC RTUs, this would be an opportune time to replace both.

Replacing the HVAC RTUs with heat pumps will decarbonize building operations.

Upfront Cost to Decarbonize

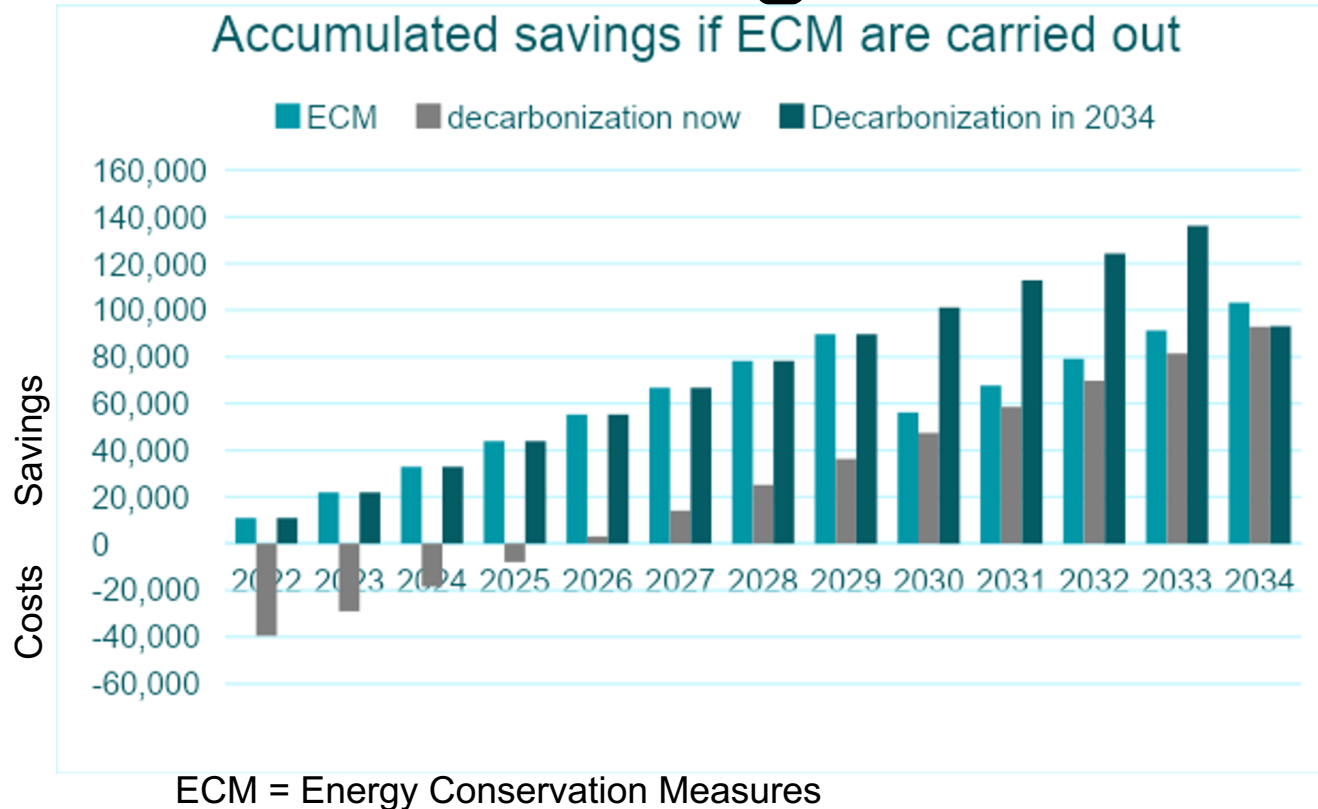
The full upfront costs (purchase and labor to install new HVAC RTUs + removal of existing RTUs) to electrify the building is approx. \$30,000-50,000.

Of this, the marginal cost to choose a heat pump is about \$3,000, and likely will be required by regulation by 2035.

The technology to decarbonize is available now.

SPUR doesn't anticipate a need for an electrical service upgrade to electrify.

Estimated Savings



Accumulated savings in 2034
With ECM: \$93,000. Without ECM: -\$60,000

Conclusions on Costs

The energy savings from ECM can pay for the investment in the decarbonization. The determining factors are the remaining lifetime of the installations and how big the potential for other savings is.

SPUR already uses so little heat and cooling that upgrading to more efficient heat pumps will yield little in bill savings.

Select Estimated costs

Baseline	Decarbonization Plan	Notes

Next Steps

We respectfully request that the Building Committee recommend that the SPUR Board Finance Committee approve a Master Plan to decarbonize the Urban Center. The Master Plan should be high-level and set in motion the information gathering and decisions that need to be made, rather than determining final outcomes. Should be flexible enough to respond to regulatory changes as they emerge.

Background

Project Partners:

- **Danish Energy Agency**
Government to Government (G2G) program between the Danish Energy Agency and the California Energy Commission
- **San Francisco Department of the Environment**
Has set 2035 as target year for decarbonizing commercial buildings and wishes to see high-profile successful pilot efforts.
- **SPUR**
Has a policy objective of ending the use of fossil fuels in buildings. In an exciting position as an organization dedicated to public education that owns a property in San Francisco.

Overview of SPUR Urban Center Energy Use

The only use of natural gas in SPUR's Urban Center is for space heating, which is provided by four HVAC rooftop units (HVAC RTUs).

Air conditioning, water heating, cooking and other energy uses are electrical. SPUR purchases 100% clean energy.

The building was already designed to use very little energy, but there still are conservation opportunities.