
# Presentation to the Somerville Commission on Energy Use and Climate Change (CEUCC)

Tuesday, July 11th, 2023

# Agenda

- Context for Net Zero and Net Negative Targets
  - Quick review of Existing GHGs
- Terminology and a Pathway to Net Negative
- Pathways for local reduction and potential of broader strategies
- Defining the Target & Discussion

# Context for Target Setting



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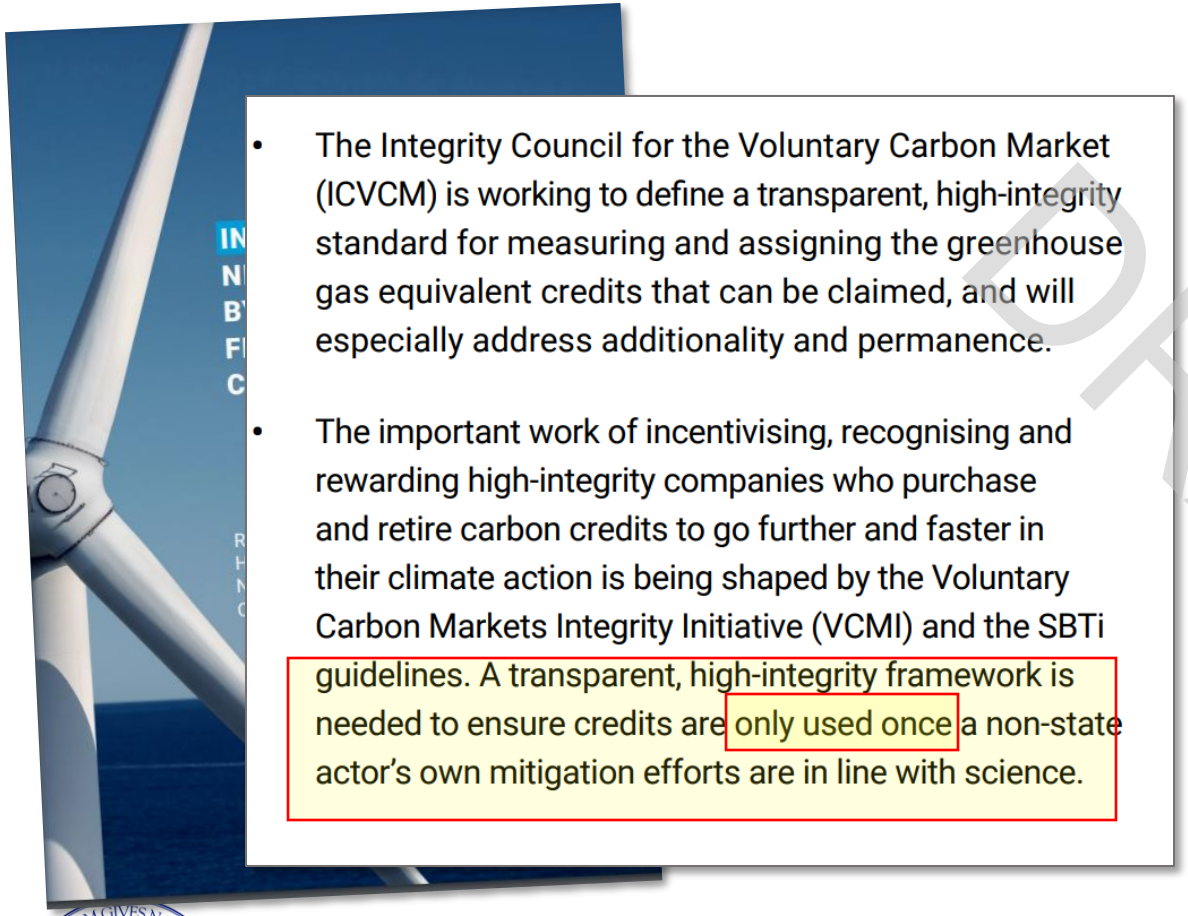
# Challenge: Credible "Net Zero" Targets

- Science-Based Target: for US Cities 62% by 2030
  - ~Electrify 90% of Res; 70% Com, 50% of vehicles
- Full Divestment from fossil fuels
- All Scope 1 (in-boundary point sources) eliminated




https://www.un.org/en/climatechange/high-level-expert-group

# Demonstrating Net-Zero

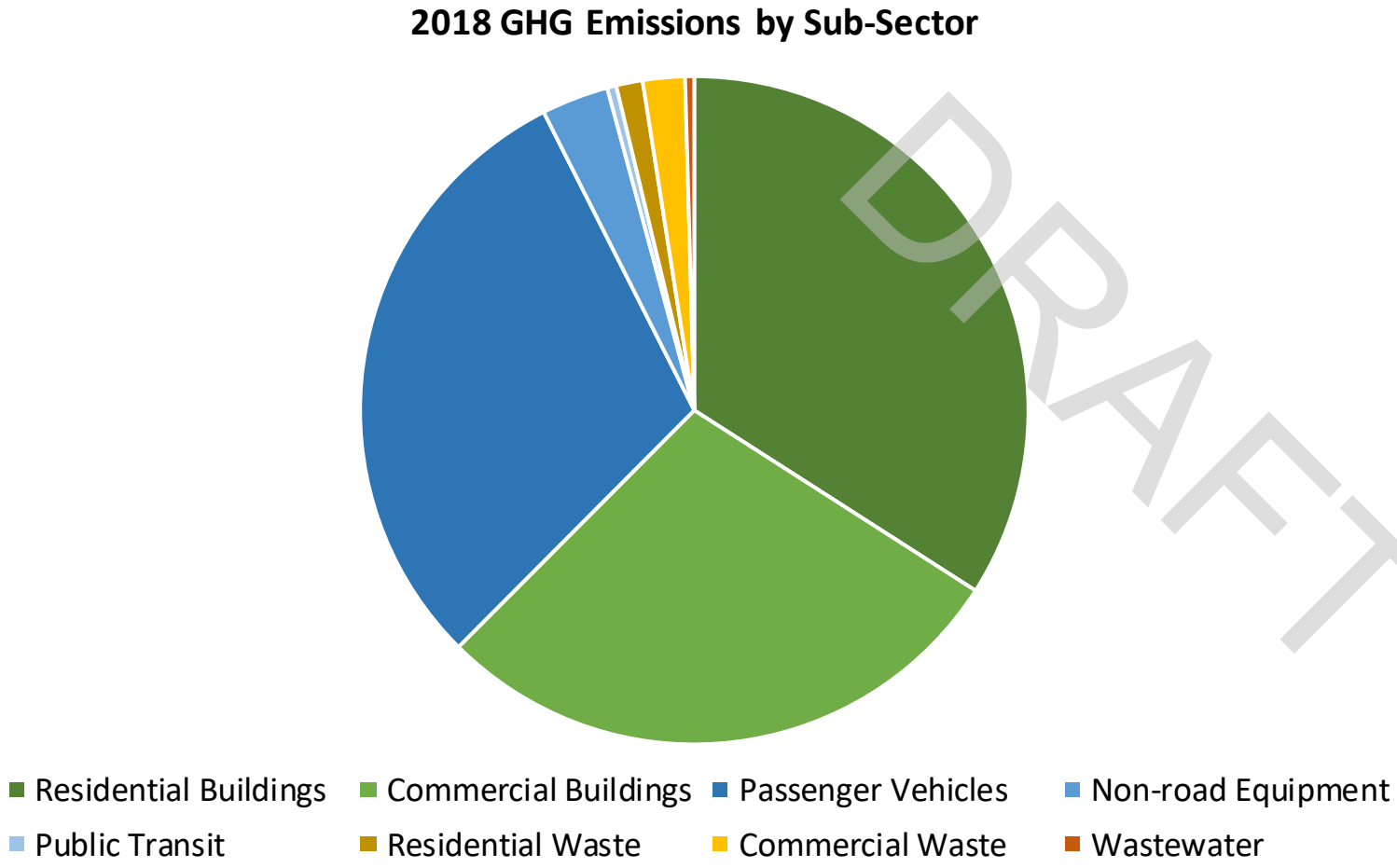


- The Integrity Council for the Voluntary Carbon Market (ICVCM) is working to define a transparent, high-integrity standard for measuring and assigning the greenhouse gas equivalent credits that can be claimed, and will especially address additionality and permanence.
- The important work of incentivising, recognising and rewarding high-integrity companies who purchase and retire carbon credits to go further and faster in their climate action is being shaped by the Voluntary Carbon Markets Integrity Initiative (VCMI) and the SBTi guidelines. A transparent, high-integrity framework is needed to ensure credits are only used once a non-state actor's own mitigation efforts are in line with science.



- Be ready to pay for verification services for all credits and reduction claims
- RECs will need to be fully owned and retired (not applied to State targets)

# AECOM Geographic Inventory

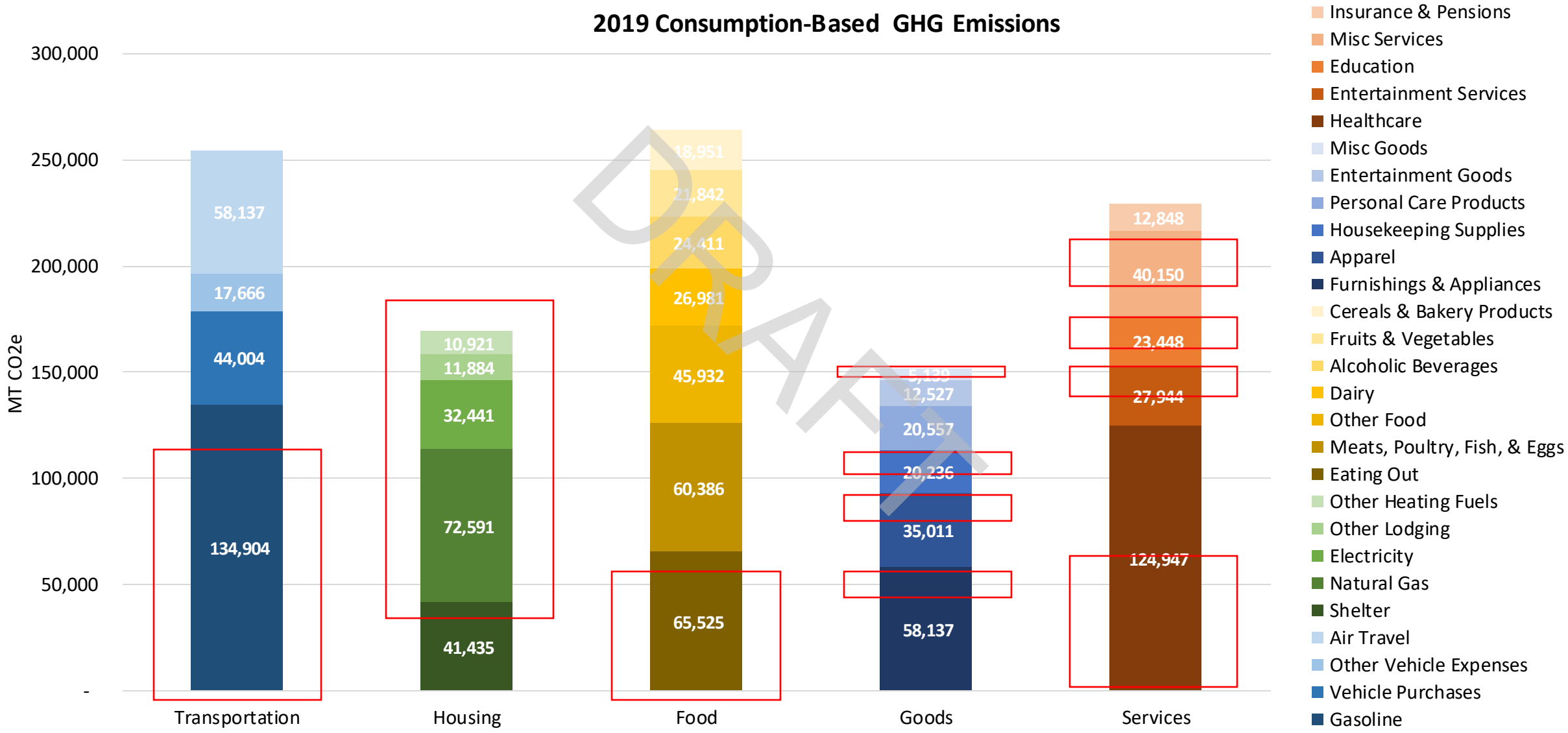





| Sub-Sectors | 2018 | % Share |
|---|---|---|
| Residential Buildings | 211,174 | 34% |
| Commercial Buildings | 175,940 | 28% |
| Passenger Vehicles | 186,484 | 30% |
| Non-road Equipment | 20,097 | 3% |
| Public Transit | 2,731 | 0% |
| Residential Waste | 7,944 | 1% |
| Commercial Waste | 12,620 | 2% |
| Wastewater | 2,727 | 0% |
| **Grand Total** | **619,717** | **100%** |

Source: City of Somerville Community Greenhouse Gas Inventory Workbook (AECOM)

# Consumption-Based Inventory & Overlap






Source: City of Somerville Greenhouse Gas Inventory Report (AECOM & EcoDataLab)

# Geographic Inventory vs CBEI

- Geographic 2018 Total Emissions:  619,717 MT CO2e
  - Details emissions that occur within the City's borders

- CBEI 2019 Total Emissions: 1,068,954 MT CO2e
  - Considers emissions that may occur outside the City's borders if they are directly or indirectly a result of the City's residents' activities

# A Journey to Net-Zero and Negative



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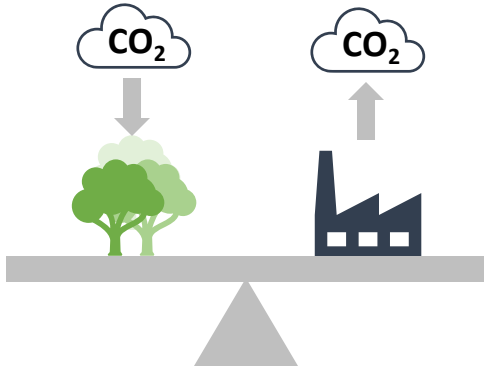
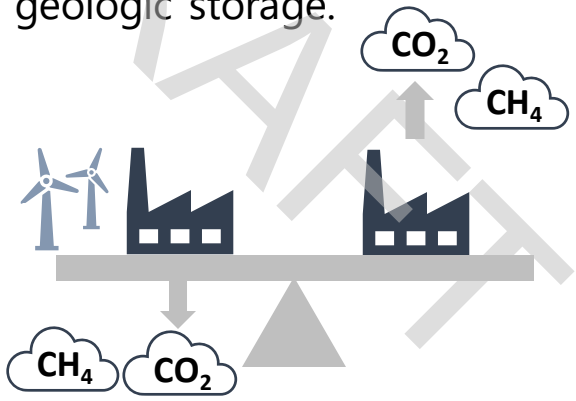
# The Path to Carbon Negative

| | Carbon Neutral | Net Zero | Carbon Negative |
|---|---|---|---|
| **How is it defined?** | The emissions released into the atmosphere from a community's activities is equal to the amount removed. | Removals are balanced and they are equivalent in terms of the source and sink, meaning that fossil GHGs require permanent geologic storage. | The emissions that are removed exceeds the emissions from a community's activities. |




# The Path to Net Carbon Negative

| | Carbon Neutral | Net Zero | Carbon Negative |
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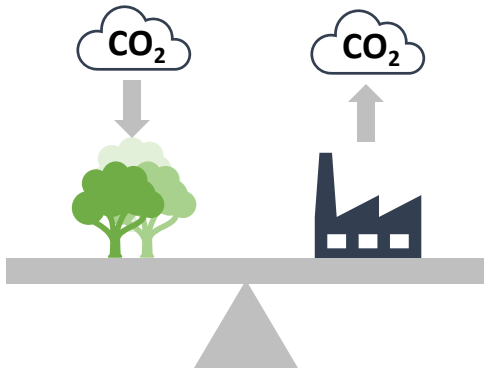
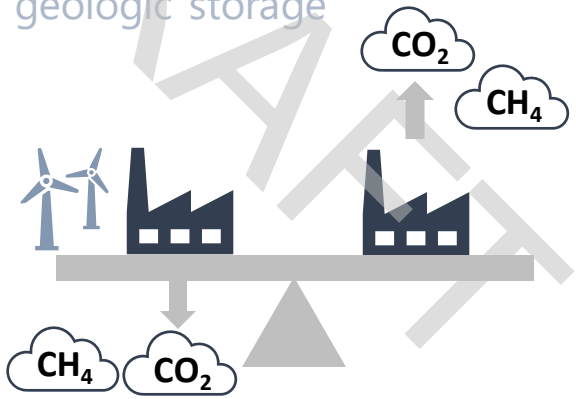
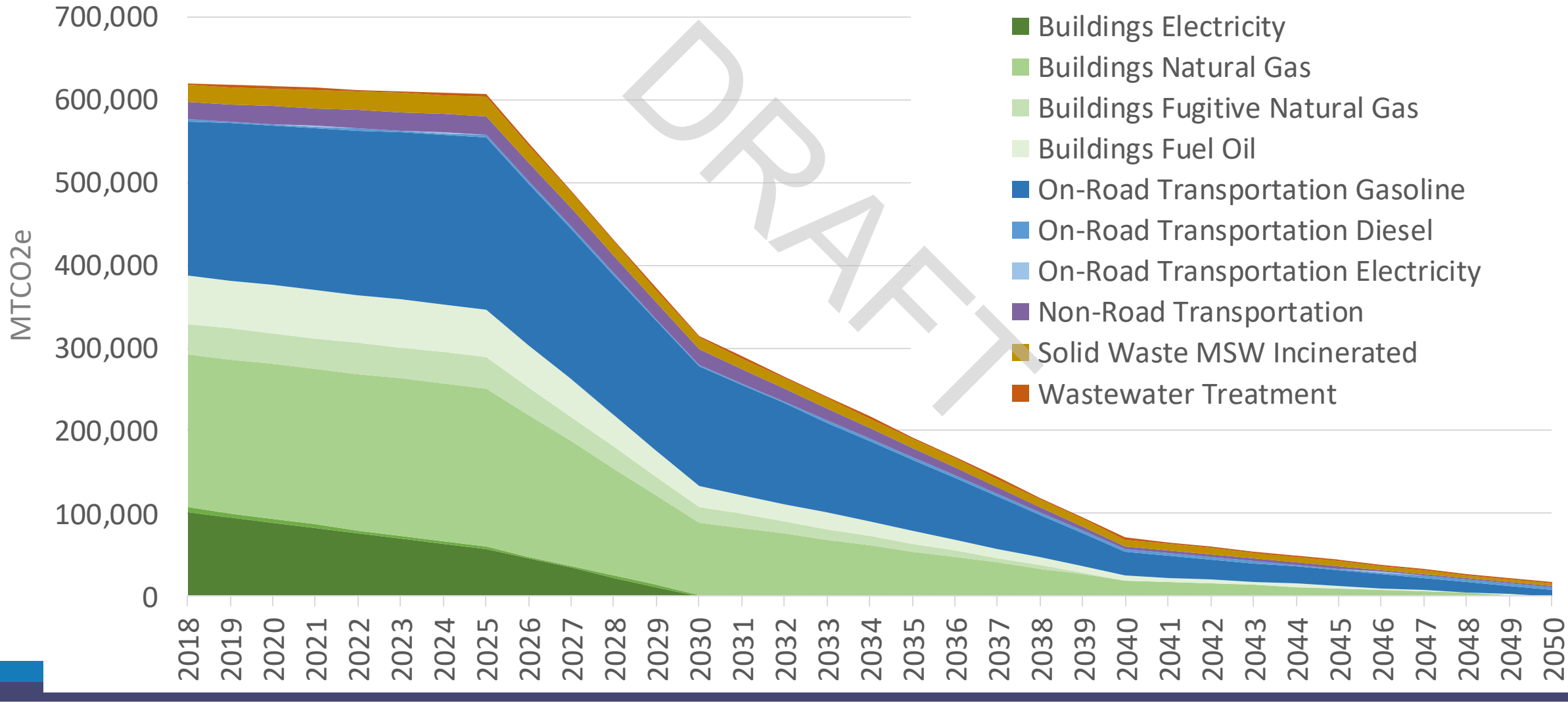
| |  |  |  |
| **What does it mean for Somerville?** | ✓ Owning clean energy with renewable purchasing<br>✓ Growing and maintaining tree canopy in Somerville and elsewhere<br>✓ Avoidance of significance generation of upstream GHGs | ✓ Maximize direct investments to eliminate/decarbonize remaining sources attributable to Somerville<br>✓ Pay for removal of remainder | ✓ Develop enforceable net-zero embodied carbon requirements to use regenerative materials in the built environment |

# Reducing Local GHGs



# Existing Buildings

- Retrofit and electrify as quickly as possible

- 50% overall reduction would require:
  - 55% of residential buildings electrified & deep retrofit
    - ~1,400 per year or 4-5 per day
    - ~$350-400 million investment by 2030
  - 40% of commercial area
    - ~1.3 million square feet / year
    - ~$400-500 million investment by 2030

# Transport

- Green Line Extension and Bike Plan targets baked in first
- Still need 40% of vehicles electric by 2030
  - ~6,000 per year
- 75,000 registered vehicles.  Assume 12-year lifespan
  - ~6,200 new cars per year
  - Every new vehicle needs to be electric starting now

# Balance Point and Going Beyond



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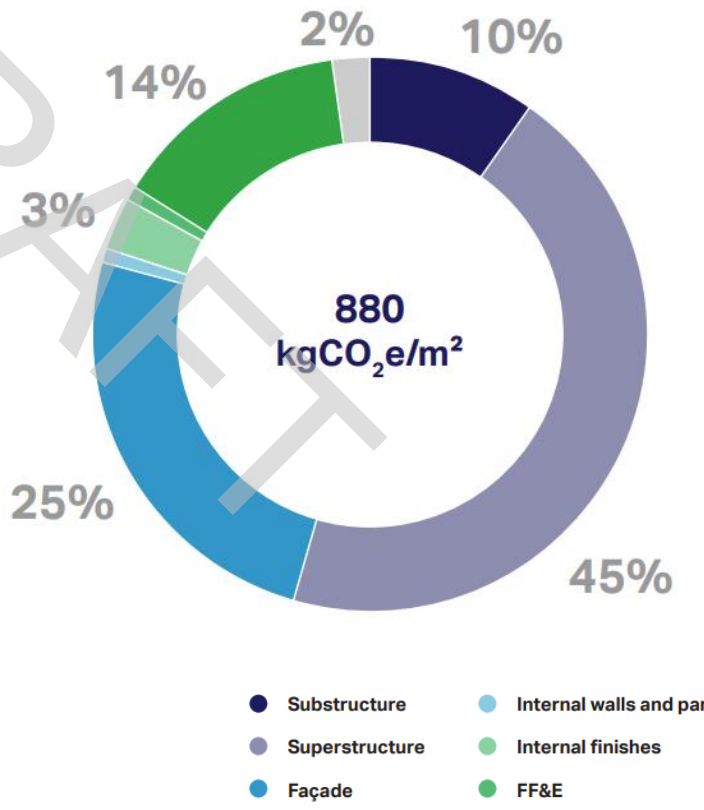
# Embodied Carbon in Buildings

- Depending on many factors but assuming development at a rate of Somerville by Design;
- A ~50% reduction in embodied carbon from Mass Timber construction could yield 100,000-300,000 MTCO2e / Year in avoided carbon

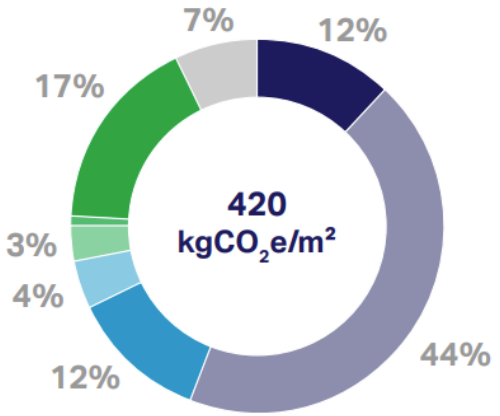
Mixed Use

**Figure 85:** Embodied carbon at practical completion (A1-A5)




Mass Timber

**Figure 30:** Embodied carbon at practical completion (A1-A5)



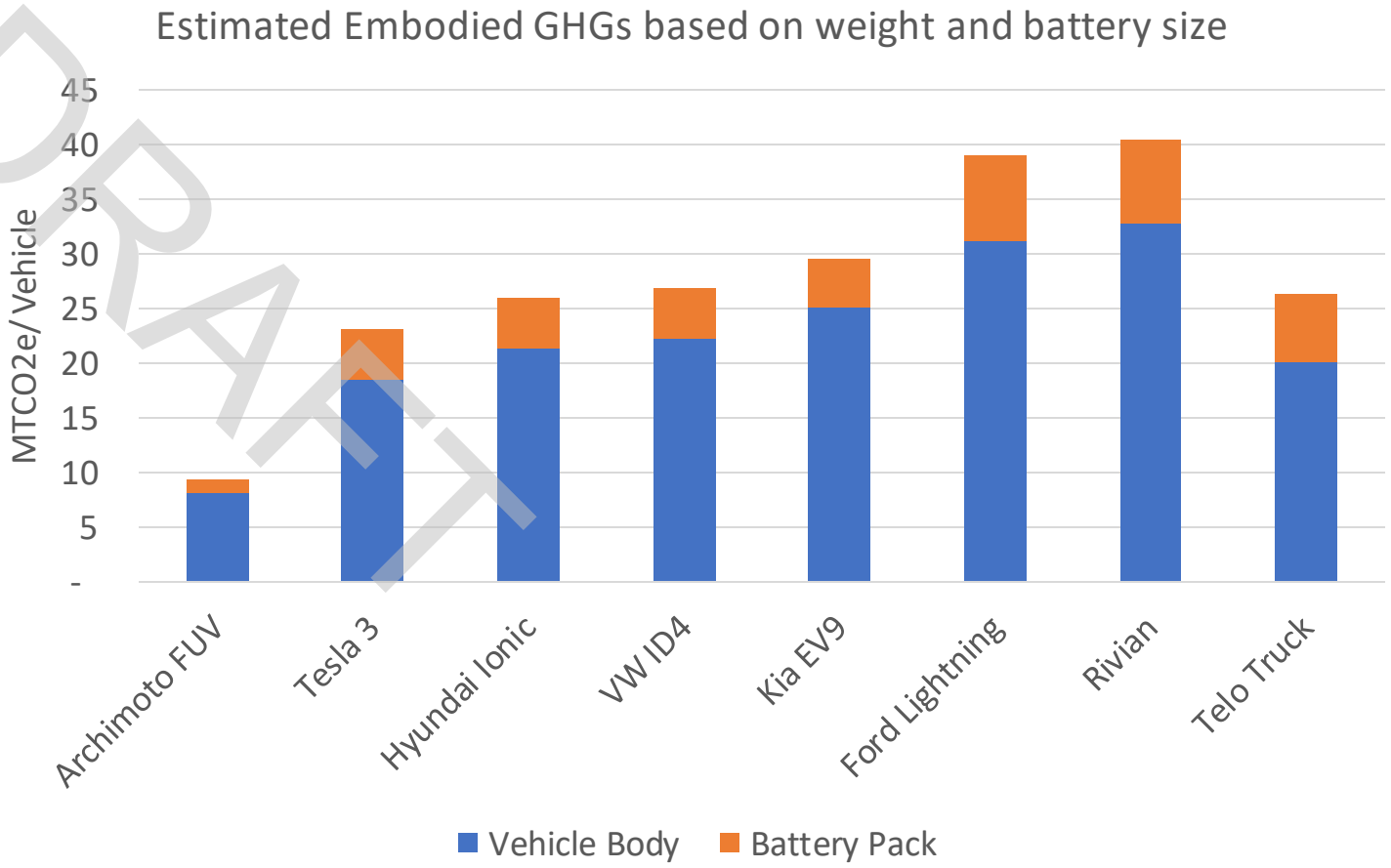



[Net zero buildings: where do we stand? - Arup]

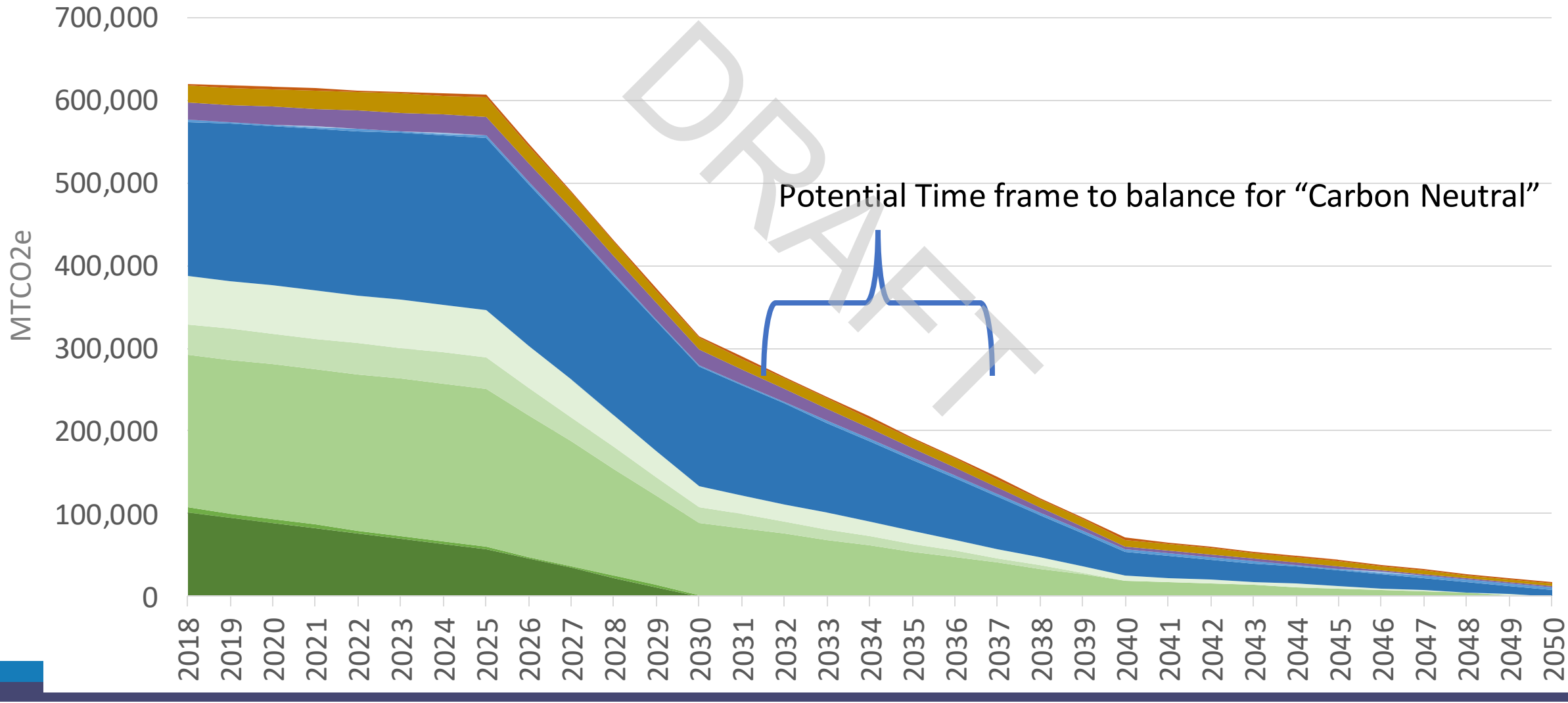
# Embodied Carbon in Vehicles

- 10% Adoption of Small Urban Electric Vehicles could avoid ~84,000 MTCO2e Total





# Scale of Avoidable Embodied GHGs

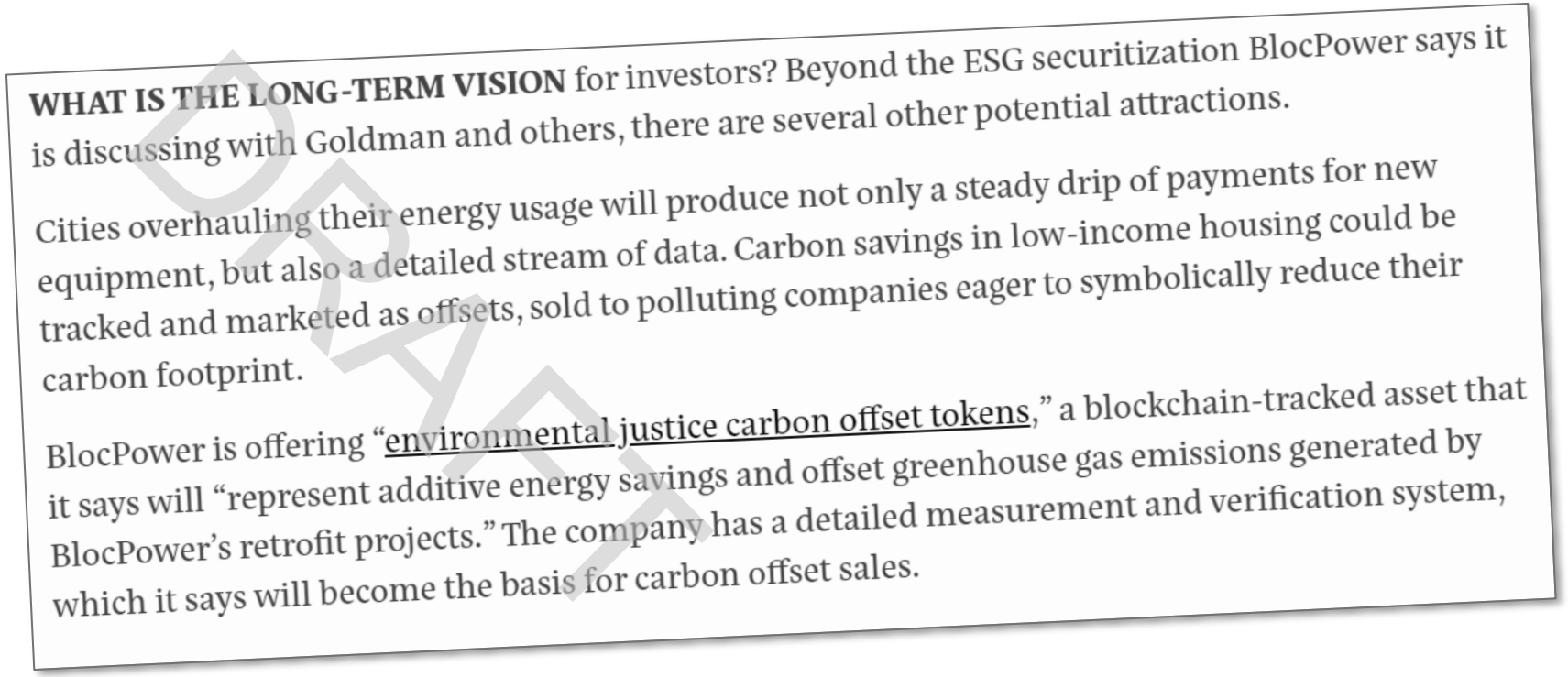


# Making Defensible Claims

- Reductions will need to be compelled by the City and Exclusively Retained w/ 3rd Party Verification using Consequential Impact Assessment Methods
  - Building Performance Standards
  - Embodied Carbon Standards (will need to wait for products to catch up)
  - Regulate vehicle sizes or compel them with fees
  - Fully retire all renewable energy attributes

# Retaining Credits

- BlocPower is amazing, but who gets to claim credit?
- These are things Somerville would need to prevent (or buy) for exclusive claims



**WHAT IS THE LONG-TERM VISION** for investors? Beyond the ESG securitization BlocPower says it is discussing with Goldman and others, there are several other potential attractions.

Cities overhauling their energy usage will produce not only a steady drip of payments for new equipment, but also a detailed stream of data. Carbon savings in low-income housing could be tracked and marketed as offsets, sold to polluting companies eager to symbolically reduce their carbon footprint.

BlocPower is offering "environmental justice carbon offset tokens," a blockchain-tracked asset that it says will "represent additive energy savings and offset greenhouse gas emissions generated by BlocPower's retrofit projects." The company has a detailed measurement and verification system, which it says will become the basis for carbon offset sales.



https://prospect.org/environment/2023-01-23-wall-street-rewiring-america-ithaca-green-new-deal/

# Messaging Carbon Net Negative

- "By the Books"
  - Somerville will become Carbon Net-Negative by compelling an end to fossil fuel use within our border and achieving 100% clean electricity by 20XX or else commits to pay for removal

- A lighter commitment, w/o specific words
  - Somerville will make substantial cuts to local GHGs, aims to be carbon neutral by driving economy-wide carbon reduction in consumption emissions, and supporting restorative production systems that ultimately store more carbon than they produce

# Summary / Discussion

- Using Language that is clear about the intent is important
- “Beyond Carbon Neutral” or similar maybe captures the intent w/o specifics

# Baseline Assessment & Background Data



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# 2023 Heat Fuel Breakdown

| Heat Fuel | # of Residential Units | % Residential Share | # of Commercial Units | % Commercial Share |
|---|---|---|---|---|
| Oil | 2,611 | 13.96% | 125 | 14.33% |
| Gas | 15,608 | 83.47% | 699 | 80.16% |
| Electric | 476 | 2.55% | 30 | 3.44% |
| Solar Assisted | 1 | 0.01% | 8 | 0.92% |
| Coal or Wood | 2 | 0.01% | 10 | 1.15% |
| **Total** | **18,698** | **100%** | **872** | **100%** |



Source: City of Somerville Assessor Database

# 2023 Residential Heat Fuel per Heat Type

| Residential Units | Coal or Wood | Electric | Gas | Oil | Solar Assisted | Total |
|---|---|---|---|---|---|---|
| Electric Baseboard | - | 382 | 4 | - | - | **386** |
| Floor Furnace | - | - | 24 | 1 | - | **25** |
| Forced Air-Duct | - | 77 | 7,965 | 747 | 1 | **8,790** |
| Hot Air-no Duct | - | 8 | 38 | 2 | - | **48** |
| Hot Water | 1 | 2 | 4,941 | 860 | - | **5,804** |
| None | 1 | 3 | 3 | - | - | **7** |
| Radiant | - | 4 | 62 | 1 | - | **67** |
| Steam | - | - | 2,571 | 1,000 | - | **3,571** |
| **Total** | **2** | **476** | **15,608** | **2,611** | **1** | **18,698** |



Source: City of Somerville Assessor Database

# 2023 Commercial Heat Fuel per Heat Type

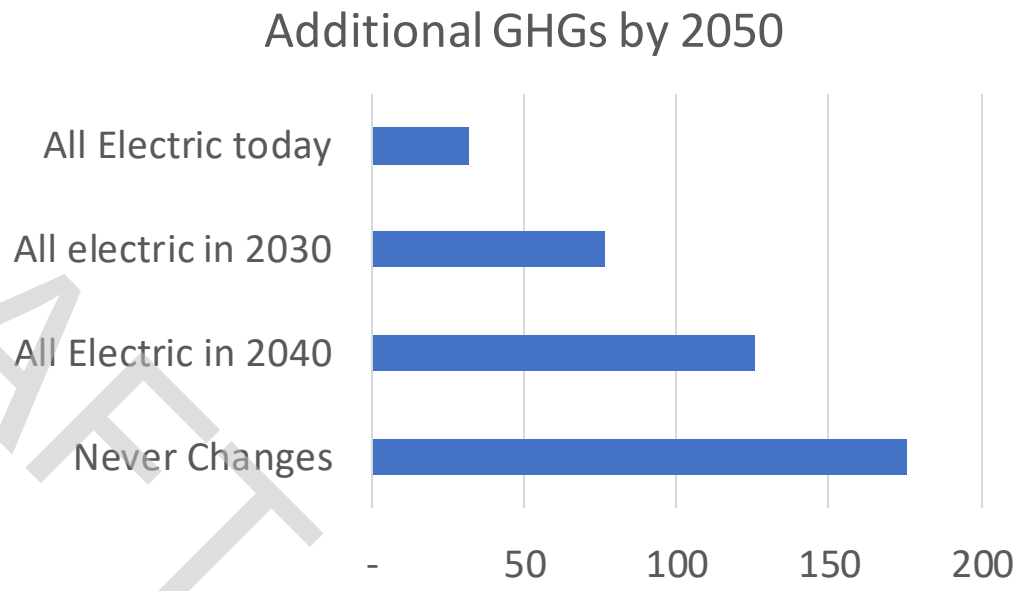
| Commercial Units | Coal or Wood | Electric | Gas | Oil | Solar Assisted | Total |
|---|---|---|---|---|---|---|
| Electric Baseboard | - | 8 | - | - | - | **8** |
| Floor Furnace | - | - | 2 | - | - | **2** |
| Forced Air-Duct | - | 20 | 481 | 43 | 3 | **547** |
| Hot Air-no Duct | 1 | - | 56 | 12 | - | **69** |
| Hot Water | - | - | 148 | 52 | 1 | **201** |
| None | 9 | 2 | - | 1 | 2 | **14** |
| Radiant | - | - | 3 | - | 2 | **5** |
| Steam | - | - | 9 | 17 | - | **26** |
| **Total** | **10** | **30** | **699** | **125** | **8** | **872** |



Source: City of Somerville Assessor Database

# Residential Buildings Pathway Indicators

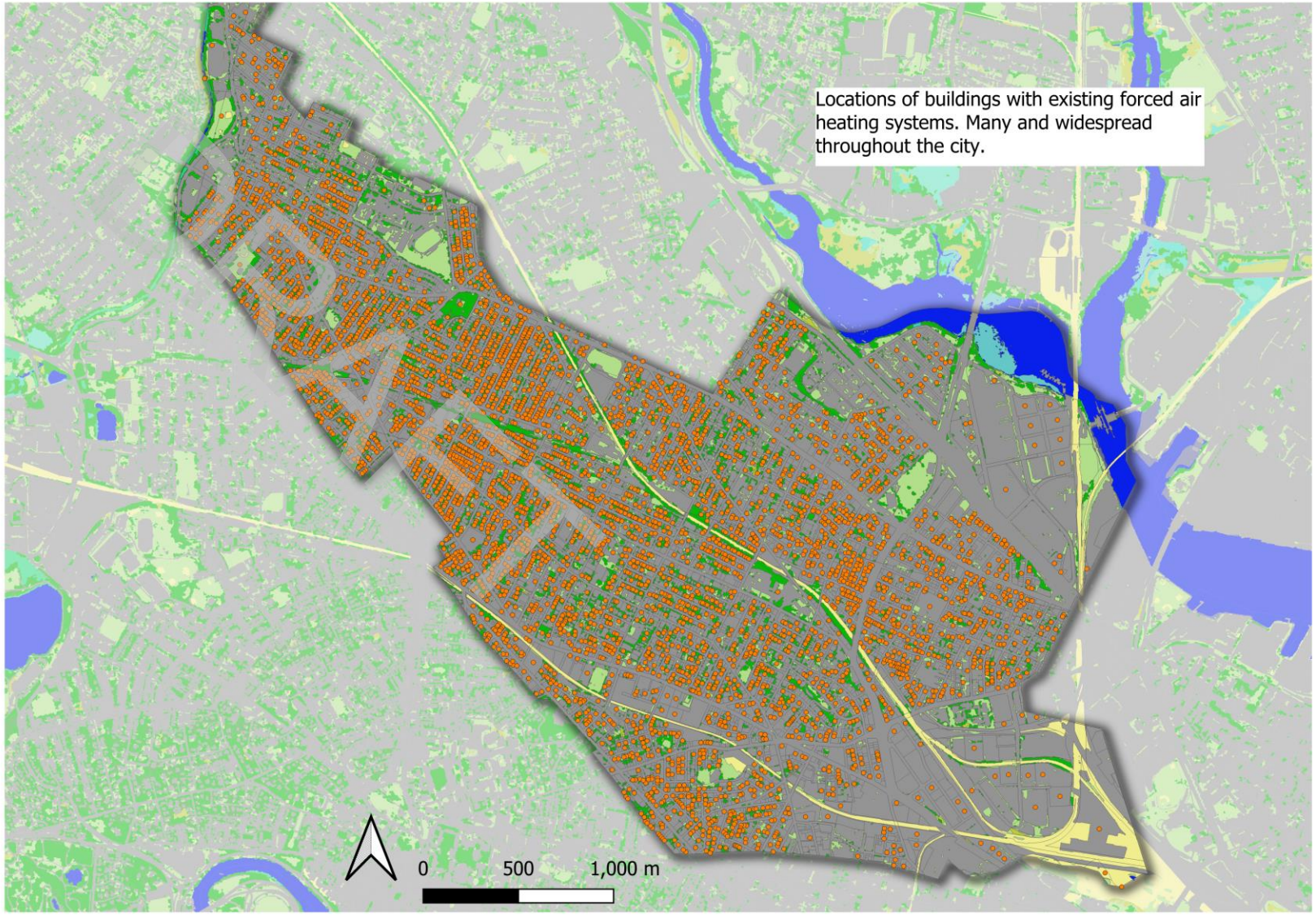
| | 2030 | 2040 | 2050 |
|---|---|---|---|
| % of Homes Retrofitted | 55% | 90% | 100% |
| Total # of Homes Retrofitted | 10,175 | 16,650 | 18,500 |
| Avg Homes / Year | 1,454 | 648 | 185 |
| GHG Reduced (MTCO2e) | 78,496 | 132,501 | 152,971 |
| New Electricity Added (MWhs) | 62,605 | 102,445 | 113,828 |



# Retrofit Wave 1 – Existing Ducts

Structures with existing forced air distribution should be relatively simpler to electrify and offer potential to make significant progress if they can be prioritized

Count: 8,790

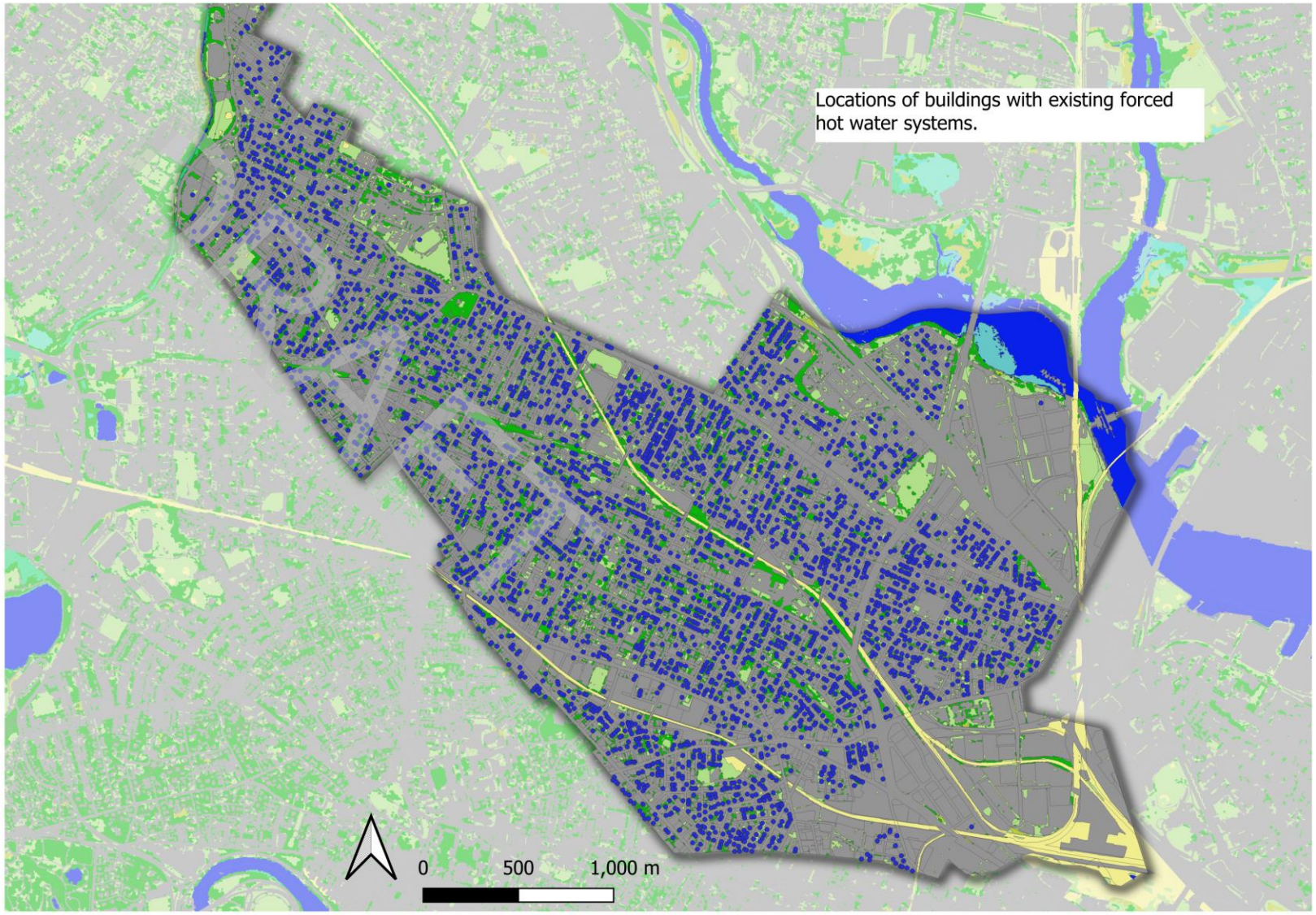


# Wave 2 – Hot Water Heating

Air-to-Water Heat Pump technology is in development

These structures could benefit with simpler projects that retain the existing heat distribution system

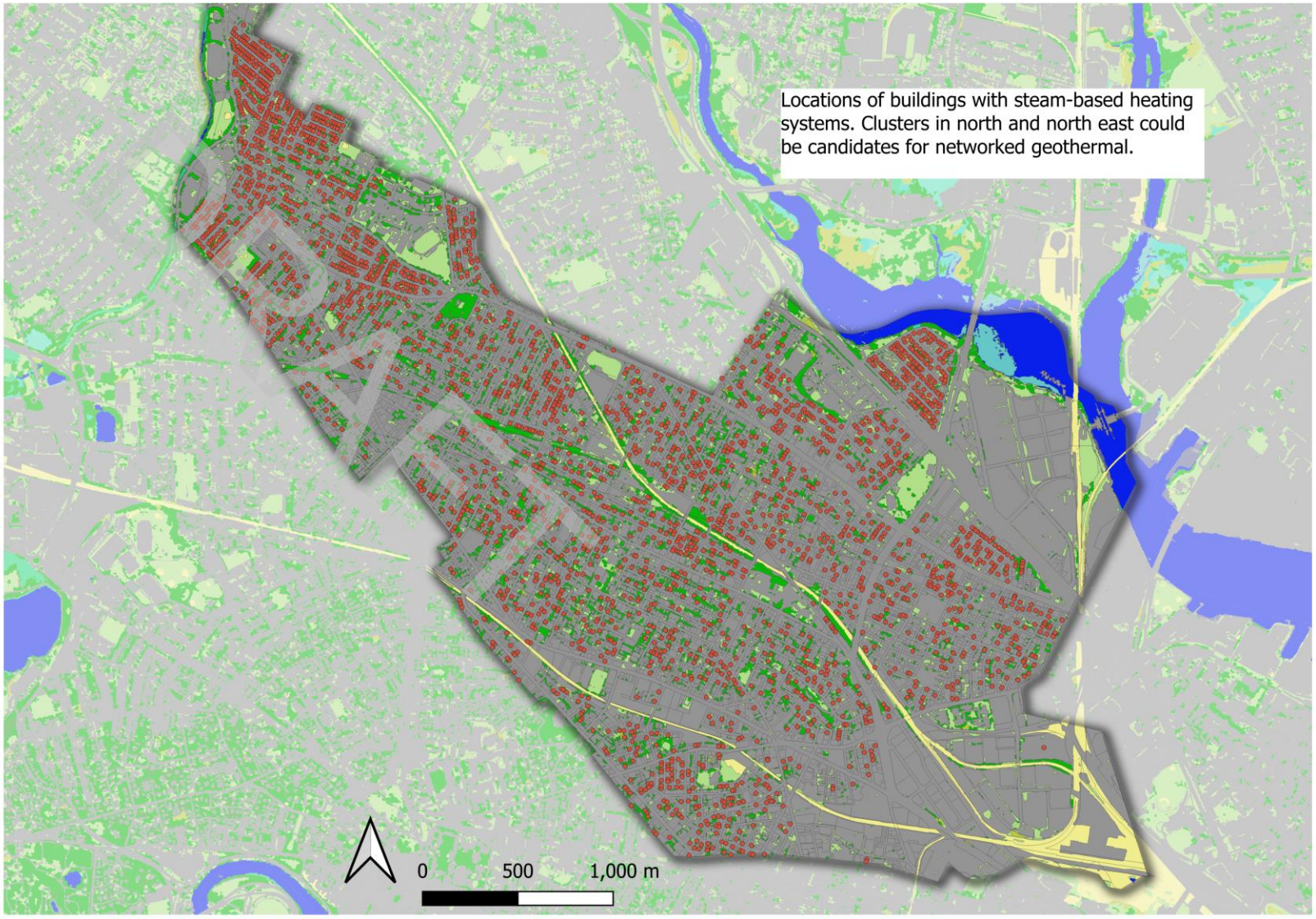
Count: 5,804



# Wave 3 & Special Projects

Steam systems may be most challenging, but interesting clusters could be opportunities for district-scale solutions

Count: 3,571



# Commercial Buildings Pathway Indicators

| | 2030 | 2040 | 2050 |
|---|---|---|---|
| % of Building Space Retrofitted | 50% | 90% | 100% |
| Total Area Retrofitted (SQFT) | 12,161,665 | 21,890,997 | 24,323,330 |
| Avg SQFT / Year | 1,389,905 | 972,933 | 243,233 |
| GHG Reduced (MTCO2e) | 43,079 | 78,956 | 89,733 |
| New Electricity Added (MWhs) | 19,843 | 35,717 | 39,685 |

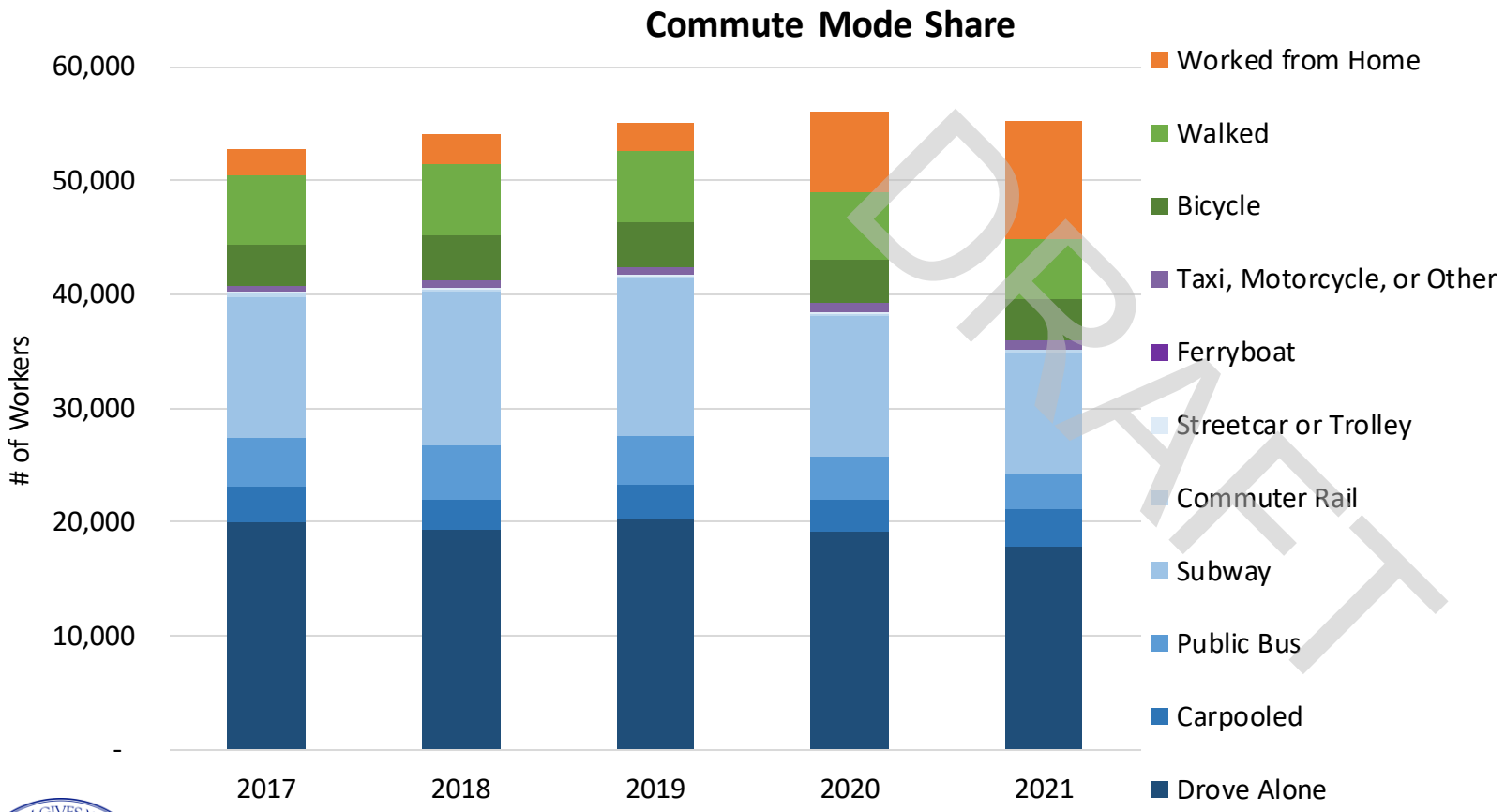
# Solid Waste

| Waste Incinerated | Residential tons | Commercial tons | Total tons | Residential % Change | Commercial % Change | Total % Change |
|---|---|---|---|---|---|---|
| 2014 | 17,382 | 24,457 | 41,840 | | | |
| 2016 | 17,045 | 25,047 | 42,091 | -2% | 2% | 1% |
| 2018 | 16,660 | 26,465 | 43,125 | -2% | 6% | 2% |
| 2020 | 10,252 | 34,946 | 45,198 | -38% | 32% | 5% |

# EV Uptake Pathways Indicators

| | 2030 | 2040 | 2050 |
|---|---|---|---|
| **Passenger Vehicles & SUVs** | | | |
| Percent EV/PHEV | 40.0% | 90.0% | 100.0% |
| Registered EV/PHEV in Somerville | 30,152 | 67,843 | 75,381 |
| ~ New Vehicles per Year | 6,030 | 6,784 | 7,538 |
| Additional Electricity Use (MWh) | 44,512 | 103,799 | 120,802 |
| **Commercial Trucks** | | | |
| Percent EV/PHEV | 9.9% | 80.0% | 90.0% |
| Registered EV/PHEV in Somerville | 216 | 1744 | 1962 |
| ~ New Vehicles per Year | 43 | 174 | 196 |
| Additional Electricity Use (MWh) | 9,695 | 81,256 | 95,783 |

# Commute Mode Share, Trips, EVs






| Commute Mode | 2017 vs 2021 |
|---|---|
| Drove Alone | -11% |
| Carpooled | 6% |
| Public Bus | -24% |
| Subway | -16% |
| Commuter Rail | -9% |
| Streetcar or Trolley | -72% |
| Ferryboat | 1100% |
| Taxi, Motorcycle, or Other | 46% |
| Bicycle | 3% |
| Walked | -13% |
| Worked from Home | 350% |

Source: U.S. Census ACS Means of Transportation to Work