

The All-Electric Multifamily: Trends, Technologies and Best Practices for Designing a Gas-Free Future

In order for New York and other northeastern states to reach their carbon emission reduction goals, there needs to be a large emphasis on electrification in buildings. This session will explore the trend towards electrification in Multifamily type buildings by looking at data from past multifamily projects that were enrolled through the Mass Save program in Massachusetts.

We will also look into modeled and actual energy consumption data for projects in New York that went through the Energy Star Multifamily High Rise program, with more typical gas fuel source versus electric for space heating. Then we will dive into the current technologies to go all electric for space heating using VRF and heat pump and other technologies, address some of the concerns we hear from the industry and potential solutions.

We will conclude with the current challenges for domestic hot water and what electric options we have for multifamily buildings.



The All Electric Multifamily

Trends, Technologies and Best Practices for Designing a
Gas-Free Future

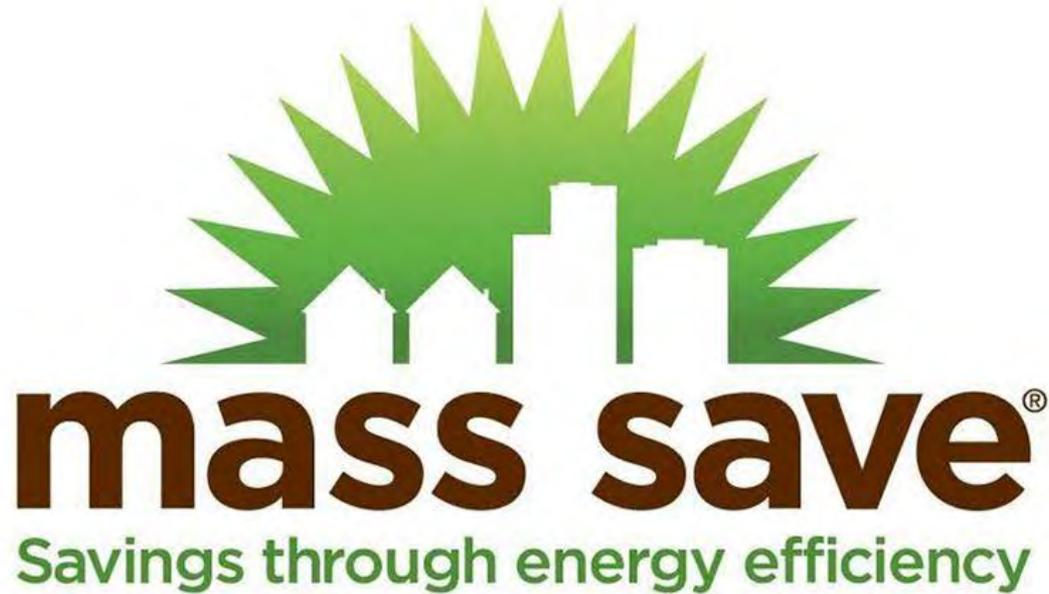
About the Speaker:

Bill Womeldorf



- Consultant for the Mass Save Multifamily Program (New Construction and Renovations)
- Director for MassLandlords, Inc., and Western Mass Real Estate Investment Association, Inc.
- Chairman for the USGBC Mass Chapter Residential and Multifamily Committee and State Advocacy

About Mass Save:



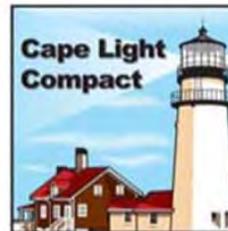
About Mass Save:

EVERSOURCE

nationalgrid

HERE WITH YOU. HERE FOR YOU.

 **Liberty Utilities**



**BLACKSTONE
GAS COMPANY**

**Columbia Gas[®]
of Massachusetts**

A NiSource Company

 **Unitil**
energy for life


**BERKSHIRE
GAS**

What is your big picture goal?

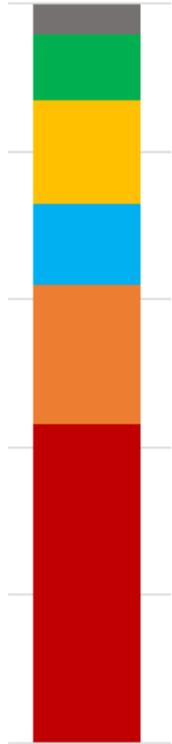
To help create a world in which all buildings run on clean, renewable energy...

How do we break down this goal?

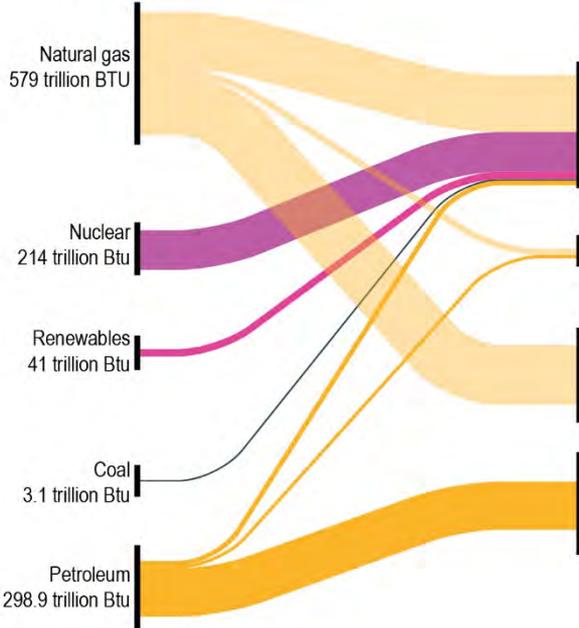
Pillars of Clean, Sustainable Buildings



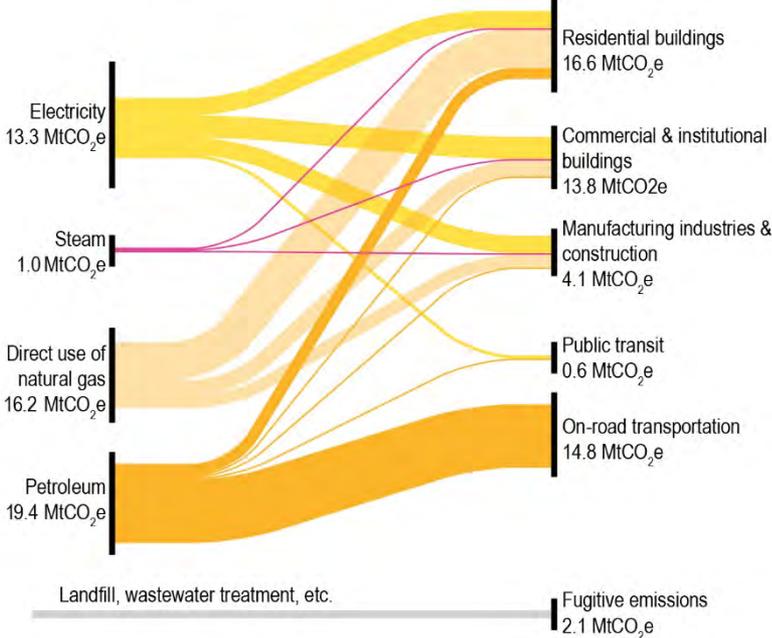
Why Electrification?



Source energy 1,136 trillion Btu



GHG emissions 52.0 MtCO₂e



Why Electrification?



Why Electrification?



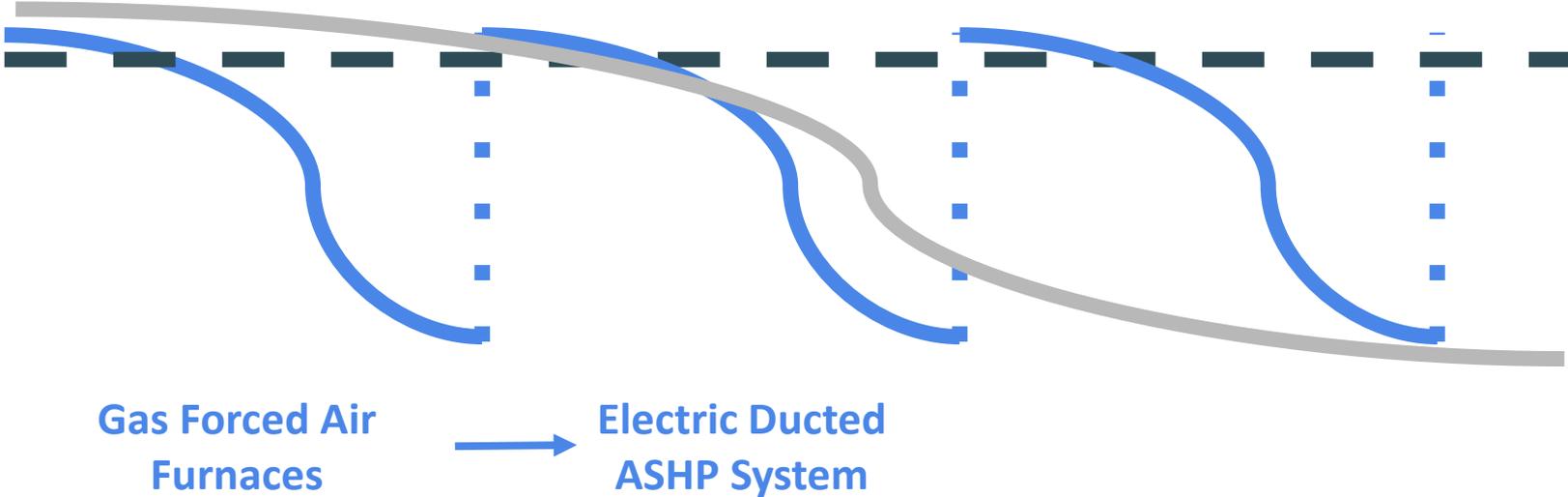
How Should We Electrify Buildings?

Micro-Level:

- **Needs to be non-invasive** or exotic for existing buildings (think ease of adoption on large scales)
- **Needs to be cost effective** and make financial sense for the property owner / investors, lenders
- **Needs to be market driven** - i.e. electric buildings should feel better for the occupant (think Tesla Motors)

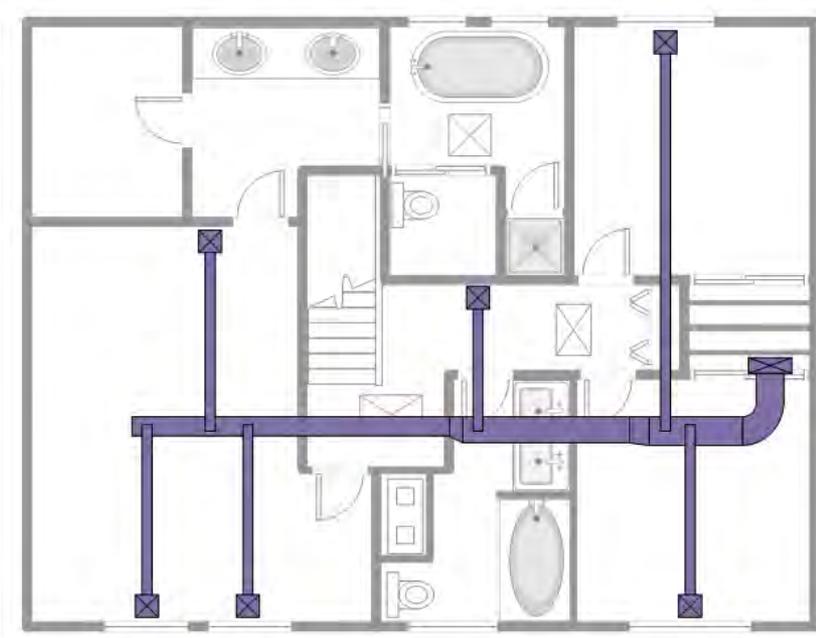
How Should We Electrify Buildings?

Needs to be *Non-Invasive*...



How Should We Electrify Buildings?

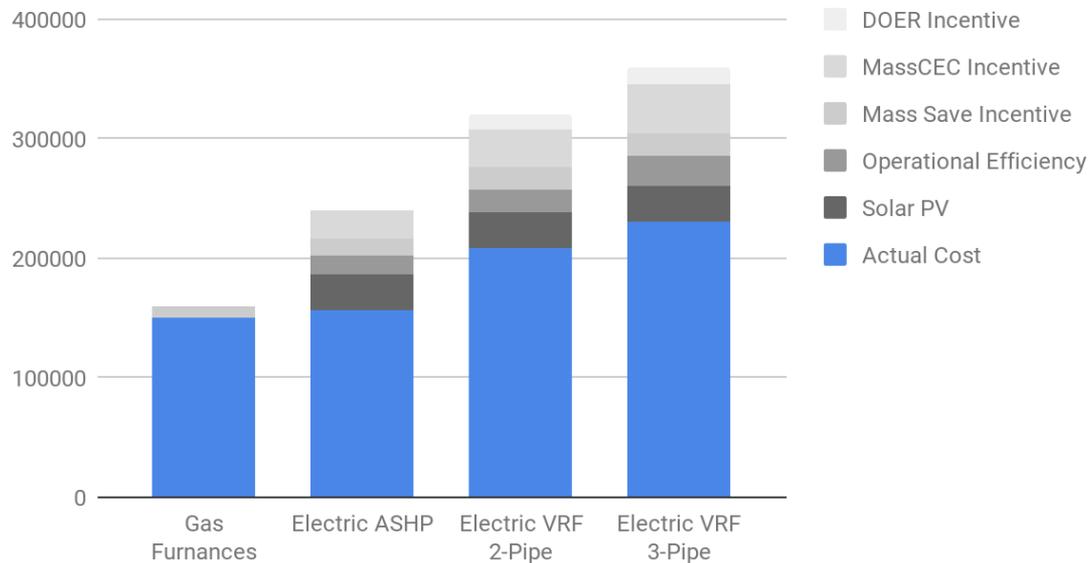
Needs to be *Non-Invasive*...



How Should We Electrify Buildings?

Needs to be **Cost-Effective** to do so...

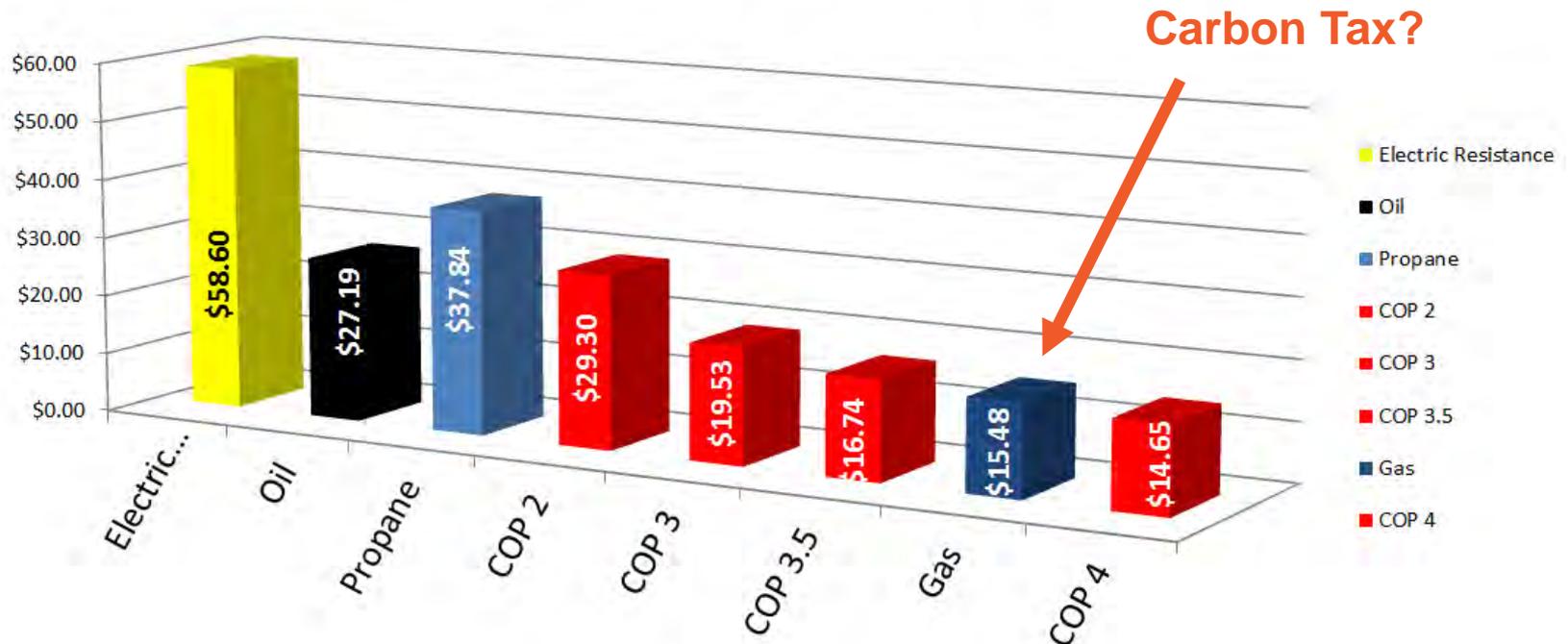
Analysis of Up-Front Costs



How Should We Electrify Buildings?

Needs to be *Cost-Effective* to do so...

Cost per Million BTU's



How Should We Electrify Buildings?

Needs to be *Market Driven...*

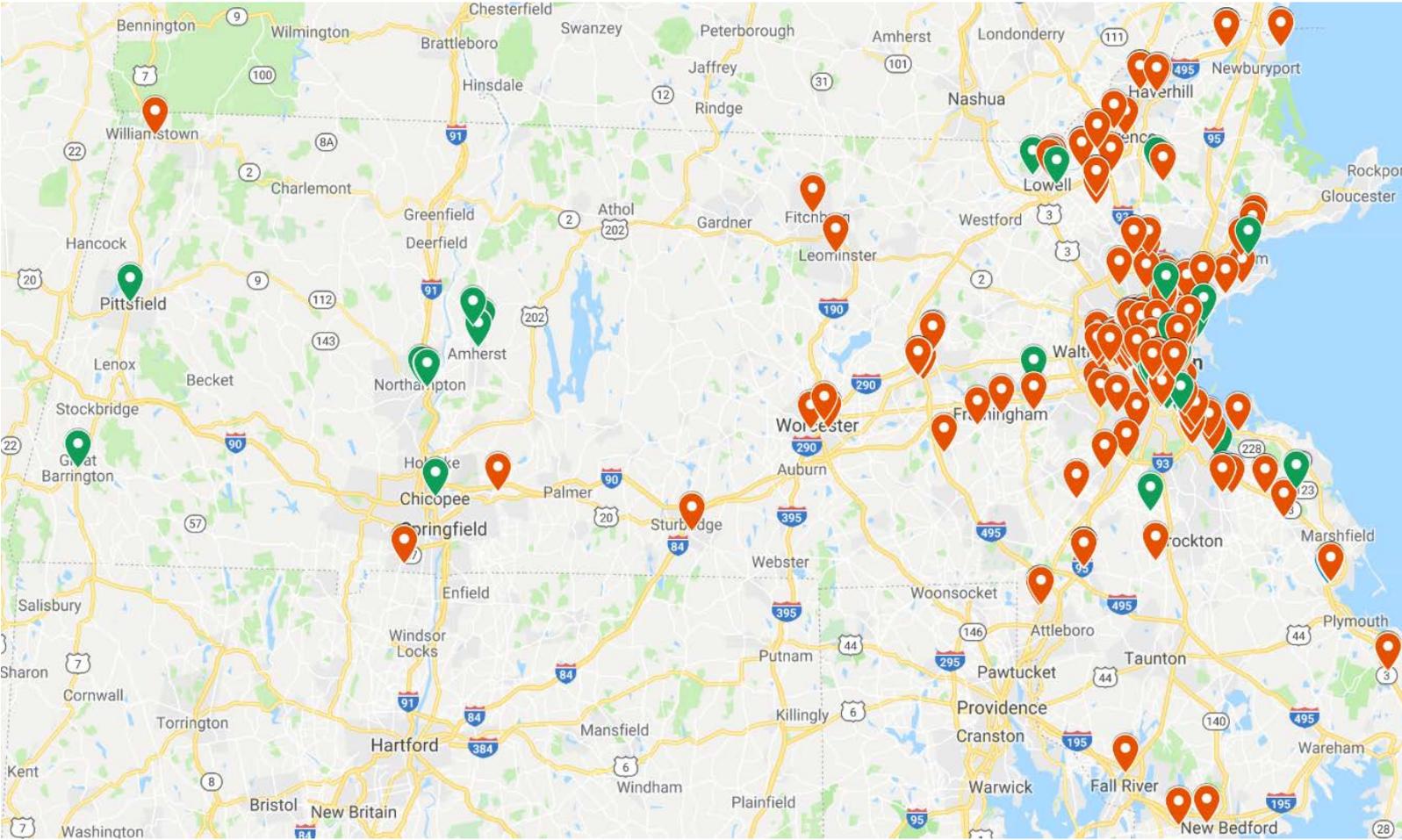


How Should We Electrify Buildings?

Needs to be *Market Driven...*



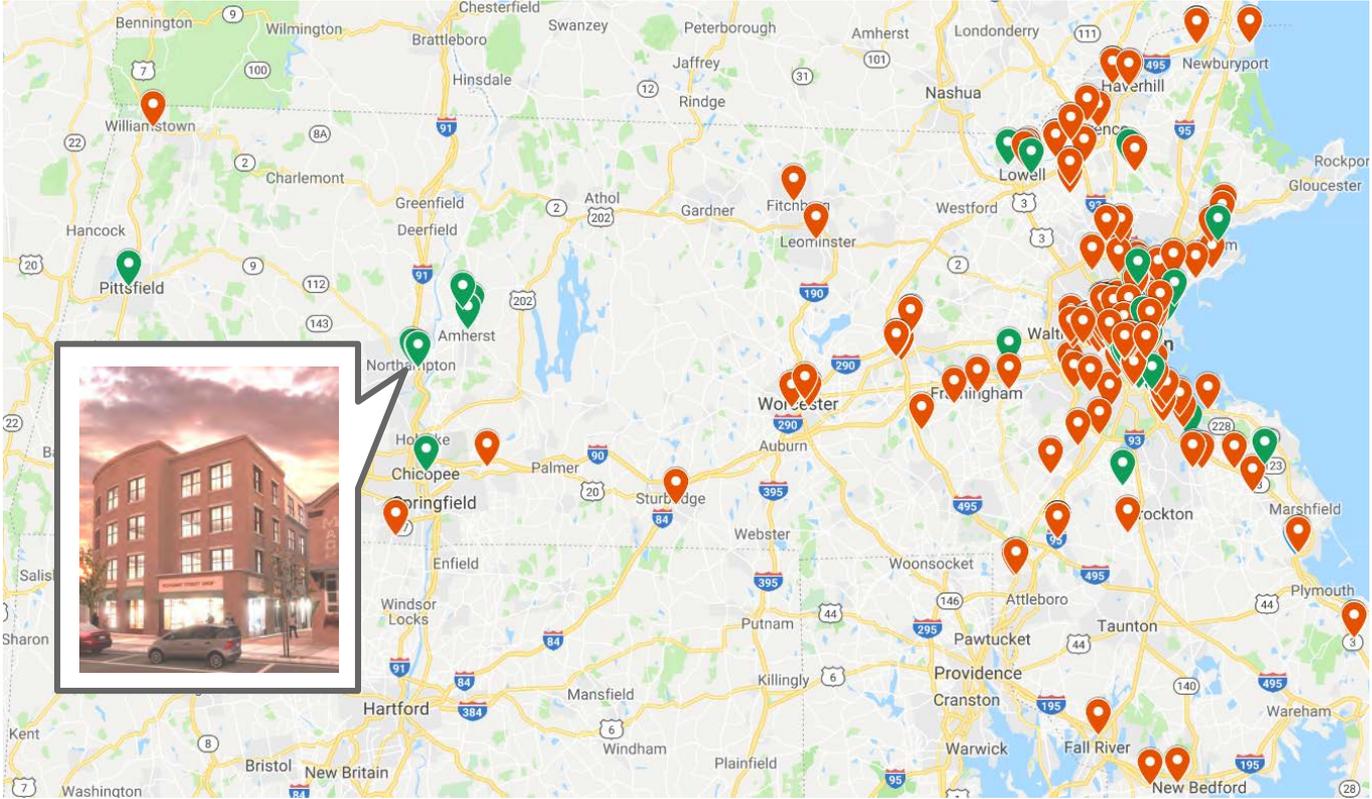
Massachusetts Multifamily Projects



Massachusetts Multifamily Projects



Northampton, MA



Northampton, MA



55 Units + Retail

High efficiency central heating plant (propane) for DHW

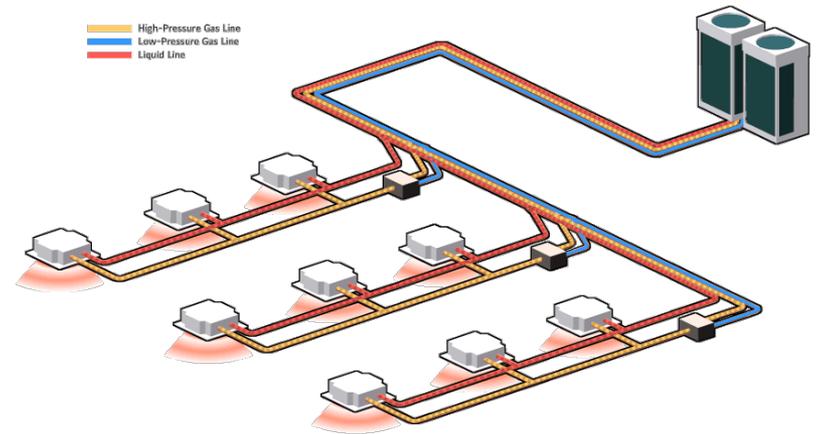
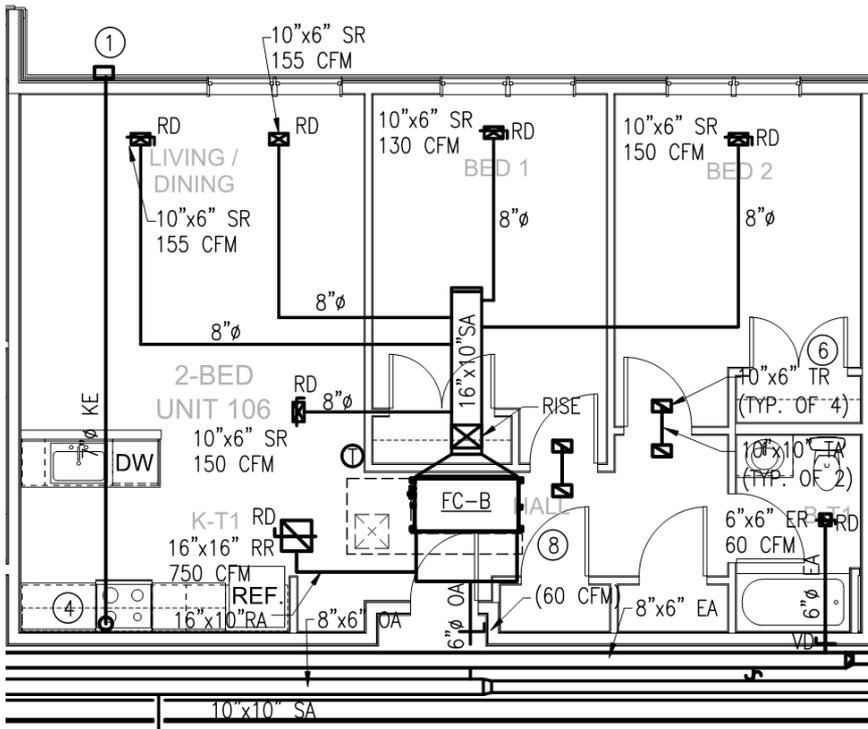
All electric VRF in-units and common areas

R-8 CI with cellulose in a 2x6 cavity

ERV with supply into the residential units

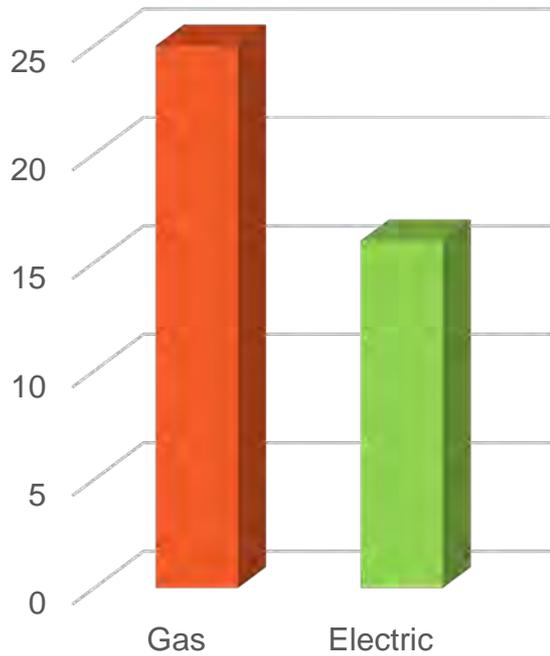
On-Site Solar PV, Owner pays all electric

Northampton, MA

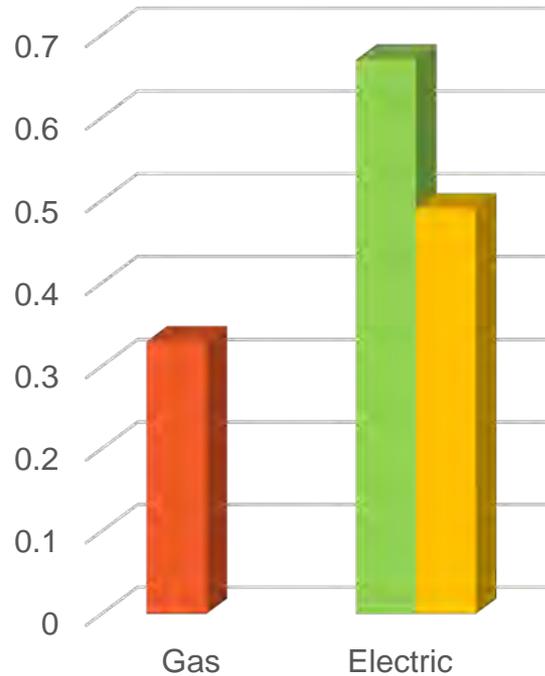


Northampton, MA

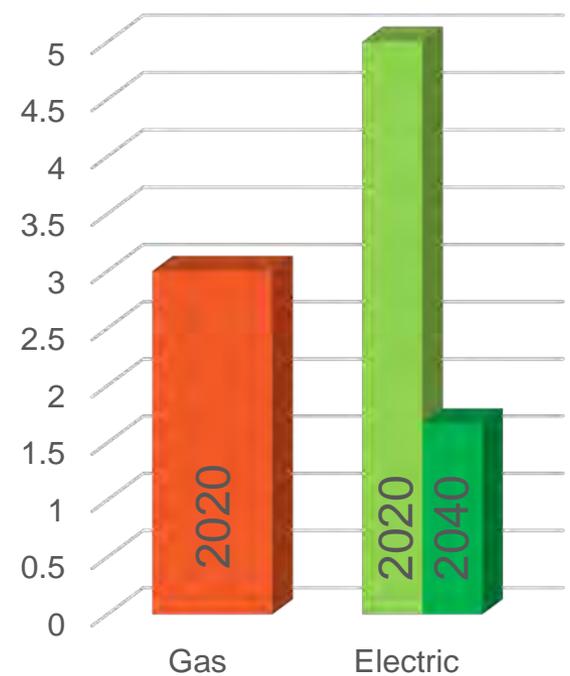
Heating Site Energy (kBtus/SF)



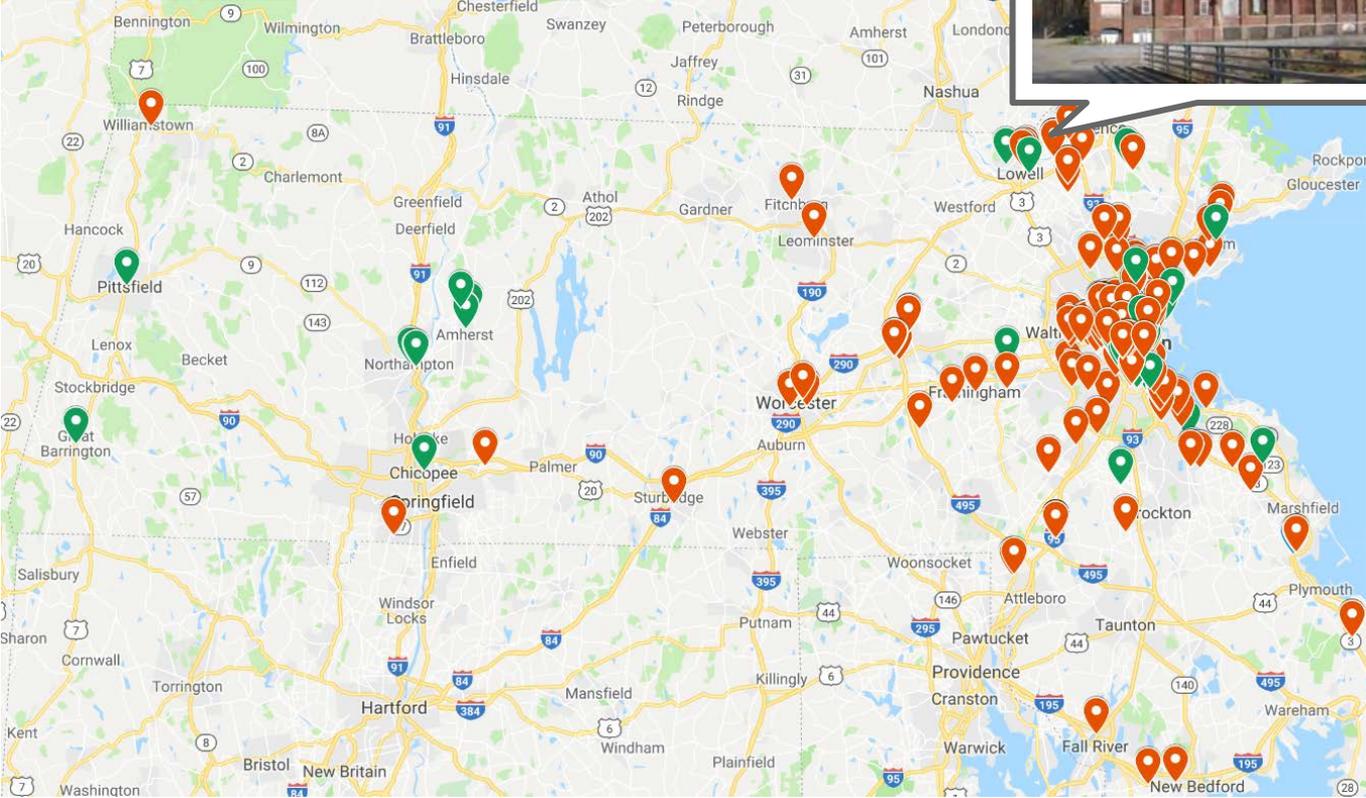
Annual Costs (\$/SF) with Solar



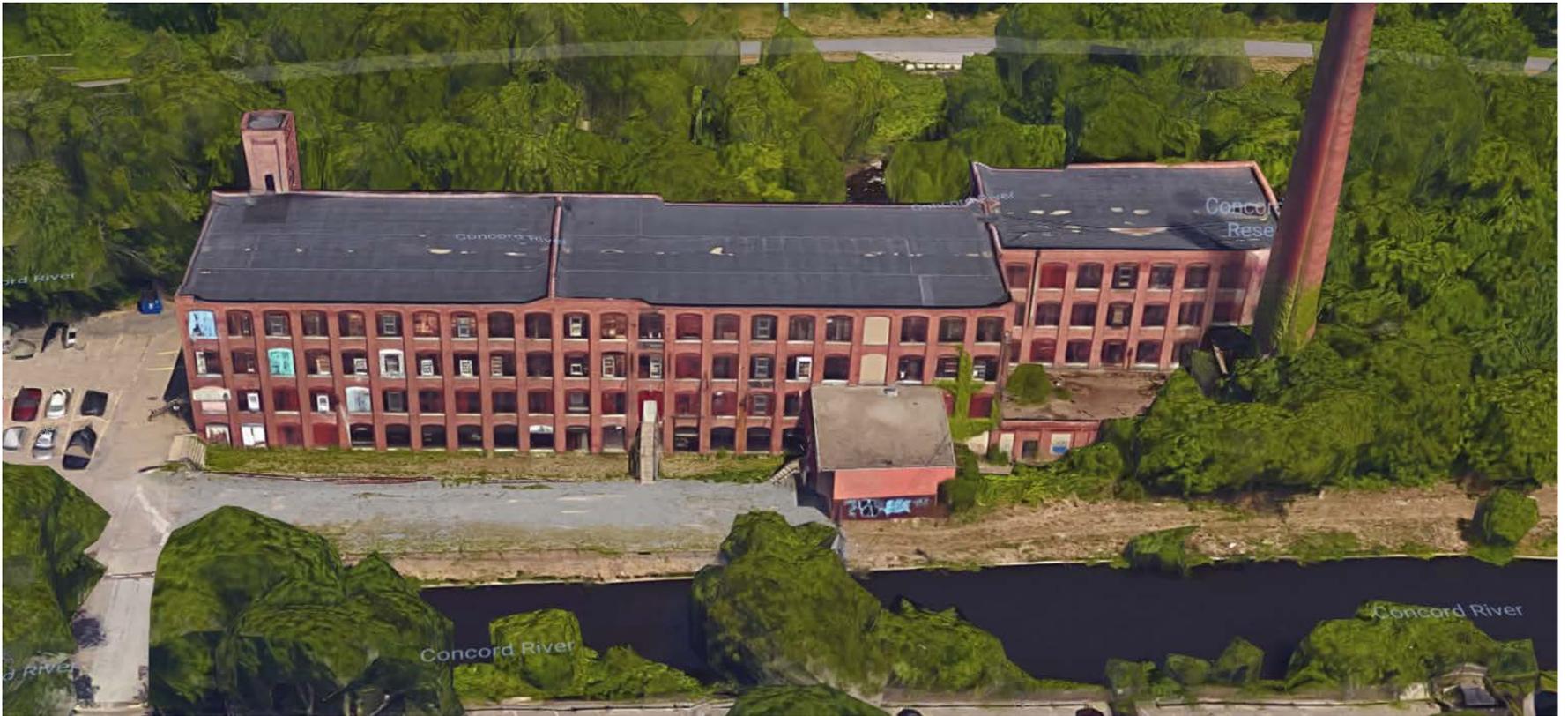
GHG Emissions (Lbs/SF)



Lawrence, MA

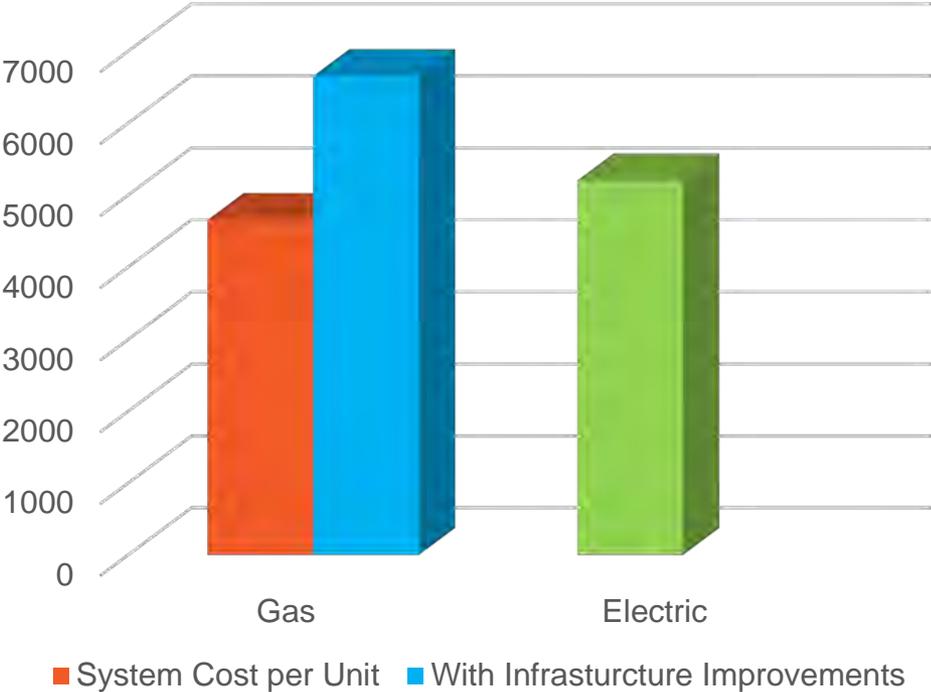


Lawrence, MA

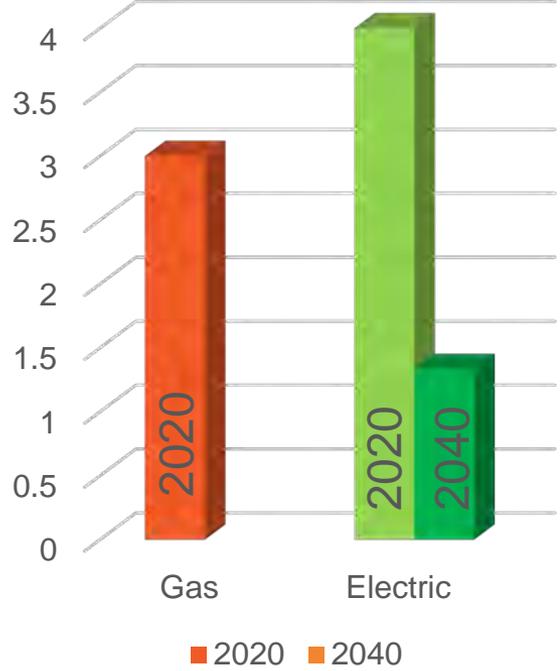


Lawrence, MA

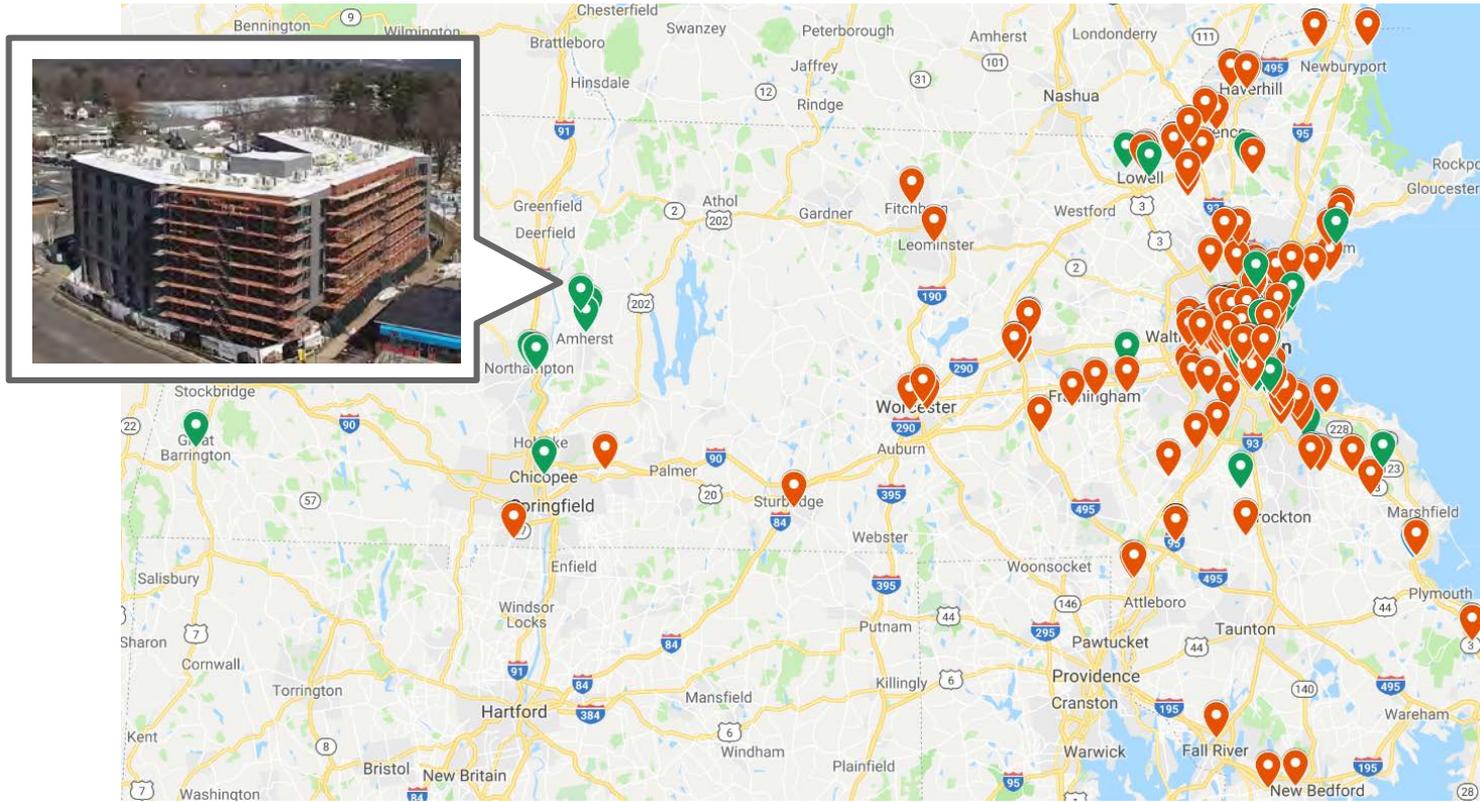
Up-Front Capital Cost (\$/Unit)



GHG Emissions (Lbs/SF)



Amherst, MA



Amherst, MA



135 Units (Studio, 1-Beds)

High efficiency central heating plant (propane)

Ductless, and Ducted air source heat pumps, VRF with heat recovery considered

R-8 CI with cellulose in a 2x6 cavity

ERV with supply into the residential units

How Should We Electrify Buildings?

Macro-Level:

- **Utility, State and City Incentive Programs** geared towards helping developers and owners in the added costs for electric systems; and remove incentives for gas based systems
- **Limiting the supply of gas** so that the economics make more sense for electric buildings (think Western Mass)
- **Adding a tax on gas based systems** - tax could fund more electric incentive programs.

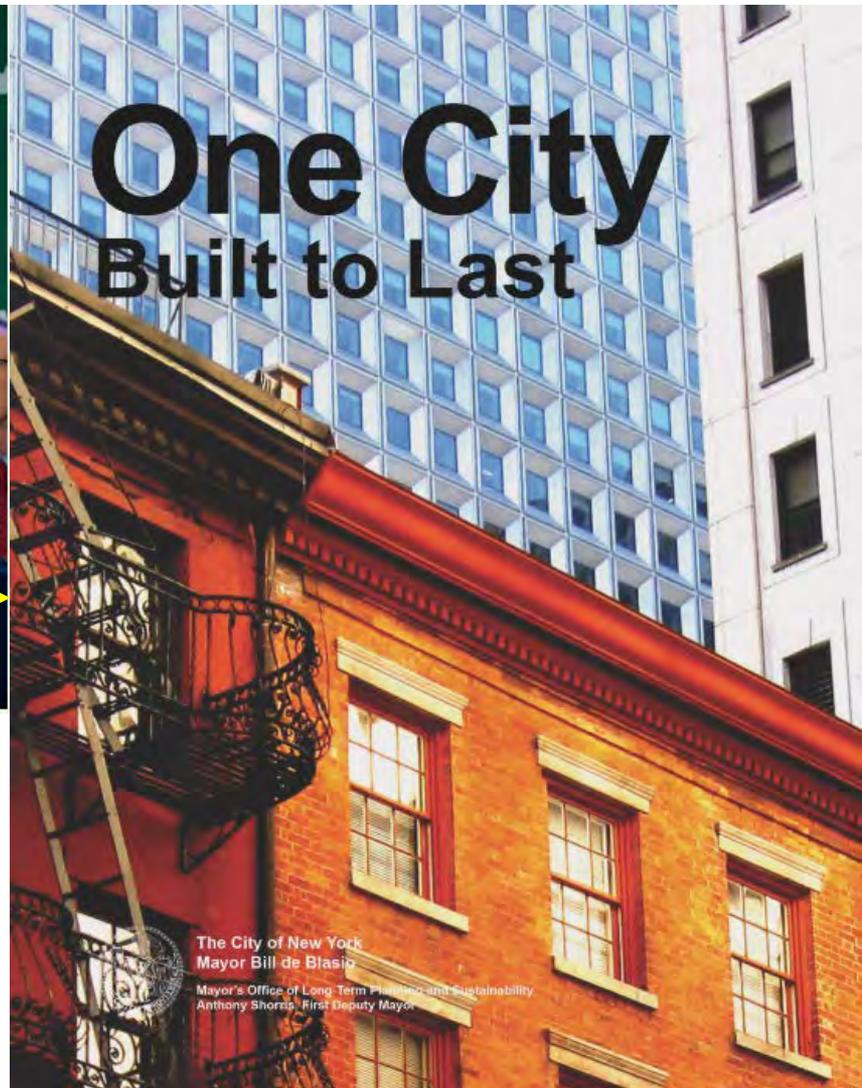
Sofia Melo
Building Systems Director
Steven Winter Associates, Inc.



Some more background...



- An all-electric building has the potential* to operate 100% based on renewable and clean energy sources



Energy Star MFHR Projects in NY

- Certification mostly driven by NYSERDA incentives
- More than 100 Energy Star completed projects: less than 10% with electric heating
- Why we do not see more electric heating in these projects?

Energy Star MFHR Projects in NY

- Mostly affordable housing projects
- Heating is often paid by the owner
- Installation & Operation costs





Energy Star Multifamily High Rise

- **Modeled** energy cost savings 15-20% over ASHRAE 90.1
- Compartmentalization: 0.3 cfm50/sf
- Continuous insulation through envelope, min double glazed windows (< 40% WWR)
- Apartment kitchen and bathroom ventilation per ASHRAE 62.2
- Corridors and Common areas ventilation per ASHRAE 62.1
- Additional HVAC duct leakage testing required as applicable

System types: Mini Split Heat Pumps



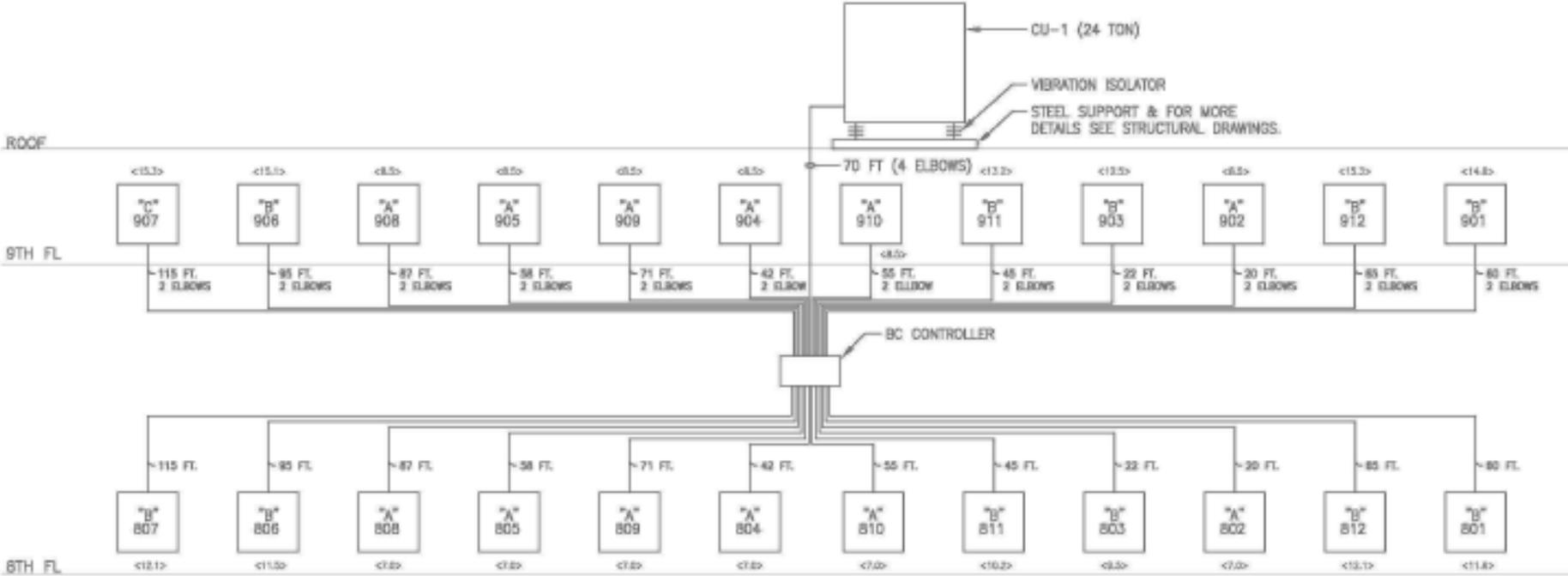
System types: VRFs



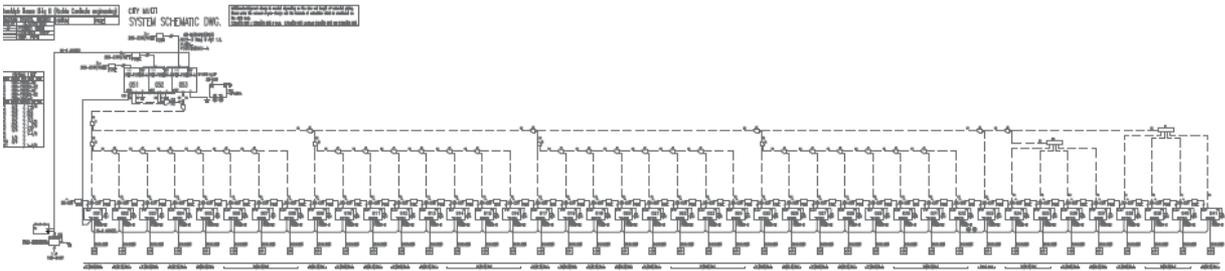
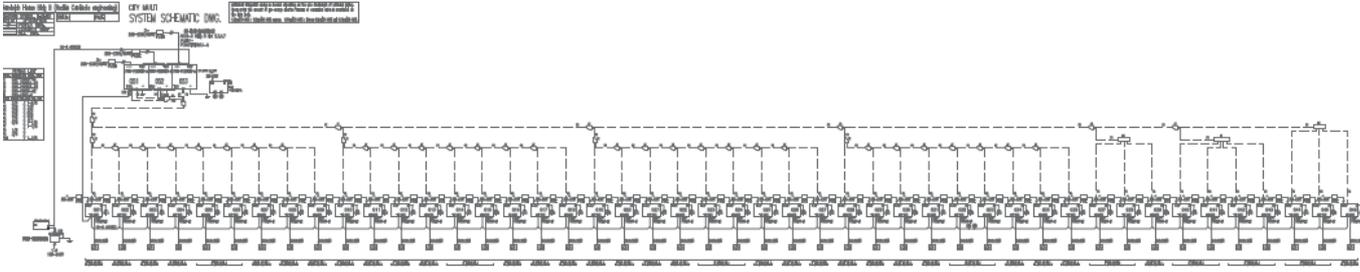
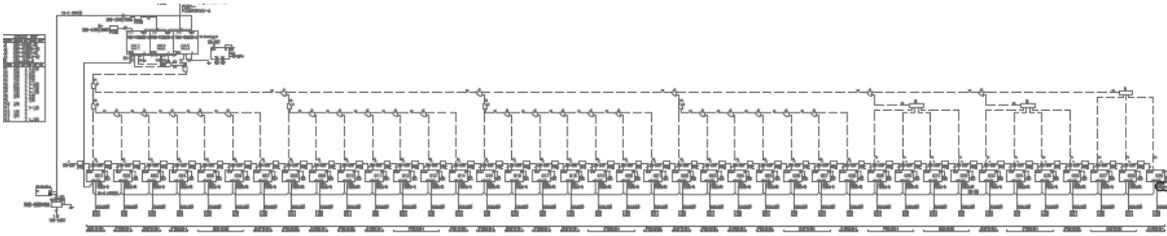
Indoor Units – Ducted vs split



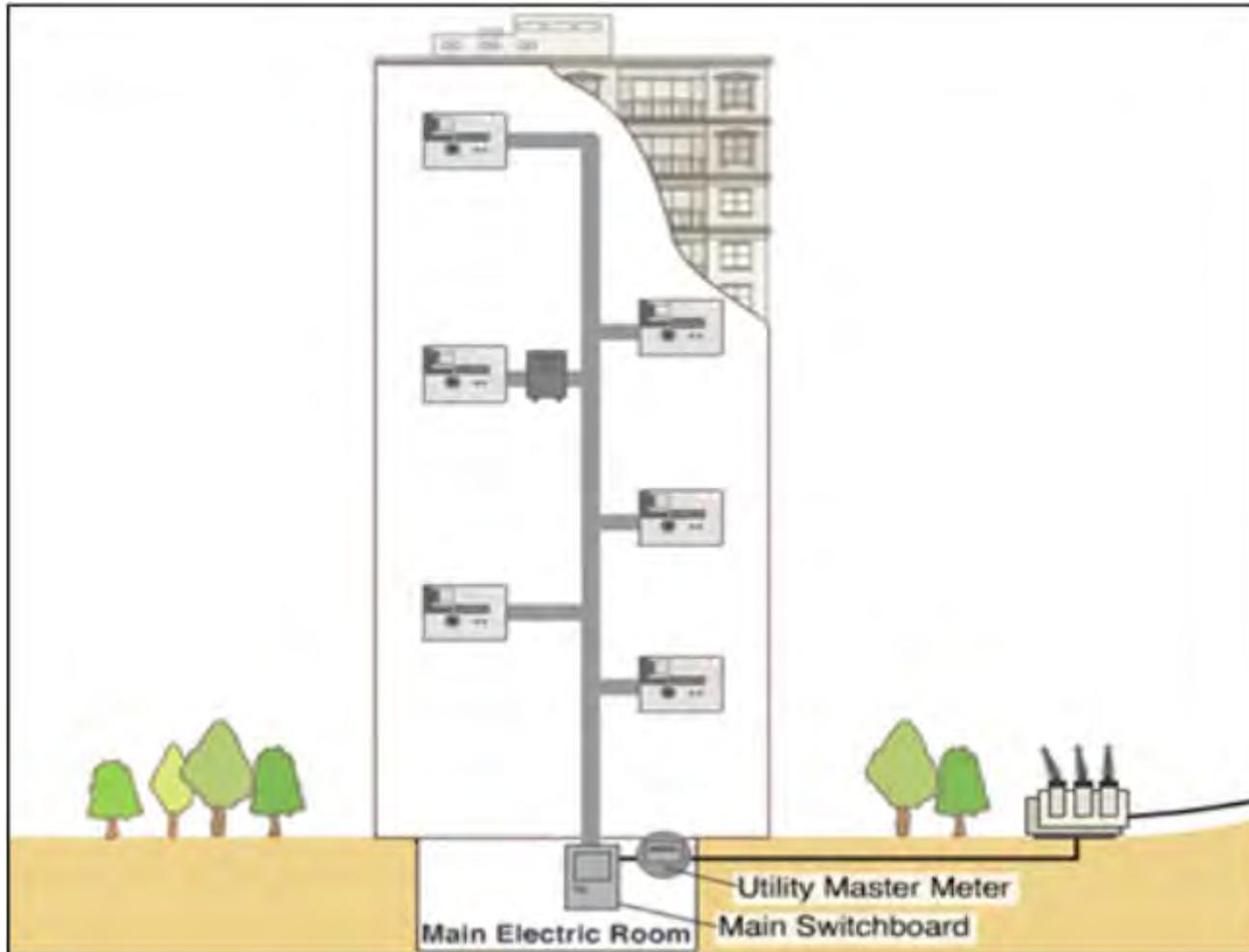
Most common Electric Heating options – VRFs



Most common Electric Heating options – VRFs



VRFs Submetering



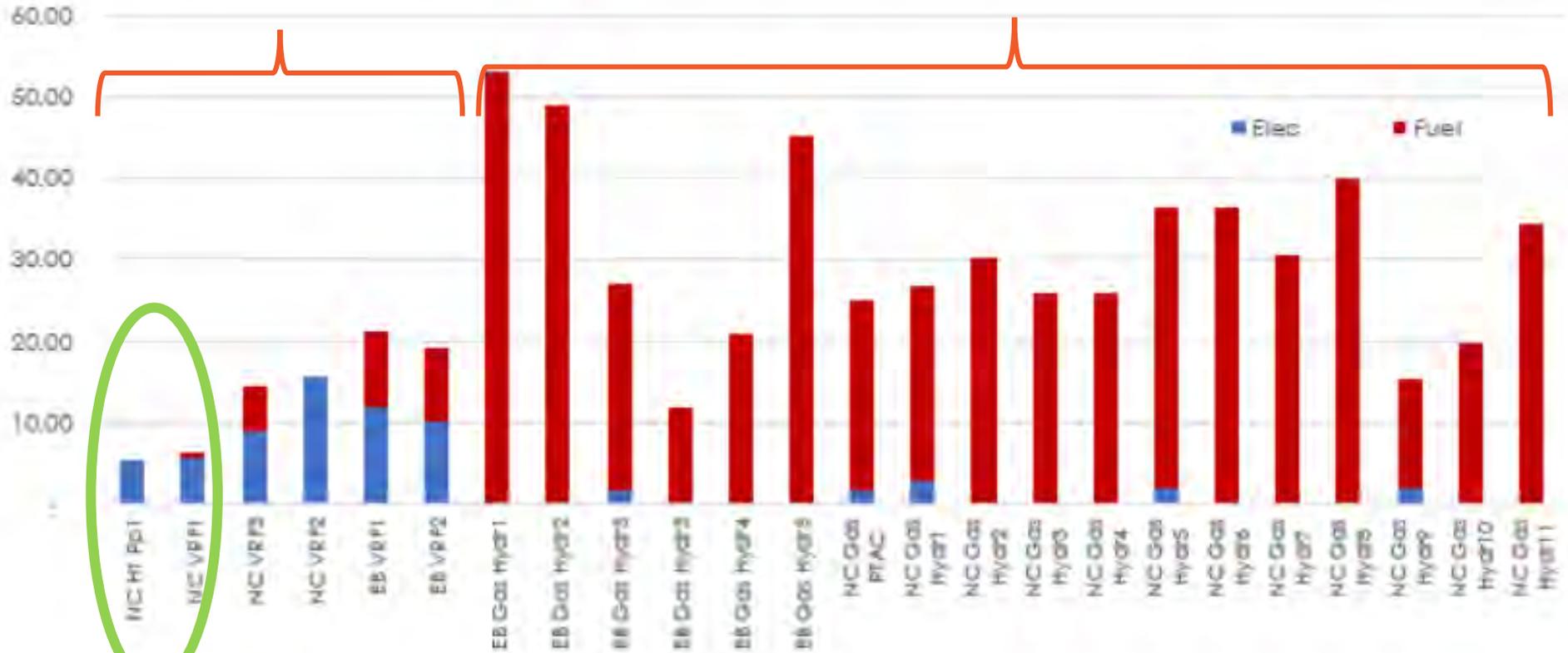
Side Note – Packaged Heat Pumps PTHP



Site Heating Energy Use per SF (kBtu/SF)

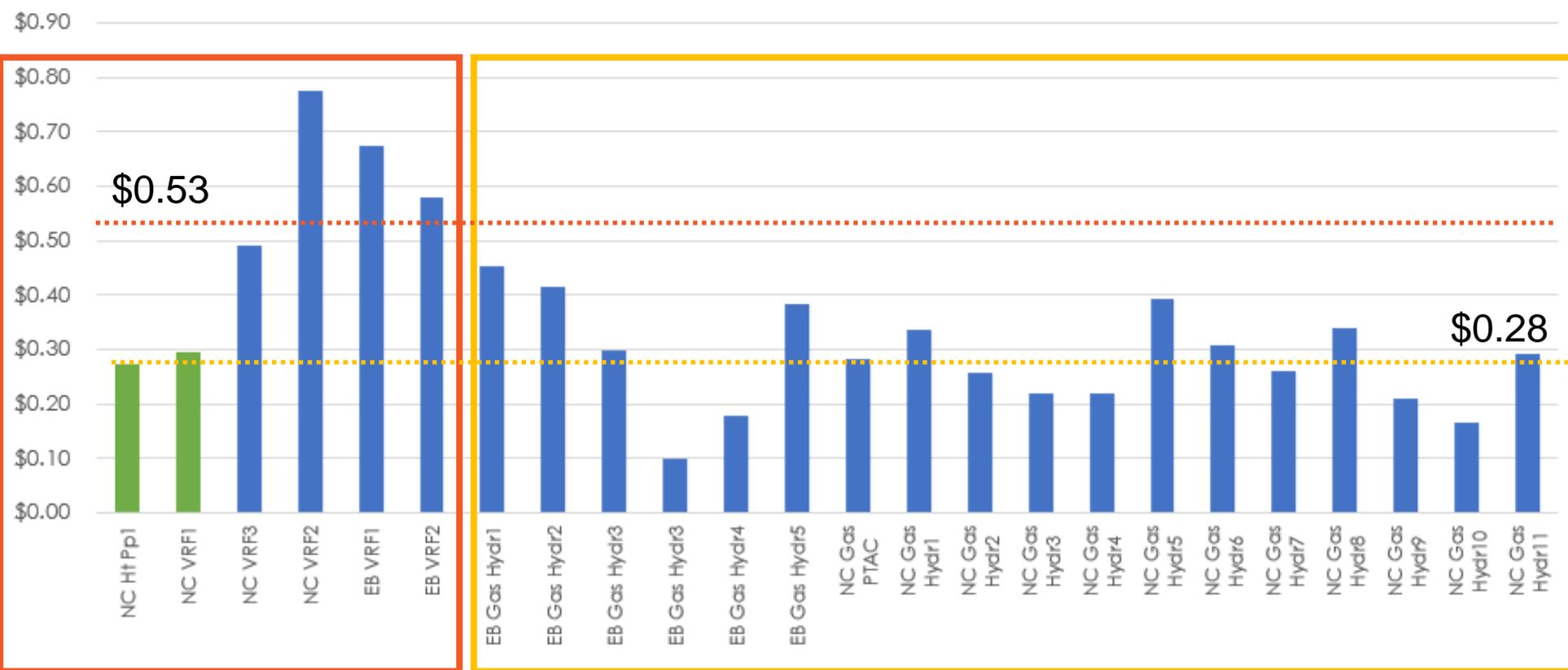
Electric

Gas

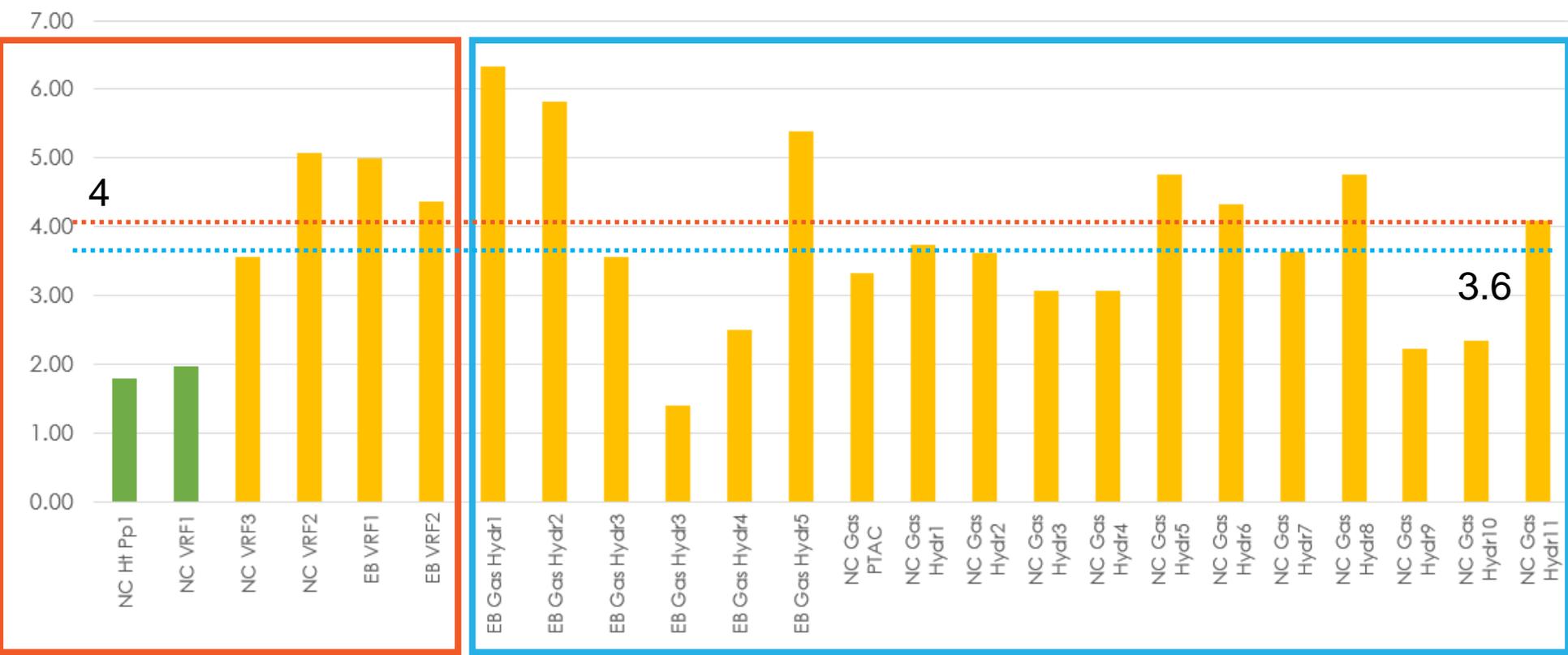


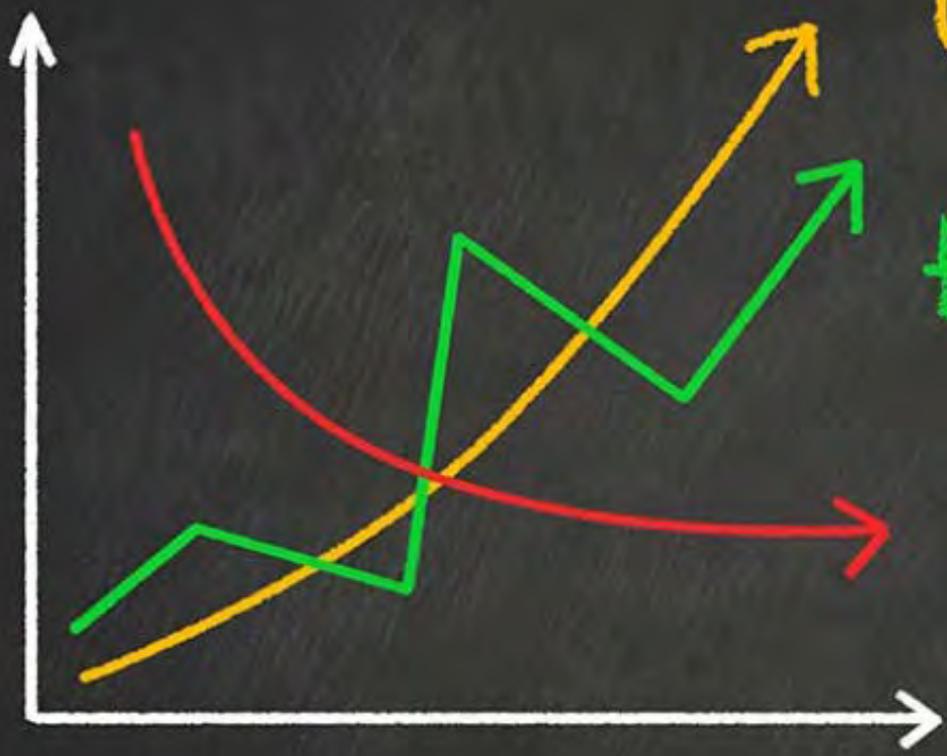
High performance buildings

Total Heating Cost per SF (\$/SF)



Heating GHG (Lb/SF)
Using NYC non-baseload coefficients





QUALITY

EFFICIENCY

COST

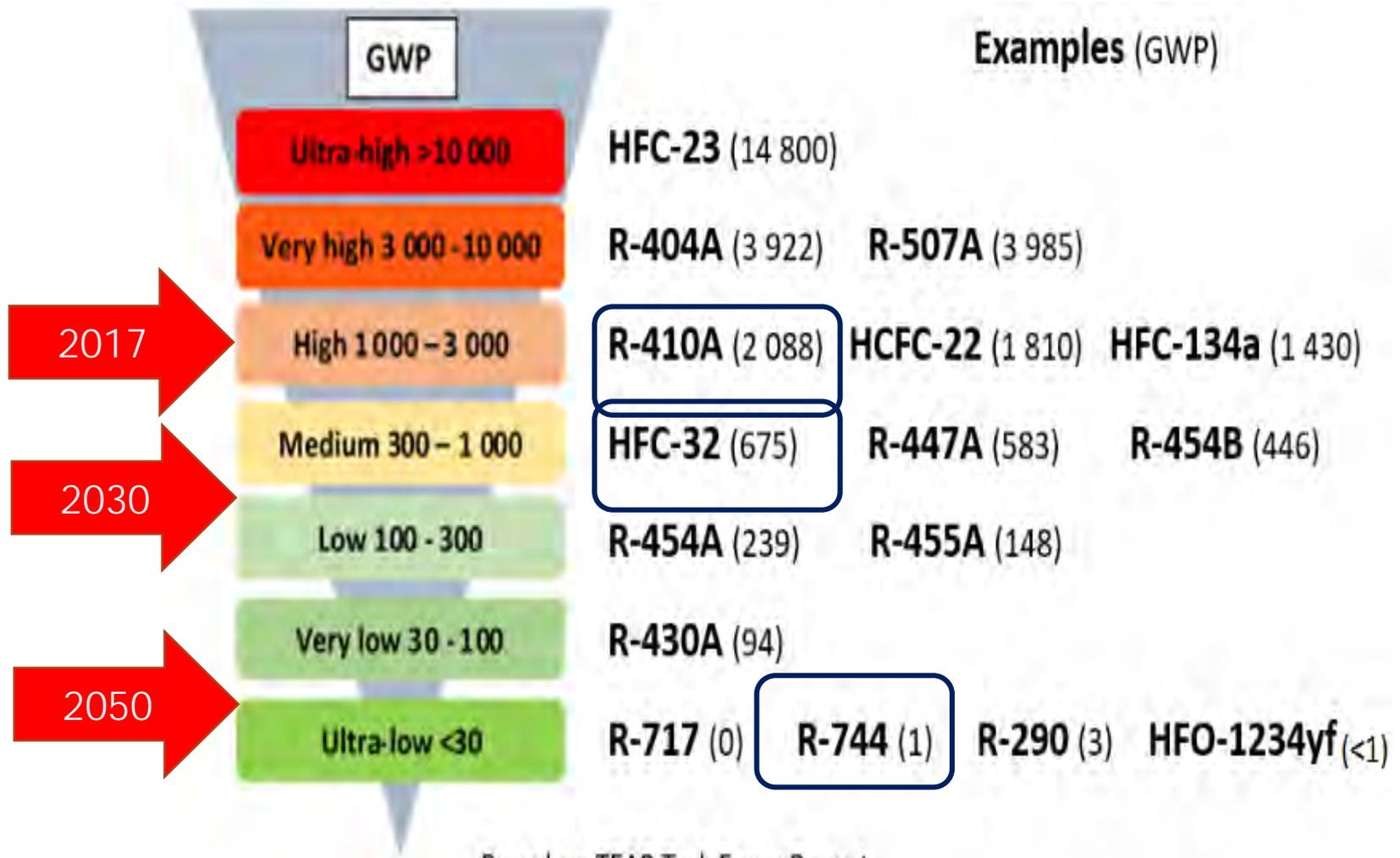


More critical factors to consider

- Properly sizing ALL the systems!
- Air leakage testing for ducted systems
- System must be properly commissioned!
- Refrigerant charging and leakage monitoring



Refrigerants



Based on TEAP Task Force Report

Look I know
I said 'energy saving' but this
is ridiculous!



Questions?