From Condensing to Heat Pump

Updating NYC's favorite multifamily domestic hot water conservation measure

Steven Winter Associates, Inc.

DHW in NYC

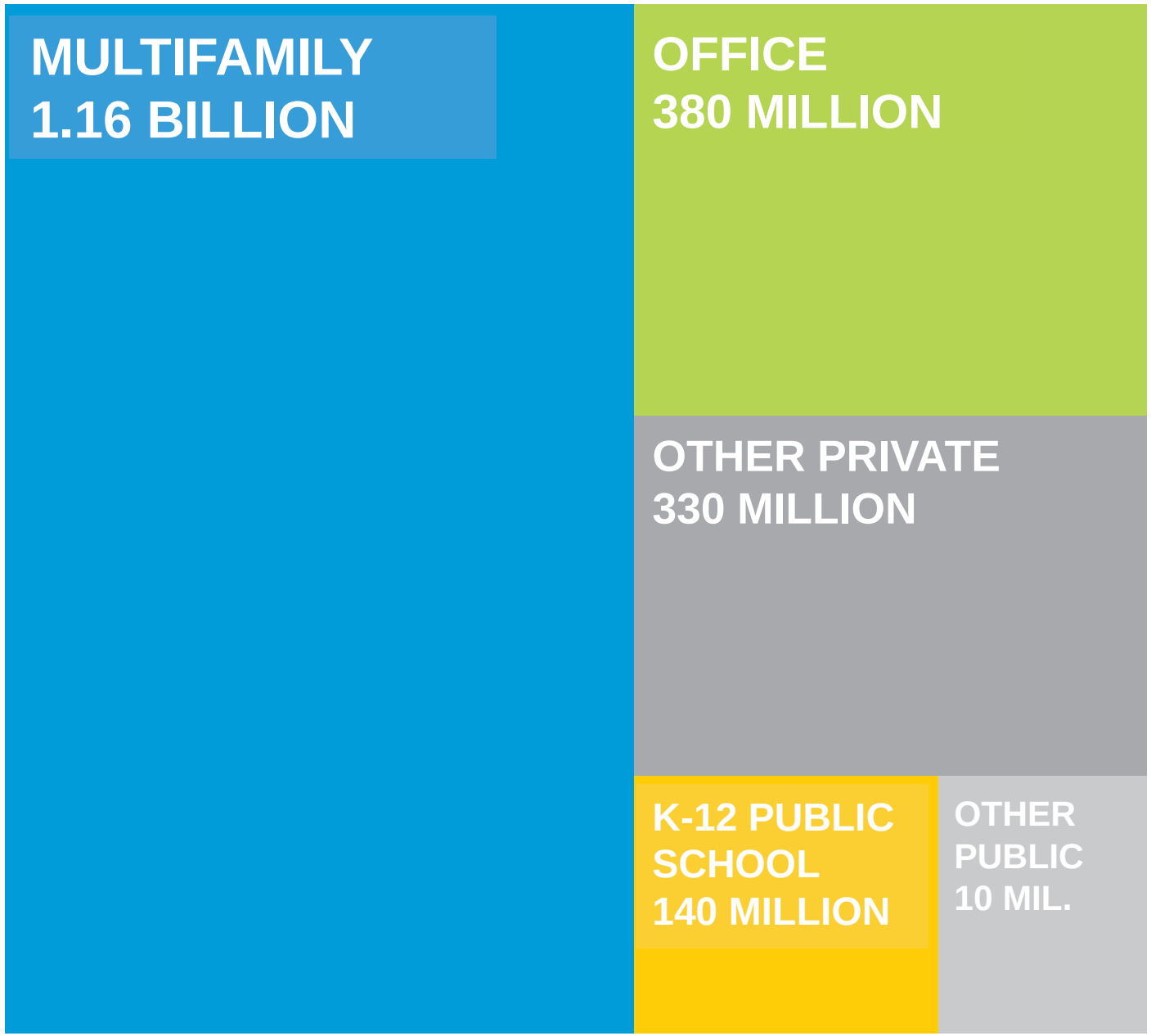
THE CURRENT STATE

Figure 3:

2015 Floor Area by Type for Public and Private Buildings

Multifamily buildings occupied the majority of benchmarked space, followed by office buildings, and public, K-12 schools. Hotels and private hospitals accounted for more area than the next five building types combined.

DATA: LL84 PUBLIC AND PRIVATE DATA



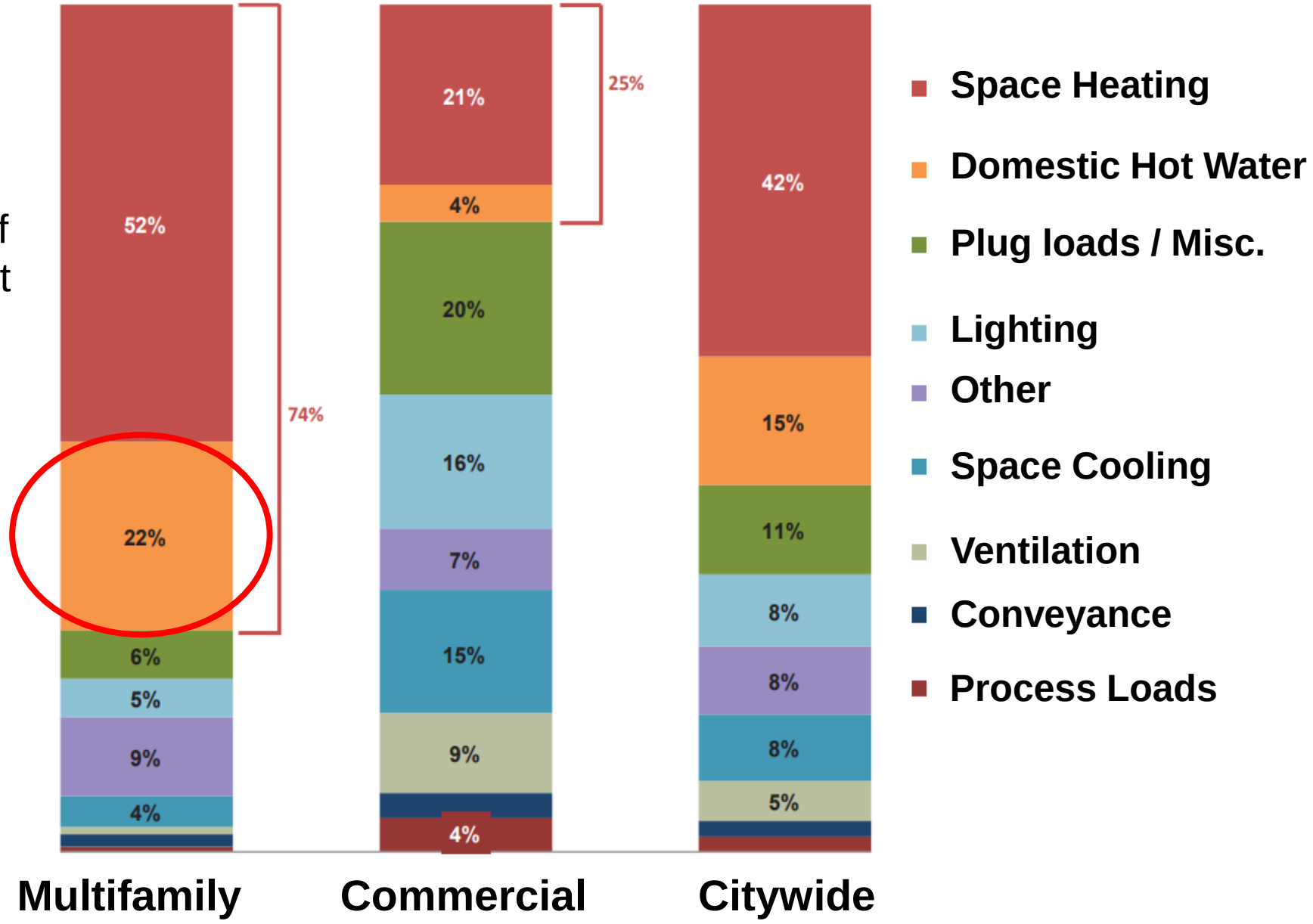
DHW in NYC Buildings

Figure 13:

Building Greenhouse Gas Emissions by End Use*

*The energy use breakdown of tenant-owned equipment is not collected in the LL87 submission forms which may impact the overall building energy use breakdown data. Original LL87 data has not been adjusted to accommodate for this limitation.

Source: NYC Mayor's Office



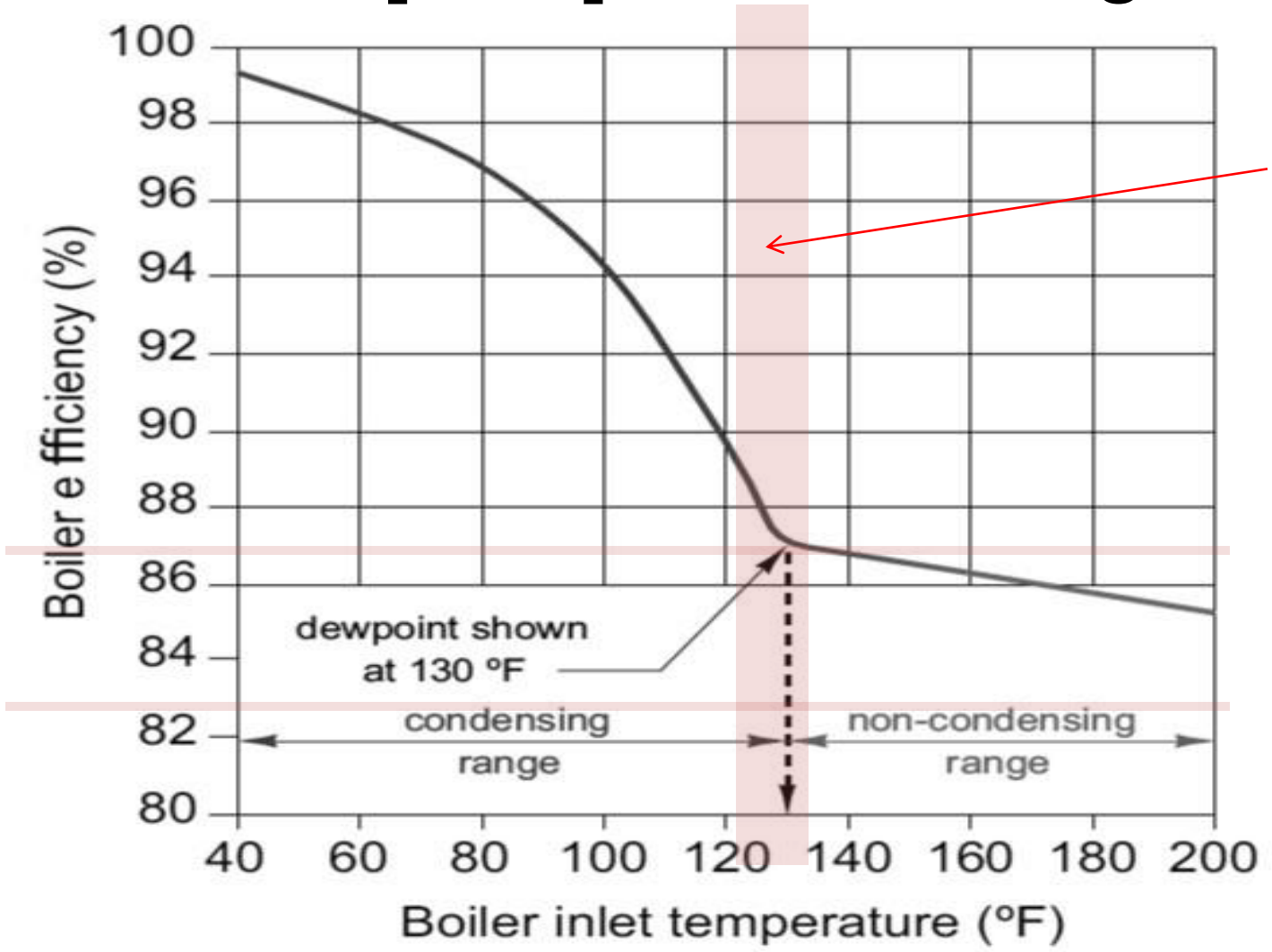
How NYC Makes DHW

- Central systems- scotch marine steam boiler in basement, DHW from tankless coil in boiler

- Auditors recommend separating DHW from heating boilers VERY often
  - "Running a big steam boiler for a small DHW load is inefficient"

Fuel Savings Are Not Big

Why the bad performance?
[Non] Condensing Boilers



Measured return water temperatures

“condensing” boiler ~87%

scotch marine boiler ~83%

The Verdict

- We would expect to see some savings (3-5% of DHW)
- Cost is HIGH (NYC = tall flues, expensive gas service, high cost of doing business)

- NYC climate goals require more GHG reduction

DHW in NYC

THE FUTURE

80x50 Roadmap

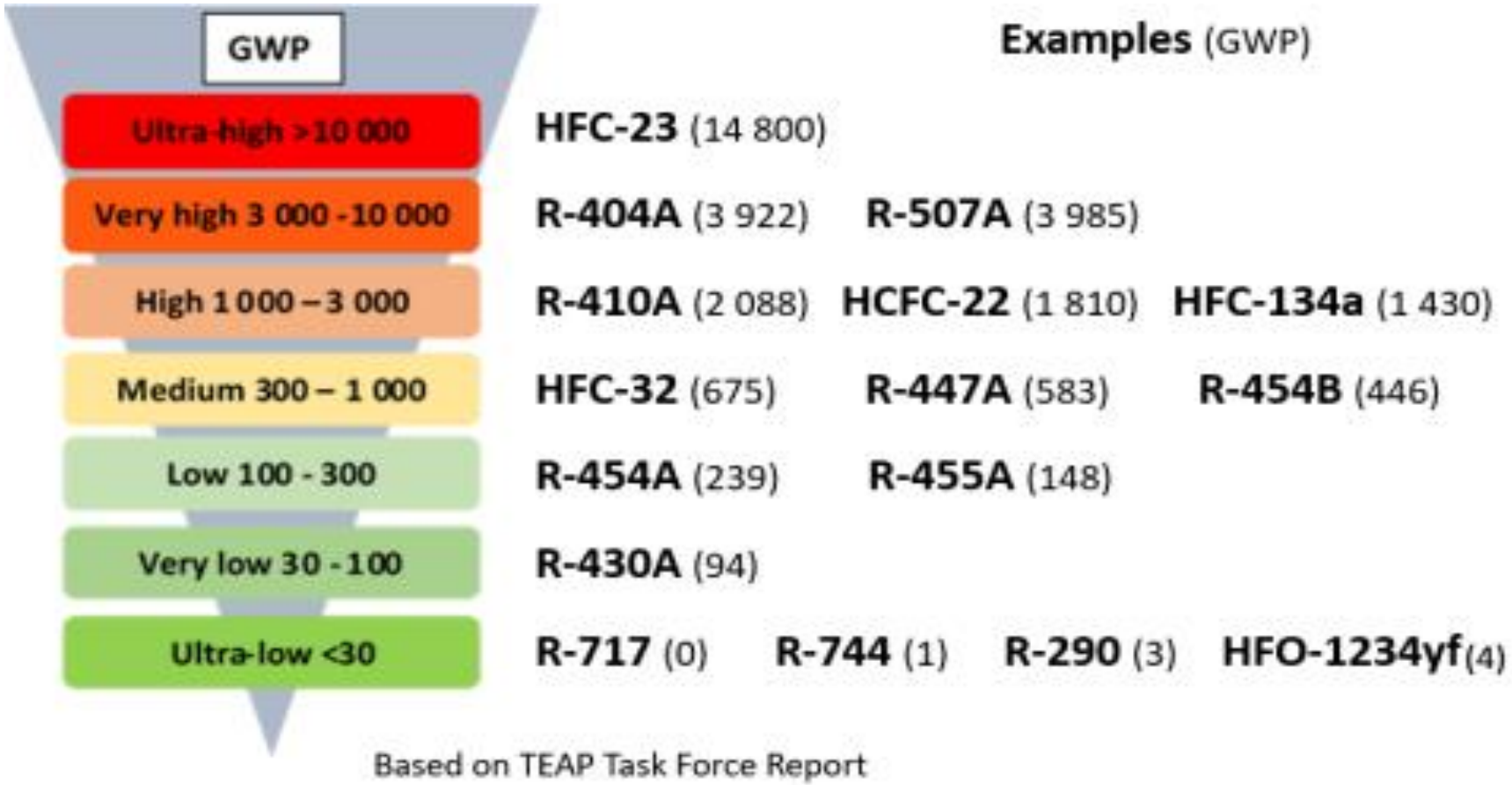
- 70%+ Renewables based grid
- Deep energy retrofits across all buildings
- Efficient electrification of:
  - ~95% of domestic hot water
  - 50-60% space heating
- 7 GW distributed solar
- District heating and cooling in key locations

We Are Not Electrifying Overnight

- New installations in 2030 reach end of useful life in 2050
- No new fuel-fired water heaters after ~2025 if 80x50 is to be reached without ripping out live equipment
- Installing ASHP DHW in a few big buildings in the next year

NYC's Other Interest in CO2

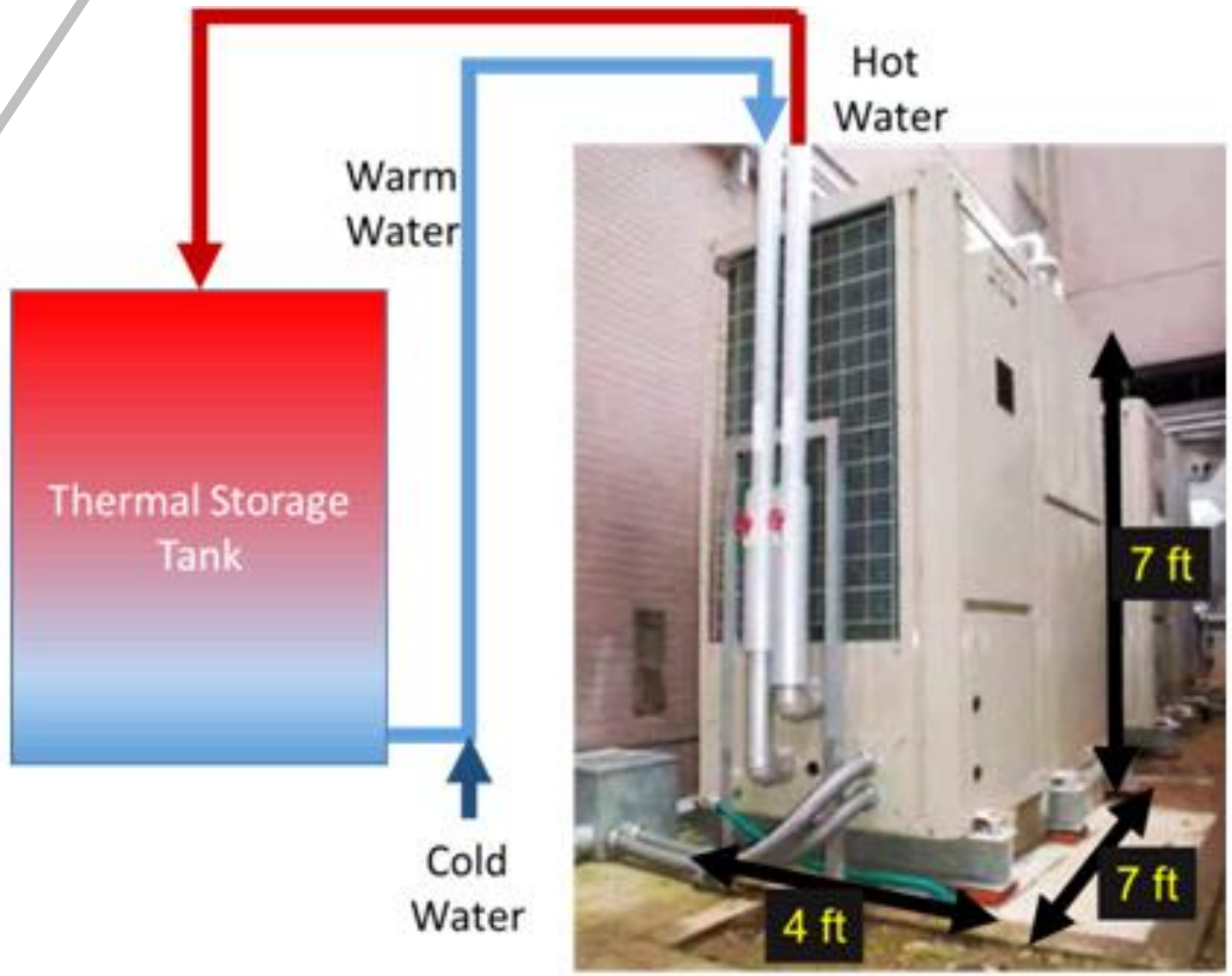
- Refrigerants have different greenhouse gas equivalences
- CO_2 can have higher discharge temperatures than HFCs – **needed for NYC central plants and Legionella concerns**



Product [un]Availability

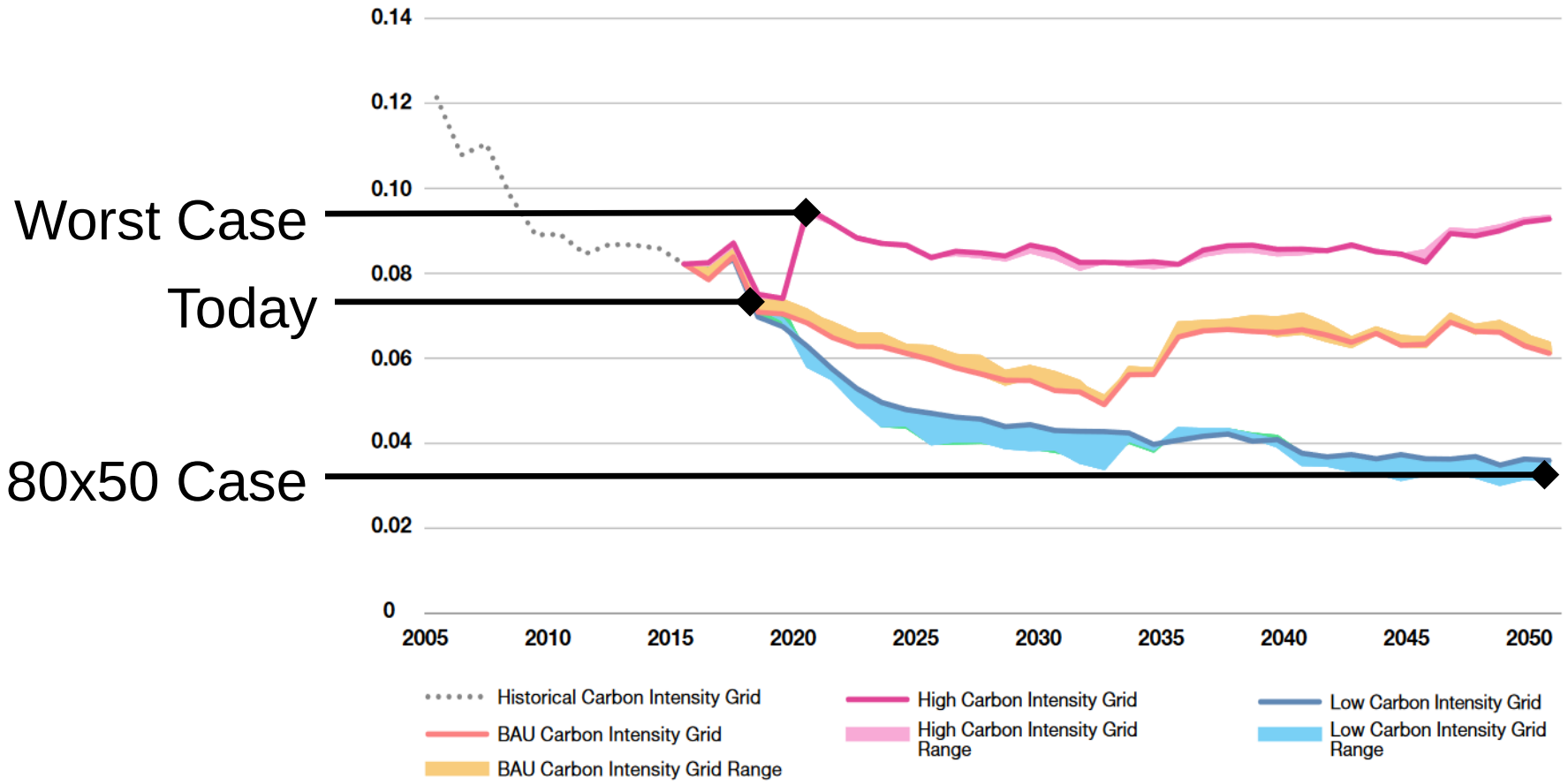
- Very few options on the market in US (many elsewhere)
- It gets very cold outside
- Balance of system upgrades required
  - Electrical service to roof, plumbing penetrations/ties ins, pumps
- Rooftop installation trouble – small halls, door openings + large components
- UL listing cost

Goldilocks Product Offerings

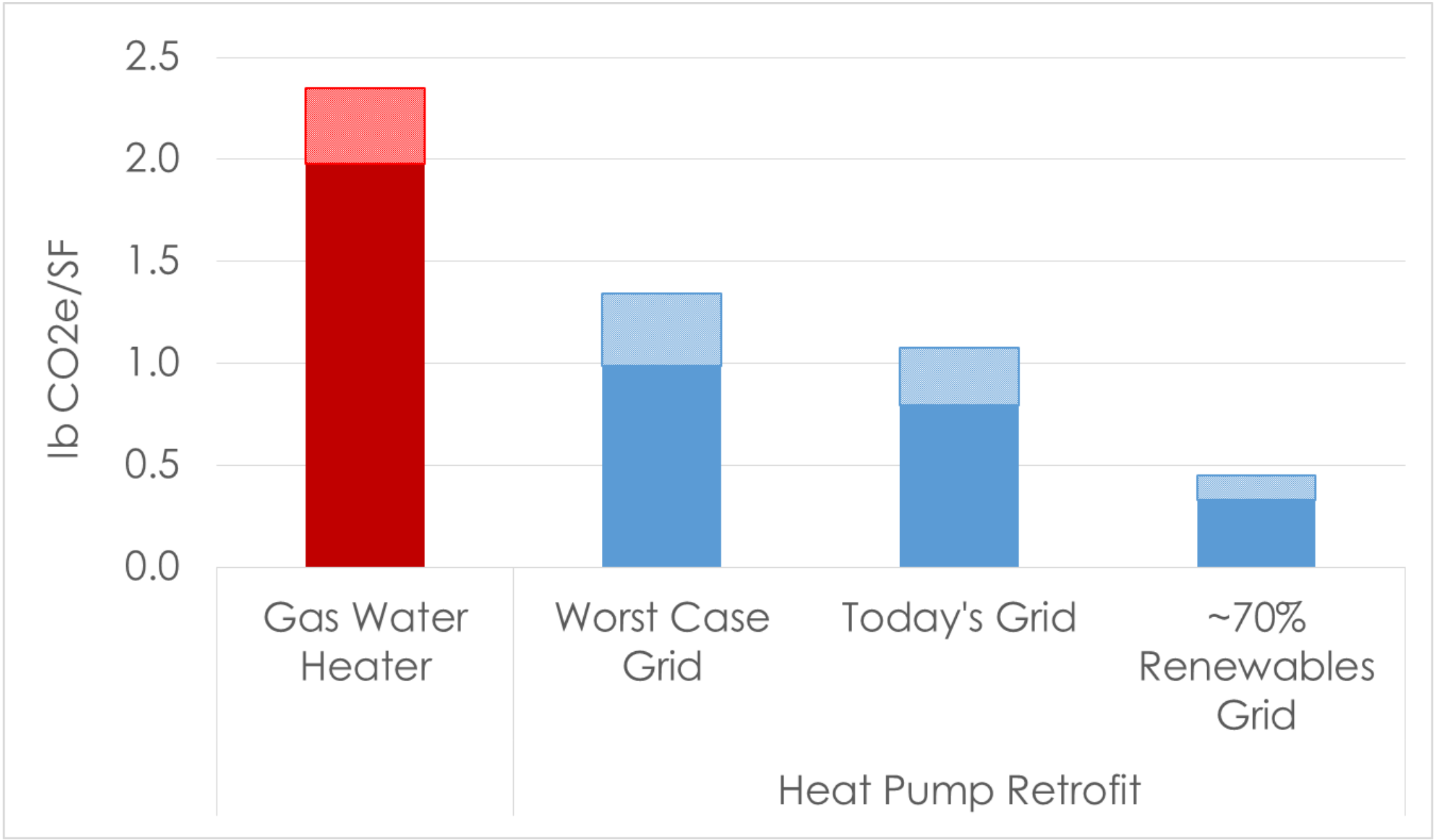


When Will the NYC Grid Catch Up?

- Increasing NYC's clean electricity supply is a challenge
- ASHPs save carbon today – no waiting for tomorrow's cleaner grid

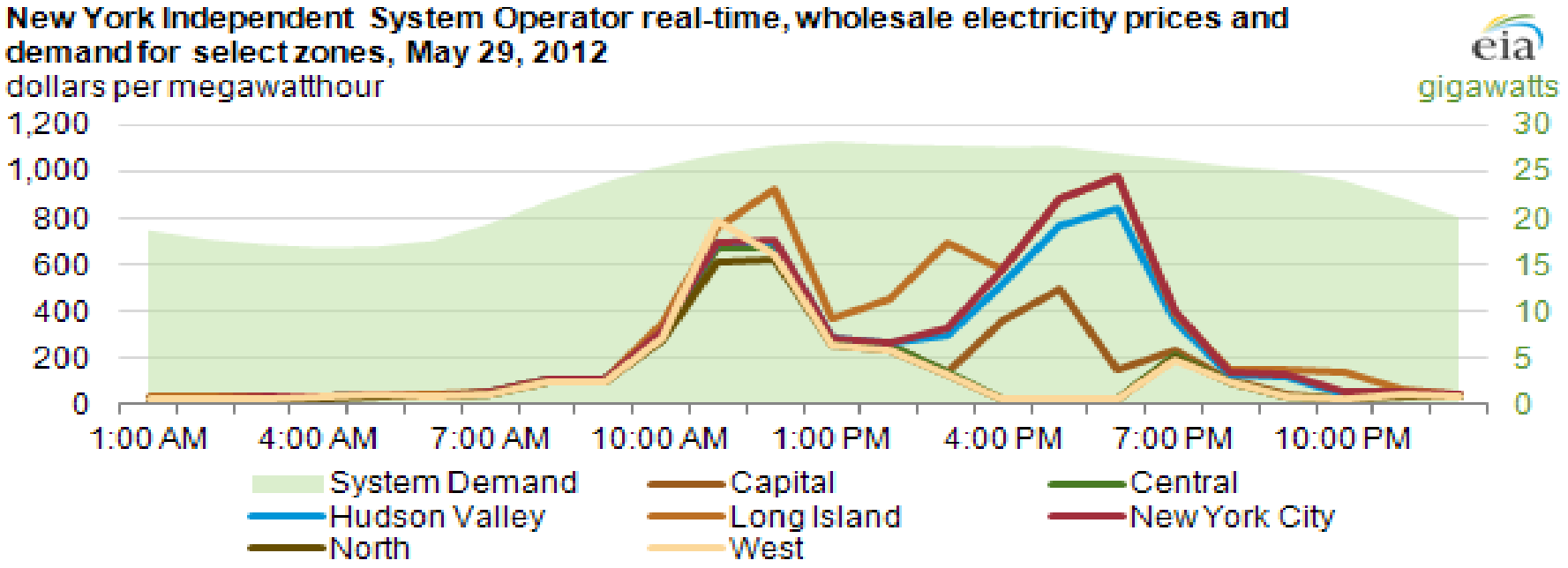


Emissions from Traditional DHW vs Heat Pumps in NYC



Can We Make the Accounting Work?

- Not enough (any) installations, so no real pricing yet
- Cheap gas, expensive electricity – NYC @ $1/Therm, 17 cents/kWh
- REV: New rate structure to improve system efficiency by balancing peaks and valleys



The Future of DHW in NYC

- 95% of DHW to come off of fuel sources
- ASHPs save emissions with today's grid
- CO_2 ASHP = low impact refrigerant and high leaving water temperature
- Difficult to retrofit into NYC multifamily buildings today, but we have a few years to make it work

Nicole Ceci, PE
Principal Mechanical Engineer
Steven Winter Associates, Inc.
307 Seventh Avenue, Suite 1701
New York, NY 10001
nceci@swinter.com