Intervention Points and Best Practices

Prioritizing Decarbonization Interventions

While each individual building has a unique capital improvement plan and timeline, retrofit projects or decarbonization interventions may be organized and grouped by similarity over the coming thirty years. Below is the overarching hierarchy for decarbonization intervention points according to industry best practices.

Best Practice Interventions

1. Facade Upgrades
2. Windows Upgrades
3. Ventilation Upgrades with Energy Recovery Ventilators (ERV) – weight decentralization against maintaining central systems
4. Maximize the reduction of distribution temperatures – weigh against abandonment
5. Maximize surface area of terminal units – weigh against abandonment
6. Supplement 90% of peak load with hybrid electrification strategies
7. Eliminate peak load “last-mile” with innovative strategies in storage and/or thermal demand response

Short Term

Short Term Interventions (2020-2023)

1

Delay replacement of gas-fired equipment with new gas-fired equipment as long as possible. Rebuild and maintain existing equipment until replacement.

2

Replace all remaining non-LED lighting and include lighting controls at the time of retrofit.

3

Seal rooftop bulkhead doors and windows.

4

Add smoke-activated fire dampers or annealed glass to the elevator shaft vent grill in the elevator machine room.

5

Install algorithmic controls on top of the existing boiler control system.

6

Balance steam distribution systems:

- Identify condensate return leaks
- Right-size air vents and master vents
- Ensure all radiators are properly draining condensate
- Ensure all steam traps are functioning properly

7

Implement Radiator Efficiency and Controls Measures:

- Install thermostatic radiator valves (TRV) where possible
- Install RadiatorLabs radiator cover systems where possible (integrate with algorithmic boiler control)

8

Balance air supply and ventilation systems using proper air registers, louvers, dampers, and technology like Constant Airflow Regulator (CAR) dampers:

- Need innovative methods of balancing temperature across commercial office floors (heat shifting and sharing from one building exposure to another: north vs. south)
- Balance air supply and return across vertical pressure gradients
- Seal vent stack perforations/leaks (mastic sealer)

9

Increase efficiency of pumps and motors:

- Add VFD controllers to all pumps and motors
- Replace rooftop exhaust fans (mushroom fans or similar) with electronic commutated motors (ECM)

10

Implement algorithmic controls on top of existing Building Management Systems (BMS) in commercial office buildings.

11

Hybrid Domestic Hot Water (DHW) Plants: Add DHW heat pump equipment to an existing gas-fired DHW plant

- Consider the option to direct bathroom exhaust air to DHW heat pump equipment

12

Install Energy Recovery Ventilation (ERV) system.

13

Install rooftop solar.

14

Procure New York State-sourced renewable power.

15

Procure biomethane from utility via pilot program.

16

Procure renewable hydrogen blend from utility via pilot program.

17

Develop innovative means of participating in gas demand response:

- Delay boiler firing with controls or other means
- Procure biodiesel blend for fuel switching requirement
- Thermal storage and hybrid plants (electrification)
    - DHW electrification (partial or full load)
    - Split system or PTAC partial load heating electrification

Medium-Term Interventions (2024-2030)

1

Add central-control compatible thermostats to apartments and office suites to control decentralized heating and cooling systems (heating, cooling)

- Enable aggregate demand response activity

2

Fully electrify DHW systems:

- Air source DHW heat pump
- Resistance DHW
- High-efficiency thermal storage
- Supplement with solar thermal where compatible

3

Overland/insulate masonry facades with high ongoing Local Law 11 cost.

4

Eliminate uninsulated radiator cabinets/niches (in exterior walls)

- Install wall-mounted slim radiators with TRV or other controls
- Install RadiatorLabs technology

5

Begin routine window replacement plan with high-performance windows.

6

Support cogen systems with biomethane (injection) procurement.

7

Explore hydrogen (injection) procurement to support cogen and centralized heating plants.

8

Develop on-site battery storage systems to manage building load profiles and reduce peak usage

- Integrate with an existing on-site generation where compatible

9

Increase thermal mass/thermal inertia and expand thermal storage capacity using Phase Change Material (PCM) products. Products currently include: ceiling tiles, wall panels, AHU inserts, thermal storage tank inserts:

- Embrace overnight free cooling
- Shift loads associated with thermal demand

- Capture and store waste heat

10

Implement centralized or in-building distributed thermal storage systems to shift thermal loads to off-peak periods

11

Convert low-temperature heating distribution systems to shared loop systems or geothermal systems; building distribution is already optimized for low-temperature distribution: water source heat pumps, large surface area terminal units (radiant panels, underfloor heat, fan coils, etc.)

- Interconnect with early shared loop system phases (private or utility-led)
- Eliminate cooling tower as a primary cooling system (may remain as a backup as feasible)

12

Where necessary, convert high-temperature heating distribution systems to low-temperature distribution systems; systems converted from fin tube to radiant panels, fan coils, or water source heat pumps as feasible.

- The supplement heat source for hydronic heat pumps with solar thermal technology (water source heat pumps)

13

Embrace consumer products that reduce building loads and peak demand:

- Appliances with onboard battery storage
- Networked smart appliances
- Power over Ethernet (PoE) DC-powered, low voltage products
    - DC power distribution networks make use of on-site renewable energy and energy storage

14

Advanced DC and AC/DC hybrid Power Distribution Systems

15

Install HVAC Load Reduction Technology:

- Capture VOCs and CO2 in liquid sorbent
- Engage with the liquid sorbent management company to safely dispose of scrubbed gases (carbon sequestration, etc.)
- Using buildings hosts for negative carbon technology, focusing on direct air capture, is necessary to achieve larger decarbonization goals (carbon capture and sequestration)

16

Electric Distribution Upgrade Needed:

- Begin replacement of centralized heating systems with decentralized heating and cooling systems where appropriate. Technology includes: PTAC, VTAC, ducted PTAC, VRF, and similar technology.
- Replace stoves, ranges, and cooktops with electric equipment: resistance, convection, or induction.
- Integrate Building Distribution with an advanced electric vehicle (EV) charging network to provide power to parked EVs and to extract power at peak periods (EV owners opt-in for reduced parking rates, other benefits, etc.)

Long-Term

Long-Term Interventions (2031-2050)

1

Install multi-function glass during window or facade replacement:

- Install building-integrated PV during facade retrofits
- PV glass
- Electrochromic glass
- Vacuum Insulated glass

2

Install highly insulated panels at spandrels:

- Vacuum insulated panels
- Aerogel insulated panels

3

Replace cooling towers with advanced heat rejection technology:

- Subambient (passive) radiative cooling technology

4

Interconnect with 100% hydrogen distribution network

5

Pair advanced, on-site battery storage systems with hydrogen fuel cells

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