# **Technical Barriers to Decarbonization**

Large commercial and residential buildings must overcome various hurdles before implementing deep retrofits or capital projects that help achieve building decarbonization. In this section, we address technical barriers and questions often faced by building owners and retrofit project developers.

Decentralized Systems and Tenant Equipment

## **Decentralized Systems and Tenant Equipment**



#### Infrastructure

## Infrastructure

# Con Edison Steam: assume district steam system will decarbonize

High temperature renewable resources are limited and face hurdles:

- Deep Bore Geothermal
- Renewable Hydrogen
- Carbon Capture and Sequestration
- Biomethane
- Electric Boilers
- High-temperature thermal storage

- Hight-temperature industrial heat pumps
- Waste Heat Capture and Reuse
- Fission

# **Barriers to Electrification:**

#### Utility Capacity Limitations:

- Electric riser capacity
- Switchgear expansion
- New service/vault expansion/point-of-entry space constraints
- Capacity competition with other electrification needs:
  - ° Space heat and cooling
  - DHW
  - Cooking
  - Pumps and motors
- Excess Distribution Facility Charges (EDF)
- Contributions in Aid of Construction (CIAC)
- · Partial Electrification concepts achieve deep decarbonization but do not necessarily achieve peak gas demand reductions (debatable)

Demand reduction strategies do not obviate capacity limitations unless the utility accepts the solution as a permanent demand/load reduction strategy.

- Battery Storage:
  - Fire danger
  - Space constraints
  - Electricity distribution
  - limitations
  - Structural loads
- Building Automation/BMS/Demand

Response:

- CostIntegration limitations;
- Blackbox software
- Microgrid development
  - 1. Cost
    - 2. Lack of expertise
- On-site Generation:
  - Space constraints
  - ° Gas use; Zero carbon fuels
  - availability is non-existent
  - Structural loads
  - Pipe infrastructure
- Space constrains
- Structural loads
- Technology limitations:
  - Vacuum insulated storage tanks
    - Phase change material (DHW, space heating)
- Building pipe riser
  - limitations; need

- loops are
- typically "top down" - cooling
- capacity is
- typically located at rooftop

mechanical penthouses; cooling towers at roof. 1. Some exceptio

- ns to
- this rule Space
  - Constraints
- Drilling Difficulty:
  - Outdoor space constraints for geothermal wellsDifficult

  - permitting • Mud and cuttings
    - disposal 1. Contami
      - nated soil
      - disposal
  - Overhead clearance constraints for drilling in basements

/garages

- Shared Loop/Thermal
  - Utility Limitations: Requires entity

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that may operate in public ROWs and across property lines Utilities are limited by regulations for gas, steam or electric delivery versus shared loop media . (ambient temperature water). 1. Only utility entities can provide very long amortiza tion periods 2. Utilities are best suited to work amid crowded undergr ound municip al ROWs.

• Deep Bore Geothermal Limitations:

- Requires test drilling and geological assessment
- Seismic risk
- Drilling equipment is

- very large more akin to oil and gas development equipment Subsurface land rights and DEC
- restrictions
- Lighting with lighting controls
  High-efficiency electrically commutated motors (ECM)
  Variable Frequency Drives (VFD) on pumps and motors
  Retro-commissioning tasks and maintenance
- Staggered work scheduling Telework ٠
- ٠
- Submetering and billing: potentially creates split incentive between landlord and tenant:
  - ° Water
  - ° Electric
  - 1. Onerous regulatory compliance Heat and Cooling
  - - 1. Rent stabilized buildings prohibit billing for heat

#### Facade and Windows

Facade and Windows	
1	Work must be completed at the end of facade/window useful life; very long useful life
2	Building code
3	Glazing reduction at odds with aesthetic/marketability concerns
4	Difficult installing with occupied spaces
5	<ul> <li>Reduce Local Law 11 recurring cost via overcladding</li> <li>Aesthetic concerns</li> <li>At odds with historic preservation</li> <li>Capital intensive</li> <li>Lot line limitations</li> </ul>
6	<ul> <li>Technology Limitations</li> <li>Need higher R-value/inch for thinner wall assembly:         <ul> <li>Vacuum insulated panels</li> <li>Aerogel panels/batts</li> </ul> </li> </ul>

• Zero-GWP blowing agents for closed cell spray foam (nitrogen blowing agent needs to be more widely adopted)

#### Ventilation



#### Heat Pump Limitations

## **Heat Pump Limitations**

Variable Refrigerant Flow (VRF) 1 · Fire and life safety concerns about volume of refrigerant gas located within occupied spaces. 2 Regulatory risk from new refrigerant policies PTAC and VTAC Ducted Supply/Exhaust Air Source Heat Pumps 5 Domestic Hot Water • Central DHW Systems: • Limited domestic production ° Performance not confirmed by independent third parties • More demonstration projects needed Decentralized DHW Systems 6 More open-source interconnection between devices/interoperability is needed to achieve energy distribution flexibility and capacity expansion:

- Air source that has a manifold connection to interconnect with water source or refrigerant gas distribution
- Interconnectivity/simplified heat exchange between refrigerants/water/air, etc.
- Other options and add-ons

Crossover Device or "Magic Box" Technology



Zero Carbon Fuels Limitations

Zero Carbon Fuel Limitations		
1	Green Hydrogen	
2	Renewable Natural Gas	
Low-Carbon Fuels		
Low-Carbon Fuels		
1	Biofuel	
2	Biomethane	

#### Renewable Energy Procurement Limitations



### Pending Carbon Trading Programs Limitations

## **Pending Carbon Trading Programs Limitations**





Price per ton of carbon is highly uncertain and will likely be volatile/low based on previous emissions trading scheme outcomes

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