DRI | NYF Decarbonization Overview

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Daniel Case

Agenda

Decarbonization: What and Why?

Decarbonization: How we get there

Decarbonization: Strategies + Costing

DRI | NYF Decarbonization Compliance

Questions

Key Terms

Gases that trap heat in the atmosphere are called **greenhouse gases**.

Decarbonization is simply the reduction of carbon emissions.

Building decarbonization is the reduction of carbon emissions through the reduction of building energy demand and the conversion of existing equipment and systems, especially systems powered by fossil fuel combustion processes, to highly efficient equipment and systems.

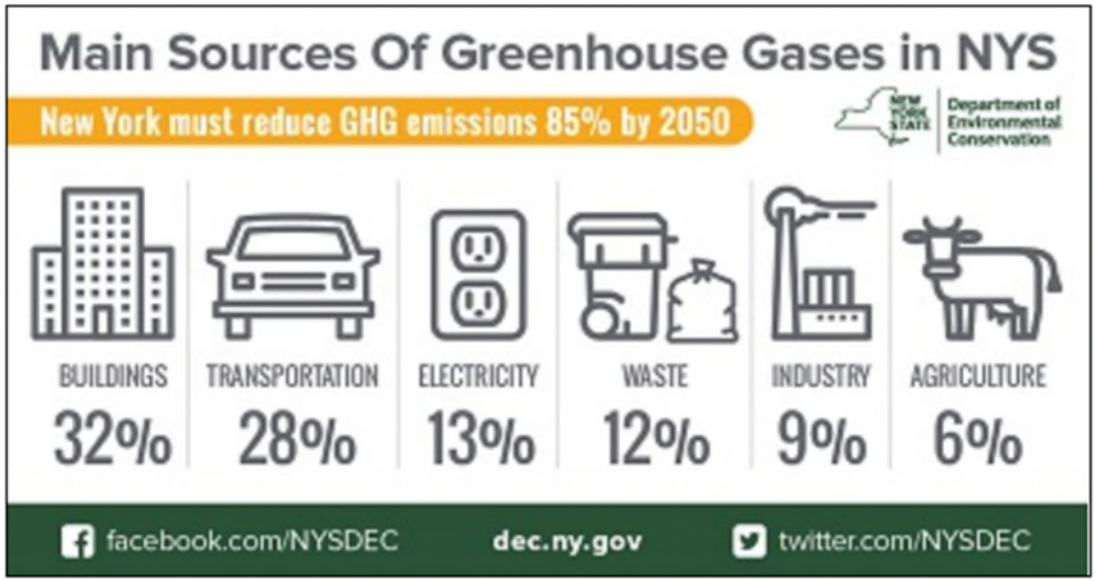
Building electrification is the shift from using fossil fuels for heating and cooking to using electricity.

Greenhouse gas emissions associated with manufacturing, transportation, installation, maintenance, and disposal of building materials are the **embodied carbon**.

A **carbon neutral building** is one where the design, construction, and operations do not contribute to emissions of greenhouse gases that cause climate change.

Resilient buildings are designed to protect the health, safety, and comfort of building occupants from shocks and stresses, including power outages, the impacts of extreme storm events, and extreme temperatures.

Background



- **New York** Climate Leadership and Community Protection Act (Climate Act)
- **Reduce carbon emissions by 85% by 2050**
- Buildings and transportation combine for 60% of New York's greenhouse gas emissions. These are touched by places made through the Downtown Revitalization Initiative (DRI) and New York Forward (NYF) projects
- 6.2 Million buildings in New York
- **Program focus on decarbonization for buildings**

Benefits of Decarbonization

Minimize Liability & Future Proof

Safeguard against a changing energy market where gas and other fossil fuels are likely to become less accessible and more expensive over time.

Maximize Usable Square Footage

Electric HVAC equipment maximizes available square footage (e.g. heat pump units installed on walls near ceiling vs. steam radiator taking up floor space).

Health Benefits

All-electric appliances, especially electric stoves and cooktops, reduce indoor air pollutants. Good building envelopes protect against pest infestation and other asthma triggers.

Increased Resilience

Weatherization and solar + storage help keep the power on and temperatures consistent in the event of a power outage or extreme weather event.

Occupant Comfort

Improved comfort from increased air-flow/movement, addressing previously unmet cooling needs (through heat pumps), and noise reduction.

Safety

Reduced risks associated with aging gas infrastructure leaks; induction cooktops reduce instances of fire and burns.

How We Get There

New Buildings

- More efficient designs
- Building electrification solutions
- Improved building envelopes
- Grid interactivity
- Clean energy sources

Existing Buildings

- Retrofits for existing systems
- Building envelope upgrades
- Clean energy sources

Transportation

- Reduce miles driven
- Alternative fuel vehicles
- Alternative modes of transportation

Considerations for Your Project Type

NEW BUILDINGS:

INTEGRATED DESIGN

- Passive lighting, heating and cooling
- Electric systems for heating and cooking
- Insulation and sealing
- More efficient systems than code

EXISTING BUILDINGS:

CONSTRUCTABILITY

- Backfitting into systems
- Minimize disruption to occupants
- Contingencies
- Due diligence
- Project economics

Decarbonization Path

1. Reduce Energy Loads
2. Maximize Energy Efficiency
3. Implement Building Electrification
4. Leverage Building Automation Systems
5. Incorporate Distributed + Renewable Energy
6. Add Energy Storage Systems
7. Embodied Carbon

Decarbonization Strategies Overview

Load Reduction Strategies	Building Electrification	Advanced Controls	Distributed Energy Resources
▪ High-performance building envelopes ▪ LED lighting systems ▪ Smart building systems ▪ Energy recovery systems	▪ Up-to-date electrical capacity and service ▪ Cold climate heat pump systems ▪ Heat pump water heaters ▪ Electric appliances ▪ Carbon-free thermal loops in campuses	▪ Load flexibility and advanced controls of hot water, HVAC, and smart appliances ▪ Commissioning approaches	▪ Renewable energy ▪ Battery storage ▪ Bi-directional Electric Vehicle (EV) charging ▪ Thermal storage

Load Reduction

Electric load is the amount of electricity required to operate anything electrical including lighting, HVAC, appliances, as well as anything plugged in to outlets.

Heating/Cooling load is the amount of heating or cooling required to maintain spaces comfortably for occupants and equipment.

Common areas to reduce load include:

High-performance building envelopes

LED lighting with occupancy controls

Smart building systems

Energy recovery ventilation

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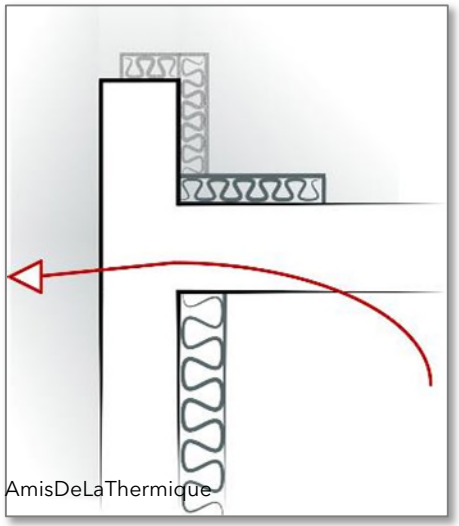
Load Reduction: High-performance building envelopes

The building envelope includes any components between conditioned and unconditioned spaces. Typically exterior walls, including windows, doors, insulation, framing, drywall and exterior surface such as brick.



Insulation + thermal bridging

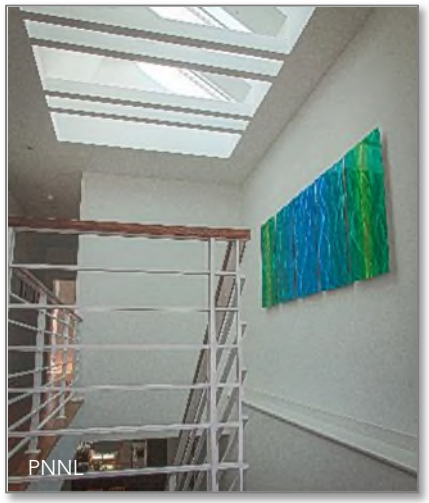
Window replacement, shading, films

Weatherization + air sealing

Load Reduction: LED lighting with occupancy controls

Lighting performance can be improved by installing LED fixtures, using occupancy sensors to turn lights off when spaces are empty, and using skylights to increase natural light.

- Interior
- Exterior
- Occupancy controls + scheduling
- Daylighting + skylights



Load Reduction: Smart building systems

Smart building systems can automatically schedule on and off times for appliances, machines, and anything plugged in to reduce energy usage.

Potential applications include:

- Appliances
- Vending
- Computers
- Plug loads

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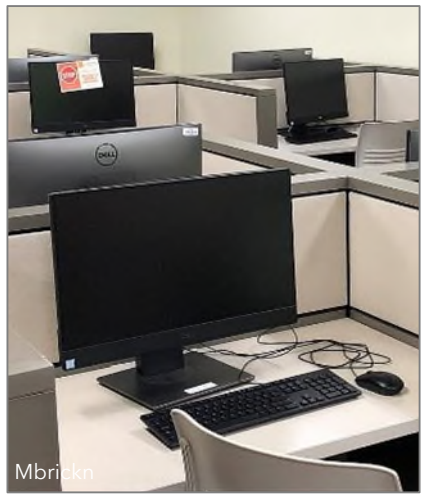
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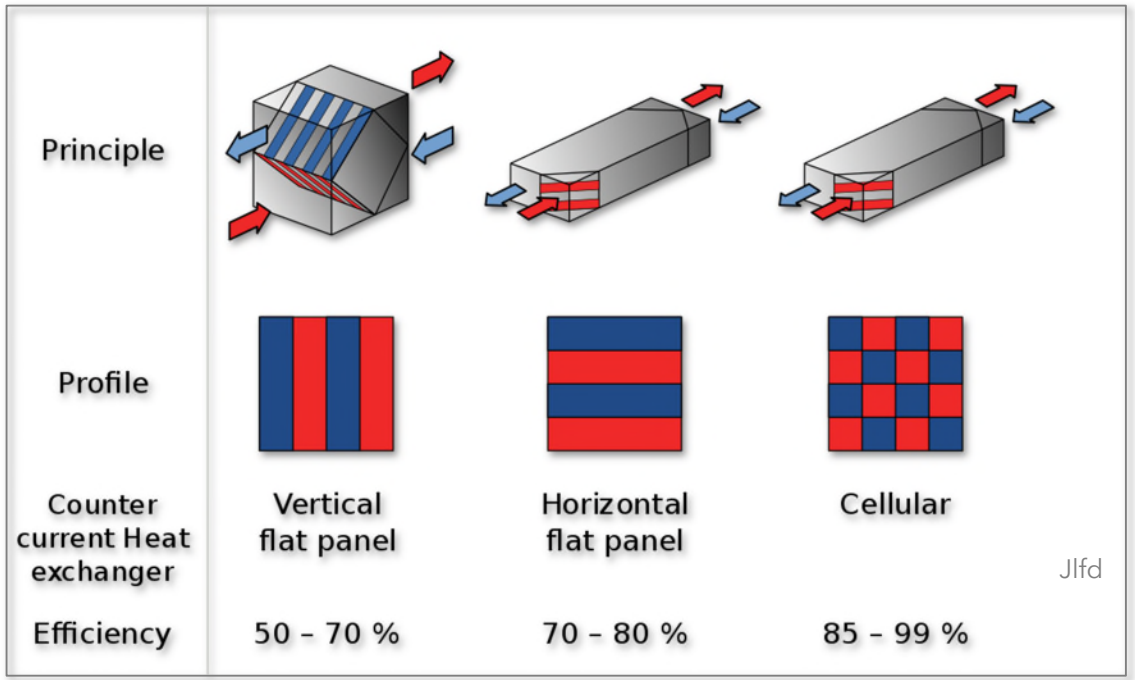
Load Reduction: Energy recovery ventilation

Energy recovery ventilation is a process that exchanges the energy in exhausted air or water and uses it to "precondition" incoming fresh air or water.

- HVAC
- Natural ventilation
- Exhaust systems
- Domestic Hot Water Systems
- Be creative



Exchanger Concept

Building Electrification

Building electrification is the transition away from gas powered appliances to fully electric powered. It significantly reduces emissions reduction.

Common areas to electrify include:

Electrical Capacity

Cold climate heat pump systems

Heat pump water heaters

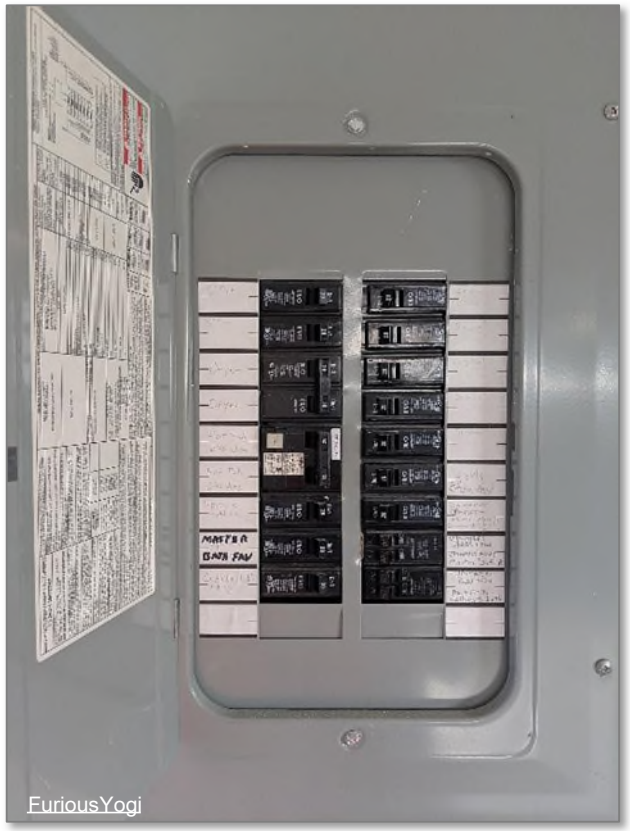
Electric appliances

Carbon-free thermal loops in campuses

Building Electrification: Electrical Capacity

The move to electric buildings systems for applications like space and water heating may require increased electrical capacity for these new systems.

- Electric ready (no savings)
- Electric demand analysis
- Utility service upgrade



Building Electrification: Cold climate heat pump systems

Heat pumps use electricity to move heat from indoors to out during the summer (cooling season), and then switch and move heat from outdoors to in during the winter (heating season).

Heat pumps appropriate for cold climates include:

- Air-source heat pumps
- Water-source heat pumps
- Ground-source heat pumps

Building Electrification: Heat pump water heaters

Heat pump water heaters use electricity to move heat from one place to another instead of generating heat directly. This makes them much more efficient than electric resistance or natural gas water heaters.

- Heat pump water heaters
- Storage Tanks
- Demand-flexible controls

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Building Electrification: Electric appliances

Electric appliances replace conventional natural gas powered appliances to increase efficiency and decrease emissions as well as improve indoor air quality.

- Induction cooktops
- Heat pump dryers

Building Electrification: Carbon-free thermal loops in campuses

Carbon- free thermal loops are large scale ground source heat pumps that operate on a district basis. They can be used to heat and cool groups of buildings, especially in dense developments such as urban downtowns.

Advanced Controls

Advanced controls support decarbonization by automating on/off schedules and temperature setpoints, as well as collecting valuable building operational data in real time.

Common controls areas include:

Load flexibility and advanced controls of hot water, HVAC, and smart appliances

Retro-commissioning

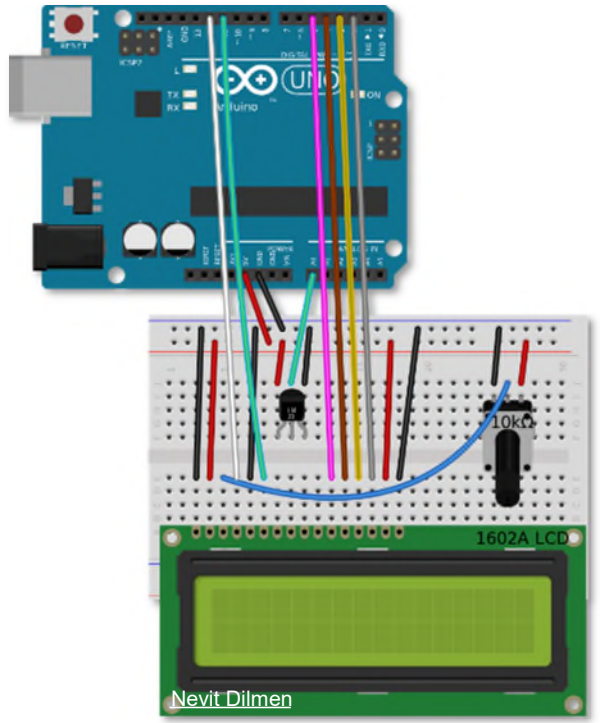
Re-commissioning

Monitoring based commissioning

Advanced Controls: Load flexibility and advanced controls

Load flexibility and advanced controls of hot water, HVAC, and smart appliances offer several opportunities to reduce emissions including:

- Schedule optimization
- Reset strategies
  - Temperature
  - Pressure
- Ventilation strategies
  - CO / CO2
  - Economizers
- Demand response



Advanced Controls: Retro-commissioning, Recommissioning, and Monitor based commissioning

Retro-commissioning is a process of inspecting existing systems and building components seeking to improve how equipment and systems function together, on a system that has never been commissioned.

Recommissioning inspects and recalibrates an existing system that was commissioned before and has deviated from optimal function.

Monitoring based commissioning provides ongoing commissioning of systems to maintain optimal function.


MTA Capital Construction Mega Projects

Distributed Energy Resource (DER)

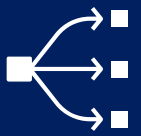
Distributed energy resource (DER) systems are small-scale power generation or storage technologies that provide an alternative to or an enhancement of the traditional electric power system.

Common DER areas include:

Renewable energy

Battery energy storage systems

Bi-directional Electric Vehicle (EV) charging



Thermal storage

DER: Renewable energy

Renewable energy sources may be located on or off site to provide energy derived from natural processes such as sun or wind.

- Solar Photovoltaic arrays
- Wind systems

DER: Battery energy storage systems

Battery storage is integrated with renewable resources to enable energy from sources such as sun or wind to be stored and then released when needed.

DER: Bi-directional Electric Vehicle (EV) charging

Bi-directional Electric Vehicle (EV) charging allows energy to flow both into and out of a vehicle to provide backup power.

DER: Thermal storage

Thermal storage involves heating or cooling a medium to then use the energy when needed, similar to a battery except heating or cooling energy is stored rather than electricity.

- Demand shifting
- Chilled water storage systems
- Ice storage systems

Decarbonization Cost Estimating

Strategy	Description	Added Cost Range
Building Envelope Improvements	Added insulation, air-sealing, high-efficiency windows	$10-$15/square foot
Window Films	Solar control and low-E films	$1-$3/square foot of glazing
Heat Pump Conversion		$5,000-$10,000/ton
Air-Source Heat Pumps	Supplement HVAC systems in cold climates	$4,000-$8,000/ton
Ground-Source Heat Pumps	Require excavation for wells (horizontal or vertical)	$6,000-$12,000/ton
Heat Recovery Ventilators		$5,000-$10,000/unit
Heat Pump Water Heating		$2,000-$3,500/system
Advanced HVAC Controls	Centralized controllers and submetering for monitoring	$2-$5/square foot
Solar PV System		$3-$5/Watt (includes tax credits)
Battery Storage System		$400-$500/kWh
Electric Vehicle Charging Stations		$4,000-$6,000/station
High Efficiency Appliances	Commercial/multifamily kitchens, laboratories, laundries	20%-50%/appliance
Electric Induction Cooking		$500-$1,000/stove
Thermal Energy Storage	Chilled water or ice storage	$5-$15/ton-hour
Infrastructure Upgrade	**Description**	**Added Cost Range**
Electrical Upgrades	Electrical panels, wiring	$2,000-$4,000/panel
Heat Pump Electric Upgrades	Conduit, wiring, prep for future heat pumps	$2-$5/square foot
Electric Vehicle Charging Upgrades	Conduit, wiring, prep for future EV stations	$1,000-$1,500/station
Roof Structure Upgrades for PV		$2-$4/square foot

Project Compliance Matrix

	DRI | NYF Decarbonization	
	REQUIRED	OPT-IN
New Buildings < 5000 ft²		●
New Buildings ≥ 5000 ft²	●	
Building Addition ≥ 5000 ft²	●	
Non-Substantial Renovation		●
Substantial Renovation < 5000 ft²		●
Substantial Renovation ≥ 5000 ft²	●	

Compliance Path Options

NYStretch

- Approximately **10% more energy efficient** than standard NY energy code
- **Prescriptive Improvements**
  - Building Envelope
  - Building Lighting
  - Renewable energy compatible
  - Electric vehicle compatible

OR

- **Performance Based**
  - Whole-building energy modeling

ENERGY STAR

- EPA program to determine building energy performance
- **SCORE OF 90 OR BETTER**
- **Target Finder**
  - Project building performance
  - Basic building information required

Third-Party Certifications

- **Energy & Environment Focus**
  - ENERGY STAR Certification
  - LEED BD+C, ID+C, O+M, Homes, ND
  - Green Globes
  - BREEAM
  - Passive House
  - Living Building Challenge
- **Occupant Focus**
  - WELL
  - Fitwel
  - Living Building Challenge
- **Other**
  - Enterprise Green Communities
  - SITES
  - National Green Building Std.

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Compliance Path Applicability

NYStretch

- **Good Path When:**
  - Partial upgrades
  - Historical buildings with limitations on specific scopes
  - Buildings with high energy use compared to similar type (e.g. old buildings)
  - Jurisdictions that require NYStretch
- **Considerations:**
  - Prescriptive requirements are more stringent than base energy code
  - Performance path requires energy modeling

ENERGY STAR

- **Good Path When:**
  - ENERGY STAR score needed for other obligations
  - High-performing building
  - Familiar with Portfolio Manager
  - Planning to use energy model/simulation
  - Simple and straightforward results
- **Considerations:**
  - Requires energy modeling/simulation to predict energy use after upgrades

Third-Party Certifications

- **Good Path When:**
  - Already considering certification for other goals
  - Desire added distinction within community
  - High-performing building
  - Credit for ESG reporting
- **Considerations:**
  - Added costs for registration
  - May need licensed or accredited professional to certify
  - May require additional inspections (beyond local building code requirements)

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Thank you

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