

solution package

Cooling

A guide to cooling system solutions that improve comfort, marketability, and energy efficiency.

The BE-Ex solution packages are a suite of six documents compiled from the *Anatomy of an Energy Efficient Building* exhibit on view at Building Energy Exchange's downtown resource center, or virtually at be-exchange.org/anatomy

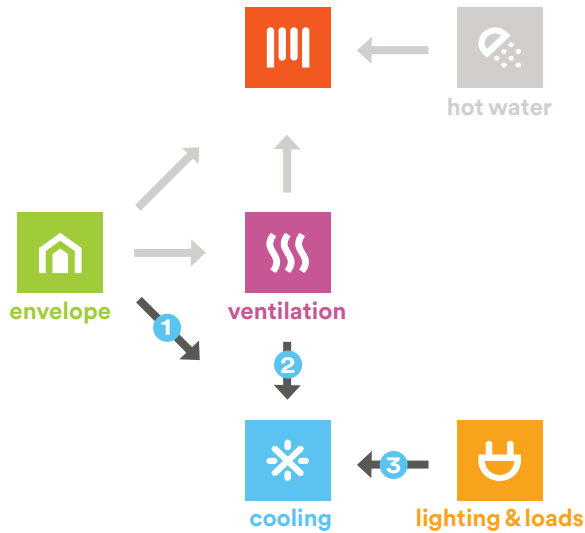
**Anatomy
of a
Building**

HEALTHY
SUSTAINABLE
ENERGY EFFICIENT
ATTRACTIVE
COST EFFECTIVE
BETTER!!!

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The performance of cooling systems is often contingent on the function of other building systems. Cooling upgrade decisions should be made in the context of how other systems will impact cooling operation and performance.



1 envelope → cooling

Envelope improvements that minimize heat gain, such as increasing airtightness and insulation, help reduce demand on the cooling system.

2 ventilation → cooling

Energy recovery ventilation (ERV) systems pre-cool incoming air, reducing demand on the cooling system.

3 lighting & load → cooling

Lighting, appliances, and electronics generate heat, increasing demand on cooling systems.

Decentralized air conditioning systems increase plug loads and drive up utility bills during the summer months when electricity is most expensive.



Investing in operations and maintenance best practices ensures that building systems run optimally, enabling proper performance in existing equipment and maximizing return on investment in new systems. Best practices for cooling systems include:

centralized cooling:

- Inspect and repair terminal units.
- Monitor set points and re-calibrate sensors and controls on a regular basis to maximize and maintain efficiency.
- Test chiller refrigerant for oil contamination.
- Modify chiller refrigerant levels to optimize power consumption.
- Inspect and clean condenser and evaporator tubes and treat chiller water to prevent scale, corrosion, and bacterial growth.
- Conduct routine equipment surveys and maintain a daily operating log.

air conditioners:

- Air seal gaps around window air conditioners (ACs), Packaged Terminal Air Conditioners (PTACs), and Packaged Terminal Heat Pumps (PTHPs) to reduce energy loss.
- Establish a winter removal or weatherization policy for window and through-wall ACs.

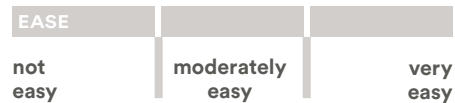
cooling efficiency measures



Cooling system improvements vary significantly between centralized and decentralized cooling systems. Comprehensive upgrades for both types offer significant benefits in terms of long-term energy savings, tenant comfort, and emissions reductions.

Key

EASE OF IMPLEMENTATION



Ease of Implementation reflects technical and financial feasibility.

Measures marked “not easy” are typically expensive, complex, highly disruptive, or pay back slowly, while “very easy” measures tend to be in-expensive, quick, and straightforward.


PROJECT IMPACT





Project Impact reflects potential to reduce energy and emissions and to improve system performance.

“Low impact” measures typically yield minor savings and incremental improvements, while “high impact” measures achieve major savings and comprehensive improvements.

ADDED BENEFITS

 **operations & maintenance**
Keeps building performing optimally when completed on a routine basis

 **health & comfort**
Enhances indoor environmental quality and advances occupant wellbeing

 **marketability**
Improves aesthetics and upgrades occupant spaces, increasing appeal to potential tenants

 **future-ready**
Puts building on path for long-term emissions reduction and legislative compliance

RATING SYSTEM METHODOLOGY

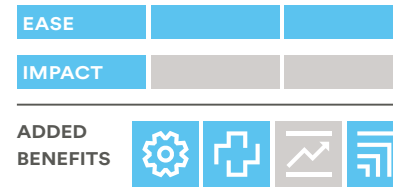
Ratings and benefits of energy conservation measures were assigned based on NYC energy audit data and analysis by industry experts. Actual results will vary by building type, use, and baseline conditions.

ALL SYSTEM TYPES

Improve System Responsiveness

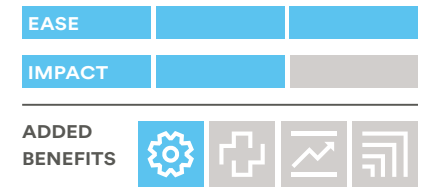
Install Controls & Indoor/ Outdoor Sensore

Install temperature sensors and controls that adjust cooling systems to meet real-time needs. When possible, use smaller control zones in centralized systems.



Change Set Points & Schedule Setbacks

Many cooling systems run at higher settings than needed. Raise the set point and schedule setbacks during times of low-occupancy to save energy.

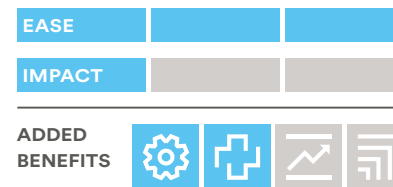


DECENTRALIZED SYSTEMS

Improve Efficiency of In-Room Units

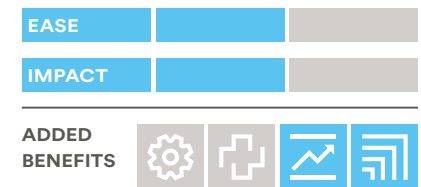
Airseal & Maintain AC Units

Seal gaps to keep out heat and moisture and improve AC efficiency. After each cooling season, remove or weatherize AC units to reduce drafts and prevent equipment damage.



Install PTHPs

Packaged Terminal Heat Pumps (PTHPs) may be a convenient, high efficiency electric heating and cooling upgrade for buildings with PTAC units. Look for PTHP models that fit existing wall sleeves.



cooling efficiency measures



DECENTRALIZED SYSTEMS

Improve Efficiency of In-Room Units, cont.

Install Mini-Splits

Replace AC units with mini-splits—a room-scale, high efficiency electric technology that can be used for heating and cooling spaces.

EASE		
IMPACT		
ADDED BENEFITS		

Install VRFs

Replace AC units with a variable refrigerant flow (VRF) system—a high efficiency electric technology for heating and cooling spaces that can be configured in centralized or decentralized layouts.

EASE		
IMPACT		
ADDED BENEFITS		

CENTRALIZED SYSTEMS

Improve Efficiency of Mechanical Cooling

Install or Commission an Economizer

Air- or water-side economizers provide efficient pre-cooling and can even operate in place of compressors to provide free cooling when the outdoor temperature drops below a certain point.

EASE		
IMPACT		
ADDED BENEFITS		

Conduct Routine Operations & Maintenance

Follow best practices for each piece of equipment, such as: cleaning coils, replacing filters, removing fouling, rebalancing and treating water, and calibrating refrigerant levels.

EASE		
IMPACT		
ADDED BENEFITS		

CENTRALIZED SYSTEMS

Improve Efficiency of Mechanical Cooling, cont.

Install High Efficiency Terminal Equipment at Terminal Units

Install responsive units that maintain a high temperature differential. Depending on existing system type, install variable air volume (VAV) fan coil units with direct drive motors, or a chilled beam system.

EASE		
IMPACT		
ADDED BENEFITS		

Install Variable Speed Devices

Right-size equipment like pumps, motors, and fans to meet the building's energy use profile and install devices with variable frequency drives (VFDs) to maximize efficiency.

EASE		
IMPACT		
ADDED BENEFITS		

Install High Efficiency Equipment at Central Plant

Specify units that exceed code and consider converting to a variable flow system. Central chillers tend to be more efficient than distributed DX units with a condenser loop.

EASE		
IMPACT		
ADDED BENEFITS		

Consider Converting to a Heat Pump or Hybrid System

Consider installing heat pumps that provide heating and cooling. Hybrid systems may offer a stepping stone between existing systems and high performance electric ones.

EASE		
IMPACT		
ADDED BENEFITS		



CENTRALIZED SYSTEMS

Optimize Heat Rejection

Install Condenser Water Heat Recovery

For buildings with central domestic hot water (DHW) plants, install a heat recovery system to use heat normally rejected at the cooling tower for DHW.



ADDED BENEFITS

Install Variable Speed Fans

Install variable speed fans that can modulate speed and run in reverse to respond to changing conditions and maximize efficiency.



ADDED BENEFITS

Add or Upgrade Cooling Tower

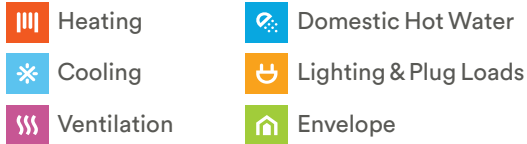
Select cooling towers that have the lowest overall size and power consumption to meet the building's needs.



ADDED BENEFITS

Further Reading

The BE-Ex solution packages cover the following building systems:



To access the suite of solution packages, visit:
be-exchange.org/anatomy-solutions

Acknowledgements

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