

solution package

# Heating

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

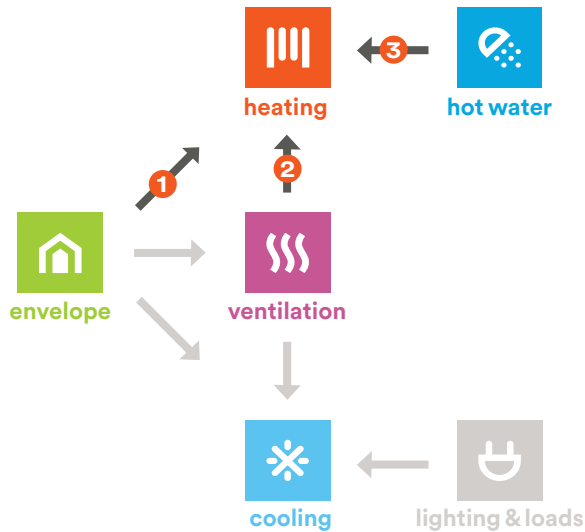
The BE-Ex solution packages are a suite of six documents compiled from the *Anatomy of an Energy Efficient Building* exhibit on view at Building Energy Exchange's downtown resource center, or virtually at [be-exchange.org/anatomy](http://be-exchange.org/anatomy)

COMFORTABLE  
HEALTHY  
AFFORDABLE  
SUSTAINABLE  
ENERGY EFFICIENT  
ATTRACTIVE  
COST EFFECTIVE  
BETTER!!!

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# system interaction

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



## 1 envelope → heating

Building envelope improvements that minimize heat loss, such as increasing air tightness and insulation, help reduce demand on the heating system.

## 2 ventilation → heating

Energy recovery ventilation (ERV) systems use a building's waste heat to precondition incoming air, reducing demand on the heating system.

## 3 hot water → heating

Many heating systems and domestic hot water systems share a single, large boiler. These boilers waste considerable amounts of fuel heating up water when space heating is not also needed.

# operations & maintenance



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 heating systems include:

## steam and hydronic systems:

- 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.

## heat pumps:

- Periodically clean or replace air filters in indoor units and annually clean and powerwash outdoor units.
- Test for refrigerant leaks before and after each heating season, starting within one year of installation.
- Seal gaps between walls and refrigerant piping or heat pump units.
- Educate tenants in proper use of heat pumps, particularly when systems are tenant controlled.

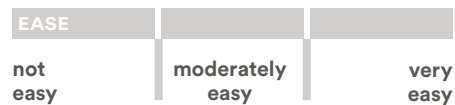
# heating efficiency measures



Minor improvements to existing systems offer noticeable benefits to both landlords and tenants. Wholesale system conversion (such as switching from steam heat to electric heat pumps) yields even greater 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

#### Change Set Points/Setbacks

Many heating systems are programmed at higher settings than necessary. Lower the temperature set point or schedule setbacks to save energy.



#### Install Indoor Room Sensors

Install indoor temperature sensors to improve the heating system’s ability to respond to actual heating needs.



## ALL SYSTEM TYPES

### Improve System Responsiveness, cont.

#### Install Window Sensors

Install window sensors to detect when windows are opened in a space and turn off heat in that area.



#### Install Heating Controls

Install central controls to regulate heat output, collect data, adjust setpoints, monitor the system remotely, and improve operations and maintenance.





## STEAM SYSTEMS

### Improve Boiler Operation & Efficiency

#### Clean & Tune Boiler

Clean and tune boiler to optimize performance and efficiency.



#### Replace or Upgrade Boiler

Size new boilers correctly to avoid inefficiencies. Many NYC boilers are oversized, resulting in heat and energy waste.



#### Upgrade Burner

Install a modulating burner to adjust boiler heat output precisely and efficiently in response to changing heating demands.



### Repair System Leaks

#### Repair Leaks

Repair steam system leaks to reduce energy loss. Leaks often occur at pipe connections, fittings, and valves.



## STEAM SYSTEMS

### Ensure Quick & Even Heat Flow to Radiators

#### Install Thermostatic Radiator Valves (TRVs) or Enclosures (TREs)

Install TRVs or TREs to give occupants ability to adjust radiator heat output and to enable building-wide or room-by-room setbacks and temperature limits.



#### Repair Steam Traps/Add Orifice Plates

Test steam traps for leaks to ensure proper operation. In two-pipe systems, steam traps can be substituted with orifice plates at each radiator.



#### Add Insulation

Insulate exposed riser pipes to optimize heat distribution. Insulate condensate tanks and behind radiators to reduce heat loss.



#### Install Master Venting

Master venting enables air to escape the distribution system quickly, improving the flow of steam to radiators.





## HYDRONIC SYSTEMS

### Improve Efficiency of Heating Equipment

#### Upgrade Terminal Units

Install terminal units capable of delivering heat at reduced distribution supply water temperatures.



#### Convert to Air-to-Water Heat Pumps

Replace boiler with an air-to-water heat pump for a high-efficiency electric alternative to a condensing boiler.



#### Replace or Upgrade Boiler

Install condensing boilers, the most efficient option for fuel-fired heating.



## HYDRONIC SYSTEMS

### Balance and Improve Heat Distribution

#### Correctly Size Water Pumps

Right-size pumps to improve efficiency and better regulate speeds to meet changing heating demands.



#### Install Pressure Independent Control Valves

Install pressure independent control valves at each terminal unit to provide both temperature and flow control.



#### Install Variable Frequency Drives

Install variable frequency drives (VFDs) on pumps to modulate speeds and maximize energy savings.





## HIGH PERFORMANCE

### Install a High Efficiency Heat Pump Technology

#### Install Mini-Splits

Install mini-splits—a decentralized, room-scale, high efficiency electric technology that can be used for heating and cooling spaces.

|                |   |   |   |   |
|----------------|---|---|---|---|
| EASE           |   |   |   |   |
| IMPACT         |   |   |   |   |
| ADDED BENEFITS |  |  |  |  |

#### Install PTHPs

Install Packaged Terminal Heat Pumps (PTHPs), single packaged, high efficiency heating and cooling units that can be installed in existing PTAC wall sleeves.

|                |   |   |   |   |
|----------------|---|---|---|---|
| EASE           |   |   |   |   |
| IMPACT         |   |   |   |   |
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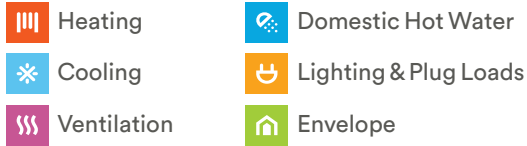
#### Install VRFs

Install a Variable Refrigerant Flow (VRF) system—a high efficiency electric heating and cooling technology that can be configured in centralized or decentralized layouts.

|                |   |   |   |   |
|----------------|---|---|---|---|
| EASE           |   |   |   |   |
| IMPACT         |   |   |   |   |
| 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](http://be-exchange.org/anatomy-solutions)

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