

## Common Eligible Energy Conservation Measures

Upgrades eligible for C-PACE financing:

- Lower the energy consumption of the building or enable the building to produce clean energy;
- Are “permanently affixed” to the property (with the exception of district heating and cooling systems and microgrids);
- Meet a “Savings to Investment Ratio” of greater than 1 (meaning that projected lifetime savings from the energy measures must exceed the total investment over the full term of the C-PACE assessment).

The following list of predominant, long-standing, proven energy efficiency technologies is intended as a reference list of technologies for C-PACE applicants. For a complete list of eligible and ineligible measures and technical requirements, please view the [C-PACE Program Guidelines](#). If not included on this list, The Connecticut Green Bank will review proposed ECM(s) and accept them on a case-by-case basis.

- High efficiency lighting
- Heating, ventilation and air conditioning (HVAC) upgrades
- New automated building and HVAC controls
- Variable speed drives (VSDs) on motors fans and pumps
- High efficiency chillers
- High efficiency boilers and furnaces
- High efficiency hot water heating systems
- Combustion and burner upgrades
- Fuel switching
- Water conservation measures to the extent they save energy
- Heat recovery and steam traps
- Building enclosure/envelope improvements
- Building automation (energy management) systems
- Renewable energy systems (e.g., solar, fuel cells, geothermal)
- Combined heat and power systems (CHP)
- District thermal
- Microgrids

The following end use savings technologies are generally more applicable to industrial facilities:

- New automated process controls
- Heat recovery from process air and water
- Cogeneration used for peak shaving
- Process equipment upgrades
- Process changes

Shown below are key aspects of some of the most commonly applied technologies listed above, with their typical simple payback range. These payback periods are only provided for informational purposes and should not be construed as a guarantee of performance or requirement for C-PACE funding eligibility.

**Lighting (typical 2 to 3 year simple payback):**

- Daylight controls and natural day lighting designed to reduce energy and improve visual comfort
- Upgrades for existing fluorescent fixtures including electronic ballasts, T8 lamps, and reflectors
- Meeting rooms and other intermittently occupied spaces can garner significant energy savings with the use of timers and occupancy sensors
- Smaller impact opportunities including security lighting, stairwell lighting, exterior night-time security lighting and exit signs.

**Motors (typical 3 to 5 year simple payback):**

- High efficiency electric motor replacements usually pay back when a motor is running for long periods at high load, or at the end of motor life
- The cost premium over standard motors normally can be recovered in less than 2 years
- Motor sizing to the actual load profile to improve efficiency and control electrical power factor.

**Variable Speed Drives (typical 3 to 5 year simple payback):**

- Applied to motors, pumps and fans
- Matches motor use to variable operating load
- Can save up to 40 percent in power consumption
- Can be packaged with controls
- Extends motor life.

**HVAC (typical 2 to 8 year simple payback)**

- New packaged units can increase efficiency and indoor comfort
- Proper sizing of HVAC equipment is a major opportunity, since full-load operation is more efficient than part load operation - consider fan capacity reduction or staging of 2 smaller units rather than partial loading of one large unit
- Install VSDs on HVAC motors
- Balance air and water supply systems to remove trouble spots demanding inefficient system operation
  - Improve maintenance
  - Eliminate simultaneous heating and cooling
  - Install economizers and direct digital controls
- Variable air volume conversions versus constant air flow
- Ventilation reduction
- Unoccupied shutdown or temperature setback/setup (controls).

**Chillers (typical 5 to 10 year simple payback):**

- New chiller models can be up to 30-40 percent more efficient than existing equipment.
- Upgrade lead chiller(s) (base load) to high efficiency
- Manage chiller and condenser settings to minimize compressor energy
- Optimize pumping energy for distribution of chilled water
- Optimize HVAC operation to:

- Improve temperature/humidity control
  - Eliminate unnecessary cooling loads
- CFC reclamation program/inventory - chiller replacement may achieve both CFC management and energy efficiency objectives.

#### **Boilers (typical 3 to 5 year simple payback):**

- Replace steam with hot water boilers for hot water heating loads
- Improve maintenance
- Optimize operation/staging in multiple boiler plants
- Optimize boiler controls
- Tune or replace burners
- Add small “pony” boilers for low loads:
  - Reduced fuel consumption/energy costs
  - Reduced emissions
  - Reduced maintenance costs
  - Higher reliability.

#### **Heat Recovery (typical 2 to 4 year simple payback):**

- Heat recovery devices to capture waste heat from water, process heat and exhaust air to re-use it for preheating: of Building intake air
  - Boiler combustion air
  - Boiler feed-water
  - Inlet water for domestic hot water.

#### **New Automated Building and HVAC Controls (typical 3 to 5 year simple payback):**

- Old controls may still be pneumatic systems based on compressed air - new electronic controls are more precise and reliable, with greater capabilities.
- Can automate lighting, chiller, boiler and HVAC operation:
  - Load shedding
  - Optimal start/stop/warm up
  - Ventilation control.
- Whole-building energy management systems may come with other advanced control technologies:
  - Security, fire and life safety
  - Alarm monitoring and report generation
  - Preventive maintenance scheduling
- Remote monitoring/metering capabilities may be attractive.

#### **Building Shell and Fenestration (typical 3 to 10 year simple payback):**

- Roof insulation, combined with reflective roof coatings in warm climates, reduces energy consumption
- Review building pressurization for proper ventilation:
  - Balance exhaust and intake air quantities
  - Add weather-stripping on doors and windows

- Seal cracks and unnecessary openings
- Window films to reduce solar heat gain and/or heat loss
- Replace windows with more energy efficient glazing.

### **Renewable Clean Energy Improvements for Commercial Property**

The following are examples of renewable clean energy improvements as defined in Subsection (A) of Section 16-245N of the General Statutes.

- Solar power
- Solar thermal
- Wind Power
- Geothermal energy
- Fuel Cell
- Methane Gas from landfills
- Low emission advanced renewable energy conversion technologies
- Projects that seek to deploy electric, electric hybrid, natural gas or alternative fuel vehicles and associated infrastructure and any related storage, distribution, manufacturing technologies or facilities
- Sustainable Biomass Facility

### **Ineligible Measures**

All C-PACE related improvements must be permanently affixed to the commercial property and part of a retrofit to existing infrastructure, with the exception of district heating and cooling systems. The following items will not be considered as efficiency measures under the C-PACE program:

- Appliances, e.g., refrigerators, dishwashers, etc.
- Plug load devices
- Vending machine controls
- Any package of measures with a weighted average effective useful life (EUL) that does not meet or exceed the life of the loan
- Any package of measures that does not achieve an energy savings (over the life of the loan) to total project investment ratio greater than one
- Any measure that is easily removed or not permanently installed
- Any measure that does not result in improved energy efficiency or renewable energy generation
- Extending natural gas lines to the property line to enable a PACE-eligible gas conversion project.