

## Appendix B: Common Eligible Improvements

Eligible Improvements for the expanded VA C-PACE Program include energy efficiency, water efficiency and safe drinking water, renewable energy, resiliency, stormwater management, EV infrastructure, and environmental remediation measures installed as part of an Eligible Project. Any deviations from these Eligible Improvements legislated through local C-PACE programs are delineated in the Existing Local Program Matrix in [Appendix F: Supplemental information](#).

### Energy Efficient Improvements

The following list of predominant, long-standing, proven energy efficiency technologies, water conservation technologies, and renewable energy generation systems is intended as a reference list and can change at any time. If not included on this list, the Program Administrator will review proposed Eligible Improvements and accept them on a case-by-case basis.

- High efficiency lighting
- Heating ventilation 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 resulting in an overall reduction in the number of BTUs required to achieve a given end use
- Heat recovery, including air, water, or steam condensate heat or energy recovery
- Steam traps
- Building enclosure/envelope improvements
- Building automation (energy management) systems

The following end-use savings technologies are 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 applied technologies listed above, with their typical simple payback range. These payback ranges are only provided for informational purposes and should not be construed as a guarantee of performance or requirement for C-PACE Financing eligibility.

### **Automated Building and HVAC Controls**

- New electronic controls which are more precise and reliable when compared to old controls that may still be pneumatic systems based on compressed air
- Automated lighting, chiller, boiler, and HVAC operation including
  - Load management, including load shedding, scheduling, and other building-to-grid interactive features;
  - Optimal start/stop/warm up
  - Ventilation control
- Whole-building energy management systems, which may come with other advanced control technologies, such as:
  - Security, fire, and life safety
  - Alarm monitoring and report generation
  - Preventive maintenance scheduling
- Remote monitoring/metering capabilities
- Plug-load controls

### **Boilers**

- Replacement of steam with hot water boilers for hot water heating loads; including heat pump water heaters
- Improved maintenance
- Optimized operation/staging in multiple boiler plants
- Optimized boiler controls
- Tuning or replacement of burners
- Addition of small “pony” boilers for low loads, which result in
  - Reduced fuel consumption/energy costs
  - Reduced emissions
  - Reduced maintenance costs
  - Higher reliability

### **Building Shell and Fenestration**

- Roof insulation, which, when combined with reflective roof coatings in warm climates, reduces energy consumption
- R review of 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
- Replacement windows with more energy efficient glazing
- Present value of the embodied energy in the building envelope

## Chillers

- New chiller models, which can be up to 30-40 percent more efficient than existing equipment
- Upgrades of lead chiller(s) (base load) to high efficiency
- Management of chiller and condenser settings to minimize compressor energy
- Optimization of pumping energy for the distribution of chilled water
- Optimization of 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

## Heat Recovery

- Heat recovery devices to capture waste heat from water, process heat and exhaust air to re-use it for preheating of
  - Building intake air, including energy recovery units, heat pipes, enthalpy wheels or similar
  - Boiler combustion air
  - Boiler feedwater
  - Inlet water for domestic hot water

## HVAC

- New packaged units for increased efficiency and indoor comfort
- Heat pumps
- Proper sizing of HVAC equipment
  - Full-load operation is more efficient than part load operation
  - consider fan capacity reduction or staging of two (2) smaller units rather than partial loading of one large unit
- Installation of VSDs on HVAC motors
- The balancing of air and water supply systems (by installing economizers and direct digital controls) which removes trouble spots demanding inefficient system operation
- Improves maintenance and eliminates simultaneous heating and cooling
- Variable air volume conversions, which differ significantly from constant air flow
- Ventilation reduction (when possible and not below ventilation rates required by USBC)
- Unoccupied shutdown or temperature setback/setup (controls)
- Combined heat and power

## Lighting

- Daylight controls and natural daylighting designed to reduce energy and improve visual comfort
- Upgrades for existing fluorescent fixtures including electronic ballasts, T8 lamps, reflectors, and the installation of LED bulbs and fixtures
- Timers and occupancy sensors for meeting rooms and other intermittently occupied spaces
- Smaller impact opportunities including security lighting, stairwell lighting, exterior night-time security lighting, and exit signs

## Motors

- High efficiency electric motor replacements
  - The cost premium over standard motors normally can be recovered in less than two (2) years
- Motor sizing to the actual load profile to improve efficiency and control electrical power factor

## Refrigeration

- Improvements to refrigerated cases and walk-in coolers to improve efficiency and decrease waste
  - Additional insulation, anti-sweat heater controls, auto-closers for cooler/freezer doors, case-lighting controls, improved defrost controls, suction line insulation, etc.
- Thermal Storage Systems (for load shifting)
- Compressors (VFD and controls, heat recovery, mechanical sub-cooling, evaporative condensers)

## Variable Speed Drives

- VSDs 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

## **Water Efficiency and Safe Drinking Water Improvements**

- Replacement of toilets, urinals, and other bathroom fixtures which can greatly impact domestic water use
- Replacement of pre-rinse valves, dishwashers, and icemakers in commercial kitchens, which can save water
- Upgraded laundry equipment in commercial properties and Laundromats
- Installation of cooling towers, condensers, and steam boilers HVAC systems, which can reduce water consumption
- Installation of new equipment in car washes to achieve 80-100% recycled water use or utilization of applicable gray water sources, film and x-ray processing, and high-tech manufacturing which can reduce industrial water consumption
- Replacement of lead pipes that serve potable water supply

## **Renewable Energy Improvements**

- Solar photovoltaic power
- Solar thermal
- Wind power
- Geothermal energy
- Fuel cell

- Green Hydrogen (hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity)
- Combined heat and power
- Solar battery storage
- Voltage optimization devices: Savings may be achieved by reducing energy lost during the transmission and transformation processes

## Resiliency Improvements

- Stormwater management systems
  - Green roofs
  - Blue roofs
  - Pervious pavement/pavers
  - French drains
  - Rainwater capturing systems and other stormwater management systems as approved by the Virginia Best Management Practices (BMP) Clearinghouse, or the Chesapeake Bay Basin wide BMP Verification Program
- Wind
  - Wind resistant felt underlayment
  - Existing roof-structural-framing-member-to-wall connections (e.g., hurricane straps)
  - Commercial doors including roll-up, overhead, and sectionals
  - Reinforced gutters and downspouts
  - Hurricane shutters
  - Wind resistant shingles
  - Secondary water barrier
- Flood mitigation/inundation adaptation
  - Relocation of HVAC, plumbing, servers, electrical rooms, backup generators, and other critical infrastructure above the height of expected flood levels
  - Dry flood protection such as flood gates, walls, or doors, inflatable barriers
  - Direct Costs to build > 3 feet above base flood elevation
  - Infrastructure to raise equipment above 3-foot freeboard
  - Site Perimeter floodproofing
  - Flood vents
  - Floating foundations
  - Thermal protection/insulation
  - Sump Pumps (permanent)
  - Backwater Valves
  - Waterproof or water-resistant materials for flooring, foundation etc.
  - Windows and doors on ground level to be watertight
  - Elevators to include water detectors that stop the elevator above flood inundation levels;
  - Elevating sites
  - Sea walls

- Energy Storage systems
- Stormwater management project
  - green roofs
  - blue roofs
  - pervious pavement/pavers
  - rainwater capturing systems

## Environmental Remediation Improvements

- Soil and groundwater remediation
- Asbestos remediation in tiles, ceilings, and other interior building areas
- Mold remediation of walls and ceilings
- Removal of lead paint in building interiors
- Protect water piping from contamination due to flooding
- Ultra-violet lamp systems in air handling units or hospital rooms

## Electric Vehicle Infrastructure

- Electric vehicle charging stations
- Electrical upgrades necessary to install EV charging stations

## Non-Eligible Improvements

- Improvements that are not permanently installed and can be easily removed
- Any measure that cannot be explained in terms of industry-standard engineering or scientific principles