

Driving our nation’s buildings to low and zero carbon saves money, creates jobs, and leads to a healthier environment and more resilient economy. The table below includes steps that building owners and operators can implement to achieve smart, healthy, and low-carbon supermarkets within their existing building portfolios. Supermarkets include built-up refrigeration systems and refrigerated display cases and often use packaged rooftop units for heating, cooling, and ventilation. Assess current conditions in your building against the simple, intermediate, and advanced options to begin planning your next steps to reduce carbon emissions. If you have a commercial kitchen, include [low carbon strategies for kitchens](#) (equipment, ventilation, refrigeration, and water heating).

Technology		Simple	Intermediate	Advanced
Lighting	Interior Lighting	<ul style="list-style-type: none"> <li>Install Type B tubular LEDs that meet <a href="#">DesignLights Consortium (DLC)</a> technical requirements</li> <li>Reduce overlit spaces</li> <li>Install occupancy sensors or vacancy sensors</li> </ul>	<ul style="list-style-type: none"> <li>Install <a href="#">dimmable LED retrofit kit</a> or <a href="#">replace with LED fixture</a> that meets DLC technical requirements</li> <li>Install daylighting controls and occupancy / vacancy sensors</li> <li>Integrate with building automation system (BAS) if possible</li> </ul>	<ul style="list-style-type: none"> <li>Install retrofit kit or new luminaire with luminaire level lighting controls</li> <li>Include integrated daylight and occupancy sensor networked lighting controls that meet DLC requirements, load shed via Auto-DR interface, and integrate with BAS</li> </ul>
	Display Case Lighting	<ul style="list-style-type: none"> <li>If display cases are not capable of more sophisticated control, turn lighting off when the store is unoccupied</li> </ul>	<ul style="list-style-type: none"> <li>Verify that current display case lighting is efficient</li> <li>Replace fluorescent tubes with LEDs</li> </ul>	<ul style="list-style-type: none"> <li>Install LED display cases or LED tubes</li> <li>Install occupancy sensor controls</li> </ul>
	Exterior and Parking Lot Lighting	<ul style="list-style-type: none"> <li>Install LED screw base replacement for HID lamps that meets DLC requirements</li> <li>Install photocell to control lighting</li> </ul>	<ul style="list-style-type: none"> <li>Replace with area luminaires that meet DLC requirements</li> <li>Install time clock and reduce lighting at night</li> </ul>	<ul style="list-style-type: none"> <li>Redesign using the <a href="#">Better Buildings Parking Lot specification</a> and include video-based occupancy sensors</li> </ul>
Space Conditioning and Water Heating	HVAC	<ul style="list-style-type: none"> <li>Verify and repair dampers</li> <li>Test and seal ducts</li> <li>Install advanced RTU controls retrofit (variable speed supply fan, integrated air-side economizer, and RTU-level demand-controlled ventilation (DCV))</li> </ul>	<ul style="list-style-type: none"> <li>Replace equipment with right-sized, high-efficiency equipment (CEE Advanced Tier)</li> <li>Install air source heat pump RTUs, dual fuel RTUs, or variable refrigerant flow (VRF) systems</li> <li>Add energy recovery ventilators</li> <li>Install active thermal energy storage for load shifting and system optimization</li> <li>Add evaporative cooling in dry climate zones</li> </ul>	<ul style="list-style-type: none"> <li>Install water source or ground source heat pumps</li> <li>Implement natural ventilation, controlled in coordination with mechanical ventilation</li> </ul>
	Water Heating	<ul style="list-style-type: none"> <li>Reduce water heating demand through various technologies like low-flow faucets and showerheads</li> </ul>	<ul style="list-style-type: none"> <li>Install point-of-use electric water heaters for small, distributed loads</li> <li>Install high-efficiency, connected heat pump water heaters</li> </ul>	<ul style="list-style-type: none"> <li>Install CO<sub>2</sub> air-to-water heat pumps</li> </ul>

Technology		Simple	Intermediate	Advanced
<b>Refrigeration</b>		<ul style="list-style-type: none"> <li>• Verify temperature setpoints</li> <li>• Clean and maintain cases, particularly airflow paths</li> <li>• Check and maintain proper refrigerant charge</li> <li>• Perform refrigerant leak inspection or add automated leak detection system per state and EPA requirements</li> <li>• Use night curtains to reduce infiltration</li> </ul>	<ul style="list-style-type: none"> <li>• Replace evaporator and/or condenser fan motors with more efficient motor technology</li> <li>• Add doors to open display cases</li> <li>• Implement floating head pressure and floating suction pressure control</li> <li>• Retrofit systems to use lower GWP refrigerants</li> </ul>	<ul style="list-style-type: none"> <li>• Replace systems using higher GWP refrigerants with systems using low GWP refrigerants</li> <li>• Add heat recovery to preheat hot water or ventilation air</li> <li>• Replace air-cooled condensers with evaporative condensers</li> <li>• For CO<sub>2</sub> systems, use ejector systems instead of flash tanks</li> </ul>
<b>Controls and Analytics</b>	Install or Upgrade Controls	<ul style="list-style-type: none"> <li>• Widen zone temperature dead band on existing thermostats</li> <li>• Install wireless networked thermostats to centrally manage heating/cooling set points, setbacks, and schedules</li> <li>• Implement building <a href="#">Re-tuning™</a> process</li> <li>• Automatically shut off equipment (exhaust fans, room air cleaners, other loads) during unoccupied times</li> <li>• Add or tune anti-sweat heater controls to refrigerated cases</li> </ul>	<ul style="list-style-type: none"> <li>• Add controls to support holiday scheduling, optimal start, and additional monitoring points</li> <li>• Reduce airflow to zones during unoccupied times with zone-level DCV monitoring points</li> <li>• Implement demand limiting RTU controls and continuous demand management</li> <li>• Implement temperature setpoint control based on refrigerated product (multiple setpoints)</li> <li>• Shift load by pre-cooling refrigerated cases</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce airflow to zones during unoccupied times by integrating the occupancy sensors from the lighting control system into the HVAC control system</li> <li>• Implement controls that integrate building loads, thermal/battery storage, on-site co-generation plants, PV, and EV charging to provide demand flexibility (<a href="#">Market Brief</a>)</li> <li>• Use demand-based defrost of refrigerated cases as opposed to set defrost schedules</li> <li>• Add occupancy sensors for refrigerated case lighting</li> </ul>
	Install Energy Management and Information System (EMIS) ( <a href="#">EMIS Primer</a> , <a href="#">Specification</a> )	<ul style="list-style-type: none"> <li>• Install energy information system (EIS) with whole building interval meters</li> <li>• Submeter critical loads to verify operation</li> <li>• Compare whole building EUI among portfolio or against similar buildings</li> <li>• Implement remote monitoring of refrigerated case temperatures and compressor run time</li> </ul>	<ul style="list-style-type: none"> <li>• Subscribe to remote monitoring and diagnostic service for HVAC and refrigeration systems</li> <li>• Flag when floating head and floating suction control at constant setpoint</li> <li>• Flag when anti-sweat heaters are consistently at max power</li> </ul>	<ul style="list-style-type: none"> <li>• Install an EMIS as an integrated platform for monitoring and control of lighting and HVAC systems</li> <li>• Utilize EMIS to control and monitor for demand flexibility (<a href="#">Market Brief</a>)</li> </ul>
<b>Building Envelope</b>	Opaque Building Envelope	<ul style="list-style-type: none"> <li>• Use reflective roof materials</li> <li>• Use cool roof paints, <a href="#">climate dependent</a></li> <li>• Identify thermal bridges with IR camera; mitigate (complexity varies)</li> <li>• Add loose fill insulation in the attic space</li> <li>• Deploy radiant barrier or spray applied low-E paints/coatings in attic spaces (where applicable)</li> </ul>	<ul style="list-style-type: none"> <li>• Add or increase level of continuous insulation when replacing roof membrane</li> <li>• Add attic ventilation, hot climate</li> <li>• Install phase change material (PCM) panels in dropped ceiling (multiple technologies available)</li> </ul>	<ul style="list-style-type: none"> <li>• Add continuous insulation to exterior walls</li> <li>• Use advanced techniques to fill gaps with spray foam</li> </ul>
	Building Airtightness	<ul style="list-style-type: none"> <li>• Seal obvious cracks</li> <li>• Install weather stripping</li> <li>• Seal around receptacles</li> <li>• Apply window flashing to prevent moisture penetration</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct blower door test along with smoke test to locate and seal where needed</li> <li>• Caulk and seal above dropped ceiling</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Install air barrier</a> (preferably combined with other retrofit measures, such as adding exterior or interior insulation)</li> </ul>

Technology		Simple	Intermediate	Advanced
<b>Building Envelope (cont.)</b>	Windows and Attachments	<ul style="list-style-type: none"> <li>• Install applied films</li> <li>• Caulk/seal windows</li> <li>• Install window shading or attachments</li> <li>• Automate interior attachments</li> </ul>	<ul style="list-style-type: none"> <li>• Add storm window/<a href="#">secondary glazing</a> or replace existing windows with <a href="#">double-pane or Low-E</a></li> <li>• Automate existing exterior attachments</li> <li>• Add automated exterior attachments/awnings</li> </ul>	<ul style="list-style-type: none"> <li>• Install dynamic windows</li> <li>• Install thin triple windows</li> <li>• Install vacuum glazing</li> </ul>
<b>Plug and Process Loads (PPLs)</b>		<ul style="list-style-type: none"> <li>• Procure ENERGY STAR® rated or better products</li> <li>• Enable low-power or sleep settings</li> <li>• Consolidate and reduce loads</li> <li>• Procure and install PPL control technologies: <ul style="list-style-type: none"> <li>– <a href="#">Advanced Power Strips</a></li> <li>– <a href="#">Wireless Meter and Control Systems (aka Smart Outlets)</a></li> <li>– <a href="#">Automatic Receptacle Controls</a></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Integrate smart PPL controls with other building systems, such as lighting</li> <li>• Load shift by implementing advanced scheduling technologies for charging EVs</li> </ul>	<ul style="list-style-type: none"> <li>• Integrate PPL controls to shed, shift, and modulate during times of peak fossil generation</li> <li>• Implement power over ethernet (PoE) systems</li> <li>• Integrate PPLs into demand response</li> </ul>
<b>Renewables and Battery Storage</b>		<ul style="list-style-type: none"> <li>• Participate in a community solar program or access renewables via a power purchase agreement (PPA)</li> </ul>	<ul style="list-style-type: none"> <li>• Purchase on-site PV to cover roof area (verify roof structure and age) and parking as needed</li> <li>• Integrate electric batteries and additional thermal energy storage to balance PV production</li> </ul>	<ul style="list-style-type: none"> <li>• Integrate renewables, battery storage, and building loads into demand flexibility controls (EMIS platforms often provide this integrated-control capability)</li> </ul>

**Need additional support?** See the [Path to Zero: Getting Started Guide](#). Reach out to [Better Buildings](#) for support on your path to low carbon.