Commercial buildings

Energy efficiency checklist

EECA

DECARBONISATION PATHWAY

COMMERCIAL BUILDINGS

The energy efficiency checklist for commercial buildings

The energy efficiency checklist for commercial buildings is a practical guide to help commercial building operators establish energy efficient opportunities. This document has been developed as part of the Sector Decarbonisation Programme and is a joint initiative between the Energy Efficiency & Conservation Authority (EECA), and Facilities Management Association of New Zealand (FMANZ). We would also like to acknowledge and thank the U.S. Environmental Protection Agency, ENERGY STAR Program and EP100 (part of Climate Group) for collaborating on this document.

This checklist sets out a variety of energy efficiency opportunities with a wide range of costs (including many that are no-cost) which can be taken when embarking on a process towards decarbonising your Commercial Building. There are five separate one-page checklists focusing on:

1. Operations
2. Maintenance
3. Occupant & Staff Education
4. Building envelope
5. Equipment upgrades

Before you start this guide, you can set the foundations by:

1. Putting in place an energy & carbon management plan with regular feedback from stakeholders and staff around how to improve your performance.
2. Assign energy management responsibilities to staff.
3. Maintain an updated action list of energy efficient opportunities.
4. Meet regularly and report on actions – provide the opportunity for staff feedback.
5. Start with a few simple actions from the low-cost list to see what savings you can make and then progress towards more complex actions as you feel comfortable.

Operations

ALL OPERATIONAL OPPORTUNITIES	COMPLETE?
HEATING & VENTILATION MAINTENANCE	
Visibly display a list of operating parameters and service log for each piece of cooling equipment in a readily accessible location - initiate a continuous commissioning programme for large energy using assets.	
Take stock of any occupant complaints, consider how they relate to system operation.	
Maintain controls for proper operation - preferably centrally controlled from a single source place .	
Close all windows and doors when cooling and heating system is in use, eliminate personal heaters and remove heaters mounted above windows or doors.	
Shorten HVAC schedules to occupancy hours (reduce the morning warm up to **1 hour**, monitor the result; check if the morning warm up temperature setting is the most appropriate).	
Fix HVAC damper seals and reduce minimum outdoor airflow to zero during unoccupied periods.	
Apply a seasonal reset to the supply air temperature in the HVAC system.	
Adjust diffusers and other parts of air distribution systems to minimize overcooling or overheating; re-adjust minimum and maximum air flow rates on VAV boxes to minimize over cooling and reheat.	
Make sure that areas in front of vents are clear of furniture and paper. As much as 25 percent more energy is required to distribute air if your vents are blocked.	
Minimize HVAC system exhaust and makeup ventilation rates where possible.	
Ensure HVAC system dampers can move freely through entire operating range; clean, lubricate, and repair dampers.	
Modify HVAC system controls to implement night precooling.	
Create a seasonal Air Handling Unit (AHU) supply air temperature and investigate the benefit of a floating supply air temperature base on outside air.	
Investigate use of air compressors and decommission/switch off the compressors if not used.	
Identify heat reclaim opportunities where possible.	
Serve relatively constant and weather-independent loads with separate controls or systems from those serving perimeter loads to suit solar exposure and occupancy.	
In multiple-zone HVAC systems, identify any rogue zones that cause the reset of system-level setpoints.	
CHILLER & WATER MAINTENANCE	
Schedule the chilled water system to match the site's operating hours and turn off chilled water on weekends.	
Maintain chilled water and condenser flow rates at greater than 90% of design.	
Increase the temperature setpoint of the chilled water and decrease the temperature setpoint of the condenser water.	
Operate cooling tower as close to wet bulb temperature as possible and turn off hot water circulation pump at night and on weekend if possible.	
Deploy chiller sequencing for multiple chillers, i.e. adjust the chillers' loads to achieve the most efficient combination.	
Prevent chilled water or condenser water flowing through the offline chiller & reduce over pumping.	
LIGHTING & CONTROL SYSTEMS	
Building Management Systems (BMS) response to reduced occupancy, public holidays, day light savings, and seasonal changes.	
Revise janitorial practices to reduce the hours that the lights are turned on each day. Consider switching to day-cleaning, which takes place while occupants are in the building and has shown to also reduce complaints.	
Activate light-sensing function in occupancy sensors (if available) to implement basic daylight harvesting.	

Maintenance

ALL MAINTENANCE OPPORTUNITIES	COMPLETE?
HEATING & VENTILATION MAINTENANCE	
Clean air filters on your heating, ventilation, and air conditioning (HVAC) system – replace if need be.	
Increase fan belt tension on HVAC system; consider installing fan belts designed for minimum energy losses, such as cog belts .	
Clean heat transfer surfaces, including cooling and condensing coils on HVAC system.	
For unitary and air-handling systems, maintain condensate drain pan and piping.	
Conduct combustion analysis and tune the boiler to improve efficiency.	
CHILLER & WATER MAINTENANCE	
Remove fouling from a water-cooled chiller's condenser water tubes.	
For evaporative coolers, ensure the pads are sufficiently wet; maintain proper fill, drain operation, water compartment moisture and air containment.	
Maintain piping and duct systems against leakage, and maintain their insulation especially outside of conditioned spaces; ensure any water distribution systems are free of leaks and entrained air.	
For existing refrigerators, clean refrigerator coils twice a year and replace door gaskets if a dollar bill easily slips out when closed between the door's seals.	
Maintain chilled water-cooling control valves against leakage.	
Maintain serviceable points of lubrication.	
For refrigerated warehouses, examine walls and ceilings for evidence of frost build up, make repairs if needed.	
Monitor and address refrigerant leakage and fix low refrigerant charge to improve efficiency and maintain safety. Recover or recycle refrigerant (and deliver to a reclamation centre if feasible); do not vent refrigerant to the atmosphere.	
Tune up your HVAC system with an annual maintenance contract. Even a new HVAC system, like a new car, will decline in performance without regular maintenance. A contract automatically ensures that your HVAC contractor will provide "pre-season" tune-ups before each cooling and heating season. Your chances of an emergency HVAC breakdown also decrease with regular maintenance.	
Check fan coil chilled water valves - replace if necessary.	
Have large and walk-in refrigeration systems serviced at least annually. This includes cleaning, refrigerant top off, lubrication of moving parts, and adjustment of belts. This will help ensure efficient operation and longer equipment life.	
Repair leaking faucets and equipment. A dripping hot water faucet can leak hundreds of gallons per year.	
Insulate hot water cylinder pipes.	
LIGHTING & CONTROL SYSTEMS	
Continuously check after hours setback/setpoints mode on equipment.	
Re-set occupancy sensor time delays to shorter periods to maximise off-time during vacancy periods.	
Continuously monitor and improve the overnight shutdown of equipment and displays – including TV's.	
Standardise timers for occupancy sensors that control lighting.	
Check and align all floor terminal unit setpoints to eliminate hot/cold fighting.	
Carry out an afterhours survey on tenant equipment to investigate what is being left on during unoccupied hours.	
Check equipment pressure sensors and optimise variable speed drives (VSD) commands.	
Set goals and a methodology to track and reward improvements.	

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Occupant education

LOW-COST EDUCATION OPPORTUNITIES	COMPLETE?
Create a mechanism for occupants or employees to share their suggestions with you. Make sure you respond to comments and act on recommendations when feasible. You may even offer a reward for the best energy-saving ideas. Check out ENERGY STARS treasure hunt below	☐
Educate staff members about the basic principles of energy management and empower them to establish their own departmental green teams. Check out the ENERGY STAR Green Team Checklist for steps and considerations to consider when establishing a green team.	☐
Display the past 6–12 months of energy use information in a high-traffic area or distribute it as part of a regular report. Seeing the data and any trends in energy use can inspire occupants and employees to contribute to continued savings.	☐
Encourage actions that apply to most of your employees' workspaces, or that can be practiced at work and at home, like turning off lights when not in use and activating computer power management features.	☐
Print and hang banners, posters, and signs with energy-saving messages in high-traffic areas in your space or in areas like lobbies, elevators, hallways, over water fountains, and in break rooms.	☐
Create door hangers, post-it-note reminders, or light switch covers to help occupants or employees remember to take action.	☐
Conduct an energy awareness event in the lobby or offer building tours to give occupants a sneak peek at the inner workings of the building.	☐
Host a lunch and learn session, hold a webinar, or present about why it's important to save energy at staff meetings, tenant meetings, or other get-togethers. You can also integrate information about your energy programme into your organisation's orientation training.	☐
Give incentives and recognition. Consider starting small with something like a pizza party, ice cream social, bagel breakfast, or other food rewards for hitting goals or making progress. Depending on savings levels, you may also consider awarding cash or prizes for great energy-saving ideas or to energy champions.	☐
Share your energy efficiency goals. Transparency is the first step to getting the people inside your building or space interested in what you're doing. When you share your energy reduction goals and progress toward saving, employees and occupants sit up and take notice of your efforts.	☐

To view other resources which will assist you on your decarbonisation journey, please visit the links below:

- ENERGY STAR - Checklist of Common Energy-Saving Measures
- ENERGY STAR - Action Workbook for Small Business (See Appendix B)
- ENERGY STAR - Activity Kits focusing on Energy and Water efficiency
- ENERGY STAR - Treasure Hunts (Employees & Occupants)
- ENERGY STAR - Employee Education Kit & Cubicle poster
- The Climate Group - EP100 Cooling Challenge

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Building envelope

LOW-COST BUILDING ENVELOPE OPPORTUNITIES	COMPLETE?
Install self-closing or revolving doors to outdoor spaces.	☐
Install automatic doors, air curtains, or strip doors at high-traffic passages between conditioned and unconditioned spaces.	☐
Insulate outdoor ducting for supply air.	☐
Apply corrosion prevention coating to outdoor units.	☐
Treat windows with low-emissivity (i.e. low-e) coating or use solar window films.	☐
Install exterior shading (e.g. blinds, awnings) or plant trees to create shade.	☐
Leverage natural ventilation where possible.	☐
Seal the building envelope wherever needed, by: applying sealing at exterior joints and all-around penetrations by utility services; sealing or capping air chases; replacing broken or missing windows or exterior door weather stripping.	☐

HIGHER-COST BUILDING ENVELOPE OPPORTUNITIES	COMPLETE?
Add insulation to walls (including external post insulation), roofs, basements, and floors.	☐
Increase insulation levels above the existing building code requirements.	☐
Lighten roof colour/apply high-reflectance roofing material. Alternatively consider a green roof.	☐
Look to implement green facades or solar photovoltaics (PV's) where possible.	☐
Utilise argon filled thermally broken aluminium or PVC window frames.	☐
Install automated window shades.	☐

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Equipment

LOW-COST EQUIPMENT UPGRADE OPPORTUNITIES	COMPLETE?
Exhaust hot air from attics or spot-ventilate heat sources e.g. from computer rooms or mechanical equipment rooms, without compromising heat recovery opportunities.	
Install smart equipment such as smart plugs that cut down on standby power consumption by switching devices off when not in use.	
Install occupancy sensors for thermostats and lighting.	
Ensure refrigerant servicing equipment is upgraded as needed to handle new refrigerants; ensure technician follows best practices when installing equipment with new refrigerant to minimize risk of leaks.	
Install lighting sensors in the parking garage.	
Activate sleep settings on all printers, copiers, scanners, and multifunction devices so that they automatically enter a low-powered sleep mode when inactive. Use the owner's manual to make the setting changes yourself or ask your service vendor to ensure your machines are configured to take full advantage of these features.	
HIGHER-COST EQUIPMENT UPGRADE OPPORTUNITIES	**COMPLETE?**
HEATING & VENTILATION UPGRADES	
Replace mechanical dehumidification with desiccant systems using heat-recovery regeneration.	
Switch to oil-free technologies where applicable.	
Install an air-side and/or water-side economiser cycle with enthalpy switchover.	
Install an air-to-air heat exchanger (i.e. air-to-air energy recovery ventilator).	
Consider converting a constant-air-volume system into a variable air volume system with variable frequency drives (VFDs) on fan motors; also consider converting constant-volume central exhaust systems into demand-based controlled central exhaust systems.	
For fan systems, upgrade to a more efficient fan type and upgrade evaporator fan motors to high-efficiency motors.	
Consider hybrid variable refrigerant flow (VRF) or a central HVAC plant with low global warming potential (GWP)refrigerants instead of standard VRF.	
Consider replacement of all-air HVAC system with a combination of a dedicated outdoor air system coupled with a radiant cooling system.	
Install more efficient cooling equipment e.g. see ASHRAE Standard 90.1-2016 for a set of efficiency standards for cooling equipment.	
CHILLER & WATER MAINTENANCE	
Install absorption chiller when there is cogeneration system, waste heat, or solar thermal available.	
Install evaporative cooled, evaporative precooled, or water-cooled condensers in place of air-cooled condensers. For evaporative cooling systems, install drift eliminators and submeters for makeup water and bleed-off water.	
Integrate free cooling cycle into chiller system by piping chilled water to condenser during cold weather.	
Install variable speed drives (VSD), such as variable frequency drives (VFD), in motor systems (e.g. centrifugal fans, cooling tower fans, blowers, pumps, or chiller compressors).	
Use two-speed or variable-speed fans instead of water bypass to modulate the cooling tower capacity.	
Install refrigeration floating head pressure control.	
Replace cooling equipment with equipment that uses a lower-global warming potential (GWP) refrigerant, particularly for refrigerants that are being phased out, and especially when equipment reaches the end of its life. This is not an energy efficiency measure.	
LIGHTING & CONTROL SYSTEMS	
Convert interior and exterior lighting to LED wherever appropriate equipment exists for the application.	
Retrofit open refrigerated display cases with glass doors and install LED lighting for display cases.	
Install energy-efficient office equipment and other plug loads to improve energy efficiency.	