Energy Efficiency Checklist

Commercial Baking

Cost saving measures, productivity enhancements and optimisation opportunities

EECA

DECARBONISATION PATHWAY

COMMERCIAL BAKING

Introduction

The Energy Efficiency Checklist is a practical guide to help the maintenance team in commercial bakeries establish energy efficient opportunities. It has been developed as part of the Sector Decarbonisation Programme, which is a joint initiative between the Energy Efficiency & Conservation Authority (EECA) and the Baking Industry Research Trust.

This checklist sets out both low-no cost and medium cost energy efficient opportunities to assist with decarbonising your processing facility.

There are five sections within the checklist focusing on:

1. Measuring Energy
2. Staff Engagement
3. Energy Maintenance
4. Process Changes
5. Equipment & Plant upgrades

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

1. Putting in place a climate action 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

TASK	DETAIL	COMPLETE?
Measure Energy Usage	Monitor energy consumption (electricity, diesel, petrol) as well as water usage regularly to identify any unexpected increases.	☐
	Use the 'Energy Intensity Calculator' available here to measure and keep track of energy use and emissions.	☐
	Compare monthly energy consumption data to the same month a year prior and on a rolling 12-month basis to identify trends (i.e., increasing/decreasing energy consumption).	☐
Staff Engagement	Educate staff about the importance of being as energy efficient as possible, managing hot water use and turning off equipment when not in use. • Run an introductory session to update staff about why it's important to save energy. You can also integrate information about your energy programme into your sites induction training. • Create a mechanism for contractors and staff 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.	☐
Energy Management & Maintenance	Choose the best power tariff that best suits the electricity load profiles in the plant. Similarly, reduce peak electricity loads by rescheduling processes so that they do not coincide with peak times.	☐
	Turn off lights, heaters, conveyors, and other electrical equipment when not in use. Put time switches on lighting and heating.	☐
	Implement appropriate scheduling to regularly perform basic energy maintenance by a qualified technician.	☐
	Check for leaking utilities (hot water/refrigerant/air).	☐
	Check lights are clean and free from dust.	☐
	Maintain and service motors used for air conditioners, refrigeration/freezing, pumps, ovens, dryers, and conveyors to save energy and reduce wear and tear.	☐
	Reduce heat losses. Lag all hot pipes. Avoid long pipe runs.	☐
	Shed peak heat loads. Operate the minimum number of boilers needed and reschedule heat loads so that the capacity of those boilers is not exceeded.	☐
	Ensure good door discipline in cold rooms. Keep doors on cold stores, chillers, and freezers shut when not in use for loading.	☐
	Minimise air flow into freezer by maintaining seals around room doors.	☐
Process Change	Optimise material flows through the factory. Linear processes may reduce production time, energy, and cost.	☐
	Explore options to segregate warm and cool areas to minimise heating and cooling demands.	☐
	Size boilers and heaters according to their use. (A correctly sized boiler may operate at 85+% efficiency compared with 60-70%. A second-hand boiler may cost more than a new one due to inefficient operation).	☐
	Allocate budget for preventative maintenance to save energy and prevent disruptions from breakdowns and unscheduled maintenance.	☐
Production Planning	Minimise downtime between products.	☐
	Optimise schedule by starting off the schedule with lower temperature profile products roast to higher temperature products.	☐
	Review options to have longer runs of product with less product changes.	☐
Asset Register	Develop asset register capturing key details, such as: • Make • Model • Type of unit (i.e., screw or reciprocating) • Age/year of install • Power rating • Efficiency • Operating temperatures	☐
	Implement asset replacement strategy focusing on more energy efficient replacements.	☐
Baking Process	Turn off ingredient conveyors when not in use.	☐
	Explore the option of adjustable speed drives on mixers.	☐

TASK	DETAIL	COMPLETE?
	Minimise oven heat up time. The oven warm up period should be kept as short as possible. • Record how long after start-up the oven temperature sensors indicate a desired baking temperature. This value is the minimum heat-up time and is the absolute minimum time needed before product enters the oven. To ensure all products are fully baked an oven start-up time should be established that is greater than the oven heat-up time. • Starting with the current operating parameters, gradually delay the oven start-up time (e.g. 15 minutes at a time), over several days, until you find the shortest time needed to start the oven while ensuring all products are baked. Decreasing the start-up time by small amounts will ensure you achieve energy efficiencies without adversely affecting your product quality. This method will not indicate the absolute minimum heat-up value.	
	Undertake over temperature profiling. Temperature profilers are fitted with multiple thermocouple temperature sensors mounted along the width of the belt on a pan. The sensors travel through the oven capturing a picture of the oven's thermal profile.	
	Explore opportunities of heat recovery for proofer heating or waste heat recovery on ovens and dryers.	
	Check and monitor oven burner efficiency. This can be achieved by analysing combustion stack gases. Three possible outcomes from stack gas analysis are: • Excess air: Adjust and maintain the air/fuel ratio so that it is optimised for the operating load condition of the oven. An oxygen trim control may be appropriate to control systems where combustion inefficiencies cannot be managed by air/fuel ratio adjustments. Oxygen trim controllers can be installed and will reduce time required to assess efficiency and maintain oven efficiency in the future. • High stack temperatures: Use for heat recovery. This action reduces flue temperature and improves combustion efficiency. • Incomplete combustion: A lack of adequate combustion air will lead to incomplete combustion. This will result in unburned or partially burned fuel being released from the oven, wasting fuel. Possible fixes include burner control adjustment and burner maintenance.	
	Frequently test and calibrate over and dryer controls.	
	Ensure good oven cleaning practices to reduce build up on elements which can reduce energy efficiency.	
	Ensure most efficient cooling method and cool away from heat sources.	
Pumps	Review pump load management & ensure the most efficient pumps are scheduled to reduce pump demand.	
	Ensure controls are set to ensure pump load management is efficient.	
	Ensure you're using high efficiency pumps and implement multiple pumps for variable loads.	
	Install trimming impellers to pump systems to improve efficiencies. Trimming should be limited to about 75% of a pumps maximum impeller diameter – **excessive trimming can result in a mismatched impeller and casing**.	
	Install adjustable speed drives to ensure maximum efficiency.	
Frozen Storage / Refrigeration	Select appropriate freezer technologies depending on product needs, floor space, and efficiency.	
	Check for refrigerant contamination including oil, water, or debris.	
	Ensure that cold storage areas are not cooled to a lower temperature than is needed (refrigeration system energy use will increase by 1% to 3% for every degree of additional cooling).	
	Ensure the control settings for the refrigeration system are easy to find and interpret for ease of system tuning and adjustment.	
	Ensure that products are not stacked directly under or in front of evaporators in cold storage units.	
	Minimizing other heat sources (such as lights and forklifts) in cold storage areas, which produce heat that will have to be removed by the refrigeration system.	
	Report the formation of ice on cold storage area floors and walls. Ice indicates that a lot of air is entering the cold storage area, which carries moisture that gives off heat as it freezes, adding to the refrigeration load.	
	Switch off system pumps and fans (such as those used for circulating cold air, chilled water, or anti-freeze) when not required. Pumps and fans can add significant heat loads to the refrigeration system during operation.	
	Regularly check compressor oil levels to ensure proper lubrication.	
	Report and repair any refrigerant leaks and repair damage to pipe insulation.	
	Ensure compressor control systems and scheduling are optimised.	

TASK	DETAIL	COMPLETE?
	Investigate floating head pressure control as an effective control strategy.	☐
	Report and repair any pipes that are vibrating.	☐
	Ensure an indirect lubricant cooling system is in place.	☐
	Raise system suction pressure from -34 °C to -28 °C.	☐
	Install variable-speed drives (VSDs) on compressor motors to run in conjunction with your control systems. Use VSD's below a part-load ratio of about 95%.	☐
	Investigate dedicating a compressor to defrosting.	☐
	Ensure optimal control strategies are implemented. Avoid the following control strategies that may compromise efficiency: • Slide valve unloading of oversized screw compressors. • Hot gas bypass of compressors. • Throttling valves between evaporators and compressors. • Evaporator control by starving refrigerant supply. • Too frequent defrosts. • Condenser head pressure controls, except when necessary.	☐
Condensers & Evaporators	Ensure condensers are clean. Condensers should be checked regularly for dirt, ice buildup, or plugged nozzles, which can reduce heat transfer rates and thus raise the condensing temperature.	☐
	Investigate automatic purging of condensers.	☐
	Investigate reducing condenser fan use to reduce energy wastage.	☐
	Investigate reducing condensing pressure. Condensing pressures and temperatures should be set as low as possible.	☐
	Investigate use of axial condenser fans.	☐
	Investigate the use of variable-speed drives (VSDs) on condenser fans.	☐
	Investigate the use of variable-speed drives (VSDs) on evaporator fans.	☐
	Investigate cycling of evaporator fans in cold storage.	☐
Compressed Air	Air receivers can be employed near high-demand areas to provide a steady supply buffer and meet short-term demand spikes to reduce load on compressor.	☐
	Identify and repair leaks in compressed air systems.	☐
	Multiple-stage compressors theoretically operate more efficiently than single-stage compressors.	☐
	Use multiple smaller compressors instead of one large compressor.	☐
	If multiple compressors are present, review compressor schedule to optimise for load profile.	☐
	Investigate the use of variable-speed drives (VSDs) on compressors.	☐
	Keep the compressor and intercooling surfaces clean and foul-free by inspecting and periodically cleaning filters.	☐
	Reduce pressure drop over filters, consider adding filters in parallel to decrease pressure drop.	☐
	Keep motors and compressors properly lubricated and cleaned. Sample and analyse compressor lubricant every 1000 hours and ensure that it is at the proper level.	☐
	Inspect fans and water pumps regularly to ensure proper performance.	☐
	Inspect drain traps periodically to ensure they are not stuck in either the open or closed position and are clean.	☐
	Maintain the coolers on the compressor and the aftercooler to ensure that the dryer gets the lowest possible inlet temperature.	☐
	If using compressors with belts, check the belts for wear and adjust them. A good rule of thumb is to adjust them every 400 hours of operation.	☐
	Check water cooling systems for water quality (pH and total dissolved solids), flow, and temperature. Clean and replace filters and heat exchangers as suggested by the manufacturer.	☐
	Applications requiring compressed air should be checked for excessive pressure, duration, or volume. They should be regulated, either by production line sectioning or by pressure regulators on the equipment itself.	☐
	For individual applications that require a higher pressure, consider special equipment modifications instead of raising the operating pressure of the whole system.	☐
	Explore the opportunity of heat recovery and waste heat recovery on air compressors.	☐

TASK	DETAIL	COMPLETE?
Hot Water and Steam Distribution Systems	Improve and maintain distribution system insulation.	☐
	Improve and maintain steam traps. Efficient steam traps have these qualities: • Open when the temperature is very close to that of saturated steam (2˚C). • Purge non-condensable gases after each opening. • Open on startup to allow a fast steam system warm-up.	☐
	Repair and monitor for any leaks within the steam traps.	☐
	Where possible recover flash steam.	☐
HVAC	Adjust air conditioning temperature set point band to the largest range by implementing a dead-band between which neither heating nor cooling occurs (this is usually achievable using AUTO function). For instance, set a room to heat to 20 ˚C and cool to 23 ˚C.	☐
	Use the economy cycle to draw in cooler outside air.	☐
	Ensure heat pump ducting systems are cleaned annually for good airflow through the registers.	☐
	Clean air filters, fans, and coils in your heating, ventilation, and air conditioning (HVAC) system – replace if need be.	☐
	Install energy monitoring and control systems.	☐
	Consider variable-air-volume systems.	☐
	Install variable-speed drives (VSDs).	☐
	Develop a motor management plan, ensure they’re properly sized, and maintain.	☐
Lighting	Only have lights on when required & turn off when not in use (consider installing sensors).	☐
	Use a light meter to review minimum level of lighting.	☐
	Replace lights with LED’s where possible.	☐
Boiler	Implement maintenance programme and control boiler processes.	☐
	Reduce flue gas quantities using visual inspection and recover flue gas heat.	☐
	Reduce excess air.	☐
	Properly size boiler systems.	☐
	Improve boiler insulation.	☐
	Return condensate to the boiler.	☐
	Recover blowdown steam.	☐
	Replace old boilers.	☐
Other	There are several computer software packages that help with the decision-making processes during production of an energy management programme.	☐
Notes		