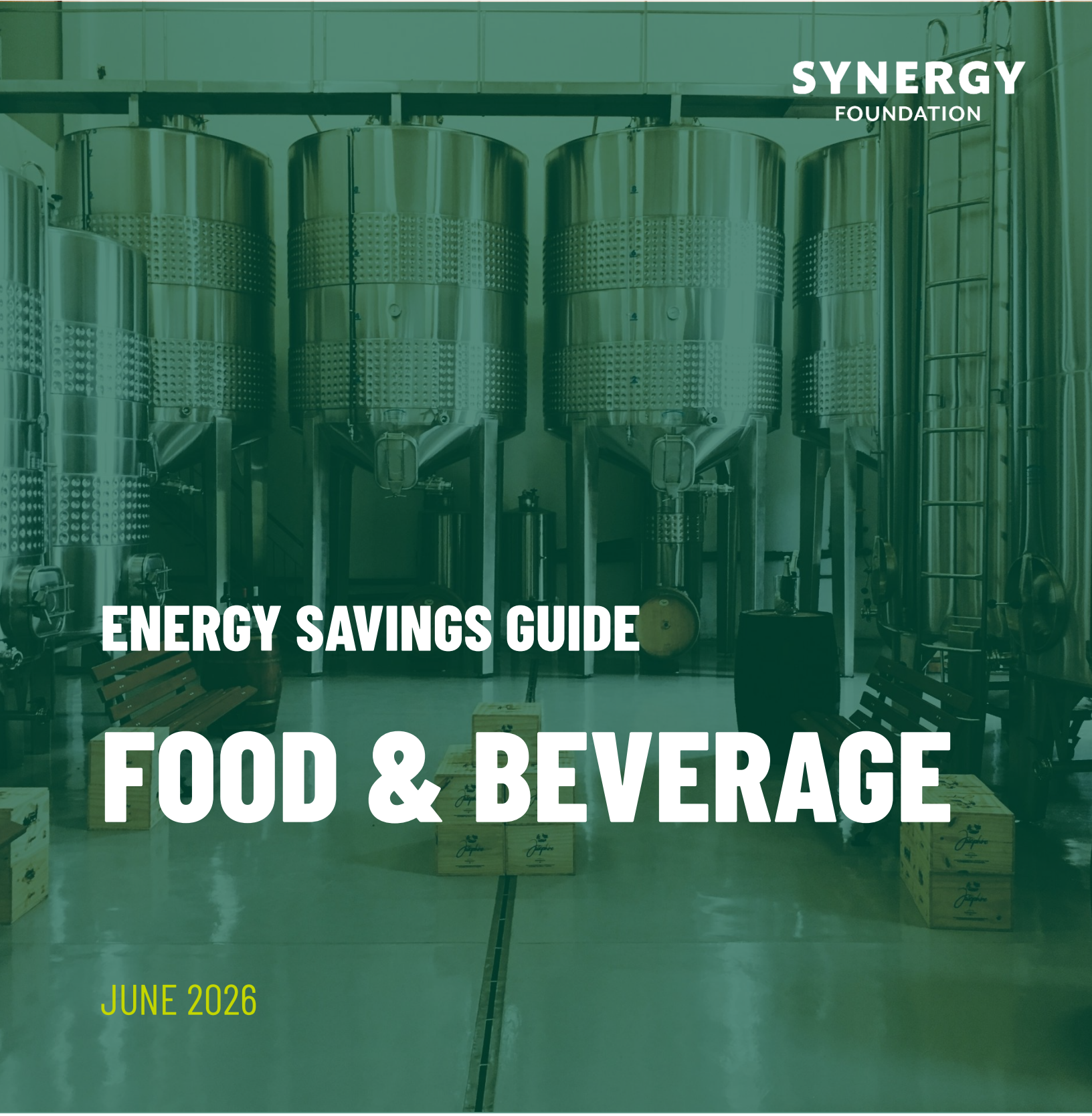

SYNERGY FOUNDATION

ENERGY SAVINGS GUIDE

FOOD & BEVERAGE

JUNE 2026

BC GREEN BUSINESS

BC Hydro Power smart

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1. Executive Summary

Food and beverage (F&B) processing facilities are among Canada's most energy_intensive industrial operations, driven by continuous refrigeration, thermal processing, pumping, mixing, cleaning systems, and strict sanitation and quality requirements. Energy-intensive processes such as heating, cooling, refrigeration, and mechanical processing collectively make this sector one of the highest users of energy across the industrial landscape. In Canada, the food and beverage processing industry is the country's largest manufacturing sector—representing over 20% of all manufacturing sales[1].

This guide provides practical, proven steps that food and beverage processors can take to reduce energy consumption, enhance operational efficiency, and strengthen overall sustainability performance. Canadian processors are increasingly pursuing decarbonization and operational optimization, with 69% investing in new equipment, 62% focusing on employee training, and 58% optimizing processes as part of their sustainability goals[2].

In the sections that follow, we outline strategies that offer meaningful opportunities to lower operating costs and environmental impact while maintaining production reliability and product quality.

2. Understanding Energy Use

Food and beverage producers rely on several energy-intensive processes that drive the majority of their electricity and utility consumption. According to the Industrial Consumption of Energy Survey, food manufacturing alone is one of the five largest industrial energy users in Canada.

Across the F&B sector, substantial energy use is tied to the following operations and equipment[3]:

- **Refrigeration and cooling**
- **Motors, pumps, compressed air systems**
- **HVAC**
- **Water Heating**
- **Lighting**

3. Refrigeration and Cooling

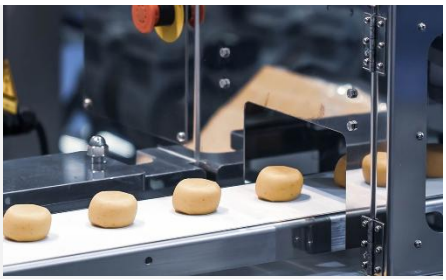
Refrigeration and cooling systems are essential to food and beverage manufacturing because they maintain strict temperature control needed for food safety, product quality, and production stability. These systems are especially critical in frozen food, dairy, meat processing, and beverage operations. Industrial energy analyses confirm that refrigeration systems account for 30–50% of total electrical energy use in these facility types, making them the single largest electricity consumer in much of the F&B sector[3].

Because refrigeration typically operates continuously and under tight thermal tolerances, improving refrigeration system efficiency represents one of the most impactful opportunities for reducing energy consumption and operational costs.

3.1 High Efficiency Compressor Components

Compressors are the heart of industrial refrigeration systems and have the strongest influence on energy performance. Industrial refrigeration studies confirm that **compressors make up the largest share of system energy demand**, meaning upgrades here deliver the greatest savings[4].

High-efficiency rotary screw compressors can deliver 10–30% greater energy efficiency compared to traditional reciprocating compressors, thanks to their smoother compression process and lower internal losses.



3.2 Low-GWP / Natural Refrigerant Systems

Modern industrial refrigeration systems using natural or low-GWP refrigerants (such as CO_2, R290, or ammonia) offer performance benefits alongside climate advantages. Multiple studies confirm equal or improved refrigeration efficiency, with experimental data showing that natural-refrigerant systems in beverage cooling applications deliver significant energy reductions. For example, test-bench

evaluations found that replacing R134a with natural refrigerants like R290 and R1270 reduced energy use by 26–27%, depending on operating conditions.

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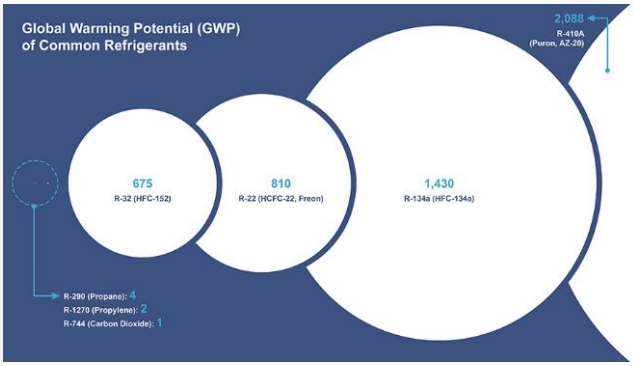


These refrigerants also help facilities remain compliant with global refrigerant_phase_down policies and regulatory transition.

3.3 Thermal Insulation & Building Envelope

Food and beverage facilities with walk-in coolers and freezers face continuous heat gain through walls, floors, ceilings, and door openings. Without adequate thermal barriers, ambient heat forces compressors to run harder and longer to maintain setpoint temperatures—accelerating equipment wear and increasing energy consumption across the entire refrigeration system.

High-performance insulation panels and properly sealed envelopes reduce heat transfer at the source, before it reaches the compressor. Door gasket integrity and strip curtains on high-traffic openings are equally important: PVC strip curtains alone can reduce cold air loss by up to 40%, with upgraded insulation panels typically paying back within 2–3 years[17].

4. Motors, Pumps & Compressed Air Systems

Motors, pumps, and compressed air systems are fundamental to nearly every stage of F&B production. They power material handling, mixing, grinding, conveying, fluid transfer, aeration, packaging support, and automation. These systems typically run for long hours, often continuously, making them a major contributor to electrical consumption in process-heavy F&B environments. Industrial energy analyses show that compressed air systems alone account for approximately 10–15% of total electrical use in food and beverage facilities, while pumps and fans are repeatedly identified as key energy consumption hotspots across processing plants. Because these systems underpin core production operations, improvements in motor efficiency, airflow control, and air_system management offer some of the most immediate and cost_effective energy_saving opportunities[3].

4.1 Compressed Air System Upgrades

Compressed air is one of the most expensive forms of energy in a production plant, and ENEF confirms that **compressed air systems typically consume 10–15% of total plant electricity.**

Efficiency opportunities include[6]:

- Eliminating air leaks (often 20–30% of system losses in typical plants)
- Installing VFD-driven air compressors
- Adjusting system pressure to the minimum required setpoint
- Improving dryer and filtration efficiency
- Implementing ultrasound leak detection program
- Establishing tagging and repair schedule for identified leaks

These measures lower compressor load and extend equipment life while maintaining consistent pneumatic performance needed for packaging lines, valves, and controls.

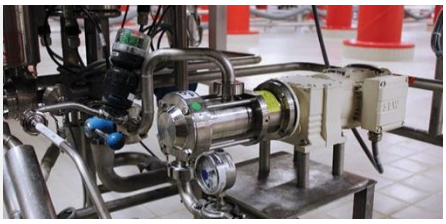
4.2 High Efficiency Motors & Variable Frequency Drives

Upgrading legacy motors to high-efficiency electronically commutated motors (ECMs) can significantly reduce energy consumption; an ECM is a high-efficiency brushless DC motor with integrated electronic controls that deliver far better performance than traditional AC induction motors[15].

Variable-frequency drives (VFDs) on pumps and fans, allow motor speed to match real process loads instead of running at full speed continuously. This reduces electricity use, cuts wear and tear and stabilizes product temperatures and process flows[6]. In food and beverage facilities—where motors run pumps, fans, compressors, mixers, and conveyors—VFDs typically reduce motor energy use by 15–25%[14].

4.3 Pump System Optimization

A pump system is the network of pumps, pipes, valves, and controls that moves liquids, and can consume up to 25–30% of the facility's total electricity use.



Pumps handle jobs like circulating cleaning chemicals in CIP systems, transferring product between tanks, and supporting hydraulic equipment, but when they're oversized or inefficient, they waste energy by pushing more flow or pressure than needed.

Optimization measures include:

- Pump resizing or impeller trimming
- Adding VFDs
- Improving piping layouts to reduce pressure drop

5. HVAC Systems

Heating, ventilation, and air conditioning (HVAC) systems play a critical role in small and medium food and beverage (F&B) production facilities. They maintain temperature, humidity, and air-quality conditions needed for food safety, employee comfort, and consistent product quality. Even in small facilities, HVAC can be a major energy consumer, as mechanical systems—including ventilation fans, heaters, chillers, and air movers—operate for long hours to meet regulatory and production needs.

Industry analyses confirm that HVAC systems are among the largest energy loads in F&B plants, alongside refrigeration and process equipment.

Outdated or improperly sized HVAC units are especially common in small businesses and can significantly increase energy costs. **Upgrading to more efficient HVAC technologies can reduce energy consumption by 20% or more**, offering meaningful reductions in utility costs for SMBs.

5.1 Variable-Speed Fans and Motors

Traditional fixed-speed fans operate at full power regardless of occupancy, process intensity, or seasonal load. **Variable-speed drives (VSDs)** allow motors and fans to adjust their speed in real time to match actual ventilation requirements. As a result:

- Airflow is delivered **only at the rate needed**, reducing unnecessary electrical consumption.
- Systems operate more quietly, generate less heat, and experience less mechanical wear.
- Improved airflow control supports targeted ventilation, pressurization, and humidity management—critical elements in food-safe HVAC design.

5.2 Right-Sizing for Production Spaces

Small producers often inherit HVAC systems designed for different tenants or facility uses, leading to oversized units.

Oversized HVAC systems:

- Short-cycle frequently, wasting energy
- Struggle to maintain consistent humidity
- Increase the risk of condensation and contamination

Modern right-sized systems, especially when paired with zoning strategies, ensure each part of the facility receives exactly the airflow and conditioning it needs—no more, no less.

5.3 Energy Recovery Ventilation (ERV) & Demand-Controlled Ventilation (DCV)

Small F&B facilities often experience high ventilation loads—particularly in bakeries, breweries, and kitchens. ERVs and DCV systems help reduce energy waste by:

- Recovering heat from exhaust air
- Adjusting ventilation rates based on occupancy or process activity
- Reducing unnecessary outdoor air intake

Research in the HVAC sector highlights that **energy recovery systems can lower ventilation-related heating/cooling demand significantly**, especially in climates where outside air temperatures vary widely.

5.4 Regular Maintenance (Filters, Coils, Airflow Management)

Poor HVAC maintenance is a hidden cost driver in small F&B operations. Simple issues—clogged filters, dirty evaporator coils, or blocked ducts—force HVAC systems to run longer and harder, wasting energy.

Industry guidance notes:

- Regular filter changes and coil cleaning keep HVAC systems operating at peak efficiency
- Neglected HVAC components significantly raise energy use and reduce lifespan
- Maintenance also helps avoid food-safety issues such as condensation buildup and airborne contaminants

Proper HVAC maintenance is highlighted as a core strategy for reducing energy waste and preventing costly breakdowns. Find a short checklist preventative maintenance checklist in the resources section below.

6. Water Heating Systems

Hot water is essential in small and medium food and beverage facilities for sanitation, washdowns, hand-washing stations, equipment cleaning, and CIP (Clean-in-Place) cycles.

These applications require large volumes of consistently heated water, often at strict temperature ranges to meet hygiene and regulatory standards. Because water heating must support multiple cleaning points, fluctuating production schedules, and peak-demand events, it can represent a significant portion of thermal energy consumption in SMB facilities. Industry analysis confirms that **steam and hot water generation are major thermal loads in food & beverage operations**, driven by cooking, sanitation, and CIP demands. Selecting efficient water-heating technology and optimizing system design can reduce fuel use, improve production reliability, and shorten payback periods for small processors[8].

6.1 High Efficiency Water Heating Systems

Traditional boilers remain common in F&B plants because they can supply large volumes of hot water or steam to multiple use points. However, older boiler systems lose substantial heat through distribution losses, poor insulation, and inefficient cycling.

Modern upgrades such as boiler economizers that capture waste heat and return it to the hot_water loop can significantly improve system efficiency and support CIP operations. **Using a properly sized economizer can lead to 5-10% reduction in boiler fuel use[16].**

6.2 Steam Injection Heating for CIP & Sanitation

Facilities with heavy sanitation cycles—such as dairies, breweries, and meat/poultry processors—often depend on CIP, where large amounts of hot water are required at precise temperatures. Steam injection heating systems offer major advantages:

- Provide on_demand hot water
- Maintain precise temperature control
- Can support multiple cleaning devices simultaneously

Steam injection heaters use 100% of steam energy, eliminating condensate loss and lowering energy costs for hot_water generation.

6.3 Solar Thermal & Renewable Water-Heating Options

Renewable thermal systems, such as solar thermal collectors and high-efficiency industrial heat pumps, are increasingly used by F&B manufacturers to lower long-term operating costs. Some F&B facilities have achieved 70% emissions reductions and annual cost savings exceeding $62,000 by integrating solar-thermal water heating with their existing plant infrastructure[9].

6.4 High Efficiency Water Heating Systems

Refrigeration compressors generate substantial heat as a byproduct of the compression cycle. In most facilities, this heat is rejected to the atmosphere through the condenser—but heat recovery systems, using a desuperheater or heat exchanger on the discharge line, can intercept this waste heat and redirect it to pre-heat washdown water or CIP supply lines.

For dairies, breweries, and meat processors running continuous refrigeration alongside high hot-water demand, this is one of the highest-return energy projects available. **Heat recovery can offset 20–30% of a facility's water heating energy demand**, with payback periods typically ranging from 2–4 years[4].

7. Lighting Systems

Lighting plays an essential role in food and beverage production facilities—not only for visibility and safety, but also for sanitation, compliance, quality control, and worker productivity. Poor or outdated lighting increases energy bills, reduces visibility during inspections, and can compromise hygiene if fixtures are not designed for washdown environments.

Modern LED systems specifically designed for food processing environments offer major advantages: they consume **significantly less energy**, withstand harsh cleaning processes, and provide bright, uniform illumination that improves accuracy and safety on the production floor[10].

7.1 Equipment Upgrades

Switching from fluorescent, HID, or incandescent lighting to high efficiency LEDs is one of the fastest payback energy upgrades for small facilities. Food processing experts report that:[11]

- LED fixtures can reduce lighting electricity use by up to 75% compared to HID, and up to 50% compared to fluorescent, even high-output T5HO lamps.
- LEDs maintain higher output in cold temperatures, unlike fluorescents, which can lose up to 80% of output in freezer conditions, requiring more fixtures to compensate.

Food-processing environments are demanding: fixtures must withstand chemicals, high humidity, steam, and forceful hose-down cleaning. Food-safe LED fixtures engineered for washdown environments can handle high-pressure water jets up to 1,500 psi while remaining sealed and safe[11].

8. Staff Engagement

Staff play a major role in the day-to-day energy performance of a production facility, since they regularly interact with refrigeration doors, lighting, and HVAC systems. Simple behavioural actions—such as keeping cooler doors closed, turning off lights in unoccupied areas, and reporting equipment issues early—**can reduce overall energy use by 5–10%, based on workplace studies showing similar behavioural interventions achieving 5% or more in savings**[12]. Building awareness and encouraging consistent habits strengthens food safety, reduces shrink, and supports long-term sustainability.

8.1 Practical Engagement Strategies

Energy Awareness Training

Incorporate energy efficiency practices into new-hire onboarding and regular staff meetings.

Reinforce simple habits such as:

- Keeping cooler and freezer doors closed
- Turning off lights when leaving stock rooms
- Reporting equipment issues early

See BC Green Business Staff Engagement Guide.

Energy Champion Program

Designate one staff member per store as an Energy Champion to coordinate actions, monitor progress and celebrate successes. This fosters accountability and boosts team motivation.

Visible Reminders & Signage

Place reminders in key areas, such as:

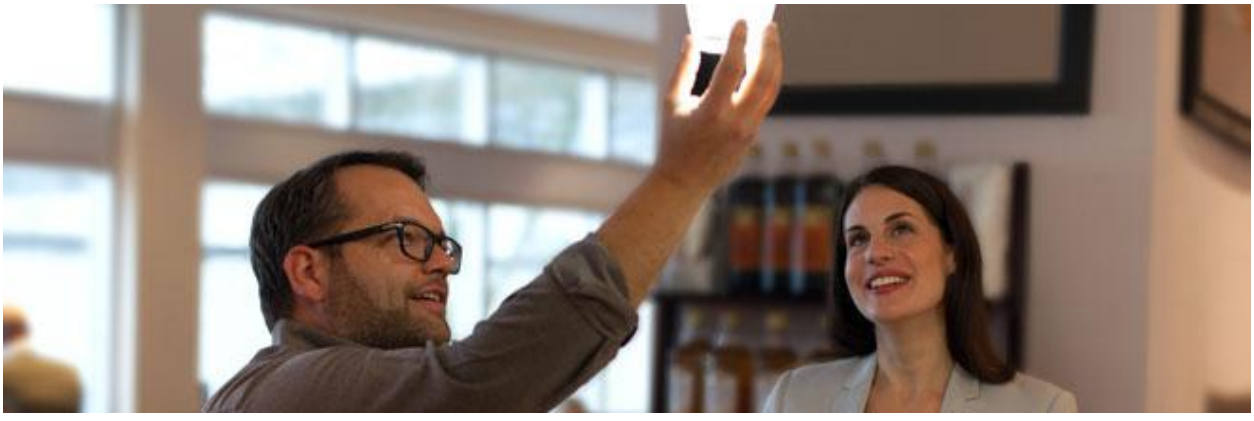
- "Lights Off When Not in Use" in back-of-house spaces
- "Please Keep Door Closed" on coolers and freezers
- Temperature checkpoints in perishable departments

Monthly Micro-Challenges

Examples:

- "Best Door Discipline Week"
- "Lighting Reduction Challenge"
- "Refrigeration Inspection Marathon"
- These micro-competitions keep engagement fun and consistent

9. BC Hydro Programs & Support



Below are key BC Hydro programs that support large commercial customers, including grocery stores, in managing energy use and identifying efficiency opportunities. Programs offer expert guidance, funding, and technical assessments to help reduce operating costs and improve long-term energy performance.

Resource	Eligibility	About
Commercial Energy Manager	Annual electricity use of 6.5 gigawatt-hours or more.	Hire an energy manager, partially funded by BC Hydro, to look after energy management changes and projects at your organization.
Business Energy Advisors	Business Energy Advisors are available to business customers who don't have a Key Account Manager and who operate in one of the following regions: • Lower Mainland • Fraser Valley • Vancouver Island • Interior B.C. • Northern B.C.	A free consultation at your facility from a Business Energy Advisor. They'll identify energy-saving opportunities, provide you with a report on your current technologies and the new, energy-efficient replacement options, and give you advice about next steps and financial incentives that you may qualify for.
Regional Energy Manager	Combined annual electricity use of 2 gigawatt-hours or more across all your sites.	An assigned regional energy manager will help you identify operational energy efficiency opportunities and access programs.
Energy Wise Network	Eligibility: Annual electricity use of 2 gigawatt-hours or more.	Join to help engage people in your organization to save energy through training, networking, coaching, funding and more.
Continuous Optimization	Owner or long-term leaseholder of a large commercial or institutional building, or a facility with a total indoor floor area of at least 40,000 square feet.	Incentives, tools, and support to improve your building's energy efficiency now and in the future.
Integrated Energy Audit	Annual company-wide electricity use of two gigawatt-hours or more.	An energy expert will audit your facility and determine major areas of energy usage and which of your

		systems present the best opportunities for improved efficiency.
Feasibility Study	Annual company-wide electricity use of two gigawatt-hours or more.	An energy expert will conduct an in-depth study and evaluation of energy solutions within a single or multiple systems and provide the cost/benefit details you need.
Business Energy Saving Incentives (BESI)	Available to commercial and small industrial sites using under 500 MWh/year and requires installation by an Alliance of Energy Professionals contractor.	Provides funding for energy-efficient upgrades such as lighting, refrigeration add-ons, and HVAC/mechanical measures, typically covering ~40% of costs with an additional 30% bonus available.
Self-Serve Incentive Program (SIP)	For facilities using over 500 MWh/year, with eligible technologies including compressed air (40–300 HP) and lighting, and requiring an Alliance vendor.	Offers incentives (25–50% of project costs) for large-facility lighting and compressed-air upgrades, with a 30% bonus available during the current offer window.

10. Additional Resources

List of sustainability and operational resources:

- BC Green Business
- HVAC Maintenance form
- Canadian Food Innovation Network
- BC Food & Beverage Association
- BC Hydro Energy Hub

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