

**Grab a clipboard and take this map along on your treasure hunt.** Focus on uncovering opportunities to save. When you find something, make notes about location; tools, materials, or expertise needed; or further research required. Feel free to add to or modify this list to suit your own needs, and be sure you have all Treasure Hunt resources.

Facility Name \_\_\_\_\_ Floor \_\_\_\_\_ Date \_\_\_\_\_ Team \_\_\_\_\_



## Facility Management

### Low Cost Upgrades

- Review the brewery's energy tracking system, billing records, production history, or other sources of consumption data. Identify any spikes or unusual changes in energy use over the past year.
- Check the facility's energy action plan and reports from energy audits, assessments, and treasure hunts (if available) to see if earlier identified energy savings measures have been implemented.
- Inspect maintenance plans and records to identify areas to review during the Treasure Hunt. Routine or preventative maintenance on neglected equipment may yield energy savings.
- Review building management system (BMS) and/or building automation system (BAS) code, if applicable, to ensure that specific commands to reduce unneeded energy consumption (e.g., on/off times) remain active.
- Consider facility maintenance during daylight hours to reduce the need for lighting and HVAC during unoccupied periods.



## Brewing/Production Equipment

### Low Cost Upgrades

- Evaluate if the start-up times currently used to bring process equipment to its operating conditions can be reduced, optimized or rescheduled to avoid high electric demand charges.
- Review setpoints used on equipment with operating manuals or equipment manufacture specifications to see if changes can be made to save energy.
- Check thermal processes for insulation damage, and radiant and convection heat losses.
- Inspect burners, temperature setpoints, and heat exchangers to ensure optimal operating conditions.

#### NOTES:

#### TIP:

- Get recognition for conducting a treasure hunt and finding energy savings by sharing your results with the [ENERGY STAR Find the Treasure Campaign](#).

#### TIP:

- See the [Brewers Association Energy Manual](#) for detailed industry recommendations on Energy Usage, GHG Reduction, Efficiency and Load Management. Also for members, benchmarking tools and more on sustainability at the Resource Hub.



- Check if conveyors and other transport equipment have automatic stop controls to avoid idle running.
- Check control systems to determine that they have not been overridden and evaluate the impact on energy use.
- Evaluate equipment capacity and runtimes to determine whether production schedules can be created to avoid operating under reduced production volume. For example, will running one piece of equipment at 80% capacity versus two at 40% capacity save more energy?
- Consider opportunities for reusing the final preheated rinse water as a source of the initial rinse water for cleaning-in-place operations in brewery.
  - Consider capture of first rinse water of cans or bottles and its re-use as the exterior can or bottle rinse after filler.
- Assess if labeling glue pot temperatures can be setback or turned off during non-production times.
- Assess if process equipment that is left on during non-production times can be shut off.
- Conduct an ultrasonic leak audit on any CO<sub>2</sub> and Nitrogen system and repair leaks.

## Capital Investment Upgrades

- Inventory motors used on process equipment and production lines and identify opportunities to install high-efficiency motors, variable frequency drives (VFDs), and/or opportunities to reduce motor size or the number of motors used. See motors and pumps section for more recommendations.
- Assess opportunities for waste heat recovery from the brew kettle such as:
  - Reduce boil time to a minimum without compromising product quality, thereby reducing energy and vapor loss. Example: reduce boil time by 5 or 10 minutes.
  - Using vapor condensers or heat exchangers to preheat incoming wort.
  - Using brew kettle cover to recapture vapor and condense directly back to brew kettle.
  - Using vapor condensate for cleaning, space cleaning, or other applications.
- Assess opportunities for transferring heat from wort that is being cooled to wort that is being heated.

## NOTES:

## TIP:

- Review your electrical bill for demand (KW) charges and penalties. If there are penalties, then ask your utility for load profile to identify when demand peaks occur. There may be opportunities to avoid demand penalties by rescheduling when specific equipment is turned on.



- For example, using a flat plate heat exchanger to cool wort using municipal water and returning the warmed municipal water to a hot liquor tank for use in next brew and/or Clean in Place water.
- Assess appropriateness of creating a more concentrated wort which can be diluted to optimal gravity prior to fermentation.
- Control any CO<sub>2</sub> exhaust fans such as cellar fans using CO<sub>2</sub> level controlled VSD motors on the fans.



## Hot Water and Steam Systems

### Low Cost Upgrades

- Review boiler setpoints. Locate the boiler's operating manual.
- Verify proper boiler preventative and predictive maintenance schedules are being followed. Ensure all boiler components are optimized.
- Measure the boiler's exhaust temperature to determine if combustion efficiency can be improved.
- Inspect the boiler's air-to-fuel ratio and ensure that it is correctly calibrated.
- Check and reduce excess air (O<sub>2</sub>) to lowest level possible based on boiler's configuration.
- Inspect burners and fire-side heat exchangers and clean, calibrate, or adjust as needed.
- Inspect boiler fire tubes for excessive scale build-up.
- Review frequency of boiler blowdown, and assess the minimum required blowdown needed to maintain acceptable boiler water quality.
- Establish daily boiler operation log and regular boiler preventative maintenance program to assure that boilers and control systems are operated to achieve optimum fuel efficiency.
- Clean heat exchangers. Verify heat exchanger actual pressure drop against the designed pressure drop and actual heat transfer against the designed heat transfer.
- Review steam trap maintenance practices. Establish a Steam Leak Management Program.
- Ensure that steam distribution systems are properly insulated.
- Confirm overall control system operations.

#### NOTES:

#### TIP:

- For tasks beyond your staff's skills or capacity, consider professional services.

#### TIP:

- Consider an "all utility audit" that will look for billing errors and proper rate classification for your electricity, natural gas, heating oil, water/sewer, and telecommunications. Such audits are free unless the analysis finds you are due refunds, then the auditing firm is paid a pre-agreed percentage after your refund is complete. If you find no refund, you have confirmed you are not overpaying.



## Capital Investment Upgrades

- Evaluate energy source for reheat coils to determine if switching to or from electric is beneficial and use waste heat where possible.
  - Depending upon electric supply, it may be more environmentally friendly to use electric reheat.
- Check boiler water treatment system.
- Review hot water and steam demands to determine if boilers are oversized or if the number of boilers used can be reduced. If there are multiple boilers, optimize the number and sequence of boilers working to keep them as close as possible to nominal load and optimum system efficiency.
- Determine minimum header pressures required by the process, and lower boiler pressure and/or pressure-regulating valve to minimum requirements. Evaluate pressure setpoints based on seasonal approach.
- Inspect all steam traps and identify traps which are passing steam for repair or replacement.
- Check for ineffective, broken, and wet insulation in steam distribution systems. Use an IR/thermal camera if one is available.
- Check for condensate leaks and measure condensate return percentage.
- Evaluate if excess heat from condensate could be used for heat transfer and recovery.
- Evaluate if a waste heat from flue gasses can be used to preheat boiler feed water with an economizer.
- For example, using a flat plate heat exchanger to cool wort using municipal water and returning the warmed municipal water to a hot liquor tank for use in next brew and/or Clean in Place water.

### NOTES:

### TIP:

- See [Efficiency Vermont on Green Breweries](#).

### TIP:

- See [EPA's GreenChill Partnership](#) for Advanced Refrigeration program.



## 4 Chillers

### Low Cost Upgrades

- Consider raising chilled water temperature to decrease the required temperature lift.
- Consider decreasing condenser head pressure/temperature or install floating head pressure controls.
- Verify proper chiller maintenance schedules are being followed.
  - Keep heat transfer surface clean.
  - Remove trapped air from the condenser.



- Check water cooling systems for water quality (pH and total dissolved solids), flow, operations and temperature.
- Evaluate overall preventative and predictive maintenance of system.
- Confirm overall control system operations.
- Confirm operations of cooling towers with VFDs on pumps, two-speed fans, and overall sequence of operations.
- Consider insulating cooling lines and tank jackets if there is a significant average temperature difference with surroundings.
- Check water cooling systems for water quality (pH and total dissolved solids), flow, operations and temperature.
  - Specify pressure regulators that close when failing.

## Capital Investment Upgrades

- Investigate whether a sanitary chilling system can be used to preheat process water while cooling wort.
- Consider augmenting or replacing chilled water with naturally occurring cooling water, such as municipal or well water.
- Consider replacing absorption chillers with electric drive centrifugal chillers.
- Consider replacing HFC-based chillers with lower GWP natural refrigerant based chillers.



## Refrigeration

### Low Cost Upgrades

- Assess whether the doors to cold storage areas are kept closed whenever possible.
- Evaluate whether cold storage areas are cooled to a temperature not lower than is truly needed.
- Ensure products are not stacked directly under or in front of evaporators in cold storage units.
- Minimize other heat sources (such as lights and forklifts) in cold storage areas.
- Check for the formation of ice in cold storage area floors and walls.
- Ensure proper levels of refrigerant charge.
- Have a refrigerant leak audit and repair to prevent loss of refrigerant charge.
- Maintain sufficient airflow around evaporators.

### NOTES:

### TIP:

- Read this [Colorado Craft Brewer's Success Story](#).



- Note that your refrigeration is designed for worst case temperatures in your climate. Floating head and suction pressure controls react to actual ambient temperatures to maintain necessary temperatures for savings.
- Install strip curtains/ensure strip curtains cover entire openings, and keep condenser and evaporator coils clean.
- Confirm door seals are airtight.
- Verify thermostat and recalibrate if necessary.
- Replace any non-electronically commutated motors (ECM) with ECM motors.
- Check that refrigerator coils are clean and free of obstructions.

## Capital Investment Upgrades

- Consider programming ECMs to speed or slow motors based on cooling needs, offering significant savings over evaporator fans in walk-in coolers and over split capacitor and shaded-pole motors in refrigerated cases.
- Ensure correct operation in anti-sweat controls that monitor both humidity and temperature. Anti-sweat controls activate heaters in cooler and freezer doors to prevent condensation only when needed.
- Ensure correct operations of defrost controls that use sensors to intelligently sense when evaporator coils need defrosting, and only then consume the energy necessary to perform that operation.



## Motors

### Low Cost Upgrades

- Locate and identify all motors. Inventory conditions and specifications of each motor.
- Assess motor needs against actual use to determine if properly sized to meet the needs of its driven equipment. Replace wrong-sized motors with correct size and high-efficiency motors.
- Replace standard v-belts with cog belts or synchronous belts.
- Evaluate overall preventative and predictive maintenance of system.
- Confirm overall control system operations.
- Check shutdown practices for motors that are not in use to prevent idling. Consider automatic shutdown of motors.

### NOTES:

### TIP:

- For tasks beyond your staff skills and capacity, find professional “green/sustainability” services for the industry.

### TIP:

- See [Energy Trust of Oregon: Savings on Tap](#).



## Capital Investment Upgrades

- Consider maintenance, repairs, and upgrades to the motor systems, including economic costs and benefits using life-cycle costs.
  - If upgrades are pursued, monitor the upgraded system's performance to determine actual cost savings.
  - Consider purchasing energy-efficient motors in order to reduce the motor's life-cycle costs.
  - Consider purchasing variable speed drives to better match load requirements to motor operations.



## Pumps and Piping Systems

### Low Cost Upgrades

- Assess how many pumps are required to maintain proper pressure and flow.
- Check system to eliminate unnecessary pressure drops from filters, dampers, valves, or poorly designed pipelines.
- Check piping insulation and replace or repair as needed.
- Check for primary and spare motors running simultaneously.
- Inspect piping to identify obstructions (especially water systems).
- Confirm overall control system operations.

### Capital Investment Upgrades

- Check if 3-way valves are being used and can be replaced by a VFD.
- Evaluate if the flow of the piping system matches the need of systems or is oversized.
- Look for multiple parallel pump systems with same number of pumps always in operation.



## Compressed Air

### Low Cost Upgrades

- Evaluate if air pressure can be reduced to the lowest practical set point.
- Verify proper maintenance schedules are being followed, including:
  - Check filters are cleaned or replaced.

### NOTES:

### TIP:

- Identify and assess opportunities for installing variable frequency drives (VFDs) for fan and pump motors and variable air volume (VAV) boxes in the ductwork – especially where variable loads are being served.

### TIP:

- Check out [Energy Efficiency Opportunities in the Canadian Brewing Industry by Natural Resources Canada](#).



- Check motors and compressors are properly lubricated.
- Inspect fans and pumps, where applicable.
- Inspect drain taps periodically to ensure they are clean and not stuck in the open or closed position.
- Inspect belts, where applicable.
- Review compressed air applications for excessive pressure, duration, or volume.
- Confirm air is completely turned off to equipment no longer active (at solenoid valve).
- Evaluate if air pressure can be reduced to the lowest practical set point. Every 2-3 PSI decrease in system pressure can reduce energy use of the compressors by 1%.
- Replace standard timed condensate drains with zero air loss condensate drains.
- Evaluate overall preventative and predictive maintenance of system.
- Confirm overall control system operations.
- Consider if compressed air could be replaced with centrifugal fans.

## Capital Investment Upgrades

- Inspect, or consider installing, ultrasonic acoustic detector to identify leaks and the high-frequency hissing sounds associated with air leaks.
  - Track identified leaks to ensure they are repaired. Develop a leak program to assure leak detection and correction are ongoing.
- Assess, or consider implementing, a control strategy to ensure that only the right amount of compressed air, at the right time, is generated and used in the production system.
  - To determine proper control systems, assess compressed air requirements over time to establish a load profile.
- Assess if pneumatic controls or tools can be replaced with electrical systems.
- Identify opportunities for heat recovery of wasted heat from the compressors.
- Identify opportunities to replace compressors with a VSD compressor.
- Evaluate the potential to reduce header pressure during non-production time.
- Replace any electronic cabinet coolers using compressed air with fan or heat pipe type cabinet coolers.

## NOTES:

## TIP:

- When purchasing signage displays, monitors, televisions, water coolers, vending machines, and other products, [look for the ENERGY STAR label](#). Use your Zip Code in the rebate finders for ENERGY STAR® and WaterSense® labeled products to check on utility or retail vendor cash rebates before you buy any products. Utilities may have pre-purchase application requirements.





## Fans

### Low Cost Upgrades

- Check for pressure drop elimination (e.g., grates, dampers, poor design ductwork).
- Reduce exhaust flow to its minimum (e.g., ovens, rooms).
- Shut off unnecessary air curtains.
- Confirm overall control system operation.

### Capital Investment Upgrades

- Assess whether dampers can be removed and replaced with a VFD.
- Replace low-efficiency fans with high-efficiency fans.



## Lighting

### Low Cost Upgrades

- Identify where lights have been left on in unoccupied spaces (e.g., common areas, storage rooms, restrooms, break rooms, outdoor areas).
- Identify and assess opportunities to use automated lighting controls:
  - Occupancy/motion sensors for low-traffic areas.
  - Timers or daylight sensors to dim or turn off exterior parking lot lights during the day.
  - Timers to turn off decorative lighting.
  - Dimming controls in locations where there is natural lighting (e.g., near windows, skylights, light tubes).
- Confirm that installed lighting controls are operating as intended.
- Assess need to institute a regular cleaning plan for lamps/fixtures for maximum light output.
- Identify where reflectors can be practically added to existing lighting.
- Assess whether any areas are over-lit, compared to requirements or design levels; consider opportunities for de-lamping.
- Identify and de-energize and/or remove ballasts that are not in use.

### Capital Investment Upgrades

- Evaluate the opportunity to upgrade to more energy-efficient lighting options:

### NOTES:

### TIP:

- Download the [ENERGY STAR Action Workbook for Small Business](#) for more strategies, action items, and ideas. Start and support an employee Green Team. Find resources to [Build Your Own Competition](#) for savings

### TIP:

- Celebrate your success and recognize contributors. Help your guests and employees achieve [savings at home](#) and at guests' [workplaces](#) with ENERGY STAR's [Bring Your Green to Work](#).



- Replace T12 fluorescents with T8s or T5s with electronic (rather than magnetic) ballasts; consider the use of tubular LEDs (TLEDs), OR...
  - Replace all fluorescent fixtures with LED fixtures and consider including integrated controls as part of the lighting system replacement
- Upgrade incandescent and CFL applications to LED (especially for task lighting or specialty applications).
- Use LED Exit signs in place of incandescent or CFL models.

## NOTES:

## TIP:

- The Brewers Association has significant resources for members on [water use](#) at and [wastewater](#).



## Building Envelope

### Low Cost Upgrades

- Inspect doors and windows to identify gaps or cracks that can be repaired.
  - Note damaged or missing weather stripping.
- Note air leaks that should be sealed with caulking or other sealant.
- Inspect insulation levels and identify inadequacies to be addressed (including loading docks and garage doors, if appropriate).
- Assess opportunity to install vinyl curtains in loading areas, if applicable.
- Note any doors left open to the outside and to any unheated or uncooled areas.
- Assess the opportunity to install solar film or other window coverings on east, west, or south exposures to reduce solar heat gain and heat loss.

### Capital Investment Upgrades

- Assess the opportunity to install air lock doors for main entrances.
- Assess the opportunity to install a reflective (“cool”) roof covering in warm climates.



## HVAC

### Low Cost Upgrades

- Identify and make plans to address instances of simultaneous heating and cooling.
- Ensure that thermostats and outside air temperature sensors are properly calibrated/maintained.



- Ensure that thermostats are set to appropriate temperatures based on season and local weather conditions.
- Ensure that thermostats are properly located to be representative of the room or zone for which the temperature is being controlled.
- Ensure that electronics are located away from thermostats.
- Identify where locking covers for thermostats and ventilation controls can be installed to prevent unauthorized adjustments.
- Confirm proper implementation of a temperature setback policy for heating/cooling when the building is unoccupied (including any special considerations for summer months).
- Ensure that space heaters are not being used in offices, break rooms, and other spaces.
- Ensure free airflow to and from registers; clear furniture, books, papers, and other materials.
- Ensure window shades are available to block excess heat gain; make a plan to educate staff about when to use them.
- Identify where ceiling fans can be installed to move and de-stratify air layers. Ensure all existing ceiling fans are operating properly.
- Monitor make-up air ventilation; ensure the proper functioning of dampers to achieve outside air requirements.
- Ensure that HVAC system components are being maintained regularly, including:
  - Replace filters on a regular schedule.
  - Inspect and clean evaporator and condenser coils.
  - Clean fan blades and adjust belts as needed.
  - Inspect water/steam pipes and ducts for leaks and/or inadequate insulation; address as needed.
  - Verify and calibrate operation of variable air volume (VAV) boxes, where applicable.
  - Evaluate furnace/boiler efficiency and clean/tune up as needed (including boiler water treatment and inspection of steam traps, as appropriate).
  - Check chiller and cooling tower components for fouling or corrosion; ensure proper water treatment is in place.
  - Check for unusual noise, vibration, and/or decrease in performance of compressors/motors.

## NOTES:

## TIP:

- [YouTube: Integrated Water and Energy Management at a Sustainable Craft Brewery.](#)

## TIP:

- Consider the potential for anaerobic digestion of spent grain waste to produce biogas fuel.



## Capital Investment Upgrades

- Assess the opportunity to install and use air-side economizers, so that outside air can be used for “free cooling.”
- Identify and assess opportunities for heat recovery.
- Identify and assess opportunities for demand-controlled ventilation in areas with variable loads (e.g., conference rooms, auditoriums, and cafeterias).
- Identify and assess opportunities to use occupancy sensors to control HVAC in personal offices.
- Perform testing and balancing of air and water systems.



## For Brewpubs and Employee Kitchens: Food Service Equipment

### Low Cost Upgrades

- If possible, be sure heating equipment is not near cooling equipment, and turn heating equipment off when possible.
- Identify worn and/or leaky door seals/gaskets on refrigerators and freezers. Close the door on a dollar bill or piece of paper, and if it is easily pulled out, replace the gasket.
- Survey water use to identify major uses; find and fix any leaks—especially hot water leaks.
- Typically, set water temperature to 110 – 120 degrees or per local code to prevent scalds and to save energy and money.
- Verify oven thermostat accuracy and recalibrate if necessary.
- Establish operating procedures for cooking/baking equipment (for instance, preheating only when necessary, turning down/off equipment when not in use).
- Ensure that range hoods and exhaust fans are only running when the range is being used.
- Ensure that unused appliances are unplugged or on a power strip that is shut off.
- Determine if [low-flow pre-rinse spray valves](#) can be installed.
- Monitor and control all the equipment you can and look into predictive diagnostics. Receive real time alerts.

### NOTES:

#### TIP:

- Translate energy savings opportunities to cost savings using the [Detail Sheets](#) available at the [Treasure Hunt resources page](#).

#### TIP:

- Develop an action plan for implementing your most cost-effective findings.



## Capital Investment Upgrades

- If the store anticipates purchasing new kitchen equipment, [review the ENERGY STAR models, calculate savings, and find rebates](#) in advance.
- Some restaurants may have residential type refrigerators, which should be replaced if 9-10 years old. Commercial refrigerators/freezers are much larger and are typically silver/stainless steel.
  - Dispose of old refrigerators properly. See the [EPA's Responsible Appliance Disposal \(RAD\) Program](#).
- Check out ENERGY STAR labeled water heaters, including "tankless/on-demand," solar and other models; [find local retailers and rebates](#).
- See [EPA's WaterSense® program](#) for water saving labeled products and rebates, for indoor/outdoor water efficiency tips, and best practices.
- Identify and assess opportunities to install VFDs on kitchen hoods.

## NOTES:



## Office Equipment/ Plug Loads

### Low Cost Upgrades

- Ensure that power management settings are activated on office equipment such as computers, monitors, printers, and copiers, and that any office equipment left on overnight (including equipment left in sleep/idle or screen saver mode) is turned off when not in use.
- Identify where power strips can be used for easy disconnect from power source. Consider the use of advanced power strips.

## TIP:

- Register for the [ENERGY STAR Challenge for Industry](#). Breweries that can set and achieve a goal of a 10% energy intensity reduction within five years can receive U.S. EPA recognition for their achievements.

## Capital Investment Upgrades

- Identify any new office equipment that will be needed soon. Start looking for [ENERGY STAR certified equipment options, use the online savings calculators and look for available rebates](#).





# Treasure Map FOR MICROBREWERIES

**ADDITIONAL NOTES:**

