FOODSA

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COOKING & HEATING
ENERGY EFFICIENT EQUIPMENT TOOLKIT

CONTENTS AND PARTNERS

PARTNERS

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Zero Waste SA

INTRODUCTION

Cooking and heating equipment include ovens, provers, pasteurisers, sterilisers, dryers, dehydrators, evaporators, blanchers, and steam peelers. Ovens, provers, dryers, and dehydrators usually run on electricity. Pasteurisers, sterilisers, evaporators, blanchers, and steam peelers usually use steam or hot water, although there are alternatives. Cooking and heating equipment contributes 10-50% of the total site energy use.

EQUIPMENT & PROCESSES

By using your equipment settings more efficiently you can reduce your energy consumption.

UPGRADE EQUIPMENT

You can evaluate what energy reduction benefits your organisation could gain from upgrading to more efficient equipment and/or adjusting combinations of equipment. Consider adopting a selection of the following opportunities according to available resources.

SELECT & PRIORITISE

Learn how to get the best from your equipment and processes and whether you need to upgrade.

COLLECT & CHECK

Learn how to collect data and engage with your suppliers.

ENGAGE YOUR STAFF

In the food manufacturing sector cooking and heating requirements vary widely. Because of this, general statements on how to use heating equipment and processes for best energy outcomes are of limited use.

IMPROVE THE OPERATION OF EXISTING COOKING AND HEATING EQUIPMENT

Much can be done to reduce electricity and gas consumption of existing cooking equipment, purely by putting in place practices to cut idle/stand-by time and pre-heat time for cooking, and reducing temperature set points so that overheating doesn't occur.

Many of these opportunities simply relate to the behaviour of staff operating the equipment and challenging 'the way it's always been done'.

Reduce energy consumption of existing equipment by inspecting the practices of staff, as well as the current flow of processes and production, to suggest more efficient ways of operating equipment and achieving production targets with less energy consumption. Ask your team to review your own processes for ways to reduce heating costs by improving processes and avoiding unnecessary stress on your equipment.

For further suggestions on how to mobilise your staff to improve energy efficiency, refer to Food SA's Your Guide to Sustainable Business in Food.

REPLACE EQUIPMENT COMPONENTS

You can evaluate what energy reduction benefits your organisation could gain from upgrading to more efficient equipment and/or adjusting combinations of equipment. Consider adopting a selection of the following opportunities according to available resources.

INSTALL ADVANCED ROTARY BURNERS

Old or inefficient components often use more energy than is needed to do the job. Consider whether some of the following could be viable for your organisation.

Conventional rotary and stationary burners require electrical air distribution systems to aid combustion. Advanced rotary burners are more efficient.

Advanced rotary burners use a gas expansion process that mixes air and fuel for combustion nearly perfectly, resulting in more-efficient radiative and convective heat transfer and low nitrous oxide emissions. Reduce burner power use by installing advanced burners on combustion equipment such as boilers, fryers, and dryers.

POTENTIAL ENERGY SAVINGS

- Savings can be up to 4% of burner power use

OTHER BENEFITS

- Low nitrous oxide emissions

EQUIPMENT/MATERIAL

- Purchase and installation

Ohmic heating is an inside-out heating process that heats foods faster and more evenly than conventional, outside-in heating processes.

INSTALL AN OHMIC HEATER

It works by passing an electrical current through food products. Reduce burner power by installing ohmic heating equipment for pasteurisation, sterilisation, dehydration, evaporation, blanching, fermentation, and/or extraction.

POTENTIAL ENERGY SAVINGS

- Savings vary depending on the volume and type of food product, and comparison between current heating/ cooking system and new ohmic heating system

OTHER BENEFITS

- Improved product quality due to faster and more uniform heating of food product. Normally, food quality degrades when the heating process is too long and too slow. Ohmic heating enables the sterilisation of food products without overheating and affecting food quality

EQUIPMENT/MATERIAL

- Purchase and installation

Examples of Ohmic heating equipment

REPLACE EQUIPMENT COMPONENTS *CONT.*

Insulation and seals prevent heat transfer out of from cooking and heating equipment, such as ovens, provers, pasteurisers, sterilisers, dryers, dehydrators, evaporators, and blanchers.

INSTALL INSULATION AND SEALS

Insulation and seals can often be cost-effectively installed or improved on exposed surfaces. Consider materials such as solid doors rather than glass and seals around doors. Eliminate glass doors, as these are comparatively poor insulators.

Insulate burners, heat exchangers, roofs, floors, walls, pipes and ducts, and consider insulating areas of thermal bridging, such as metal joints. Reduce heat loss by installing insulation on any surface over 50°C.

Good insulation has:

- Low thermal conductivity
- Dimensional stability under temperature change
- Resistance to water absorption
- Resistance to combustion

Other important characteristics, depending on the application, are tolerance to wide temperature variation and system vibration, and compressive strength where insulation is load bearing. Eliminate moisture sources to minimise degradation.

POTENTIAL ENERGY SAVINGS

- Savings vary depending the state of the existing heating equipment

OTHER BENEFITS

- Improved productivity - shorter time to reach the desired temperature on start up

EQUIPMENT/MATERIAL

- Insulation
- Thermographic camera to find where existing insulation is degraded, if required

Thermographic camera

(Table 1) Insulation materials and their typical applications.

TYPE OF MATERIAL	MAXIMUM TEMPERATURE (°C)	APPLICATION
Insulation		
Polyethylene	80	Internal and external locations (joints sealed)
Synthetic rubber	105	Internal and external locations (joints sealed)
Ball blankets		
Polypropylene	110	Metal treatment tanks
High density polypropylene	230	External freezing prevention, UV stabilised
Glass mineral fibre, aluminium foil faced, preformed	230	Internal, concealed surfaces
Glass mineral fibre, aluminium clad	230	Surfaces exposed to damage and external surfaces open to the weather (joints sealed)
Rock mineral fibre aluminium foil faced, preformed	830	Internal, concealed surfaces
Rock mineral fibre aluminium foil faced, preformed, aluminium clad	830	Surfaces exposed to damage and external surfaces open to the weather (joints sealed)

INSTALL NEW PASTEURISER COMPONENTS

Steam boilers, which are about 50-90% fuel efficient, are poorly suited for pasteurisation because they overheat water, consuming excessive energy.

INSTALL A HOT WATER BOILER FOR PASTEURISATION

They are also often centrally located, making steam distribution more susceptible to heat loss.

Hot water boilers, however, are about 90-95% efficient and are well suited to pasteurisation because they can heat water to the typical pasteurisation temperature of about 60-70°C. Reduce power use by installing a hot water boiler near the pasteuriser.

POTENTIAL ENERGY SAVINGS

- Savings can be up to 20-30% of boiler power use depending on the distance between the boiler and the pasteuriser

OTHER BENEFITS

- No need for a heat exchanger to recover the excess heat from steam
- Lower maintenance costs

EQUIPMENT/MATERIAL

- Purchase and installation

Decrease heating power use by reclaiming heat.

INSTALL RECLAMATION UNITS ON PASTEURISERS

Product usually leaves the pasteuriser hotter than it entered, taking with it heat that must then be replaced. Heat reclamation units can recover 95%+ of this heat to pre-heat new input fluid, and can be made more efficient by adding plates that increase the surface area for exchange.

Heat exchangers are also a suitable alternative. Helical (coil/spiral) heat exchangers are more efficient and need less maintenance than shell-and-tube (rows of tubes in a container) heat exchangers.

POTENTIAL ENERGY SAVINGS

- Savings vary depending the amount of useful waste heat captured and used for pre-heating. If the volume of waste heat re-captured is large, savings can be significant – for example a dairy plant installed a heat exchanger for reclamation at a payback period of 1.5 years.

OTHER BENEFITS

- No other significant benefits identified

EQUIPMENT/MATERIAL

- Purchase and installation

INSTALL NEW DRYER COMPONENTS

Controls reduce the energy a dryer consumes.

INSTALL CONTROLS ON DRYERS

It reduces energy by more precisely controlling energy inputs to meet the needs of the product being processed, specifically through optimising air temperature, air humidity, and product surface temperatures.

POTENTIAL ENERGY SAVINGS

- Savings vary depending on choices made. For example a sugar beet plant, using rotary dryers to dry beet pulp, installed controls at a cost of A$270,000. The controls save the plant A$28,350 per year in dryer power use, A$21,000 per year in downstream energy, and A$92,400 per year though increased yields. (Note: the original figures were in British Pounds and converted to Australian Dollars based on 1997 exchange rate)

OTHER BENEFITS

- Improved productivity by controlling the ramp-up/ramp-down of energy required, and drying time, to match varying loads of product

EQUIPMENT/MATERIAL

- Purchase and installation

INSTALL NEW EVAPORATOR AND STILL COMPONENTS

Vapour recompression systems are suited to evaporators that boil a moderate or low concentration product at atmospheric or moderate vacuum conditions.

INSTALL A VAPOUR RECOMPRESSION SYSTEM ON EVAPORATORS AND STILLS

Vapour emissions from evaporators contain useful heat and water. Vapour recompression systems capture and compress vapour emissions (pressure factor of 1.2-2.0) to increase temperature and then feed this recovered heat back into the cycle. They recover more energy than they use for compression. They usually save more energy than systems with multiple evaporation stages (or 'effects'), which use heat from one evaporator to help the next. The best strategy to reduce the evaporator's power is to use Vapour recompression and multiple effects.

Of the two types of recompression systems, mechanical vapour recompression (MVR) is generally more efficient than thermal vapour recompression (TVR) but each is best suited to particular situations:

- MVR uses a centrifugal compressor or turbo fan to compress all vapour emissions and then adds a small amount of steam for additional heating. It has a steam economy (ratio between total steam evaporated versus steam consumed) of 10-30 and is best suited where electricity costs for the compressor and recirculating pump are low. MVR systems usually have higher capital costs and much lower operating costs than TVR systems
- TVR uses a steam injector, which requires high-pressure steam, to compress some of the vapour emissions. It has a steam economy of 4-8 and is best suited where high-pressure steam costs for the steam injector are low

POTENTIAL ENERGY SAVINGS

(Table 2) Energy consumption of multiple-effect evaporators and vapour recompression.

TECHNOLOGY	TYPICAL SPECIFIC ENERGY CONSUMPTION (KWH PER KG WATER EVAPORATED)
Triple-effect evaporator	0.14
Five-effect evaporator	0.085
Thermal vapour recompression + triple-effect evaporator	0.12-0.15
Mechanical vapour recompression + triple-effect evaporator	0.01-0.02

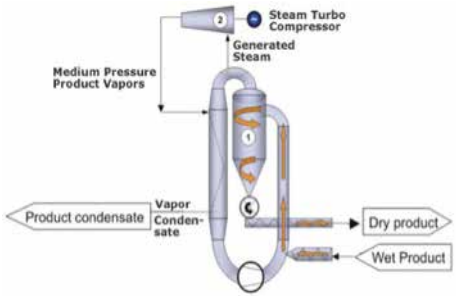
OTHER BENEFITS

- Lower water consumption do to recirculation/recovery
- Higher product quality due to gentler boiling
- Fewer aromatic emissions, resulting in reduced Occupational Health & Safety risks

EQUIPMENT/MATERIAL

- Purchase and installation

Thermal vapour recompression system



Mechanical vapour recompression system

INSTALL NEW EVAPORATOR AND STILL COMPONENTS *CONT.*

Ovens, such as baking ovens, can have a useful life of over 10 years, during which they usually accumulate higher operating costs than their capital cost.

INSTALL AN EFFICIENT OVEN

Decrease oven power use by installing an efficient unit. Using an efficient oven has the added benefit of emitting less heat, leading to a lower HVAC cooling load and a more-comfortable workspace.

Efficient ovens have double-glazed door windows, individual controls on each deck, thick insulation, and a stand-by-mode that activates when the oven is empty. Stand-by-mode maintains the oven temperature while slowing the recirculation fan speed and closing the exhaust.

Oven

Some products can be cooked or baked using different oven technologies:

- Direct-heating ovens use a mixture of air and combustion gases to heat product, rather than air only. They have high efficiency and short backing times, and they start-up rapidly and control baking conditions well. They might be unsuitable for some foods that are sensitive to contamination by combustion gasses
- Microwave and other dielectric (electronic or high frequency heating) ovens

You can also reduce power use by installing a separate system that moves only the product from the proving racks to the oven racks (rather than the product and racks together) so that oven racks can be reused while hot. This can make baking faster and more consistent.

POTENTIAL ENERGY SAVINGS
- Savings vary depending on choices made

OTHER BENEFITS
- More efficient and consistent cooking

EQUIPMENT/MATERIAL
- Purchase and installation

Provers store solid products, such as baked goods, at a particular temperature and humidity to facilitate fermentation.

INSTALL AN EFFICIENT PROVER

Decrease prover power use by installing a multi-cabinet, multi-door prover system. Each cabinet can have its own temperature and humidity settings, increasing flexibility of use. Each door allows access to only a single rack, decreasing the disruption to products on other racks.

POTENTIAL ENERGY SAVINGS
- Savings vary depending on choices made. One bakery reported a 35% reduction in prover power use

OTHER BENEFITS
- Less disruption to products

EQUIPMENT/MATERIAL
- Purchase and installation

Multi-cabinet, multi-door prover system

STERALISATION ALTERNATIVES

Compared with tunnel pasteurisers, flash pasteurisers use less space, steam, electricity, and coolant.

INSTALL A FLASH PASTEURISER

Note: Flash pasteurisers are unsuitable for foods that are sensitive to contamination that can occur between pasteurisation and packaging.

Flash pasteurisation uses a third of the power of best-practice tunnel pasteurisation, but since it applies only to unpackaged product, the additional steriliser for containers also uses power. Overall, flash pasteurisation uses less power, mostly through the inbuilt recovery of 94-96% of heat.

Capital costs are about 15% of the capital costs of a tunnel pasteuriser, but you may need to add the cost of a steriliser for containers.

POTENTIAL ENERGY SAVINGS
- Savings vary depending on the application

OTHER BENEFITS
- No other significant benefits identified

EQUIPMENT/MATERIAL
- Purchase and installation
- Additional steriliser, if needed

Microwaves are well suited for pasteurising packaged products, but not canned products because microwaves (the wave) cannot penetrate metal.

INSTALL A MICROWAVE

They are usually less cost effective than flash pasteurisation for bulk product.

Microwaves are nearly 90% efficient in converting electricity to heat. You can further decrease heating power use if you reclaim heat from the heated product to apply to input product.

Microwaves are flexible in use. They can top up the temperature of the product, meet a variable heating load, or heat 'cool spots' of the product.

Capital costs may be higher than the capital costs of tunnel pasteurisers.

POTENTIAL ENERGY SAVINGS
- Savings vary depending on the application

OTHER BENEFITS
- Faster processing of product leading to improved productivity
- No water use

EQUIPMENT/MATERIAL
- Purchase and installation

Induction heaters are well suited to continuous pasteurisation of liquid products, and they have fewer heat losses than tunnel pasteurisers.

INSTALL AN INDUCTION HEATER

POTENTIAL ENERGY SAVINGS
- Savings can be up to 17% of pasteuriser power use. A diary plant that pasteurises milk reported a 3.3-year payback

OTHER BENEFITS
- Faster processing of product leading to improved productivity
- No water use

EQUIPMENT/MATERIAL
- Purchase and installation

Heating-by-flames sterilisers use direct flames at 1770°C and atmospheric pressure to sterilise spinning containers.

INSTALL HEATING-BY-FLAMES STERILISER

They are well suited to sterilising small cans. This type of direct heating has fewer opportunities for heat loss than steam sterilisation.

POTENTIAL ENERGY SAVINGS
- Savings can be 20% of steriliser power use

OTHER BENEFITS
- Higher quality product
- Faster process

EQUIPMENT/MATERIAL
- Purchase and installation

DRYER AND EVAPORATOR ALTERNATIVES

Contact dryers are well suited to food because they can operate without oxygen, preventing food oxidation.

INSTALL A CONTACT DRYER

Contact (or heated-surface) dryers, such as drum dryers, evaporate moisture when the product comes into contact with a hot surface. They use less power than hot-air dryers because they do not need to heat large volumes of air. Contact dryers use 2-3kJ of heat energy per kg of water evaporated, compared with 4-10kJ of heat energy per kg of water evaporated for hot-air dryers.

POTENTIAL ENERGY SAVINGS

- Savings can be 50-70% of dryer power use compared to hot air dryers

OTHER BENEFITS

- Prevent food oxidisation

EQUIPMENT/MATERIAL

- Purchase and installation

Contact dryer

Direct-fired dryers evaporate moisture when product comes into contact with combustion gasses.

INSTALL A DIRECT-FIRED DRYER

Note: They are unsuitable for foods that are sensitive to contamination by combustion gasses.

They use less power than indirect-fired dryers (steam-based) dryers because they do not need to transfer heat from combustion gasses to steam (in a boiler) and then to air.

POTENTIAL ENERGY SAVINGS

- Savings can be 35-45% compared to indirect-fired dryers

OTHER BENEFITS

- No non-energy benefits identified

EQUIPMENT/MATERIAL

- Purchase and installation

Direct-fired dryer

You can reduce power use of an evaporator by adding effects (stages).

INSTALL A MULTIPLE-EFFECT EVAPORATOR

The most-efficient evaporators use multiple effects and mechanical vapour recompression (refer to energy efficiency improvement option mentioned earlier in this Workbook, Install a vapour recompression system on evaporators and stills.

Multiple-effect evaporators

Multiple-effect evaporators use multiple evaporators in sequence to progressively remove moisture from product.

INSTALL A VAPOUR RECOMPRESSION SYSTEM ON EVAPORATORS AND STILLS

Heat from the hot vapour that evaporates in one effect is used at lower pressure in the next effect to evaporate more moisture.

This reuse of heat allows a given amount of heat to evaporate more moisture. For each 1kg of input steam, a single-effect evaporator will evaporate 0.95kg of moisture. A double-effect evaporator will evaporate 1.8kg of moisture and a triple-effect evaporator will evaporate 2.6kg of moisture.

Up to five effects might be suitable in food processing and capital cost increases with the number of effects.

POTENTIAL ENERGY SAVINGS

- Savings can be 50% of boiler power use for the first additional effect, 30% of boiler power use for the second additional effect

OTHER BENEFITS

- No other significant benefits identified

EQUIPMENT/MATERIAL

- Purchase and installation

MIXER AND BLANCHER ALTERNATIVES

Pulsed air mixers (or pneumatic mixers) use a process in which compressed air or gas is released in bursts (pulses) at the bottom of a tank, vessel, or basin to circulate and mix 100% of the product..

INSTALL A PNEUMATIC MIXER

These systems are well suited to liquid foods of any viscosity.

These have a number of benefits over mechanical mixers (listed).

POTENTIAL ENERGY SAVINGS
- Savings can be up to 95% of mixer power use

OTHER BENEFITS
- Lower maintenance costs
- No separate mixing equipment, such as eductors and mud mixers, outside the tank
- Faster mixing times as it is mixing in the original container
- No downtime because of moving parts, higher reliability
- Higher quality and homogenised product
- Homogeneous product and uniform temperature maintained
- Less stratification of product during storage

EQUIPMENT/MATERIAL
- Purchase and installation

Heat-and-hold blanchers cook by exposing the product's surface to a small amount of steam in a heating section, and then moving the product to a constant-temperature holding section where the heat penetrates the product's core.

INSTALL A HEAT-AND-HOLD BLANCHER

They use less energy than conventional steam blanchers because they avoid the need to continuously apply steam to cook the product.

Heat and hold blanchers process 6-7kg of product per kg of steam compared to steam blancher, which processes 0.5kg of product per kg of steam.

POTENTIAL ENERGY SAVINGS
- Savings can be up to 50% of boiler power use

OTHER BENEFITS
- Improved productivity/throughput of the process by up to 60%

EQUIPMENT/MATERIAL
- Purchase and installation

Hot water blanchers, such as reeler blanchers and pipe blanchers, cook by holding the product in hot water at 70-100°C for a specified time and then moving the product to a cold-air, dewatering-cooling section.

INSTALL AN EFFICIENT HOT WATER BLANCHER

Note: Hot water blanchers are unsuitable for foods that are sensitive to contamination by thermophilic bacteria.

They use less energy than conventional steam blanchers because they heat water to a lower temperature. Installation of a heat exchanger as well can add to power savings by recovering up to 70% of heat.

Hot water blanchers use about 1m³ of water per 10t of product. This volume and the subsequent water treatment might generate high operating costs. Decrease water use and pollution by recirculating a water-steam mixture.

Hot water blanchers treat 20kg of product per kg of steam compared to steam blanchers that treat 0.5kg of product per kg of steam. Capital costs are lower than installing steam blanchers.

POTENTIAL ENERGY SAVINGS
- Savings can be 98% of boiler power use

OTHER BENEFITS
- No other significant benefits identified

EQUIPMENT/MATERIAL
- Purchase and installation

Heat-and-hold blancher

Hot water blancher

Pulsed-air system

EQUIPMENT AND PROCESSES

Use the following table to select which energy efficiency opportunities your business would be interested in pursuing, as well next steps in terms of actions and responsibilities.

Tick the box if you plan to pursue an Energy Efficiency Option.

X	ENERGY EFFICIENCY OPTION	NEXT STEPS & TIMING	WHO RESPONSIBLE	NOTES
	Optimise operating conditions			
	Engage staff to improve the operation of existing cooking and heating equipment			

UPGRADE EQUIPMENT

Use the following table to select which energy efficiency opportunities your business would be interested in pursuing, as well next steps in terms of actions and responsibilities.

Tick the box if you plan to pursue an Energy Efficiency Option.

X	ENERGY EFFICIENCY OPTION	NEXT STEPS & TIMING	WHO RESPONSIBLE	NOTES
	Replace equipment components			
	Install advanced rotary burners			
	Install an ohmic heater			
	Install insulation			
	Install insulation and seals			
	Install new pasteuriser components			
	Install a hot water boiler for pasteurisation			
	Install reclamation units on pasteurisers			
	Install new dryer components			
	Install controls on dryers			
	Install new evaporator and still components			
	Install a vapour recompression system on evaporators and stills			
	Replacing ovens and provers			
	Install an efficient oven			
	Install an efficient prover			
	Install an efficient pasteuriser			
	Install a flash pasteuriser			
	Install a microwave			
	Install an induction heater			

UPGRADE EQUIPMENT *CONT.*

Use the following table to select which energy efficiency opportunities your business would be interested in pursuing, as well next steps in terms of actions and responsibilities.

Tick the box if you plan to pursue an Energy Efficiency Option.

X	ENERGY EFFICIENCY OPTION	NEXT STEPS & TIMING	WHO RESPONSIBLE	NOTES
	Install an efficient steriliser			
	Install heating-by-flames steriliser			
	Install an efficient dryer			
	Install a contact dryer			
	Install a direct-fired dryer			
	Install an efficient evaporator			
	Install a multiple-effect evaporator			
	Install a vapour recompression system on evaporators and stills			
	Install an efficient blancher			
	Install a heat-and-hold blancher			
	Install an efficient hot water blancher			
	Install an efficient mixer			
	Install a pneumatic mixer			

CHECKLIST TO ENGAGE WITH SUPPLIERS

By gathering the information suggested in this supplier checklist, you can build a complete picture of your equipment and energy uses.

This will help you to identify which actions are likely to benefit your business so that you can establish a business case to support decision making now and planning for the future. Some of the information you can collect within your own business resources, but some may need you the help of suppliers or experts (e.g. an energy audit).

Note: This checklist can be used by either the food business or the supplier.

COMPILE A COOKING AND HEATING EQUIPMENT INVENTORY

COMPILE A LIST OF THE FOLLOWING EQUIPMENT

Tick those that apply to your business

- ○ Pasteurisers: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Sterilisers: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Spray dryers: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Dehydrators: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Evaporators: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Blanchers: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Steam peelers: number, make, model, type, power rating (kW), efficiency (%), time in use (h/y)
- ○ Other

CHOOSE AN APPROACH TO ESTIMATE TIME IN USE

Tick those that apply to your business

- ○ Record readings on the hour-run meter (h) at regular intervals
- ○ Divide the hour-run meter reading (h) by the total time (h) that the equipment has been installed
- ○ Compare the energy (kWh) and power readings (kW) (if the equipment has an electricity meter)
- ○ Examine electricity meter load profiles (kW)
- ○ Use existing control systems and manual procedures
- ○ Check control settings (if the equipment has controls)

ESTIMATE THE COOKING AND HEATING REQUIREMENTS

COMPILE A LIST OF THE FOLLOWING INFORMATION FOR EACH END-USE

Tick those that apply to your business

- ○ Product: name, temperature (°C), viscosity (Pascal-seconds), Pa.sec), solids concentration (%) and particle size (m), and density (kg/m3) or specific gravity
- ○ Flow rates (l/s) required
- ○ Location of end-use
- ○ Operating times or events that require cooked and heated product
- ○ Reason the end-use requires heat or steam

This list enables you to:

- Identify the products that dominate the heating requirements (kW)
- Identify wasteful and unnecessary heating
- Estimate the base and peak heating requirements (kW), and the variation in heating requirements (kW), now and in the future

CHECKLIST TO ENGAGE WITH SUPPLIERS *CONT.*

By gathering the information suggested in this supplier checklist, you can build a complete picture of your equipment and energy uses.

This will help you to identify which actions are likely to benefit your business so that you can establish a business case to support decision making now and planning for the future. Some of the information you can collect within your own business resources, but some may need you the help of suppliers or experts (e.g. an energy audit).

Note: This checklist can be used by either the food business or the supplier.

ESTIMATE THE ENERGY USE OF YOUR EXISTING COMPRESSED AIR SYSTEMS

Tick those that apply to your business

CHOOSE AN APPROACH

- ○ Install a power demand analyser or a suitable meter to measure the average power (kW) of, or the energy used (kWh) by, the system over a test period
- ○ Install a clip-on ammeter to measure the instantaneous currents (A) of each of the three phases with the compressor running at the most common load (kW). Calculate the average phase current (A). Repeat this process with the compressor at no load (kW) and at full load (kW). Multiply the average phase currents (A) by the time (h) that the compressor runs at each load (kW)
- ○ For equipment with control systems, record energy use (kWh) readings weekly to determine annual energy use (kWh)

DETERMINE THE BUSINESS PARAMETERS OF THE COOKING AND HEATING EQUIPMENT

QUANTIFY OR QUALIFY THE FOLLOWING VALUES

Tick those that apply to your business

- ○ Energy price(s) ($/kWh, $/l gas/fuel)
- ○ Capital budget ($)
- ○ Targets for running costs ($/y)
- ○ Required level of redundancy in the system
- ○ Acceptable level of risk for new technologies
- ○ Acceptable payback period or return on investment
- ○ Equipment constraints, such as specific brands of equipment, specifications for electrical wiring, compatibility with existing infrastructure or floor space, and adaptability to future upgrades

If the existing equipment needs to be replaced, then calculate the payback period (y) based on the extra (rather than total) costs ($) (if any) of the efficient equipment.

CONFIRM EQUIPMENT PERFORMANCE

CHECK THE FOLLOWING CONDITIONS

Tick those that apply to your business

- ○ The equipment meets the peak heating load (kW)
- ○ The equipment is optimised for the most common heating loads (kW)

CHECKLIST TO ENGAGE WITH SUPPLIERS *CONT.*

By gathering the information suggested in this supplier checklist, you can build a complete picture of your equipment and energy uses.

This will help you to identify which actions are likely to benefit your business so that you can establish a business case to support decision making now and planning for the future. Some of the information you can collect within your own business resources, but some may need you the help of suppliers or experts (e.g. an energy audit).

Note: This checklist can be used by either the food business or the supplier.

SELECT A SERVICE PROVIDER

SELECT AN EQUIPMENT SERVICE PROVIDER THAT CAN PROVIDE THE COMBINATION OF SERVICES THAT YOU SEEK

Tick those that apply to your business

- ○ Measurement and analysis of the heating profile, and power (kW) of cooking and heating equipment
- ○ Reporting on equipment and process performance
- ○ Optimisation of the equipment, including: optimisation of the control system and flow rates (l/s); management of air and product leaks; assessment of heat recovery potential; and minimisation of the heating requirements
- ○ Design of a cooking and heating system that aims to minimise losses
- ○ Supply, service, and installation of equipment for optimal energy efficiency (%)
- ○ Supply of spare parts, including shipping/transport
- ○ Guarantee of minimum efficiency (%) of the proposed system
- ○ Guarantee of maximum running costs ($/y) of the proposed system
- ○ Technical support and after sales service
- ○ In-house repairs and onsite service
- ○ Emergency service
- ○ Emergency rental equipment
- ○ Appropriate removal and disposal of old equipment
- ○ Other

NEGOTIATE A CONTRACT

DETERMINE YOUR PREFERRED TYPE OF CONTRACT

Tick those that apply to your business

- ○ Service contract - the supplier performs certain actions for a fixed price ($)
- ○ Energy performance contract - the supplier performs certain actions that meet certain levels of energy reduction (kWh) for a lower upfront price ($) and a share of the cost savings ($/y)

REFERENCES

The following references were used in the development of the Cooking & Heating section of the Food SA BCEEE toolkit. We encourage you to access these references as they may provide additional useful information for your business in evaluating energy efficiency opportunities.

Food SA's Your Guide to Sustainable Business in Food

Carbon Trust: Food and drink processing

Carbon Trust: How to implement process thermal insulation

Department of Resources, Energy and Tourism: Energy Efficiency Exchange

Department of Industry, Tourism and Resources: Pasteurisation Options for Breweries

Department of Industry, Science and Resources: Good Energy Practice Guide: Improve energy efficiency and increase profits in shop bakeries

GEA: Evaporation Technology using Mechanical Vapour Recompression

Knirsch et al. (2010) 'Ohmic heating: a review', Trends in Food Science & Technology, vol. 21, no. 9, pp. 436-441

Lawrence Berkeley National Laboratory: Energy Efficiency Improvement and Cost Saving Opportunities for Breweries

Lawrence Berkeley National Laboratory: Energy Efficiency Improvement and Cost Saving Opportunities for the Dairy Processing Industry

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Leonardo Energy: Application Guide for Food and Beverage Industry

Smith, M., Hargroves, K., Desha, C., Stasinopoulos, P., and Pears, A. (2009) Factor 5: Food and Hospitality Online Sector Study, The Natural Edge Project, Australia

Steam Blanching vs Water Blanching - cost, efficiency, and product quality

Sustainability Victoria: Energy Efficiency Best Practice Guide– Steam, Hot Water and Process Heating Systems

Sustainability Victoria: Energy Efficiency Best Practice Guide – Pumping Systems

US Department of Energy: Improving Pumping System Performance - A Sourcebook for Industry

Working Group for Cleaner Production: Eco-Efficiency Resources for the Queensland Food Processing Industry