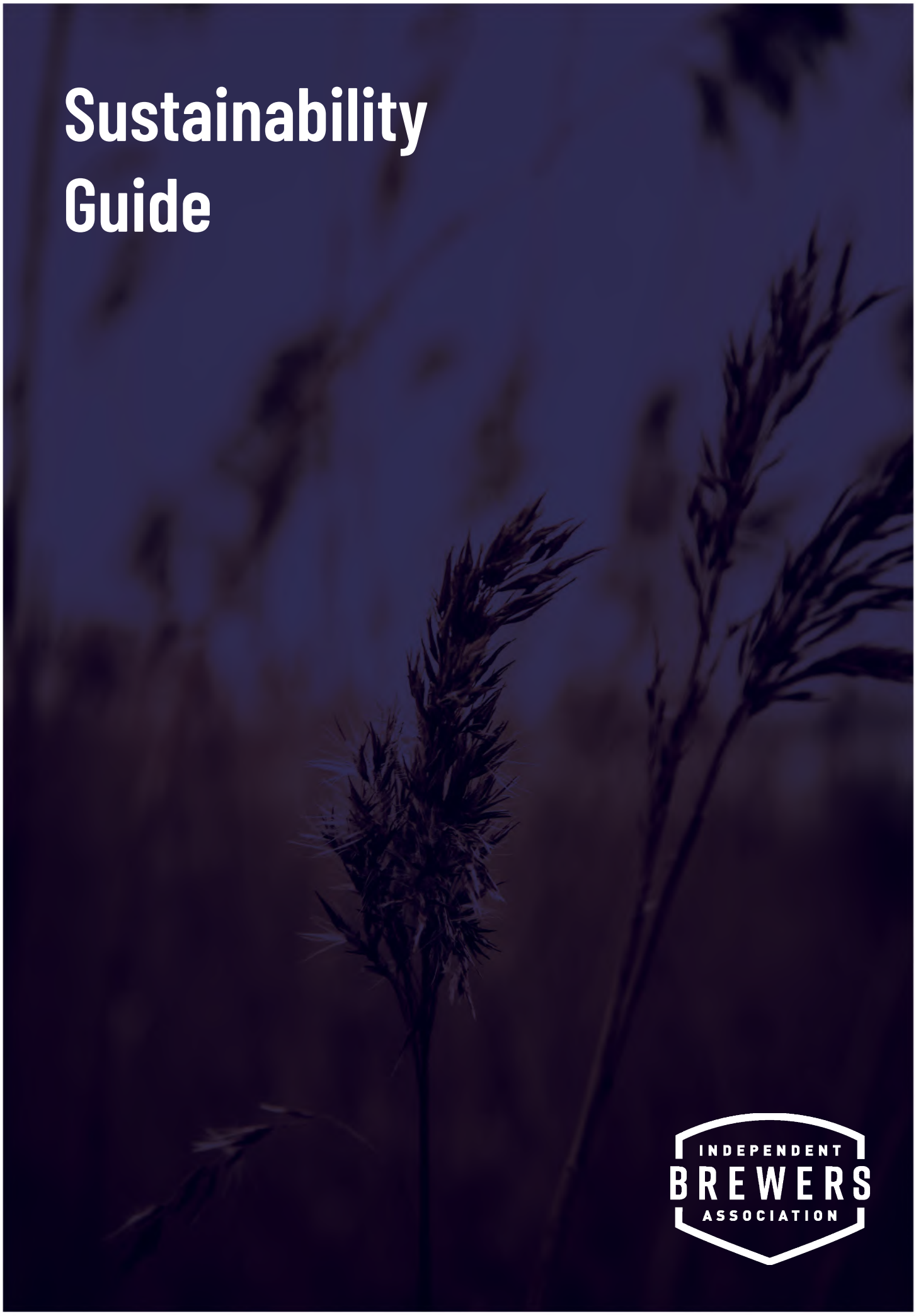
Sustainability Guide



Green Industries SA

Green Industries SA is proud to have partnered with the Independent Brewers Association to deliver this Sustainability Guide and accompanying Resource Use Benchmarking Tool for Independent Brewers across Australia.

As an enabler and driver of change, Green Industries SA supports South Australian businesses and industry sectors to accelerate sustainability and transition to a more circular economy. The Business Sustainability Program helps businesses do more with less, and to do it faster and smarter. We support businesses to extract the maximum value from materials while reducing resource use, helping them to become cleaner and leaner, which cuts costs, improves profits and benefits the environment. We assist businesses to implement best practice waste management systems, and develop and deploy measurement and monitoring systems for smarter energy management and reduced water-use.

Green Industries SA's Business Sustainability Program has a long track record in helping businesses of all sizes shrink their carbon and material footprint while increasing output. Our team provides expert insights, free advice, toolkits, guides and customised recommendations for South Australian businesses to adopt circular economy principles.

For more information about SA's Business Sustainability Program visit
http://www.greenindustries.sa.gov.au/bsp-overview

Government of South Australia
Green Industries SA

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Introduction

"Deciphering patterns in your energy use data can really help in making tangible business decisions about how our breweries and venues operate. By capturing ongoing energy use data in an industry-owned platform we are not only able to build a snapshot of how we are tracking individually, but we can then also benchmark ourselves against others in the industry, hence allowing us to plan for future investment and improvements."

Marthijs Heuperman, IBA Sustainability Project Lead and Sustainability & Logistics Manager at Bright Brewery

The IBA, Green Industries South Australia (GISA) and 2XE have collaborated to develop a bespoke industry tool and best practice guide that will enable you, members of the Association to measure your energy use, boost sustainability credentials and reduce operating costs by adopting energy, water and waste efficiency improvements across their operations.

Sustainability is incredibly important to the IBA and the funding provided by GISA has enabled us to develop an asset that assesses and provides evidence that aims to encourage and empower breweries to make data-driven, evidence-based decisions on process improvements, while at the same time maximising profitability. No matter the size of your brewery this tool and resource guide will assist in meeting your sustainability goals.

Why benchmark?

Benchmarking enables breweries to compare their production costs and resource use against peer breweries. This can enable breweries to understand what they are doing well as well as identify opportunities for improvement.
This can lead to product improvements for the brewery, which will ultimately affect sustainability and their bottom line.

Monthly data collection

A critical first step for breweries to become more sustainable is to collect data on their energy/water consumption and waste production. Many breweries have little idea about their sustainability performance nor resource costs or use other than tracking from an accounting perspective.

The Sustainability Benchmark Tool helps breweries to identify the information they need to collect this data and track this data over a longer period of time.

Resource comparison

The Sustainability Benchmark Tool current collects information about:

- Electricity
- LPG
- Natura Gas
- Water
- And bulk carbon dioxide deliveries

Performance metrics

The Sustainability Benchmark Tool converts resource use data into performance metrics. These performance metrics allow breweries of a similar size to make meaningful comparisons of their performance (e.g. comparing electricity per hectolitre of beer produced instead of just comparing to comparing electricity used). As part of this comparison, breweries are divided into categories (small, medium, large and extra large) depending on their production volume. Likewise, as more breweries take part in the program, more divisions will be implemented (e.g. breweries with a pub attached, breweries with solar, etc). to further improve future benchmark comparisons.

Industry Benchmark

The monthly data collected from breweries is used to develop and improve a preliminary set of industry sustainability benchmarks. These aggregated metrics are anonymous. This means participating breweries can compare their performance against the industry as a whole, but will be unable to determine anyone else's results. Privacy is important.

How to improve your brewery

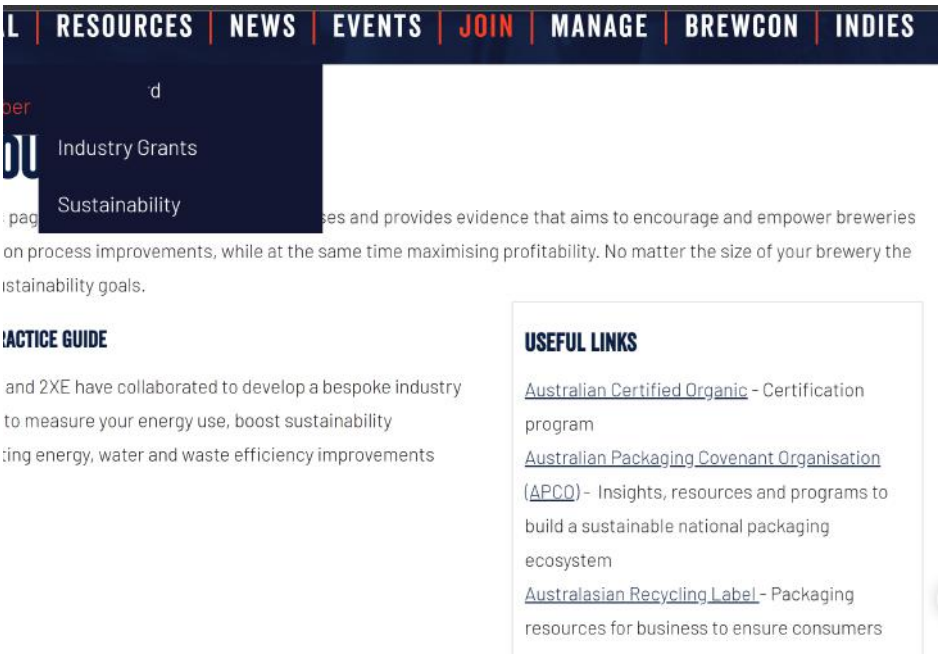
The results from the benchmark enable breweries to figure out where to focus efforts for sustainability. If a brewery is using more electricity or more water than peer breweries, the brewery can target sections of the IBA Sustainability guide for recommendation to improve their brewery.

How to use the Sustainability Benchmarking Tool

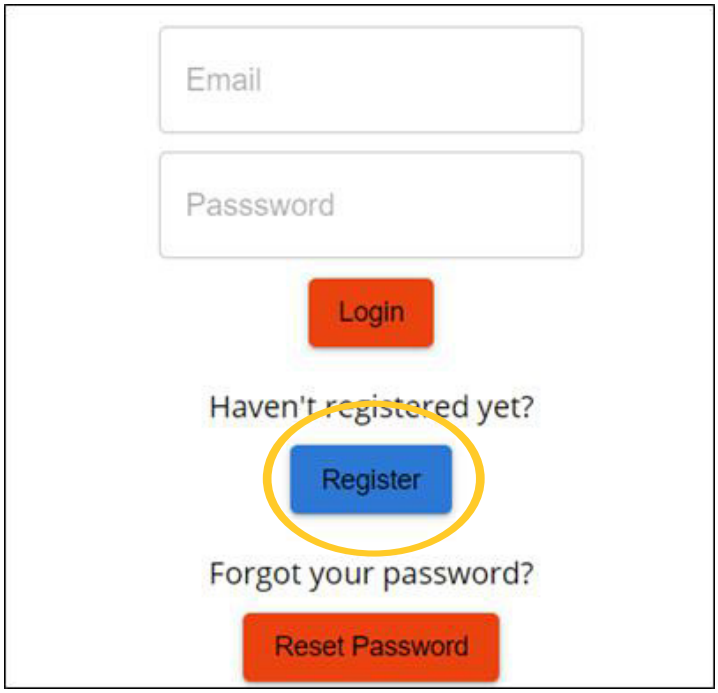
Step 1 - Collect 12 months' worth of bill and data for:

- Monthly Production Volume
  Litres of beer - 12 months
- Monthly Electricity bills
  Total kWh and $ - 12 months
- Monthly Gas / LPG Bills Total GJ, Litres, etc and $ - 12 months
- Monthly Water bills Litres + $ - 12 months

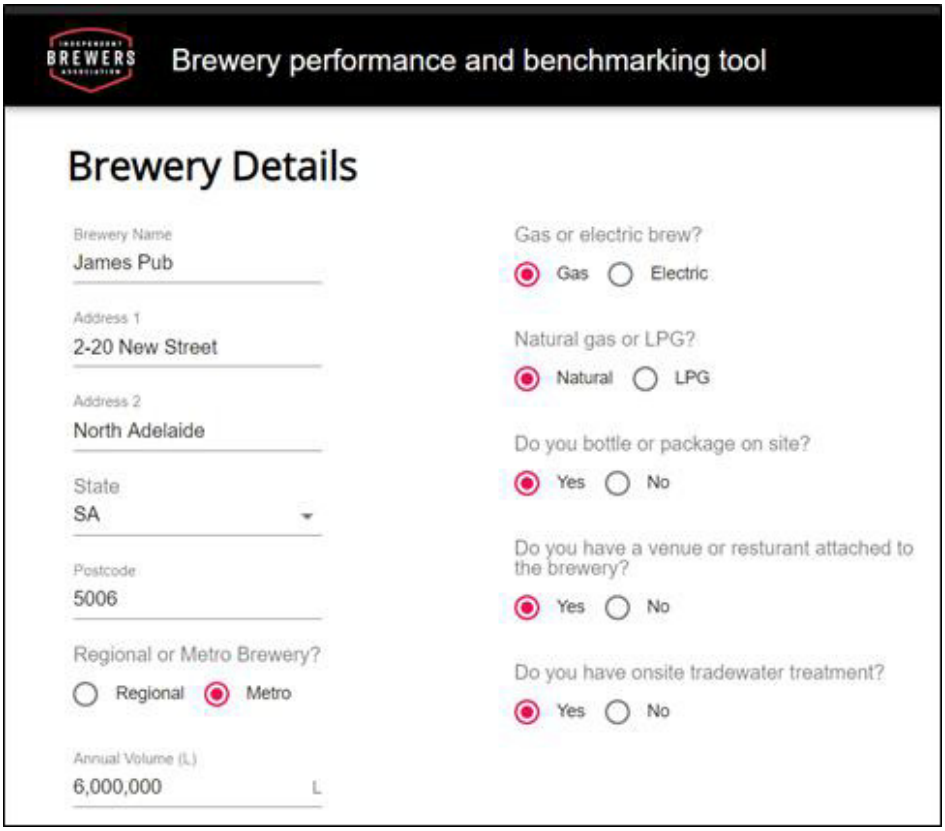
Step 2 - Login into the IBA website and go to Sustainability under Resources



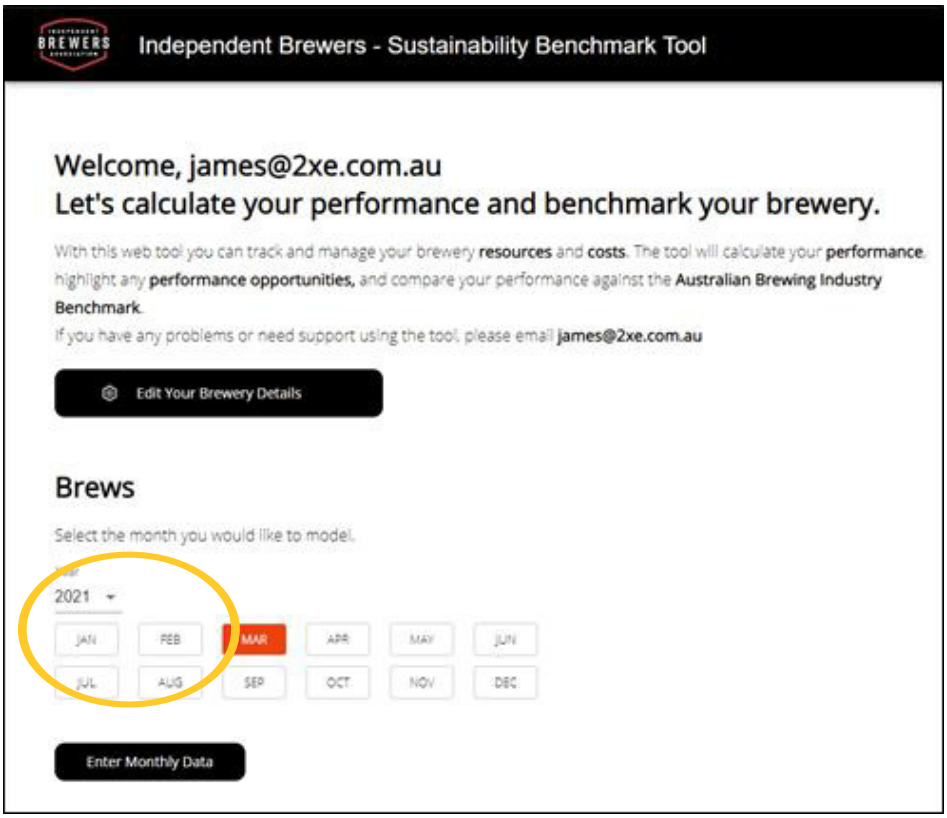
Step 3 - Click on Register



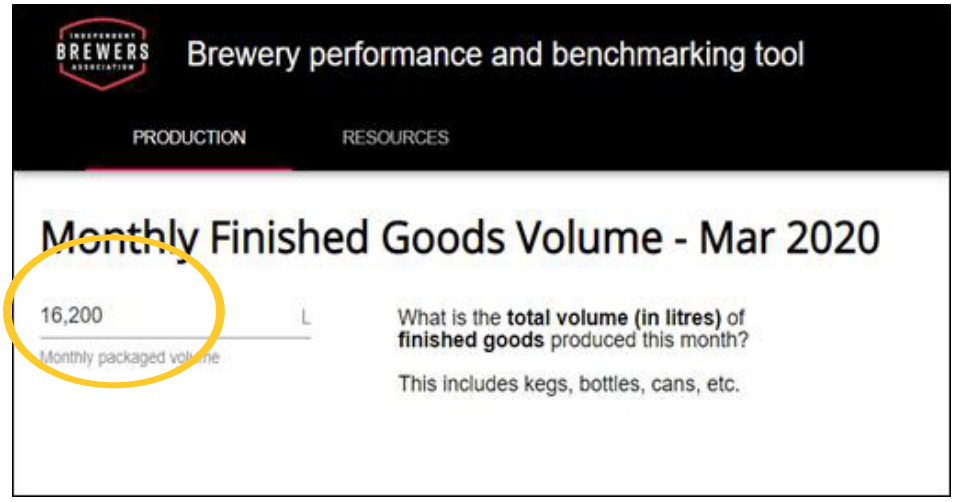
Step 4 - Enter in your brewery details and save



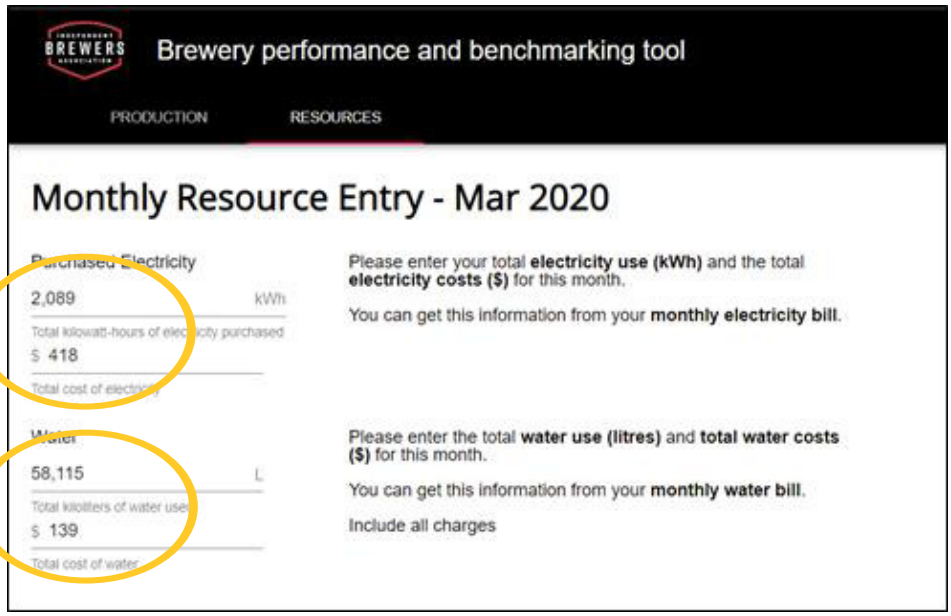
Step 5 - Look at your home screen, select the year and month, and enter data in for that month



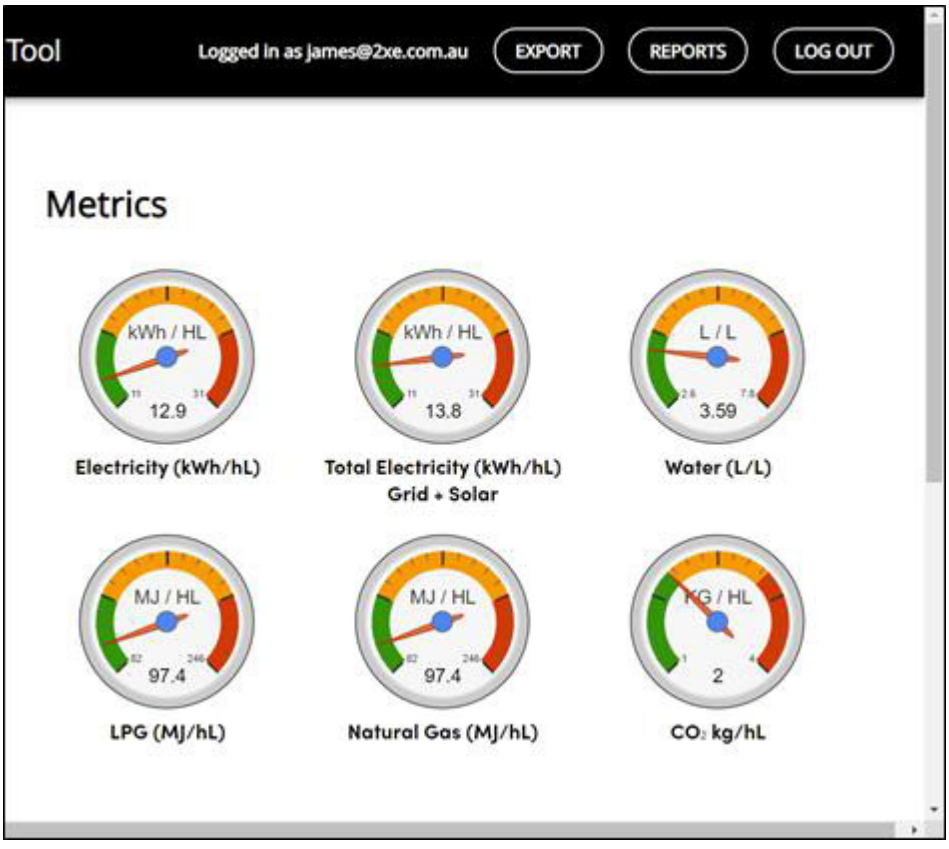
Step 6 - Enter in the monthly finished goods volume (into each month)



Step 7 - Click on the resources tab and enter in your electricity, gas, water, and any other info you have.



Step 8 - You will now have an indication of your resource performance compared with the industry average



Green = Better than average / Best in class
Orange = About average
Red = Metrics are poor compared with industry average

Step 1: Make your operations as productive as possible

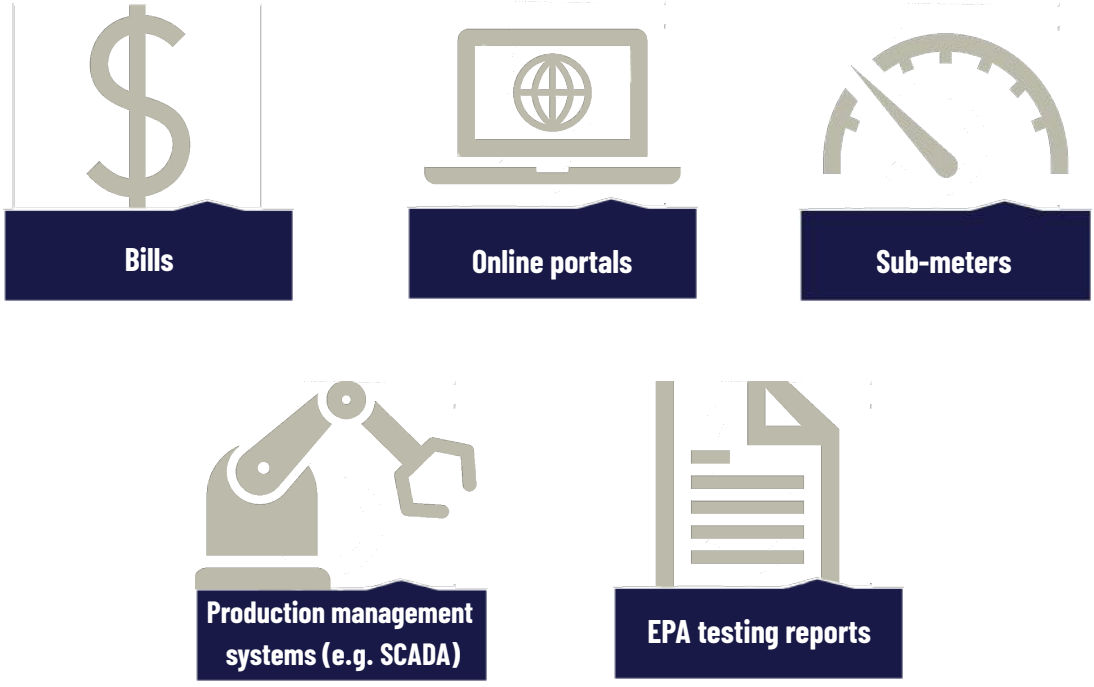
Sustainability Data

Getting to know your data is critical for making tangible improvements to your brewery and achieve cost savings.

Why knowing your data is important

- *You can't manage what you can't measure.*
  - Without **data** you wouldn't know:
    - how you're **performing**;
    - what **areas** you need to focus on to improve the health of your business,
    - what **changes** to make with limited time, resources and capital.
- If you want to boost your operation's sustainability performance and drive cost savings without the need for significant capital spend, you **MUST** get to know your data.
- Data drives informed **decision making**

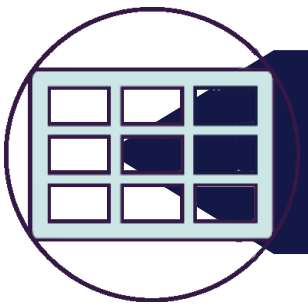
What data do you already have?



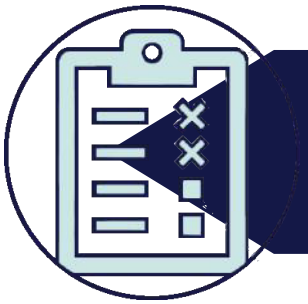
Data to Information

1. Figure out what you want your data to tell you.
Example 1 - Should I install a solar system in my brewery?
Example 2 - Do I use more or less water compared with other breweries?

2. Identify and collect data relevant data.
Example 1 - How much electricity do I use during daylight hours, and will I benefit from solar? What size?
Example 2 - What's my water use per month? What's my beer production per month?



3. Extract and convert data into useful information.
Example 1 - I use 200kWh of electricity during daylight hours. A 50kWp Solar system will generate 200kWh per day and costs $75,000
Example 2 - I use 8 litres of water for every litre of beer I produce.



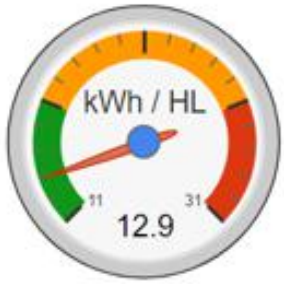
4. Use data for decision making
Example 1 – A 50kWp solar system will reduce most of my daylight electricity use and has a payback of 6 years
Example 2 – I use more water than other breweries. I should look at my cleaning practices

IBA Sustainability Benchmarking Tool

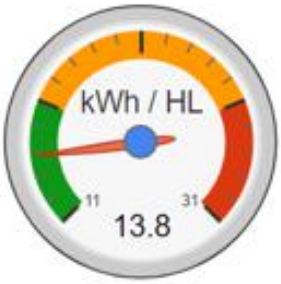
- You can use the **IBA Sustainability Benchmarking Tool** (log into IBA website) to input your **energy, water, trade waste** and **solid waste data**.
- This tool **converts** your data into **useful information** for analysis, and to **benchmark** your performance against your peers.
- This information can be used for **decision making** and to help identify business improvement projects
- Converts **resources** (gases and other fuels) into common units of energy (GJ)
- Compares your **resource use** to **production volume** to create your **performance metrics**
- **Compares** your metrics with other breweries of your size
- Helps you **identify** where you need to improve
- Tracks and compares your **performance** over time
- Helps validate the **impact** of any projects

Metrics

These dials how your **benchmark performance** compared with breweries of your **size**. How do you compare? Where could you improve your performance?



Electricity (kWh/hL)



Total Electricity (kWh/hL) Grid + Solar

Water (L/L)

LPG (MJ/hL)

Natural Gas (MJ/hL)

CO_2 kg/hL

Green = Better than average / Best in class **Orange** = About average **Red** = Metrics are poor compared with industry average

Deep Dive - Data Sources (Electricity)

Data Source	Types of data contained	Where available	Types of insights you can get
Bills	On a monthly or quarterly basis: • Electricity cost – retail & network charges ($) • Electricity consumption (kWh) • Maximum power demand (kVA)	Energy Retailer	• Monthly or quarterly electricity use • Compare seasonal variations (summer / winter), year-on-year electricity consumption trends and performance vs peers. • Can provide you with an electricity intensity metric (e.g. kWh / hectolitre of product)
Interval meter data	Historical data from your main meter. 30-minute intervals. Includes: • Electricity consumption (kWh) • Maximum power demand (kVA) • Reactive power (kVAr) • Power factor	Energy Retailer Network provider	• More granular picture of your energy load profile on an hourly/daily/weekly basis. • Identify when you use electricity during the day • Useful for identifying spikes, sizing solar/battery systems • Useful for matching energy demand and solar production
Smart Meters	Real-time energy consumption at various points in the process. 1 second intervals.	Numerous metering technology suppliers can provide, or your local electrician	• Highly detailed data on whatever you want to measure. • Useful for measuring the efficiency of specific equipment or processes (refrigeration, packaging lines, solar systems). • Can be used to identify maintenance issues or equipment upgrades

Deep Dive - Data Sources (Gas)

Data Source	Types of data contained	Where available	Types of insights you can get
Bills	On a monthly or quarterly basis: • Gas consumption (GJ) • Gas cost ($)	Gas Retailer	• Monthly or quarterly gas profile • Compare seasonal variations, year-on-year gas consumption trends and performance vs peers. • Can provide you with an gas intensity metric (e.g. GJ / hectolitre)
Smart Meters	Depends on the type of meter used, but can measure: • Gas flow (m3/second) • Gas temperature • Gas pressure • Gas composition	Numerous metering technology suppliers	• Very useful for measuring the efficiency of specific equipment (e.g. boilers), or the real-time gas consumption of the whole site to check against billing data

Deep Dive - Data Sources (Water)

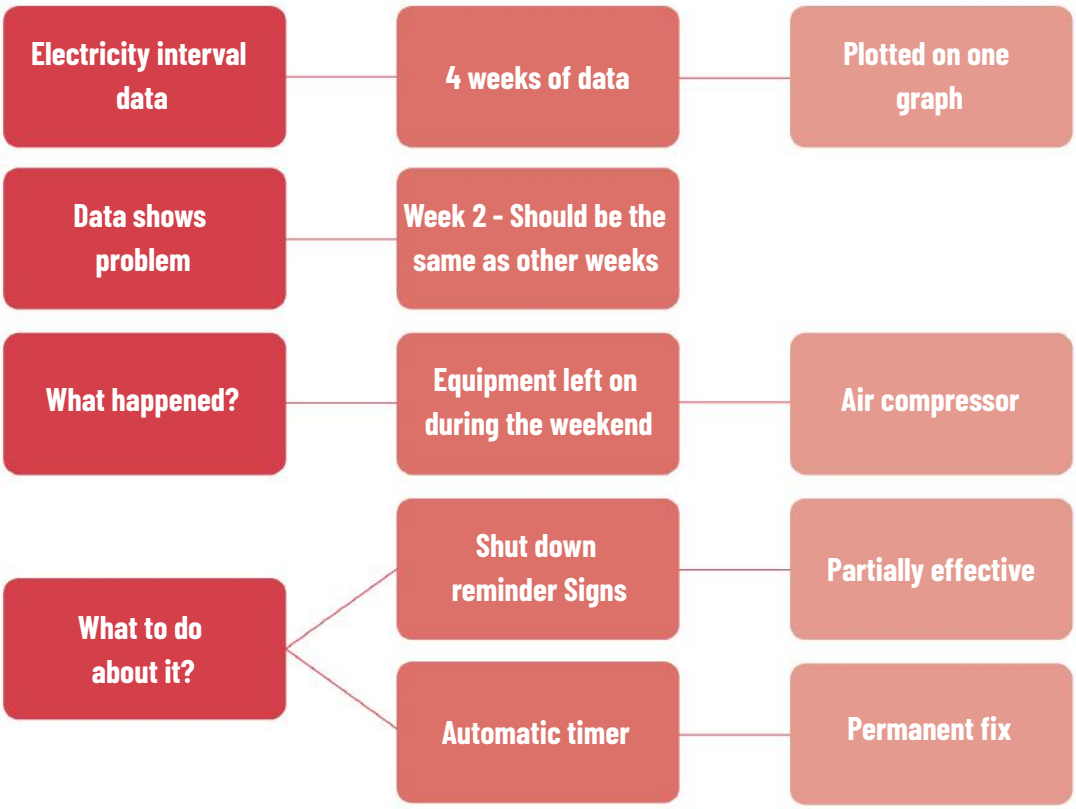
Data Source	Types of data contained	Where available	Types of insights you can get
Bills	On a monthly or quarterly basis: • Water consumption (MJ) • Water cost ($)	Water utility	• Monthly or quarterly water consumption profile • Compare seasonal variations, year-on-year water consumption trends and performance vs peers. • Can provide you with a water intensity metric (e.g. Hectolitre of water/hectolitre of product)
Smart Meters	Depends on the type of meter used, but typically can measure real-time water flow (m3/second)	Numerous metering technology suppliers	• Very useful for measuring the efficiency of specific equipment, or identification of water leaks in the facility • Useful for reviewing cleaning practices and maximising water efficiency

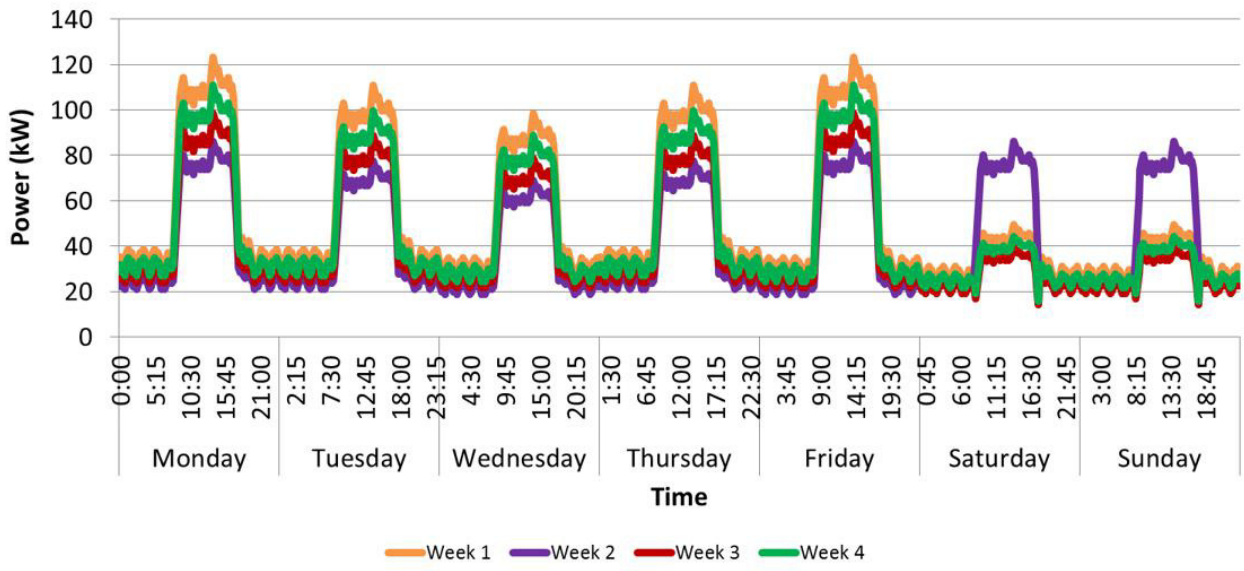
Deep Dive - Data Sources (Trade Waste)

Data Source	Types of data contained	Where available	Types of insights you can get
Bills/Lab reports	On a quarterly basis: Total wastewater discharge (kL) And the average: • Average pH • Biochemical Oxygen Demand BOD (mg/L) • Total Dissolved Solids TDS (mg/L) • Total Suspended Solids TSS (mg/L) • Total Phosphorous TP (mg/L) • Total Kjeldahl Nitrogen TKN (mg/L)	Water utility, service providers, in-house labs	• Quarterly trade waste profile • Useful to compare seasonal variations, year-on-year water consumption trends and performance vs peers. • When combined with quarterly production data, it • can provide you with a trade waste intensity metric (e.g. $ Trade waste / hectolitre of product) • Extremely useful for adhering to Trade Waste discharge limits (and avoiding penalties) • Useful for identifying trade waste sources in the process for segregation and recaptured.

Data for Decision Making

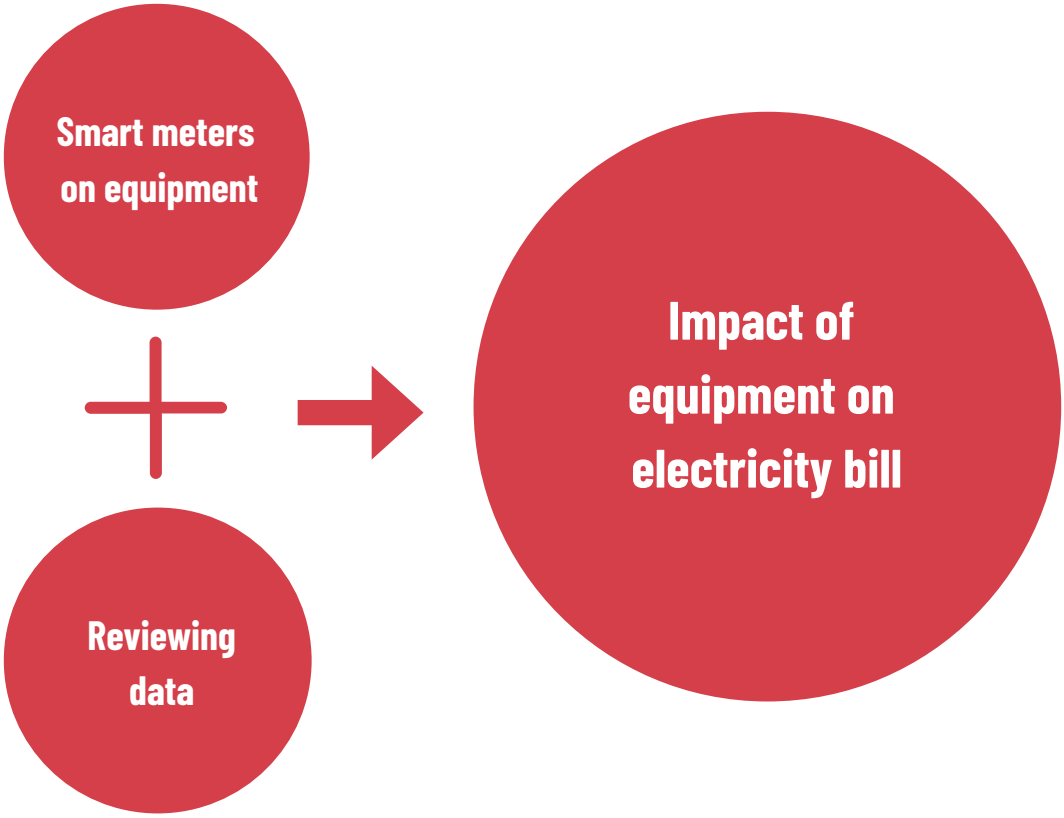
Example 1

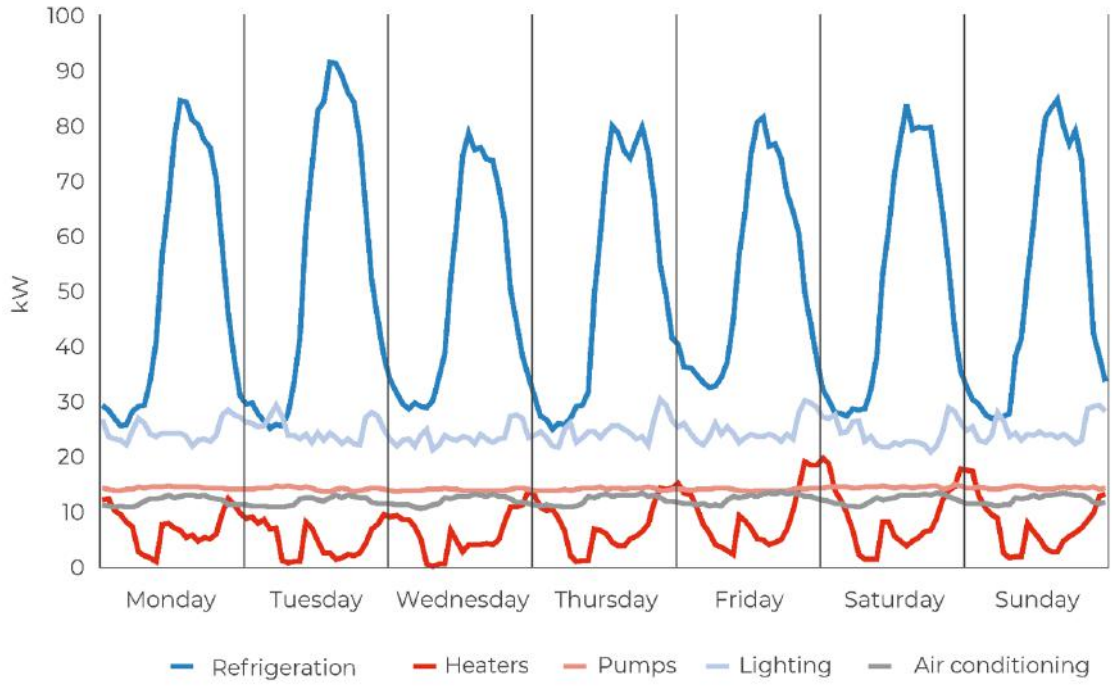




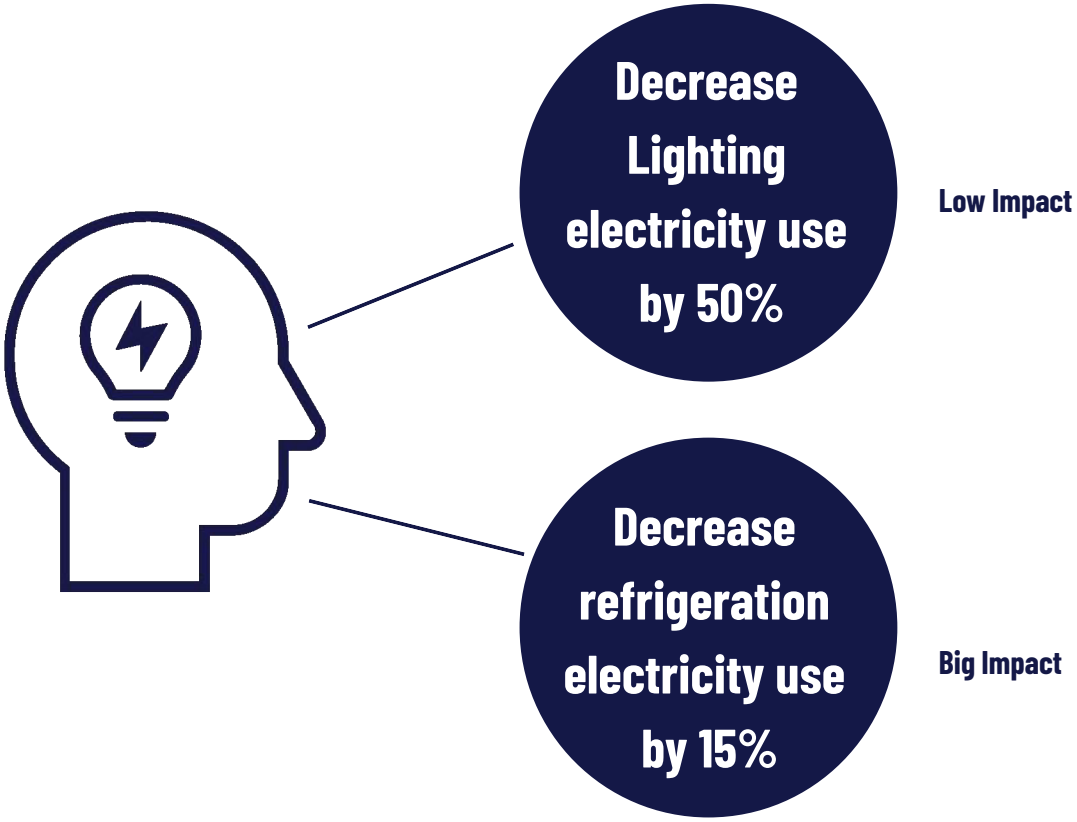
Data for Decision Making

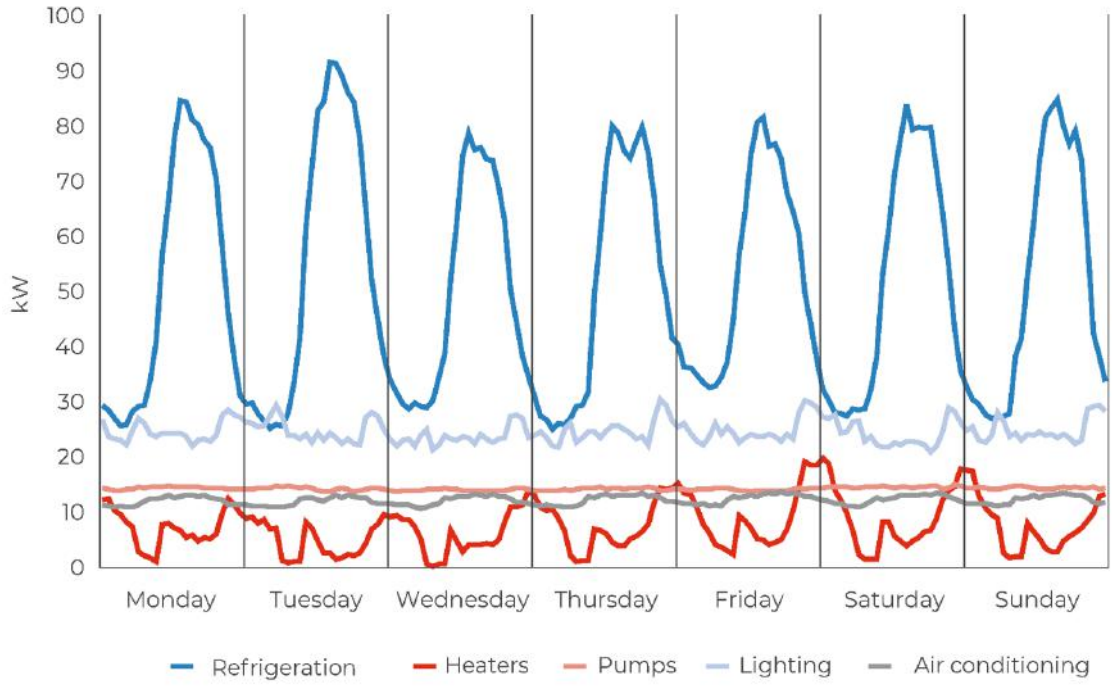
Example 2





Example 2


Decrease Lighting electricity use by 50%
Low Impact
Decrease refrigeration electricity use by 15%
Big Impact


100
90
80
70
60
50
40
30
20
10
0
kW
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Refrigeration
Heaters
Pumps
Lighting
Air conditioning

Electricity Efficiency

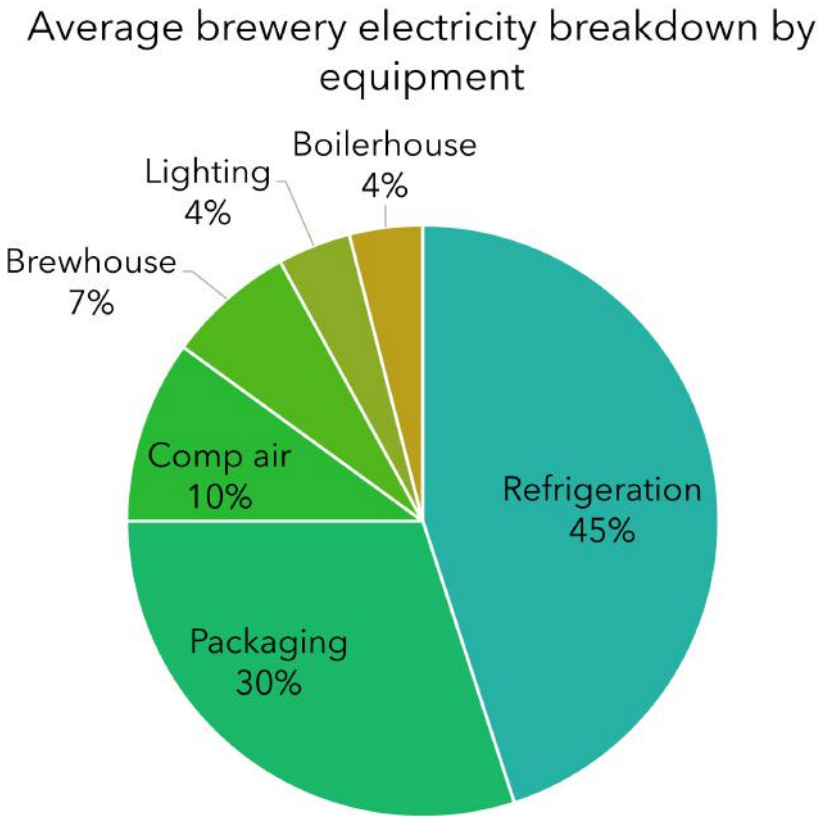
Energy prices are at record levels. Breweries have lots of potential to improve energy efficiency, reduce business costs and greenhouse gas emissions. There are some simple steps to capitalise on these opportunities depending on the kind of equipment you're using.

Why is managing electricity now an important priority for breweries?

- Electricity accounts for an average of **70%** of **total energy costs** in a brewery
- The **rising price** of electricity in recent years and the volatility in the market will make electricity costs increasingly significant for breweries

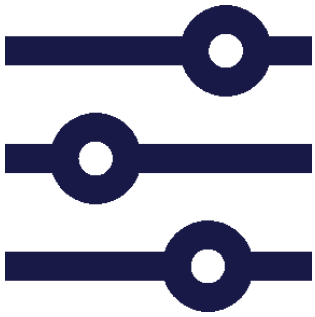
What is driving electricity use in my brewery?

- Target efforts at high use areas



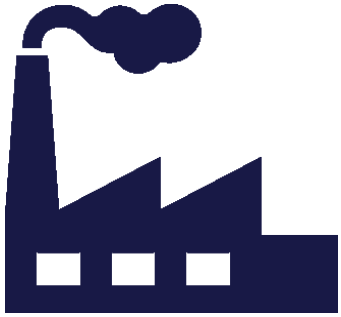
How can I lower my electricity consumption?

Split into 2 basic techniques



Optimising equipment

Modest cost savings
Usually little or no cost
Need some understanding of equipment



Upgrading equipment

Large costs savings
More expensive to implement
Allows for large changes to processes
(ideally at growth phase)

Optimising vs Upgrading

Refrigeration	
Optimisation Options	**Upgrading Options**

• Clean condenser coils
• Optimise temperature set-points (use max glycol temp)
• Adjust the production schedule to balance the cooling load on the plant
• Repair damaged insulation on refrigerant lines (use a thermal camera to identify 'cold spots' around equipment.
• Install insulation on refrigerator equipment, especially the suction line
• Maintain good air flow around evaporators and condensers
	• Install **'smart' controls** to automatically:
	  • Balance refrigeration loads
	  • Maximise off-peak electricity rates and minimise network demand
	  • Automatically change the glycol setpoint temperature
	  • Maximise the use of solar electricity
	• Install **insulation** on brite tanks
	• Use **'pulse cooling'** to maximise cooling efficiency
	• Chill return glycol (**warm glycol**), rather than blend warm and cold glycol
	• Install **variable speed drives** on refrigerator compressors & fans
	• **Optimise pipework** and 'smart' return systems
	• Install **heat recovery** systems to reuse heat from the
	• refrigerator for hot boiler

Brewhouse	
Optimisation Options	**Upgrading Options**
• Schedule production to match maximum solar generation (for electric kettles / mashing) • Program hot liquor tank to pre-heat using off-peak electricity (or solar)	• Maximise insulation on hot liquor tanks, kettles and tuns • Insulate lines (use a thermal camera to identify 'hot spots') • Recover heat from the refrigeration system to use in the hot l liquor tank • Vent hot air from hot tanks (using hoods and extractor fans, and replace make up air with outside air) instead of cooling the hot area with HVAC systems

Optimising vs Upgrading

Compressed Air	
Optimisation Options	**Upgrading Options**
• Ensure that the inlet air is being drawn from a cool space (such as a shaded, outdoor area) • Ensure that all air compressor equipment is serviced well • Repair air compressor leaks in lines • Relocate air compressor to a cool (out of direct sunlight), well-ventilated location	• Install controls to operate compressors only when required • Install a variable speed drive • Install automated compressor staging and capacity control • Replace internal cooling with external oil coolers on screw compressors

Packaging	
Optimisation Options	**Upgrading Options**
• Frequent cleaning and maintenance of packaging lines • Turn off packaging lines when not in use (either manually through staff practices or via installation of automated system)	• Install variable speed drives on motors • Install an automated control system to ramp-up-and-down line speeds to reduce energy consumption when not in use

Lighting	
Optimisation Options	**Upgrading Options**
• Use a light meter to check that lighting (Lux) levels are appropriate for the workspace –remove excess lighting by removing light fittings (de-lamping) • Maintain clean light fittings	• Install day-lighting devices (e.g. solar tubes, light-shelves) • Install efficient light fittings (e.g. LED lighting) • Install occupancy sensors so lights automatically turn on or off depending if staff are detected

Gas Efficiency

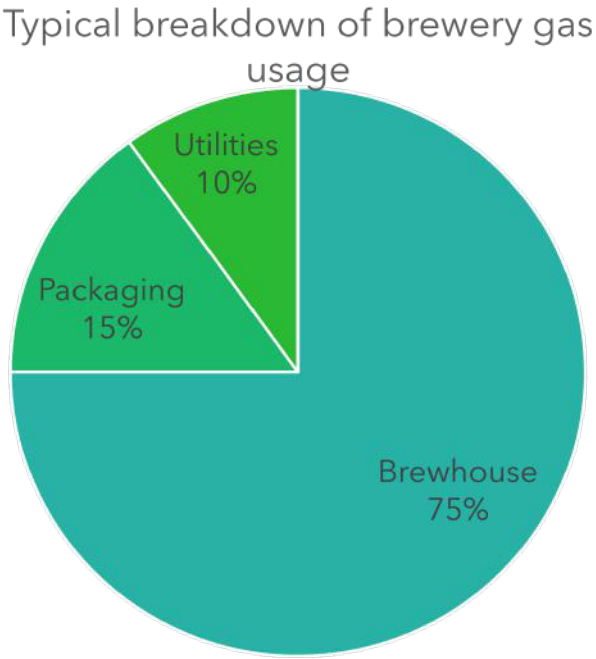
Energy prices are at record levels, but the good news is that breweries have lots of potential to improve energy efficiency, reduce business costs and greenhouse gas emissions, and there are some simple steps you can take to capitalise on these opportunities depending on the kind of equipment you're using.

Why is gas consumption something to watch?

- Gas has historically been a cheap source of fuel for Australian businesses
- Gas prices have increased to record levels in recent years.
- Gas prices are expected to stay at high and/or volatile prices in the near future.
- Carbon mitigation strategies will push renewable fuel alternatives
- Exploring opportunities to reduce gas consumption can lead to both cost savings now and future-proofing against the future price of gas.

What is driving gas consumption in my brewery?

- Most gas is used in the brewhouse
- Utilities can vary from 10-25% depending on food preparation services



How can I lower my gas consumption?

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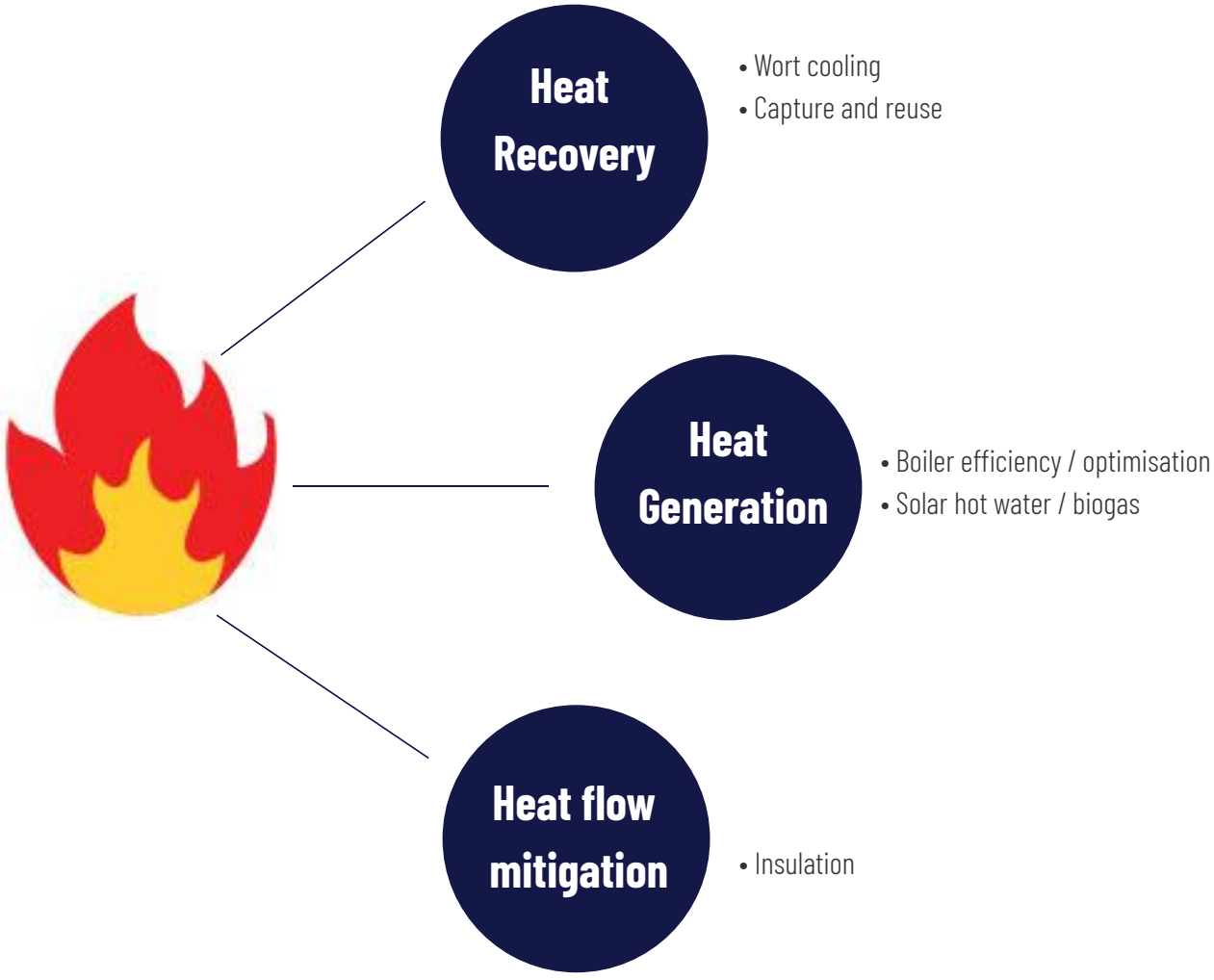
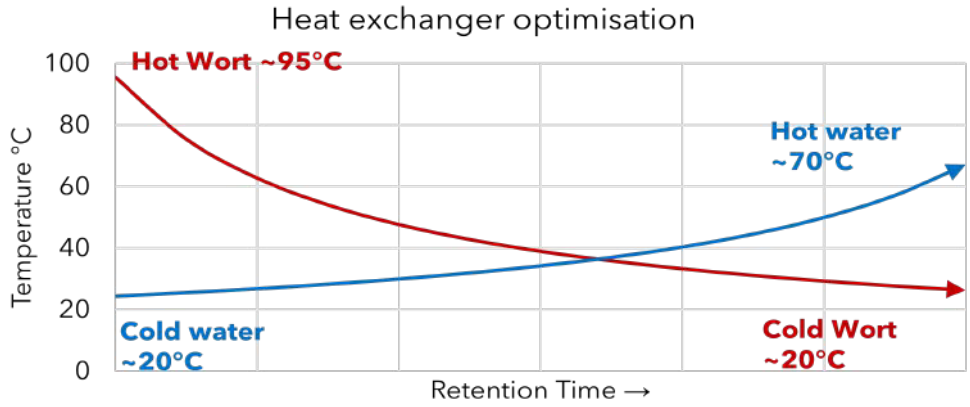


Heat recovery - wort to mash

- An **optimum area** for heat recovery is from the hot wort to the next mash
- Use a **counter current** heat exchange system to maximise heat recovery
- Check inlet and outlet temperatures with **inline thermometers**
- **Adjust flow rates** to ensure both the hot wort and cold water achieve their **end target temperatures**



Heat recovery - capture and reuse

Sources of waste heat

- Boiler Kettle flue stacks
- Chiller systems
- Compressed air systems

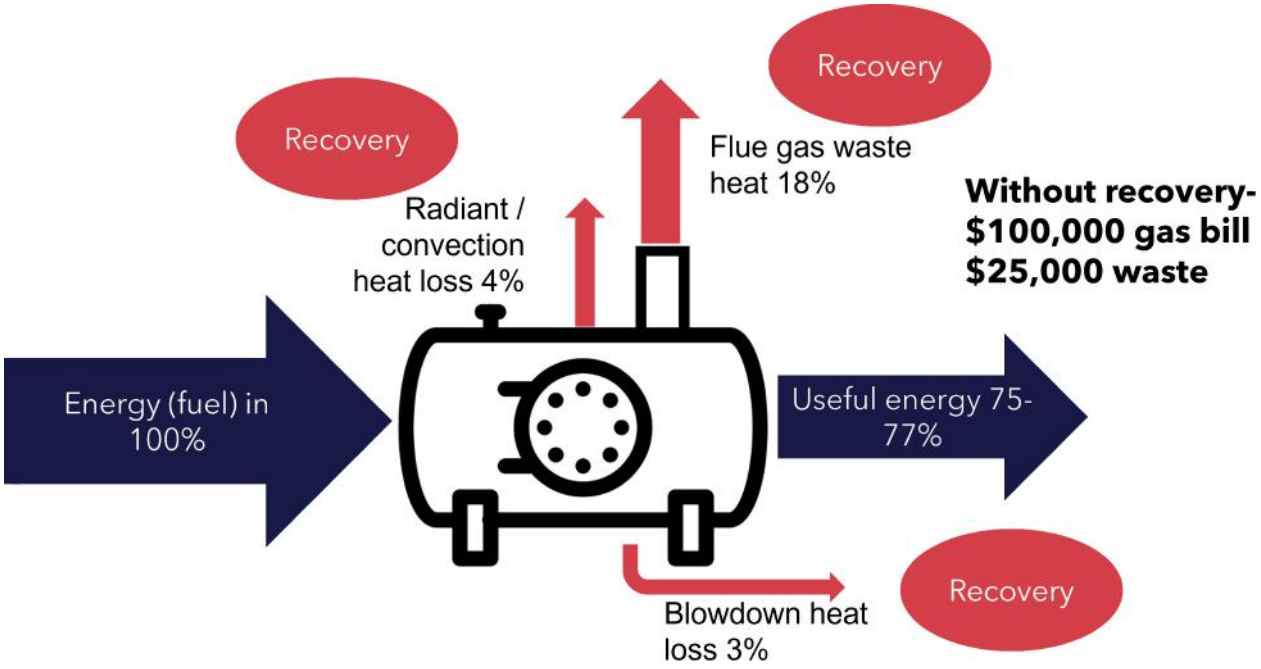
Uses for waste heat

- Brewing
- CIP / Cleaning
- Boiler feed water
- Heating in winter

NOTE: **Waste heat** is different to **heat loss**. Heat loss occurs in areas of poor insulation. Waste heat is a by-product from a production process.

Waste heat can be **recovered** and **used Heat loss** needs to be **mitigated** by **insulation**

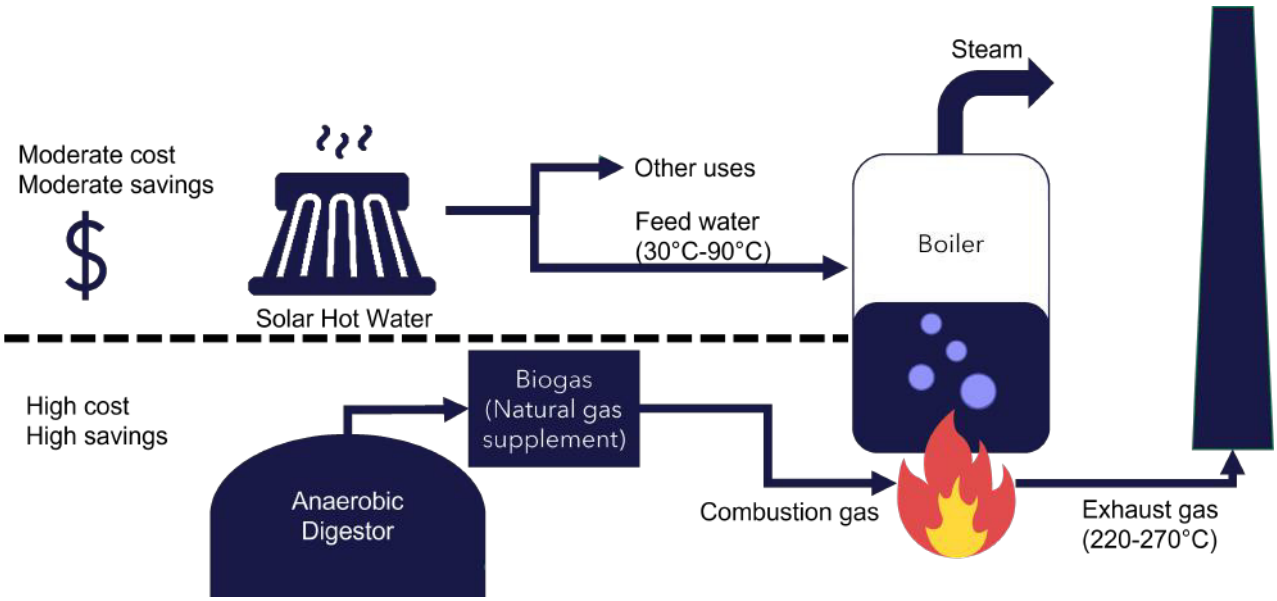
Heat recovery from heat generation sources



Boiler efficiency - optimising vs upgrading

Boiler Efficiency	
Optimisation Options	**Upgrading Options**
• Use a minimum temperature set-point • Optimise inlet air to reduce unnecessary heat loss up the boiler stack • If you have multiple boilers, try running them in parallel to reduce overall load on each boiler (e.g. one boiler can meet baseload while the other one can meet variable load) • Repair steam/hot water leaks in pipe network	• Install an economiser, recuperator and/or a flue gas condenser to recover waste heat and reuse to pre-heat feed water • Recover blowdown steam • Install a condensate return system to recover condensate and flash steam for reuse • Install thermostatic steam traps • Install insulation on pipe network and boiler

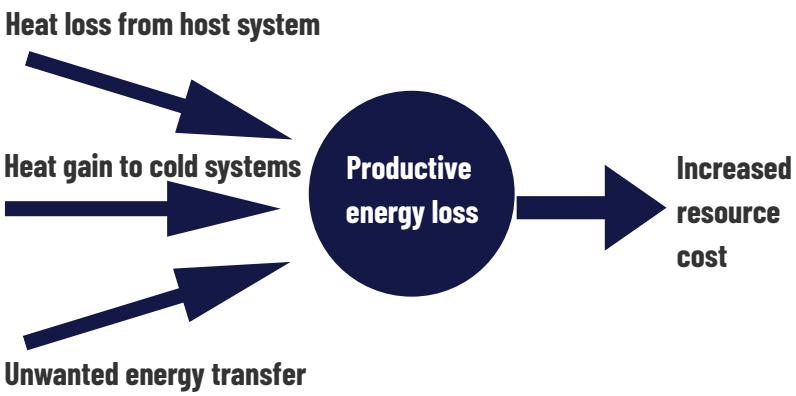
Heat generation - renewables



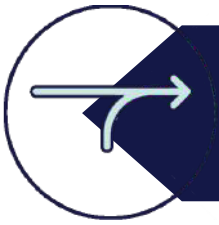
Prioritise Heat Recovery improvements before considering renewable heat generation projects

Heat Generation	
Solar Hot Water	**Biogas**
• Relatively low cost and low savings • Dependent on solar radiance • Need to identify a use and insert into the process • High temperatures not always possible	• High cost but high savings • Potential to offset most / all fossil fuel gasses • Uses waste water as a feedstock • Requires an anaerobic digestor and ongoing management • Biogas generated may require some cleaning before use • Biogas can be used in boilers to generate steam or Combined Heat and Power (CHP) systems to generate both steam and electricity.

Heat Flow Mitigation

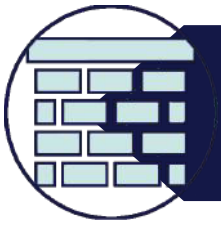


Unwanted heat transfer is increasing your resource use and costing your brewery money



Common areas of unwanted heat transfer include uninsulated glycol, steam lines and tanks

A thermal camera can be used to help identify areas of unwanted heat transfer



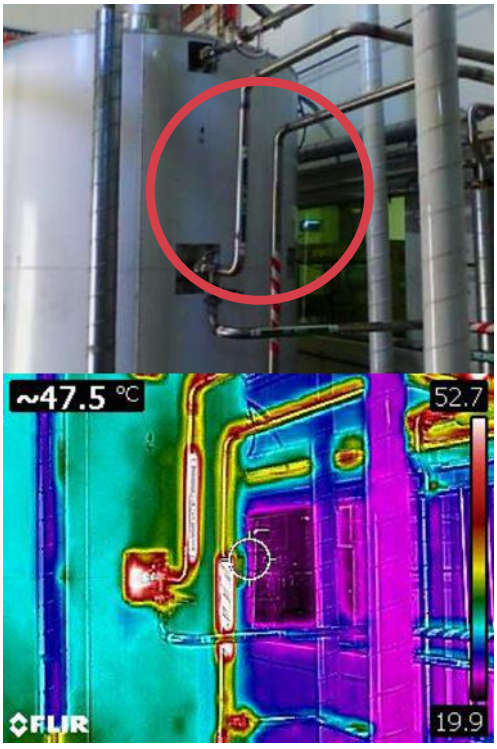
Targeted insulation will reduce unwanted heat transfer and save your brewery money

Areas of unwanted heat flow

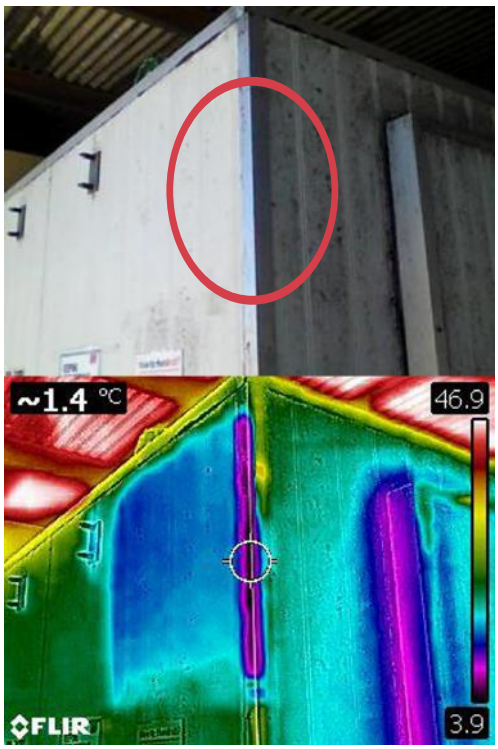
Insulation Targets	
Optimisation options (low cost)	**Upgrading options (high cost)**

• Repairing damaged insulation
  • Glycol lines (look for water condensation)
  • Steam / Hot water lines (infrared camera)
• Install missing insulation (typically elbow areas or valve areas)
• Use a thermal camera to identify hot or cold spots
	• Install adequate insulation on
	  • Boiler system
	  • Boiler jacket
	  • Condensate lines / tanks
	  • Lines, elbow joints, valves
	  • Glycol system
	  • Lines, elbow joints, valves
	  • Glycol pump heads
	  • Tanks
	  • Glycol tanks
	  • Brite tanks
	  • Kettles / tuns
	  • Heat exchange systems

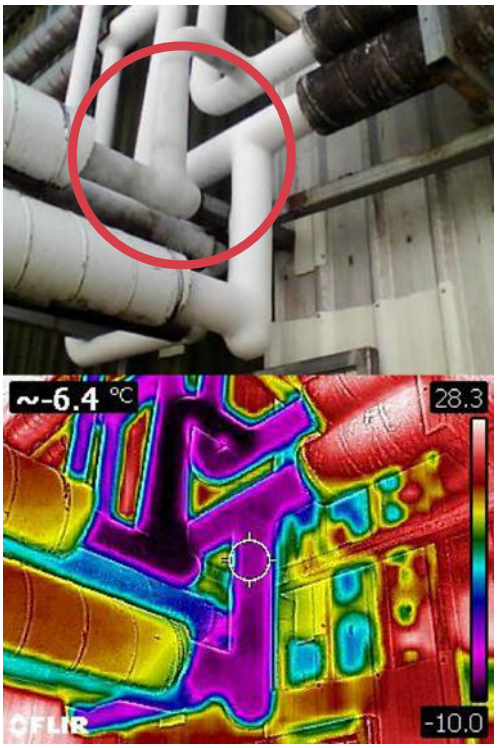
Heat Flow Mitigation



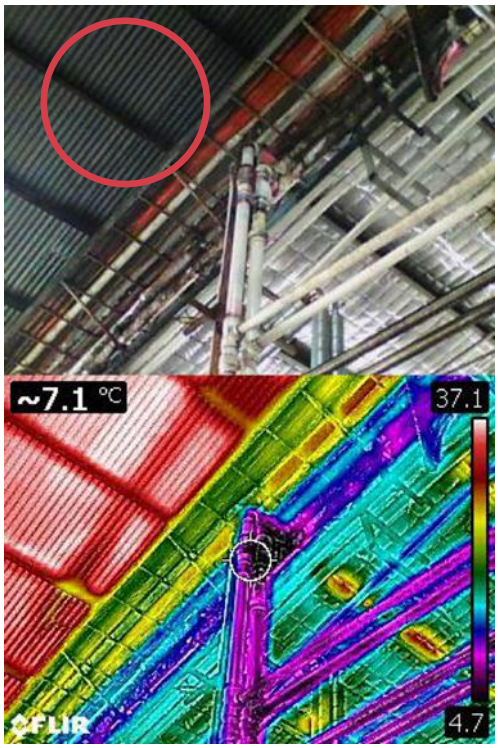
Missing insulation on hot water systems



Hidden damage inside cool room



Missing insulation on glycol systems



Missing insulation on roof

Water and wastewater management

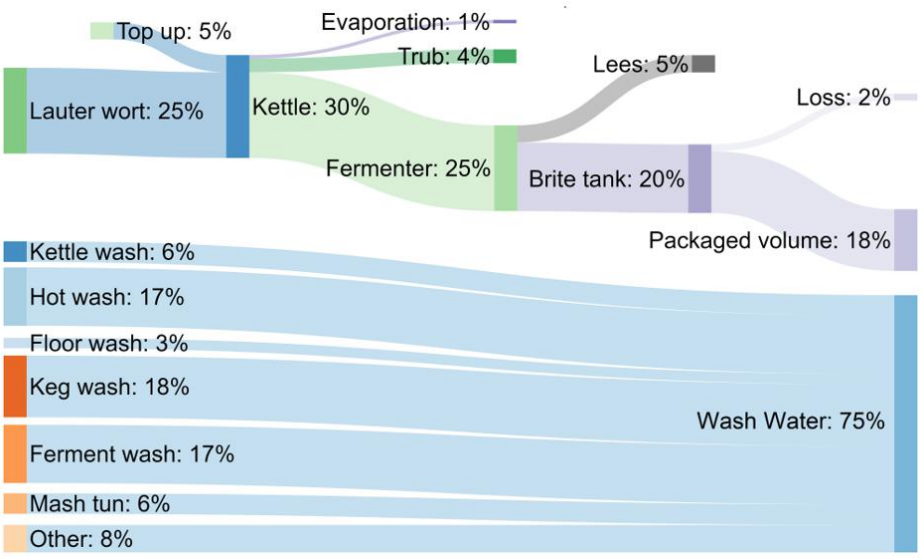
Trade waste is any brewery wastewater discharged into sewerage systems. Water authorities are tightening regulations about what is put into sewerage.

Why is water and wastewater something to watch?

- **Water prices** and **water security** continue to be an issue in Australia
- Breweries must have a **trade waste permit** for discharging to the sewer.
- Trade waste permits define the limits on the **volume** and **contaminant loading** of the wastewater leaving your brewery
- Water authorities are **tightening regulations** on what (and how much) is discharged to the sewer network (particularly Biological Oxygen Demand (BOD)
- These **costs** are expected to **increase** over the coming years.
- Breweries can address water and wastewater costs in a variety of ways:
  - **Front-of-pipe** solutions that focus on minimising waste generation at the source
  - **End-of-pipe** technologies that treat and / or reuse wastewater

Permits and charges will vary depending on regional location of brewery, infrastructure, local and state-based rules.

What is driving water consumption in my brewery?



Areas of unwanted heat flow

Water efficiency is best improved by controlling cleaning practices.

Some breweries can use up to 10 litres of water for every litre of beer produced. Through targeted water efficiency improvements this can reasonably be reduced to less than four litres of water per litre of beer.

Water Efficiency			
Optimisation options	**% Typical reduction**	**Upgrading options**	**% Typical reduction**
Where possible, **remove solids** manually instead of water blasting (e.g. using scrapers and brushes to clean fermenter walls first and recover solids	20%	Fit **float operated** valves in the hot liquor tank to avoid overflow Use **automation devices** to automatically fill mash / lauter (avoid overflow and loss)	15%
Use **high pressure, low volume** systems (high pressure hose) instead of a standard hose. Use soaking detergents, wait, then use high pressure cleaning	20%	Automated wash water **reuse**	50%
		Install a **CIP**	60%
Manual wash water **reuse**	50%	**Closed loop** water cleaning	>90%

What is driving trade waste generation in your brewery?

- Washing in general
- Spent grain, trub (moderate generation)
- **Fermenters (50% of total BOD and 70% of TSS)**
- Targets for improvement

Sources of loading for most breweries	pH	BOD (g/L)	TSS (g/L)	Volume (kL)
Typical trade limits (Greatly varies depending on location)	**6-10**	**0.3 - 2.5**	**0.3 - 0.5**	**Variable**
Spent grain (wort retention)	6-7	~100	30	Low to Med
Trub and rinsing	5-6	85	35	Med
Fermenter rinsing (lees / yeast)	4-5	100	6-10	High

How can I reduce waste water loading

Front of Pipe

- Prevents waste loading prior to treatment.
- Prevention at front of pipe decreases end of pipe expenses.
- Generally less energy intensive than treatment (end of pipe) solutions.
- Requires additional effort and planning to segregate solids away from treatment systems.

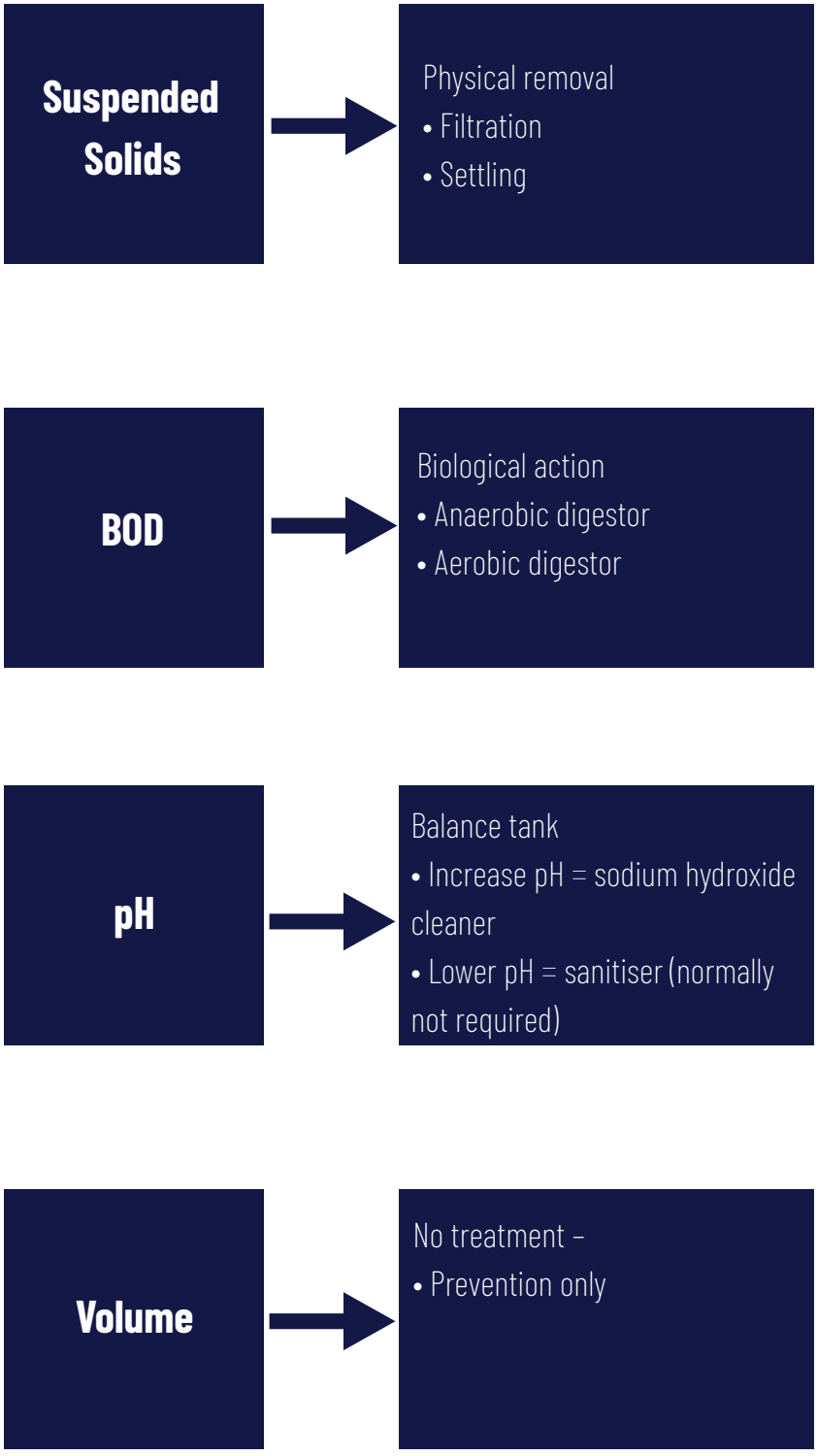
End of Pipe

- Treats any contaminate loading that enters the waste water stream.
- High volumes and loading require larger and more expensive treatment systems.
- Generally requires high levels of energy and management to effectively treat waste water.

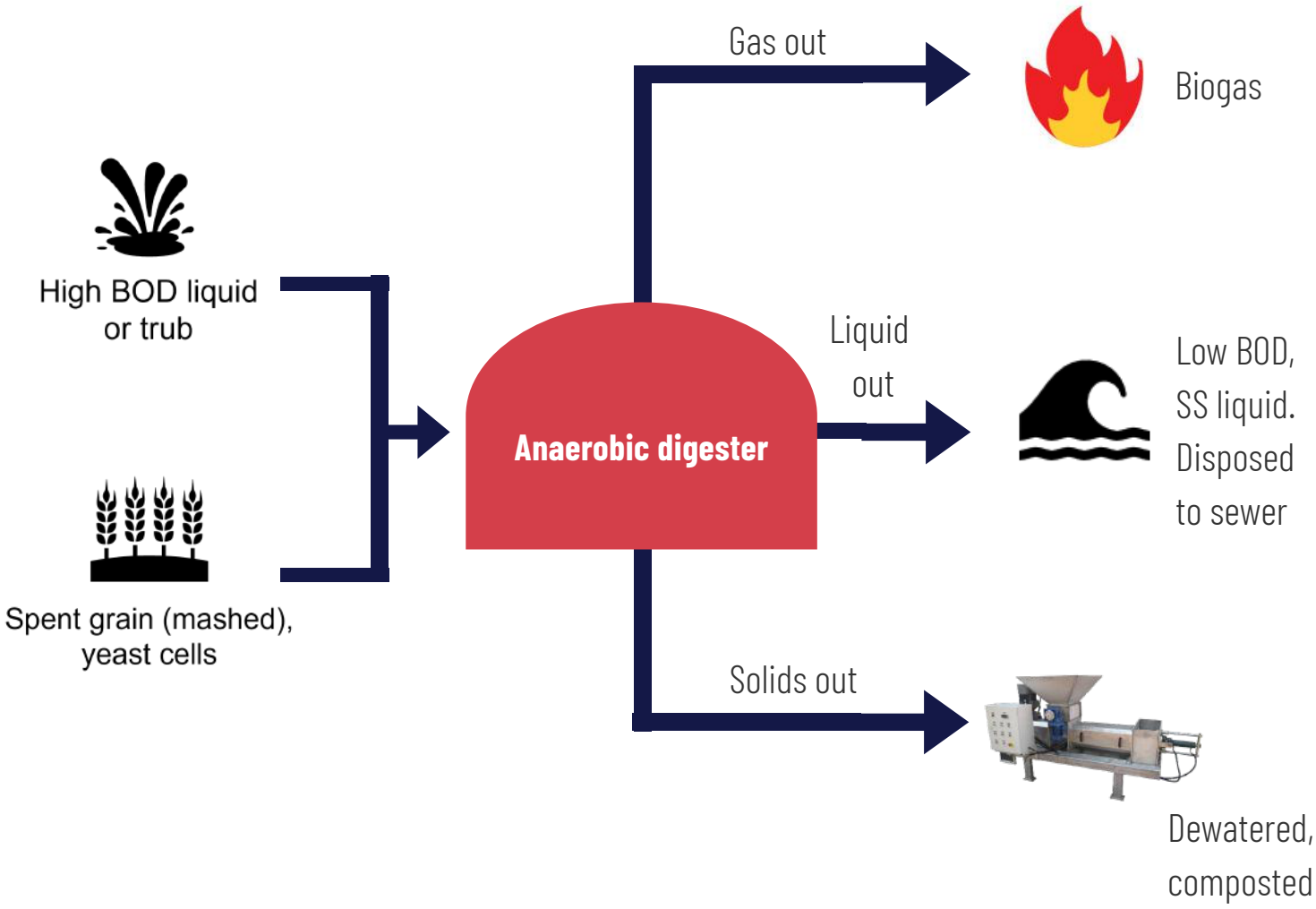
How can I reduce wastewater loading?

Wastewater loading reduction (front of pipe)		
Spent Grain Lauter	**Trub and Kettle**	**Fermentation and yeast lees**
Recover as much wort from lauter to the kettle or future batches (high value product). Agitate spent malt with rakes to remove trapped wort in pockets. Rinse lauter and pipework back to the kettle with hot liquor While expensive, dewatering systems (belt presses, decanters, etc) will maximise yield and decrease spent grain weight. Ideally, spent grains should be separated and relatively dry for feed. Ideally, all liquid generated at this stage should enter kettle to maximise yield and avoid discharge to sewer.	Recover as much wort from kettle to the fermenter (high value product). Avoid discharging trub directly to sewer Whirlpooling should common for most breweries and is a critical step for trub separation Trub centrifuging can reduce solids from wort decreasing SS discharge into sewerage. Ideally under sanitised centrifuge conditions, the wort could return to the fermentation vessel, or discharge to the sewers with lower SS. Solid trub can be disposed of through organic waste	Yeast slurry has a high BOD, high SS and low pH (acidic). Avoid disposing of yeast slurry down the drain. Recover, store and reuse yeast where possible. Exhausted yeast should be dewatered (GeoBags, filter press etc) and the yeast cake diverted with spent grain for feed. Ideally, a centrifuge can help remove dry hop additions and suspended yeast. This will increase yields, clarify the beer and concentrate solids for disposal as animal feed.

How can I reduce wastewater loading? Treatment (end of pipe)



How can I reduce wastewater loading? BOD to Energy



Solid Waste

Most states will continue to set policy targets towards creating a circular economy and reducing the amount of waste that is sent to landfill

Why is waste management important for breweries?

- Waste levies will continue to rise across the country
- Old landfills will continue to be closed and capped
- Any new landfills will be further away from populated areas and increase costs
- Organic waste diverted from landfill will reduce GHG emissions
- Reducing the generation of waste will reduce operating costs
- Social expectations regarding clean green images will continue in future years

What is creating waste?

Where is waste being generated by my brewery?

Organics/ingredients

- Spent grain
- Spent yeast
- Spent trub

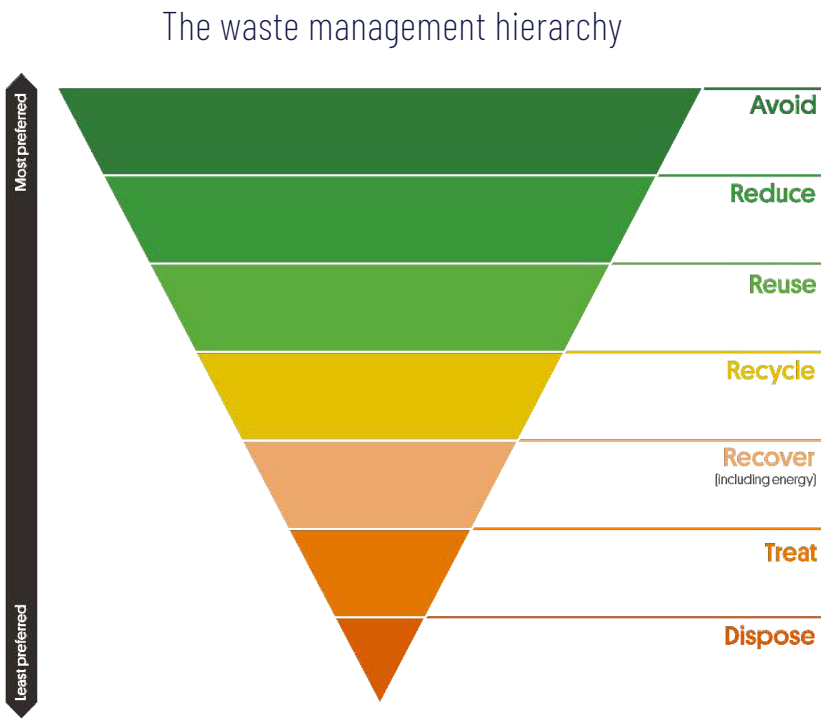
Incoming packaging

- Bulka bags (polypropylene)
- Cardboard
- Plastics
- Bulka bags (polypropylene)

Outgoing packaging

- Spent grain
- Spent yeast
- Spent trub

What can I do to reduce waste?

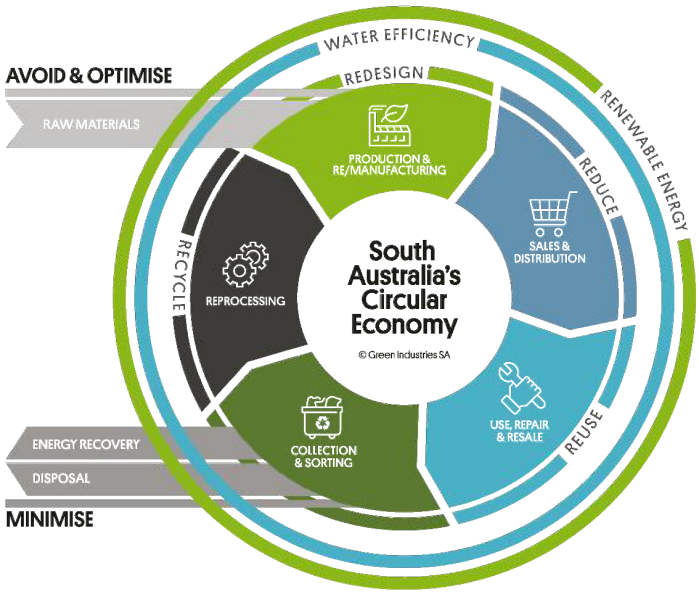


Any changes you make to improve your brewery's waste and recycling system should be based on the waste management hierarchy.

This is the internationally accepted preferred order of waste and recycling managemAent practices.

The circular economy of waste avoidance and reduction

The circular economy is different from a 'take, make, dispose' economy, which is unsustainable due to limited resources. The circular economy involves redesigning systems and products so they can be easily repaired, disassembled and recycled to keep materials circulating indefinitely. Designing out waste is important to get the most value out of materials.



What can I do to manage waste?

Avoid / Reduce	Avoiding creating waste or reducing the amount created are the best options. This reduces the cost of purchasing materials that will be wasted in the first instance and paying for their disposal. Talk with your suppliers to find out if there are options to reduce the amount of packaging waste you receive.
Reuse	Many items can be reused multiple times before they are recycled or disposed. Pallets are one good example of this. Reuse can happen within your brewery or items can be reused by other partners, like a farmer reusing spent grain to reuse as cattle feed.
Recycle	Preference the purchase of items made from materials that can be easily recycled or composted, and use the right systems to keep materials separate and at their highest value (right bins in the right places). This keeps resources in use and reduces the reliance on virgin materials.
Recover / Treat / Dispose	Where there is no way to recycle certain wastes, energy recovery may be a possible alternative to landfill. The resources and energy used to produce items is wasted when sent to landfill and it can often be the most expensive option.

Managing waste streams at a brewery

Good practice brewery waste management systems include:

- Bottles and cans sent directly to recycler
- All organic material either collected for animal feed or for composting
- Dedicated cardboard and paper collection for recycling
- Dedicated plastics collection for recycling
- Residual waste sent for energy recovery or to landfill as a last resort

Tips for common brewery wastes

Organics/ingredients

Spent Grain	Is commonly reused as animal feed and can also be reused as a baking ingredient. Where this isn't viable, it can easily be collected and recycled by commercial composters. Energy recovery may also be possible via anaerobic digestion
Spent Yeast	Its possible to reuse yeast for multiple brews, reducing both ingredient cost and waste disposal cost. Once inactivated, spent yeast can also be used as animal feed. If neither if these options are viable, it can easily be collected and recycled by a commercial composter along with other organics.
Trub	Reuse options for trub are limited due to its undesirable flavour, however it can readily be collected and recycled by a commercial composter along with other brewing organics.

Outgoing Packaging

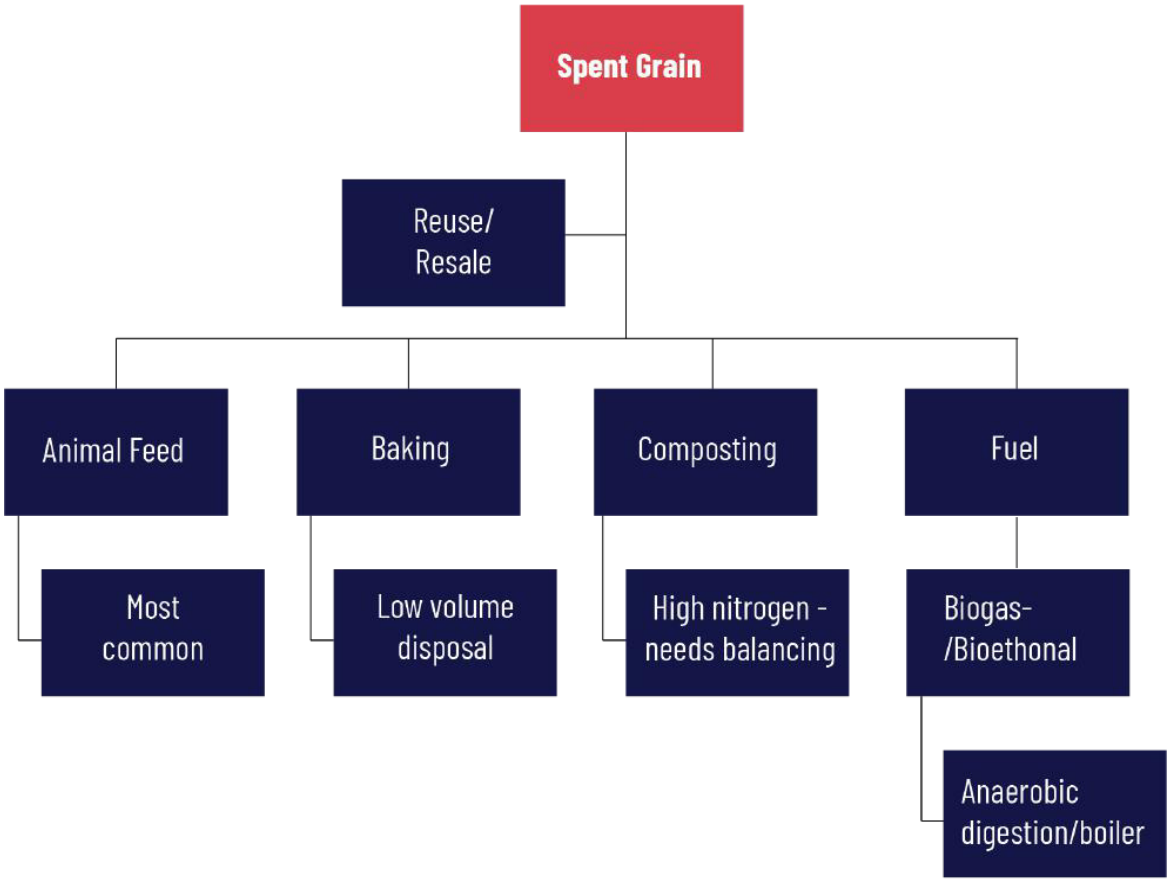
Product Packaging	Both bottles and cans are highly recyclable, most states have now introduced container deposit schemes to ensure these materials are collected for recycling. Cardboard is also readily recyclable through kerbside collection systems.
Food services	Reusable, lightweight ceramic service ware for food will help reduce the volume of waste generated. Alternatively, if using single-use service ware, look for Australian certified compostable items which can be collected and recycled by commercial composters along with any food scraps.
Plastics	Film plastics are commonly used for securing pallets, but there are other materials that can be used. Consider reusable pallet webbing or strapping as an alternative and/or minimizing the amount of wrapping used to secure outgoing loads.

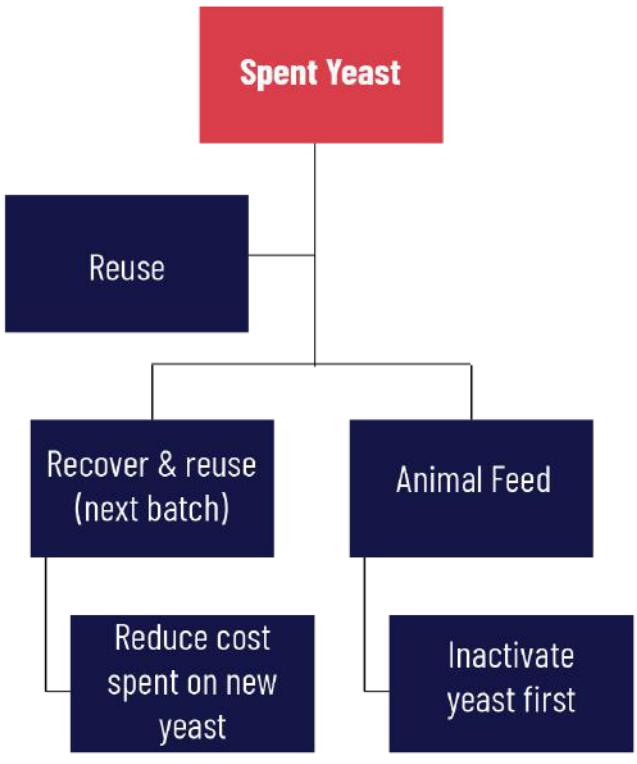
Tips for common brewery wastes

Outgoing Packaging

Bulka bags	Work with your supplier to find out how you can reduce the number of bulka bags you use – can you buy materials in larger quantities and/or store in a silo? Can your supplier provide stronger, reusable bags (or other container) for grain and if so, will they accept return of the bags for reuse? Some soft plastics recyclers may accept these woven polypropylene bulka bags at a cost.
Cardboard	Pallet liners can often be reused for outgoing pallets. Clean carboard should be collected separately and is suitable for recycling by your waste contractor. Wet or soiled cardboard is best managed through an organics collection service for composting. Waxed cardboard is not easily recycled or composted and should be avoided.
Other Plastics	Talk with your suppliers about how you can avoid or reduce the amount of plastic packaging you are receiving. Many plastics can readily be recycled, particularly if they are free from contamination of other materials. This includes pallet wrapping without paper labels and pallet straps when they are made entirely from PET (i.e. no fibre thread contaminant).
Pallets	Repair where possible and continue to use pallets for product movement at your brewery. Damaged pallets can be given away for reuse by other businesses either as refurbished pallets or remanufactured into furniture and other products. Where this isn't possible, pallets can be processed by commercial composters.

Waste to value - Brewing organics





Step 2: Change the way you buy

Energy Procurement

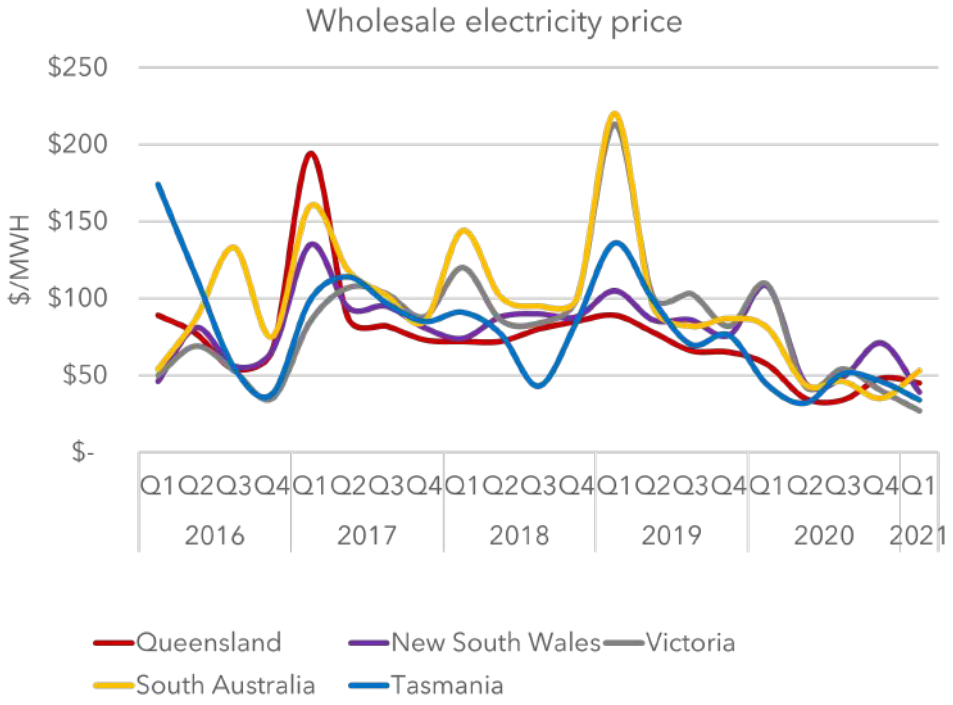
Getting on the right energy contract for your brewery can be the simplest way to reduce your electricity and gas costs.

What can I do to get a better energy deal?

- The Australian energy market is very **volatile**.
- **New energy retailers** have entered the Australian market each competing for customers
- State wholesale and retail prices have **dropped** by **50-70%** since **2019**.
- With these changes, energy customers are in a good position to negotiate and find the **best deal** for their brewery.
- Use your **data** to get a better energy deal

Volatile energy prices

Depending on when you negotiated your last electricity deal, you could be paying a lot more than the current market price. Find the best price for your brewery.



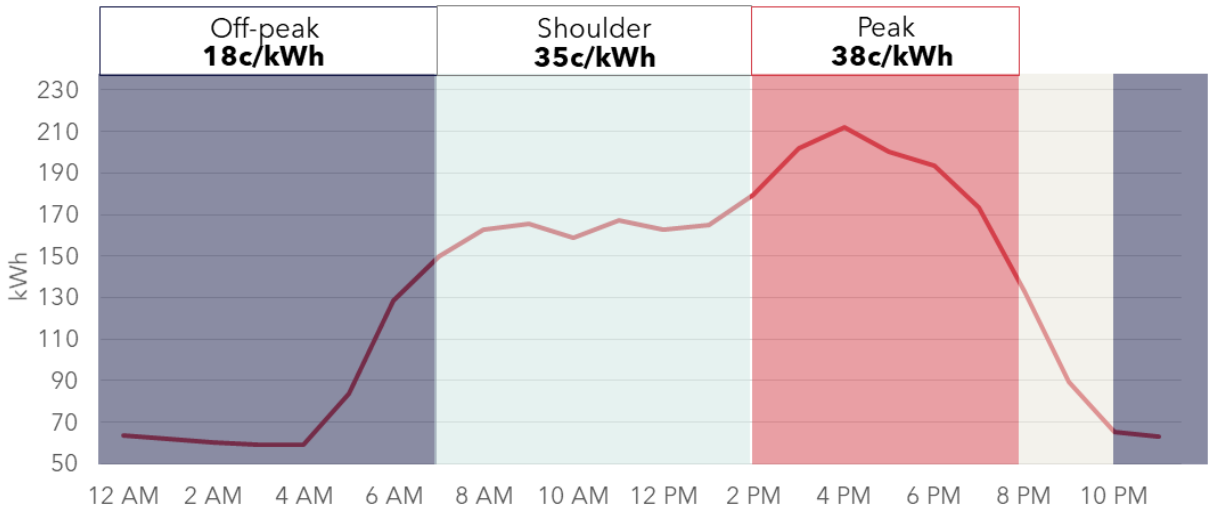
Change the way you buy
Lots of variables

- Time of Use (Peak, shoulder and off peak retail rates)
- Length of contract
- Green Power options and costs

Time of use

Time of Use graph	Below provides an overview of a typical Time of Use graph for a brewery. Electricity use is low after 10pm and before 4am Electricity use is highest at 4pm
Rates	In this example: Electricity rates are lowest after 10pm and before 7am Electricity rates are highest after 2pm and before 8pm (The times and rates are different in every state and vary depending on your contract type)
Changes	Brewery can take advantages of these scenarios: a) Pick a rate that works for your use profile (e.g., lower peak costs, higher off-peak costs) b) Change your profile (heat water or overchill refrigeration systems at night during off peak times)

Different rates for different times (and different times for different states)

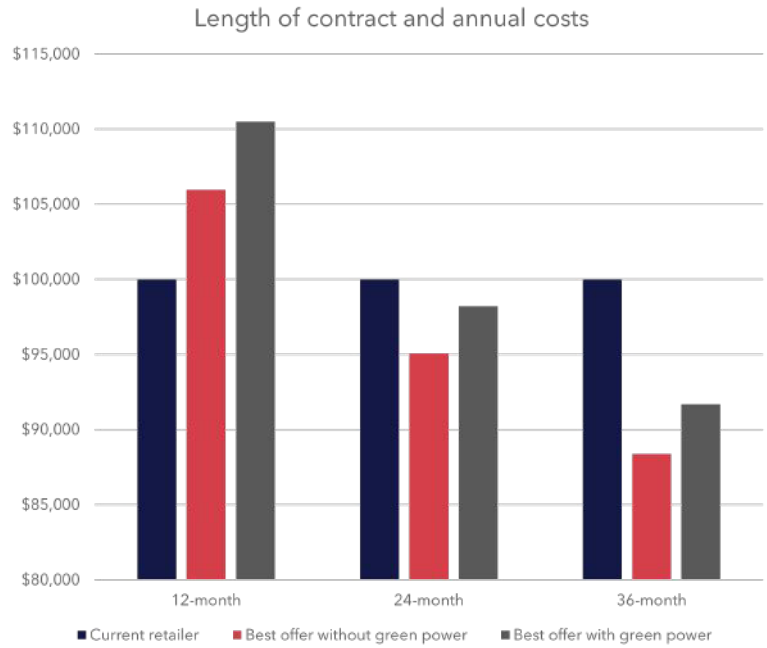


What can I do to get a better energy deal?

Pick a rate that works for your use profile (e.g. lower peak costs, higher off-peak costs)

OR

Change your profile (heat water or overchill refrigeration systems during off peak times)



Length of contract

The length of your contact can influence your electricity rates and overall annual cost.

Generally, the longer the contract, the lower the rate BUT large price drops in the future may leave you locked in to a higher rate.

How can I compare?

How can I compare what I currently have against what the market is currently offering?

The Federal Government have set-up a website to help you compare options: www.energymadeeasy.gov.au/

The portal uses your actual meter data to model and calclate what your new costs will be (based on your profile)

This is available to small business energy users only)

Electricity Provider	Peak (c/kwh)	Off Peak (c/kwh)	Shoulder (c/kwh)	Monthly cost (estimated)
A	28.28	17.42	15.86	$5,080
B	38.81	21.32	21.32	$7,160
C	28.57	14.89	14.89	$3,880
D	21.99	9.99	19.03	$3,320
E	26.2	13.12	13.12	$4,200

Renewable Energy

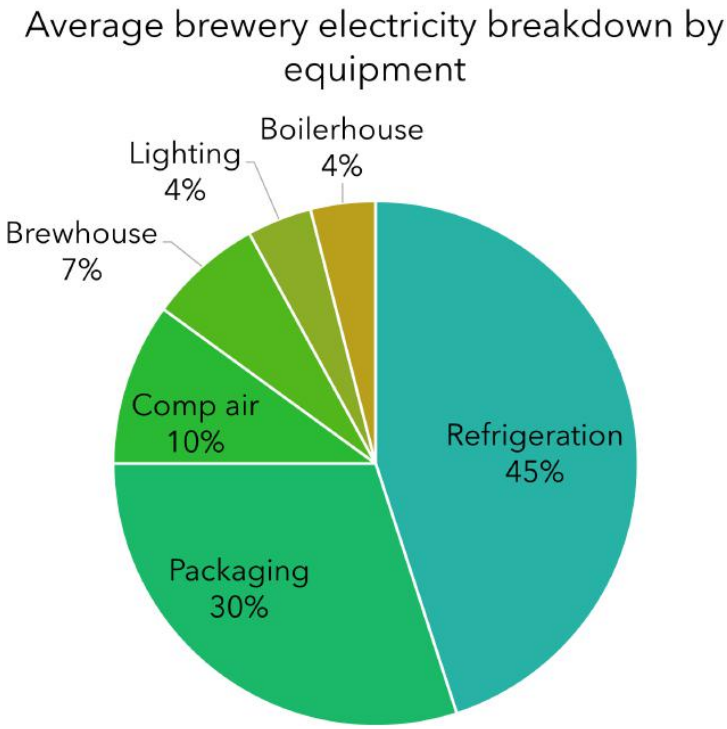
Reduce your site's energy consumption through efficiencies before installing solar. Make sure your solar size is matched for your brewery and change the way you use energy to maximise solar use

Why should you look at installing a solar system or alternative renewable energy?

- Currently a strong push from both customers and society to reach net zero carbon
- Renewable energy, in particular solar PV systems can help reduce a breweries carbon footprint
- Renewable energy can help reduce operating costs

When should I install solar PV panels

- Make sure you understand your electricity profile first and understand what is driving electricity consumption.
- Try and implement energy efficiency projects first (especially improving refrigeration efficiency) before purchasing a solar PV system.
- Efficiency projects can often be less expensive and save you more than a Solar PV system.
- Managing electricity demand on site may mean you need to purchase a smaller solar PV system

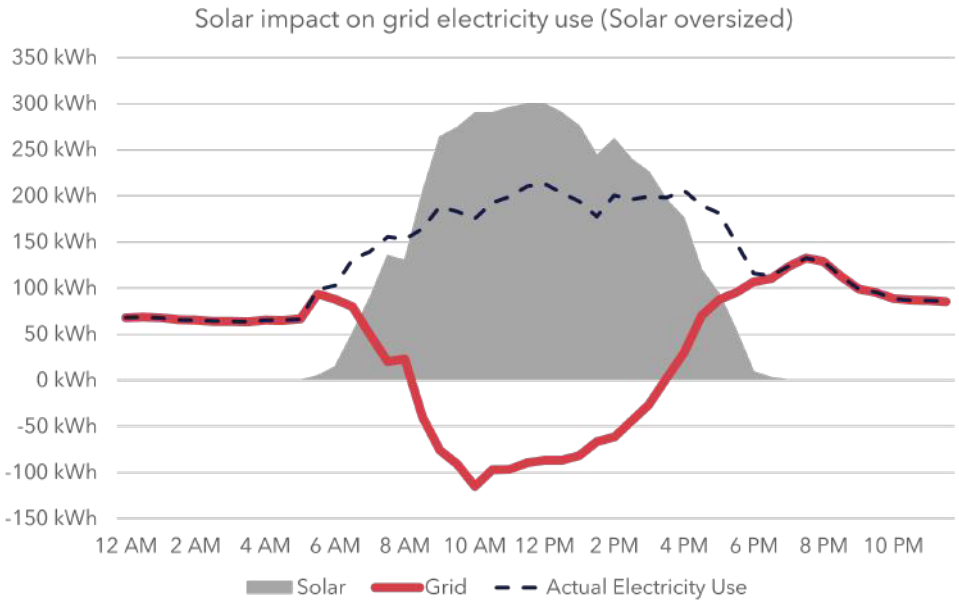


What size system do I need?

- An important step for any brewery is making sure you size your solar system correctly for your needs.
- Part of scoping a Solar PV system is planning for the future. Are you planning on growing? Are you planning on installing a battery?
- The amount of solar electricity generated and the quantity of electricity used by breweries is different between summer and winter.
- A good solar provider will be able to model your current electricity use and help determine the ideal size for your brewery.

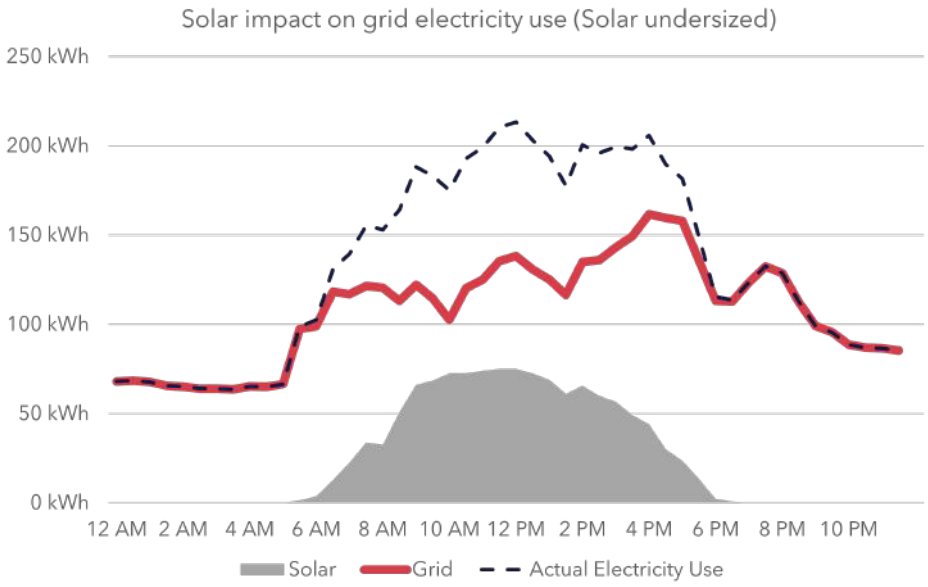
What happens if the solar system is oversized?

If your solar system is oversize, any unused solar electricity will be exported back to the grid. The rate for exporting electricity back to the grid is a lot lower than the price for purchasing electricity. In some cases, you cannot export electricity at all. This means that the payback time for your solar system is a lot longer.



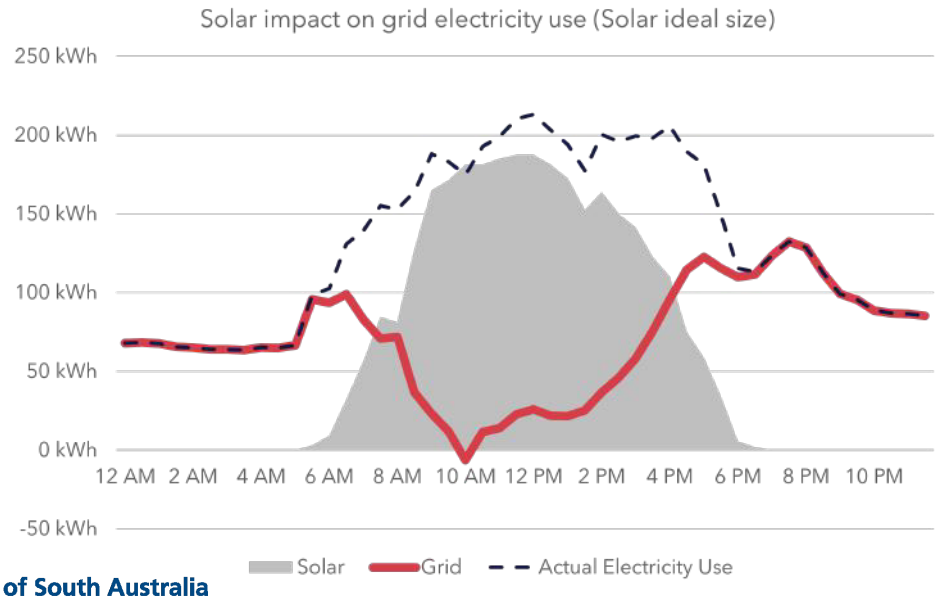
What happens if the solar system is undersized

- An undersized solar system will reduce the quantity of electricity exported back to the grid (and ensure electricity is used on site).
- In many cases, a solar PV system needs to be undersized due to inadequate roof space.
- Savings from undersized systems are generally lower, however the capital costs are lower and are more economical compared to an oversized system



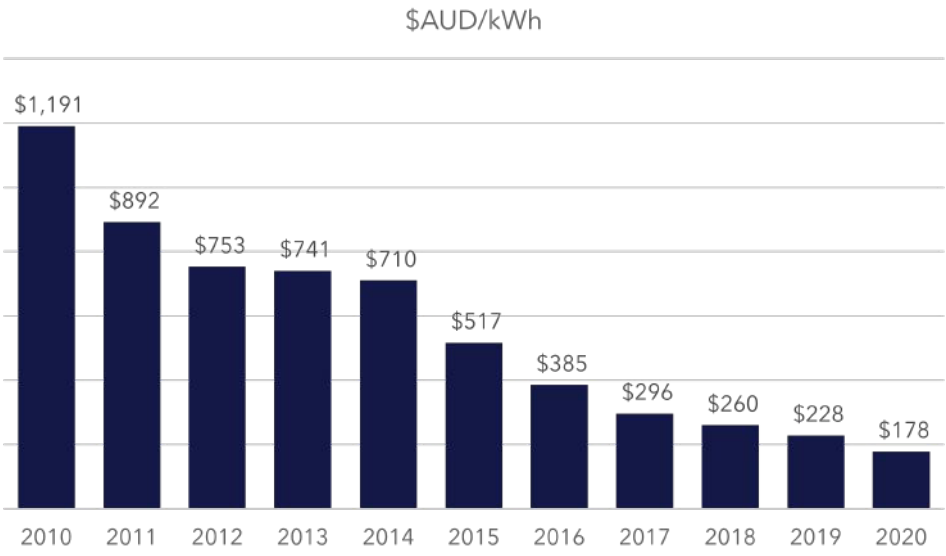
Ideal solar PV size

- An ideal solar PV system will offset most of your daily grid electricity use while minimising export back to the grid
- Naturally this will change between summer and winter and any time the brewery is not running (e.g. weekends)



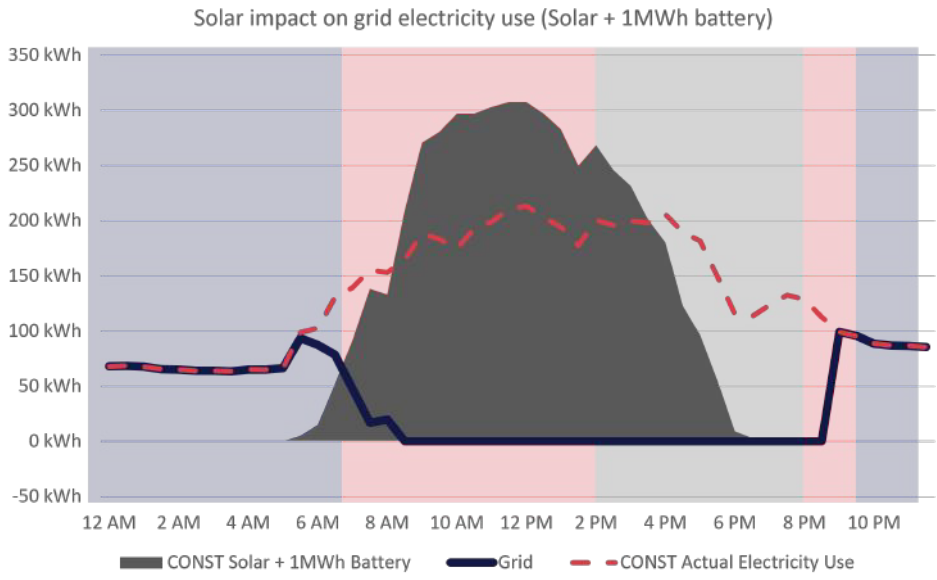
What about batteries?

- Lithium-Ion batteries continue to drop in price – however, this cost reduction has not yet translated to cheaper power packs for industry.
- Batteries can provide some energy security from blackouts.
- Batteries can level the energy demand from the grid and, in some cases, help offset peak energy costs.
- Currently, the 'payback' for batteries is higher than the expected life of the batteries. This will improve as retail prices decrease.



Electricity profile with battery

- A battery can allow you to store excess Solar PV electricity (or low cost off peak electricity).
- This electricity stored can be used on site, ideally during peak times to avoid peak electricity prices.



Sustainable Packaging

Breweries either use cans, bottles or kegs for their beer – from a sustainability perspective, there are pros and cons for either option

Why is your choice of product packaging important?

Due to Covid restrictions and pub / bar temporary closures, many smaller breweries have moved away from kegs and instead moved to cans or bottles for direct sale to the public.

There are a variety of factors to consider when deciding to package in either cans and bottles. These relate both to packaging on site and packaging using contract packagers

- The cost of cans vs bottles
- The CAPEX cost of either a bottle or canning line
- Transportation costs (and weight of bottles vs cans)
- Environmental/carbon footprint

What is more sustainable - bottles or cans?

Cans

- Highly recyclable
- Low energy use to recycle
- Very expensive to produce new aluminium
- Light weight for transport (lower truck emissions)
- **Use 100% recycled cans if possible**

Bottles

- Highly recyclable
- High energy use to recycle
- Moderate cost to produce new glass
- Higher weight for transport (high truck emissions)
- **Use glass bottles if 100% recycled cans are not an option**

For more information about packaging and recycling, visit The Australian Packaging Covenant Organisation (APCO)

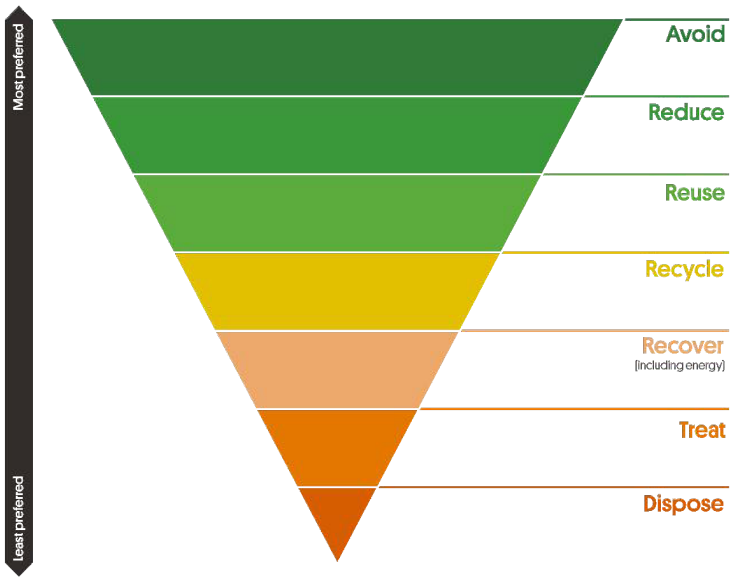
APCO website

What other options are available?

Using the waste hierarchy, make conscious decisions about how to chose the most sustainable packaging. This include:

- Actual containers
- Any wrapping or pallet fastenings
- Recovering any pallets

Think about the waste that your customers need to dispose of and what you can do to change it. Can you incentivise customers to return cans, bottles or can carriers for reuse or recycling?



Step 3: Eco-Certification and Labelling

Eco-Certification and Labelling

There are lots of sustainability labels that breweries may be able to take advantage of to create a point of difference in the marketplace.

Why is Sustainability Labelling a good idea for your product?

- More customers are becoming **sustainability aware**
- Large supermarket chains are increasing their focus on **sustainability** and **Corporate Social Responsibility (CSR)**. Breweries that are consistent with these CSR values through sustainability initiatives are more likely to be stocked by these large chains
- Certification and labelling means the brewery has taken **active steps** or **formal processes** to achieve certification
- These processes encourages **innovation** to improve sustainable manufacturing
- Certification promotes **sustainability values** within the brewery and can influence customer behavior

Pros and cons

Benefits of certification process

- The certification process requires breweries to actively become more sustainable and certification demonstrates a commitment to sustainability
- Certification promotes sustainability culture within the workplace and influences breweries to measure and monitor sustainable performance
- Breweries values are aligned with environmentally conscious customers providing additional customer base (both now and into the future)
- Sustainable projects may be eligible for economic support by government organisations

Risks of certification process

- Sustainable certification may not be valued by customers. Breweries may waste time and effort if their goal is to attract more customers via sustainable certification
- Customer base is not willing to pay a premium for sustainable beer
- Certification and certification projects may not demonstrate a positive impact expected by the customer
- Prohibitive costs for certification, especially for smaller producers

What types of certification and labelling systems are out there?

Hundreds of certification labels – Below are 4 examples.

Australian Certified Organic

- Focus on ingredients
- Requires all ingredients are certified organic grown and processed without synthetic chemicals, fertilizers or GMO's) and traceable back to source
- Largest certifier for organic produce in Australia and complies with international organic standards

Website

Climate Active

- Focus on Net Zero Emissions
- Certification means that a business has reached a state of achieving net zero carbon emissions
- Australian initiative as a partnership between Australian Government and Australian business

Website

Certified B Corporation

- Focus on social and environmental aspects of a business
- Commits companies to balancing profits with employees, communities and the environment
- Private certification

Website

Box Australasian Recycling Label arl.org.au

APCO

- Focus on packaging. Objective is to help customers correctly recycle their packaging.
- The Australasian Recycling Label (ARL) Program is exclusive to members of the Australian Packaging Covenant Organisation (APCO).
- APCO membership also includes support and resources for sustainable packaging design.

ARL Website **APCO Website**

How do I decide which certification is right for me?

Evaluate why you want certification

Do you want to promote your own business initiatives? (E.g. Becoming sustainable as an intrinsic value for the brewery)?

Do you want to improve market advantages or satisfy demands from major retail customers?

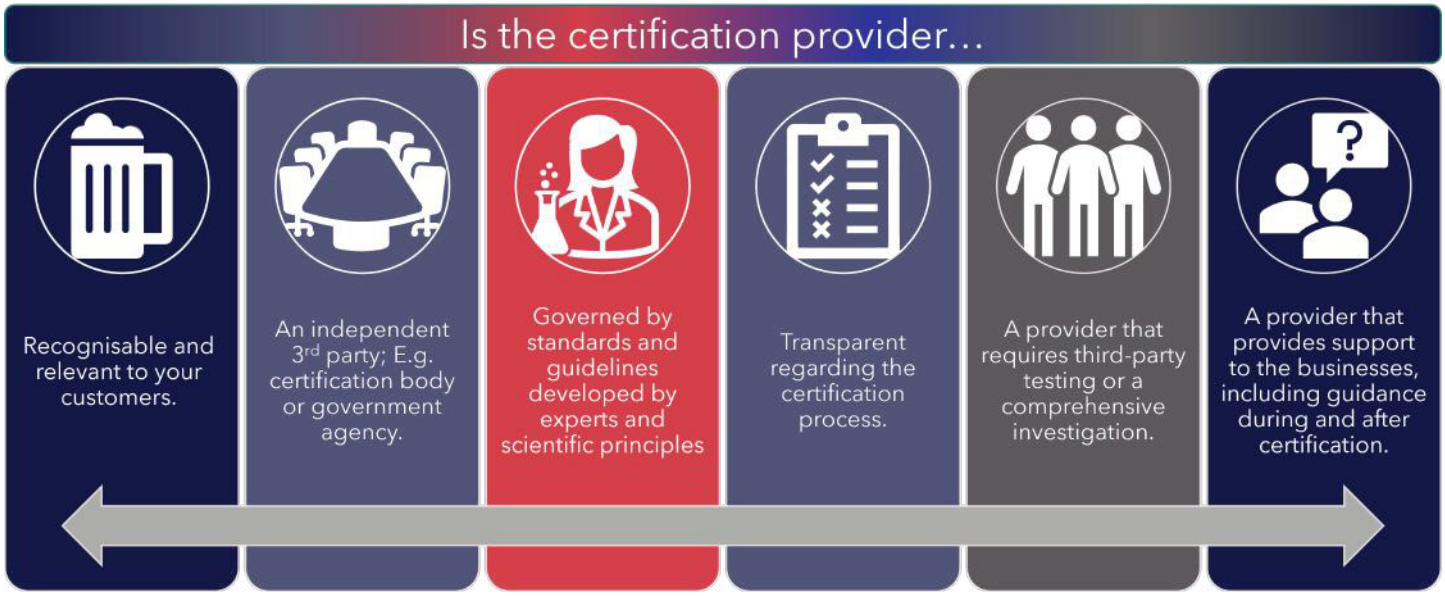
Do you want to decrease risk from resource scarcity or mandatory regulation?

Do you want to satisfy (or create) customer demand

Based on your answers, identify the certifications that resonates with your brewery. The next step is to evaluate your choices

How do I decide which certification is right for me?

Evaluate your choice of certification against each of the following criteria



• Once you have decided on your certification provider, follow the steps to understand what is required for certification, and begin the certification process.
• Most certification bodies will outline the steps and costs in advance so your brewery can understand the effort and costs involved in becoming certified
• Certification can help improve your own processes and provide guidance to help identify areas for future improvement
• Contact the IBA for recommendations on future certification systems

4. Case Studies

Bright Brewery

Our sustainability mission is to make our beer production as close to carbon neutral as possible and minimise overall environmental footprint on Bright.

Some of the sustainability measures you'll find at Bright Brewery are:

• **Solar brewing** – We have 50kW of solar on the roof of our Great Alpine Road venue, which produces about a third of our daily energy usage. In its lifetime, our solar system has saved 3772 trees (as at April 2019). Read more about our solar brewing here.
• **Reduce, reuse recycle** – around the brewery, you'll find many repurposed items including old kegs as light shades, wash basins and seats, plastic kegs as bins, keg bladders as light shades, and pallets as tables and dividers.
• We recognise that our two steam-driven breweries are highly energy and water intensive, so we attempt to mitigate this impact by **brewing sustainably** with **back to back brews**, which recycles both heat and water and significantly reduces energy consumption.
• Our **Green Transport Scheme** encourages employees to walk, cycle, run, or even paraglide to work instead of driving. Employees are rewarded for every commute they make without a car.
• Our beer is a genuine **low food-mile** product! The water comes from the snow-fed water of the Ovens River, which flows past our brewery; the hops are grown 10 minutes down the road at the Rostrevor Hop Gardens; 64% of the malt we use for brewing comes from Victoria; and, most of all, 80% of our beer is consumed within 50 paces of the brewhouse where it is brewed!
• **Green freight** – when one of our customers in Bright places a small order for our beers, we load up a trolley and walk the beer to them!
• Our **brewery grain** is transported directly from the brewery to a nearby farm where it's fed to a local cows owned by local farmers. Watch the video here.
• We participate in an organics transfer box system with our local Bright Community Garden. We send over 150L of organic food waste every week, which equates to roughly 5 tonnes of food waste not going into landfill.
• The rest of our kitchen waste is recycled through a green food-waste recycling system called the Orca.
• **Shredded office paper** is used for padding fragile packages that we ship from our brewery.
• Our Food & Drink Menus are housed in **reusable plastic sleeves** instead of laminating. When the menus changes, the paper insert can simply be shredded or recycled.
• We subscribe to **The Last Straw** initiative and have removed plastic straws from our venue. We offer paper straws upon request.
• We run a **used battery collection** point at Bright Brewery and these batteries are recycled through an approved recycling centre regularly.
• We don't serve our coffee in takeaway cups or sell plastic bottles of water.

Helios Brewing

Helios is the Sun God of Greek myths. Each morning the rising sun marks Helios' crossing over into the mortal world, driving a chariot drawn by wild horses that only he can control. Helios Brewing Company harnesses the sun's power to sustainably create craft beer.

Our brewing infrastructure has been custom-designed to maximise energy and water efficiency, minimize waste and carbon-footprint while capitalising upon Queensland's renewable natural resources. We do all of this for maximisisng our efforts towards eco-friendly sustainable brewing.

Helios Brewing's Electric Van

We own and run our very own Mitsubishi MINICAB MiEV for running events and doing deliveries around Brisbane. It's a nifty little van that's pretty zippy and is charged in-house using our solar power generated from the brewery.

More information

Wirra Wirra Vineyards

Investment in energy efficiency brings immediate returns for Wirra Wirra

Wirra Wirra Vineyards made a significant commitment to energy efficiency in 2014 and the returns were immediate. In the first year after upgrading its refrigeration plant and buying a solar system for its McLaren Vale winery, the company used 300,000 kWh less power from the grid, halved its ratio of electricity consumed to tonnes of grape crushed, and produced 330 tonnes less of CO2-e. It's electricity bill was around $49,000 lower than in the previous year.

With support from a Clean Technology grant Wirra Wirra decided to invest in a "green" ammonia chiller system to replace its old Freon chiller, replace damaged or missing insulation on its brine lines and install a 100 kW solar system.

"We wanted to reduce our reliance on the regional power grid through solar and reduce the high risk of a major tank cooling breakdown during vintage, leaving us unable to produce wine, through the new refrigeration plant," said Environmental Coordinator Emmanuelle Walton. "We also were willing to invest to improve our energy efficiency and reduce both direct and indirect carbon emissions."

The timing was right, with funding available, but Emmanuelle said the company was committed to the changes anyway, particularly with rising electricity prices making solar a good return on investment. "The upgrades realised during the project involved quite significant work and up-front costs at implementation; however, once installed they can all continue to generate very good benefits over a long period of time, with fairly low maintenance in terms of costs and time," she said.

Wirra Wirra decided to invest extra money to get the greatest efficiency possible from its new refrigeration plant. It is so efficient, in fact, that there are not necessarily any advantages in running it a night and its high-tech monitoring system allows the operators to access most of the plant data.

It also doesn't generate any fugitive emissions and this, coupled with the winery now using much less electricity from the grid, led to a 60% reduction in carbon emissions over the whole winery in the first year and estimated total carbon savings over the life of the conservation measure of 5.3 KT CO2-e.

Accolade Wines

Taking Recycling to another level

Accolade Wines has won international acclaim for environmental initiatives such as the Banrock Station wetlands, but equally impressive work is going on quietly behind the scenes.

The Berri Estates winery at Glossop in the Riverland, which produces such well-known brands as Hardys, Omni and Renmano, has set new standards for recycling in the industry by developing an innovative system that meets its specific needs rather than relying on what happens to be available.

And it is saving money in the process. A little research showed, for example, that it costs half as much to transport baled bags to Adelaide for recycling as it does to take them to the local landfill.

5. Useful links

Useful links

Below are useful links to assist you in your sustainability journey

Australian Certified Organic - Certification program

Australian Packaging Covenant Organisation (APCO) - Insights, resources and programs to build a sustainable national packaging ecosystem

Australasian Recycling Label - Packaging resources for business to ensure consumers are recycling correctly

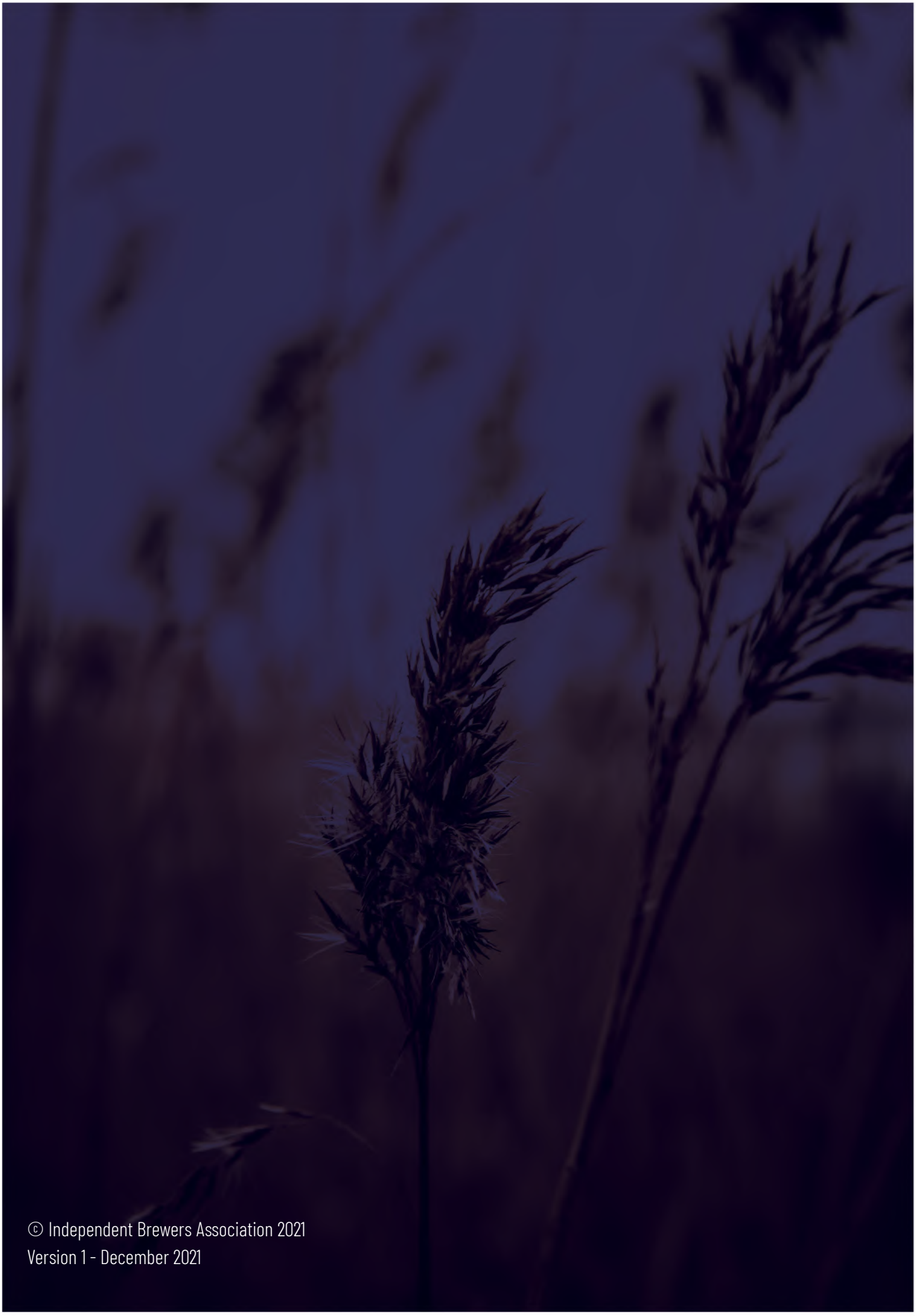
Business Support - Australian Government - Information, grants, services and support to help your business succeed including EPA and Sustainability

Carbon Calculator - Calculate your carbon footprint and find out how much you need to offset to compensate for your greenhouse gas emissions

Certified B Corporation - Certification program

Climate Active - Certification program

Green Industries - South Australia



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