AIB

For the life you're after

Manufacturing Sustainability Guide

At AIB, sustainability is a key pillar of our strategy.

As a financial institution at the heart of the Irish economy, we recognise that the scale and impact of our business gives us a responsibility to the wider economy and society. We have committed to do more to help ensure a greener tomorrow, by backing those building it today.

AIB has a target to achieve Net Zero in our own operations by 2030 and an ambition that green/transition lending will account for 70% of overall new lending by 2030, with a target to achieve Net Zero in our financed emissions by 2040 for our lending portfolio (2050 including agriculture).

To support our customers on their own sustainability journey, AIB has developed a series of sector specific sustainability guides. These guides aim to provide practical tips and information which can be used by businesses to transition their operations to a more sustainable footing.

This series has been produced in partnership with Mabbett, a leading environmental consulting and engineering firm.
To view the full series of guides, please visit **www.aib.ie/business**.

Manufacturing - Sustainability Guide

The manufacturing sector is a cornerstone of the Irish economy, generating over 30% of the country's GDP – while employing over 260,000 staff[1].
Key sub-sectors include pharmaceuticals, medical devices, food products, building materials, chemicals and chemical products, and computer, electronic and electrical equipment.

As a rich and diverse sector within the economy which consumes resources and energy, Ireland's manufacturing industry can play a significant role in reducing the country's carbon emissions and make a positive impact on Ireland's environmental objectives.

This guide looks at some key resource intensive areas in the Manufacturing Sector, including:

- Energy
- Transport
- Waste
- Raw materials
- Water and wastewater
- Social sustainability

For each topic, we identify common issues and share some ideas for how you could enhance the sustainability performance of your business.

The business case for sustainability

Adopting more sustainable approaches to manufacturing within your business can have multifaceted benefits. These benefits relate not only to environmental impact, but also in terms of efficiencies across the entire business operation. This can lead to lower costs, increased competitiveness and increased market opportunities. Furthermore, sustainability can enhance safety, health & wellbeing – both within the workforce and local community. What approach you take, depends largely on business needs.

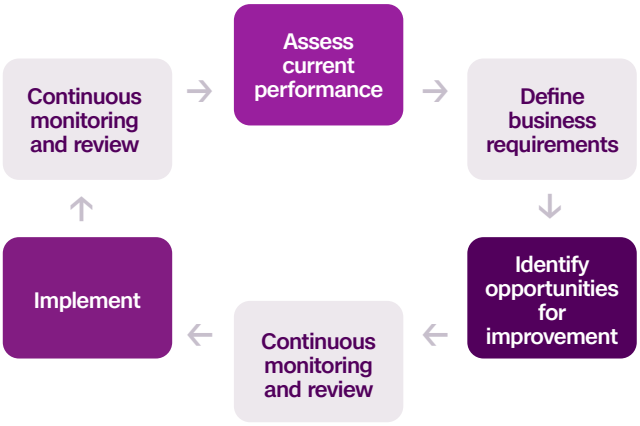
It is recommended that a business undertakes the appropriate review of its environmental priorities, operational requirements and life-cycle costs assessments, in order to identify the most relevant manufacturing activities which can be targeted for improvement.

[1] https://www.ibec.ie/manufacturinginireland

Developing a sustainable manufacturing strategy for your business

You can't manage what you don't measure. Before any improvement can be implemented, it is essential to understand what the current performance indicators are within your manufacturing operations. The first stage in any strategy will be understanding your current baseline.

Reviewing company policy, resource and energy usage, expenses, maintenance costs, etc. can help you to understand this. The following model sets out an example of measures you might take to identify improvement opportunities. When you have developed an understanding of the inefficiencies, you can look at opportunities for improvement. This guide contains some useful considerations across several areas of operation.



Whole business approach to efficiency action

When introducing environmentally efficient changes to business practices and operations, knowing where to begin can be challenging. Not only that, but adapting to climate friendly solutions may feel daunting and expensive. Luckily, some of the most effective solutions are ones that are not only low cost, but take a whole business approach.

Measuring monitoring and targeting (MM&T)

Monitoring your energy usage and waste output gives you the tools to measure your impact and assess where change would be most useful. This information will enable you to target 'hot spots' and implement initiatives that will lead to the most effective change. Good data management will make this much easier, provide you with the most accurate picture of your impact, and the most valuable insights. The table below outlines the steps for effective MM&T which can be used to manage efficiency across all operational areas, including energy, raw material usage, and waste management. See appendix 1 for sample MM&T table.

Identify activities and process that are energy / resource intensive

Make a list of all areas of your manufacturing activities that take place on site, from delivery of raw materials, production processes, packaging, and storage to outbound shipment.

Target "hot spot" activities that have the highest impact

Prioritise efficiency initiatives based on potential highest volume of savings, most cost-effective and easiest changes to implement.

Monitor performance across each stage and record the information

Documents such as energy invoices and waste management reports can provide detailed information on consumption levels.

Report your findings

Maintaining a system that charts your performance is crucial for ongoing measuring and monitoring. Publishing and communicating this data to staff, customers and wider stakeholders also ensures environmental accountability.

Measure the data at regular intervals

To analyse performance and view waste related trends, ensure data is recorded consistently for the most accurate picture of your performance. Measuring data for different areas, activities, and times of day can also help to see where process changes are most needed to drive improvements.

Review your findings

Reviewing your performance, particularly where initiatives have been implemented, enables you to see if they have been successful or not. It will also highlight if you have achieved your targets and support you to increase targets, driving further progress.

Setting energy usage key performance indicators

Once you have an MM&T system in place, another key action manufacturing businesses can take to drive further efficiency and carbon reduction is establishing a set of environmental Key Performance Indicators (KPIs). Environmental KPIs provide businesses with a tool for measurement. These are quantifiable metrics that reflect the environmental performance of a business in the context of achieving its wider goals and objectives. KPIs help businesses to implement strategies by relating various areas or activities within an organisation to clearly defined targets and benchmarks.

When establishing or reviewing your KPIs you should:

- Define relevant KPIs to drive improvement.
- Choose a key site activity/product output as a parameter to compare against (static factor).
- Use analysis and trending.
- Set clear targets that define what success looks like.

Reviewing your KPIs on a regular basis will make it easier for your team to see whether efficiency initiatives are successful, or where additional performance measures should be targeted. Don't forget to share any KPI successes! Communicating the team's achievements can boost morale and encourage continued improvement.

Staff training & behavioural change

Does your business include sustainability as part of its training programme? If not, consider introducing staff training on sustainability when onboarding new staff. Doing so can establish a commitment to working with environmentally sound practices in mind from an early stage. For longer serving members of staff, consider introducing a new sustainability training module, with regular refresher training sessions, to fully embed the importance of the message to staff, factoring in two-way communication.

Key priorities are:

- Ensuring all staff are aware of the importance of improving environmentally efficient practices across all activities and departments.
- Ensuring all staff know what best practice looks like.
- Providing regular training and support to staff to improve their confidence and sense of value in the team. Staff who feel valued and included within the team are more likely to perform well and foster company loyalty. This can reduce costs associated with staff turnover and low productivity

The Sustainable Energy Authority of Ireland (SEAI) provides a range of training supports and resources for SMEs designed to help businesses increase their energy efficiency in addition to reducing their energy related costs.

www.seai.ie/plan-your-energy-journey/for-your-business

Similar to training, behavioural changes are based on people changing their work practices with a view to more efficient and sustainable ways of operating. These changes can influence energy and resource consumption in two main ways: **direct consumption** and **more efficient use of resources**.

Behavioral changes on average can reduce energy consumption by 5%.

Preventative maintenance

A committed approach to maintaining process equipment, efficiency of operational processes, and team training can be a cost-effective way of increasing your environmental performance – with potential for financial savings.

You can carry out preventative maintenance by:

Evaluating the performance and reliability of existing equipment

- Determine the energy efficiency of existing equipment.
- Identify priority replacements through regular review of performance data.

Replacing or retrofitting older equipment

- Retrofitting may be less expensive although is often dependant on the complexity of modification

Consulting with suppliers or specialist advisors

- Determine what is best in class and what is right for your specific business.
- Consider whether buying second hand is the right thing for you. Be wary of older and less efficient motors/operation.

Holding regular training and refresher training sessions

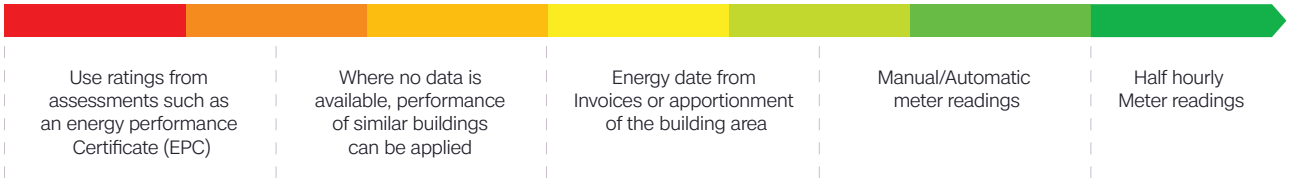
- Reinforcing top-down commitment to best practices can provide motivation and employee buy-in.
- Consistent approach to sharing best practice techniques reduces the potential of team members not knowing what is expected of them.

Efficiency measures - Energy

One of the first steps towards improving the energy efficiency of your operations is to understand what your current energy performance is. Doing so will provide you with the tools for making effective change by being able to see where change is most needed.

To do this, you should have access to good data, such as energy bills or any energy usage reports related to specific equipment. The Energy Data Hierarchy provides an overview of the best sources of energy data to support you with establishing your energy consumption.

Best quality data:



Lighting

Correct levels of lighting are an important health and safety requirement, but manufacturers should consider additional concerns when looking at increasing lighting efficiency. The table below highlights some things to think about.

Effective lighting

is your lighting system doing the right job? Different activities require different levels of light. With this in mind, different lux levels are recommended depending on the type and function of the operational area.

- In general, the more detailed the task, the greater the light requirement. For example, a process control room should be lit at an illuminance of 300 lux2, studying an engineering drawing or carrying out precise technical job may require 750 lux, whilst a corridor may only require 100 lux.
- Using a lux meter will measure the lux levels to understand if the area is under or over lit. More information on lux levels can be found in the SEAI lighting guide in the Resources and Further Information section

Efficiency

upgrade to more efficient lighting – replace tungsten light bulbs with compact fluorescent lamps (CFLs) or light emitting diode (LED) bulbs to achieve up to 80% cost savings. CFLs and LEDs have the added benefit of longer lifespan, providing additional savings in reduced replacement costs. Low wattage bulbs can also save energy.

Switch off policy

encourage staff to switch off lighting in areas of low occupancy (e.g. offices, storage areas, corridors).

Maintenance

ensure lighting systems including the lamp and automatic sensors are cleaned regularly to remove dust and other debris which will reduce their effectiveness.

Replacement

ensure that flickering, failed or blown lamps are promptly replaced – these continue to consume energy so remove or replace them immediately.

Occupancy censors

automatic sensors can achieve savings of 30% to 50% on lighting costs (and energy consumption). They are particularly handy in stock rooms, staff toilets and zoned areas.

Heating, ventilation and air conditioning (HVAC)

Heating, ventilation and cooling systems can be some of the most intensive areas of energy usage in the manufacturing sector. We look at some of the quick wins for energy efficiency in each of these areas.

Heating

Pace heating management

- Do you know the recommended temperature for different areas of your site? Check your thermostat for each area to ensure you aren't heating spaces higher than necessary.
- Do you have zoning in place? Space heating systems can be zoned into appropriate areas (e.g. offices, corridors and production). Timing and temperatures can be optimised to avoid unnecessary operation. This is particularly useful for some areas that may be less frequently inhabited.
- Maintain boilers to ensure they are running as efficiently as possible. Leaks and damage to equipment can result in the boiler working harder than necessary.

Insulation

- All hot process pipework should be insulated to reduce heat loss. This also protects employees from burn hazards!
- Foil-backed pipe insulation is highly effective and can reduce heat loss by more than 90%!
- Valves & pipe fittings lose more heat than pipes due to high surface areas. Consider targeting these areas as a priority.

Heat Recovery

- There may be many areas on site where lost heat could be recovered. Consider whether you could capture heat from: ventilation systems, air compressors, refrigeration systems, steam vents and hot water drains.

Recommended temperatures for different areas and activities

Space temperature guidelines (CIBSE)*

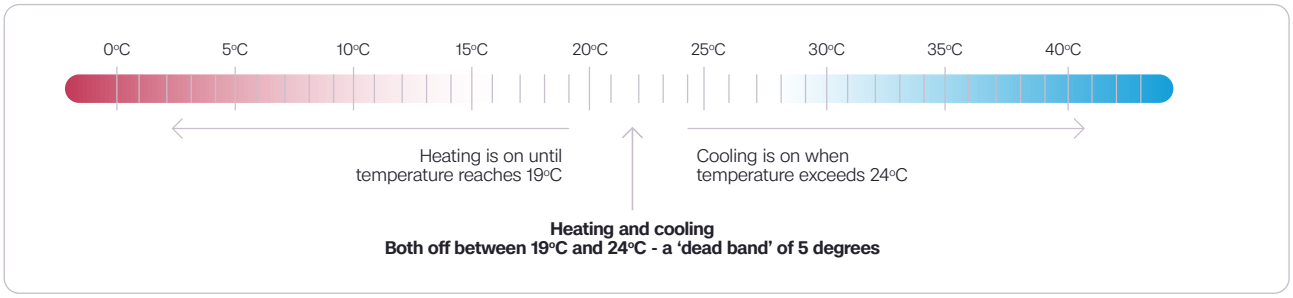
Room Type		Production areas	
Office	21 - 23 ºC	Sedentary Work	19 - 21 ºC
Corridors /Entrance Lobby	19 - 21 ºC	Light work	16 - 19 ºC
		Heavy Work	11 - 14 ºC

*Chartered Institution of Building Services Engineers

Air Conditioning

One of the most effective ways of improving energy efficiency from air conditioning systems is to ensure that they are not working against the site's heating systems. Avoid letting heating and cooling operate at the same time by setting a temperature 'dead band' — a wide gap between the temperatures at which heating and cooling cut in.

For example, the heating might switch off when a temperature of 19ºC has been reached, but then cooling would not come on until the temperature exceeded 24ºC.



Other areas to consider are:

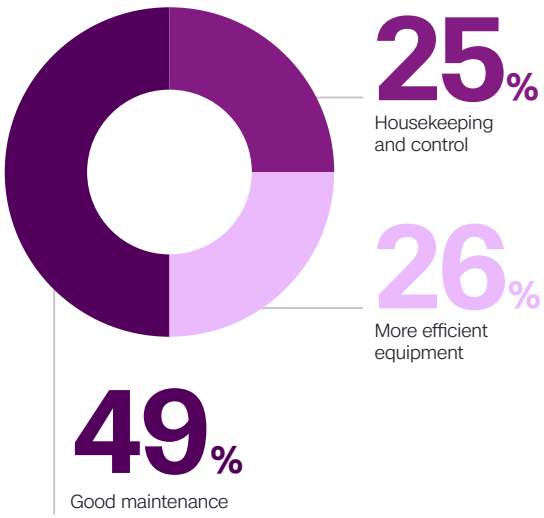
- Can you make use of free cooling? Free cooling uses cool ambient air temperatures to reduce the energy consumed by a cooling circuit as well as the electrical power load of a system.
- Reducing the heat load in certain areas. Ensuring equipment is running as efficiently as possible, not producing excess heat through operation, and ensuring any lost heat is being captured are all measures that can be taken to reduce temperatures – and the need for additional air cooling.

Refrigeration

Refrigeration is essential for manufacturing in such as food and drink and chemicals, where it can account for a significant proportion of overall site energy costs. Fortunately, there are many simple and affordable actions manufacturers can take to reduce energy usage and make significant savings.

No matter what type of refrigeration equipment you have, The Carbon Trust estimates that up to 74% of energy savings can be made from improving maintenance, housekeeping and control.

Typical source of savings in refrigeration



Cold rooms

Cold rooms are typically the most common method of manufacturing product refrigeration. In the table below we focus on the most effective actions you could implement to reduce your site's cold room energy requirements.

General housekeeping measures

- **Keep doors closed:** Introduce good door management procedures and keep cold store doors closed whenever possible. This will keep warm air and moisture out, and energy costs down.
- **Do not obstruct evaporators:** Ensure airflow from the evaporators isn't obstructed. Obstructing air flow can lead to warm air build up, making your refrigeration system work harder to keep temperatures low.
- **Run at the highest temperature for product:** Run your cold store at the highest possible temperature for the product.
- **Don't allow warming in transfer:** Ensure the product loaded into your cold room has not warmed up by being left in an ambient temperature area.
- **Switch off lights:** Turn off lights when not needed or out of hours to save energy.
- **Ensure the cold room is appropriately stocked:** Overstocking can cause refrigeration systems to work harder to keep things at an appropriate temperature, using more energy.

Maintenance and low-cost saving measures

- **Repair any damaged door seals:** If you have automatic or rapid-closing doors, make sure they are not overridden and are maintained in good working order.
- **Install strip curtains:** Well-maintained strip curtains will keep warm air and moisture out. Insulated curtains are available, offering an improved thermal barrier.
- **Upgrade lighting to LED with auto control:** Consider low-power, instant-on lighting which switches off automatically if the store is unoccupied.
- **Maintain and repair wall panel seals:** Ensuring the outside of the cold store is sealed, air-tight and well insulated will keep air infiltration and heat gain to a minimum.
- **Interlocking doors with evaporator fans:** Install interlocks so fans are switched off when the doors are opened, meaning cold air is not blown out of the unit.
- **Ensure regular servicing of the system:** Servicing including cleaning can improve the energy efficiency of the system.

Investment measures

- **Fit automatic/rapid close doors:** If regular access is required, rapid close doors can reduce opportunity for temperature increase.
- **Install defrost on demand system:** Doing so can keep the evaporators in better condition.
- **Install a variable speed drive (VSD) on the evaporator fans:** Doing so will match the evaporators fans to the demand of the system.
- **For forklift accessible cold rooms:** Install a dehumidifying airlock to reduce ice build-up and the need for defrosting.
- **Invest in sliding doors:** When purchasing or replacing a cold room, choose sliding door entry. These have better seals and are less prone to damage.

Compressors

The average factory changes air compressors every 7-10 years, meaning that the initial capital expenditure is only a fraction of how much your compressor will cost you in total. 70% or more of your air compressor's lifecycle cost will come down to its energy usage[3].

Did you know?

- For every degree that temperature lift is reduced, you will save around 4% of the compressor energy for chill temperature systems and 2% for low temperature systems[4].
- A typical condensing temperature in a refrigeration system is 40°C all year round. Setting this to float down to 20°C when the weather allows, would typically reduce compressor energy consumption by 25% to 35% for a chill temperature system[5].

When reviewing energy usage at your site, why not consider the following:

Are compressors located effectively?

It's important to install compressors in a suitable location for maximising energy efficiency. Make sure the initial air temperature in the room is cool. Air compressors generate their own heat, which means additional heat can cause your machine to overheat and shut down. Avoid installing compressors in areas higher than 40oC. Compressors should also be located in spaces where there is good air circulation and ventilation. As they exhaust warm air, keeping compressors in an enclosed space can cause air temperature to rise, making your unit work harder or overheat.

Condensing temperature

Set the condensing temperature as low as possible. It may be possible to upgrade control valves or condensing capacity to allow a further reduction.

Compressor suction pressure

On multi-compressor systems, check if compressor suction pressure is set to as low as required. This can change seasonally. For example, often the summer set point can be lower than winter.

Making use of variable speed drives (VSDs)

Most production processes require different levels of demand in different periods, which may mean that the compressor is running off-load or idle. Great savings can be made if a fixed speed compressor can be replaced by a VSD as it only produces compressed air as and when required. This also minimises offload running of the compressor, which is known to waste energy. A VSD compressor saves an average 35% of energy consumption. They can be retrofitted to existing units or new compressor packs can be bought that include variable speed drives. Consider which option would be most suitable for your site.

Checking and maintaining your compressors regularly

Refrigerant loss is a major cause of direct emissions and system inefficiency. Undercharged systems need to operate for longer to achieve the same cooling capacity, reducing efficiency and putting strain on the system.

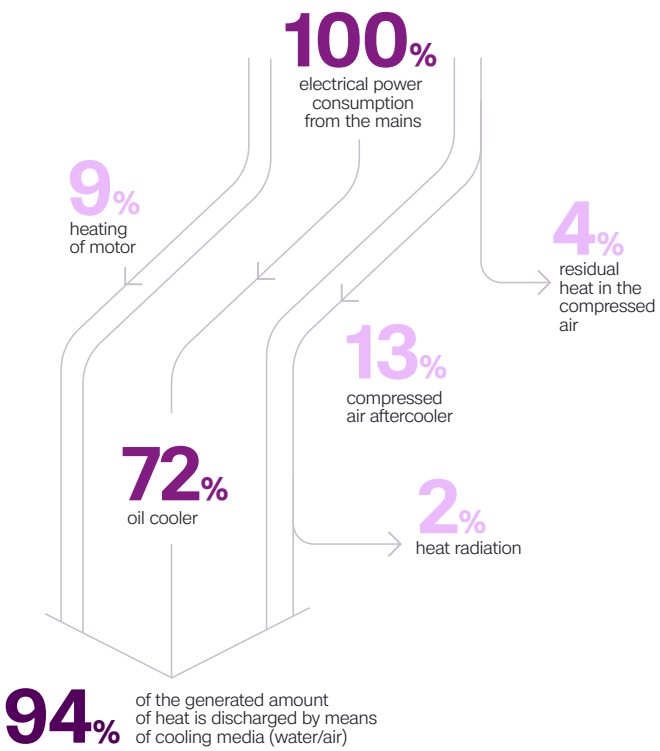
Heat recovery

Refrigeration systems produce a lot of heat which is usually 'dumped' externally and lost. Some, or all, of the heat generated by refrigeration systems can be recovered and used elsewhere on site to reduce heating bills associated with space heating, heating for manufacturing processes and/or for hot water. Consider carrying out a walk-round assessment to identify any potential areas for heat recovery from your refrigeration systems.

[3] https://www.theengineer.co.uk/content/product/10-ways-to-make-a-compressor-installation-energy-efficient/
[4] https://www.atlascopco.com/en-uk/compressors/compressed-air-tips/the-hidden-value-of-compressed-air-heat-recovery
[5] https://www.atlascopco.com/en-us/compressors/wiki/compressed-air-articles/energy-recovery

Heat available from typical refrigeration systems[6]

- Up to 10% at 50 – 60°C : Hot water / Thermal processes
- Remainder at 20-30°C : Supporting space heating / Underfloor heating
- Heat pumps can be used to boost temperatures by design



Data shows that compressed air typically accounts for about 12% of the total energy costs for industrial manufacturers, and for some facilities, this can reach as high as 40%. As over 90% of energy consumed by air compressors is wasted as heat. However, most of this heat can be recovered from hot air or from a cooling water circuit – meaning that there are plenty of opportunities for recovering this heat for better use[7].

Some compressors can generate 90°C hot water while others are limited to air space heating. Consider contacting local specialists to explore how heat recovery could reduce energy usage on your site[8].

Motors

Looking at the impact of the motors used on site may be a source for improving energy efficiency. Technological advances have seen improvements made to the energy efficiency of motors in recent years, but there are still a number of actions you can take to improve your performance further.

Heating

Sizing

- Lightly loaded motors are less efficient than fully-loaded ones, so it is much better that they are loaded as near to their full capacity as possible.
- Consider replacing larger, partially loaded motors with smaller, fully loaded ones.
- Could you optimise a system or process so that motors are running at full capacity for shorter time periods, instead of running continually with a partial load?

Servicing

- Regular servicing will ensure motors are running as efficiently as possible and highlight where further improvements can be made.
- Regular cleaning and maintenance of motors is a crucial step in preventing damage and supporting longer life of the machinery.

Variable Speed Drives (VSDs)

- VSDs can lower energy use, reduce peak demand and improve power factor in many applications.
- Reducing motor speed at start-up and during operation can cut maintenance costs (reducing wear and tear), increase uptime and extend equipment life.
- Controls flow of energy from mains to the motor.
- Regulates and allows for control of motor torque, allowing motor speed to match demand or shut off the motor when not needed.

Good practice

- Leaving electric motors running when they are not needed, e.g. during evenings or at the weekend, is expensive and wasteful. It can also reduce the motor's lifespan.
- Overheating and dirt can also reduce the lifespan of a motor.

[6] https://ctprodstorageaccountp.blob.core.windows.net/prod-drupal-files/documents/resource/public/Refrigeration-guide.pdf
[7] https://www.atlascopco.com/en-uk/compressors/compressed-air-tips/the-hidden-value-of-compressed-air-heat-recovery
[8] https://www.atlascopco.com/en-us/compressors/wiki/compressed-air-articles/energy-recovery

Process equipment

Manufacturing sites use many and various types of process equipment depending on the nature of the sector they are operating in. Fortunately, there are many things that can be done to improve energy efficiency, no matter the equipment you use.

Data collection & management systems

- Data collection, management and analysis are key to maximising the benefits of variable speed drives and motors.
- Doing so can help understand energy output and where reduction opportunities lie.
- This can be done by compiling historical data, installing panel-mounted power meters and using data analysis software.

Slow down or shut off

- Power measurement data combined with variable speed drivers/motors means machines and equipment can be shut down when not needed or turned down where possible.
- Identify key areas of inefficiency and wastage to know where and when to shut off or slow down equipment.
- Adjust speeds and run time to match production demands.

Operator control

- Ensuring staff have relevant machine handling training is essential for understanding best practice and improving the efficiency of equipment.
- Regular refresher training should be carried out to ensure 'bad habits' don't creep in and reinforce commitment to improving energy efficiency.

There are many benefits to increasing the energy efficiency of your site's process equipment. These include:

- Increased output efficiency
- Reduced cost-of-production
- Reduced downtime
- Streamlining production

Renewables

Switching to renewable energy can be another way your site could improve its environmental performance by decarbonising your energy use. There are many sources of renewable energy, each with their own strengths and weaknesses. These include:

Solar photovoltaic (PV)

These versatile systems require daylight to generate electricity. They are most suitable for buildings with a roof or wall that faces within 90 degrees of south, although the output of the system decreases when in shadow so beware of high buildings or tall trees.

Wind turbines

These large and heavy structures require a structurally sound ground or roof foundation, as they exert significant force. Turbines also generate noise and require optimum wind speeds in order to operate at peak efficiency. Planning permission will also be required.

Biomass

Biomass boilers can displace oil, gas and other fossil fuels to provide heating for buildings, water and other process heat demands.

Solar thermal

Solar thermal panels are highly efficient for heating water and require less surface area and light than Solar PV. They should be maintained regularly to ensure smooth running.

Battery storage

Can be used to store excess renewables generation (Solar / Wind) primarily during low consumption. They result in no carbon emissions although are expensive to purchase.

Hydro electric

Hydro-electric energy has a high efficiency rate and, with access to a stream or river, is more consistent than wind or solar. However, technology remains extremely expensive, requires planning permission, and may harm local ecology.

Case study

Euro Quality Cladding Ltd is a Kildare based manufacturing firm, specialising in producing high quality roof and cladding products for a diverse range of sectors including agriculture, commercial, education, healthcare, leisure & residential.

In Q4 2022, as part of an extensive capital investment programme, the business installed 20 solar panels on the roof of its facility. In their first month of operation in January 2023, the solar panels generated approximately 27% of the business's energy requirements - resulting in a material saving for the business with a potential payback period of between 3 to 5 years.

EQC
Euro Quality Cladding

Efficiency measures - Transport

The transport used across your business activities – both on site, and outbound transportation of goods – can have a huge effect on your environmental impact. Manufacturing operations often require heavy duty and fuel intensive vehicles, designed to carry large and heavy loads. With this in mind, ensuring transport is used as efficiently as possible has the potential to generate significant environmental and financial savings.

Consider the following measures for improved efficiency:

Vehicle efficiency

Vehicle spec

Look for vehicles with excellent fuel economy and low CO2 emissions.

Vehicle sizing

Larger, heavier vehicles will generally be less fuel efficient, so consider vehicle size and aim for the smallest appropriate vehicle for the operation.

Speed limiters

Are a common means used to improve fuel efficiency.

Idling

Use of stop start technology reduces fuel consumption from idling.

Fuel management

Measurement

Fuel consumption should be tracked though fuel card invoices or staff expense claims on a fleet, driver and vehicle basis.

Fleet management software

Telematics software is a precise way of collating fuel use data within vehicle fleets. It can provide operators with information from location and speed, to engine diagnostics and driver behaviour.

Replacing inefficient vehicles

Data

Information such as mileage, fuel efficiency, disposal costs, salvage value, expected maintenance costs and fuel cost estimates, can all be used to calculate the optimal replacement time for older vehicles.

KPIs

Setting targets can highlight when vehicles are past their peak performance which can allow businesses to plan strategically.

Driver training

Poor driving behaviours

Speeding, frequent breaking, and idling are strongly associated with inefficient fuel consumption, contributing to higher fuel and maintenance costs. Sustainable driving awareness training could be offered during new start induction sessions or staff refresher sessions.

Accelerating only when necessary

The accelerator is not a constant requirement. Going downhill and slowing down present opportunities to activate the fuel cut-off switch by removing the foot from the accelerator at the earliest opportunity and remaining in gear as the vehicle travels, reducing fuel flow.

Early gear changing

The higher the gear (relative to the desired speed), the lower the RPM, the better the fuel economy. Moving to a higher gear earlier, and skipping gears if appropriate, helps reduce fuel consumption.

Going electric and alternative fuels

Electric options

Different options have emerged over the last few decades including electrification and hydrogen fuel cell batteries. Electric (EV), battery powered electric (BEV) and plug-in hybrid (PHEV) trucks are becoming more popular amongst urban operators.

Alternative fuels

Such as Hydrotreated Vegetable Oil (HVO) and biogas have offered lower emission fuel alternatives for Internal Combustion Engines, often can be used as drop in replacements and these can have up to 96% less carbon emissions.

Efficiency measures - Water & wastewater

Looking at your site's water usage – and how that waste water is treated – can provide additional opportunities for cleaner, greener performance.

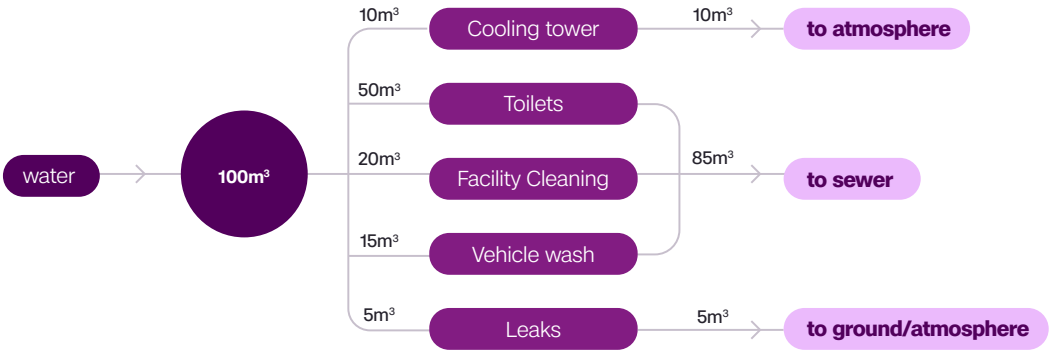
We outline a few simple techniques that can be used to target and reduce water demand.

Water balance

A water balance is based on the simple concept that what goes in must come out. Ideally your water balance will numerically account for: the types and sources of water entering your business, where water is used within your business and how water is exiting your business. Understanding where and how water is used in your business on a quantifiable basis will help you manage water use.

A good water balance will typically account for over 90% of water use in your business.

An example of what a mass water balance looks like[9].



Once you have established an overview of your water usage, and are confident that your water data is accurate, you can begin to develop a water profile for your site's daily water use. This can inform where water efficiencies can be made through water reduction opportunities.

Questions to consider when developing a water profile for daily usage:

- Is water being used unnecessarily during out-of-hours?
- Does water use reduce during breaks? If so, are staff leaving non-essential water using equipment on?
- Are there irregular spikes in water usage?
- Identify reasons for irregular water usage where applicable.

[9] https://www.investni.com/sites/default/files/documents/static/library/invest-ni/documents/water-efficiency-guide-a-practical-guide.pdf

Water saving techniques for manufacturing processes

Flow controllers

Many types of manufacturing equipment require pre-set water flow rates to operate effectively. Often that equipment may be commissioned at the pre-set flow rate but due to pressure fluctuations, operator interference or the use of a poorly designed control system water is often wasted through overuse. The use of in-line process control or flow limiting technology can minimise water wastage. Consider installing process control devices or flow limiting devices to limit unnecessary water usage.

Nozzle & spray technology

New advanced nozzle and spray device technology available can reduce water use. Nozzle configuration should be matched to process requirement (e.g. flow rate, spray pattern, physical and chemical properties of material to be rinsed, spray impact and droplet size). For existing nozzle systems, ensure they are well maintained as blocked nozzles can result in increased water use.

Water management equipment for mechanical seals

Mechanical seals are leakage control devices found on rotating equipment such as pumps, compressors, rotating equipment and mixers to prevent the leakage of liquids and gases into the environment. To allow seals to operate correctly, clean water is injected to provide lubrication, which is referred to as seal water. While seal water flows are typically small, they are often continuous and can result in high water use over time. To minimise seal water use, water can be conserved by optimising flow rates using a flow regulator or by recycling seal water.

Leakage detection equipment

Due to the complex and inaccessible nature of a water distribution network, it is often difficult to identify leakage without the help of leakage detection equipment. Several technologies exist for logging data, monitoring systems and identifying inconsistencies that may indicate leakage in your water distribution network.

Vehicle wash water reclaim equipment

Vehicle wash water reclaim equipment is purpose designed - consisting of a collection, treatment, and storage and control system. Treatment usually involves filtration of the wash water to remove grease and oils and settlement to remove suspended solids. Removal of suspended solids is particularly important to prevent damage to vehicles during washing activities.

Clean-in-place (CIP) systems

CIP systems can achieve significant savings through the more efficient in-situ cleaning of pipes, tanks and other process equipment. This technology is generally used in businesses that regularly clean vessels, pipework and fittings. As well as saving water, a good CIP system will provide substantial benefits such as reduced cleaning chemical use, energy and labour time; the opportunity to recover and re-use fluids; and improved cleanliness and hygiene.

Rainwater harvesting equipment

Increased mains water charges and increasing water supply risks have led to renewed interest in a wide range of technologies for the collection, storage and treatment of rainwater. Rainwater can be useful in non-potable applications such as cooling and cleaning. Rainwater harvesting equipment is purpose-designed consisting of collection, storage, pumping, control and treatment system(s) as appropriate, and can reduce your demand for mains water to save money.

Industrial cleaning equipment

Alternative cleaning equipment can reduce the need for water. For example, **scrubber/driers** operate by recovering dirty wash water from the floor surface, processing it and then reusing it with dirty effluents stored in a reservoir in the machine. Steam cleaners use high temperature steam to sterilise an area which can kill bacteria and breakdown grease without the need for chemicals.

Wastewater treatment

The toxicity, mobility and loading of industrial pollutants have potentially more significant impacts on water resources, human health and the environment than actual volumes of wastewater.

The first step in managing wastewater s to keep the volumes and toxicity of pollution to a minimum at the point of origin, from concept to design and in operations and maintenance. This includes substitution with more environmentally friendly raw materials and biodegradable process chemicals, as well as staff education and training to address pollution-related issues. The second step is to recycle as much water as possible within a plant, thus minimizing discharge10. After these issues have been considered and addressed, there are a wide range of filtration technology options available to return wastewater to acceptable standards.

The planned use of treated and partially treated wastewater for ecosystem services can increase resource efficiency and provide benefits to ecosystems by reducing freshwater abstractions, recycling and reusing nutrients, allowing fisheries and other aquatic ecosystems to thrive by minimizing water pollution, and recharging depleted aquifers.

Case study

Glenisk is an award-winning, family-owned and managed organic dairy from Killeigh, Co Offaly. A pioneer of organic agriculture, Glenisk sources organic cows' and goats' milk from 50 small family farms across Ireland.

A leader in sustainability, the business operates its BRC AA manufacturing facility on renewable energy and uses certified carbon-neutral packaging. Known for innovation, Glenisk was first to market with many ranges including goats' dairy; high protein yogurt; no-added sugar children's yogurt and on-the-go granola yogurts.

Located away from municipal water infrastructure in rural County Offaly, the business has developed a novel approach to managing wastewater. Following an initial separation process, the production water then passes through seven individual reed beds which are set out across six acres - before flowing safely back into the local ecosystem. The reed beds not only act as a natural means of purifying wastewater to meet the highest regulatory standards, but also have the added benefit of encouraging biodiversity across the site, in addition to acting as a carbon sink.

glenisk
naturally from Ireland

Efficiency measures - Raw materials

The raw materials used in your manufacturing process all contribute to your business's environmental impact. Luckily, there are many opportunities for ensuring you are using the most sustainable options for your requirements. One of the most effective ways to improve the efficiency of your raw materials is to ensure they are being used to their fullest potential and used at their highest value possible.

Why not take a look at the most frequently purchased goods with your Procurement Manager and for each, ask the following questions.

Questions to consider when purchasing raw materials:

- Is this item necessary?
- Is the item reusable?
- Are you using all of the material?
- How durable/repairable is the item?
- Is the item recyclable?
- Has the item been made with a high virgin or recycled content materials?
- How energy efficient is the item/service?

As well as the raw materials you purchase, it's also important to consider the packaging used for your product. Different packaging materials all have different properties that can make them more or less effective for protecting and transporting specific products.

Unsurprisingly, these different materials have different impacts on the environment.

To help you assess if you are using the most effective packaging type for your product, consider these areas:

Material sourcing

- What type of material is it?
- Where is it produced / supplied from?
- Is it produced sustainably (e.g. FSC cardboard, made from recycled plastic)?
- Is your packaging made from a renewable source?

Functionality

- Can you switch to a more sustainable material without impacting packaging functionality?
- How does the weight and size of your packaging impact outbound transportation?
- Can your packaging be made smaller to fit more products into a delivery load?

Disposal

- Can your packaging be reused?
- Is your packaging recyclable?
- Are sustainable disposable methods labelled on the packaging?

Efficiency measures - Waste

For all material types, all businesses should aim to prevent or eliminate waste by using materials efficiently from the outset, wherever possible, as this will almost always save money as well as environmental impact.

The Waste Hierarchy identifies waste management options and ranks them in terms of sustainability, providing you with a sustainability framework for material use to work towards.

Waste hierarchy

Prevention

The best way to manage waste is to prevent it from occurring in the first place! This could include adapting working practices and purchasing products that don't result in unnecessary waste.

Reduce

Where the elimination of waste is not possible, consider how it can be reduced. This could include purchasing products that have less packaging or using less of the material, slowing down the waste generation process.

Reuse

Making use of your raw materials again (and again, if possible!) to increase product lifespan.

Recycle

Recycling makes use of a material and processes it for further use in another form. This process is energy intensive and still results in residual waste, therefore should be considered where waste prevention or reduction is not possible.

Recover

Waste from energy (or energy from waste) is the generation of energy in the form of heat or electricity from waste as can be seen in anaerobic digestion, pyrolysis and modern incinerators as part of an integrated waste management strategy.

Disposal (to landfill)

Disposal is often the most costly waste management option – both financially and to the environment. Aim to 'move up' the waste hierarchy so that your business can save money, raw materials, water, energy, and your environmental impact.

Order to follow

Did you know?

→ Preventing waste has been estimated to save up to 10 times the actual disposal cost, due to the hidden costs of waste such as lost labour time, energy costs, lost materials.11

Common waste streams in manufacturing

Process wastes and by-products

Process wastes are materials, energy, or by-products that are generated as a result of the manufacturing process but are not fully utilised or discarded. These can have environmental and economic implications. Examples of process wastes include:

Scrap materials

such as leftover metal pieces, swarf, plastic trimmings, skeletal wastes, off-cuts or fabric scraps, which are discarded and may require proper disposal or recycling.

Heat or energy waste

such as excess heat or energy generated during production processes, which may require proper management or utilisation to reduce energy consumption and environmental impact.

By-products

are secondary products that are generated during the manufacturing process.
They may have commercial value or can be utilised in other applications. These may include:
slags, shavings, sawdust, or organic feedstocks e.g. wood shavings and sawdust from wood product manufacturing processes can be used for heat generation purposes

Case study

The Galtee Group is a family owned and operated wood product manufacturing firm located in Ballylanders, Co. Limerick. Across its' three companies it produces an extensive range of high quality doors, wooden panelling in addition to a range of sustainable wood fuels.

The group has invested in a wide number of initiatives to reduce its carbon footprint and create financial savings within the business – with further investment planned in the short and medium term. One key initiative was the installation of a biomass boiler, which is fuelled by wood chip and shavings from the businesses manufacturing processes. Since its' installation, the boiler now generates all of the Groups' operational heating requirements – saving the business an estimated €60,000 per year.

Galtee Group

Hazardous

Hazardous waste arises from any waste classified as hazardous under the European Waste Directive. Generally, it pertains to chemicals and other dangerous substances. These are often more expensive to deal with as they require specialised storage, handling, transporting and processing. Hazardous waste can be reduced by:

- Researching and procuring non-hazardous substitutes
- Preventing overstocking and ensuring expiry dates are observed
- Ensuring correct procedures for storage are observed
- Ensuring plant machinery, equipment and processes are making optimal use of chemicals and substances
- Consider recovery technologies for "spent" chemicals and other hazardous materials.

[11] https://www.investni.com/sites/default/files/documents/static/library/invest-ni/documents/waste-minimisation-efficient-management-for-cost-savings.pdf

Food waste

Food waste from food manufacturing can occur at various stages of the operational processes. The most effective way to reduce food waste is to identify where the waste is occurring most frequently. Consider if food is being wasted:

- Due to damage during delivery?
- As a result of process equipment not working efficiently?
- As a result of human error during processing?
- Through loss during the packaging process?
- By not passing quality control? Is this preventable?

Packaging waste

Consider if efficiencies can be made:

- By purchasing in bulk. Larger order quantities often mean that more units can be delivered in the same volume of packaging.
- By returning packaging to the supplier for reuse.
- By reusing inbound packaging internally. If it isn't reusable, could you switch to a reusable one?

Circular economy opportunities

Reframing waste as a resource could also support manufacturers' move up the waste hierarchy and improve their environmental impact. Consider if you could adapt your current practices to more circular ones by exploring if your wasted resources:

- Could be unnecessary, is there a need for them to be used at all?
- Could be recovered and reused again? – solvents, shot blast, swarf, shavings
- Could be used as a resource within your existing product?
- Could be used to create another product?
- Could be used by another company, instead of going to waste? Or, can you use another company's wasted resources instead of using virgin materials?
- Could be used as part of a take-back scheme to keep items in circulation?

Social sustainability

Social sustainability assesses a company's engagement with, and impact on, its workers, customers, suppliers, and the local community. Organisations can positively contribute to fairness in society, investing in fair and equal opportunities and conditions for employees, people working in the supply chain, and local communities.

The benefits of improving social sustainability in your business include:

- Improving business reputation.
- Attracting employees who value working for a socially and environmentally conscious employer.
- Attracting customers who may be more willing to support socially and environmentally progressive businesses compared to those who are less so.

There are many ways in which social sustainability can be promoted in your operation, depending on the different stakeholder groups you interact with. We've outlined some of the top things to consider when engaging with these three, key stakeholder groups.

Workforce

- Providing regular training and support to staff to improve their confidence and sense of value in the team. Staff who feel valued and included within the team are more likely to perform well and foster company loyalty. This can reduce costs associated with staff turnover and low productivity.
- Supporting health, safety, and wellbeing, making your operation a safe, welcoming, and desirable place to work.
- Promoting equality in the workforce with diversity and inclusivity policies.
- Identifying and supporting career development.

Suppliers

- Preventing abuses within the supply chain, such as labour rights, including modern slavery.
- Uphold standards of fair trade and social equality.

Customer and community

- Ensuring products and services are safe for customer consumption.
- Preventing social injustices and promoting equality and inclusion within customer base.
- Contributing to the local community, such as investing in local projects or funding educational initiatives,
- Donating products or redistributing surplus food/drink to those in need.

Additional resources

- **Sustainable Energy Authority of Ireland** is Ireland's national sustainable energy authority, working with businesses to create a cleaner energy future.
  https://www.seai.ie/business-and-public-sector/

- **SEAI Lighting Guide** provides information on efficient lighting advice and best practice tip
  https://www.seai.ie/publications/SEAI-Energy-Efficient-LED-Lighting-Guide.pdf

- **The Carbon Trust** provides advice and support to businesses looking to improve their environmental performance.
  https://www.carbontrust.com/

- **The Environment Protection Agency** The EPA advise on and regulate many waste management topics and are an excellent source for compliance and good practice advice and publications.
  https://www.epa.ie/publications/

- **WRAP** (The Waste and Resources Action Programme) offers advice and support on how to manage waste. It encourages businesses to prevent landfill waste by efficient resource use, maximising reuse and increasing recycling streams.
  www.wrap.org.uk

- **Repak** Repak's Prevent & Save Programme offers free packaging optimisation and design advice to Repak Members, helping them to reduce packaging and waste.
  https://repak.ie/members/packaging-optimisation-design/

Appendix 1

Sample - measuring, monitoring & targeting table

Weekly or Monthly Period	Total Consumption (kWh, Litres etc.)	Total Cost [€]	Influencing Factor (production units, tonnes output, miles travelled etc.)	Normalised Key Performance Indicator (kWh/tonnes, litres/mile etc.)
Jan				
Feb				
Mar				
Apr				
May				
Jun				
Jul				
Aug				
Sep				
Oct				
Nov				
Dec				
Total				

	Electricity			Day Units				Night Units		
Weekly or Monthly Period	Total Consumption [kWh]	Total Cost [€]	No. Units [kWh]	% Units [%]	Total Cost [€]	% Cost [%]	No. Units [kWh]	% Units [%]	Total Cost [€]	% Cost [%]
Jan										
Feb										
Mar										
Apr										
May										
Jun										
Jul										
Aug										
Sep										
Oct										
Nov										
Dec										
Total										

Mabbett

Established in 1996, Mabbett are a leading independent environment, engineering, planning and safety consultancy with offices throughout Ireland and the UK.

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