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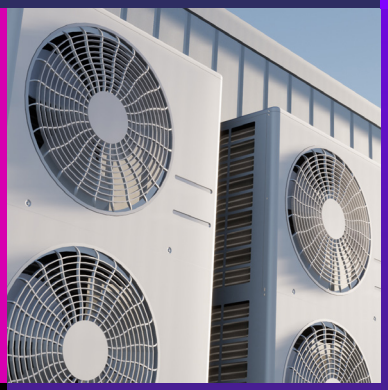





Energy efficiency playbook

Lessons from manufacturers on adopting energy efficient and low-carbon technologies

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Introduction

The UK is widely recognised for its world-class research and innovation base, producing breakthrough discoveries and technologies that have shaped industries worldwide. However, innovation only delivers its real economic and societal value when it is adopted and implemented at scale.

Introducing new technologies into existing processes and products can present significant technical and organisational challenges. For many businesses, concerns about cost and disruption can slow adoption, even when the benefitsof the technologies are clear.

Government research estimates that the impact of adopting emerging technologies like robotics would result in an **8.39% growth of real GDP by 2035**.[1] Adoption is therefore a critical part of the innovation process and key to delivering the government's Modern Industrial Strategy. Where research creates new possibilities, adoption turns them into increased productivity and economic impact.

Why a playbook?

Technology adoption is a journey of multiple business decisions made over time. Businesses need to identify the opportunity, build confidence, secure investment, manage change and overcome practical barriers to implementation.

This playbook responds to a gap highlighted by manufacturers and industry experts. Businesses are often told that they should reduce energy use and emissions, but not how to identify and implement the right intervention for their site. Many also lack the in-house capability to do so, as experienced engineers retire and SMEs often cannot support dedicated energy or sustainability specialists.

The playbook therefore focuses on the how, not just the what. Drawing on practical lessons and real-world examples, it presents common challenges and how others have approached them. There is no single route that works for every manufacturer, but the playbook provides practical principles to help businesses make informed decisions and move forward with confidence.

[1]Equivalent to £223.4 billion when measured in 2023 GBP. PwC for the Government Office for Science, 2025.

We focus on six stages of the technology adoption journey:



1. Recognise the need

Should we be thinking about adopting new technologies?
Identify the challenge and if new technologies or processes could help.



2. Explore the options

What options should we consider?
Explore the right opportunities for your business.



3. Find the right time

When should we act?
Recognise and prepare for key adoption windows.



4. Build the business case

Is this worth investing in?
Assess costs, benefits, risks, and evidence to align the project with business priorities.



5. Secure agreement

How do we get agreement?
Engage the right stakeholders and gather support.



6. Deliver the project

How do we implement successfully?
Plan delivery carefully and ensure expected benefits are realised.

Why focus on energy efficiency and low-carbon technologies?

Energy efficiency and low-carbon technologies help address both national and business priorities. The government's missions and Modern Industrial Strategy identify growing clean energy industries and reducing emissions as key national objectives. At the same time, manufacturers are increasingly focused on strengthening their resilience and reducing exposure to volatile energy prices. Make UK and Ecotricity Business found that **90% of manufacturers** have seen energy bills increase since 2022, and half of them cite these as their biggest business challenge.[2]

Many energy efficiency and low-carbon technologies already exist and have proven benefits that can help address these issues. Yet businesses still often face practical challenges when deciding whether and how to adopt them. This makes them a useful technology to explore the wider realities of technology adoption.

[2] Make UK, 2026.
[3] IEA, 2014.
[4] BEIS, 2021.

Technology definitions

Energy efficiency

A process is more energy efficient if it delivers more services for same energy input or same services for less energy input.[3]

Low carbon technologies

These technologies supply or use energy with much lower greenhouse gas emissions than fossil-fuel alternatives. For manufacturers, these include heat pumps, solar PV and thermal, battery storage and switching to lower carbon fuels.[4]



Why manufacturing?

Manufacturing accounts for **8.3% of the total economic output of the UK**[5] and for around half of all business R&D expenditure.[6] Its importance also comes from its position within supply chains, which means improvements in productivity can reduce costs and create wider benefits across the economy.

The Modern Industrial Strategy highlights the importance of supporting both high-growth manufacturing sectors and the wider supply chains and the foundational industries they depend on. Technology adoption therefore presents an opportunity to strengthen the industrial ecosystem that enables future growth.

The playbook takes a cross-sector manufacturing perspective but draws heavily on insights from food and drink manufacturing. As the UK's largest manufacturing sector, employing almost **485,000 people** across more than **12,000 businesses** and a major user of energy,[7] it provided a valuable case for understanding how businesses approach technology adoption in practice. The sector also includes a large number of SMEs which makes many of the challenges around resource constraints particularly visible.

Consultation with technology and industry experts validated that many of the lessons are relevant across manufacturing. While individual technologies and processes may differ across sectors (and are not all covered within this playbook), many of the challenges and decision-making considerations are remarkably similar.

The food and drink manufacturing sector employs almost 485,000 people across more than 12,000 businesses[7]



[5] House of Commons Library, 2026.
[6] Department for Business and Trade, 2025.
[7] Department for Business and Trade, 2025.

How was this playbook developed?

This playbook is grounded in the experiences of businesses and experts involved in technology adoption across UK manufacturing.

It draws on insights from:



Workshops

Attended by 26 organisations from across Innovate UK Business Connect's network.



In-depth interviews

With 10 manufacturers, consultants, technology providers and innovation specialists with direct experience of energy projects in manufacturing. Together they have worked with more than 500 businesses across the UK.



Desk-based research

On published case studies and reports, complemented by sector and technical expertise from Innovate UK Business Connect specialists in our clean energy, agri-food, design, health, chemistry and industrial biotechnology and futures teams.

No two businesses are the same and this playbook is not intended to be a definitive or statistically representative guide. However, recurring themes emerged across our workshops and interviews which signal that many of the challenges and lessons captured are widely shared.



Check out

A full list of contributors and interviewees can be found in the **'Special thanks'** section.

The adoption journey

Technology adoption rarely happens in a single decision. A key insight from our engagement with experts is that businesses tend to move through a series of questions, from recognising a need for change to successfully implementing a solution.

While the stages are presented separately in this playbook, manufacturers often revisit earlier decisions as new information emerges and priorities change.
This playbook follows that journey.



The adoption journey

Policy and regulation

Government policy, regulation and customer requirements can create both opportunities and constraints.

Market conditions

Energy prices, economic pressures and market demand influence what is commercially viable and when investment is possible.



Support and finance

Grants, funding programmes and external support can help de-risk investment and open up new opportunities.

Learning from others

Peer networks, case studies and shared experiences can help build confidence and accelerate progress across the sector.

Beyond businesses' control

Many of the decisions in this playbook sit within a business's control. The wider environment does not. Policy, market conditions, support programmes and industry learning all influence what is possible and attractive to invest in. Understanding these factors can help businesses anticipate challenges and opportunities and decide when to act. Some of them include:



Policy and customer expectations

Businesses often make equipment investments that need to deliver value for decades, while the policy and commercial environment can change much faster. Changes in regulation and customer expectations can therefore affect both the case for investment and what businesses are expected to demonstrate on emissions and sustainability.



External support moves things forward

External support can certainly help businesses look into opportunities that may otherwise be too daunting to explore. Participants stated that grants, demonstrators, funded assessments and advisory programmes are instrumental to reduce both the cost and uncertainty of adoption. However, access to these programmes can change over time and may not always align with a business's investment plans.



Uncertain market conditions

The past few years have created uncertain market conditions for UK businesses. Geopolitical tensions disrupted supply chains and the cost-of-living crisis has exacerbated the tight margins manufacturers such as those in food and drink work with. Even technologies that make operational sense may not progress if the financial conditions are not right.



Learning from others

Businesses value learning from other businesses. Manufacturers repeatedly asked for practical case studies and lessons from organisations that had implemented similar technologies. Sharing experiences helps reduce uncertainty and build confidence across the sector.



Need help finding the right support?

Innovate UK Business Connect can help you connect with relevant experts, partners, facilities, and funding opportunities. It can help you identify where to go for further advice, connections and support as your project develops.

Explore Innovate UK Business Connect support

Recognise the need

Should we be thinking about adopting new technologies?

Every journey towards adopting new technologies starts with recognising a need for change. This may be driven by external pressures, future challenges or internal priorities. Across the businesses we spoke to, several common drivers emerged:

Internal drivers

Business strategy and leadership vision

Some businesses view technology adoption as part of a wider strategy to improve competitiveness and access future markets, driven by strong leadership and a clear vision.

Growth and expansion plans

New production lines or site expansions can expose limitations in existing systems, creating an opportunity to upgrade energy infrastructure ahead of future growth.

Operational needs

Ageing equipment, reliability issues, excessive heat, maintenance costs and health and safety concerns can trigger change. New technologies can improve working conditions, reduce risks and offer alternatives to like-for-like replacement.

Consider

The decision to act isn't always driven by energy or sustainability goals. Health and safety concerns or insurer requirements can create a stronger case for change, making energy efficiency a solution to operational challenges rather than a sustainability initiative.

Productivity and operational performance

Some businesses adopt new technologies to improve reliability, productivity or reduce waste, with energy savings an added benefit.

Building a more resilient business

Rising costs and uncertain energy markets are encouraging manufacturers to strengthen resilience. Technologies that improve flexibility and supply chain security can support long-term stability.

Sustainability commitments

Although often secondary to cost savings and resilience, carbon reduction targets and net zero ambitions remain important drivers for reviewing energy use and reducing emissions.

External drivers

Energy costs and market volatility

Energy prices keep getting higher and harder to predict due to geopolitical instability and changing energy-market conditions. In 2025, 79% of businesses expected their energy bills to increase for the fourth consecutive year, and 48% reporting that energy accounted for at least a quarter of total business costs.[8] As a result, manufacturers are investing more in energy management and efficiency to protect themselves from future price shocks.

> Of 40 SME businesses surveyed after Covid, only one had seriously considered sustainable energy systems as part of its business development strategy. While awareness of decarbonisation, sustainability, and resilience had been growing, it was the recent energy crisis that brought these issues into focus.



Insight from
Steve Peace, Datrys

Supply chain and customer requirements

While sustainability was less prominent than cost or resilience in our workshops, customer expectations can create a commercial reason to act. This can be particularly important for businesses supplying larger organisations with net zero commitments or SBTi targets or where sustainability requirements may form part of procurement decisions. Make UK found that 61% of manufacturers receive enquiries from customers about ESG standards.[9]

Regulatory and policy pressure

Changing requirements can create new expectations around measuring energy use and demonstrating progress towards decarbonisation. Anticipating policy developments can help identify risks and requirements early, before they become more difficult or costly to address.



[8] Department for Business and Trade, 2025.
[9] Make UK, 2026.

What successful adopters need to do:

- Identify the main operational, commercial or strategic challenge before looking for solutions
- Consider how customer, supply chain and market expectations may change over the next few years
- Stay informed about relevant policy and regulatory developments through trade associations, industry newsletters, and business-support organisations
- Explore whether new technologies or processes could address current or upcoming business needs

Try the Innovation Canvas

If you are exploring an innovation project, the Innovate UK Business Connect Innovation Canvas can help you take a broader look at the opportunity, identify areas of uncertainty and bring colleagues together around next steps.

While not specifically designed for technology adoption, it can complement the questions in this playbook by helping you consider the wider factors that could affect your project.

Explore the Innovate UK Innovation Canvas



Explore the options

What options should we consider?

Manufacturers can often attribute energy efficiency to costly technologies and high investments. However, there are several steps that manufacturers can take with varied levels of investment and disruption. We identified six stages to improve energy efficiency.

The most effective approach to reduce energy consumption and emissions is to make the most of existing assets before investing in major new equipment. Manufacturers and industry experts mentioned that significant savings can often be gained from optimising and reviewing current processes before large capital projects need to be considered.

Stage 1
understand and optimise

- Monitoring and metering
- Maintenance and leaks
- Process optimisation
- Review energy tariffs and contracts

Stage 2
reduce losses

- Insulation and heat loss reduction

Stage 3
recover and reuse

- Heat recovery

Stage 4
upgrade to efficient equipment

- Motors
- Refrigeration and cooling upgrade

Stage 5
switch to low-carbon energy

- Solar PV or thermal
- Heat pumps and fuel switching
- Batteries storage

Stage 6
redesign the process

- Major process redesign

End of equipment life?

As identified as one of the potential adoption windows before, when equipment is due for replacement, use the opportunity to bring **Stages 4 and 5** forward.

Stage 1 understand and optimise

Start by understanding where energy is used and removing waste through better monitoring, operation and maintenance. These measures typically require little or no capital investment.

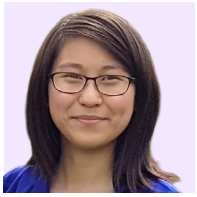
1.1 Measure and monitor energy use

You cannot manage what you do not measure. Manufacturers and industry experts identified monitoring as one of the biggest missed opportunities to educe energy consumption. Monitoring includes assessment on operation and identifies obvious inefficient practice. This includes site-level utility data, sub-metering of production areas, and machine-level measurement.

Digital tools that can support process monitoring include:

- Smart monitoring system
- Energy management software
- AI-assisted optimisation

> Businesses have an overall energy bill, but without more detailed data, they can't break down where that energy is being used. Having that visibility is key to identifying inefficiencies and making savings.



Antonia Cheng, Businesswise Solutions

Raynor Foods: turning sub-metering into a factory-wide game

Sub-metering only cuts energy if people act on what it shows. This Chelmsford sandwich manufacturer linked every meter to team targets and rewarded the staff who hit them.

The problem: Sandwich production is especially resource-intensive, and most businesses in the sector lack the tools to measure and reduce their footprint. Raynor wanted to focus on its internal operations and the role its people play.

The solution: Every factory process was sub-metered and linked to individual or team KPIs. Staff wore 'game links' to track positive actions that allowed them to earn points, such as by cutting overproduction, and waste and electricity per pack. An AI engine powered real-time dashboards and alerts. The devices were deliberately called 'game links' rather than 'tags' to avoid any sense of surveillance, and taking part was voluntary.

Savings: | 19% cut in energy use and emissions | over 400 tCO2e | up to £50,000 (initial 7 months).

Source: Made Smarter, Raynor Foods case study.

1.2 Maintain equipment and reduce leaks

Identify equipment that is not operating as intended. Ensuring that all equipment and processes are maintained at appropriate frequency can reduce unnecessary energy use. This step needs to be done prior to process optimisation. Steam and compressed air systems leakage are typically highlighted as a major source of wasted energy.



Consider

When was your maintenance schedule and your compressed air system last audited?

Industrial bakery: finding compressed-air losses during shutdown

This large 24/7 bakery uses around 3.8 GWh of electricity a year and relies heavily on compressed air. Continuous energy monitoring revealed a problem that was difficult to spot during normal production.

The problem: Small leaks and open valves are hard to detect amid the noise and activity of a busy production floor. During the Christmas shutdown, monitoring showed an unexpectedly high baseload on the distribution board serving the compressed-air system.

The solution: A targeted site survey found several small valves left open in remote locations. Because of where they were, and the plant's normal background noise, they had gone unnoticed. The valves were isolated and repaired, removing unnecessary demand on the compressors.

Savings | 88,500 kWh a year | £20,000 a year | 11.6 tCO_2e a year (Scope 2) | | Payback under 1 month |

Source: Businesswise Solutions Ltd.



1.3 Optimise existing processes

Simple process changes can often deliver immediate savings with little or no capital investment. This means ensuring the manufacturing process is being efficiently operated.

Areas to review:

- Production scheduling
- Control parameters
- Production throughput
- Manual record-keeping and data collection
- Equipment shutdown procedures
- Equipment left running idle



Consider

Could the same output be achieved using less energy?

Optimisation is an important first step for smaller manufacturers:

> Businesses are often very reactive rather than planning ahead. Equipment fails, it gets repaired or replaced, and investment decisions are made around immediate operational needs rather than a longer-term energy strategy.



Insight from Victor Gutierrez, Businesswise Solutions

Smaller companies tend to operate under tight margins and limited capital, meaning investment decisions are often driven by immediate operational needs rather than long-term optimisation. Where large investments seem unreasonable, optimising existing processes are a useful and first step to reducing energy costs.

Harrogate Brewing Company: live production data in a craft brewery

As production and the product range grew, the brewery's manual processes became unsustainable. Digital production management and remote fermentation monitoring gave the team live data to run the brewery more efficiently.

The problem: Facing tight margins and rising energy and ingredient costs, the brewery needed better information and more control over production.

The solution: A brewery management system covering planning, stock, and traceability was combined with connected equipment to monitor fermentation remotely which reduced manual sampling. This ran alongside separate work to monitor energy use across the brewery. Made Smarter provided a digital roadmap and a £7,500 grant towards the £17,000 project.

Savings | 3% lower daily energy usage (1st yr) | 12% shorter brew times | | 5% higher production yields |

Source: Made Smarter (Yorkshire).

1.4 Review energy tariffs and contracts

Once it is understood where and when electricity is used, verify if the current tariffs and supply contracts are still suitable for the site's operation. An unsuitable contract can add significant cost without any changes in consumption and renegotiating it can be one of quickest savings available.

Areas to verify:

- End date of current contract and the rates for new contract
- Tariff structure matches production pattern (e.g. peak and off-peak use)



Stage 2 reduce losses

2.1 Insulate to reduce heat loss

Poorly insulated equipment was cited as one of the easiest opportunities for improvement.

Opportunities include:

- Lagging, hot pipe, and boiler insulation
- Cold store improvements

Industrial brewery: insulating non-standard equipment

At this mid-sized industrial brewery, vessels, pasteurisation tunnels, heat exchangers, steam traps and boiler-house equipment were releasing waste heat into occupied areas. Thermal imaging showed that equipment most plants assume is not worth insulating was a real opportunity.

The problem: Frequently accessed equipment had often been left bare because conventional belt- or lace-fastened jackets sagged and were difficult to remove and refit. During the summer, the heat raised room temperatures, increasing cooling demand and safety risks.

The solution: Priority surfaces were fitted with removable, equipment-specific insulation modules with snap-button fastenings, keeping quick maintenance access. Lower heat release also cut summer cooling demand and improved working conditions.

Savings | 2,012 MWh a year (1st yr) | 433 tCO2e a year | Payback in under 1.5 years

Source: Inzonex

Consider

Energy losses are not always obvious. In chemical manufacturing, for example, significant losses can occur across steam, compressed air and gas systems through leaks, heat loss and inefficient operation. Looking across all the utilities used in the process. Identifying and stopping leaks can prevent avoidable energy waste.

Stage 3 recover and reuse

Many manufacturers produce waste heat that can potentially be reused. Heat recovery projects can reduce overall energy demand and improve site efficiency.

Potential sources of waste heat include:

- Refrigeration and cooling systems
- Air compressors
- Ovens and process-heating systems
- Cleaning-in-place and hot-water systems

Consider

Across food and drink and medicines manufacturing, businesses identified opportunities by considering heating and cooling demands together. Heat generated by refrigeration, cooling, clean-room environments or process-heating equipment may be recovered and reused elsewhere on site. Before investing in new equipment, ask whether existing energy could be reused.

> In older bakeries, you can see heat simply going out of the window. Simple measures such as insulation and heat recovery can turn that waste into meaningful savings.
>
> Andrew Collinson, Food and Drink Forum



Basell Polyolefins UK Ltd: recovering process heat to reduce steam use

At the Carrington polypropylene plant, significant amounts of low-pressure steam are used in production. Heat available in the propylene recycle system offered an opportunity to reduce steam demand and the natural gas used by the site's boilers.

The problem: Heat from the propylene recycle vapour stream would otherwise be wasted, while the propane rejection column reboiler has the second-largest steam demand on site.

The solution: Sensible and latent heat from the propylene recycle vapour stream will be used to heat the propane rejection column reboiler, avoiding the need for steam for the vast majority of the time.

Savings | 30% reduction in natural gas used to produce steam | Over 4,000 tCO_2 a year | 20% reduction in total site CO_2 emissions

Source: UK Government, Industrial Energy Transformation Fund, Phase 2 Spring 2022.

Ipsen Wrexham: improving boiler efficiency and preparing for heat recovery

As Ipsen's Wrexham manufacturing site grew over several decades, facilities were added with their own independent steam-raising boilers. Metering showed that changing steam demand was leaving some boilers underused and operating inefficiently.

The problem: The independent boilers could not reduce their output sufficiently to match periods of lower demand. This resulted in poor efficiency and energy being consumed while boilers remained on a hot standby.

The solution: Ipsen worked with equipment manufacturers to link the site's steam systems, improving demand management and enabling combustion optimisers, boiler sequencing and economisers to recover flue-gas heat for feedwater preheating.

Savings | 543,000 kWh and 102 tCO_2 a year from linking the steam systems | Planned efficiency and heat-recovery measures expected to save a further 110 tCO_2 a year

Source: BioIndustry Association, Ipsen Wrexham Horizon 2030 poster.



Stage 4 upgrade to efficient equipment

When equipment approaches the end of its life, consider whether replacing it with a more efficient alternative could deliver wider benefits. This step usually costs money upfront, so a clear plan that shows the investment is worth it is important. Equipment reaching the end of its life can be one of the greatest opportunities to implement this **stage four** and **stage five**.

Instead of replacing equipment on a like-for-like basis, manufacturers should consider:

- Higher-efficiency alternatives
- Electrified solutions
- Future production needs
- Integration with heat recovery

For cooling:

- New refrigeration systems
- Refrigerant upgrades
- Centralised chillers

Timing matters

Start assessing alternatives before equipment reaches end of life.

See “Find the right time” for more on planning for replacement.

EE Ingleton Engineering: combining solar PV and equipment upgrades to reduce energy costs

Rising energy costs were becoming a major challenge for EE Ingleton Engineering, a manufacturer of perforated metal products and heat-treated wear parts.

The problem: The company operated an energy-intensive heat-treatment furnace with ageing controls that took around eight hours to reach operating temperature and required continuous running throughout the working week.

The solution: With support from **Made Smarter Yorkshire**, the business used energy monitoring to identify opportunities before investing in solar PV, energy-efficient equipment and upgrades to its heat-treatment furnace, including digital controls, improved insulation and automated heating cycles.

Savings | 29% reduction in energy consumption during a three-month trial (2,976 kWh) | Estimated annual savings of approximately £20,000

Source: Made Smarter, EE Ingleton Engineering case study.

Stage 5 switch to low-carbon energy

Manufacturers can then consider switching to low-carbon energy. Heat pump and solar technologies are receiving growing attention as manufacturers explore alternatives to gas. However, several challenges have been identified, including high electricity prices, capital cost, grid capacity requirements, and retrofit complexity.

Potential opportunities include:

- Solar PV
- Solar thermal
- Heat pump
- Batteries energy storage
- Fuel switching

> Single biggest barrier to industrial electrification in UK manufacturing is the difference in unit price of electricity versus natural gas.
>
> Martin Beckford, Fox's Burton's Companies (FBC) UK



Nestlé Halifax: using refrigeration heat to produce hot water

The site required significant amounts of hot water but was using high-grade heat where lower-temperature heat would have been sufficient. Reviewing heating and cooling requirements together highlighted a more efficient approach.

The problem: A coal-fired steam system was being used to provide heat for applications that did not require steam temperatures.

The solution: An ammonia heat pump was installed to recover heat from refrigeration systems and produce 54,000 litres of 60°C water per day.

Savings | £143,000 a year heating saving | 119.1 tCO_2 a year

Source: Star Refrigeration



Drinks manufacturer: decarbonising space heating

Some of the site's warehousing and operating areas were large, poorly insulated high-bay spaces whose occupants frequently left the area. The business questioned the norm: did the whole space need heating, or just specific spots?

The problem: Gas-fired air blowers heated these whole areas, yet anyone working there was at a control station or on mobile equipment.

The solution: Electric infrared heaters with button-activated timers were installed at specific places, so operators could switch on heat for a short period and it would turn off automatically.

Workers were also given warm company uniforms. Heater placement had to be carefully considered because electricity is much more expensive than gas.

Savings | 1,000,000 kWh less gas | Negligible increase in electricity use | £2,500 investment | Payback under 1 year

Source: Businesswise Solutions Ltd



Stage 6 redesign the process

Once the earlier stages are deployed, considering changing the process itself can be strategic for the long-term.

This means exploring whether the product could be made in a different way that consumes much less energy.

Potential opportunities include:

- Moving from batch to continuous production
- Combining, reducing or removing heating and cooling steps
- Changing process routes or operating conditions
- Rethinking how the product is manufactured as production scales
- Reviewing recipes, formulations, and product specifications to reduce energy-intensive processes.

Brightside Brewing Company: bringing kegging in-house

Kegging, about 30% of the brewery's revenue, was outsourced to a plant around halfway across the country. Bringing it on site removed transport and plastic packaging from the process.

The problem: Outsourced kegging was costly, caused operational problems and limited the brewery's growth.

The solution: An £80,000 in-house kegging plant, supported by a £20,000 Made Smarter grant, uses process control, sensors and flow meters to manage temperature, pressure and carbonation. It automatically washes, sterilises and fills kegs.

Savings | 1,000,000 kWh less gas | Negligible increase in electricity use | £2,500 investment | Payback under 1 year

Source: Made Smarter, Brightside Brewing Company case study.

Look beyond your own business

Businesses do not always have the capacity or evidence they need to assess new technologies alone. Local networks and industrial clusters can provide access to expertise and help businesses explore opportunities in a real operating environment.

For example, Park Royal Net Zero Food Systems brings together universities and local partners to work with food and drink businesses on areas including energy reduction, waste, digitalisation, automation and low-carbon production. Its work includes practical studies with individual businesses to assess options and provide evidence for future investment.

Check out

The **practical checklist** at the end of this Playbook to help you identify opportunities relevant to your site.

Consider

Looking for local programmes and networks that can help you understand your options and build the evidence for action.



Find the right time

When should we act?

Recognising a need and appropriate options does not always mean a business is ready to act. New technologies often need to be integrated with existing infrastructure and production processes. Choosing the right moment can reduce disruption and costs, while making it easier to introduce a different solution. The best opportunity may come up when the business is already planning a change.

Some key questions to ask to identify upcoming adoption windows are:

Is the equipment reaching the end of its life?

When a boiler, oven, refrigeration system or other major asset needs replacing, this is an opportunity to consider alternatives. Missing this point may lock the site into the same technology for years and make a later retrofit more disruptive or expensive.

Manufacturers highlighted that once that window is gone, retrofitting is very difficult if there is a need to stop the process.

Give yourself enough time to assess the alternatives

> Consider equipment replacement around 18 months in advance of installation to allow time to assess alternative solutions.
>
> Kerry Whiteside, Samworth Brothers



This serves as a benchmark for **food and drink** yet the right lead time will vary depending on the equipment. In **chemicals** manufacturing, for example, major equipment changes can involve significant design, internal approval, procurement, installation and commissioning.

Consider

Starting early gives businesses more time to assess alternatives and avoid defaulting to a like-for-like replacement when equipment reaches end of life.

Is there a shutdown approaching?

Some technologies can only be installed while production is paused. Aligning installation with a planned shutdown such as for maintenance activity can reduce additional disruption. Suppliers may also be able to help integrate compatible add-on technologies into equipment they already support.

Different sectors, similar challenge

Workshop participants from **food and drink** highlighted that shutting down production to install new technologies can be difficult to justify. In high-volume operations, downtime is very expensive and production schedules are tight.

Similar challenges can happen in **medicines manufacturing**. Production facilities often support multiple successive products leaving few opportunities to make changes. Introducing new equipment may also need additional testing and approval before it can be used which makes upgrades more complex and time-consuming.

Consider

Aligning implementation with planned shutdowns, maintenance activities, facility upgrades or other site projects can reduce disruption and make adoption easier to justify internally.

Are there any site changes like an upgrade or refurbishment planned?

Changes to buildings or production areas are an opportunity to consider how energy systems will support the future site. Coordinating the work can avoid the need to revisit the same infrastructure later.

Is the business expanding?

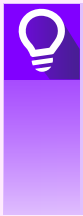
Increased output or site expansion may require additional heat or operational capacity. If not, it can also just offer an opportunity to purchase newer and more efficient equipment. Manufacturers should consider whether existing energy systems remains suitable before new infrastructure is installed.

Has external support become available?

A grant, a funded assessment or other support may make it possible to investigate or invest in an opportunity earlier than planned.

Local funding can create an opportunity

Funding and support for energy efficiency projects can vary across the UK. For example, **Business Energy Scotland's SME Loan Scheme** provides eligible Scottish SMEs with interest-free loans of up to £100,000 for energy and carbon-saving upgrades, alongside cashback grants of up to £30,000 for eligible measures



Consider

Checking out what support is available in your area. Local and devolved programmes may help strengthen the business case or bring investment forward.

These moments create an opportunity to consider a different technology, but they do not automatically make adoption the right choice. The business still needs enough time to assess the available options (if it didn't before), understand how they would integrate with the site and secure internal agreement before the window closes.



Common pitfalls when assessing the business case

- What successful adopters do
- Starting too late to properly assess alternatives
- Replacing equipment like-for like-without considering other options.
- Delaying stakeholder engagement until decisions become time-critical



What successful adopters do

- Map out upcoming equipment replacements, shutdowns, maintenance, and site changes
- Explore alternatives early and consider the cost of delaying investment
- Understand installation, infrastructure, and downtime requirements early
- Work backwards from the adoption window to allow time for agreement and procurement
- Record future opportunities to revisit if the business is not ready yet

Build the business case

Is it worth investing in?

Once an opportunity is recognised, it does not necessarily make it an investment priority. Although many manufacturers may identify the need to implement a new solution, these projects still need to compete for limited capital and attention.

Manufacturers told us that projects often struggle to secure funding because the value is unclear or the proposal does not align with how investment decisions are made within the business.

To decide if a project is worth investing in, the business case must be built and assessed carefully.

There are a few aspects successful projects consider:

How are investment decisions made?

Understand how investment decisions are actually made within your organisation. Different businesses have distinctive approval processes and investment criteria.

A project that appears attractive from an engineering perspective may not always align with the way the business is allocating capital.

You should ask:

- Who approves investments of this size?
- What criteria are usually used to assess projects?
- What level of risk is considered acceptable?
- What evidence is typically required?
- What other investments will this project compete against?

What value will this project create?

One of the common mistakes is to build the business case around energy savings alone. While reduced energy costs are important, there is often a wider set of outcomes that can be easily overlooked.

Some other ways a technology can deliver value to consider including:

- Reduced maintenance costs
- Improved reliability and uptime
- Increased production capacity
- Better product quality
- Reduced use of water, materials and other resources
- Reduced waste and improved resource efficiency
- Reduced exposure to energy price volatility
- Lower carbon emissions
- Improved resilience
- Progress towards customer or supply- chain requirements
- Progress towards organisational sustainability and net-zero targets

What will make this investment worthwhile?

Different businesses may use different approaches to assess investments. Include measures that are typically used to allow for the business case to be compared across other priorities.

Some include:

- Simple payback period
- Return on investment
- Net present value
- Internal rate of return
- Cost avoidance - rising energy costs, maintenance, production losses
- Strategic value - customer expectations, supporting sustainability commitments



Consider

One size does not fit all

A project that looks attractive to a large multinational may not meet the investment criteria of an SME. Smaller manufacturers often need investments to deliver returns quickly and compete with other immediate business priorities. Larger organisations may be able to take a longer-term view if the investment supports strategic objectives, operational resilience, productivity improvements or net zero commitments.

Is there confidence in the project?

Throughout the workshops, participants mentioned the need of trusted evidence, independent validation, and realistic projections. Businesses want confidence that a technology will work in a site like theirs and that the benefits can withstand scrutiny before committing capital.

Some things to consider include:

Has it been done successfully in a similar site?

Workshop participants consistently highlighted the value of:

- Case studies from similar manufacturers
- Site visits and demonstrations
- Independent feasibility assessments
- Trusted expert advice
- Examples of realised savings and payback periods
- Peer recommendations from businesses that have already implemented the technology

Is there data to strengthen the case?

Decision makers want confidence that projected savings and returns are based on evidence, not best-case assumptions. Where possible:

- Use historical energy and cost data
- Reference comparable projects or industry examples
- Use supplier guarantees and performance commitments
- Clearly explain how savings have been estimated
- Understand what could affect the outcome



Learn from others

This playbook includes some case studies, but there are many more available. Programmes such as Made Smarter provide practical examples of projects undertaken by manufacturers. Reviewing similar projects can help strengthen both the business case and confidence in the solutions.

Address the risks upfront

Victor Gutierrez (Businesswise Solutions) finds that engineers usually understood the technical proposal quickly. The harder conversation was often with the Chief Financial Officer (CFO) or accountant responsible for deciding where the business should invest.

Their first question was: "What are the risks?"

He would use long-term UK energy-price data to support assumptions and show how the payback changed under different conditions. He would compare a realistic projection with more conservative and favourable scenarios, including what happened if energy prices remained flat or project costs increased.

Consider

Be open about the risks affecting ROI rather than presenting the best possible outcome.

Showing the evidence, acknowledging the risks, and explaining how they could be managed helps the financial decisionmaker trust the case.

Common pitfalls when assessing the business case

- Leading with the technology rather than the business need
- Building the case around energy savings or payback alone
- Relying on generic data or optimistic assumptions
- Focusing on benefits without addressing uncertainty

What successful adopters do

- Show the problem the investment addresses and why it matters to the business
- Capture wider operational, financial and strategic value
- Use site-specific evidence and test realistic scenarios
- Be clear about assumptions, risks and how they will be managed

Secure agreement

How do we get agreement?

Adoption depends on more than evidence alone. Even the strongest business case can slow down if the people responsible for funding and operating the project are not aligned behind it. Businesses during the workshops frequently mentioned organisational barriers such as competing priorities and unclear ownership.

But even with complex internal structures, some manufacturers still managed to introduce technologies and new processes that significantly reduced their energy use and improved their productivity.

Here are some learnings from those who were successful:

Find the champion

Successful implementation of new technologies has at least one person who takes responsibility for moving the proposal forward. The champion maintains momentum and navigates internal decision-making processes by coordinating the right stakeholders.

Champions can come from many parts of the business. Regardless of their title, they should be able to connect the project to other business priorities and bring the right people into the conversation.

Champions need sponsors

Interviewees highlighted the importance of support from senior decisionmakers who can remove barriers, approve funding and help connect with wider business priorities.

If the champion is not at executive level, support from a senior sponsor can help give the proposal credibility and visibility. Projects are more likely to progress when both roles are in place.

Consider

Without a clear champion, projects can lose momentum as attention shifts to other priorities.



Build alignment early

Identify who needs to be involved in the decision and what matters to them.

The stakeholders will depend on the size and structure of the business. In smaller organisations, the same person may fulfil several roles, whereas in larger organisations may need additional approval from a central team or parent company.

Senior leadership

- How does this support the wider direction of the business, whether that's resilience, competitiveness or future readiness?

Engineering and maintenance

- Will this work with existing equipment and processes?
- Can we operate and maintain it effectively, and what changes will it require from the team?

Finance

- Is this a worthwhile investment?
- Are the costs and risks understood?
- Does it stack up against other competing priorities?

Sustainability and energy leads

- Will this help us reduce energy use or waste, and support the environmental commitments we have made?

Health and safety

- Will this create any new safety concerns?
- Could it help reduce existing risks for employees, equipment or operations?

Quality and regulatory

- Could the change affect the validated process or product?
- What testing or regulatory engagement will be required?

Consider

Not every stakeholder needs to be involved in every discussion. However, involving key decisionmakers early can help avoid situations where a project reaches the approval stage only for fundamental concerns to emerge for the first time.

Address resistance directly

Resistance is not always a sign that people oppose the project. More often, it reflects legitimate concerns that need to be understood and addressed ahead of any project.

Common concerns may include:

- **Disruption:** Will installation affect production or result in costly downtime?
- **Risk:** Will the technology deliver the expected benefits in practice? What could go wrong?
- **Competing priorities:** Is this the best use of limited capital, time and resources?
- **Established ways of working:** Is there a compelling reason to change current processes?

Consider

Don't underestimate the importance of storytelling.

Tailor the conversation to what matters most to each stakeholder and explains why the projects matters to their priorities. A strong proposal is rarely the same proposal for everyone since different stakeholders need different reasons to support the project.



Existing processes are often optimised around historical decisions. Questioning those assumptions can reveal opportunities that would otherwise remain hidden.

An example comes from Seamus Higgins' (University of Nottingham) experience in cereal production:

The process relied on 90-metre-long conventional oven followed by a short microwave heating stage. Rather than simply optimising the existing process, he asked whether new technologies could fundamentally change how the product was manufactured, potentially reducing energy consumption and processing time.

The response was revealing:
"We've always made it that way."

Consider

Culture eats strategy for breakfast?
Several manufacturers and technology providers emphasised that successful adoption also depends on an organisational culture that is open to change. Businesses are more likely to progress projects when people are willing to challenge existing assumptions and explore alternatives.

Common pitfalls when assessing the business case

- Developing the proposal in isolation
- Expecting the technical or financial evidence to speak for itself
- Leaving ownership unclear once initial interest has been secured
- Discovering approval requirements from a parent company, insurer, or central team too late

What successful adopters do

- Identify who will influence, approve, and deliver the project
- Tailor the case to the responsibilities and concerns of each stakeholder and translate technical information into clear business outcomes
- Identify an internal champion and senior sponsor
- Understand the decision process, required evidence, and approval criteria early

Deliver the project

How do we deliver successfully?

With approval secured, the focus shifts to delivery. The next test is whether the solution can be installed, commissioned, and run without harming production, safety, product quality or reliability.

This part sets out seven steps in three phases with key considerations to check during delivery;

Prepare the project

Before installation

Step 1:	Bring the factory team into the project
Step 2:	Hold suppliers to what they promise
Step 3:	Plan the installation around production
Step 4:	Record the baseline
Step 5:	Protect product quality and safety

Install and commission

During installation

Step 6:	Commission the project properly

Measure and sustain

After commission

Step 7:	Measure the benefits and assign responsibility

Prepare the project | **Before installation**

Step 1: Bring the factory team into the project

Involving the right people early is key. Keep them involved during implementation, particularly those who will operate, maintain or be affected by the technology or process. **Make sure it is clear:**

- Who owns the project during installation
- Who runs the equipment after handover
- Operations, engineering, maintenance, safety and quality, the energy manager and suppliers are to be involved

Step 2: Hold suppliers to their promises

Seek multiple competitive quotes and independent expert reviews, particularly for complex projects. **Require suppliers to provide clear guarantees upfront on:**

- Agreed capacity, energy performance, commissioning, testing, warranties and maintenance

Step 3: Plan installation around production

Downtime is costly for manufacturers. **Ensure that the installation plan covers:**

- Identifying any affected production lines and required shutdowns
- Aligning installation work with planned maintenance wherever possible
- Putting into place contingency and restart plans

Step 4: Record the baseline

Without a baseline, savings cannot be proven. **Important measurements include:**

- Electricity and gas use
- Energy per tonne or unit produced
- Carbon emissions
- Downtime
- Waste
- Maintenance needs

Ensure a baseline has been recorded before installation– measuring energy alongside production output.

Step 5: Protect product quality and safety

Changes in cooling or heating processes may mean product safety and quality need revalidating. If a project changes the taste of the product or increases waste, the losses can outweigh the energy saved. **Ensure that:**

- Product quality, safety, and regulatory validation requirements have been identified
- The relevant quality, safety and regulatory teams have approved the proposed approach
- Quality, safety and waste are checked against established specifications

Install and commission | **During installation**

Step 6: Commission the project properly

Commissioning should show the solution works with your processes, not just that it switches on. Pilot or lab trials may not be enough, because processes can behave differently at full production scale. Therefore, new technologies and processes must be reviewed before handover to production.

- Changes have been tested under real production conditions
- Controls, set points, and alarms have been checked
- Operators and maintenance staff have been trained
- Unresolved issues have been recorded, each with an owner

Measure and sustain | **After commission**

Step 7: Measure the benefits and assign responsibility

Compare results against the baseline from Step 4.

- Sub-metering is essential. Without it, changes in energy use cannot be confidently linked to the project
- Monitoring can be built up in stages, from whole site to individual processes, and then to individual zones



Special thanks

Innovate UK Business Connect would like to thank everyone who generously gave their time, knowledge, and experience to this playbook. We are particularly grateful for the following people, whose interviews shaped the guidance throughout. Together, they bring decades of experience across manufacturing, energy, technology, and research.

Martin Beckford | Sustainability Manager, Fox's Burton's Companies (FBC) UK



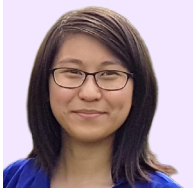
Martin has worked in the food and drink industry for 27 years. He led Burton's Foods' feasibility study into electrifying biscuit production (Project Zap, 2022), under the UK Government's Industrial Fuel Switching programme.

Nicola Binks | Director, Urban Smart Power



Nicola has more than 20 years' experience in the energy sector, with a focus on turning energy innovation into commercial growth. Her experience includes supporting businesses to deploy emerging energy technologies in real-world settings.

Antonia Cheng | Energy Manager, Businesswise Solutions



Antonia has six years' experience working across manufacturing and retail, helping businesses optimise their processes to reduce energy consumption and carbon emissions. Projects include decarbonising space heat and managing energy for a company with over 200 sites.

Andrew Collinson | Former Director of Operations, Food and Drink Forum



Andrew has 27 years of experience supporting the food and drink sector, including through his work with the Food and Drink Forum, a not-for-profit, memberled organisation that operated for 26 years. During this period, the Forum helped secure around £40 million in public business support funding for the sector and operated three specialist food parks, supporting thousands of food and drink businesses to grow and create jobs in the East Midlands.

Victor Gutierrez | Senior Energy Manager, Businesswise Solutions



Victor has 26 years' engineering experience and 13 years working in the energy sector. His experience includes implementing energy-efficiency and renewable-energy technologies across the UK public and private sectors.

Stuart Harvey | Head of Business Development, Naked Energy



Naked Energy is a solar thermal technology company that provides end-to-end services, with over 150 projects delivered across 10 countries. Stuart implements solar thermal technology to provide low-carbon process heat in food and beverage manufacturing.

Seamus Higgins | Associate Professor of Food Process Engineering, University of Nottingham



Seamus has more than 30 years' experience across industry including engineering and management roles with Nestlé and Premier Foods. Since joining the University of Nottingham, he has developed its MSc in Food Process Engineering and published his book 'Food and Us'.

Amanda Johnston | Director, Advanced Food Innovation Centre



Amanda brings over 20 years of experience across manufacturing and higher education. She has supported more than 20 food and drink manufacturers explore innovation opportunities and is the Director of the Advanced Food Innovation Centre, a £10 million-funded facility.

Steve Peace | Business Manager, Datrys



Steve has 40 years' experience in the food and drink industry, worked with numerous businesses, mainly SMEs, to help them optimise processes, reduce energy consumption, increase profitability and better align with sustainability compliance and customer demands.

Kerry Whiteside | Head of Science and Technology, Samworth Brothers



Kerry has 30 years' experience in the food and drink industry, with expertise spanning food safety, microbiology and the future automation of manufacturing processes.

Practical checklist

Exploring the options

1. Understand and optimise

- Install sub-metering on key equipment
- Maintain equipment at the right frequency
- Fix compressed-air leaks; optimise pressure
- Shut down equipment left running idle
- Identify process/equipment hotspots
- Review scheduling and process settings
- Review electricity tariff and contract end dates

2. Reduce losses

- Add lagging and hot pipe insulation
- Insulate boilers
- Improve cold store performance
- Improve building insulation

3. Recover and reuse

- Find waste heat: refrigeration, compressors
- Find waste heat: ovens, cooling systems
- Reuse the recovered heat on site

4. Upgrade to efficient equipment

- Consider efficient options at end of life
- Upgrade motors
- Consider electrified options
- Plan for future production needs
- Integrate with heat recovery
- Upgrade refrigeration and controls
- Build a clear business case

5. Switch to low-carbon energy

- Check grid capacity
- Check capital cost and electricity prices
- Assess solar PV or solar thermal
- Assess heat pumps for hot water
- Assess heat pumps for low-temp heating

6. Redesign the process

- Consider major process redesign
- Assess batteries energy storage

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