

Why *low-carbon energy?*

From pasteurisation and sterilisation to refrigeration and fermentation, there's a long list of energy-intensive processes involved in the production of food and drink. It should come as no surprise, therefore, that the UN's Food and Agriculture Organisation (FAO) estimates current food systems use about 30% of globally available energy, around 70% of which is consumed after food leaves the farm gate – in transportation, processing, packaging, shipping and storage¹.

Intensive use of energy in food and drink manufacturing is putting a heavy burden on both the bottom line and the planet. Energy is estimated to account for around 15% of an average food and drink manufacturer's total costs². Although energy price pressures have eased somewhat since 2022, when the Food and Drink Federation (FDF) warned that companies were facing 400-500% rises in their energy bills linked in part to Russia's invasion of Ukraine, the cost of maintaining essential processes like heating and cooling continues to pile pressure on operational margins.

Moreover, a continued reliance on fossil fuels means that around 30% of the greenhouse gas (GHG) emissions ascribed to food and drink are related to energy consumption³.

High and often volatile prices of key energy sources, such as oil and gas, coupled with an urgent need to decarbonise energy-intensive industries like food and drink, have put the onus on manufacturers to use less energy overall and to seek greener alternatives to fossil fuels for their remaining power requirements.

As we shall see in this whitepaper, many businesses are rising to the challenge with investments in efficiency initiatives and renewable self-generation, including wind and solar power, as well as through their support for emerging technologies such as solar thermal and green hydrogen. Others are throwing their weight behind research into new ways to reduce energy usage – for example, by raising the baseline temperature for storing frozen foods.

Net-Zero goal

Investment in low-carbon energy solutions will be essential in meeting industry-wide net-zero commitments. The FDF has set a target for the UK food and drink manufacturing sector to achieve net-zero carbon emissions by

2040 as it seeks to build on a 61.4% reduction in CO₂ emissions by FDF members' operations between 1990 and 2021⁴.

Within this context, FMCG businesses are setting their own specific targets. Drinks giant Diageo aims to reach net-zero across its direct operations by 2030, having already halved its GHG emissions across direct operations since 2007⁵.

PepsiCo, meanwhile, has a target to reduce absolute GHG emissions across its value chain by more than 40% by 2030, including a 75% reduction in emissions from its direct operations, on the path to achieving net-zero emissions by 2040⁶.

These businesses, and many others besides, realise that low cost and low carbon are two sides of the same coin where energy is concerned. Based on expert insight, this whitepaper sets out the practical business case for investing in low-carbon energy through the profiles of manufacturers that are already realising the benefits of investing in current and future energy solutions.

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The business case for *low-carbon energy*

The food and drink manufacturers making it pay

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¹ <https://www.fao.org/energy/home/en/>

² <https://www.fdf.org.uk/globalassets/resources/public/general/powerstar-food-and-drink-white-paper.pdf>

³ <https://www.sciencedirect.com/science/article/pii/S0924224417303394>

⁴ <https://www.fdf.org.uk/globalassets/resources/publications/reports/environmental-sustainability/ambition-2025/sustainability-ambition-2025-progress-report-2022.pdf>

⁵ <https://media.diageo.com/diageo-corporate-media/media/eb2cxsp/accelerate-to-a-low-carbon-world-our-net-zero-carbon-strategy-october-2022-pdf-290mb.pdf>

⁶ <https://www.pepsico.com/our-impact/esg-topics-a-z/renewable-energy>

Chapter 1

Seizing the opportunity



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An attractive prospect

The prospect of using cheaper, lower-carbon energy *is* attractive to food and drink manufacturers. However, unlocking these opportunities comes with its challenges. Many production sites are operational 24 hours a day, meaning disruption to the running of the site needs to be kept to a minimum when new infrastructure is being installed.

The capital cost of investment in low-carbon technologies needs to be weighed against savings that can be generated over the longer term, while the capacity of the grid to support additional on-site energy demand is another key consideration – for example, where electric vehicle charging points are being installed. Even more fundamentally, manufacturers need to be certain that alternatives to natural gas will be capable of providing the consistent heat required to sustain high-temperature manufacturing processes in a commercially viable way.

Many food and drink manufacturers are overcoming these challenges and investing in low-carbon technologies. Cost reduction is a key motivation, but so too is the need to meet stretching decarbonisation targets with pressure coming both internally from boardrooms and externally from key external stakeholders, including investors and retail customers. PepsiCo alludes to this in a renewable energy explainer on its website in which it notes that: “Our stakeholders expect us to reduce our energy use and transition to renewable energy to create a low-carbon value chain.”

Efficiency savings

The road to lower bills and carbon often begins with low-cost, low-regret actions to reduce the use of energy in manufacturing facilities, such as switching off machines when they are not in use.

Popular measures, aimed at delivering greater energy efficiency include, switching from

Approx. 80% (nearly 3,500 GWh) of PepsiCo's direct global electricity needs were met by renewable electricity in 2023.

incandescent lighting, such as halogen bulbs, to LED lighting, which has a longer lifespan and lower maintenance costs. Some businesses are going further and installing Solatube Daylighting Systems, which capture sunlight from a building's roof and efficiently distribute it throughout the building, minimising the need for artificial light.

Others are investing in ORC (Organic Rankine Cycle), a closed cycle process where waste heat is used to evaporate an organic fluid which, via an expander, then drives a generator to produce clean energy.

Financing options

A key question for businesses looking to invest in low-carbon technologies concerns how best to finance the transition. For

investments where the payback is relatively quick, such as LED lighting, it often makes sense for companies to find the capex as part of their annual budgeting cycle and deploy it immediately. Conversely, where upfront investment requirements are large and payback periods tend to be longer, businesses may prefer to look at flexible financing options. These involve a supplier such as E.ON providing the upfront finance to purchase and install technologies, which is then paid back via an energy contract over the long-term.

Self-generation

One of the greatest areas for energy investment for FMCG manufacturers is in renewable self-generation. To meet its climate ambitions, PepsiCo

is aiming to achieve 100% renewable electricity in its own operations by 2030 and, additionally, in its franchise and third-party operations by 2040. A key part of achieving this goal is through investment in on-site solar and wind installations at PepsiCo's plants and distribution centres. One example is the Walkers Crisp site in Skelmersdale, West Lancashire, which uses a wind turbine, installed and managed by E.ON, to produce 25% of the site's electricity needs. Overall, approximately 80% (nearly 3,500 GWh) of PepsiCo's direct global electricity needs were met with renewable electricity in 2023.

Commercial heat pumps are another option for businesses looking to move away from natural gas. “The biggest challenge in the food and beverage industry is the decarbonisation of heat and moving away from fossil fuel boilers towards the electrification of heat using technologies like heat pumps,” explains James Cottrill, director of B2B sales at E.ON UK.

Heat pumps take heat from natural sources like the ground, air or water and then store the heat or distribute it as central heating or hot water. Relatively low ongoing running costs, compared with fossil-fuel based alternatives, allow businesses to save money over the long-term.

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– James Cottrill, Director of B2B sales, E.ON UK

Chapter 2

**The manufacturers
making it pay**



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Case Study 1

Production savings at Diageo St. James Gate Brewery

Diageo has set a target to reach net-zero across its direct operations by 2030 and to achieve net-zero across its entire business and value chain by 2050 or sooner. The drinks company, whose brands include Guinness and Johnnie Walker, says reducing the amount of energy it consumes, making its facilities more efficient, and recovering as much energy as possible from the production process are essential steps in meeting that 2030 target.

The St. James Gate Brewery in Dublin, Ireland, has been brewing Guinness for 264 years and is the world's largest producer of stout. E.ON previously worked with the brewery to deliver efficiency savings in the production process. This involved installing cutting-edge hybrid coolers in a project externally recognised by the Sustainable Energy Authority of Ireland. The brewery also introduced variable speed drives (VSDs) on pumps and began recovering heat from the CO₂ vaporisation process.

Taken together, these efficiency measures delivered over 680MWh of energy savings, resulting in a reduction of over 400 tonnes of CO₂, and produced a financial benefit to the site of €70,000 per year.

E.ON continues to work with Diageo in Scotland where the partners recently joined forces with Emtec Energy to install 7,700 solar panels on an area of land the size of eight football pitches, adjacent to Diageo's packaging plant in Leven, Fife. Solar power has the potential to generate around 22% of the site's annual electricity needs in the winter months, rising to 60% during the summer months.



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Case Study 2

Energy efficiency at Peter's Food Service

Based at its manufacturing facility in Merthyr Tydfil, Wales, Peter's Food Service bakes bespoke pies and pastries for customers including supermarkets, sports stadia, pubs and restaurants, and food-to-go outlets.

Its large 14-acre site means that refrigeration is a significant expense for the business and the subject of energy is frequently discussed at board level.

After carrying out a site audit, E.ON proposed a series of energy efficiency measures that would help Peter's reach its cost-cutting target and reduce its carbon emissions in the process.

Cloud-based data analytics were employed to monitor and control the site's energy usage in real-time, with the software able to capture and store energy usage data every half hour

to identify potential inefficiencies on-site and propose behaviour change initiatives that could save energy.

In addition, the installation of a full sub-metering system, including 44 new meters, allowed E.ON to monitor performance and identify further energy savings. This included the ability to monitor individual production line efficiency across the entire site.

Interventions at the Merthyr Tydfil site included efficiency measures related to the steam system – including boiler insulation, operation and steam leak repairs – and the improvement and rationalisation of the site's compressed air system. Lighting at the site was also upgraded to energy-efficient LED lighting.

The project achieved annual energy cost savings of 15% in the first year, beyond the targeted level of savings, and led to improved energy awareness across the business.



Case Study 3

Combined heat and power at Frischli Milchwerke GmbH

German dairy supplier Frischli produces a wide range of dairy products for retail and foodservice customers. The business has committed to reduce the carbon emissions relating to its own milk production by 22.5% before 2030, a target that has been validated by the Science Based Targets Initiative.

Production of dairy products requires energy in the form of heat, and a key priority for Frischli is to ensure that no single kilowatt hour of energy leaves the dairy unused.

E.ON worked with Frischli at its Milchwerke GmbH facility, one of the most modern and efficient dairies in Germany, on a combined heat and power (CHP) solution, with the aim of delivering savings in both cost and carbon.

A CHP unit burns natural gas to create electricity and uses the heat generated to power other processes. By generating heat and power simultaneously, CHP can reduce carbon emissions by up to 30% compared to the use of a conventional boiler. It is often favoured by manufacturers that need a consistent supply of heat to sustain high-energy manufacturing processes.

The Frischli project involved the construction of a 10t/h (tonne per hour) saturated steam boiler for steam generation, replacing an inefficient boiler that was approaching the end of its lifespan, and the addition of a third storey to the existing building to house a new CHP unit and waste heat boiler.

Frischli compared the energy- and cost-saving potential of several concepts before settling on the solution, which was completed in early 2020. As well as reducing the share of electricity purchased from the grid, the investment has delivered a 50% reduction in CO₂ emissions.

The company says it plans to maintain the CHP solution as it further develops its energy strategy and takes additional steps to reduce carbon emissions.

Chapter 3

A glimpse into the future



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Solar thermal technology

As we've already seen, there are a range of actions FMCG businesses can take to make their manufacturing operations more energy-efficient and greener.

Looking ahead, further deployment of low-cost renewables will be key in decarbonising the sector – and here there remains a number of untapped opportunities.

One of these is solar thermal technology, which experts say should be at the forefront of the conversation around the decarbonisation of heat. Solar thermal applications involve the transformation of solar energy into thermal energy and can be applied in domestic buildings as well as large manufacturing plants.

Solar thermal collectors are sets of tubes mounted onto frames that are most commonly positioned on the roof of a building. They use the energy from the sun to heat water up to 120°C and can also be combined with conventional solar photovoltaics (PV) to generate both electricity and heat from a single solar collector.

Naked Energy is a British-based solar thermal technology supplier, in which E.ON is an investor. The business has set out to decarbonise heating and cooling globally and says its technology delivers up to 3.5 times the energy per m² in comparison to conventional solar electricity or PV technology.

Modern solar thermal technology can achieve temperatures in the range of 50-250°C – suitable for

many industrial processes and non-domestic applications, including low- and medium-temperature industrial applications.

Businesses with a constant demand for hot water throughout the year can install a solar thermal system to supply 50% or more of their demand, which in turn reduces their reliance on volatile wholesale energy markets.

While solar energy typically performs better in the summer than in the winter, it can still contribute a portion of energy supply all year round. Energy storage solutions can also be integrated with solar thermal to balance out seasonal fluctuations in generation.

Naked Energy claims that, for a typical UK or North European installation, around 40-60% of the heating and hot water



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– Frank Bruce, Head of marketing, Naked Energy

requirement can be met by solar thermal technologies, which can halve the end-user's gas bill and carbon emissions from heating and hot water.

Currently, the technology is generally used in combination with other approaches to provide hot water and/or heating. "You can view solar thermal essentially as an efficiency booster because you can pair the technology with all forms of heat pumps; you can pair it with gas boilers and oil boilers and you can pair it with solar PV if you have that running in your energy system," explains Naked Energy head of marketing Frank Bruce.

He notes how the food and drink industry relies on energy-intensive processes like pasteurisation and sterilisation.

"Often, businesses have powered these processes with steam, which isn't the most energy-efficient way to do that," he says. In Brazil, for example, PepsiCo is using solar thermal to deliver process hot water for several daily washings of a single production line for various snacks, while cutting natural gas use.

The integration of a solar thermal system means that a heat pump or gas boiler doesn't have to run on its usual capacity, which means it uses less gas, generates lower carbon emissions and delivers financial savings. "And importantly for the operator of the product, because the heat pump or gas boiler doesn't run at maximum capacity, solar thermal extends its shelf life," Bruce adds.



Freezer innovation

Innovation is also advancing in the area of energy efficiency. Nomad Foods, the owner of frozen food brands including Birds Eye, Findus and Iglo, recently announced the results of its 18-month study exploring whether frozen food storage temperatures could be increased without impacting product safety or quality⁸.

Results of the study, which was carried out in partnership with Campden BRI, suggest that storing frozen food at -15°C, instead of the industry-standard -18°C, can reduce freezer energy consumption by 10-11% without any noticeable impact on the safety, texture, taste or nutritional value of a product, resulting in significant carbon emission

reductions as well as cost savings. Options for the study to be peer-reviewed are now being explored.

"We already know that frozen food compares very well against alternative preservation methods in terms of carbon footprint," says Nomad Foods' chief executive officer Stefan Descheemaeker. "The latest results of our study with Campden BRI underline the critical role frozen food has in reducing the impact of the wider food industry on climate change."

From cutting-edge renewable technologies to innovative energy efficiency initiatives, food and drink manufacturers must explore all the tools at their disposal to keep energy costs down and deliver the sector's ambitious climate commitments.

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– Stefan Descheemaeker, Chief executive officer, Nomad Foods

⁸ <https://www.nomadfoods.com/news/landmark-study-from-nomad-foods-confirms-potential-to-increase-freezer-temperatures-and-reduce-carbon-emissions/>

High hopes for hydrogen

If solar thermal is potentially part of a future decarbonisation pathway for food and drink manufacturers, then so too is green hydrogen. Around the world, green hydrogen is being recognised by governments and businesses for its potential to support the transition to net-zero emission economies.

The cutting-edge technology works by splitting water into

oxygen and hydrogen, using renewable energy, and thus providing a greener alternative to natural gas. The fuel is especially exciting for food and drink manufacturers since it can support the sustained high temperatures required in processes such as sterilisation, pasteurisation and chlorination.

Although practical application of the technology remains in its

infancy, food manufacturers are engaged in trials over potential use cases. Quorn and Unilever are among the businesses to have previously unveiled plans to explore the deployment of green hydrogen at their production facilities, in a bid to reduce their reliance on fossil fuels and help achieve their climate commitments.

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