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Sustainable energy strategies for food and beverage manufacturers



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A diverse sector, hungry for energy change

Food and beverage (F&B), by far the largest industrial manufacturing sector within many developed regions, is a broad and highly diverse category. It encompasses agriculture, food processing, cold storage, transport, logistics and grocery/retail. The sector is full of variety; for example, food and drink processing covers everything from abattoirs to wineries – each with different energy requirements in scale and scope.

Over the past century, the F&B sector has produced **sufficient food** to sustain population growth while reducing its real price, improving affordability and helping to reduce world hunger. The result is a global food system valued at around \$8 trillion, or 10 per cent of the global economy.

Going forward, the sector faces a significant challenge; to grow sustainably so that it can provide food and drink for a population that is forecast to reach over 10 billion by the end of the century. Achieving sustainable growth will require fundamental changes that address land degradation, biodiversity loss, changing consumer preferences and, not least, greenhouse gas (GHG) emissions.

A full lifecycle ‘farm-to-fork’ **analysis** suggests that food production is responsible for 30% of global energy consumption and over a **third** of global GHG emissions. The same analysis reports that by 2030, the industry will demand 45% more energy than it required in 2021 due to population growth and the impact of climate change. As well as emissions from production, food waste is estimated to be responsible for a further 8-10% of GHGs.

F&B businesses are working to make the food supply chain more sustainable by embracing technology in areas such as precision agriculture, vertical farming, cultured/plant-based meat, automation and many other innovations. As well as using fewer natural resources, agritech promises higher yields and lower emissions.

Food production and energy consumption are intrinsically linked, both in traditional agriculture and agritech. For example, producing **fertilisers** consumes 1.2% of the world’s energy, refrigerators and freezers consume around 15% of global electricity supplies, while **food transport** consumes up to 15% of the world’s fossil fuel energy. The entire supply chain depends on having access to reliable – and increasingly low-carbon – sources of energy.



Given that a key macroenvironmental factor impacting the F&B sector is the energy it uses, the current volatility in world energy markets is being felt across the industry. Alongside increased demand post-Covid, there has been a more gradual shift away from coal and gas as governments have moved to deploy more renewable generation. This has caused regulators to tighten up reserve margins in many regions. When capacity is tight, there is upward pressure on costs and questions over security of supply. The imperative to decarbonise has taken on new urgency as industries look to reduce their dependence on gas by converting fuel input to electrify their plant and operations.

For many businesses operating in F&B, the rising cost of energy has changed the balance in favour of investing in energy efficiency as payback times have come down from around eight years to typically three years. Commercial and industrial businesses are taking the opportunity to electrify more of their operations as, for example, gas boilers come to the end of their lifetimes. The cost savings from implementing energy efficiency measures can be significant and provide a welcome financial boost in many of the mature food industry sectors that traditionally face tight profit margins.

Heat and refrigeration are frequently involved in F&B manufacturing processes and both are major consumers of electricity. However, the use of heating and cooling assets also present a significant opportunity to deliver energy flexibility initiatives to reduce costs and emissions.

Environmental and social governance (ESG) is also now a key driver for many food and beverage businesses. Pressure to improve ESG credentials comes from investors, supply chain partners and consumers. Many new entrant AgriFoodTech companies have adopted the UN's **Sustainable Development Goals**, which mandate reducing energy use and emissions.

Addressing key business drivers

From emissions reporting to virtual power plants, this white paper considers these key energy-related business drivers and highlights the initiatives that F&B businesses are taking to address them.

Understanding energy use and emissions reporting

Emissions reporting is becoming increasingly important, whether for compliance reasons or as part of a broader ESG initiative.

Some **studies** suggest that F&B companies are missing the mark on whether the goals they set are significantly reducing global emissions. Of the top 100 global F&B companies, only about half have measured, disclosed and set goals for their **scope 3** emissions, which on average account for 88% of a company's emissions across the entire value chain.

There are numerous emissions reporting schemes available. It is important to consider an internationally recognised carbon accounting standard or framework, such as GHGP, ISO 14064, **CDP**, SBTi or **TCFD**. Using a recognised standard ensures that carbon reduction claims are credible and can withstand scrutiny. Carbon accounting standards define emissions calculations and provide guidance on strategies that can be implemented and used to reduce and mitigate emissions from an accounting perspective.

Regulatory requirements to report GHG emissions vary between jurisdictions. Larger firms and businesses operating in energy intensive industries are often subject to mandatory GHG and environmental reporting. Around **half of SMEs** across all sectors calculate emissions primarily to enhance brand reputation.



Accurately measuring and reporting emissions is an increasingly complex task, especially for businesses that operate globally within extensive supply chains. Accurate reporting requires a single version of the truth, resulting in data that can be shared and actioned.

As well as using appropriate technology to measure energy consumption and calculate emissions, organisations may have to overcome cultural resistance to sharing energy data. It is therefore, crucial to raise awareness of the value of measuring data across an entire global organisation by identifying pain points, running educational workshops and facilitating a global solution framework that acknowledges regional needs.

Enel X Global Retail supplies a wide range of software-based solutions as part of Enel X Connect: an all-in-one digital platform that helps companies monitor

energy usage, cost and emissions through a single and easy-to-use access point. Enel X Global Retail uses a sustainability reporting platform that also tracks energy spend, which enables emissions reporting. The platform provides visibility into how and when organisations use energy, providing a baseline for further efficiency measures.

Carbon reporting is an integral part of the platform that can help capture the environmental benefits of renewable programmes. This allows organisations to track all data associated with buying, consuming and generating renewable energy – including its impact on sustainability goals and environmental benefits – using market-based and location-based emission calculations. As a **CDP Gold partner**, Enel X Global Retail has visibility into supply chain disclosures and works with its customers to facilitate analysis of their upstream and downstream partners.

Enel X Connect gives ADM real-time visibility to optimise energy use

Archer Daniels Midland Company (ADM) is one of the world's largest agricultural processors and food ingredient providers. Its global value chain includes more than 460 farms and 200 ingredient manufacturing facilities. With such a large global footprint, tracking energy costs and identifying areas for improvement is critical to the company's bottom line.

ADM uses Enel X Connect to optimise its energy use by identifying opportunities for flexibility in plant operations to reduce peak demand.

For example, it has implemented a strategy to adjust temperature set points in on-site cold storage during peak hours, which reduces demand without worsening product quality. This minor operational change required no capital investment and saves \$23,000 per year.

By identifying demand spikes at a flour mill, ADM has been able to shift the runtime of individual processes to flatten the load, resulting in a further \$19,000 in annual savings.

The value of asset flexibility

Deploying renewable power sources on electricity grids results in increased supply variability. Having flexible assets that can modify the power they produce or consume enables operators to balance their grid systems by compensating for that increased variability on the supply side. Flexibility is a powerful mechanism to ensure grid stability, especially when combined with energy storage, but it requires system operators to evolve regulations to incentivise asset owners to participate in new energy markets. Navigating the new energy landscape requires deep expertise.

There are many opportunities across the F&B sector for businesses to deploy their energy assets. Through more sophisticated energy market participation, flexible energy generation assets and battery energy storage solutions, F&B businesses can earn more revenue and achieve greater performance visibility – enabling them to realise investment returns and support grid operators in the journey to net zero.

Sustainability and security of supply

Demand side response, or DSR (also referred to as demand response or DR), where a business turns down or turns off an electrical asset in response to a grid event, is the mechanism typically used to deliver asset flexibility to grid operators and realise a stack of value streams across various markets with various assets and facilities.

As well as reducing their carbon emissions, many businesses are increasingly concerned with grid-related issues such as security of supply and maintaining demand in times of grid stress.

Typically, on-load testing of backup systems is planned in advance, but grid outages don't occur at pre-planned times. Proving that a business can respond without advanced notice is the most realistic way to test its systems. Participating in demand side response programmes can provide a real-life testing environment while the grid is still available. This carries significantly less risk than discovering a problem during a real grid interruption.





Egg farm boosts energy security through flexibility programme

Versteden Egg Farm's concerns over potential electricity supply shortfalls in Victoria first led it to explore options to reduce its exposure to power outages. Losing power for an extended period could result in the death of its hens and loss of egg production.

By participating in Enel X Global Retail's demand response programmes, Versteden was able to confirm its concerns over the reliability of its primary back up unit. Revenue from participating in the DR programme helped to fund almost 30% of the cost of a new generator.

“To protect against power outages, businesses require a reliable back-up supply capable of providing power within milliseconds...”

Responding to DSR events can also prevent an actual outage of the national or regional grid system that would result in more downtime and longer time running on back-up generators. This is an example of how food and beverage manufacturers can be “good grid citizens” enabling broader societal benefits.

DSR also facilitates the integration of higher levels of renewable generation on the system. Increasing levels of renewable generation make the power system more challenging to operate in two main ways: first, their variability means that it is harder to keep supply and



demand in balance; second, because they are not synchronous generators, they do not contribute to system inertia, which makes it more difficult to manage the system frequency after any perturbation. Without large energy users participating on the demand side, grid operators must address these issues by calling on conventional generators and by paying renewable generators to reduce their output. By participating in DSR, customers are improving grid sustainability by enabling more renewable generation, without increasing costs to consumers.

As well as being a means to boost resiliency measures, DSR provides companies with additional energy, capacity and ancillary payments simply for being on standby within an energy market flexibility programme; valuable income to help offset energy costs. Coupled with battery energy storage, on-site generation further reduces dependency on the grid and improves business resilience.

Extreme weather events and natural disasters are disrupting electricity supplies more frequently than ever. The severe winter storms that struck Texas in 2021 – causing a massive electricity generation failure and leaving more than 4.5 million homes and businesses without power – illustrate how power systems, even within developed countries, are vulnerable to extreme weather. Such vulnerability is further exacerbated by the remote, rural location of many front-line F&B businesses.

To protect against power outages, businesses require a reliable back-up supply capable of providing power within milliseconds of an outage occurring. A back-up power supply will typically consist of batteries, to provide an instant response, and diesel or gas generators to cover any outage longer than a few seconds. Businesses can use their back-up energy supplies to operate independently of the grid to support stability through capacity and ancillary market mechanisms.

How much is your electricity demand flexibility worth?

Any business with the ability to turn down or switch on one MW or more of capacity across a single site, or combined across multiple sites, can participate in Demand Side Response, also called Demand Side Management or DSR. Participating businesses are paid to free up grid capacity when it is needed most, for instance by switching to their own backup generation and storage, or by curtailing equipment to reduce external load at peak periods. This is valuable incremental revenue to help mitigate the high cost of energy and spiralling inflation.

For example, the high clearing prices in the recent Capacity Market auctions in Great Britain means that qualifying businesses can earn an average of up to £30,000 per MW per year over the next 4 years. The examples below illustrate two different scenarios and the annual earning potential for each one:

Scenario A

- > Single manufacturing site
- > Site electrical import 4MW
- > 7MW CHP with 5MW load + 2MW head room

Capacity Market Earning Potential

- > Average 4-year pricing: £191,814
- > Additional gas cost: -£3,422

Gross income: £188,372 pa

(4-6 hours estimate)

Scenario B

- > 10 mixed use commercial buildings across GB
- > Site loads between 1MW and 4MW. Curtailment varies.
- > Aggregated flexible load 4MW

Capacity Market Earning Potential

- > Average 4-year pricing: £85,740
- > Electric import saving: £7,200

Gross income: £92,940 pa

(4-6 hours estimate)

Revenue estimates are based on DSR Capacity Market participation with Enel X from October 1st 2023 and are subject to eligibility, terms and conditions. Closing date for applications is the 31st of May 2023. Completed applications submitted after this date may not qualify for £30,000 per MW.

In addition to the financial rewards associated with participation in DSR schemes, energy flexibility is increasingly becoming a key pillar of Net Zero strategy for many organisations. DSR provides them with a revenue stream that they can invest into energy efficiency projects while also supporting the adoption of renewable energy at a national level.

There are different flexibility programmes available in every market and, in some cases, businesses may participate in more than one. Enel X Global Retail currently holds the leading position in DSR programmes worldwide, with over 8.5GW of capacity currently managed in the Americas, Europe, Asia and Oceania.



Demand Response in F&B

Andrew Sutherland explains how Enel X Global Retail works with F&B processors across Australia to save thousands in energy bills each year.

It can be tricky for businesses new to DSR to grasp the concept that they can turn off or turn down machinery and it will have no impact on their operations. We minimise the impact on business operations by considering what flexibility exists to turn off individual assets at the right point in time, and typically for only a handful of hours each year.

Our starting point is to identify elements of a customer's existing infrastructure and assets or processes that can help deliver a cost reduction if they are used in a slightly different way. We can then roll those assets in to flexibility or demand response programmes that help them lower costs. Any equipment used has to first serve its operational purpose and secondly provide some benefit to the grid.

For example, we have a customer that specialises in cold storage, which, thanks to our metering solution, can curtail the energy load at strategic points in time. This saves power and earns revenue by participating in a DSR programme. The net benefit to the customer is a saving of around 10 percent of the annual power bill.

As well as making financial savings, many of our customers view the societal benefits that they provide by participating in DSR programmes as increasingly important. By enabling grid operators to balance supply and demand even in times of grid stress, businesses help to ensure the continued reliability of our electricity systems.

DSR is still evolving, and many countries now see demand flexibility as a key tool in managing their energy transition to the greater use of renewables. The flexible use of assets can help to keep electricity grids stable by reducing demand instead of turning to fossil fuel powered generation assets.

DSR programmes can also make use of back-up power generators, transforming them from underutilised, largely dormant assets for emergency use only to active market participants.



Virtual power plants: an exceptional opportunity for F&B

A virtual power plant (VPP) is a platform that consolidates and coordinates a range of distributed energy resources (DER), including equipment, infrastructure, storage assets, backup generators and so on. The VPP enables aggregation of a host of smaller assets to provide a larger asset with electricity, equivalent to what might be available from a large power generator – but without having to construct the physical asset.

There is a host of equipment that businesses have invested in right across the F&B value chain, which can be utilised in a VPP. For a food processor with cold storage, for example, those assets could include chillers, compressors and any DER that has flexible attributes, which can be harnessed to deliver value to the grid. In agriculture, water pumps can be used. Grocery stores typically have HVAC systems and refrigeration that have thermal mass and are ideal for flexing.

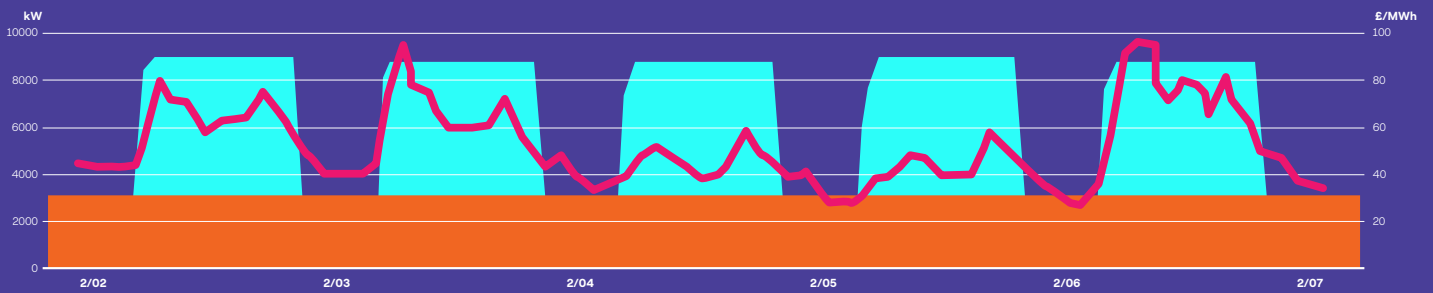
Regulators are innovating their capacity markets and balancing mechanisms to reward businesses for flexing their loads to deliver services to the grid. Businesses are increasingly informing their investment in

new assets not just on how the asset will fulfil its operational role, but also based on how it might be used as part of a VPP. In other words, flexibility becomes part of the business case for the new equipment.

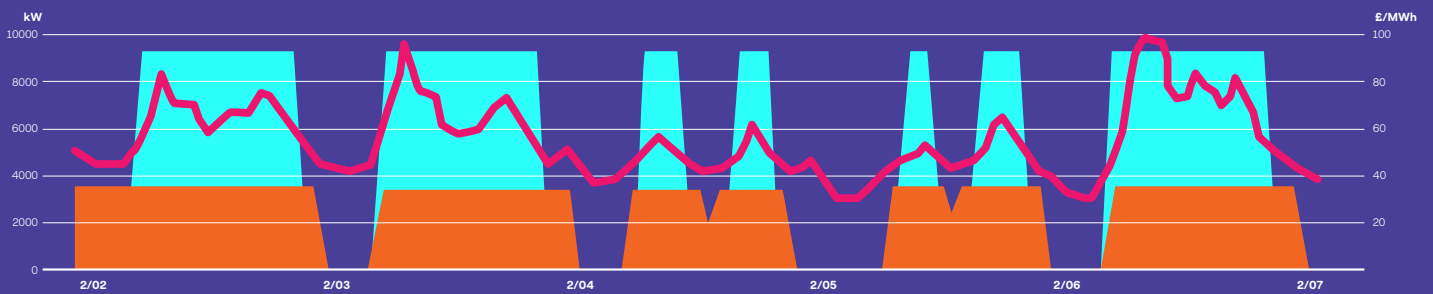
In one scenario, a flour milling company is looking to develop a new site. They are familiar with the concepts of flexibility and are prepared to change the operating model of that site to deliver real cost advantage. By using energy market signals as one of the key drivers for the design of the site, and by investing in control and automation, they can shift their energy demand to reduce costs and generate revenue by participating in the flexibility market. And this can be done without compromising production schedules.

In another scenario, a business operating a cold storage facility could choose to specify higher capacity chillers and compressors, improved temperature control, regulation and insulation. Investing in these incremental features improves the tolerance for more strategic energy consumption and increases the dispatchable capacity. These measures give the business more versatility to ‘stack value’ in flexibility markets and generate additional revenue while improving the stability of the grid.

Static Operating Schedule



Dynamic Operating Schedule



Static and dynamic operating schedules

The static schedule shows two CHPs – a 3.6MWe CHP unit in yellow and a 6MWe unit in orange, alongside the power price (blue line). The 3.6MWe CHP operates at 100% output 24x7, while the 6MWe unit operates at 100% during business hours. The dynamic operating schedule shows how the same units

would respond to changes in power prices. The 3.6MWe CHP operates at 100% during business hours (8am – 8pm) but reduces output midday on 2/04 and 2/05 reacting to a dip in power price. The 6MWe CHP operates at 100% during business hours but shuts off completely midday 2/04 and 2/05 reacting to the dip in power price.

Optimising co-generation for food manufacturing

Combined heat and power (CHP), or cogeneration, plants provide a highly efficient way to generate on-site electricity, heating, cooling and high-pressure process steam.

CHP technology provides operational benefits for F&B manufacturing facilities such as enhancing supply resilience, as well as its mitigating energy price volatility and greenhouse gas emissions. By deploying intelligent, dynamic software management technology, operators can increase control and monitoring over the whole CHP system. This enhanced level of visibility provides clarity over site energy costs; helps energy managers to understand and accommodate site and contract constraints; further minimises energy costs by reducing waste and inefficiencies and enables efficient energy trading in flexibility markets.

Implementing dynamic operating schedules

CHP units that haven't been optimised to serve variable site loads typically operate at sub-optimal performance. Generating constant heat and electricity surplus to requirements simply wastes energy, reduces site efficiency and is bad for the environment.

Using intelligent software to combine knowledge of operating parameters with grid signals and market indicators, such as energy market price information, it is possible to create the best running schedule for the CHP plant. The algorithms can then identify opportunities to trade any flexible capacity in the most appropriate markets.

Battery energy storage

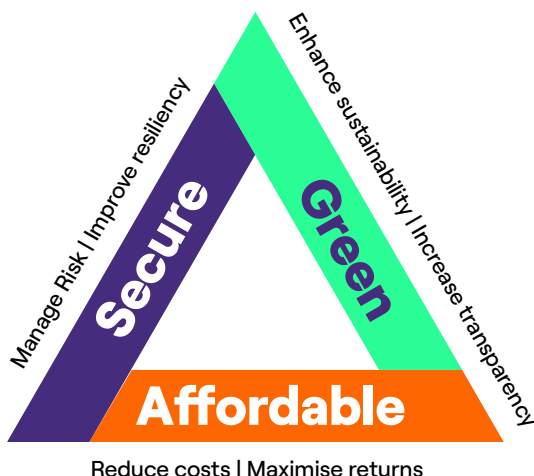
Maximising your asset value

“... the transition to net zero is a risk that needs to be managed as well as an enormous commercial opportunity to grasp.”

Mark Carney, Finance Adviser to the Prime Minister for COP 26 and UN Special Envoy for Climate Action and Finance

With technology costs falling rapidly, battery energy storage systems (BESS) are becoming pivotal in the energy transition as they can provide the flexibility and resilience needed to accommodate the increased penetration of renewable energy on the electricity grid. Battery energy storage systems typically drive three main sources of value.

Depending on an organisation's specific needs and priorities, each of these value sources may be more or less important in achieving your goals.



Sustainability Value

Battery energy storage can improve your ROI for on-site solar power, and storage also enables the grid to support increasing amounts of renewable power, which will drive down wholesale power costs over time.



Economic Value

A battery energy storage system has the ability to capture all flexibility opportunities. You earn a share of the value captured by the battery system each month, with immediate positive cash flow impact to your business.



Resiliency Value

The system will improve your ability to operate critical equipment in the case of a grid power outage, especially if installed as part of a micro grid.



Energy storage enables Algoma Orchards to shift peak demand

Algoma Orchards is a family-run commercial orchard in Ontario, Canada. Having partnered with Enel X Global Retail since 2010 on demand response programmes, the company is aware of the financial opportunities available to it by managing demand strategically.

The business has more recently worked with Enel X Global Retail to install a 1 MWh energy storage system that enables it to automatically shift its loads on and off the grid to deliver the most value possible. The

battery storage is charged when electricity prices are low and is used as its primary power source when grid peak events are most likely.

By working with Enel X Global Retail, Algoma Orchards was able to finance and install the energy storage system with no upfront costs. The additional flexibility offered by energy storage enables Algoma Orchards to help maintain grid stability without any impact to production at its sites

Procuring low-carbon energy

Measures that improve efficiency and optimise energy demand using flexibility can only go so far; the next step is to look at sourcing green electricity for power.

Good procurement of renewable contracts is a complex issue. A typical requirement is to make a long-term agreement with an energy company that can guarantee to deliver a supply of clean electricity sufficient to meet an organisation's changing needs.

Switching to clean sources of power has a dramatic impact on emissions. F&B businesses that choose to become off-takers using power purchase agreements (PPAs) to buy renewable energy can complement the use of on-site generation and storage. This further increases the proportion of low-carbon energy that makes up their fuel mix, so reducing emissions. As well as guaranteeing supply, PPAs allow them to reliably predict future costs. Above all, purchasing renewables through a PPA signifies a long-term commitment to the zero-carbon agenda.

However, negotiating PPAs can be technically complex. Some key PPA parameters include the term of the agreement; whether the PPA is a corporate arrangement; if it is purchased directly from the generator or a supplier; if it includes a private wire and/or storage; and how risk is allocated between procurer and generator or supplier, including the volume risk. Optimising these parameters to deliver a bespoke agreement that suits both generator or supplier and off-taker requires depth of knowledge and experience.

Enel X Global Retail helps organisations simplify their energy purchases through a holistic, three-step process:

1 Strategy

Understanding how different renewable energy resources and product options accomplish different objectives is the cornerstone of an effective renewable energy strategy. Enel X Global Retail helps businesses prioritise their goals across emissions and cost reduction, budget stability, contractual complexity, speed to market and contract duration.

2 Implementation

Given the complexity of renewable energy contracts, RFP (request for proposal) definition is crucial to make "apples-to-apples" comparisons. Enel X Global Retail helps businesses structure RFPs to manage market, basis, counterparty, and contractual risks effectively. For example, COD (commercial operation date) guarantees, production guarantees, and energy attribute certificate deliveries should all be consistent across bidders so that organisations can evaluate deals on equal terms.

3 Continuous optimisation

Throughout the life of the PPA, Enel X Global Retail continues to support clients via activities such as energy attribute certificate retirement and integration with wider energy risk management strategy.



Holistic approach to sustainability for Italy's largest agricultural company

Genacricola, Italy's largest agricultural company, is working with Enel X Global Retail to achieve its goal of becoming the first zero-impact Italian agricultural company. The partnership started with an analysis of Genacricola's current position, measuring its carbon footprint by applying the GHG Protocol to all national and international sites, and subsequently identifying the strategy required to begin its full decarbonisation process.

Initially, Enel X Global Retail is working with Genacricola to deploy 1.2 MW of solar PV and 42 charging stations to enable the conversion of the company fleet to electric vehicles. By deploying renewables and implementing energy management initiatives Genacricola expects to reduce its emissions by 12,000 tonnes over the next 20 years.



Conclusions

The global food and beverage industry is one of the most emissive economic sectors. Given its significant and growing contribution to GHG emissions, it has a critical role to play in tackling the climate emergency.

There is an array of opportunities for businesses operating in F&B to play an active role in supporting the energy transition. With a comprehensive energy strategy, F&B businesses can reduce carbon emissions, maintain resilience, predict future energy costs and enhance their ESG performance. An effective strategy must include optimising energy use, planning and implementing a procurement strategy, and exploring ways to co-operate with energy companies and grid operators.

By committing to PPAs with clean energy suppliers and participating in flexibility programmes, F&B manufacturing businesses can help maintain the stability of the grid and find valuable new sources of income; in short, going beyond adopting energy efficiency measures to become good grid citizens.

For most F&B organisations however, sustainable energy is not a core business competence and implementing an energy strategy that addresses all of these priorities takes knowledge and expertise and a deep understanding of current regulatory and compliance issues.

Enel X Global Retail has a strong track record of working with F&B businesses globally to deliver advisory services, energy strategies, enable demand response and virtual power plants.

Enel's sustainability journey

The Enel Group of companies has been on its own sustainability journey for more than 20 years. Enel has fundamentally changed its business model and invested in renewables, networks and digitisation. The company has a core value embedded into its purpose and strategy, which is to create lasting value for society and work for sustainable progress. Our aim is to become a leader in shared value and sustainability. Enel recently brought forward its target commitment to fully decarbonise by 10 years, to 2040.

About Enel X

Enel X Global Retail is the Enel Group's global business line that enables more independent and sustainable energy use. As a global leader in the energy transition, we provide consumers, businesses, and cities with innovative, platform-based solutions that embrace electrification and digitalisation to create new value. We help our customers develop their own energy roadmaps that enhance energy performance and achieve net zero targets, from initial consultation to execution.

Enel X Global Retail currently manages 8.5GW in total flexible demand response capacity and has installed 760MW of battery energy storage capacity. (BTM, FTM, Enel Plants)

The Enel Group has 15+ years of inclusion in major sustainability indexes, including the FTSE4Good, DJSI, CDP, ECPI, Euronext and STOXX, and the Group is committed to achieving 100% carbon neutrality by 2040.

760MW

battery energy storage
installed capacity
BTM, FTM, Enel Plants

246MW

Distributed energy
generation assets

8.5GW

demand side response
capacity managed

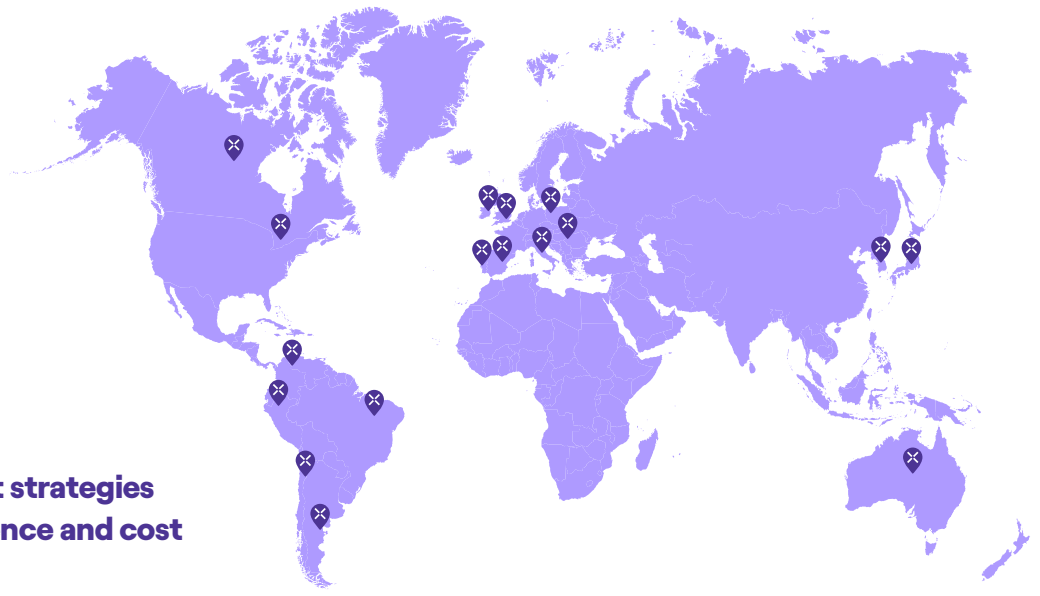


Let's Talk

Contact us to learn more about strategies for energy sustainability, resilience and cost management with Enel X.

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