smartEn
SMART ENERGY EUROPE

COLLECTION OF BEST PRACTICES FOR FLEXIBLE ENERGY-INTENSIVE INDUSTRIES

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About smartEn - Smart Energy Europe

smartEn is the European business association of the Flexible Demand Management Industry. We integrate consumer-driven solutions in the clean energy system by unlocking demand-side flexibility. Our mission is to create opportunities for every company, building, and vehicle to support an increasingly renewable energy system.

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Best practices are organised by sector and each case study follows the same structure. After a brief introduction, the opportunity section outlines the flexibility potential, the solution explains how it is unlocked, and the benefits highlight the value for both the company and the power system.

INTRODUCTION

European electricity systems are undergoing a profound transformation, driven by the growing share of renewable electricity generation. With variable generation and increasing electrification posing significant challenges in terms of grid stability, the need for flexibility has become critical. In this context, industrial consumers are shifting from passive users to active participants in the power system, leveraging their operational flexibility to support the grid while unlocking new revenues, reducing energy costs, increasing resilience to price volatility, and contributing to decarbonisation.

This report shows how demand-side flexibility (DSF) is being successfully implemented in industries across a wide range of sectors, including agriculture, cement, chemical, data centres, glass, iron and steel, mining, pulp and paper, timber production, and waste and water management. Despite their operational differences, these cases share a common insight: DSF is not a constraint on production, but a strategic asset that can unlock significant economic and operational value.

smartEn has identified key patterns across the examples:

1. **Industrial processes inherently possess flexibility potential**, for example through thermal inertia (e.g. furnaces, kilns, e-boilers) or material storage (e.g. water reservoirs, pulp tanks). When properly identified and managed, these characteristics enable sites to adjust electricity consumption without compromising operations.
2. **Industrial flexibility unlocks numerous value streams.** Revenues can come from participation in balancing markets (e.g. FCR, aFRR, mFRR), capacity mechanisms, or short-term price arbitrage, often reaching tens or even hundreds of thousands of euros per MW annually. Additionally, sites benefit from reduced energy costs, improved energy management, and enhanced resilience to price volatility.
3. **The whole system benefits.** Industrial flexibility helps maintain grid stability, reduce peak demand, avoid costly infrastructure investments, and facilitate the integration of renewable energy sources. In doing so, it contributes to the decarbonisation and reliability of the electricity system.
4. **Flexible Demand Management Industry (FDMI) actors are key enablers.** Companies such as Sympower, Agregio Solutions, Enel X, Energy Pool, ESFORIN, and INEA support sites throughout the entire flexibility journey: from technical assessment and testing, to market access, real-time control, and revenue optimisation. Their expertise allows even highly complex or critical processes to participate in energy markets with minimal risk and operational disruption.

Taken together, these case studies demonstrate that demand-side flexibility is no longer a niche practice: it is a scalable, mature solution that aligns industrial economic performance with grid needs. However, this is possible only where appropriate markets and flexibility mechanisms exist to offer and activate it.

COMPANIES

agregio solutions GROUPE EDF Agregio Solutions is an energy services company specialised in managing and aggregating decentralised energy assets. It is a subsidiary of EDF, global leading utility with activities around the globe in electricity generation, transmission and distribution, energy supply, and optimisation and trading.	enel x Enel X is a global business line of the Enel Group focused on smart, innovative and sustainable energy technology and services. It helps individuals, businesses and cities optimise energy use and adopt more sustainable practices, creating both economic and societal value. Operating worldwide, Enel X plays a key role in enabling the energy transition.
Energy Pool Energy Pool is an independent energy services company specialising in demand side flexibility. Founded in 2009, it has been one of the pioneers in the French electricity flexibility market and is now a key player in the energy transition. It operates in several regions of the world, Europe, the Middle East, Asia and Africa, and manages 8 GW of flexibility.	ES·FOR·IN Energy Services for Industry ESFORIN specialises in short-term flexibility valorisation of electricity and gas. It uses customer-specific programmed algorithms to optimise how customers' systems react to price signals from energy markets. Its solutions are aimed at industry, utilities, battery storage, energy suppliers and power plants, renewable energies and aggregators/VPP.
INEA INEA d.o.o. is a Slovenia-based technology provider specialising in industrial automation, digitalised data-driven solutions, and optimisation of industrial energy systems through flexibility.	sympower Sympower is an independent flexibility service provider with more than 10 years of experience across Europe's energy markets, currently managing over 3 GW of flexible assets. They help their clients turning flexibility into profit with advanced BESS, demand response, and RES tailored solutions.

AGRICULTURE

A DECADE OF FLEXIBILITY IN AGRICULTURE

Sector	Agriculture
Location	Ireland
Solution	Load shedding through participation in the Capacity Market
Benefits	Annual revenue between €10,000 and €12,000
Company	Enel X

A family-owned agricultural business has been growing cereal and forage crops to produce feed for livestock since the mid-1950s. The site runs energy-intensive machinery for five and a half days per week and consumes between 2.7 and 3 GWh of electricity annually, representing approximately 17% of total operating costs. The company has progressively integrated sustainability into its operations, installing on-site renewable assets including a Vestas V44 wind turbine and solar panels.

Opportunity

Critical equipment such as mills, conveyors, and processing systems cannot operate at partial load, meaning flexibility cannot be delivered through continuous load modulation. Instead, it must rely on planned downtime. A previous load shedding programme, operating between 5 p.m. and 7 p.m., proved inadequate as it was not flexible enough for the site's operations and did not generate sufficient financial returns. Moreover, it created operational inefficiencies, as production often had to resume after 7 p.m., forcing the site to run late into the night to compensate for lost output. This is why the business decided to partner with an aggregator to develop a flexibility solution capable of delivering a higher revenue stream and providing greater control over when and how consumption is reduced.

Solution

Enel X designed a tailored demand response strategy to align with the nature of the site's business. The solution included:

- A **site visit and engineering assessment** to identify the demand response programme most suitable for its operational requirements and where the flexibility could come from;
- **Rapid and non-intrusive equipment installation**, completed in less than a day with no shutdowns and no impact on operations;
- Introduction of **forecasting tools** providing weekly predictions of upcoming dispatch events, allowing proactive response planning.

Based on the assessment, participation in the Capacity Market was determined as the best solution. This mechanism ensures grid security by balancing supply and demand during periods of system stress. Participants are remunerated both for their availability and for the actual activation of demand reduction during dispatch events.

The aggregator's support has proven successful over the long-term, facilitating participation in the Capacity Market for almost 10 years and ensuring seamless integration into daily operations.

Benefits

Enel X's no cost, low risk demand-side response programme has allowed the business to reduce its operational costs, decrease its emissions, and support the stabilisation of the grid. The average revenue from demand response activities is between €10,000 and €12,000 per year, representing nearly 2% of the company's annual energy spend. Additionally, forecasting capabilities provide operational flexibility and enable the efficient use of planned downtime for other critical activities. Lastly, the site retains full control over its operations. During busy periods it can choose wither to not participate or to run its 350 kW on-site generator and reduce its offer to Enel X.

TOWARDS PROFITABLE HYBRIDISATION

Sector	Agriculture
Location	France
Solution	• Recommendations on flexible equipment design and operation • Participation in electricity markets (aFRR) • Energy arbitrage
Benefits	€220k per MW per year
Company	Energy Pool

This case highlights a major achievement: the out-of-factory certification of a 1 MW electric boiler for participation in the aFRR market in France, marking a key step toward embedding flexibility into assets from day one, as truly flex-ready devices.

Opportunity

In a context of persistent energy price volatility, operational resilience alone is no longer sufficient. Agricultural producers are increasingly turning their thermal assets into sources of revenue. Greenhouse production depends on reliable heat production, making energy both a critical input and a major cost driver. In September 2025, a leading tomato producer in France integrated a 1 MW electric boiler on the aFRR market. The objective was to reduce reliance on gas while unlocking new revenue streams through participation in flexibility markets.

Solution

Energy Pool, in collaboration with the e-boiler provider, developed a comprehensive flexibility valorisation strategy. The first step is to certify the e-boiler for participation in aFRR for 1 MW capacity (with the certification currently underway) and to sign dedicated electricity supply contract for the asset. This resulted from tripartite exchanges between the customer, to understand their energy needs; the equipment supplier, to assess the capabilities of their hardware; and Energy Pool, to ensure compliance with aFRR requirements, including reliable communication with the e-boiler.

Building on this foundation, a multi-energy and multi-market arbitrage strategy will be implemented, enabling the site to dynamically switch between gas and electricity based on price signals:

- High gas prices: activate the e-boiler and position on upward aFRR (reduced consumption)
- Competitive gas prices: position on downward aFRR (increased consumption)
- Negative electricity prices / intraday opportunities: increase consumption to maximise savings

To ensure effective execution of this strategy, Energy Pool provides continuous operational support, including real-time market monitoring and activation of flexibility. This guarantees optimal responsiveness to market signals and adherence to the site's operational constraints.

Benefits

The project is currently in its implementation phase, with 2026 forecasts supporting the strength of the business case. Estimated revenues could reach up to €220k per MW per year, while the site benefits from increased resilience to gas price volatility. This case demonstrates how an electric boiler is not just a decarbonisation tool, but also a financial asset. Looking ahead, the next step will be to expand into intraday markets, enabling more granular, hour-by-hour optimisation.

CEMENT

FLEXIBILITY MONETISATION IN THE CEMENT INDUSTRY

Sector	Cement
Location	France
Solution	• Load shedding and load shifting • Activation of flexibility based on price signals • Participation in the Capacity Market
Benefits	17.5 MW of flexible capacity, 100+ activations/year, ~€300k revenue per trimester
Company	Energy Pool

Cement production is highly energy-intensive, with electricity driving a significant share of costs. Despite processes that can be shifted without disrupting output, most sites struggle to leverage this potential due to limited visibility and coordination with energy markets. This case shows how Energy Pool helped a cement group turn hidden flexibility into a new source of value.

Opportunity

The cement industry is one of the most energy-intensive sectors, accounting for around 7% of global industrial energy consumption. Electricity alone can represent 30-40% of total production costs, making energy a critical lever for competitiveness.[1] At the same time, cement production processes inherently offer flexibility. Several stages, such as crushing, raw milling, and cement grinding, are time-bound and supported by intermediate storage. This allows production to be shifted without interrupting output.

Despite this strong potential, flexibility remains largely underutilised. Key barriers include:

[1] Mossie, A. T., Khatiwada, D., Palm, B., & Bekele, G. (2025). Energy demand flexibility potential in cement industries: How does it contribute to energy supply security and environmental sustainability?. *Applied Energy*, *377*, 124608.

- Limited visibility on real consumption patterns
- Difficulty identifying safe operating margins
- Lack of tools to coordinate production with energy market signals

As a result, the client ultimately approached Energy Pool to support the valorisation of their load.

Solution

To overcome these barriers, Energy Pool collaborated with the industrial group to deploy a structured flexibility programme across five cement production sites. Their approach started with a detailed mapping of processes and electricity uses across all sites, enabling the creation of asset-level consumption benchmarks. Based on this analysis, Energy Pool identified modular production sequences and implemented a dedicated control system to steer asset consumption in response to energy price signals.

Among the equipment studied, crushers and silos proved particularly effective. Their operation allows for load adjustments or time shifts without significant impact on production, provided these actions are properly anticipated and planned.

Today, the sites activate flexibility based on price signals. Additionally, the sites have been participating in the Capacity Mechanism since 2021. Activations occur only when market conditions justify and consistently respect process constraints. The sites retain operational control over production, within a predefined framework.

Benefits

Thanks to Energy Pool's solution, the five sites make the most of their flexibility in harmony with their production processes. In total, available flexibility amounts to 17.5 MW, resulting in more than 100 activations per year and €300k in revenues per trimester.

The programme also generates system-wide benefits. Load is shifted to off-peak periods, supporting grid stability. This facilitates the integration of renewable energy and has a positive impact on emissions.

BEYOND EFFICIENCY: SCALING SAVINGS WITH DEMAND RESPONSE

Sector	Cement
Location	Ireland
Solution	Participation in demand response schemes, load shedding
Benefits	Annual savings of 3-5% of energy spend
Company	Enel X

A global leader in construction aggregates, ready mixed concrete and related products operates a network of over 50 energy-intensive quarries across Ireland. This case shows how, with energy efficiency gains largely exhausted, flexibility offers an additional lever for savings.

Opportunity

With rising energy costs over the past decade, the company recognised that even small reductions in consumption could translate into substantial savings and launched a broad efficiency programme across its sites. By fostering a culture of accountability and implementing measures such as lighting upgrades, heating controls and operator training, it achieved consistent energy savings of 3-5% year-over-year since 2007. However, as most low-hanging opportunities were gradually exhausted, sustaining these gains became more challenging. The company turned to demand-side flexibility, initially participating in a winter peak load reduction scheme, but its discontinuation left the energy manager seeking a more durable solution.

Solution

The company partnered with Enel X to participate in demand response schemes unlocking more flexibility than the previous curtailment scheme. Eight sites are now involved and, although each typically curtails only a few hundred kW, the cumulative reduction generates a sizeable revenue stream.

The aggregator developed site-specific curtailment strategies, allowing engineers to temporarily shut down or scale back selected equipment (e.g. rock crushers, conveyors, grinders). Dispatches require action within 30-60 minutes and, being infrequent, are seen as opportunities to carry out much needed maintenance projects. The customer is not exposed to penalties for opting out if production cannot be stopped, leaving the company free to put business first. Importantly, the programme required no upfront capital investment, as metering infrastructure was provided by Enel X and costs are recovered gradually from the programme's payout.

Benefits

Demand response enabled the company to sustain its energy reduction targets, maintaining annual savings of around 3-5% of energy spend. So far, demand response single-handedly met savings targets at each participating site. Crucially, participation did not disrupt production processes and was positively received by site engineers, who integrated activations with planned maintenance.

For the power grid, the programme increases reliability and reduces the need for costly investments in peak power plants or grid expansion. For the environment, it lowers greenhouse gas emissions by reducing reliance on fossil fuel-based generation and supports the transition towards a more renewable-based energy system.

CHEMICAL

MAXIMIZING THE VALUE FROM ELECTROLYSIS: A 12 YEARS SUCCESS STORY

Sector	Chemical
Location	France
Solution	Participation in the Capacity Mechanism, FCR, aFRR
Benefits	>1,5 million gross revenues
Company	Energy Pool

A global player in the chemical industry established a long-lasting partnership with Energy Pool, driving competitiveness and sustainability through flexibility. Over more than a decade the site has moved from occasional load shedding to active participation in balancing services for the French electricity grid.

Opportunity

Among its plants located all over the world, Energy Pool's client operates a sodium chlorate production plant via electrolysis in France with a maximum production capacity of 42 MW. Under normal operation conditions, up to 25 MW of this capacity is made available for flexibility services, including demand response during peak periods and participation in grid balancing mechanisms such as secondary reserves (aFRR), with 4 MW of symmetrical capacity.

Electrolysis is an electricity-intensive process in which electric current is used to drive chemical reactions. It runs continuously and requires a stable power input. The electrical load can be adjusted within certain limits by modulating current intensity without immediately affecting output. This flexibility is enabled by the thermal and chemical inertia of the process, which allows short-term deviations while maintaining product quality.

Solution

Energy Pool implemented a progressive and tailor-made flexibility strategy. Its success is driven by solutions aligned with the site's operational constraints, supported by unique technological expertise that integrates data intelligence, automation, and real-time control. Over 12 years of collaboration DR capacity increased by a factor of 30. Timeline:

- **2014 – Beginning of the partnership:** participation in the Capacity Mechanism, with the ability to reduce consumption by up to 25 MW for two hours, on TSO request.
- **2017/2018 – Real-time participation, FCR:** integration into ancillary services (FCR) thanks to Energy Pool's real-time dynamic modulation of consumption. Participation in the Demand Response Tender (AOE, *Appel d'Offres Effacement*).
- **2023 – Next level participation, aFRR:** certification of 4 MW of symmetrical capacity for the secondary reserve (aFRR), contributing to frequency regulation services.
- **2025 – Continuous optimisation:** implementation of consumption arbitrage strategies based on spot market signals and aFRR activations.

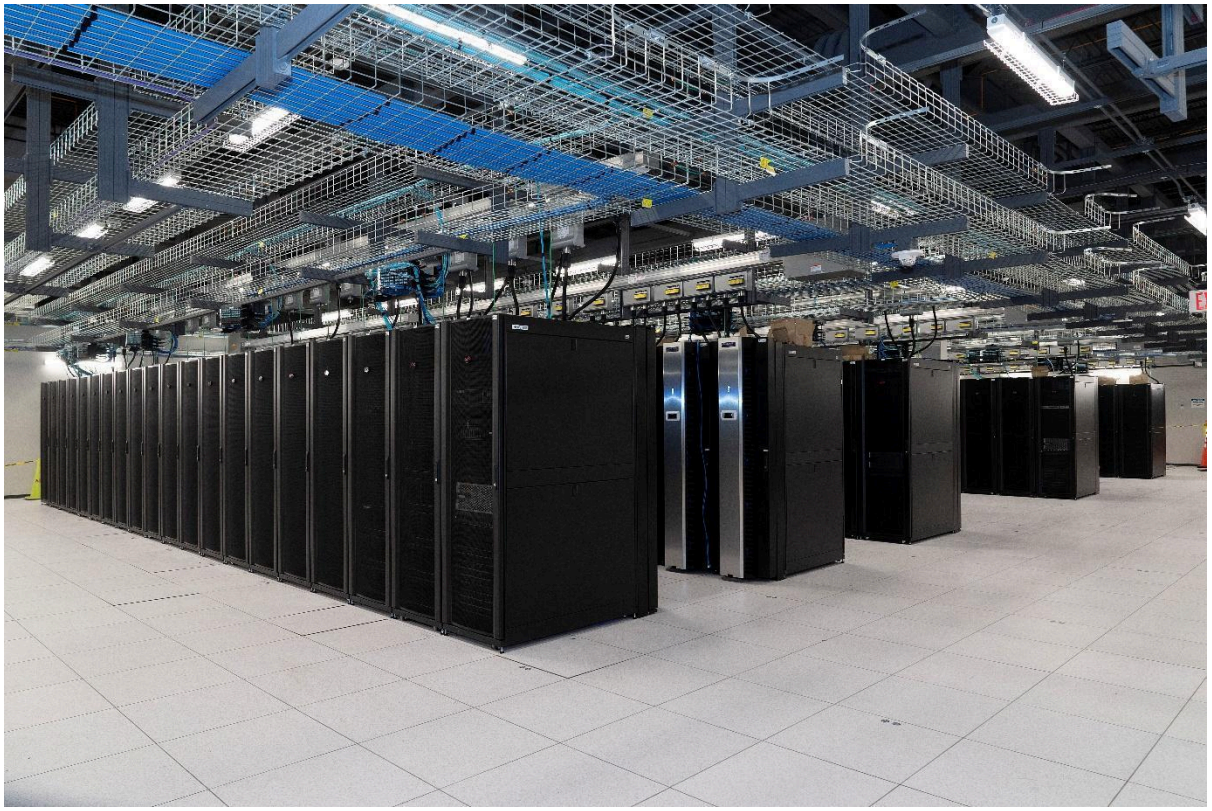
In the future there might be even newer uses: multi-site flexibility, integration of batteries (BESS) and smart demand management.

Benefits

Thanks to this collaboration, the sodium chlorate producer taps into multiple revenue streams across different market mechanisms, generating €1.5 million in total revenues, including €350k from energy market mechanisms and €805k from capacity mechanisms in 2025. Optimised energy consumption also reduces overall electricity costs.

The site provides flexibility services that support grid stability and actively contributes to the decarbonisation of the electricity system. The case shows how roles traditionally reserved for electricity producers can be effectively fulfilled from the demand side, and how industrial consumers can become long-term, strategic providers of flexibility within electricity markets.

DATA CENTRES



GRID-INTERACTIVE UPS FOR FREQUENCY BALANCING

Sector	Data centres
Location	Ireland
Solution	Participation in the DS3 programme
Benefits	• Revenues • 24,000 tonnes of CO_2 avoided annually
Company	Enel X

Two data centres in Ireland participate in the DS3 programme ("Delivering a Secure, Sustainable Electricity System") and demonstrates how backup energy assets in data centres can act as fast-response flexibility providers, supporting frequency stability while maintaining full reliability.

Opportunity

EirGrid, the Irish Transmission System Operator (TSO), established the DS3 programme to achieve renewable electricity targets of 80% by 2030 and to securely manage the voltage and frequency of the electricity system. It requires assets capable of reacting within seconds or milliseconds to maintain the grid frequency at 50 Hz.

Digital Realty, major global data centre operator, runs facilities offering colocation and interconnection solutions with 99.999% availability. They are equipped with uninterruptable power supplies (UPS) to provide power conditioning and backup electricity in the event of a grid supply failure. With response times below 0.5 seconds they are fast enough to respond to grid signals and provide frequency services.

Solution

Starting with two of its Dublin data centres, Digital Realty partnered with Enel X to enable a grid-interactive UPS through advanced control technology, to actively support grid stability

without compromising their primary backup function. At the core of the solution is a dynamic controller, developed in collaboration with an IoT technology provider, which continuously monitors grid frequency in real time. When deviations occur, the system automatically modulates the charging or discharging of the batteries to help restore balance. The solution successfully passed all grid compliance tests and is in line with the technical requirements of the Irish TSO. A total of 6 MW of UPS capacity has been integrated into the programme, with further available capacity planned.

Benefits

The project transforms UPS systems from passive backup assets into revenue generating resources, without compromising uptime. It also strengthens the operator's sustainability profile and has been recognised with multiple industry awards, including Data Centre Power Project of the Year and Sustainable Project of the Year at the ER & DCR Excellence Awards, as well as Private Sector Project of the Year at the Tech Excellence Awards.

The integration of 6 MW of fast-response capacity stabilises grid frequency in real time, supporting a system with increasing renewable energy and providing valuable resilience to grid operators. Additionally, it is estimated to avoid over 24,000 tonnes of CO_2 emissions annually.

Company

Enel X is a global business line of the Enel Group focused on smart, innovative and sustainable energy technology and services. It helps individuals, businesses and cities optimise energy use and adopt more sustainable practices, creating both economic and societal value. Operating worldwide, Enel X plays a key role in enabling the energy transition.

BEYOND DATA HOSTING: HOW HPC INFRASTRUCTURE BECOMES A FLEXIBILITY ASSET

Sector	Data centre
Location	Sweden
Solution	Participation in the FCR-D Up market and soon the mFRR market
Benefits	Revenues range between €90,000 - €120,000 per MW per year

By leveraging the inherent flexibility of High Performance Computing (HPC) systems, a Swedish data centre operator has successfully transformed its data hosting operations into an active participant in balancing markets, positioning itself among the leading providers of demand-side flexibility in Sweden.

Opportunity

The operator was introduced to the aggregator through their BRP (and electricity supplier). As electricity demand rises and renewable generation increases, the operator saw an opportunity to actively support grid stability while creating new revenue streams. However, it lacked prior experience in demand response and needed guidance to unlock and operationalise its flexibility potential.

Solution

In 2022, the data centre embarked on a journey with the aggregator to assess, unlock, and commercialise the flexibility potential of its HPC infrastructure. Thanks to their ability to rapidly increase and decrease power usage without impacting overall functionality, these systems are ideal to respond to real-time grid signals. The aggregator supported the operator across three key areas:

- **Flexibility assessment and testing:** the technical teams identified the assets suitable for demand response and mapped which market they could participate in. They also tested them to ensure requirements for participation in balancing markets were met.
- **Market integration (FCR-D Up):** with the aggregator's help, the operator began participating in Sweden's FCR-D Up market with an initial capacity of 9.4 MW, later

expanded to 10.4 MW. Assets must respond within seconds to grid imbalances, activating 50% of capacity within 5 seconds and reaching full activation within 30 seconds, with events lasting up to 15 minutes.

- **Expansion to additional markets (mFRR):** building on early success, the operator is now entering the mFRR market, which requires slower, manually dispatched, responses (within 15 minutes).

Benefits

By participating in the FCR-D Up market, the data centre operator earns a gross total of between €90,000 - €120,000 per megawatt per year. Participation is compensated through energy payments, i.e. when flexibility is activated, with the total amount depending on the capacity contributed and market prices at time of delivery. Additional revenues are expected from its entry into the mFRR market.

Beyond financial gains, the operator actively contributes to grid stability by adjusting its electricity consumption in response to real-time signals, supporting overall system reliability. It has also strengthened its strategic positioning, establishing it as a trusted and leading provider of flexibility in Sweden's energy landscape.

FOOD AND DRINK

SMARTER HEAT, STRONGER RETURNS: MONETISING FLEXIBILITY WITH E-BOILERS

Sector	Food and drink
Location	France
Solution	• Arbitration between electricity and gas spot markets • Participation in electricity markets (Capacity Mechanism, mFRR, aFRR, and the spot market)
Benefits	• Capacity revenue: 100 k€/MW • Activation revenue: 30 k€/MW
Company	Agregio Solutions

Agregio Solutions enables industrial sites with steam production or heat networks, including in the food and beverage sector, to optimise energy costs and unlock new revenues by combining fuel switching with access to electricity markets.

Opportunity

Steam is used across a wide range of processes in the food and beverage industry. Among these:

- Sterilisation and pasteurisation to ensure product safety and extend shelf life
- Cooking and blanching to preserve the nutritional quality and flavour of food
- Cleaning and sanitisation to maintain hygienic, contaminant-free equipment and surfaces
- Drying and dehydration to efficiently reduce moisture content and preserve foods

The switch to electric boilers (e-boilers), which replace or operate alongside combustion-based heat generation and offer a high degree of controllability, is creating a major revenue opportunity for industrial sites. Whether by switching resistances on and off (resistance e-boilers) or by modulating water levels in contact with electrodes (electrode e-boilers), these systems can operate at partial load with fine granularity. This controllability,

combined with the inherent thermal inertia of heated water, makes e-boilers particularly well-suited for flexibility services.

Solution

Agregio Solutions offers its customers a comprehensive aggregation service that enables industrial sites equipped with e-boilers to fully valorise their assets and their flexibility. The solution is based on integrating the e-boiler into Agregio's aggregation portfolio.

The aggregator performs daily arbitration between the gas and electricity spot markets to select the cheapest energy source for steam production. At the same time, it continuously monitors market signals and activates flexibility when economically optimal. Depending on market value, the sites can participate in several mechanisms, including the French Capacity Mechanism, mFRR, aFRR, and the spot market.

The erasable power can range from 1 MW to several hundreds of MW. Activations can occur dozens of times per day depending on the bid price, with durations ranging from 4 seconds to 300 seconds. RTE checks the real flexibility every day.

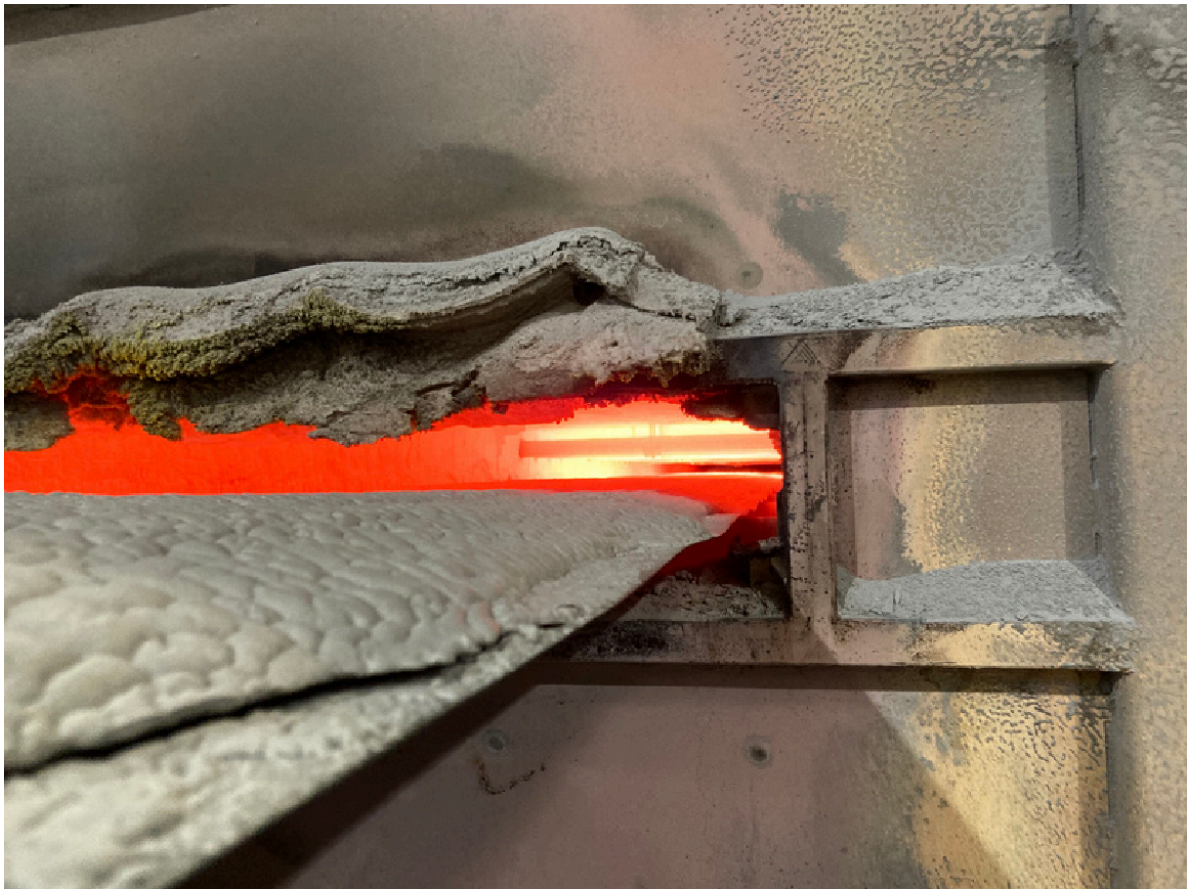
Benefits

For winter 2026-2027, estimated revenues are around 100 k€/MW from capacity payments and around 30 k€/MW from activation revenues, depending on the activation price. Beyond direct remuneration, the approach helps and reduce the cost of heat by optimising the energy source used for steam production.

In the long-term, the solution also supports decarbonisation. When electricity becomes the more attractive option, the electric boiler replaces fossil-based heat production and contributes to lowering the carbon footprint of the site.

For the power system, this flexibility supports grid balancing, helps avoid local congestion, and can reduce the need for grid reinforcements.

GLASS



SUSTAINABLE GLASS, SMARTER ENERGY

Sector	Glass
Location	Sweden
Solution	Participation in the FCR-D Up market and soon the mFRR market
Benefits	Extra revenues (€100,000 in 2024)
Company	Sympower

In its commitment to sustainability, a glass manufacturing company partnered with Sympower to integrate demand response solutions, helping to stabilise Sweden's electricity grid while unlocking new revenue opportunities.

Opportunity

A Swedish foam glass manufacturing company operates energy-intensive kilns (furnaces) with a total installed capacity of around 2.5 MW. It specialises in foam glass aggregate, an innovative and sustainable lightweight material used in infrastructure, building and construction projects. As renewable energy increases, grid imbalances have created a need for flexible demand. In response, the company explored demand response solutions with Sympower to support grid stability while maintaining efficient operations.

Solution

During the autumn of 2022, a detailed Flex Scan and on-site testing confirmed that demand response activations would have minimal to no impact on production. By spring 2023, the company committed to participating in demand response programs and, thanks to Sympower, integrated 2.3 MW of qualified capacity into Sweden's balancing markets (FCR-D Up). The solution leverages 7 kilns, which are activated for flexibility on average four times per month. Each event lasts approximately four to five minutes.

The FCR-D Up is a fast frequency containment reserve used to stabilise the grid by increasing production or reducing consumption when frequency drops. It requires a rapid response

capability, with 50% of the contracted capacity to be activated within 5 seconds of a frequency deviation, with 100% being ready for activation within 30 seconds.

Looking ahead, the company is expanding the solution by testing for mFRR qualification, a market that requires response within a longer (15-minute) timeframe and offers additional flexibility monetisation opportunities.

Benefits

By participating in demand response, the company successfully transformed its energy-intensive operations into a source of strategic value, generating over €100,000 in additional revenue in 2024. This value is achieved with minimal to no impact on production.

At the same time, the initiative is fully aligned with the company's broader sustainability commitments: the company is deeply invested in environmental responsibility and sees demand response as a concrete way to enhance its sustainability strategy.

By optimising energy consumption and reducing stress on the power grid, the company is actively contributing to Sweden's transition to a more resilient and renewable-driven energy system.

IRON AND STEEL

PEAK POWER REDUCTION AT CIMOS-VUZENICA

Sector	Iron and steel
Location	Slovenia, Vuzenica
Solution	Price-driven demand response via thermal flexibility
Benefits	>20% peak power reduction and ~€72k/year saved
Company	INEA

As electricity systems integrate more renewable and distributed energy sources, industrial consumers are increasingly incentivised to provide flexibility. The Cimos-Vuzenica metalworking plant in Slovenia demonstrates how price-driven demand response using thermal process flexibility can significantly reduce peak power and energy costs without disrupting production.

Opportunity

In 2022 the Slovenian NRA introduced a new network tariff system[2], moving from 2 tariffs to 5 seasonal tariffs, with the aim of incentivising system users to use the grid during periods of least load. With the new system, besides used energy [EUR/kWh], a significant network charge is levied on measured power [EUR/kW]. Cimos-Vuzenica, a metalworking plant with several electric furnaces (1x5MW; 2x1,2MW), experienced large fluctuations in instantaneous power demand. This operating profile created the opportunity for DSF: by avoiding the simultaneous operation of all furnaces, the plant could reduce peak power demand and consequently lower its network costs.

Solution

To unlock this flexibility, the plant implemented the inGenious Peak smart control algorithm by INEA to enable automated, price-driven demand response while maintaining full control over operations. INEA supported Cimos-Vuzenica with their technical expertise by:

[2] Agencija za energijo (2022), *Metodologija za obračunavanje omrežnine za elektrooperaterje*, Uradni list RS, št. 146/2022.

- Designing proper electrical wiring on the device controllers;
- Analysing the furnace's temperature flexibility;
- Transforming the operational constraints into control parameters.

The result was a smart algorithm with short time total power predictions forecasting whether the 15-minute average power limit (which determines billing) will be exceeded. If the limit is likely to be exceeded, the system temporarily reduces loads. Loads are controlled based on priority level and can go full power, half power or off. The algorithm avoids unnecessary interventions if the forecast suggests the situation has capabilities to correct itself within the 15 minutes window.

Benefits

Optimisation and control are managed by one single tool, the inGenious Peak smart control algorithm, while plant operators maintain full control over the process and can interrupt the optimisation at any time if needed. The site became flexible in less than two months. Since the furnaces were not initially controllable, dedicated controllers had to be designed and installed. Implementation typically takes a few weeks to a couple of months, depending on the controllability of the assets.

The optimisation algorithm reduced the plant's peak power by more than 20%, resulting in a reduction of network charges and therefore of the total energy cost. Annual savings are estimated at €72,000.

Beyond direct economic benefits for the company, the solution also supports the wider electricity system. By smoothing consumption peaks, the plant helps avoid local congestion and reduces the need for costly grid reinforcements.

ENERGY ARBITRAGE AND PEAK SHAVING SOLUTION

Sector	Iron and steel
Location	Slovenia, Šentjanž pri Dravogradu / Slovenj Gradec
Solution	An advanced energy management solution optimising with the following objectives: peak shaving, energy arbitrage and PV self-consumption increase
Benefits	~€5k savings (€3k peak shaving + €2k arbitrage), increasing to ~€10.8k with dynamic pricing
Company	INEA

The case of MIHEU d.o.o. shows how an industrial site can leverage battery storage and smart energy management to reduce costs, limit peak demand, and maximise the value of on-site solar generation.

Opportunity

MIHEU d.o.o. is a metalworking company based in Slovenia, where it faces the new 5-tariff network tariff system described in the previous case, that charges both on used energy [EUR/kWh] and on measured power [EUR/kW]. Additionally, in recent years, the installation of a photovoltaic (PV) system has significantly altered the site's consumption profile. The production processes, characterised by inherently variable and peak-intensive energy demand due to thermal and mechanical metal processing, were further impacted by intermittent PV generation. This resulted in a more complex but also more opportunity-rich load profile, enabling profitable utilisation of battery storage for peak shaving, energy arbitrage, and increased self-consumption. Additionally, the company plans to transition to dynamic electricity pricing after the expiration of current supply contracts, which will further improve the economic performance of the system.

Solution

INEA developed and implemented an advanced energy management solution combining:

- Existing measurement infrastructure (inGenious Cube + View) with detailed sub-metering
- Battery Energy Storage System (BESS): TAB C183 (183 kWh / 92 kVA)
- Optimisation algorithm (inGenious Link) for real-time control of energy flows

The control system continuously monitors site consumption, PV production, and battery state-of-charge, and performs short-term power prediction. Based on these elements and predicted price time series, it optimises operation with the following objectives:

- Peak shaving: limiting maximum grid import power and reducing network charges
- Energy arbitrage: shifting energy consumption by charging the battery during low-price periods and discharging during high-price periods
- PV self-consumption increase: storing surplus PV generation and minimizing grid export

The flexibility potential and control parameters were derived from analysis of 15-minute interval consumption data and on-site assessment of process constraints.

Benefits

All optimisations and energy arbitrage are managed through a single tool, enabling centralised and automated control of energy flows while ensuring full operational reliability. The solution developed by INEA adds value by transforming the site into a prosumer with predictive optimisation capabilities.

Annual benefits currently amount to around €5,000 (€3,000 from peak shaving and €2,000 from arbitrage). With the transition to dynamic pricing, arbitrage revenues are expected to increase to €7,800, bringing total yearly savings to €10,800.

From a system perspective, the solution contributes to a reduction of local peak loading on the grid, improved integration of distributed renewable generation, and a smoother and more predictable consumption profile.

MONETISING STEEL FURNACE FLEXIBILITY IN THE FRENCH CAPACITY MECHANISM

Sector	Iron and steel
Location	North France
Solution	• Load shedding through furnaces • Participation in the Capacity Mechanism
Benefits	• 25% power consumption reduction • €54k revenue + additional activation payments (winter 2026-27)
Company	Agregio Solutions

Agregio Solutions supported a steel transformation site in North France in its decision to monetise the flexibility of its high-temperature furnace processes.

Opportunity

Steel production represents a major and growing source of electricity demand, with European steel consumption expected to increase to 165 TWh by 2030, and up to 400 TWh by 2050 due to electrification[3].

High-temperature furnace processes consume large amounts of electricity in a stable and predictable pattern, which makes them well suited for demand-side flexibility. At this site, these processes have high availability for power demand reduction activation, for short periods of time. Power consumption reduction is typically of 25%.

Solution

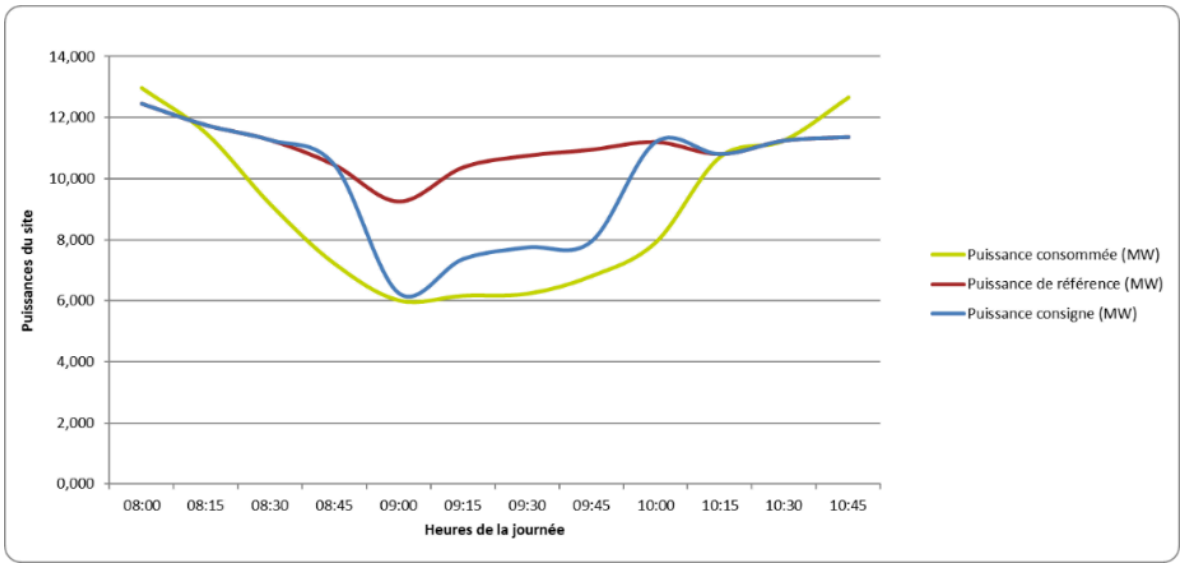
[3] European Steel Association (EUROFER), 2024. *The European steel industry recommendations on industrial demand side response*. Available at: https://www.eurofer.eu/publications/position-papers/the-european-steel-industry-recommendations-on-industrial-demand-side-response (Accessed: 9 April 2026).

Agregio Solutions assessed the site's load shedding potential on the basis of consumption data, using a number of criteria: the shreddable electrical power the company was prepared to make available to the grid and the length of time it was committed to doing so. Based on a study of these elements and certified methods for determining the reference power, the aggregator proposed a load shedding valorisation contract tailored to the site's operational constraints and objectives. As the solution fully met the company's needs, it started participating in the French Capacity Mechanism, thereby securing remuneration for both availability and activation.

Activations are scheduled within defined time slots, from 7-10 AM and 5-8 PM. They typically occur once per year and last between one and three hours, with up to two activations in a single day. Real flexibility is calculated using consumption forecasts. For winter 2026-27 the site provides 3 MW of erasable power.

Benefits

The solution delivers added value through revenues of around €54k over the winter period, complemented by activation payments. For the power system, the site provides 3 MW of reliable flexibility during peak periods, supporting grid balancing and overall system stability. The graph illustrates how flexibility is delivered in practice, with the red curve representing the flexible power reference, the blue one showing the power the site must not exceed and in green the power consumed during the load shed.



FLEXIBILITY FROM METAL CASTING

Sector	Iron and steel
Location	Poland
Solution	Participation in demand response schemes such as the Polish Capacity Mechanism, load shedding
Benefits	Financial compensation for availability and for participation to readiness tests
Company	Enel X

A Polish foundry, supported by Enel X, used DSR to optimise its energy consumption. The company produces a wide range of individual, small-series castings for multiple industries, including energy, transport, and chemical.

Opportunity

The company faced rising electricity prices, creating strong pressure to optimise energy consumption. At the same time, the nature of its production processes offered inherent flexibility. In fact, the melting phase includes planned technological production breaks of 2.5 to 4 hours. This created an opportunity to reduce electricity consumption by shifting the process without incurring significant costs or losing production profits.

Solution

Thanks to the collaboration with Enel X, the company was able to participate in a power reduction mechanism. The plant that was chosen for participation operates three furnaces for melting metal and cast iron with a total installed capacity of 12 MW. More specifically, one induction furnace of 6 MW and two arc furnaces each of 3 MW.

The aggregator provides the site operational support, advanced energy monitoring tools, protection against penalties for non-delivery, and simple rules for participation in the programme with minimal administrative burden. To reduce electricity consumption when

needed, furnace operations are shifted in line with existing production breaks, allowing the company to unlock flexibility without sacrificing productivity.

Benefits

Aggregator support allows the company to generate additional income by being ready to temporarily reduce electricity consumption. The company receives regular financial compensation for its availability and for participating in one-hour readiness tests, which helps reduce overall electricity costs. In the event of critical drops in power reserves, the temporary limitation of consumption contributes to restoring grid balance.

The programme integrates seamlessly into day-to-day operations and does not affect production. The company's Vice President highlighted the strong fit of the DSR mechanism with the company's technological processes, and emphasised the value of the continuous support provided by Enel X through competitive technologies and a responsive communication system.

OPTIMISING FLEXIBILITY IN HIGH-HEAT FURNACES

Sector	Iron and steel
Location	Sweden
Solution	Participation in the FCR-D Up market
Benefits	Extra revenues
Company	Sympower

A Swedish steel producer introduced flexibility as part of its broader sustainability strategy and transformed its electrified furnaces into a new source of value.

Opportunity

A global leader in the production of special steels for toolmaking based in Sweden is actively working to achieve fully fossil-free production by 2030, with a focus on electrification, energy efficiency, and substituting fossil fuels with renewable alternatives. As part of this shift, gas-fired furnaces at the headquarter site have been electrified, turning them into a great source of flexibility. High-heat furnaces are required across several production areas and, depending on their size, can individually consume more than 1000 MWh annually. Given the long and heat-intensive nature of these processes, the system exhibits substantial thermal inertia, meaning slight changes in electricity consumption don't immediately affect temperature and output quality.

Solution

Sympower provided a tailored solution for harnessing the flexibility of the site. The teams first ran pilot projects to evaluate how demand response would impact operations and identified the most suitable assets for demand-response. Thanks to their long and thermally stable processes, furnaces were the best candidate. Given that furnaces operate at different stages of the production cycle, the company can adjust consumption without disrupting manufacturing or compromising product quality.

Each furnace was equipped with a controller, enabling Sympower's operators to activate them individually and reduce power consumption in gradual 25% increments. During an activation the site's teams receive four signals from the aggregator, one before each increment. In 2024, the furnaces were activated less than four times per month.

Building on these results, the site gradually increased its energy flexibility from 0.9 MW in 2021 to 13 MW in 2024 and is now seeking new ways to expand its position in the demand response markets. Together with Sympower, the teams are exploring where existing flexibility lies in other processes, which other equipment could be used, and in which markets it could be valorised.

Benefits

By activating demand response with Sympower, the company turned their energy-intensive equipment into a strategic advantage to unlock new revenue and reduce their energy costs. The number of activations, fewer than four per month, minimizes disruption and simplifies operational integration.

In addition to generating a new revenue stream, the site is directly contributing to Sweden's energy transition by participating in balancing markets, stabilising the grid and ultimately helping the integration of renewable energy sources.

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MINING

A LITTLE DISRUPTION, A LOT OF VALUE

Sector	Mining
Location	Sweden
Solution	Participation in the FCR-D Up market
Benefits	Revenues range between €175,000 and €210,000 per MW per year
Company	Sympower

At first glance, disrupting production might seem like the last thing an industrial site would want. Yet at Sweden's largest open-pit copper mine, controlled disturbances linked to participation in balancing markets have become a major source of value. Doing less for a few minutes can actually mean earning more.

Opportunity

The company operates a large-scale mining site, extracting and enriching around 45 million tonnes of ore per year. It relies on two energy-intensive lines with primary and secondary mills to grind the crushed ore, forming copper, gold, and silver metal concentrates.

Solution

A flexibility assessment conducted on-site by Sympower confirmed that the primary mills could adjust their electricity consumption rapidly enough to meet the FCR-D requirement to significantly reduce consumption within seconds from the signal.

Initially, the site was sceptical, as the flexibility potential lied in critical assets for production, implying that any load reduction would inevitably lead to operational disturbances.

To address these concerns, Sympower collaborated closely with the site to design and test an optimised setup through two key analyses:

1. **Test 1 – Production impact assessment:**
    - Identified how much production the site could afford to lose during the activation.

- **Result:** the extra revenue earned from being available and activated far surpassed the production loss.

2. **Test 2 – Process stability assessment:**
    - Examined whether such a rapid change in production would cause disturbance downstream.
    - **Result:** determined that 8 MW was the optimum set-up.

Based on the strong business case demonstrated, the site proceeded to connect 8 MW of flexible capacity to the FCR-D Up market.

Benefits

The site is compensated by the TSO for every hour it is available and able to deliver, regardless of whether the assets are activated. This creates a stable and predictable revenue stream, further enhanced by additional earnings during activation events. The financial impact has been significant:

- Gross revenues range between €175,000 and €210,000 per MW per year
- Within the first eight months of participation, flexibility generated several hundred thousand euros in gross revenue, despite being activated only five times

The company is strongly committed to supporting grid stability and ensuring reliable system operations. Building on the success of its initial participation, the site is now proactively assessing the flexibility potential of all newly acquired equipment, with the ambition to expand its contribution to the grid.

PAPER AND PULP

UNLOCKING 15.5 MW OF INDUSTRIAL FLEXIBILITY IN THE PAPER INDUSTRY

Sector	Pulp and paper
Location	France
Solution	Participation in the Capacity Mechanism and the mFRR market
Benefits	€500k-€750k per year
Company	Energy Pool

The French paper industry has reached a key milestone in its energy transition: a flagship site demonstrates that it is possible to generate up to 15.5 MW of energy flexibility while maintaining stable production. Supported by Energy Pool, this project illustrates the convergence of industrial performance and support for the French power grid.

Opportunity

The pulp and paper industry ranks as the fourth-largest energy consumer globally, representing about 6% of total industrial energy use worldwide[4]. The production process involves multiple steps: raw material preparation, pulping, cleaning and screening, bleaching, forming, pressing, drying, and finally cutting and finishing.

Within this production process, several assets offer significant flexibility potential. These include crushers, whose operation can be remotely managed and timed; dryers, where pump speeds can be adjusted; and air compressors, where compressed-air storage enables load shifting. Additional flexibility can be provided by all sources of storage, such as battery energy storage systems (BESS) for example, which can be charged or discharged in response to grid signals; HVAC systems, whose operation can be adjusted without compromising temperature requirements; and e-boilers, which can rapidly modulate their output to shift electricity consumption.

[4] Wu, C., Zhou, Y., Gan, W., & Wu, J. (2025). Robust scheduling of a pulp and paper mill considering flexibility provision from steam power generation. *Applied Energy*, *377*, 124595.

A major French paper producer engaged with Energy Pool to identify its flexibility potential and to valorise it on flexibility markets using directly its industrial tanks.

Solution

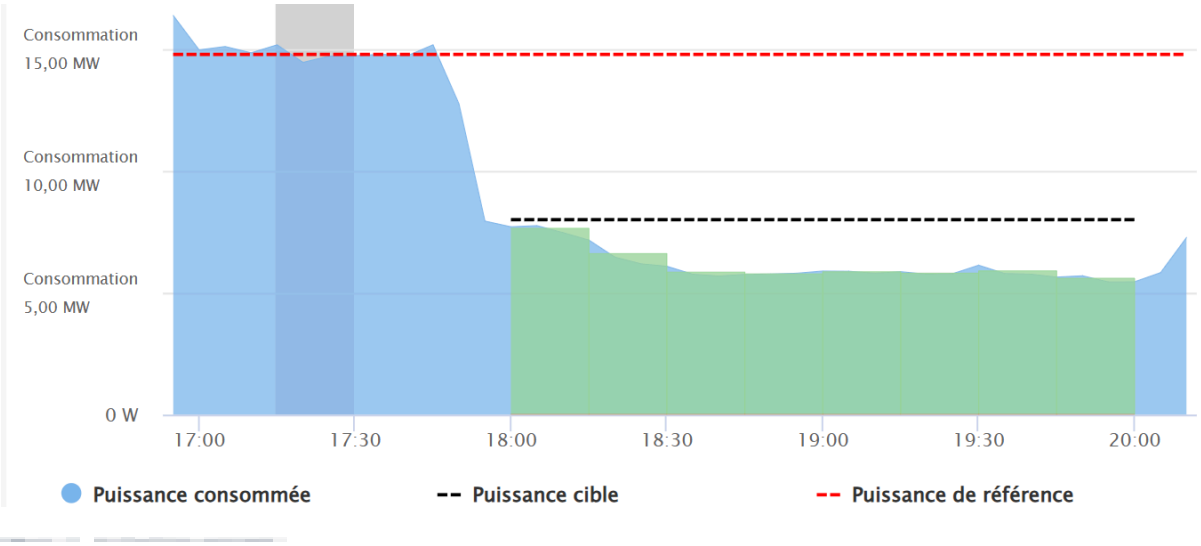
Energy Pool defined a flexibility strategy for the site. An initial flexibility assessment identified approximately 8 MW of load reduction capacity. Certain key equipment, such as defibrators, was not immediately available for use. Energy Pool then analysed the operation of the pulp storage tanks and identified their energy potential: these tanks, originally designed to store raw material, could become true reservoirs of flexibility. The site presented the following characteristics:

- Power available from the tanks: 8 to 10 MW
- Additional power via the defibers: 6 to 7 MW
- Response time: < 15 minutes
- Availability: > 98%

Following the assessment, the gradual integration of defibrators, synchronised with tank management, made it possible to:

- Ensure material balance and process continuity
- Leverage flexibility without impacting production
- Achieve full site flexibility: 15.5 MW, available almost continuously

Active in the Capacity Mechanism and the mFRR market, the site performs approximately 15 activations per year, demonstrating the reliability and consistent deployment of its flexibility.



Each site activation is monitored in real time, with OK status meaning compliant activation and KO status meaning deviation. Figure 2 shows an example of activation. This monitoring ensures reliable and nearly continuous activation, in accordance with the requirements of the balancing markets.

The site is also planning to participate in the mFRR Down market, further capitalising on targeted increases in consumption of their assets.

Benefits

This project shows that industrial flexibility can be deployed without compromising production performance. By leveraging existing assets such as storage tanks and defibrators, the site unlocks significant flexibility with limited additional investment, turning operational constraints into a source of value.

The site generates approximately €500k–€750k per year across all flexibility mechanisms (excluding mFRR), depending on the year. In addition, around €14k is generated specifically from mFRR energy. These revenues represent a clear benefit of the site's participation in flexibility and balancing markets.

Beyond site-level gains, the project also delivers system-wide value by contributing to grid stability and facilitating the integration of renewable energy, reinforcing the role of industry in the energy transition.

FROM PAPER MILL TO POWER ASSET: UNLOCKING 40 MW OF INDUSTRIAL FLEXIBILITY

Sector	Paper
Location	North France
Solution	• Load shedding through paper machines • Participation in the Capacity Mechanism
Benefits	• 75% power consumption reduction • €800k revenue + additional activation payments (winter 2026-27)
Company	Agregio Solutions

Agregio Solutions harnesses 40 MW of power from a paper manufacturing site in the North of France demonstrating how a big consumer can become a virtuous player in the electricity grid.

Opportunity

The pulp and paper industry offers strong potential for demand side flexibility. It relies on energy intensive processes and a wide range of controllable assets such as heat pumps, e-boilers, conveyor belts, crushers, dryers, compressors, Mechanical Vapor Recompression (MVR) evaporators and wood pulp refiners. These assets can adjust consumption without significantly affecting production.

At site level, this manufacturer produces recycled and specialised paper-based products. With annual consumption reaching 400 GWh, it has a significant impact on the grid. The challenge was to activate this flexibility without impacting operations, as the customer and its production processes always have priority.

Solution

Thanks to the help of Agregio Solutions, the site implemented a demand-side management strategy based on controlled load reduction. The approach was tailored through a detailed

analysis of the site's operations, including a review of at least one year of load curves to identify patterns, as well as an assessment of availability constraints such as maintenance periods and holidays. Specific machines and processes suitable for load shedding were identified based on their power and responsiveness, alongside key operational constraints such as shutdown and restart times. Potential impacts on production were also carefully evaluated, including workforce disruptions and whether processes could resume from the same point or required a full restart.

Since the solution met the company's expectations, it began participating in the French Capacity Mechanism through reservation and activation, with 40 MW of erasable capacity contracted for winter 2026-27. Activations occur within fixed time windows (7-10 AM and 5-8 PM), typically once or twice per year. During these events, the site can reduce its electricity consumption by up to 75%. Activation prices are high to compensate for the long start-up time of the process. Real flexibility is determined using consumption forecasts.

Flexibility is activated through a simple and transparent process. The client has access to an online portal to declare unavailability when needed, ensuring full operational control. When an activation is triggered by the TSO, the site is notified with clear instructions on timing and duration. Load reduction is performed manually, without the need for additional hardware. After each load shed, the client can access its load curve on the portal and receives and analysis of the activation.

Benefits

Load shedding represents a lever for profitability that:

- Becomes a source of additional revenues (estimated at €800k for the 2026-27 winter season, plus activation payments);
- Brings extra savings over the long-term by enabling a better control of consumption, encouraging analysis and improved management of installations.

Reducing consumption also helps balancing the grid during peak demand or low supply periods. Large industrial consumers like this have a significant and immediate impact on system stability, helping reduce stress on the grid and limiting the need for additional infrastructure.

ASSET-SPECIFIC ALGORITHMS TO UNLOCK FLEXIBILITY IN THE PAPER INDUSTRY

Sector	Pulp and paper
Location	Germany
Solution	Participation in short-term intraday markets and price arbitrage
Benefits	€150,000 annual profit (2025)
Company	ESFORIN

A German paper production facility leverages the flexibility of its energy-intensive processes to capture value from short-term intraday markets and price arbitrage. While core assets like the paper machine typically run continuously, temporary adjustments in consumption can be economically beneficial when market conditions justify it.

Opportunity

A large paper production facility in Germany operates an energy-intensive recycling and papermaking process. The site includes several electricity-driven assets, such as a paper machine, an e-boiler for heat generation, and a de-inking plant, that represent significant flexible loads. While the paper machine normally runs continuously, extreme price spikes in short-term power markets provide an opportunity to monetise flexibility, provided that the interruption is technically and economically justifiable.

Solution

The industrial site partnered with ESFORIN, which deploys asset-specific algorithms to market flexibility autonomously in short-term electricity markets. The facility provides multiple types of demand response:

- Paper machine with on/off flexibility; approx. 18 MW
- De-inking plant with load shifting and temporary curtailment
- E-Boiler thermal flexibility; supports sector coupling by providing process heat

- Additional machines for pre-processes (e.g., shredders)

However, stopping a paper machine is complex: it incurs significant setup costs, risk of paper breaks and requires additional personnel for cleaning and restarting. The solution ensures that flexibility is provided only when market conditions justify it, resulting in fewer than 10 activations per year but with significant revenue potential. Flexibility is offered both through explicit, market-based activations in short-term intraday markets using 15-minute products, and through implicit, price-driven price arbitrage during extreme market episodes. Recent examples include an 18 MW curtailment activated for one hour on 8 January 2026, and a 6 MW flexibility deployment through financial trading on 6 January 2026.

Benefits

- €150,000 annual profit (2025) achieved with a handful (<10) physical activations.
- Monetisation without compromising production quality, thanks to strict price limits.
- Reduced exposure to price volatility by using flexible assets strategically.
- Contribution to the site's decarbonisation: the e-boiler enables sector coupling, replacing fossil heat with electricity when prices are low or renewable-heavy. This case demonstrates how even highly integrated, production-critical industrial assets can unlock substantial value through well-orchestrated flexibility valorisation. By combining precise operational constraints with ESFORIN's automated, market-driven optimisation, the site transforms rare activation opportunities into financial gains while simultaneously supporting grid stability and the integration of renewable energy.

TIMBER PRODUCTION

FROM WOOD DRYING TO GRID STABILISING

Sector	Wood processing
Location	Finland
Solution	Participation in the FCR-D Up market
Benefits	Extra revenues and a 15% reduction in electricity consumption
Company	Sympower

A Finnish sawmill unlocks flexibility in wood drying, turning 0.7 MW of load into new revenue, lowering energy use, and providing fast-response support to the grid.

Opportunity

A Finnish sawmill producing kiln-dried spruce lumber operates with a capacity of 82,000 m^3. Its most energy-intensive assets are their kiln chambers used for wood drying, where heat is distributed via water radiators and circulated using electric fan motors. Across 13 chambers, these motors represent around 700 kW of installed capacity. Because the drying process can tolerate adjustments, these assets offer strong potential for demand-side flexibility.

Solution

Sympower enabled the site to unlock new revenue streams by participating in Finland's FCR-D Up balancing market. Following an on-site assessment, they identified the most suitable assets for flexibility and selected the optimal market to monetise them. By analysing energy consumption patterns, operations were optimised to maximise market availability without affecting core production processes.

The site now provides around 0.7 MW of flexible capacity. Activation is automated and occurs within seconds, supporting grid stability during frequency deviations. Assets are available to respond to market needs around 15 times per year.

Benefits

The company achieved a 15% reduction in their electricity consumption without any impact on their core lumber drying processes. As confirmed by the site, the implementation of Sympower's solution has enabled lower energy use while maintaining the same high-quality output.

From a system perspective, the site provides fast and reliable balancing capacity. Participation in the Nordics' FCR-D market supports grid stability, helping maintain frequency at 50 Hz and preventing outages.

WASTE AND WATER MANAGEMENT

DEMAND SIDE FLEXIBILITY IN URBAN WATER MANAGEMENT

Sector	Water management
Location	East France
Solution	• Load shedding: pre-filling reservoirs and temporarily switching off pum • Participation in the Capacity Mechanism
Benefits	• 20% power consumption reduction • €30k revenue + additional activation payments (winter 2026-27)
Company	Agregio Solutions

This case highlights how a large public water management company in the east of France leverages demand-side flexibility to support the electricity system. By adjusting the operation of its pumping infrastructure, the company participates in the French Capacity Mechanism.

Opportunity

Water management systems represent a significant share of urban electricity consumption and are inherently well suited to provide demand-side flexibility. Electricity is consumed in the water industry for sourcing, conveying, treating and distributing water to consumers, as well as for managing wastewater for disposal or recycling. Pumping operations are highly controllable and easily interruptible, while embedded water storage capacity allows electricity consumption to be shifted over time without affecting service delivery. Moreover, the opening of the Capacity Remuneration Mechanism to DR in France enables this type of profile to valorise its flexibility.

Solution

Agregio Solutions supported the site in valorising its flexibility on energy markets by developing a customised flexibility solution. This enabled the company to adapt its electricity consumption, obtain remuneration in return, and play an active part in the energy transition by

balancing the electricity system. The support included identifying the most relevant market mechanisms, determining which assets could provide flexibility, and coordinating activations.

Flexibility is activated through the pumping system, allowing for power consumption reductions of around 20%. Operationally, this is achieved by pre-filling water reservoirs and temporarily switching off pumps during predefined time windows. Activations occur within fixed time windows (9-11 AM and 6-8 PM) and approximately once per year, lasting between one and three hours, with the possibility of up to two activations in a day. The site provides 1.5 MW of erasable capacity for Winter 2026-2027. Real flexibility is checked by using the 10 days median before activation.

Figure 3 - Flexibility activation example

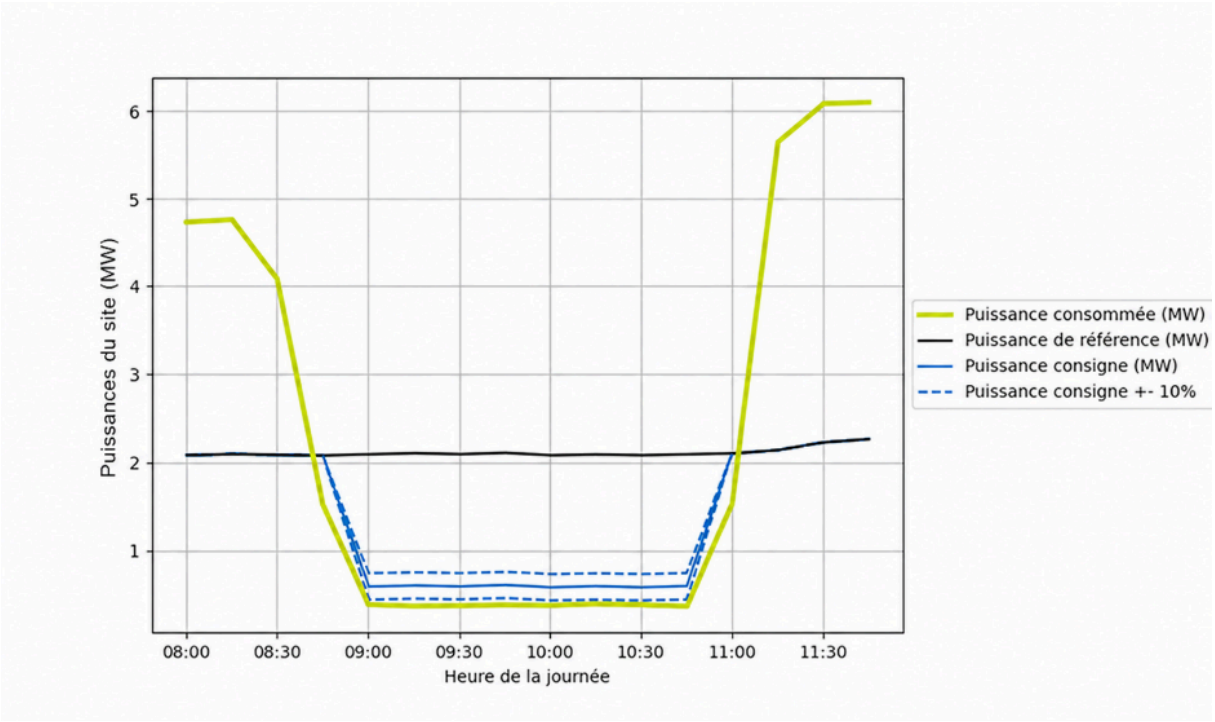


Figure 3 shows a representative flexibility activation of the site's pumping system. The green curve represents the site's actual electricity consumption, which is reduced well below the reference baseline (black line) meeting the dispatch setpoint (blue line). The dashed blue lines indicate the setpoint ±10% tolerance margin.

Benefits

The company generates direct revenues, estimated at around €30,000 for the winter period (November to March), in addition to activation payments. Beyond financial gains, participation reinforces the company's public service mission by aligning operations with sustainability goals and contributing to grid balancing.

TURNING WASTE (MANAGEMENT) INTO FLEXIBILITY

Sector	Waste and water management
Location	Poland
Solution	Participation in the Capacity Market
Benefits	Cost savings (tens of thousands of PLN)
Company	Enel X

Since 2020, a major waste and water management group in Poland has been leveraging DSR as part of a broader energy optimisation strategy. Operating across multiple energy-intensive facilities, the company partnered with Enel X to integrate flexibility into its operations and reduce electricity costs.

Opportunity

The group continuously invests in waste management facilities, including polystyrene granulation plants, green waste composting plants, alternative fuel production plants, electronic and electrical equipment processing plants, secondary raw materials and glass sorting plants, and mechanical-biological processing plants. It supports 4 million residents in 15 voivodeships, has offices and installations in 50 cities and in 2019 had total revenue of PLN 1.4 billion. It has a significant energy demand of 15 GWh per year.

Across the sites, several optimisation measures were established over the years, such as group purchasing, consumption analysis, tariff selection, optimisation of ordered power and fixed charges, and reactive power compensation. However, in light of rising electricity prices, additional levers have been explored to further reduce energy costs, among which DSR. Despite its potential, the adoption of DSR has been limited by several barriers, including a lack of internal expertise, operational complexity, and the risk of financial penalties in case of non-compliance.

Solution

To navigate the complexities associated with DSR, the company partnered with an experienced aggregator, Enel X. Following a preparation phase in 2019, it joined the Polish Capacity Market operated by the Polskie Sieci Elektroenergetyczne (PSE, the Polish TSO) in 2020. The process began with a comprehensive assessment of flexibility potential across individual plants, aimed at identifying opportunities to reduce consumption without disrupting operations, which led to the initial onboarding of five sites on a trial basis. These sites underwent reduction tests to validate their operational readiness, a necessary step to qualify for participation. All tests were successful and the plants successfully provide flexibility, with a declared reduction of 0.8 MW.

The aggregator played a central role by:

- Offering the ability to report periods of downtime;
- Providing protection against PSE's penalties for non-delivery;
- Providing support and taking responsibility with the risks associated with managing the entire energy reduction process.

Benefits

The group achieved significant cost savings (amounting to tens of thousands of PLN) while reducing exposure to electricity price increases. Participation in the programme, supported by the aggregator, established a scalable framework: following the successful rollout across the first five plants, the group plans to continue and expand its participation by onboarding additional sites.

Its contribution has been recognised by PSE through the "I support Poland's energy security" emblem, reflecting its role in strengthening system resilience and supporting the energy transition by providing the grid stability needed to integrate more renewable energy.

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