Whitepaper
Besso Energy

Industrial Electrification & Energy Flexibility

Pieterjan Espeel & Frederik Vanmaele

2025

CONTEXT

Replacing gas with electricity in an industrial process increases energy costs by at least 140%. That single number explains why most companies hesitate to electrify, even when their 2050 targets demand it.

But that number assumes a naive approach. Simply swapping one energy source for another, without rethinking how and when you consume energy. The reality is more nuanced. Electricity markets are changing fast, driven by renewable production, new regulation and emerging flexibility mechanisms. Companies that understand these dynamics can build an electrification case that is not just sustainable, but economically sound.

This whitepaper breaks down the key evolutions in the Belgian energy market and shows how industrial companies with gas-driven processes can turn electrification from a cost problem into a strategic advantage.

Introduction

To understand why the electrification case is better than it looks, we need to look at three things: how the cost of gas is rising beyond the commodity price, how electricity prices are creating new opportunities, and how flexibility changes the equation entirely. Let's start with gas.

THE TRUE COST OF GAS IS RISING

Gas is often seen as the stable, predictable option. For a long time that was justified, as Europe had access to abundant (Russian) gas, which provided a steady and cheap flow of energy for industrial processes. In 2019, gas prices sat between €10 and €20 per MWh. But that perspective is shifting. The war in Ukraine shifted the European supply chain for gas completely. Prices spiked to as high as €250/MWh in 2022. Since then the market has settled into a new reality, with prices between €25 and €60 per MWh, a structural premium on top of pre-war level gas prices and nervous reactions to every geopolitical event.

The tools available to manage this are limited. Long term fixed contracts may smooth out the peaks, but they lock in structurally higher costs and they do nothing to address the underlying trend. The idea that gas is the safe, predictable baseline is no longer grounded in reality.

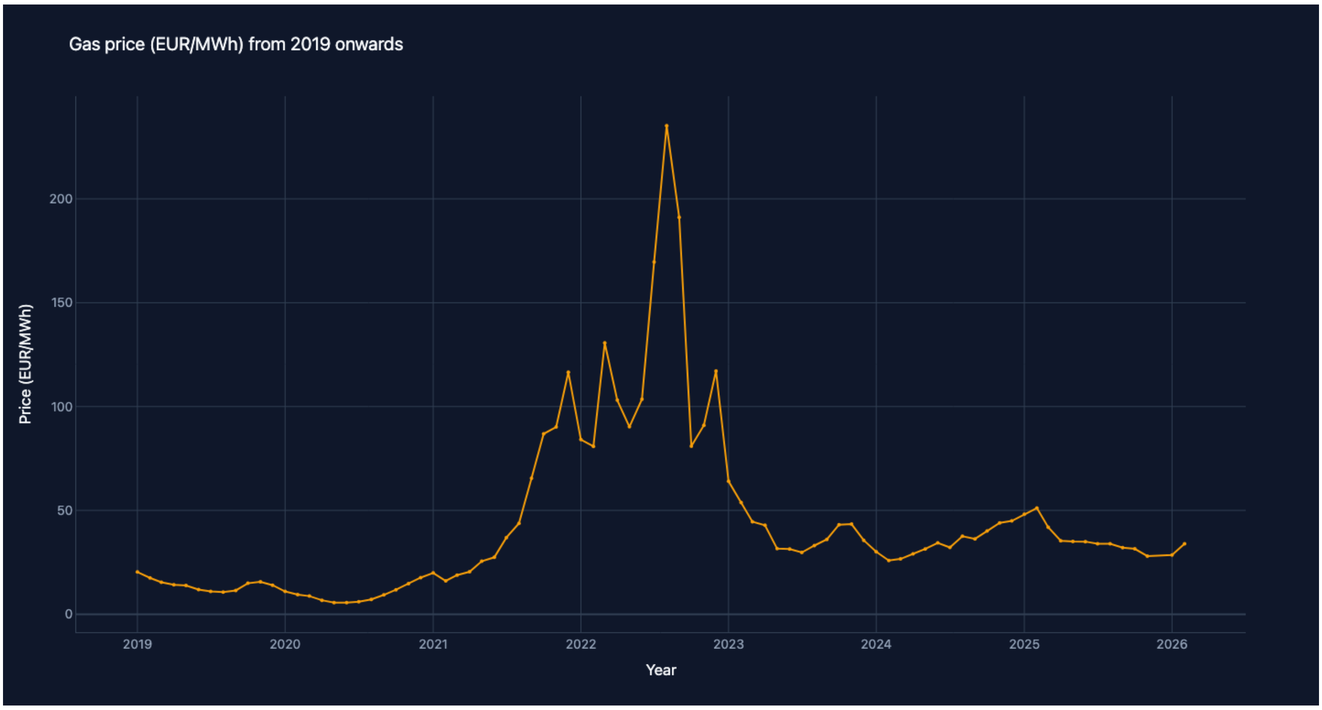

Fig 1: Evolution of the price for one MWh of gas over the past years.

Still, there is a reason companies stay on gas. Today, it is genuinely cheaper than electricity for most industrial processes. The reason is straightforward. When a gas fired power plant sets the electricity price, it converts gas to electricity at roughly 50% efficiency. That means the electricity price at those moments is roughly double the gas price. For a company that needs heat, it is almost always more efficient to burn gas directly than to buy electricity that was generated from gas in the first place. Especially in winter, when gas fired plants are setting the price most of the time, electricity is the more expensive option by a wide margin.

So why would any company consider electrification? Because the raw commodity price is only part of the picture, and that picture is changing in two important ways.

Impact of the European Trading System

First, regulation. Companies with more than 20 MW thermic installations are already subject to the EU European Trading System. In this system, emission rights for CO_2 are auctioned and therefore, adding a direct cost on top of every unit of gas consumed. The idea behind the system is that the revenue flows back to industry to support their industrial electrification process.

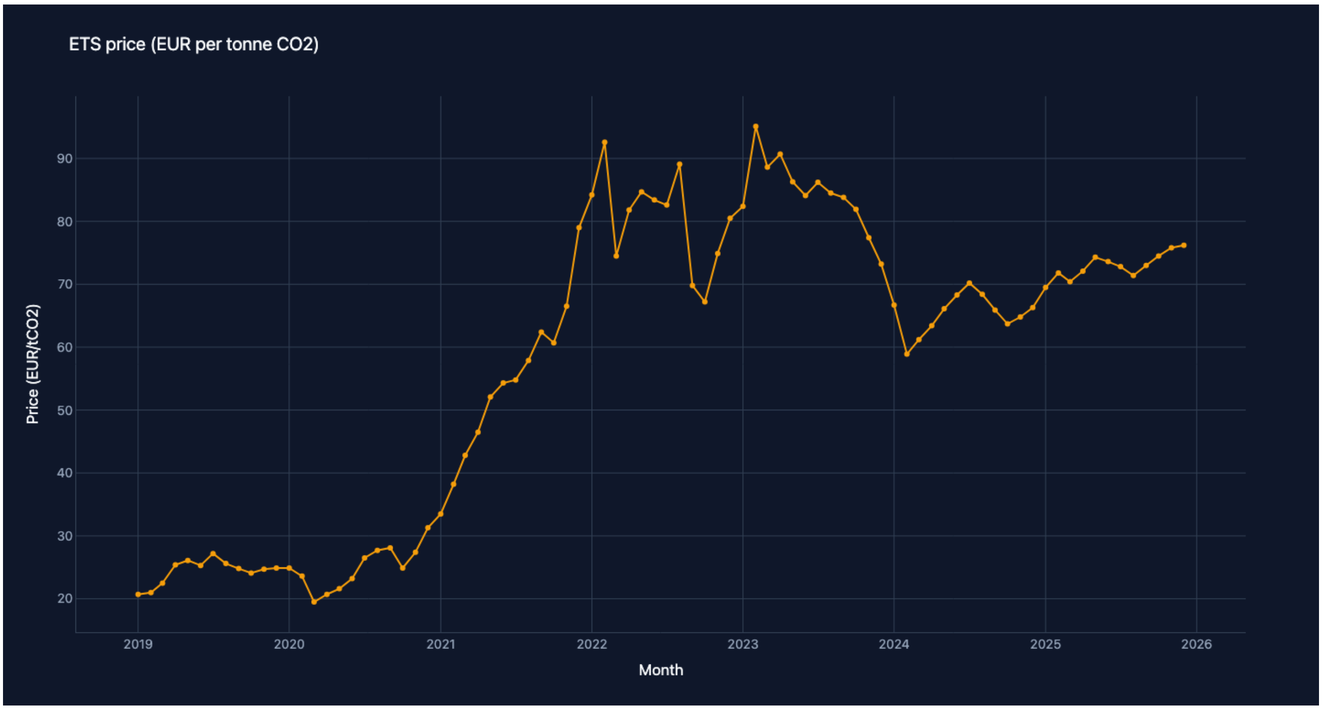

Fig 2: Evolution of the price for one tonne of CO_2 over the past years.

From 2028 onwards, this system expands. ETS2 will bring smaller industrial players into scope. Companies that today pay nothing for their right to emit will face a new cost, passed through by their energy supplier alongside grid tariffs and taxes. The exact price evolutions are hard to predict, but simulations until 2035 show both ETS1 and ETS2 becoming increasingly expensive. ETS2 is expected to catch up with ETS1 relatively quickly, even though there is no mathematical relationship between the two.

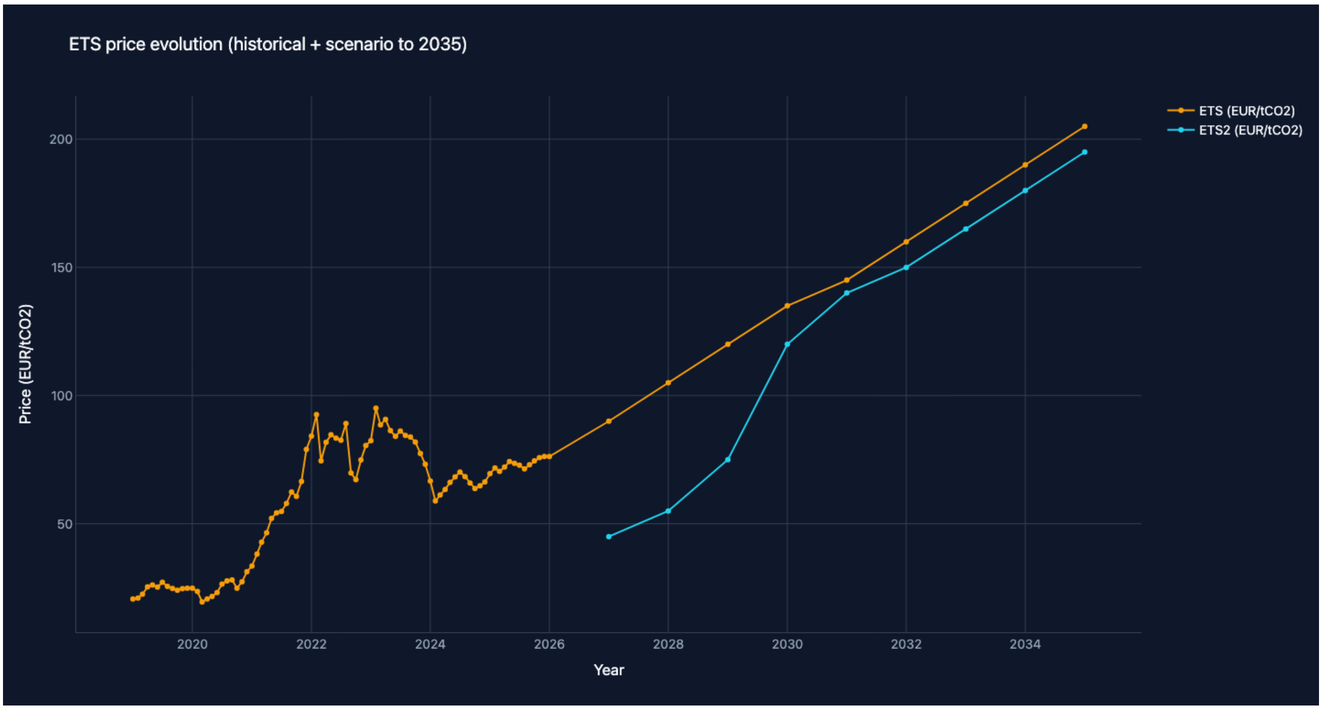

Fig 3: Forecasted evolution of ETS1 and ETS2 price.

When you combine the gas commodity price with current and expected ETS costs, the full cost of gas looks very different from the commodity price alone. The graph below is based on a gas price of €28/MWh, which assumes consistent supply in a calm geopolitical environment. Even under that optimistic assumption, the regulatory cost of burning gas keeps climbing. Under less favourable conditions, the picture is significantly worse.

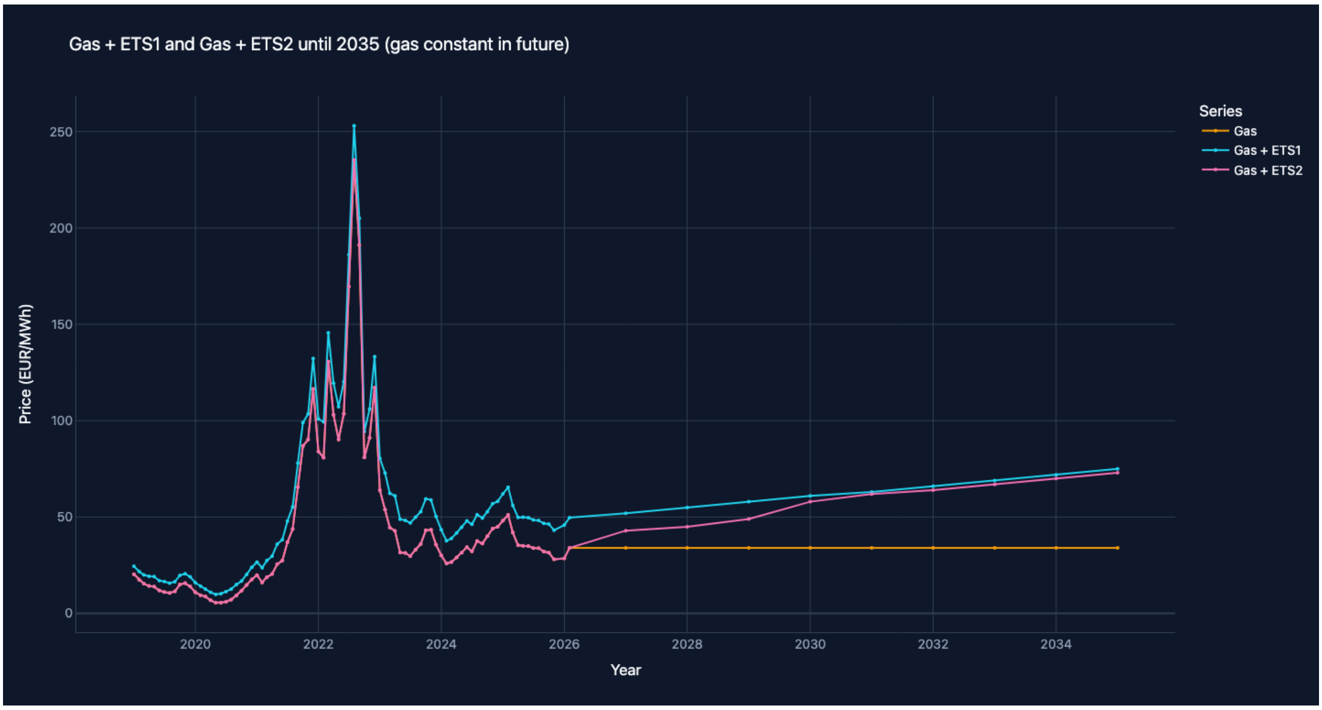

Fig 4: Forecasted evolution of the net gas price including ETS.

This changes the narrative around electrification entirely. Rising ETS costs push the true cost of gas upward, especially after 2035, closing the gap with electricity prices. Combined with tightening scope 1 reporting obligations and growing pressure from customers and investors on decarbonisation, the case for staying on gas weakens on every front.

> “The cost of staying on gas is not standing still. Price volatility, rising carbon costs and growing sustainability pressure make gas no longer the safe haven it used to be for industrial processes.”

WHAT'S HAPPENING ON THE ELECTRICITY SIDE

If gas is getting more expensive, the obvious question is whether electricity is getting cheaper. The short answer is: not on average. But averages hide the most important trend in the electricity market today.

Electricity prices in Belgium are set by the most expensive production unit needed to meet demand at any given moment. This is called marginal pricing. For each quarter hour, the demand and supply curves are matched, yielding a single price for the entire market. Industrial companies can hedge against these dynamics by choosing a fixed contract and paying a premium on spot prices. Nevertheless, it is always this quarter hour to quarter hour process that sets the baseline price.

The electricity grid was historically designed for central production on the high-voltage grid and decentralized consumption through local, low-voltage distribution networks. Over the past 15 years, this model has been completely overturned. Household solar, onshore wind and offshore wind have grown exponentially and now represent a large share of total production capacity. What makes these installations different is that they have no fuel costs. Their marginal price is zero. This combination of marginal price setting and zero cost renewable production creates a market with entirely new dynamics.

The graphs below show the price duration curves for 2019, 2021 and 2025. These curves show how prices are distributed over time, from the most expensive hours to the cheapest. In 2019, the overall price level was significantly lower, reflecting cheaper gas and more nuclear capacity on the grid. By 2025, two things have changed. The expensive hours have become more expensive, but more importantly, an entirely new region has appeared at the bottom of the curve. In the cheapest 10% of hours, prices are now at or below zero. This region did not meaningfully exist six years ago. It is created by renewable production, and as more capacity is added every year, it is expected to only keep growing.

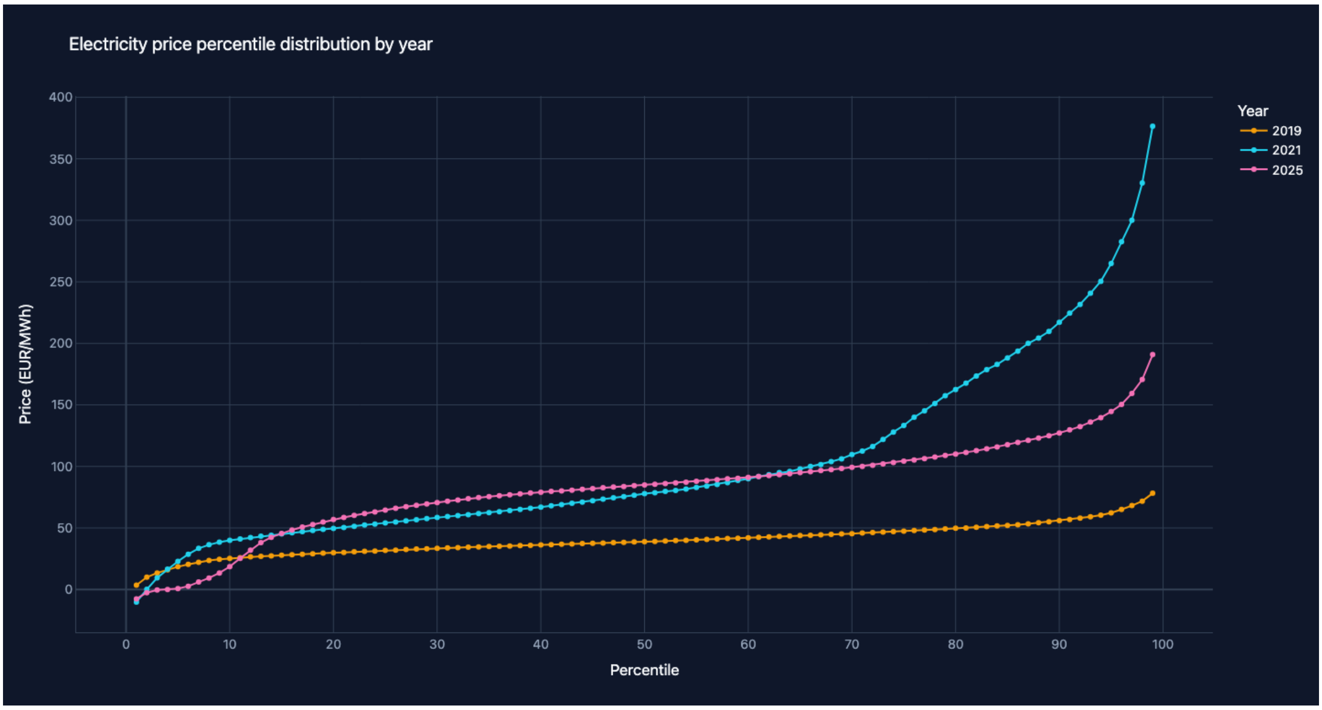

Fig 5: Price Duration Curves of Electricity in 2019, 2021 & 2025

The effect of renewables is strongly seasonal. The graphs below show the average daily price curves for February and May across 2019, 2021 and 2025. In February, prices in 2025 are clearly higher than in previous years. All curves are characterized by a morning and evening peak driven by household consumption. The dip around noon is modest, caused by slightly lower demand and some renewable production.

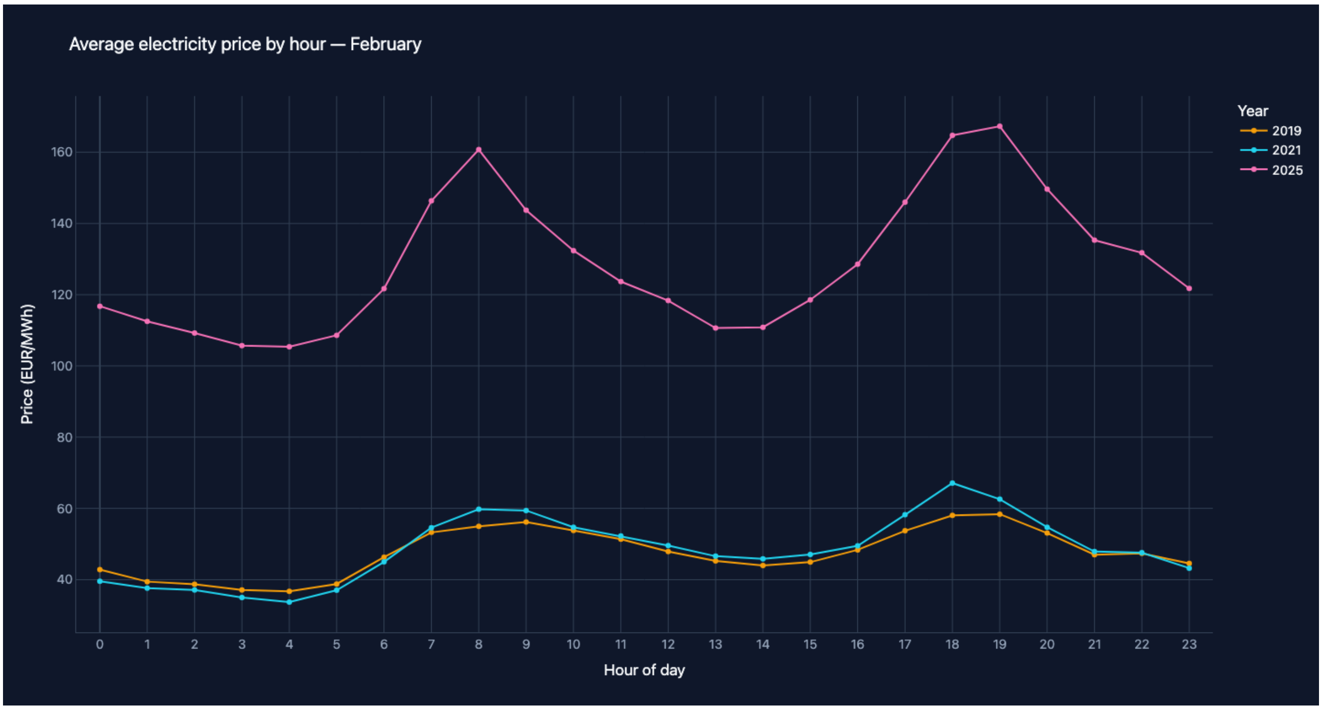

Fig 6: Average electricity price by hour in February for 2019, 2021 & 2025

In May, the picture is dramatically different. A deep dip forms between the peaks as solar panels produce en masse. This is the so-called duck curve, named for its resemblance with the animal. When solar or wind is the marginal unit, the entire market clears at a very low price. In May 2025, the average price between 12h and 16h was negative. As renewable production keeps accelerating, these dips will become more prominent, wider and deeper.

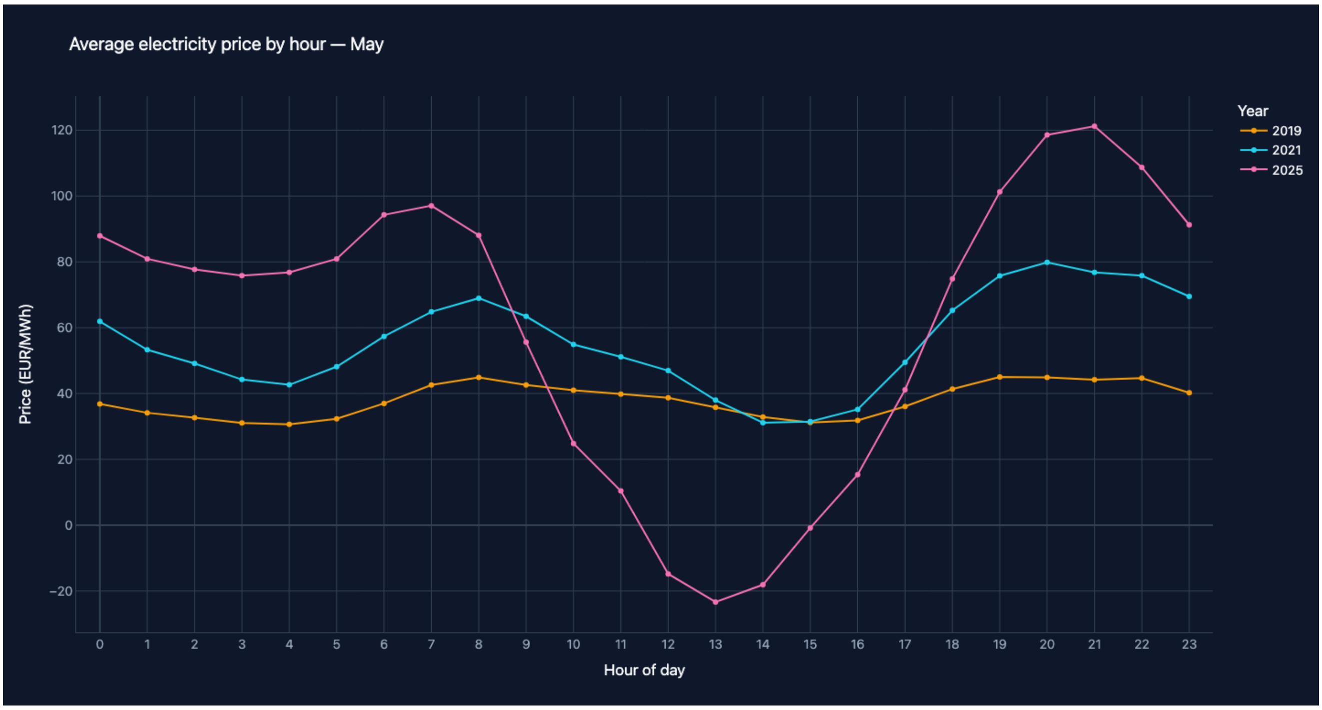

Fig 7: Average electricity price by hour in May for 2019, 2021 & 2025

But prices don't just drop to zero. On some days they go deeply negative. This happens because a large part of the renewable fleet simply does not respond to market signals. Household solar installations in particular have no mechanism to curtail production when the market is oversupplied. They produce whenever the sun shines, regardless of the price. For older installations that still receive guaranteed certificates per MWh produced, there is even a financial incentive to keep injecting at any price. The result is that on high production days, prices have been pushed as low as €-400/MWh for several hours at a time.

So what does all of this mean when we compare it with gas? The duck curves for February and May already hint at the answer. In winter, when gas plants are the marginal unit most of the time, electricity prices are largely determined by the cost of gas. In summer, when renewables push gas plants out of the merit order at midday, that relationship breaks down. The graph below makes this explicit. It shows electricity prices at 12h and at 21h from 2021 to 2025. At 21h, when gas plants are typically setting the price, the correlation between gas and electricity is strong. At 12h, it disappears in summer, because solar, not gas, is the price setting unit at that time.

Fig 8: Monthly average price at selected hours for electricity and gas

When you compare gas and electricity prices across all timestamps from 2023 onwards, the seasonal pattern becomes clear. In winter, electricity is almost always more expensive than gas. In summer, that picture shifts. In 2025, electricity was cheaper than gas 25% of the time (figure 9), with significantly higher ratios in the warmer months.

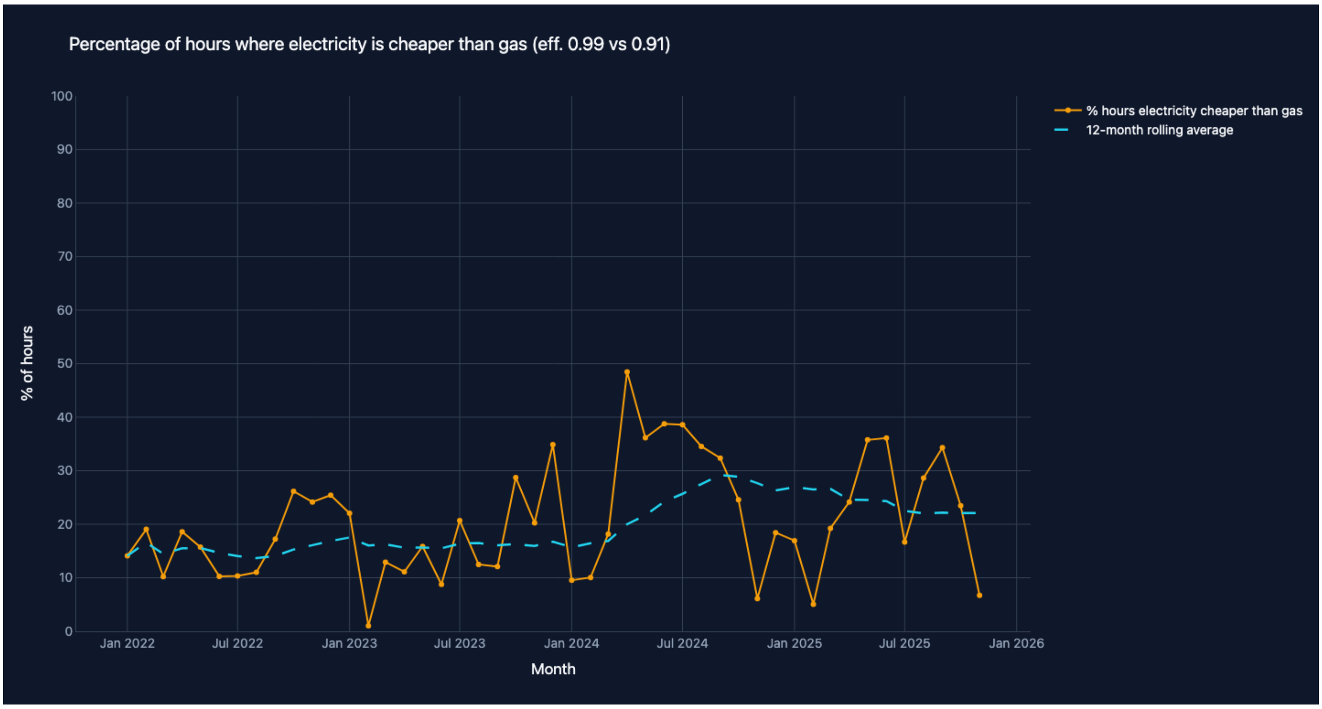

Fig 9: Percentage of hours where electricity is cheaper than gas

On raw prices alone, the business case for electrification is still negative more often than not. This is the number that most companies look at, and it is the reason many conclude that electrification simply does not work. But that conclusion misses something fundamental. The price dynamics behind gas and electricity are completely different. Gas prices are mainly driven by long term supply dynamics and geopolitical context. Electricity prices are mainly driven by the Belgian weather.

> "Electricity is not simply expensive. It is extremely cheap at certain moments and extremely expensive at others. The key to navigating the energy transition is not choosing between gas and electricity. It is exploiting the difference in what drives their prices."

FLEXIBILITY IS THE MISSING PIECE

The previous sections show a clear pattern. Gas is getting more expensive. Electricity swings between very cheap and very expensive. For a company looking at these dynamics, the question is no longer which energy source is better. It is whether you can position yourself to benefit from the moments when electricity is at its cheapest, rather than being stuck paying whatever price the market gives you.

That ability to respond to market conditions is called flexibility. On the electricity grid, it means being able to increase or decrease your electrical load in response to price signals or grid conditions. The forms it can take vary widely, from batteries to adapted industrial processes, each with different reaction speeds, volumes and durations. What they share is the same underlying principle: instead of consuming energy passively, you actively steer when and how much you consume.

For companies that electrify, this becomes directly relevant. By adding electrical capacity, a company becomes an active player on the electricity grid with significant load. As we saw, electricity is cheaper than gas 25% of the time, with prices close to zero or even negative in the right hours. A company with flexible load can target those hours deliberately.

The graph below shows what this opportunity looks like on a single summer day in 2025. It shows the price dynamics of gas and electricity over 24 hours. During the middle of the day, when renewable production peaks, electricity drops well below gas. A company with flexible load can capture these hours and avoid the most expensive ones, saving up to €300/MW on that single day. That is a 40% reduction in that day's energy bill.

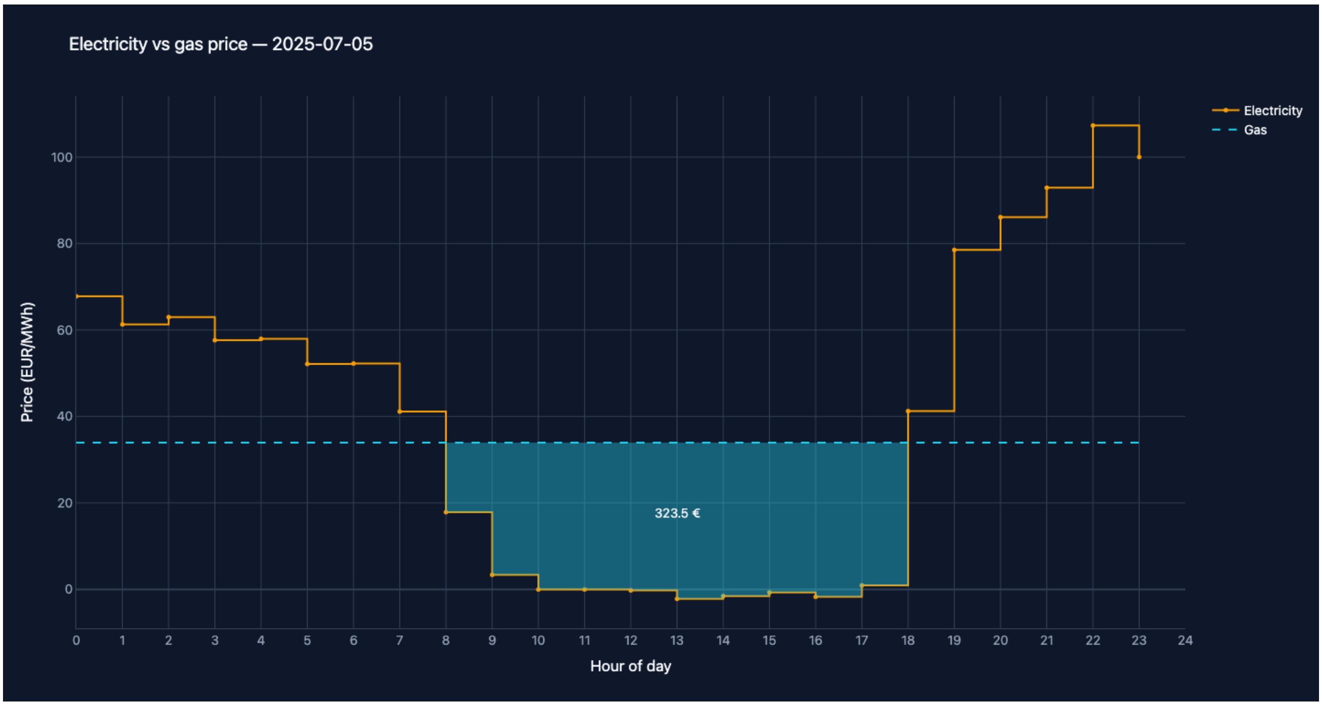

Fig 10: Example optimisation of electricity vs gas over a single summer day.

But optimising against the day ahead price is only part of the picture. The electricity grid needs to be balanced at every moment. When there is an unexpected surplus or shortage, the system operator needs assets that can adjust their consumption in real time. A company with flexible load can offer exactly that. By increasing consumption when there is too much electricity on the grid, or reducing it when there is too little, the company earns revenue for a service it provides to the system. This real time balancing is a separate income stream that stacks on top of the day ahead savings, and it is accessible to any company with sufficiently flexible electrical load.

> “Flexibility is indispensable in any electrification trajectory. It removes the choice between sustainability and economics. The companies that are already investing in electrical assets and integrating smart steering of their load are building a competitive advantage that will only grow stronger.”

HOW TO NAVIGATE THE ENERGY TRANSITION

The picture that emerges from the previous sections is clear. Gas is no longer the stable reference point it once was. Electricity is not simply expensive. It is extremely cheap at certain moments and extremely expensive at others. And flexibility is what allows a company to turn that volatility from a risk into a source of value.

The question then is: how do you put this into practice? We see four principles that should be at the core of any industrial energy strategy.

Hybridise, don't replace

The most important practical insight is that full electrification is not the right move today. For most industrial processes, and especially those operating at temperatures above 100°C, electricity costs in winter are still structurally higher than gas. A company that replaces its gas installation entirely will face months where the business case simply does not hold.

The better approach is hybridisation. An electric boiler or heat pump is placed in parallel to the existing gas installation. Both are available, but not necessarily running at the same time. When electricity is cheap and clean, the process runs on electricity. When gas plants are setting the price and electricity is expensive, the process falls back on gas. The production itself is unaffected. What changes is the energy source behind it, decided on a quarter hourly basis by market signals.

A hybrid setup is also, by definition, a flexible asset. It can switch between energy sources in response to the market. That brings us to the second principle.

Put flexibility at the centre of your strategy

Having a flexible asset is one thing. Capturing the value it creates is another. That requires actively engaging with the energy markets, and it is where much of the financial return is generated.

There are two main ways to valorise flexibility. The first is day ahead optimisation: planning which hours to run on electricity and which on gas, based on the spot market prices published the day before. The second is real time balancing: responding to grid imbalances as they happen and earning revenue from the system operator for helping keep the grid stable. These revenue streams stack on top of each other.

Accessing these markets is not something most industrial companies can do on their own. It requires knowledge of market mechanisms, the right technical infrastructure and specialised partners. But for companies that set this up well, flexibility transforms from a technical capability into a structural source of income.

Build on what you have

No two companies are in the same position. Many have already invested in sustainability. There may be solar panels on the roof, a wind turbine on site, a CHP producing both heat and electricity. A good energy strategy does not ignore these assets. It builds on them. Depending on the load profile, the existing equipment and the grid connection, the optimal path forward may look very different from company to company.

The same goes for the less visible factors. Existing supply agreements may lock a company into fixed pricing or volume obligations. There may be legal constraints around installed assets, such as an obligation to never curtail a solar installation. Strengthening a grid connection comes with one off investment costs and recurring capacity charges. And as grid congestion becomes a growing reality, demonstrating flexible consumption can be the difference between getting connected in months or in years.

All of these shape what is possible and what makes economic sense. An energy strategy that ignores them may look good in a spreadsheet but will not survive contact with reality.

Think in decades, not in quarters

Energy markets are noisy. Macro economic shocks, grid incidents, local disruptions. It is tempting to postpone decisions until there is more clarity. But the long term trends are clear, and they all point in the same direction.

Renewable production will keep growing. It is the economically rational investment for energy producers. This means cheap, low price hours will become more frequent and the periods of oversupply will grow. The value of flexibility will increase with it, because the grid will need more of it to stay balanced.

At the same time, the cost of gas will keep rising. ETS costs will accumulate, especially after 2035, and scope 1 reporting pressure will only tighten. The gap between gas and electricity during the cheapest hours will widen. The business case for a well structured electrification strategy, with flexibility at its core, is supported by every market mechanism in play. These forces are not temporary. They will intensify.

Companies that invest in the ability to be flexible now are not making a bet on an uncertain future. They are positioning themselves on the right side of trends that are already well underway.

HOW WE SUPPORT ALONG THE WAY

At Besso Energy, we believe that electrification investments should not be a choice between sustainability and competitiveness. The two reinforce each other, if the strategy is right.

We help industrial companies build that strategy. We start from the current situation: the assets already in place, the contracts already signed, the investments already planned. From there, we work across four areas:

- **Investment analysis.** We analyse the return on investment over the full lifetime of the site, combining real time data with load profiles, market projections and scenario analysis. We account for different risk appetites and deliver investment cases that are grounded in data, not assumptions.
- **Flexibility valorisation.** We model the revenue potential from flexibility markets, including day ahead optimisation and real time balancing, and help our clients set up the arrangements needed to access them.
- **Market navigation.** The energy market is complex and often opaque. We map out which partners are needed, what to expect from them and how to structure agreements to get the most out of your assets.
- **Long term roadmap.** We develop a clear, step by step path towards a fully electrified production site. Not a generic plan, but one built on your specific situation, with the confidence to act on it.

WHO ARE WE?

Besso Energy was founded by two Elia alumni, Pieterjan Espeel and Frederik Vanmaele. Having seen the energy transition develop from the system operator side, we recognise the opportunity that many industrial companies are still missing. We fill that gap by providing the tools and expertise to build a data driven, well structured energy strategy, from the first step all the way to full electrification.

We focus on the areas that remain unclear for most companies: the regulatory frameworks, the necessary partnerships, the costs of connection and capacity, the value of flexibility. We combine all of these into a complete assessment of an economically sound path to net zero. We take into account all processes on a site to deliver a clear roadmap that combines local energy production, storage and hybrid solutions, optimising both capital and operational expenditures while lowering scope 1 emissions.

Get in touch: frederikvanmaele@besso.be