Ireland's trusted **energy advisor.**

Right-Sized Energy

Why Pairing CHP and Solar Pays Off

How hybrid systems protect margins, resilience and returns for medium-sized businesses.

Prepared by

Dr Genaro Longoria,
Senior Energy Engineer

May 2026

Exemplar

INTRODUCTION

Energy has moved to the boardroom.

In recent months, energy has moved from the boiler room to the boardroom. Driven by volatile pricing, environmental mandates, and the need for secure supply chains, energy management is no longer just about keeping the lights on; it is essential for maintaining a competitive edge in the market.

THE CHALLENGE

Finding the optimal energy mix is challenging. Decision makers must balance rates, technologies, and efficiencies within a landscape that is in constant motion. While diversifying energy sources is the standard approach to mitigating this risk, random diversification is not enough; it requires a meticulously integrated, synergistic strategy.

To mitigate these risks, diversification is key. Yet, in the modern energy arena, diversification must be both meticulous and synergistic. For medium-sized enterprises, strategically pairing specific technologies can secure short-term and medium-term energy needs while firmly locking in cost certainty.

INSIDE THIS PAPER

THE PAIRING

Solar Energy and Combined Heat and Power (CHP) represent a highly effective pairing to reduce financial volatility and bolster operational resilience. While each technology delivers significant standalone benefits, integrating them with precisely matched capacities exponentially leverages their individual potential, creating a robust, future proof energy strategy.

Two technologies, precisely matched and a smarter risk profile for the businesses that rely on them.

CAPACITY PLANNING

Why Sizing Matters.

When integrating CHP and solar PV arrays, a "bigger is better" philosophy is highly counterproductive. Simply put, an oversized system quickly devolves from an energy asset into an operational liability.

Successful integration requires rigorous capacity planning. A CHP unit must be meticulously sized based on a precise understanding of the facility's thermal and electrical load profiles. If a CHP unit is specified too large for the facility's baseline thermal load, it risks frequent shutdowns from heat buildup or it is forced to dump valuable thermal energy into the ambient environment wasting the fuel used to create it.

The financial risks extend to electrical generation as well. Running a CHP unit outside its optimal duty cycle often results in exporting excess power to the grid for free, meaning the business bears the gas and running costs with no financial upside. Similarly, an oversized solar array will generate surplus electricity that provides no commercial benefit to the business, needlessly inflating the project's initial CapEx.

An accurately sized energy system is critical for maximizing returns, but seasonal shifts in demand can expose costly vulnerabilities in single-technology setups. A frequent pitfall is sizing a CHP unit to meet winter baseloads. As heat demand drops during the summer, the unit is left with nowhere to shed its thermal output.

This thermal bottleneck forces the CHP into a continuous cycle of automated shutdowns. This is more than an operational nuisance; it triggers a chain reaction that damages other capital equipment. Every time the CHP trips, the facility's backup boilers must fire up to compensate. This relentless on-and-off cycling causes profound mechanical stress, particularly on expensive heat exchangers, drastically shortening the lifespan of both the CHP and the boilers.

Attempting to solve this by running the CHP at partial capacity is not a viable alternative. Modulating the unit down incurs a steep efficiency penalty, and prolonged part-load operation strictly violates most manufacturers' operating guidelines.

THE ENGINEERING SOLUTION

Seasonal Diversification.

The optimal engineering solution is seasonal diversification. By pairing the CHP with a solar array, the facility creates a holistic, hybrid system. During the summer, the CHP can be taken offline or scaled back to prevent thermal stress, while the solar array steps in to seamlessly carry the electrical load. This integrated approach protects infrastructure, eliminates operational headaches, and guarantees peak performance across every season.

Protect infrastructure

Fewer trip cycles, less thermal stress on boilers and heat exchangers.

Remove headaches

Summer electrical load handed off to solar; the CHP scales back safely.

Steady performance

Continuous, efficient output across every season of operation.

A PRACTICAL EXAMPLE

From Liability to Asset.

The pinnacle of hybrid energy design is a CHP unit calibrated perfectly to the site's annual thermal baseload, operating in tandem with a carefully scaled solar array. However, if your facility is already experiencing the consequences of baseload misalignment, there are practical, high-impact alternatives. By integrating a complementary technology, a misaligned system can be corrected to deliver performance that very nearly matches the optimal design.

Consider an oversized CHP with a rated thermal capacity of 175 kW and electrical output of 100 kW. During the summer months there is an excess of 65 kW thermal. Hybridizing the CHP with a 100 kWp solar array could fundamentally changes the system's economics. The corrective configuration can still yield energy savings of 59% virtually indistinguishable from the 60% savings of a theoretically perfect design. Maintaining a payback period of under four years.

While the Net Present Value (NPV) of this retrofitted project is 23% lower than an ideal design, it delivers a staggering **87% higher NPV** compared to leaving the standalone CHP to struggle through suboptimal summer operations.

In the modern energy landscape, operational flexibility is synonymous with profitability and does not require abandoning existing assets; it requires unlocking their full potential through intelligent diversification. Relying on a single, isolated technology leaves a facility vulnerable to market volatility, mechanical strain, and seasonal inefficiencies. By strategically pairing CHP with solar energy, businesses can transform operational liabilities into compounding financial assets. Whether designing a hybrid system from scratch or correcting an existing load misalignment, the synergy between these two technologies provides a definitive pathway to resilient, cost-effective, and future-proof energy management.

CONFIGURATION	ENERGY SAVINGS	PAYBACK	NPV VS. IDEAL
Ideal ground-up hybrid design	60%	< 4 years	Baseline
175 kW CHP + 100 kWp solar (retrofit)	**59%**	< 4 years	−23%
Oversized CHP, standalone	—	—	**−87%**

How Exemplar Can Help.

Exemplar can support your organization by translating complex technical variables into clear, actionable financial strategies. We help cut through complex energy economics through rigorous life cycle cost analysis and precise engineering, we work alongside clients to ensure their energy infrastructure delivers an optimal Return on Investment. When capital intensive energy decisions are critical for you, data driven engineering advice is the difference between an operational liability and a compounding business asset.

To discuss whether a CHP and Solar is right for your organisation, contact Genaro Longoria, Senior Energy Engineer or any member of the Exemplar team.

When capital decisions carry weight, informed advice makes the difference.

Exemplar House, Unit 623, Harbour Point Business Park,
Little Island, Cork, T45 KF62, Ireland.
T +353 (21) 423 2865 **E** info@exemplarenergy.ie
exemplarenergy.ie