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Power Couples

Enhancing industrial competitiveness through electrification

JUNE **2026**

Electrification as a strategic lever for Europe's sovereignty, competitiveness and climate trajectory

Why must industry electrify now?

Europe's industrial base is at a strategic inflection point. The technologies to electrify are ready. The window to act competitively is narrowing. What stands between ambition and deployment is not innovation, but system alignment.

Building on last year's Eurelectric-Accenture report **"The New Industrial Age "**[1] this study moves the question from 'should Europe electrify?' to 'how does it scale in practice?'. As energy markets stay volatile and geopolitical risks disrupt supply chains, shifting industrial demand from imported fossil fuels to domestically produced electricity can improve cost stability, strengthen resilience and support long-term growth.

Technology is not the bottleneck to scaling electrification

Europe is already progressing where system conditions are aligned. The evidence in this report shows that the constraint is not technological readiness, but the complexity of the surrounding system, infrastructure, investment frameworks and policy.

These are not parallel tracks. Price visibility is the prerequisite. Without it, grid investment and capital mobilisation follow slowly regardless of intent. Europe must act on four fronts – providing stable long-term investment signals, aligning infrastructure with industrial timelines, enhancing investment clarity and bankability and creating coherent, execution-focused policy frameworks. Each reinforces the other and none are sufficient in silos.

Breaking dependency and building competitive edge

Europe's industrial base still relies heavily on imported fossil fuels, exposing companies to price shocks, supply uncertainty and strategic risk. Electrification offers a direct path to reduce the exposure. By expanding the use of clean, locally produced power, Europe can anchor more industrial activity in a safer, more self-reliant energy system.

At the same time, electrification is moving from cost premium to competitive edge. In many industrial applications, electric solutions are approaching cost parity while offering greater price stability and lower exposure to volatile fuel markets, creating more predictable and resilient cost structures that benefit both companies and the system.

The model exists and the time to act is now!

Industry remains a major source of emissions, especially from process heat and heavy operations. Many of these uses can already shift to electric solutions. Rapid electrification can cut emissions, improve energy efficiency and make industrial operations more resilient to climate and market disruption.

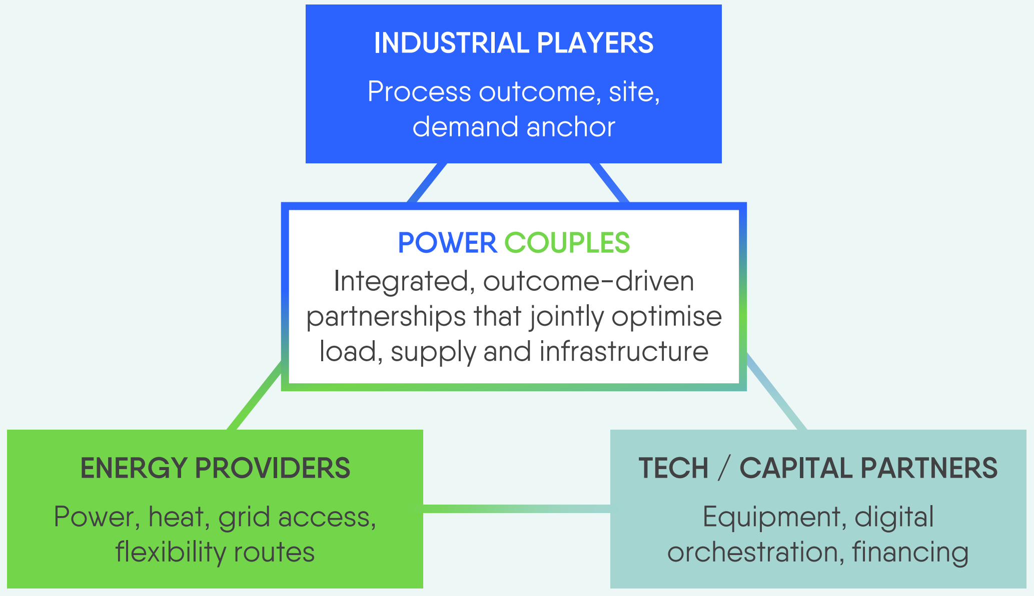
For industrial leaders and policymakers, the immediate imperative is to align the system fast enough to capture investment. This report introduces the Power Couples framework — an integrated partnership model developed from cross-sector evidence — as Europe's most scalable deployment path.

[1] The new industrial age

Power Couples: A new class of integrated partnerships

Power Couples could be a new class of multi-layer partnership that brings together industrial players, energy providers, technology and capital partners in integrated, outcome-driven models that jointly optimise system-level coordination across industrial demand, low-carbon supply and infrastructure design.

How Power Couples are structured:



Why this concept is different

Instead of traditional demand pooling and collocation, Power Couples jointly optimise for system benefits across industrial demand, low-carbon supply and infrastructure. The result is faster deployment, lower risk concentration and better outcomes for all partners and the system.

Typical commercial models

Power Couples voluntarily collaborate through a combination of commercial structures such as long-term power purchase agreements (PPAs), heat-as-a-service, energy-as-a-service, waste-heat offtake, flexibility revenues or blended public-private financing; structures that convert volatile cost exposures into predictable, bankable outcomes.

What they deliver

For the partners: Lower upfront capital exposure, faster time-to-deployment and clearer accountability for outcomes. For the system: better grid utilisation, easier renewable integration and shared infrastructure that reduces cost.

> **Power Couples contribute to solving the electrification deployment challenge by optimising coordination of fragmented decisions for system-level delivery.**

How we built the evidence

Electrification cannot be understood sector to sector. It operates as a system.
This methodology was designed to surface that system logic: triangulating market signals, stakeholder perspectives, synthetic data and real-world project data to isolate the recurring enablers and constraints that cut across industries.

From fragmented insights to a coherent system-level understanding of electrification

Desktop research	Stakeholder insights: Roundtables	Stakeholder insights: Interviews	Real-world evidence	System level synthesis
• Public-domain research • Sentiment analysis*	4 Power Couples Roundtables: • Electricity consumers (Nov 13, 2025) • Energy-Intensive Industries (Nov 27, 2025) • Data Centres (Mar 3, 2026) • Low-/mid-heat Industries (Mar 4, 2026)	• Live C-suite interviews for energy-intensive industries; AI-derived CEO perspective** for data centres and low-/mid-heat industries	• Project-level analysis to highlight what works in practice, then identify the conditions and success factors that enable replication at scale.	• Cross-sector integration: from sector-specific insights to a shared system logic, identifying interdependencies, trade-offs, and common enablers across industries.
→ Capture patterns, challenges and emerging priorities	→ Structure cross-stakeholder dialogue (industry, utilities, policymakers) → Bring operational and strategic perspectives		→ Anchor findings in real-world strategic perspectives	→ Combine all inputs to reveal cross-sector dynamics and a shared electrification logic

* Sentiment analysis based on ~3,500 data points from expert calls, company reports, and industry discussions across 61 energy-intensive companies. AI-assisted analysis, combined with expert validation, was used to cluster signals related to electrification challenges and opportunities and identify areas of convergence.

** AI-derived CEO perspectives were reconstructed using AI-assisted analysis of verified public sources (including executive statements, interviews and reports), to reflect representative leadership viewpoints.

See appendix for methodology details

Content

Electrification in Europe is no longer constrained by technology, but by the system's ability to enable it at scale

Building on the turning point

The question is no longer whether to electrify, but how to do so at speed and scale. For a large share of industrial processes — particularly in low- and medium-temperature heat — technologies are mature, proven and already deployable. Electrification is therefore not just a decarbonisation pathway, but a strategic lever for competitiveness — enabling more predictable costs, higher efficiency and greater resilience to fossil fuel dependency. Given the weight of industry in Europe's emissions, this shift is not a marginal one. It is a system-wide transformation shaping the future of both the energy system and industrial competitiveness.

A policy window opening now

For the first time, the political and economic cases for electrification are also converging. The European Commission's proposed AccelerateEU package[2] signals that this agenda is now at the centre of EU policy. Its core objective of making electricity cheaper and more widely available directly mirrors the system alignment challenge this report addresses. For industrial leaders and policymakers, the timing is significant and the signal is clear: the conditions for scaling electrification and the political will to act are converging. The window is open — the question is whether Europe's industrial system can move fast enough to seize the opportunity.

From electrification potential to system delivery

While the previous report established that electrification is both viable and strategic, this report takes the next step — examining how electrification plays out in practice. It focuses on where projects succeed, where they stall and what makes the difference, highlighting how "Power Couples" can enable more coordinated, system-level delivery at scale. Specifically, it addresses three questions: what system constraints recur across sectors; what successful projects have in common; and what conditions must be replicated to scale those models across Europe. Together, these insights shed light on how Europe's industrial base can capture the competitive advantages of electrification — or risk leaving them unrealised.

Three sectors, one system reality

To address these questions, the report draws on cross-sector evidence from three critical industrial frontiers: energy-intensive industries, low-/mid-heat sectors and data centres — covering more than 3,500 market signals across 61 companies and 30 documented projects. Despite the difference in processes, load profiles and operational realities, these sectors reveal a consistent finding: electrification progresses when system conditions are aligned and stalls when they are not. The implication is clear — solving electrification is not a sector-to-sector challenge. It is a system design challenge.

[2] Commission proposes actions to protect Europeans from the fossil energy crisis and accelerate the shift to clean, homegrown energy

Imagine if:

in 5 years, electrification in Europe no longer competed for power but orchestrated it

Imagine if electrification no longer looks like a queue of steel plants, food factories, paper mills and data centres competing for scarce, volatile power. Instead, Europe builds **Power Couples**: multi-layer partnerships that jointly optimise load, supply, infrastructure and system value. In a Power Couples model, one load anchors long-term clean power, another shifts demand when prices spike, a third provides fast balancing and all of them share infrastructure, risk and system value.

The prize is **not only decarbonisation**. For industry, it is a **lower-cost, faster-to-deploy** and **competitive electricity system** that results in **improved returns for electrification** investments.

Each actor in the Power Couples system has a distinct role; together, they solve what no single player can

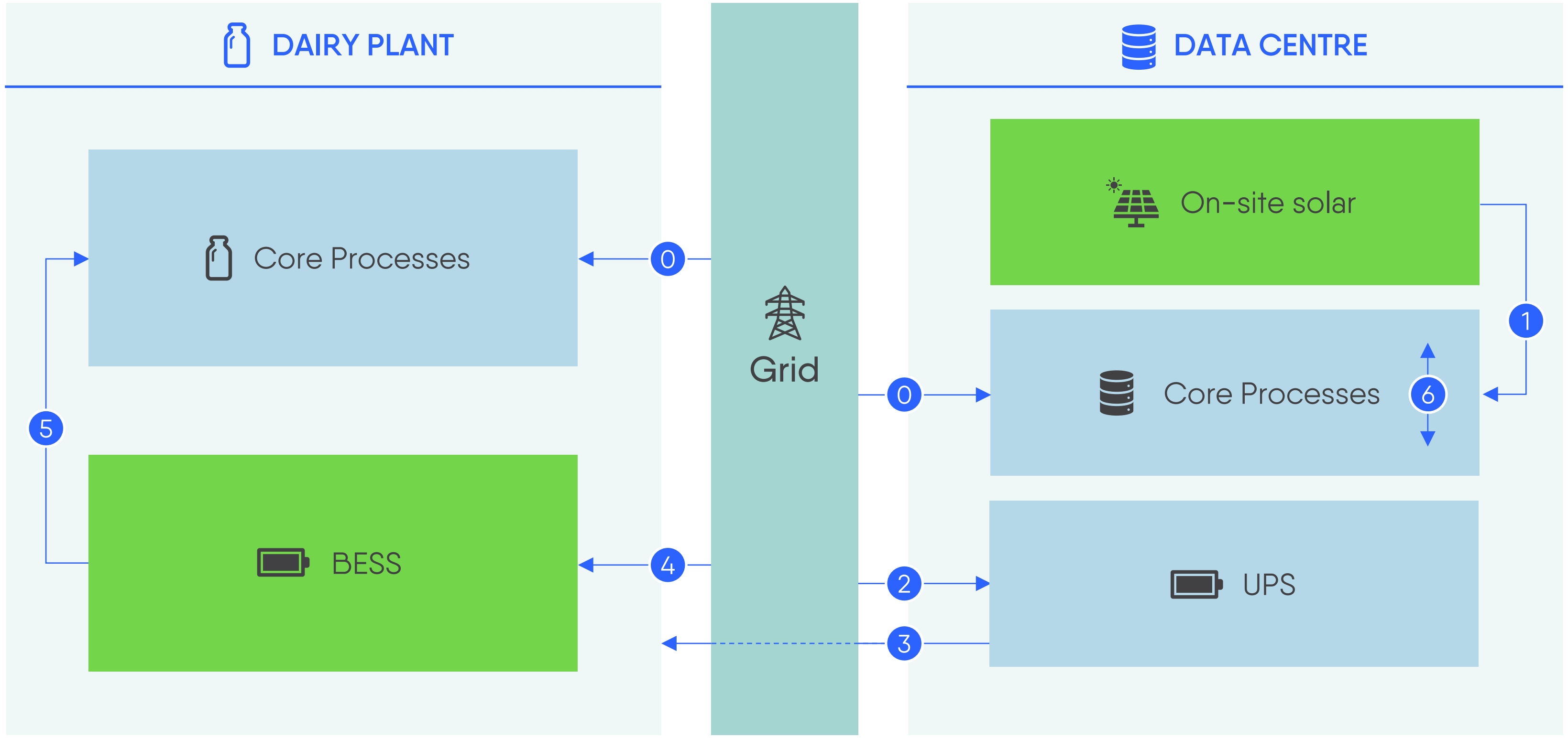
Non-exhaustive

	ROLE IN THE ENERGY SYSTEM	SYSTEM BENEFITS
ENERGY-INTENSIVE INDUSTRIES	• Anchor large, bankable demand* • Underwrite PPAs* and shared infrastructure • Justify grid reinforcement and new clean supply* • Provide long-term offtake certainty* • Contribute selected waste-heat and structured flexibility where feasible	• Improves bankability of power and grid investment • Raises infrastructure utilisation • Reduces industrial power-cost risk • Strengthens adequacy and investment signals • Supports competitiveness and lowers carbon-leakage risk
LOW-/MID-HEAT INDUSTRIES	• Provide flexible electrified heat demand • Deploy heat pumps, electric boilers, thermal energy storage (TES), hybrid systems • Shift load across hours without major output loss • Scale brownfield retrofit packages • Absorb low-cost renewable power	• Delivers intraday and daily flexibility • Lowers peak demand and curtailment • Reduces effective cost of electrified heat • Improves renewable integration • Makes brownfield electrification scalable
DATA CENTRES	• Provide stable high-volume power demand • Deliver fast flexibility via uninterruptible power supply (UPS) and recoverable waste heat • Enable advanced digital control and forecasting • Support co-located power, storage, and heat design • Improves bankability of power and grid investment • Raises infrastructure utilisation	• Delivers seconds-to-minutes balancing • Improves heat-network economics • Monetises waste heat • Increases visibility of load and system conditions • Improves utilisation of local power infrastructure
CROSS-SECTOR VALUE IN POWER COUPLES	• Energy-intensive industry anchors • Low-/mid-heat industry flexes • Data centres anchor, stabilise and export heat • Utilities orchestrate complementary loads and flexibility across the grid • Networks and policy enable scale	• Lowers total system cost • Reduces duplication of infrastructure through grid-enabled coordination • Improves flexibility and renewable uptake • Cuts electrification risk and delivery time • Strengthens industrial competitiveness and resilience

* Role also applicable to data centres

In practice, these roles connect into a more integrated energy system that rewards flexibility

Imagine a scenario where a dairy plant (low-/mid-heat sector) and a data centre in Poland invest in on-site energy solutions* and leverage their flexibility together...



Legend: New investment | Standard facility assets | Power flows

Illustrative

Working together

- 0 Data centre (DC) and dairy plant purchase electricity from the grid to run their operations
- 1 By installing on-site solar, DC reduces its baseload consumption
- 2 During negative-price periods data centre charges its UPS
- 3 During price spikes DC provides electricity from UPS to dairy plant
- 4 During negative price periods dairy plant charges its battery energy storage system (BESS)
- 5 During price spikes dairy plant discharges BESS and reduces its grid consumption
- 6 DC decreases its workloads during price spikes and increases during negative price periods

* In a market, where flexibility is priced effectively, and flexible assets and grid are well developed, benefits can already be delivered at system level. Illustrative example presented herein provides simplified view for the purpose of calculating indicative benefits for the involved energy consumers.

Coordinated flexibility unlocks higher electrification returns than standalone deployment

Flexibility is rewarded – but only when it is coordinated

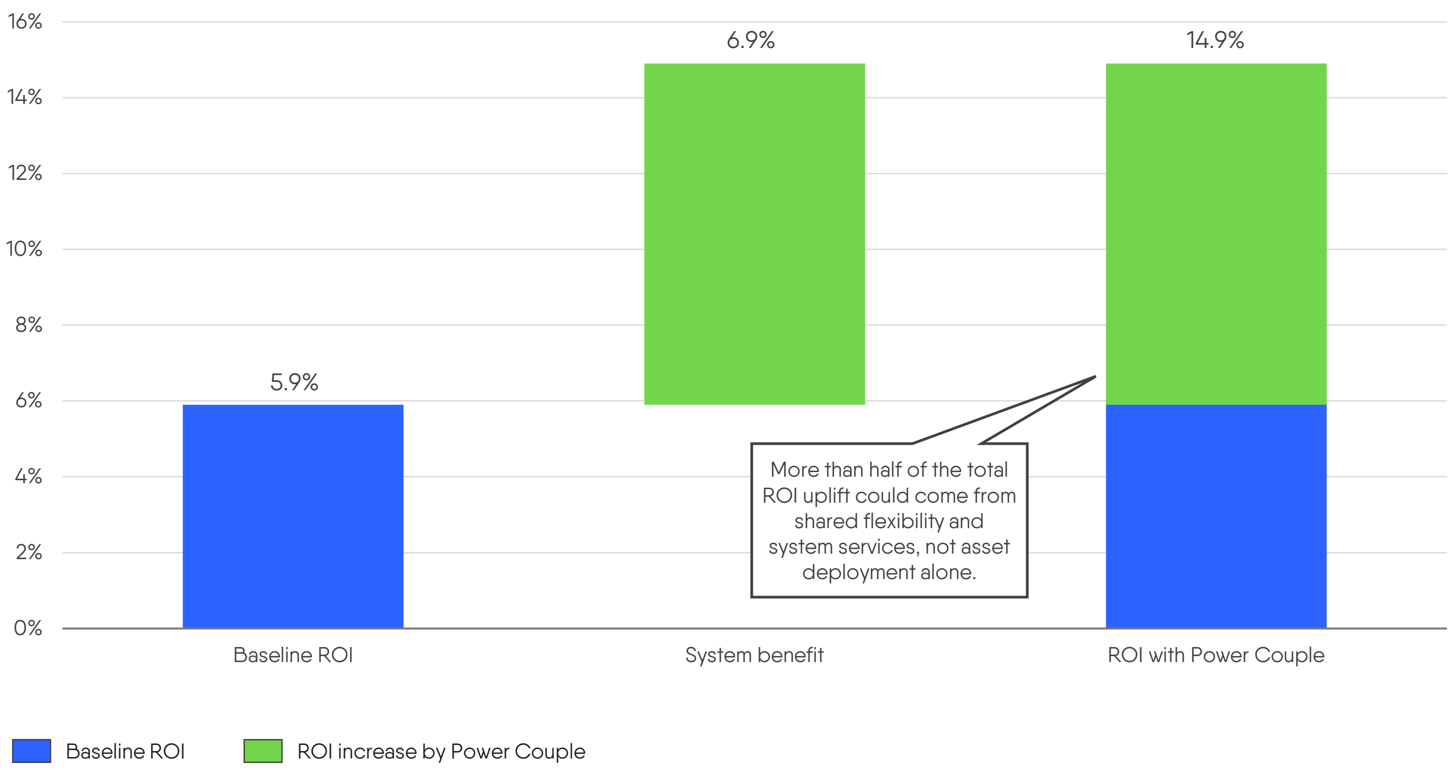
Chart to the right presents combined return on investment (ROI) of solar and BESS installation in data centre and dairy plant. Baseline represents both facilities operating individually. Increase in returns is achieved by optimising facilities together.

Lessons:

- Coordinating solar and BESS across data centre and dairy plant generates higher combined ROI.
- System-level value does not accrue evenly. Collaboration models must be designed so each participant remains commercially viable.
- Storage and load flexibility capture the highest value in volatile markets with frequent price spikes and dips.
- On-site generation performs best in high-price markets, while flexibility delivers disproportionate value under volatility.

System-level flexibility in Power Couples model adds material returns beyond baseline electrification ROI

Indicative



Sources: (a) Accenture on Eurostat, Electricity price statistics, as of October 2025; Eurostat, Electricity prices for non-household consumers - bi-annual data (from 2007 onwards), as of April 20, 2026; (b) Kamiya, G. and Bertoldi, P., Energy Consumption in Data Centres and Broadband Communication Networks in the EU, Publications Office of the European Union; (c) IEA, Energy and AI; (d) IEA, Key Questions on Energy and AI; (e) public industry portals & news.

See appendix for assumptions

With the value case established, the priority now is coordinated, no-regret action across the system

	IMMEDIATE NO-REGRET MOVES	WHY IT MATTERS
POLICYMAKERS	Create a fast-track framework for electrification areas[3] with anticipatory grid build-out and parallel permitting for new and existing investments.	Removes the most common deployment bottleneck across sectors: infrastructure and approvals lagging investment readiness.
UTILITIES	Engage in orchestration of integrated portfolios of products and services supporting end-to-end electrification needs, including piloting them in electrification areas	Utilities continue focusing on customer-centricity to further support clients in optimising power, heat, storage and contracting across multiple users and locations across the grid.
DSO / TSO*	Publish transparent connection, congestion and flexibility maps for industrial areas, and coordinate local flexibility procurement.	Gives developers visibility on where electrification can move fastest, reduces queue uncertainty, creates the basis for non-wire alternatives and coordinated flexibility procurement, and supports security of supply.
ENERGY-INTENSIVE INDUSTRIES	Aggregate future load and flexibility into one bankable electrification roadmap.	Strengthens negotiations around PPAs*, improves grid-planning credibility, supports shared infrastructure and reduces the risk of fragmented site-by-site decisions.
LOW-/MID-HEAT INDUSTRIES	Prioritise thermal flexibility before full process conversion.	Creates fast optionality, lower exposure to volatile power prices and makes brownfield electrification easier to scale using heat pumps, electric boilers and thermal storage.
DATA CENTRES	Encourage every new site to be flex-ready and waste-heat-ready by design.	Avoids costly retrofits later, improves connection quality, enables UPS/BESS* participation and creates a route to monetise heat from day one.

[3] Eurelectric: Electrification Acceleration Areas position paper: https://www.eurelectric.org/wp-content/uploads/2026/05/Electrification-Acceleration-Areas-Eurelectric-position.docx.pdf
* DSO: Distribution System Operator; TSO: Transmission System Operator; PPA: Power Purchase Agreement; UPS: Uninterruptible Power Supply; BESS: Battery Energy Storage System

In five years, electrification becomes a standard, bankable industrial investment

What customers expect from the future system

Customers expect electricity to become a predictable industrial input, not a market risk to hedge against.

Power infrastructure and operations are planned together, giving early visibility into cost, capacity and timelines.

Electrification is designed as a system, not a retrofit. Process redesign, storage, flexibility and digital control are integrated upfront.

Risk shifts from individual projects to coordinated delivery. Policy, capital and infrastructure frameworks reduce execution risk and speed up decisions.

Electrification scales as a repeatable choice. Investment cycles shorten, system costs decline and electrification becomes the default option.

How a fully aligned electrification system operates:

System outcome
Reliable industrial output with improved cost visibility, uptime and carbon intensity

Operational layer
Electrified processes, digital control, storage and coordinated operations

Commercial layer
Long-term power visibility, demand assurance and flexibility revenues

Infrastructure layer
Visible capacity, phased connections, co-location options, heat networks and storage

Policy & capital layer
Strategic prioritisation, technology-neutral support, de-risking and market access for flexibility

What this system enables

Faster investment decisions

Projects are underwritten on visible costs, timelines and risk-sharing frameworks

Lower total system cost

Coordinated demand and infrastructure reduce overbuild, delays and inefficiencies

Higher asset utilisation and value capture

Flexibility, storage and heat integration increase utilisation and improve both system and project economics

Stronger industrial resilience

Reduced exposure to volatility through diversified sourcing and structured contracts

When systems align, electrification becomes a competitiveness lever — not just a decarbonisation solution

"The New Industrial Age" already established in 2025 that electrification could be a cost-effective alternative to direct use of fossil fuels. With recently disrupted hydrocarbon supply chains resulting in historically high price volatility, electrification offers even more benefits today.

1 Competitiveness

Predictable domestic power becomes a competitive input against price shocks

Electrification reduces exposure to fossil price volatility, making energy a more predictable input and supporting the case for industrial and digital growth in Europe.

- Supports cleaner, higher-value product propositions
- Enables new industrial service and business models
- Improves investment attractiveness in energy-intensive sectors

2 Resilience

A more electrified system increases operational resilience

Electrification lowers reliance on imported fossil fuels while enabling more flexible and diversified energy use, strengthening overall resilience.

- Multiple sourcing strategies (grid, contracts, on-site)
- Flexibility, storage and heat recovery increase optionality
- Better system visibility improves planning and coordination

3 Decarbonisation

Decarbonisation becomes a structural outcome of system strength

When electricity becomes predictable, low-carbon and available on time, emissions naturally decrease, enabling cleaner industry and more efficient digital growth.

- Accelerates electrification of process heat
- Improves renewable integration and reduces curtailment
- Turns waste heat and flexible demand into system assets

Europe's real prize is to move from compensating for system frictions to scaling a new industrial operating model built on low-carbon power.

Reality check:
cross-sector constraints

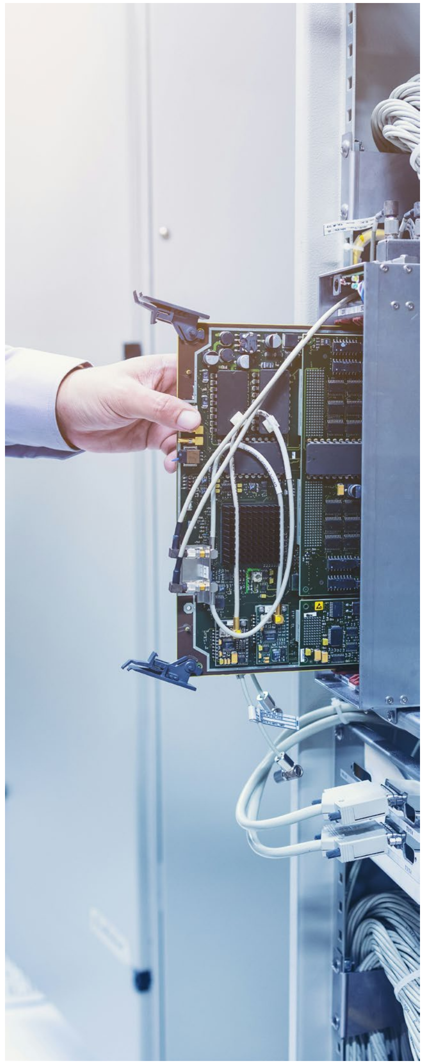
Electrification is not constrained by ambition – it is constrained by execution

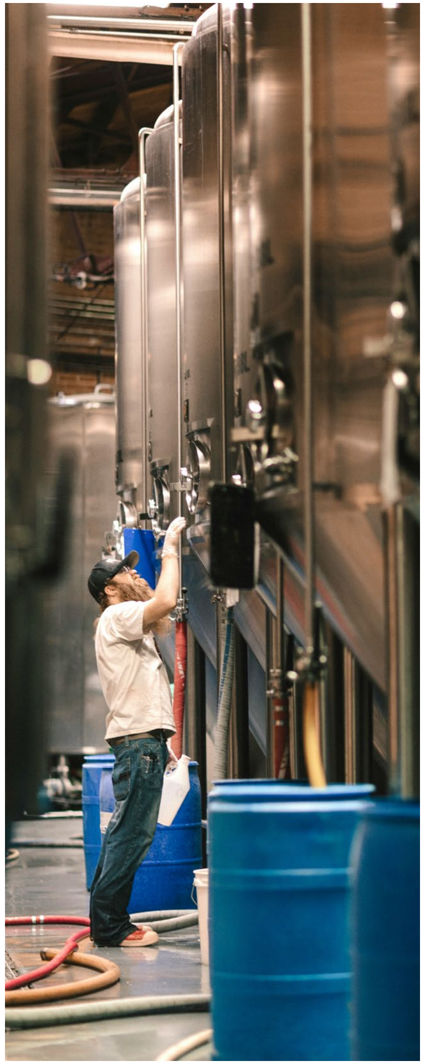
The vision is clear. This is where delivery breaks down today.

Across industries, electrification projects slow or stall for the same reasons. Electricity costs remain volatile and hard to underwrite. Grid access is uncertain and delayed. Investments struggle to reach bankability. Integration into operations is complex. Policy frameworks fail to support delivery at pace.

Drawing on cross-sector evidence, this analysis isolates where projects consistently break down – across price uncertainty, infrastructure delays, financing risk and operational complexity – and where they succeed when these constraints are addressed together.

The challenge is no longer whether electrification should happen, but whether the system can execute – reliably, predictably and at scale.





Electrification at scale is constrained by a system of mutually reinforcing bottlenecks

These constraints do not act independently. They interact and compound at the moment of investment decision, creating a system-level constraint to electrification at scale. The challenge is therefore not to resolve individual issues in isolation, but to address the combined effect of bottlenecks to improve bankability and enable projects to scale.

1. Power economics: the first investment gate

Price volatility, limited forward visibility and tariff distortions prevent the formation of bankable, long-term cost structures aligned with industrial investment cycles. As a result, technically viable electrification projects fail to reach final investment decision (FID) due to unpredictable operating economics.

2. Grid access and delivery: the binding constraint

Grid access, capacity availability and delivery timelines determine project viability. Connection queues, local capacity limits and misalignment between generation build-out and industrial load delay access to power. Fragmented permitting across site, grids and generation further extends timelines, misaligning infrastructure delivery with industrial investment decisions.

3. System integration: the hidden execution risk

Electrification must be integrated into existing operations under strict performance and uptime constraints. Retrofit complexity, process redesign and embedded flexibility (load shifting, storage, hybrid operation) increase execution risk when treated as downstream add-ons. In practice, system integration must be a core design parameter, not an afterthought.

4. Bankability: what's impacted by other bottlenecks

Projects must clear a bankability test: electrification CapEx competes with core operational projects, while FOAK (First-of-a-kind) and retrofit risks sit on a single balance sheet with uncertain demand and payback. This leaves a persistent gap between technical feasibility and investment-grade projects.

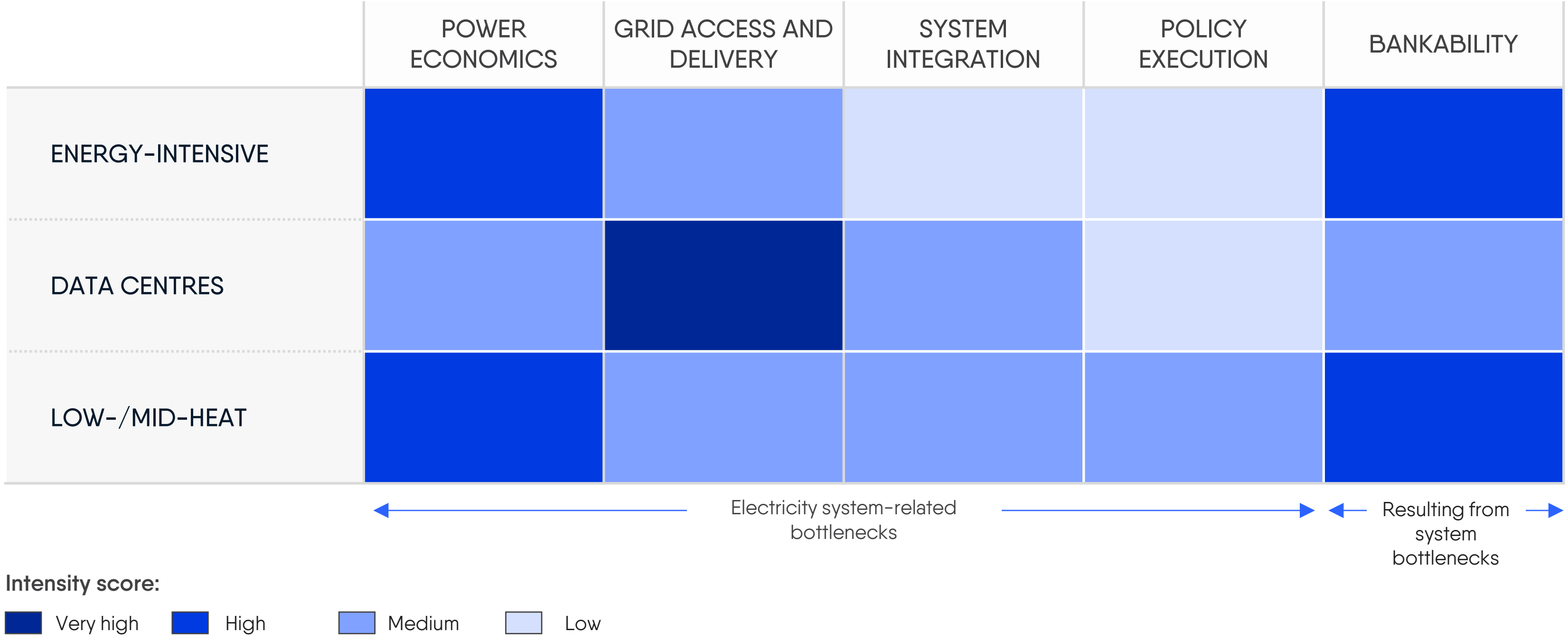
Policy: the system overlay

Policy shapes how power economics, grid access, delivery and system integration interact in practice and how they ultimately impact bankability. While ambition is often clear, delivery capacity lags. Fragmented permitting, inconsistent support and unclear frameworks push execution risk downstream, making coordinated, timely delivery the critical constraint.

The same system constraints apply across sectors – intensity differs

Electrification is advancing across very different industrial contexts — from high-temperature continuous processes to distributed heat demand and fast-growing digital loads. While each sector faces distinct technical and operational constraints, projects progress only when the same system conditions are met: predictable power economics, timely grid access, shared risk to achieve bankability and operational solutions that integrate into existing processes. Policy frameworks matter when they reduce execution risk and align delivery with industrial timelines.

Customer perspective on electrification barriers intensity* across sectors



Power economics remains the baseline constraint across all sectors, shaping whether projects enter the pipeline at all.

- Grid access is most binding for data centres, where speed-to-power and load concentration make infrastructure the primary gating factor.
- Impacts on bankability are more acute in energy-intensive and low-/mid-heat sectors, driven by capital intensity, retrofit risk, and exposure to uncertain returns.

* Intensity reflects how frequently and critically each constraint emerges across market signals, roundtables and interviews.

Sector differences shape how electrification is delivered – not why it stalls.

Industrial contexts vary in processes, load profiles and operational requirements.

Yet at the point of investment and execution, outcomes are driven by the same underlying system conditions.

What differs is where pressure concentrates: on power economics in energy-intensive industries, grid delivery and timing in data centres, and unit economics and retrofit models in low-/mid-heat sectors.

Cross-sector comparison of electrification dynamics

	ENERGY-INTENSIVE	DATA CENTRES	LOW-/MID-HEAT
LOAD CHARACTERISTICS	Established large, continuous loads; often 24/7 and strategically important	Rapidly growing large, continuous loads	Smaller, fragmented and heat-driven site loads
OPERATIONAL CONSTRAINT	High-temperature process fit and uninterrupted operation	Power–cooling–compute integration; uptime requirements; speed-to-power	Downtime, space, engineering and ROI constraints
WHERE DELIVERY BREAKS DOWN	Power cost uncertainty; lack of firm low-carbon supply; FOAK risk	Grid access delays and infrastructure bottlenecks; planning uncertainty	Weak unit economics and grid access at site level; fragmented project pipeline
PRIMARY FLEXIBILITY LEVER	Storage, hybrid supply and residual heat	Workload shifting and UPS/BESS* response	Thermal storage and BESS, and load shifting
KEY ENABLING REQUIREMENT	Secure long-term power certainty and de-risk FOAK investment	Anticipatory grid planning and integrated power–site development	Short-term ROI and as-a-service models
HOW POWER COUPLES MATERIALISE	Consortia, public-private risk sharing and market-based dedicated voluntary supply models	Utility–developer–operator models turning load into system asset	Service models; third-party ownership; portfolio aggregation

* UPS: Uninterruptible Power Supply. BESS: Battery Energy Storage System

From barriers to scale:

What works in practice and across industries

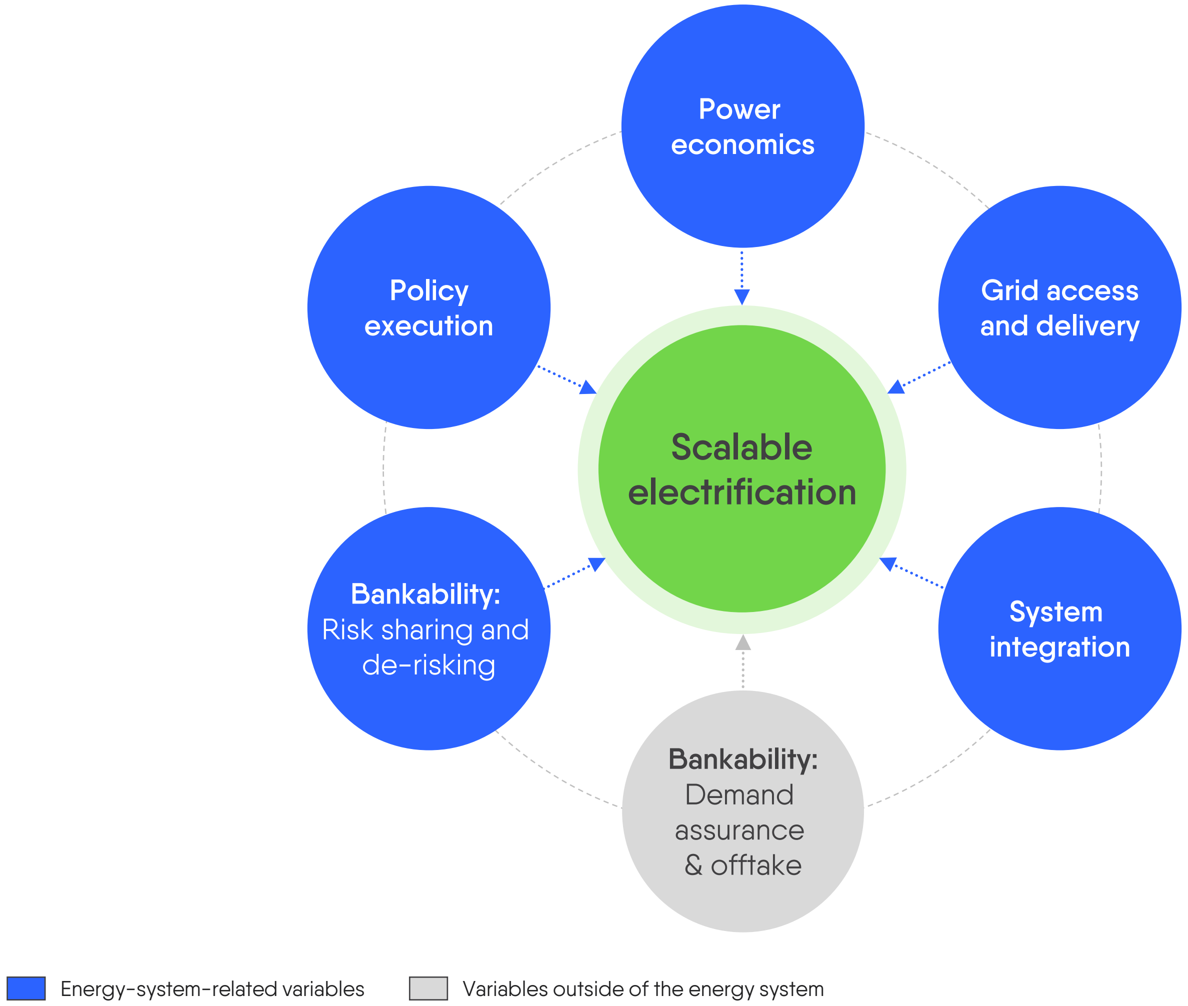
Electrification becomes investable when key conditions converge

Electrification stalls when power economics, grid access, risk allocation and system integration remain misaligned at the point of investment. Addressed sequentially, these constraints leave uncertainty that is sufficient to delay or prevent final decisions.

Not all conditions for electrification sit within the energy system. Demand assurance and offtake lie outside the grid and market design but are critical to bankability. They refer to long-term commitments that anchor demand and revenues, ensuring that electrified assets can be financed and scaled. Public subsidies remain important in transition, but reducing underlying system risks is key to scaling electrification.

Projects scale when these conditions converge early, reducing combined risk across economics, infrastructure and execution to a level that supports bankability and capital commitment.

Electrification fails at the margins – but scales when uncertainty is solved system-wide



Restoring power economics – making industrial electrification investable

At scale, electrification fails first on power economics — before grid or integration constraints even come into play.

Industrial electrification investments require long-term visibility, yet electricity is often procured under short-term, volatile conditions. This creates a structural mismatch between industrial investment cycles and power market exposure, undermining final investment decisions.

Successful industrial projects do not eliminate price risk; they structure it into predictable, long-term cost envelopes aligned with asset timelines.

PRIORITY ACTIONS	WHY THIS MATTERS
• **Scale long-term contracting mechanisms** (PPAs, indexed contracts) tailored to real load profiles • **Expand voluntary service-based delivery models** that convert CapEx into predictable unit-cost contracts (e.g., heat-as-a-service) • **Combine multiple sourcing options** (grid, on-site, storage) to stabilise long-term costs.	• Electricity price uncertainty is the **most recurrent barrier across all sectors** • Industrial investment decisions depend on **predictability over asset lifetime — not spot competitiveness** • Without price visibility, grid and capital follow slowly regardless of intent

Key conditions addressed

Power economics | Grid access and delivery | System integration | Policy execution | Bankability: Risk sharing | **Bankability: Demand assurance & offtake**

FOOD & BEVERAGE

Case in practice: Contracted low-carbon steam model

Turning volatile electricity prices into bankable cost structures

A large-scale **brewing and food facility** electrified **steam generation (100–200°C)** using a hybrid model — combining long-term power contracts, on-site solar, and thermal storage under a heat-as-a-service structure.

Impact:

- Eliminates exposure to power price volatility
- Removes upfront capital constraints
- Enables immediate deployment without process disruption

Grid access and infrastructure readiness — aligning grid delivery with industrial investment timelines

At scale, electrification stalls when grid delivery follows investment — instead of being designed into it.

Recent EU Grids Package initiatives on permitting mark an important step toward accelerating infrastructure delivery. Yet their impact depends on EU-wide implementation as a widening mismatch remains between industrial timelines (2–3 years) and grid delivery (5–10 years).

Successful projects reverse this dynamic by integrating grid constraints into early design — through location, phasing, co-location, or on-site solutions. Grid readiness is treated as a strategic variable, allowing infrastructure delivery and investment timelines to align.

PRIORITY ACTIONS	WHY THIS MATTERS
• **Plan grid development around strategic loads and clusters**, not individual queue positions • **Enable phased or flexible connection models** to accelerate time-to-operation • **Synchronise permitting across site, grid and generation** into a single delivery pathway	• Infrastructure lag is one of the **most cited barriers across all industries** • Projects are lost not due to lack of power, but due to **timing misalignment** • Grid access increasingly determines **siting decisions and investment flows**

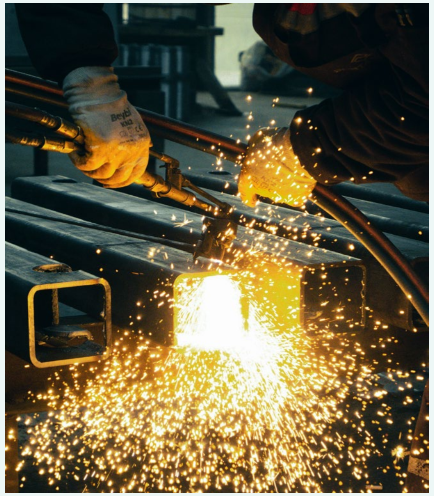
Key conditions addressed

Power economics | **Grid access and delivery** | System integration | **Policy execution** | Bankability: Risk sharing | Bankability: Demand assurance & offtake

STEEL INDUSTRY

Case in practice: Anticipatory grid integration for large-scale industrial load

Aligning infrastructure with investment timelines



A large **steel production** site transitioning from blast furnace to **electric arc furnace (EAF)** integrates grid reinforcement and connection planning early, supporting a high-load, continuous process with multi-hundred MW electricity demand.

Impact:

- Removes connection risk as a barrier to FID
- Aligns infrastructure delivery with project timelines
- Enables multi-gigawatt (GW) electrification deployment

System integration through flexibility – improving economics and system fit

At scale, electrification fails when demand remains inflexible – even if power and grid access are available.

Electrification increases demand but also creates opportunities to enhance system efficiency. The key lies in designing assets as responsive components rather than passive consumers.

Advanced deployments embed flexibility directly into operations. Storage, demand response, hybrid systems and digital optimisation are not secondary features – they are core to improving both economics and deliverability. Electrification thus goes beyond energy substitution, redefining how demand interacts with the energy system.

PRIORITY ACTIONS	WHY THIS MATTERS
• **Integrate storage and hybrid configurations** to decouple generation and consumption • **Enable demand-side flexibility and load shifting** where operationally feasible • **Use digital optimisation and control systems** to align demand with system conditions	• Flexibility can **improve system efficiency** by shifting, balancing or reducing demand based on system conditions • It creates **new revenue streams** (ancillary services, load shifting) • It improves **resilience and operational optionality**

Key conditions addressed

Power economics | Grid access and delivery | System integration | Policy execution | Bankability: Risk sharing | Bankability: Demand assurance & offtake

DATA CENTRES

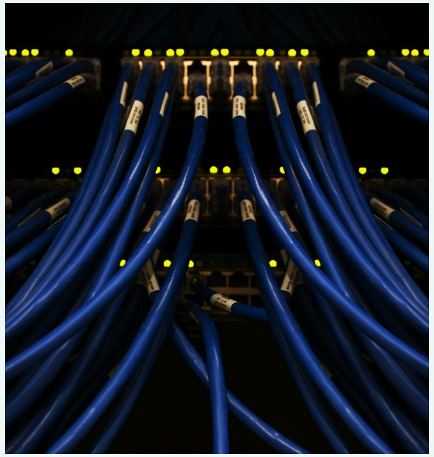
Case in practice: Grid-interactive infrastructure model

Addressing system integration as a requirement for bankable electrification

A **hyperscale data centre** optimises **backup and compute systems** for grid interaction, enabling participation in ancillary services markets, while supporting high-density digital operations with strict continuous uptime requirements.

Impact:

- Generates new revenue streams with limited additional CapEx
- Reduces net electricity cost
- Turns infrastructure into a system asset without affecting core operations



Risk-sharing & capital models – unlocking investment at scale

At scale, electrification stalls when risk remains concentrated on a single balance sheet.

In many cases, industrial actors are expected to absorb market risk, technology risk, infrastructure uncertainty and operational complexity simultaneously – exceeding acceptable thresholds and delaying investment.

Advanced implementations do not eliminate risk; they redistribute it via co-investment, third-party ownership, or public de-risking, making projects financeable by design rather than dependent on exceptional effort.

PRIORITY ACTIONS	WHY THIS MATTERS
• **Deploy blended finance and public de-risking mechanisms** for high-value or FOAK projects • **Structure co-investment models** across utilities, developers and off-takers • **Use service-based and third-party ownership models** to shift risk off balance sheet	• Electrification often competes with core business CapEx under **strict ROI thresholds** • First movers face **disproportionate exposure to uncertainty** • Many projects fail not on economics – but on **risk concentration**

Key conditions addressed

Power economics | Grid access and delivery | System integration | Policy execution | Bankability: Risk sharing | Bankability: Demand assurance & offtake

CHEMICAL INDUSTRY

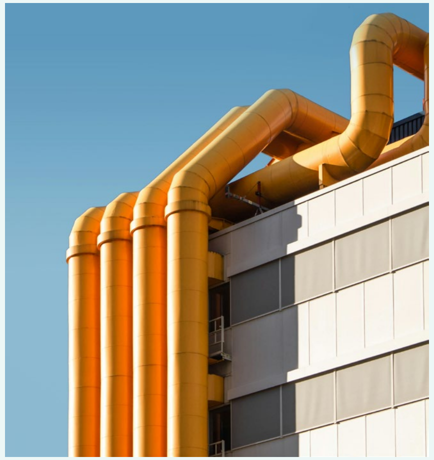
Case in practice: Service-based electrification model

De-risking electrification through co-investment

A **large chemical site electrified** a core high-temperature process (e.g., steam cracking/process heating) via **a multi-partner investment structure**, addressing high energy intensity and significant CapEx needs.

Impact:

- Risk-sharing enables FOAK industrial deployment and unlocks investment
- Removes upfront CapEx and shifts performance and operational risk
- Replicable model supports scalable deployment across multiple industrial sites



Electrification scales when the system is coordinated backwards from the industrial outcome at the outset

Electrification becomes bankable when market, infrastructure, operational and capital layers are aligned early at the point of investment. This upfront coordination reduces uncertainty where markets alone struggle under long infrastructure and investment cycles, enabling clearer delivery paths, stronger economics and repeatable models beyond individual sites. This requires a mindset shift so actors in the system voluntarily engage in early coordination.

Today: Technology-driven approach

Starts with the equipment and asks the system to adapt afterwards.

Typical result:

- Viable asset, weak business case
- Unresolved connection risk
- No route to replicate beyond one site

Industrial outcome
Required heat/power, uptime, quality and carbon target

Operational design
Storage, hybrid operation, digital control and process integration

Commercial & risk design
PPAs, flexibility markets, demand assurance, service models

Grid & infrastructure
Connections, co-location, heat networks, on-site generation

Policy & capital
Strategic status, de-risking, market access and planning alignment

Future: Outcome-driven approach

Starts from the required industrial output, cost and reliability envelope, then enhances coordination of contracts, infrastructure and operations around it.

Typical result:

- Investable economics
- Clearer delivery path
- Repeatable scaling model

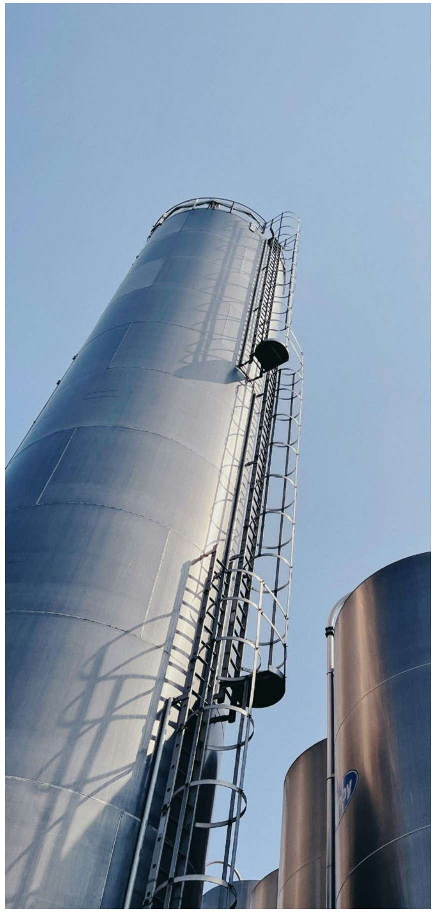
Power Couples facilitate the coordination of these layers by distributing infrastructure, operational, market and financing risks across stakeholders, so no single actor carries the full execution burden alone.

The question is no longer whether viable models exist, but which of them are most ready to scale and under what conditions

Blueprints are valuable because they are replicable

Replicable blueprints or proven use cases are not isolated "hero projects." Their value lies in what they make transferable: combinations of technical design, commercial structure, infrastructure coordination and risk-sharing that can be reproduced, under defined conditions. The objective is not to celebrate uniqueness, but to identify models that align system logic, business judgment and operational constraints, and to understand where and how fast they can be scaled.

Across the evidence base, five electrification models already stand out as working in practice.



Urban multi-vector systems – Scales where demand density and local coordination are high

Exemplified by projects such as **Silvertown ECTOgrid**, heat, cooling, storage and electricity demand are co-optimised at the district level. Rather than deploying isolated assets, this model creates shared infrastructure and shared operational value across users.

Data centres as a grid asset – Scales through standardised market access and certification

Illustrated by **Microsoft's grid-interactive UPS* model**, existing backup infrastructure becomes a source of flexibility, providing ancillary services or peak support without compromising uptime. It's less about hardware; it's market access, certification and control integration.

City-scale heat-reuse platforms – Scales where long-term urban heat demand is anchored

Seen in **Stockholm Exergi**'s approach to integrating data centres into district heating, waste heat is no longer treated as a by-product but instead as a tradable energy stream, anchored in urban infrastructure and long-term demand.

Service-based process heat models – Scales by removing risk from industrial balance sheets

Demonstrated by **Heineken's Vialonga project**, thermal storage, renewable electricity and third-party ownership are combined to deliver low-carbon steam with no upfront CapEx from the offtaker, effectively removing both financial and operational barriers to adoption.

High-temperature industrial transformation model – Unlocks structural emissions

As seen in **Wienerberger's electrified kiln and heat-pump integration**, this approach goes beyond fuel switching to redesign core industrial processes, typically requiring tight integration between operators, technology providers and support frameworks.

* UPS: Uninterruptible Power Supply.

See appendix for replicable blueprint one-pagers

Replicable blueprints distinguish themselves by combining multiple enabling factors into a coherent system

01
Energy design built into business case

Energy design is embedded directly into the business model. Commercial structures — whether service-based contracts, long-term offtake agreements or market participation mechanisms — are integral to the value proposition, not layered on top of it.

02
Dependencies addressed early

Infrastructure and spatial dependencies are addressed early. Successful projects have clear answers to where power, heat and network capacity come from, and who is responsible for coordinating them. This reduces execution risk and shortens development timelines.

03
Value created for the broader system

These models create value beyond the site boundary. That value can take different forms: reduced exposure to volatile energy prices, revenues from flexibility markets, avoided grid reinforcement, monetisation of waste heat or improved system efficiency. In all cases, the project contributes to the wider energy system, not just the host site.

04
Risk spread across multiple parties

Risk is distributed rather than concentrated. Ownership structures, public support, utility participation or third-party financing mechanisms ensure that the burden does not fall solely on the first mover. This redistribution is often what makes projects bankable.

05
Solutions aligned to existing operations

Each solution is designed for operational fit. Electrification is integrated into existing production or service requirements — throughput, reliability, quality — rather than treated as an external constraint. This alignment is critical for adoption in industrial and mission-critical environments.

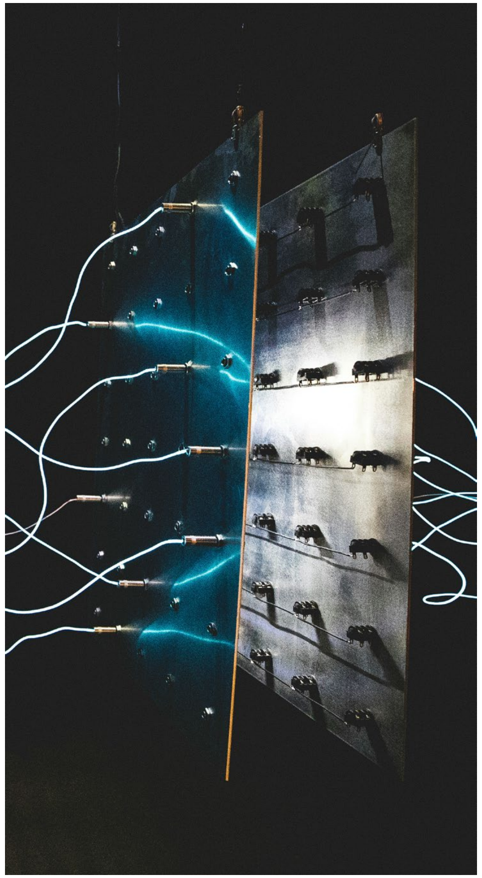
Taken together, these cases demonstrate that success comes from the alignment of commercial, system and operational logic. Replicability depends on reproducing that alignment, not on copying individual technologies.

Scaling these models depends less on technical feasibility than on the ability to reproduce the enabling conditions that made them viable

Replication depends on the standardisation of context, not the duplication of assets

Across the evidence base, electrification models scale only when six conditions are consistently met together.

#1	**Power economics:** predictable access to low-carbon power
#2	**Grid access and delivery:** timely coordinated connection and capacity
#3	**System integration:** effective grid-based ecosystem coordination
#4	**Policy execution:** supportive policy environment
#5	**Risk sharing*:** replicable commercial frameworks
#6	**Demand assurance & offtake*:** credible, long-term revenue anchor



Where several of these conditions are already in place, replication can accelerate rapidly. Where they are missing, projects require more structured support, clearer sequencing and often public intervention to reach viability.

Not all models are equally mature. Some data centre configurations remain early-stage; heat-reuse platforms are powerful but geographically constrained; high-temperature industrial electrification is progressing but still faces bankability and execution challenges. Scale will not come from replicating flagship projects one by one. It will come from embedding a small number of robust blueprint models into standard practice — and systematically putting the conditions for their success in place.

* Bankability results from risk sharing and demand assurance & offtake.

Conclusion

Scaling electrification requires a structural shift from fragmented optimisation to coordinated system delivery

Across energy-intensive industries, low-/mid-heat sectors and data centres, the same pattern emerges: electrification projects fail when price, grid, capital and operations are addressed sequentially — and succeed when they are aligned upfront. The core challenge is not sector-specific. It is a coordination challenge across system layers that continue to optimise independently, creating residual risk that hinders investment decisions.

Three conclusions define the path from diagnosis to action:

- The core barrier is not individual project risk, but unstructured aggregate system risk
- Electrification outcomes are also determined by system architecture, not only sector characteristics
- The real value of electrification is systemic, but it remains unpriced and therefore undeployed

Power Couples are the missing system architecture that enables electrification to become bankable, executable and scalable

Power Couples make electrification bankable by design

Power Couples align commercial structure, infrastructure, operations and capital before investment decisions — turning fragmented dependencies into coordinated delivery logic. These integrated electrification models replace risk accumulation with integrated risk design, convert electricity into a predictable contracted input, and embed flexibility, storage and heat as part of the business case. Across the evidence base, no replicable project succeeds on a single lever alone.

The five replicable blueprints already operate as Power Couples in practice — each proving a different pathway

Silvertown (E.ON, Lendlease and local energy infrastructure ecosystem) integrates heat, cooling, storage and shared infrastructure at district scale, embedding long-term demand and coordinated planning to reduce peak load and de-risk investment.

Microsoft Dublin (Microsoft, EirGrid and Enel X) turns backup assets into a grid service, leveraging market access and certification to monetise flexibility with near-zero additional CapEx while preserving uptime.

Stockholm Data Parks (Stockholm Exergi, City of Stockholm and 30+ data centre operators) make waste heat tradable across a city-wide platform, standardising contracts and infrastructure to convert a by-product into a scalable revenue stream.

Heineken Vialonga (Heineken, EDP, Rondo and public financing partners) combines PPA, on-site solar, thermal storage and heat-as-a-service to lock in predictable steam costs, eliminate upfront CapEx and enable immediate deployment without process change.

GreenBricks (Wienerberger, research partners and public funding ecosystem) combines process redesign, clean power and public-private de-risking to deliver a first-of-a-kind electric kiln model, creating a credible and replicable pathway for high-temperature industrial electrification.

Scale now depends on replicating this model

Europe's bottleneck is no longer technology discovery but system execution. Power Couples are central because they convert electrification from isolated proof points into repeatable deployment models — the form required for scale, faster investment decisions and lower system cost. **Where Power Couples are modelled, coordinated flexibility and system integration more than double baseline electrification ROI.**

Europe's competitiveness will depend on its ability to systematise electrification at scale — not just deploy it

The shift from fragmented execution to Power Couples at scale requires five structural changes — each already demonstrated in the evidence base.

TODAY: FRAGMENTED EXECUTION	FUTURE: POWER COUPLES AT SCALE
Decisions taken at asset level	Demand aggregated into system-level investment signals
Electricity treated as a market risk	Improved accessibility of long-term market instruments providing price predictability
Grid access determined ex-post	Infrastructure planned to bridge supply and demand with higher level of coordination
Risk concentrated at project level	Risk between actors addressed through market instruments across full value chains
Value assessed within site boundaries	System value integrated into the business case

Europe no longer needs to prove that electrification works. It must now **scale at industrial speed**. Progress remains too slow: electrification increased by just +1 percentage point in 2024,[4] despite a power mix already ~72% low-carbon. The constraint is no longer technology; it is the system's ability to turn solutions into investable outcomes.

Across sectors, electrification only advances where electricity is **predictable, competitive and delivered on time.** While wholesale prices fell by ~20% in 2024,[5] it continues to be structurally higher and more volatile than in competing regions, continuing to weaken industrial business cases.

Policy direction is now converging around the same priorities this report identifies: affordability, grid acceleration, long-term contracting and system integration.[6] These are not standalone levers — they must be aligned as a system.[7]

The implication is decisive: electrification will not scale through incremental fixes, but through integrated delivery models that coordinate demand, infrastructure, capital and risk.

It will create a more distributed and coordinated system, with DSOs, flexibility providers, and industrial consumers actively supporting grid stability and security of supply.

The closing stakes: regions that make electricity bankable and timely will attract industrial reinvestment and digital growth. Others risk delays, fragmentation — or relocation.

[4] Power Barometer 2025
[5] Electricity Report 2025
[6] Action Plan for Affordable Energy
[7] Competitiveness compass

System-level action is now required to make electrification investable and scalable

The Power Couples model becomes a facilitator for this action — coordinating industrial players, energy providers and capital partners into integrated delivery.

Policymakers & Grid Operators Shape the system

Immediate moves

- Fast-track electrification areas covering both new and existing investments, with anticipatory grid build-out and parallel permitting
- Provide transparent connection, congestion and flexibility maps

Impact

Removes the primary bottleneck — the misalignment between infrastructure readiness and investment timing — and signals where capital should flow first.

Utilities Orchestrate system delivery

Immediate moves

- Expand the accessibility of products combining power, heat, storage into tailored propositions for industrial use cases within market boundaries
- Engage in piloting Power Couples concept in terms of outcome-driven partnerships that jointly optimise load, supply and infrastructure

Impact

Reinforces customer-centric energy solutions, unlocks new value streams while preserving transparent cost allocation and investment signals

Industry & Data Centres Activate demand at scale

Immediate moves

- Aggregate demand and flexibility to support long-term bankable structures coordinated across actors
- Design electrification for flexibility in thermal storage, hybrid systems and flex- and waste-heat-ready sites

Impact

Strengthens business cases, reduces price exposure and converts fragmented demand into investable, scalable opportunities.

Coordinated action today creates the competitive energy system of tomorrow — and determines who leads it.

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About Eurelectric

Eurelectric represents the interests of the electricity industry in Europe. Our work covers all major issues affecting our sector. Our members represent the electricity industry in over 30 European countries. We cover the entire industry from electricity generation and markets to distribution networks and customer issues. We also have affiliates active on several other continents and business associates from a wide variety of sectors with a direct interest in the electricity industry.

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Appendix

Indicative ROI calculation methodology for Power Couple of Data Centre and Dairy Plant

The analysis uses a deterministic annual model with flat hourly loads, predefined price-event windows, simplified dispatch rules, and straight-line annualization of storage and solar CapEx, and is indicative in nature. Methodology is based on four sets of foundational assumptions.

1. Market Conditions

- Base electricity price (excl. taxes)
- Number and duration of negative-price periods annually
- Number and duration of elevated-price periods annually
- Flat load assumed; price windows non-overlapping
- Established cost baseline
- Potential subsidies are excluded from analysis

2. Operational Response

- Charge DC UPS* and dairy BESS* during negative-price periods
- Discharge UPS and BESS during elevated-price periods
- DC flexes utilization during elevated- and negative-price periods
- On-site solar reduces DC baseload

3. Economic Treatment

- Flexibility premium for UPS and BESS charging
- Flexibility premium for demand reduction
- Solar treated as avoided grid purchases
- BESS/solar CapEx via straight-line depreciation

4. Scenario Outcome

- Calculate annual grid electricity cost per facility
- Calculated rewards from charging, discharge and flexibility
- Calculated annualized new-asset depreciation
- Calculated ROI based on electricity cost savings (baseline), flexibility reward (net benefits) and depreciation (investment)

* UPS: Uninterruptible Power Supply; BESS: Battery Energy Storage System

Modelling assumptions for indicative ROI calculation methodology for Power Couple of Data Centre and Dairy Plant

PARAMETER	VALUE	UNIT
Dairy plant annual electricity demand	6,600.000	MWh/year
Data centre annual electricity demand	88,000.000	MWh/year
Data centre UPS* nameplate capacity	2.500	MWh
Data centre base compute utilization	50.0%	%
Data centre high compute utilization in negative-price periods	51.0%	%
Data centre low compute utilization in elevated-price periods	49.0%	%
Average electricity price	€132.50	EUR/MWh
Negative-price periods per year	53	count
Average hours per negative-price period	3.720	hours
Market discount during negative-price periods	€108.00	EUR/MWh
Elevated-price periods per year	111	count
Average hours per elevated-price period	2.790	hours
Market premium during elevated-price periods	€166.78	EUR/MWh
Facility share of discount / premium captured as reward	50.0%	%
UPS usable charge/discharge share per event	50.0%	%
Dairy BESS* nameplate capacity	2.000	MWh
Dairy BESS usable share per event	80.0%	%
BESS installed cost	192.000	USD/kWh
USD per EUR exchange rate	1.082	USD/EUR
BESS depreciation period	15	years
Solar capacity	1.000	MWp
Solar capacity factor	12.4%	%
Solar installed cost	779.000	USD/kWp
Solar amortization period	5	years
Hours per year	8,760	hours

Sources: Accenture on Eurostat, Electricity price statistics, as of October 2025; Eurostat, Electricity prices for non-household consumers - bi-annual data (from 2007 onwards), as of April 20, 2026; Kamiya, G. and Bertoldi, P., Energy Consumption in Data Centres and Broadband Communication Networks in the EU, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/706491, JRC135926; IEA (2025), Energy and AI, IEA, Paris Energy and AI, Licence: CC BY 4.0; IEA (2026), Key Questions on Energy and AI, IEA, Paris Key Questions on Energy and AI, Licence: CC BY 4.0; public industry portals & news.

* UPS: Uninterruptible Power Supply; BESS: Battery Energy Storage System

Heatmap Methodology: Cross-Sector Electrification Barrier (1/2)

The heatmap supports a directional, cross-sector comparison of constraint profiles. It does not represent a single statistical model applied uniformly across all underlying data. It is a qualitative synthesis reflecting the recurrence and strategic importance of themes across insights from three different sources, rather than a single normalized scoring model.

DESKTOP RESEARCH	• Based on AI-augmented sentiment analysis of publicly available sources (earnings calls, executive statements, analyst reports, industry publications). • Insights are converted into structured "electrification signals" capturing challenges, opportunities, and constraints.	**~3,500 public-domain signals analysed across 61 companies (Q1 2025–Q1 2026).** **Sector evidence used in the synthesis:** • 449 records from **14** energy-intensive industry companies • 1,079 records from **21** data centre companies • 1,976 records from **26** low-/mid-heat industry companies	• High volume and breadth (thousands of signals across sectors) • A market-wide view of recurring themes • Early identification of emerging priorities and pressure points
ROUNDTABLES	• Based on roundtable transcripts and detailed notes, with inputs from industry leaders, utilities, policymakers, and experts. • Extracts key issues, areas of consensus/divergence, recurring challenges, and signals of urgency (e.g. calls for action, investment concerns, delays).	**Roundtable inputs from 4 sessions**: • Electricity Consumers (Nov 13, 2025) – included for audit, excluded from baseline • Energy-Intensive Industries (Nov 27, 2025) • Data Centres (Mar 3, 2026) • Low-/Mid-Heat Industries (Mar 4, 2026)	• Cross-actor validation of key challenges Insight into how constraints are perceived and prioritised collectively • Identification of system-level bottlenecks through dialogue
INTERVIEWS	• Based on executive interview transcripts, with discussions structured around three themes: Unlocking Electrification Potential, Ecosystem Benefits & Impact, and Scaling Success Drivers. • Identifies operational constraints, investment barriers, project risks/delays, and references to real electrification outcomes.	**24 interviews conducted**: • **9** live interviews with C-level executives in the energy-intensive sector • **5** AI derived CEO perspectives* in the data centre sector • **10** AI derived CEO perspectives in the low-/mid-heat sector	• Granular, real-world evidence • Direct insight into decision-making and execution constraints • A strong link between perception and actual investment behaviour

* AI-derived CEO perspectives were reconstructed using AI-assisted analysis of verified public sources (including executive statements, interviews and reports), to reflect representative leadership viewpoints.

Heatmap Methodology: Cross-Sector Electrification Barrier (2/2)

The heatmap does not rank sectors by volume of evidence, it shows where the same system constraints become most binding in each sectoral context.

Harmonisation logic: From sector-specific themes to a common system lens

All source-specific challenge labels were recoded into five common constraints

POWER ECONOMICS	• Prices, volatility, tariffs, margins, cost competitiveness, electricity cost exposure
GRID ACCESS AND DELIVERY	• Capacity, connection delays, reinforcement, queue uncertainty, speed-to-power
BANKABILITY	• Capital intensity, financing risk, payback pressure, FOAK risk, CapEx prioritisation
SYSTEM INTEGRATION	• Retrofit complexity, process fit, operational uptime, flexibility integration, coordination
POLICY EXECUTION	• Permitting drag, regulatory uncertainty, unclear support frameworks, delivery fragmentation

Scoring logic: How intensity was assigned

Each heatmap cell reflects **the relative intensity of a constraint within a sector, based on:**

- Recurrence across coded signals
- Convergence across desktop research, roundtables and interviews
- Criticality for investment and execution

Intensity scale:

VERY HIGH	• Dominant, cross-source and repeatedly investment-critical
HIGH	• Frequent and clearly constraining
MEDIUM	• Recurring but less systematically binding
LOW	• Present but more contextual or secondary

Retaining economic potential of the European energy-intensive sectors requires urgent and joint action from policymakers, industries and utilities

Industries call for stable policies and frameworks that should enable long-term predictability of domestic electricity prices, pointing to critical role of rapid grid expansion.

THE SHARED RISK

- **Cost disadvantage:** Regional disparities in energy costs, with some markets above global benchmarks while others (e.g., Nordics, Iberia) remain highly competitive.
- **Carbon pricing:** Concerns about rising CO_2 costs for certain industries, impacting inflation and competitiveness.
- **Infrastructure:** Grid bottlenecks, uneven interconnection and slow permitting processes
- **Carbon leakage:** High risks of industrial attrition for chemicals & metals sectors
- **Dependency:** Reliance on China and the US/Middle East for critical materials and energy poses strategic vulnerability

WHAT ENERGY-INTENSIVE INDUSTRY AGREES IT NEEDS

- **Predictable Costs:** Achieving lower baseload costs via long-term contracts for an affordable electricity supply
- **EU Framework:** Supportive framework for PPAs preserving contractual flexibility, alongside CO_2 compensation and tariffs
- **Grid Expansion:** Double capacity & streamline permitting
- **Stable Policy:** Smooth transition for Carbon Border norms (CBAM/ETS), combined mechanisms to manage costs
- **Sovereignty:** Strengthen European production of critical materials and recycling capacity

THE LEVERS TO MAKE IT HAPPEN

- **De-risk long-term industrial PPAs:** EU/EIB guarantees and blended finance to enhance bankability and predictability
- **Competitiveness:** Reform ETS and tariffs to protect local industry
- **Digital Grids:** Accelerate interconnections & smart management
- **Public Demand:** Green public procurement to drive market
- **Finance mobilisation:** Expand EIB's role in guarantees, green industrial funds, and de-risking instruments for strategic projects

Only rapid, coordinated action from heavy industries, utilities and policymakers can prevent industrial flight, keep the transition affordable, and synchronise infrastructure, financing, and innovation to avoid bottlenecks

Note: The Power Couples Roundtable on 27 November convened ~20 participants, including EU policymakers, Eurelectric leadership, and C-level executives from energy-intensive industries, to align on electrification as a lever for competitiveness, resilience, and decarbonisation. Post-event transcript analysis supported the identification of core themes, areas of consensus and divergence, and key implications

* CBAM: Carbon Border Adjustment Mechanism; ETS: Emissions Trading System

Data centres are driving AI-led electricity demand growth but system readiness is lagging behind

Roundtable highlights that data centre expansion is reshaping demand patterns — yet grid speed, coordination, and system optimisation remain the critical bottlenecks to scale

THE SHARED RISK

- **Speed mismatch:** Digital infrastructure scales in years, while grid expansion still takes a decade — creating structural delays
- **Connection uncertainty:** Limited visibility on timelines and queues slows investment decisions
- **Affordability pressure:** Peak-driven pricing risks consumer and political backlash
- **Fragmented planning:** Weak coordination leads to inefficient system outcomes
- **Underutilised capacity:** Flexibility potential remains untapped due to rigid frameworks

WHAT DATA CENTRE INDUSTRY AGREES IT NEEDS

- **Faster "speed-to-power":** Accelerated, predictable grid access aligned with deployment timelines
- **System-level coordination:** Joint planning to anticipate and integrate large loads
- **Clarity on flexibility value:** Defined frameworks for flexibility and remuneration
- **Better data access:** Visibility on grid capacity, constraints, and demand evolution
- **Reliability-first solutions:** Enable system contribution without compromising uptime

THE LEVERS TO MAKE IT HAPPEN

- **Anticipatory planning:** Shift to forward-looking, system-wide infrastructure design
- **Flexibility incentives:** Reward demand-side participation, storage, and hybrid solutions
- **Grid digitalisation:** Scale AI, modelling, and real-time optimisation tools
- **New connection models:** Enable phased and flexible access to accelerate deployment
- **Cross-sector collaboration:** Structure partnerships across utilities, tech, and regulator

The challenge is not the volume of new electricity demand, but the system's ability to anticipate, coordinate, and optimise at the pace of digital growth — without which deployment will outstrip infrastructure readiness

Note: The Power Couples Roundtable on 3 March convened ~20 participants, including Eurelectric leadership and C-level executives from the data centre industry, to align on electrification as a lever for competitiveness, resilience, and decarbonisation. Post-event transcript analysis supported the identification of core themes, areas of consensus and divergence, and key implications.

Low-/mid-heat industries are ready to electrify but execution barriers remain critical

Industry consensus confirms electrification readiness, yet grid constraints, cost gaps, and lack of predictability continue to delay large-scale deployment

THE SHARED RISK

- **Grid access bottlenecks**: Long connection timelines and capacity shortages delay projects by years
- **Uncompetitive energy costs:** Electricity prices and grid fees outweigh gas, breaking business cases
- **Lack of predictability:** Volatile prices, shifting policies, and unclear long-term signals hinder investment
- **Capital trade-offs:** Electrification competes with core business investments despite available solutions
- **Location mismatch:** Clean power not available where industrial demand and assets are located

WHAT LOW-/MID-HEAT INDUSTRY AGREES IT NEEDS

- **Electrification at scale:** Accelerate deployment as the primary decarbonisation pathway
- **Proven technologies adoption:** Scale heat pumps, e-boilers, and storage solutions already available
- **Bridging the execution gap:** Convert technical potential into tangible industrial roll-out
- **Flexible energy configurations:** Combine electrification, on-site generation, and hybrid systems
- **New delivery models:** Expand energy-as-a-service and third-party operated solutions

THE LEVERS TO MAKE IT HAPPEN

- **Faster and anticipatory grid development:** Align infrastructure with industrial timelines
- **Improved cost competitiveness:** Address electricity price, grid fees, and spark ratio
- **Greater policy stability:** Ensure long-term visibility on ETS, regulation, and incentives
- **Bankable frameworks:** Enable PPAs, guarantees, and de-risking mechanisms
- **System-level optimisation:** Scale digitalisation, storage, and integrated energy management

Electrification is technically viable and widely endorsed — but without grid readiness, cost competitiveness, and policy predictability, industrial scale-up will remain constrained

Note: The Power Couples Roundtable on 4 March convened ~20 participants, including Eurelectric leadership and C-level executives from low-/mid-heat industry, to align on electrification as a lever for competitiveness, resilience, and decarbonisation. Post-event transcript analysis supported the identification of core themes, areas of consensus and divergence, and key implications.

Silvertown ECTOgrid shows how a multi-vector local system can electrify heat while reducing peak demand and sharing risk

Urban Energy Infrastructure Initiative in East London

Lead: E.ON | Country: UK
Sector: Urban multi-vector energy system (district heating/cooling + power flexibility)
Stage: Planning / deployment phase
Financing: Risk-sharing mechanisms (developer–utility)

Silvertown ECTOgrid combines large-scale heat pumps, energy storage, smart grid controls, waste heat recovery and hydrogen readiness to deliver low-carbon heat and power while improving flexibility and resilience. The project integrates these energy vectors to serve thousands of homes and businesses in a dense city environment with reliable and decarbonised district heating and electricity.

Key metrics:

- ~760,000 m² site
- ~6,000–6,500 homes & businesses served
- ~4,000 tCO_2/yr avoided (~88% vs gas boilers)

SUCCESS FACTORS & IMPACT

01. Price visibility
- 40-year concession agreement secures predictable, long-duration demand at stable prices
- Long-term customer demand embedded within the redevelopment masterplan

02. Infrastructure Readiness
- Integrated heating, cooling, and storage infrastructure smooths and shifts electrical demand
- Reduces overall heat and power demand while flattening the local grid peak

03. Flexible Systems & Economics
- Long-term delivery agreement to design, finance and operate the network bolsters investability
- Utility-led model embeds operational responsibility and long-term revenue visibility

04. Risk Sharing & Capital Models
- System designed in coordination with local planning and heat-network frameworks

SYSTEM-LEVEL VALUE

Enhances flexibility by reducing grid reinforcement needs and capturing waste heat for reuse.

Optimises heating, cooling, storage and local power demand via risk sharing between the utility, developer and network.

De-risks broader market learning for deploying integrated and flexible solutions in dense urban settings.

Key: ▪▪▪▪ Critical Success Factor

Source: E.ON

Microsoft and EirGrid show how data centre assets can support grid flexibility where market frameworks enable participation*, without compromising operational resilience

Grid-Interactive Data Centre Initiative with Fast Frequency Response

Lead: Microsoft | Country: Ireland

Sector: DC + Grid (Grid-interactive UPS, liquid immersion cooling and hydrogen fuel cells)

Stage: Post-FID / operational

Financing: Ancillary services revenue (FFR market participation)

Microsoft's Dublin data centre repurposes its existing UPS** batteries to participate in grid services, delivering Fast Frequency Response (FFR) to stabilise the power system within milliseconds while fully preserving backup functionality. Operated through Enel X, this turns the data centre into a distributed energy asset. The initiative also incorporates hydrogen fuel cells, liquid immersion cooling, and high-density cold plate solutions.

Key metrics:

- ~2M tCO_2/year avoided (Baringa estimate)
- 3x payment for <150ms response time

SUCCESS FACTORS & IMPACT

01. Price visibility

- EirGrid's DS3 ancillary services market provides clear revenue for sub-150ms grid response
- 3x premium payment embeds long-term demand signal for grid-interactive data centre assets

02. Infrastructure Readiness

- Existing UPS batteries repurposed as a grid-interactive FFR asset, near-zero additional CapEx
- Backup functionality fully preserved while enabling additional ancillary services revenue stream

03. Flexible Systems & Economics

- Market access via Enel X removes need for a direct TSO relationship, lowering entry barrier
- Ancillary revenue offsets operational costs with no major hardware investment

04. Risk Sharing & Capital Models

- Market access and certification frameworks enable participation in regulated FFR markets
- EirGrid certification frameworks enable UPS participation in ancillary services markets

SYSTEM-LEVEL VALUE

Enhances grid frequency stability and reduces reinforcement needs during peak stress events.

Optimises DC infrastructure via risk sharing between the data centre operator, market aggregator and grid operator.

As the first DC UPS in the FFR market globally, de-risks broader market learning for deploying these assets for ancillary services.

Key: ▪▪▪▪ Critical Success Factor

* Note: Replicability depends on ancillary services market maturity, technical requirements and local regulatory frameworks.
** UPS: Uninterruptible Power Supply
Source: Microsoft

Stockholm Data Parks shows the potential for scaling the reuse of waste heat when it becomes a tradable product

Open District Heating Initiative between Data Centres and Utility

Lead: Stockholm Exergi | Country: Sweden
Sector: DC + District Heating (Heat recovery and heat pump)
Stage: Post-FID / operational
Financing: Mixed (Utility investment and heat purchase agreements)

Stockholm Exergi's Open District Heating platform allows data centres to sell waste heat into the city's district heating network under standardised, temperature-indexed contracts. Stockholm Exergi invests in pipe connections while DC operators invest in heat pumps, converting a cooling cost into a revenue stream of SEK 2M/MW/year. The platform now connects 30+ DCs across 16 providers.

Key metrics:

- 30,000+ apartments heated annually
- ~€170k/MW/year paid to DC operators
- 3.5% of Stockholm heat supply; target 10%

SUCCESS FACTORS & IMPACT

01. Price visibility

- Temperature-indexed ODH contracts transform waste heat into a standardised, tradable commodity with predictable pricing
- SEK 2M/MW/year revenue signal makes heat reuse commercially attractive for DC operators

02. Infrastructure Readiness

- The utility funds pipe connections while DC operators fund heat pumps, splitting investment and coordinating infrastructure across parties to lower individual risk

03. Flexible Systems & Economics

- Open platform aggregates 30+ DCs under one framework, enabling cluster-level heat supply supported by long-term offtake agreements
- City partnership gives institutional backing, and accelerates permitting and connection

04. Risk Sharing & Capital Models

- EU Energy Efficiency Directive (EED) creates regulatory tailwind by mandating waste heat recovery assessments for large DC operators
- Requires city-level infrastructure, like the existing district heating networks in Nordic cities

SYSTEM-LEVEL VALUE

Reduces city-level fossil heat demand, cutting Stockholm's carbon footprint and reinforcement needs.

Optimises cooling infrastructure for DC operators by converting a cost centre into a revenue stream via risk sharing.

Provides a replicable model, particularly in Nordic countries which are already leaders in DC-district heating integration.

Key: ▪▪▪▪ Critical Success Factor

Source: Stockholm Exergi

Heineken Vialonga shows how heat-as-a-service unlocks zero-carbon industrial steam with no process change and no CapEx

Thermal Energy Storage and On-site Solar in Low-carbon Steam Production for Brewing

Lead: Heineken | Country: Portugal

Sector: Food & Beverage (TES*, solar PV, green PPA* and steam-as-a-service)

Stage: Pre-FID / go-live in April 2027

Financing: HaaS* / heat purchase agreements and EIB & Breakthrough Energy Catalyst grant

Heineken's brewery near Lisbon contracted a Rondo Heat Battery to deliver continuous, zero-carbon high-pressure steam for brewing. The battery charges from a 7 MWp on-site solar array and a flexible grid PPA with EDP. Under a heat-as-a-service model, EDP designs, builds and operates the system, allowing Heineken to receive low-carbon steam with no process changes and no CapEx exposure.

Key metrics:

- 100 MWh Rondo Heat Battery capacity
- 6,600 tCO_2/yr emissions reduction
- 25 GWh/yr renewable energy input (solar + PPA)

SUCCESS FACTORS & IMPACT

01. Price visibility

- Under HaaS model, Heineken pays per unit of steam with no upfront CapEx exposure
- Steam delivered at identical pressure and quality to fossil-fired supply, requiring no process adaptation and eliminating reliance on gas boilers

02. Infrastructure Readiness

- On-site solar array and flexible grid PPA ensures continuous charging of the heat battery
- Thermal storage decouples generation from consumption, smoothing demand and reducing grid reinforcement needs

03. Flexible Systems & Economics

- EIB and Breakthrough Energy Catalyst grant support closes the financing gap for first-of-a-kind thermal storage at industrial scale
- Public backing signals investability, enabling EDP to own and operate the system as a long-term asset

04. Risk Sharing & Capital Models

- Grid PPA availability, EIB financing and regulatory approvals allow for scale-up
- Model is replicable across food & beverage, pharma, chemicals and pulp & paper, all sectors with continuous 100–200°C steam demand

SYSTEM-LEVEL VALUE

Reduces industrial gas demand and grid peak load by storing renewable electricity as heat.

Optimises capital deployment via HaaS risk-sharing, eliminating the investment barrier for industrial heat decarbonisation.

De-risks broader market learning and replicability as the first large-scale heat battery in the European beverage sector.

Key: ▪▪▪▪ Critical Success Factor (03. Flexible Systems & Economics)

* TES: Thermal Energy Storage; PPA: Power Purchase Agreement; HaaS: Heat-as-a-service

Source: Heineken

Wienerberger GreenBricks shows how integrating an electric kiln with heat pumps can decarbonise heavy clay manufacturing at scale

Sustainable Brick Production Using Industrial-scale Electric Kiln and Heat Pumps

Lead: Wienerberger AG | Country: Austria
Sector: Construction Materials (Electric kiln, HTHP* drying, on-site solar PV, digital twin)
Stage: Post-FID / operational
Financing: Corporate investment (€30M) and NEFI / Austrian Climate and Energy Fund grant

Wienerberger replaced its gas-fired kiln at Uttendorf, Upper Austria, with the world's largest industrial-scale electric kiln (~90 m), powered entirely by green electricity (on-site solar PV + certified hydro). Three heat pumps handle drying via exhaust air waste heat. Digital twin and automated guided vehicles cut energy further. Roll-outs planned to at least five other plants across three countries.

Key metrics:

- 7,340 tCO_2/yr avoided (90% CO_2 reduction)
- 30% energy consumption reduction
- 270 t/day production capacity; 100,000 t/yr

SUCCESS FACTORS & IMPACT

01. Price visibility

- Certified, contracted hydropower guarantees 100% renewable electricity for the electric kiln
- On-site solar PV reduces grid dependency and further lowers operating costs, improving long-term competitiveness

02. Infrastructure Readiness

- Electric kiln, HTHP drying stack and on-site solar PV cut emissions more than any individual technology
- Waste heat from the kiln is captured by heat pumps for drying, creating an integrated circular energy loop within the plant

03. Flexible Systems & Economics

- EU DryFiciency HTHP demonstrator (with AIT) de-risked the drying electrification concept before the €30M full-plant investment was committed
- NEFI model (industry + research institutions) offers replicable funding and co-development template

04. Risk Sharing & Capital Models

- Consistent national and EU-level policy signals (carbon pricing, industrial decarbonisation targets) essential in justifying roll-out across further sites
- Public grants de-risk first-of-a-kind investments, enabling Wienerberger to commit €30M of capital

SYSTEM-LEVEL VALUE

Reduces industrial grid peak demand by integrating on-site renewables and waste-heat recovery.

Optimises capital efficiency via the NEFI co-creation model and public grants to de-risk private investment.

With plans to roll out to at least five more plants, establishes a replicable blueprint for the entire ceramics and heavy clay sector.

Key: ▪▪▪▪ Critical Success Factor

* HTHP: High-Temperature Heat Pumps
Source: Wienerberger