energy storage europe

A GUIDE FOR INDUSTRIAL STAKEHOLDERS

Powering Industrial Heat:

The Business Case for Thermal Energy Storage

An **Energy Storage Europe guide** to understanding the transition toward electrified process heat and how Thermal Energy Storage (TES) turns decarbonisation into a competitive advantage for the European industry.

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The EU Industrial Challenge & The Path Forward

Industry accounts for **25% of the EU's final energy consumption**, yet only **3–4% of EU industrial heat at high temperatures is currently electrified,** while 75% of heat demand is still met by fossil fuels. Transitioning to a flexible, electrified model is the only way to insulate your operations from global price volatility.

25%
of EU final energy consumption is industrial demand

~4%
hight temperatures heat electrified

75%
of industrial heat demand still met by fossil fuels

Sectoral Heat Needs

Industrial heat demand is not uniform; different sectors and processes require specific temperature ranges, which determines which decarbonisation technologies apply.

Sector	Sub-processes	Low (<100°C)	Medium (100–400°C)	High (>400°C)
Pulp & Paper	Drying, pulping, bleaching, paper drying	●	●	–
Food & Beverage	Pasteurisation, cooking, sterilisation, drying	●	●	–
Plastics (PVC)	Polymerisation, extrusion, compounding	●	●	–
Gypsum	Calcination, drying	●	●	–
Chemicals (general)	Steam cracking, ammonia synthesis, distillation	–	●	●
Cement	Clinker production (kiln), grinding	–	–	●
Ceramics	Firing, sintering, drying	–	–	●
Lime	Calcination of limestone	–	–	●
Iron & Steel	Blast furnaces, rolling	–	–	●
Aluminium	Melting & large use of furnaces	–	–	●
Glass	Melting, forming, annealing	–	–	●
Insulation materials	Mineral melting, fiberising	–	–	●

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Thermal Energy Storage: What Benefits for EU Industry?

Electrifying industrial process heat is critical to support the EU's 2040 climate goals, while ensuring the competitiveness and long-term technology innovation of EU industry.

1 **Billing Cost Reduction**

By fostering self-consumption maximisation from renewable generation and demand charge management, electrification enables optimisation of electricity use, reducing overall energy and demand costs.

2 **On-Site Reliable Heat Solutions**

By providing on-demand heat solutions close to the industrial site, electrification limits exposure to grid power failures and supports operational continuity.

3 **Industry Process-Level Benefits**

By enabling up to 90% of gas-fuelled industrial process heat to switch to electricity, industries gain greater control of operations, improving energy efficiency and output consistency.

4 **Energy Security & European Value Creation**

Industries reduce reliance on external energy suppliers, gaining protection against supply disruptions and fuel price volatility, strengthening local value chains and the “Made in Europe” industry.

INVESTMENT OUTLOOK

Estimated installed costs for thermal storage systems are becoming increasingly affordable

If CAPEX for sensible thermal storage systems falls by 50% by 2030, profitable systems are found across all EU regions.

90% of gas-fuelled industrial process heat can be switched to electricity with TES, giving industries greater control of operations and output consistency.

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The Dual-Value Strategy: New Revenue Streams

Beyond decarbonisation, a TES-equipped industrial site becomes a dynamic financial asset. Operational flexibility opens diverse revenue opportunities that significantly reduce net energy costs.

01 Wholesale Market Arbitrage

TES charge using excess electricity during low/negative price periods and discharge as energy when prices peak.

Operational benefit: Off-takers shift purchases to low-price periods & profit from price differences without impacting operations.

02 Revenue from System Services

TES allows industry participation in flexibility markets, by allowing them to adapt to market signals in a short time.

Operational benefit: TES suits slower, sustained responses (e.g.: 12.5–15 minute response times).

03 Self-Consumption Maximisation

TES + PV/wind stores renewable electricity from high-generation periods into heat, limiting fossil backup.

Operational benefit: Stored heat is discharged as needed, without requiring continuous electricity from the grid.

04 Demand Charge Management

TES caps or flattens peak electricity demand by shifting charging to off-peak hours.

Operational benefit: TES delivers structural flexibility, improving grid connection feasibility and avoiding costly upgrades.

Combined, these four streams mean TES is rarely a pure cost, **it is an operating asset that pays part of itself back through smarter energy management.**

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Choosing the Right Business Model

For EU industries, the transition to net-zero heat supply is a dual challenge: maintaining global competitiveness while meeting environmental targets. TES offers a flexible bridge to electrification, with contractual frameworks that let industrial actors adopt the technology with a clear focus on risk management and financial stability.

Contractual Model	Financial Structure	Strategic Advantage
Direct Sale	Heat is purchased as a commodity on a €/MWh basis. Off-takers avoid asset ownership but may bear integration costs.	Simple, transparent model that allows companies to retain control of energy procurement.
Heat Purchase Agreement (HPA) / Heat-as-a-Service	Fully OPEX-based; payment only for heat consumed under a long-term agreement similar to a PPA, but for heat.	Predictable energy costs, guaranteed supply; performance and market risks transfer to the provider.
Leasing & Site Leasing	Off-taker provides site access and pays a fixed/usage fee over 10–20 years, converting CAPEX into predictable OPEX.	Enables decarbonisation without significant CAPEX; maintenance and tech risks stay with the provider.
Benefit Share	Savings and revenues generated by TES are shared between parties according to a predefined agreement.	Aligns incentives; both parties benefit from operational flexibility and cost savings.

Which model fits your business?

If you… Want to retain full control of procurement	→ **Direct Sale**
If you… Prefer predictable OPEX and zero upfront investment	→ **Heat-as-a-Service (HPA)**
If you… Want decarbonisation without major CAPEX	→ **Leasing & Site Leasing**
If you… Want to share risk and reward with a partner	→ **Benefit Share**

05

TES in Action: Steel & Pharma Decarbonisation

High-temperature industries are already proving the case for TES at scale, cutting emissions, unlocking new revenue, and safeguarding operations against volatile fuel markets.

CASE STUDY 1 Tata Steel

Industry	Steel Production
Location	Jamshedpur, India
Technology	Kraftblock High-Temp Storage: captures waste heat from sinter coolers.
Capability	20 MWh capacity; stores heat at 500°C with a 1.8 MW max discharge.

Results & Benefits

- Emissions impact: saves 22,000 tons of CO2 per year — equivalent to removing 5,100 gas-fuelled cars from the road.
- Resource efficiency: eliminates ~110 GWh of fossil gas use annually.
- Additional revenue from aFRR market participation: €164,250.
- Process optimisation: accelerates sintering and improves stability of high-temperature operations.

CASE STUDY 2 Bayer Asturias

Industry	Pharmaceuticals (Aspirin production)
Location	La Felguera (Asturias), Spain
Technology	Inerco Molten Salt Storage: converts renewable electricity into industrial steam.
Capability	15 MW renewable facility; transforms electricity into 24/7 industrial steam.

Results & Benefits

- 100% decarbonisation of the plant's steam supply — a global benchmark for pharma.
- Energy security: protects against fossil fuel market volatility via locked-in renewable costs.
- Operational flexibility: stores energy at peak renewable hours, consumes when needed.
- Socio-economic impact: creates 30+ jobs and supplies surplus heat to a public health laundry.

06

TES in Action: Food & Beverage Decarbonisation

In the food sector, modular TES systems and high-temperature slag-based batteries are replacing gas boilers, providing stable steam and substantial gas savings through flexible charging.

CASE STUDY 3 KALL Project	
Industry	Food / Agri-industrial (Grain Processing)
Location	Tiszapüspöki, Hungary
Technology	Modular Heatcube: molten-salt thermal battery (heat-to-steam), heating salt to over 400°C.
Capability	56 MWh storage capacity; equipped with a 7 MW steam generation system.

Results & Benefits

- High efficiency: achieves 93% round-trip efficiency (electricity to steam).
- Decarbonisation: reduces CO2 emissions by up to 8,000 tons annually.
- Energy shift: replaces natural gas with over 30 GWh of clean process heat per year.
- Economic security: 15-year Heat-as-a-Service (HaaS) agreement.

CASE STUDY 4 Volt Project (PepsiCo)	
Industry	Food (Snack Production)
Location	Broek op Langedijk, Netherlands
Technology	Kraftblock Net-Zero Heat System: high-temperature storage using sustainable iron slag, stored at 800°C.
Capability	70–150+ MWh (total) capacity; replaces a 25 MW gas-fired boiler.

Results & Benefits

- Drastic emissions cut: up to 17,000 tons of CO2 annually; targets 98% reduction on Scope 1 completion.
- Significant fuel savings: up to 9 million m^3 of gas saved per year.
- Operational continuity: 24/7 decarbonised heat for 1 million bags of chips daily.
- Strategic flexibility: hybrid electrification, charging during low-cost power hours.

These four projects span steel, pharma, grain processing and snack food, **proving TES delivers across virtually every industrial heat profile.**

Your Questions Answered

Do I need to reduce or pause my production to implement or charge TES?

No. TES decouples energy charging from heat discharging. The system charges when electricity is cheap without interrupting operations, then stores and releases heat on demand for your production.

Is the technology safe for an industrial environment?

Yes. Modern TES systems use non-flammable, non-explosive, and non-hazardous materials, designed to meet standard industrial safety norms without burdensome approvals.

What are the maintenance requirements and equipment lifetime?

These systems are built for long-term industrial use, typically exceeding 25 years. Storage materials are stable and require no refilling; maintenance focuses on standard mechanical parts like pumps and valves.

Can my facility really generate money from the grid?

Yes. By reacting to grid signals and using electricity when the grid is oversupplied, your facility acts as a flexible reserve, providing a steady stream of revenue.

Ready to explore TES for your facility?

Energy Storage Europe stands ready to work with industrial actors, policymakers and authorities to make Industry TES a cornerstone of Europe's industrial electrification future.

The unified voice of energy storage

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