POLICY BRIEF

JULY 2025

Scaling Thermal Energy Storage for Decarbonizing Heat

Recommendations by Future Cleantech Architects

Future Cleantech Architects

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Executive Summary

Thermal Energy Storage (TES) is the missing link in the EU's path to decarbonize industrial heat. It is an overlooked yet critical enabler of Europe's energy transition. TES delivers on Europe's strategic energy triangle: competitiveness, decarbonization, and security, by replacing imported fossil fuels with flexible, clean, and locally sourced heat. Heat demand in industry and buildings accounts for half of the EU's energy use and over a quarter of greenhouse gas emissions. TES enables clean, reliable, and flexible heat by storing heat made from low-cost electricity and waste heat. The upcoming industry features several leading innovators from the EU.

Yet despite its readiness in many applications from low to high temperatures, TES remains underutilized. This is due to a combination of factors: historically low gas prices, especially built upon Russian supplies, reduced incentives to store heat, as storing gas was cheaper and more flexible. TES also faces natural efficiency losses through heat dissipation, unlike gas storage. Moreover, the economic case for TES has only recently improved, driven by the growing availability of low-cost renewable electricity, including frequent periods of surplus power. TES can, to some degree, decouple energy supply from demand, making electrified heating both scalable and operationally more cost-effective, particularly when powered by cheap renewable electricity. While this opens new opportunities, confidence in long-term market trends and supportive policy is still necessary to justify upfront investments in this technology.

Despite the commercial readiness of technologies for low and medium temperatures, where 80% of the heat is utilized, insights from ten of the US and Europe's advanced TES startups highlight several gaps in current policy frameworks. These include a grid rate design issue, high and unjustified connection costs for flexible loads, the need for upfront capital expenditure (CAPEX) support, and derisking tools. Their input is also reflected across the recommendations in this paper.

The EU must act now to unlock the full potential of thermal energy storage. Future Cleantech Architects proposes five urgent priorities to integrate TES into the EU decarbonization agenda.

Recommendations

1. **Recognize TES as a grid asset,** by adapting grid fees, fast-tracking connection, and planning for flexible loads.
2. **Support flexible technologies like TES,** through price certainty and improved market access to build a viable business case.
3. **Accelerate innovation** with funding for first-of-a-kind applications, manufacturing, and industrial deployment.
4. **Decarbonize low-temperature heat** with heat pumps, e-boilers, solar thermal, geothermal, and TES in buildings and industry.
5. **Include TES in EU strategies,** such as the Industrial Decarbonization Accelerator Act and the Electrification Action Plan, to signal commitment to industry.

Sector Overview

The sheer size of the heat sector and its emissions are often overlooked: Heat accounts for 50% of global final energy use and over 25% of global greenhouse gas emissions. In the EU, heating accounts for half of Europe's total energy consumption, with only about 25% of this demand being derived from renewable energy sources. Heat is an essential input for many hard-to-abate industries, all of which will continue to be necessary and is even expected to grow further in a net-zero future. Therefore, European policymakers and innovators should put the decarbonization of industrial heat at the top of their agendas.

Much of the EU's heat demand (Fig.1) comes from hard-to-abate industrial sectors, such as chemicals, cement, steel, and food processing, where heat is not only essential but expected to grow further in a net-zero economy. Temperatures required vary widely, from <100°C for food and building heat to >1,000°C in heavy industry. About 80% of industrial heat demand is below 500°C, a range where electrification and TES are already technically and economically viable.

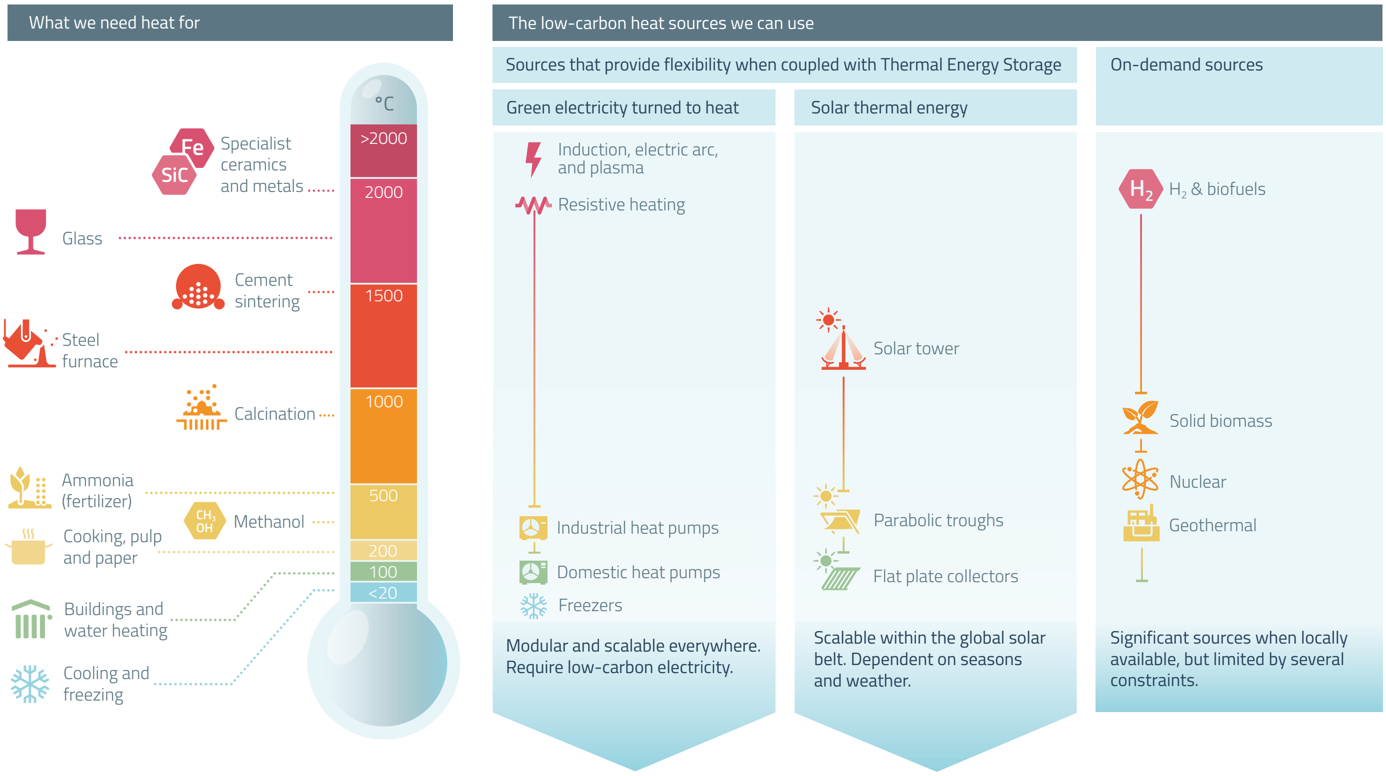

Figure 1: What heat is used for and low-carbon sources to provide it. Source: Thermal Energy Storage, The Basics & the Gaps Factsheet Series #5, Future Cleantech Architects.

Clean heat can be delivered using electric heat pumps (typically up to 150°C), resistive or e-boilers (up to ~500°C), or advanced technologies such as molten salt or solid media storage (reaching up to 1,000°C). These can be powered by increasingly cheap renewable electricity: In 2024, wind and solar made up 29% of the EU power mix and continue to lead on lowest-cost energy production (down to ~€50/MWh for new installations).

However, solar and wind pose the challenge of variability to direct electrification. This is where TES offers a uniquely suitable and cost-effective solution to balance this variability[1], and to decouple energy supply from heat demand, absorbing cheap electricity or waste heat and delivering it flexibly when needed. TES systems can range from simple hot water tanks (€0.1–10/kWh$_{th}$) to high-temperature solid or molten systems (€15-70/kWh$_{th}$) depending on scale, temperature, and application.

Given the size, cost, and emissions profile of industrial heat, thermal energy storage should be treated as a strategic enabler of Europe's clean energy and industrial policy. Its inclusion across EU decarbonization frameworks is essential.

[1] More information about TES applications and technology solutions in FCA factsheet.

Opportunities to Decarbonize Heat in Upcoming EU Initiatives

Future Cleantech Architects has identified several opportunities within the existing and upcoming EU policy landscape to support the integration of TES. These initiatives, if aligned with TES deployment needs, could significantly accelerate the decarbonization of heat.

- The Clean Industrial Deal and the Affordable Energy Action Plan target both industrial decarbonization and competitiveness, which make them clear frameworks recognizing the added value of energy storage and in particular TES.
- The 2024 removal of the EU Emissions Trading System (ETS) "exchangeability clause" (Art. 22) allows electrified heat users to retain free CO_2 allowances, just like fossil-based ones, without emissions. This creates a new financial incentive: Clean heat users can now sell surplus allowances, improving the business case for electrification and TES.
- Under the Net Zero Industry Act (NZIA), energy storage is classified as a strategic net-zero technology. This opens the door to faster permitting, priority access to public procurement, and eligibility for national and EU funding schemes, critical to scaling TES deployment across Europe. Member states should share best practices in faster permitting.
- The Electricity Market Design reform can unlock TES by ensuring fair access to capacity mechanisms, exempting TES from double charging, and supporting flexible electric loads when coupled with storage. TES should be recognized as a non-fossil storage solution essential for balancing variable renewables and enabling loads to operate flexibly.
- The Commission's 2023 Energy Storage Guidelines recognize the role of storage in decarbonization but mostly focus on electricity storage. These guidelines should be expanded to include Thermal Energy Storage (TES), which offers cost-effective, low-loss solutions for heat and grid flexibility, especially in industrial and district heating applications.
- Only ~3% of the European Innovation Council's climate related funding currently involves TES. This underscores the need for targeted, challenge-based calls to incentivize innovation in this currently neglected technology.
- Less than 0.5% of the funding through the Innovation Fund explicitly cover TES.

Several upcoming EU initiatives represent major opportunities to unlock and scale up TES:

- The upcoming update to the EU Heating and Cooling Strategy is a key opportunity to embed TES as a priority technology for clean, flexible heat.
- The Industrial Decarbonization Accelerator Act can support TES by funding research and deployment of innovative storage technologies to reduce reliance on fossil fuels. It must also encourage the integration of TES systems to enhance energy efficiency and flexibility in energy-intensive industrial processes.
- The upcoming Electrification Action Plan is another opportunity to drive widespread adoption of electrified heating systems combined with TES to significantly boost energy efficiency and industrial decarbonization. It should also remove regulatory barriers and provide strong financial incentives to accelerate implementation in energy-intensive industries.
- The Industrial Decarbonization Bank and its pilot auction from the Innovation Fund on industrial process heat decarbonization, scheduled for 2025, is welcomed as it targets electrification coupled with storage, and in particular TES is eligible.
- The 2026 Grids Package should recognize electrified heating systems combined with TES as a key grid flexibility asset with fair tariffs and market access to support its integration and operation.
- State aid rules revision should enable targeted capital expenditure (CAPEX) and operational expenditure (OPEX) support for TES to reduce investment risks and accelerate large-scale deployment.

Five Recommendations to Scale up TES Solutions

Electrification of industrial processes, coupled with TES, can boost industrial decarbonization and enhance energy systems by improving sustainability, efficiency, and flexibility, particularly in integrating renewable energy and reducing peak energy demand. TES also helps alleviate grid congestion, making it possible to defer costly infrastructure upgrades and better utilize existing capacity. However, the energy sector faces several barriers rooted in negative market signals, which hinder the optimal deployment of low-carbon technologies like TES. Targeted policy interventions can address these issues, enabling TES to accelerate decarbonization while strengthening energy security, industrial competitiveness, and EU leadership.

1. Recognize TES as a Grid Asset

It is crucial to ensure that regulation recognizes the unique characteristics of flexible loads and energy storage assets and rewards these. Current market, grid structures, and transmission and distribution operators (TSOs/DSOs) often perceive the electrification and TES pathway as a burden on the network without recognizing its system value benefit. Moreover, electricity transmission and distribution are natural monopolies due to high upfront infrastructure costs and economies of scale. Without appropriate regulation, monopolistic structures can distort prices and restrict access for innovative solutions like TES.

- Recognize TES as a valuable flexibility asset: Grid charges should reflect the value of a highly flexible load. Since TES operates off-peak or in times of excess supply when electricity is cheap, it should face lower fees. Countries like Germany, Denmark, and the Netherlands have already eliminated double charging or offer 50-80% grid fee discounts for "atypical" or "interruptible" loads. Spreading this across Europe and creating a distinct category for energy storage would simplify market participation and incentivize storage adoption. Some sites can also add load to the grid, so long-term grid planning must account for the value of flexible, clean assets like TES in reducing overall system costs.
  Ensuring that incentive schemes reflect system value, not just consumption regularity, is crucial. TES use should not invalidate cost reductions where it improves grid behavior. In Germany, for example, reduced electricity fees for steady demand can even actively discourage TES scale-up, as greater flexibility, though essential for the grid, may disqualify industrial users from this "baseload" privilege. This policy, designed for an energy system that prioritizes constant consumption, is no longer suited to the needs of a renewable energy system.

- Give priority grid access to clean flexible loads, such as electrified plants with TES, instead of operating on a first-come, first-served basis. The Netherlands has introduced non-firm connection agreements that offer preferential grid connection to flexible loads willing to accept curtailment. To fully realize system benefits, the EU should couple these connection models with market mechanisms that allow participants to be paid for delivering flexibility, not just rewarded with lower grid fees. Also, encouraging anticipatory investment is a must: France's model plans grid upgrades in industrial clusters where electrification of heat is expected, by pre-building at least 20% of the capacity needed to electrify heat demand.

- Harmonized EU-wide grid connection standards are needed: inconsistent treatment across Member States delays deployment and increases investor risk. Grid access should be fast-tracked for flexibility assets. By setting clear guidelines for the grid integration of TES, under the 2026 Grid Package, the grid connection process can be sped up, thus reducing project delays caused by different national regulations. In Germany, for instance, electricity storage assets and electrolyzers are exempt from grid charges, but only when the stored energy is fully returned to the grid. This definition excludes most TES systems used for industrial or district heating, which are treated as final consumers once heat is extracted. As a result, these systems face full grid charges, even though they often operate off-peak and provide flexibility to the system.

Impact of the recommendation: Differentiating flexible from inflexible assets and reforming grid fees accordingly to reflect the real value of TES can significantly improve the business case for these systems, spurring deployment and therefore enabling faster delivery of much-needed flexibility to the grid, making this a win-win proposition. Recent modeling across four European countries suggests that deploying TES could reduce renewable curtailment by more than half, lower peak heat prices, and bring down total energy system costs, saving several billion euros per year. Critically, U.S. research shows such benefits depend on early system-level planning: delaying energy storage integration until after generation and transmission planning erases a majority of the potential savings.

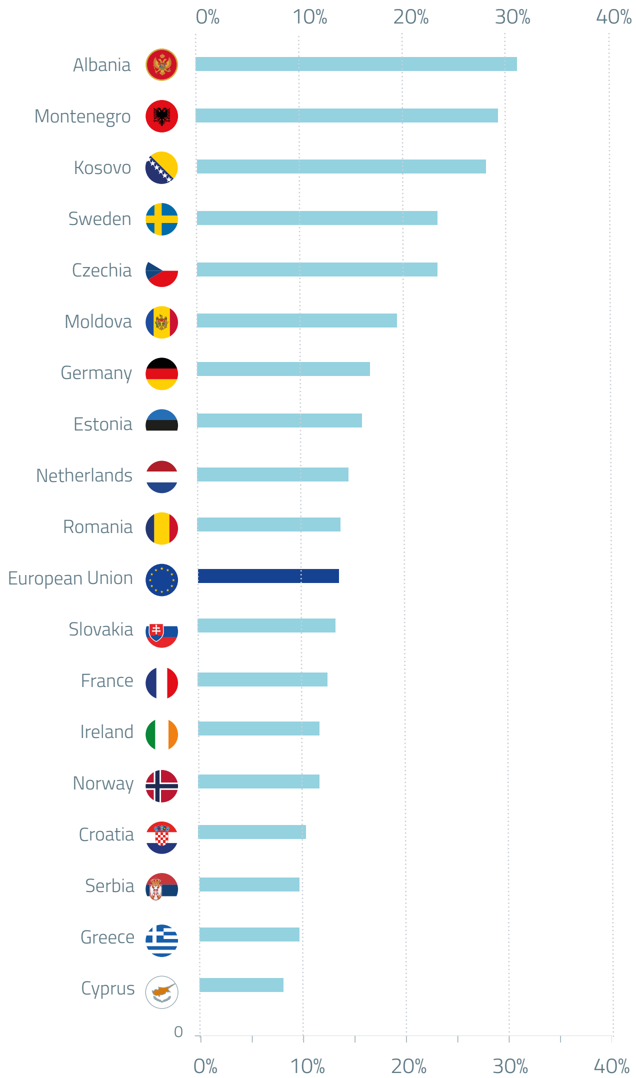

Figure 2: Share of network costs in total electricity costs for non-household consumers in Europe in 2024. Data from Eurostat.

The View Across the Pond: US Incentives at the Federal Level

The Investment Tax Credit (ITC), traditionally available for solar energy systems, has been extended to include energy storage systems, including TES, when installed with solar. The credit allows for a percentage of the installation cost to be deducted from federal taxes, making TES investments more financially attractive.

There are also two Federal Energy Regulatory Commission (FERC) orders:

- Order 841 requires grid operators to remove barriers for energy storage participation in wholesale electricity markets, which can directly benefit TES by providing more opportunities for revenue.
- Order 2222 enables distributed energy resources (DERs), including TES, to participate in regional wholesale energy markets, further integrating TES into the grid.

Finally, the Department of Energy supports TES through various research, development, and demonstration projects aimed at advancing energy storage technologies. Programs like the Energy Storage Grand Challenge and grants under the Office of Energy Efficiency and Renewable Energy (EERE) provide funding and resources for TES projects.

As of mid-2025, U.S. support for clean energy and TES is facing major uncertainty. The Republican-led House has passed a bill aiming to repeal or shorten key tax credits from the Inflation Reduction Act, including the 30% Investment Tax Credit and Production Tax Credit, potentially disqualifying most new TES projects after 2025. Simultaneously, over $3.7 billion in DOE grants for industrial decarbonization and thermal storage demonstrations have been canceled, while the DOE Loan Programs Office remains active, for now. Though these measures have only passed the House, they signal a broader rollback that could significantly slow U.S. TES deployment unless blocked or altered by the Senate.

2. Enable Clean Flexibility and Create a Business Case for TES

Low-carbon flexibility providers often struggle to build a compelling economic case due to long-term market uncertainties, significant capital costs, and competition with existing polluting flexibility assets such as gas turbines. In addition, current energy pricing models, which focus on overall energy usage rather than peak demand, hinder TES deployment while TES helps balance grid demand and support renewable energy integration, making it a crucial component of stable and flexible clean energy systems. TES provides significant benefits that are not adequately reflected in current market prices.

- Long duration energy storage systems like TES require stable long-term investment signals, especially due to their sensitivity to electricity market conditions and revenue uncertainty. This is at odds with industry's typical preference for payback periods, which depend on the sector and risk profile (under 5 years for comparable investment projects and retrofits, up to ~20+ years for new plants). The variability in market returns therefore makes stabilizing mechanisms interesting, such as the Contracts for Difference (CfD) as used in the Dutch 2024 SDE++. The Dutch scheme now includes TES and offers price guarantees, a valuable tool for reducing investment risk and ensuring revenue stability. By extending CfDs or similar financial mechanisms to TES and other energy storage technologies, investors can be assured of consistent returns, which can encourage greater capital investment into TES solutions.
- Also, offering 24/7 round-the-clock Power Purchase Agreements (PPAs) to the industry will boost the demand for complementary flexibility solutions such as TES. This means more granular hedging energy certificates to match production and consumption hour by hour, and more closely reflect the physical reality of the energy flows. Germany's 2024 reform also introduced auctions for pre-curtailable renewable energy, allowing storage operators to purchase otherwise wasted electricity. This creates a new revenue stream and makes TES more competitive.
- Capacity markets must consider the technical characteristics of different storage technologies, including their charging constraints and discharge durations. Nonetheless, TES can significantly reduce peak demand and integrate variable renewables when deployed strategically. A low-effort measure to strengthen the business case for electrified heat and clean flexibility solutions would be to rebalance energy surcharges by shifting them from electricity to gas.
- While OPEX often drives the TES business case more than CAPEX, investments are still heavily influenced by upfront costs. Incentives must reflect TES long-term value. However, large CAPEX projects carry risks if future energy prices change. Tools like flexibility markets (e.g. in Finland, UK, Netherlands) and Germany's Carbon Contracts for Difference help make TES investments more viable.
- Use more granular bidding zones or nodal pricing to reflect grid congestion and identify where thermal storage adds the most value. Letting thermal storage access local electricity prices, before zonal balancing costs are added, will help reduce curtailment while passing on lower prices and delivering cheaper power to industrial users.
- Raise awareness of TES across EU industry by emphasizing its high technology readiness and low risk, its main barrier being market novelty, not technical feasibility. Sharing data on TES advancements, performance metrics, and successful project deployments is essential for increasing visibility and building confidence. This transparency can help position TES as a low-hanging fruit for decarbonizing heat. Energy audits related to the energy efficiency directive can be a good starting point for identifying untapped TES potential.

Impact of the recommendation: Stronger investment signals for TES and reduced dependence on fossil flexibility assets. TES in industry could replace up to 1,800 TWh of fossil fuels annually and reduce over 500 MtCO_2e in emissions.

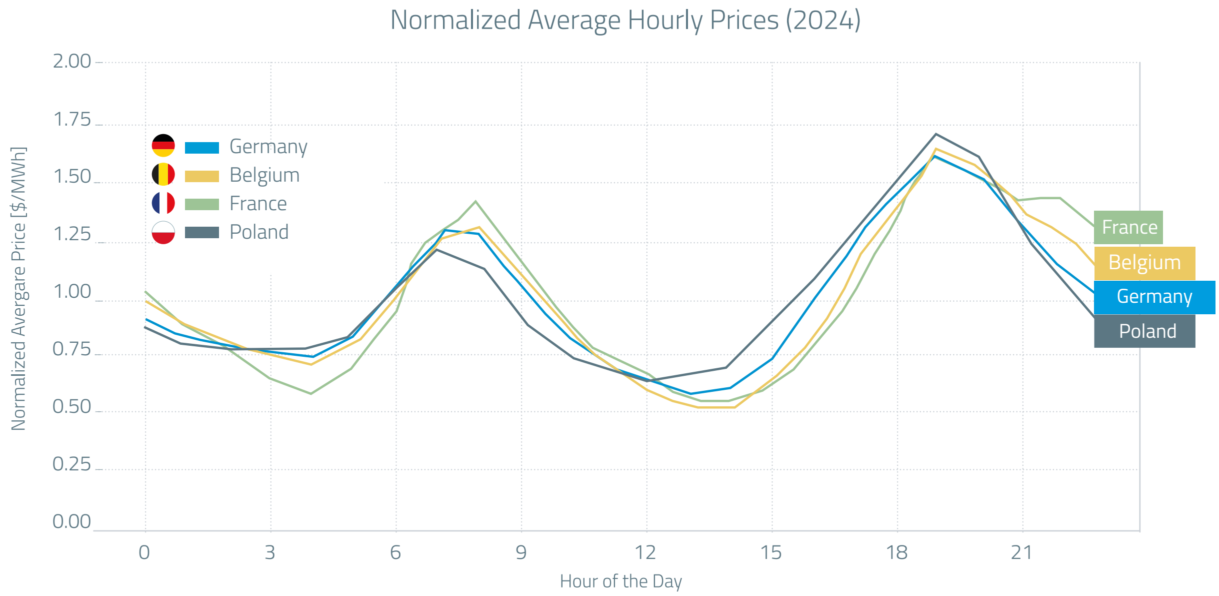

Figure 3: Average hourly electricity prices for various EU countries. Thermal storage would charge at off-peak times when renewable production is high (i.e. low emissions electricity) and prices are low, bringing down operating costs for electrifying industry and helping to balance the grid with valuable flexibility, reducing the need for gas peaker plants during hours of low renewable production. Source: data from GEM Energy Analytics.

Repurposing Existing Power Plants Via Thermal Storage to Create Grid-Scale Electricity Storage

Thermal energy storage can make use of existing assets such as coal power plants that would otherwise be stranded, as they cannot compete with renewables anymore. Thermal energy storage can be added to such a site to replace the fossil heat source, e.g. the burning of coal, while keeping the steam turbines, generators, grid connections, and existing workforce. In this way, the plant would be converted from generation to effectively a large battery, and this grid-scale energy storage could be added both quickly and with low capital investment. This not only meets economic requirements but also aligns with climate regulatory needs by advancing clean energy.

Repurposing coal plants for thermal energy storage can preserve jobs in the energy sector and support local economies. It allows for the continued operation of power plants, maintaining employment and economic activity in communities that rely on these facilities. FCA recommends repurposing solutions to be eligible for additional points in member states' auction award criteria, in particular under the principle set out under the Net Zero Industry Act delegated act on non-price criteria that "requires Member States to apply certain non-price criteria to at least 30% of the volume auctioned per year per Member State or alternatively to at least 6 Gigawatt per year per Member State for the deployment of energy from the renewable sources using these technologies" including storage.

3. Accelerate TES Innovation and Scale-Up

The industry is at an inflection point where, especially for higher temperatures, first-of-a-kind (FOAK) pilot and demonstration plants are key to proving the technology's potential to customers, thus de-risking investment and kickstarting further and faster deployment in a virtuous cycle. TES developers have been gaining momentum, raising US$800 million in 2024 compared to 75 in 2022, and with the pipeline of announced projects for industrial heat storage growing from 75 MWh in 2022 to 5 GWh in 2024. Many of the promising TES solutions focus on mid- to high-temperature industrial heat.

- Promote increased R&D efforts of advanced TES technologies, such as higher temperatures, higher energy density (notably with latent heat and thermochemical storage), insulation materials, and optimizing heat transfers from the stores to the target application.
- Recognize: Official certification may help to increase consumer confidence regarding performance, especially for novel components like thermophotovoltaic (TPV) converters. Industrial users often lack sufficient data or market transparency to assess the economic value of TES solutions.
- Support scale-up through the Innovation Fund, EIC, and public guarantees: The new pilot auction for industrial heat decarbonization through electrification is a powerful signal to the market. It is indeed necessary to include TES in the EU Industrial Decarbonization Bank. The upcoming EIB Tech investment program is also crucial to ensure public guarantees lower the financial risk for investors, improve project bankability, and counteract high upfront costs and risk premiums on TES projects. Moreover, many TES technologies face challenges transitioning from the lab to the market due to high capital expenditure. To overcome these barriers, it is essential to support demonstration projects that showcase TES systems at various scales and in different operational environments, as could be the case through the European Innovation Council scheme (see Exploring Energy Storage and Sustainable Construction: Insights from the Future Cleantech Festival, Future Cleantech Architects and European Innovation Council, 2024).

Impact of the recommendation: Scaling TES could support new and repurposed jobs across the value chain by 2030 and enable Europe to lead not only in climate tech research but also transform such research into globally competitive start-ups and scale-ups in sectors central to the future energy system and economy (Fig. 4). According to the IEA, clean energy contributed a disproportionate third of European GDP growth in 2023.

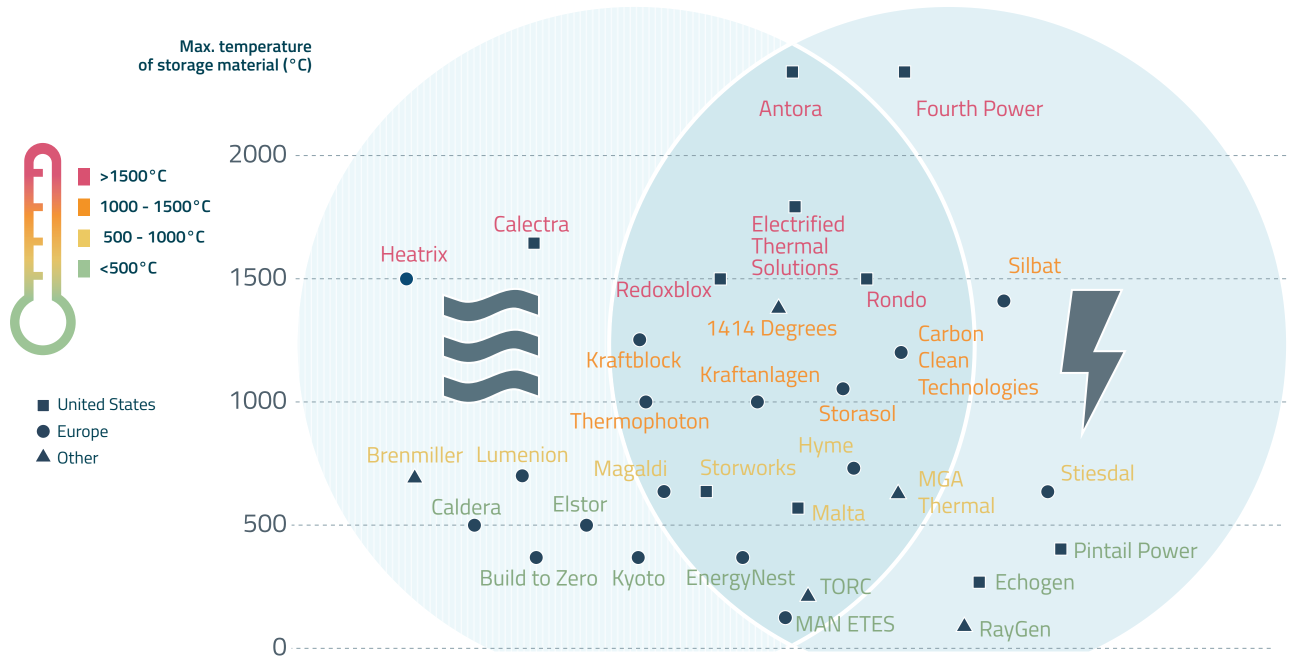

Figure 4: Non-exhaustive overview of main thermal storage companies, ranked by temperature of heat supplied, target application (industrial heat, power, or both), and location of headquarters. Data taken from company websites.

4. Urgently Decarbonize Low-Temperature Heat

Nearly 80% of heat demand is below 500°C, with 60% being used below 100°C. At these temperatures, low-carbon heat sources - such as heat pumps, e-boilers, solar thermal, and geothermal - are already commercially available and cost-effective. They can be coupled with proven TES technologies such as sensible heat storage in water tanks, which can store thermal energy at low temperatures. These solutions are not future concepts, they are deployable today. Our recommendations include:

- Expand the deployment of heat pumps, e-boilers, solar thermal energy, and geothermal energy to decarbonize low-temperature heat applications in both domestic and industrial settings, through subsidy schemes and carbon pricing. They can supply a stable, renewable heat source with minimal emissions.

- Use building codes as a regulatory tool to phase out fossil fuels from heating systems in new buildings, while also cutting red tape for clean alternatives. Mandating low-carbon systems like heat pumps is key, but regulations should streamline approval and installation. The UK recently did just that by loosening restrictive rules on heat pumps. These requirements should be paired with financial support, like grants or low-interest loans, to ease upfront costs, especially for households and small developers.

- Where possible, build district heating networks supported by seasonal storage to boost energy flexibility, particularly to stabilize energy use in dense urban areas. Large heat demands can be decoupled from electricity use with seasonal storage, reducing the need for peak power generation by storing excess energy from renewables during summer months and discharging it during winter.

Impact of the recommendation: Near-term decarbonization of 80% of Europe's heat demand with existing, scalable technologies. However, as the electrification of heat progresses, Europe needs to continue its efforts in decarbonizing the grid to avoid inadvertently increasing emissions. Ensuring sufficient access to affordable, renewable electricity will be critical, making TES, demand-side flexibility, and system-level planning essential to avoid new pressure on the grid.

Inspiration from Nordic Countries for Domestic Settings

Nordic countries are already deploying thermal storage systems for low-temperature heat at scales that far exceed battery installations[2]. For example, Denmark already had 50 GWh of non-seasonal thermal storage in steel water tanks in 2013, as well as 14 GWh of seasonal storage in pit reservoirs in 2018. The Finnish city of Vantaa alone is building a 90 GWh underground cavern for seasonal thermal energy storage. By comparison, batteries across the EU could store around 23 GWh of power in 2023.

Crucially, these large-scale thermal stores work in combination with district heating, which is widespread in Scandinavia but serves only 13% of Europe's final energy use for heating and hot water in buildings. While this share is growing at double-digit percentage rates in laggard countries such as Germany and France, the development of district heating should be further encouraged (at the municipal level) in order to better take advantage of large-scale thermal storage systems.

Finally, some of these systems (e.g. pit reservoirs) can be used for seasonal balancing, i.e. from summer to winter, which is especially valuable since this is precisely the use case for which the fewest competitive energy storage options are available today.

[2] This comparison is made on an energy basis, not an exergy basis, which would account for the low value of low-temperature heat.

5. Establish a Long-Term Vision and Strategy for the EU

It is imperative to assess needs at regional, national, and EU levels in order to decarbonize the heat sector in both domestic and industrial settings. Energy storage and flexibility must be integral elements of energy transition plans at all levels of governance. TES requires visibility in all key policy frameworks to succeed.

- Update the EU Heating and Cooling Strategy (2016): Modernize the strategy to reflect current decarbonization goals, prioritizing the deployment of renewable and clean heating technologies, such as TES, in both buildings and industrial sectors. Integration with district heating and energy system planning is key.
- Develop a European energy storage strategy under the next EU Electrification Action Plan: Ensure the strategy explicitly includes TES alongside other technologies. National Energy and Climate Plans (NECPs) should also set measurable targets for storage capacity across all durations, from short-term to seasonal, to support grid stability and higher renewable integration. This would provide clearer signals to all the stakeholders.
- Strategically plan for TES deployment: identify optimal locations for TES development at nodes, such as industrial clusters, dense urban zones, and renewable-rich regions. Differentiated planning based on TES type (e.g. high-temperature vs. low-temperature) will unlock targeted investment. Promote regional energy hubs where TES integrates with smart grids or microgrids. Many regions still lack clear flexibility targets and grid assessment needs, which hampers planning and market signals.

Impact of the recommendation: A coherent EU-wide strategy aligning decarbonization and net zero goals with funding priorities would help scale up support for TES, which currently accounts for less than 0.5% of Innovation Fund investments (4 out of 208 projects) and around 3% of the EIC's climate related funding.

National Policies and Initiatives for TES in China

- 13th and 14th Five-Year Plans: The Five-Year Plans outline China's strategic priorities for economic and social development. Both the 13th and 14th Five-Year Plans emphasize the development of energy storage technologies, including TES, as critical for achieving energy security and integrating renewable energy sources.
- National Energy Administration (NEA) Guidelines: The NEA has issued several guidelines to promote energy storage. These guidelines encourage the development of TES technologies and pilot projects to demonstrate their feasibility and effectiveness in various applications, such as industrial processes, district heating, and cooling systems.
- Renewable Energy Law: The Renewable Energy Law mandates the development and utilization of renewable energy sources, including provisions that support energy storage to balance and stabilize the grid. TES is recognized as a valuable technology for enhancing the reliability of renewable energy systems.
- Carbon Neutrality Goals: China's commitment to achieving carbon neutrality by 2060 includes significant investments in clean energy technologies, including TES. Policies are being developed to support the deployment of energy storage systems that can help reduce greenhouse gas emissions and increase energy efficiency.


Source: Antora

Conclusion

Thermal Energy Storage is an essential tool for a decarbonized, secure, and flexible energy system. It eases renewables penetration, lowers peak demand, and unlocks the electrification of heat, especially needed to enable a competitive industry. The EU must act now to fully integrate TES into climate, energy, and industrial policy. With smart regulation, proportionate grid fees, and de-risking investment, Europe can lead both innovation and large-scale deployment in this key technology.

Future Cleantech Architects advocates for the adoption of the following measures:

1. **Recognize TES as a Grid Asset**

   Deploying TES could reduce renewable curtailment by more than half, lower peak heat prices, and lower total energy system costs, saving several billion euros per year.

2. **Enable Clean Flexibility and Create a Business Case for TES**

   TES can replace up to 1,800 TWh of fossil fuels annually in industry and cut over 500 $MtCO_2e$ in emissions, strengthening investment signals and reducing reliance on fossil flexibility assets.

3. **Accelerate TES Innovation and Scale-Up**

   Scaling TES could support new and repurposed jobs across the value chain and enable Europe to lead not only in climate tech research and transform such research into globally competitive start-ups and scale-ups.

4. **Urgently Decarbonize Low-Temperature Heat**

   Low-carbon sources and technologies like heat pumps, solar thermal, and geothermal are scalable and cost-effective for nearly 80% of heat demand, which is below 500°C, including 60% under 100°C.

5. **Include TES in EU Strategies**

   An EU-wide strategy aligning decarbonization and funding priorities would help scale up support for TES, which currently accounts for less than 0.5% of Innovation Fund investments (4 out of 208 projects) and around 3% of the EIC's climate related funding.

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About Future Cleantech Architects:
We are a climate innovation think tank. We exist to close the remaining innovation gaps to reach net-zero emissions by 2050. To reach this objective, we accelerate innovation in critical industries where sustainable solutions are still in very early stages.

Address: Martin-Luther-Straße 29, D – 42853 Remscheid, Germany
E-mail: mail@fcarchitects.org

Further Information:

Head of EU Policy:
Dr. Marlène Siméon
marlene.simeon@fcarchitects.org

Cleantech Analyst - Lead Energy Systems:
Dr. Antoine Koen
antoine.koen@fcarchitects.org

Cleantech Analyst:
Dr. Peter Ruschhaupt
peter.ruschhaupt@fcarchitects.org

FCA Future Cleantech Architects