EERA
European Energy Research Alliance
Energy Efficiency in Industrial Processes

Policy brief

INDUSTRIAL THERMAL ENERGY STORAGE

Supporting the transition to decarbonise industry

The European Energy Research Alliance Joint Programme for Energy Efficiency in Industrial Processes (EERA JP EEIP) published a White Paper on ***"Industrial Thermal Energy Storage – Supporting the transition to decarbonise industry"*** in December 2022. This briefing summarises the policy recommendations from the paper.

Setting the scene

Thermal energy storage (TES) can significantly support the decarbonisation of industrial heating and cooling, and at the same time increase energy system flexibility and security.

One quarter of total final energy consumption in the European Union is consumed by industry. Within that quarter, over 80% is consumed by heating and cooling processes. The continued, wide-scale use of gas, oil, coal, and other fossil fuels for industrial thermal processes leads to an estimated greenhouse gas (GHG) emission of 513 Mt CO2 equivalent per year, which equates to around 60% of the total industrial GHG emissions and 12% of total GHG emissions in the EU. The full roll-out of industrial TES could enable a potential 1,793 TWh of fossil fuel replacement by renewable energy and/or surplus heat, leading to a reduction of 513 Mt CO2 equivalent GHG emissions per year.

To unlock the full benefits of using TES in industries, collaborative promotion and support is needed. **This requires coordinated action between policy makers, technology developers, industry, energy suppliers and grid operators.**

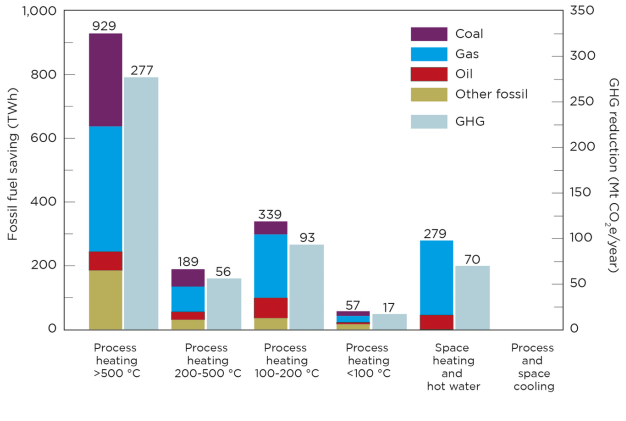
Industrial energy consumption within the EU has shown a continuously increasing trend since 2015. By 2019, industries in the EU were responsible for 260 Mtoe (3,026 TWh) of final energy consumption, which corresponds to almost 25% of the total final energy consumption (1,057 Mtoe/12,292 TWh), with only the transport sector and domestic sector being higher.

Thermal Energy System Integration

The scale of industrial process heat demands, combined with limited power grid capacity and the intermittency of renewable energy sources, calls for more energy flexibility.

The increasing focus by industry towards reducing its carbon footprint and increasing the use of renewable energy sources in the power grid and industrial processes greatly increases the attractiveness of TES technologies both as cost effective and energy efficient.

As a consequence, some companies are now seeking to move away from fossil fuel based process heat production systems, with fuel switching to low carbon hydrogen or electrification. **TES provides resilience to the fluctuation of renewable energy source and enables storage and reuse of heat from thermal processes.**



Fossil fuel and GHG emissions reduction through integrating industrial TES.

FIGURE 1

Fossil fuel and GHG emissions reduction through integrating industrial TES

Challenges and barriers to TES

The potential benefits of TES are clear, however, adoption within industry is sluggish, lagging far behind the contribution it could make. Barriers include: a lack of awareness of the potential of the technology, lack of knowledge of implementation and operation, high investment costs, or lack of incentives that support its uptake. Additionally, often a company investing in the technology may not be the one that obtains the greatest benefits.

These barriers fall primarily within four policy areas identified as: 1) markets, 2) financial sector, 3) legislative sector and 4) industrial process operations.

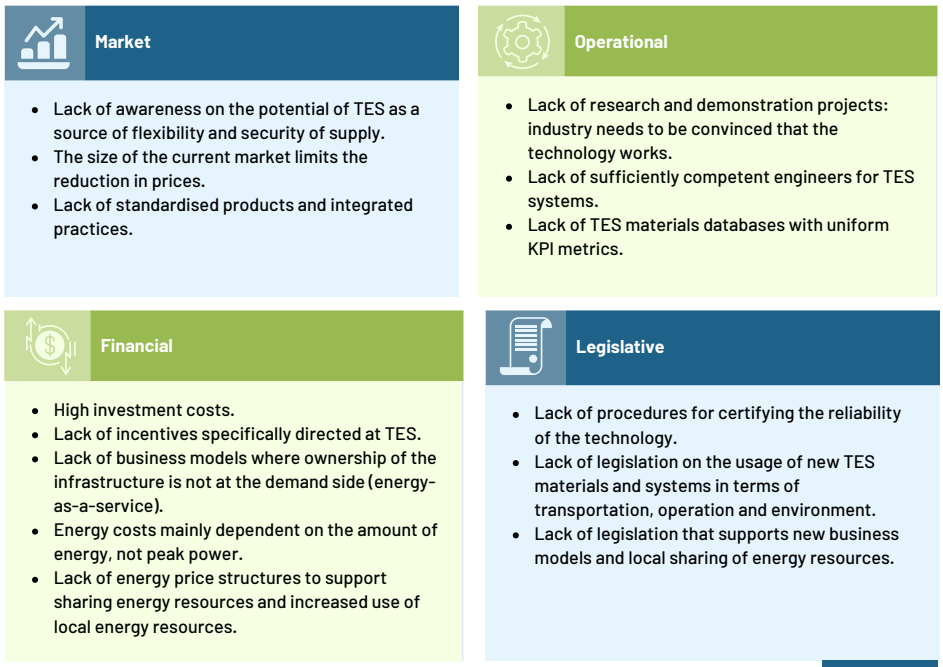


FIGURE 2

Non-technical barriers hindering the implementation of TES

Changes to policy in these areas are required if we are to achieve the benefit that TES offers for carbon emission reduction across Europe.

Enabling participation in the electricity market yields the potential for industry to reduce its energy costs and emissions. Emerging technologies and grid flexibility increasingly favour incorporating TES as both viable and necessary, however, they need the financial and legislative framework to allow these to be fully integrated.

Priority actions

The white paper calls for the following priority actions for thermal energy storage (TES) on regional, national and EU levels:

Immediate actions (Pre-commercial phase)

- Increase awareness of the importance of TES for the future energy system:
  - As a flexibility provider in decarbonized and electrified industrial heating systems, matching fluctuating renewable electricity to industrial heating demand.
  - In increasing energy efficiency and reducing peak energy demands in industrial batch processes.
  - In providing low-cost energy storage based on abundant and recyclable materials.
- Ensure that energy efficiency, storage and flexibility are embedded as an integral part of EU, national, regional, and local energy transition plans.
- Provide support to the demonstration and scale up of innovative and commercially promising industrial TES technologies, to encourage greater adoption in industry.
- Provide support to the dissemination of best practices for industrial TES, essential for knowledge sharing and the wider implementation of the technology.
- Provide support to targeted R&D programs for TES technologies to address identified technical barriers.
- Support the development of a platform in which the different stakeholders in TES development (e.g. industrial partners, technology suppliers, standardization institutes and researchers) exchange information and best practices.
- Promote and develop dynamic price structures, adjust the energy system regulatory framework, tariffs and taxation to accommodate TES and energy flexibility.

Near future (Commercial phase)

- Develop clear conditions and long-term perspectives for investments in industrial TES to support investment.
- Establish independent TES materials testing institutes to support technical development.
- Support the development of a platform of regulators, professional bodies and industry to develop standardized TES systems.

To download a copy of the white paper and read about the work of the EERA JP EEIP, follow this link.