

About THERMINATOR



Harnessing Waste Heat for a Greener Future

Every year, **energy content of more than 200 million barrels of oil** are lost through inefficiencies in industrial, transport, and residential systems. This **waste of heat**, if recovered, could become a key source of clean energy.

The **THERMINATOR project** sets out to **challenge conventional limitations** in thermal energy conversion. We are creating an integrated solid-state approach to thermal management: by combining electrocaloric and thermoacoustic effects, we design high-performance cooling systems that also harvest and convert waste heat into electricity—tailored for decentralized energy and e-mobility environments.

Backed by **Horizon Europe** and the **Swiss State Secretariat for Education, Research and Innovation (SERI)**, THERMINATOR brings together **material scientists, energy engineers, microelectronics developers, and innovation experts** to rethink energy efficiency from the bottom up.



Key Facts

- Combines thermoacoustic and electrocaloric technologies
- Compact, flexible and highly efficient
- Zero moving parts = Low maintenance, high reliability
- Applications: Industry, transport, buildings, renewables



ABOUT THE PROJECT



DURATION
36 months
(2024–2026)



CONSORTIUM
8 partners
across 7 countries



COORDINATOR
GAC Group,
France



<https://therminator.eu>



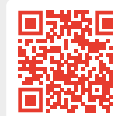
THERMINATOR



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Consortium Members



This project has received funding from the EU Horizon Europe programme (GA No 10119283) and the Swiss State Secretariat for Education, Research and Innovation (SERI)



Funded by the European Union

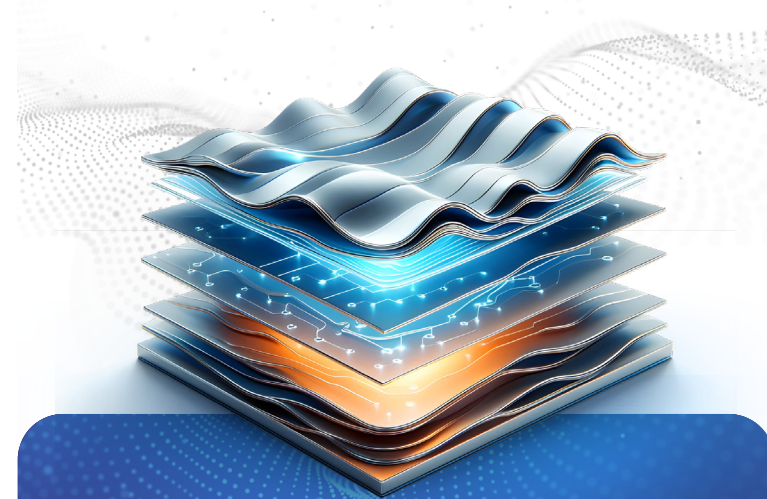
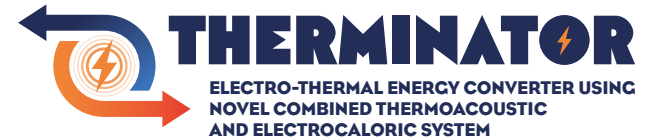
Project funded by



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Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Education,
Research and Innovation SERI



Cool smarter. Recover more.

Merging electrocaloric and thermoacoustic innovations to power a greener future.

Our Mission

By 2026 THERMINATOR aims to reach TRL (Technology Readiness Level) 4 and deliver:



A compact, scalable, and flexible conversion skin operating at:

- Up to 1 W/cm² power density
- 50 K temperature lift
- Coefficient of performance (COP) > 2
- 10 W direct thermal-to-electric output



A modular architecture compatible with multiple sectors:

- Technologies are scalable and designed for industrial integration, opening the door to applications in solar panels, batteries, buildings, and thermal networks



Prototypes validated in realistic application scenarios, demonstrating benefits in:

- Waste heat valorization
- Decentralized power generation
- Electrification and net-zero strategies



Environmental & Strategic Impact:

- Reduction of greenhouse gas emissions
- Enabling circular energy flows
- Acceleration of Europe's Green Deal and energy transition goals



Technology behind THERMINATOR

At the heart of THERMINATOR is the **hybrid integration of two solid-state technologies** that have never before been combined at system level:

→ Thermoacoustic Energy Conversion

Uses thermal gradients to create sound waves, which are converted into electrical power. Key advantages:

- No moving parts
- Broad operating temperature range
- Durable, silent, and scalable

→ Electrocaloric Conversion

Uses materials that heat up or cool down under electric fields. These temperature shifts drive a thermodynamic cycle that generates electricity. Features:

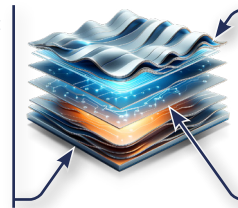
- High energy efficiency (COP >2)
- Solid-state control with minimal footprint
- Strong compatibility with thin-film integration

Power density of 1 W/cm²

Very high power in a very compact space

Thermoacoustic

- Harnesses temperature variations to generate acoustic waves (vibrations)
- Waves converted into electrical energy
- Technology used in certain heat pumps



Electrocaloric

- Materials that change temperature when exposed to an electric field
- Controls thermal energy
- Refrigeration technology

Software

→ Why Combine Them?

Individually, these technologies are powerful but limited. Together, they form a **multi-stage conversion cycle** that overcomes the drawbacks of each—enabling a **compact, high-frequency energy conversion system** with superior efficiency, density, and integration potential.

→ THERMINATOR Target:

A compact, scalable, and high-frequency energy conversion skin operating at up to **1W/cm²** with a **50 K temperature lift at COP>2** and **10W in thermal to electric conversion**.

Get involved!

→ Meet the Stakeholder Advisory Board

To bridge the gap between **research outcomes and societal impact**, THERMINATOR has established a **dedicated Stakeholder Advisory Board** composed of **industry, policy, and innovation leaders**. The board:

- **Guiding Strategic Direction:** Offering invaluable insights that help align our technology with emerging market trends and regulatory landscapes.
- **Shaping Innovation:** Contributing technical and strategic expertise to refine our thermoacoustic and electrocaloric systems, ensuring that they meet both current and future industry demands.
- **Strengthening Collaborations:** Fostering partnerships across different fields to create synergies that drive more efficient and effective energy solutions.

→ A Diverse Assembly of Experts:

- **Leading Academics:** Pioneering research in energy conversion and sustainability.
- **Industry Trailblazers:** Professionals with hands-on experience in innovative product development and energy efficiency.
- **Policy Shapers:** Officials and advisors influencing regulatory frameworks and sustainable practices.
- **Innovation Catalysts:** Experts from complementary sectors working together to anticipate future needs and foster new applications for our technology.

THERMINATOR is always looking to broaden its network with professionals who share a commitment to driving innovation in energy conversion. If you are an industry expert, researcher, or policy maker interested in contributing to the future of sustainable energy technology, we welcome you to explore opportunities for collaboration with our Stakeholder Board.

Visit our website to learn more and apply:

