USES4HEAT

Co-funded by the European Union

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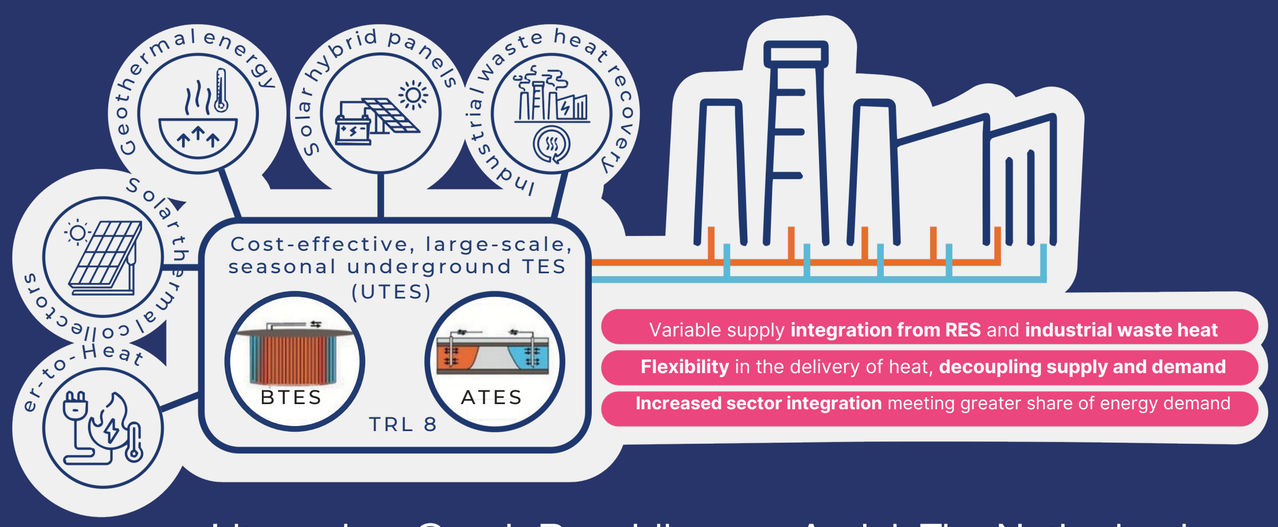
UNDERGROUND LARGE SCALE SEASONAL ENERGY STORAGE FOR DECARBONISED AND RELIABLE HEAT

WHY USES4HEAT

USES4HEAT will implement two large-scale, cost-effective underground thermal energy storage systems and four replication cases, each using locally available renewable energy sources, waste heat and a range of innovative technologies.

HOW WE DO IT

- Two large-scale underground thermal energy storage units - aquifer TES and borehole TES - to decarbonise heat supply.
- Intelligent energy management systems based on AI, big-data analytics and predictive operation & maintenance (O&M).
- Assessment of the social, economic, financial, circular, and sustainability impacts of the proposed solutions to support informed decision-making and long-term implementation.
- Market uptake, widespread commercialisation and replication of the solutions across the EU and beyond.



Six innovative key enabling components/technologies and their integration with seasonal TES

- a drilling solution for geothermal applications
- high-temperature ground-water heat pump
- highly efficient hybrid photovoltaic thermal panels
- collector piping materials and solutions
- highly efficient solar thermal collectors
- AI driven and big data analytics based predictive energy software

Demo sites

Litomerice, Czech Republic
BTES Demonstration



Andel, The Netherlands
ATES Demonstration



Replicators

Replication 1: Balkan region – Zagreb DHN, HEP
Replication 2: East Europe – AquaTonic
Replication 3: South East Europe – Kozani DHN, DEYAK
Replication 4: Northern Europe – Kvarnholmen DHN, KUAB

WHAT DID WE ACHIEVE SO FAR

Significant progress has been achieved in the engineering of the two demo sites, including the completion of comprehensive technical and economic assessments, as well as impact and risk evaluations.

Preliminary definition and modelling integration of performance maps for the key technologies developed within the project. This approach aimed at simplifying the representation of technologies, maximising the models' transferability whilst maintaining an appropriate level of detail.

Key enabling technologies are mostly designed, and several components have been successfully tested.

- Hybrid PVT + high-temperature groundwater heat pump for ATES: System design and integration are complete, including fluid selection, operating-condition analysis, and environmental/acoustic assessments. PV technologies were screened, PVT components redesigned, and selected solutions validated in initial lab tests.
- U-shaped BTES collector pipes: Extrusion parameters are defined, and validation tests for pressure, fusion, flexibility, weathering, and impact resistance completed. Joint and fitting designs passed initial pressure tests, with alternative clamping options identified.

Studies show that heat pumps are essential for decarbonising district heating, with TES and UTES improving their efficiency, sector coupling, and smart electricity use.

The software and hardware architecture of the intelligent energy hub has been defined, along with preliminary site-specific control strategies, laying the foundation for future predictive-maintenance applications.

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