



ETES – Electric Thermal Energy Storage – Technology

ETES - Making Money with Industrial Decarbonization and Renewable Energy Utilization
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RENEWABLE ENERGY

Energy transition increases demand for large-scale energy storage

Global trends 2020 to 2030

The global energy storage demand is expected to reach 741 GWh by 2030

Increasing renewable electrical energy penetration **+170%**

Increasing market volatility 

Increasing CO₂ price (€/t) **>+100%**

Committed coal phase-out **~100 GW acc.**

CO₂-neutral and sustainable supply chains 

Increasing share of renewable energy for heat consumption **~+70%**

Resulting Energy System Challenges

Grid Stability

Renewable Energy Utilization

Flexibility of Conventional Generation

Security of Supply

Energy Storage Solution



Versatile



Scalable



Clean
and Safe



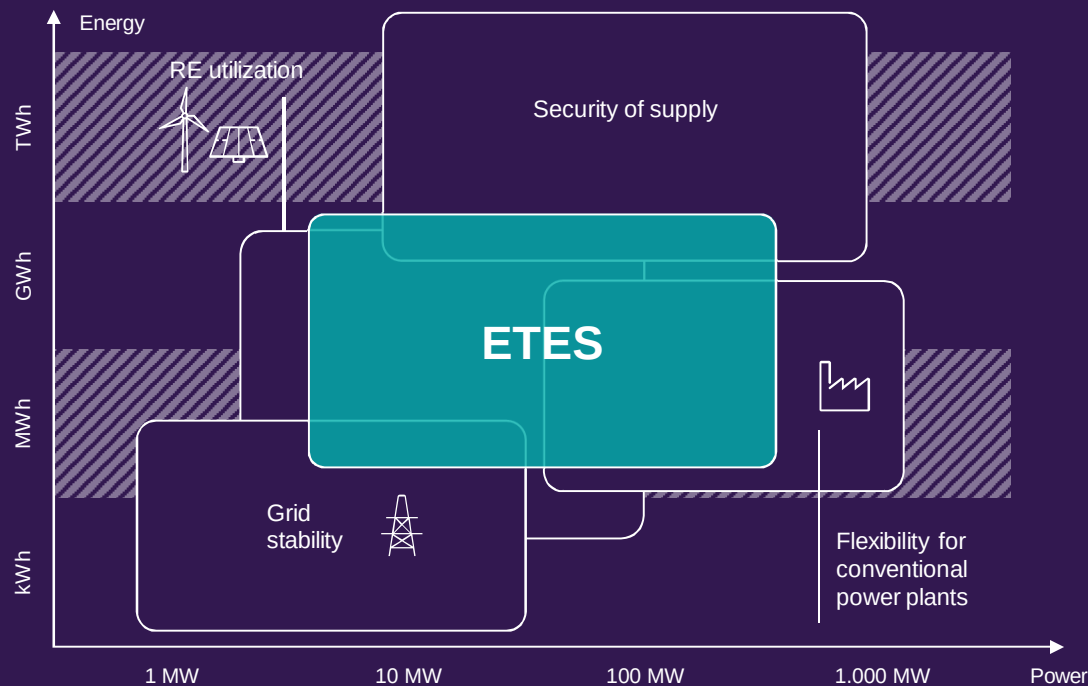
Geographically
Unrestrictive



Low Cost

ETES' contribution to solve the challenges

ETES market positioning



Benefits of the ETES technology – Why ETES?



Temperatures of up to 800°C



Emission-free energy storage



Large-scale energy storage to flexibilize and prevent curtailment



Possibility for combined heat and power



Customizable for versatile applications



Sustainable and non-hazardous materials



Long design lifetime



Low permitting barriers



No geographical restrictions



High potential for localization of content

The reliable ETES working principle



Charge

- Low-price electricity is converted via a resistive heater to thermal energy
- Air at ambient pressure is used as heat transfer fluid
- High temperature air
- Flexible and fast to respond

Store

- Volcanic rocks
- No Phase change
- Storage ambient pressure and at high temperature
- Insulated concrete container
- Heat is stored up to weeks

Discharge

- Discharged heat is converted to electricity in water steam cycle
- Alternatively, direct use of heat and process steam possible

Stages of ETES

● Technology Development Since 2011



2014



2019



2021

Test Site

- Small-scale demonstrator in Hamburg Bergedorf with **5 MWh storage capacity** and a **750 kW** gas burner
- Testing of various storage concepts, materials and setups
- Over 2,500 testing hours per storage module

Demonstrator

- Demonstrator with **130 MWh storage capacity** and a **5.4 MW** resistive heater
- Grid connection June 2019
- Partners: TUHH, Hamburg Energie
- Biggest German public funded storage R&D project
- Successfully Demonstrate full cycle

Commercial Pilot

- world-class partners on various global projects
 - Power: 10 – 100 MW
 - Capacity: 100 – 2,000 MWh
 - Steam temperature: 300 – 720°C

ETES offers a large variety of applications with use cases along the entire electricity value chain

ETES:Switch



CO₂-free second life for thermal power plant

Conversion of power plants

- CO₂-free storage systems
- Sustainable second life
- Minimizes CAPEX
- Positive local economic impact

ETES:Add



Decarbonizing the industry

Added storage to existing heat cycles

- Heat electrification and heat recovery for industrial plants
- Adds flexibility to industrial plants
- Reduction in CO₂ emissions

ETES:Base

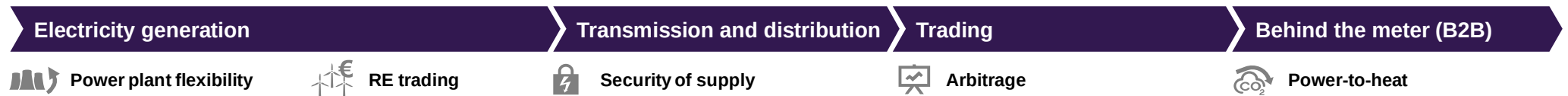


GWh-scale storage anywhere

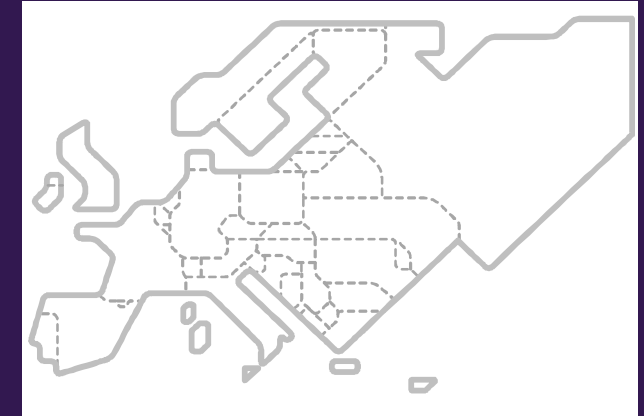
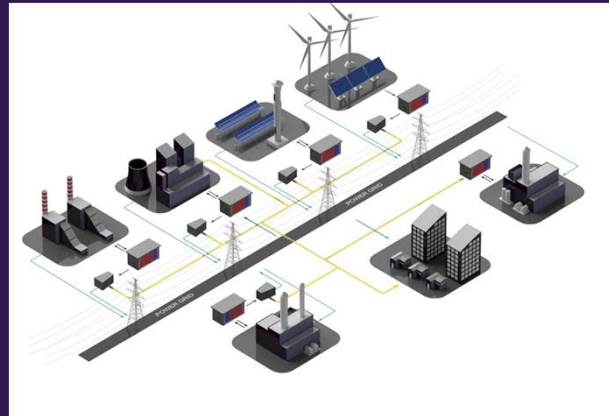
Universal stand-alone storage

- Can be installed anywhere
- Several outputs possible:
 - process steam
 - electricity
 - district heating

Revenue streams along the electricity value chain



Incentivizing Commercial Solutions



Current Electrical Market

Market Events & Technical Challenges

- Volatile in spot prices: high and negative pricing
- Wind curtailment occurring in many markets
- project revenues streams KPIs

Regulatory Framework

Limited Incentives for solutions

- Wind Generation priority grid dispatch
- Grid stability burden of cost on the consumer
- Incentives for flexibility
- Business models for projects

Emerging Commercial Revenues

Positive Business model incentives

- European lead programs
- CO2 reduction assessment
- UK National Grid Pathfinders: commercial grid stability contracts



Mature and Ready

ETES is based on **80% existing** and mature technologies and has been validated in **130 MWh/5.4 MW** demonstration plant.



Adaptable and Flexible

ETES allows for **different power sources**, such as **electricity and heat**, and it provides multiple energy products: electricity, heat and steam.



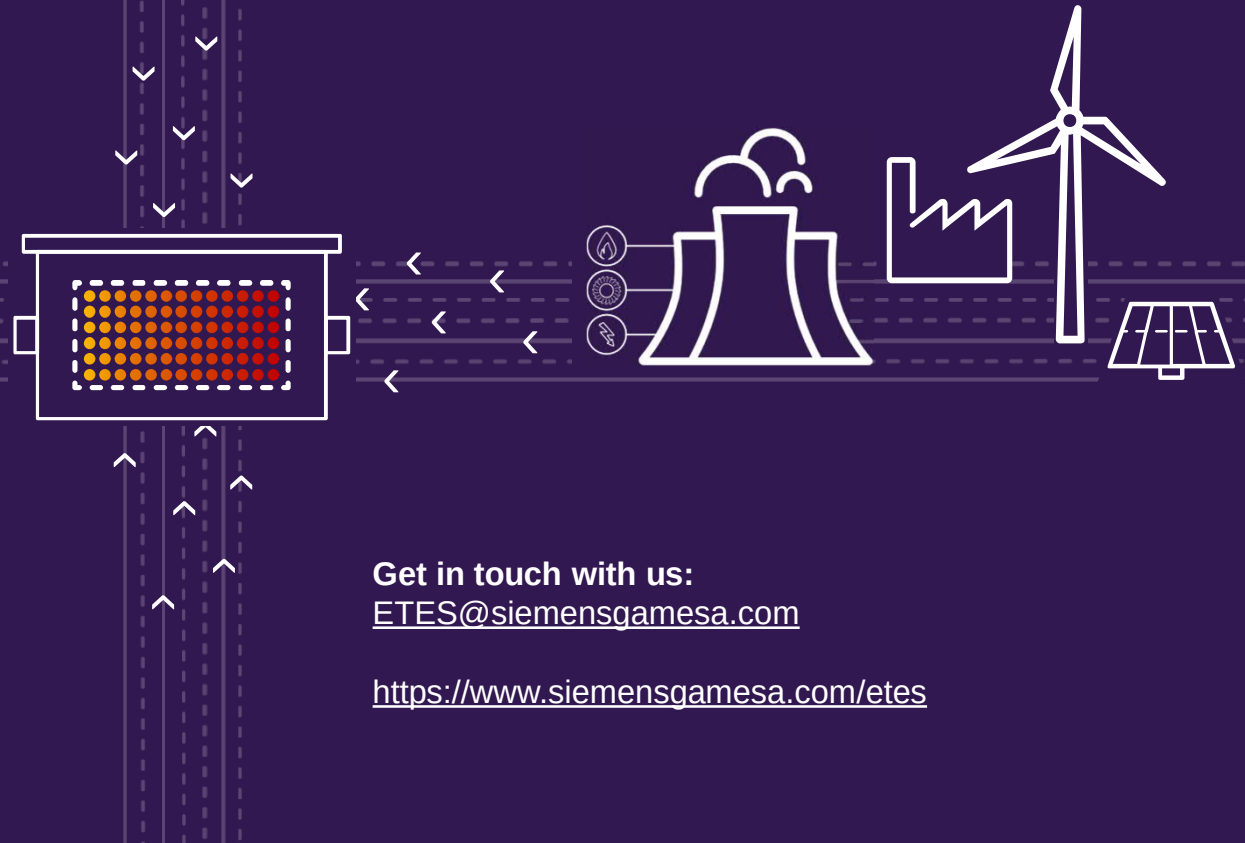
Scalable and Modular

ETES is a **large-scale GWh storage solution** with low investment and operating costs due to significant economies of scale.



Economical and Sustainable

ETES **does not require environmentally or physically harmful material.**



Get in touch with us:

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