

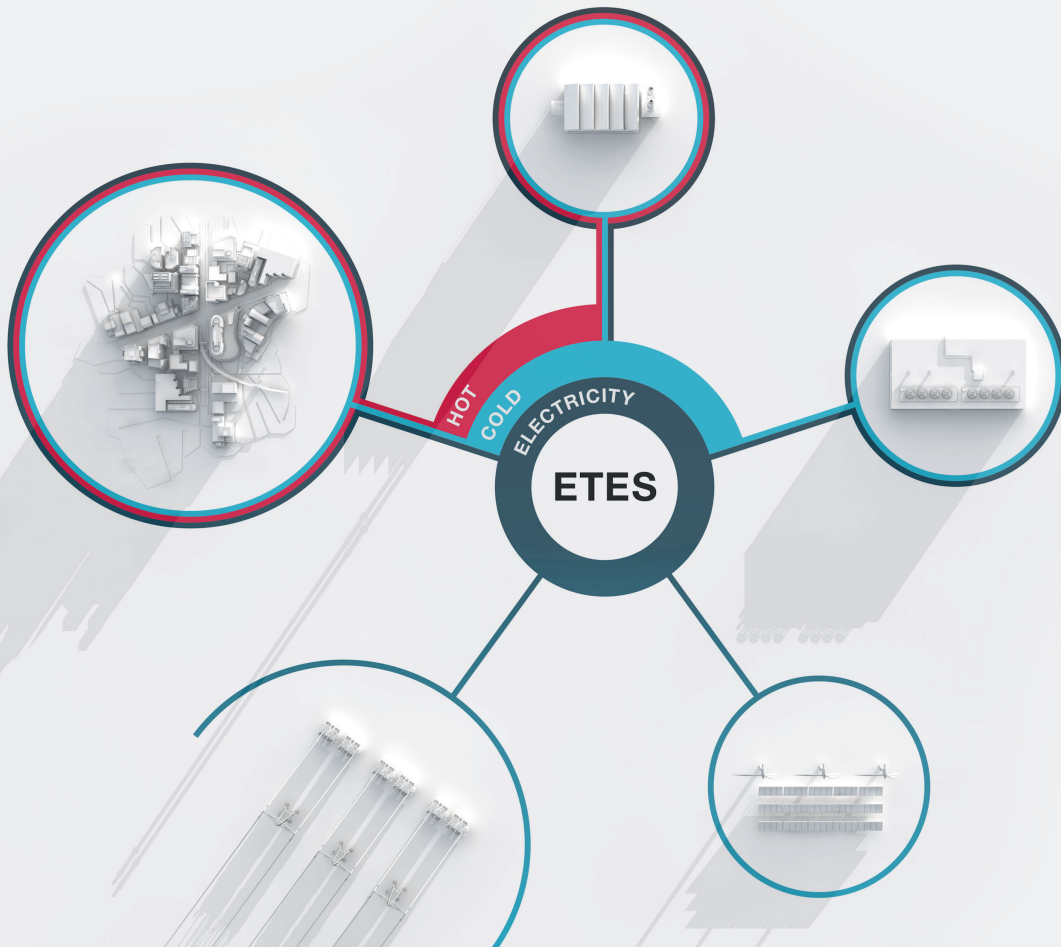
MAN ETES

Electro-thermal energy storage

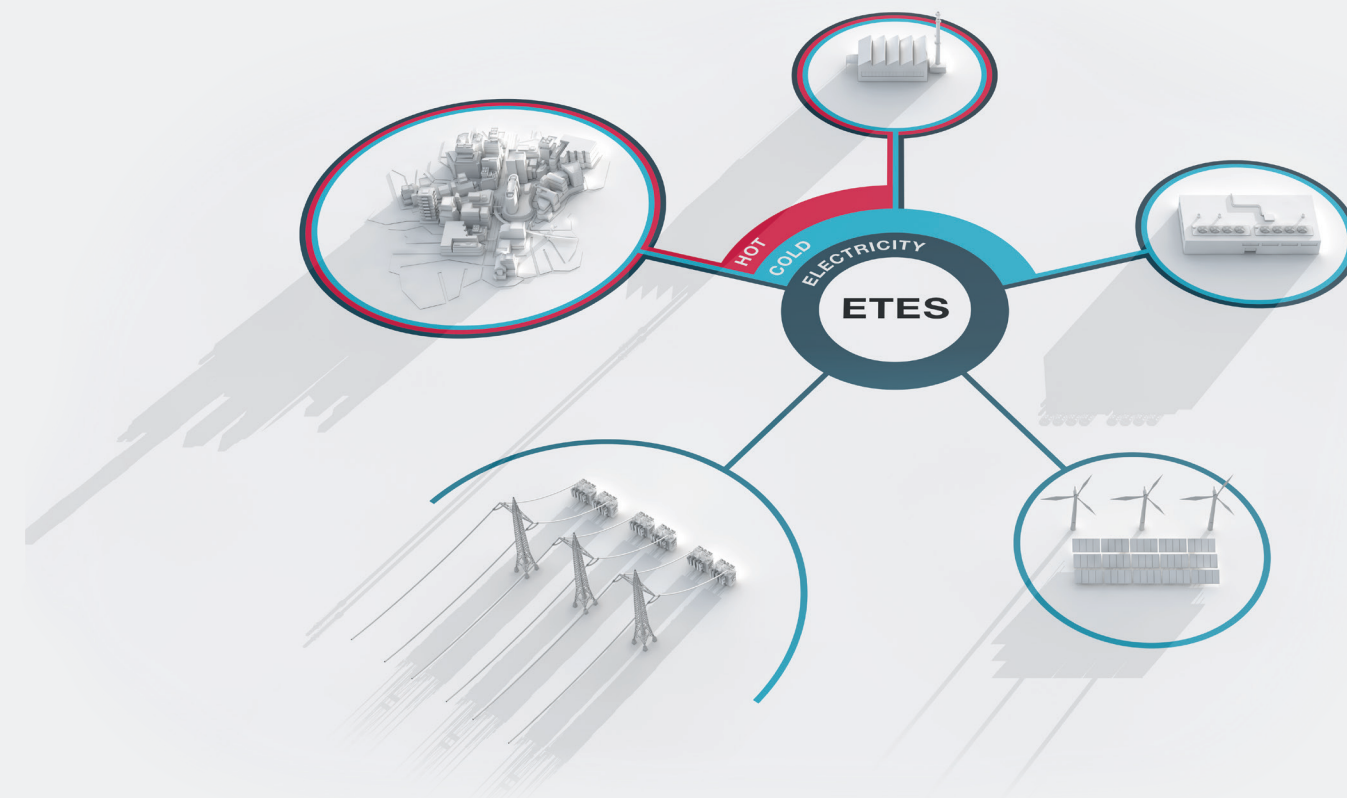
Creating carbon-neutral energy systems means making the most of renewable resources. This can be done by cleverly managing thermal energy. The MAN electro-thermal energy storage (MAN ETES) is a large-scale trigeneration energy storage and management system for the simultaneous storage, use and distribution of electricity, heat and cold.

Benefits at a glance

- Trigeneration – integrated heating, cooling and electricity system
- Ideal for sector coupling, process industries, and energy suppliers
- Integration and storage of renewable energy and reduction of CO₂ emissions
- Scalable, location-independent, and very low environmental impact



Low-emission sector coupling



Decarbonizing the heating, cooling and electricity supply

Heating and cooling account for 48 % of global energy consumption and 39 % of all CO₂ emissions. This is because only 10 % of the energy used for heating and cooling comes from renewable sources. In order to reduce emissions and decarbonize the whole energy system, it is crucial to develop solutions which consider all sectors, not just electricity generation.

MAN ETES offers a scalable and CO₂-neutral energy storage and sector coupling system. MAN ETES responds to two fundamental challenges: On the one hand, it helps balance the grid by absorbing large amounts of surplus or off-peak electricity from renewables and feeding it back into the grid on demand. On the other hand, it can integrate multiple sectors by generating, storing, and providing thermal energy for heating and cooling purposes.

The technology behind MAN ETES

The basic principle of MAN ETES is the reversible conversion of electrical energy into thermal energy via storage in the form of hot water and ice. The solution is based on heat pump and thermal engine technologies using CO₂ cycles and the storage of pumped heat.

In charging mode, the system uses electrical energy to drive a MAN HOFIM™ compressor. The compressed CO₂ is heated, then passes through a heat exchanger and heats the hot water tanks. The cooled-down CO₂ is further chilled by a turbo-expander until it reaches liquid state. Then it passes through an additional heat exchanger and stores the cold energy in the form of ice.

MAN ETES has two discharging options:

- 1) In thermal discharging mode, the thermal energy can be distributed directly from the thermal storage, e.g. for process cooling or district heating purposes.
- 2) In electrical discharging mode, the CO₂ circuit loop is reversed and the system produces electricity using the stored thermal energy. This electrical energy is fed back into the grid or is used straight away as a decentralized electricity supply.

A flexible solution

MAN provides the complete solution with system support from ABB. MAN ETES can be built as a stand-alone system or integrated into other facilities. The system is scalable, location-independent and has a very low environmental impact.

Thanks to its modular design, MAN ETES can be configured to specific customer needs:

- Electrical input and output from 2 to 50+ MW
- Storage capacity ranges from 10 to several 100 MWh
- Flexible export temperature level from 0°C to more than 120°C – with a COP > 6 (depending on temperature levels)
- Optional re-electrification with round trip efficiency of around 50%

Selected applications

Scalable and modular, MAN ETES is suitable for mid- to large-scale thermal and electrical consumers.

Process industries

MAN ETES provides cost-efficient carbon-neutral energy for all kinds of industrial processes with intensive heat, cold and electricity demands, especially in the food, beverage and pharmaceutical industries.

Municipal, urban, and large facilities

MAN ETES can decarbonize the complete energy supply for urban quarters, small towns and large facilities like airports, universities or shopping malls.

Data centers

Data center operators can reduce their CO₂ emissions and electricity costs with a direct supply of cooling energy and generate additional revenue streams by participating in the power markets and exporting the thermal energy, e.g. for district heating.

Power producers/utilities

Grid operators and power producers have to integrate renewable energy sources and ensure the stability of the grid. As a large-scale energy storage system, MAN ETES can balance the supply and demand of renewable energy while providing hot and cold thermal energy.

Key components

- **Renewable energy**
Wind, solar or other renewable energy sources provide the electricity for a MAN ETES system.
- **MAN HOFIM™ compressor**
Efficient, oil-free, and robust compressor to generate heat.
- **Expander**
The cold energy is generated via an efficient and compact CO₂ expander.
- **Storage tanks**
The size of the tanks determines the capacity of the system. The storage fluid is water.
- **Heat exchanger**
The different circuits of the system are connected via heat exchangers. They are also used to export the thermal energy.
- **Power turbine and generator (optional)**
In electrical discharging mode, the turbine drives a generator in order to generate electricity.
- **Energy management system**
The complete charging, storage, and discharging process is controlled and optimized by the energy management system.

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