MAN Energy Solutions
Future in the making

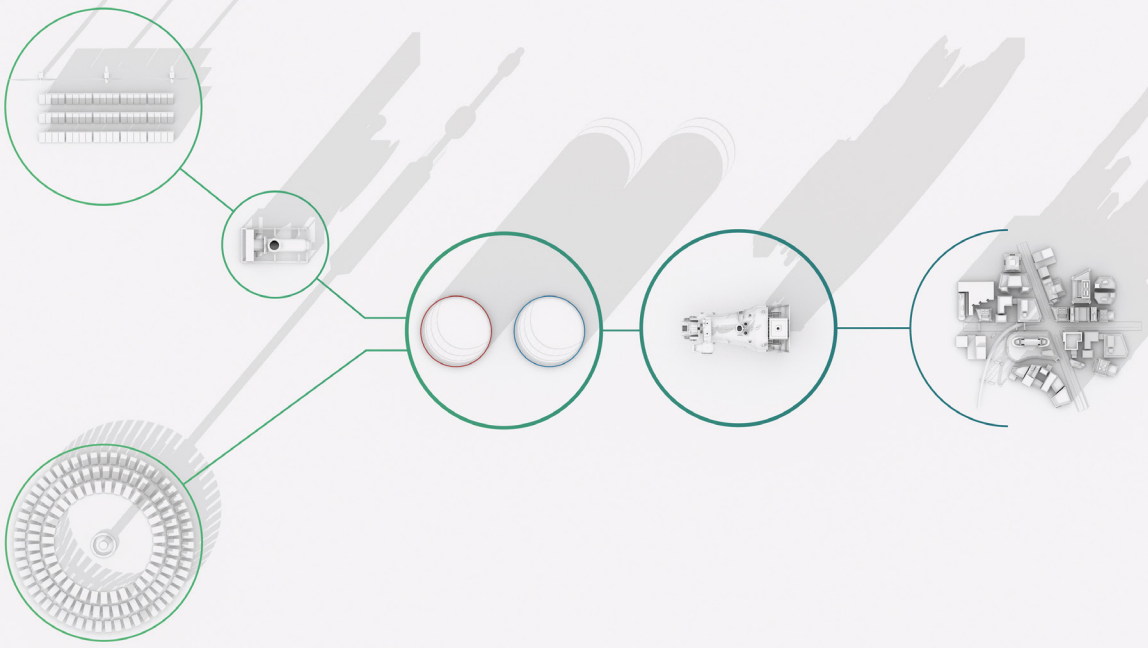
MAN MOSAS

Molten salt energy storage

MAN molten salt energy storage (MOSAS) is an economical and flexible technology that can be integrated in various applications. It stores the heat of renewable energies directly, e.g. from concentrated solar power (CSP), or indirectly via electric heaters or heat pumps. The heat is later converted into steam to directly feed the consumer or to power a steam turbine and generate electricity when there is no sunshine or wind. Storage systems based on MAN MOSAS achieve excellent efficiency due to the high operating temperature and heat transfer properties of molten salt.

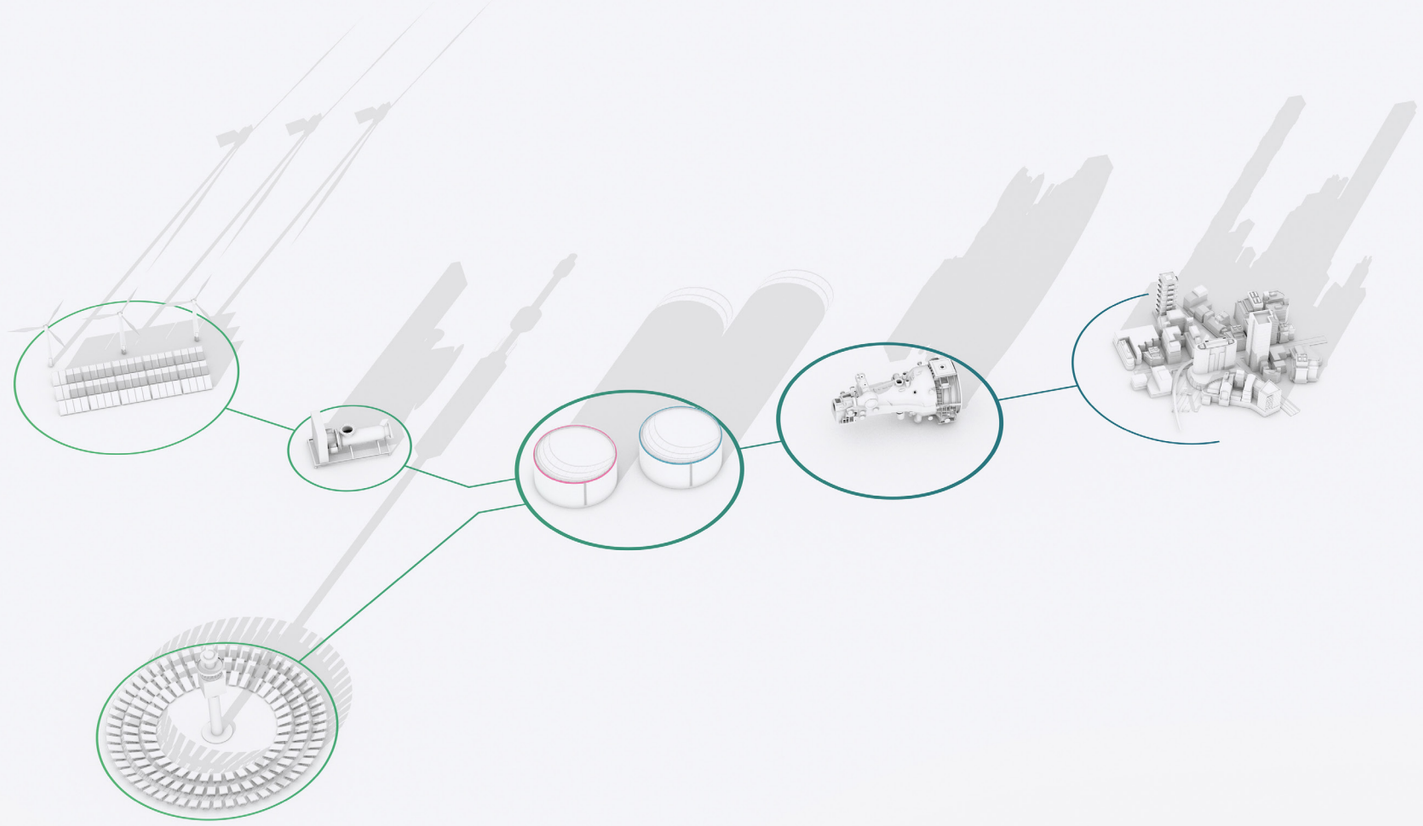
Benefits at a glance

- Makes fluctuating renewable energy dispatchable
- Long-duration storage technology for renewable energy
- Decarbonized power generation
- Retrofitting of thermal power plants, e.g. coal-fired power plants
- Grid stabilization, peak shaving of volatile electricity
- Optimized levelized costs of electricity in combination with CSP technology



Energy & storage systems

Decarbonized energy for the future



Grid stabilization is needed

The energy sector is the main producer of CO_2 emissions. Renewable energy sources have become widely available, increasingly replacing conventional power generation based on fossil fuels or nuclear. The increasing expansion of renewables inherently leads to supply fluctuations which put a strain on the grid. Due to the non-dispatchability of solar and wind energy, a mismatch between supply and demand often needs to be dealt with. It is just as important to reduce CO_2 emissions in other sectors where full electrification has not been possible so far. In both cases, MAN MOSAS can play an essential role. Firstly, by combining renewables with MOSAS, fluctuations can become manageable. Any mismatch between supply and demand can be solved by shifting large amounts of renewable peak energy into hours of high demand, allowing further expansion and integration of renewables. Secondly, by connecting MOSAS to a renewable energy source and providing sufficient capacity for energy storage, large amounts of renewable steam at the required temperature and pressure levels can be made available in an efficient and reliable way. MOSAS has the ability to become a key element in the transformation of energy markets. MAN MOSAS targets mainly long-term power storage for a discharge duration of beyond four hours, as well as power-to-heat applications providing a renewable and dispatchable steam supply to various industrial processes.

General competence

MAN DWE is the market leader in molten salt reactor systems and has more than 70 years of experience. We offer full engineering, procurement, and construction (EPC) services for MAN MOSAS plants all over the world. With effective technologies, renewable energy is economically sustainable at a global level. That is why we are developing our technology and looking for new and more advanced storage solutions together with our partners in power generation, industry, and science.

Key components

- **Renewable energy**
  Renewable energy sources provide the power for a MOSAS plant.

- **Electric heaters**
  Electric heaters powered by renewables transform surplus electricity into heat stored in molten salt.

- **Heat pumps**
  MOSAS in combination with heat pumps leads to further efficiency increases.

- **Molten salt storage**
  Hot and cold storage tanks are part of the system for adjusting the storage capacity by means of tank volume.

- **Molten salt heat exchangers**
  Heat exchangers provide an efficient and technologically proven way to convert the heat stored by molten salt into steam.

- **Steam turbines**
  Steam turbines driving a generator transform the heat stored by molten salt back into electricity when needed.

MAN MOSAS system solutions

Long-duration energy storage

Renewable energy is used to run an electric heater or heat pump to heat up cold molten salt, which is then pumped into a hot molten salt storage tank. For discharging, the hot molten salt is processed further through a steam generator, followed by electrification in a steam turbine cycle. Therefore, the combination of renewable energy with MOSAS provides the requisite dispatchability offering “higher-value” electricity to the grid or the customer.

Energy recovery

MAN MOSAS can optimize industrial batch processes with high flue gas temperatures. By transferring flue gas energy to the molten salt storage, the fluctuation is compensated for and continuous energy production is possible, thereby reducing the costs associated with the process.

Concentrated solar power

In combination with concentrated solar power (CSP), MAN MOSAS offers a sustainable way to achieve low levelized costs of electricity (LCOE) and increased capacity factors in the Sun Belt region. By storing thermal energy in an integrated molten salt energy storage system, CSP plants can keep operating at nighttime or when the sun is not shining.

Power-to-heat

For charging, the same principle as above is applied. For discharging, steam generated in the molten salt steam generator is fed to the consumers. For special applications, the hot molten salt may be directly used for process heating. Hence, MOSAS connected to a renewable energy source ensures sector coupling, allowing decarbonization of industrial heat generation with high steam demands.

Conventional power plant retrofits

Long-term storage systems like molten salt are suitable for retrofits, for instance as a replacement for coal-fired steam generation parts in an existing coal plant. By adding electric heaters or heat pumps (driven by renewable energy sources), storage tanks, and molten salt heat exchangers for steam generation, the rest of the plant’s facilities, such as power block and cooling systems, can be kept in place. Thus, a truly decarbonized generation asset can be created by modifying existing plants with reduced investment costs compared to a new built plant.

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