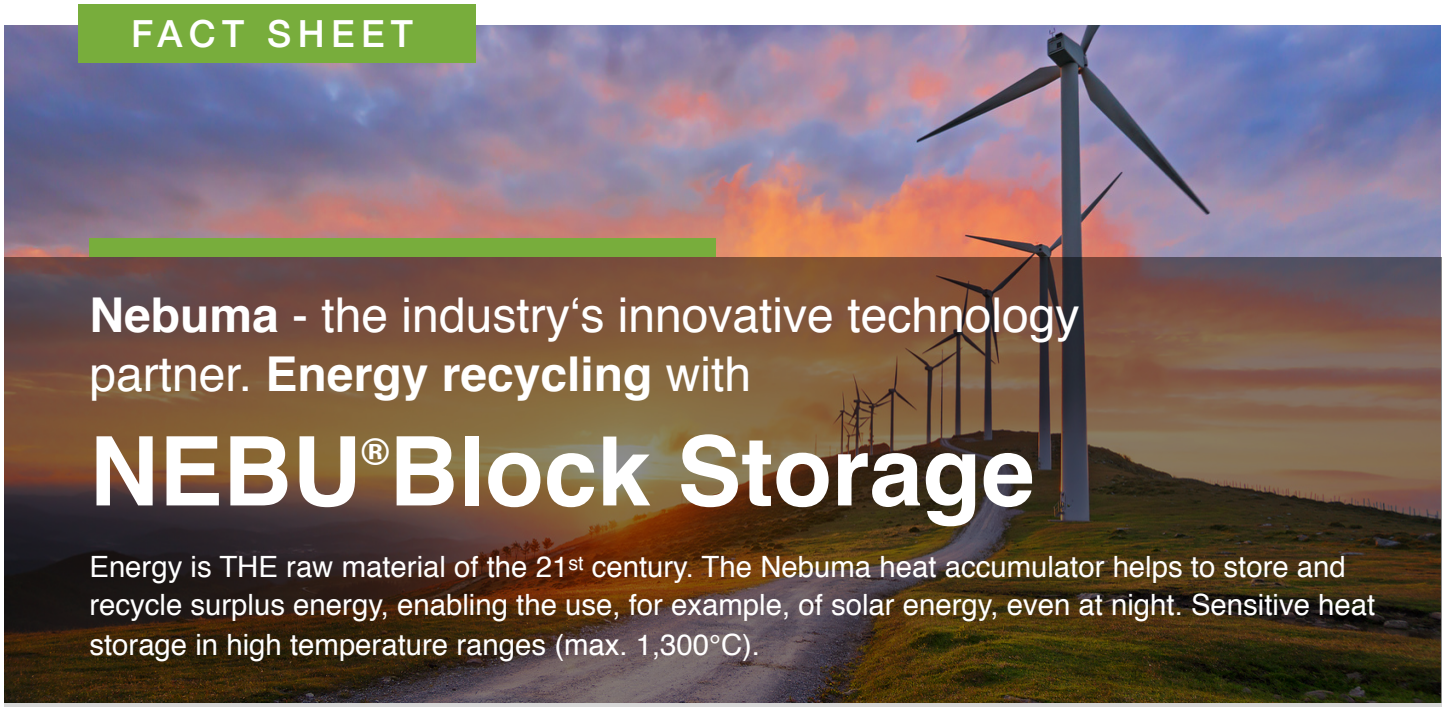
FACT SHEET



Nebuma - the industry‘s innovative technology partner. **Energy recycling** with

NEBU®Block Storage

Energy is THE raw material of the 21st century. The Nebuma heat accumulator helps to store and recycle surplus energy, enabling the use, for example, of solar energy, even at night. Sensitive heat storage in high temperature ranges (max. 1,300°C).

Why heat storage?

- **Huge abundance of waste heat sources (around 280 TWh/year in Germany)**
- **Heat demand at 51.7% of the total energy requirement (Germany)**
- **Heat recycling makes both economic and ecological sense**
- **Mobile heat expands the standard repertoire**
- **By recycling, primary energies (Gas, Oil and Coal) are spared and the carbon footprint of energy production is reduced (increased sustainability and energy efficiency)**

Innovative storage materials

The key feature of this piece of innovation is the capability for efficient heat storage. The calculous, synthetic storage material combines, through nano-technological processes, natural material properties with the high-temperature properties of technical ceramics. This opens the door to an incredibly broad scope of application, from room temperature right up to 1,300°C. This thermal stability, paired with an extraordinary thermal energy absorption capacity, and outstanding storage capability, ensures maximum efficiency through the whole storage process (heat absorption/storage/discharge). NEBU®Block varies both in model and composition. Alongside our patented high-temperature binding agent, we are able to utilize many raw materials from recycled materials. Alongside increased material efficiency (sustainability), optimum storage capacity and thermal conductivity are achieved with a clever combination of raw material and binding agent. Other storage materials available on the market lack this advantage. In terms of shape, the storage material can be produced either as a solid block (similar to concrete) or as granulate. Granulate storage units can be charged directly with hot waste gases (thermal oil, salt and concrete require a recuperator and heat exchanger), making the process engineering considerably simpler. The storage granulate is charged directly with hot waste gas without being diverted through a heat exchanger, thus enabling its use in temperatures above 500°C.

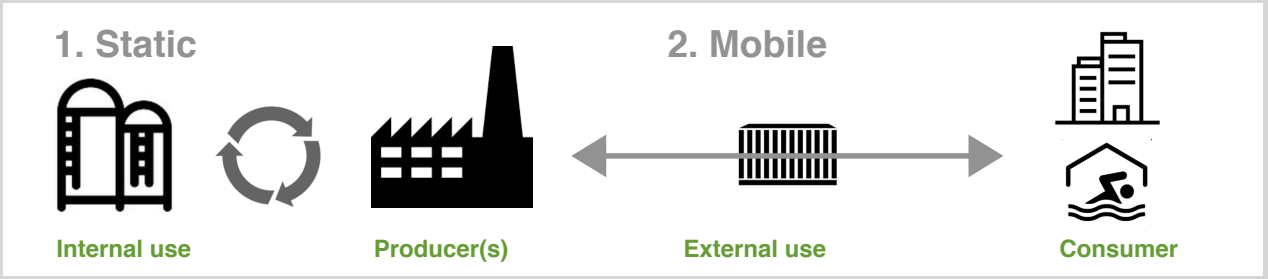
- **Heat storage of 20 – 1,300 degrees C**
- **high storage capacity, minimal space requirements**
- **simple “mechanical” concept (few moving parts, valves etc.) therefore reduced probability of default, and rapid maintenance**
- **Easily exchangeable storage material**
- **Both static and mobile concepts**
- **Chargeable with (waste) gas, steam, oil, liquid salt**
- **standardized modular concept (replicable as desired)**

NEBUMA



With the development of standard modules, the storage can be constructed as “mobile”, where the modules are installed into customary containers and can be easily transported from the heat source to the new energy user. This container construction method also allows for the stacking and linking of multiple units. This flexibility combined with the granulate’s extraordinary material properties facilitates a widespread use of such energy storage, from renewable energy (industrial solar thermal energy, wind and photovoltaic electricity can all be coupled and converted into heat), to industrial operations (e.g. galvanizing plants and metal works) to classical industry sectors such as chemicals, ceramics, glass or heavy industries. There are, as yet, no mobile storage concepts on the market that match this efficiency and capacity. In this way, considerable advantages now present themselves to energy providers and consumers.

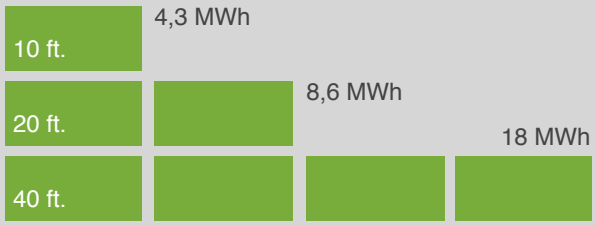
Areas of application: https://www.nebublock.com/



Storage capacities

40 - 15.000 m^3
20 MWh - 6,4 GWh

Static



Modular

The technical specifications depend a lot on the boundary conditions of the technology’s effective implementation. The performance indicators also, owing to the very large spectrum of sensitive storage units (from a few liters to 15,000m^3), vary greatly. Both types of storage are unpressurized storage units, the maximum storage unit temperature thus 1,300°C. Usable temperature difference 50-1,300 K. Loss over time dependent upon insulation thickness, thermal conductivity and surface-to-volume ratio, typical figures approx. 5-8 K/day for mobile units and approx. 50 K/month for static storage units.

Sustainability is the keyword in our developments. This begins with material selection (generally recycling materials), goes on to the carbon (CO_2) balance (only 320kg/tonne storage material, compared to 900kg/tonne concrete) and progresses into application, heat storage and recycling.

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