



bGen™ - Energy when you need it

High Temperature Energy Storage for Industrial Heat



bGen™ - ES-7013

Storage Based Steam Generator

Charged With Electricity, Deliver Industrial Heat on Demand

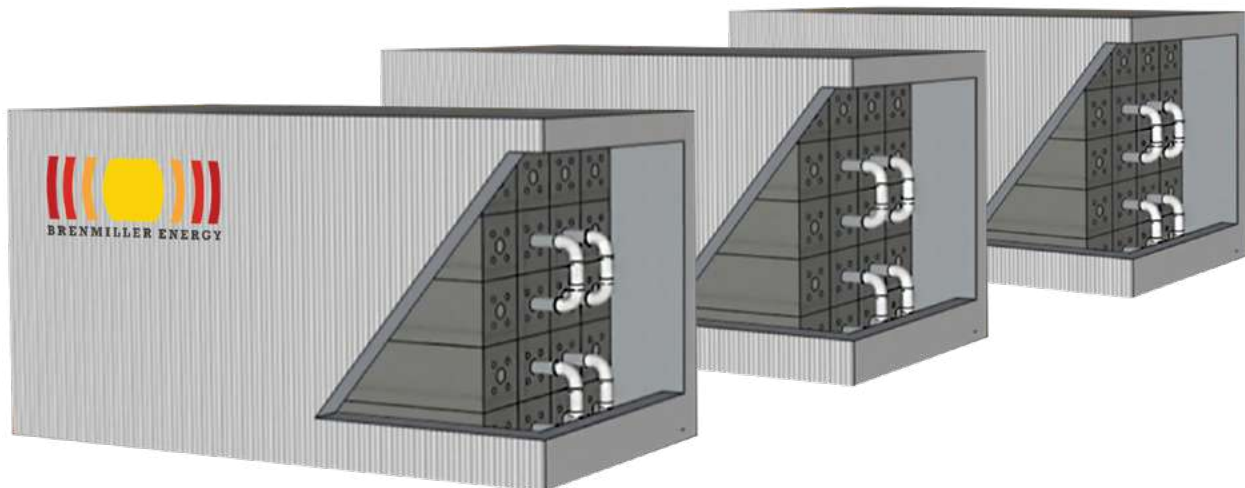




Product Functionality

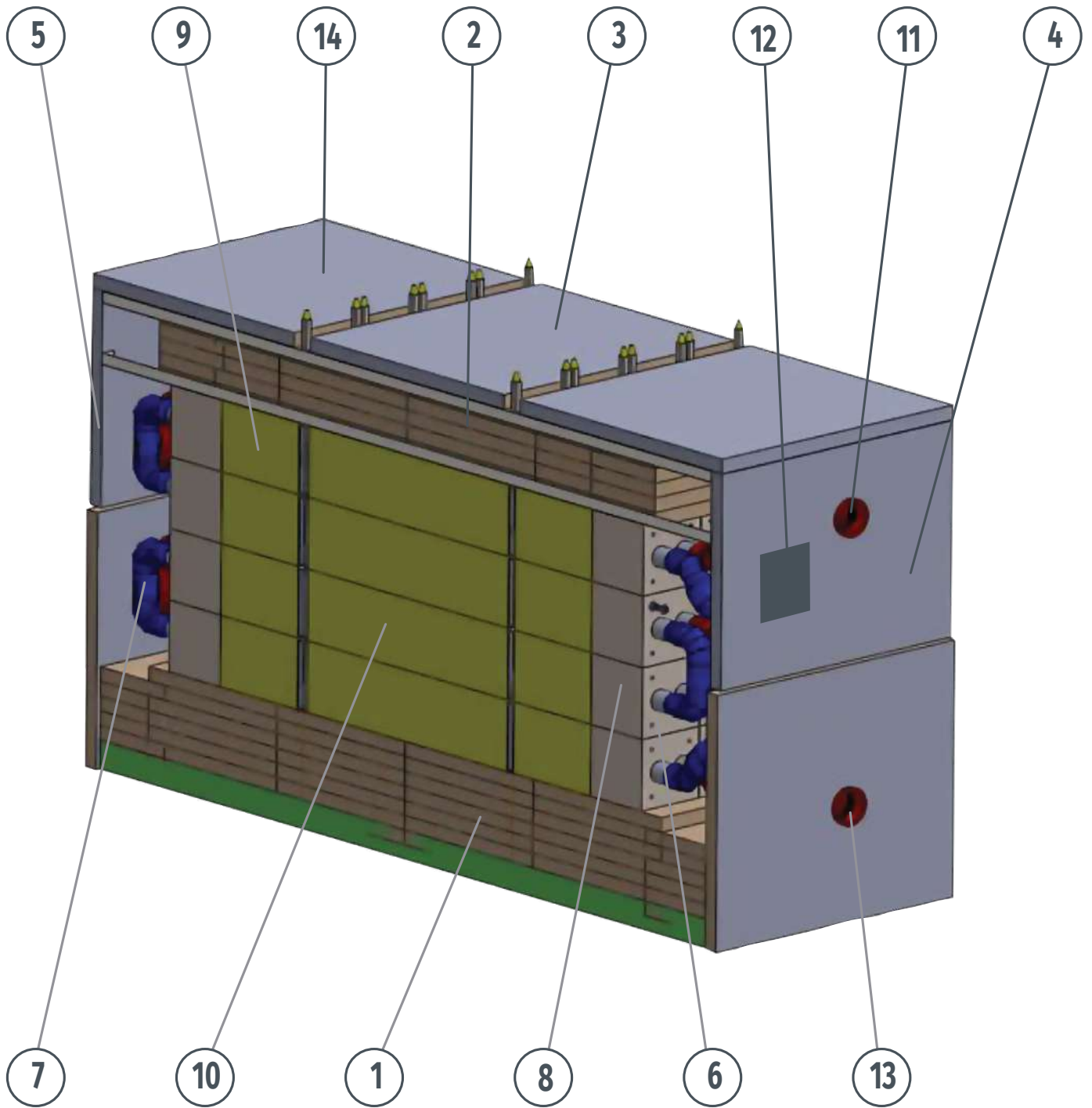
The ES-7013 product from Brenmiller Energy is a high temperature Energy storage unit, charged from an Electrical source such as renewable energy from a PV field, renewable energy from a Wind Turbine or directly from the Grid when electricity tariffs are low. The electricity input is converted to a high temperature heat inherently within the ES-7013 unit, using embedded conversion heaters. As a result, the achieved conversion efficiency from electricity to heat is 99%. Through the patented technology, utilizing inherently the electricity conversion to heat, the heat exchanger, the steam generator and the storage media, the charged energy is stored internally as high temperature heat and delivered as Industrial Steam, Hot water or Hot Air. Such an output delivery takes place only when demanded by the industrial process or tool, at the production floor. The technology decouples between the intermittent charging time

slots of the Electricity sources and the diverse delivery time slots of the output. As part of the system design, charging from electricity sources and delivery of steam can take place in parallel or in serial, with no dependency between the 2 cycles. PV for instance, can charge the ES-7013 during the 8 sunlight hours while steam output from the charged unit can be delivered continuously for 20 hours during the working shifts of the production floor. In a different scenario, steam can be delivered during the evening 6 hours of high Grid tariff. The system has a high economic value in cases of high gaps between TOD electricity slot prices or high gaps between the Grid electricity prices and the available renewable electricity sources as wind or solar. Multiple ES-7013 units can be used to form the size of a certain application.



Key Advantages

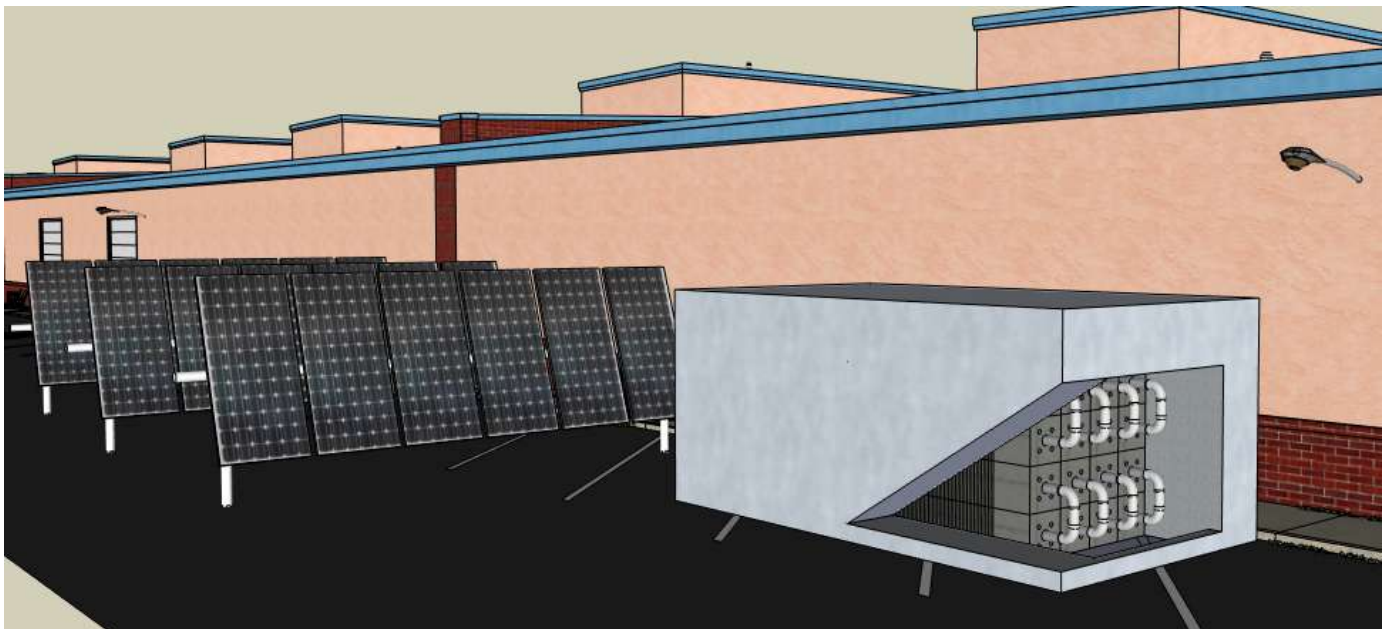
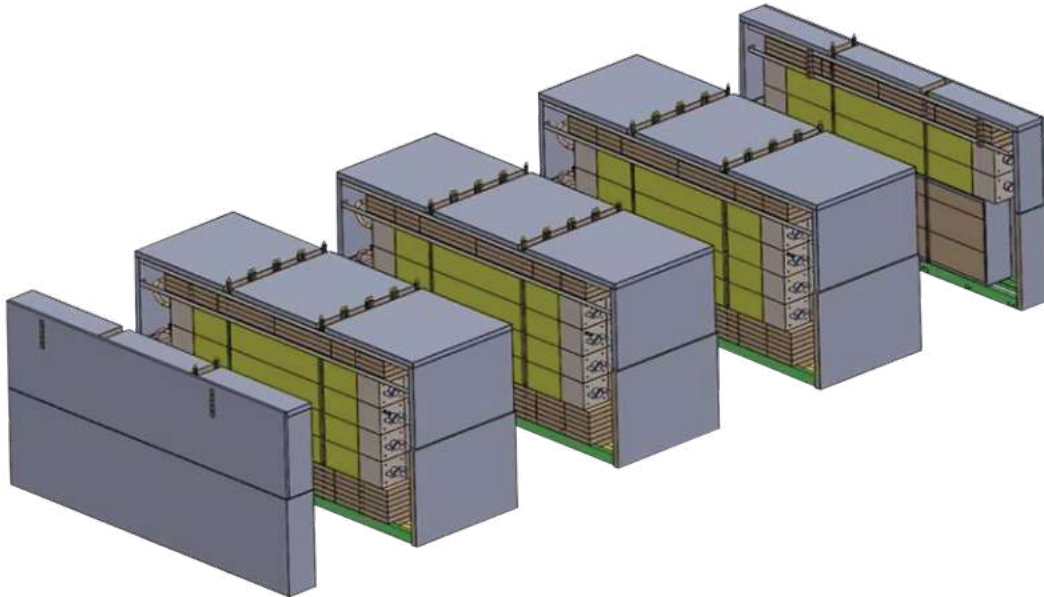
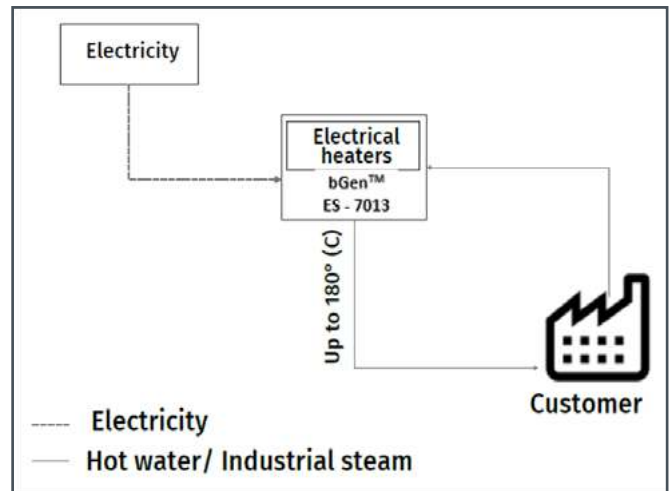
- 1 Renewable Enabler** – The system method is an enabler for utilization of intermittent renewable electricity sources for a steady industrial heat delivery with reduced CO2 emissions.
- 2 Financing** – A significant saving through the switch to the PV or Wind energy source
- 3 Flexibility** – The ES-7013 can accept different electricity sources from PV, Wind or direct Grid
- 4 Efficiency** – By decoupling between the charging from intermittent electricity sources and the delivery in different time slots of the industrial heat, overall efficiency is increased.
- 5 Lifetime** – The used storage media enables tens of thousands of charge/discharge cycles with no performance degradation and a lifetime of 30 years with no storage media replacement.
- 6 Modularity** – Multiple units can be utilized to form a size which matches the customer need.
- 7 No Hazardous** – Zero Emissions are added to the environment due to the use of the ES-7013. The system is built from green only materials with no hazardous to the environment or special chemicals inside.
- 8 Heat Losses** – The internal storage losses are only 3% in a 24 hours time period.



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|-----------------------------------|-------------------------------|
| ❶ Bottom Insulation | ❸ Front Insulation |
| ❷ Top Insulation | ❹ Back Insulation |
| ❸ Sealed Housing | ❺ Storage Media Cubes |
| ❹ Front Housing | ❻ Steam Outlet |
| ❺ Back Housing | ❼ Electricity Charging Supply |
| ❻ Internal Interconnecting Piping | ❽ Water Inlet |
| ❼ Back Interconnecting Piping | ❿ Unit Handling Points |

Technical Details and Performance

Electricity from renewable sources, is input directly to connection point of the ES-7013. The conversion to high temperature heat is performed by the embedded Electrical heaters in the charging piping of the system. No gasses or emissions are produced at this stage. In parallel or in a totally different timing, cold water is flowing through the separate discharging piping system of the unit and industrial steam (180°C, 10 bars) is delivered to the process or tool. Returned water goes back to the ES-7013 unit for a new cycle of heat delivery. The 2 separate cycles inside the unit enable a full control and flexibility for the charging and discharging conditions in regards to timing, flow and temperatures.



Technical Details and Performance

The ES-7013 unit can be used as a stand alone unit or multiple such units can be integrated to form storage based steam generator with a bigger size, suitable to the specific application and customer. Input and output conditions will stay the same while the energy storage size can be multiplied to the required scale. Modifications will be performed to optimize to total new configuration in regards to the input and output piping, used Biomass burners and integration hardware.

Technical Data of the ES-7013	
Storage Capacity	2000 Kwh
Max. Power	300Kw
Full Discharge Time	6.7 hours
Efficiency	96%
Electricity Input	3 Phases, 400V
External Dimensions (W x H x L)	2.0 x 3.0 x 5.8 m
Steam Output Pressure	10 bar
Steam Output Temperature	180°c
Heat Losses	3% / 24 hours
Response Time	60 seconds

Construction

The ES-7013 is supplied and shipped as one and integrated unit. Once the ground preparations are performed, installation is short and focused on connections to the required interfaces. Specifications are supplied for the various interfaces according the below topics. Installation and integration are completed when a full acceptance test has been performed.

- SW/Control Interface
 - Piping Interface
 - Ground preparations
- Water Requirements
 - Installation Tools
 - Acceptance Test



Safety and Standards

Standard	Description
ISO 9001	Quality management systems
ISO 14001	Environmental management systems
OHSAS 18001	Health and safety management system
CE / UL	Directives for CE/UL listed
ASME 31.1	Power piping
Eurocode8, US ASCE 7-98	Building and foundations
TA-LUFT, BEMS	Gas emissions

Operations & Maintenance

The ES-7013 unit is fully automatic and operated through a software communication protocol. No special local operator is required for operating the system. Local customer maintenance or operating staff will go through a grade A O&M course which will enable them to give full support of the hardware and communication topics. A special monitoring screen for control of the unit. Hardware items of the system do not require any preventive or periodic maintenance. Brenmiller Staff will support the customer with any grad B topics which are not covered by the local maintenance or operating staff, upon demand.

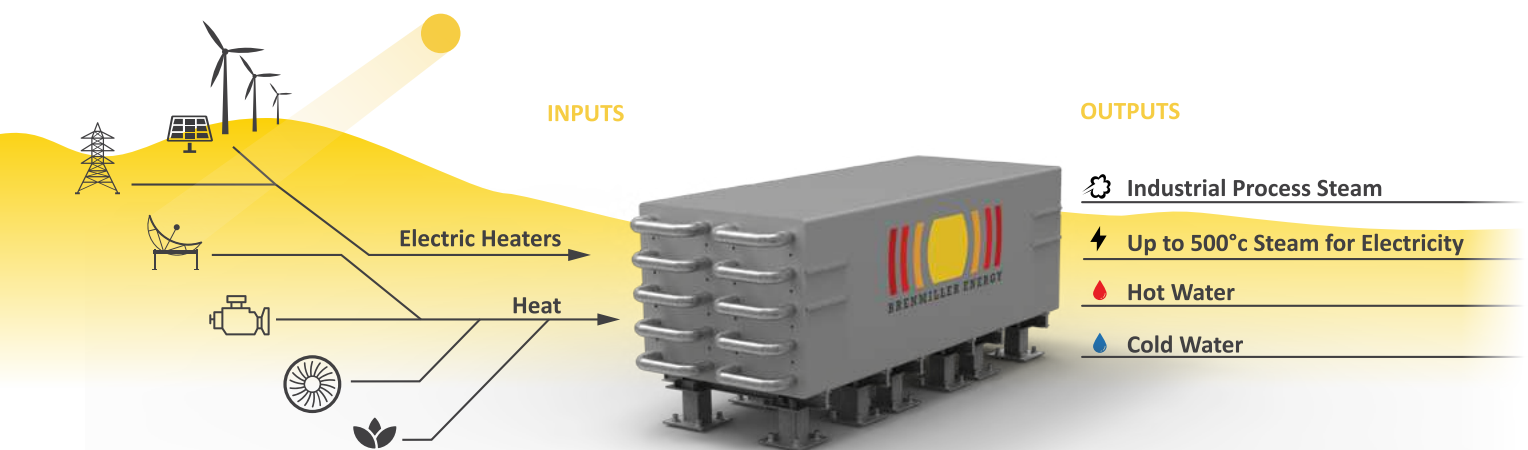
Company Profile

Brenmiller Energy, based on its unique storage technology, provides sustainable energy solutions to the distributed generation market.

The company was founded in 2012 by Avi Brenmiller, former CEO of Siemens CSP and Solel, and a team of experts in the field of renewable energy. Brenmiller Energy's knowledge and expertise are well-grounded and are based on years of field experience in designing, building and operating solar power plants in Spain and in US of over 500MW.

Recent accomplishments include being awarded a \$1M grant for a joint project with the New York Power Authority, as well as being awarded a grant by the Ministry of Defence for an energy storage project.

The company completed a successful IPO in August 2017 and is now being traded on the Tel Aviv Stock Exchange.



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