Decarbonizing Industrial Process Heat

Steam generation with Integrated Energy Storage

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Magaldi Group

Founded in 1929 in Italy, **Magaldi Group** is a leading manufacturer of **steel belt conveyors** to handle **high temperature materials**, used in solid-fuel power plants, foundries, steel mills, mineral processing plants, cement plants and waste-to-energy plants, with more than 2000 installations worldwide.

In recent years, the Group has started to be active in the renewable energy field developing innovative **CST technologies** and a **Power-to-Heat (P2H) Thermal Energy Storage (TES)** based on **solid particles fluidized bed**.

Dependable innovation (50+ patents, 20 proprietary technologies)

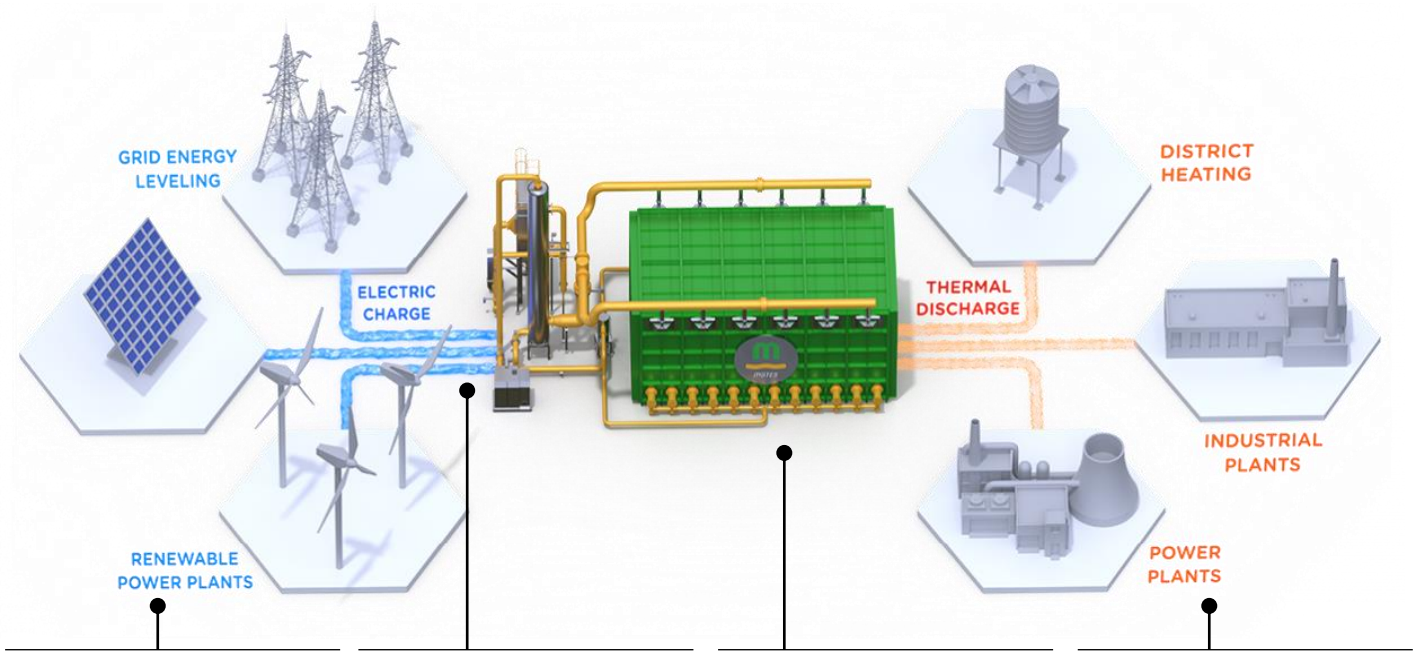
Manufacturing steel belt conveyors for high temperature materials, present worldwide

Focus on Concentrated Solar Power technology

Development of Long Duration Thermal Energy Storage technology

MGTES - Magaldi Green Thermal Energy Storage

MGTES is a worldwide patented **P2H Thermal Energy Storage**, based on Fluidized Bed of Solid Particles.
When charged by **Renewable Energy Sources (RES) electricity**, MGTES is able to deliver **Green Heat on demand,** releasing it at medium high temperature heat, at the user's request**.**



1. Electricity is used to heat sand with resistive heaters
2. Air is blown to fluidize the sand and enable energy charge/ discharge
3. Heat is stored in sand at high temperature (up to 620°C)
4. Steam is generated and delivered on demand, tailored to meet customer needs

Decarbonize industrial processes

Optimize heat generation costs

Magaldi TES Fluidized bed operation

Fluidized Sand Bed
The system transfers energy
Charge and Discharge phases

Solid particles are **stable** at temperatures up to **+1000°C**
Charge and **Discharge** phases can be **simultaneous** or **not.**

Not Fluidized Sand Bed
The system stores energy
Hot stand-by phase

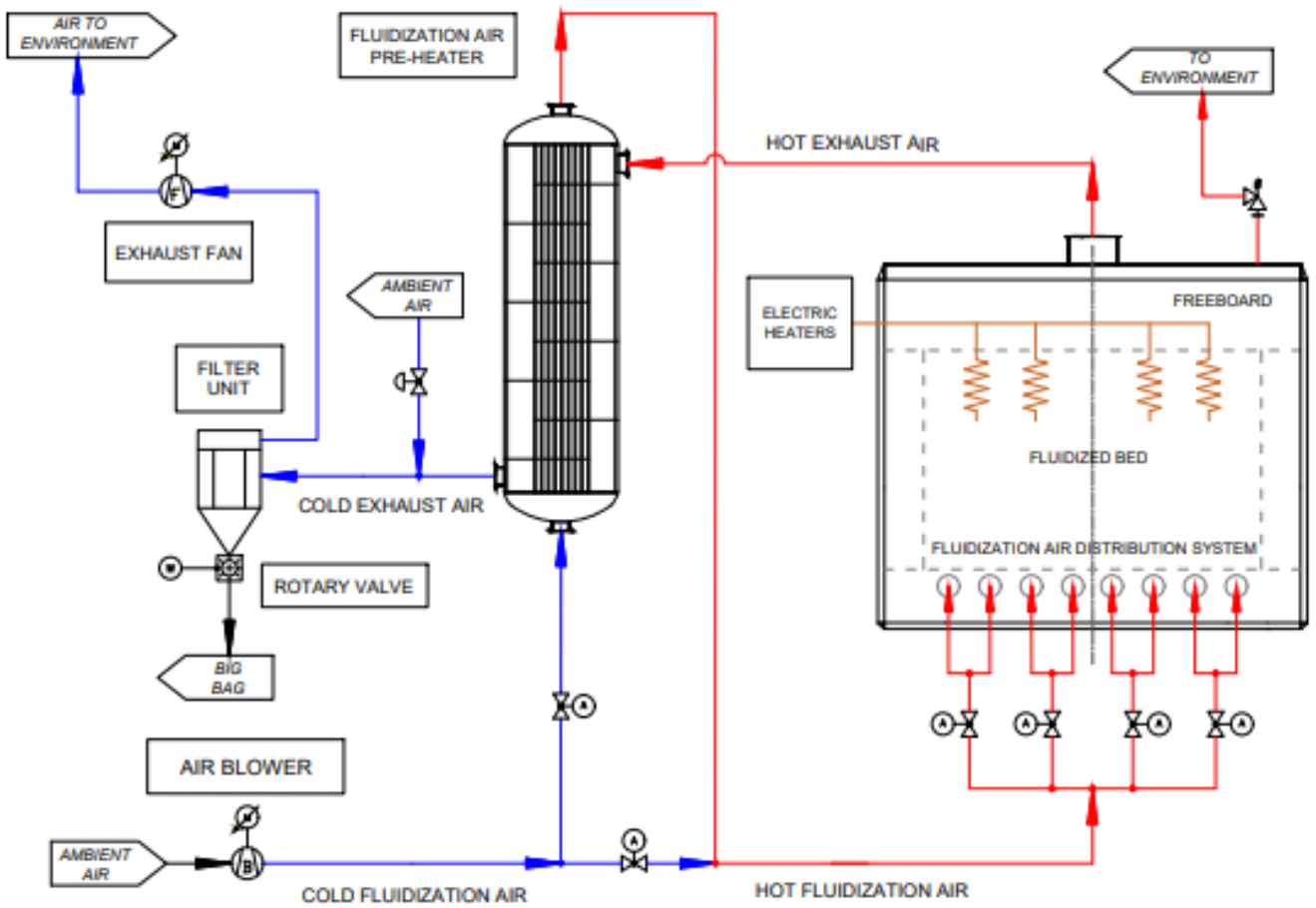
High Thermal Diffusivity
~ 1 x 10^{-3} [m^2/s]
i.e. ~ 1000 times higher than concrete, rocks, gravel etc.

Fast Response Time

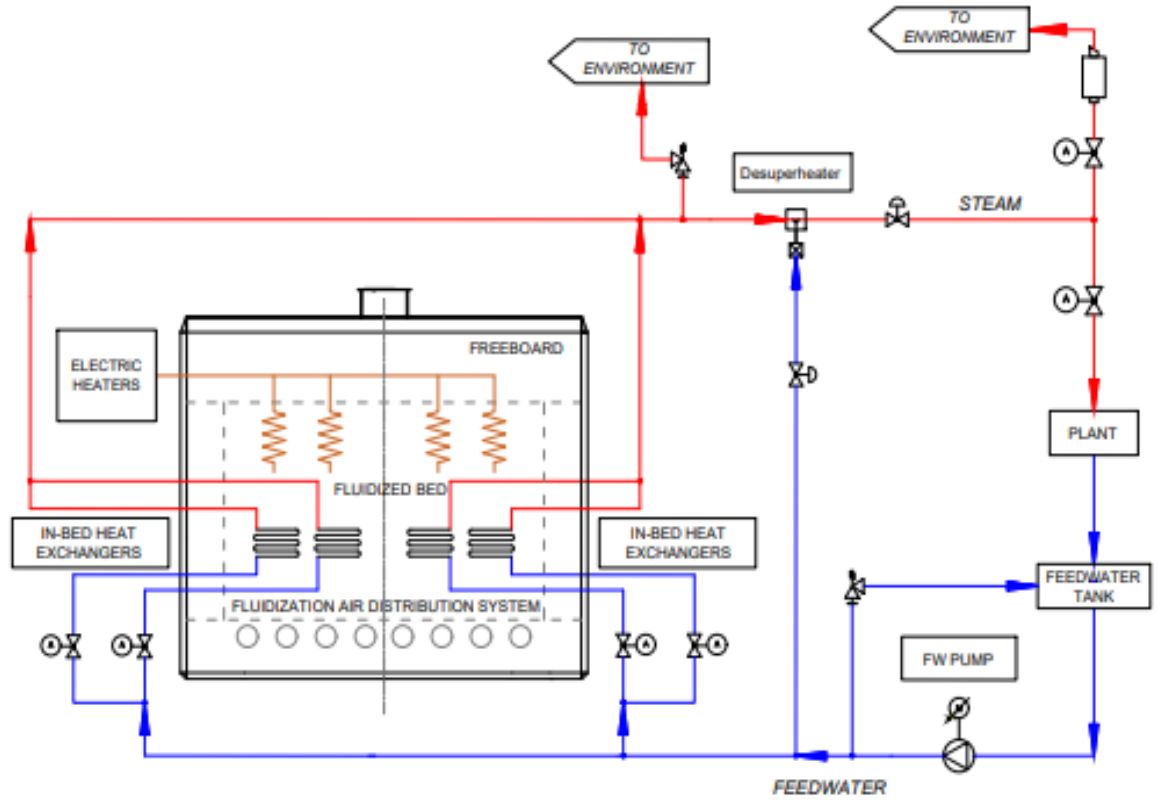
Long duration energy storage

< 1.5-2.0 % per day
Negligible losses

MGTES – Concept P&ID



Fluidization System



Steam Generation System

2021

Alpha 4 - Pilot Plant

Fluidized bed sand mass: up to 40 tons
Thermal Energy Storage: up to 4.3 MWh (@ΔT= 360 °C)
Charging Power: 450 kWe
Steam generation: 0.36 @ T/p >190 °C / 10 bar
Industry: test plant

2025

Beta X - Industrial Plant

Fluidized bed sand mass: 70 tons
Thermal Energy Storage: 7.5 MWh
Charging Power: 1.9 MWe
Steam generation: 0.72 t/h @ T/p 200°C/11.5 bara
Industry: Food & Beverage (vegetable oil refinery)

MGTES – Modules Standard Design

Typical MGTES module size	140 tons sand 56 m²	280 tons sand 97 m²	560 tons sand 178 m²	1120 tons sand 322 m²
Charging power (MW)	3.9	7.8	15.7	31.4
Full charge duration (hrs)	4 to 6			
Energy storage capacity (MWh)*	13	30	60	120
Discharging power and duration (hrs)	Customized to user's specifications			
Round trip efficiency	> 90%			

*steam temperature 200°C

Different **module sizes all utilize standardized components** (e.g. electrical heaters, fluidization air manifold, in-bed HXs, steel casing panels etc), for **easier scale-up** and **cost-effectiveness**.