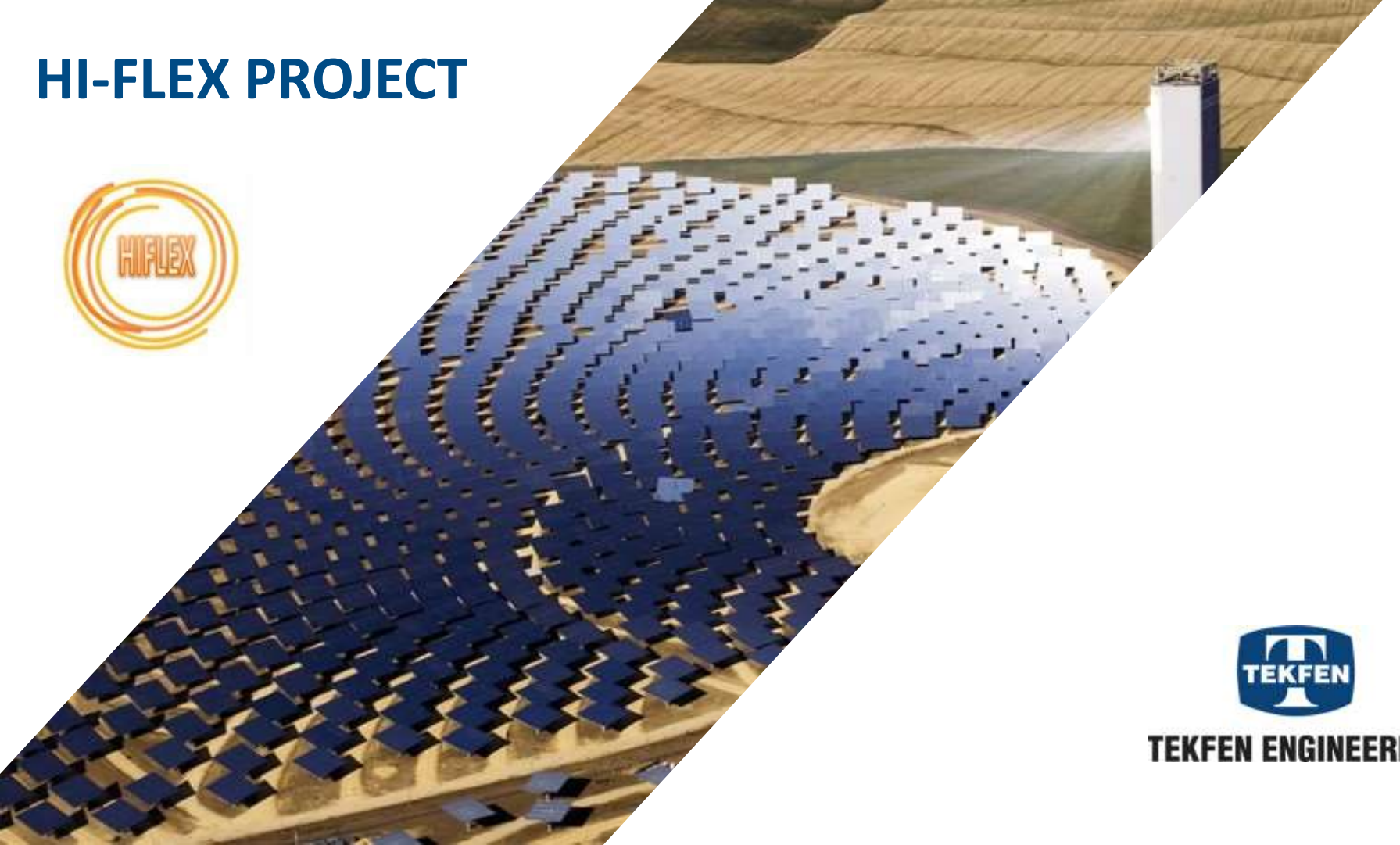
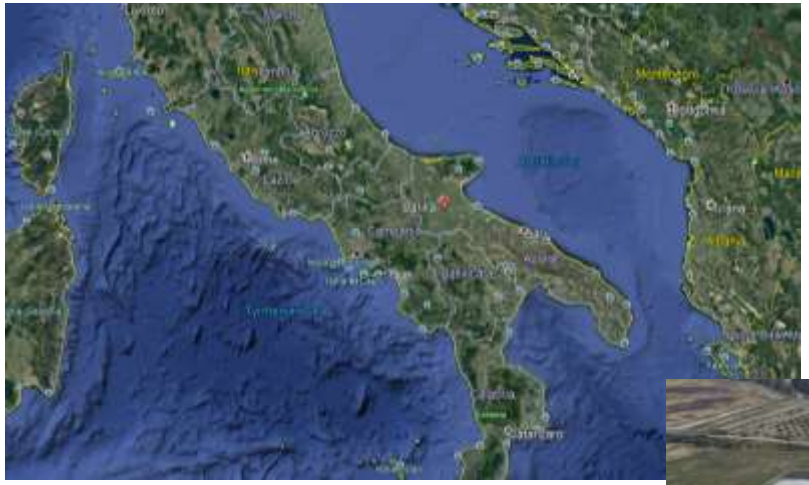
HI-FLEX PROJECT



TEKFEN ENGINEERING

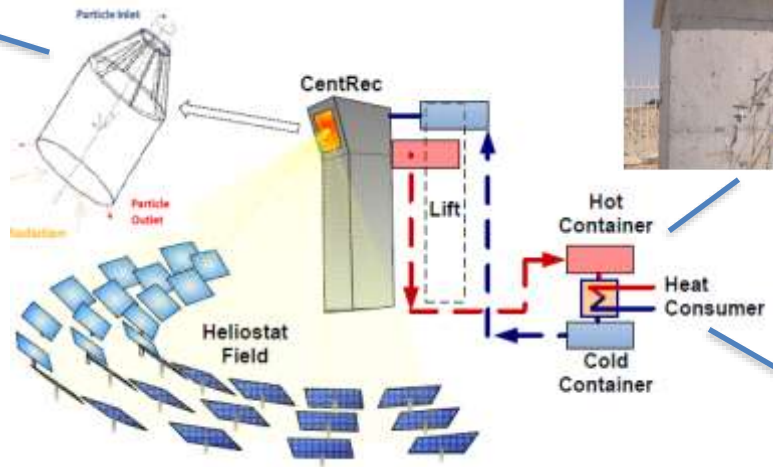
Project Location;

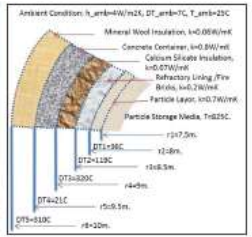


Hi-Flex is a tower type concentrated solar power plant project, which will be built in Barilla's Foggia pasta factory in Italy to supply process steam to facility.

Project Components;

HIFLEX project the worldwide first complete pre-commercial system using particle technology will be developed, built and demonstrated by eleven different partners; from seven different countries. The demonstration plant with 20 MWh thermal energy storage, 6000m² heliostat field and a 2.5 MWth receiver includes all components of a commercial-scale plant except for the state-of-the-art steam turbine.

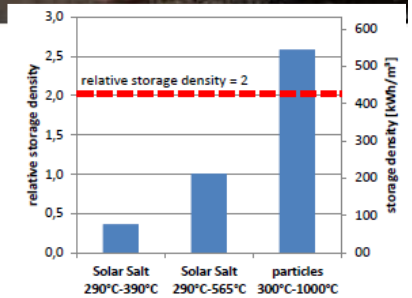


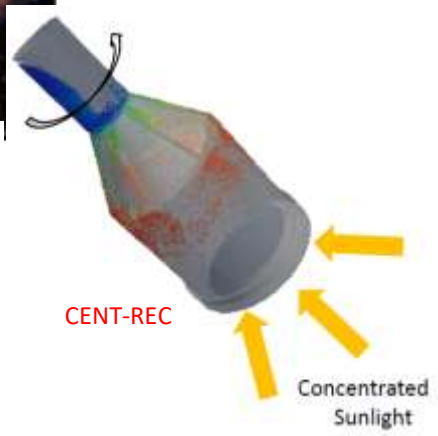


Solid Particle Technology;

The HIFLEX concept uses solid ceramic particles that are stable for temperatures up to 1000°C as heat transfer and storage medium. This innovative technology is the key to several advantages compared to state-of-the-art CSP technology. The large temperature range of the particles leads to very high storage densities and low storage cost, and enables dispatchable power supply with a high-efficiency CSP system. In addition, particle technology results in a significant reduction in investment cost.

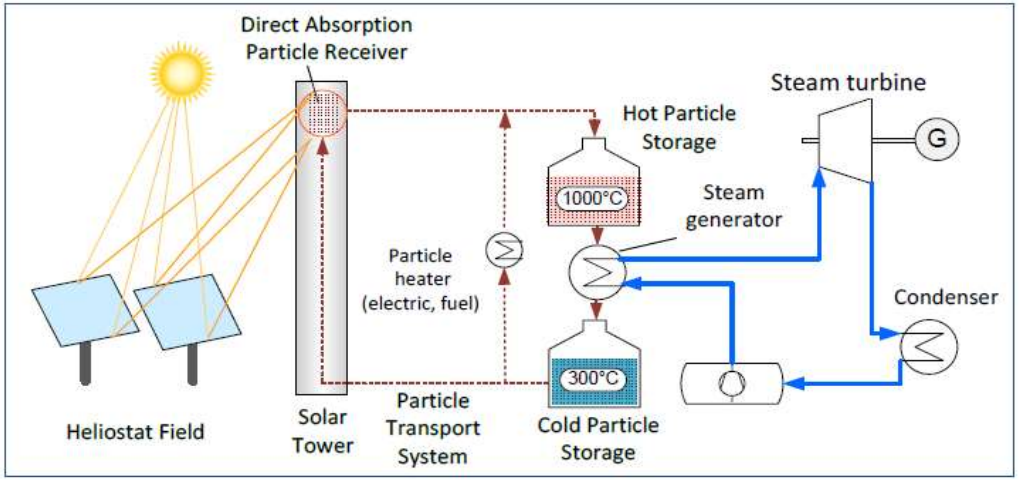
	Specific heat [kJ/kg]	Mass per kWh [kg/kWh]	Volumetric storage capacity [kWh/m3]	Specific material costs at 1€/kg [€/kWh]
Solar Salt (60%NaNO3,40%KNO3) T = 288°C - 565°C	446	8.1	204	8.1
Sintered bauxite particles T = 288°C - 565°C	314	11.5	175	11.5
Sintered bauxite particles T = 400°C - 1000°C	735	4.9	408	4.9





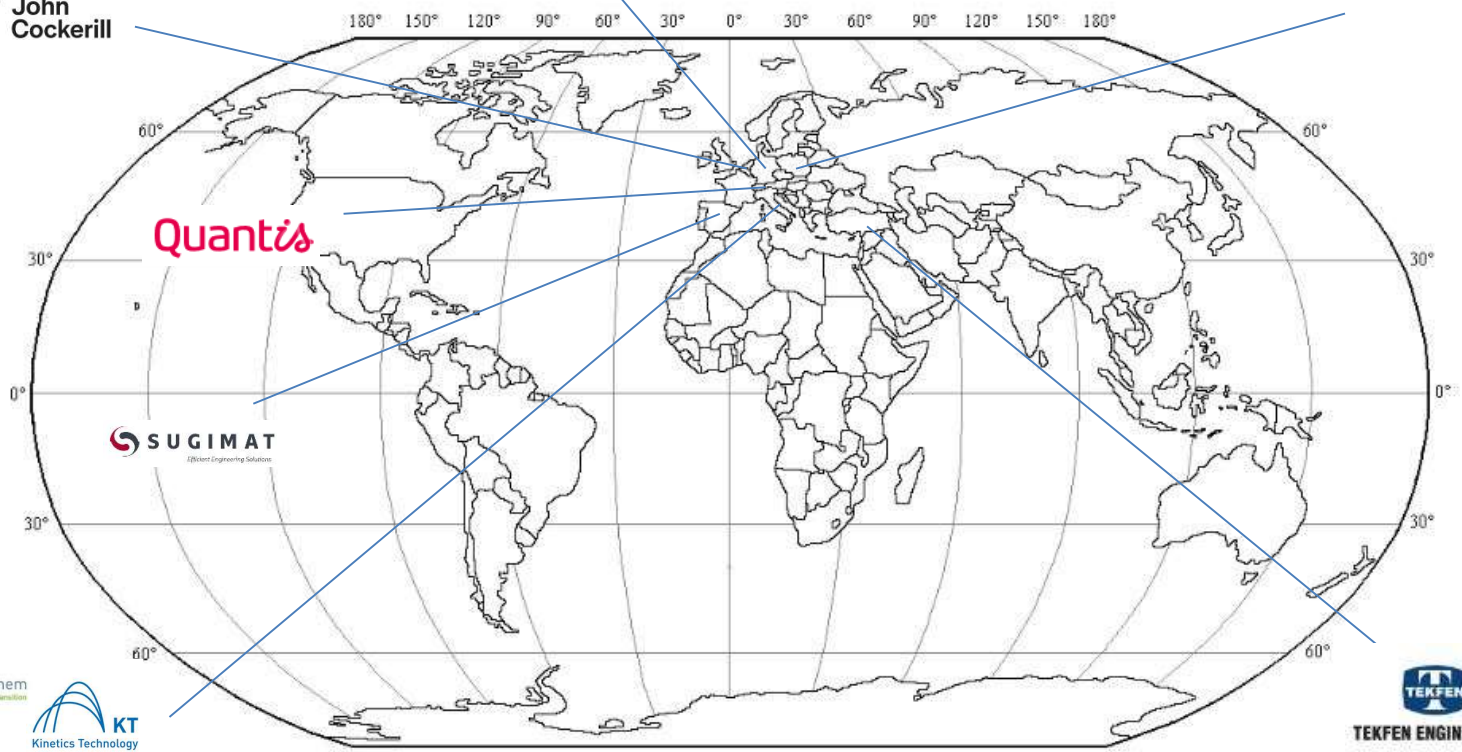
System Process;

The solar radiation is concentrated by heliostats onto the direct absorption particle receiver, where the particles are heated up (e.g. to 1000°C) while passing through the receiver. The hot particles are then stored in the hot storage container. For power production, particles are passing through the steam generator to generate steam for the steam cycle for power production. After passing through the steam generator, the cooled particles are collected in the “cold” storage (e.g. at 300°C).



During sunshine hours, the particles are transported up to the tower and get heated again. Hot and cold temperatures of the particles can be selected according to a techno-economic optimization, without strict technical limits. Unlike with molten salt, the particle system does not experience the danger of fluid freezing and thus does not need any trace heating.

Project Partners;



DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

HELIOHEAT

DÜRMEIER ANLAGENBAU & VERFAHRENSTECHNIK

INDYGOTECH MINERALS

John Cockerill

Quantis

SUGIMAT Efficient Engineering Solutions

NextChem Maire Tecnimont for Energy Transition

KT Kinetics Technology

TEKFEN ENGINEERING

Barilla The Italian Food Company. Since 1877.

Project Partners;

- Kinetic Technology-Nextchem (Italy): coordinates and supervises the project.
- DLR (Germany): designs the centrifugal particle receiver, electrical heater and back-up heater system with HelioHeat. Works on designing the steam generator that is supported by particle-CFD simulations and is focus on material issues such as particle characterization and optimization of the particle composition.
- Barilla (Italy): is the end user.
- John Cockerill (Belgium): is responsible of the particle Steam Generator basic and detail engineering.

KT Kinetics Technology

NextChem Maire Tecnimont for Energy Transition

DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

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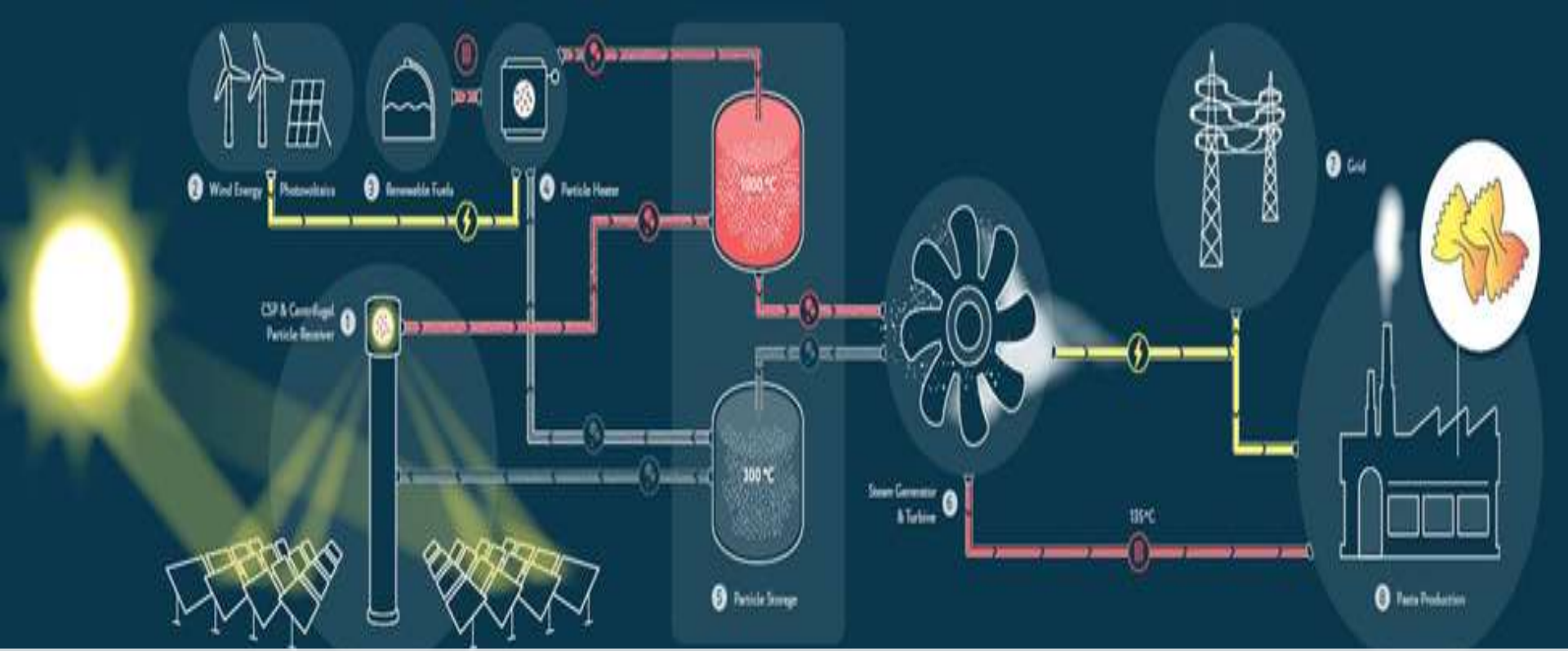
John Cockerill

Project Partners;

- Sugimat (Spain): is in charge for the manufacturing of steam generator and the condenser.
- Tekfen (Türkiye): is mainly responsible for the optimization, detailed engineering and manufacturing of heliostats and heliostat field.
- HelioHeat (Germany): manufactures and delivers the centrifugal Particle Receiver, the electric and the backup particle heater.
- Indygo Tech Mineral (Poland): is responsible for the production and delivery of the ceramic particles.
- Dürmeier (Germany): is responsible for design and delivery of the transport system for particles.
- Quantis (Switzerland): assessed the environmental and integrated sustainability performance of HiFlex project.


2 Wind Energy
Photovoltaics
3 Renewable Fuels
4 Particle Heater
1000 °C
CSP & Centrifugal Particle Receiver 1
300 °C
5 Particle Storage
Steam Generator & Turbine 6
135°C
7 Grid
8 Pasta Production

Thank you!