PEGASUS Renewable **P**ow**e**r **G**eneration by Solar P**a**rticle Receiver Driven **Su**lphur **S**torage Cycle

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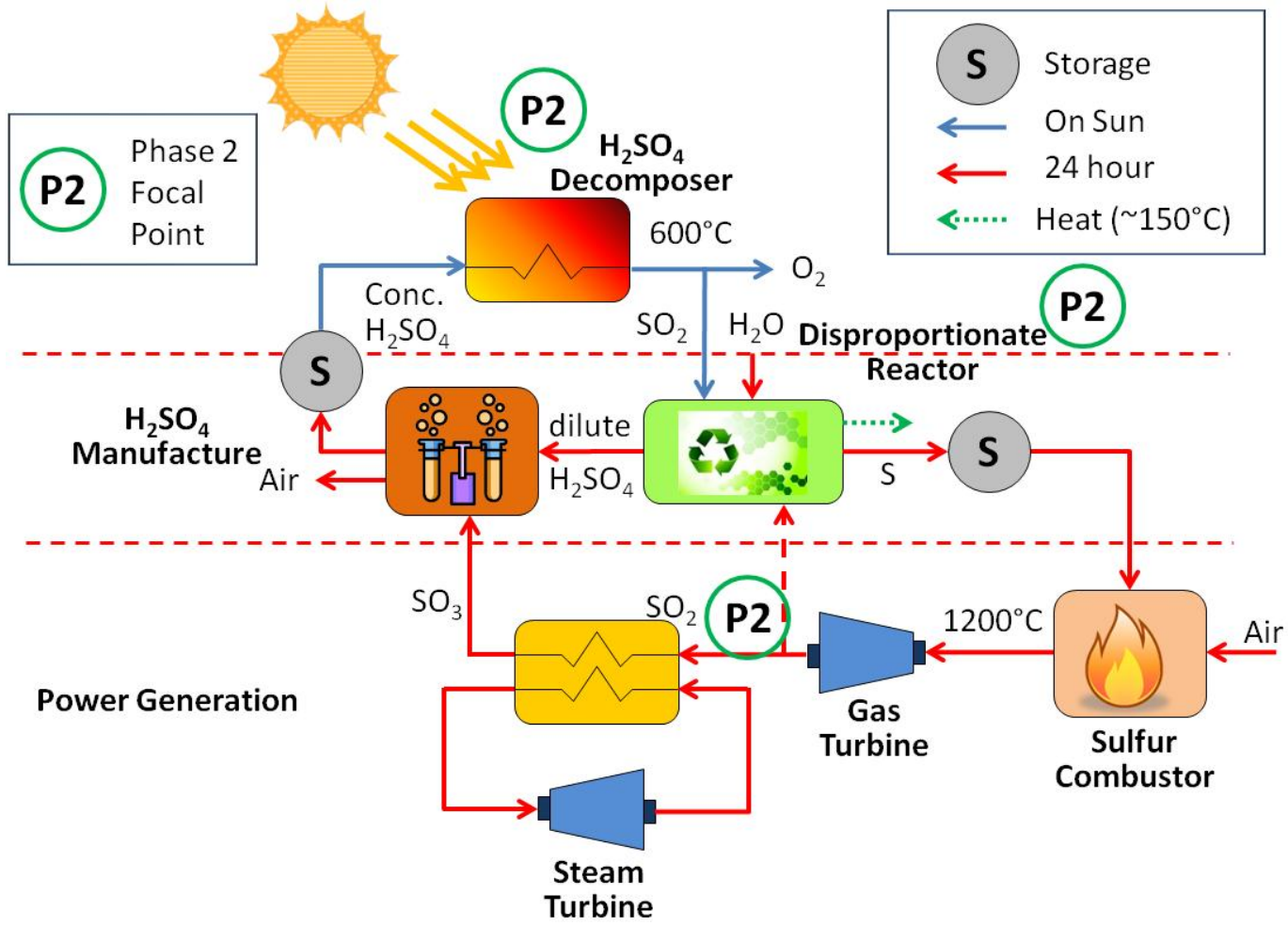
Sulfur Storage – The Baseload Project

DOE Metric	LCOE (¢/kWh$_e$)
DOE Goal	6.5
CSP /Sulfur Storage	~6*



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Sulfur in industrial processes

Sulfur pile

- Sulphur is required for **sulfuric acid** (SA) production
  - SA is world's most produced chemical
    $\Rightarrow$ Global annual rate **>200 Mio. tons**
  - SA is measure of industrial development
  - SA is mainly needed for **fertiliser production**

Sulfuric acid plant

- Sulfur from **desulfurisation of hydrocarbons** via Claus process

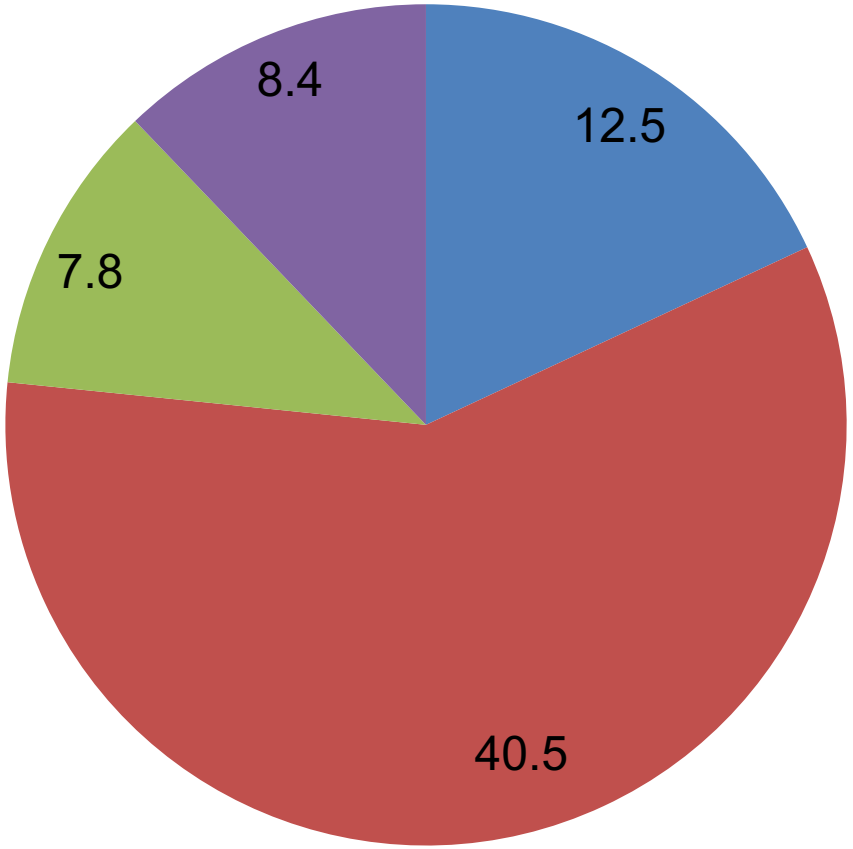
Claus process

- Sulfur is by-product of **metallurgic processes**

Ore roasting

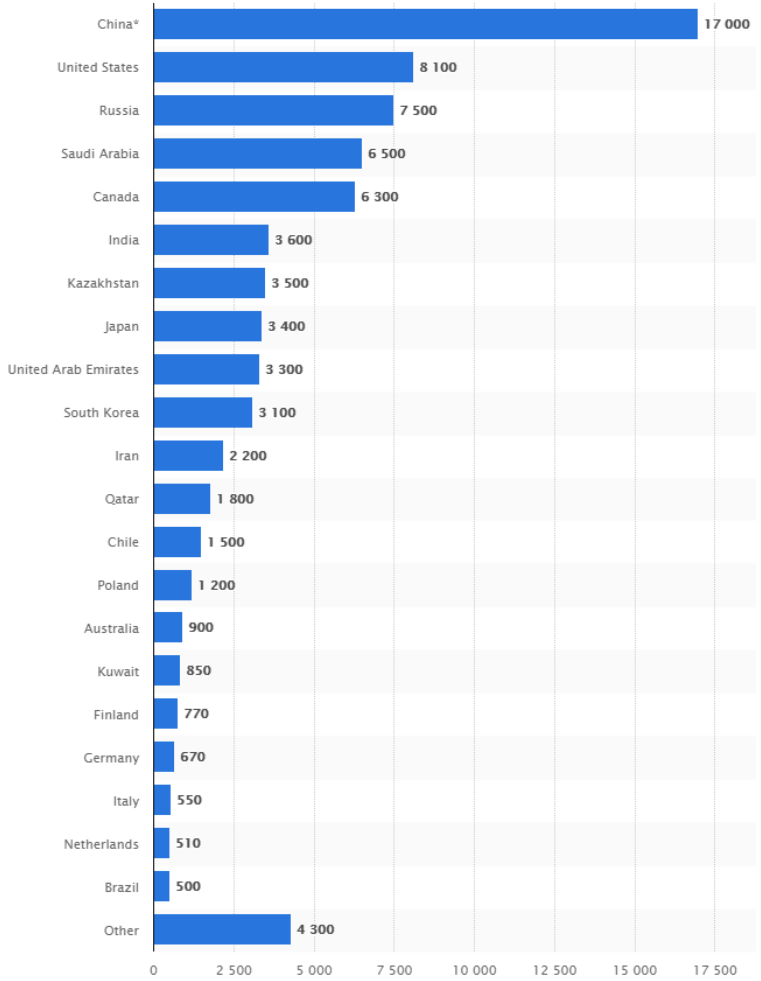
Sulfur world production 2014 and 2020

2014: 69.1 Mio. tons (avg. world price of US$160 per ton), 2020: 78.Mio. tons



Mio. tons

- Metallurgy (smelting of sulphide ores)
- By-product sulphur from refineries etc. (processing natural gas, petroleum and oil sands)
- Mining (pyrite, native sulphur, underground deposits)



Source: 2014 Minerals Yearbook, SULFUR, U.S. Geological Survey

APA, Chicago, Harvard, MLA & Bluebook

Transportation and storage of sulfur

In solid or liquid form

Train

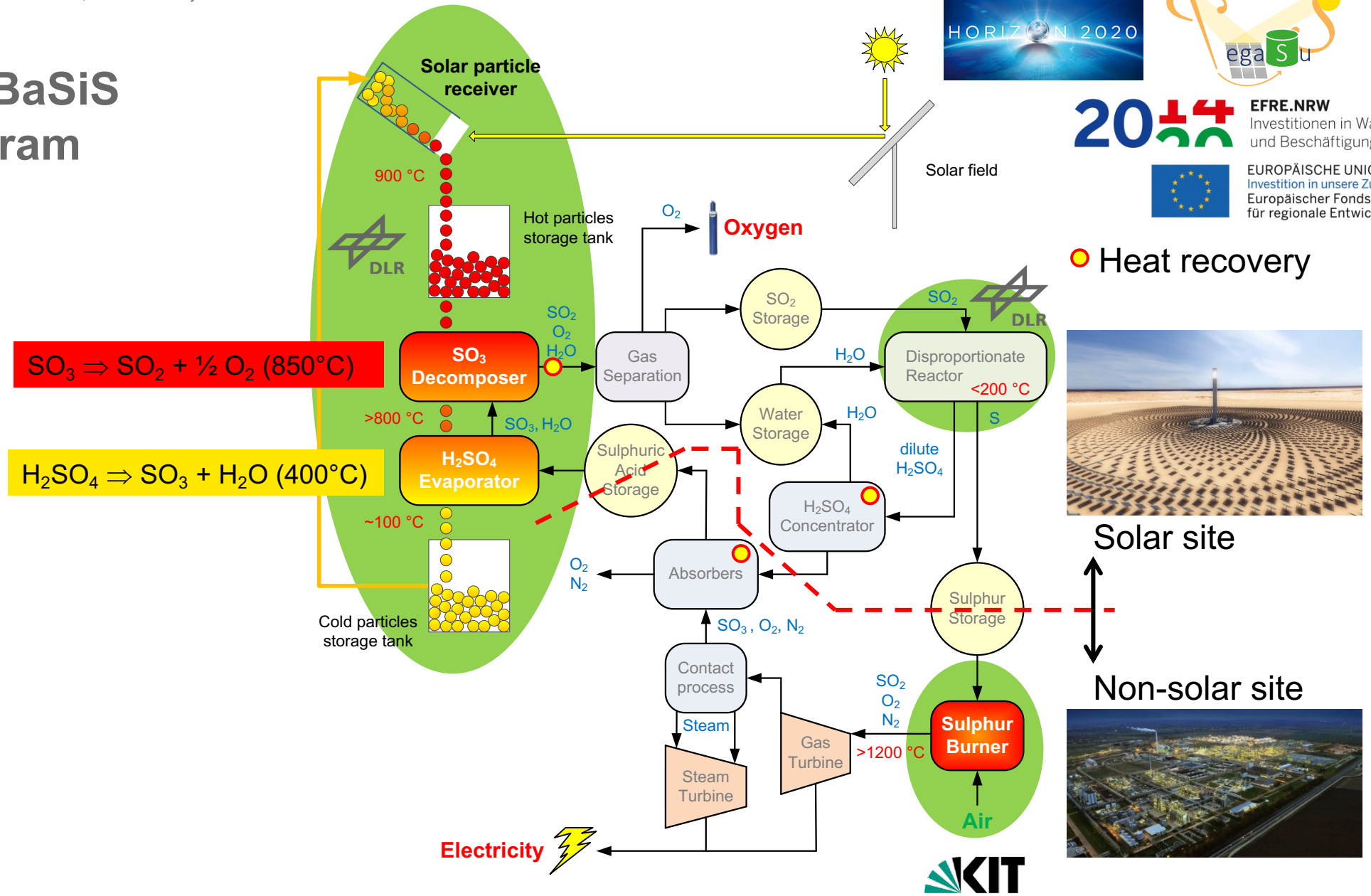
Pipeline

Molten sulfur in heated pipelines (~140 °C)

Truck

Ship

PEGASUS + BaSiS
Process diagram



Heat recovery

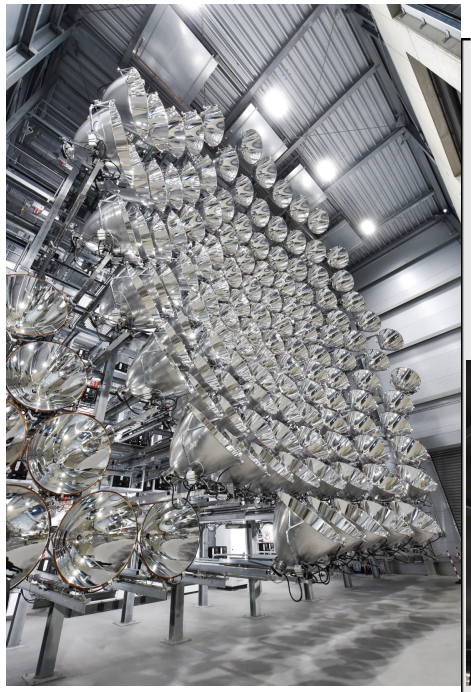
Solar site

Non-solar site

EFRE.NRW
Investitionen in Wachstum und Beschäftigung
EUROPÄISCHE UNION
Investition in unsere Zukunft
Europäischer Fonds für regionale Entwicklung

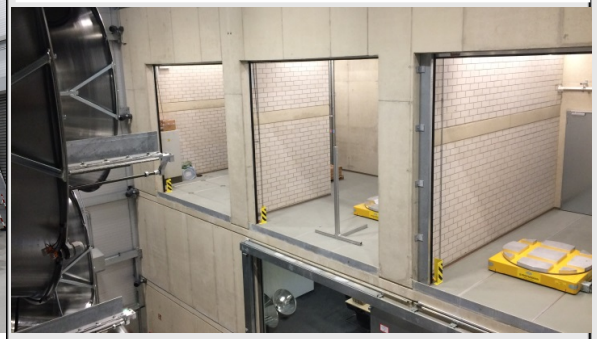
System integration and Demonstration

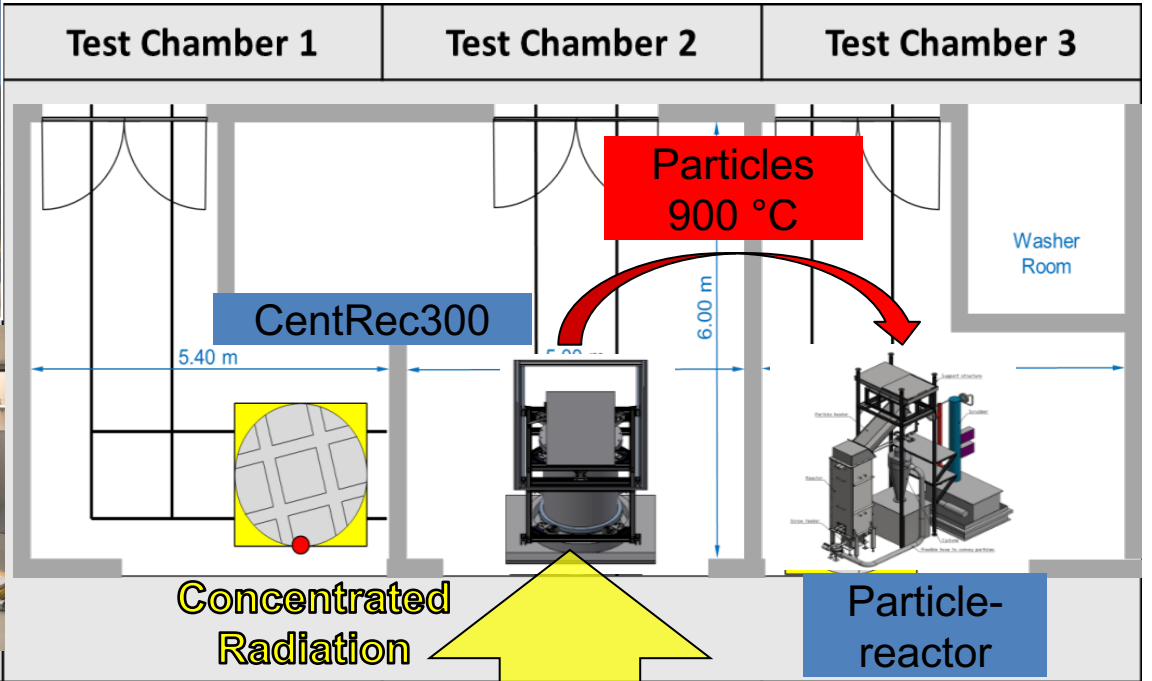
Coupling of the CentRec300 Receiver with the particle reactor in Synlight



149 Xenonlamps

synl'ght





	Test Chamber 1	Test Chamber 2	Test Chamber 3
# of Xenon lamps to be focused on reference points	96	121	96
Max. solar radiation power with 7kW$_{el}$ standard lamps	240kW$_{rad}$	310kW$_{rad}$	240kW$_{rad}$

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Thank you very much for your attention!