Évora Molten Salt Platform (EMSP)

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The EMSP facility at a glance

HelioTrough® 2.0: 684 m, 4,500 m²
HTF: Molten Salts
Power: **3.5 MW_{th}**
Tmax: **565 ºC**

Power: **1.8 MWth @ 14.0 MPa / 560 ºC**
Economizer/evaporator, air cooled condenser, pressure reducing station

2-Tank TES
34 m3 (ca. 92 tons salt)
Capacity: **5.4 MWh @ 565 °C / ΔT = 275 K**

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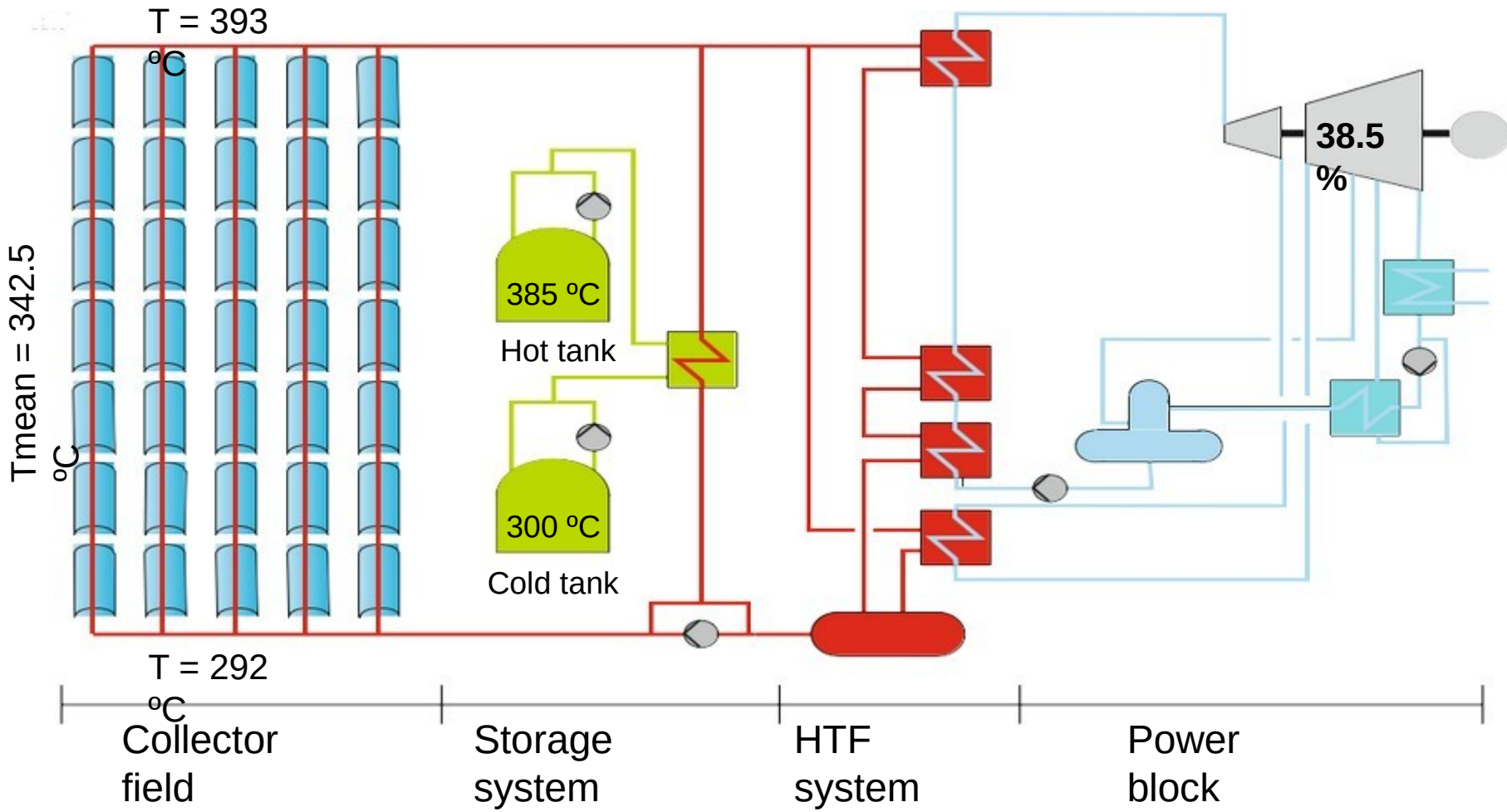
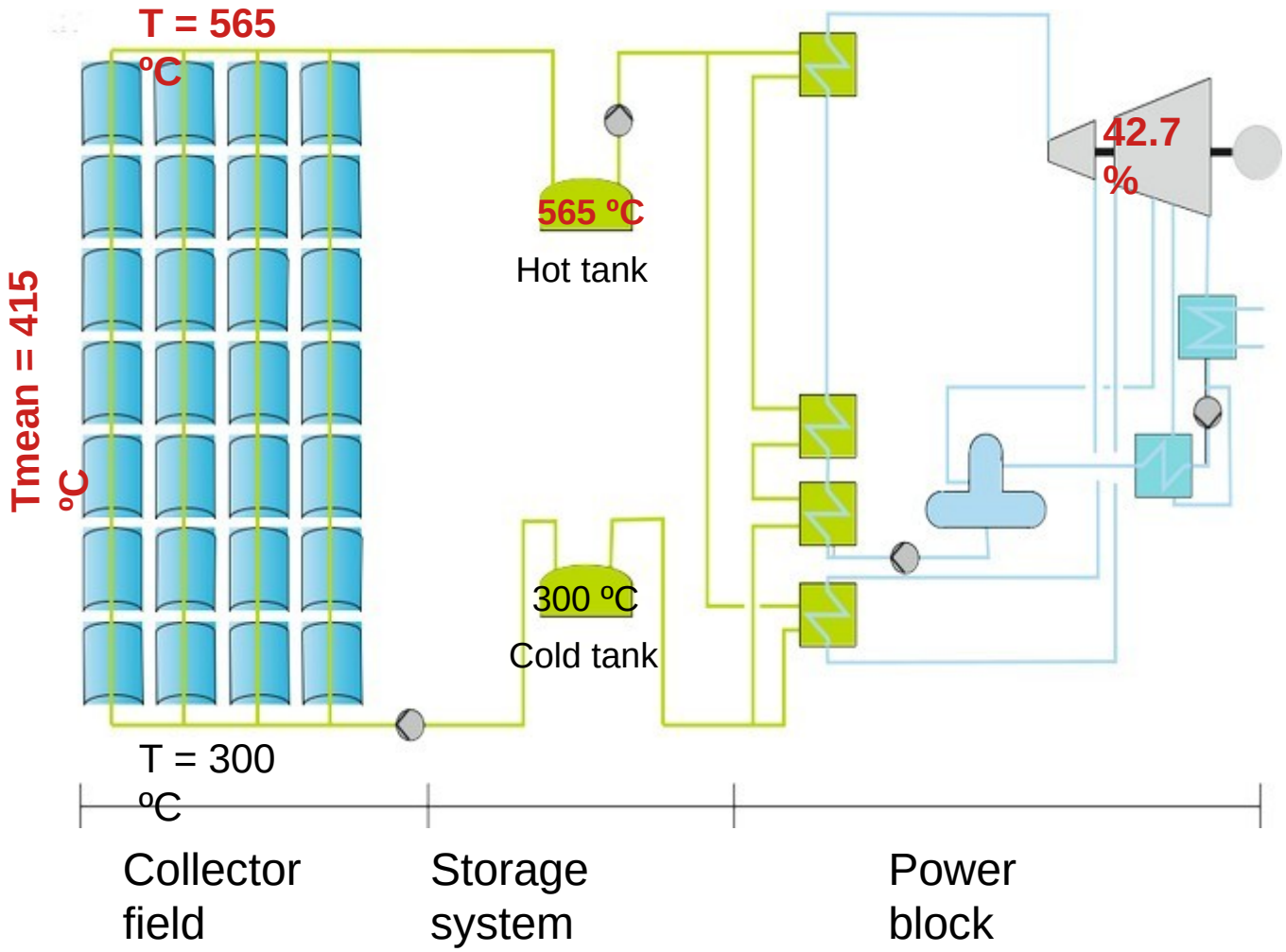
Virtues of molten salts in parabolic troughs



Virtues of molten salts in parabolic troughs

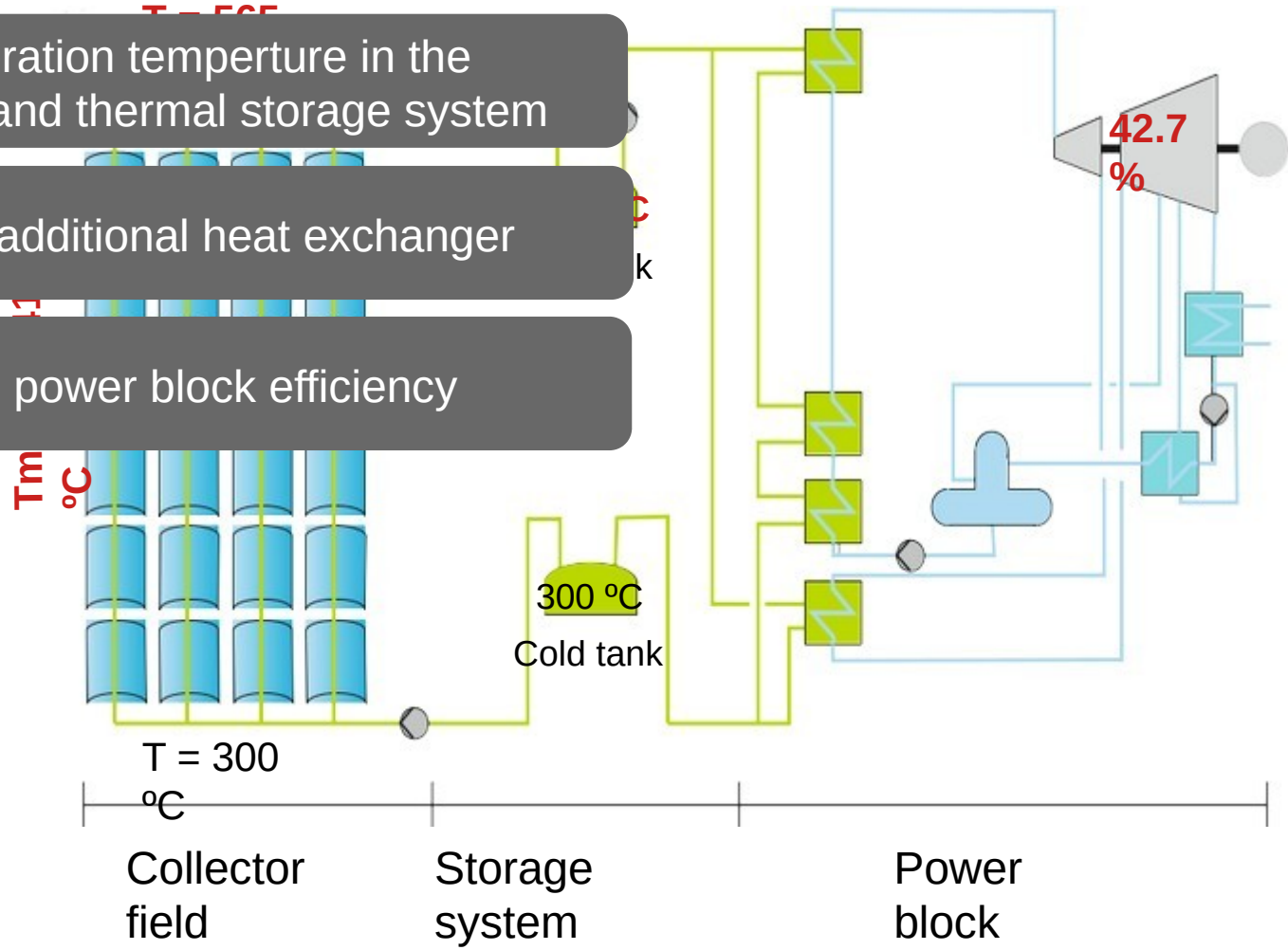


Virtues of molten salts in parabolic troughs

565 °C operation temperture in the collector field and thermal storage system

No need for additional heat exchanger

Increased power block efficiency



Virtues of molten salts in parabolic troughs

565 °C operation temperture in the collector field and thermal storage system

No need for additional heat exchanger

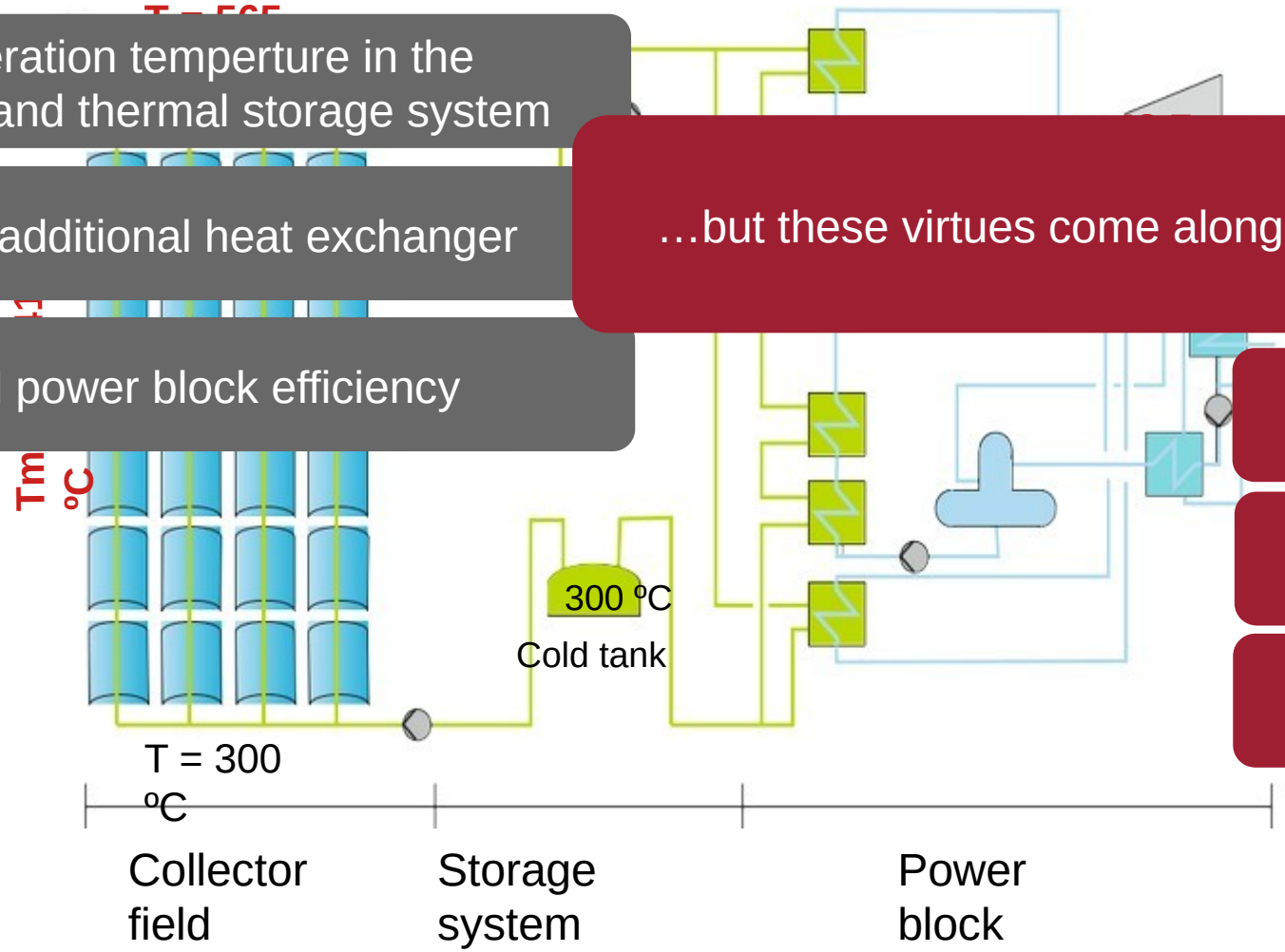
Increased power block efficiency

…but these virtues come along with some challenges.

Danger of freezing?

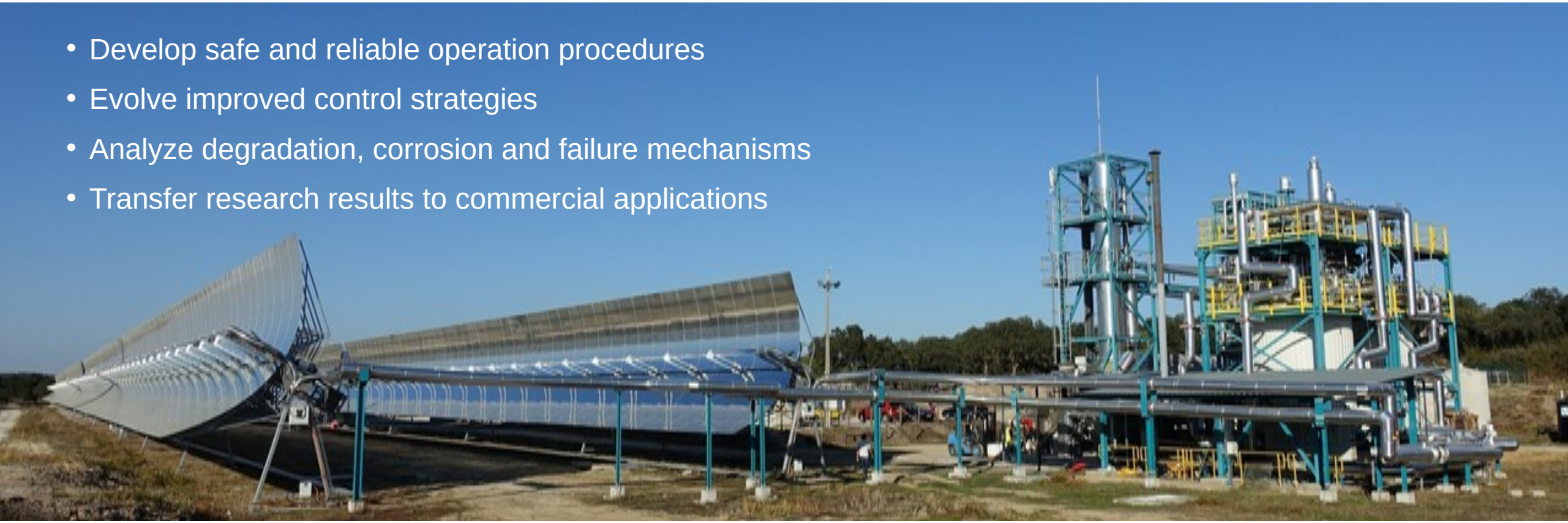
Receiver heat tracing?

Filling? Draining?…?



Our joint research targets
Tackling major concerns

- Develop safe and reliable operation procedures
- Evolve improved control strategies
- Analyze degradation, corrosion and failure mechanisms
- Transfer research results to commercial applications



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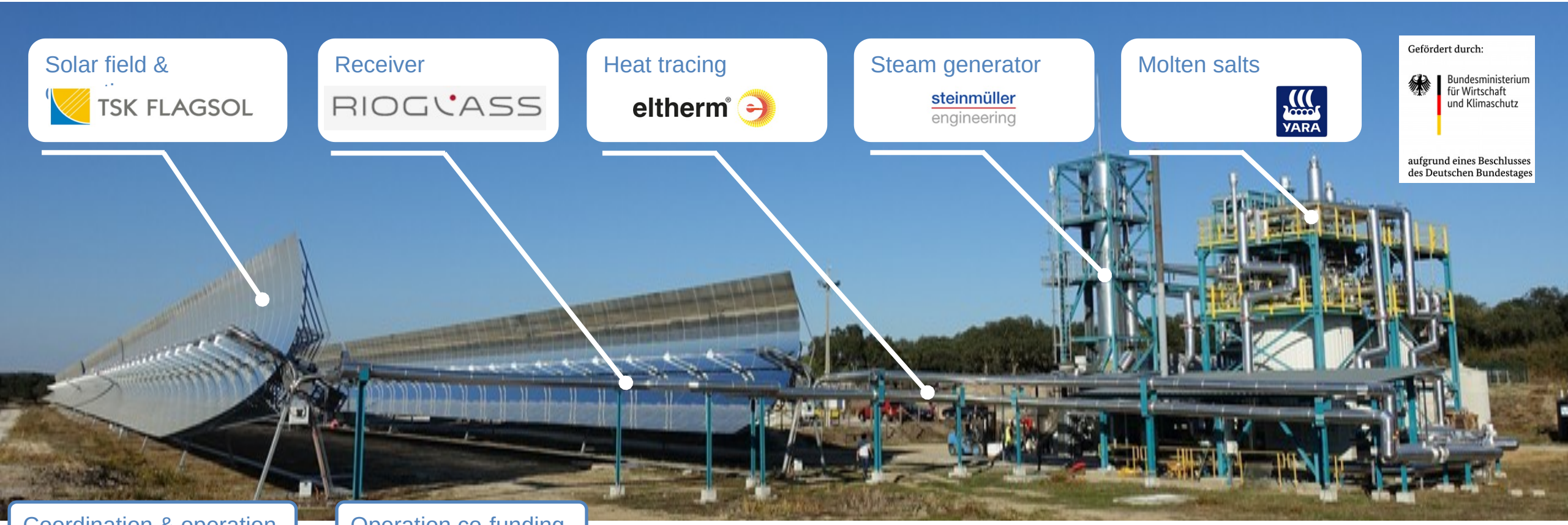
Complementary roles of EMSP industrial and R&D partners
HPS2 project consortium



Coordination & operation

Operation co-funding

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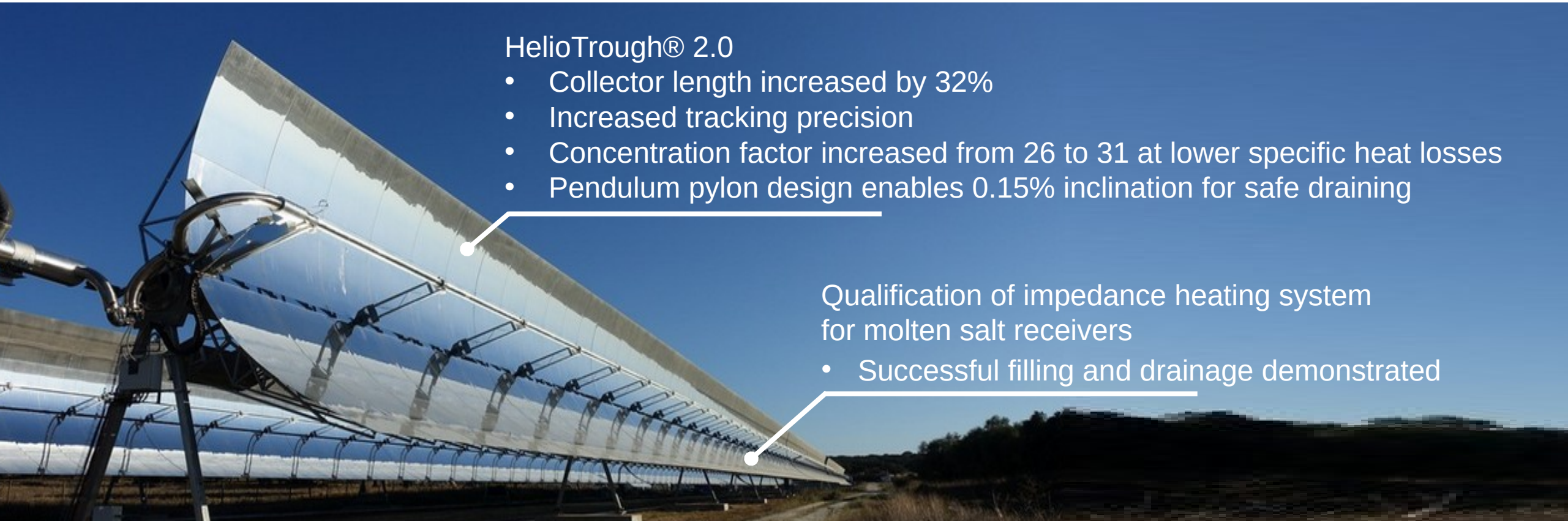
Achievements in technical improvement
Optimized components for molten salt operation



HelioTrough® 2.0
- Collector length increased by 32%
- Increased tracking precision
- Concentration factor increased from 26 to 31 at lower specific heat losses
- Pendulum pylon design enables 0.15% inclination for safe draining

Qualification of impedance heating system for molten salt receivers
- Successful filling and drainage demonstrated

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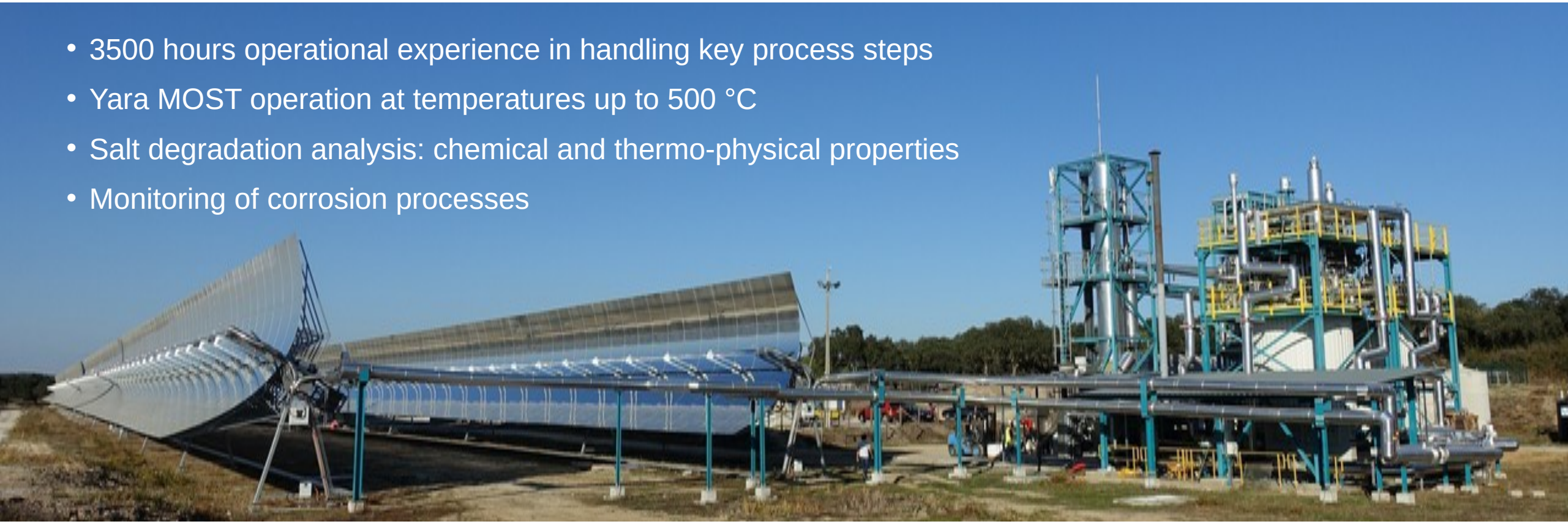
TSK FLAGSOL
eltherm®

Achievements in molten salt operation
Safety and reliability demonstrated

- 3500 hours operational experience in handling key process steps
- Yara MOST operation at temperatures up to 500 °C
- Salt degradation analysis: chemical and thermo-physical properties
- Monitoring of corrosion processes



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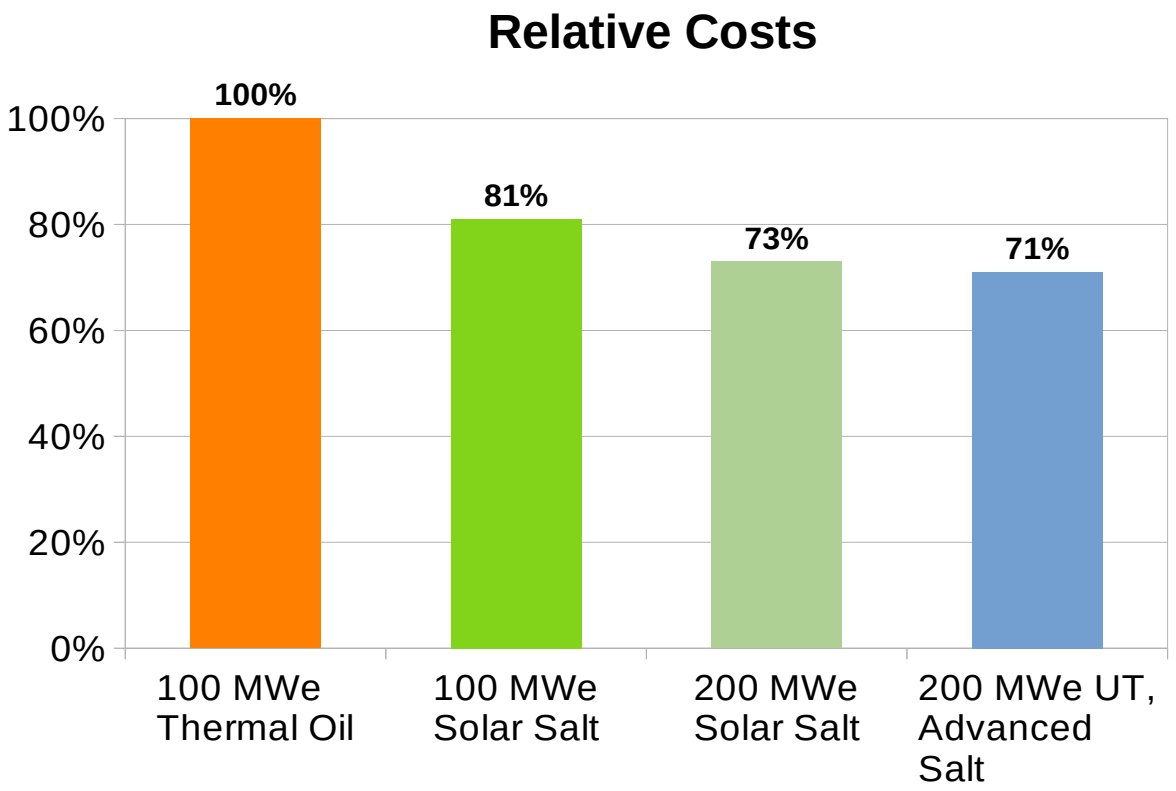
Technology outlook

Cost reduction potential of molten salt-based CSP

Cost reduction by

- Higher cycle efficiency by increased outlet temperature
- Higher storage capacity
- Fewer components
- Cheaper, more stable and more sutainable heat transfer fluid
- Less pumping power – better scaling



Weinrebe et al: SolarPACES 2013

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Role of molten salt in the future energy system

System benefit of molten salt storage

EMSP CURRENT

HPS2 / INIESC

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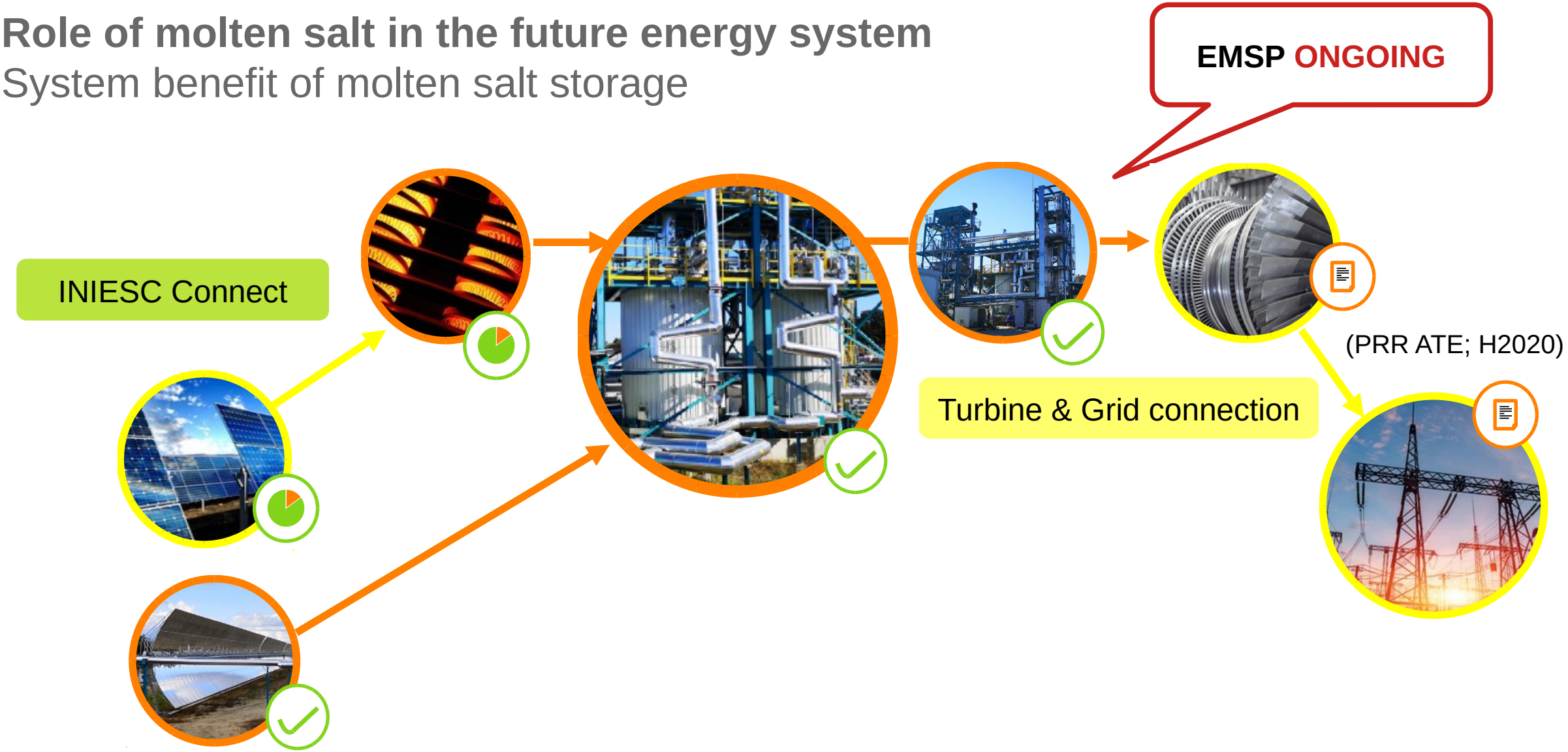
Role of molten salt in the future energy system

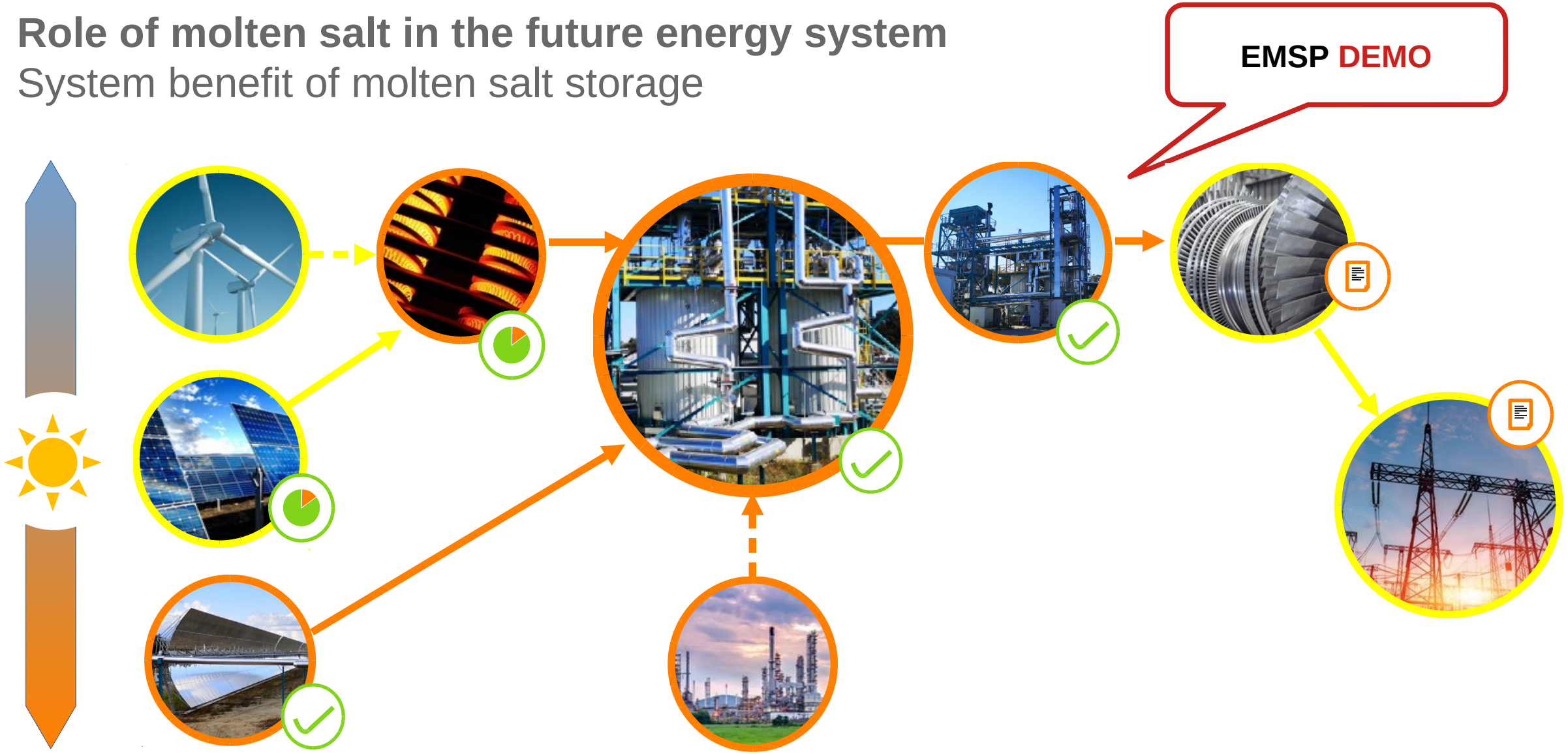
System benefit of molten salt storage



Pictures *in* https://www.istockphoto.com/pt

Role of molten salt in the future energy system

System benefit of molten salt storage



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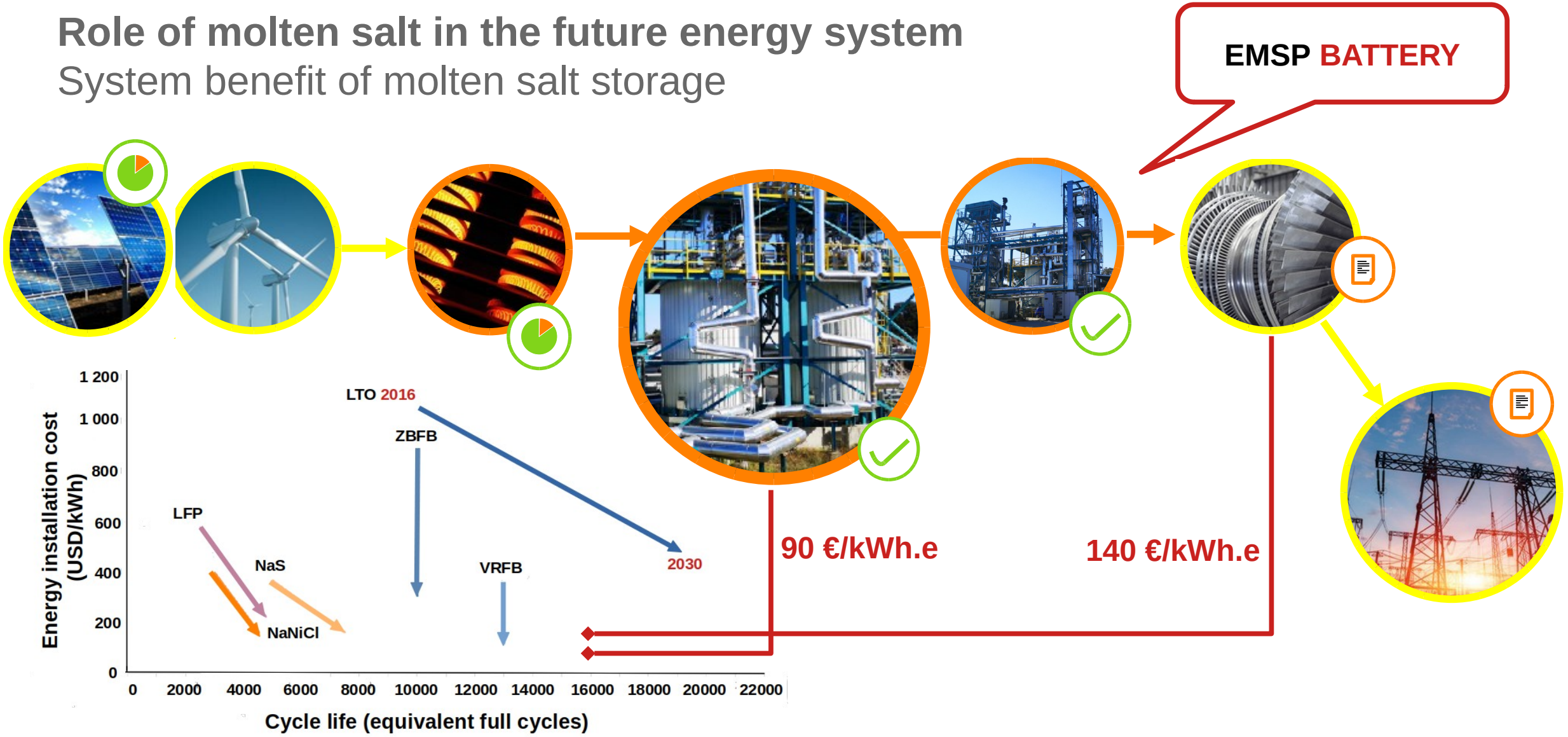

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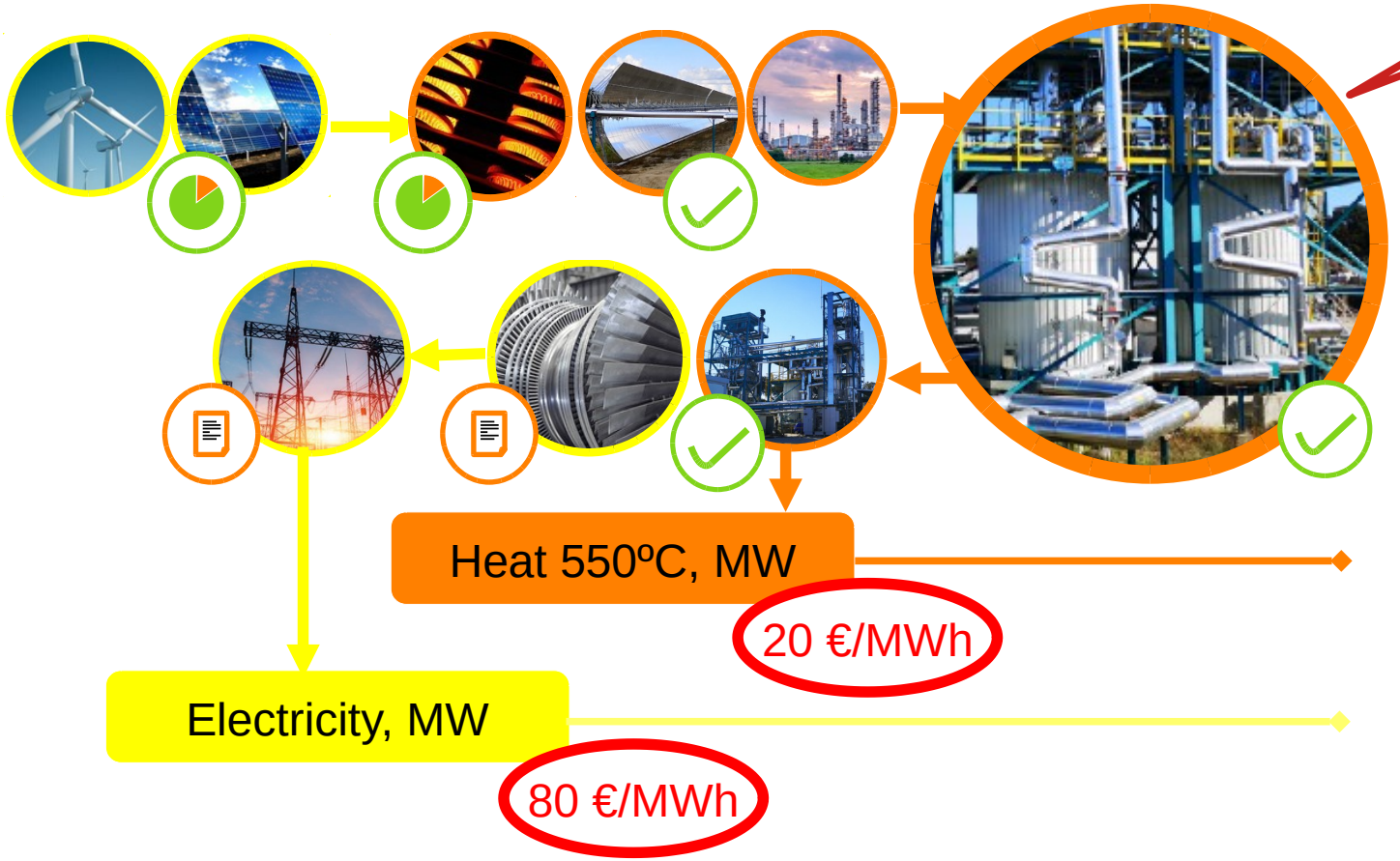
Role of molten salt in the future energy system
Chances to accelerate hydrogen production



Heat 550ºC, MW

20 €/MWh

Electricity, MW

80 €/MWh

EMSP DISPATCHABLE ENERGY +

Solar desalination

Solar waste water treatment

0.5 €/m3

High-Temp Electrolysis

Electrolysis

1.5 €/kg

Pyrolisys

Pictures *in* https://www.istockphoto.com/pt

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Technology hub EMSP

Attracting new businesses in the Alentejo region





Manufacturer	Procurement	Steel, mirrors, concrete, power electronics & cabbling	Steel, electrolyz.	Steel, RO	Reactors	
	Manufacturing					
	Sales support	IT, control				
Commercial / Service	Marketing	Financing				
	After sales	O&M				
	Management	Accountants, Managers, Lawyers				
Academia R&D	Human resources	Engineers, Technicians, Researchers				
	New technology	PCM-TES	sCO2	HT-Electr.	ZLD	Solar fuel
	Raw materials	Salts			Brine	Biomass

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Technology hub EMSP

Impacting the economy and promoting Regional development

Construction

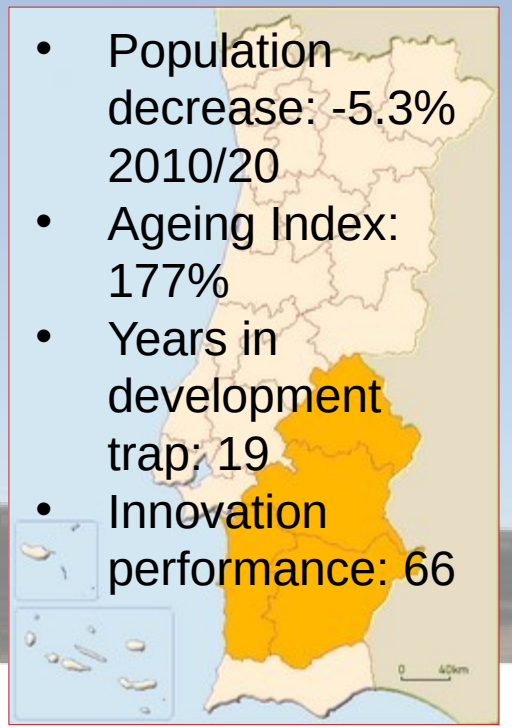
- **GDP impact: 9 116 M€** (6 401 direct + 40% indirect)
  2.9 x more than other renewables
- **Job creation: 72 093 jobs** (23 437 direct + 200% indirect

Operation

- **Job creation: 2 109 jobs** (937 direct + 1172 indirect)
- **Electricity production: > 2.3 GWh / (GW.year)**
- **Capacity factor: > 35%** (PV 12%, Hydro 17%, Wind 24%
- **Avoided emmissions: 1.1 M tCO2 / year**

CSP Impacts (1 GW)

- Population decrease: -5.3% 2010/20
- Ageing Index: 177%
- Years in development trap: 19
- Innovation performance: 66



La industria termosolar como motor económico en España
Impacto económico en 2019 y potencial del aumento del almacenamiento y el cumplimiento de los objetivos del PNIEC. Pwc, 2019 para PROTERMO SOLAR

Summary and Acknowledgements

Achieved to date

- Successful demonstration of innovative “full Molten Salt” CSP Plant concept
- Improved component performance and overall Plant efficiency
- Experience with O&M enabling “fast track” to bankability and market
- Industry “show room” for MS components and O&M strategies

- **Ensuing steps**
- Power block and Grid connection to dispatchability demonstration
- MS electrification for Carnot Battery concept demonstration
- MS driven Renewable gases production via pyrolisys and H Electrolysis

- **DEMONSTRATION OF 100% RENEWABLE AND DISPATCHABLE ENERGY SYSTEM**

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Summary and Acknowledgements

Financing

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Bundesministerium für Wirtschaft und Klimaschutz
aufgrund eines Beschlusses des Deutschen Bundestages

RWE

FCT Fundação para a Ciência e a Tecnologia

ALENTEJO 2020

PORTUGAL 2020

UNIÃO EUROPEIA
Fundo Europeu de Desenvolvimento Regional

Industrial Partners

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