ASTERIX CAESAR

Concentrated Solar Power

CENER

NATIONAL RENEWABLE ENERGY CENTRE

CSP

Compressed Air Energy Storage

Adiabased Solar Thermal Electricity for Efficient Renewable Energy Integration & Compressed Air Energy Storage

ASTERIx-CAESar project overview

SolarX Webinar "Solar Concentration Technologies for Flexible Power Production Side"

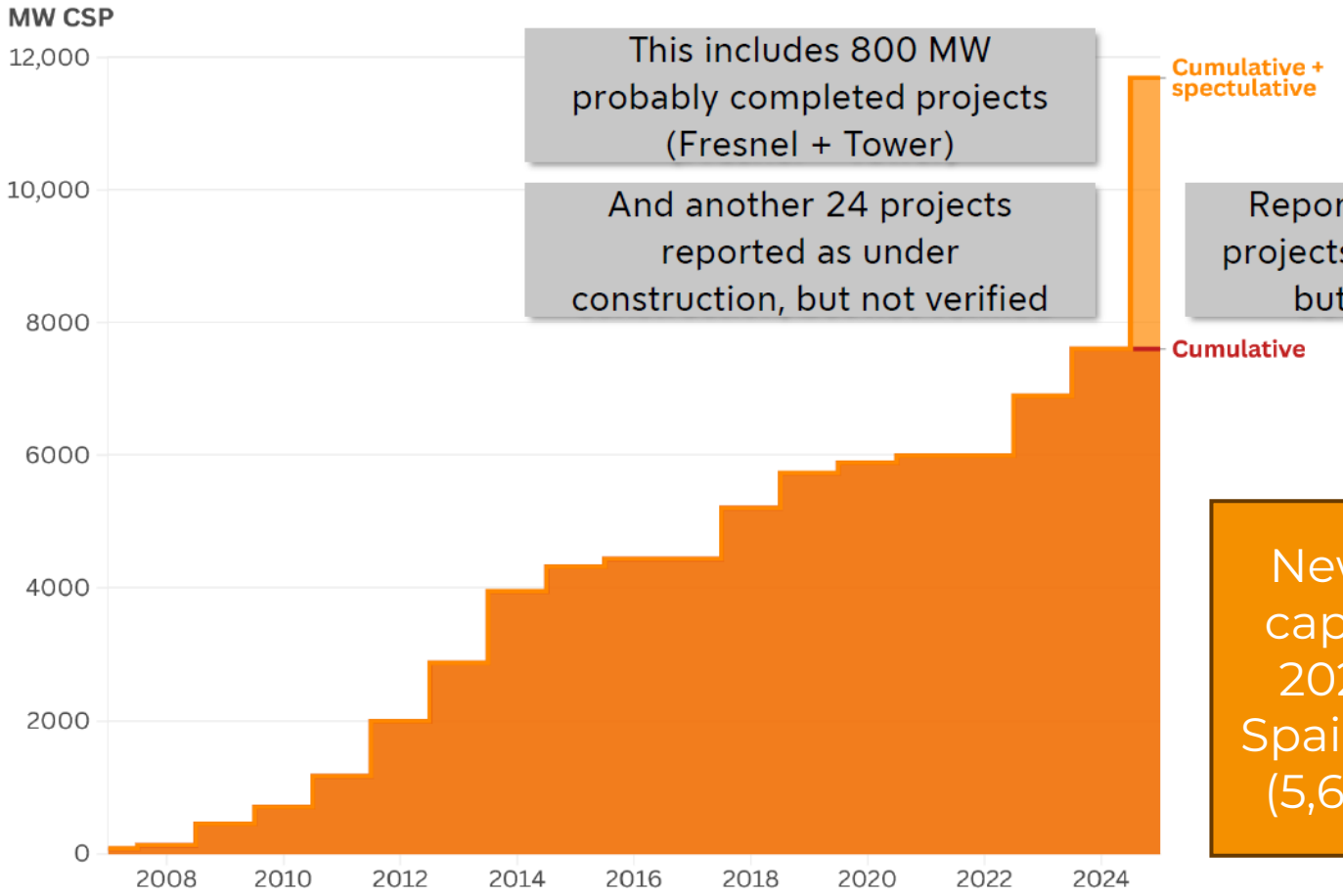
Fritz Zaversky, Javier Bayón, Xabier Rández

Funded by the European Union

UK participant in Horizon Europe Project ASTERIx-CAESar is supported by UKRI grant number 10097908 (Bluebox Energy).

This work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Is Concentrated Solar Power in a Crisis?



Source: Johan Lilliestam, Concentrating solar power: a solution looking for a problem

The CSP sector is tiny!

New PV capacity 2023 in Spain only (5,6 GW)

World wide 346 GW new PV capacity 2023

1419.0 GW total PV capacity in 2023

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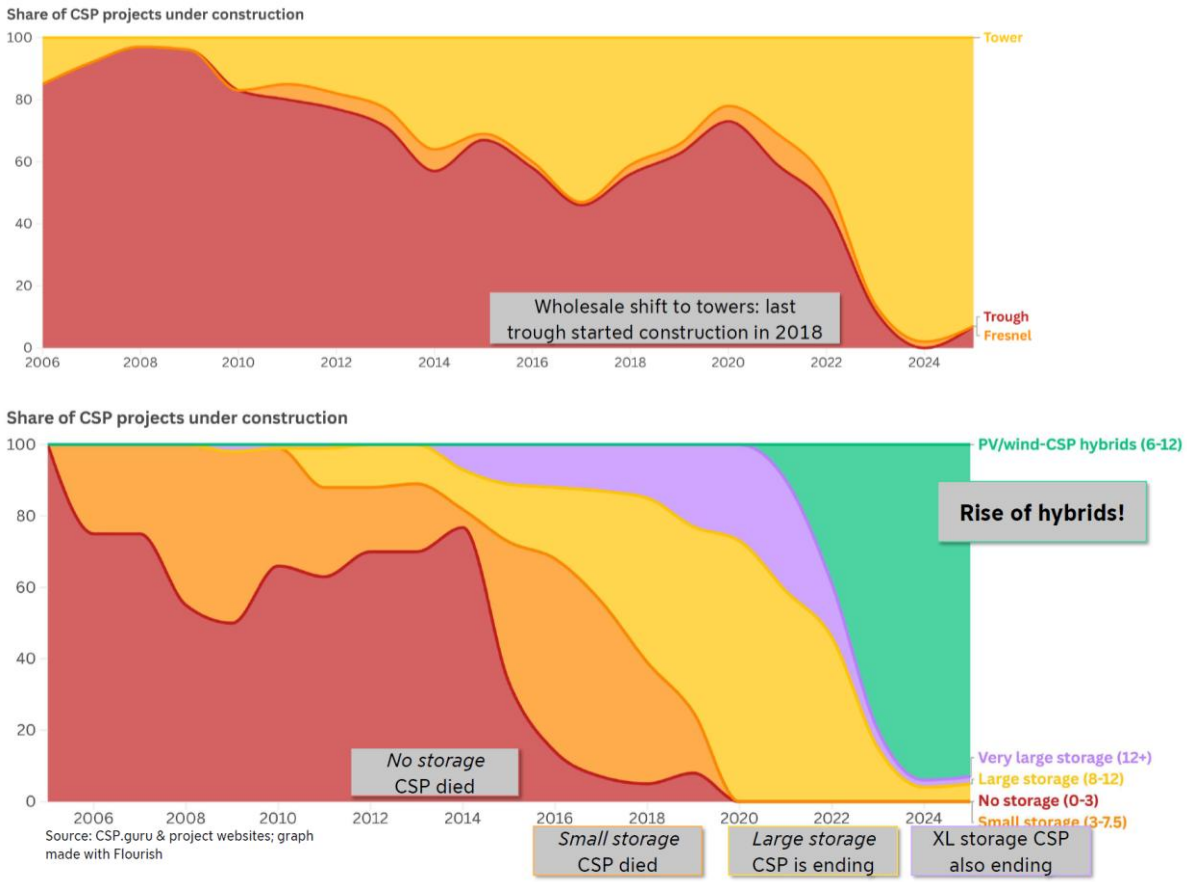

Source: Johan Lilliestam, Concentrating solar power: a solution looking for a problem

- CSP is a hybrid generation/storage technology, to enable the integration of cheap, not dispatchable PV and Wind energy!
- The ASTERIx-CAESar project addresses exactly this objective!

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ASTERIx-CAESar project

17 Partners **10** Countries **4** Years(Oct 23-Sept 27) **7.2** M€ Budget **6-7** TRL

Concentrated Solar Power (CSP)

+

Compressed Air Energy Storage (CAES)

=

Higher share of variable output renewables and **new operation strategy** and business model for CSP

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ADItech
Ciemat PSA
Universidad de Sevilla 1505
DOOSAN Škoda Power
Roma Tre – Ingegneria Industriale Elettronica e Meccanica – Dipartimento di Eccellenza 2023-2027
Fraunhofer IKTS
EURIDA Research Management
AALBORG CSP - Changing Energy
ETN Global
institute IMDEA energy
Nova Therm Tech
HEDNO
Keramikblech® Walter E. C. Pritzkow Spezialkeramik
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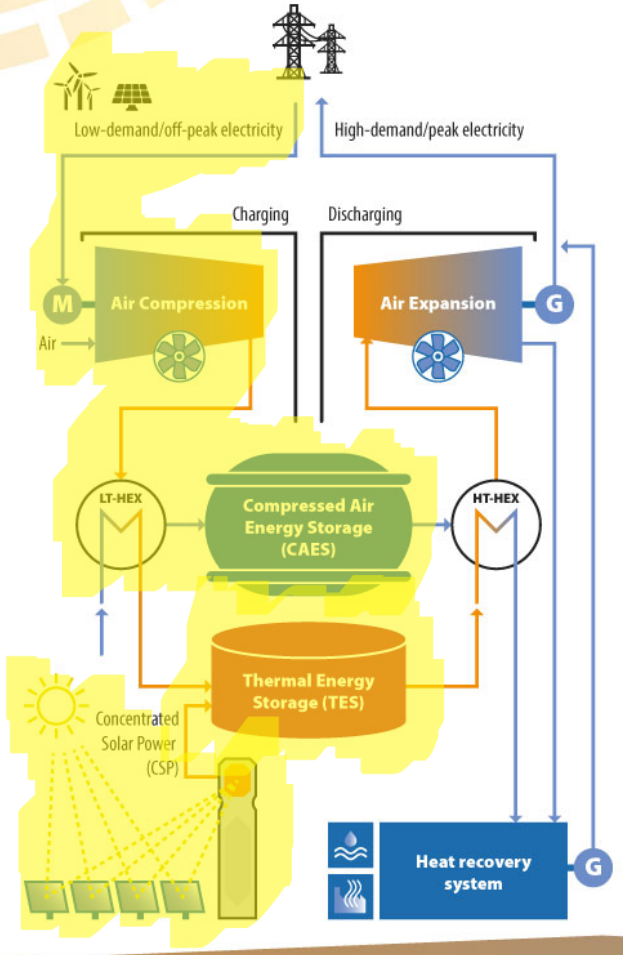
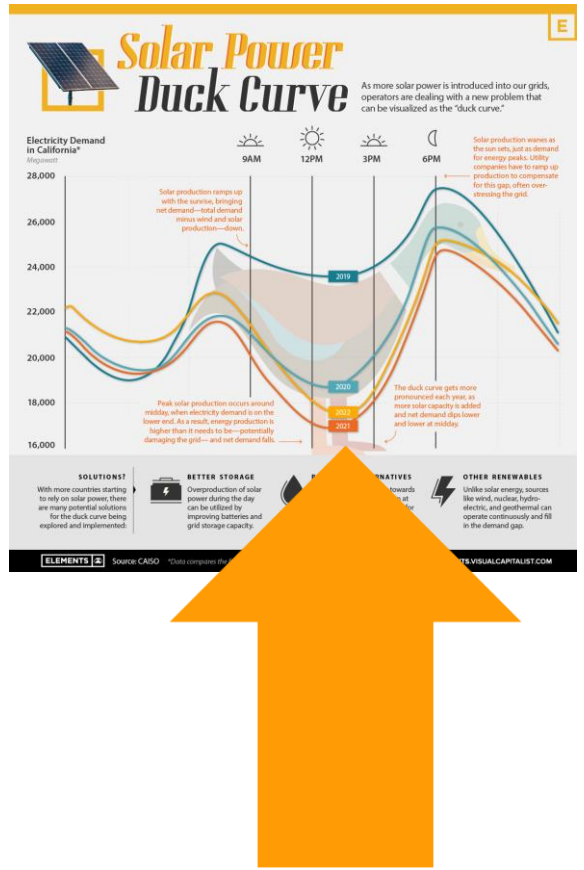
The project concept:
CSP-CAES innovative & adaptive power plant



Charging

- **Off-peak low-price electricity is used to drive a compression train** – compressed air is stored – heat of compression is also stored
- **Solar energy is captured through the air-based CSP** in the form of high-temperature heat (800°C)
- Thermal Energy Storage units consist of air-based **thermocline packed-bed** storage technology



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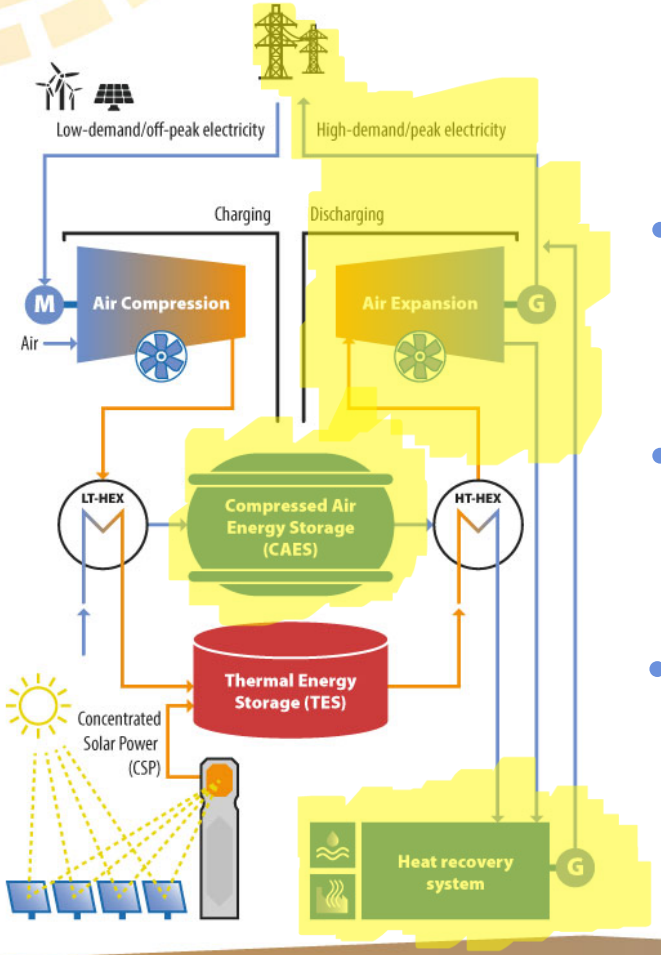
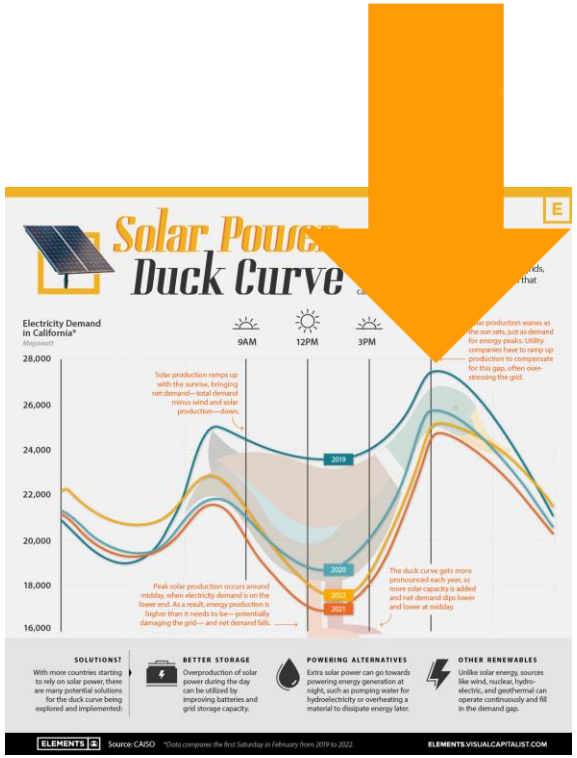


Discharging

- During **peak-hours**, the plant produces electricity via an **air expansion train**
- The **compressed air** is used to **substitute the compression work** of the topping gas turbine
- The project concept includes a **Heat Recovery system**: Rankine cycle, process heat for industry and/or desalination unit



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Key Innovation of the project - Charging

Advanced solar Receiver

A highly efficient **Open Volumetric Air Receiver** operating at high temperature (800 °C).

Advanced sensor technology and AI-based solar flux control

New **fiber-optic sensors** and advanced **AI-based** heliostat field/solar flux **control** and monitoring system to **reduce O&M**

Tailored air compressor Technology

Advanced compression train for small-scale and large-scale. Design and optimization of **cost-effective artificial pressure vessel**

CHARGING

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Key Innovation of the project - Discharging

Advanced heat exchanger Technology

Advanced **air-to-air heat exchangers designs** that guarantee high conversion efficiency.

Tailored air expander Technology

Turbomachinery architecture is optimized for covering **a wide range of rated power outputs**, between 1 and 1[illegible]0 MW electric.

Effective exhaust heat recuperation & integration with desalination

Advanced **gas/liquid pressure exchanger** uses the energy stored in the compressed air vessel to power the re[illegible]verse osmosis desalination unit.

DISCHARGING

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Path of the project

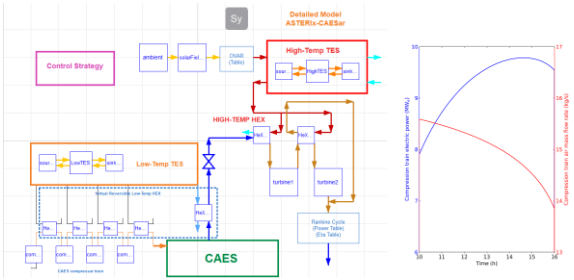
Oct 2023

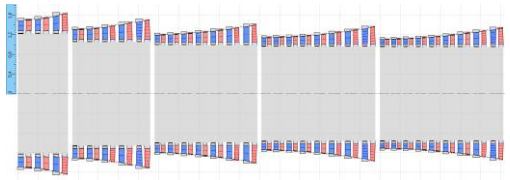
Start

Jan 2025

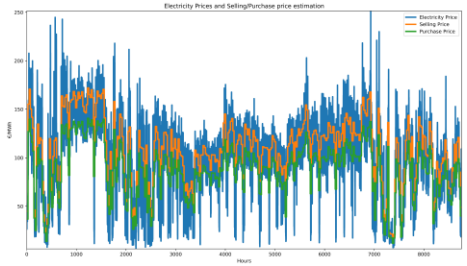
End of 1st RP

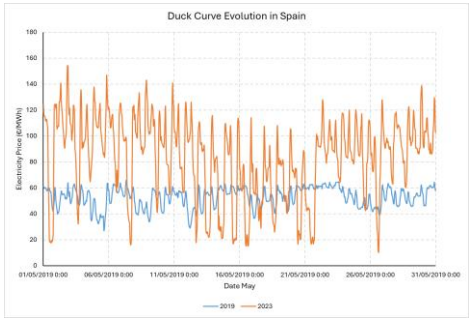
Thermodynamic Analysis: Evaluation of ASTERIx concept



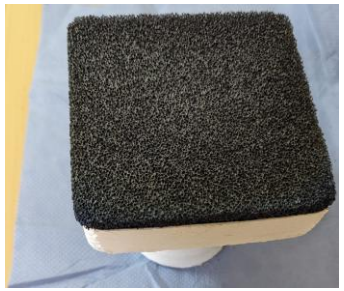


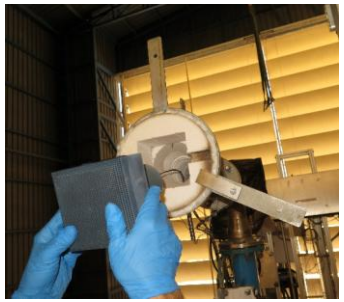
Grid Analysis: Electricity prices



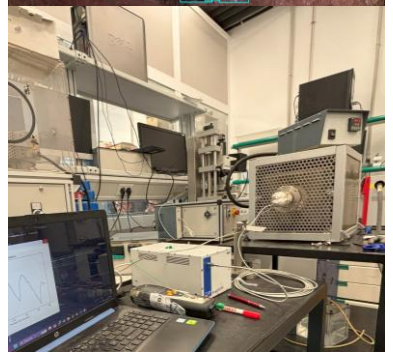


Testing of Advanced Open Volumetric Air Receiver





Developing of Optical Sensors and AI-based tracking control



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Thank you for your attention!

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