

October 2026 | No. 3

The ASTERix-CAESar project is a Horizon Europe funded project that started in October 2023.

The project's main goal is to develop a novel **high-efficiency solar thermal power plant** concept with an integrated electricity **storage solution**.

In this issue

2 Project progress

Read detailed progress of individual technical and non-technical work packages.

6 Events

Find more about events where we participated.

6 Public deliverables

Read four newly published public deliverables.

7 Publications

Have a look at our recent scientific papers and posters.

8 Communication highlights

Check out how to find more information about us.

Dear readers,

Welcome to the third ASTERix-CAESar project newsletter!

As we look back on the progress made over the past months, we are pleased to share the latest developments across our technical and non-technical work packages. From advances in solar receiver development, compressed air energy storage and power cycle optimisation to progress in automation, monitoring and the project's techno-economic assessment, our partners continue to work towards demonstrating an innovative, high-efficiency solar thermal power plant concept with integrated electricity storage.

We have just now entered the **fourth and final year of the project**, a particularly important period as we move closer to demonstrating our integrated solution under real-world conditions. With the development of the final prototype nearing completion and testing about to begin at CIEMAT-PSA, the coming months will be dedicated to validating the technology and bringing together the results of our collaborative efforts.

In this issue, you will also find updates on recent events, newly published public deliverables, and our latest scientific publications and communication activities.

In our next newsletter, we will focus on the finalisation of the prototype, the progress and results of its testing, and the release of a second project video dedicated primarily to the prototype.

Stay with us & enjoy reading!

ASTERix-CAESar team



Funded by
the European Union

(GA 101122231)

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).

ASTERIx-CAESar update – Technical work packages

WP1 – Concept definition and Techno-economic Optimisation

The main activities can be divided into two areas:

Definition and optimisation of the ASTERIx-CAESar power plant concept

The techno-economic optimisation of the system is currently in its final stage. We have published the second journal article about the use case in Chile (find the article [here](#)). The optimisation of the remaining use-cases (Greece, Spain, Morocco, South Africa, Australia, UAE, China and USA) is ongoing. The objective is to optimise the project concept for different specific application cases around the world. In addition, an online use-case simulation environment will be soon available on the project website.

Definition of the ASTERIx-CAESar project's prototypes

Experimental testing is implemented at different scales. Small solar absorbers (12 x 12 cm) were tested in the solar furnace at CIEMAT-PSA. Larger absorber samples (25 x 25 cm) were tested at the solar tower at IMDEA. These tests are now completed, and results are available to the consortium. During the last project year, the final ASTERIx-CAESar prototype will be tested at a solar tower at CIEMAT-PSA. It consists of a 500 kW_{th} receiver with approximately 0.7 m² of aperture area. This receiver will provide heat to a hot air turbine that is connected to a small-scale CAES unit, providing between 1 and 2 hrs of nominal turbine

mass flow. In addition to the hot air turbine, a tailored pneumatically driven reverse osmosis system is also connected to the CAES unit. As of October 2026, the final ASTERIx-CAESar prototype is about to start operation.

WP2 – Solar Receiver Development

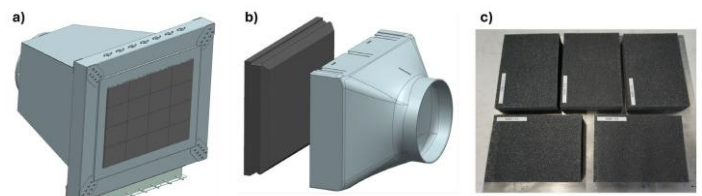


Figure 2: (a) 500 kW_{th} receiver design composed of 16 modules, each measuring 24.65 cm x 17.5 cm. (b) Rear view of one unassembled module consisting of a ceramic foam absorber and one cup. (c) Photograph of ceramic foam absorbers awaiting installation in the receiver front frame.

The ASTERIx-CAESar solar receiver is an open volumetric air receiver designed to efficiently heat air up to about 800°C. The design applies the novel concept of “free floating” absorber modules. The idea is that the ceramic absorber modules themselves, in stacked configuration, form the receiver structure. This allows free thermal expansion of each module and keeps thermal stress at a minimum. The receiver aperture area is divided into 16 modules, each measuring approximately 25 cm x 18 cm. The prototype is described in the recent publication: [High-Temperature Open Volumetric Air Receiver Integrated with Compressed Air Energy Storage: Design of Experimental Prototype](#).

The testing activity is foreseen until project end in September 2027. In parallel to the testing activity that will demonstrate thermal efficiency and oxidation resistance of the absorbers, the receiver design will be upscaled for future commercial operation.

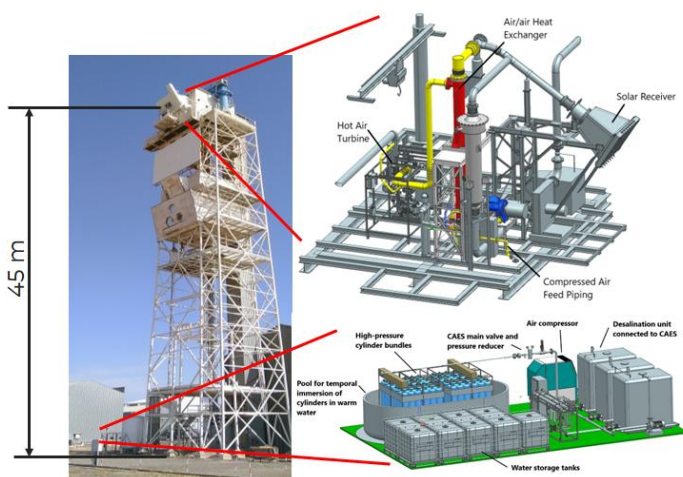


Figure 1: ASTERIx-CAESar prototype at CIEMAT-PSA

WP3 – Advanced Heat Exchangers

WP3 has been completed at the end of February 2026. Activities planned in tasks T3.1: Low-temperature heat exchange design (reuse of heat of compression) and T3.2: High-temperature heat exchanger design (heat input in power cycle), have been finalised at the end of 2025, as reported in the previous Project Newsletter.

Activities carried out in the last period were aimed at completing the task T3.3: Process control challenges (system level). The task focuses on the identification of control issues and control policies related to heat transfer equipment to ensure safe and efficient plant operations.

The charging phase analysis identifies the need for precise temperature control at each compression stage to maximise storage density. The recommended solution involves a common air collector pressurised by a variable-speed blower, feeding four independent control valves. This architecture successfully manages the wide dynamic range of cooling required, especially for the final aftercooler which must accommodate high temperature fluctuations.

Concerning the discharge phase, three different operation modes have been taken into consideration: Constant Pressure, Sliding Pressure-Constant Mass Flow, and Sliding Pressure-Constant Volumetric Flow. Analyses carried out have shown that these modes can be managed through a single, integrated control framework. By manipulating the atmospheric air mass flow, the system effectively stabilises the turbine inlet temperatures, ensuring reliable power generation despite the evolving state of the air reservoir.

Technical and scale-related challenges were also assessed, noting that while single-blower systems suffice for small and medium-scale plants, large-scale applications will necessitate multi-blower arrays.

The deliverable D3.3 related to Task T3.3 has been successfully submitted to EC.

WP4 – Advanced CAES and power cycle development and Optimisation

Delivering datasets in 2026

The work in WP4 has made good progress in 2026. The partners have worked on deliverables reporting the final configurations of the compressor and expan-

der trains of the small and large-scale ASTERix-CAESar plants.

Bluebox has led the development of the small-scale expander train, incorporating innovations that increase the autonomy of the discharge system (discharge time from the same storage vessel). This information is now available in Deliverable report D4.2, already submitted to the European Union.

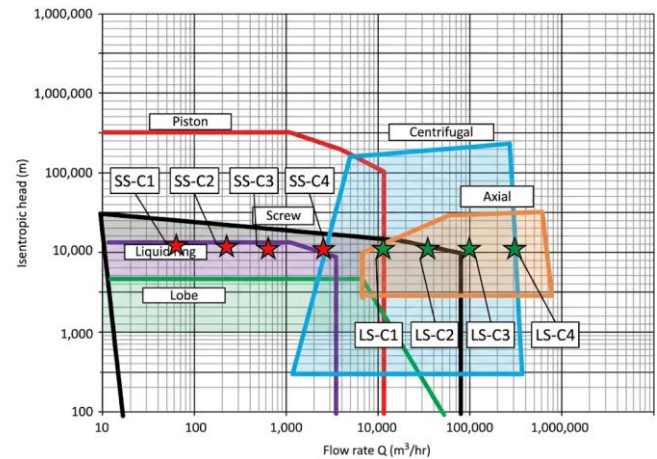


Figure 3: Compressor selection chart showing specs corresponding to the small-scale compression train (originally comprised of four stages, later designed with five stages) and the large-scale train. Legend: SS/LS is Small/Large scale and C# is casing number.

In parallel, University of Seville has led the development of the compression train for both the small-scale and large-scale plants. The small-scale is comprised of five reciprocating compressor stages; the low-pressure section of the train makes use of three low speed, double-acting pistons (two cylinders in parallel in the first stage and one single cylinder in the second one) whilst the high-pressure section is comprised of three single acting cylinders in series (running at a higher speed). Intercoolers are installed in between compression stages. The compression system is designed to be API 618 compliant.

The compression train of the large-scale facility is, on the other hand, comprised of parallel trains, each one comprised of four casings in series, with intercoolers in between casings. Each train has a capacity of 50 kg/s, meaning that the reference power plant is comprised of two parallel trains, whereas each casing is comprised of two centrifugal stages. The shaft of each casing is driven by an independent electric motor, the last of which (highest pressure) incorporates a variable frequency drive to enhance operability. The assembly is designed to be API 617 compliant. The information about compressor train design will soon be available in deliverable D4.1.



WP4 (cont.)

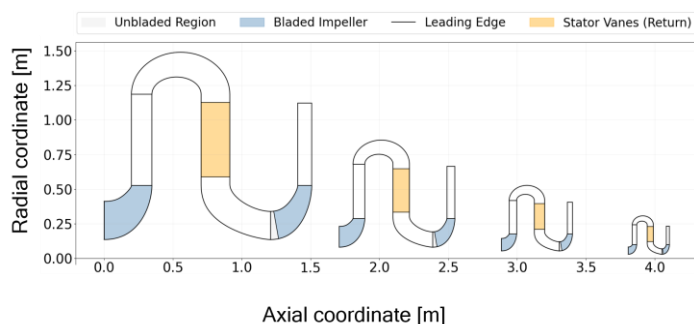


Figure 4: Flow path of large-scale compressor train showing four compressor casings, each one comprised of two radial stages with vaneless diffusers and vaned return channels. The large-size reduction due to density increase (owing to pressure rise and intercooling) is visible.

Finally, Doosan Škoda Power and SoftInWay are finalising their work on the high-pressure and low-pressure expanders, information that will be reported in deliverable D4.3.

As a complement to these activities, the work on overall CAES system integration and optimisation is progressing according to plan and producing very interesting results, some of which have recently been published in collaboration with WP1. Also, T4.5 on control challenges is generating noteworthy results regarding the selection of operating strategies leading to optimisation of revenues, operational flexibility, and charging times.

WP5 – Automatization and improved plant operation and monitoring via AI methods

WP5 focuses on innovative approaches for improving plant operation and monitoring, addressing three main activities:

Development of advanced high-accuracy aiming strategies. The developed methodology combines precomputed flux-map databases, interpolation techniques and an optimisation algorithm (TABU search) to calculate optimised heliostat aiming strategies. The methodology showed relative errors below 3% for total power and 5% for maximum flux when compared with reference simulations for the same operating conditions, while reducing the calculation time. The strategies were also successfully validated through on-sun testing at IMDEA Energy, comparing measured flux maps and power values with ray-tracing simulations.

Development of a reliable fiber-optic-based sensor measurement system for concentrated solar flux and temperature distributions on central receivers.

A testing campaign was carried out at IMDEA Energy to assess optical fibres and Fiber Bragg Grating sensors under high solar flux and temperature conditions. Quartz protections and diffusors were tested to improve fibre resistance and measurement performance, reaching concentrated flux levels of up to 1 MW/m². Temperature measurements using FBG sensors directly exposed to high radiation successfully identified operating temperatures of 800°C and peaks of 1000°C. Work has also progressed on integrating the sensors into the volumetric receiver and the PSA SCADA system.

AI-based heliostat tracking control for low-cost operation.

The Hel-IoT platform continues to automatically acquire images every 15 minutes, supporting the training and refinement of neural-network models. Improved models have increased detection accuracy and reliability, while the AI tracker has been further integrated into the heliostat-field SCADA infrastructure. A new camera-based measurement device and dedicated procedure have also been developed to compare the AI-based tracking approach with a conventional industrial tracking system, with the experimental validation campaign currently underway.



Figure 5: Target installed at the tower for performing the aiming strategy tests and a Gardon sensor (black circle) to measure the flux and compare with simulations.



Funded by
the European Union

(GA 101122231)

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).

WP6 – Validation & Demonstration of receiver and power cycle

The work package is aimed at validating the concept under real-world conditions, as well as the testing of absorber samples at smaller scales. Small solar absorbers (12x12 cm) were tested in the solar furnace at CIEMAT-PSA. Larger absorber samples (25x25 cm) were tested at the solar tower at IMDEA. These tests are now completed, and results are available in the public deliverable D6.1 (visit [here](#) to access it).



In parallel, since the start of the project, modifications to the CAPTure prototype have been underway with the objective of integrating a small-scale CAES system (shown in Figures 6 & 7) into the existing solar-powered hot air turbine prototype. The CAES system is installed at ground level next to the tower. It consists of 8 bundles of 12 industrial high-pressure gas cylinders with a total storage volume of 4.8 m³.



Figure 6 & 7: CAES system

ASTERIx-CAESar update – Non-technical work packages

WP1 – Concept definition and Techno-economic Optimisation (Social aspects)

The project social impact inventory that had been developed during earlier project stages has been continuously assessed and refined to make sure that only validated data will be used for the social impact assessment and for identifying regional aspects and factors that could influence public acceptance and risks emerging from public perceptions.

First validated data to be used for the s-LCA have been analysed from the Chile use case, one of the eleven defined use cases in ASTERIx-CAESar. Based on the data available from that use case, the social impact inventory has been updated and refined, and results are being transferred to a social SWOT and s-LCA tools for further analysis

In addition to the data evaluation and refinement of the social impact inventory, a first version of a public survey has been developed. This survey will be used to develop a better understanding of public perceptions of the CSP-CAES technology, to understand expectations and concerns towards it, especially once it will be scaled up to industrial, large-scale operations and to assess whether we can expect regional differences

in perceptions, needs, opportunities and risks on the way to market.

WP7 – Dissemination, Communication and Exploitation (Exploitation and Innovation Management)

Progress was made in developing the project's Exploitation Road Map and follow-up strategy. In addition to refining the key innovations and exploitable results generated by ASTERIx-CAESar, EURIDA, CENER, and PSA-CIEMAT elaborated a business case for integrated hybrid CSP-CAES plant concept. EURIDA supported internal discussions to connect innovation and exploitation planning with the latest technical and techno-economic results generated by the project. Robust data for the business case came mainly from the first validated project use-case in Chile / Antofagasta.

This work helps to identify remaining gaps to be addressed before final exploitation and business planning can be completed. These include the need for more quantified performance and cost indicators, clearer exploitation routes for selected KERs, and alignment between market, techno-economic and sustainability assumptions.



Funded by
the European Union

(GA 101122231)

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).

ASTERix-CAESar on the stage

- **ETN Global Webinar: “Flexible Energy Integration: Lessons from EU-Funded Projects”** (28 September 2026, online) – project presentation
- **ECOC 2026** (20-24 September 2026, Málaga, ES) – poster
- **SolarPACES 2026** (15-18 September 2026, Bad Neuenahr-Ahrweiler, DE) – four presentations, one poster
- **ASME Turbo Expo 2026** (15-19 June 2026, Milan, IT) – panel participation, expo
- **NextGen CIEMAT** (4-6 June 2026, Madrid, ES) – poster
- **ETN Global's AGM & Workshop** (23-25 March 2026, Malmö, SE) – expo, media sponsor
- **Transfiere** (24-26 February 2026, Málaga, ES) – presentation of the smart heliostat and tower concept & mock-up
- **CIES2026** (23-25 March 2026, Almería, ES) – five papers

Only recent events are listed.

See all of them here →

[Read more](#)



Figure 8: Javier Bonilla (CIEMAT) at Transfiere

Public deliverables available online

Four new project public deliverables were recently published; three from Work Package 3 (**Advanced Heat Exchangers**) and one from Work Package 6 (**Validation & Demonstration of receiver and power cycle**):

- WP3: Optimum low-temperature heat exchanger design (reuse heat of compression)
- WP3: Optimum high-temperature heat exchanger design (solar heat input in power cycle)
- WP3: Process control challenges and recommended methods
- WP6: Small-scale experimental evaluation results of advanced volumetric absorber modules

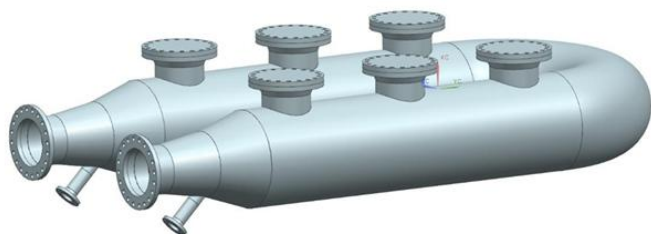


Figure 9: High-pressure regenerative bed 3D drawing (Flanges DN600 – charging- and DN150 - discharging) [WP3]

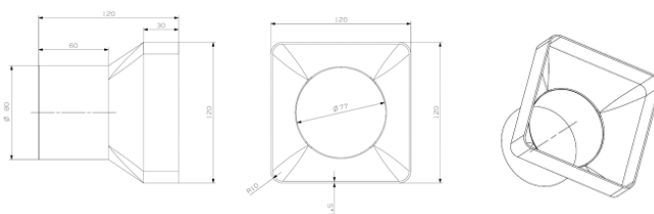


Figure 10: Cup dimensions for the solar testing [WP6]

Find all our public deliverables here →

[Read more](#)



Funded by
the European Union

(GA 101122231)

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).

Our scientific papers & posters

European Conference on Optical Communications – ECOC (September 2026)

- A New Optical Fiber-Based Sensor for Concentrated Solar Flux Monitoring in Concentrated Solar Power Plants – poster & abstract ([link](#))

SolarPACES (September 2026)

- Concentrated Solar Flux Measurements Based on Optical Fibers and Multiple Photodetectors ([link](#))
- High Temperature Distributed Measurements Based on Femtosecond Fiber Bragg Gratings ([link](#))
- Real-Time Flux Map Generation and Aiming Optimization for Solar Tower Systems Using Interpolation and Fast Optimization Algorithms – poster ([link](#))
- Receiver Design Optimization for Passive Flow Regulation in an Open Volumetric Air Receiver – poster ([link](#))

Journal of Energy Storage (August 2026)

- Evaluating a compressed air energy storage (CAES) system with high-temperature concentrated solar power (CSP): Techno-economic and sensitivity analysis ([link](#))

Applied Sciences – MDPI (July 2026)

- High-Temperature Open Volumetric Air Receiver Integrated with Compressed Air Energy Storage: Design of Experimental Prototype ([link](#))

NextGen CIEMAT (June 2026)

- ¿Cómo absorber 1000 soles sin achicharrarse en el intento? – poster ([link](#))

Journal of Engineering for Gas Turbines and Power (January 2026)

- Multi-Objective Optimization of Expansion Trains in CAES: Incorporating Organic Rankine Cycles for Improved Efficiency ([link](#))

Journal of Physics: Conference Series (December 2025)

- Heat Transfer Equipment for a Compressed Air Energy Storage (CAES) Integrated with a Concentrated Solar System ([link](#))

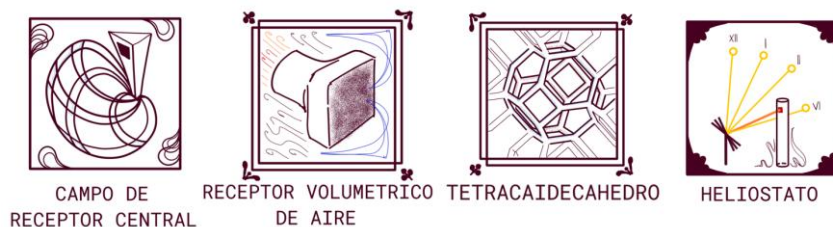


Figure 11: Symbols from Laura Alonso's (CIEMAT) poster, winner of the poster competition at NextGen CIEMAT

Only recent papers are listed.

See all of them here →

[Read more](#)



Figure 12: Alejandro Carballar (University of Seville) presenting their poster at ECOC



Funded by
the European Union

(GA 101122231)

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).



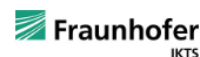
Find more information about us!

- The project website  is accessible via the link www.asterix-caesar.eu and is regularly updated
- Our leaflet, poster, roll-up, and the public presentation are available for download [here](#) 
- Check out our official project video as well as other short films on our [YouTube](#) channel 
- Follow us on social media: [LinkedIn](#) 



CENER

NATIONAL RENEWABLE
ENERGY CENTRE



Views and opinions expressed in this newsletter are those of the author(s) only and do not necessarily reflect those of the European Union, UKRI, or Swiss State Secretariat for Education, Research and Innovation (SERI). Neither the European Union nor any other granting authority can be held responsible for them.



Funded by
the European Union

(GA 101122231)

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).