

# ECOSun

## Economic COgeneration by Efficiently COncentrated SUNlight

*Project duration: from 02.2020 to 01.2023*

*Report submitted: 08.2021*

### **Publishable Summary**

ECOSun targets a radical cost reduction of electricity and heat co-generation via a CPV-T system, by applying low-cost materials and advanced industrial manufacturing methods. Solar radiation is captured in a parabolic through concentrator based on a novel support structure fabricated by injection molding and focused on a Co-Generation Absorber Module (CAM), where special c-Si-PV-cells are operated under concentration. The heat dissipated through the cells is transferred into a heat transfer fluid (HTF) and - in combination with the generated electricity - can be used for various applications, such as solar cooling or heating, significantly increasing system efficiency.

A significant cost reduction is achieved by designing and optimizing the economically most relevant elements of the ECOSun system:

#### **1. CPV-Cell**

As a novelty, a low-cost solar cell based on crystalline silicon will be designed, which can reach high efficiencies under 60 x concentration and perform well under elevated operating temperatures. Due to the concentration, much less active cell area is required, which reduces specific cost (€/Wp). (At high production volumes, mirrors can be acquired for 2~5 €/m<sup>2</sup>, while flat-plate PV panels range from 70~100 €/m<sup>2</sup>.)

#### **2. Heat Sink and Thermal Management**

The heat rejection strategy and hardware for optimal cell cooling (i.e. a sweet spot between cell service life, efficiency and temperature level for heat use) will be optimized with respect to low-cost industrial manufacturing, maximum service life and highest system performance. Integration of the cell with the heat sink will be studied for sake of robustness, ease of application and industrial feasibility of the system.

#### **3. Mirror and Support Structure**

Since mirror, support structure and related assembly represent the biggest cost share in most concentrating solar power systems, a novel approach using industrially manufacturable support elements (e.g. injection molding) is proposed. This will not only allow to reach independency from metal price fluctuations on the global market, but also enable easy assembly by untrained personnel, as well as a significant CO<sub>2</sub> reduction of the transportation process due to light-weight design.

All strategic goals of the ECOSun project are in accordance with the TWP SET-Plans by the European Union:

Europe is a high wage area and the only chance to regain leadership as CSP/CPV supplier is to substitute labor-intensive manual tasks with high-tech manufacturing know-how. This ambitious goal can be achieved by introducing automated manufacturing methods, like injection molding, instead of conventional welded/riveted support structures for through concentrators made of aluminum or steel. Austria has a long history in industrial manufacturing due to the strong relation to the automotive industry (MAGNA, BMW, etc.), where low-cost, large-scale serial production plays an important role. Many of Austria's companies are well known for innovation in the field of automated manufacturing and material science. From the steel industry (Böhler, VOEST, etc.) to high-tech fiber composite (Carbotech, SECAR) Austria's companies and related know-how must be considered a catalyst and ideal breeding ground for low-cost solar power components. Despite all the potential for design and engineering innovation, Austria needs research and business partners in southern Europe to realize its new ideas in the CSP and CPV market. The ECOSun project will be a door-opener for the desired international cooperation by integrating partners from Turkey and Spain.

### Project consortium

Coordinator and all contact details:

Full name of organisation	Graz University of Technology
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Participating countries and financing:

Country	Number of organisations involved	Project costs in EUR	Public funding in EUR
Austria	2	687 183	571 899
Turkey	2	357 010	357 010
Spain	1	191 000	145 500
<i>Total</i>	5	1 235 193	1 074 409

### Funding agencies involved and contracts

Funding Agency	Contract N° and Title
Austrian Research Promotion Agency (FFG)	Project number: 873785
Türkiye Bilimsel ve Teknik Araştırma Kurumu (TÜBİTAK)	219M027 219M028
Agencia Española de Investigación (AEI) Ministerio de Ciencia e Innovación (MINECO)	Project reference: PCI2019-111922-2  Title: COGENERACION ECONOMICA MEDIANTE LUZ SOLAR EFICIENTEMENTE CONCENTRADA