

# Techno-economic analysis of a hybrid solar-biomass heating system for the cork industry. What makes it profitable?

Filipe Gonçalves<sup>a</sup>, Ricardo Nepomuceno Pereira<sup>a</sup>, Isabel Malico<sup>a,b</sup>

<sup>a</sup>Universidade de Évora, Escola de Ciências e Tecnologia, Rua Romão Ramalho 59, 7000-671 Évora, Portugal.

<sup>b</sup>LAETA, IDMEC, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal.

e-mail: [filipegoncalves.100@gmail.com](mailto:filipegoncalves.100@gmail.com)

## Abstract

The industrial sector is an important energy consumer, which accounted for 29% of the world's final energy consumption in 2015 [1]. In the European Union this share is slightly lower, 25% in 2016, and in Portugal 27% [2]. Moreover, its energy consumption is still dominated by fossil fuels and industry is therefore an important contributor to the emission of CO<sub>2</sub> into the atmosphere. Looking at the penetration of renewable energies in the industrial sector, in 2016 in the EU28, only 8% of the final industrial energy consumption was supplied by renewable energies, being biomass presently the only renewable energy source with some expression and mainly in the biomass residue generating industries.

This paper focuses on the cork industry, a sub-sector where Portugal is an important player worldwide. Many industrial units already use biomass as an energy source; however, part of it could be replaced by solar energy, freeing biomass for other uses. The use of solar energy is technically possible, and for some of the industrial processes can be provided with commercially available solar collector. However, this is not done. One of the reasons is that the solar systems are costly and the industry has energy systems with a long life and is sensitive to costs. According to [3], the implementation of solar systems in the industry requires the installation of pilot plants with the help of public funds or incentives.

This work presents a techno-economic viability study for the implementation of a hybrid solar-biomass systems to provide process heat for the boiling of cork. As expected, for the proposed scenario, the implementation of the system is not profitable. The critical incentives in terms of CAPEX that would be required to implement the system with no financial losses are identified. Although the study focuses on a particular industrial sub-sector, it sheds light on the required incentives for the promotion of renewable process heat in industry.

**Keywords:** Process heat; cork industry; renewable energies; solar thermal systems; incentives.

## References

- [1] IEA (2018). <http://www.iea.org/statistics/>. Last accessed on 26.04.2018.
- [2] Eurostat (2018). <http://ec.europa.eu/eurostat/data/database>. Last accessed on 26.04.2018.
- [3] Guerrero-Quijano, A. Fernández-García, M. Pérez, E. Zarza and L. Valenzuela. Modelling of small- sized parabolic-trough solar collectors field for process heat production in a cork industry. *30th ISES Biennial Solar World Congress 2011, SWC 2011 3*, pp. 3412-3420. Kassel, Germany, August 28 – September 2, 2011.