TECHNO-ECONOMIC ANALYSIS OF SOLAR HEAT FOR INDUSTRY USE

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Overview

Industry represents more than 20% of GHG emissions in Europe and in many developing countries. Given that, in many cases, and more particularly for heavy industry and basic materials, there are not yet commercial technologies available, decarbonizing industry is a very significant challenge. However, there is a quite large part of industry (in terms of economic activity and energy use) that does not require large temperatures, and in which electricity or solar heat could play a very important role, especially in countries with a large solar resource such as Spain. Solar systems are being increasingly deployed globally, with thermal capacities up to 330 MWth. Most plants used parabolic troughs, but flat panels and vacuum tubes are also being used, depending on the heating needs. However, the large potential of this technology is not being fully used yet, mostly because of concerns about its economic feasibility. In this paper we compare the different solar heating options for industry applications for the case of Spain, and assess its competitiveness with the most popular alternative (natural gas).

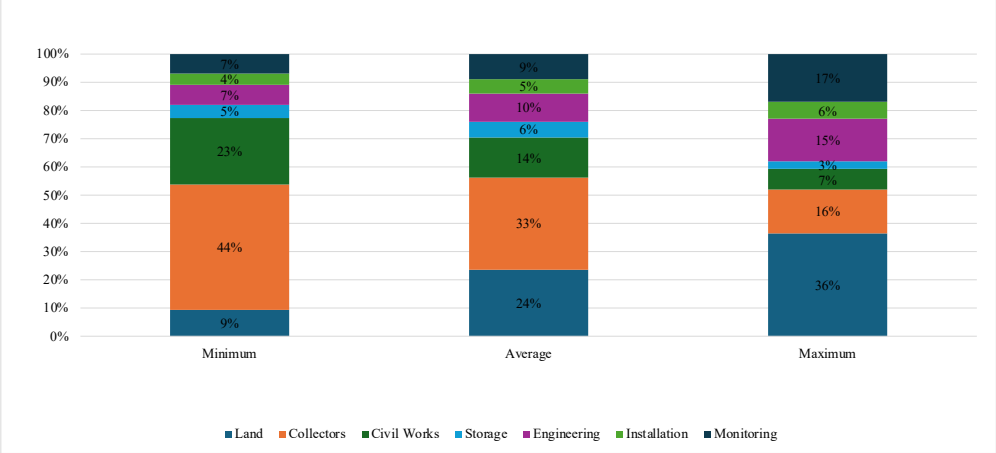
Methods

We carry out an extensive review of the academic and grey literature, searching for technical parameters and cost elements of the different solar heating technologies, and build detailed cost assessments of them. Based on these data, we estimate the levelized cost of heat (LCOH) for each type of technology, making different assumptions about heat production, investment cost, or solar resource availability.

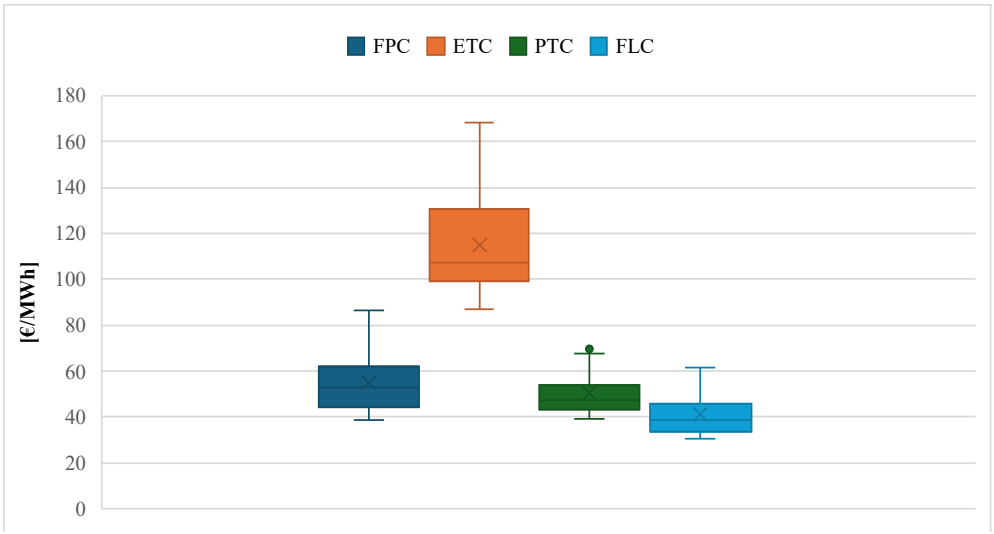
This LCOH is then compared to the LCOH of natural gas under different gas price assumptions.

Results

The following figure shows an example of the investment cost for parabolic throughs:



When we account for all costs, we obtain the following results for all technologies considered:



As may be seen, parabolic troughs and Fresnel collectors show competitive costs, well in the range of current heating systems fueled with natural gas. Flat panels are also in a similar cost range, although their applicability is limited to lower temperatures.

Conclusions

Our analysis shows that solar thermal heat may already be competitive compared with fossil alternatives, especially in countries with a large solar resource (such as Spain). It can also compete with the electrification of heat, which is typically the other option considered for decarbonizing low-temperature heat in industry. Solar heat also has a large advantage over other options: the cost of the resource is very low, and hence cost volatility is very small.

However, solar heat needs large investment volumes, and also large areas for deploying the solar collectors. Therefore, its application will probably depend on the particularities of the industry being studied, and also on the availability of good financial conditions. More research is underway in this regard.

References

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