

Industrial solar heat potential in Chile: A technical-economic analysis

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Abstract

This paper presents a comprehensive techno-economical potential analysis for integrating solar heat for industrial processes (SHIP) in Chile. Utilizing TRNSYS software for simulation and Python for data analysis, the study evaluates the levelized cost of heat (LCoH) and solar fraction for various industrial sectors across different regions of the country. The findings indicate that regions such as Coquimbo, Antofagasta, and Metropolitan exhibit high solar fractions and competitive LCoH values, particularly in hot water production. The central zone, especially the Metropolitan region, demonstrates significant potential for steam generation, achieving an average solar fraction of 50 % and producing 295 GWh/year of solar thermal energy. Validation with real-world data demonstrated an average error margin of 21 %, underscoring the developed heat load calculation model's reliability. The study concluded that SHIP is a viable solution for reducing energy costs and greenhouse gas emissions in Chile. It has the potential to displace over 3,500 GWh/year of fossil fuel energy in the considered productive sectors. These findings highlight the strategic importance of supporting SHIP implementation through favorable policies and investments.

Keywords: Solar heat for industrial processes, TRNSYS, Techno-economical potential, Levelized cost of heat, Chile

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