

# Mechanical Engineering Thesis Defense

## Fresnel Lens Solar Concentrator Application for Cement Production

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### Abstract

Concentrating solar thermal systems gained a wide interest for a long time to serve as a renewable and sustainable alternate source of energy. While the optimization and modification are ongoing, focused generally on solar power systems to provide solar-electrical energy or solar-thermal energy, the production process of Ordinary Portland Cement (OPC) has not changed over the past century. A refractive Fresnel lens application in cement production process is investigated in this research to provide the thermal energy required (350 C or 623 K) with zero carbon emissions for one stage in a two-stage production process. The location is considered to be Phoenix, Arizona, with a linear refractive Fresnel lens facing south, and concentrating solar beam radiation on an evacuated tube collector with tracking system rotating about the north-south axis and a seasonal tilt with zero degrees tilt angle (horizontal) in May, June, and July and a 33.45 degrees tilt angle for the rest of the year to minimize the angle of incidence. The mathematical analysis showed promising results based on averaged monthly values representing an average hourly useful thermal power and receiver temperature for each month throughout the year. The maximum useful thermal power throughout the year was obtained for June as 38.3 kWth with a maximum receiver temperature achieved of 819 K, and the minimum useful thermal power during the month of December with 29.7 kWth and a minimum receiver temperature of 701 K.



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Zoom Link: <https://asu.zoom.us/j/89504231882?pwd=WmNidGxyODFtRnFIZ01GUFBKVzNTZz09>