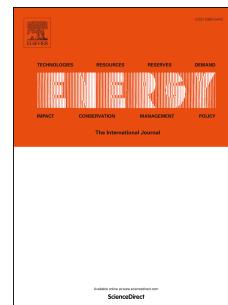


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Economic evaluation of flameless phosphate rock calcination with concentrated solar power and high temperature reactors

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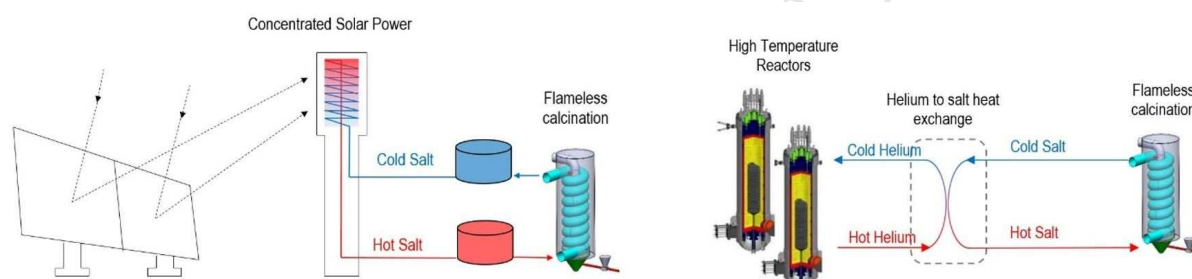
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Graphical abstract:



Abstract:

Flameless calcination, where a heat transfer fluid is used to provide heat for the calcination reaction to a mineral feed material may reduce direct carbon dioxide emissions during calcination by 50%. Concentrated solar power (CSP) and high temperature reactors (HTRs) are low-carbon emitting energy sources suitable for flameless calcination. This work provides a brief economic evaluation of flameless phosphate rock calcination with CSP/HTRs as heat sources. The economic evaluation consists of cost comparisons against gas-fired kilns and economic feasibility calculations based on the net present value method. The flameless system with CSP/HTRs is currently not cost-competitive. Anticipated cost reductions and higher natural gas prices may, however, change this outcome in the future. For the flameless system to be competitive low-interest rates (5-10%) and higher natural gas prices (7.5-10 US\$/mmBTU) need to be present. Although the flameless system with CSP/HTRs is presently not cost-competitive it can be economically viable given low-interest rates ($\leq 5\%$) and higher end heat selling prices (≥ 45 US\$/MWh_{th}).

Keywords: Flameless calcination, concentrated solar power, high temperature reactors, economic evaluation, phosphate rock

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