Article

Modeling of Combined Lead Fast Reactor and Concentrating Solar Power Supercritical Carbon Dioxide Cycles to Demonstrate Feasibility, Efficiency Gains, and Cost Reductions

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Abstract: Separate cycles for solar concentrating power and lead fast reactors, which innately have issues with weather, grid demand, and time of day, have potential to benefit when coupled into a single supercritical CO2 Brayton cycle. Combining these cycles could allow for the lead fast reactor cycle to thermally charge the salt storage in the solar concentrating power cycle during low demand periods and be utilized when grid demand increases. The implementation of the independent cycles into one cycle must be modeled to find the preferred location of the lead fast reactor heat exchanger, concentrating solar power heat exchanger, salt charging heat exchanger, turbines, and recuperators within the supercritical CO2 Brayton cycle. Three cycle configurations were studied: a two-cycle configuration which uses CSP and LFR heat for dedicated turbocompressors, combined cycle with two high temperature recuperators for both the CSP and LFR, and a combined cycle with CSP and LFR heat sources in parallel.

Keywords: Supercritical carbon dioxide Brayton Cycle; Concentrating Solar Power (CSP); Lead Fast Reactor (LFR), Cogeneration, Thermal Energy Storage

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Text.

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This is the example 1 of equation:

$$a = 1, \tag{1}$$

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

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$$\begin{aligned} a &= b + c + d + e + f + g + h + i + j + k + l \\ &+ m + n + o + p + q + r + s + t + u + v + w + x + y + z \end{aligned} \tag{2}$$

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Nomenclature

The following abbreviations and variables are used in this manuscript:

Abbreviations:

NREL	National Renewable Energy Laboratory
EES	Engineering Equation Solver
CSP	Concentrating solar power
LFR	Lead-fast reactor
MC	Main compressor
RC	Re-compressor
PC	Pre-cooler
HX	Heat exchanger
LTR	Low temperature recuperator
HTR	High temperature recuperator
A	Alternator
T	Turbine
P	Pump

Variables [Units]:

NTU	Number of transfer units [-]
CR	Capacitance Ratio [-]
$\dot{C}$	Capacitance Rate [W/K]
UA	Conductivity of heat exchanger [W/K]
$\dot{Q}$	Heat transfer rate [W]
$\dot{W}$	Power [W]
η	Isentropic efficiency [-]
ε	Effectiveness of heat exchanger [-]
δ	Approach temperature of heat exchanger [K]
h	Enthalpy [J/kg]
$\dot{m}$	Mass flow rate [kg/s]
T	Temperature [K]
y	Splitter Fraction [-]
P	Pressure [Pa]
v	Volumetric flow rate [m^3/kg]
Δ	Temperature difference [K]

```
#My ees file
def myfunc():
    return x
x = y

f = 8*y^2
```

$$a^2 + b^2 = c^2 \tag{3}$$

References

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