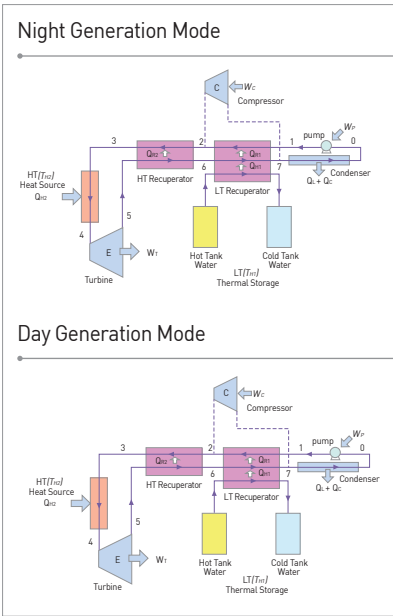


System Configuration and Operation Method of Supercritical CO₂ Power Cycle with Improved Exergetic Efficiency Using Both High-temperature Heat Source and Low-temperature Heat Source

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➤ System Configuration and operation method of a supercritical CO₂ power cycle that effectively uses the low-temperature heat source to obtain higher output from the same high-temperature heat source



Client / Market

- Coal-fired power plant, solar power plant, nuclear power plant

Necessity of this Technology

- Need to improve the efficiency and output and enable load control
- There is a limit to efficiency improvement as the high-pressure side has a higher specific heat than the low-pressure side in the regenerative heat exchange process of the supercritical CO₂ power-cycle.
- A recompression cycle had been proposed, but the output was reduced due to increased compression work.
- There is increasing interest for supercritical CO₂ power cycle system that could directly utilize different heat sources such as fossil fuel, biofuel, solar heat, nuclear power, and waste heat.
- There is a difficult with load control for coal-fired power plant or nuclear power plant, therefore, a supercritical CO₂ power cycle system needs to be developed, which can improve efficiency from the same heat source and enables load control.

Technical Differentiation

- By utilizing low-temperature heat sources like low-temperature waste heat and geothermal heat, high-efficiency generation using high-temperature heat sources like coal-fired power generation, solar power generation, and nuclear power generation can be achieved.
- For thermal power plant and nuclear power plant, using the same high-temperature heat source, 20% efficiency improvement and 40% load control can be achieved compared to the existing method.
- The proposed supercritical CO₂ power cycle utilizes low-temperature waste heat to obtain 20% higher output and efficiency improvement from the same high-temperature heat source.
- Compared to the thermal power plant and nuclear power plant that have a difficulty with load control, using the same high-temperature heat source, over 40% load control can be achieved.

DESIRED PARTNERSHIP

Technology Transfer

Licensing

Joint Research

Other

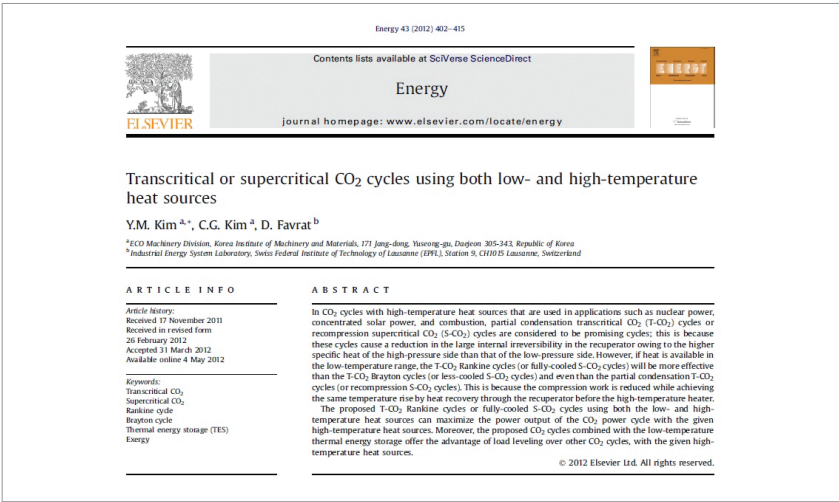


TECHNOLOGY READINESS LEVEL [TRL]

- | | | | | | | | | |
|-----------------------------|-------------------------------------|------------------------------|-----------------------|---|---------------------------|--|----------------------------------|---|
| Research, basic explanation | Project concept or idea development | Technology idea verification | Prototype development | Trial product production/ evaluation in similar environment | Pilot field demonstration | Development and optimization of commercial model | Commercial product demonstration | Mass production and initial market launch |
|-----------------------------|-------------------------------------|------------------------------|-----------------------|---|---------------------------|--|----------------------------------|---|

Excellence of Technology

- During the night, the supercritical CO₂ cycle operated for partial cooling and the low-temperature waste heat is stored.
- During the day, stored waste heat is used to run the proposed supercritical CO₂ cycle.
- For example, for nuclear power, the generating output is 358 MWe and the thermal efficiency is 37.6%. During the day, the generating output is 500 MWe, and the thermal efficiency is 52.5%.
- Using the same heat source, over 40% load control can be achieved.
- Published a SCI paper: Transcritical or supercritical CO₂ cycles using both low- and high-temperature heat sources (Energy 43 (2012), quoted 132 times (as of December 2018))
- Has several patents and papers on high-efficiency power cycle and energy storage.



Current Intellectual Property Right Status

PATENT

- Heat Engine Based on Transcritical Rankine Cycle with Improved Exergy Efficiency and Method Thereof (KR1345106, PCT/KR2012/010664)