

# **Recuperated versus single-recuperator re-compressed supercritical CO<sub>2</sub> Brayton power cycles for DEMO fusion reactor based on dual coolant lithium lead blanket**

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**Abstract—** The EUROfusion research program is currently exploring alternative solutions for a future fusion power plant with DEMO (DEMONstration Power Plant) prototype. One of the most important issues arising from a dual coolant lithium lead blanket-based reactor is the correct integration of the four thermal sources in order to achieve the highest electricity production. This study analyses the technical feasibility of supercritical CO<sub>2</sub> Brayton power cycles. Starting with a classical re-compressed cycle, which is taken as the baseline case, two alternative proposals are investigated. On the one hand, a modified re-compressed layout with only one recuperator is studied, and is found to achieve the same electric efficiency as that of the baseline case (34.6%). On the other hand, an optimised recuperated layout is proposed, which achieves a 33.6% electric efficiency. A parametric study is conducted in order to optimise the heat exchanger size. When the re-compressed layout is optimised, a loss of efficiency (5%) is experienced. In the case of the recuperated layout optimisation the efficiency loss is reduced to 3%, achieving a reduction in heat exchanger size of 2/3.

**Index Terms—** Balance of plant; Fusion power; Supercritical CO<sub>2</sub> Brayton cycle; DCLL; DEMO

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