Discussion: “Beyond Brayton Cycle: It is Time to Change the Paradigm” (S. Can G€ulen, 2018, ASME J. Eng. Gas Turbine Power, 140(11), p. 111702)

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Discussion: "Beyond Brayton Cycle: It is Time to Change the Paradigm" (S. Can Gülen, 2018, ASME J. Eng. Gas Turbine Power, 140(11), p. 111703)

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Discussion

The author makes a compelling argument that the continued effort of increasing the cycle pressure ratio and TIT will hit a wall of diminishing returns, and therefore, new variations to the Brayton Cycle should be looked into, such as intercooling, reheat, and constant volume combustion [1].

The acceptable complexity for any machine is mainly determined by the economic drivers and reliability constraints. In the end, the increase in efficiency achieved by the added complexity should be economically viable. With the global energy scenario changing more rapidly than ever before due to the increase in renewable energy sources, the role of GT in the power generation business remains uncertain at the moment. Such uncertainties are not conducive to introduce radical changes in the architecture, and that is why OEMs are trying to push the current GT architecture as much as possible. Although intercooler and reheat have been applied to stationary GT in the past, the uncertainty with constant volume combustion is high.

With the arrivals of CMC and the advancements in the cooling technologies, the wall of diminishing returns for the current GT architecture seems to be pushed back. The NO_x boundary is difficult to overcome; nevertheless, there are promising technologies on the horizon which could push the operating boundary even further. With renewables playing a greater role in the energy sector, parameters like startup times, off-design performance, and fuel flexibility are gaining importance as compared to maximum design efficiency. In this regard, a GT with reheat cycle is attractive. However, the market did not reward the OEM that introduced reheat in GT, forcing the OEM to sell its assets.

The aero engine OEMs, on the other hand, have taken significant steps in their pursuit to decrease fuel consumption by introducing concepts such as geared turbofan and ultra-high bypass turbofan. This drive for change is supported by the market requirements as a decrease in engine fuel consumption has a nonlinear effect on the overall aircraft fuel burn. Moreover, aviation is poised to grow at approximately 5%/year for next few decades, thereby providing a stable and a long-term perspective for OEMs to take risks. Unfortunately, industrial gas turbines OEMs are facing unpredictability on their role in the future energy market.

Reference

[1] Gülen, S. C., 2018, "Beyond Brayton Cycle: It is Time to Change the Paradigm," ASME J. Eng. Gas Turbine Power, **140**(11), p. 111703.

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