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Status of Cryogenic and Superconducting Components for MW-Class Electric Power Systems

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Superconducting and cryogenic power system components are understood to have strong advantages for MW-class power systems, such as greatly reduced weight, size and heat loss and increased energy efficiency. In this work, the unique properties and technical readiness assessment of cryogenic and superconducting components will be reviewed, and compared to alternate traditional technologies such as Cu-wire based and semiconducting. For almost every component considered, superconductor devices typically provide 5-10x and sometimes larger reductions of weight and heat loss, and even 3-10x reductions at the system level. There are also other advantages such as greatly increased lifetime and potentially much higher reliability in operation, because of significantly less mechanical degradation from high heat stressing and wear. The improved properties can enable the development of new capabilities for aerospace systems, such as vertical-take-off-and-lift (VTOL) with lightweight components, 2-5x higher improved energy efficiencies from electrical propulsion, and reduced operation noise.

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