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13. ABSTRACT (Maximum 200 words) New solid-state static frequency converters (SSC) can be used in place of motor-generator sets to produce 400-Hertz (Hz) power more efficiently. All government installations that use, repair, or build electronic components for aircraft or ships use 400-Hz power. Overall, SSCs can save 20 to 25 percent of the required input power for existing motor-generator (MG) sets used for 400-Hz power generation. In most cases, SSCs are cost effective in both new installations and in the replacement of existing MG sets. DTIC QUALITY INSPECTED 1				
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TechData Sheet

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July 1995

Solid State Frequency Converters

New solid-state static frequency converters (SSC) can be used in place of motor-generator sets to produce 400-Hertz (Hz) power more efficiently. All government installations that use, repair, or build electronic components for aircraft or ships use 400-Hz power. Overall, SSCs can save 20 to 25 percent of the required input power for existing motor-generator (MG) sets used for 400-Hz power generation. In most cases, SSCs are cost effective in both new installations and in the replacement of existing MG sets.

MG sets consist of two main components: the **motor** and the **generator**. The conversion process starts with 60-Hz AC input power to a motor. The motor converts electrical energy to mechanical energy via the shaft, which turns a generator. The generator then converts the mechanical energy back to electrical energy but at 400 Hz; this power is finally supplied to the load. Energy losses occur in both the motor and generator due to heat, windage, and friction.

The SSC is an electronic device and has no moving parts. The main components are the **rectifier** and the **inverter**. The rectifier converts 60-Hz AC input power to DC and then the inverter delivers 400-Hz AC power to the load. This electronic design is inherently more efficient than the mechanical process used by MG sets.

Most SSCs are approximately 20 percent more efficient than equivalent MG sets. SSC full load efficiencies range from 90 percent for units rated less than 50 kVA to over 95 percent for units over 100 kVA. Synchronous MG sets have an average full load efficiency in the range of 70 to 80 percent, while induction MG sets have full load efficiencies in the

65 to 75 percent range. Like SSCs, an MG set's efficiency decreases when the percent load decreases. Figure 1 shows typical efficiency versus percent load curves for all three types of converters.

The savings from an MG set to SSC change-out can be calculated from the output power requirements and the percent load on the existing MG sets. The Naval Facilities Engineering Service Center (NFESC) has developed a spreadsheet to calculate the energy savings, the dollar savings, the savings to investment ratio (SIR) and the simple payback of an SSC retrofit. Figure 2 shows sample output from the spreadsheet using 120-kVA data.

Calculations are based on input from the user or default values in the spreadsheet. Required data includes:

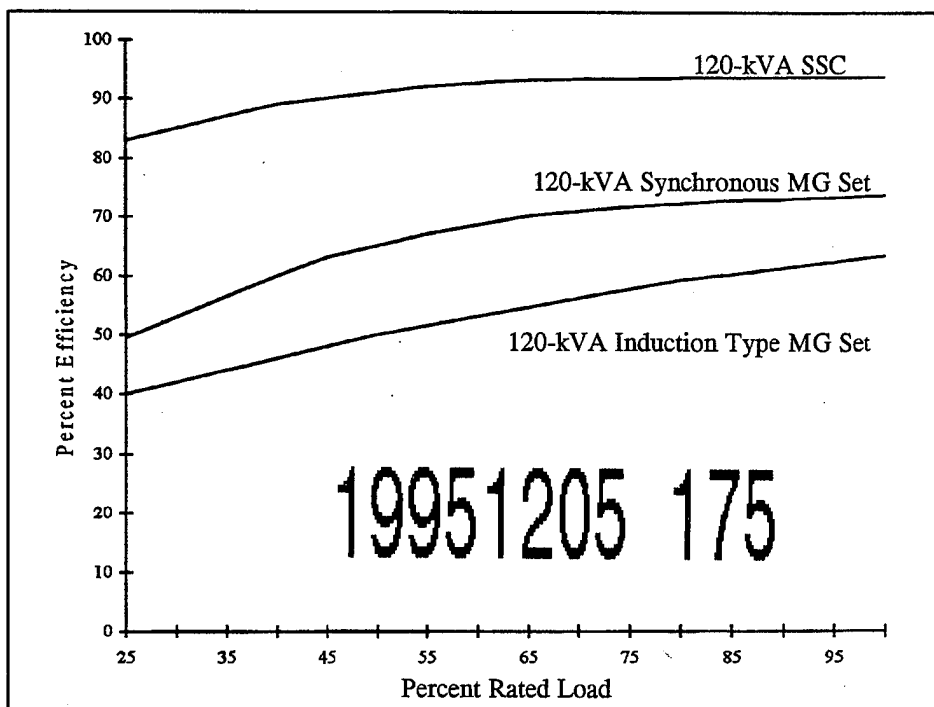


Figure 1. Efficiency versus percent load for MG sets and SSCs.

Figure 2. Sample output from NFESC 400 Hz MG/Static Converter Spreadsheet Version 3.2.

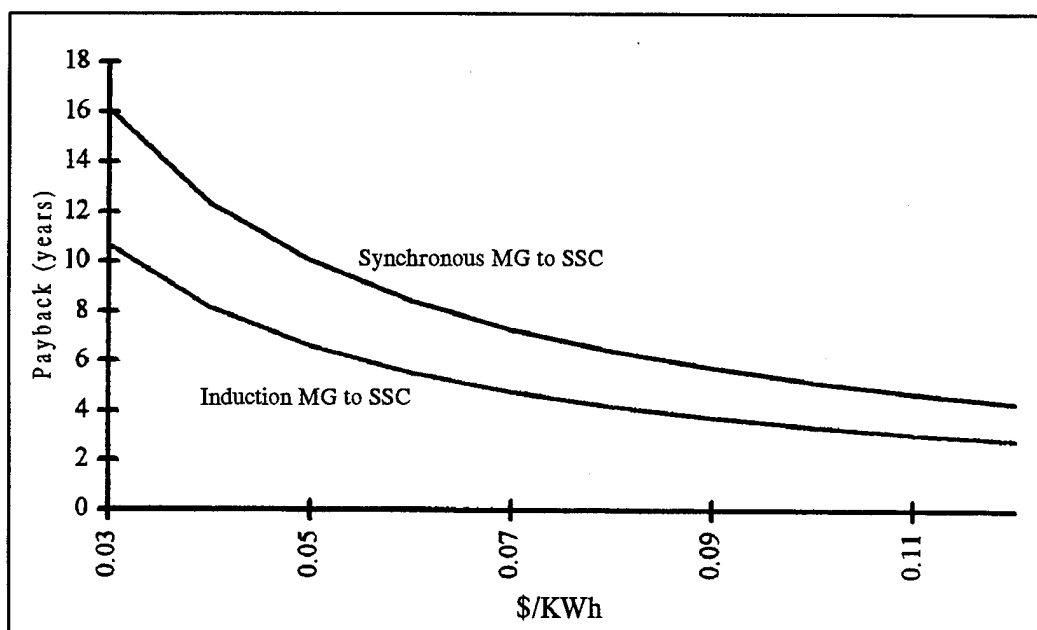


Figure 3. Payback for 120-kVA SSC retrofits.

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