PROBLEM Thousands of turbine generators contain retaining-ring material that is susceptible to stress corrosion cracking in moist environments. Though ring replacement is costly ($250,000–$500,000 per set), ring failures are more so, causing extensive machine damage and lengthy forced outages. Generator manufacturers recommend retaining-ring inspection and replacement schedules, but some utilities would prefer to develop in-house evaluation capabilities. Until recently, however, they lacked a practical independent means of deciding whether to delay inspection or ring replacement past the manufacturer-recommended dates. For example, at the Lower Colorado River Authority’s (LCRA’s) Gideon 3 and Fayette plants, the original equipment manufacturer recommended replacing the retaining rings. Given that replacement would cost more than $1.5 million, LCRA sought to evaluate the need for replacement independently.

SOLUTION LCRA used EPRI-developed guidelines to evaluate its generator retaining rings. Authored by engineers from EPRI’s Palo Alto office and Nondestructive Evaluation (NDE) Center in North Carolina, the guidelines grew out of a review of the literature on fracture mechanics and relevant materials properties, an extensive survey of inspection methods, analysis of utility experience with retaining rings, and NDE Center evaluations. The guidelines summarize available inspection methods, and suggest ways to plan and conduct ring inspections and to minimize stress corrosion cracking. Using these guidelines to evaluate the status of the four generator rings recommended for replacement, LCRA determined that replacement was not necessary.

BENEFITS
• LCRA estimates that its use of the EPRI guidelines saved $1.7 million in ring replacement costs at its four units.
• The utility also avoided vendor inspection costs of $25,000 per unit.

• Continued use of the guidelines will allow LCRA to evaluate future vendor recommendations and to improve maintenance planning and retaining-ring protection.
Calculated Value of Lower Colorado River Authority's Application

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<tr>
<th>Estimated Saving ($000)</th>
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<td>Investment Saving ($000)</td>
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<td>Total</td>
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| Year          | 1989–1993 | 1794 | 1794 |

Present value of total estimated saving ($000) 1794
Levelized annual saving ($000) 467

Assumptions Used in Calculations

1. This application involves no investment saving or fixed charges.
2. O&M saving is based on the following:
   - LCRA's use of the EPRI guidelines avoided ring replacement costs of $395,000 at its Gideon unit and $433,000 at each of three Fayette units. The utility also saved installation inspection costs of $25,000 per unit.
   - All costs are 1989 present value estimates. The calculation levelizes the total saving over five years using a 9.5% annual discount rate.
   - LCRA plans to use the guidelines in future testing and expects to avoid replacing four sets of generator retaining rings that the vendor has recommended replacing. However, the utility has not attempted to include these potential savings in this calculation.

References


EPRI reports are available from the Research Reports Center, (415) 956-4081.

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