

SUCCESS STORY



Four Utilities Publish Outage Guide for Gas Turbine Maintenance Outages

Member utilities in conjunction with EPRI developed and demonstrated key guidance for improving the overall quality control and quality assurance of planned hot gas path (HGP) outage activities for GE 7EA gas turbines.

The efforts of the utilities—DTE Electric Company (DTE), Great River Energy (GRE), Tri-State Generation & Transmission Association (Tri-State), and Tennessee Valley Authority (TVA)—resulted in the publication of the *7EA Hot Gas Path (HGP) Outage Guide* (3002022786) and the development of an accompanying GE 7EA Outage Quality Checklist to be released later this year.

IMPROVING QUALITY OF PLANNED MAINTENANCE OUTAGES

Planned maintenance outages account for over 70% of gas turbine (GT) unit unavailability. Improper reassembly procedures and wrongly applied maintenance practices can increase outage times and costs, and may result in catastrophic failure and loss of human life.

Owner/operator concerns have grown regarding the quality of GT planned maintenance outages, particularly regarding the tasks of inspection, reassembly, and re-commissioning.

RESEARCH

To lessen their dependence on outside service providers, with their limited availability of qualified maintenance personnel for this GT design, from 2020 to 2021 DTE, GRE, Tri-State and TVA in collaboration with EPRI developed and demonstrated key methods and guidance for improving the disassembly, inspection, reassembly, and re-commissioning

GE 7EA gas turbine units during planned HGP outages, including:

- Key maintenance activity checklists that include disassembly and reassembly hold points, verification points, and witness points with acceptance criteria.
- Inspection techniques and quality control criteria for the rotating, stationary, combustion and structural turbine parts, including expected dimensions, typical findings, and field repair methods with GO- or NO-GO acceptance criteria

APPLYING GUIDANCE AND METHODS

The developed guidance and methods were applied at three subsequent GE 7EA HGP outages – Tri-State in 2020, TVA in Spring 2021 and Great River Energy in Summer 2021. Following these demonstrations, DTE, GRE, Tri-State and TVA worked with the EPRI team to revise and publish a comprehensive GE 7EA Hot Gas Path Outage Guide (3002022786) in December 2021.

BENEFITS

The GE 7EA HGP outage guide aims for optimal execution of outage and maintenance activities, which can reduce unit downtime.

For outage team members, the manual serves as shared language and expectations, thus minimizing uncertainties in decision-making. For discussions with the OEM, owners/operators have credible data to challenge the OEM's criteria, such as whether to refurbish or repair rather than replace a component. Therefore, owners/operators can im-

plement real-time corrective actions to mitigate premature component failures resulting from improper reassembly procedures, reduce outage times to correct wrongly applied maintenance practices, eliminate costly replacement of repairable parts, meet emission compliance requirements, avoid unit capacity derating, improve gas turbine performance, and avoid catastrophic failures and possible loss of human life. Avoided costs from these types of failures are on the order of \$100Ks to \$1Ms per event. Most typically, damage from these events range for \$2M to \$5M per event, but can easily exceed \$10M for a single event.

Owners/operators can use the guide to develop in-house expertise. For example, TVA typically spends nominally \$700K per 7EA outage, and \$60K is spent on technical oversight and QA/QC by third-party service providers. In 2021 TVA had four hot gas path/major outages for their 7EA gas turbine fleet, thus spending about \$240K on outside oversight. With the outage guide, TVA staff can now oversee

7EA outages without having to pay third-party providers. TVA gains little gas turbine core knowledge using outside service providers. Implementing this outage guide within TVA Regional Engineering provides an additional step to developing existing staff into technically sound gas turbine centerline subject matter experts.

The knowledge developed throughout this project assisted DTE, GRE, Tri-State and TVA to plan, manage, and document the quality control and quality assurance of HGP outages at four GE 7EA power plants, including DTE's Belle River station (Michigan), GRE's LJS station (Minnesota), Tri-State's Knutson station (Colorado), and TVA's Lagoon Creek & Kemper County Stations.

While the 7EA HGP outage guide is derived from these members' experiences, it can be applied to the more than 5000 units throughout the world. Furthermore, the process and resulting outage guide has served as an approach for other gas turbine models.

RELATED EPRI PRODUCTS

REPORT TITLE	PRODUCT ID
7EA Hot Gas Path (HGP) Outage Guide	3002022786
Field Guide: Siemens 501F Outage Quality Checklist	3002020846
GT26 Overhaul Technical Support Manual, Volume 1—Outage Planning: Inspections, Quality Control Process, and Field Service Instructions	3002019992
GT26 Overhaul Technical Support Manual, Volume 2— Part 1: Combustion Component Inspection Forms and Guides	3002019993
GT26 Overhaul Technical Support Manual, Volume 2—Part 2: Rotating Component Inspection Forms and Guides	3002019995
GT26 Overhaul Technical Support Manual, Volume 2—Part 3: Stationary Component Inspection Forms and Guides	3002019996
GT26 Overhaul Technical Support Manual, Volume 2—Part 4: Structural Component Inspection Forms and Guides	3002019997
GT26 Overhaul Technical Support Manual, Volume 3—Commissioning Procedures: Cold and Hot Commissioning for GT26 Units	3002019998
GT26 Overhaul Technical Support Manual Web Application (GT26 App) V1.0	3002012593

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