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K. C. Cotton's Steam Turbine Performance Improvement Seminar
For Fossil and Nuclear Power Engineers
Presented by
Sam Gibson, P.E.

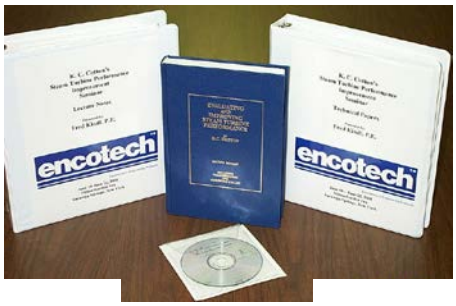
Formerly presented and originated by Ken C. Cotton, and based on his book "Evaluating and Improving Steam Turbine Performance", this continually updated seminar is a four and a half-day study of the topics listed in the accompanying outline. This seminar is now presented by Sam Gibson, Principal Engineer and Founding Partner of Performance Engineering, LLC. The knowledge and on-going experience Mr. Gibson brings to this seminar is unsurpassed by other seminars on the subject of steam turbine performance. Encotech's Steam Turbine Seminar offers an "open floor" atmosphere allowing attendees to bring forth questions to problems they may be currently experiencing, and in most cases, walking away with the answers they have been looking for.

Seminar material has been recently updated to cover performance improvements made possible by replacing steam path components:

- **New stage design technology**
- **Modern last stage blade design**
- **Improved sealing techniques**
- **Change of use possibilities**

This intensive seminar will enable you to:

- Determine the effect of power plant operation on turbine efficiency, heat rate, and power output
- Learn diagnostic techniques to pinpoint location and types of damage
- Develop testing programs to determine location and extent of deterioration
- Interpret diagnostic test data using case histories as examples
- Develop a better appreciation for optimum turbine design evaluation of proposed efficiency improvements
- Utilize steam path audit techniques to reduce repair and replacement costs



Who Should Attend

Plant Engineers, Performance Engineers, Turbine Engineers, Turbine Systems Engineers, Operations and Maintenance Superintendents and Managers, and Plant Managers

Seminar Outline:

I. Introduction

Annual fuel savings, heat rate improvement program, problem analysis technique

II. Basic Concepts

Calculation of flows, turbine efficiency, etc.

III. Fundamental Stage Designs

Impulse and reaction, stage packing leakage control, end wall loss, vortex design, last stage tip design, operating practices to minimize packing and spill strip damage.

IV. Turbine Efficiency

Factors affecting turbine efficiency: valve position, volume flow, pressure ratio, leaving losses, moisture loss, total exhaust loss

V. Control Valves

Full arc versus partial arc admission, effect of pressure drops on turbine performance

VI. Abnormal Operating Conditions

Feedwater heaters out of service, sliding pressure operation, ways to improve light load performance

VII. Turbine Cycle Monitoring

Enthalpy drop efficiency test, section efficiencies, maximum capacity test, trending: section efficiency, corrected MWe, flow, P1st, PHRH, and PIP BOWL, P1st/PHP EXHAUST, heat rate, alternative test, calculating expected efficiency, heater performance, acceptance testing

VIII. Turbine Characteristics

Flow, pressure, temperature, pressure ratio and area relationships, stage flow function, effect of moisture on flow function, unique 1st stage characteristics, last stage characteristics, pressure feedback

IX. Interpreting Test Data

Reconciling test data, verifying test data, trending test data, calculating expected section output, case histories - determining types of deterioration

X. Turbine Performance Deterioration and Correction

Quantify and evaluate losses from solid particle erosion, deposits, rubs, mechanical failure, foreign object damage, last stage water erosion, and leakages, Steam path audits: corrective action, repairing flow path damage, modifications to minimize future SPE damage, modifying designs to eliminate steam whirl, reconciling steam path audit and test results, dollar value of repair

XI. Combined Cycle Plants

Special design and operational characteristics, effect of deterioration on performance, testing and monitoring

XII. Operating Cycle Maintenance to Improve Heat Rate

Cycle leakage and its impact on performance

XIII. Summary Review

Rules of thumb, acceptance testing (bench mark) if not available calculate expected performance, monitoring, analysis of test data, inspection

About the Presenter:

Sam Gibson co-founded Performance Engineering, LLC in 2000 after over 10 years with Southern California Edison. Sam has over 25 years of experience in performance engineering and continues to work actively in the field conducting performance tests, economic analysis, and performing turbine steam path audits. Sam was also involved in the original development of the Encotech Steam Turbine Performance Evaluation Program (STPE).

Experienced in:

- Performance Testing
- Turbine Steam Path Audits
- Performance Analysis
- Nuclear Plant Component Design
- Station Performance Engineering