

Steam Turbine Service

Condenser Upgrade

The overall efficiency of a steam power plant is strongly influenced by the performance of its condenser. Poor condenser performance may result in thermodynamic losses and thus reduces the profitability of the power plant.

Another important factor is the condenser's operating reliability. In the worst case the entire water/steam cycle could be damaged by corrosion effects triggered by condenser problems.

Our solution

Upgrading the condenser by implementing optimized tube bundle design and tube material to achieve and sustain low condenser pressure may improve utilization of the thermal potential in the water/steam cycle.

Siemens can offer the following products for upgrading and modernizing your condenser:

- Tube bundle replacement
- Tube bundle optimization
- Tube replacement with new material
- Continuous tube cleaning system
- Optimization of air removal and evacuation system
- Erosion protection sleeves
- Cooling water system analysis and optimization

Your benefits

Condenser upgrades can offer the following potential benefits:

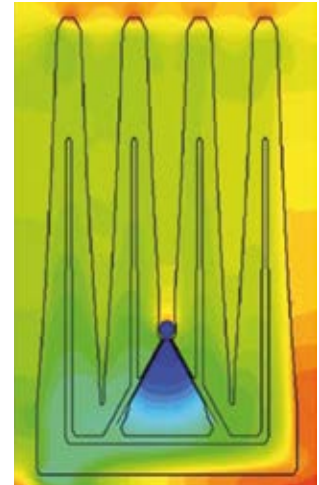
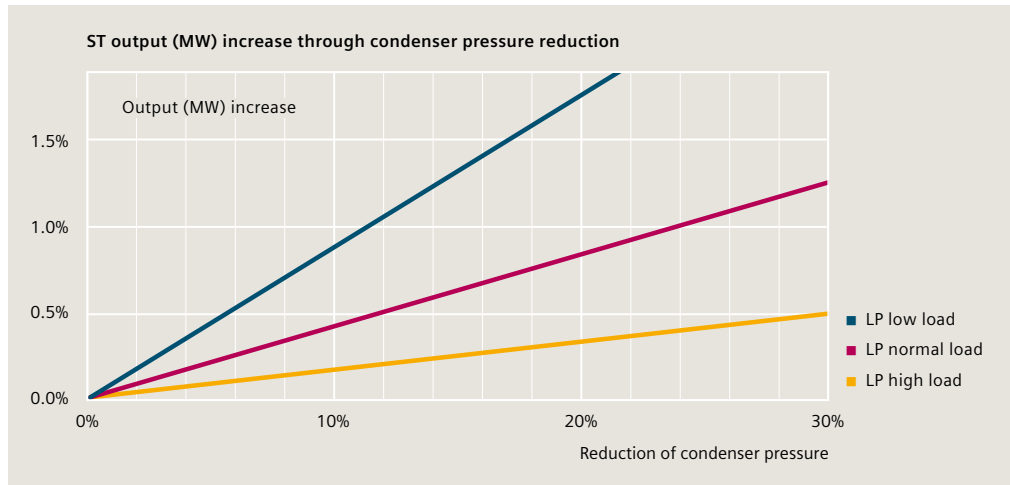
- Reduced condenser pressure – increased output and efficiency of the steam turbine
- Increased condenser operating reliability and reduced forced outages
- Reduced cooling water in-leakage and air ingress
- Reduced condenser tube corrosion
- Reduced bio-fouling and improved cleanliness factor
- Avoided corrosion effects in the water/steam cycle
- Lower future condenser maintenance expenditures

Features

- Replacing the complete tube bundle(s) can improve condenser performance in various areas. The unique Siemens condenser tube bundle design provides a uniform steam flow to all tubes, thus reducing the pressure drop and therefore lowering the backpressure at the turbine exhaust. Furthermore, sub-cooling of the condensate and the dissolved oxygen in the condensate can be reduced significantly. The accumulation of non-condensable gases in the tube bundles can be eliminated.



Tubing of the new Farge condenser at the Siemens manufacturing plant



Increase in plant output vs. condenser vacuum*

Computational fluid dynamics simulation

- The condenser pressure can be reduced by optimization of the existing tube bundle configuration through selective pulling of tubes.
- Using high-grade tube and tubesheet materials like stainless steel and titanium can significantly reduce or prevent the occurrence of erosion and pitting, often observed with copper alloys, as a function of the mineral salt and suspended matter content of the circulating water. This also eliminates the need for descaling and ferrous sulfate dosing.
- To improve the cleanliness factor of the condenser tubes and to reduce bio-fouling to maintain the design heat transfer rate, a continuous tube cleaning system and water filters can be installed.
- Erosion protection sleeves provide protection against droplet erosion, thus avoiding repair of leaking condenser tubes, especially in saturated steam turbine units. Siemens holds a patent on a unique type of erosion protection sleeve and the installation method.
- An analysis of the complete cooling water cycle includes all relevant components of the cooling water system, like condenser, cooling towers, cooling water pumps, etc. and proposes the necessary measures to fully utilize the potential of the steam turbine.

References

Some typical projects in steam power plants:

- Genkai nuclear power plant, Japan: Increased performance of the condenser was achieved through replacement of eight modules, optimized tubing, improved material (titanium) and high quality of manufacturing.
- Farge steam power plant, 350 MW, Germany: In 2004 the steam turbine and the condenser were upgraded. The replacement of the condenser modules resulted in an additional output.
- Ibbenbueren steam power plant, 752 MW, Germany: In 2009 Siemens modernized the steam turbines as well as the two condensers. The four tube bundle modules in both condensers were replaced with cutting-edge technology. This allowed the LP turbines to be designed with larger last stage blades. In total the whole modernization package resulted in additional power output of 86 MW.

* For illustrative purposes. Actual results may vary.

Published by
Siemens AG 2017

Power Generation Services Division
Freyeslebenstrasse 1
91058 Erlangen, Germany

For more information, please contact our Customer Support Center.
Phone: +49 180/524 70 00
(Charges depending on provider)
E-mail: support.energy@siemens.com

Article No. PSPG-B10211-00-7600
Printed in Germany
Dispo 34805
TH 288-161286 DA 0417

Subject to changes and errors.
The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.