BENSON®
Once-Through
Heat Recovery Steam Generator
BENSON® Once-Through technology for Heat Recovery Steam Generators

New application of proven technology

Siemens’ development of the Once-Through (OT) technology started in 1924 with the acquisition of the patent rights from Marc Benson.

The BENSON® Once-Through technology using the principles introduced by Siemens has been successfully demonstrated in more than 1000 conventional steam plant applications with ratings up to 1000 MW and steam conditions up to 300 bar/610 °C (4350 psi/1120 °F). The design principles were successfully applied for an Once-Through Heat Recovery Steam Generator (HRSG) at the Cottam 390 MW combined cycle power plant in Great Britain in 1999 (as shown on the cover page).

Today, after further development and more than five years of operational experience at Cottam – with more than 50,000 operating hours – the BENSON® Once-Through HRSG technology has become the most promising one for future advanced combined cycle power plants. Simply stated, it retains all the virtues of the proven natural circulation principle of drum-type boilers (i.e. flow stability and uniform temperature distribution), yet at the same time replaces the high-pressure drum with thin-walled components to improve operating flexibility.

As the result of the excellent operating experience at the Cottam plant, Siemens is providing the BENSON® HRSG for several additional utility projects in Central Europe.
Small changes lead to big improvements

Main features of BENSON® Once-Through HRSG

The BENSON® Once-Through evaporator is implemented in the high pressure (HP) section. This provides the following attributes:

- Maintains vertical tube module arrangement in horizontal gas path as proven in drum-type boilers.
- Replaces HP drum with thin-walled components (separator), which improves operational flexibility.
- Maintains natural circulation flow characteristics and therefore assures flow stability and even heat distribution.
- Requires no changes in HP economizer and HP superheater.
- Retains proven low pressure and intermediate pressure drums.

The BENSON® system – Elimination of thick-walled components

BENSON® HRSG technology maintains proven features of drum-type boiler and improves operational characteristics
The proven choice for advanced combined cycle power plants

The BENSON® technology represents the Once-Through principle for evaporation at the highest level.

High operating reliability has been achieved by applying sound design fundamentals and extensive empirical analyses:

- Intensive research and development especially in the field of heat transfer and pressure drop of two-phase flow at the Siemens BENSON® test rig.
- Continuous exchange of design and testing information between Siemens, our BENSON® licensees and power plant owners.

The BENSON® Once-Through technology is the best choice for advanced combined cycle power plants. This is evidenced by the fact that a growing number of customers are adapting it for their power plants.

There are more than ten boiler and HRSG suppliers worldwide as Siemens BENSON® licensees and the list continues to grow:

As of the end of 2005, this list includes five major suppliers in Europe, three in North America, two in Japan and one in Korea.

For further information, please refer to the BENSON® homepage:

[www.siemens.com/bensonboiler](http://www.siemens.com/bensonboiler)
The cornerstone for operational flexibility

Integration into Siemens power plants
Since it is difficult for power plant owners and operators to predict future operating requirements, the application of the BENSON® Once-Through HRSG, along with additional system integration provided by the Siemens plant designers, gives the plant the flexibility to meet cycling and fast start requirements. And this is done while maintaining high efficiency levels and environmental friendliness required for advanced combined cycle plants.

The BENSON® Once-Through HRSG technology provides the following:
- Significant shortening of plant start-up time by allowing unrestricted gas turbine start-up.
- Increase of efficiency during start-up by minimizing gas turbine operation in part loads.
- Reduction of gaseous and liquid emissions through shorter start-up process and elimination of drum blow down.
- Reduced consumption of chemicals through advanced feedwater treatment.
- Improved efficiency at high ambient temperatures due to adjustable evaporating point.
- Capability for higher steam parameters (pressure and temperature), because there are no limitations through natural circulation.

With the optimized integration of BENSON® HRSG, Siemens advanced combined cycle power plants provide unsurpassed operating flexibility.