



# Fired Benson<sup>®</sup> steam generator

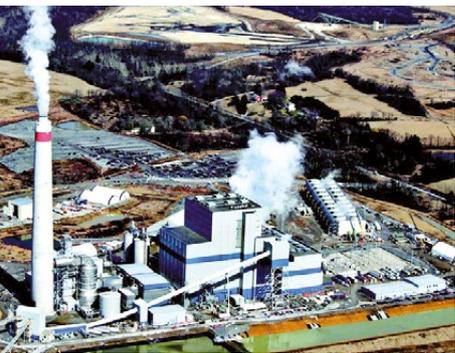
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**SIEMENS**  
ENERGY

# Fired Benson® steam generator

All features of modern once-through steam generators have been developed under the Benson license or were used for the first time by a Benson licensee. These include operation at supercritical pressure, sliding pressure operation and gas-tight welded wall heating surfaces. More than 1,380 steam generators have now

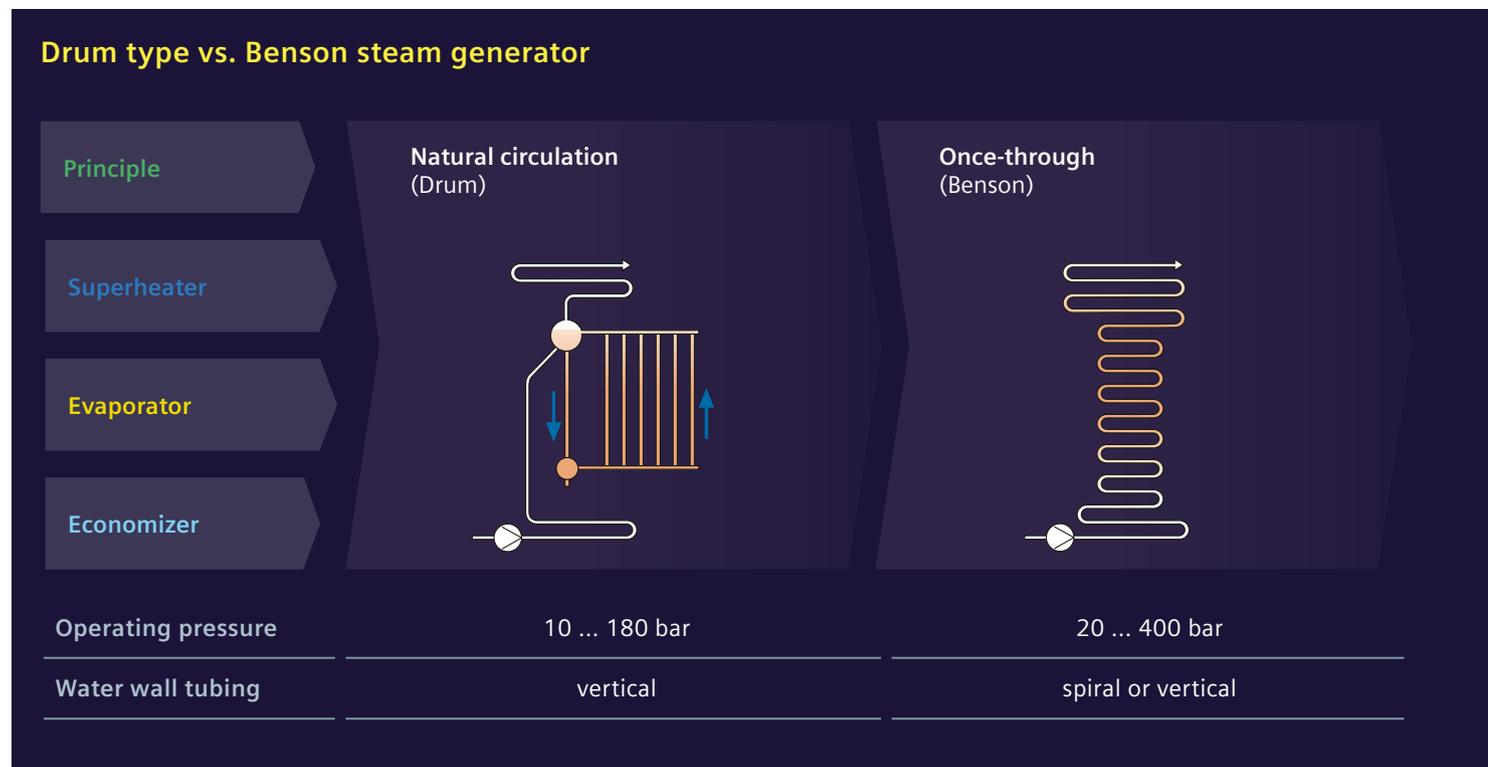
been built under the Benson license, with outputs ranging up to 1,300 MW(el) and steam pressures up to 350 bar. Since 2004, contracts have been signed for more than 80 steam generators with so-called ultra-supercritical steam parameters, i. e., with live steam temperatures in excess of 600 °C.



Longview Power LLC, USA

**Coal fired power plant Longview in Madsville, West Virginia with an installed capacity of 695 MW**

- The world's first supercritical pulverized coal boiler with vertical water wall tubing
- Application of the Benson low mass flux design patented by Siemens Energy
- Boiler supplied by BHI-FW Coporation



In contrast to drum boilers, a Benson steam generator can be operated at subcritical as well as supercritical pressure. The position of the evaporation end point can be moved freely as a function of the operating conditions.

Benson steam generators have properties and advantages that are crucial for economic success in today's deregulated electricity markets.

- Extremely high power plant efficiency levels are achieved in this design through supercritical live steam parameters. The live steam parameters are effectively limited only by the properties of the materials used.

- Thanks to the variable evaporation end point, the live steam temperature can be kept constant over a wide load range. This results in high efficiencies even under partial load.
- The thermally elastic construction of Benson steam generators allows rapid changes of output in sliding pressure operation of 4–6 % / min as well as short start-up times.

- The design of the Benson steam generator can be optimized to every available fuel. Steam output and live steam temperature are unsusceptible to variations in fuel properties in operation.

### Flexible design – Spiral and vertical water wall tubing

The great majority of once-through boilers in the last 30 years have been designed with a combustion chamber with spiral-wound tubing. Since the beginning of the new millennium, vertical tubing in the lower combustion chambers has been successfully

introduced to the market, with the Benson low mass flux design patented by Siemens Energy.

In addition to the usual pulverized coal burners, systems with wet ash removal and systems for

burning biomass are also used. The first and only supercritical plants in the world with circulating fluidized bed as well as anthracite-fired steam generators with dry ash removal have been built using vertical tubing and put into operation successfully.

### Our know-how and what we offer

Our know-how concentrates on the thermodynamic and thermohydraulic design of the evaporator system of fired Benson steam generators.

Specifically developed and highly specialized Benson design software enables us to predict:



**boiler performance**



**temperature imbalances and material temperatures**



**pressure drop and flow distribution**



**as well as static and dynamic flow stability in the evaporator heating surfaces.**

Moreover, our Benson-specific control concepts make a key contribution to ensuring the best possible operation of your particular power plant.

We offer you our specific know-how within the Siemens Energy Benson license. Basically, the license comprises the following components:

- Usage of Siemens Energy patents for the construction of Benson steam generators
- Usage of specifically developed and highly specialized Benson design software
- Training, consulting and design reviews
- Transfer of the latest findings from research and development

In addition to providing the Benson license, we also advise utilities on questions related to the evaporator system of once-through steam generators.

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