GE Hitachi Nuclear Energy

Advantages of Boiling Water Reactors (BWR)

fact sheet

Simplified, Safer, and More Economical Nuclear Reactor Technology

In the 1950s, GE Hitachi Nuclear Energy (GEH) developed breakthrough light water nuclear reactor technology: the Boiling Water Reactor (BWR). Since then, GEH's BWR technology has evolved; each design more simplified than the previous. As a result, each generation of the BWR has provided increased safety and improved economics.

Based on a single direct cycle, the inherent design of BWRs is more simplified and requires fewer components than the indirect cycle of its counterpart, the Pressurized Water Reactor (PWR). Technological innovations continue to increase BWR safety and economics through design simplification. GEH's ABWR and ESBWR designs employ the most advanced technology in the BWR evolution. These simplified designs reduce total plant capital costs, construction materials, and operation and maintenance expense.

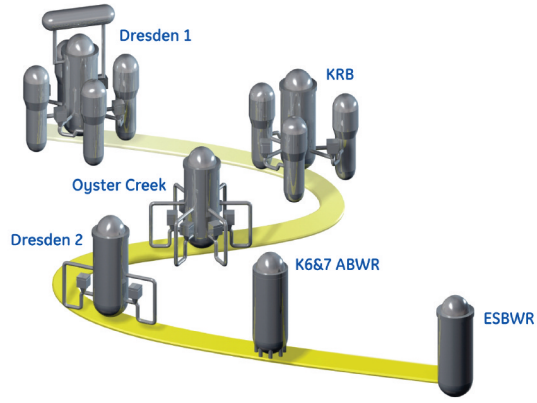
Fewer Components

Today's BWR designs significantly reduce the number of major components in the Nuclear Steam Supply System (NSSS)—the system that generates the steam needed to drive the turbine generator unit. BWRs do not carry the capital, operation, or maintenance costs of certain components that exist with PWRs such as steam generators, heat exchangers and pressurizers. The elimination of external recirculation loops in BWRs also translates into more compact containment and reactor buildings, reducing the amount of construction materials and associated costs during construction.

NSSS Component Comparison

ABWR & ESBWR	PWR
Reactor Pressure Vessel (RPV)	Reactor Pressure Vessel (RPV)
No Steam Generator	Steam Generators
No Pressurizer	Pressurizer
No external recirculation loops or pumps	External recirculation loops and pumps
Bottom entry control rod drives	Top entry control rod clusters

Evolution of BWR Reactor System Design



GEH's BWR technology accounts for 79 operating plants worldwide.

Unique Containment

Pressure suppression technology also contributes to smaller containment structures compared to PWRs, which are constructed with large, dry containment structures that rely on the strength of the steel or concrete to contain the build-up of energy released should an accident occur. Pressure suppression and wet containment are unique BWR design features that maintain safety. In the unlikely event of an accident, the suppression pool water in a BWR containment structure absorbs the energy released into the primary containment, rapidly reducing pressure build-up.

Water from BWR suppression pools is also used for the Emergency Core Cooling System (ECCS) pumps in an ABWR, and the equalizing lines in an ESBWR, to flood the reactor vessel with water—preventing overheating in the event of a Loss of Coolant Accident (LOCA).

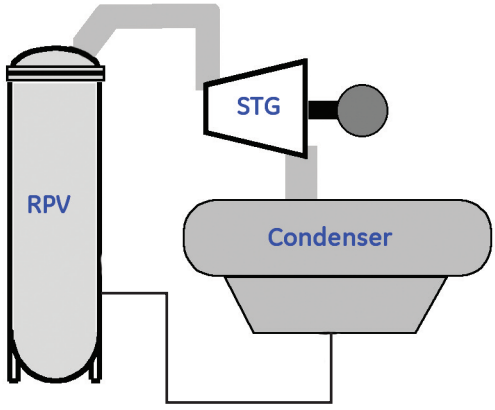
Reduced Operation & Maintenance

- No need to enter primary containment during power operation
- No rotating flywheels in the reactor coolant system to repair or replace
- Reactor moderator is in demineralized water, avoiding the difficulties associated with significant corrosion caused by borated water on the pressure vessel and other key components

HITACHI

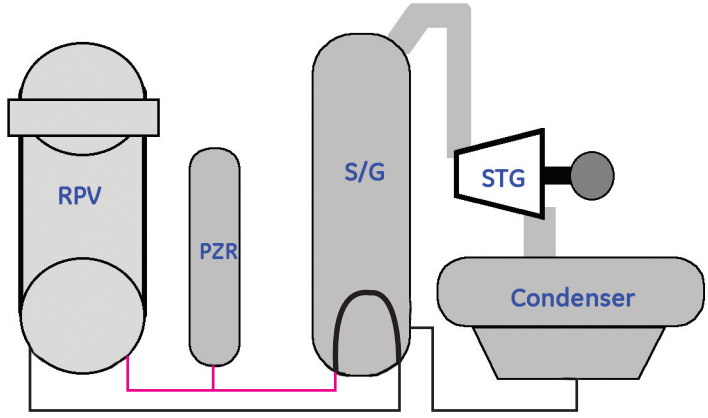
Comparison of BWR and PWR Components and Systems

Boiling Water Reactor



The reactor heats the water and turns it directly into steam. The steam drives a steam turbine, which spins a generator to produce power.

Pressurized Water Reactor



The water in the reactor is pressurized so it does not boil. This heated water then passes through a heat exchanger called a steam generator. The heat from the steam then converts another loop of water to steam, which drives the turbine to produce power.

Characteristic	BWR	PWR
Heat Generation	Direct Cycle	Indirect Cycle
Core Physics & Fuel	Similar	Similar
Thermal-Hydraulics	Two Phase Flow	Single Phase Flow
Operating Reactor Pressure	Low	High
Reactivity Control	Control Rod Based	Control Rod and Chemistry Based
Chemistry	Pure Water	Borated Water
Secondary	Contaminated	Normally Non-Contaminated
NSSS Components	Few	Many
Load Following	Easier	Complex
Life-Cycle Economics*	Better	Poorer
Operation and Maintenance Costs**	Lower	Higher
Depressurization	Fast	Slow
Loss of Coolant Accident (LOCA)	No Core Uncovery	Core Uncovery Postulated
Core Damage Frequency	Improved	Acceptable

*Based on equivalent reactor technology comparisons.
**Based on independent plant owner study.

HITACHI

For more information, contact your GE Hitachi Nuclear Energy sales representative or visit us at www.ge-energy.com/nuclear

GEA14883C