

In order to cope with the change in the environment within the electric business, Toshiba is focusing on promotion of design/manufacture/construction/maintenance of power generation plants, related facilities and machines inside and outside Japan, while further improving economics and reliability, taking global environmental problems fully into account and devoting full attention to developments in new energy technology. Toshiba also provides many social infrastructure facilities that support social and economic life lines, including power electronics products such as control device components and UPS, which have contributed to the improvement of reliability in system construction and elevator systems such as the double-deck elevator, which has improved the level of freedom in building design.

Thermal Power Plants

Recently Commissioned Large Thermal Power Plants

1,000 MW 60 Hz Tandem Compound Plant— A 1,000 MW steam turbine generator built for Chubu Electric Power Co., Inc. (HEKINAN Unit No.4) started commercial operation in November 2001. The unit incorporates 40-inch titanium blades in the last stage of the main turbine, and 24.1 MPa 566/593 °C steam condition to attain a high degree of efficiency.

9FA+ Combined Cycle plant— Toshiba has now completed the first and second units of the Tokyo Electric Power Company's Shinagawa Thermal Power Plant which will supply a total 1,140 MW of electric power. These newly developed units achieve 50 % thermal efficiency.

Turbine Rehabilitation of Geysers Geothermal Power Station: Super Rotor project

Toshiba provided new model steam turbine rotors for Calpine Corporation's Geysers Geothermal Power Stations #11 and #14. Toshiba has provided 1,610 MW Turbine/Generators for 19 existing units in Geysers area. This new model rotor is called the SUPER ROTOR which incorporates advanced 23-inch last stage blades, advanced coated nozzles, and snubber blades resulting in higher performance and reliability.

Comprehensive C&I Renovation of TACO A Power Station #7 to #9

Toshiba has won an EPC contract from Electricidad de Caracas to comprehensively renovate C&I (Control and Instrumentation) system of the TACO A P/S #7 to #9 (3 × 460 MW) in Venezuela. This large-scale, innovative C&I project includes DCS for plant control and automation, replacement of MHC with EHC, AVR, field instruments and actuators, renovation and modernization of the central control room, and a full scale simulator.

TOSMAP-DS™ is applied the latest powerful control system which enables sophisticated high-level coordinated control and plant automation.

- EPC : Engineering Procurement Construction
- DCS : Distributed Control System
- MHC : Mechanical Hydraulic Control
- EHC : Electro Hydraulic Control
- AVR : Automatic Voltage Regulator



View of installed steam turbine and generator



Shinagawa Thermal Power Station of The Tokyo Electric Power Co., Inc.



Super rotor



Renovation plan for central control room

245 kV Integrated Air Insulated Switchgear

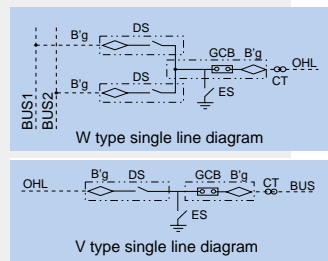
Toshiba has developed a new concept 245 kV integrated air insulated switchgear (AIS) - TSMAS™ for high voltage substations. This switchgear integrates live tank gas circuit breaker (GCB), disconnectors (DSs) and earthing switch (ES) in one unit. In order to realize this integration, an SF₆ gas insulated DS, which eliminates exposed contacts from AIS substations, and a single body operating mechanism, which operates GCB and DS is applied for the switchgear.

High voltage switchgear can be classified into three categories – AIS, gas insulated switchgear (GIS) and hybrid type GIS (H-GIS). Toshiba maintains a strong profile as a switchgear manufacturer overseas, especially for high voltage GIS. Toshiba TSMAS™ has been developed based on the design concept of "The performance of H-GIS at the price of AIS" and has opened up new categories in the field of high voltage switchgear.

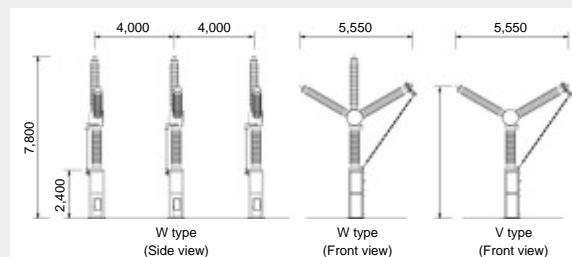
Toshiba TSMAS™ has two applications (W type; consisting of one GCB, two DSs and one maintenance ES for a double busbar scheme & V type; consisting of one GCB, one DS and one maintenance ES for a single busbar scheme, one and half breaker scheme, ring busbar scheme) which gives users the flexibility of application in any type of substation configuration.



245 kV integrated AIS



Single line diagram



Outline of W type and V type

"Hydro-e KIDS™" Newly-Developed Micro-Hydro Generating Equipment

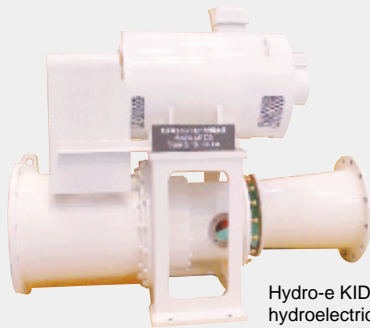
The newly-developed micro-hydroelectric generating equipment "Hydro-e KIDS™" was commissioned at Uematsuchou in Japan in 2001.

This unit is utilized to provide an electricity source for the facilities in the park.

Hydro-e KIDS™ is classified into three types, that is, S, M and L type standardized units in order of size so as to conform to the various types of site condition. The applicable effective head and generating output ranges are from 2 m to 15 m and 5 kW to 200 kW respectively. The units are designed with small and compact package construction to facilitate transportation and handling, and furthermore reduced construction cost is achieved by adopting a straight pipe-in shape for turbine water passage, which simplifies construction work.

The Hydro-e KIDS™ supplied for Uematsuchou is an S type unit and the ratings are as follows:

Generator output : 6 kW
Effective Head : 10.5 m
Discharge : 0.1 m³/s



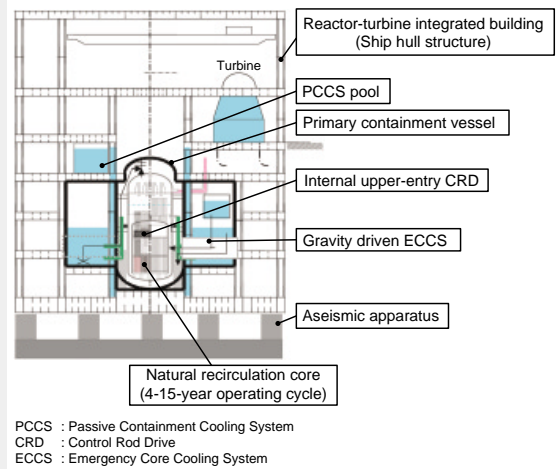
Hydro-e KIDS™ type S micro-hydroelectric generating equipment



Hydro-e KIDS™ type S system



Innovative LWRs and Advanced Core/Fuel Technology



Long-cycle simplified boiling water reactor (BWR) concept

Toward the energy market beyond 2010, Toshiba is developing two innovative light water reactors (LWRs) as well as an advanced core/fuel technology.

One of the innovative LWRs, namely the long-cycle simplified boiling water reactor (LSBWR), is being developed for flexibility in conforming with electricity market demands around the world. Major features of the LSBWR are natural circulation core cooling, a hybrid safety approach, integrated building structure accommodating both the reactor and the turbine, and a long operating cycle.

The other innovative LWR, a supercritical-water cooled power reactor (SCPR), is being developed to achieve economic competitiveness with other energy systems. Adoption of supercritical-water (25 MPa) as a coolant will deliver simple/compact plant systems as well as high thermal efficiency of over 40 %.

The advanced core/fuel technology is pursuing the high conversion capability of fissile materials by neutron spectrum hardening. This is achievable with the advanced tight lattice fuel design currently being developed by Toshiba.

Establishment of Laser Application Maintenance Techniques for In-Reactor Structures

Toshiba is promoting the development and application of laser application maintenance techniques for nuclear reactor internals.

As laser application maintenance techniques offer characteristics advantageous for nuclear plants, Toshiba is able to perform effective maintenance execution.

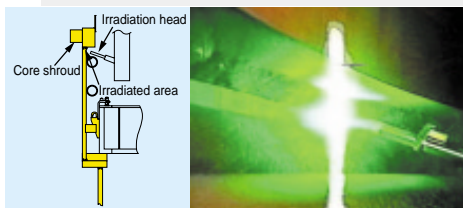
Laser application maintenance techniques have the major strengths listed below:

- The irradiation head is of such small size that it can be applied in complex shapes or narrow region.
- Repair welds with low heat effects are ideally suited to the materials used in irradiated reactor internals.

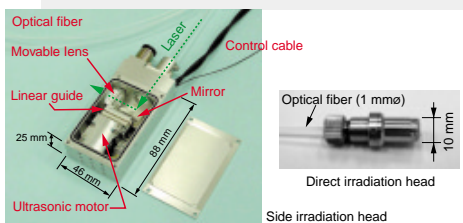
Toshiba has a great deal of experience in the execution of laser maintenance techniques in operating nuclear plants, and has already established major techniques for reactor internals, such as laser peening, laser desensitization treatment, or laser corrosion resistance cladding.

Laser desensitization treatment can be performed not only in atmospheric conditions, but also in underwater conditions.

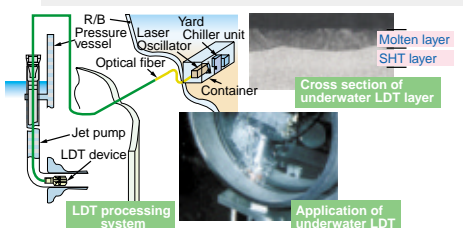
Underwater laser repair welding techniques are now at the final verification stage before execution on an actual nuclear reactor.



Application of laser peening to core shroud



Compact head for fiber laser peening



Underwater laser desensitization treatment (LDT) of jet pump for boiling water reactor (BWR)

STATCOM (SVCS™) with Application of IEGT

STATCOM (Static Synchronous Compensator) with application of IEGT (Injection Enhanced Gate Transistor) a new age high performance high capacity power device instead of the conventional GTO (Gate Turn-Off thyristor) was developed. The brand name is SVCS™ (Static Var Compensation System).

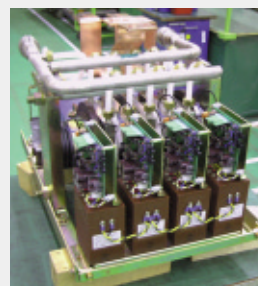
Toshiba has installed SVCS™ units at INI Steel Co. in Korea and Kishiwada Steel Co., Ltd. in Japan.

This SVCS™ system with application of IEGT a new world leading device, has made it possible to reduce power loss to 52 % compared with the conventional SVCS™ using GTO devices. Furthermore, the size of one IEGT module has been reduced to one third of that compared with one GTO module.

Control equipment with high-speed calculation controller has been developed, and Toshiba's quest for enhanced HMI (Human Machine Interface) is further demonstrated by the incorporation of a touch display on the control panel.



STATCOM (SVCS™) unit with application of IEGT



IEGT unit

G8000 Development of Global UPS

Uninterruptible power systems (UPS) are used in order to protect information equipment that can never be allowed to shut down even for a moment due to abnormalities in the power supply, such as a power failure or instantaneous voltage drop.

Toshiba has proposed various reliable power supply systems and provided them for systems of high social importance including the on-line systems of banks. UPS equipment is at the core of these high-reliability power-supply systems.

Reliability technology cultivated by focusing on domestic sales has now been utilized to develop the new UPS-G8000 series for the overseas market.

In determining the design, even the transportation, installation, and construction methods overseas were taken into full consideration as well as compliance with overseas power supply and system specifications, and it has now become equipment with high flexibility and availability.

Toshiba hopes to establish the brand of Toshiba UPS on the global market with this equipment as a core product and to make a contribution to the achievement of a high reliability power supply system.



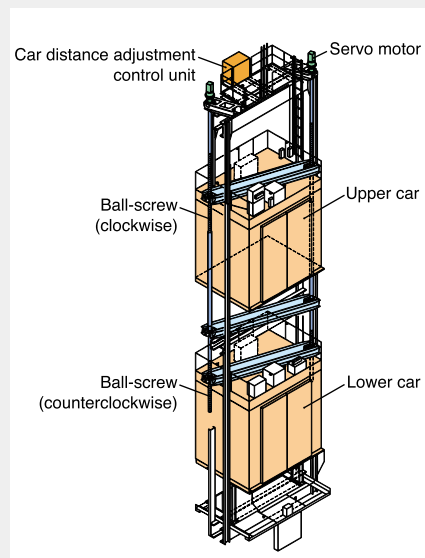
G8000 series global UPS

Adjustable Double-Deck Elevator

Toshiba has developed a new double-deck elevator with a car distance adjustment, which is equipped with an original ball screw system. Toshiba's adjustable double-deck elevator adjusts the distance between upper and lower car to the floor levels automatically, thus it can be used in buildings which have a variety of floor heights.

The major features of the ball screw system are as follows:

- The car distance adjustment has a ball screw. The revolution of this screw is precisely controlled by a servo-motor-mechanism, to realize a high degree of accuracy in adjustment to the landing levels.
- A reduction in servo motor capacity is facilitated by balancing the weight of the two cars.
- Distance between upper and lower car is adjustable within a range of 2,000 mm, and this means Toshiba's new double-deck elevator is applicable in almost all buildings.



Adjustable double-deck elevator