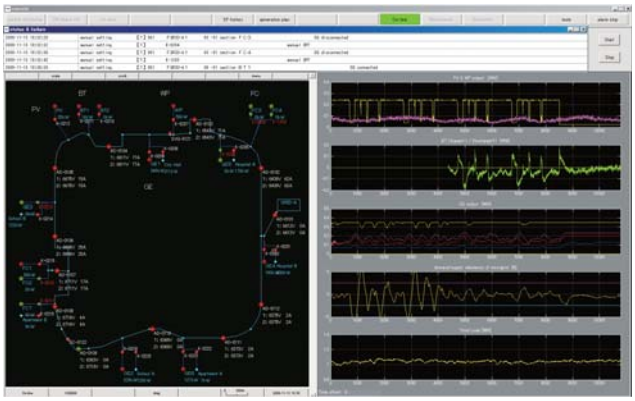
Micro Energy Management System for Smart Grid



Example of µEMS display

Rapid progress is being made worldwide toward the realization of a low-carbon society through the introduction of energy-saving measures using renewable energy sources such as solar and wind power that also benefit consumers.

As a contribution to these efforts, Toshiba has developed the micro energy management system (µEMS) to improve the power supply reliability of smart grid power systems and enhance their operations.

µEMS performs load control for smart grid power systems and adjusts power supply and demand to enable integration with high-voltage power systems.

The power output of renewable energy sources such as solar and wind power is considerably affected by the weather and is unstable compared with conventional energy sources such as thermal and hydro power. µEMS achieves optimal power control using storage batteries, thus maintaining a balance between power supply and demand.

We will continue to expand our efforts to provide comprehensive, environmentally friendly energy systems by combining our energy-saving products with µEMS.

Smart Meter and In Home Display for Smart Grid

(a) Smart meter (b) In Home Display

Smart meter and In Home Display for smart grid

The United States is actively promoting the smart grid, which will be able to solve power supply and demand problems that exist between power utilities and consumers using information and communication technology (ICT).

Toshiba has developed a smart meter and an In Home Display as the end-points of the smart grid.

The smart meter can measure the instantaneous values of active power, reactive power, voltage, current, power factor, and frequency based on the American National Standards Institute (ANSI) C12.20 0.5% accuracy class standard.

The smart meter also transmits measurement data for power utilities via Ethernet, and communicates watt-hour values to the In Home Display using ZigBee™ communication functions specified in the short-range wireless communication standard for home appliances.

The In Home Display unit can show real-time power, watt-hour, and demand trend graphs.

GRE110 Multifunctional Numerical Protection Device

GRE110 multifunctional numerical protection device

Toshiba announces the launch of the GRE110, a multifunctional numerical protection device designed for feeder protection applications in medium-voltage networks. This compact, cost-effective device provides a comprehensive range of protection and control functions and can also be applied to motor protection as well as backup protection for generators and transformers.

The GRE110 supports multiple high-accuracy overcurrent protection elements with inverse time and definite time delay functions in accordance with the latest IEC 60255-151 functional standard. A broad range of additional protection functions are also supported, including thermal protection conforming with the IEC 60255-8 standard, negative sequence overcurrent protection, and a broken conductor detection feature. Control functions such as two-step operation of circuit breakers are also provided.

All models in the GRE110 series provide continuous monitoring of primary equipment and of internal circuits. A trip circuit supervision function using two binary inputs provides high-integrity monitoring of the circuit breaker tripping circuit in both the breaker open and closed conditions. Circuit breaker condition monitoring functions provide guidance for maintenance timing, and combined 1 A/5 A secondary current inputs and a wide auxiliary power supply range simplify type selection.

A user-friendly human-machine interface (HMI) is provided through a backlit liquid crystal display (LCD), programmable light-emitting diodes (LEDs), a keypad, and a menu-based operating system.

PC access is also provided both for local connection via a front-mounted universal serial bus (USB) port, and for remote connection via a rear-mounted RS485 port or an optional Ethernet port. The communication system allows the user to read and modify the relay settings, and to access data gathered by the relay's metering and recording functions.

IEC: International Electrotechnical Commission

Development of Key High-Voltage Switchgear Products for Overseas Markets

New 245 kV GIS

New 145 kV live-tank type gas circuit breaker

Continuous expansion of the transmission and distribution (T&D) markets is expected due to the active investments being made in infrastructure-related business areas. On the other hand, competition among suppliers in terms of both price and technologies is becoming increasingly fierce. In this situation, many suppliers are introducing a succession of new state-of-the-art technologies in order to develop products for the T&D market in a shorter period.

Toshiba is also continuously developing new key products for overseas markets. We have recently completed development of the following new high-voltage switchgears with ratings of 145 kV and 245 kV, which constitute one of the largest markets in the T&D field:

- 245 kV gas-insulated switchgear (GIS)
- 145 kV live-tank type gas circuit breaker
- 245 kV live-tank type gas circuit breaker

Embodying our accumulated technologies and long experience in the development of GIS products, the new 245 kV GIS achieves one of the world's smallest bay widths (1 450 mm) and features a spring-operated mechanism realized by drastically reducing interrupting energy with the new concept of an interrupter.

Our technologies and experience were also reflected in the development of the new live-tank type gas circuit breakers, which can be applied to air-insulated substations (AIS) in overseas markets and are expected to open up new business opportunities.

We continue to introduce new and innovative products on the market, allowing us to propose various solutions with a wider product lineup to satisfy the various requirements of utilities.

Reduction of Transformer Inrush Current Using Controlled Switching System for Ganged Three-Phase Type Circuit Breakers

Inrush current reduction system for transformer

It is a well-established phenomenon that energizing a transformer at a random point on the voltage wave will produce high inrush currents. The transformer inrush current may lead to power quality reduction such as large voltage fluctuations, particularly in weak power networks.

Controlled switching methods can provide an effective and sophisticated solution to this problem by dislocating the point on the voltage wave at which the transformer is energized relative to the magnitude of the residual magnetic flux within the transformer iron core. However, controlled switching systems currently available for the reduction of transformer inrush current can only be applied to circuit breakers operating a single pole.

Toshiba has supplied an inrush current reduction system for circuit breakers with ganged three-phase operation that has been in operation at the Hamatonbetsu Substation of Hokkaido Electric Power Co., Inc. since November 2009. The system is targeted at two bays of 72 kV circuit breakers with ganged three-phase operation and three-phase transformers. The transformer inrush current has been reduced to not more than 30% of the maximum value by this system.

It has been verified that reduction in transformer inrush current can be achieved by the control of residual flux and controlled closing of the circuit breaker. These results demonstrate that this system provides an effective solution for reduction of transformer inrush current by a ganged three-phase operation circuit breaker.

System Design for Two Leading Megawatt-Class Solar Systems Progressed in Japan

Toshiba has been awarded contracts for the design, manufacturing, installation, and commissioning of two leading large-scale solar systems in Japan: the Mega Solar Taketoyo Power Plant of Chubu Electric Power Co., Inc., and the Ukishima Solar Power Plant of The Tokyo Electric Power Co., Inc.

Today, Japanese power companies are planning to construct megawatt-scale solar systems for utility use. The Mega Solar Taketoyo Power Plant is a 7.5 MW system located in the coastal area of Taketoyo Town, Aichi Prefecture, and the Ukishima Solar Power Plant is a 7 MW system located in the coastal area of Kawasaki City, Kanagawa Prefecture. Both systems will become operational in fiscal year 2011.

In these systems, comprehensive measures are being taken to achieve economic improvement by optimization of the panel layout for maximum system efficiency, deployment of a newly developed high-efficiency 250 kW power-conditioning system, design of a lightweight solar panel support and foundation structure, and rationalization of maintenance.

Artist's rendering of Mega Solar Taketoyo Power Plant

Artist's rendering of Ukishima Solar Power Plant