On the power horizon

ABB is the undisputed world leader in power technologies. Based on our close connections to customers and leading universities in the U.S., Europe and Asia, we have a clear understanding of future technology trends.

The performance and reliability of transmission grids can be enhanced quickly with proven technologies to increase capacity, with significantly lower environmental impact compared to conventional methods of upgrading the grid. Such technologies, which are being further developed, include:

- **HVDC transmission:** high-voltage direct current power systems allow electricity to flow across regions, delivering it from generators to where it is needed without further burdening existing AC (alternating current) grids, or increasing congestion. HVDC links also have built-in overload control and can be fully loaded without increasing the risk of cascade line tripping.

- **HVDC Light:** In addition to the benefits of traditional HVDC, this unique ABB technology offers a number of technical features for broader, economic applications, including enhanced voltage control and black start capability. With this technology, utilities can restart their systems more quickly following a total blackout. It is cost effective at lower power ratings than traditional HVDC systems, enabling it to be used in critical projects. The use of underground or underwater cables for transmission gives this flexible power system sound environmental benefits.

- **FACTS devices:** Flexible AC Transmission devices, such as Static VAR Compensators and Series Capacitors, enable more power to flow through existing power lines while improving voltage stability. They make the system more resilient to "system swings" and disturbances.

- **Gas-insulated substations:** Enhancements in conventional technologies have allowed large amounts of power to be

transmitted and distributed in a compact and unobtrusive way. Examples of such devices are gas-insulated substations which can enhance the reliability of an urban network using a minimum of space.

- **Life extension:** Modern materials and design analytics, together with preventive maintenance, allow manufacturers to upgrade economically the capacity of existing equipment, improving its reliability and increasing its useful life.

These technologies provide insight into grid performance, increase grid capacity and provide tools to mitigate or prevent widespread power outages.

Towards controlled grid stability

Wide area monitoring and control is a growing requirement in network electricity grids. Coupled with SCADA systems, these "overview" technologies will eventually oversee nearly all global grids. At the same time, local installations like big city substations and remote transformers in the countryside will become more intelligent. These devices will monitor themselves, while global systems take care of the whole. With more control functionality integrated into power devices, they will continue to shrink in size and respond to public demands for more environmental care.

Towards a commodity for everyone

In the world today, 1.6 billion people have no access to electricity. Local power generation employing various technologies and sustainable energy solutions will continue to grow. Connecting local power solutions to a larger grid will lead to virtual utilities with electrical storage systems to help ensure stable operation. Those systems must be inherently safe and easy to operate. Self-monitoring and highly automated control with remote service functionality will develop further to serve electrical needs.

Getting the most out of rare resources

Electrical generation is transforming primary energy into the most convenient form of energy we know today. But as primary resources are limited, this transformation has to be as efficient and environmentally friendly as possible. Optimization of power generation will become more important, and new control algorithms and systems will further improve the exploitation of primary energy.