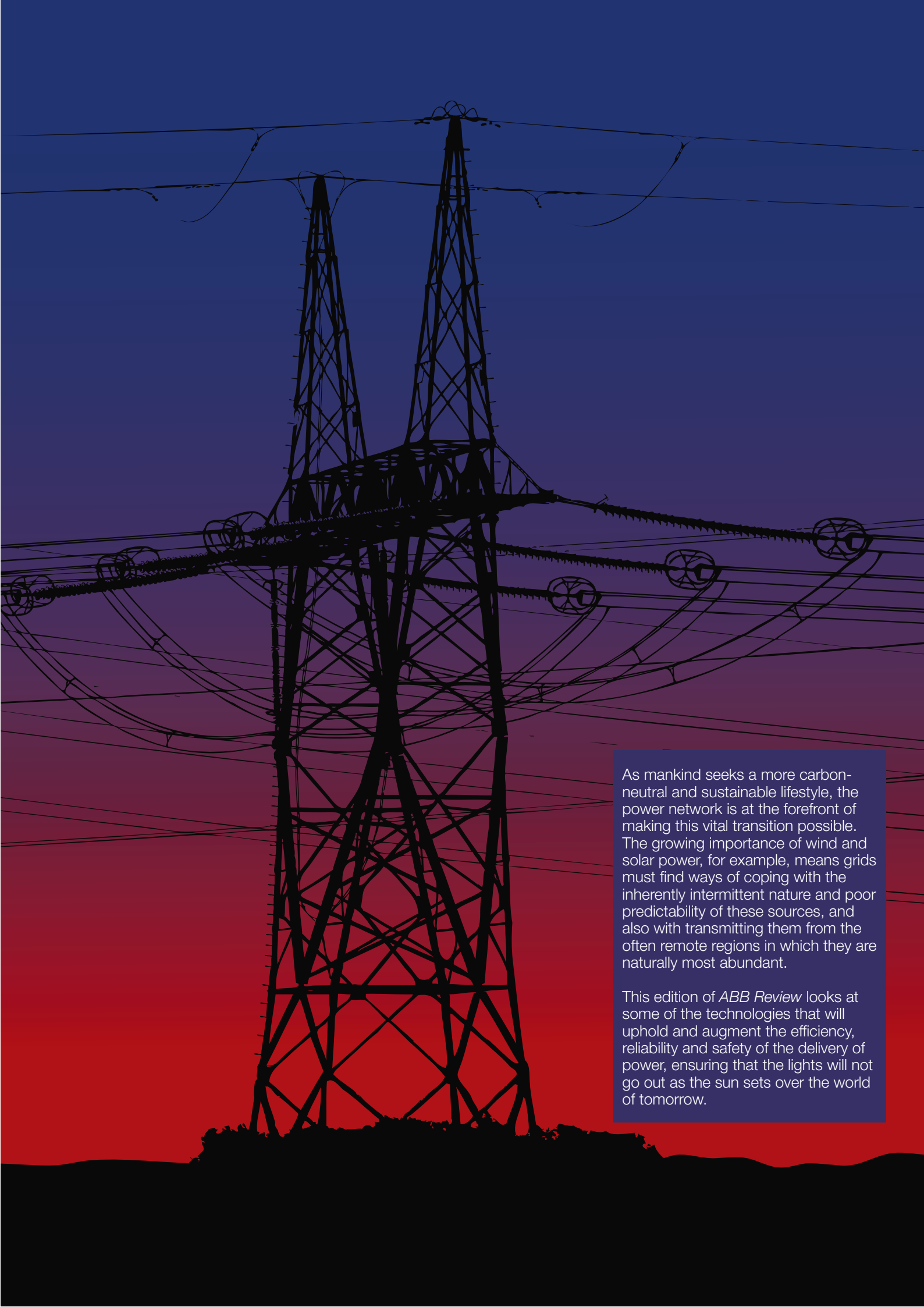

As mankind seeks a more carbon-neutral and sustainable lifestyle, the power network is at the forefront of making this vital transition possible. The growing importance of wind and solar power, for example, means grids must find ways of coping with the inherently intermittent nature and poor predictability of these sources, and also with transmitting them from the often remote regions in which they are naturally most abundant.

This edition of *ABB Review* looks at some of the technologies that will uphold and augment the efficiency, reliability and safety of the delivery of power, ensuring that the lights will not go out as the sun sets over the world of tomorrow.

Shaping tomorrow's grid

We have come to take for granted that practically every room in every building has electric power outlets and electric light. But it is not only this ubiquitous coverage that sets the electrical grid apart from any other man-made service (except maybe radio-based communication), but it is also its extremely high availability: We expect the lights to turn on whenever we want them to. From the point of view of the grid operators, this means that the supply must strictly follow the demand.

The functioning of the electrical network is undergoing a fundamental paradigm shift. One driver of this is the increased use of alternative energies such as wind and solar, whose supply is intermittent and difficult to predict; and much of whose generation is located in regions that are distant from the main load centers, and where the traditional grid infrastructure is often too weak to handle the additional power flows. Furthermore, consumers are increasingly choosing the source of their power, and hence expecting networks to be able to transmit it over longer distances.

This grid of tomorrow is often referred to as the "smart grid." The key technological enablers of this transition are progress in the power electronics and automation domains. In this future grid, there will no longer be a one-way relationship with generation following consumption, but rather a two-way interaction with such measures as energy storage or supply-dependent operation of devices permitting a more ecological and economic utilization of generation and transmission infrastructure. *ABB Review* intends to dedicate an upcoming edition to the topic of smart grids, and is hence giving it only partial coverage here. Many of the technologies addressed are, however, directly or indirectly relevant to this theme.

If the grid is to handle greater power flows, technologies are required to underpin its stability. Besides the additional transmission capacity it provides in its own right, ABB's HVDC Light® adds stability and controllability to existing corridors, and can actually enhance their overall transmission capacity by more than the nominally installed additional power.

One important aspect of the grid of tomorrow will be a greatly enhanced controllability assured by a large number of measuring and monitoring devices along with the corresponding actuators. These can, for example, make the grid self-healing by localizing and mitigating disturbances as they occur. Over longer periods, they can monitor individual items of equipment and so help schedule maintenance tasks. In contingencies (for example after a storm) they can pinpoint damage and support the deployment of repair crews, considerably shortening the time required to restore normal operations. Having to process a large number of data feeds can, however, also challenge a control system and risk causing a "data tsunami" in which the most relevant information is lost. Equally important as the measurements themselves is a strategy to handle these and convert data to information at as low a level as possible. Several articles in this edition of *ABB Review* discuss these and related aspects.

Further energy-related articles look at the management of a liquefied natural gas (LNG) supply from the dockside to the distribution network, and also at the importance of establishing standards for motor efficiency. The latter will give customers more transparency in relation to assessing the life-cycle costs and carbon footprint of their equipment.

This edition's history article looks at ABB's 100 years of experience in the manufacturing of bushings, and how these have evolved to handle ever-higher voltages.

I trust that this edition of *ABB Review* will give you fresh insight into the functioning of today's and tomorrow's energy supply, and illustrate ABB's commitment toward making this even more efficient, reliable and safe.

Enjoy your reading.

Peter Terwiesch
Chief Technology Officer
ABB Ltd.