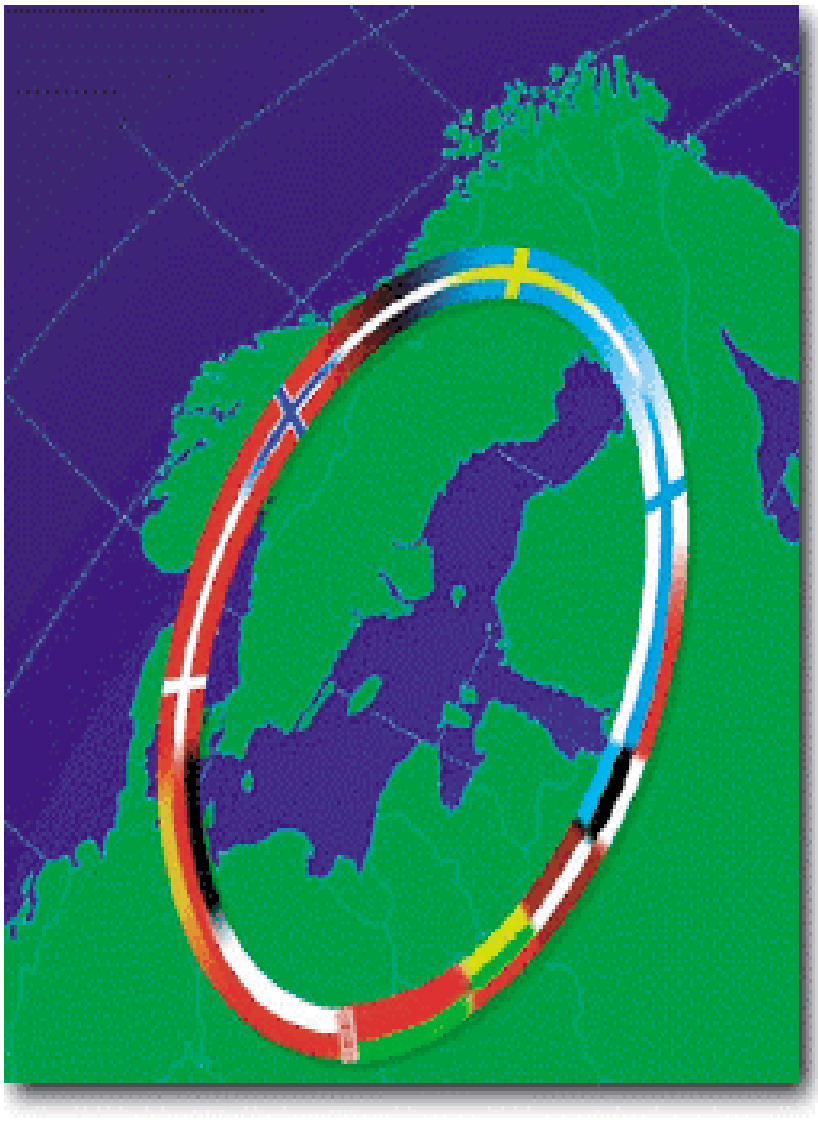
The making of the Baltic Ring

The 230-km, 600-MW cable between Sweden and Poland recently completed by ABB brought the dream of linking the power grids of all the states bordering the Baltic Sea into a gargantuan 'Baltic Ring' one step closer to reality. In this overview – the first of two articles on the subject of power supply in the region – we look at the origins of this undertaking and at how ABB are providing much of the know-how and hardware.

Staff Report



Source: BALTREL

As the glaciers inched their retreat northwards at the end of the last Ice Age, they were closely followed by groups of modern human hunters and fishers. It is easy to imagine these nomadic tribes reaching the shores of the, still mostly frozen, Baltic Sea and staring out at the icy expanse separating them from the unknown terrain beyond. But ambitious humans were quick to spread around the Baltic shores by both sea and land routes – and where such routes came into being, trade sprang up. Indeed, recent discoveries indicate that trade in Northern Europe was far more extensive than previously thought.

Ancient trade links

The Baltic Sea provided a vital seaway for trade between the settlements grouped around its shores, the hinterland and ultimately the rest of Europe and the East. Later, the Vikings, a Baltic people, took their trade westwards, to the Americas, many centuries before Columbus.

The region and its trade have survived all the turmoil history can provide – plague, revolution, war, mass migration and political division. The Second World War and its aftermath tested the region to the full, and now, with the falling away of political divisions, the region's 40 million

inhabitants are experiencing a new wave of prosperity and unity.

But prosperity today predicates access to electrical power. Huge amounts of it. This is where the 'Baltic Ring' comes in.

The Baltic Ring

The Baltic Ring will unite all private and public power resources of the states around the Baltic Sea. Financing by the World Bank, Scandinavia and other interested parties will accelerate the construction of this common and open power resource. A specially instituted body, BALTREL (see box on page 48), will oversee the entire apparatus and a control center will direct energy distribution and trade. Agreed tariffs and environmental policies will maximize the benefit for the consumer and for the environment, not least because the newest, most efficient and loss-free equipment and computer-based management and trade systems are being used.

The missing link in the Baltic Ring

The planned Estonia-Finland link will bring Estonia into the Nordic grid. This 200 MW of transmission capacity significantly strengthens the eastern part of the Baltic Ring. Likewise, the 'Viking Cable' a system of extremely long cables planned as links from south Norway to north-west Germany and the Netherlands, will upgrade the western section. The missing link in the Ring is, as described here, the gap between the non-compatible electrical systems of the old East and West blocs. But the Ring involves more than just connecting grids together; to be fully functional it must be capable of transferring huge amounts of energy in a stable and synchronized manner, and so needs advanced control and protection equipment and sophisticated energy management systems.

An attractive alternative means of coupling non-synchronized grids together is provided by HVDC technology – the current links in the Ring are all ABB HVDC. The changeover to multiterminal DC (MTDC) transmission elegantly sidesteps many of the problems raised by different frequencies and standards, short-circuit current transmission and overload handling.

The first proposals, for a Danish-Swedish link, date back more than a century. But ambition had to wait for technology to catch up, in 1915, when a submarine cable was laid between the Danish island of Zealand and Scania, in the south-western tip of Sweden. Patiently, over years, further links in this power ring have been inserted, the latest in 1999 when a 600-MW between Sweden and Poland was installed. A 200-MW link from Estonia to the Nordic net is planned.

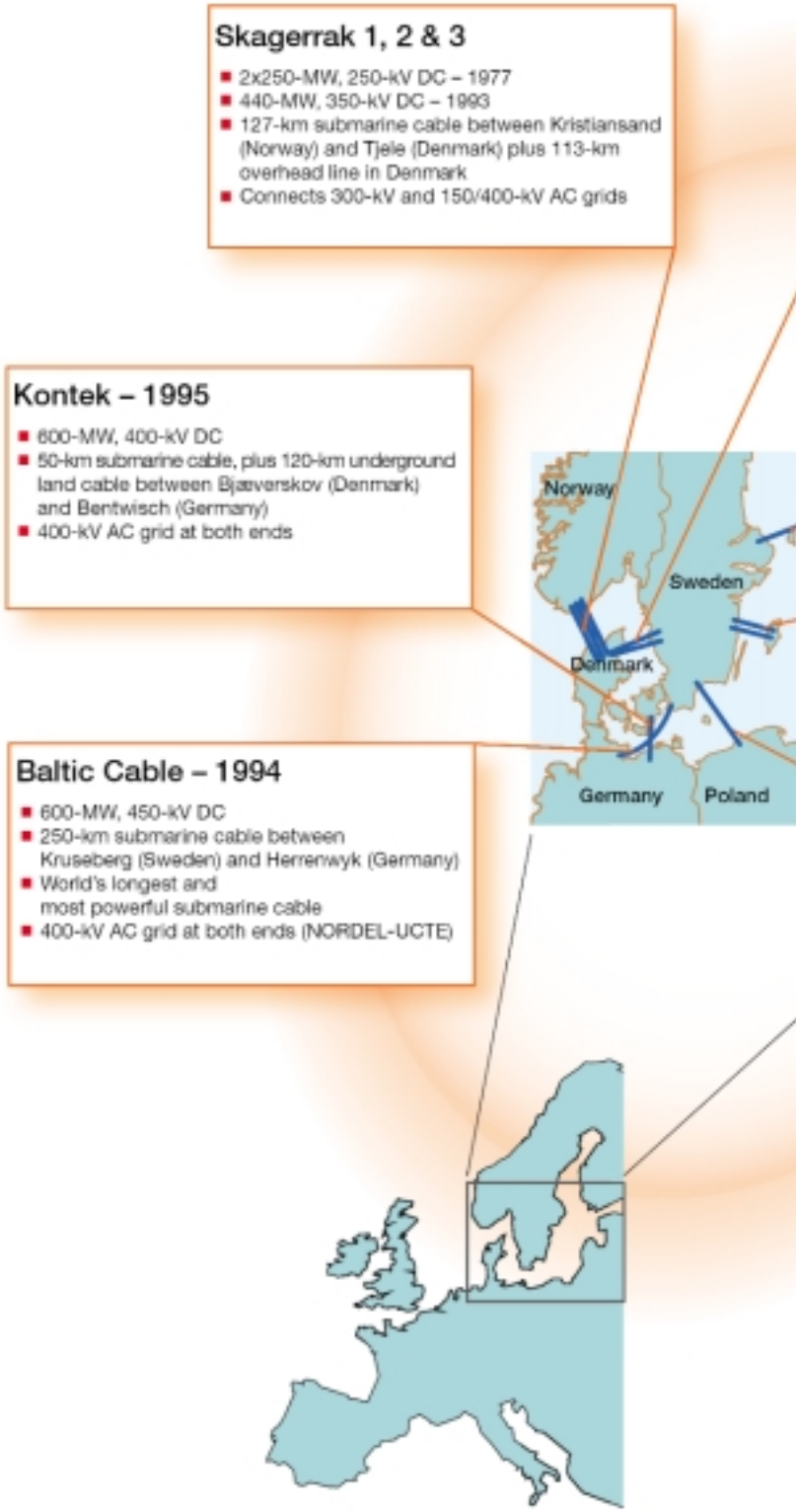
But work on the Ring did not start from scratch; valuable experience was gained by the creation of the 'Nord Pool', a supranational smaller-scale version of the Baltic Ring built by the Scandinavian countries.

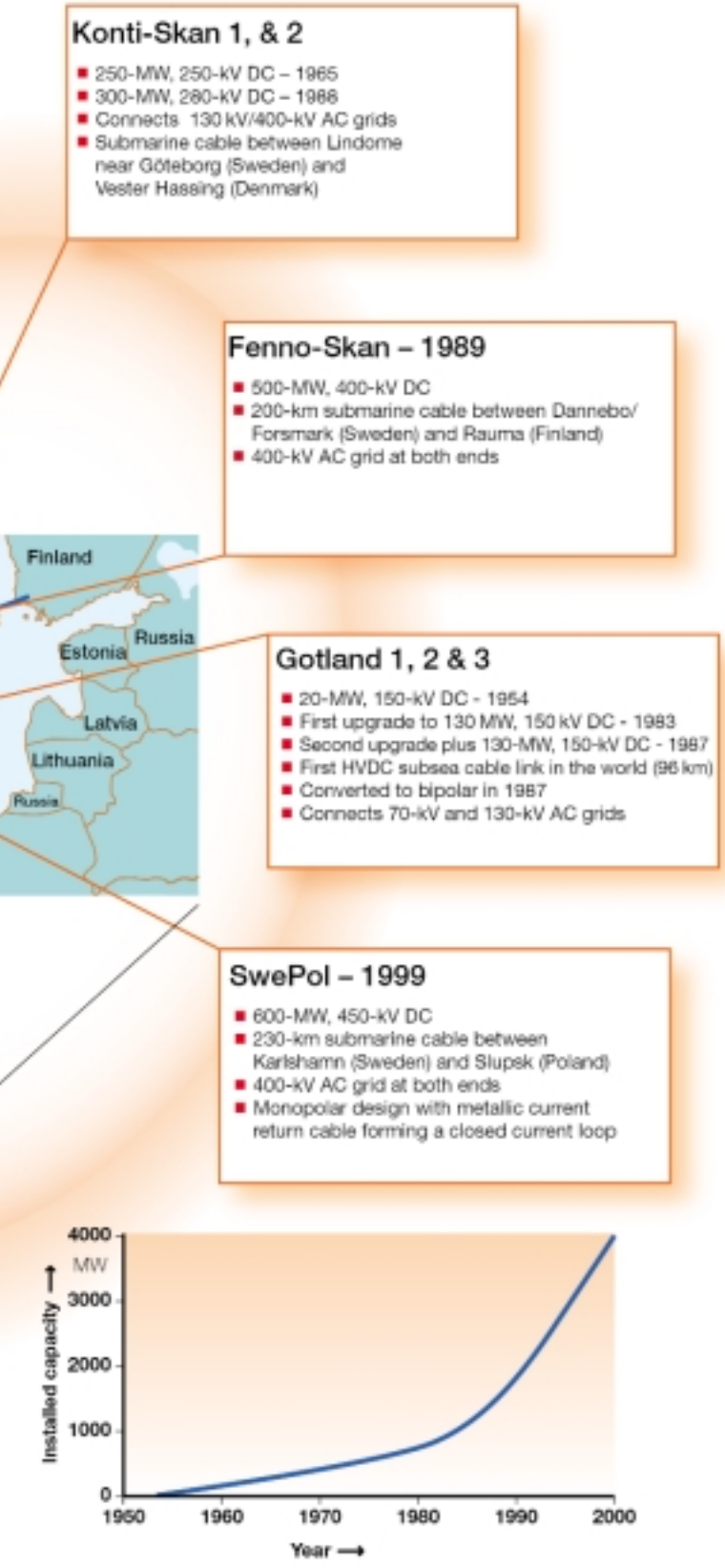
ABB has provided much of the knowledge and advanced equipment required for the Baltic Ring.

Why have a Baltic Ring at all?

Even a brief examination of power resources in the Baltic countries reveals a country-wise energy monoculture (with the exception of Finland): Norway is dependent on hydropower (99%); Denmark gets its power from coal; nuclear power delivers 50% of power in Sweden (the rest is mostly hydropower); Estonia uses mainly shale oil; Latvia has hydropower; and Lithuania relies on the 2x1500-MW Ignalina Chernobyl-type nuclear station, scheduled to close, by arrangement with the EU.

Opposition to new nuclear and hydro-plants and other environmental





concerns will bring other sources, such as wind, wave and gas, to the fore in the effort to satisfy society's increasing hunger for energy.

Obviously, a pooling of these diverse resources is to the advantage of all: Energy gaps which arise when less environmentally friendly sources are phased out can be covered by newer, cleaner sources; in times when one resource is expensive, more power can be generated and shared from the cheaper resources; peak demands in different regions at different times can be covered by shifting power through the Ring.

East meets West...

There is, however, another dimension to the Baltic Ring: After many decades of reliance on power from Soviet Russia, The Baltic states (Estonia, Lithuania and Latvia) are looking to the West for power expansion possibilities. At the moment, however, the lines stop at Kaliningrad, with no connection to the Polish grid and points further west.

The link between the two systems, revitalizing the ancient trade links, but this time with a commodity the ancients would not recognize, forms a power gateway to the East. It would seem a simple matter to build, but it's not quite that easy.

... or rather doesn't

When the Iron Curtain divided Europe, East-West energy exchange fell to practically nil. Both blocs operated their grids at 50 Hz, but not in synchronism,

so no power lines could link the two systems. Iron, though usually a good conductor, was in this case an almost perfect electrical insulator!

In the decades of isolation, the operating standards in the two systems drifted apart, especially those regulating frequency. Synchronizing the frequency throughout a grid is absolutely critical; the smallest uncorrected deviations can quickly lead to equipment shutdown. In the West, some of the most advanced technology available is utilized in meeting this challenge.

Other aspects of a power grid, such as transients and control of power flow from region to region, provide other areas of divergence that must be overcome.

Thus, the intention of the three Baltic states to disengage from the CIS grid and take up with the West involves substantial investment in equipment.

Modernizing Baltic state substations

In order to improve the capacity and the reliability of the power networks in the Baltic states, the power authorities of the three countries are busy reinforcing and modernizing their transmission and distribution networks. These investments are partly financed by proprietary funds and partly by foreign credit, mainly from the World Bank and its European counterpart, the EBRD, as well as by the EU-TEN (Trans European Network) program. Through these investments, the three countries are improving their infrastructure and building up know-how in the field of power management.

ABB is making a significant contribution to these efforts by supplying, installing and commissioning both primary high-voltage equipment and substation automation equipment. Vertical integration of control, protection and monitoring functions can significantly reduce investment requirements. (see following article).

The capability of these substation automation systems to contribute to better performance of the entire network will become even more important when the power networks around the Baltic Sea become fully connected to the Baltic Ring.

ABB is already a major contributor to the Baltic Ring and technology and know-how the company has to offer can help bring the Baltic Ring to a triumphant conclusion.

BALTREL and the Baltic Ring

BALTREL – the 'Baltic Ring Electricity Co-operation Committee' was established in 1998 by 18 electricity supply companies representing 11 countries in the Baltic Sea Region. BALTREL is working for increased cooperation in the electricity supply industry in order to create an open and integrated electricity market in the region. Such a concept is supported by the Council of Baltic Sea States, the Nordic Council of Ministers and the European Union.

BALTREL's vision of a common electricity market in the Baltic Sea Region can be described as the following:

■ There are several advantages to be gained by combining the electricity systems in the Baltic Sea Region.

■ Improved infrastructure facilitates the exchange of electric power, which in turn increases customer's right of option and leads to lower total costs, as available resources are used more efficiently.

■ By integrating environmental costs into the increased trade with electric power, environmental improvements can be achieved at the lowest possible cost.

■ Cooperation also creates better conditions for competition, based on the spirit of common responsibility for efficiency, environment and the overall economy.

Source: BALTREL Annual Report 2000