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GOTLAND HIGH VOLTAGE DIRECT CURRENT LINK

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Анотація

В статті розглядається перша в світі високовольтна лінія постійного струму. Історичне значення даної побудови.

Ключові слова: передача HVDC, Готланд, система керування, перша в світі.

Abstract

The article examines the world's first high-voltage direct current line. The historical significance of this building.

Keywords: HVDC transmission, Gotland, control system, world's first.

The Gotland HVDC Link was the world's first commercial HVDC transmission link using the first submarine HVDC cable. It connected the Island of Gotland to mainland Sweden. The 96 km-long cable used mass-impregnated technology. The Swedish manufacturer ASEA produced the link for Vattenfall, the state-owned utility. The project used mercury-arc valves for the 20 MW/100 kV HVDC converters, developed by an ASEA-Vattenfall team led by Dr. Uno Lamm.

Historical significance of the work

The world's first commercial High Voltage Direct Current (HVDC) transmission link in operation was the Gotland HVDC Link, commissioned in 1954. The Gotland HVDC was installed between the Swedish mainland and the island Gotland in the Baltic Sea. It was the Swedish State Power Board (Vattenfall, the state owned utility) that decided to connect the island's transmission system to the main transmission system in Sweden with HVDC, and placed the order to ASEA in 1950. The rating for the Gotland HVDC link was set to 20 MW, 200 A, and 100 kV. The project scope in the contract included both the HVDC converters on the mainland and the island as well as the 96 km submarine HVDC cable. The cable utilized mass-impregnated (MI) technology, and was the worlds' first submarine HVDC cable. The Gotland HVDC Link capacity was increased in 1970, when power semiconductor technology was introduced in the form of thyristor valves connected in series with the existing mercury-arc valves, raising the voltage to 150 kV. 1983 a new thyristor valve was installed as a monopole, extended to a bipole in 1987 giving the Gotland HVDC link a capacity of 260 MW at +/- 150 kV.

Features that set this work apart from similar achievements

The Gotland HVDC Link with the mercury-arc valves and HVDC submarine cable commissioned in 1954 stands for a clear milestone in the development of modern and reliable electrical transmission technology. The project comprised several of "the world's first", and was the breakthrough in both cable and converter technologies that paved the ground for a number of well-known large transmission projects using the mercury-arc valves. Examples of projects include; between England – France (the English Channel), between Denmark – Sweden (Konti-Skan), in New Zealand (Cross Sound), in the USA (the Pacific Intertie), in Japan (Sakuma), and in Canada (Nelson River).

Upgraded to enable more renewable energy integration and boost reliability

In 2018 Hitachi Energy was entrusted to carry out another upgrade to enable more renewable energy integration and boost grid reliability on the island. As a key element of the upgrade Hitachi Energy installed its state-of-the-art MACH control and protection system, the brain of an HVDC link.

Hitachi Energy's MACH control system offers unmatched calculation capacity and a high degree of integration capability to handle control and protection functions, designed to run around the clock for 30 years or more. It also incorporates advanced fault registration and remote control functions. The cooling system was also upgraded as part of the project. The upgrades replaced aging equipment and helped to improve security of power supply to the island. The addition of a modern operator interface also helped to extend the lifetime of the link in addition to providing improved availability and functionality.

In addition, deep study of a subject can help us to identify areas of opportunity for further research or exploration. By understanding the nuances and complexities of a particular field, we can identify gaps in knowledge or unaddressed challenges that may require further investigation. Studying the subject of the "Gotland High Voltage Direct Current Link" article in depth is crucial for understanding the historical significance of this engineering achievement. By delving deeply into the topic, readers can gain a comprehensive understanding of the design, construction, and operation of the world's first high-voltage direct current line. Deep study of this subject is also important for identifying opportunities for further research and innovation in the field of high-voltage DC transmission.

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