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Powering infrastructures

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Power converters play a central role in particle accelerators where both their performances are directly linked. As accelerator complexes develop towards higher beam energies and a more sustainable nature, in response to the needs of physics research and of reducing the environmental impact, power converters are required to be on the forefront of technology. They have proliferated into accelerator complexes where thousands of them are used in modern complexes as at CERN. They must, therefore, achieve high reliability and in many cases cutting-edge precision. Hence, powering normal and superconducting magnets for accelerators is a driving force for the development of high-performance power converters.

This lecture intends to introduce the requirements of power converters for magnets used in particle accelerators. After showing the power conversion principles, it describes the role of power converters, the challenges and constraints when powering superconducting magnets. The principles of redundancy and modularity are discussed in this lecture in addition to the power converter control and high precision definition. More sustainable installations would need a better management of electromagnetic energies used in accelerator complexes. This lecture shows, therefore, the latest tendencies in terms of energy storage for power converters and lists the key circuit parameters to be taken into consideration to properly specify a power converter. Finally, it describes a variety of ancillary systems and infrastructure to connect the power converters to the magnets in particle accelerators.

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