CONTRIBUTIONS OF POWER ELECTRONICS TO CARBON NEUTRALITY

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Abstract

The world is now moving towards Carbon Neutrality triggered by COP 26 in 2020. The power electronics technology greatly contributes to Carbon Neutrality in four aspects. The first one is to form the future power network by increasing the renewables and the energy storage systems. The second is to form Grid Hydrogen system, a new energy network. The third is to reduce Carbon Footprint by promoting electrification and by improving efficiency of energy use. The final one is to support the digitalization for managing the future energy networks. The speech introduces some topics related to the aspects above in industrial fields.

At the beginning, the speech briefly addresses the global goal, Carbon Neutrality by 2050. Many countries committed to pursue the goal including EU, U.S. and Japan. Their policies refer the four aspects above to achieve the goal. Studying the policies, the concept of PEiE, Power Electronics in Everything, has been improved to cover all the four aspects.

The first topic is the power electronics for the renewables and the energy storage systems, ESSs. The speech introduces the key technologies for high power and high system efficiency for the industrial MW-range PV inverters. The speech also introduces the ESSs necessary for stabilizing the power grid by managing the power and energy from the renewables. The speech also shows great interests to the grid forming control for the inverters. The power electronics for the wind power generation is briefly introduced, too.

The second topic tries to cover Green Hydrogen. The power electronics technology is essential to form a new future energy network of Green Hydrogen, which is made with the electricity from the renewables. Quite large amount of hydrogen is necessary to replace the fossil fuels now used in the world. Very high DC current of kA is required in the electrolytic process for mass production of Green Hydrogen. The speech introduces such high current equipment. The speech also introduces the power electronics for transporting Hydrogen, for generating electricity from Hydrogen.

The third topic is Carbon Footprint reduction in industries. The speech introduces two ways for reduction, the electrification and the efficiency increase. Examples are introduced for electrifying heating process with MW range power electronics. By electrification, the fossil fuels for heating process can be switched to the green electricity. A good example of efficiency increase can be found in the motor applications. Motors are reported to consume more than half of the electricity in the world. The motor drive by inverters is well recognized for better system efficiency.

The fourth topic is related to the digital transformation. For achieving Carbon Neutrality, the digitalization is

another essential technology to manage the future energy systems formed by tremendous numbers of renewables, energy storage systems including electric vehicles. The digital transition is made of two elements, the vast information in data centers and the hardware made on Silicon wafers. The power electronics technology, UPS, is essential to supply the stable power to the data centers. The other type of power electronics, MPC, multiple purpose converter, reinforce power supply systems in the semiconductor device factories for maintaining the hardware supply chain.

In the summary, the speech remarks that the power electronics technology is now embedded almost in everything. Then, in future, too, the concept of "PEiE", Power Electronics in Everything, will create new values by linking the power electronics in things. Through applications in various fields, PEiE firmly is believed to contribute to achieve Carbon Neutrality.