Introduction to NGK's NaS Batteries: Background and Future

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Electrical energy storage with the capability for real-time grid interaction has always been a dream for those who are responsible for electricity supply. To date, various energy storage technologies have been developed and introduced to the market for the purpose of power quality but limited for other applications such as load leveling and ancillary services. Realizing the full potential of this dream has not been easy because these systems have to be highly reliable for long-term usage and economically attractive compared with adding more electricity power supply capacity.

The NaS (sodium–sulfur) battery is an advanced utility-scale energy storage system that has been commercialized in Japan since April 2002 through 18 years of cooperative R&D plus extensive testing and demonstration by the Tokyo Electric Power Company and NGK Insulators, Ltd. The NaS principle was pioneered by the Ford Motor Company in the late 1960s for electrical vehicle applications. Several companies in North America, Europe, and Japan have tried to commercialize this technology, however no other company has been able to establish reliable and economic products.

This unique technology is currently used for load leveling (or peak shaving), emergency power supply, and power quality applications in Japan as a distributed power supply for the customer's site or the utility's substation. Approximately 50 MW of NaS systems are going to be installed this year in Japan. The expanded utilization of NaS batteries for renewable applications and grid frequency control are expected in the near future along with introduction to the global market.

Keywords:
Sodium-sulfur battery: An advanced secondary battery to charge and discharge up to 4500 cycles for 15 years. The sodium negative electrode and the sulfur positive electrode operate at a temperature of about 300º C.

Beta-alumina ceramics: The sodium ion conductive ceramics that functions as the solid electrolyte and separator between sodium and sulfur electrodes.

Load leveling: Charging electricity during off-peak time and discharging it during peak time, reducing the need for generation and/or transmission upgrades or expansions.

*Power quality application***:** The injection of power for a short time to mitigate power disturbances such as voltage sags and momentary outages.