March 17th, 2021

Vietnam-Japan Energy Business Forum

ENERGY STORAGE

NAS Sodium Sulfur Battery

Sodium-Sulfur (NAS®) Battery

Tomio Tamakoshi

Outline of NGK

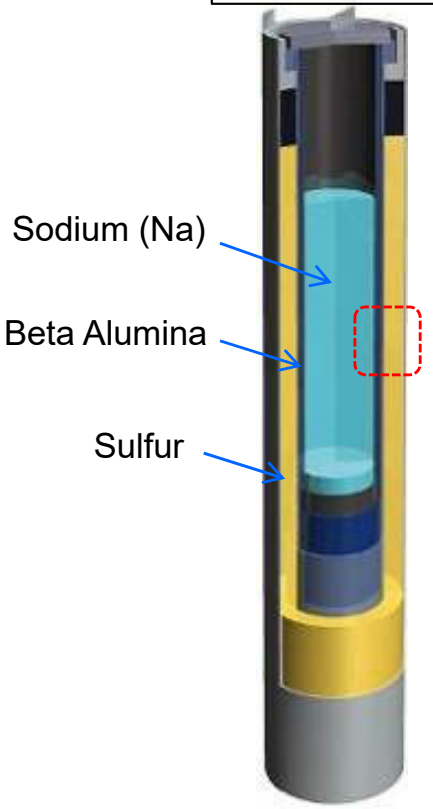
Company Name	**NGK INSULATORS, LTD.**
Date of Establishment	**May 5, 1919**
Paid-in Capital	**69,849 Million Yen**
Representative Directors	President **Taku Oshima** Executive Vice President **Hiroshi Kanie** **Chiaki Niwa**
Number of Employees (consolidated)	**20,000** ※Outside Japan employees **61%** As of March, 2020
Consolidated Subsidiaries	**55 companies** ※Outside Japan Subsidiaries **35**

As of March, 2020

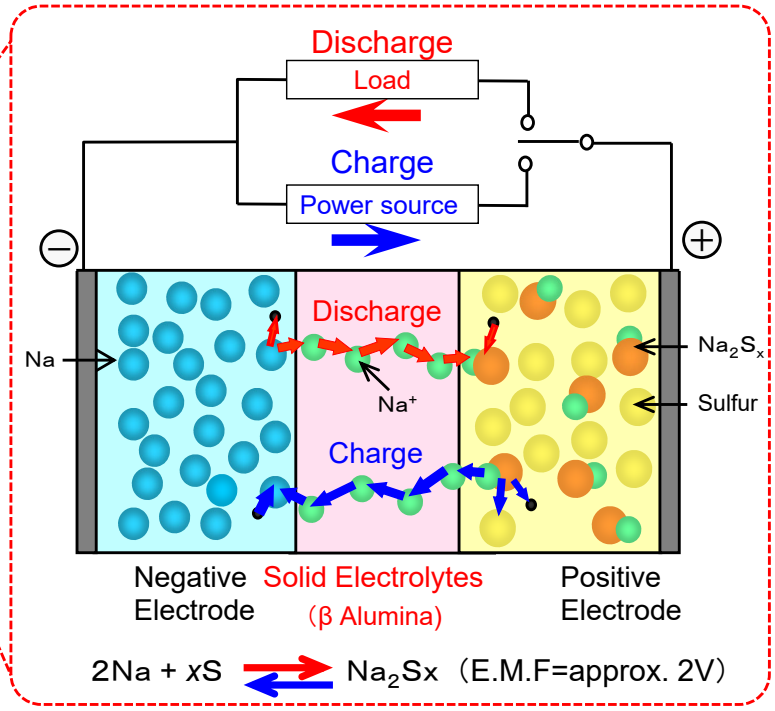
Principle of Sodium Sulfur Battery

- Sodium Sulfur Battery is a high temperature battery which the operational temperature is 300-360 degree Celsius (572- 680 °F)
- Full discharge (SOC 100% to 0%) is available without capacity degradation.
- No self-discharge
- Best performed with long duration application for more than 6hrs.

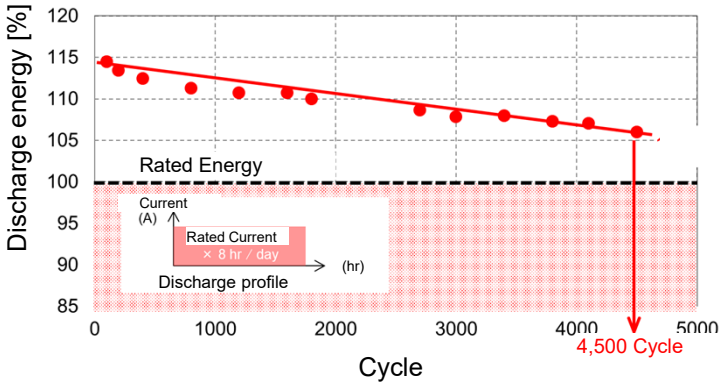
Cell Structure



Chemical Reaction



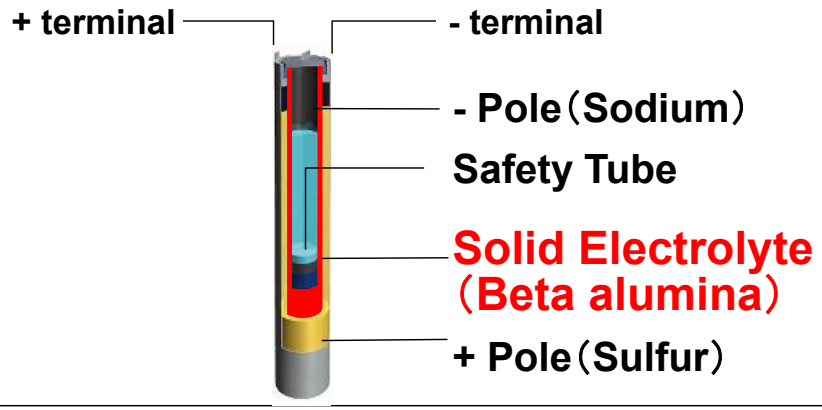
- ✓ **Cycle Life : 4500 full discharge**
- ✓ **Calendar Life : 15 years**
- ✓ **Round Trip Efficiency : 75-80%**
- ✓ **Easy Installation with containerized system**



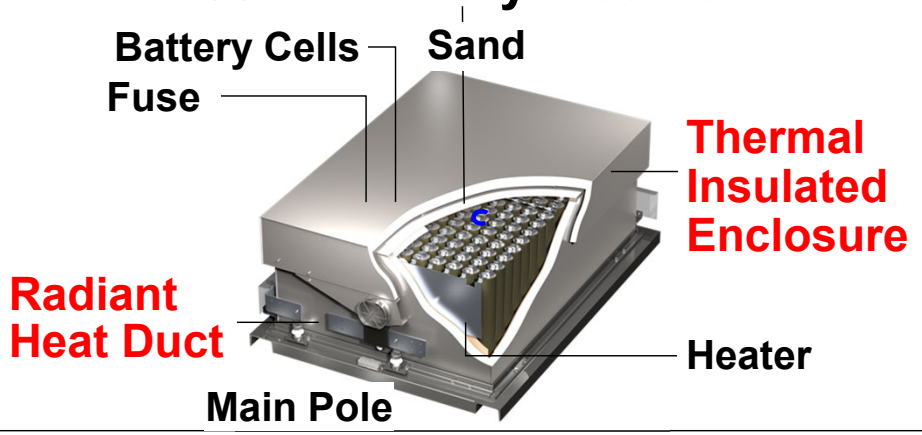
Structure of NAS® Containerized Battery System

- High efficiency achieved by combination of vacuum thermal insulation and cooling
- Plug & Play battery of 20ft container with modules and battery management system

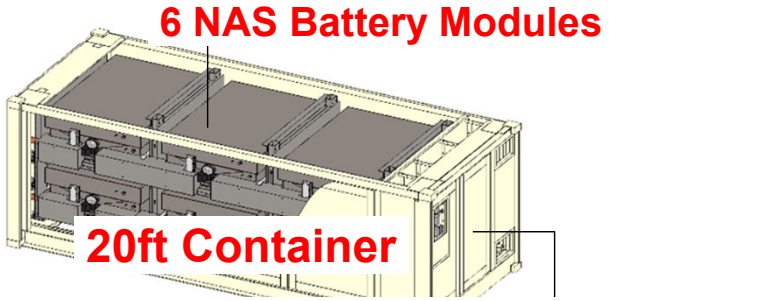
Battery Cell



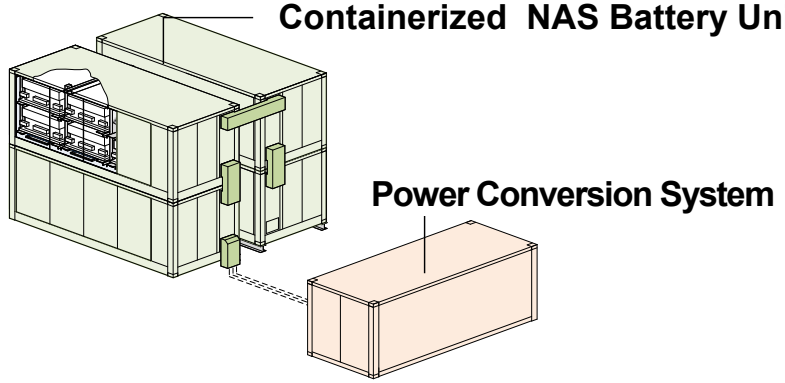
33kW Battery Module



Containerized Battery 200kW (1200kWh)



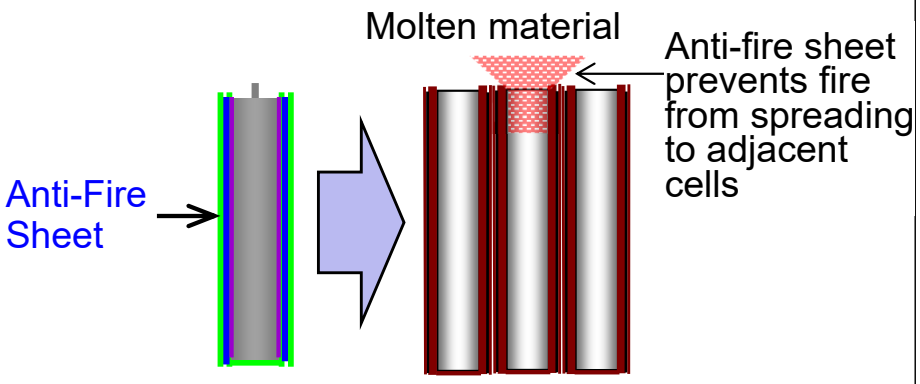
Battery System 800kW (4800kWh)



Safety of NAS® battery

- Anti-fire sheet applied to every cell prevents fire from propagating, even in the worst case of a cell catching fire.

- Japanese Fire and Disaster Management Agency (FDMA) defines the fire safety requirements for Sodium Sulfur batteries.
- Japanese Hazardous Materials Safety Techniques Association (HMSTA) witnessed the test and validated the testing methods and results



Cell ignition test

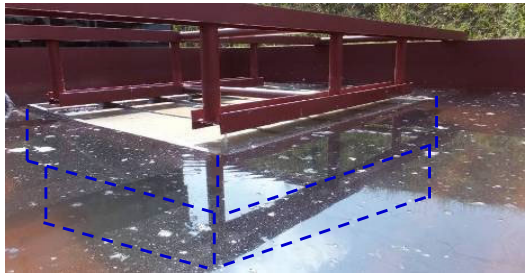
No damage
to the surrounding cells

Safety tests conducted on NAS module

Short circuit

Fire Exposure

Submerge

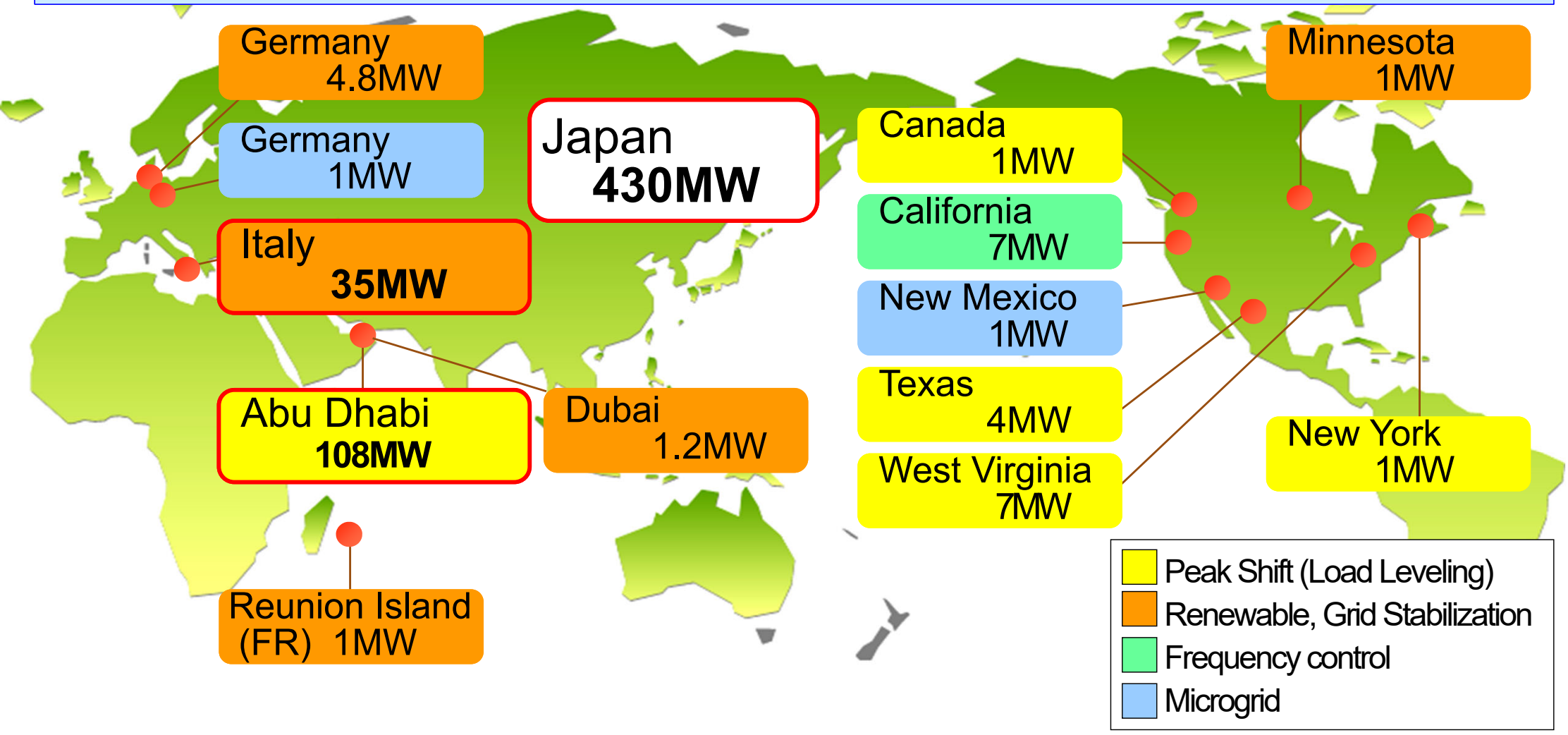


Drop

After the Test

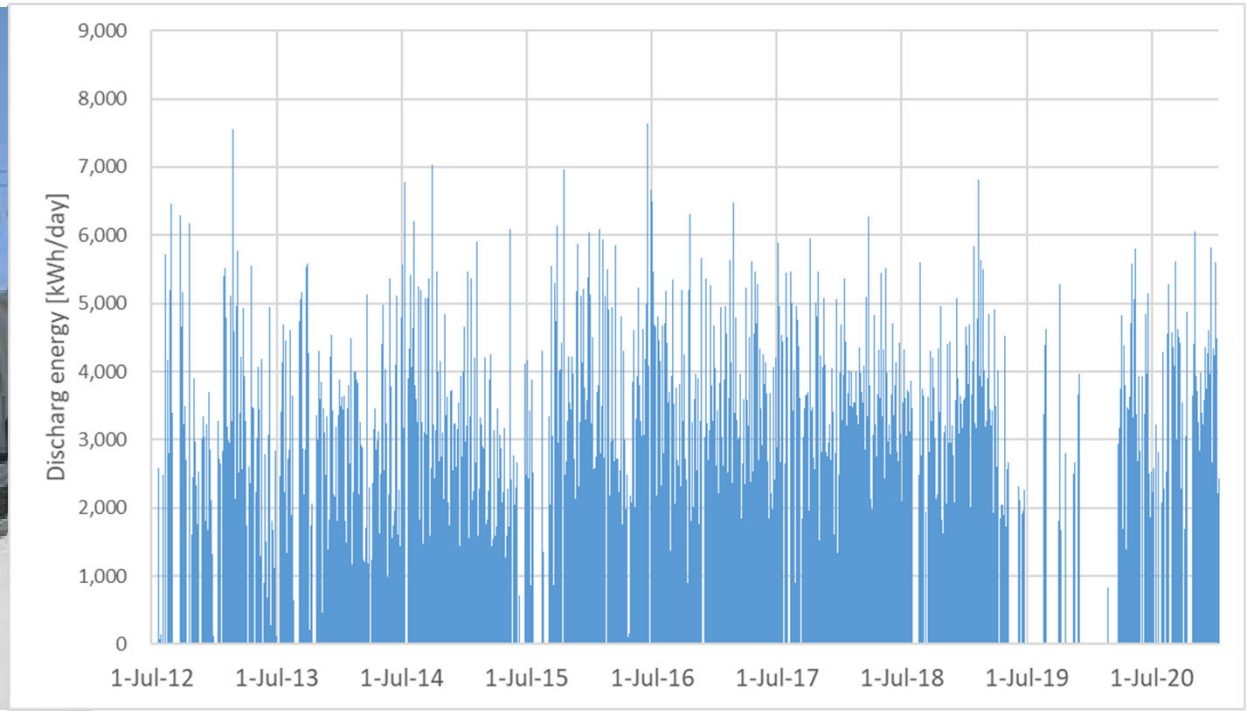
NAS® Battery Installations around the World

- Outstanding supply record in Large Scale Battery Energy Storage
  Total Installation Record of 600MW (4,100MWh)
- Annual Production Capacity 150MW (1GWh)



Example of Long Term Operation

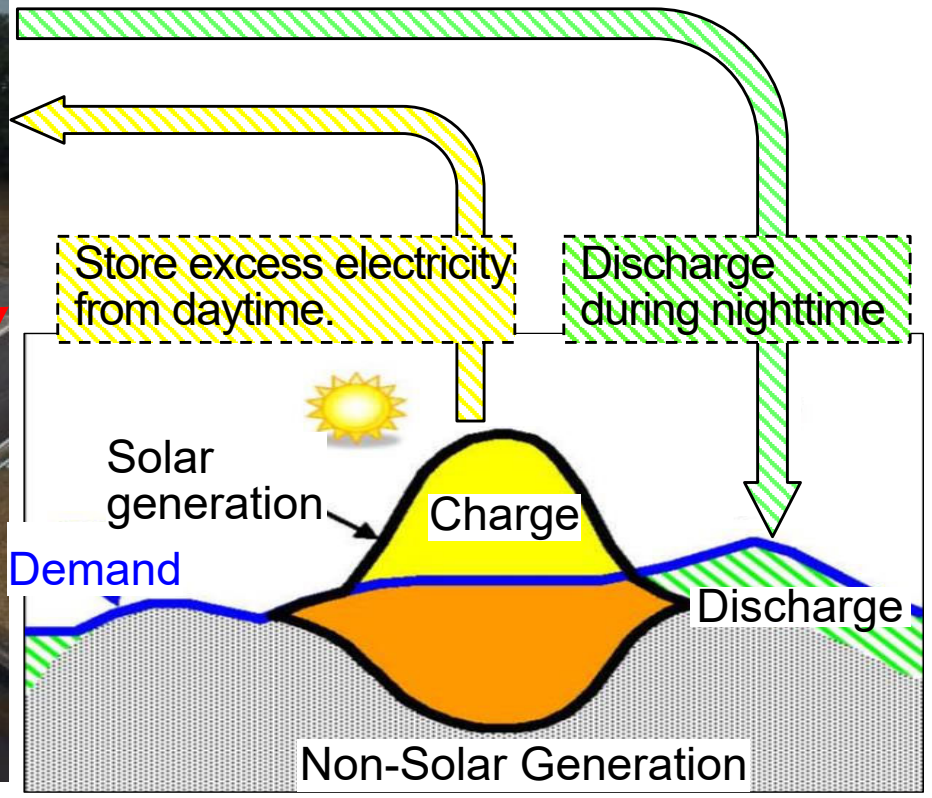
- 1MW/7.2MWh NAS® Battery system is in operation since July 2012. (9 years)
- No major failure
- No battery replacement since commencement of system operation
- Maintaining enough capacity after 9 years of operation



1MW/7.2MWh NAS® Battery system at Catalina Island
(SCE Pebbly Beach Generating Station)

50MW/300MWh NAS battery system

- 50MW/300MWh NAS® Battery start operation from March 2016.
- Main usage is to store over-generated PV energy and utilize it during nighttime.
- The system is intermittently operated to contribute to Load Frequency Control (LFC).



Buzen Power Plant, Kyushu Electric Power Company

108MW/648MWh NAS battery system

- 4 to 20MW size of NAS® Battery are installed in 11 substations in Abu Dhabi.
- Abu Dhabi has 1GW of PV to extend 6.5GW PV in 2026.
- 5.6 GW Nuclear power operation is planned from 2026.
- Energy storage will be necessary for frequency control and energy shifting.

Grid Scale
Policy
Products
Technology

UAE integrates 648MWh of sodium sulfur batteries in one swoop

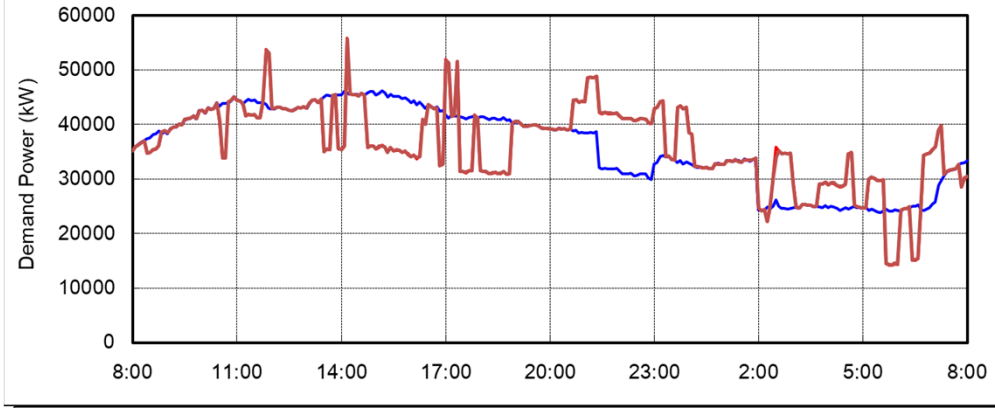
Published: 28 Jan 2019, 15:10

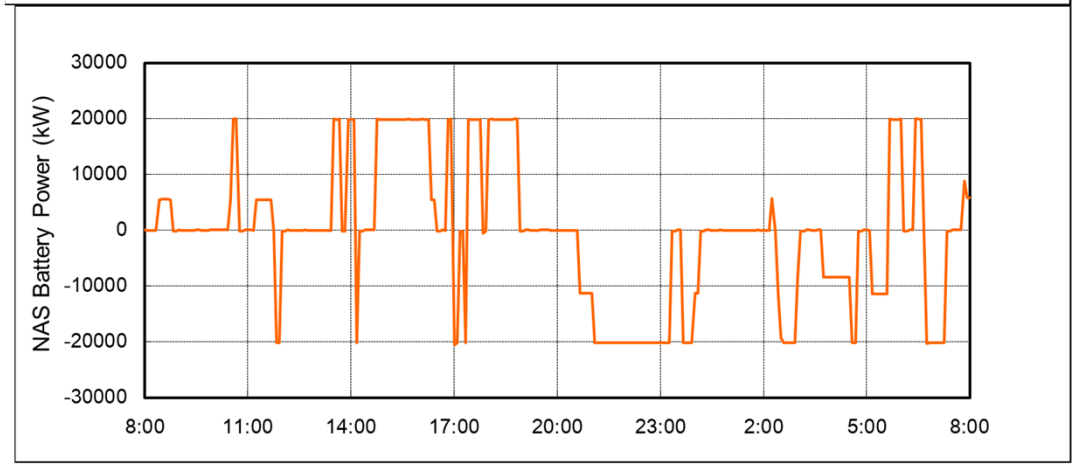
By:
Andy Colthorpe

One of the three 20MW NGK NAS (sodium sulfur) battery energy storage systems deployed as part of the project. Image: NGK Insulators / Google Maps.

Sodium sulfur (NAS) batteries produced by Japan's NGK Insulators are being put into use on a massive scale in Abu Dhabi, the capital of the United Arab Emirates.

20MW/120MWh NAS Battery Operation Example





NGK Battery Products

Nickel-Zinc Battery (ZNB)

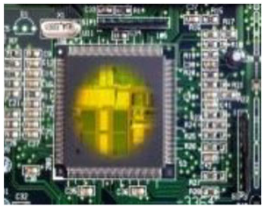
High safety battery targeted for indoor usage currently under field test stage.

In addition, **Zinc-Air battery** under development.

EnerCera® Lithium-ion battery

Applications of EnerCera battery

Wearable Devices



On-board power source

Smartcard (Credit Card, ID Card)

Coin and Pouch type lithium-ion rechargeable battery for smart card and various IoT devices. (Commercialized)

END

URL : https://www.ngk.co.jp/nas/

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