



NGK INSULATORS, LTD.

ENERGY STORAGE



Sodium-Sulfur (NAS[®]) Battery

- Renewable Applications & NAS Battery –

Central Asia Regional Economic Cooperation (CAREC)



July 27, 2015

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Outline of NGK Insulators, Ltd.

Date of Establishment

May 5, 1919

Sales Turnover

US\$ 3 Billion

Number of Employees

16,000 (consolidated)



Power Business



Suspension Insulators

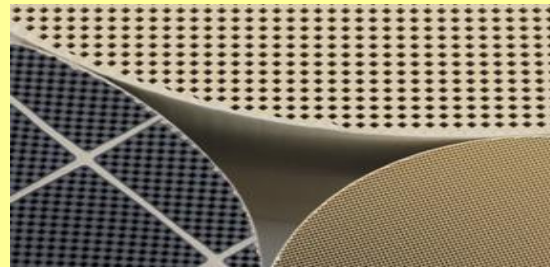


Gas Bushing for UHV Substation



Sodium Sulfur (NAS)[®] Battery System

Ceramic Products Business



HONEYCERAM[®] and Diesel Particulate Filter for Automobile Emission Control

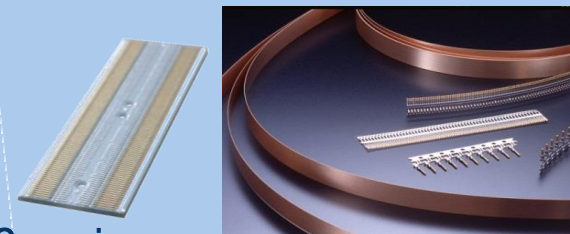


Heating System

Electronics Business



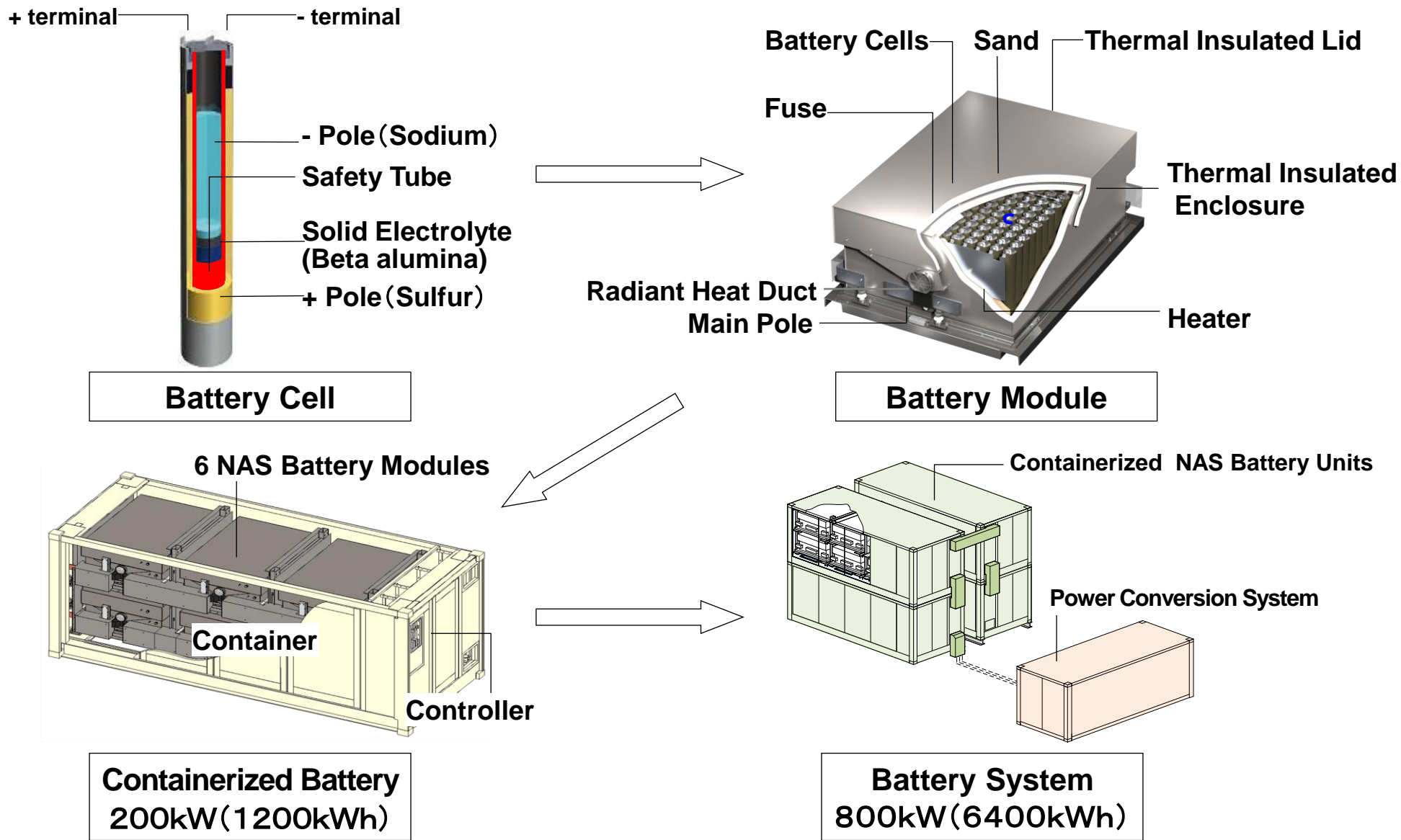
Ceramic Components for Semiconductor Manufacturing



Ceramics Micro-Actuators

Beryllium Copper

Structure of NAS[®] Containerized Battery System



Features of NAS[®] Battery Energy Storage

- Proven energy storage technology for high power, large energy capacity.
- Fully commercially available technology (large manufacturing capacity)
- Uses only common materials (Sodium and Sulfur). No rare materials used

Feature

■ Long Duration

- Can store energy up to 7 hours

■ Compact Layout

- 3 times energy density compared to lead acid battery

■ Fast Response

- Prompt response – full power charge to discharge in 2 milliseconds

■ Reliability

- Uses ceramic for electrolyte. No self discharge, superior long term durability

■ Safety

- Multiple safety features and quality control incorporated to ensure safety

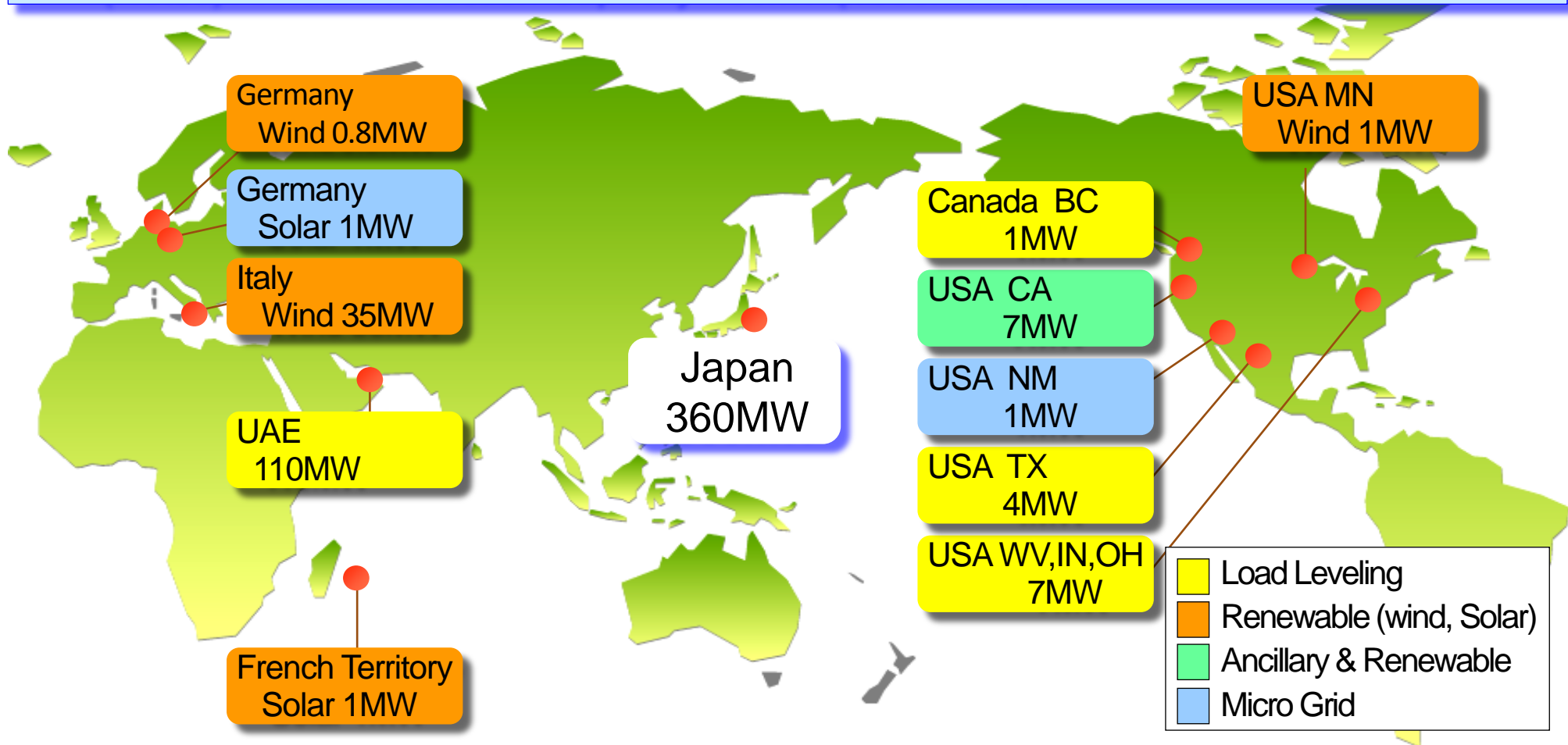
■ Easy Maintenance

- Minimal planned maintenance required. Remote operation possible



NAS[®] Battery Installations around the World

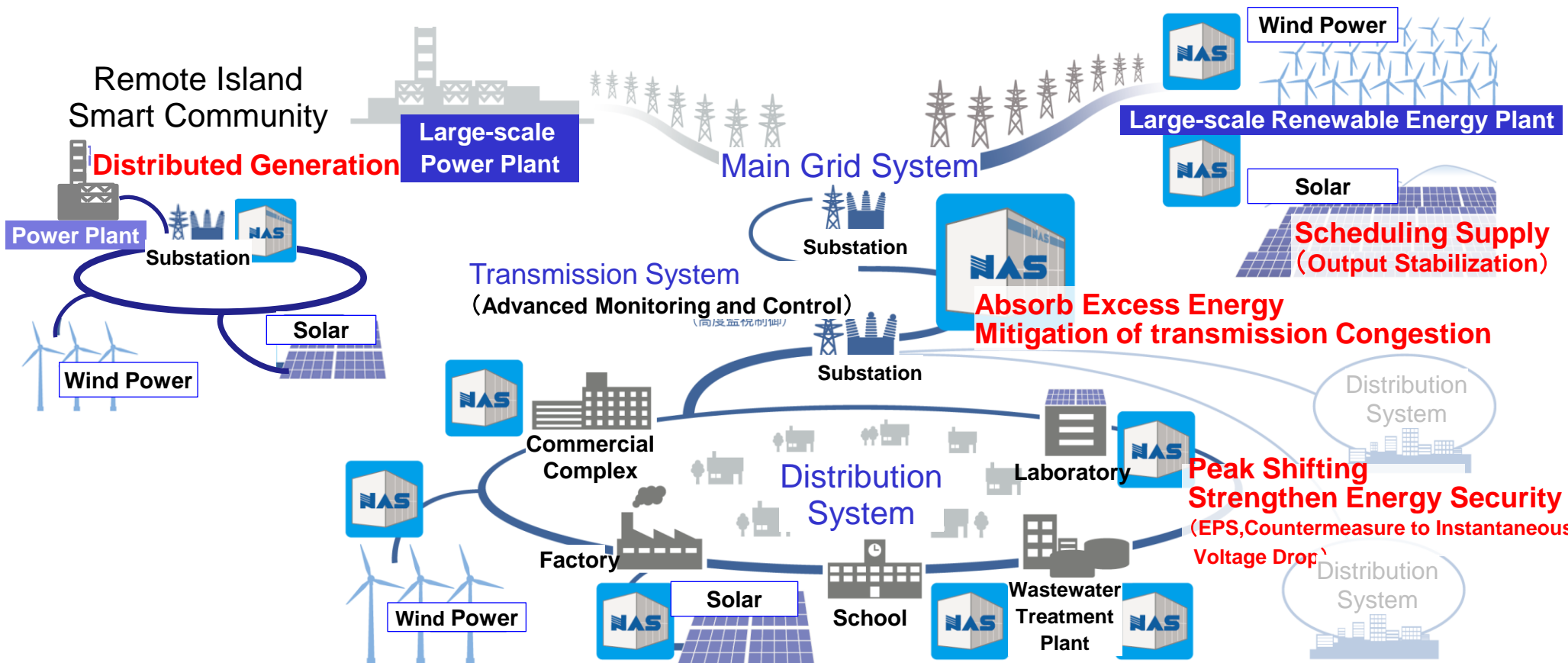
■ Commercialized in Year 2002
 ■ Total Installation Record of 530MW (3700MWh)
 Domestic 360MW, Overseas 170MW (as of May 2015, including projects under construction)
 (Notes) Annual Production Capacity 150MW(1000MWh)



Various applications of NAS[®] Battery System

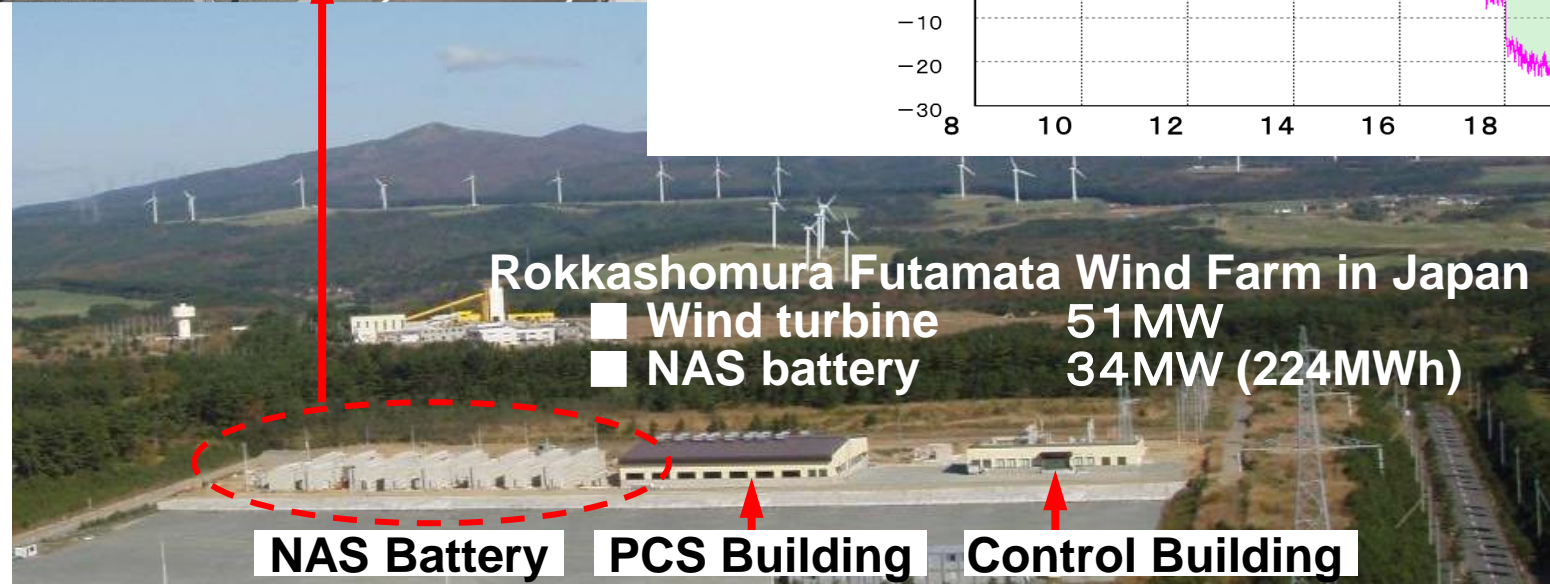
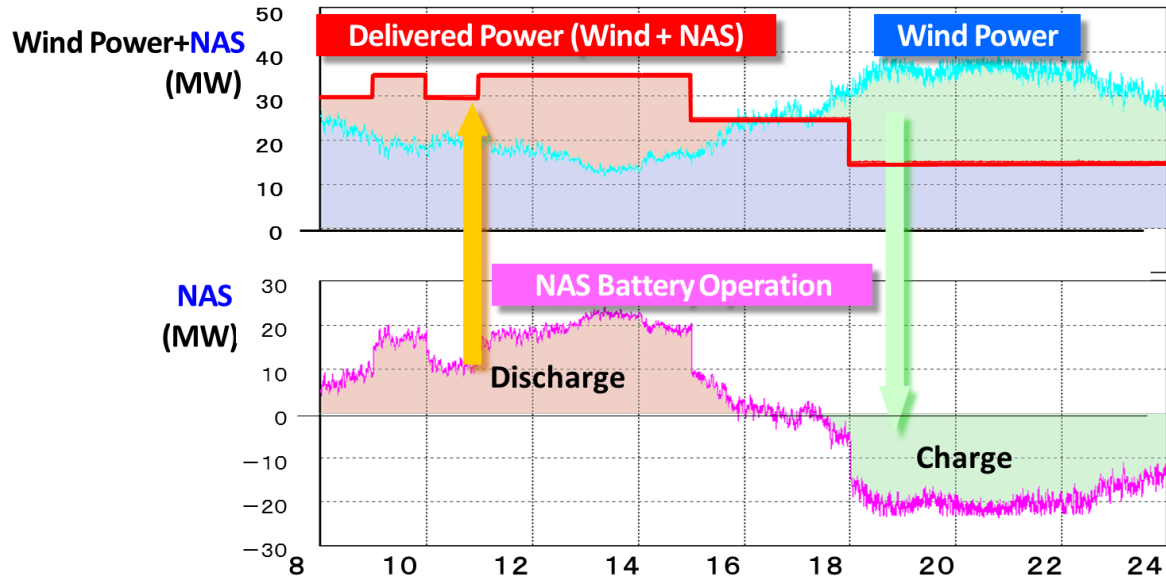
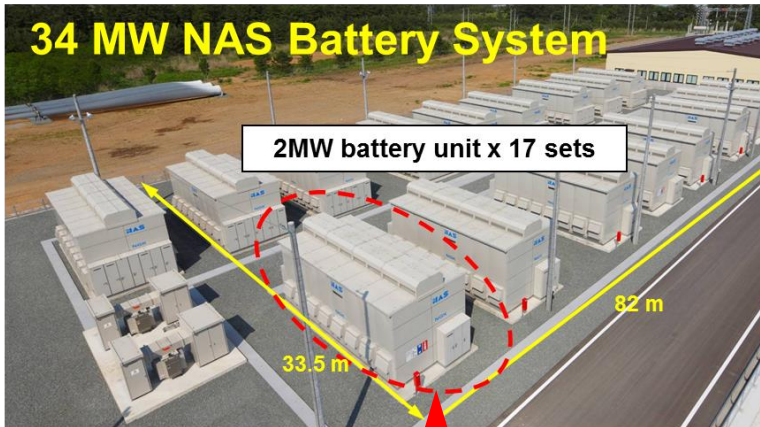
Energy Storage will enable..

- storage of electricity which was not feasible up till now
- balancing demand and supply instantaneously (location and time not restricted)
- efficient and reliable supply of electricity throughout system



Wind Turbine Application in Japan

■ JAPAN WIND DEVELOPMENT CO., LTD.(JWD) started the first commercial “Wind and NAS Battery Hybrid System” operation since August 1st, 2008.



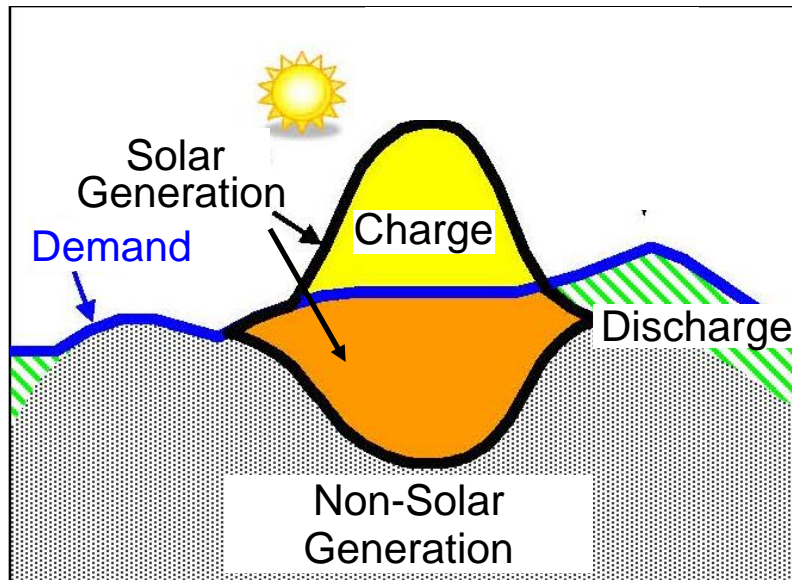
Absorb excess energy by renewable power

Purpose of Kyushu Electric project

- To enable smooth introduction of renewable power source into the grid system by balancing supply and demand.
- To verify grid voltage control

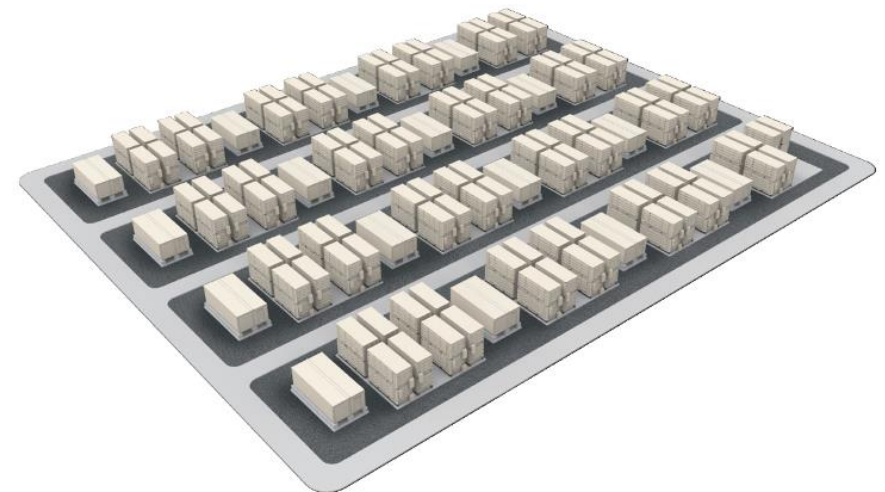
■ Kyushu Electric

Large-capacity storage system
supply / demand improvement demonstration



■ Planned Equipment

Output Power	5 0 MW
Energy Capacity	3 0 0 MW h
Location	Kyushu Electric Power Buzen Power Station (Fukuoka Prefecture Buzen)
Start of Operation	2015 Fiscal Plan



Excerpt from April 22, 2015, Kyushu Electric Power Press Release

Thank you for your time !

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