



Hitachi's Smart Grid Solutions

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Activities of Self Healing System (FDIR)

How Hitachi's Solution Worked on 3/11

3/11-2011, massive quake and tsunami damaged lots of power plants (total 25GW) and transmission/distribution systems, which caused wide range blackout.

Tsunami

3/11 quake: Center point and intensity of each area



Source: Tohoku Electric Power Company's website.

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How Hitachi's Solution Worked on 3/11

- After the quake, power outage recovered rapidly due to power utilities' hard work for damage recovery and DMS's self healing function, etc.
- Exact and detailed outage information was available on the internet, which helped the rescue and disaster recovery activity.



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Why self healing system should be required?





Distribution management system

FDIR : Automatic Power Restoration upon a fault on a distribution line



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Human-Machine Interface of FDIR (1/2)



DMS receives fault information (Trip of Feeder CB. Relay information) Change color of discharged line to green) DMS locates faulty section & outage section and those sections are displayed in different colors (Red: charged, Yellow: faulty,

Green: outage without fault)



Human-Machine Interface of FDIR (2/2)



DMS creates Switching Order automatically to isolate the faulty section and restore power to "outage sections without fault" by GA.

DMS executes the Switching Order. Power is restored to the outage sections excluding faulty section. (Purple: Restored)



GA : Genetic Algorithm



Activities of Renewable Energy and distributed power

Activities of Wind Power Plant



Japan's Largest down-wind type wind turbines (2MW)



Energy Storage (Lead Acid Battery)

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Specifications of Battery			Terminal	Safety Valve
Specifications		LL1500W-S		
Voltage		8V	Pole	
Battery Capacity (10hr)		1500Ah		Head Cover
Energy Capacity		12kW		Fiead Cover
Installation		Horizontal		
Dimensions	Heights	473mm		Container
	Widths	799mm	Negative	
	Depths	500mm	Plate	Positive Plate
Weights(4 cells)		485kg	Retainer	
Expected life time (under 25°C)		17 years		V
Recycling rate		90%		V
Storage Of Charge range		30-90%	Structure of Lea	ad Acid Battery

Bifacial PV Module



Application of Bifacial PV



Building rooftop fences - Experience



Noise barrier fences - Experience

Activities of Gas Turbine (H-25)



Product of Hitachi Quality

- Heavy duty design
- High fuel flexibility
- Low NOx emission level
- Various system application
- High reliability
- Easy maintenance
- Worldwide long-term

maintenance support





Performance

	Unit	Natural Gas
Output	kW	32,000
Efficiency	%(LHV)	34.8

Cogeneration Plant



Power Output	29,910 kW
Heat Output	(6 MPa/ 300 C) 60 Ton/Hr
Overall Efficiency	More than 80 % (LHV)



Activities of Grid Solution (HVDC)

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HVDC technology

HVDC has cost benefit because it reduces transmission loss compared to AC when it is used for long distance or submarine cables transmission.

Hitachi supplied the main equipment for this system, such as thyristor valves, converter transformers, and control & protection panels.



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Activities of Grid Solution (Micro Grid System & FEMS)

Micro Grid System in Aich Expo (Japan)

Demonstration of micro grid system with 6-types distributed

Items	Demonstration results	Conventional Technologies
Optimal Operations	 Prediction and planning of CO₂ emissions within tolerance of 2% 	 Operation without secondary battery (Large variation of output)
Demand/Supply Balance	 Output variation < 100kW Prevention of reverse power flow 	 Output variation ~300kW Potential of reverse power flow
Electricity Quality	 ON-line measurement of systems High electricity quality 	 OFF-line measurement at local point



Our own experience of FEMS

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■On the lat summer, -15% energy saving was achieved.



IGCS : Intelligent Grid Control System

Trough our Smart Grid technologies, high reliability, low loss, and high share renewables can be expected.

- 1) Hitachi is willing to respect the existing power gird, utilities and technologies of the customers.
- 2) We are intending to contribute to achieve "Best Mix" of the customers' existing power grids and our leading edge technologies as WIN-WIN solution.

Thank you for your attention!

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