



Grid-Connection Projects by NEDO: Results from Fiscal Year 2007

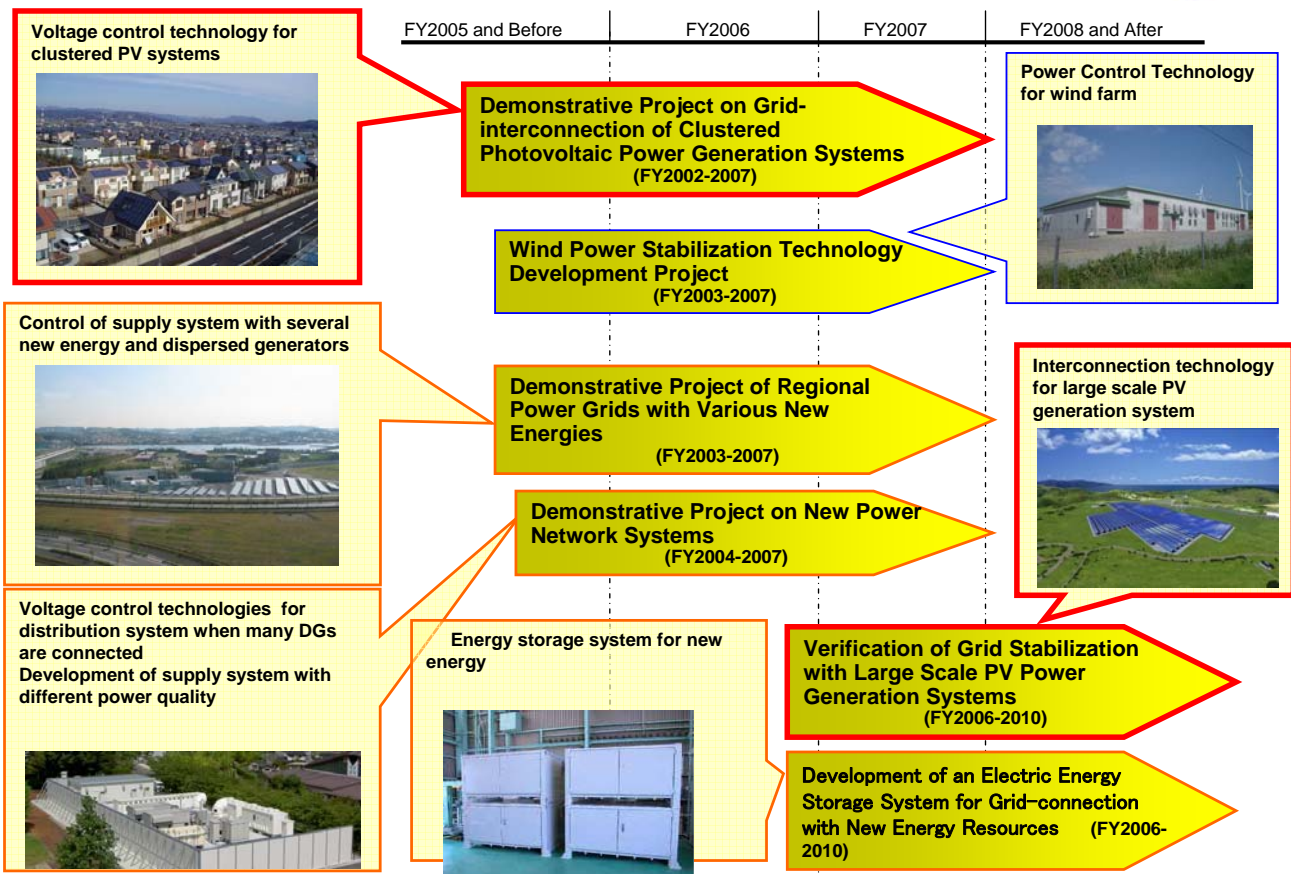
Hirofumi Nakama

New Energy and Industrial Technology Development Organization,
Japan

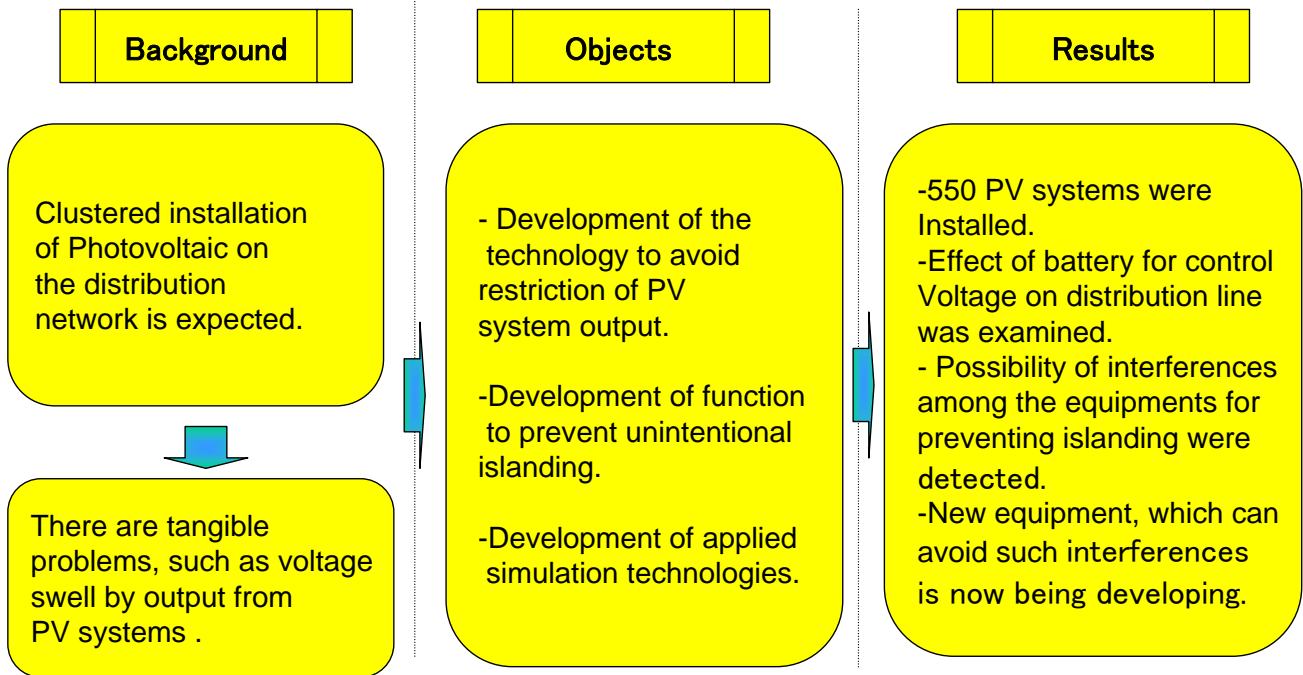
New Energy Technology Development Department
Project Coordinator for Grid-Connected Power System

New Energy and Industrial Technology Development Organization

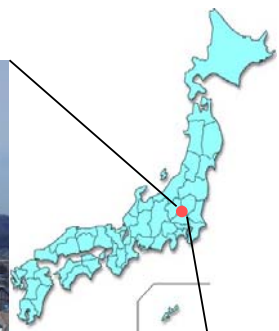
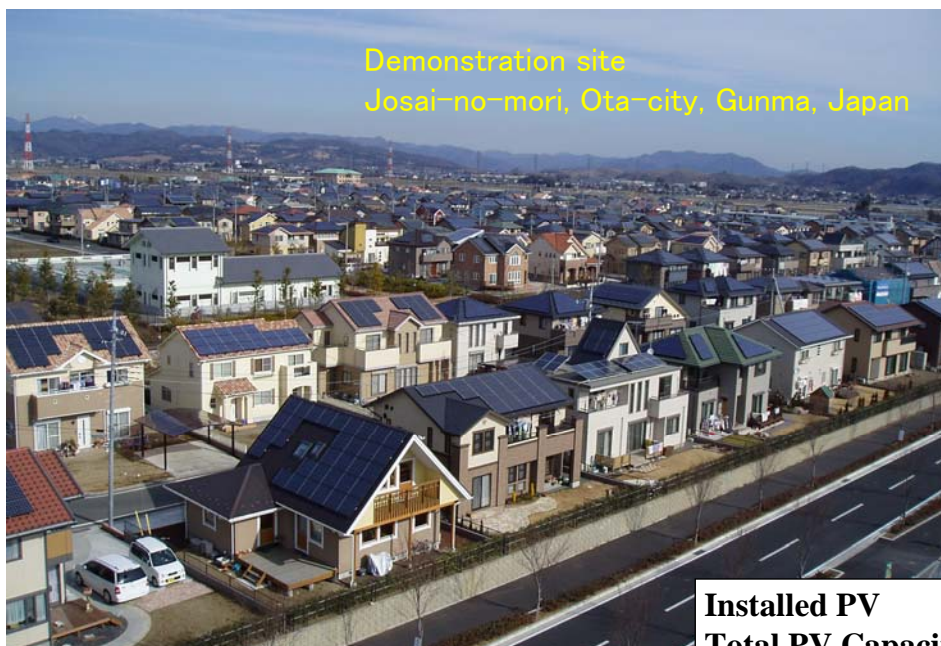
Grid-Connection related Projects in NEDO



Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)



Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)

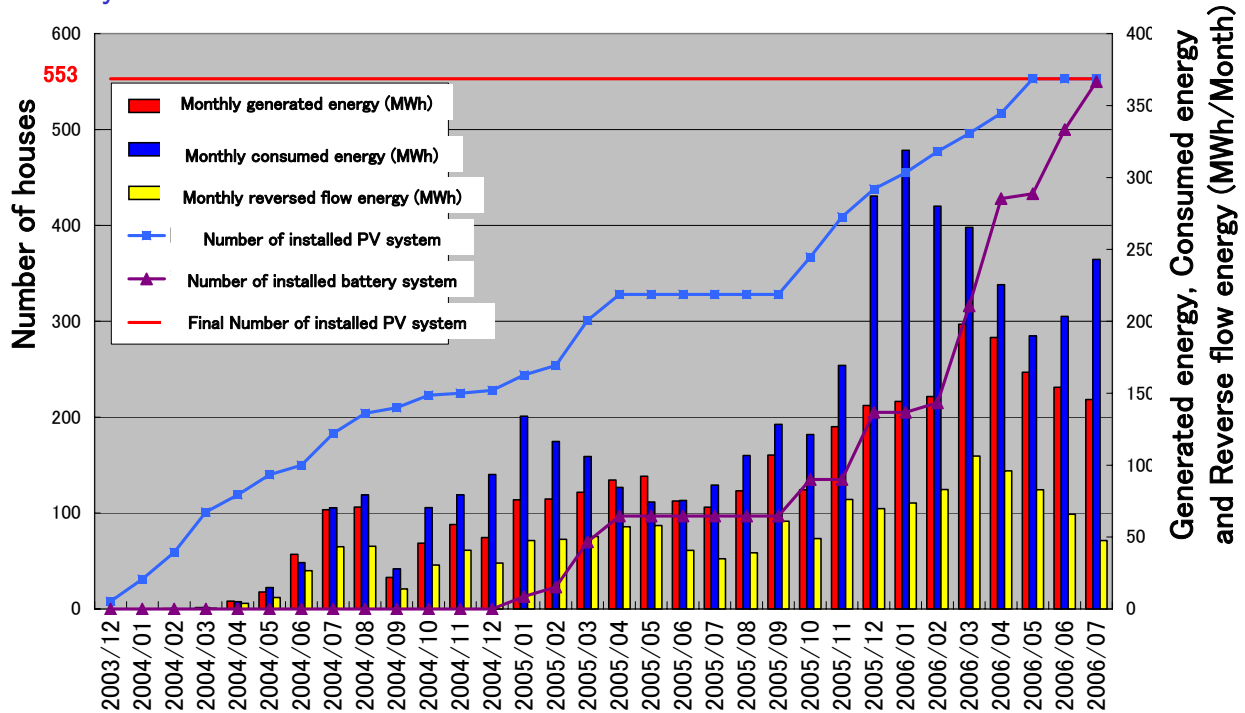


Installed PV	: 553
Total PV Capacity	: 2,129kW
Average PV Capacity	: 3.85kW

Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)



History of installation



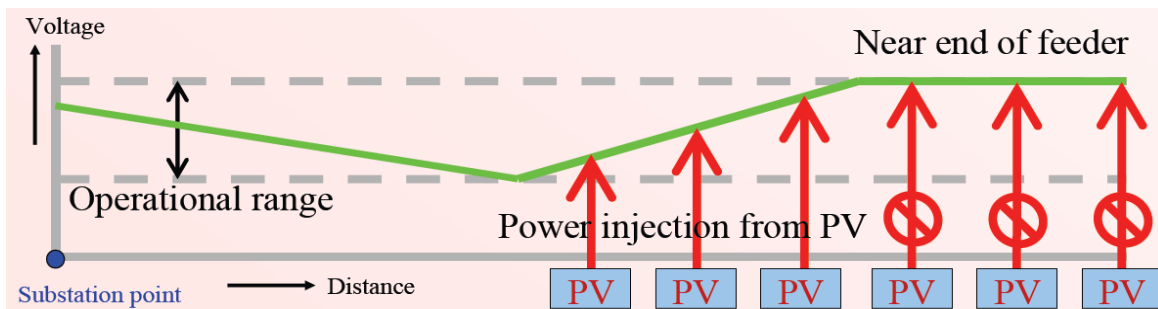
Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)



Development of technology to avoid restriction of PV system output

The voltages in distribution line sometimes becomes higher than the maximum nominal voltage of 107V or 222V because too much power injection from PV system.

Output of PV is restricted to keep line voltage within operational range (101 ± 6V, 202 ± 20V).

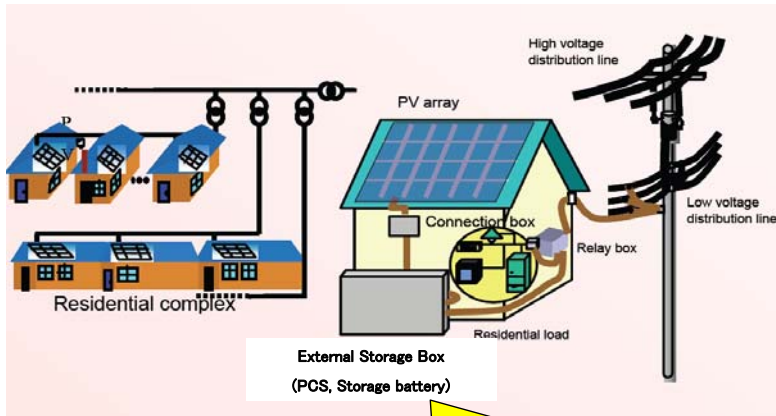


Various suppressions of the PV output are analyzed, and then several battery operation modes to reduce such suppressions are developed in this project.

Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)

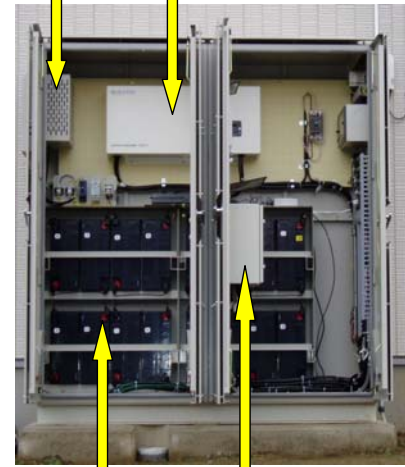


Concept of battery storage system



There is a storage box beside of PV system at each house. Inside of this box, Inverter, battery and measuring instrument are installed.

Ventilation fan
Inverter (4kVA)



Lead Acid Battery (4,704Ah·cell)
Control Terminal

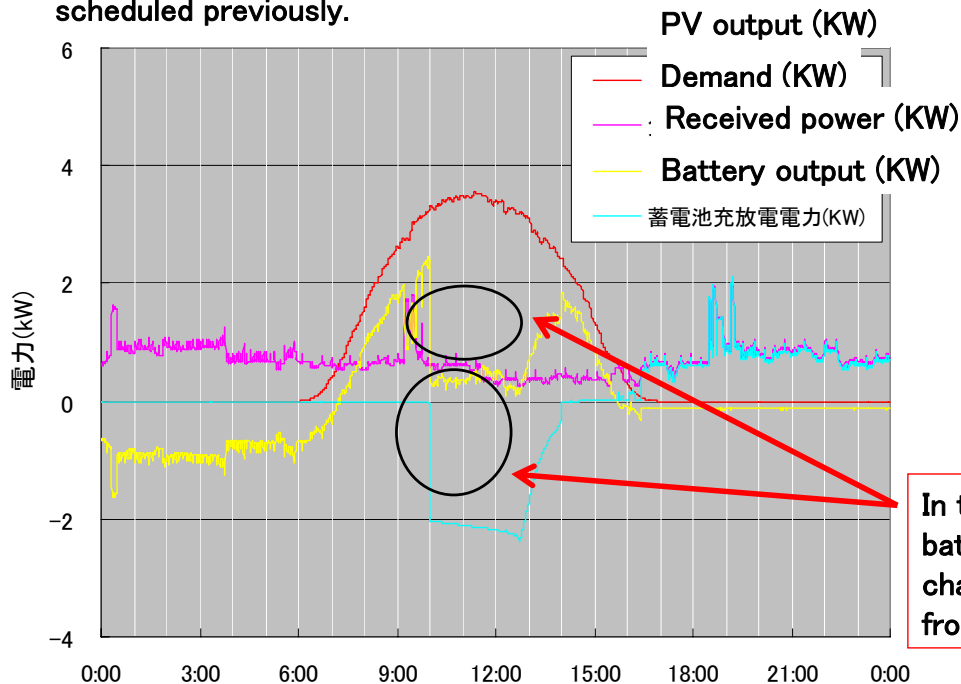
External Storage BOX

Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)



A sample of battery operation (Schedule operation)

Charging and discharging of battery are scheduled previously.



In this case, battery started to charge energy from 10 a.m..

Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)



Development of function to prevent unintentional islanding

- A function to prevent islanding operation disconnects the PV system from the power grid in the case of service interruptions. Interferences among the equipments for preventing islanding are induced when the clustered PV systems are installed.
- Methods to avoid mis-actuations of such function in the clustered PV systems are developed, the methods will be verified through demonstration.



- ✓ Developing new islanding detection method.
- ✓ Testing this method at the test facility in Maebashi City.
- ✓ Installing field-test equipment at the demonstrative site in Ota city
- ✓ Installing quality improved facility at the demonstrative site in Ota city



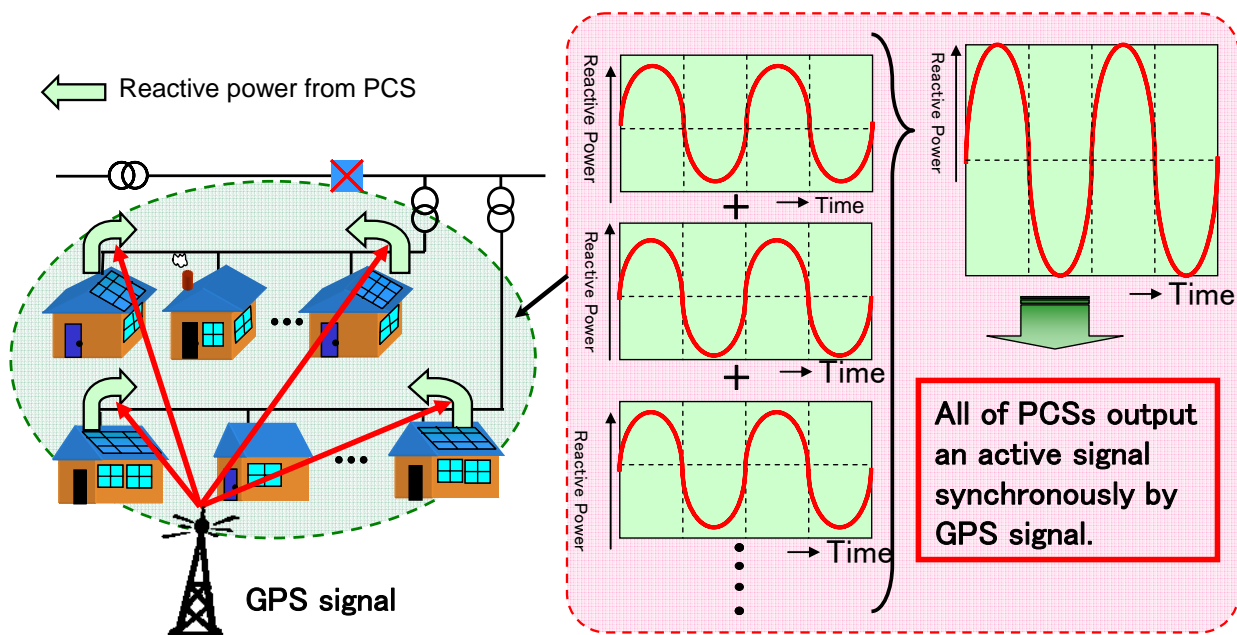
Test facility in Maebashi



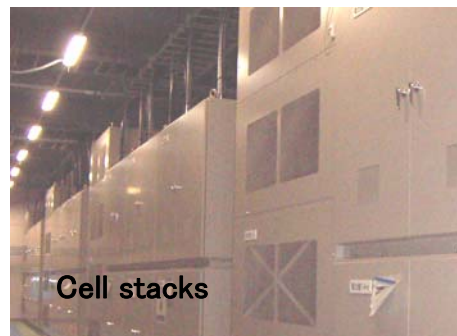
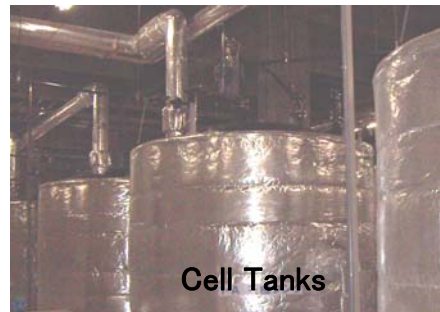
Demonstrative Project on Grid-interconnection of clustered Photovoltaic Power Generation (FY2002-2007)



Concept of islanding detection without any conflict



Wind Power Stabilization Technology Development Project(FY2003-2007)

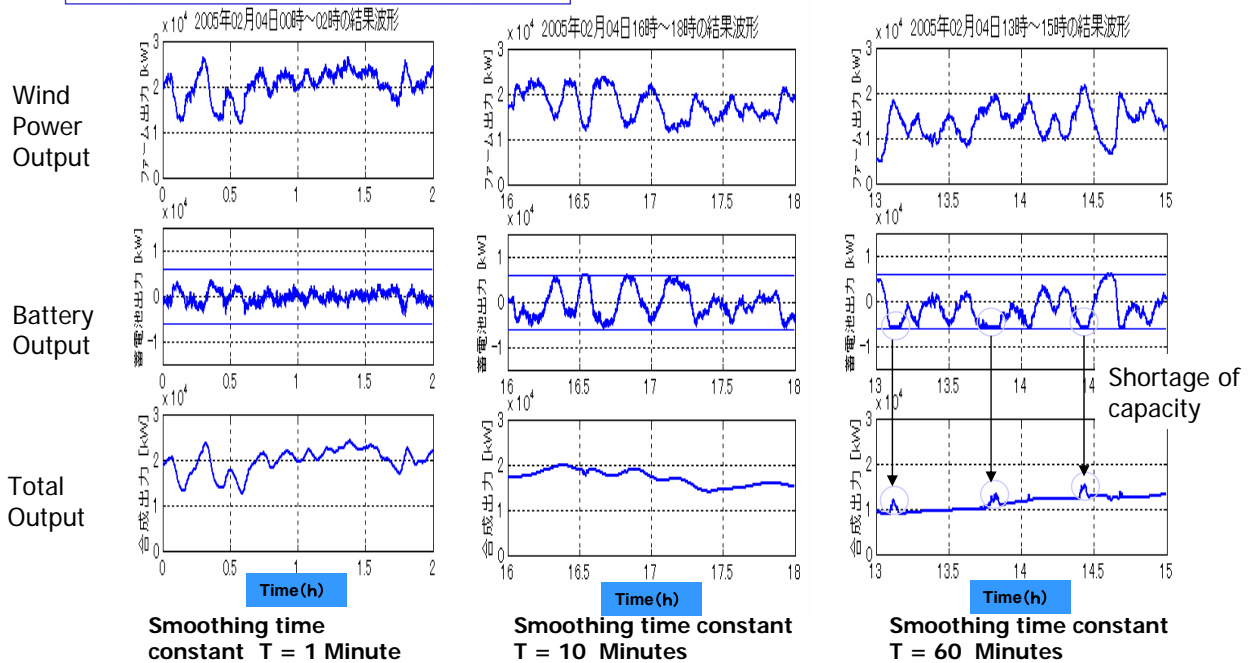


Redox-Flow battery
Inverter Capacity : 6000kW
(Same as short term output rate of battery)
Battery nominal capacity : 4000kW
Storage capacity : 6000kWh

Wind Power Stabilization Technology Development Project(FY2003-2007)



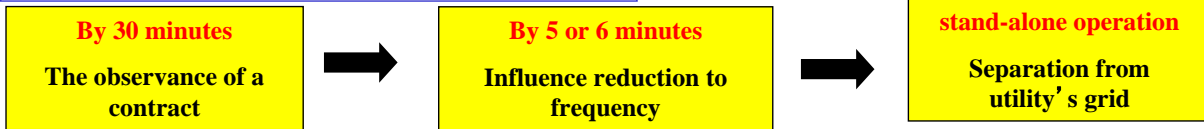
Samples of battery operation results



Demonstrative Project of Regional Power Grids with Various New Energies(FY2003-2007)



Balancing results between Demand and Supply

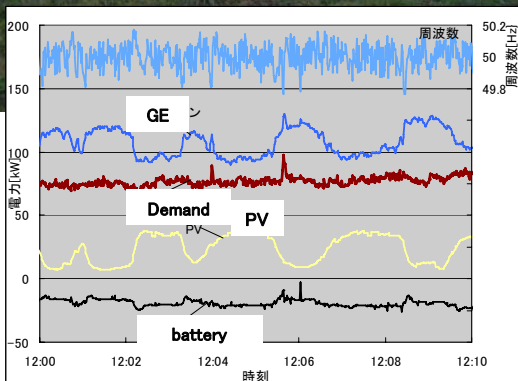


Project	Balancing error target	Achieved results
Aichi EXPO	3% by 30 minutes ↓ 3% by 10 minutes	The balancing error target was 99% achieved with operation of NaS battery system. Stand-alone operation was examined twice under a limited demand condition.
Kyotango	8% by 5 minutes ↓ 3% by 5 minutes	Continuous operation was started in Feb. 2006. By the end of the fiscal year, the target was achieved.
Hachinohe	3% by moving 6 minutes average	During operation from Oct. 2005 to Feb. 2006, the balancing error target was 98.2% achieved. November 2007, stand alone operation was examined during 8 days.

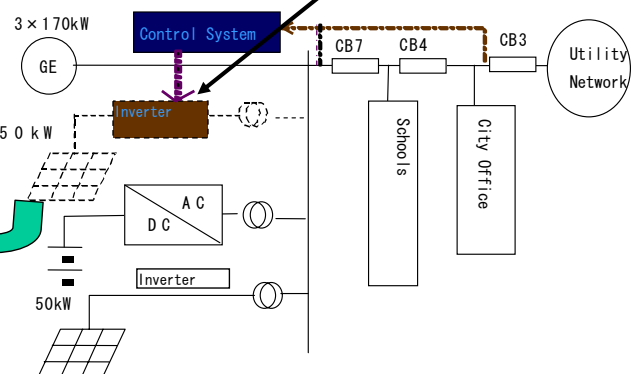
Demonstrative Project of Regional Power Grids with Various New Energies(FY2003-2007)



Hachinohe Micro grid independent operation



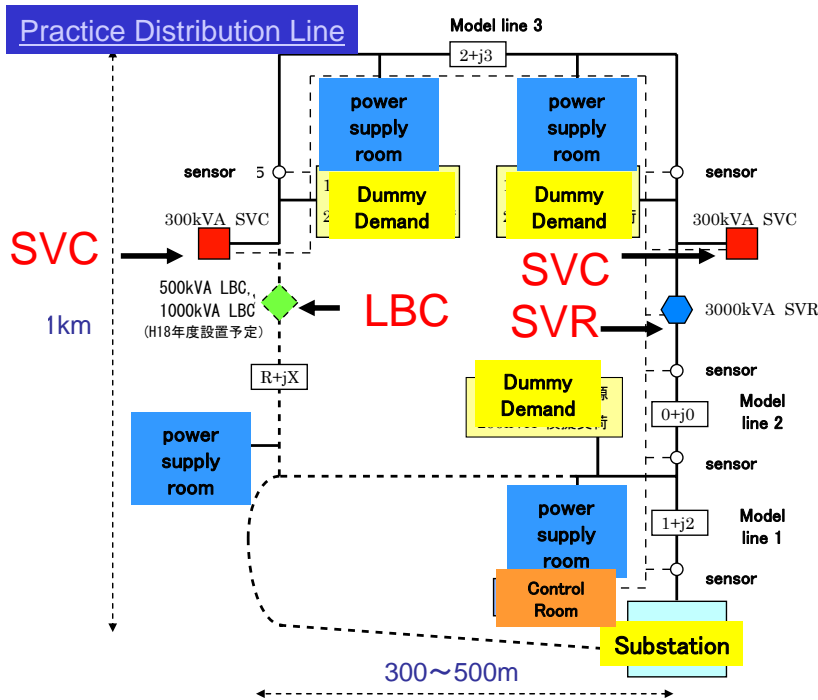
Compensate imbalance among three phase by PV PCS



Demonstrative Project on New Power Network Systems (FY2004-2007)



Demonstrative Project on Power Network Technology



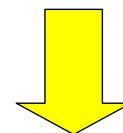
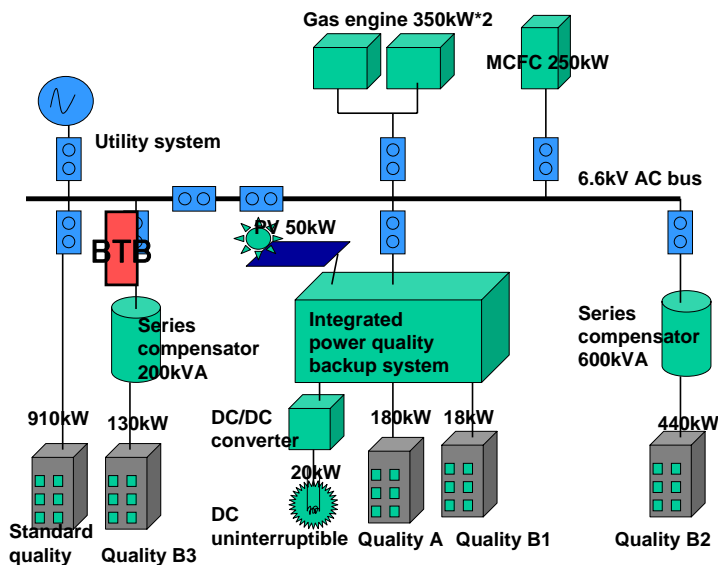
- LBC : Loop Balance Controller**
An Equipment to interchange power between feeders as BTB
- SVC : Static Var Compensator**
An Equipment to control Var and voltage
- SVR : Step Voltage Regulator**
An Equipment installed serially on the line to control line voltage

Demonstrative Project on New Power Network Systems (FY2004-2007)



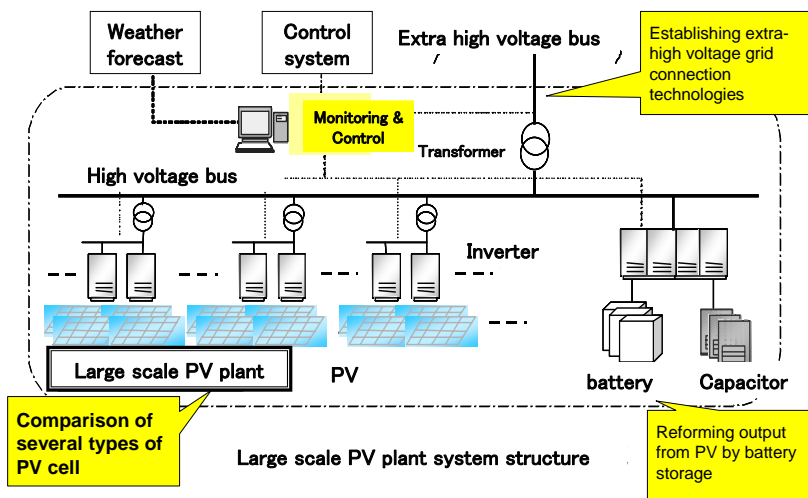
Demonstrative Project on Power Supply Systems by Service Level

Contractor :
NTT Facilities,
Sendai City,
Tohoku Fukushi Univ.,
NTT-BTI



Please refer Mr. Hirose's presentation

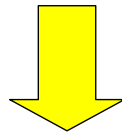
Verification of Grid Stabilization with large-scale PV Power Generation Systems (FY2006-2010)



Wakkanai Site



Hokuto Site



Please refer Mr. Hara's presentation

Verification of Grid Stabilization with large-scale PV Power Generation Systems (FY2006-2010)



Wakkanai site

FY	2006	2007	2008	2009	2010
PV capacity(MW)		Mar. 80kW	Nov. 1.7MW	Oct. 4.0MW	Oct. 5.0MW
NaS battery (MW)			Nov. 0.5MW	Oct. 1.5MW	
EDLC (MW)				Oct. 0.5MW	Oct. 1.5MW
Grid connection		Mar. 6.6kV	Nov. 33kV		

Hokuto site

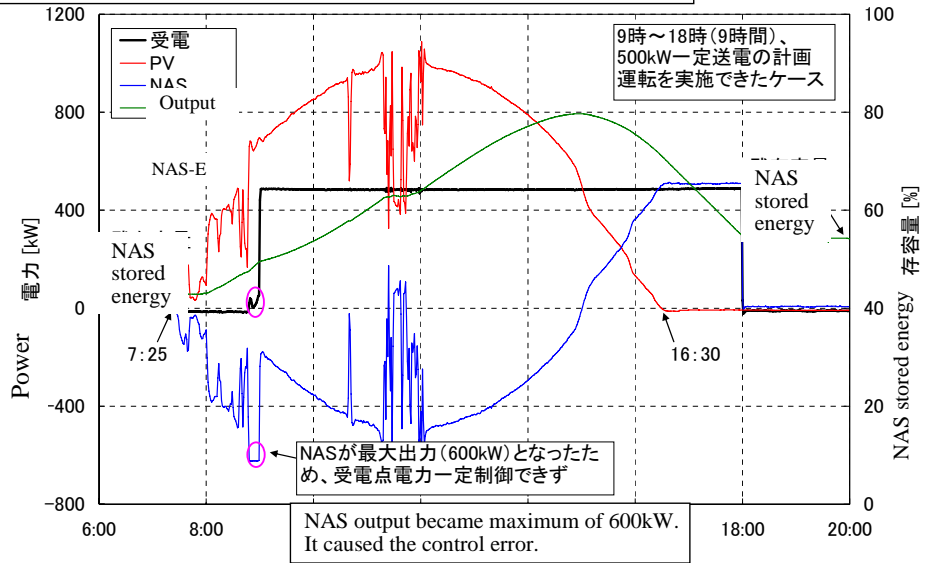
FY	2006	2007	2008	2009	2010
PV capacity(MW)			Feb. 0.6MW	Nov. 2.0MW	
Grid connection			Feb. 6.6kV	Nov. 33kV	

Verification of Grid Stabilization with large-scale PV Power Generation Systems (FY2006-2010)



Stabilization of Mega-Solar: typical planned operation of Mega-solar

Date: 2008/2/10
 Control parameter
 Proportional gain 0.5
 Time constant 1sec
 Operation schedule
 9:00~18:00 (9 hour)
 500kW constant transmission



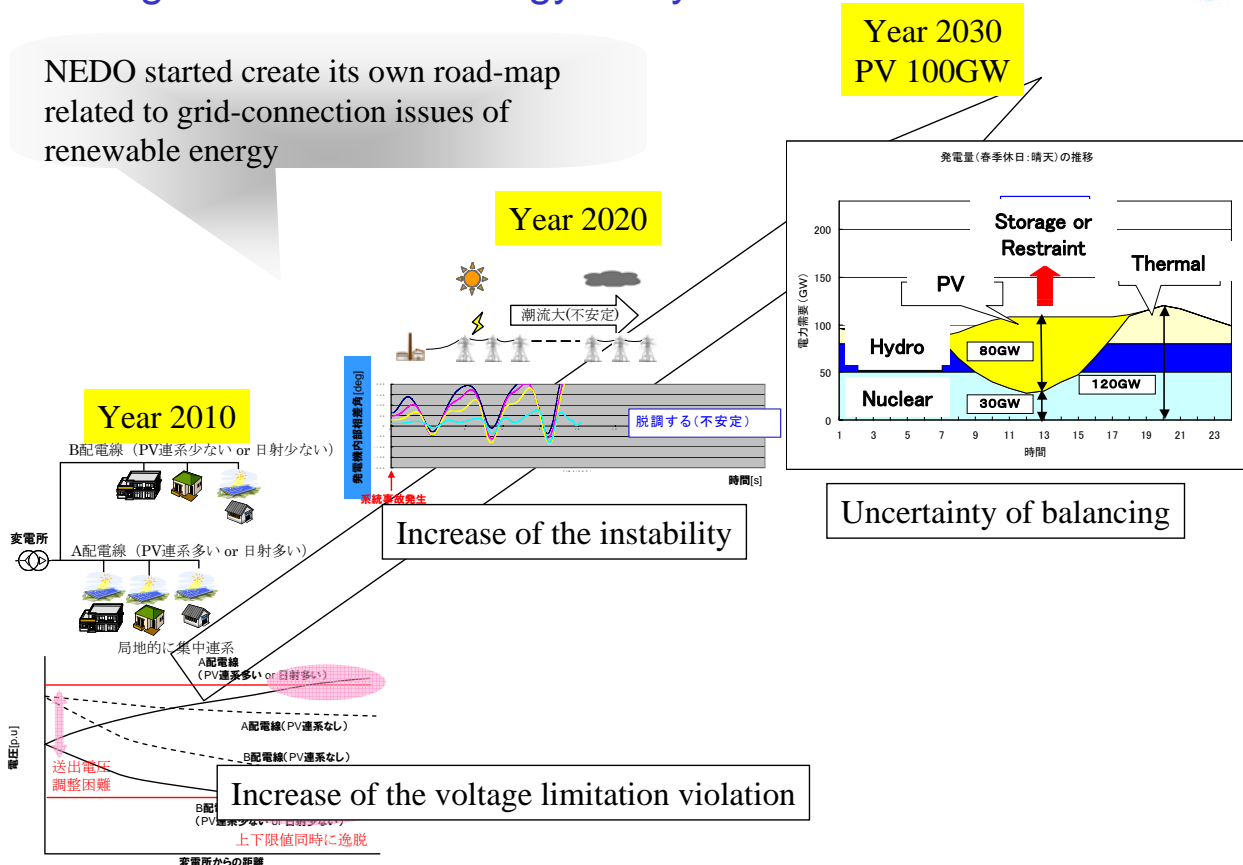
【Comment】

We succeeded in scheduled output control, which was 500kW constant transmission from 9:00 to 18:00.

Next generation technology study



NEDO started create its own road-map related to grid-connection issues of renewable energy





Thank You for your attention !!



New Energy and Industrial Technology Development Organization