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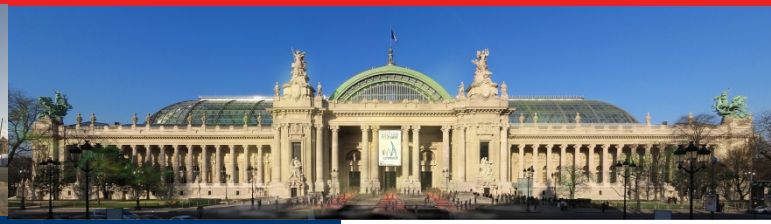

Verification tests of the energy system integrated of CGS and renewable energy

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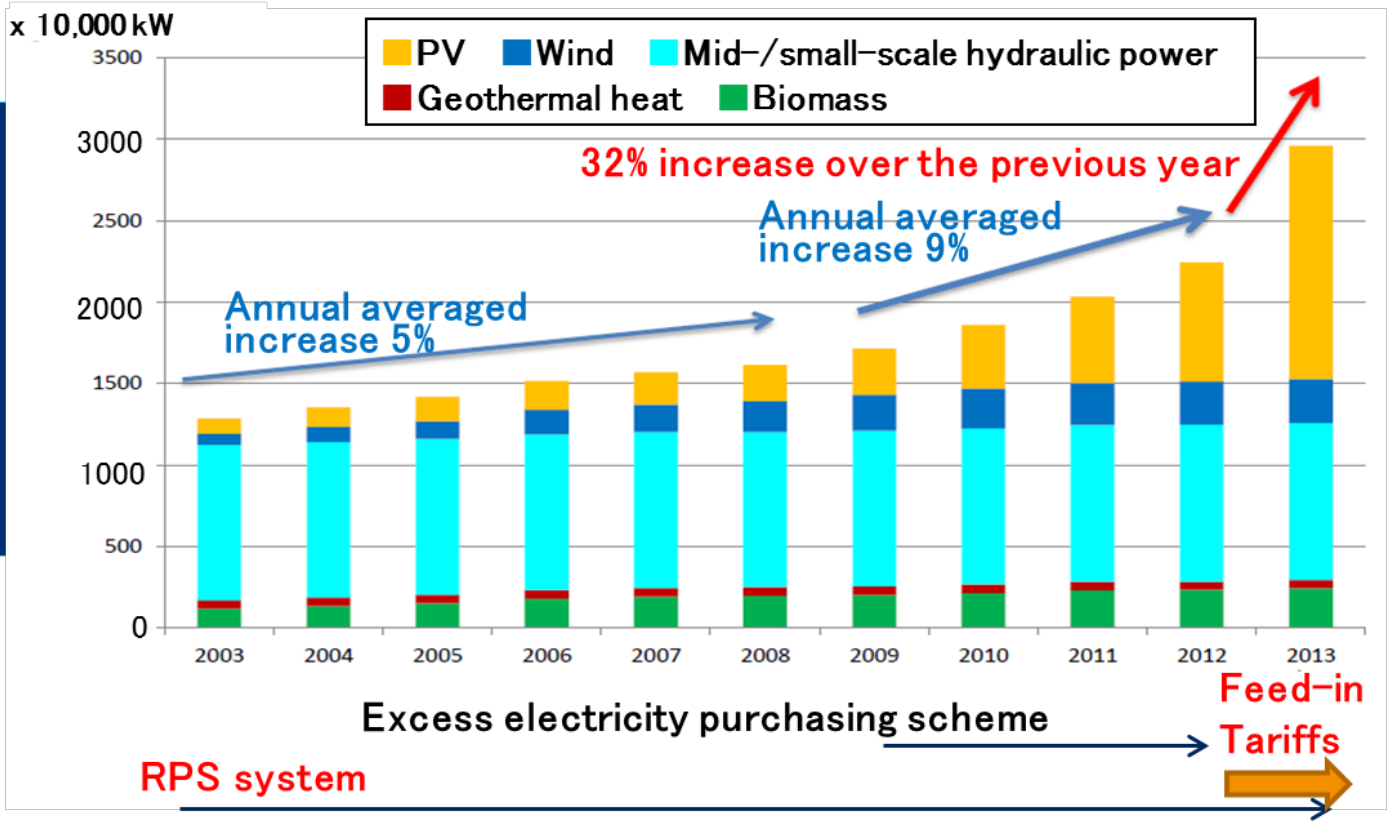
IGU
WGCPARIS2015
WORLD GAS CONFERENCE

Today’s contents

- Background
- Concept of proposed energy system
- Composition of demonstration system
- Test results
- Conclusion

Challenges for the grid interconnection

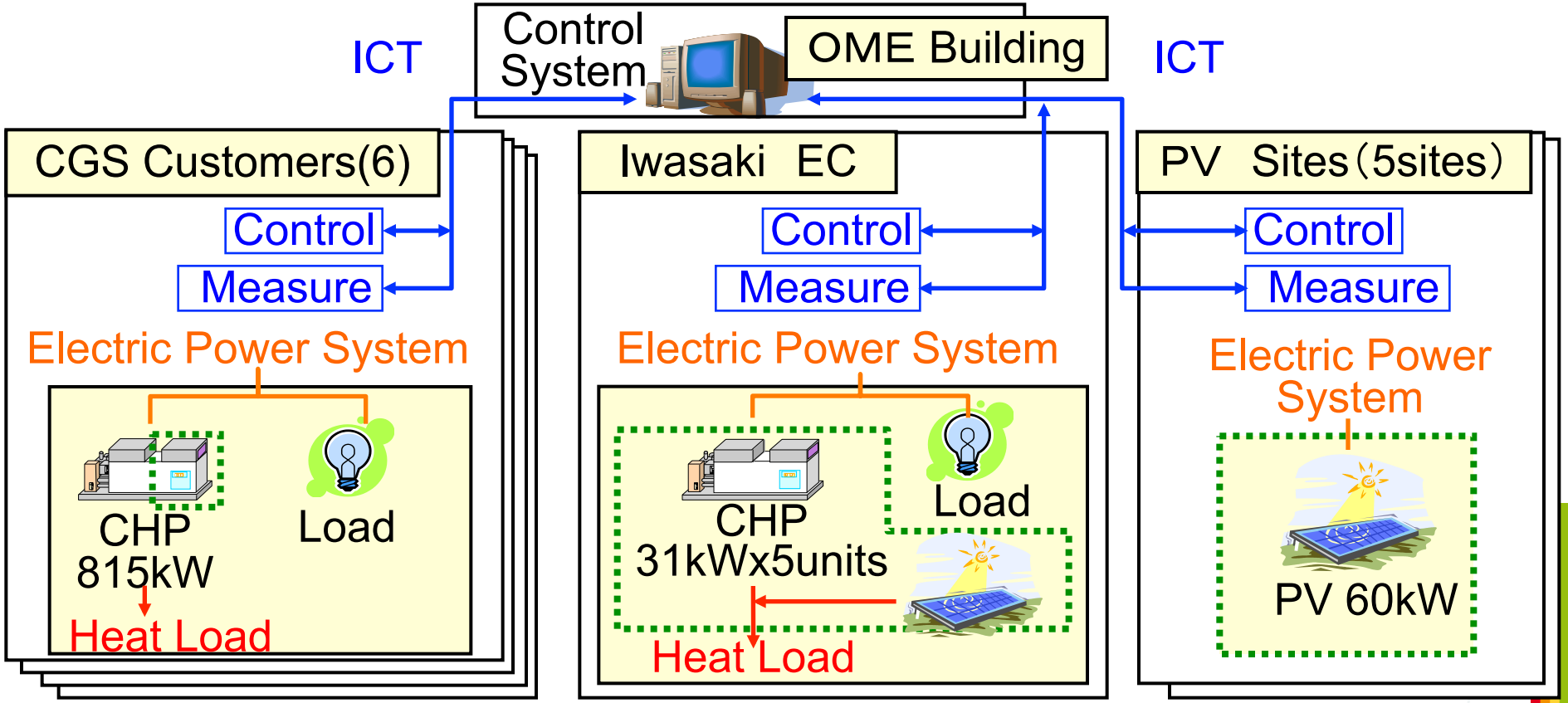
Transition of installed capacity of renewable energies



Concept of “Smart Energy Network”

<Challenges>	<Proposed countermeasures>	
CO2 emission reduction	High-degree utilization of heat and electricity generated by CGSs	TEST A
Balancing power shortage	Smoothing output fluctuation of PV/Fast-DR of aggregated CGSs	TEST B
Supply power shortage	Demand response of aggregated CGSs	TEST C

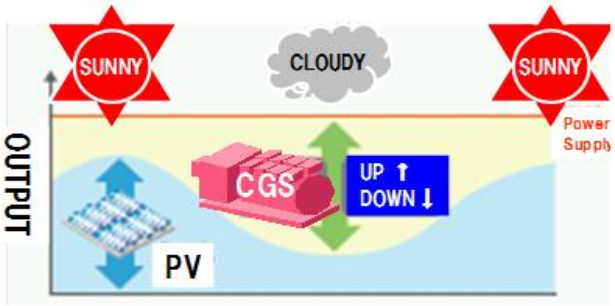
Composition of the test system



Contents of the demonstration test

Test B
(For balancing power shortage)

【Smooth PV fluctuation for contributing to power system stabilization】



Test for checking adaptively to PJM code was also conducted (Fast-DR test)

Test C
(For supply power shortage)

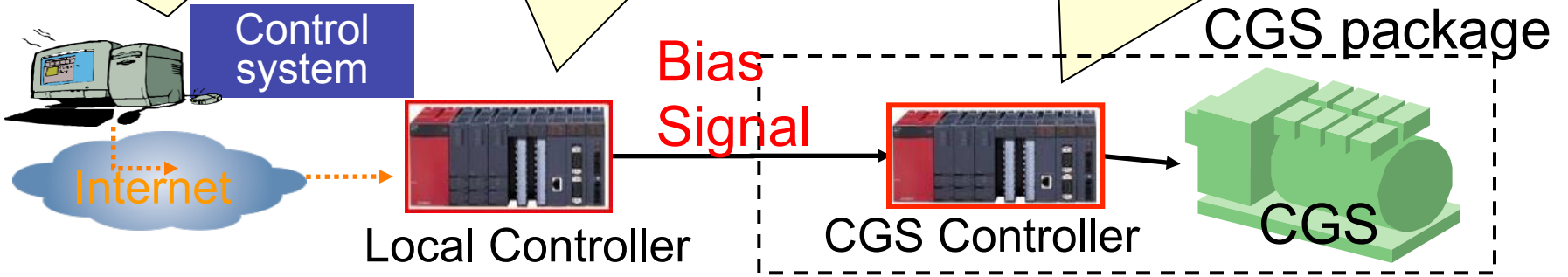
【Supply power at emergency and electric shortage, etc.】

Like huge Thermal Power Plant

Photos of CHP Customers joining this project

Total Capacity of CGS: about “6400kW”

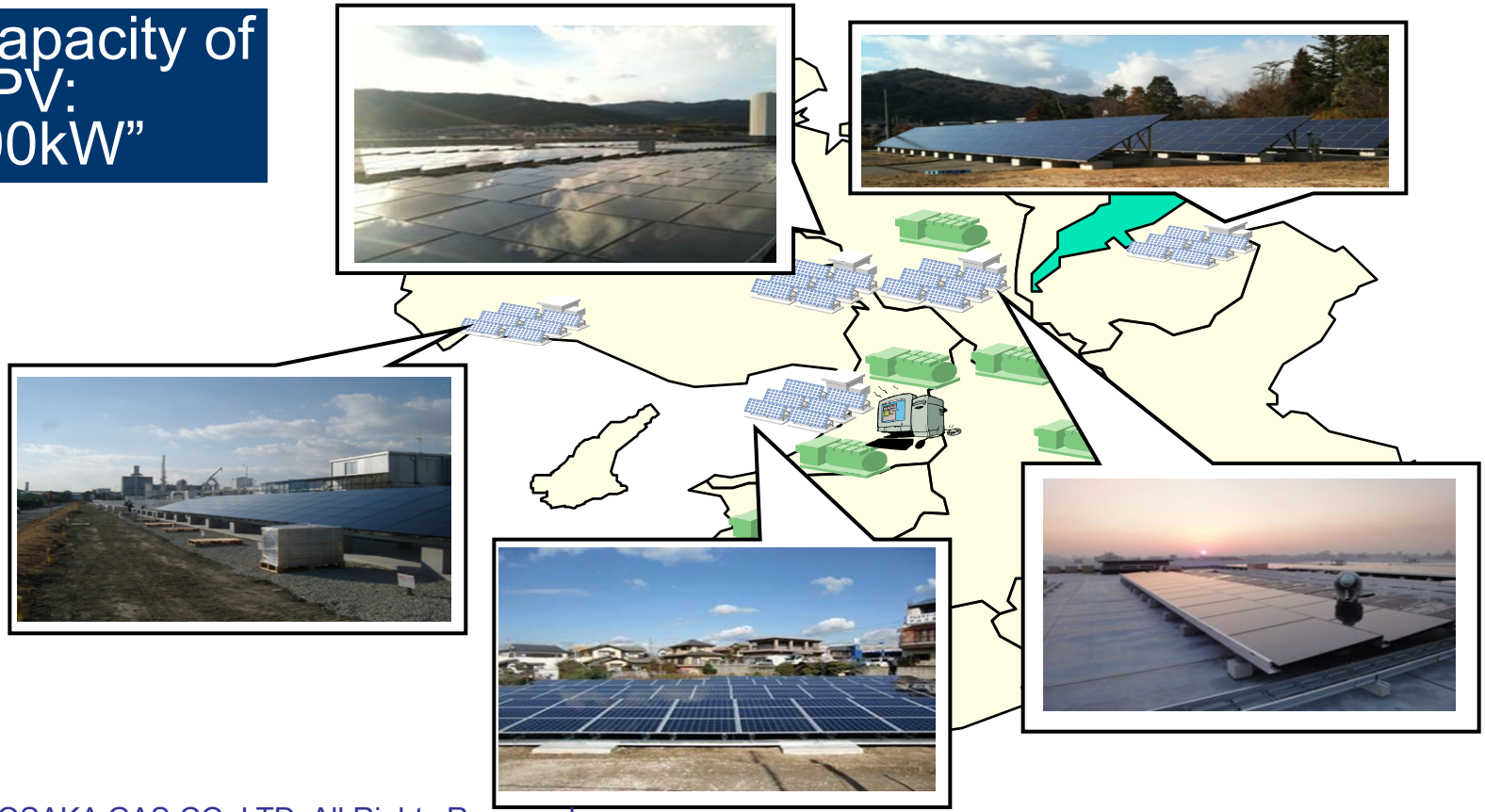
Photos of control system (Center sys–each CGS)



CGS controller was reconstructed to be accepted output signal which came from a center system via internet.

Photos of PV sites

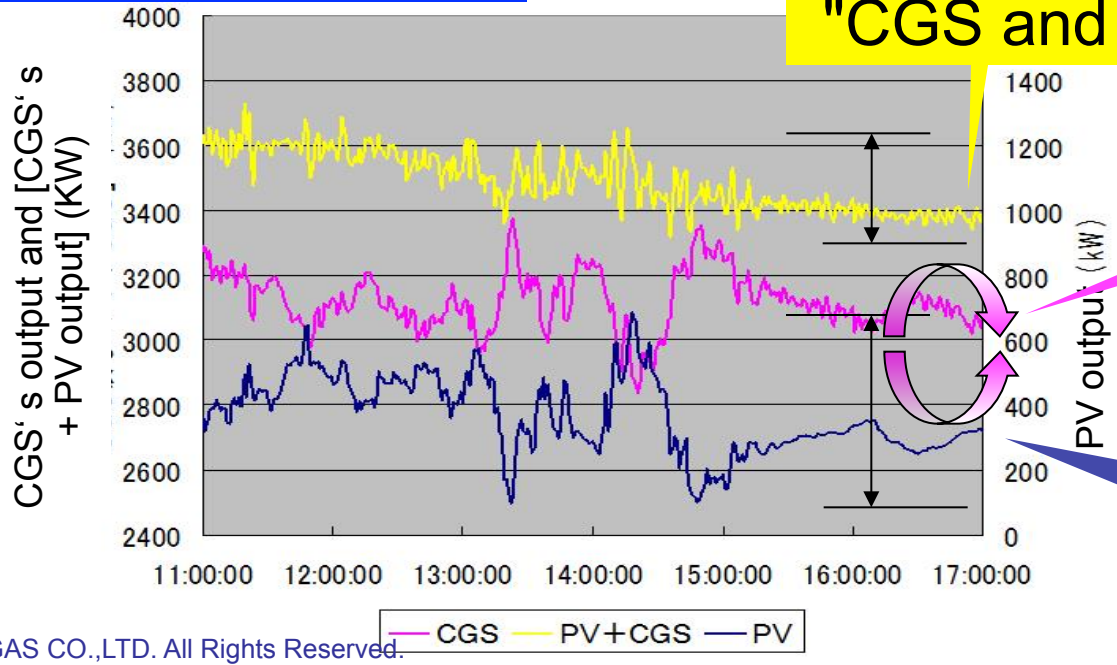
Total Capacity of PV:
“300kW”



Result of Test B

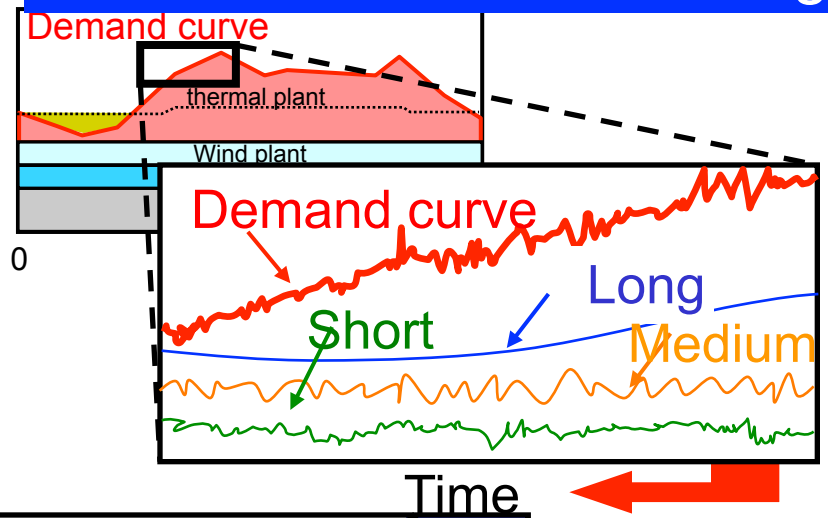
By controlling four CGS which are located at the different customers' site, smoothing PV outputs is realised.

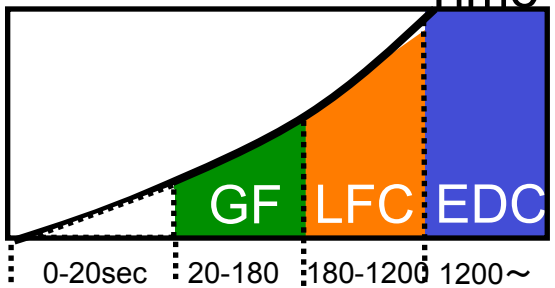
[Actual measurement value]



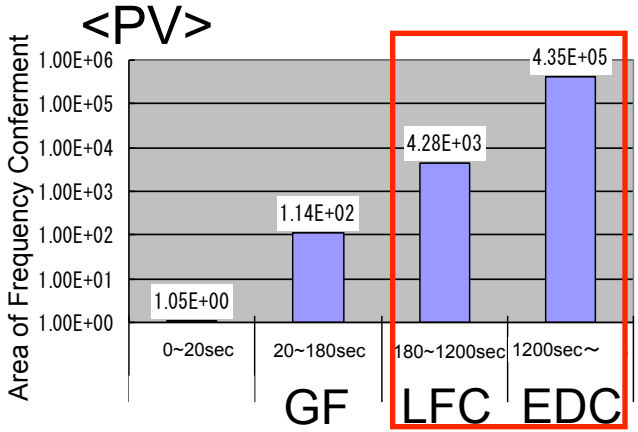
Target fluctuations of PV outputs

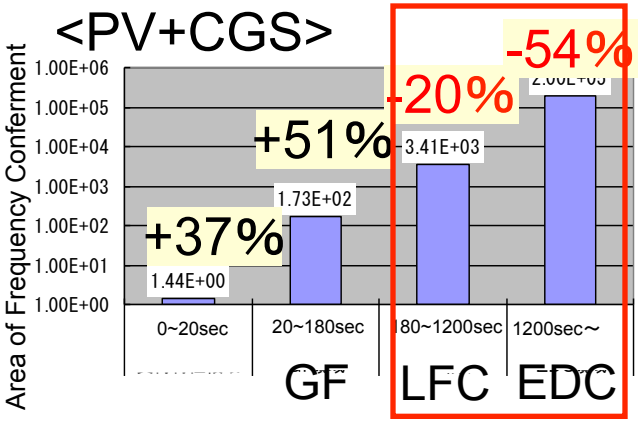
Demand Fluctuation Range





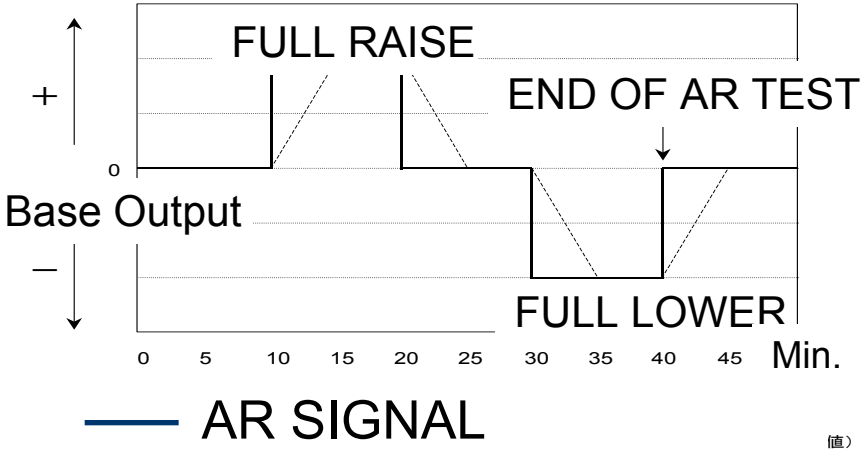
EDC: Economy Dispatching Control
LFC: Load Frequency Control
GF: Governor Free





Test B’: AR (Area Regulation) TEST Overview

【PJM’s rule】



【Evaluation Method】

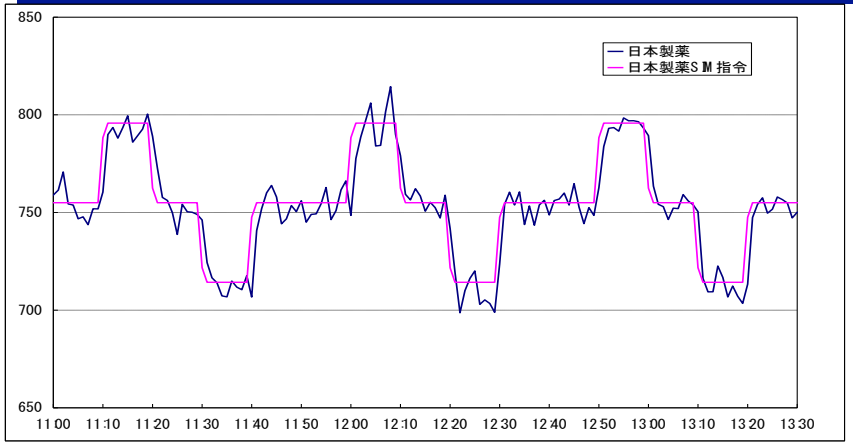
RRC
＜Rate of Response Compliance [%]＞
Response Compliance against AR signal

RMC
＜Regulation Mismatch Compliance [%]＞
Mismatch Compliance between 15-20min.

TS＜AR Test Result[%]＞
RRC + RMC
⇒ Needs to satisfy more than 75%

Test B(Optional): AR (Area Regulation) TEST Result

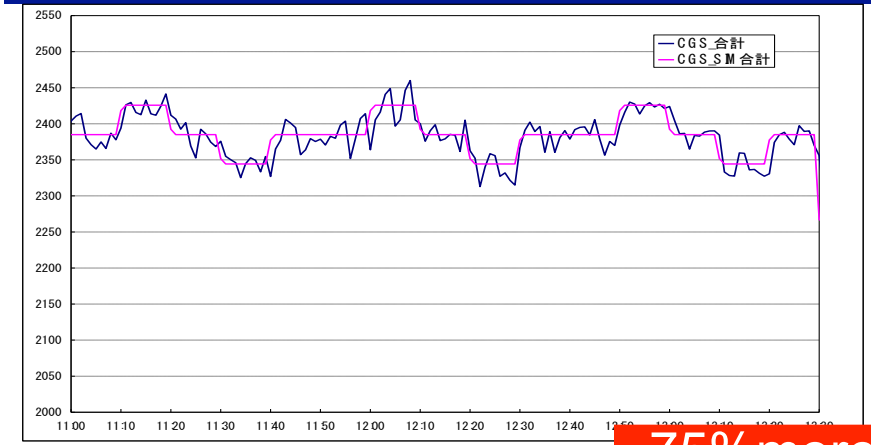
CGS815kW
Control Capacity: ±40kW



75%more

RRC	RMC	TS
88.55	95.58	92.07
95.73	95.36	95.54
100.98	98.06	99.52

CGS2,445kW
Control Capacity: ±120kW

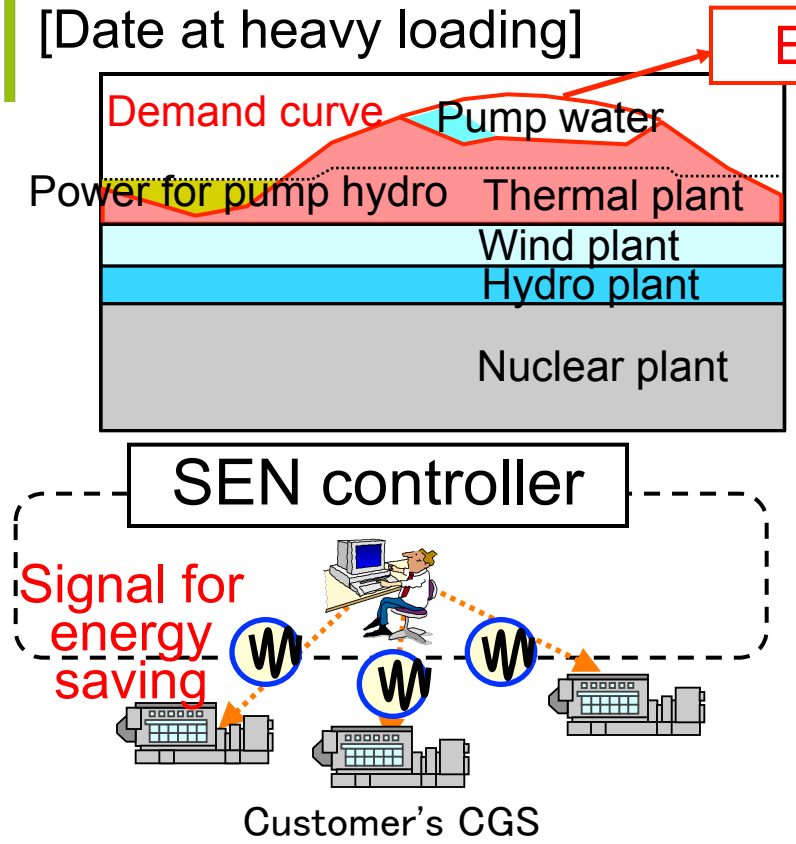


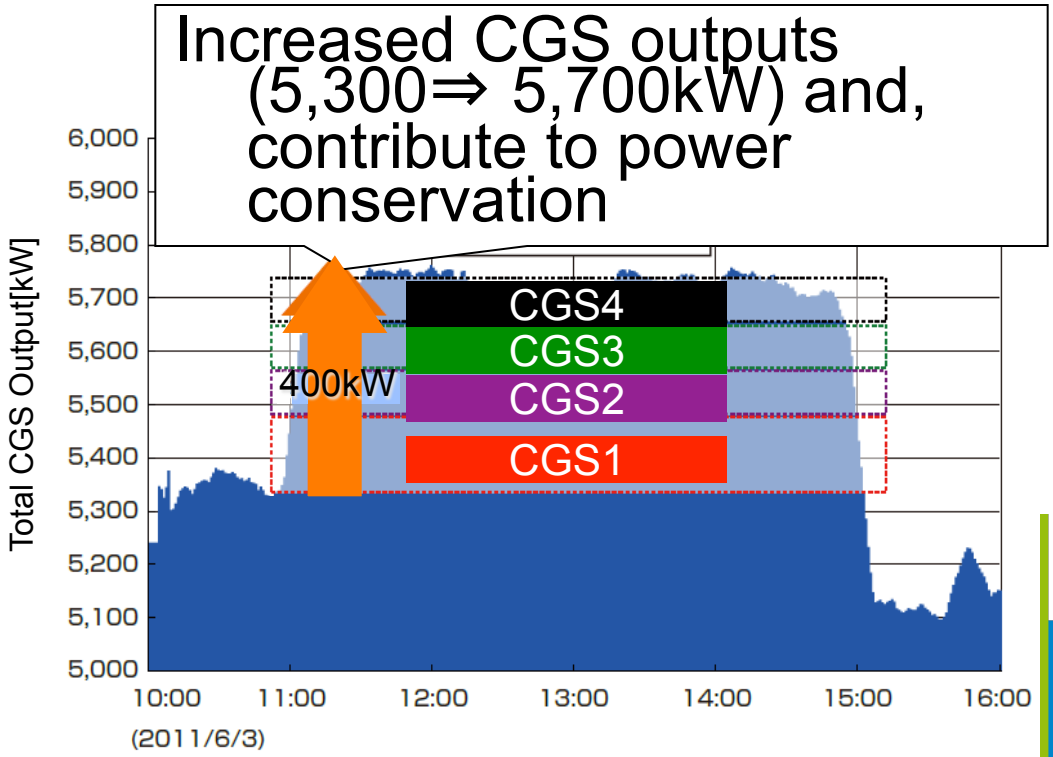
75%more

RRC	RMC	TS
96.25	98.11	97.18
94.69	99.25	96.97
95.96	98.63	97.30

Test C [Power Supply] Result

[Date at heavy loading]

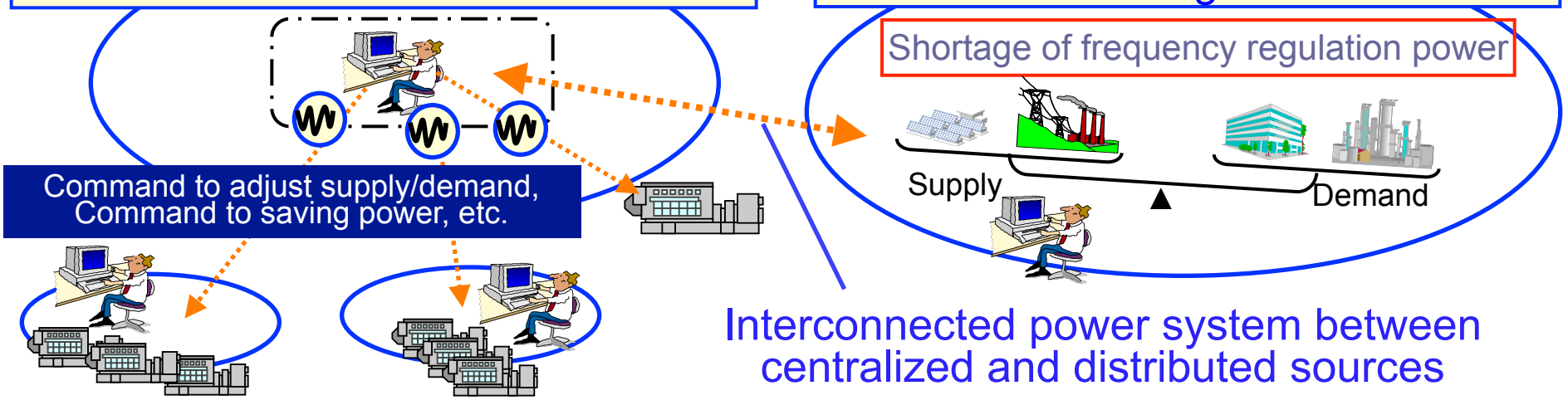




Meaning of this demonstration PJ and future vision

Control management center for distributed sources

Central control center of utility Or Exchange market



- Under the normal condition, it provides supply power by fully utilizing heat and electricity.
- It can contribute to supply/demand balancing and power saving as needed in cooperation with the grid.