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# **A system operation and planning issues in the Japanese Interconnected System in the aftermath of March 11 events**

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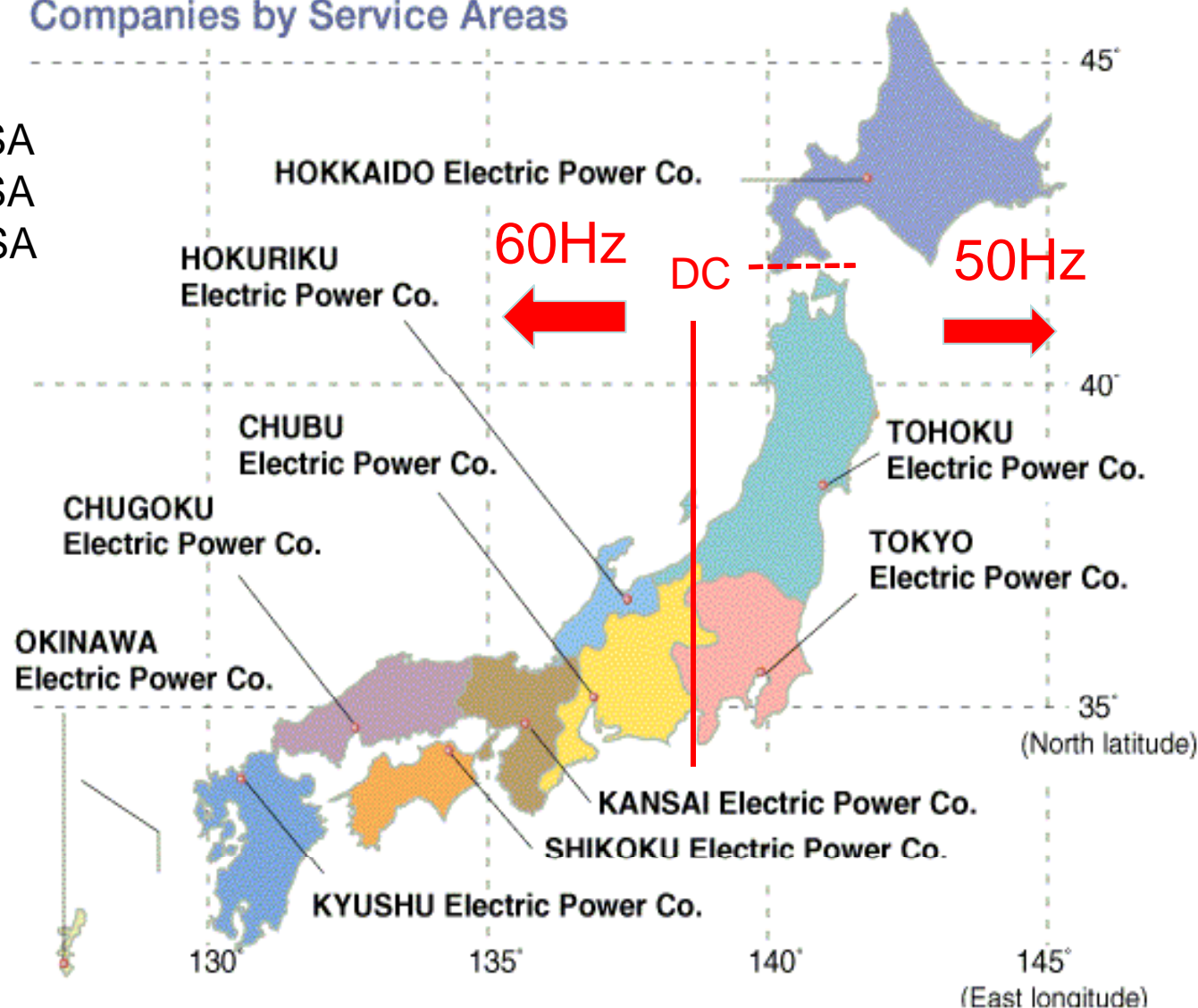


**HIROSHIMA UNIVERSITY**

# Japanese Electric Power Companies

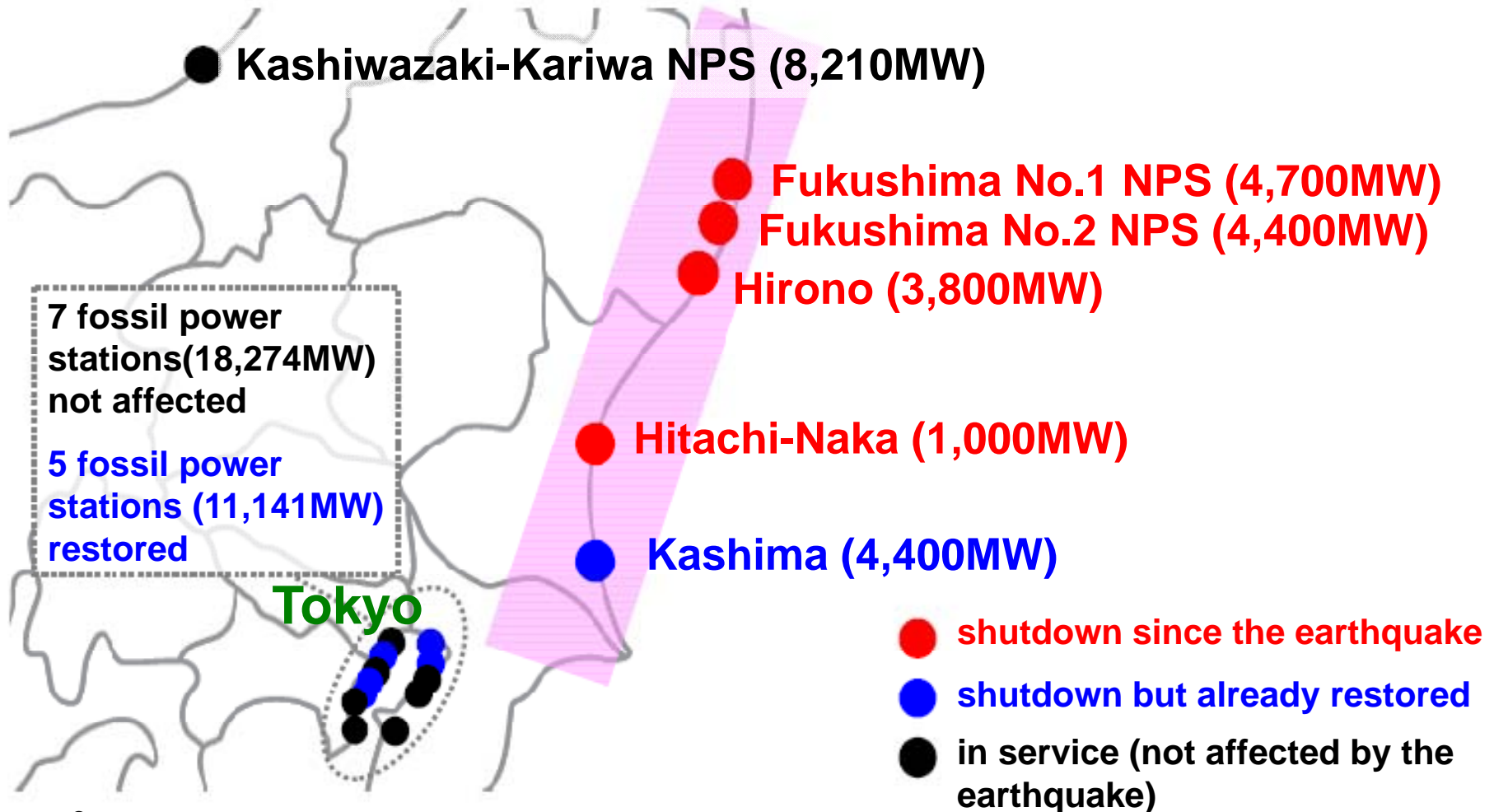
Encompassing All of Japan—The Ten Electric Power Companies by Service Areas

50Hz: 3 SA  
 60Hz: 7 SA  
 Total 10 SA



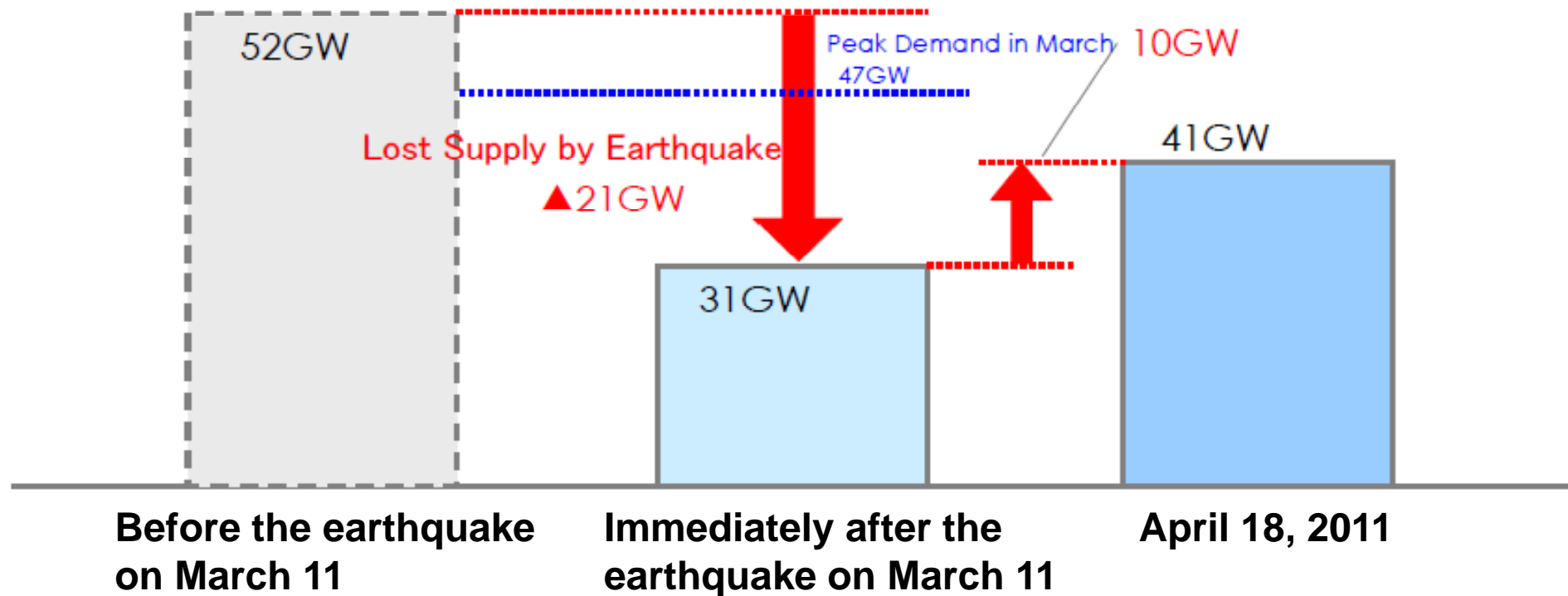
# Damage of Power Stations in TEPCO Control Area

- Nuclear and thermal power stations on the Pacific were severely damaged due to the earthquake generated tsunami.



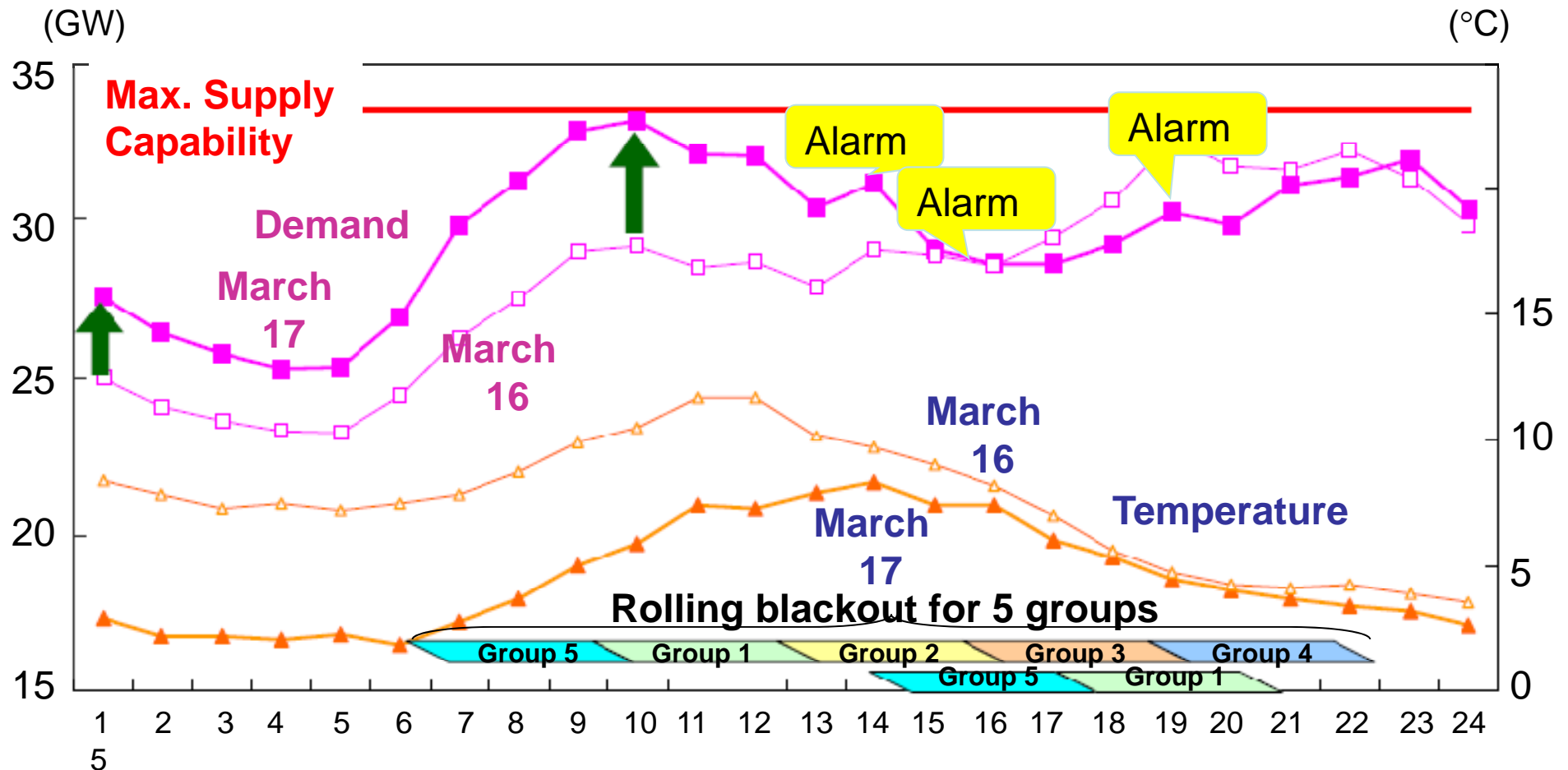
# Demand and Supply Balance after the Earthquake

- A total of 21GW installed capacity including nuclear, hydro and fossil power stations was lost immediately after the earthquake.
- Severe shortage of supply was experienced for the peak demand (47GW) in March. TEPCO was obliged to conduct rolling blackouts.



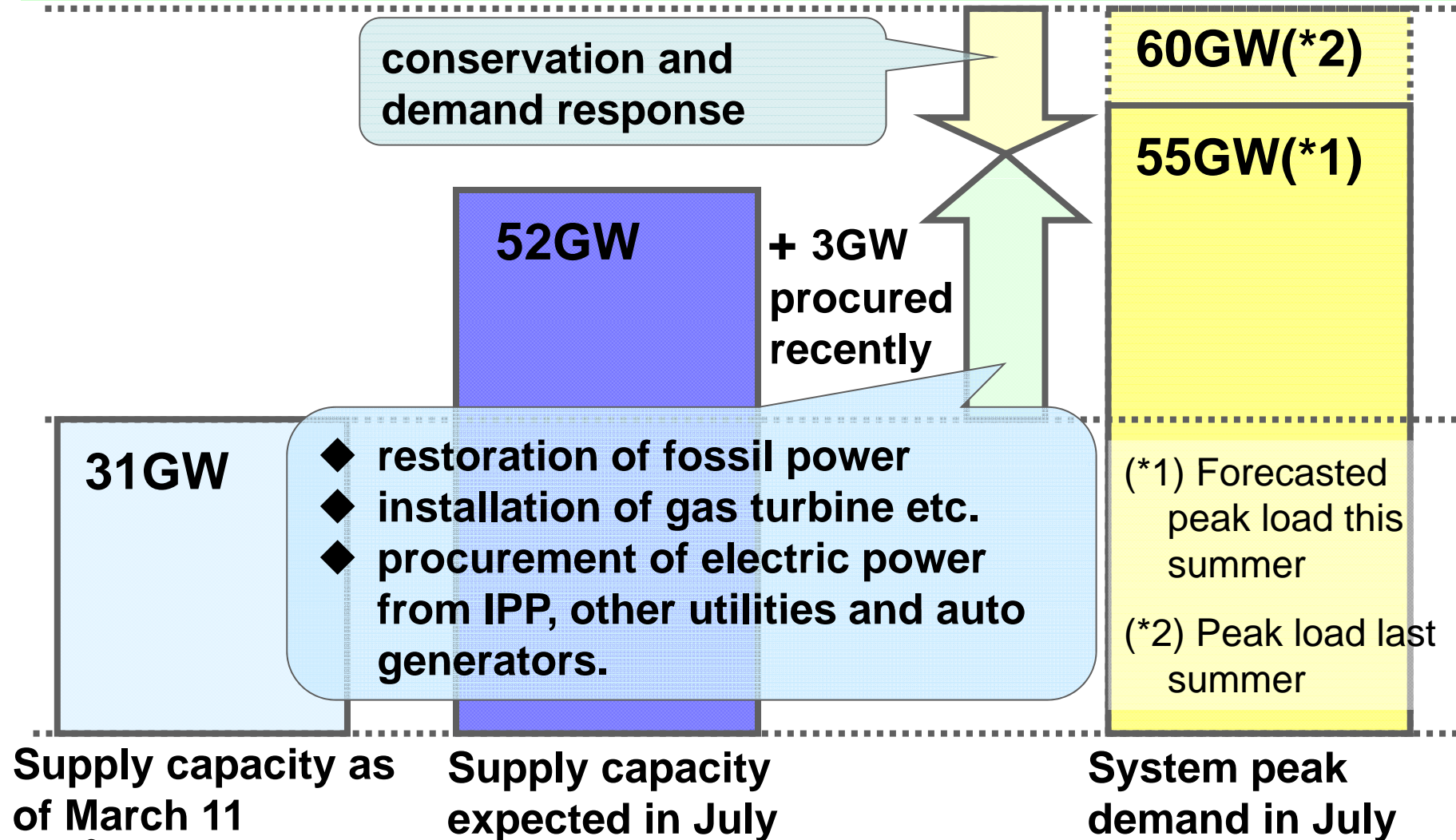
# Rolling Blackout on March 17

- About twenty percent electricity conservation had been observed after the earthquake. However, cold weather made operating reserve negative on March 17.
- Large scale blackout was avoided by emergency alarms issued by government and scheduled rolling blackout conducted by TEPCO.



# Demand and Supply in this Summer

- Government has decided that all efforts in both demand and supply side should be done to avoid rolling blackout this summer.



# Demand Side Efforts in this Summer

<p><b>Industrial Sector</b></p> <p><b>IS: -15%</b> <b>-2.5GW</b></p>	<ul style="list-style-type: none"> <li>■ Demand curtailment program</li> <li>■ Expansion and diversification of summer vacation</li> <li>■ Introduction of high-efficient equipment</li> <li>■ Utilization of auto generation, heat storage, battery storage</li> </ul>
<p><b>Commercial Sector</b></p>	<ul style="list-style-type: none"> <li>■ Demand side management utilizing demand controller</li> <li>■ Reduction of lights and illuminations</li> <li>■ Control of air conditioner</li> <li>■ Enhancement of building thermal insulation</li> <li>■ Expansion and diversification of summer vacation</li> </ul>
<p><b>Residential Sector</b></p> <p><b>CS+RS:</b> <b>-2.5GW</b></p>	<ul style="list-style-type: none"> <li>■ Publicity campaign of energy conservation through mass media</li> <li>■ Introduction of high-efficient appliance (LED, high-efficient air conditioner,...)</li> <li>■ Prevention of heatstroke ,...</li> </ul>

# Interconnections of Electric Power Companies in Japan

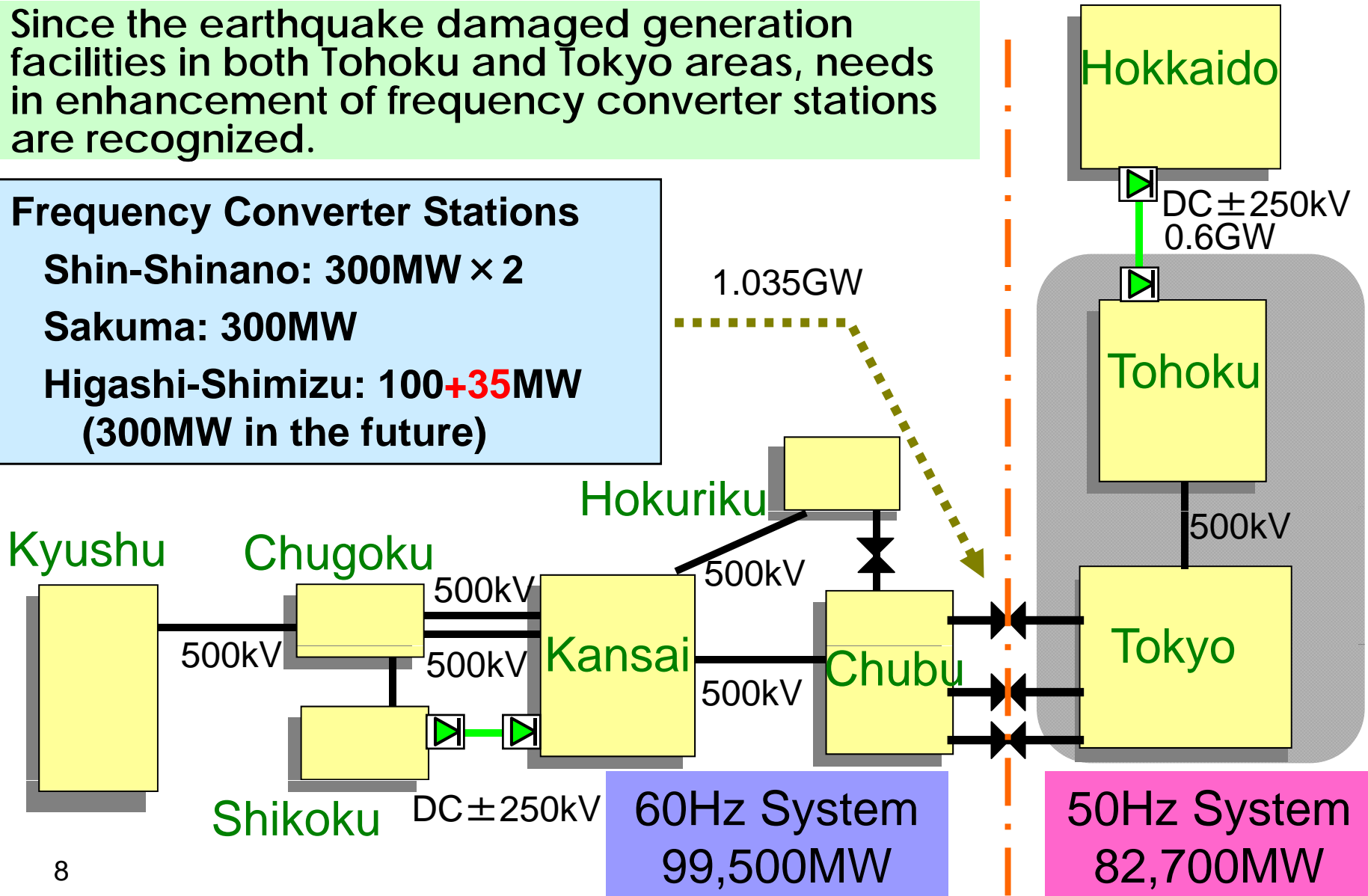
Since the earthquake damaged generation facilities in both Tohoku and Tokyo areas, needs in enhancement of frequency converter stations are recognized.

## Frequency Converter Stations

**Shin-Shinano: 300MW × 2**

**Sakuma: 300MW**

**Higashi-Shimizu: 100+35MW**  
(300MW in the future)



# Subjects to be Addressed to Restore Reliability

Government published outline of reliability improvement countermeasures. The following items are listed to be addressed over the near-to-medium term.

1. Restoration and launch of thermal power stations (including jointly owned power stations and IPP)
2. Construction and addition of thermal power stations
3. Installation of emergency power supply equipment (such as gas turbines)
4. Increase of interconnection lines between different areas
5. Promoting the introduction of renewable energies (photovoltaic, wind power, geothermal energy etc.)
6. Promoting the introduction of decentralized generation plants
7. Promotion of research and development of related technology

Thank you