

# **Electric Power Supply in Tokyo Metropolitan Area**

**March 19th 2015  
Tokyo Electric Power Company**



**TOKYO ELECTRIC POWER COMPANY**

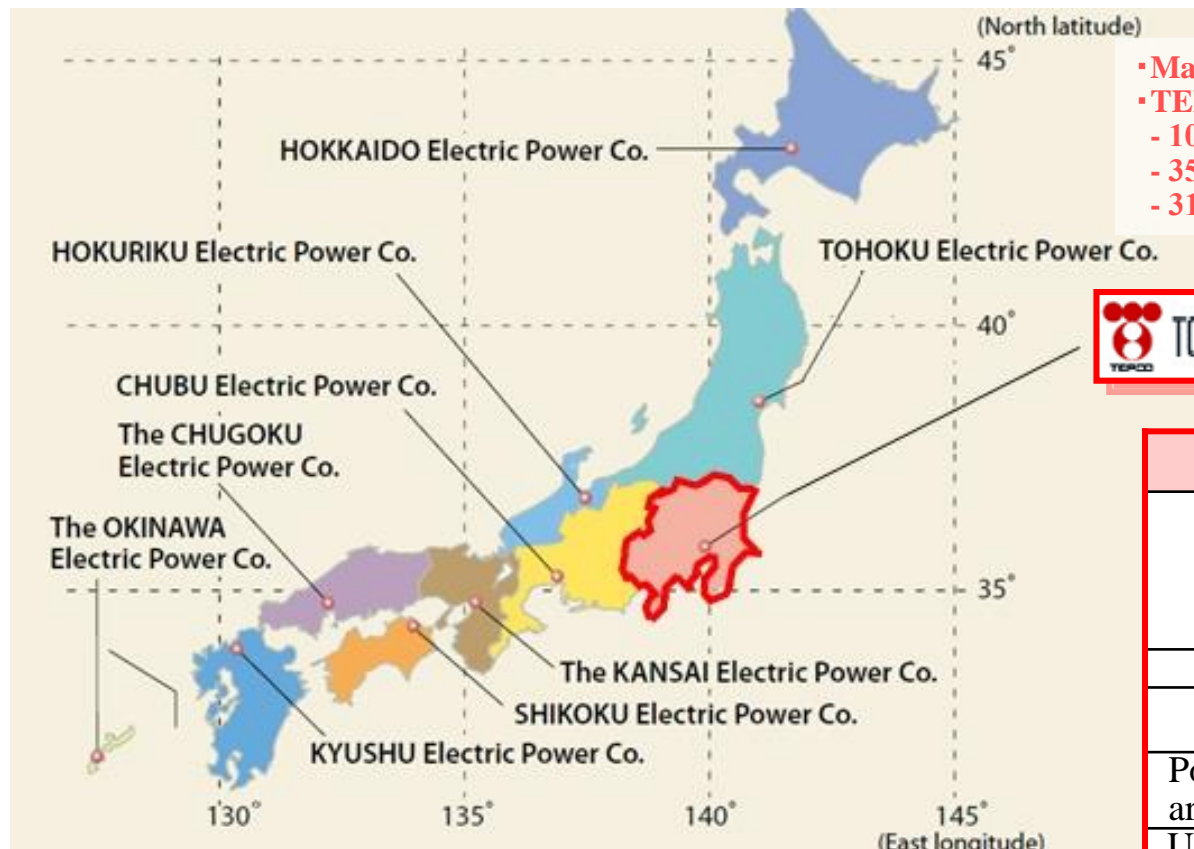
- **TEPCO at a Glance**
- **Smart Grid**
- **Underground Substations**

---

# 1. TEPCO at a Glance

# 1.1 TEPCO at a Glance

- In Japan, 10 regional, and privately owned and managed, General Electricity Utilities have the responsibility of supplying electricity to each region.

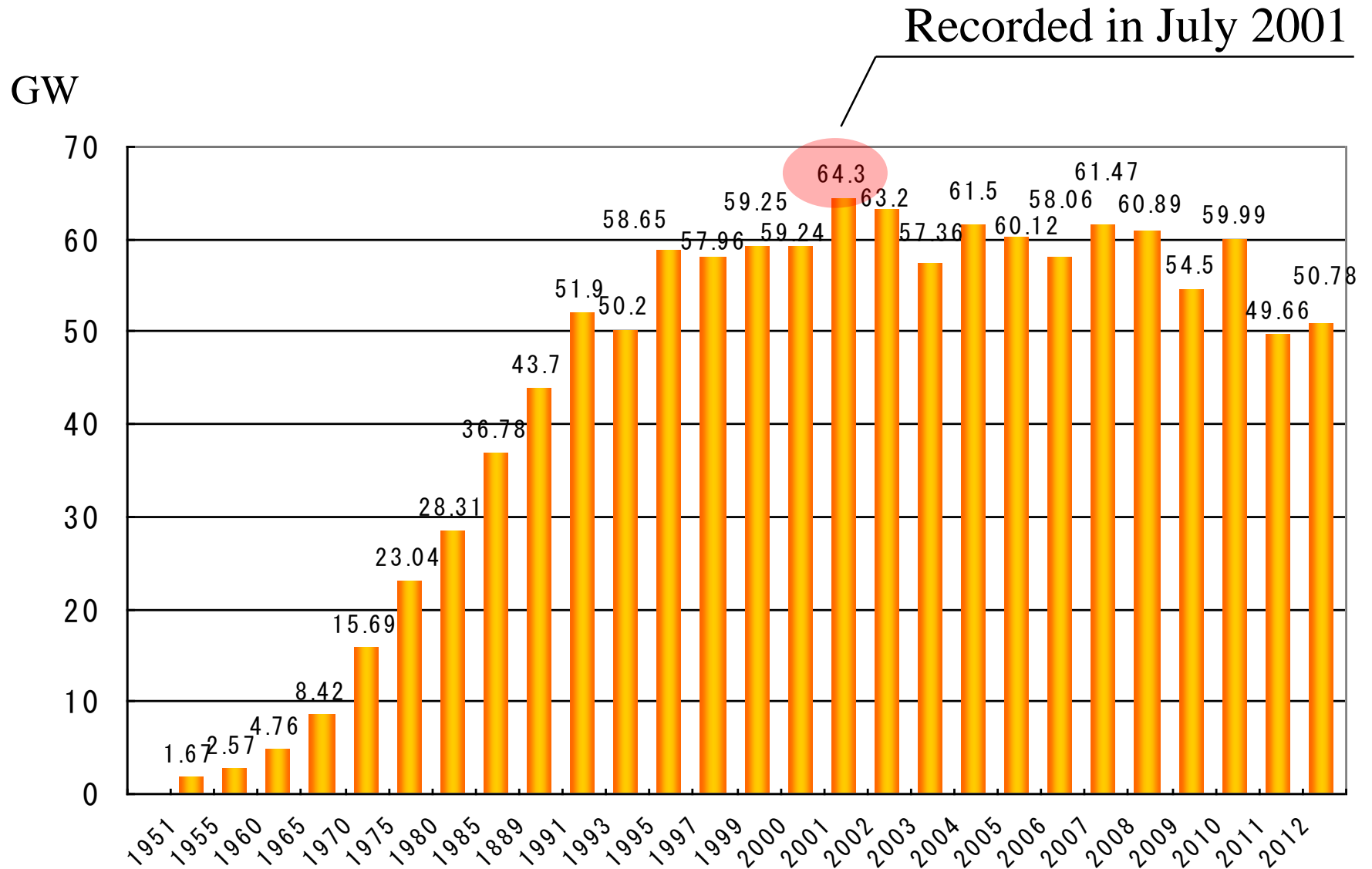


- **Main Service Area: Tokyo metropolitan area**
- **TEPCO covers:**
  - 10% of Japan's land area (39,512km<sup>2</sup>)
  - 35% of Japan's population (45 million people)
  - 31% of Japan's electricity sales

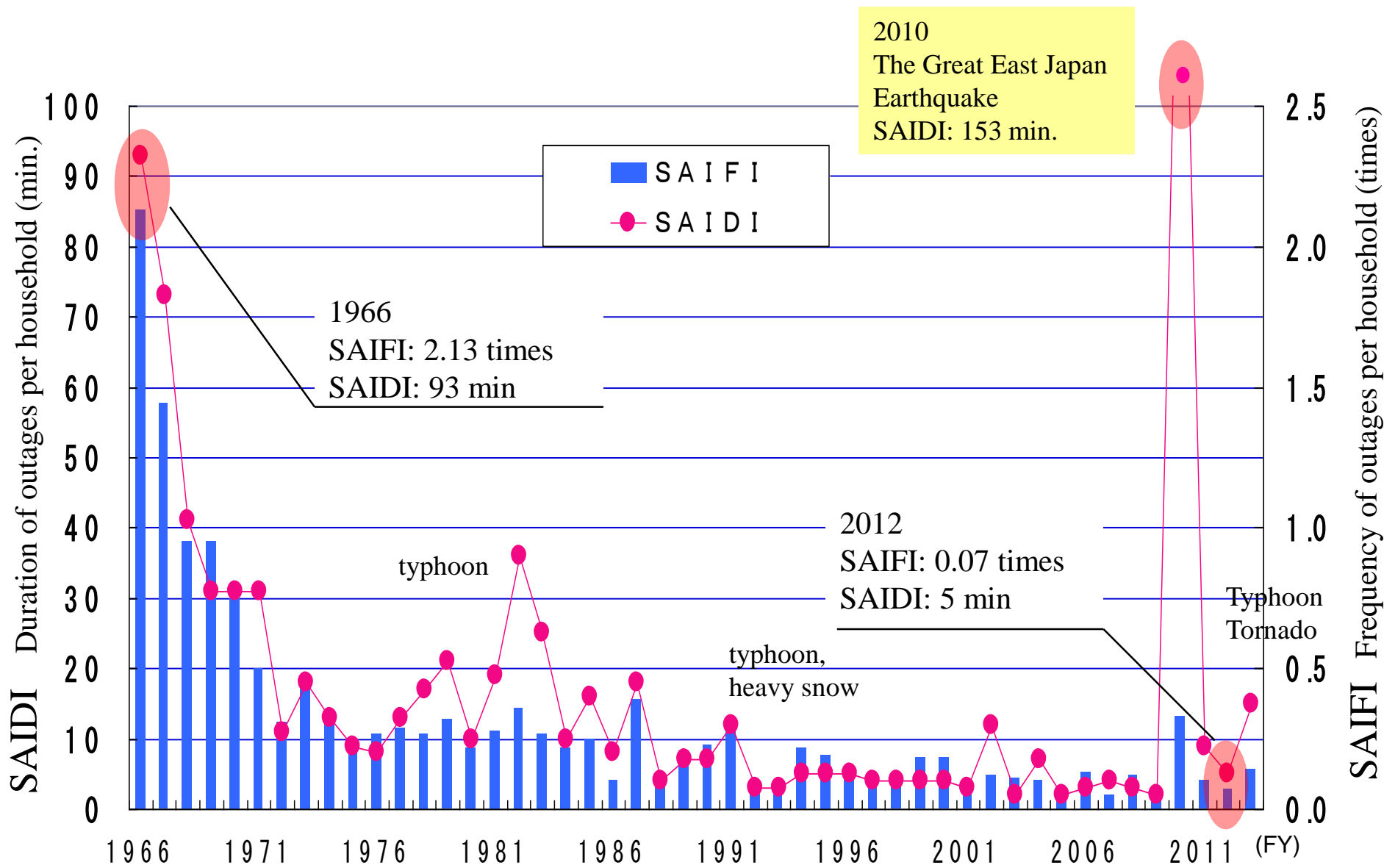


TEPCO (FY 2013)	
Peak demand	64.3GW (July 2001) 50.9GW (Aug 2013)
Service area	39,542km <sup>2</sup>
Demand density	1288kw/km <sup>2</sup>
Population in service area	45 million
UG transmission line circuit length	12,073km
OH transmission line circuit length	28,247km

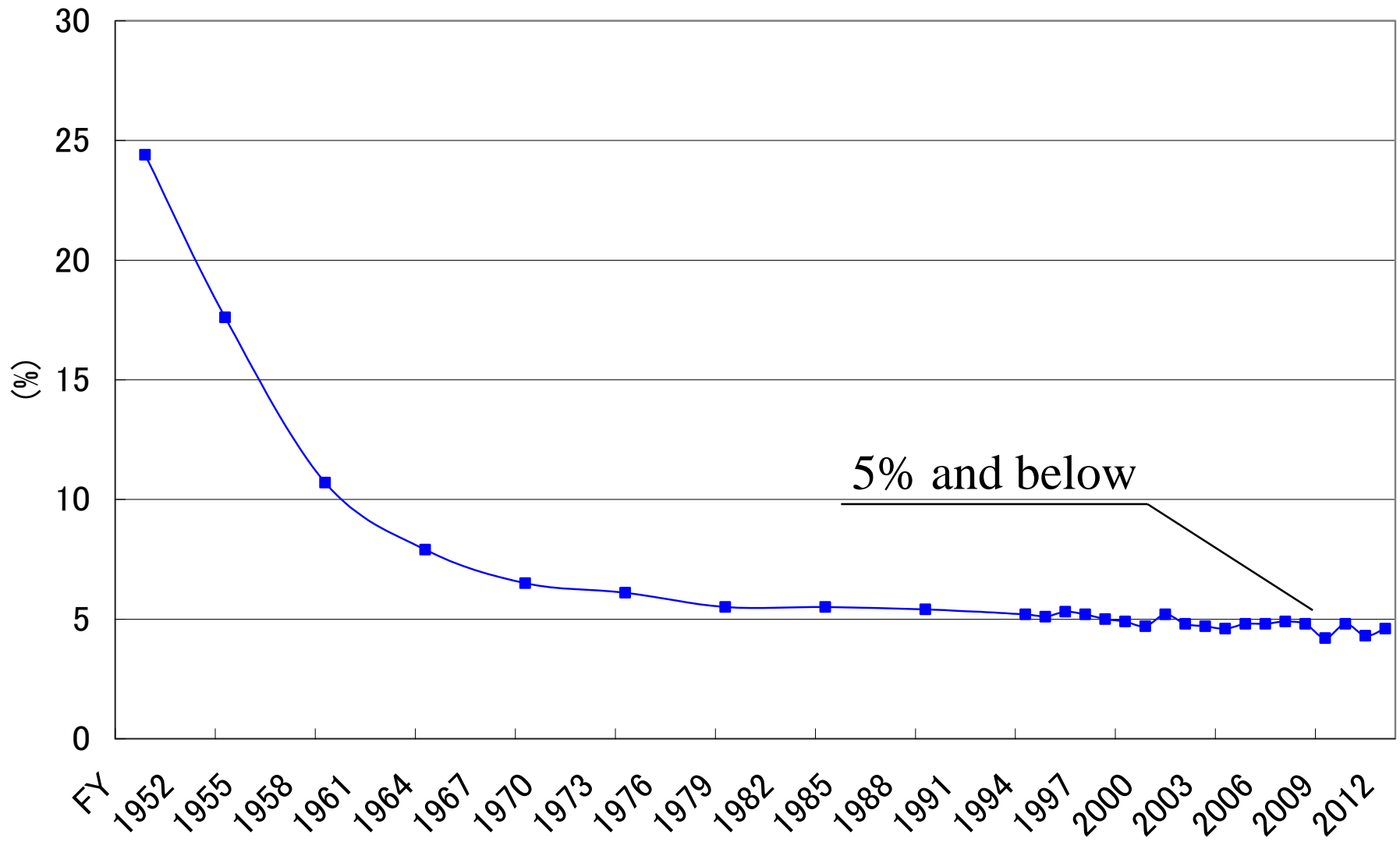
# 1.2 Maximum Power Demand of TEPCO



# 1.3 Power Supply Reliability of TEPCO



# 1.4 T&D System Loss of TEPCO



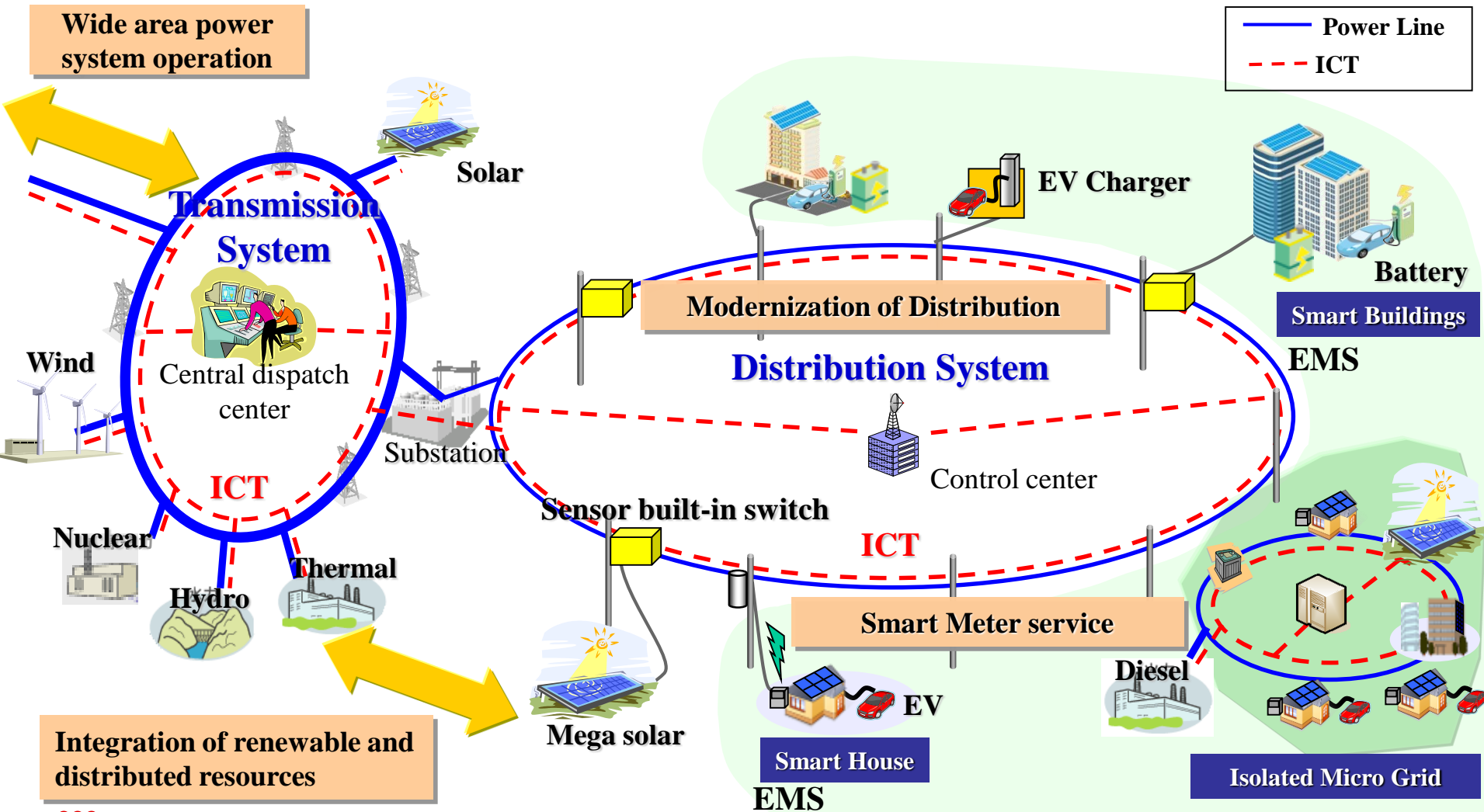
---

## 2. Smart Grid in TEPCO



# 2.1 Smart Grid in TEPCO

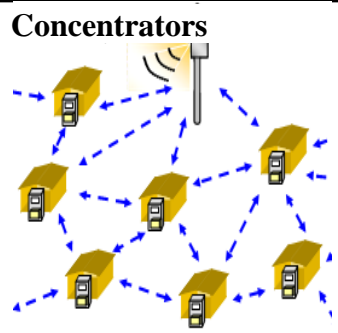
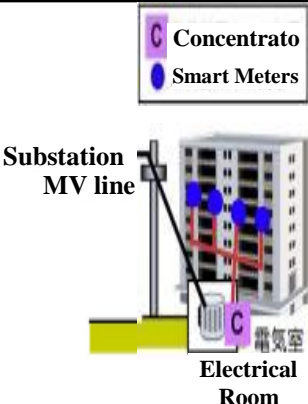
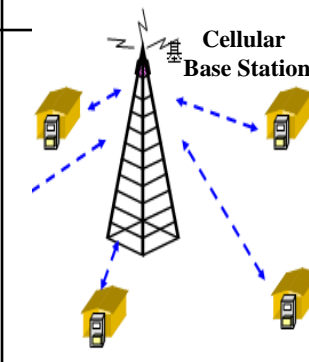
TEPCO plans to deploy 27 million smart meters by FY 2020. The purpose of this plan is the improvement of energy efficiency and the power quality of TEPCO's service territory.



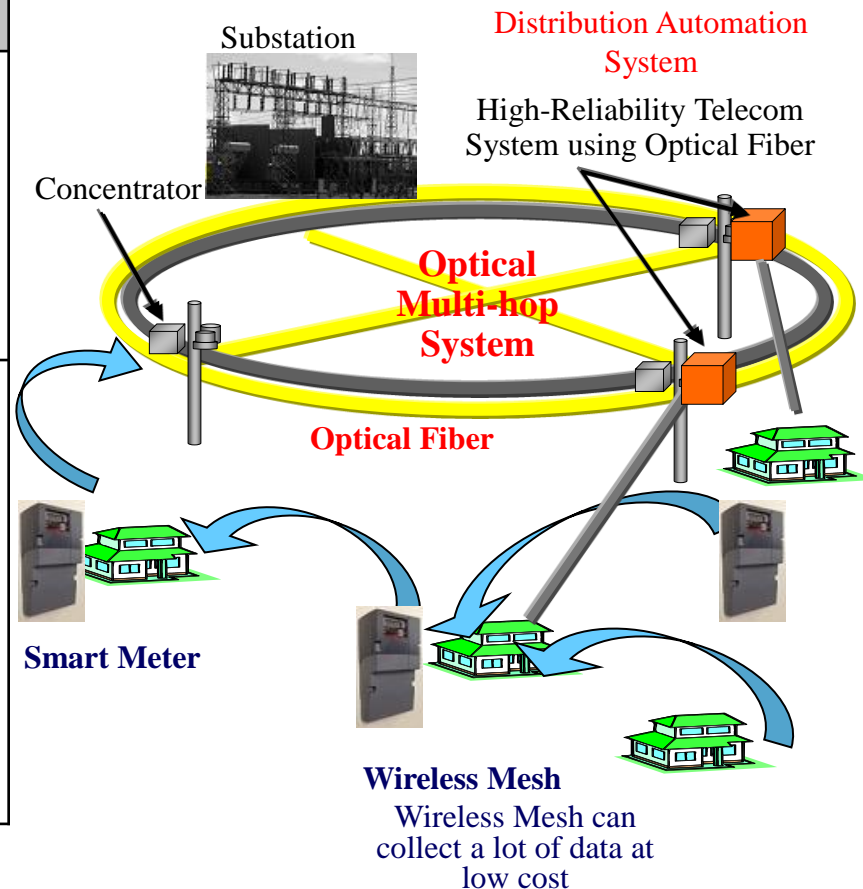
## 2.2 Telecommunication System

A highly reliable Optical Fiber Network will be employed in the trunk line of the smart grid. A combination of various telecommunication technologies will be considered for the last mile from the viewpoint of investment efficiency.

### Telecommunication System of Smart Meter

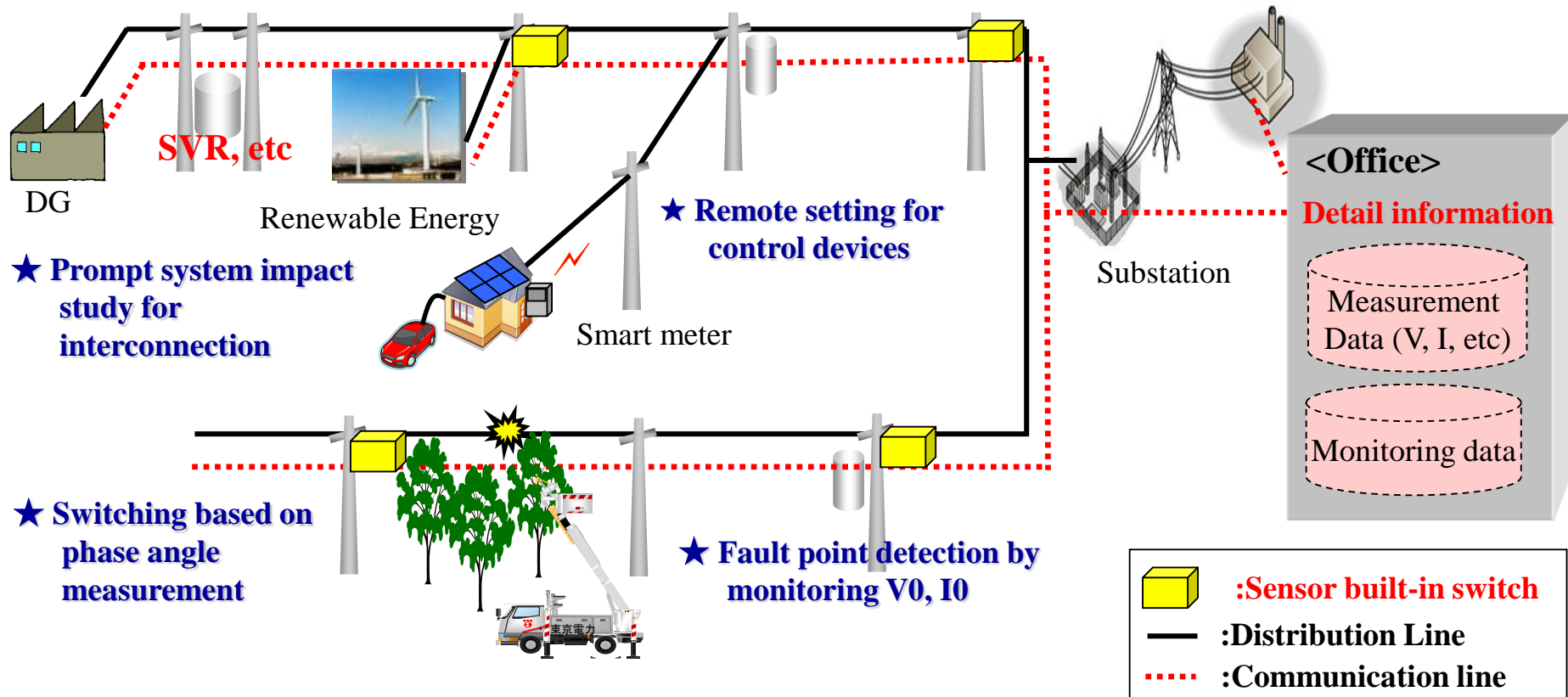
Wireless Mesh	PLC	Cellular Network
<p><b>Mesh created with meters at low cost. Suitable for relatively high-density areas.</b></p>	<p><b>Suitable for building complexes where radio signals are likely to be blocked.</b></p>	<p><b>Cellular services such as 3G and LTE. Suitable for low density areas.</b></p>
<p><b>Concentrators</b></p>  <p><b>Smart Meters</b></p>	 <p>Concentrator Smart Meters</p> <p>Substation MV line</p> <p>Electrical Room</p>	 <p>Cellular Base Station</p> <p>Smart Meters</p>

### Telecommunication System of Distribution Network (Optical Fiber)



## 2.3 Modernization of Distribution Network

Utilizing more detailed information, such as accurate voltage and current of the distribution network, TEPCO will maintain greater levels of power quality and supply reliability.

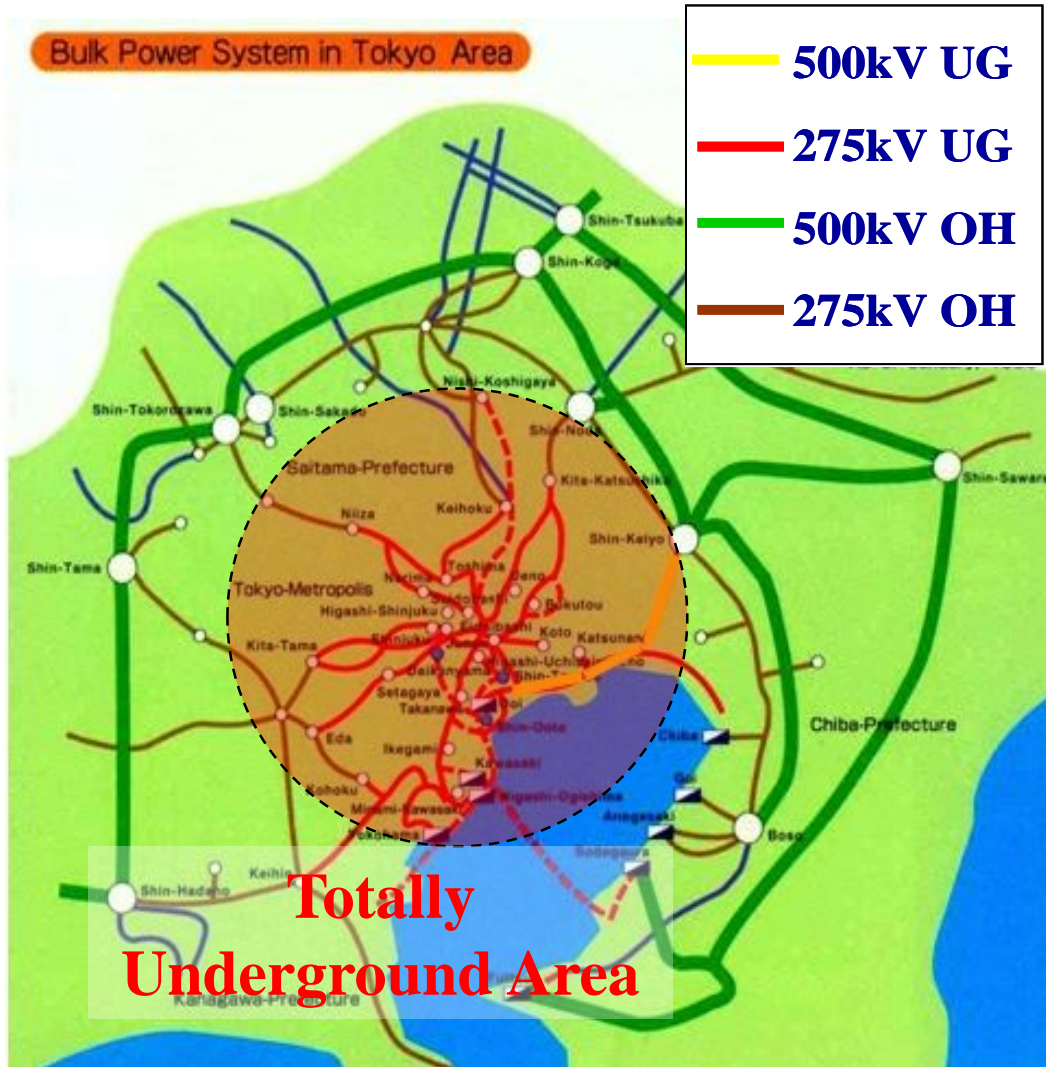


- Securing of power quality using measurement data (V, I) for Renewable Energy integration study
- Quick fault detection and prompt restoration to prevent faults
- Improvement of efficiency using remote control

---

# **3. Underground Substations in TEPCO**

# 3.1 Power Network System of TEPCO



	TEPCO-Wide	Central Area
<ul style="list-style-type: none"> <li>UGSS</li> <li>IndoorSS</li> <li>Semi-IndoorSS</li> <li>OutdoorSS</li> </ul>	<p>13%</p>	<p>86%</p>
Total	1,582	73
UGSS	204	64
RATIOS	13%	86%

## 3.2 Optimized Footprint Acquisition for Urban Areas

### Underground Substation



Footprint 30,000m<sup>2</sup>  
Voltage level 500kV  
Designed Capacity 6,480MVA  
\*4 underground stories

### Conventional Substation



Footprint 325,000m<sup>2</sup>  
Voltage level 500kV  
Designed Capacity 6,650MVA

- Same capacity can be equipped in 1/11 of the land
- Additional income expected from building business in upper space

## 3.3 Gas Insulated Equipment

TEPCO has developed underground substations utilizing its design/operation know-how and manufacturers' technologies/techniques.



**275kV 300MVA GIT**



**275kV GIS**



**Layout of Underground Substation**

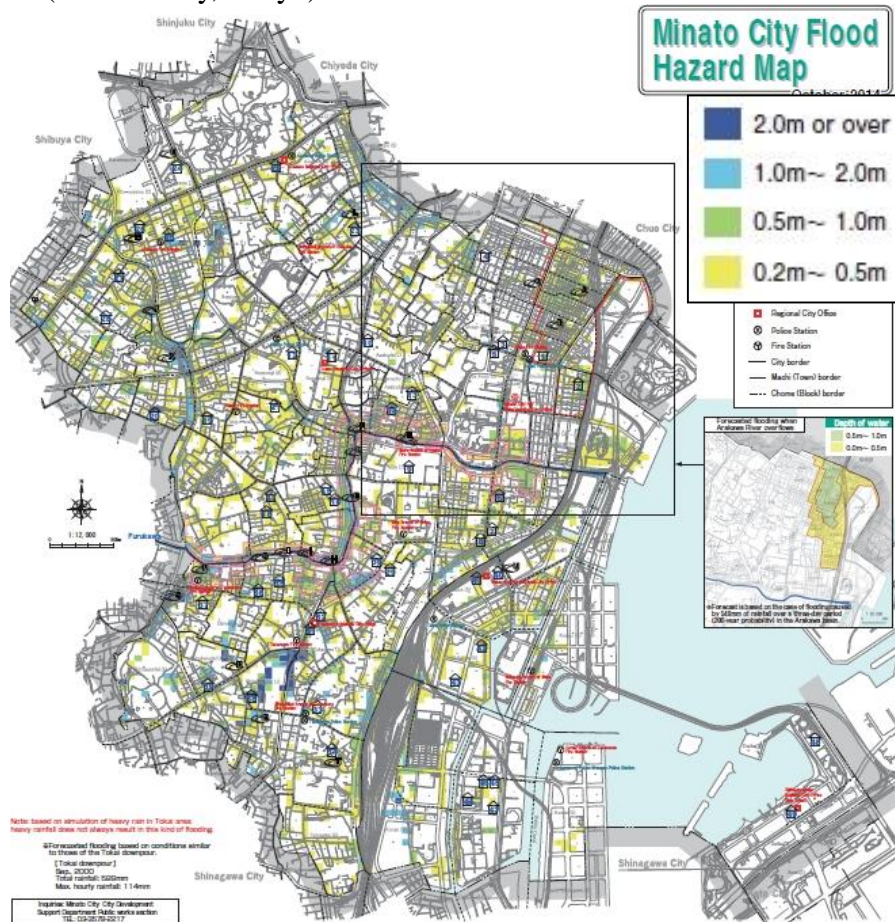
On the assumption that both GIS & GIT can be installed in the same room, it is possible to cut the number of rooms and reduce the excavation cost

# 3.4 Damage Protection from Natural Disasters

Based on experience of floods in the Tokyo bay area, inundation measures are considered at the design level.

## Flood Hazard Map

(Minato-City, Tokyo)



Flood damage in Oct. 2013



Submerged substation  
 'Interior protected by TEPCO's flood prevention system'



Water shield Machine Hatch



## 3.5 Damage Protection from Vandalism

For security reasons, entrances to the Underground Substation are camouflaged as ordinary building structures.



# Summary

---

Several decades ago, Japanese electrical utilities were faced with unacceptable T&D loss and rapid demand increase. These issues were not easily solved, but Japanese electrical utilities overcame the challenges one by one. The technologies and knowledge which have been accumulated through the efforts of Japan's power industry must surely be useful to Brazilian electrical utilities.

Contact: Takayuki Shibata

Manager, Tokyo Electric Power Co.

[shibata.takayuki@tepcoco.jp](mailto:shibata.takayuki@tepcoco.jp)

---

**Thank you for your attention!**

