

University of Tsukuba
筑波大学

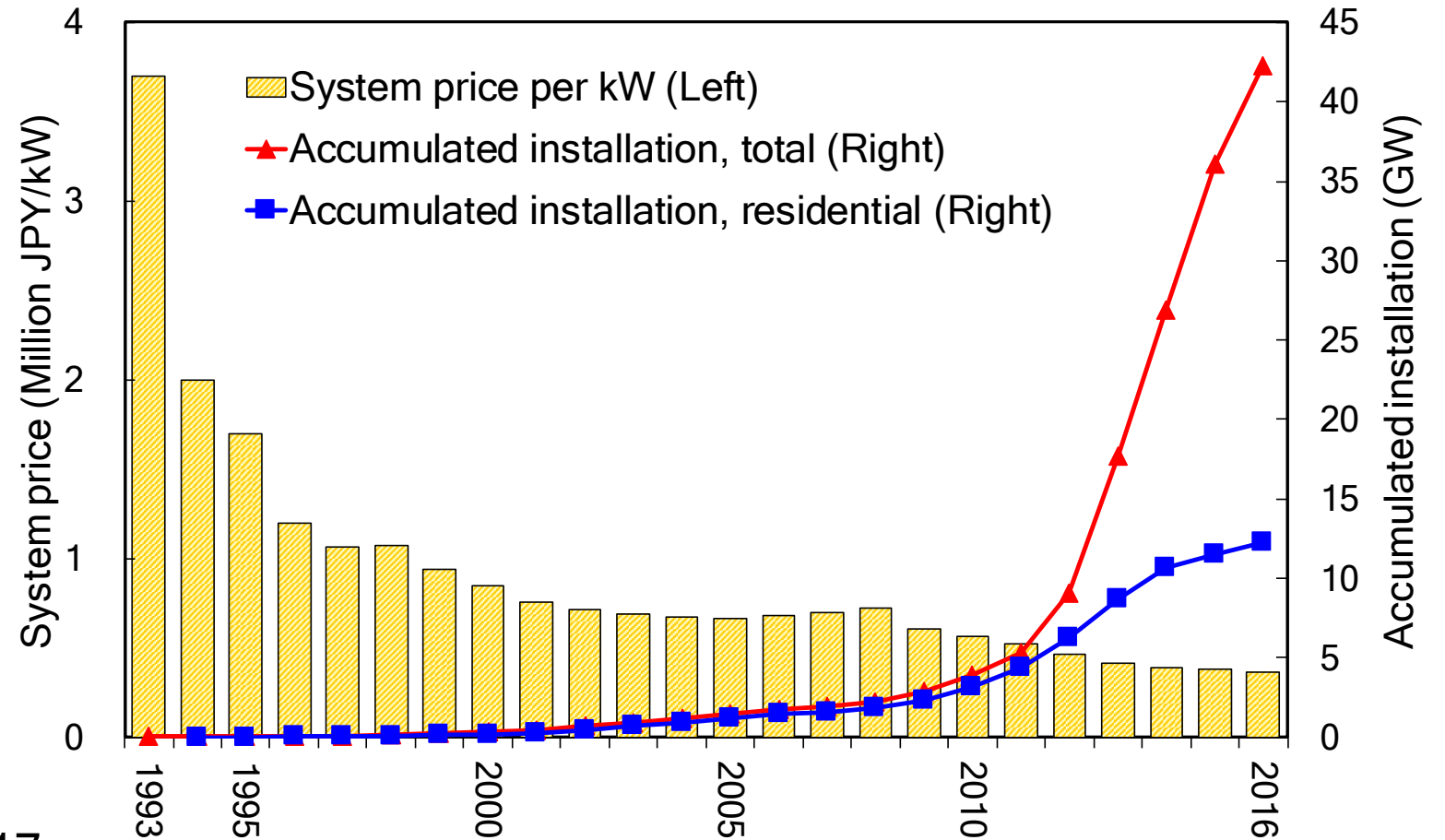
A case of Kyushu island: Large PV installation and flexibility

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PV penetration in Japan

■ Data from Government statistics



METI, Energy white paper, 2017

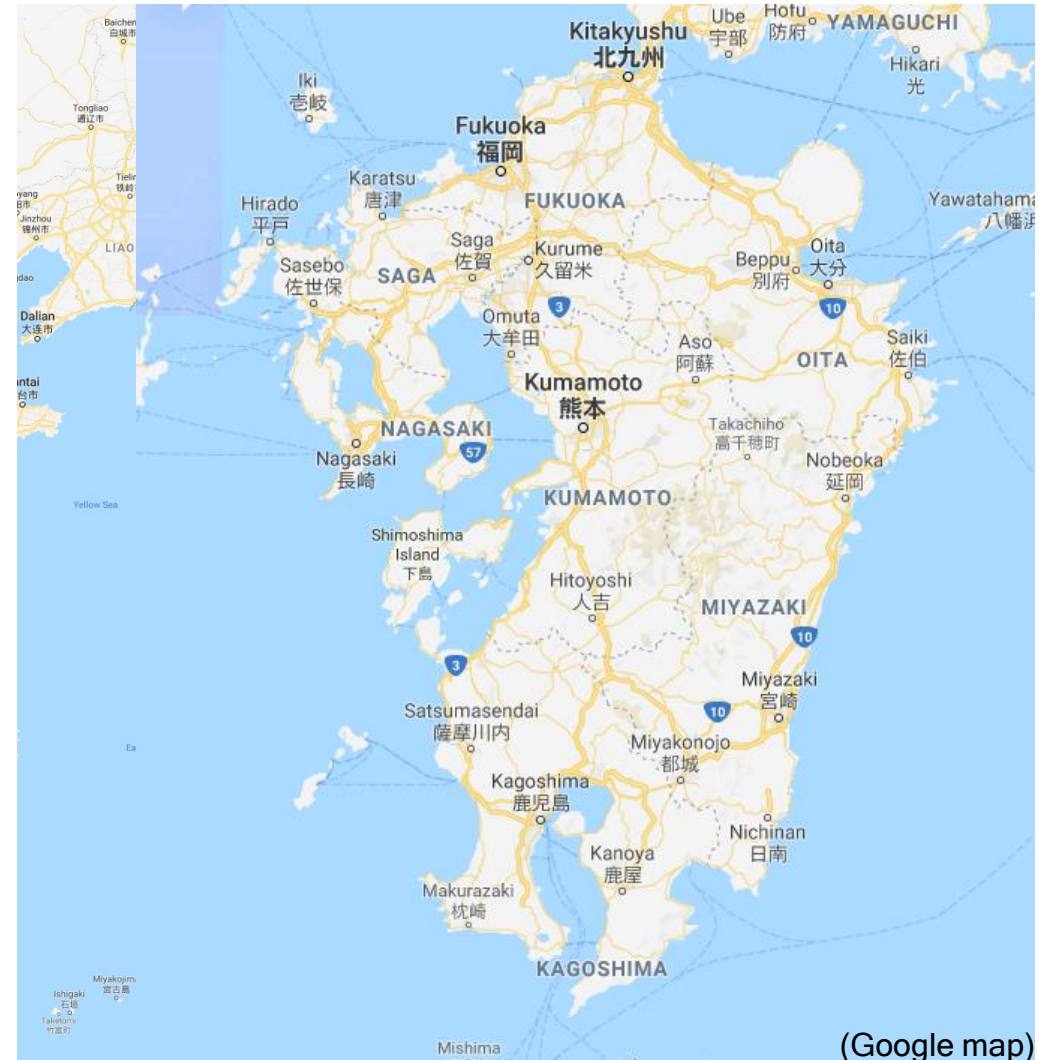
Kyushu Island

■ General information

- Area: 42,231 km² (Denmark, Switzerland)
- Population: 12.8 million
- Some volcanos and many good hot springs
- West south of Japan

■ Power system

- Utility: Kyushu Power Electric
- PV installation: 4.89 GW (Apr. 2017)
- Max. demand: 16 GW (2017)
- Ref. TEPCO: 5.56 GW (PV), 54 GW (max. demand)



(Google map)

Generation mix of a sunny day in Kyushu

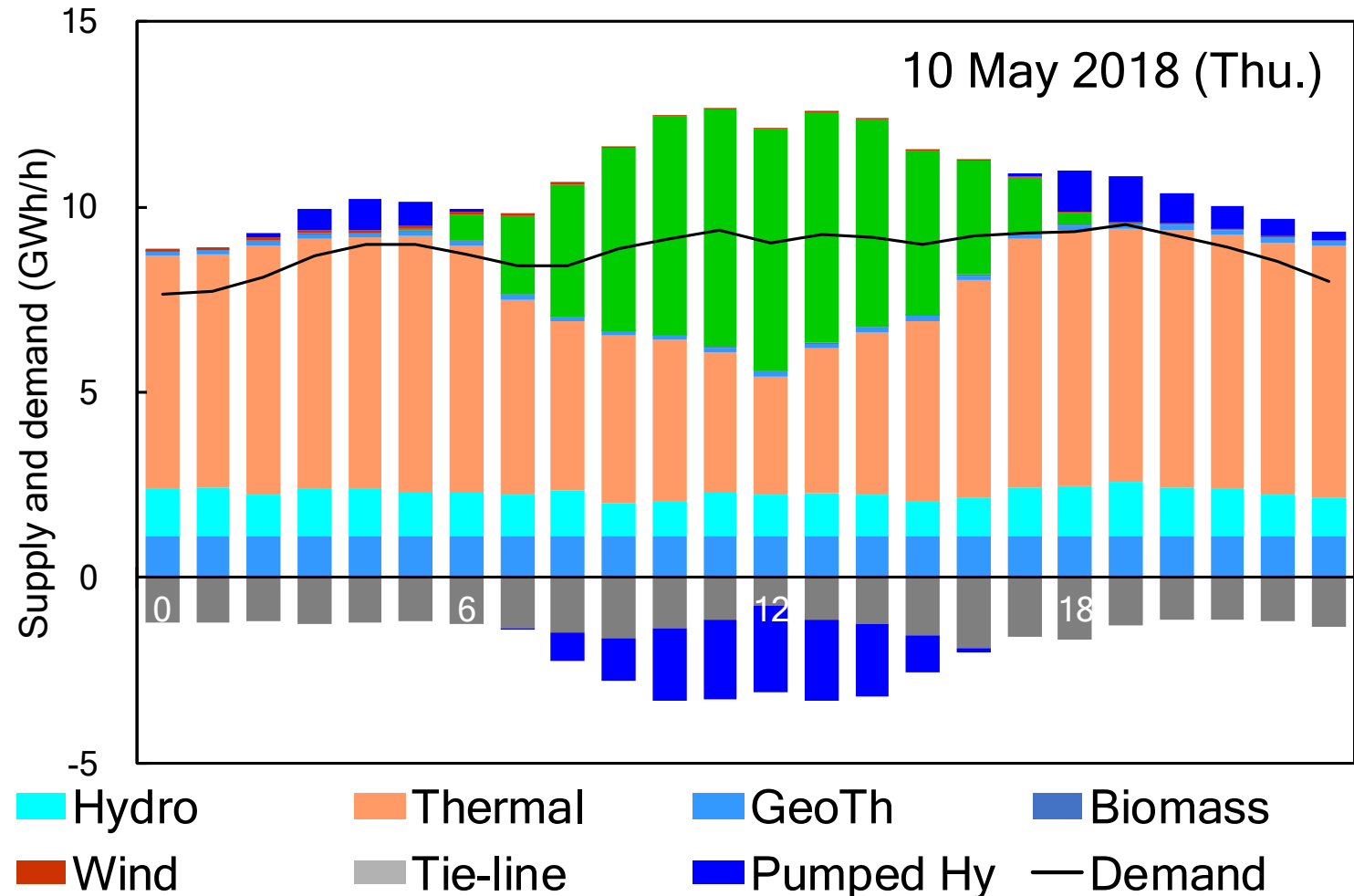
■ Pumped hydro and export via tie-line were used

■ Pumped hydro usage opposite

■ Charge in daytime

■ Dis-charge in other time

■ PV curtailment has carried out on 13 and 14 Oct. 2018



Generation mix of a sunny day in Kyushu

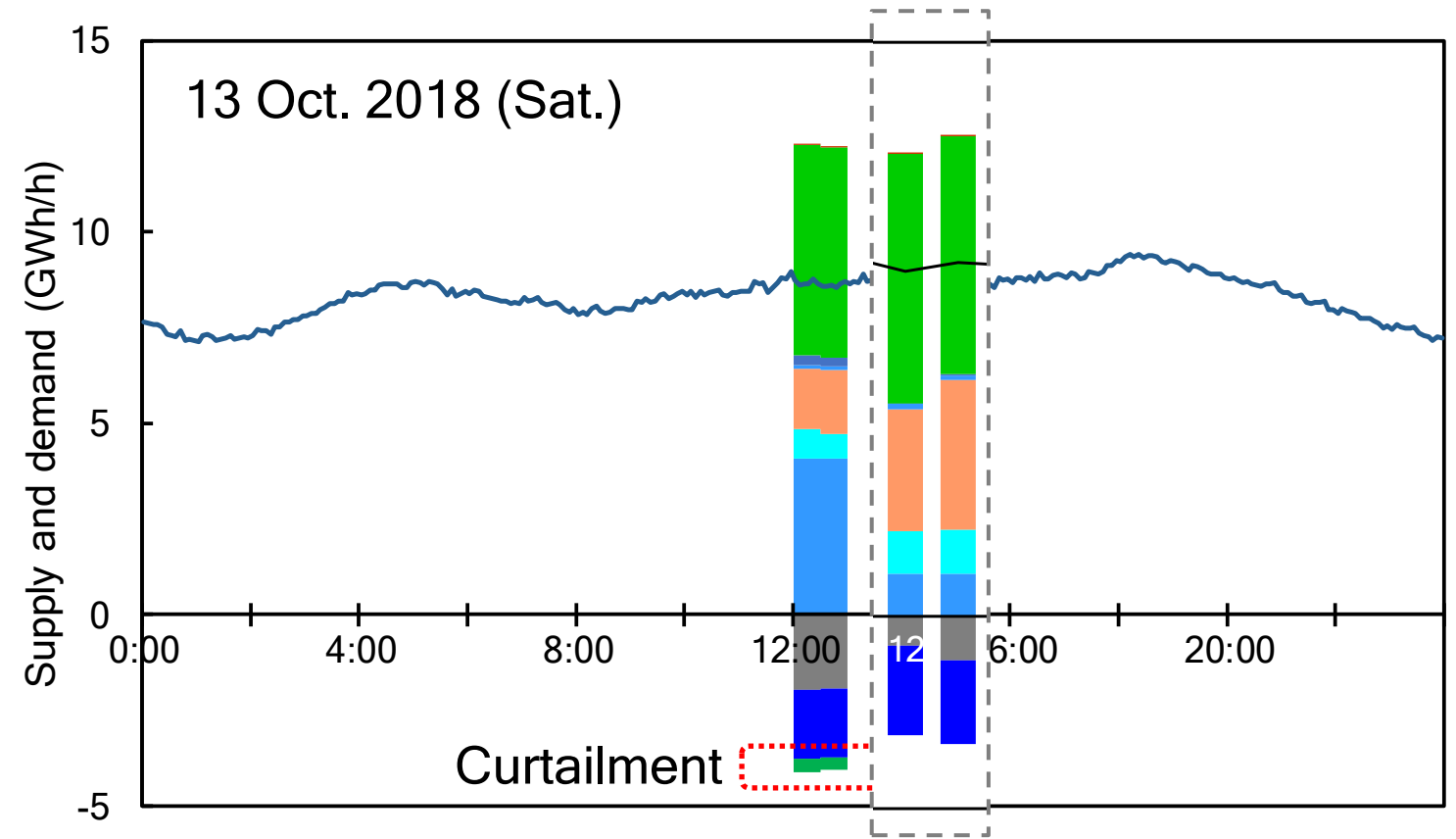
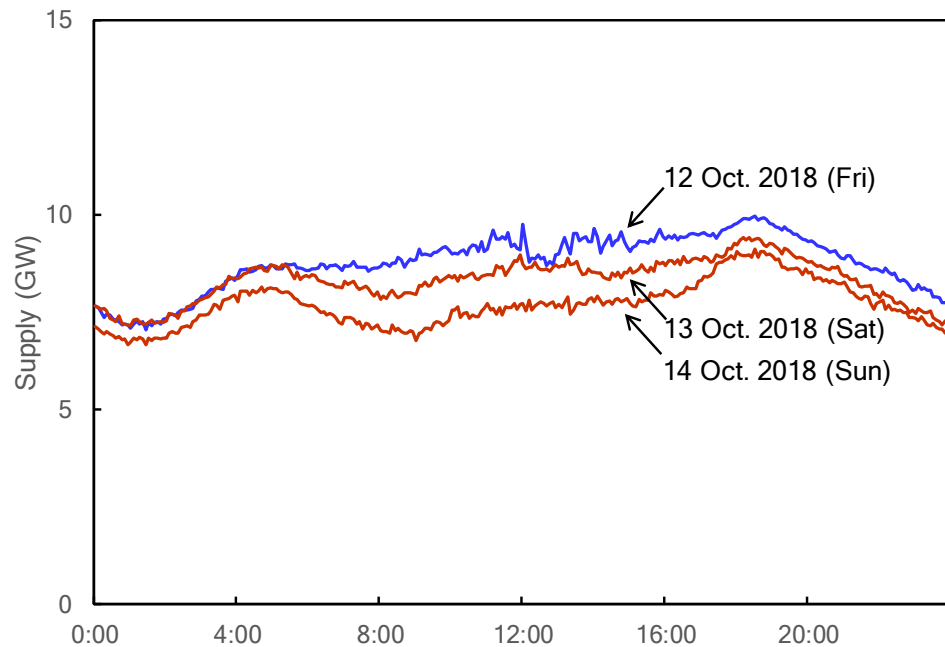
10 May 2018 (Thu.)

■ PV curtailment has carried out on 13 and 14 Oct. 2018

■ Flexibility is needed!

■ Who ?

CHP, heat pump, battery, P2X



■ Nuclear	■ Hydro	■ Thermal	■ GeoTh
■ Biomass	■ PV	■ Wind	■ Tie-line
■ Pumped Hy	■ PV Curt.	— Demand	

Hokkaido Island

■ General information

- Area: 83,423 km² (Kyushu X 2)
- Population: 5.3 million (< Kyushu X 1/2)
- Good seafood and ski resorts

■ Power system

- Utility: Hokkaido Power Electric
- PV: 0.65 GW (Apr. 2017)
- Wind: 0.35 GW (Mar. 2017)
- Max. demand: 5.25 GW (2018, winter)



(Google map)

Blackout by 2018 Hokkaido Eastern Iburi Earthquake

■ General Information

- Date: 6 Sep. 2018
- Magnitude: 6.6
- Japan seismic intensity scale: 7 (max.)

■ Complete blackout happened (1st time in Japan) → restarted

- Extremely large event
- Smaller grid + depended on a large plant
- PV and wind parallel operation stopped for a week

■ Question

- If a blackout happened in a PV+WT dominant grid (e.g. > 80%), is it possible to restart, how?