

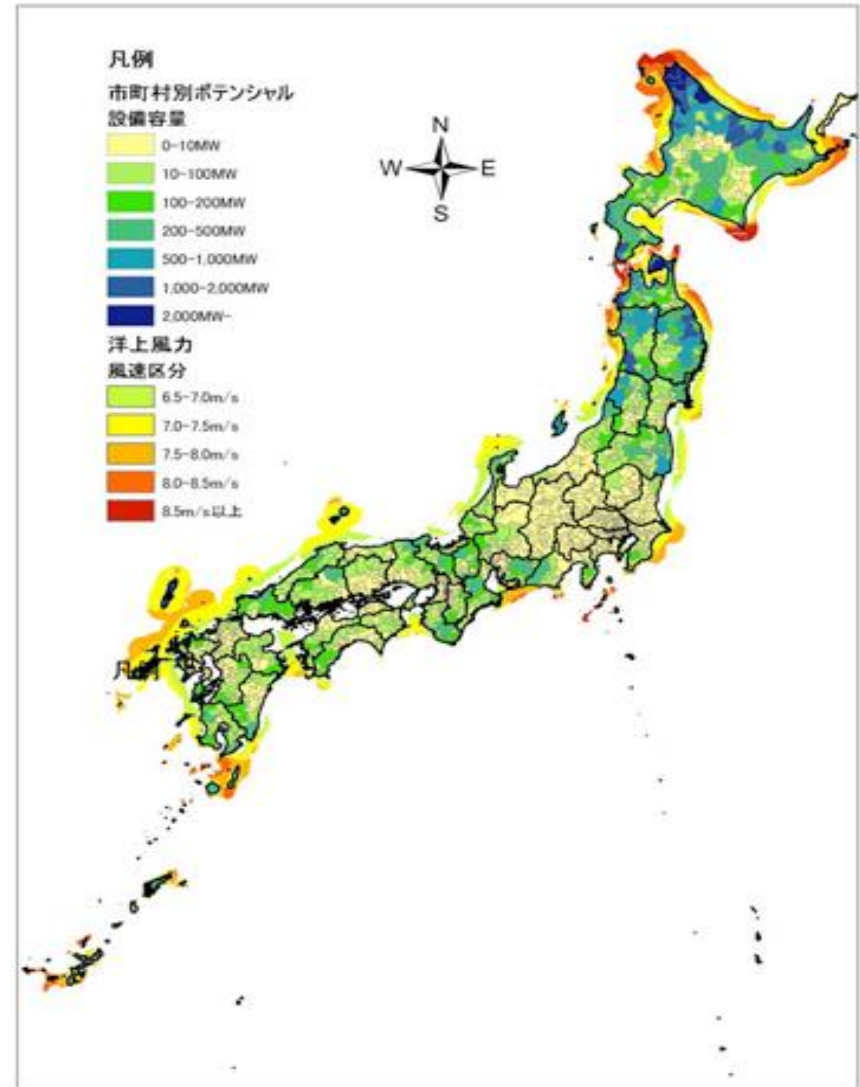
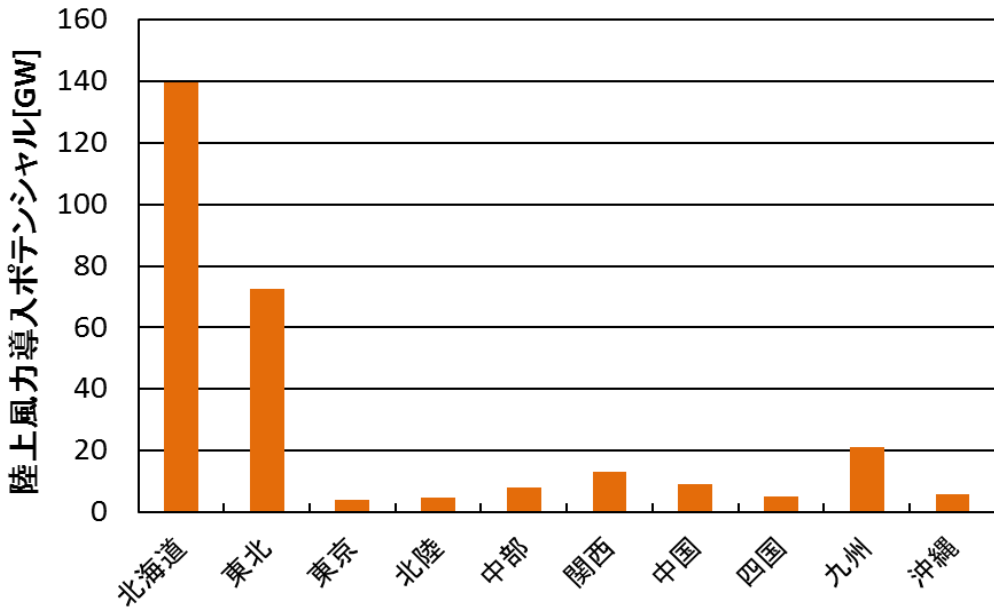
北海道における自然エネルギーの 出力変動対策に関する研究

Study on measures against fluctuation of electricity output
caused by renewable energy in Hokkaido

M1 Sato

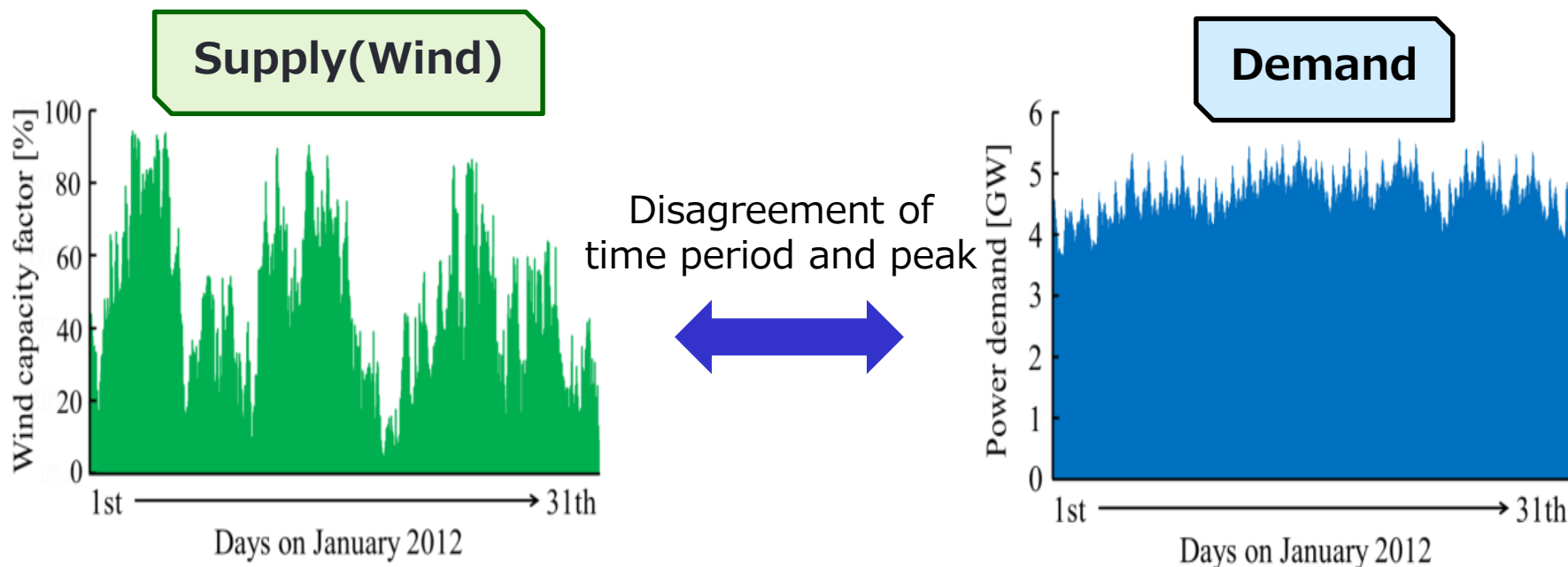
Hokkaido

- 50% wind power potential of Japan
- Solar power potential is also high level





Large amount of Renewable Energy → **Supply/Demand Gap**



Objective

Evaluating energy system with large amount of renewable energy in 2050 Hokkaido

- Best generating configuration
- Cost control effect
- Effective usage of dumping power

Data (per 1 hour)

- Demand data (HEPCO,2014)
- Wind and solar fluctuation (JMA,2014)

Energy supply

Wind Solar Coal (constant)
LNGOC(open cycle)
LNGCC(combined cycle)
Hydro(constant)

Measure of fluctuation

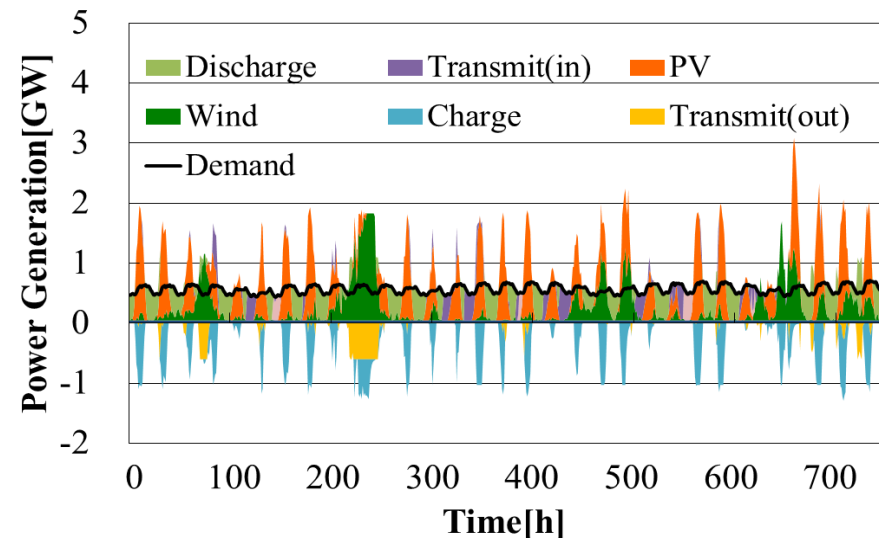
Improving transmission NaS Battery
Converting H₂ Charging EV

Total Cost

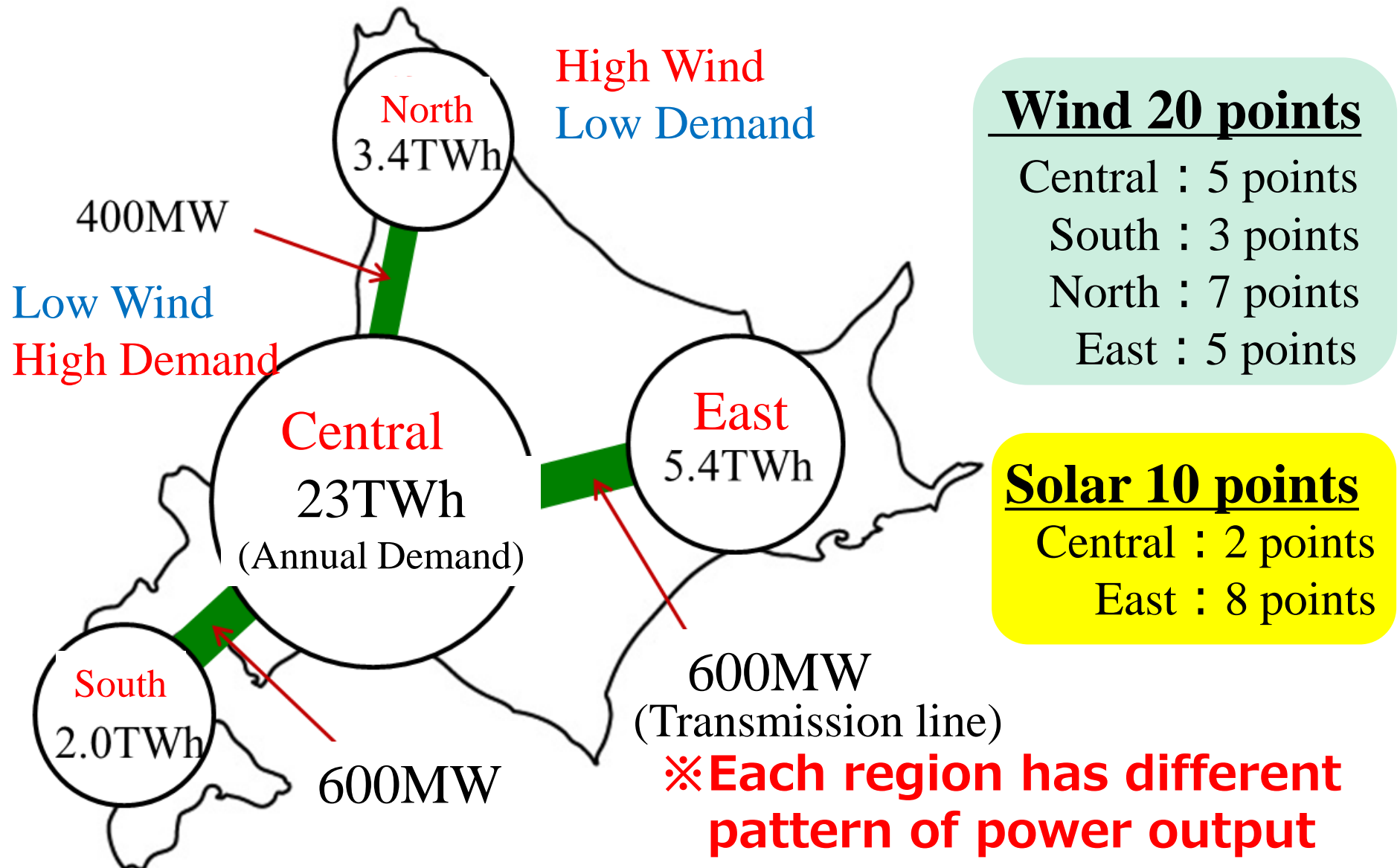
Power plant Equipment cost of
Running cost Fuel cost

**Renewable energy
Rate**

Minimize total cost



Considering the bias of demand, capacity of transmission





	Case A	Case B	Case C	Case D
Reinforcement of Transmission	×	○	×	○
NaS Battery	×	×	○	○

