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

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Simulation Target

Hokkaido

• 50% wind power potential of Japan

• Solar power potential is also high level
Large amount of Renewable Energy ➞ Supply/Demand Gap

Backgrounds and Objective

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

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

Disagreement of time period and peak
Method

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

Renewable energy Rate

Minimize total cost

Total Cost
- Power plant
- Equipment cost of Running cost
- Fuel cost
Considering the bias of demand, capacity of transmission

- **Wind 20 points**
  - Central: 5 points
  - South: 3 points
  - North: 7 points
  - East: 5 points

- **Solar 10 points**
  - Central: 2 points
  - East: 8 points

※Each region has different pattern of power output
Change of Cost

<table>
<thead>
<tr>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
<th>Case D</th>
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<tbody>
<tr>
<td>Reinforcement of Transmission</td>
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<tr>
<td>NaS Battery</td>
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![Graph showing the change of cost with different cases.](image-url)

- **Case A**: Without measure
- **Case B**: Reinforcement
- **Case C**: Battery
- **Case D**: Both

The graph plots the annual total cost against the renewable energy share. The cost increases sharply as the renewable energy share increases from 0% to 80%.