Competition of wood resource procurement among biomass power plants: Japan’s experience

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Nishiwaga Iwate Pref.
Photo: Daisuke Sawauchi
1. Backgrounds and purposes

• Utilization of solid biomass in Japan
  – Some wood biomass power plants are in operation and some more plants are planned and being constructed after FIT scheme was introduced in 2012
  – Plant owners individually build their own plans for biomass collection
  – Probably they consider collecting biomass from nearby forest which is more cost efficient
  – But, the power plants are located densely in the area which has larger forest and no coordination scheme among multiple plants is made so far
  – So, there is a possibility to occur competitions of biomass procurement among the plants
  – After all, the plants might not be able to obtain enough amount of biomass needed to keep their plants in operation
1. Backgrounds and purposes

• Purposes
  – To investigate the situation of competition of biomass procurement among multiple wood biomass power plants in Iwate prefecture, Japan
  – To identify factors causing the competition and to show lessons learned from it

• Why the competition occurs?
• What we should do to avoid the competition?
1. Backgrounds and purposes

- **Iwate Pref.**
  - Northeast part of Japan
  - Forest area is 4952 km\(^2\)
  - 77% of land is covered by forest
  - Coastal area was heavily attacked by tsunami in 2011

- **FIT scheme**
  - Introduced in 2012 reflecting the nuclear crisis in Fukushima
  - Unutilized wood resource: 32JPY/kWh
  - Other wood resource: 24JPY/kWh
2. Assumptions

- Focus on 6 wood power plants (both in operation and under construction) in Iwate Pref.
- Only thinning residue of Japanese cedar is focused
  - Main wood resource in Japan
  - FIT price for power from thinning residue is higher than normal wood biomass
  - Other tree types, construction waste and sawmilling residue are not considered
- 30% of volume is thinned at the age of 25, 35 and 45 years
- 27% of felled trees are extracted, others are abandoned in forest due to lack of economic feasibility
- 40% of extracted trees is used for energy (the rest is for timber)
- 13895m³ of wood per 1000kW is needed according to a previous study
3. Results

- Degree of competition among 6 plants

<table>
<thead>
<tr>
<th>Overwraps (Number of plants collecting biomass in the same forest)</th>
<th>Transportation distance 50km</th>
<th>Transportation distance 100km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest area (ha)</td>
<td>Share (%)</td>
<td>Forest area (ha)</td>
</tr>
<tr>
<td>No overwrap</td>
<td>12,541</td>
<td>79.4</td>
</tr>
<tr>
<td>3,225</td>
<td>20.4</td>
<td>20,343</td>
</tr>
<tr>
<td>21</td>
<td>0.1</td>
<td>33,116</td>
</tr>
<tr>
<td>Overwrapping</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>11,588</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>432</td>
</tr>
<tr>
<td>Total</td>
<td>15,786</td>
<td>100</td>
</tr>
</tbody>
</table>
4. Considerations

• Why competitions occur?
  – Ambitious plans for resource procurement
    • Their plans are based on area a circle with 50 km of radius
    • Rough sketch of resource potential
    • Do not consider actual road network and availability based on tree type and age, slope in forest etc
    • They have to travel longer distance to collect biomass feedstock
4. Considerations

– When considering resource potential based on 50km-radius from a plant, 826km$^2$ of forest is included in the area, and 30.2 million m$^3$ of thinned trees can be collected.

– If transportation distance 50km is assumed, total volume of biomass reduces to 5.6 million m$^3$ (18.5%).

<table>
<thead>
<tr>
<th></th>
<th>Forest area (km$^2$)</th>
<th>Total volume (million m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle with 50km-radius</td>
<td>826</td>
<td>30.2</td>
</tr>
<tr>
<td>Transportation distance 50km</td>
<td>153</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18.5%</td>
</tr>
</tbody>
</table>
4. Considerations

- Plants elaborate their own plans for resource procurement individually
  - No coordination scheme is introduced at regional level

<table>
<thead>
<tr>
<th>Plant ID</th>
<th>Biomass supply by transportation distance (m³)</th>
<th>Biomas demand (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25km</td>
<td>50km</td>
</tr>
<tr>
<td>A</td>
<td>7,456</td>
<td>20,065</td>
</tr>
<tr>
<td>B</td>
<td>1,738</td>
<td>9,369</td>
</tr>
<tr>
<td>C</td>
<td>8,478</td>
<td>44,600</td>
</tr>
<tr>
<td>D</td>
<td>2,345</td>
<td>7,899</td>
</tr>
<tr>
<td>E</td>
<td>4,386</td>
<td>12,719</td>
</tr>
<tr>
<td>F</td>
<td>9,857</td>
<td>39,097</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Plant F is cofiring.
5. Concluding remarks

• Serious competition of biomass procurement could occur among 6 wood biomass power plants in Iwate pref.

• When considering actual road network, feasibility of extraction and thinning schedule of forest, available amount of biomass significantly reduces
  – Some plants cannot obtain even they travel 100km for collection
  – Actually, they are collecting feedstocks from biomass other than thinning residue or imported one but FIT prices from these feedstock are lower
5. Concluding remarks

• The reasons for the competition
  – Ambitious plans for resource procurement
  – No coordination scheme for multiple bioenergy plants at the planning stage is introduced at regional or national level

• To avoid the competition
  – Plant owners should make well-organized plans considering actual situation of biomass collection (road networks, forest and tree types, economic feasibility of resource extraction etc)
  – Coordination scheme should be introduced
Thank you very much for your kind attention!

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