Biomass Availability and Identification of Feedstock Potensial in Indonesia

Bio-energy, CCS and BECCS: Options for Indonesia
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INTRODUCTION

• Biomass $\rightarrow$ solid and liquid biomass
• important biomass $\rightarrow$ agric. residues and used in traditional/modern application
• biomass from rural and urban resources
• it is important to define source of biomass before calculating the potency $\rightarrow$ criteria is needed
INTRODUCTION

• rural sector solid biomass:
  only → crops residues → agric/forest residues
• criteria: direct+indirectly do not disturb food security and environment
POTENTIAL SOLID BIOMASS

• Food crops : → food security
  > rice : only the husk, straw are for animal feed
  > corn : only corncob, leaves are for animal feed
  > sugar cane : only bagasse, cane top are for animal feed

• Estate crops : → environment consideration
  > rubber : only small log from replanting
  > palm oil : only EFB (half for compost/organic fertilizer), shells bark are for animal feed

• Forest : → waste only, log cutting, saw timber, wood industry
Production of Energy Crops in Indonesia

- Palm Oil
- Coconut
- Sugar
- Rubber
- Rice
- Corn

Production values are in 1000 tons.
Land Suitability Map for Energy Crops in Indonesia
Land Suitability Map for Jaropha Curcas in Indonesia
(1 : 1,000,000)
<table>
<thead>
<tr>
<th>Effective Residues</th>
<th>Planted Area***) (x 1000 Ha)</th>
<th>Potency Energy X 100 MJ/Ha/Year *)</th>
<th>Technical Energy Potensial mill GJ/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm Oil</td>
<td>Fruit empty bunches Palm shell</td>
<td>8,430</td>
<td>32,8****)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6,5</td>
<td></td>
</tr>
<tr>
<td>Coconut</td>
<td>Shell</td>
<td>3,808</td>
<td>9,6</td>
</tr>
<tr>
<td></td>
<td>Fibre</td>
<td></td>
<td>12,7</td>
</tr>
<tr>
<td>Ruber</td>
<td>Small log</td>
<td>3,445</td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>Bagasse</td>
<td>448</td>
<td>288,8</td>
</tr>
<tr>
<td>Rice</td>
<td>Husk</td>
<td>12,147</td>
<td>11,8</td>
</tr>
<tr>
<td>Corn</td>
<td>Cob</td>
<td>4,131</td>
<td>17,3</td>
</tr>
<tr>
<td><strong>Technical Energy Potensial of Solid Agr. Biomass</strong></td>
<td></td>
<td><strong>614.6</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note:
*) ITB
***) Ministry of Agriculture (2011)
****) Assumed that 50% of empty fruit bunches is for organic fertilizer (compost)
<table>
<thead>
<tr>
<th>Effective Biomass Residues</th>
<th>Year Period</th>
<th>Residues (Mill Ton/Year)</th>
<th>Technical Energy Potensial (mill GJ/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log cutting Residues</td>
<td>Managed Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1998 – 2004</td>
<td>2.3</td>
<td>15.643</td>
</tr>
<tr>
<td></td>
<td>2005 – 2010</td>
<td>1.91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>People Forest</td>
<td>Average 2.105</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000 – 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total 1.6</td>
<td></td>
</tr>
<tr>
<td>Saw timber</td>
<td>2006 – 2010</td>
<td>4.2</td>
<td>42</td>
</tr>
<tr>
<td>Wood industry</td>
<td>2006 – 2010</td>
<td>7.86</td>
<td>83.84</td>
</tr>
<tr>
<td>Technical Energy Potensial of Solid Forest Biomass</td>
<td></td>
<td></td>
<td>141.483</td>
</tr>
</tbody>
</table>
## Technical Energy Potensial of Solid Biomass In Indonesia 2010

<table>
<thead>
<tr>
<th>No</th>
<th>Solid Biomass Residues</th>
<th>Technical Energy Potensial of Solid Biomass (Mill GJ/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agriculture</td>
<td>614.6</td>
</tr>
<tr>
<td>2</td>
<td>Forestry</td>
<td>141.483</td>
</tr>
<tr>
<td></td>
<td><strong>Total Energy Potensial of Solid Biomass</strong></td>
<td><strong>756.083</strong></td>
</tr>
</tbody>
</table>

*(470 in 2000 !!)*
Potensial Liquid Biomass

1. Biodiesel
   Palm Oil (more than enough for supporting national target)

2. Bioetanol
   sugarcane and cassava (not enough feedstock for supporting national target) ... dedicated area?
Potensial Crops for Liquid Biomass

- Jatropha curcas ... new variety available
- Candle nut ... new variety available
- Sugar Palm 47,763 ha ... new variety available
- Sago 1,5 juta ha ... food competition
New jatropha curcas high yielding seed

Jatropha Curcas High Yielding Seed have been released in 2006, 2007, 2008 (4-6 t/ha & 6-8 t/ha & 10 t/ha)

- IP-1 A, IP2-A, IP-3 A for dry area,
- IP-1 M, IP-2M, IP-3 for medium dry area,
- IP-1 P, IP-2P, IP-3 for wet area
## CONCLUSION (1)

### Potensial Solid Biomass:

- **Palm oil**: Empty fruit bunches and palm shells
- **Coconut**: Shell and fibre
- **Ruber**: Small log
- **Sugar**: Bagasse
- **Rice**: Husk
- **Corn**: Corncob
- **Forest waste**: Log cutting, saw timber industry
Technical Solid Biomass Energy

- Agriculture residues is 614.6 mill GJ/year
- Forest waste is around 141.483 mill GJ/year or
- Totally is around 756.083 mill GJ per year
- Solid biomass energy potential are increasing along with production of energy crops in the last ten years, unfortunately its utilization is still very limited, that is around 3.25%.
Liquid Biomass Energy

• The actual readily feedstock (for liquid biofuel) from agriculture are mainly palm oil for biodiesel, sugarcane and cassava for bioethanol

• The national palm oil production recently is able to support the national target of biodiesel

• Otherwise, due to the lack of feedstocks, so the production of sugarcane and cassava are not able to support the national target of bioethanol usage
CONCLUSION (4)

There are other potential crops that usually produce non-solid biomass energy in Indonesia and grow scatterly with not so large planted areas such as:

- physic nut or jatropha curcas,
- “nyamplung” (*Calophyllum Inophyllum*),
- candle nut, and also sugar palm,
- cassava, sago and sorgum
Route of International Trade of Biomass Energy

Figure 7: Main international biomass for energy trade routes. Intra-European trade is not displayed for clarity. Source: Junginger and Faalj, 2008.

Bahan presentasi PT Solar Park Indonesia / Badan Litbang Kehutanan di Kemen Perekonomian, 22 Desember 2009

world will absorb biomass from Indonesia ???
SUGGESTION

• The solid biomass energy should be utilized in the country where the biomass were taken, that mean, solid biomass export have to be stopped or at least minimized.

• In the future, second generation biofuel have to be developed from the biomass to omit competition with food while this technology is being developed by researchers in Indonesia.

thank you