ASSESSMENT OF BRIQUETTING POTENTIAL FOR BORNO STATE

FAO SAFE ACCESS TO FUEL AND ENERGY PROGRAMME IN NORTH EAST NIGERIA
FLORENT EVEILLE – ASSOCIATE PROFESSIONAL OFFICER – ENERGY, FAO
Objectives of SAFE cooking

- Reduce woodfuel consumption (stoves and cooking techniques)
- Move from woodfuel-intensive activities (briquettes, biogas, stoves...)
- Reduce exposure to protection risks
The cooking system

- A fuel and its value chain
- A stove and its value chain and different devices
- Cooking utensils
- The system is always **context-specific**
The fuel ladder

Source: Christa Roth (2013)
Fuel typology

- Wood
- Dung
- Charcoal
- Coal
- Briquettes
- Pellets
- Biogas
- Gas
- Solar
- Electric
- Ethanol
- Methanol
- SVO
- LPG
- Kerosene

Source: the global alliance for clean cookstoves (2018)
Briquettes and pellets

- What is the difference?
- Carbonized vs non-carbonized briquettes
- Binders and pressure
- Processing
Briquettes

Ash content of different biomasses

<table>
<thead>
<tr>
<th>Biomass</th>
<th>Ash content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn cob</td>
<td>1.2</td>
</tr>
<tr>
<td>Jute stick</td>
<td>1.2</td>
</tr>
<tr>
<td>Sawdust (mixed)</td>
<td>1.3</td>
</tr>
<tr>
<td>Pine needle</td>
<td>1.5</td>
</tr>
<tr>
<td>Soya bean stalk</td>
<td>1.5</td>
</tr>
<tr>
<td>Bagasse</td>
<td>1.8</td>
</tr>
<tr>
<td>Coffee spent</td>
<td>1.8</td>
</tr>
<tr>
<td>Coconut shell</td>
<td>1.9</td>
</tr>
<tr>
<td>Sunflower stalk</td>
<td>1.9</td>
</tr>
<tr>
<td>Jowar straw</td>
<td>3.1</td>
</tr>
<tr>
<td>Olive pits</td>
<td>3.2</td>
</tr>
<tr>
<td>Arhar stalk</td>
<td>3.4</td>
</tr>
<tr>
<td>Lantana camara</td>
<td>3.5</td>
</tr>
<tr>
<td>Subabul leaves</td>
<td>3.6</td>
</tr>
<tr>
<td>Tea waste</td>
<td>3.8</td>
</tr>
<tr>
<td>Tamarind husk</td>
<td>4.2</td>
</tr>
<tr>
<td>Coffee husk</td>
<td>4.3</td>
</tr>
<tr>
<td>Cotton shells</td>
<td>4.6</td>
</tr>
<tr>
<td>Tannin waste</td>
<td>4.8</td>
</tr>
<tr>
<td>Almond shell</td>
<td>4.8</td>
</tr>
<tr>
<td>Areca nut shell</td>
<td>5.1</td>
</tr>
<tr>
<td>Castor stick</td>
<td>5.4</td>
</tr>
<tr>
<td>Groundnut shell</td>
<td>6.0</td>
</tr>
<tr>
<td>Coir pith</td>
<td>6.0</td>
</tr>
<tr>
<td>Bagasse pith</td>
<td>8.0</td>
</tr>
<tr>
<td>Bean straw</td>
<td>10.2</td>
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<tr>
<td>Barley straw</td>
<td>10.3</td>
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<tr>
<td>Paddy straw</td>
<td>15.5</td>
</tr>
<tr>
<td>Jute dust</td>
<td>19.9</td>
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<tr>
<td>Rice husk</td>
<td>22.4</td>
</tr>
<tr>
<td>Deoiled bran</td>
<td>28.2</td>
</tr>
</tbody>
</table>

Energy content per volume compared to 1l of fuel oil

Source: biomass briquetting: technology and practices (1996)

Source: adapted from Technology and Support Centre (TFZ) (2013)

Increase the resilience of livelihoods to threats and crises
Briquettes

- Charcoal briquette - smokeless
- Non-carbonized briquettes (saw dust, bagasse, coffee husks, maize cobs, wheat/beans/barley straw)
- Compressed through simple compaction (densified briquettes) or with machines (charred briquettes)
Carbonization

Increase the resilience of livelihoods to threats and crises
Briquetting presses

- Mechanical vs electrical
- Manual lever briquette press & Hand-powered screw extruder < 20 Kg/h
Briquetting presses

- Screw press machine 250 kg/h to 750 kg/h
- Hydraulic press machine 40 Kg/h to up to 800 kg/h
- Piston press machine 450 kg/h up to 2 200 kg/h
Drying

Direct sunshine

Greenhouse
Concept of the assessment

- Taking stock of existing initiatives
- Defining the feedstock
- Supporting the production process
- Testing the products
Existing initiatives

- GePADC/Ramat polytechnic
- University of Maiduguri
- UNHCR / Women development center
- MSF Spain / LETSAI – to be assessed
GePADC/Ramat

Saw dust (70%) and paper (30%)

Increase the resilience of livelihoods to threats and crises
Increase the resilience of livelihoods to threats and crises

Unimaid

- Bambara nut shell 35% + Coconut shell 35% + sugarcane molasses 30%
- Neem sawdust 75% + 25% cassava starch
- Neem charcoal 77% + gum Arabic 23%
Unimaid

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UNHCR / Women development center

- Livelihood activity
- Use of different material (sawdust 60% + paper 40%)
Biomass availability

- Definition of the feedstock
- Bioenergy and food security BEFS crop/residue ratios
- Different options + site visits
- Competition with feed and construction
Different options

- Maiduguri Metropolitan area
- Gongolong / Zabarmari
- South of Borno state + transport
Maiduguri Metropolitan area

- Sugar cane peel 1120 bags burnt / year
- Rice husk 60t per year and 5 tonnes per month.
- Sawdust is estimated at 22 500t per year and 1 875 tonnes per month.
- Coconut shell?
- Groundnut husk?
- Gum Arabic residues and cassava starch as binders?
Gongolong / Zabarmari

Residue availability in Gongolon in tonnes per month

Zabarmari, the ricehusk feedstock is estimated at
2 bags * 150 mills * 300 days = 90 000 bags or 4 500t per year 375 t per month
Briquette production process

- Carbonized / uncarbonized
- Feedstock
- Shape
- Drying
Controlled Cooking Test

Different types of stoves

Increase the resilience of livelihoods to threats and crises
Controlled Cooking Test

Different types of fuels

Increase the resilience of livelihoods to threats and crises
Next steps

- Refine and in-depth analysis of collected data
- Prepare and share report with the Working Group in May