Sweet energy
Bioenergy integration pathways for sugarcane residues in South Africa
Mirjam Röder and Patricia Thornley, Tyndall Centre for Climate Change Research, The University of Manchester, United Kingdom
Nico Stolz, RCL Foods Sugar & Milling (Pty) Ltd, South Africa

Challenges
- Insufficient and inconsistent electricity supply across the country
- Steep increase of electricity prices with largest impacts on rural and remote communities
- Strong competition within the global sugar market with decreasing prices
- Electricity production is mainly coal based with a need to decarbonise
- Leaf residues from sugarcane production are burned in field before harvest

Disadvantages
- Higher risk for pests and disease
- Difficult handling of green cane
- Increased harvesting and handling cost

Research area and biomass potential
- Nkomazi, District of Mpumalanga, South Africa
- 40,000 – 51,000 ha irrigated cane area
- 7-10 t/ha (dry matter) residues are removable

Objectives
- Integrate bioenergy from sugarcane residues into the South African sugar value chain to:
  (a) improve energy supply of local communities
  (b) reduce environmental impacts
- Evaluate the sustainable development impacts of bioenergy integration
- Develop potential bioenergy integration pathways

Methods
- Stakeholder engagement including sugar millers and cane growers of various scales and mechanisation levels
- SWOT analysis to evaluate the different aspects for each bioenergy pathway

Current sugarcane supply chain

Main energy demand along the supply chain

Livelihood activities
Field irrigation
Sugar processing

Household energy access in Nkomazi (Source: Statistics South Africa)

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity for lighting</td>
<td>83.3%</td>
</tr>
<tr>
<td>Electricity for cooking</td>
<td>64.4%</td>
</tr>
<tr>
<td>Wood for cooking</td>
<td>28.3%</td>
</tr>
<tr>
<td>Electricity for heating</td>
<td>50.6%</td>
</tr>
<tr>
<td>Wood for heating</td>
<td>10.6%</td>
</tr>
<tr>
<td>No heating</td>
<td>34.4%</td>
</tr>
</tbody>
</table>

Potential bioenergy pathways for using sugarcane residues as feedstock to improve energy supply

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Field to pump&lt;br&gt;Small scale&lt;br&gt;Manual green cane harvest&lt;br&gt;50% removal of brown leaves&lt;br&gt;Electricity generation&lt;br&gt;Electricity supplied to pumps&lt;br&gt;Energy supply to village&lt;br&gt;On-farm use of energy&lt;br&gt;Surplus energy wheeled into cane growers or fed into grid</td>
</tr>
<tr>
<td>B</td>
<td>Field to village&lt;br&gt;Small scale&lt;br&gt;Manual green cane harvest&lt;br&gt;50% removal of brown leaves&lt;br&gt;Electricity generation&lt;br&gt;Energy supply to village</td>
</tr>
<tr>
<td>C</td>
<td>Field to farm&lt;br&gt;Commercial scale&lt;br&gt;Manual or mechanical green cane harvest&lt;br&gt;50% removal of brown leaves&lt;br&gt;Electricity generation&lt;br&gt;Energy generation</td>
</tr>
<tr>
<td>D</td>
<td>Field to mill and grid&lt;br&gt;All scales&lt;br&gt;Green case harvest&lt;br&gt;Electricity generation from biomass incinerator&lt;br&gt;Energy generation</td>
</tr>
</tbody>
</table>

Conclusions
- Integrating bioenergy pathways for sugarcane can possibly improve energy supply and environmental impact
- Centralised pathways more likely to be efficient in terms of logistics, energy generation and provide benefits for overall energy supply through the grid
- Local and decentralised pathways more likely to offer additional benefits in terms of local development, empowerment and decision making and provide direct benefits to the cane grower communities and people in need
- It has to be considered carefully who will receive the actual benefits, what the social, economic and social sustainability priorities and what the consequences and what the trade-offs are between these different pathways

Contact: Mirjam Röder mirjam.roeder@manchester.ac.uk, @Mirjam_Roeder or come and speak to me at the SUPERGEN Bioenergy Hub stand in the exhibition hall (stand 41)

This research was funded by the Knowledge and Innovation Hub for Environmental Sustainability of The University of Manchester and supported by the SUPERGEN Bioenergy Hub and RCL Foods Sugar & Milling (Pty) Ltd.