Bio-waste and cooling applications in agriculture and rural communities

Potential Interventions in State of Punjab and Haryana

Findings from research study sponsored by Swedish EPA

Presentation by: Sunil Dhingra
Senior Fellow and Associate Director
Renewable Energy Technology
The Energy and Resources Institute,
New Delhi, India

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Main Objectives

• Map Government of India’s policies and specific programmes/schemes on bio-waste management, cooling and refrigeration

• Review of trends and extent of problem of bio-waste management with specific reference to the States of Haryana and Punjab

• Explore opportunities of alternative technologies and practices to minimize crop-residue burning through in-situ and ex-situ measures

• Identify cooling/co-generation/tri-generation applications in agricultural value chain – where not-in-kind (NIK) alternative technological solutions can be potentially applied
Existing policies/initiatives National and State Governments

- National Policy for Management of Crop Residues (NPMCR)-2014
- MNRE has launched a programme on Energy from Agricultural waste/residue in the form of biogas-bio-CNG, enriched biogas/power
- National Biofuel Policy 2018
  - Sustainable Alternative Towards Affordable Transportation (SATAT)
- Ministry of Power, Government of India promoting co-firing of bio-waste in thermal power plants
- Ministry of Environment, Forest and Climate Change has prepared India Cooling Action Plan
- Ministry of Food Processing Industries (MoFPI) has developed a scheme of cold chain.
- Punjab Government has announced its “New and renewable sources of energy policy”
- Haryana Bio-energy Policy 2018: To promote generation of energy from surplus biomass in the State.
Why Paddy Straw is being burnt / not being utilized?

- **Low availability** of manpower led to use of mechanical harvesting using Combined Harvester which chops only the paddy cobb’s and leaves the straw on the field.

- Paddy straw being **light**, difficult to handle and **expensive to transport**, consequently financial viability favors for its use close by or should have high value addition

- **Narrow Window** (B/w harvesting of Paddy Straw & sowing of Wheat crop)
Options for paddy straw utilization

• **In-situ Management** by spreading on field and use as manure for soil enrichments and nutrients

• **Ex-situ options:**
  – Power generation
  – Briquettes and Torified fuel production
  – Bio-gas and bio-CNG
  – Bio-ethanol production
  – Pulp and Paper/Board/Eco-panel making
## Cold Chain opportunity in India

<table>
<thead>
<tr>
<th>Type</th>
<th>Production Million Tons</th>
<th>Cold Storage Facility required for MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>97.4</td>
<td>97.4</td>
</tr>
<tr>
<td>Vegetables</td>
<td>187.3</td>
<td>164.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Onion 23.3 MT, does not require cold storage</td>
</tr>
<tr>
<td>Flowers</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Aromatics and Medicinal</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>Plantation Crops</td>
<td>17.7</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximately 10% require cold storage</td>
</tr>
<tr>
<td>Spices</td>
<td>8.6</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximately 50% require cold storage</td>
</tr>
<tr>
<td>Milk</td>
<td>176.3</td>
<td>88.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximately 50% distributed through organized sector which has cooling facilities</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>491</strong></td>
<td><strong>359</strong></td>
</tr>
<tr>
<td>Existing Cold storage capacity 2018*</td>
<td>39</td>
<td></td>
</tr>
</tbody>
</table>

Need to develop sustainable cold chain development
Shift to alternate crops - Farmer’s Perspective

- If the truck doesn’t come today, half our spinach will rot we will lose all our profit
- The mandi opens once a week, I lose half my fruit waiting to sell at the mandi
- Capsicum price will be high after 4 days, but I can’t keep it fresh till then
- Burning rice stalk on the field leads to imposition of penalties

- 99% shortfall in precooling and cooling infrastructure at farm level (NCCD, Govt. of India)
- India is the 2nd largest world producer of fruits and vegetables and largest producer of milk
- Limit the farmers shifting to growing perishables to earn more

Growing need of cooling energy in rural area for agriculture value chain development
Typical demand of cooling energy for milk collection and processing
(A case study from Sangrur District, Punjab)

- Number of Villages in the district: 571
- In every village 800-1000 L milk is collected and stored at Bulk milk chiller for about 24 h
- From every 20-25 villages, one milk collection center is established to store 15000 L of milk
- The collected milk is further transported in insulated vehicles to milk processing units in the district
- Need for cooling at each level

Need to supply sustainable cooling solutions for milk collection and storage application
Biogas based decentralized cooling system

- Membrane based biogas digester
- Approximately USD 10000 for 160 m³ digester volume, 55 m³ biogas /day to run GreenCHILL system
- 15 to 30 Ton Cold storage, pre-cooler or 1500 liter milk chiller
- Cool to -5°C
- Humidity control
- Automatic operation
- 3 RT Cooling capacity for storage at 4°C

Proposed solution provides choices to farmers to shift to horticulture crops
## Cooling energy for fruit storage facility (A case study from Punjab)

<table>
<thead>
<tr>
<th>Location</th>
<th>Kapurthala, Punjab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>15 Metric Ton storage system.</td>
</tr>
<tr>
<td>Applications</td>
<td>To precool and store Melon, Pears and other local fruits</td>
</tr>
<tr>
<td>Impact</td>
<td>Farmers able to sell their produce at 35% higher prices</td>
</tr>
<tr>
<td>Operational cost</td>
<td>Rs 220/day and saves 100 units of electricity/day costing Rs 800/day or Rs 2400/day of diesel.</td>
</tr>
</tbody>
</table>
Biogas based Cooling in Circular Economy

Minerals in soil recirculated through digested slurry when farm/cattle waste is converted into biogas and spread back in fields

Reduce water consumption by reducing spoilage of produce

• Improve livelihoods/happiness
• Reduce food spoilage
• Less stress on our environment

GreenCHILL

Food

Natural Refrigerant GWP=0

Photosynthesis

Sunlight

H₂O, CO₂, O₂

Minerals

Water

Food /Agri Waste

Biogas

Cooling

H₂O, CO₂, O₂

Reduce water consumption by reducing spoilage of produce

9/24/2019
How stubble can transform rural economy

The Times of India

Procurement of crop stubble left after harvesting a crop in Punjab and Haryana, if stopped, can transform rural economy, take care of local energy needs and even provide alternative sources of income for farmers, a study conducted by The Energy and Resources Institute (TERI) has said. Stubble burning is a major source of air pollution in Delhi-NCR, especially around Diwali.

Titled “Scoping study on bio-waste and non-ozone depleting substance-non-HFC alternatives in India”, the report points out that additional policies are needed in Punjab and Haryana on crop residues collection and aggregation.

“This will encourage private investment in crop residue collection and provide choices to farmers to dispose of bio-waste materials,” the TERI study says. “The farmers can build viable business models to establish a bio-waste supply chain mechanism. This will allow the private sector to invest in valorisation of bio-waste material valorisation through production of bio-CNG, bio-ethanol, bio-pellets, bio-power etc.”

Analysis from field visits and discussions with the farmers showed that paddy straw can be used as fuel to run decentralised cold storages to store horticulture produce and milk at the village level.

“This provides options to farmers to shift to horticulture and other crops. Farmers are reluctant to shift from paddy cultivation due to limited cold storage capacity at the local level,” the report states.

Crop residue can fuel agriculture growth: Teri

CHANDIGARH: In the backdrop of widespread air pollution from stubble burning, The Energy Resource Institute (Teri), New Delhi, has come up with a new study on the problem.

According to Teri researcher Sunil Dhingra, around 35 million tonnes of crop residue is burnt every year in Punjab and Haryana alone - the grain bowls of India. These two states have a predominant paddy wheat cropping pattern. The high water demand of these crops is also badly affecting the groundwater of the region. One of the solutions is for farmers to shift to horticultural crops such as fruits and vegetables. However, such crops are perishable and require cold storage facility for farmers to be able to take them to faraway markets and get profitable deals on them.

This scoping study by Teri explores the possibility of a course of action that addresses both these issues by converting biomass crop residue into fuel to run decentralized cold storage facilities. This study looks at the potential interventions in Punjab and Haryana to make this possible.

According to the study, utilization of paddy straw - currently, burnt off in the field at the end of the kharif season - offers tremendous potential for increasing the share of clean energy in meeting local fuel and electricity requirements. It can also meet the growing demand for cooling energy in rural areas for agriculture value chain enhancement and milk chilling in Punjab and Haryana. However, setting up bio-waste collection and supply chain mechanisms are crucial for this to take place.
Thank you

For further detail
E-mail: dhingras@teri.res.in