AGRI WASTE TO ENERGY: THE BIOGAS ROUTE

By
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Biogas: The India Journey

- Biogas technology → Used for decades
- Popular for decades as management of dung at household levels
  - Cooking gas
  - Manure for farms
  - Village level household (promoted by MNRE)
  - Sizes up to 2 m³
- Small and medium scale dairy farms → electrical power & manure
- Distilleries → management of spent wash → regulation
- Use of kitchen waste → cooking fuel & manure
- Large scale (6,000 m³) and above using dung
- Segregated organic MSW → electrical power & manure → Municipal Corp.
- Press mud / poultry litter → BioCNG and manure
Agriwaste: An untapped potential

- Present uses of agriwaste:
  - Fodder
  - Gasification / Boiler → Electrical Power

- Agriwaste → a Potential feed for generating biogas and energy

- Types of agriwaste tested as feed for biogas plants:
  - Paddy Straw
  - Wheat Straw
  - Maize Stalk
  - Bajra Stalk
  - Jawar Stalks
  - Corn Cobs
  - Banana Stems… and more
Agriwaste: A Burning Issue

Surplus agriwaste is burned today

Effects:

# Addition to Green House Gases
# Pollution
# Health problems
# Loss of water in the soil $\rightarrow$ Increased water requirement for next crop
### Agriwaste Statistics

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Crop</th>
<th>Residue</th>
<th>Biomass Generation (kT/Yr)</th>
<th>Biomass Surplus (kT/Yr)</th>
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<tbody>
<tr>
<td>1</td>
<td>Paddy</td>
<td>Straw</td>
<td>149,647</td>
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<td>Soya bean</td>
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<td>Groundnut</td>
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<td>9</td>
<td>Jowar</td>
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<td>10</td>
<td>Bajra</td>
<td>Stalks</td>
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<td>12,944</td>
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<td>Cotton</td>
<td>Husk</td>
<td>10,789</td>
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<td>Mustard</td>
<td>Husk</td>
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<td>1,575</td>
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<td>Jowar</td>
<td>Husk</td>
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<td>Husk</td>
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<td>Casuarinas</td>
<td>Wood</td>
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<td>23</td>
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<td>Secondary wood</td>
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<td>598</td>
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<td>Residue</td>
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<td>Residue</td>
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<tr>
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<td>Coffee</td>
<td>Pruning &amp; wastes</td>
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<td>1,166</td>
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<tr>
<td>27</td>
<td>Rubber</td>
<td>Primary wood</td>
<td>1,495</td>
<td>1,196</td>
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<tr>
<td>28</td>
<td>Wheat</td>
<td>Pod</td>
<td>18,672</td>
<td>8,382</td>
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<tr>
<td>29</td>
<td>Coconut</td>
<td>Husk &amp; pith</td>
<td>3,185</td>
<td>1,592</td>
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<tr>
<td>30</td>
<td>Coconut</td>
<td>Fronds</td>
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<td>Cobs</td>
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<td>1,320</td>
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<tr>
<td>32</td>
<td>Jowar</td>
<td>Cobs</td>
<td>5,044</td>
<td>1,912</td>
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<tr>
<td>33</td>
<td>Bajra</td>
<td>Cobs</td>
<td>1,987</td>
<td>940</td>
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<tr>
<td>34</td>
<td>Cotton</td>
<td>Shell</td>
<td>10,789</td>
<td>4,829</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>511,041</strong></td>
<td><strong>145,027</strong></td>
</tr>
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</table>

Source: MNRE MoRD

Surplus Biomass

> 145 Million Tons per year

Surplus Agriwaste suitable for Biogas Plants

> 62 Million Tons Every Year!
Biogas: A Complete Solution

- Photosynthetic Cycle → Nature’s way of recycle
- 100% Carbon neutral
Agriwaste: Energy Potential

- Agriwaste: 62 Million Tons per Year

  - Biogas: 17 Million m³ / year
    - BioCNG: 6.8 Million tons/year
      - Equivalent to 6.8 Million tons/year of CNG OR 8 Million tons/year of LPG
    - PROM: 37 Million tons/year
      - Equivalent to DAP: 15 Million tons / year
Benefits

- **Empowerment of Rural India → Create wealth in Rural india**
  - Increase in earnings through sale of agri waste
  - Employment: Plant O&M + logistics of collection and transport of agri waste
  - Organic farming → Higher prices for produce
  - Overall economic growth in rural areas

- **Environment:**
  - Reduction in green house gases
  - Dramatic reduction in pollution
  - Overall improvement in health
  - Soil enrichment → increase land under cultivation

- **Country:**
  - Reduction in import bill of Natural Gas (@ $ 6,000 Million LPG @ $750 /ton)
  - Reduction in import bill of DAP (@ $ 6,000 Million DAP @ $ 455 /ton)
Issues

1. Technology:
   ✓ Private sector need to demonstrate
   ✓ Make projects economical without subsidy over period of time

2. Attracting investors in this segment:
   ✓ Policy framework for attracting investors (higher risk as compared to Solar, wind & Hydro)
   ✓ Establish a Revolving Fund (zero interest loan) greater than subsidy, instead of subsidy with an obligation on the project developer to repay back to Govt. in 10 years
   ✓ Compare prices to equivalent conventional energy without subsidy

3. Sale of PROM:
   ✓ Govt. Initiatives & programs to promote use of PROM and other organic varieties of organic composts

4. BioCNG as fuel for auto:
   ✓ Include BioCNG as a fuel for automobiles (highway and off-highway)
   ✓ Policy revision for opening retail sale of BioCNG to vehicles by Project Developers
Deployment Options

Distributed
- Small Scale, Manual, Batch Type
  - Size: 400 ~ 1000 m³
  - Village level cooking fuel + Power & manure / fertilizer
  - Energy & fertilizer self sufficiency at village level

Centralized
- Large scale, Automated, Continuous Feed Type
  - Size: 12,000 m³ and in multiples
  - Commercial
    - LPG & CNG replacement on large scale
Distributed: Village Level Energy Solution

Napier Grass
7.5 TPD

Feed Preparation

Dry Digester
8 x 50 m³

Leachate Digester
60 m³

Biogas storage
Balloon

H₂S Scrubber
2 x 25 kW

PROM Preparation

Biogas Genset

Cooking

Green Electricity

Manure
~0.85 TPD

400 m³ Biogas capacity
Village Level Batch Type
Centralized: Typical installation

- Agriwaste (Paddy Straw): 45 TPD
- Biogas: 12,000 m³ per day
- Energy options:
  - Electrical Power (Gross): ~ 28 MWH per day
  - OR
  - BioCNG (Bio Methane): ~ 4.5 ton per day
- Phosphate Rich Organic manure: ~ 30 ton per day
1.2 MW Paddy Straw Biogas Plant

Dry Digesters
Pulverizer
CSTR
Genset

Fertilizer Manufacturing Plant
1.2 MW Paddy Straw Biogas Plant
About KITL

- Part of the Kirloskar Group
- A Renewable Energy company
- **Businesses: Biogas, Solar & Hydro**
- Technology Provider for Biogas based Energy Plant
- Over 8 years of R&D on biogas substrates, process and equipment
- **DSIR approved R&D**
- In process of a R&D project jointly with ICT, Mumbai and partially funded by MNRE
- **Have tested over 85 different varieties of waste for biogas potential**
- More than 14 patents filed in the areas of biogas processes, designs and equipment
Work done by KITL in Agriwaste

- R&D on more than 80% types of agriwaste generated
- Extensive R&D on paddy straw → Lab to Pilot scale
- Developed and tested “Dry Digestion” technology for using 100% agriwaste
- Developed special digesters and equipment to handle agriwaste in small scale and large scale agriwaste Biogas Plants
- India’s first plant on 100% paddy straw in Punjab under commissioning:
  - Capacity: 12,000 m³ per day
  - Paddy straw consumption: 45 ton/day
  - 1.2 MW electricity from 100% biogas genset
  - Organic compost / Organic fertilizer
Thank You

IN HARMONY WITH NATURE
&
ON WAY TO SUSTAINABILITY

Energy from Biofuel

Sustainable Cycle for Biomass to Energy

Organic Carbon + Micro Nutrients reaching back to the soil
Contact

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