“Waste to energy”

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May
Who is ibert?

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Biomass energy specialist

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Energy Economist 15y

Pilot site M2M
Abattoir, Jan Kempdorp
1st waste to energy project 2012

6 plants –
3 x abattoir
2 piggery
1 energy crops

Converting bio-waste into Green energy
What is bio-gas?

“Product” of natural process of decomposing of organic material in the absence of $O^2$

Biological process that convers carbohydrates, fats, proteins into methane $CH_4$ and $CO^2$ via Anaerobic Digestion (AD)
Waste streams (Biogas liter/kg ODM)
Methane “production” steps

Hydrolysis → Acidogenesis → Acetogenesis → Methanogenesis

- Manure: Carbohydrates, Proteins, Lipids
- Soluble organic molecules: Sugars, Amino acids, Fatty acids
- Alcohols, Carbonic acids*, Volatile fatty acids
- Acetic acid
- Metabolites: H₂, CO₂, NH₃, NH₄, H₂S
- Final product: CH₄, CO₂

Converting bio-waste into Green energy
Biogas process/ cycle from source to use
Small DIY innovation

200m³ AD energy crop (Napier grass), manure, 
Produce cooking gas & biogas fuel
Energy crops (Napier grass)

300 – 450 ton/ha/year

<table>
<thead>
<tr>
<th>Waste type description</th>
<th>Napier</th>
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<tr>
<td><strong>Unit</strong></td>
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<tr>
<td>Quantity per day</td>
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<td>tons/year</td>
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<td>Dry matter</td>
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<td>Dry matter</td>
<td>tons/year</td>
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<td>Organic dry matter ratio</td>
<td>%</td>
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<tr>
<td>Organic dry matter</td>
<td>tons/year</td>
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<td>m³ gas / ton ODM</td>
<td>m³ / ton</td>
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<td>Biogas</td>
<td>m³/hr</td>
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<td><strong>chosen CHP Size</strong></td>
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<tr>
<td>CHP Biogas usage</td>
<td>m³/hr</td>
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<td>Surplus gas</td>
<td>m³/hr</td>
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**Intervention summary**

- +/- R2.5 m overall cost
- Sales commission per plant (define agriSA -output for commission) +/- R50k/ plant
- Help with product development & marketing
- Input = +/- 2,5ton/day biomass (waste or energy crop)
- Output
  - Electricity & heat (+- 20 kW / +- 100MWh/y)
  - Bio-fuel, 120 000 litre- displacement diesel 80/20 mix
  - Bio-fertilizer, 3t/d -1’000t/y, NKP@R350/t
- Total annual revenue +/- R2m/y +/- 18m payback
Biogas plant Munich Germany 120t/day
Reference sites South Africa
Plant #1 Meat to Market Jan Kempdorp
Plant #4 & 5 Cavalier Abattoir - Cullinan

2 x 500m3 AD, 150 + 200 kW CHP, 15 – 40 t/day waste

Converting bio-waste into Green energy
135 kW CHP Cavalier Abattoir
Plant #6 Zandam Cheese & Piggery (W/Cape)

1 x 400m3 AD, 75kW CHP, 30 t/day waste