9th RENEWABLE ENERGY POSTGRADUATE SYMPOSIUM

# Biogas as a sustainable green solution


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September 2018

# Presentation objective

**To change perception of “Waste”**

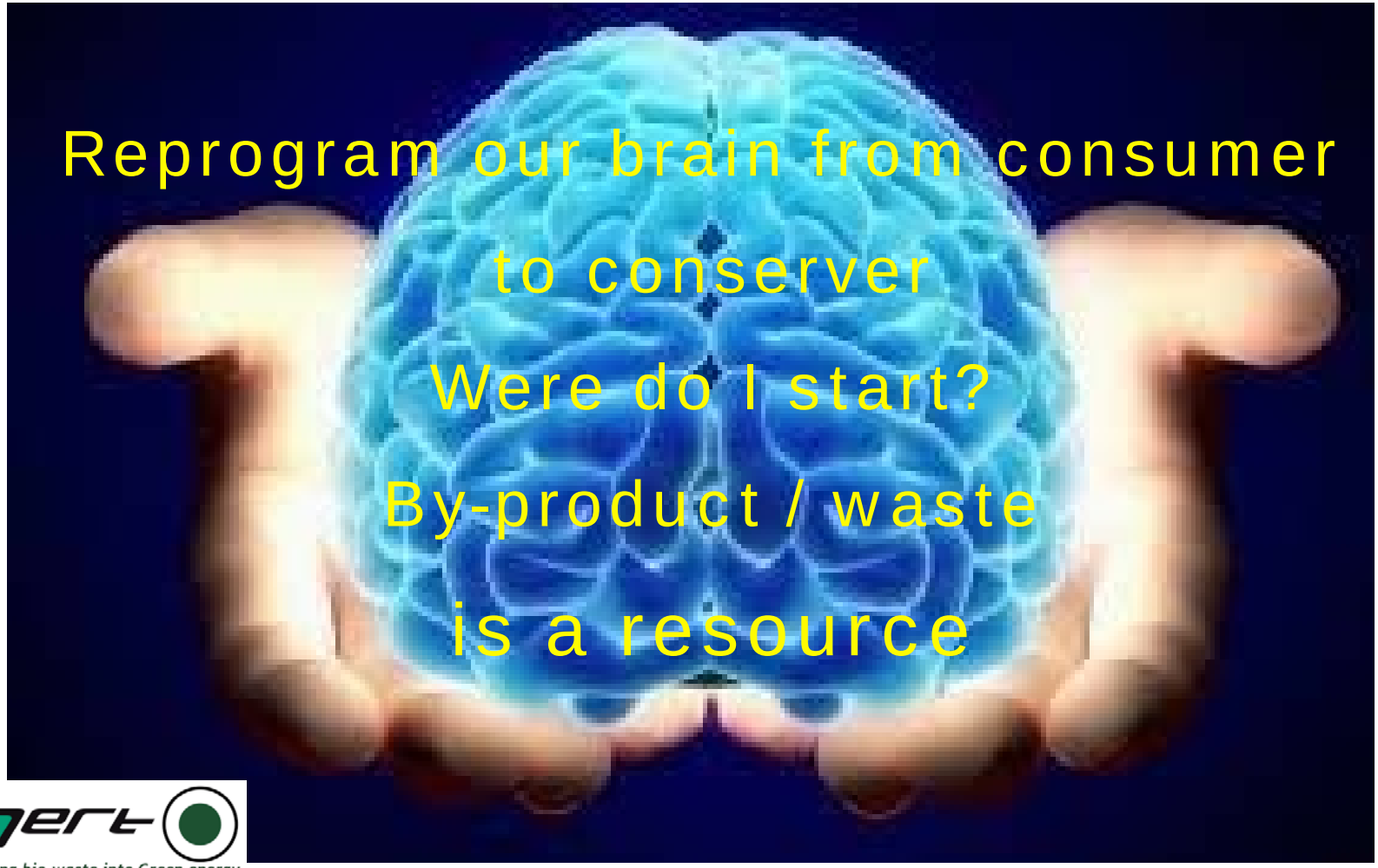
**from a problem**

**into a**

**“Renewable resource”**

Converting bio-waste into Green energy

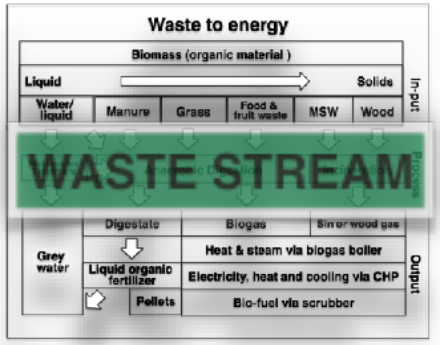
# Mind change




Converting bio-waste into Green energy

Converting bio-waste into Green energy

# Agenda





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# Biomass - Manure

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# Biomass – fruit, vegi and food waste

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# Biomass – Municipal Solid Waste

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# Energy crops – grass – hay - Silage

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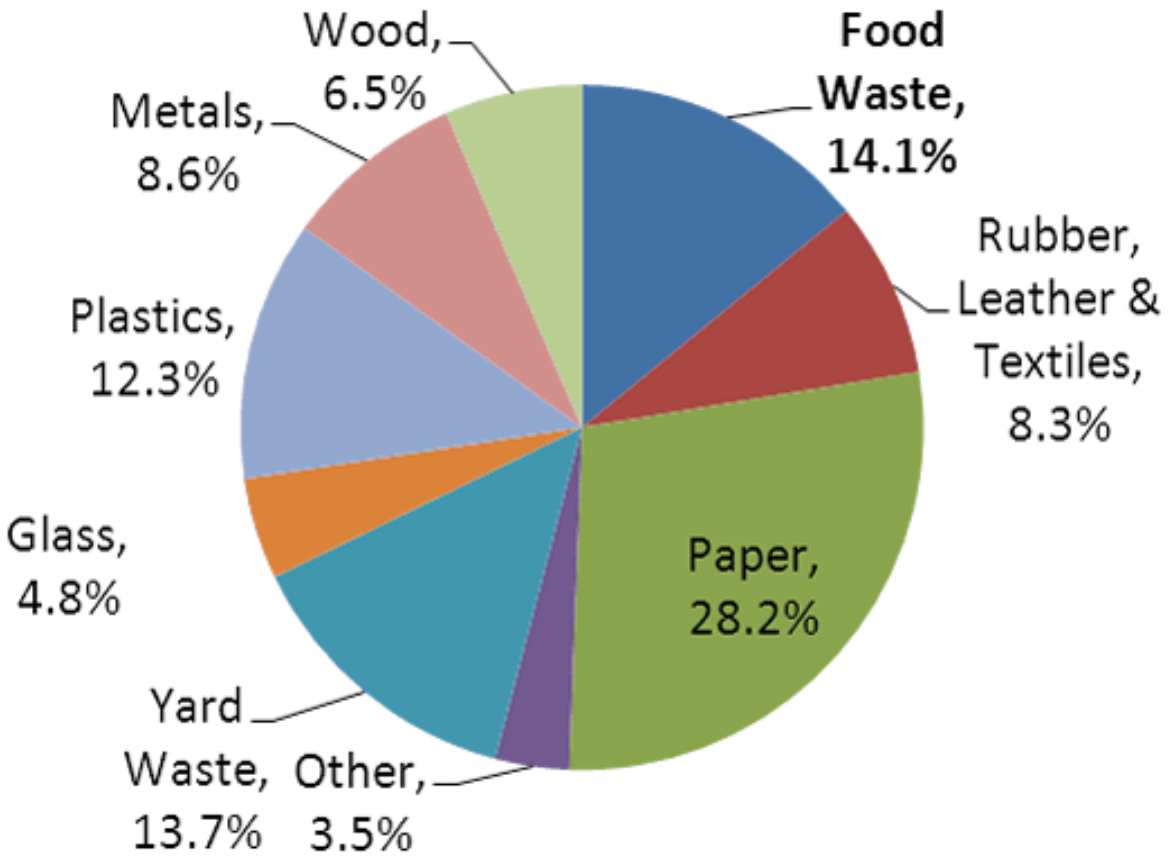
# Typical MSW break-down




*Source: Municipal Solid Waste in the United States: 2009 Facts and Figures, EPA*

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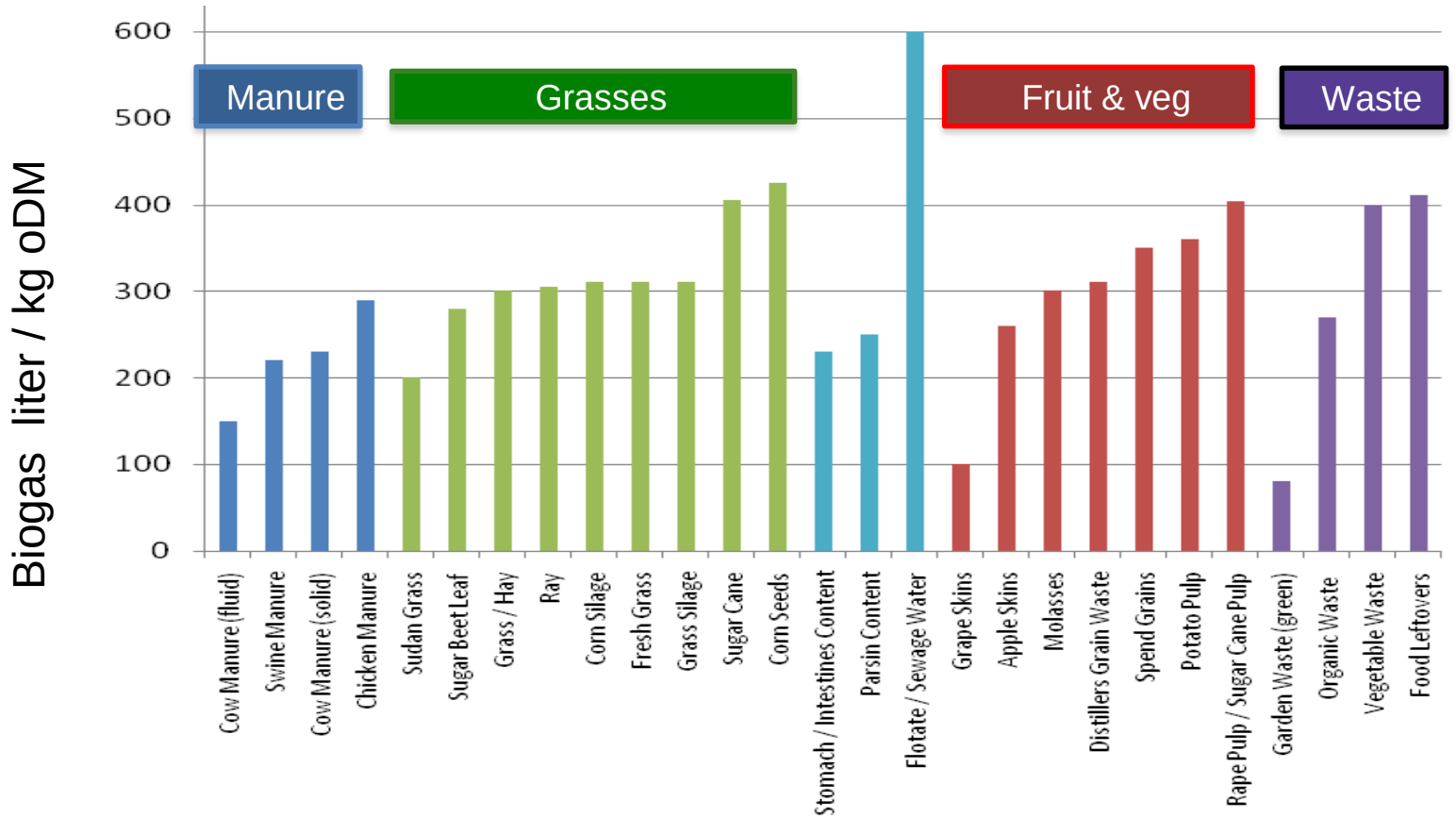
# Typical Waste Stream in Africa

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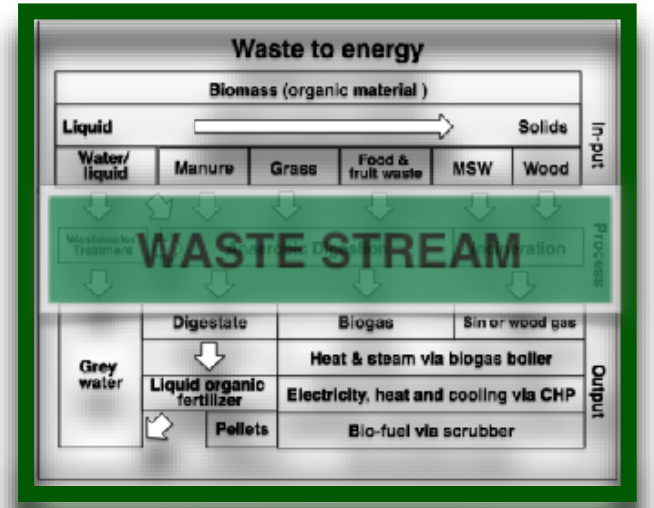


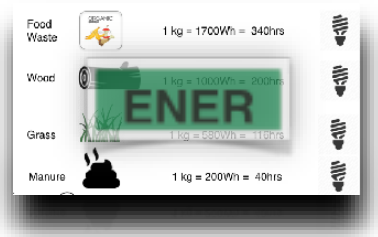


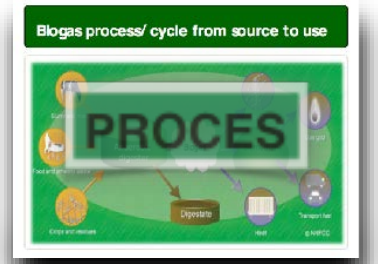



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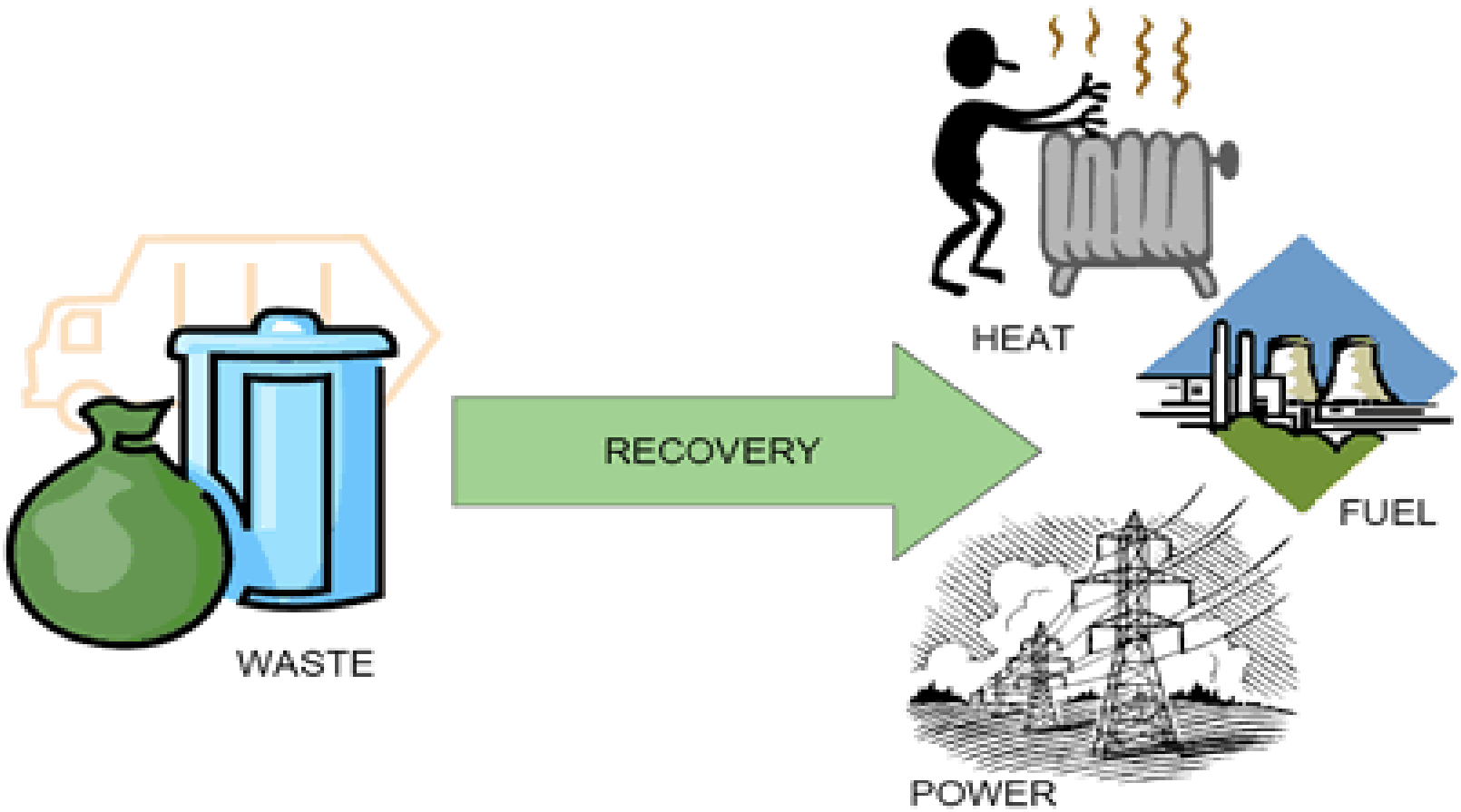
# Waste to energy process

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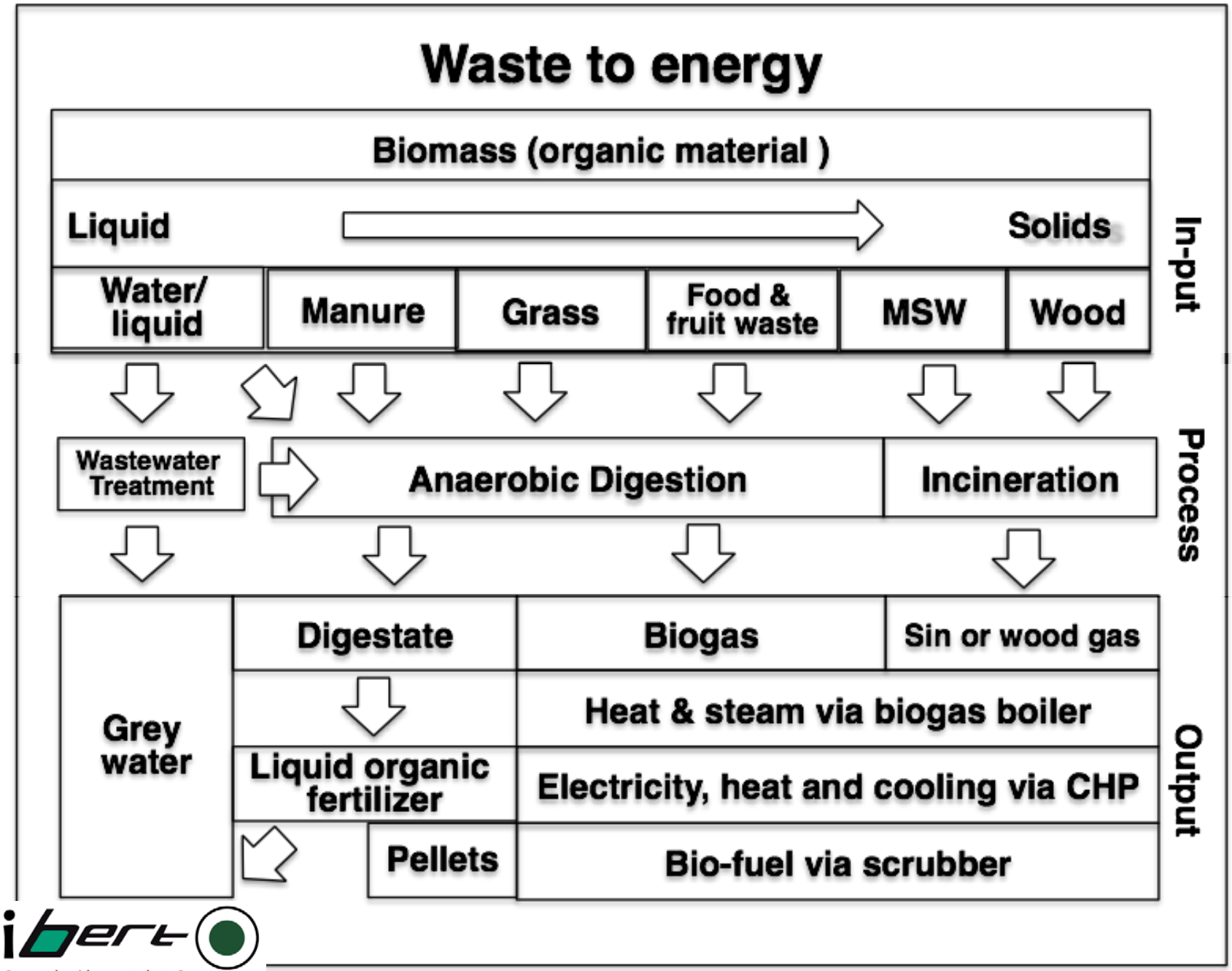
# Waste to energy

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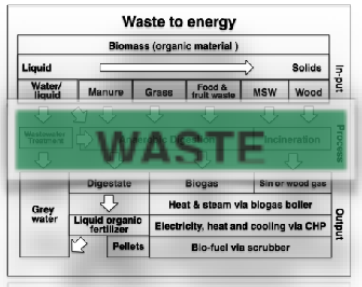



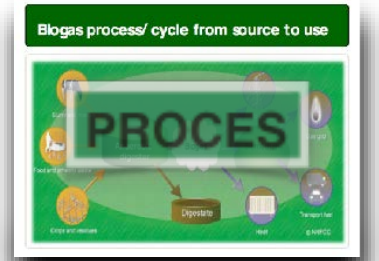



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# Energy balance

## Can only convert not create energy

| | | | |
|---|---|---|---|
| Food Waste |   | 1 kg = 1700Wh = 340hrs |  |
| Wood |  | 1 kg = 1000Wh = 200hrs |  |
| Grass |  | 1 kg = 580Wh = 116hrs |  |
| Manure |  | 1 kg = 200Wh = 40hrs |  |

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# Waste to energy potential in South Africa

| Wastewater | | MWth | MWe |
|---|---|---|---|
| Domestic black water | **Municipal WWTP** | 842 | 253 |
| Animal husbandry | Feedlots (solids & liquids) | 245 | 65 |
| | Rural cattle (kraaled at night - solids only) | 3445 | 1035 |
| | **Dairies (solid & liquid)** | 121 | 36 |
| | Piggeries (solid & liquid) | 715 | 215 |
| | **Poultry (solid only)** | 2976 | 894 |
| | Red meat & Poultry Abattoirs (liquid waste only) | 55 | 17 |
| Fruit processing | **Waste water only, no pulp or pomace** | 68 | 20 |
| Winery | | 3 | 1 |
| Distillery | Grain, grape & sugarcane (molasses) | 70 | 21 |
| Brewery | | 17 | 5 |
| Pulp and paper | | 100 | 30 |
| Petrochemical waste | | 48 | 14 |
| | | 8705 | 2606 |

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# CHP Biogas usage vs Feedstock

| CHPs | | Biogas input m3/hr required | Typical minimum daily tonnage required to achieve gas production Note: only indication, material must be available 365day/ year | | |
|---|---|---|---|---|---|
| Electrical power output (KW) | Thermal power 80C output (KW) | | Dairy cow slurry | Fruit/ food waste | Napier grass (green) |
| 20 | 26 | 9,6 | 7 | 2 | 2 |
| 30 | 39 | 14,4 | 10 | 3 | 3,5 |
| 45 | 58,5 | 21,6 | 15,5 | 5 | 4,5 |
| 50 | 65 | 24,0 | 17 | 6 | 5 |
| 64 | 83,2 | 30,7 | 21,5 | 7,5 | 6 |
| 75 | 97,5 | 36,0 | 26 | 8,5 | 7 |
| 135 | 175,5 | 64,8 | 48 | 16 | 13,5 |
| 220 | 286 | 105,6 | 75 | 25 | 20,5 |
| 360 | 468 | 172,8 | 122 | 40,5 | 33,5 |
| 530 | 689 | 254,4 | 180 | 60 | 49,5 |

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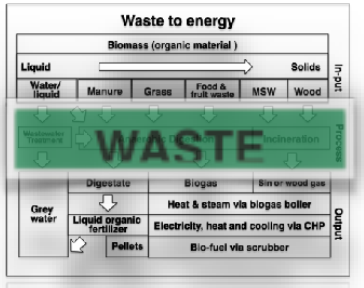


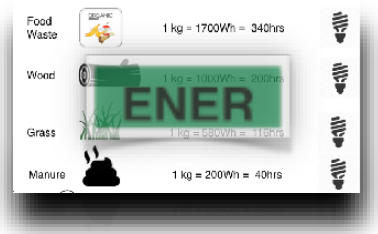




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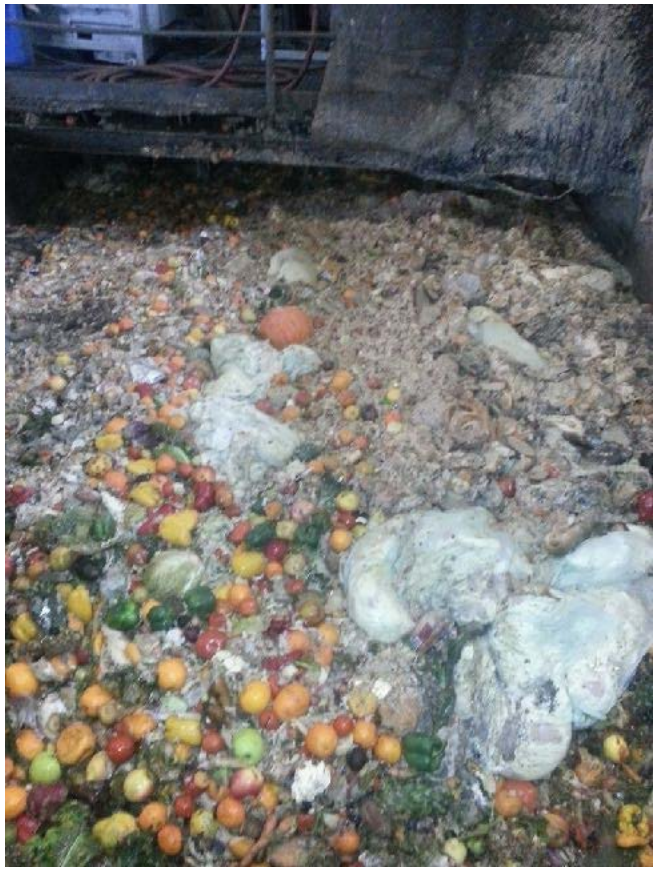
# Biomass – Municipal Solid Waste Seperation



Mixed food bio waste

Processing plant

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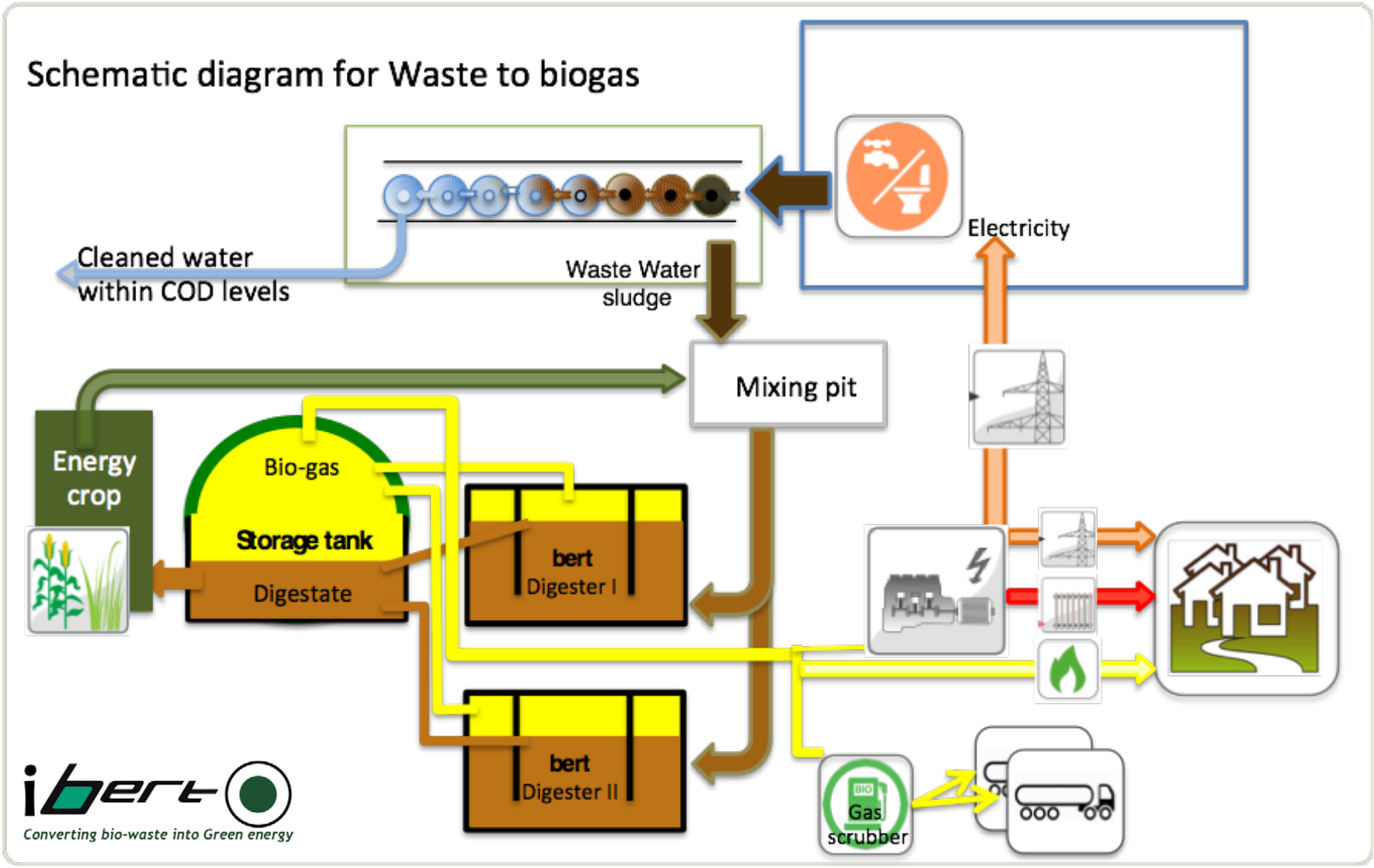
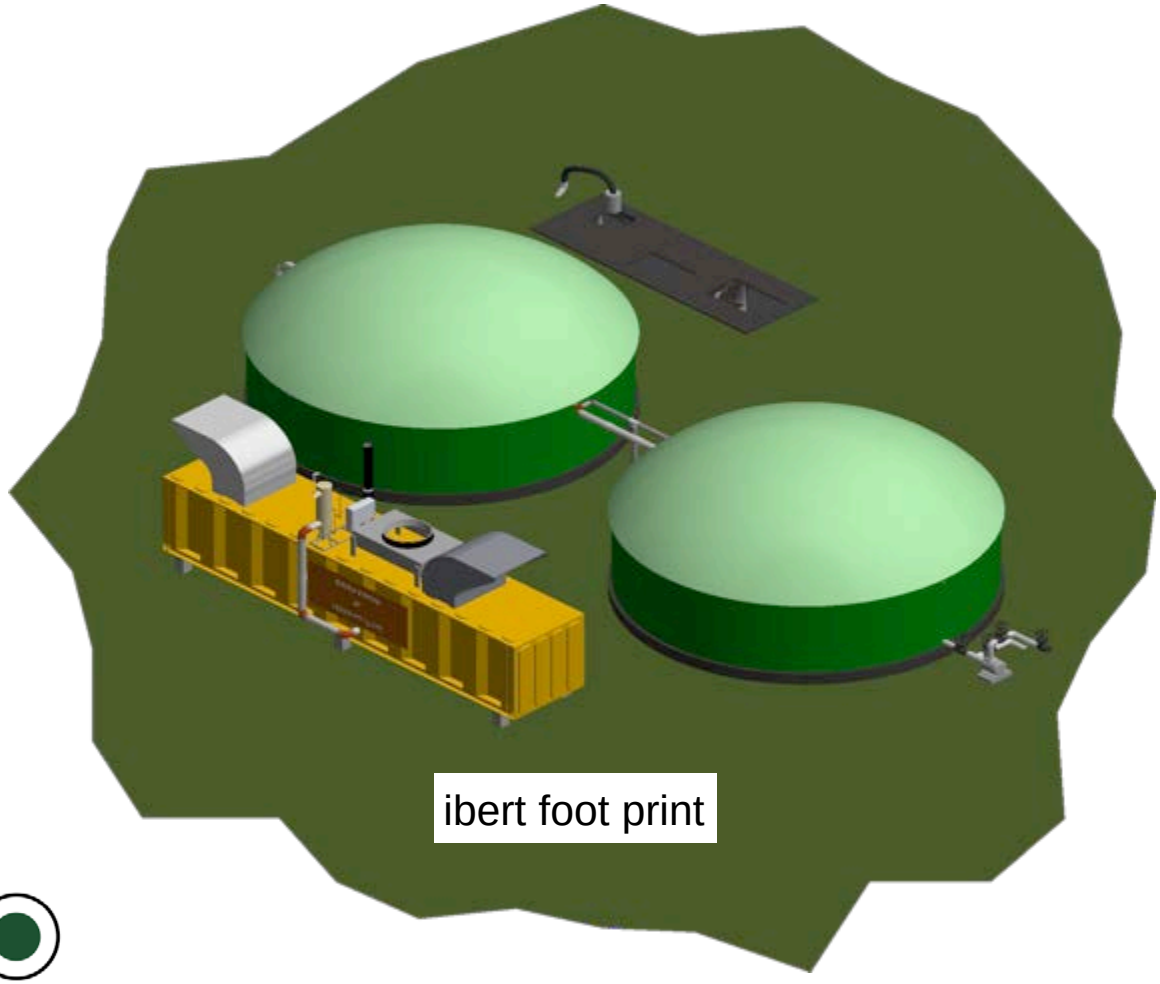
# Waste to energy process

# Biogas process / Cycle from source to use



# Biogas Plant Standard Footprint



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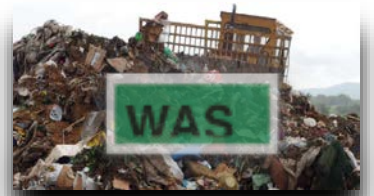


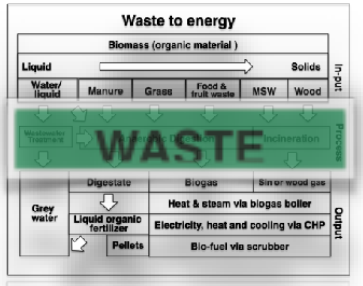


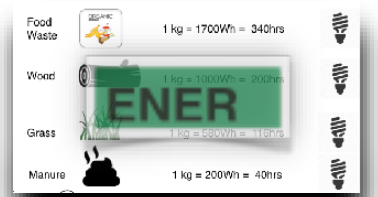




Processi ng plant

# Benefit of biogas can

**Reduce GHG**

**Produce renewable energy**

**Reduce use of fossil fuels**

**Reduce waste in environment**

**Produce organic fertilizer – improve soil quality**

**Reduce water usage**

**Create sustainable jobs**

**Stimulate farming – energy crop production**

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# Biogas to Biofuel for transport

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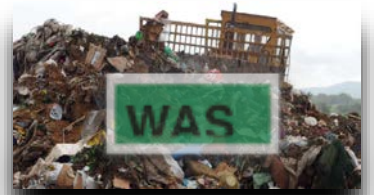


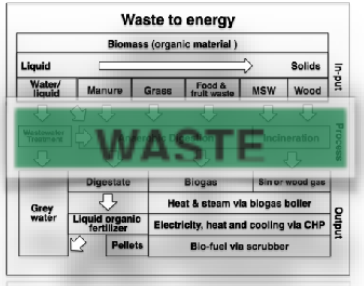


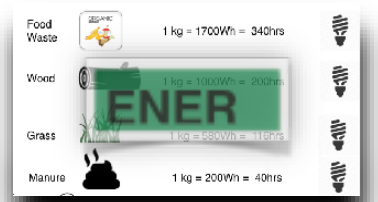


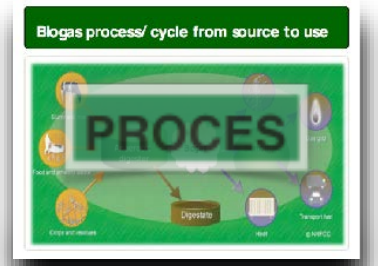



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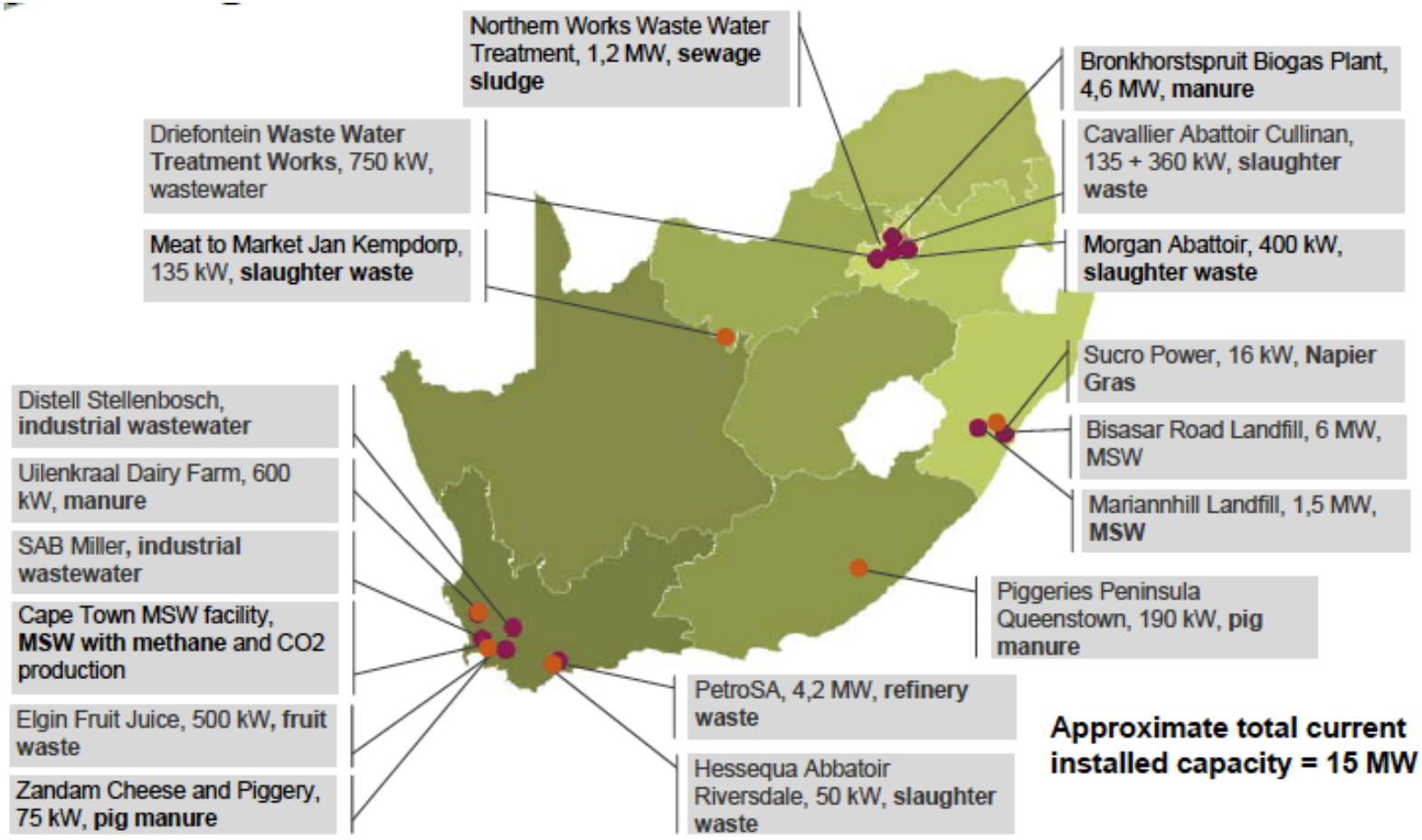
# Biogas plant in South Africa

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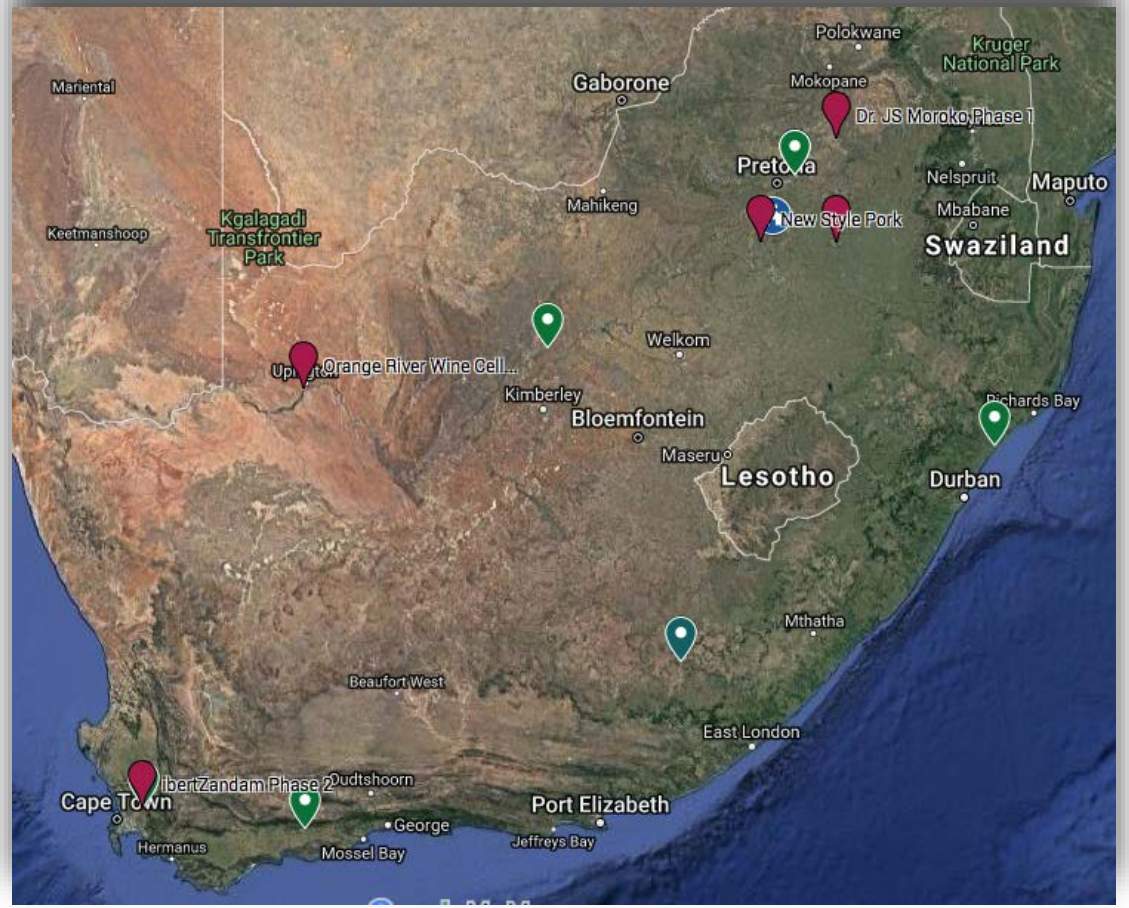
# Reference sites South Africa
# ibert plant overview




Operational

Under Construction

Designprocess

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# Reference sites South Africa
# Plant #1 Meat to Market Jan Kempdorp - 2012

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600m$^3$ AD, 135 kW CHP, 15 t/day slaughter waste

# Reference sites South Africa
# Plant #2 Hessequa Abattoir – Riverdale - 2014

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400m$^3$ AD, 50 kW CHP, 10 t/day slaughter waste

# Reference sites South Africa
# Plant #3 No2 Piggeries – Queenstown - 2015

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600m$^3$ AD, 190 kW CHP, 40 t/day pig manure

# Reference sites South Africa
# Plant #4&5 Cavalier Abattoir – Cullinan - 2015/17

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3 x 500m3 AD & storage, 340 kW CHP, 45 t/day, abattoir waste

# Reference sites South Africa
# Plant #6 Zandam Cheese & Piggery (W/Cape) 2016

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500m$^3$ AD, 75 kW CHP, 25 t/day pig manure

# Reference sites South Africa
# Plant #7 Thorny hill KZN – energy crop - 2016

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200m3 AD, 16 kW 2,5t/d Napier grass

# Conclusion

**Biomass**

**is**

**“Renewable resource”**

**IBERT have the**

**Technology available in South Africa**

**to make this a reality**

Converting bio-waste into Green energy


BIO-GAS
Q10
Q10
Last fuel station for 90 km