



The Hidden Value of Organic Wastes

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Outline



- Anaerobic Digestion and Biogas 101
- Anaerobic Technology
- What Organic “Waste” is “Food”
- Examples
- Feasibility



Waste to Energy Concept



- Process of recovering energy from waste in the form of Heat / Electricity / Fuel
- W2E processes:
 - Non-thermal – **Anaerobic digestion**, Fermentation, Composting
 - Thermal – Incineration, Pyrolysis, Gasification
- Benefits:
 - Economic
 - Environmental
 - Social

Anaerobic Digestion



- Biological breakdown of biodegradable matter in the absence of oxygen
 - Concentrated colonies of bacteria
 - In the right environment they will munch their way through tonnes of material every day.
- Products:
 - Biogas (Methane and Carbon Dioxide)
 - ✦ Heat / Electricity / Transport Fuel
 - Stabilised Nutrient Rich Digestate
 - ✦ Fertiliser
 - Clean water for reuse



Biogas 101



- $0.35 \text{ Nm}^3 \text{CH}_4 / \text{kg COD}_{\text{digested}}$
- Calorific Value $\sim 36\text{-}39 \text{ MJ/m}^3 \text{CH}_4$

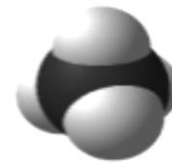
1 m³ of methane substitutes

0.9-1.1 l of diesel/petrol

1 m³ natural gas

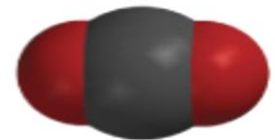
1.5-3 kg coal

3-3.5 kWh electricity



CH₄
methane

55-75%



CO₂
carbon dioxide

25-45%

1 tonne CH₄ = 21 tonnes CO₂

Biogas Uses



Simplest: **Burn it:** Boiler, drying, domestic fuel

80 – 90% Recovery



Biogas Uses



Simplest: **Burn it:** Boiler, drying, domestic fuel

More Complex: **Generate Electricity**

Power only: 30 – 40% Recovery

CHP: 80 – 90% Recovery

Sell Electricity or offset
own costs



Biogas Uses



Simplest: **Burn it:** Boiler, drying, domestic fuel

More Complex: **Generate Electricity**

Most Complex: **Transport Fuels**



Dried fertiliser
N:P:K = 6:3:4



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Clean Water Reuse



Secondary aerobic treatment

- **Class B recycled water quality**

Reverse Osmosis;

- **Class A recycled water quality**



Anaerobic Technology – Low Rate



Lagoon Based

Tank Based

ADI-BVF[®]

ADI-CGR[®]

simple,
efficient,
low-maintenance



Anaerobic Technology – High Rate



ADI-ECSB

**Small footprint,
Enhanced COD removal,
Higher biogas yield**



**Higher Capital and
Operating Cost**

ADI-AnMBR



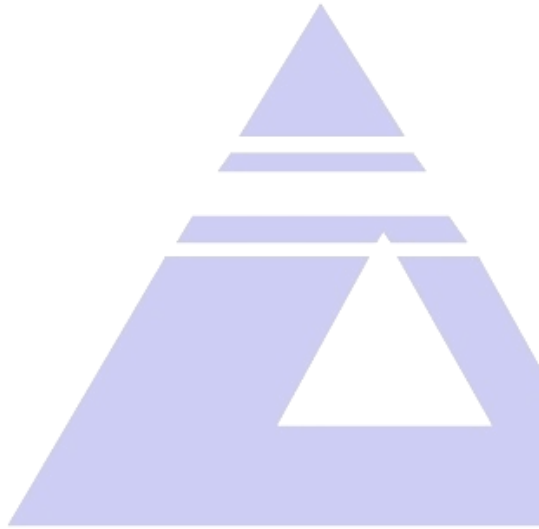
Organic Food Sources



Organic Food Sources



Organic Food Sources



Organic Food Sources



Organic Food Sources





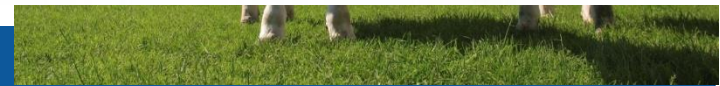


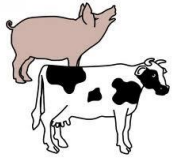


Waste Organic Material = Renewable Fuel



HD-WALLPAPERS9





Energy of waste



Waste	Wet mass methane potential* (m ³ CH ₄ /1000 kg)
Sewage Sludge	6-10
Cattle Manure (outdoor pen)	10
OFMSW	15-190
Grape Marc	45
Food grease	340
Food waste	79
Fruit & Vegetable Waste	35

* References can be provided upon request, SMP is dependent on the conditions and substrate quality

Example - Sydney Waste



- 2 x Anaerobic CSTR digesters
- Designed for 82,000 t/y of source segregated food waste and industrial sludges/flotation foams
- 26,000 m³ biogas per day
- Products:
 - dried fertiliser,
 - liquid fertiliser concentrate,
 - electricity ,
 - treated water
- Designed for 3 x 1.3MW_{el}
- Footprint of less than 1.5 ha

Example - Sydney Waste



Feasible in Regional SA?



- Possible drivers:

- Avoided cost for waste disposal
- Avoided cost of energy
- Trade Waste compliance
- Waste Minimization act 2008
- Odour control
- Avoidance/minimisation of electricity peak demand charges
- Demand for heat

- Risks:

- FEEDSTOCK!!!
 - ✦ Freely available
 - ✦ Secured (Contract)
 - ✦ Minimum amount of contaminants
 - ✦ Preferably available all year round
- Established market for the products

FEASIBILITY IS PROJECT-SPECIFIC, must be assessed individually

Analytical Planning Steps



- **Assess the resource**
 - Availability
 - Quality
 - Energy content
 - Transport costs
- **Estimate benefits**
 - Avoided costs of energy, disposal
 - Alternative disposal techniques
 - Suitability of benefits for core objectives
- **Technology Review**
 - Technology costs
 - Site Selection
 - System Design
- **Procurement Options Assessment**
- **Full Economic Assessment**



ADI Systems



- Design and construction of industrial/municipal wastewater treatment systems
- 200+ operating installations and decades of application experience
- A wide range of technologies
- Our offer:
 - waste characterization,
 - treatability and pilot studies,
 - feasibility assessment
 - process and detail design,
 - construction management,
 - commissioning,
 - operator training,
 - start-up
 - ongoing aftercare service for long-term operations assistance



THANK YOU



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