Piggery Digester Systems - Kiwi Technology at Work

Jürgen H Thiele
Waste Solutions Ltd, New Zealand
Email: *jurgen.thiele@wastetechnz.com*
021 780 727

Waste Solutions Ltd

Through the offices of the Duffill Watts and Downer EDI Group of Companies, Waste Solutions Ltd provides local support and project management for its designs in many locations throughout New Zealand, Australia and South East Asia.

Waste Solutions
Biotechnology Group

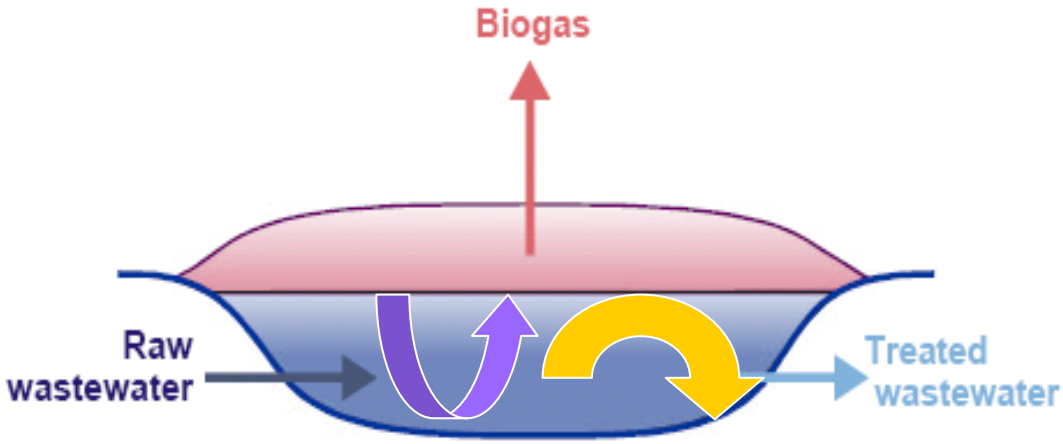
CIGAR
Ground-Breaking Technology

Digestion Technology Applications
(Design + Commissioning or Turn Key)

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Fundamental Working Principles of the Covered In Ground Anaerobic Reactor (CIGAR) Design Platform



Wastewater is pumped into the CIGAR, which collects the biogas (red) produced by the bacteria (blue)

- Substantially improved contact with the waste
- High active biomass (bacteria) retention efficiency
- High treatment reliability
- Payback period improved over covered lagoon

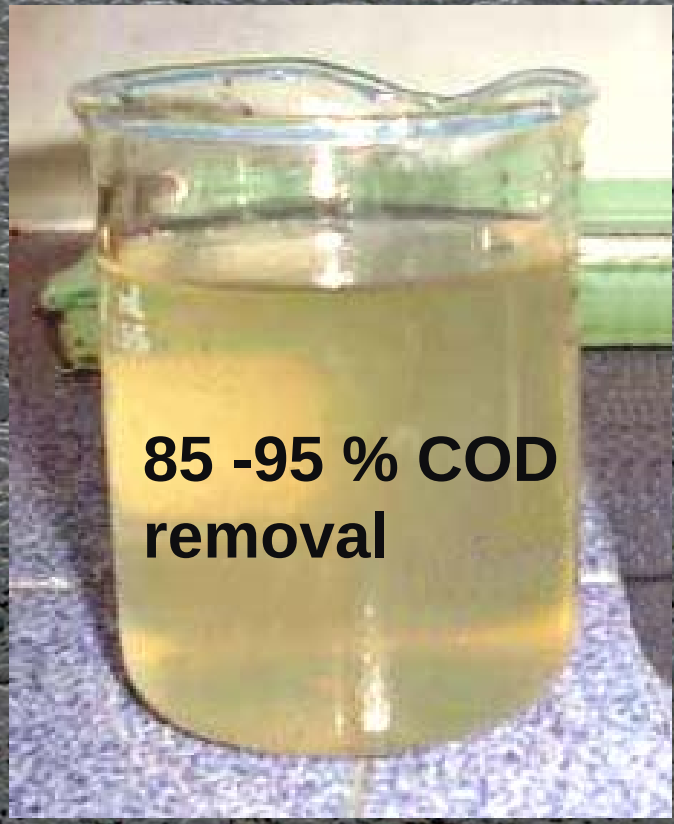
Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Wastewater Treatment Efficiency

Before

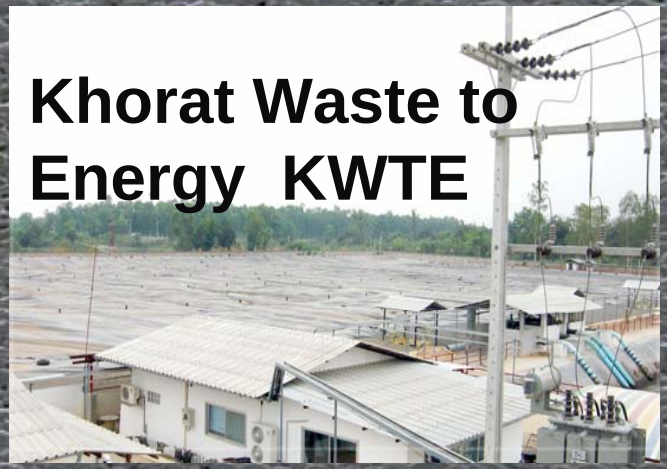
After



Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Examples of industrial CIGARs



Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Odor Destruction by Digestion of Piggery Effluent

Effluent odor:

- Urine
- Faecal matter
- Ammonia
- Fatty acids
- Skatol
- Sulfur cpds.
- Amines
- H_2S

Biogas:

- Extracted odours
- H_2S
- Methane, CO_2

Combustion :

- flare,
- boiler or
- genset/ motor

Digester (20 – 30 days):

- Destruction of volatile odorous material
- Extraction of volatiles into biogas
- pH adjustment to reduce volatility

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

The CIGAR Advantage

- Effective odor control
- Significantly smaller than lagoon
- Good reaction conditions
- Excellent flow buffer (manure and gas)
- Cheap effluent storage
- Farm scale construction methods
- Easily connected to flare, boiler or genset
- Carbon credits if lagoon is replaced with **CIGAR**
- Expected Credit **3.2- 5.3 t CO_2-equiv. /sow U/annum**
- **At 25 $/t CO_2-equiv.: 80 – 132 $NZ/sow U/annum**
- CAPEX cost range: 130 – 350 NZ$/sow U
- Loading rate: up to about 1 kg VS/m^3/day **(depends on waste strength !!)**

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

The CIGAR Requirements

- Requires more heating than a tank
- 2-3 times larger “foot print” than a tank
- 10 times smaller footprint than a lagoon
- $ advantage at sizes above approx. 500 m^3

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Floating cover retrofit to existing lagoon in NZ

Cover costs: 120 $/m^2 installed

about 510 $/sow U

Loading rate: 0.10 kg VS/m^3/day

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

The alternative – tank digesters for smaller piggeries

- CAPEX costs about 600 $/m^3 (excl. genset / ice)
- simple heated digester: approx. 1500 $/ sow U
- additional costs depends on biogas use/automation
- hot water option for the piggery extra benefit
- hot water income up to 140 $/sow U /annum (15 c/kwh)
- small foot print – good reliability
- total odour control by boiler

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Pig Waste Co-Digestion Systems

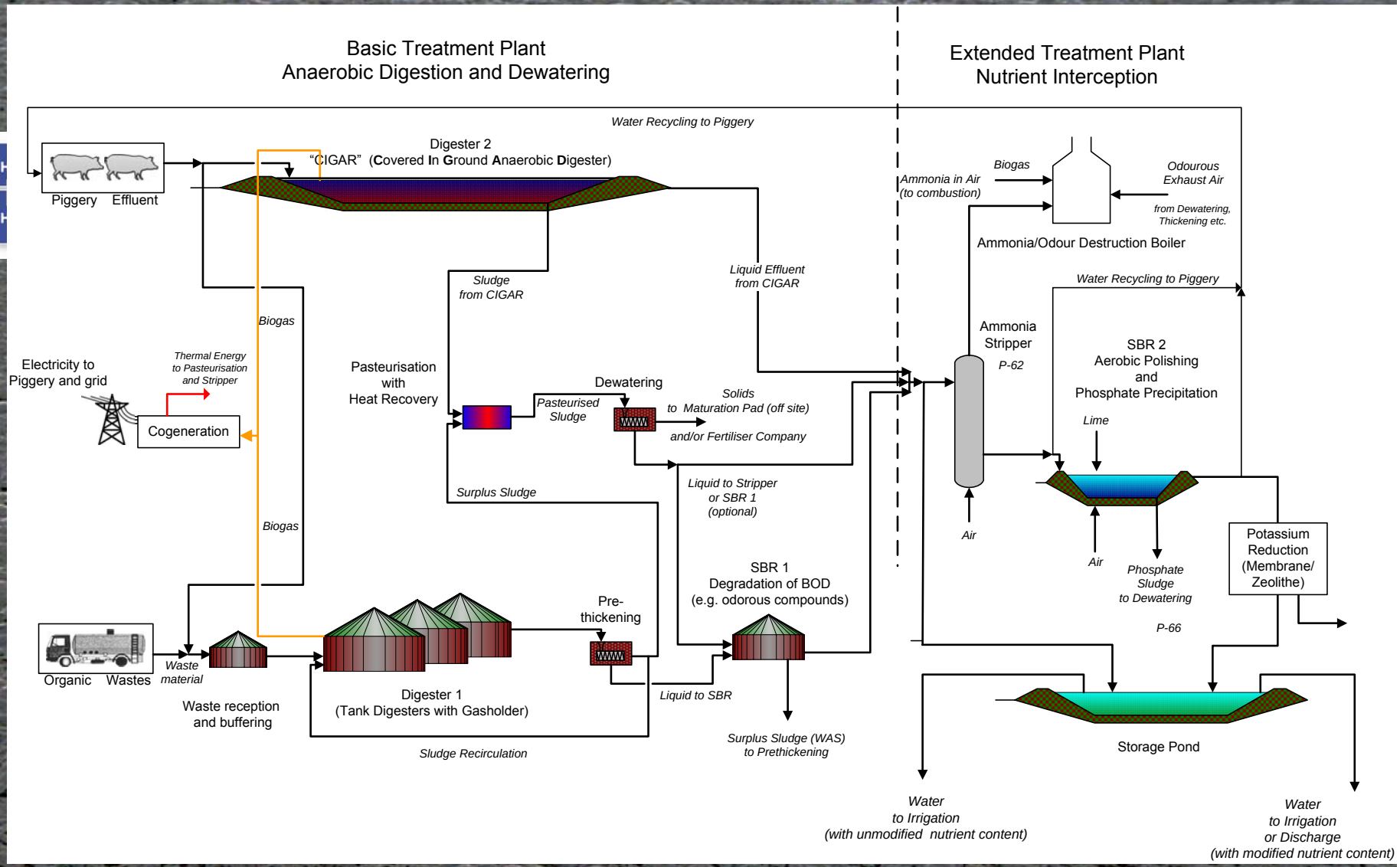
Co-digestion : Waste + Industrial Feedstocks

- Manure/ Sewage Sludge
- Food Residuals
- Primary Processing
- High Lipid Waste

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Application Examples



Waste Solutions Biotechnology Group

CIGAR Ground-Breaking Technology

Conclusions

- Range of options for different piggeries from about 50 sows up to 5000 sows
- **CIGAR** advantage from about 200 sows up
- **CIGAR** payback depends on carbon credits
- Less than 2 years payback for 500 sows up
- Lagoon cover alternative “quick fix” for odor
- Site specific options review recommended

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology

Questions?

Operational Aspects / Opportunities

▶ Wind	CIGAR cover held down by negative pressure
▶ pH	effluent recycle option is standard
▶ Variable Load	equalization through large volume
▶ CH_4 productivity	several fold improved by ABR technology
▶ Scum	dedicated hydraulic/mechanical control
▶ Sludge	sludge wastage pump/pipework is standard
▶ Sludge	project specific additional solids management
▶ H_2S	additional in ground bio-scrubber offered
▶ Biogas quality	process design to improve gas quality (CH_4, H_2S: molasses distillery waste)

Waste Solutions
Biotechnology Group

CIGAR
Ground-Breaking Technology