

Anaerobic Digesters in Industry

Why aren't there more of them in New Zealand ?

Current Industrial Digesters

Where gas biogas is generated for beneficial use, in addition to anaerobic degradation

- ▶ Fonterra Tirau
 - Large covered lagoon, solids partially emptied on an annual basis
- ▶ Globe Fisheries, Port Chalmers
 - WSL designed system, produces fertilizer
- ▶ Piggery Waste
 - Somewhere in the Wairarapa
- ▶ What else ??

Other Digesters

- ▶ Lots of WWTP digesters
 - Which work reasonably well, (some could be much better)
 - They generate significant electrical cost savings
- ▶ Some anaerobic lagoons with no gas collection
 - A few meat works have these
- ▶ Quite a few crusty ponds
 - In some small rural WWTPs
 - On dairy farms

“Partially Successful Failures”

▶ Fonterra Te Rapa

- At about \$6M plus escalation, surely the most expensive failure
- A good case of “superficial design syndrome”

▶ Alliance Lorneville

- Flocculant UASB, worked until operating expertise went elsewhere

▶ Fortex Mosgiel

- Site down-sized, operation became intermittent and too much trouble, operator errors, digester now used for buffer storage





orneville



Cedenco

“Partially Successful Failures”

▶ Cedenco Gisborne

- Tomato waste, digester undersized for variations in conditions, too much trouble to operate

▶ Piggeries

- Engineered covered anaerobic lagoons at Bardfield Piggeries in Tauranga and Roger Johnson’s piggery near Cambridge
- The digesters worked fine, the piggeries simply closed.

What are the lessons ?

▶ Get the design right

- Accepting an undersizing bid because it is the lowest cost is not smart
- Most aspects of the process actually need careful thought
- Design for simplicity of operation

▶ Get the attitude right

- Operating a bio-process is different from operating a landfill
- Anaerobic processes take more skill than aerobic processes

▶ Get the economic fundamentals right

- Take a long term view
- Only proceed if the economic drivers are firm

Potential for Industrial AD in NZ

- ▶ (Not focussing here on farm or WWTP)
- ▶ Is there really any serious potential in NZ?
 - A fair answer is “in some cases”
 - Research is expanding possibilities
 - Energy cost and greenhouse gas issues are shifting perception from “why bother?” to “how can we make this work?”
- ▶ Why is NZ different from overseas?
 - Temperature
 - Size and types of industries
 - Proximity to the sea
 - Low cost landfills or land disposal
 - Low population and industrial density
 - Cheap and freely available water

What are the Factors ?

- ▶ Not one set of criteria, but many niches
- ▶ Strength
 - Say COD > 2,500 unless soluble carbohydrate
- ▶ Size
- ▶ Temperature
 - Warm or hot
 - Proximity to waste heat

What are the Factors ?

- ▶ Disposal costs
- ▶ Gas customer
- ▶ Location
 - Available land
 - Not near an ocean outfall !!
- ▶ Potential for Synergy
 - Important !!
- ▶ Operating Expertise
 - Ownership !!

What are the Factors ?

▶ Waste Composition

- pH
- Sulphates
- Fat, Protein
- Suspended solids
- Ionic components
- Potential for toxic or inhibitory substances

▶ Variability

- Seasonality
- Load variations

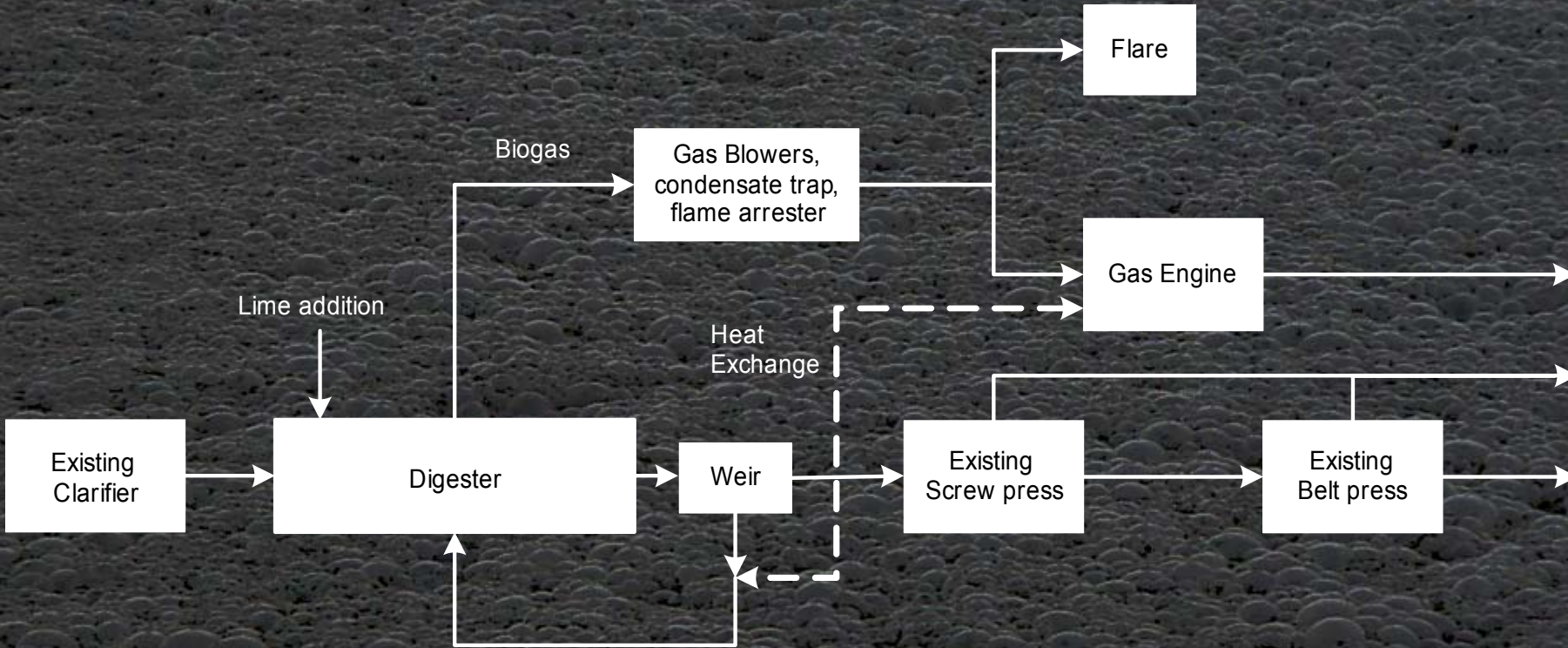
Some Quick Case Studies

- ▶ Dairy Sludge
- ▶ Pulp Mill effluent
- ▶ Fruit Juice
- ▶ Vegetable Processing
- ▶ Regional Industrial Low-strength Waste
- ▶ Regional High-strength Waste

Dairy Sludge

- ▶ DAF Float, currently soil injected
- ▶ COD load up to 8 T/day, 3,500 nm³/day biogas
- ▶ Extensive pilot plant trials demonstrated conditions for AD
- ▶ Pre-project cost estimate had IRR of 40%
- ▶ Proximity to WWTP digestion facility. This option had much higher IRR!!
- ▶ Too many conflicts of interest !!

Pulp Mill Effluent



Pulp Mill Effluent

- ▶ WW system under pressure
- ▶ Warm effluent, significant infrastructure in place
- ▶ Fibres, slow to digest
- ▶ Less than 1MWe output
- ▶ IRR 17%
- ▶ Better dewatering and combustion gave a better return

Fruit Juice Effluent

- ▶ Increase in trade waste charges
 - Objective not energy recovery
 - Exhaustive options review
- ▶ Soluble carbohydrate, some suspended solids
 - About 4 T/day COD
- ▶ Some infrastructure
- ▶ Innovative UASB design had IRR of >30%
- ▶ Better internal controls and water usage practices reduced IRR to below threshold

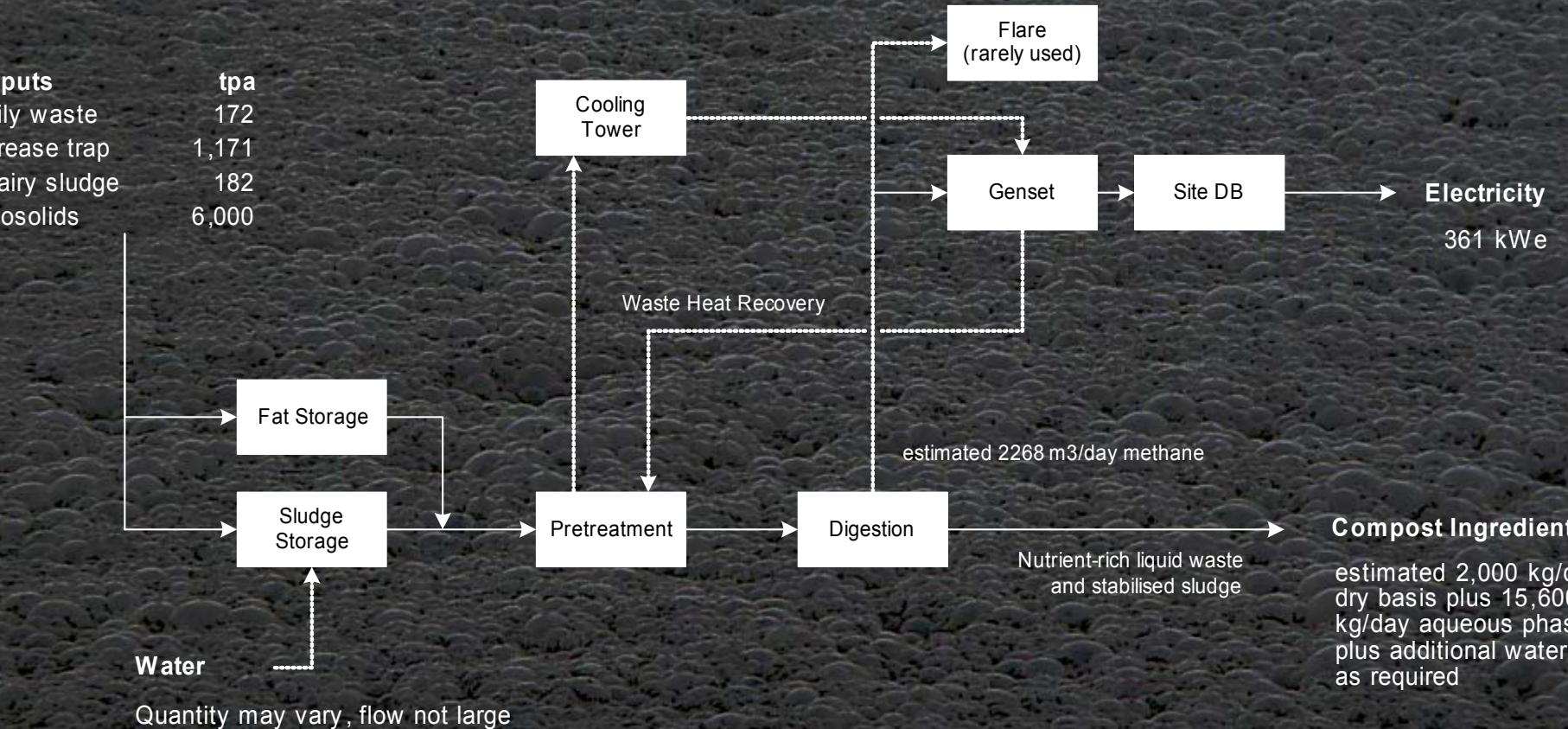
Vegetable Processing

- ▶ To meet trade waste conditions
 - 28 T/day COD
 - 100 days per year
 - \$300,000 per year gas savings
- ▶ In-ground digester possible
- ▶ IRR of 25-35%
- ▶ Lack of interest in operating a digester, preferred a mechanical solution
 - No interest in local synergy !!

Regional Industrial Low-strength Waste

- ▶ Washdyke Industrial Estate, Timaru
 - 7 ML/day
 - 16 T/day BOD
 - Other wastes in region
 - Has an ocean outfall !!
- ▶ In-ground digester possible
- ▶ Optimal Solution would require good understanding of contributor processes

Regional Industrial High-strength Waste



Regional Industrial High-strength Waste

- ▶ Not large
- ▶ A good example of synergy
- ▶ The AD feature was only a small part of waste collection and management proposal by others, client selected another option
- ▶ This kind of approach can be adapted to many regions.

What will the future bring ?

- for industrial AD, in NZ

- ▶ Some meat industry and dairy sites sites waste electricity on aerobic systems
- ▶ Most regions have a good case for a high strength waste - handling facility, probably at the WWTP
- ▶ Get past self-interest to regional interest (somehow)
- ▶ Operation contracts?
- ▶ Start within the factory, take a systems view
- ▶ Alternative sources of funding where a long-term view is feasible

