



Waste Solutions Ltd

High Rate Digesters for Tight Spots

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October 2004

Central Azucarera de Tarlac (CAT) The Philippines



Incoming fresh distillery slops



- 65 kg COD/m³
- 34 kg BOD/m³
- 6.6 % TS
- 4.2 g/L SO₄
- pH 4-4.5
- 100 C

Burning water ?

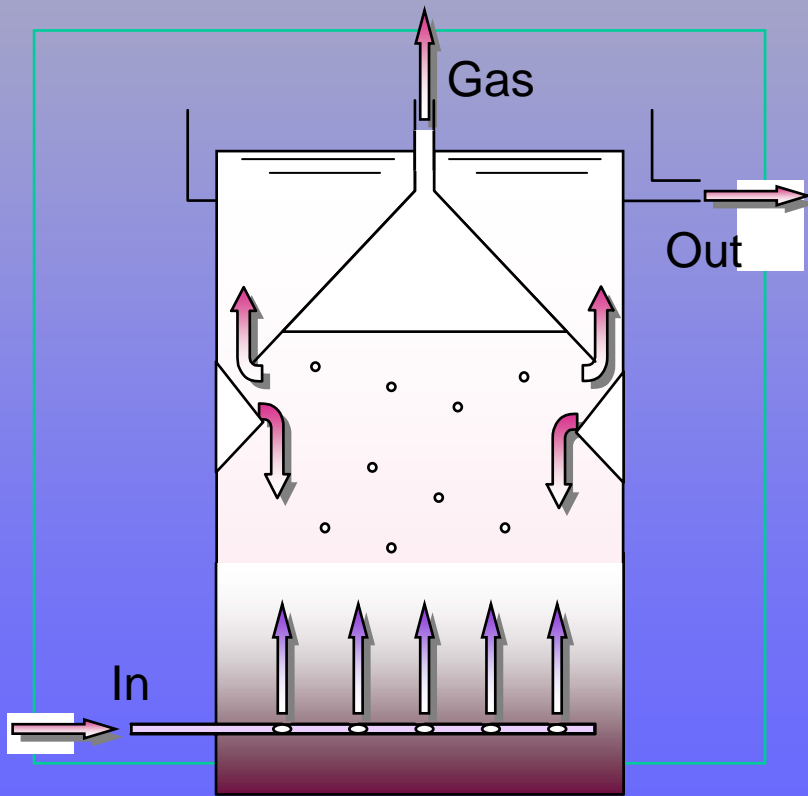


Impediments to Implementation

“Tight spot”:

- **High groundwater level makes low cost in ground digester option less attractive**
- **Sugar cane distillery waste is toxic to bacteria**
 - high sulfate
 - high H₂S
 - low pH (4-5)
 - high level of phenolics and refractory carbon compounds

The UASB reactor (Upflow Anaerobic Sludge Blanket)



High Rate Methane Recovery Options

Upflow Anaerobic Sludge Blanket reactor

- flocculent - mesophilic (2 V / V / day)
- flocculent - thermophilic (4 - 5 V / V / day)
- granular - mesophilic (5 V / V / day)
- granular - thermophilic (8 – 10 V / V / day)

Typical performance with soluble feedstock:

BOD removal efficiency: 95 %

COD removal efficiency: 85 %

Granular Anaerobic Sludge



How much is it worth ?

Carbon Credits:

1 MW_{therm} = 30,000 kWh fuel/day
= 2.15 t methane/day = 43 t CO₂ equiv. /day
= 344 US \$/day
= 110,500 US\$/year

Fuel Value:

1 MW_{therm} = 500 US \$/day saved (17 c US/L diesel fuel equ.)
= approx. 160,000 US \$/year saved

Total savings: 270,000 US\$/year / MW_{therm}

Total CAPEX: 175,000 - 260,000 US\$ / MW_{therm}

Impediments to Implementation

1. Failure of thermophilic digester (10 years ago)
2. “Seeing is believing”
3. Constrained space for construction
4. High rate of return required for investment
5. Specialist expertise required to design & install inexpensive digester systems
6. Competition from other low cost agro-industry by-products as fuel (bagasse, trash, husks, clearings etc)

Containerised UASB pilot plant CAT - The Philippines

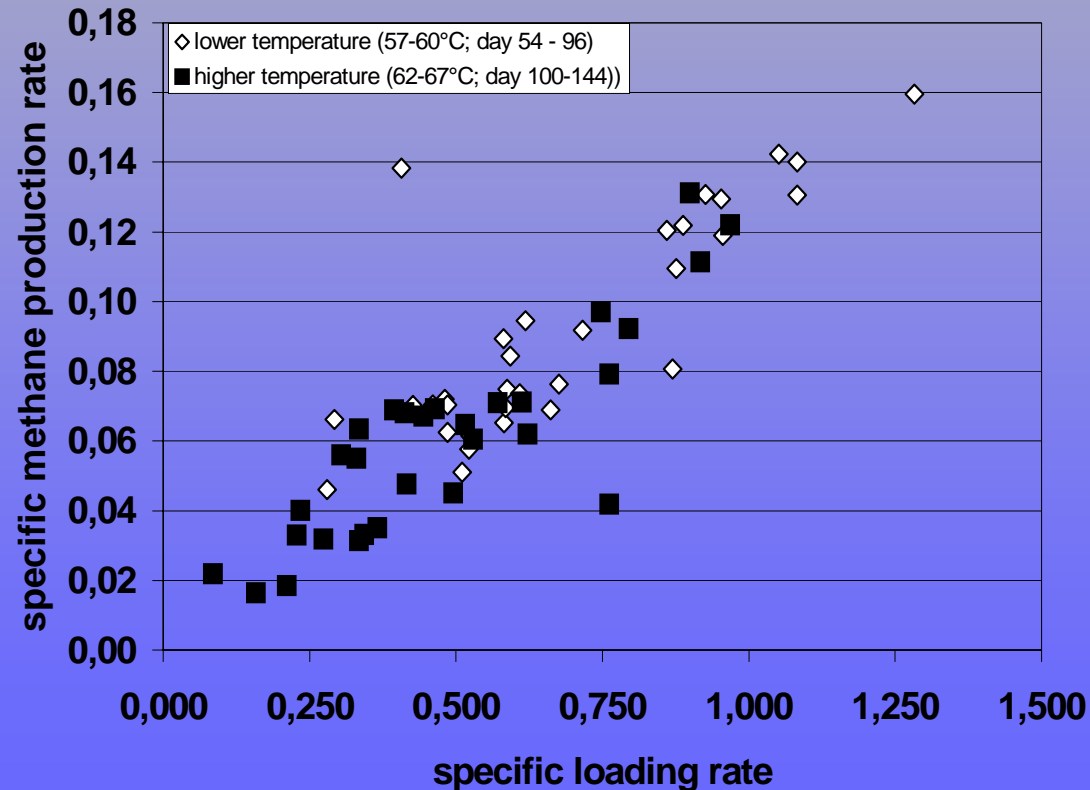


Internals of transportable pilot plant

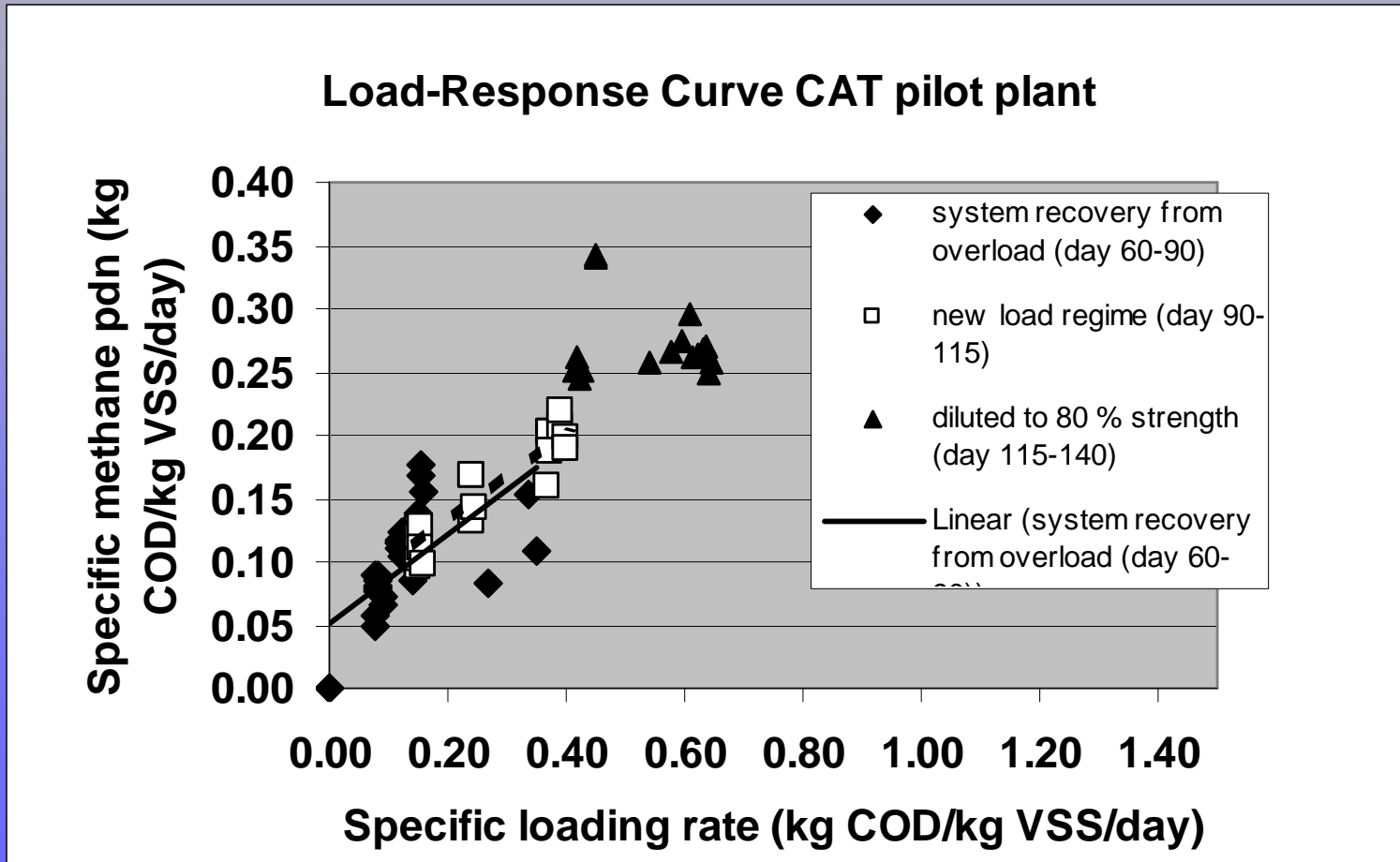


Temperature Elasticity

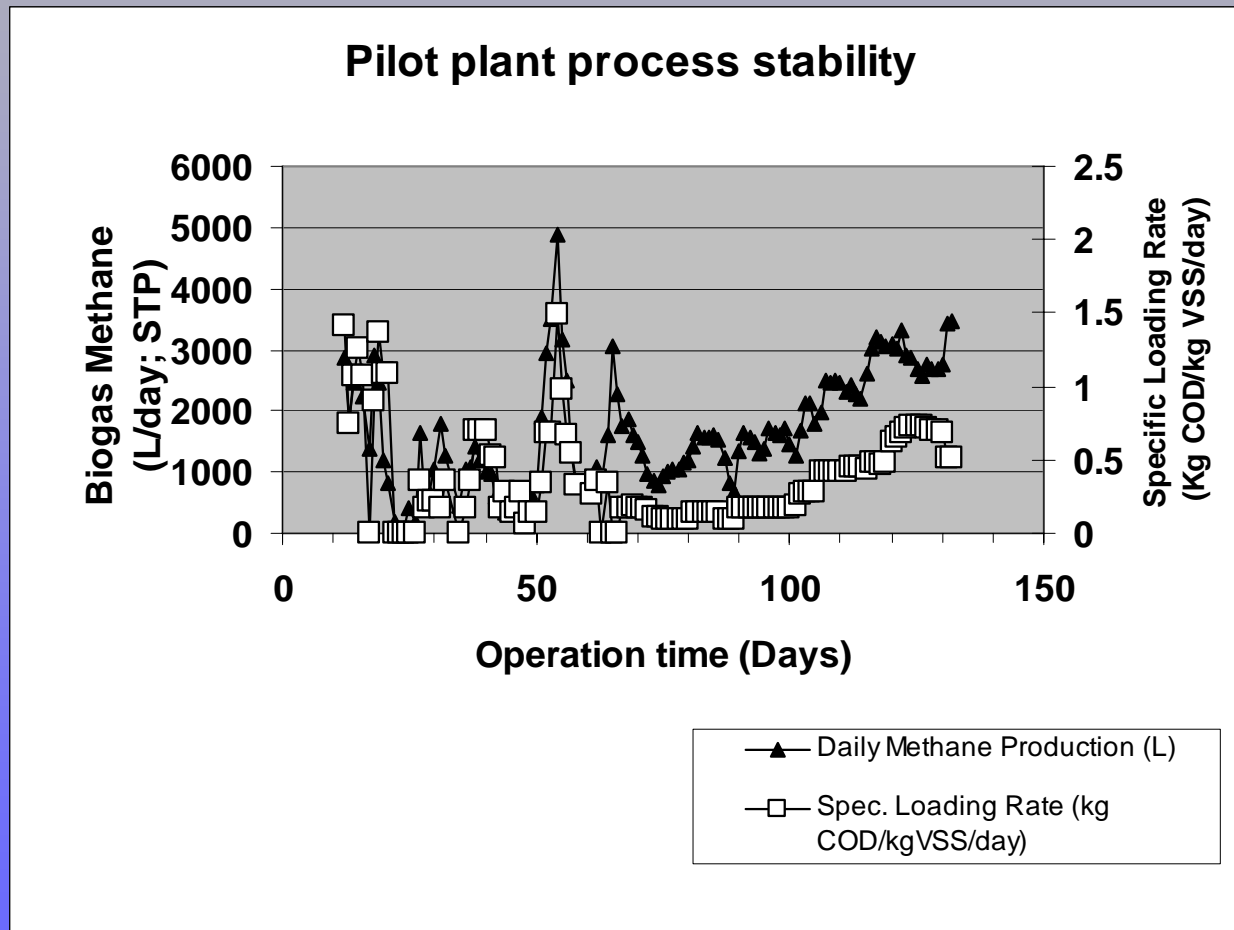
Laboratory scale – NZ with authentic culture



Load Response Curve on site



Load Elasticity

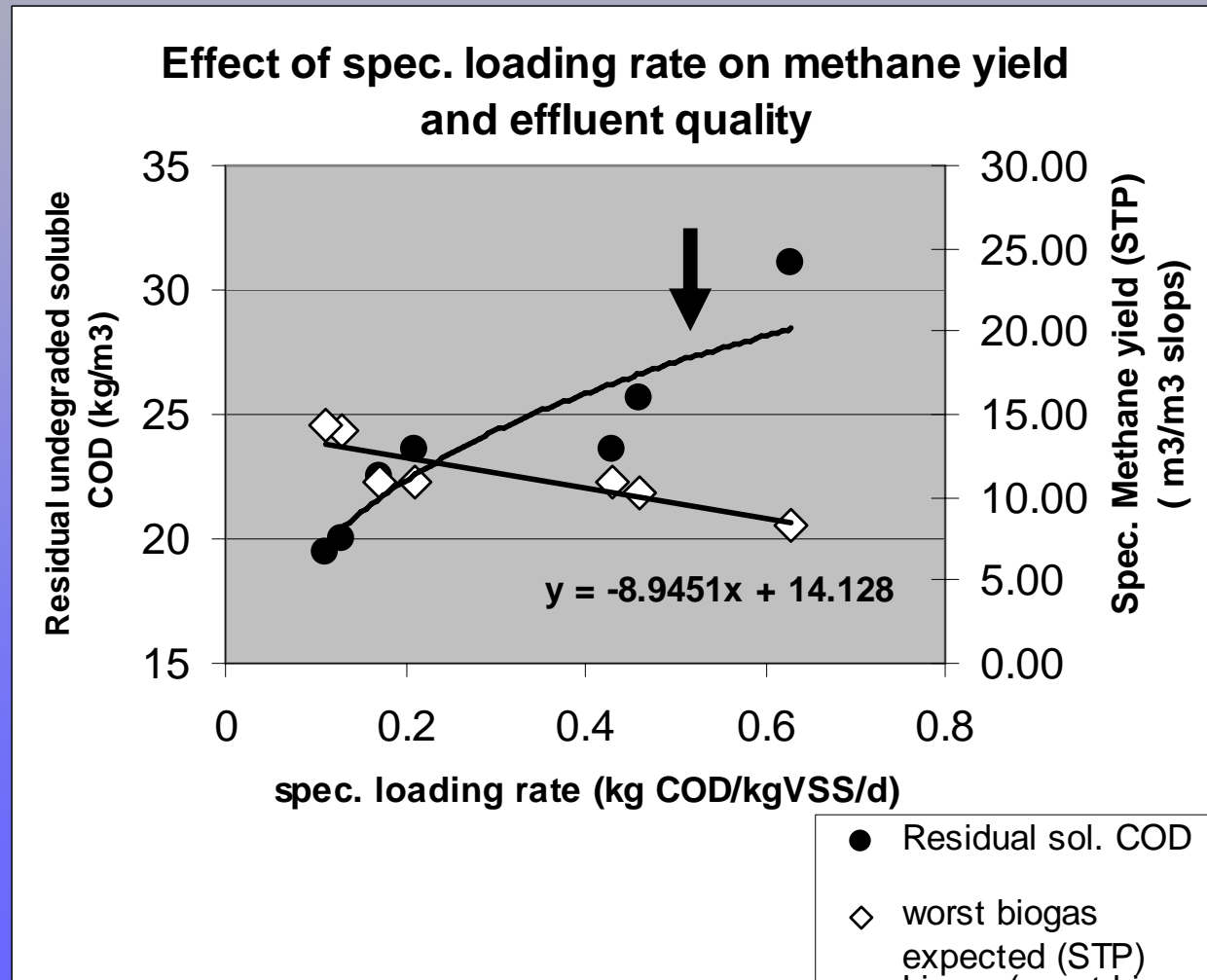


Low Cost Retrofit Option

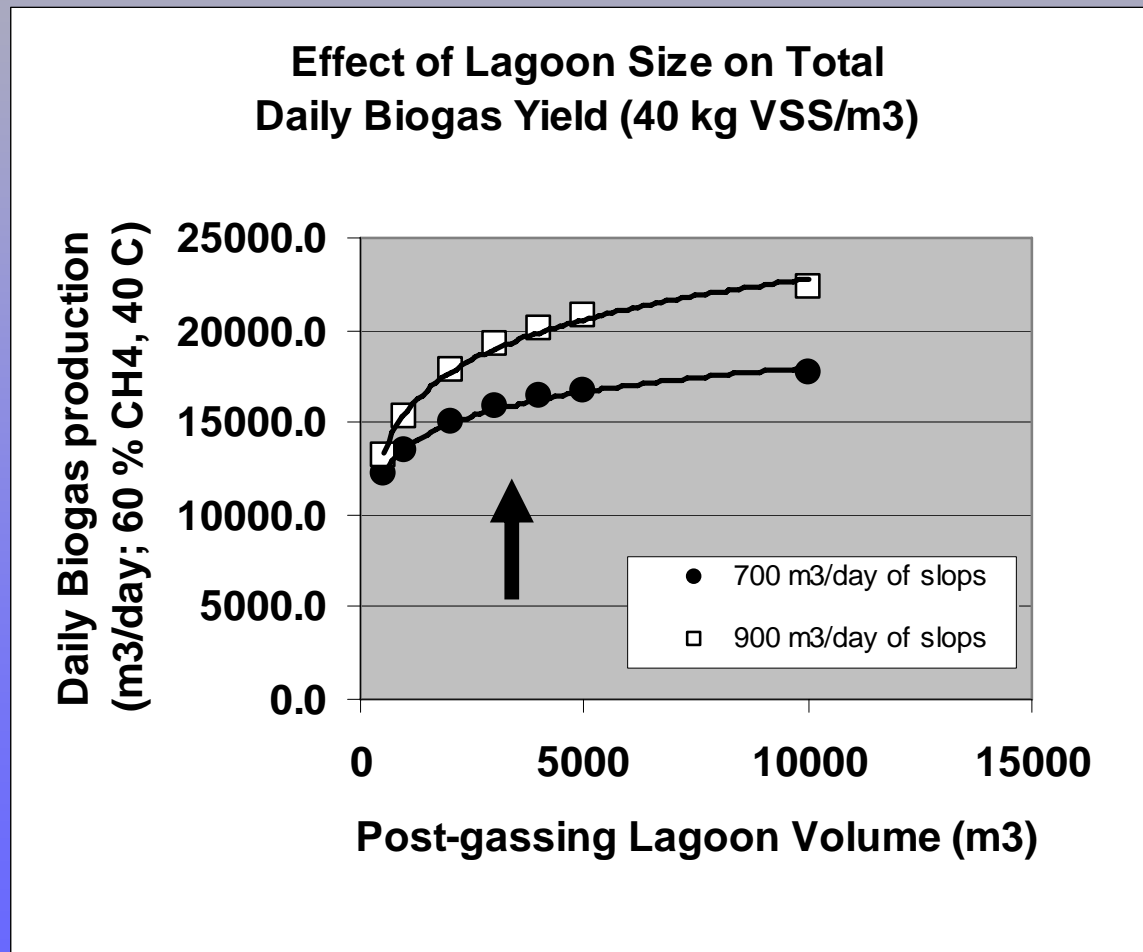


Thermophilic
Flocculent
UASB system

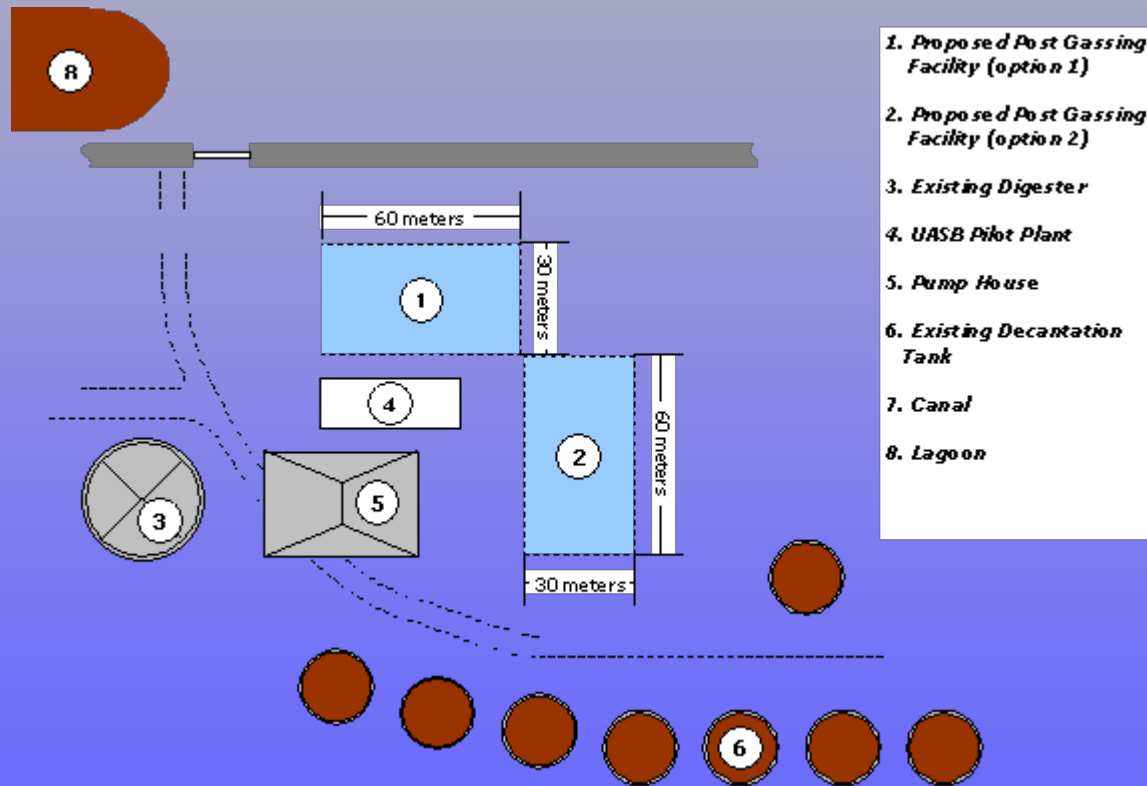
System Optimisation: Part A



System Optimisation : Part B



Constrained Site

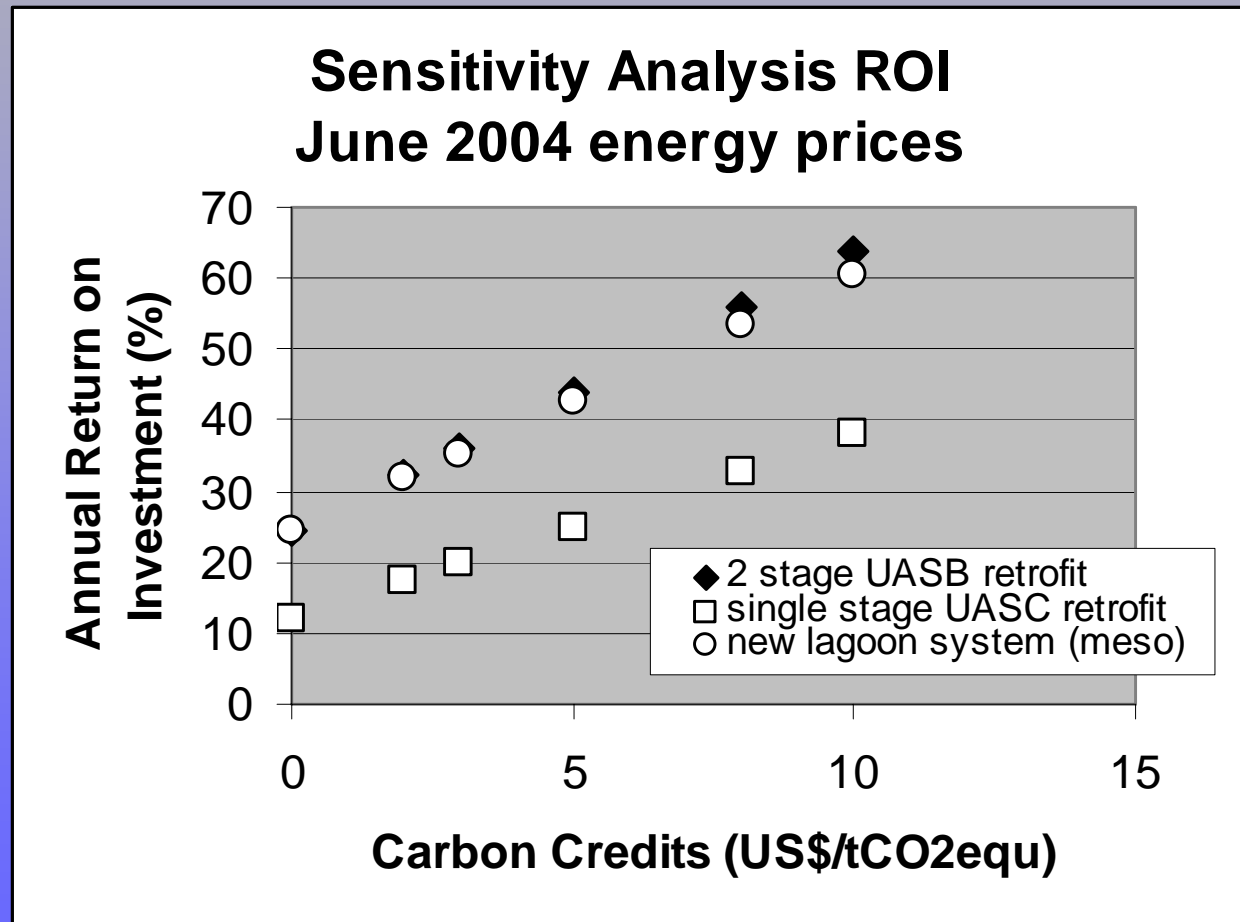


UASB Digester System Design

- **Robust performance (1/3 of maximum capacity)**
- **5000 m³ working volume**
- **23,000 m³ /day maximum biogas production capacity**
- **4.75 MW biogas energy (average)**
- **< 1.2 million US \$ CAPEX**
- **60 % COD removal**
- **90 % BOD removal**
- **100 % biogas use as boiler fuel**

Project funding by NZAID

Economically Superior



Conclusion:

- **Pilot plant tests ideal for risk management**
- **Low cost, compact, high rate system developed**
- **Thermophilic digester operation reduces costs**
- **Simple & inexpensive components used**
- **Re-use of existing assets**
- **4.75 MW of renewable boiler fuel generated**
- **CAPEX reduced to 50 % of comparable systems**
- **High return on investment**