



SIXTH FRAMEWORK PROGRAMME



Thermal hydrolysis for biosolids stabilization

Pretreatment for Anaerobic Digestion

Damien Batstone

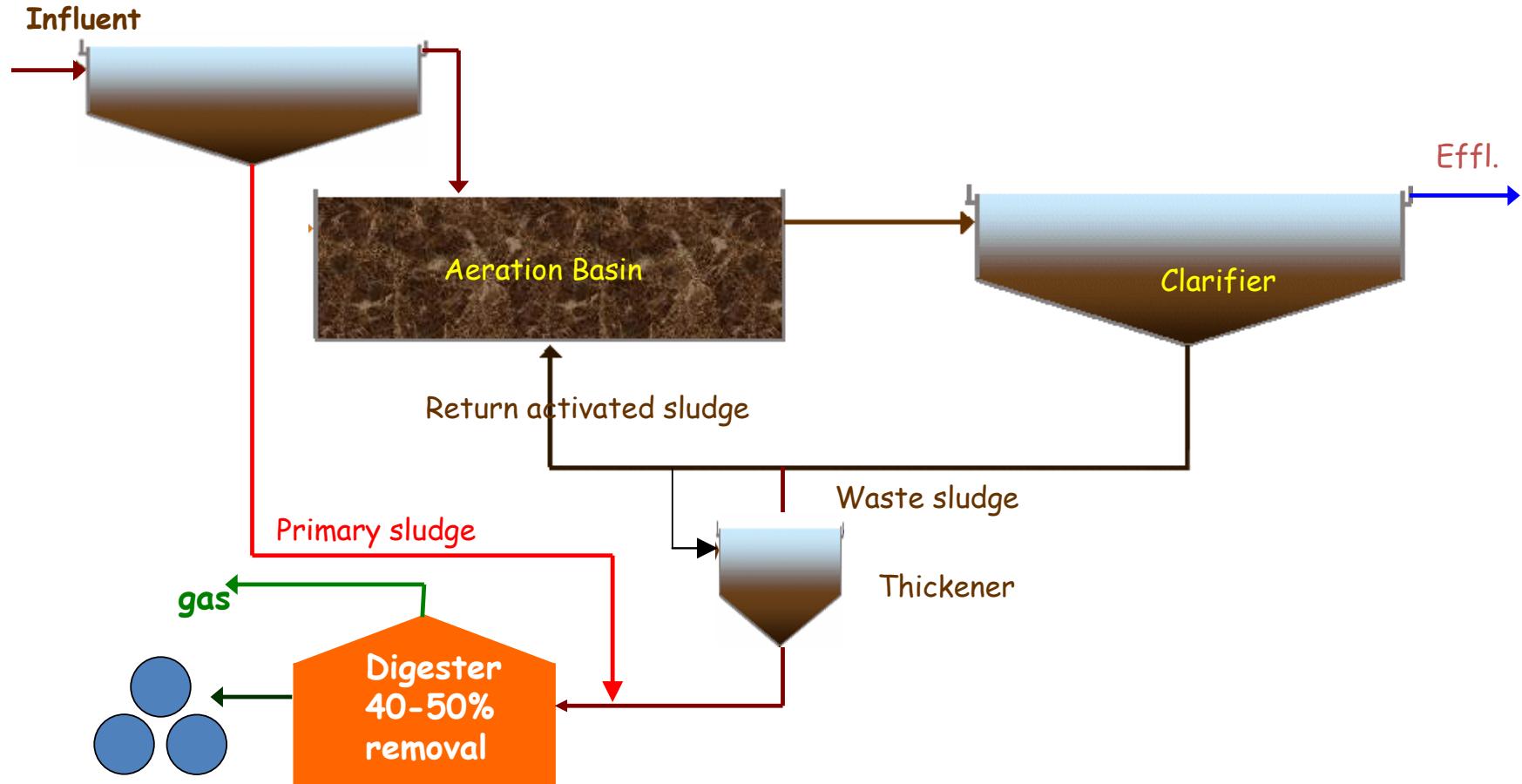
Advanced Water Management Centre, The University of Queensland



Neptune workshop: Technical Solutions for Nutrient and Micropollutants Removal in WWTPs

Université Laval, Québec, March 25-26, 2010

Sludge Steams from WWTP

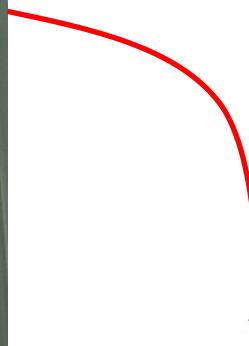


The Scale of Biosolids/Sludge

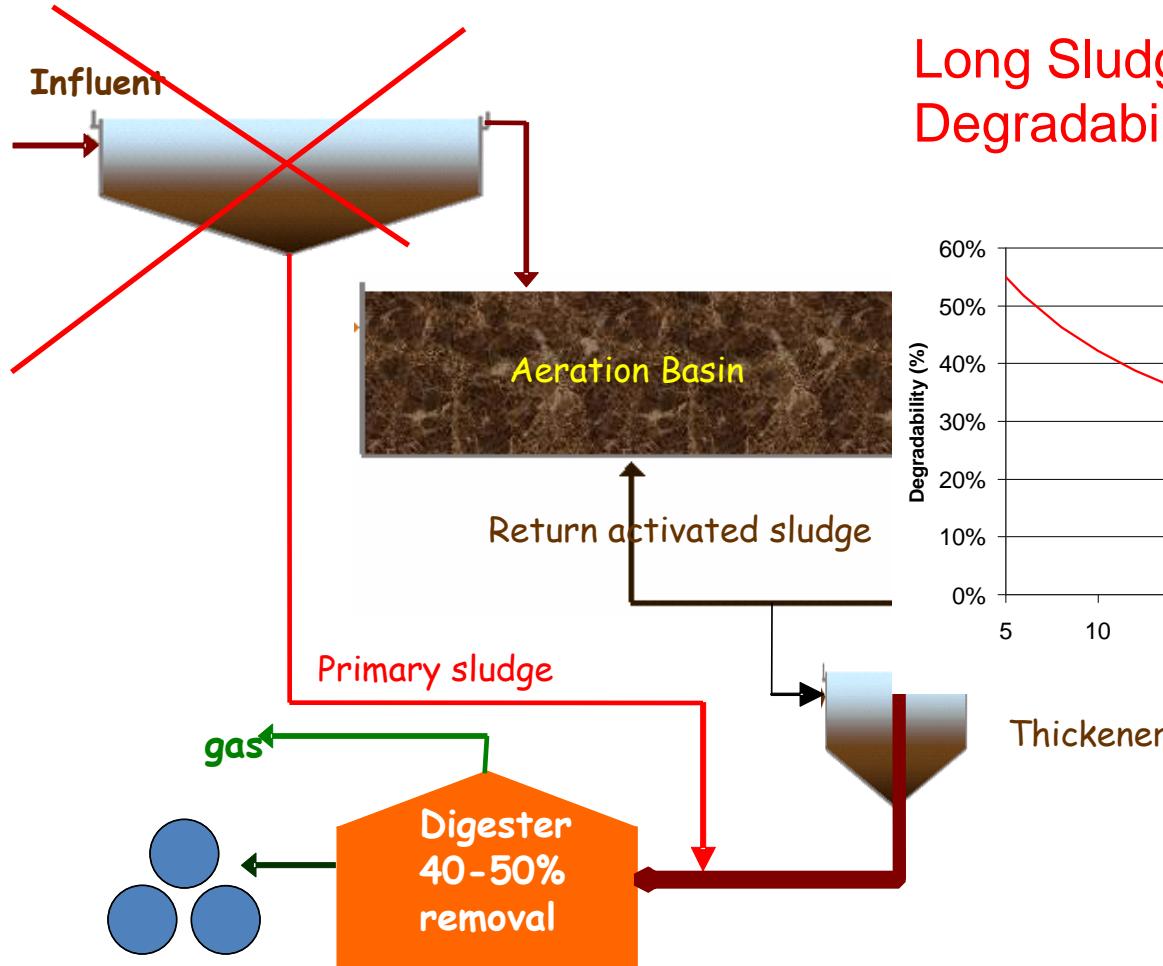
- People produce 50 g dry (400g wet) biosolids per day each
- In Australia, 5 million wet tonnes per day
 - Equivalent to 150,000x40 tonne trucks
 - Costs \$50-\$100 per wet tonne
- 30%-60% of overall wastewater treatment plant costs
- 1M people produce enough “energy” to power 10,000 homes (2% of energy demand)

And that's only from people! What about everything else??

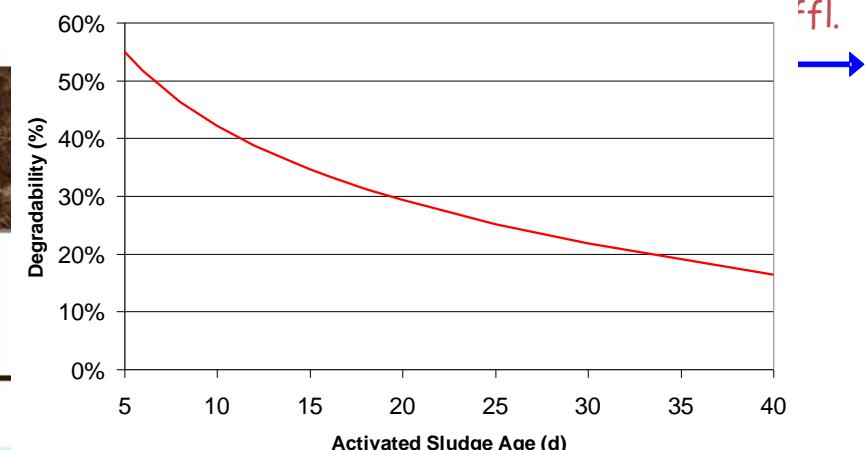
Classical Treatment Methods



Emerging trends with BNR



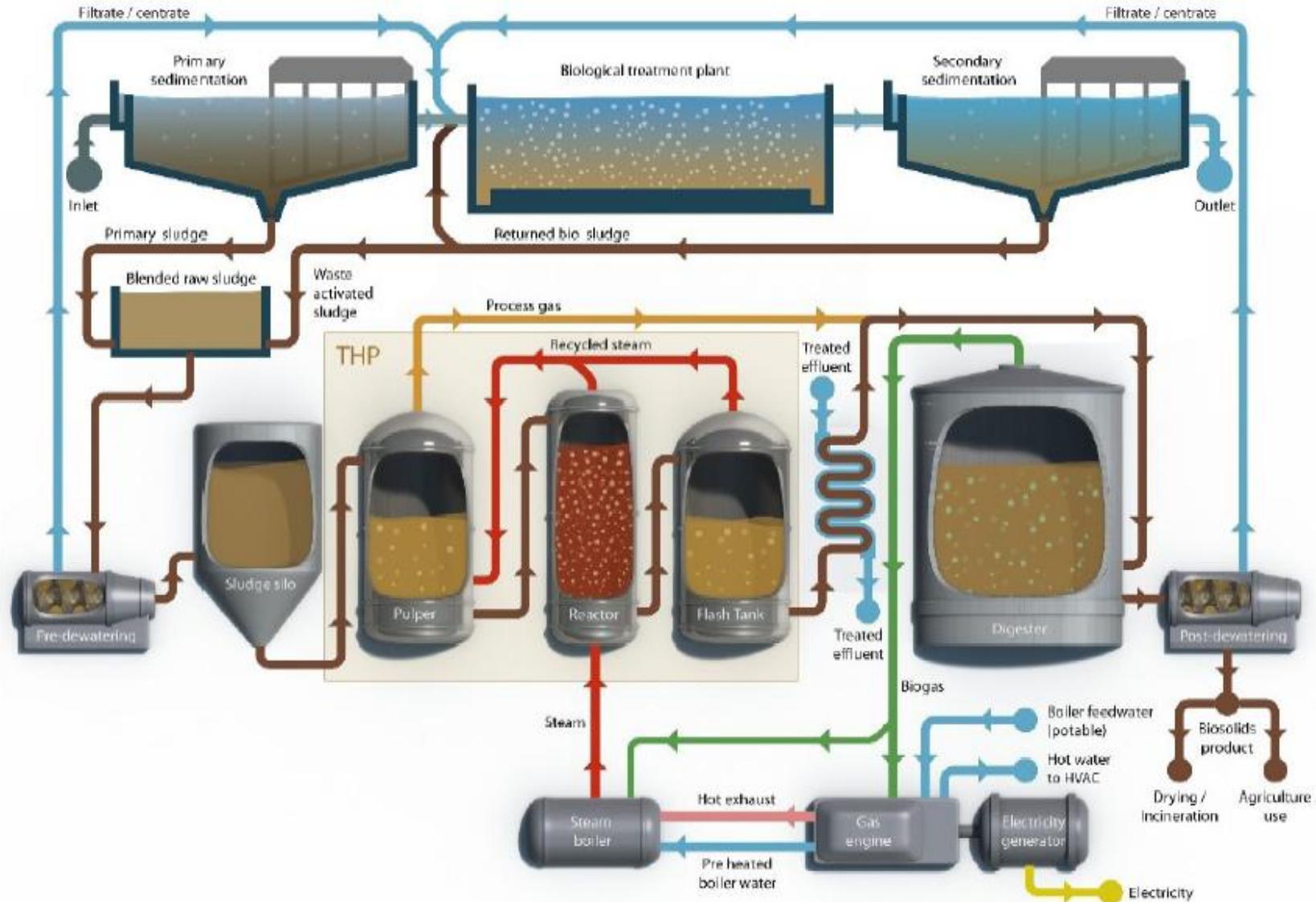
Long Sludge Age = Low Degradability!



Pretreatment – Thermal Hydrolysis



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Pretreatment – Thermal Hydrolysis

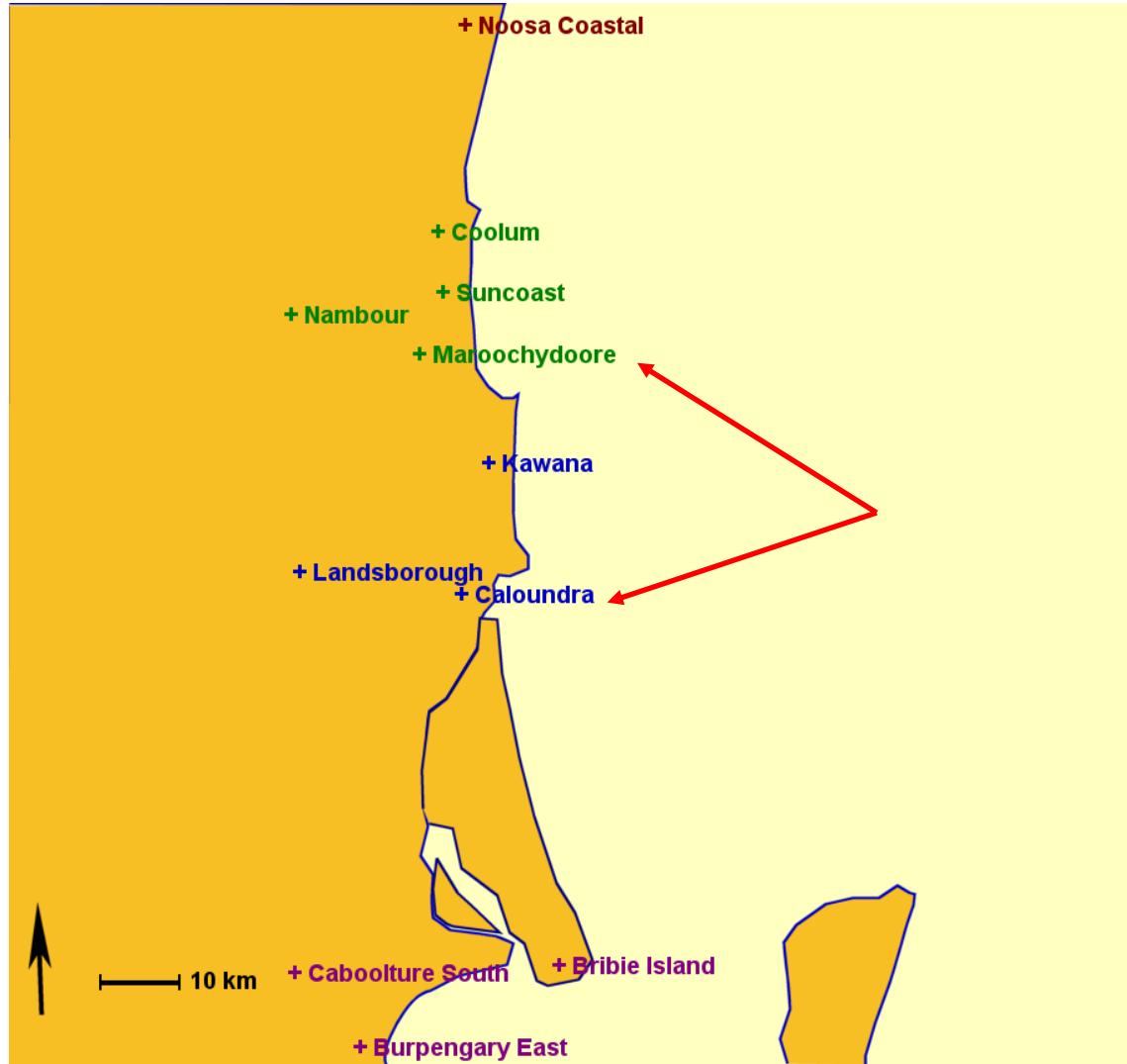


Key Outcome 1 – Neptune

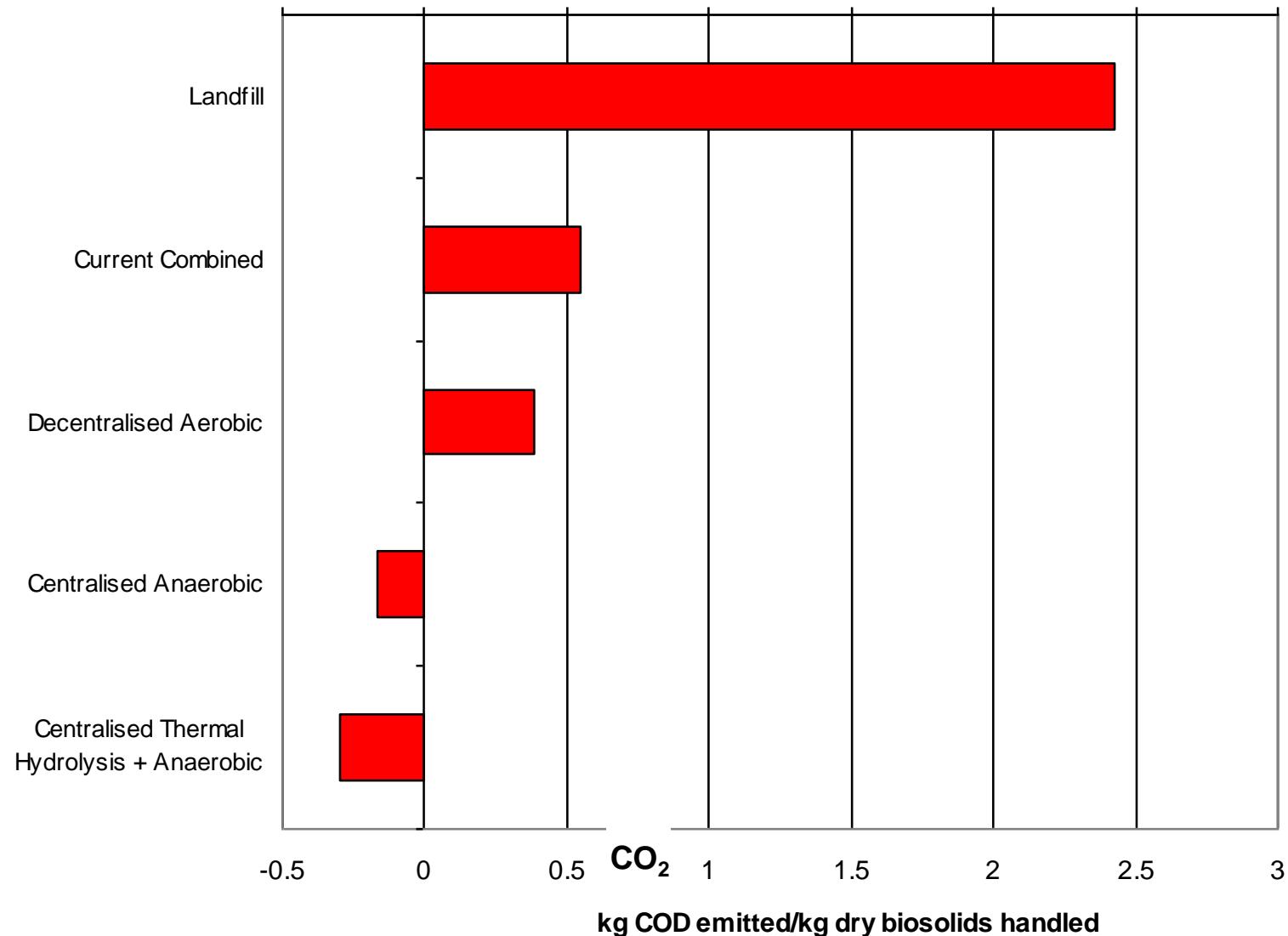
Thermal hydrolysis is cost neutral but greenhouse negative. Costs are shifted to capital expense instead of operating expense.

Batstone, DJ, Keller, J., and Darvodelsky, P.S. (2008) "Trends in Biosolids Handling Technologies: Economics and Environmental Factors" AWA Biosolids Conference June 7-10, Adelaide.

Centralised Plant Case Study

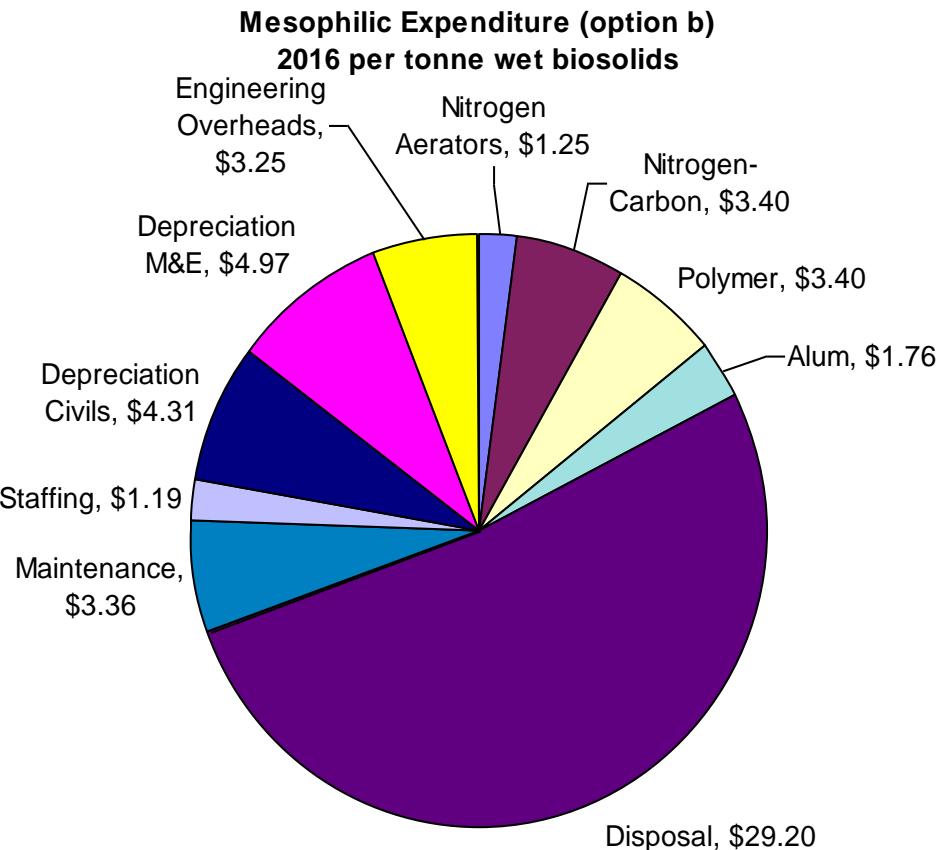
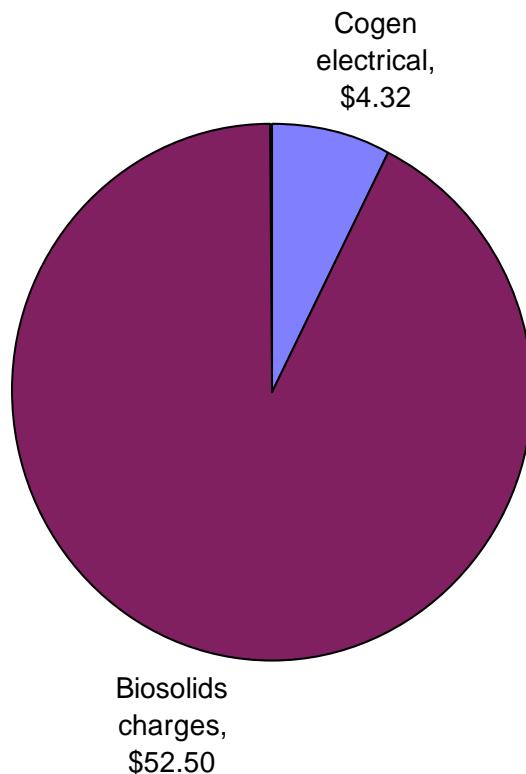


Greenhouse Gas Emissions



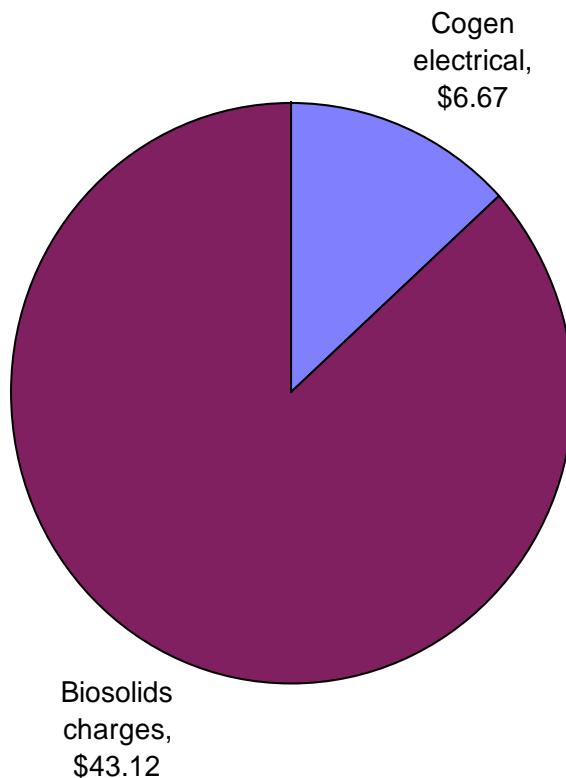
Cost – Mesophilic Alternative

Mesophilic Income (option b)
2016 per tonne wet biosolids

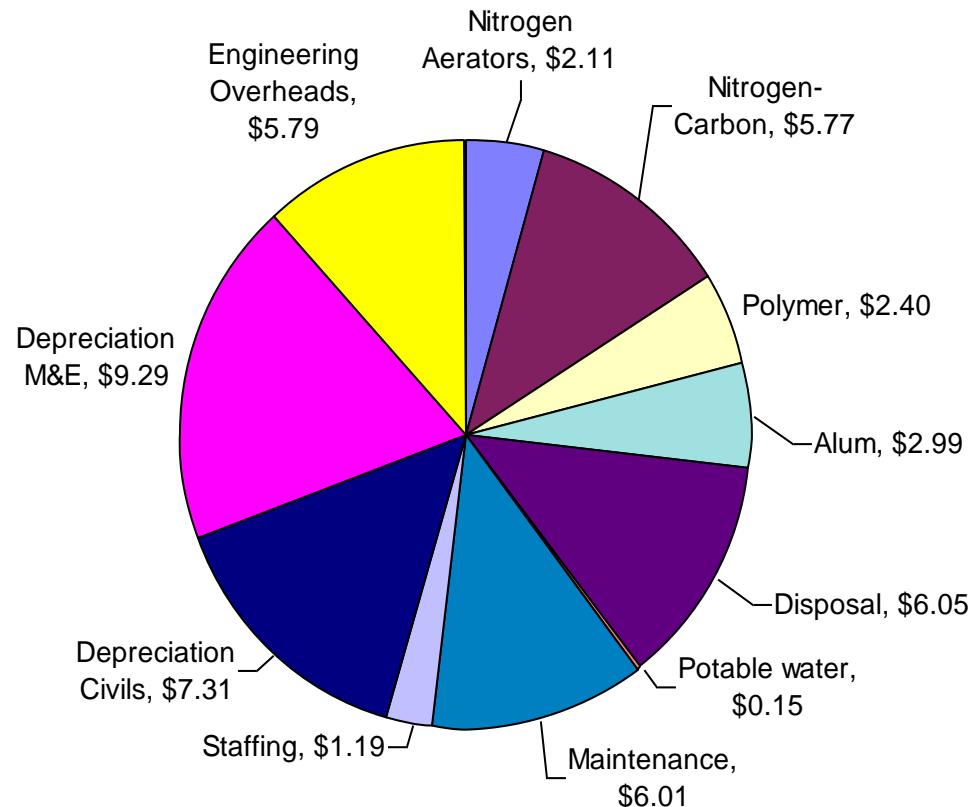


Cost – Thermal Hydrolysis

Thermal Hydrolysis Income (option f)
2016 per tonne wet biosolids



Thermal Hydrolysis Expenditure (option f)
2016 per tonne wet biosolids



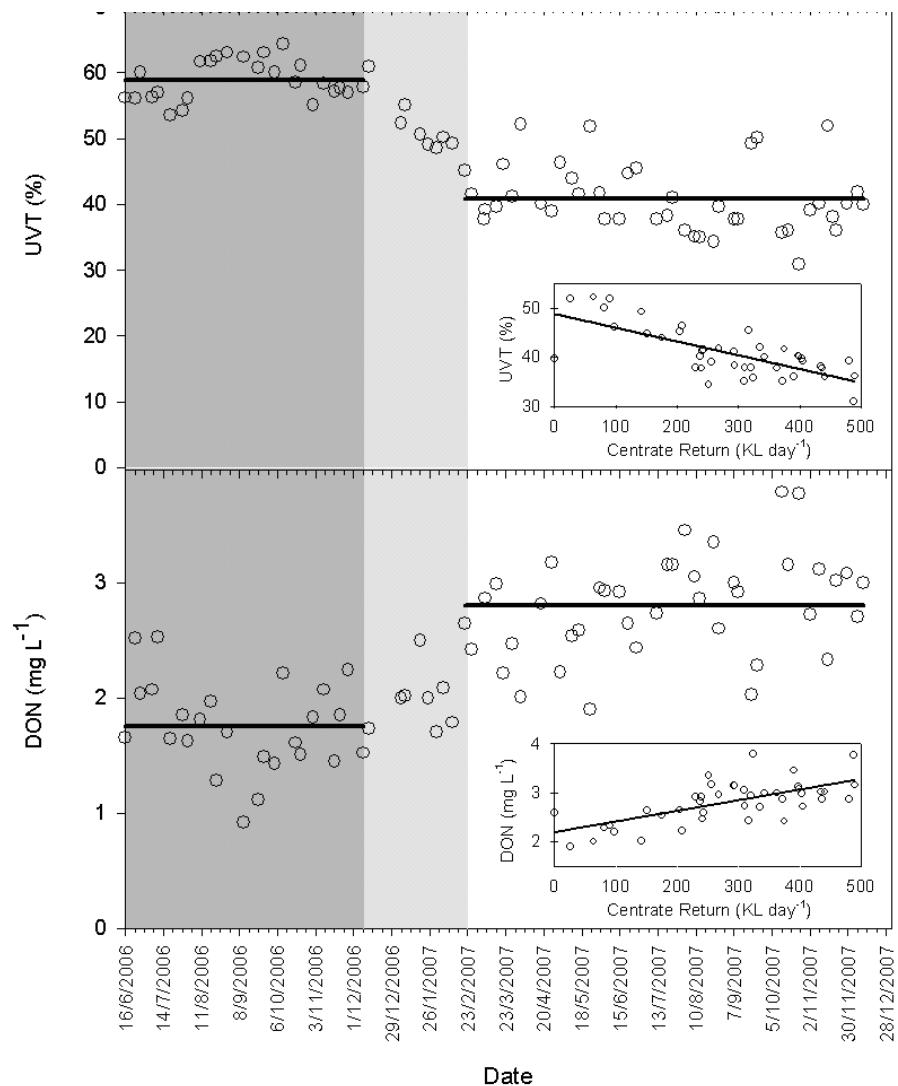
Key Outcome 2 – Neptune

Thermal hydrolysis produces coloured compounds. Colour production is dependent on temperature. Anaerobic degradability is not.

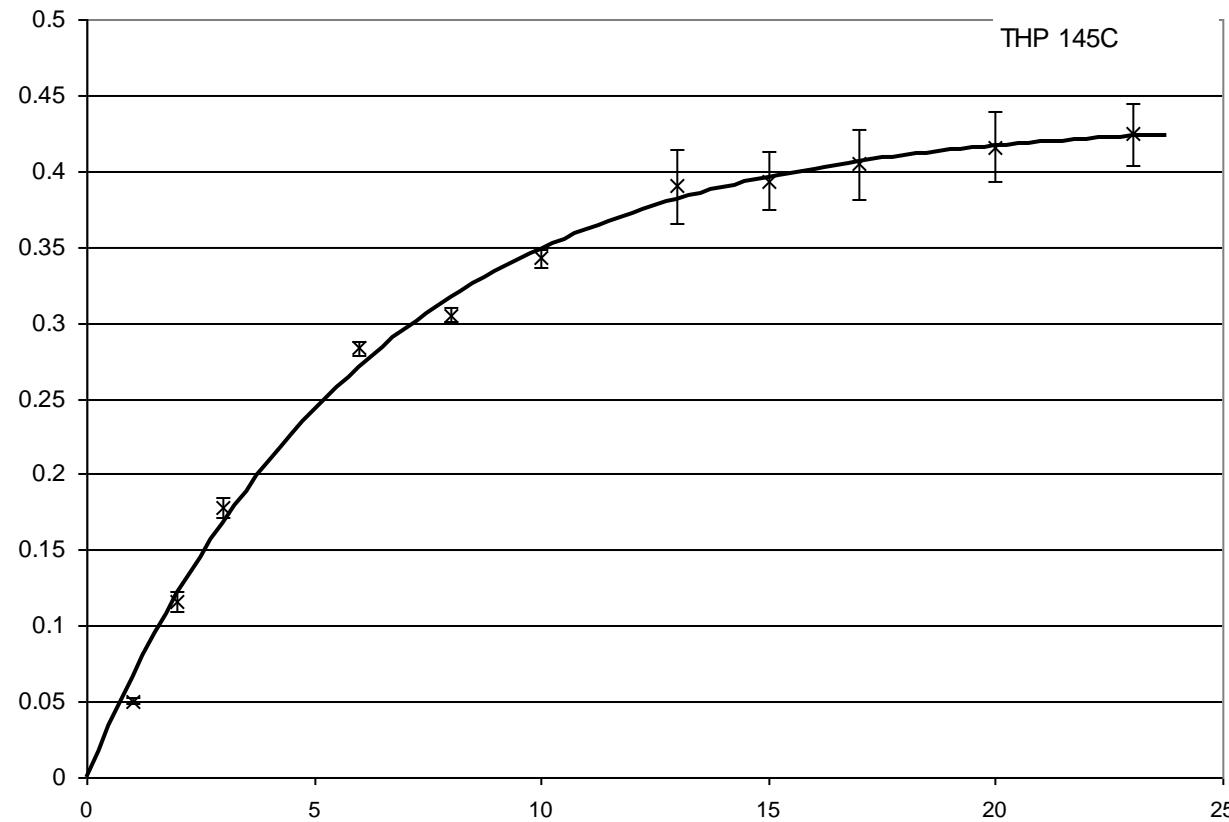
Dwyer J, Starrenburg D, Tait S, Barr K, Batstone DJ, Lant PA. (2008). The impact of thermal hydrolysis operating temperature on colour production and biodegradability of waste activated sludge. *Wat Res.* 42(18): 4699-4709.

Colour from THP is in effluent

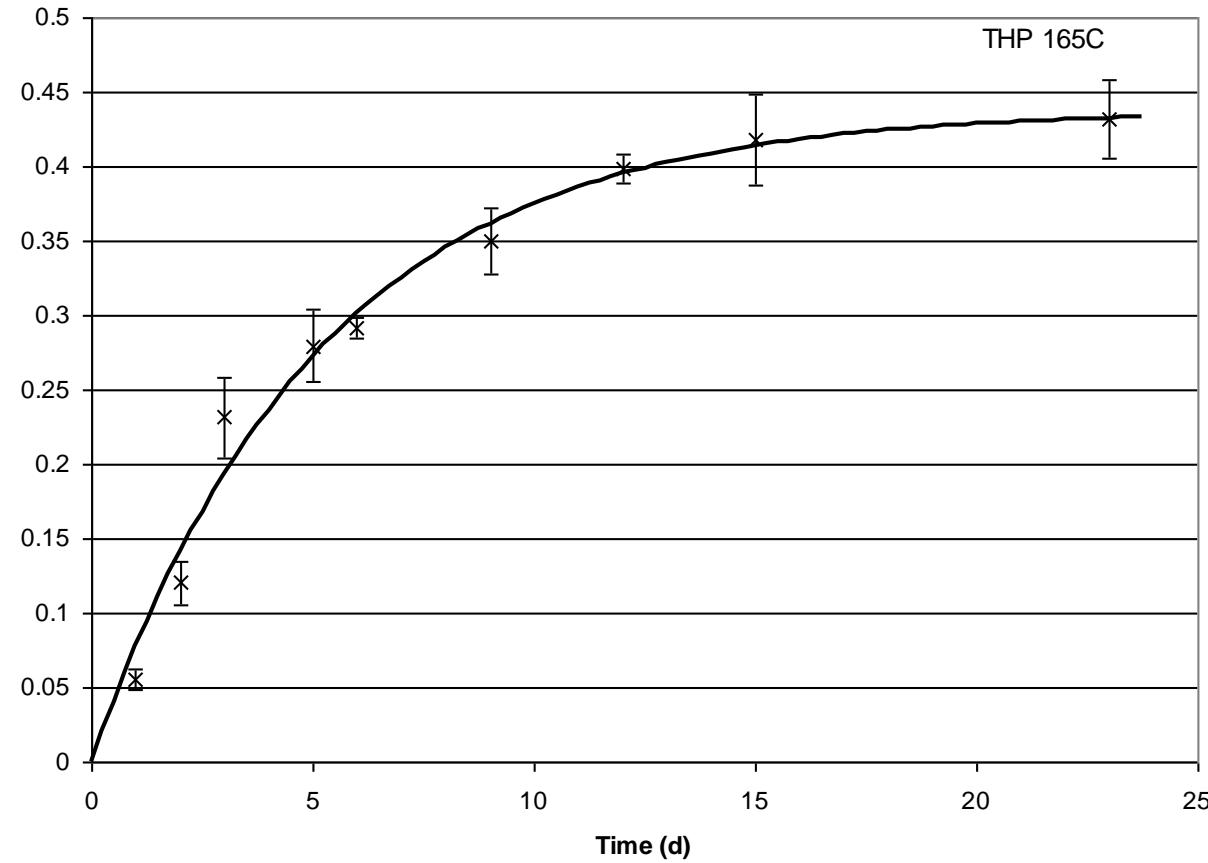
- Advanced BNR with UV disinfection
- Downstream membrane filtration
- Compounds identified as large humics by Ex-Em Spec
- Failed quality measures during thermal hydrolysis operations



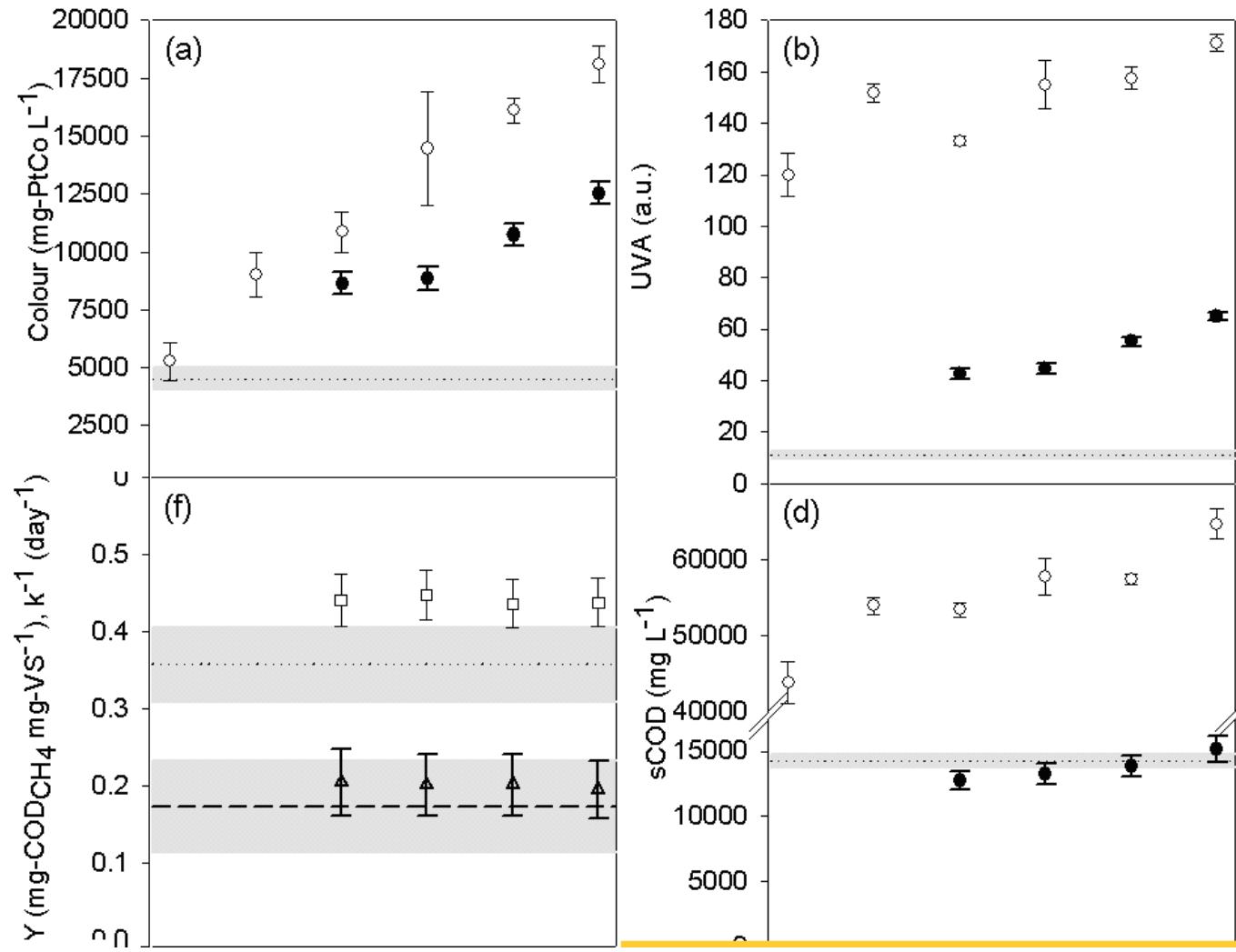
Results variation in temperature



Results variation in temperature



Other Impacts



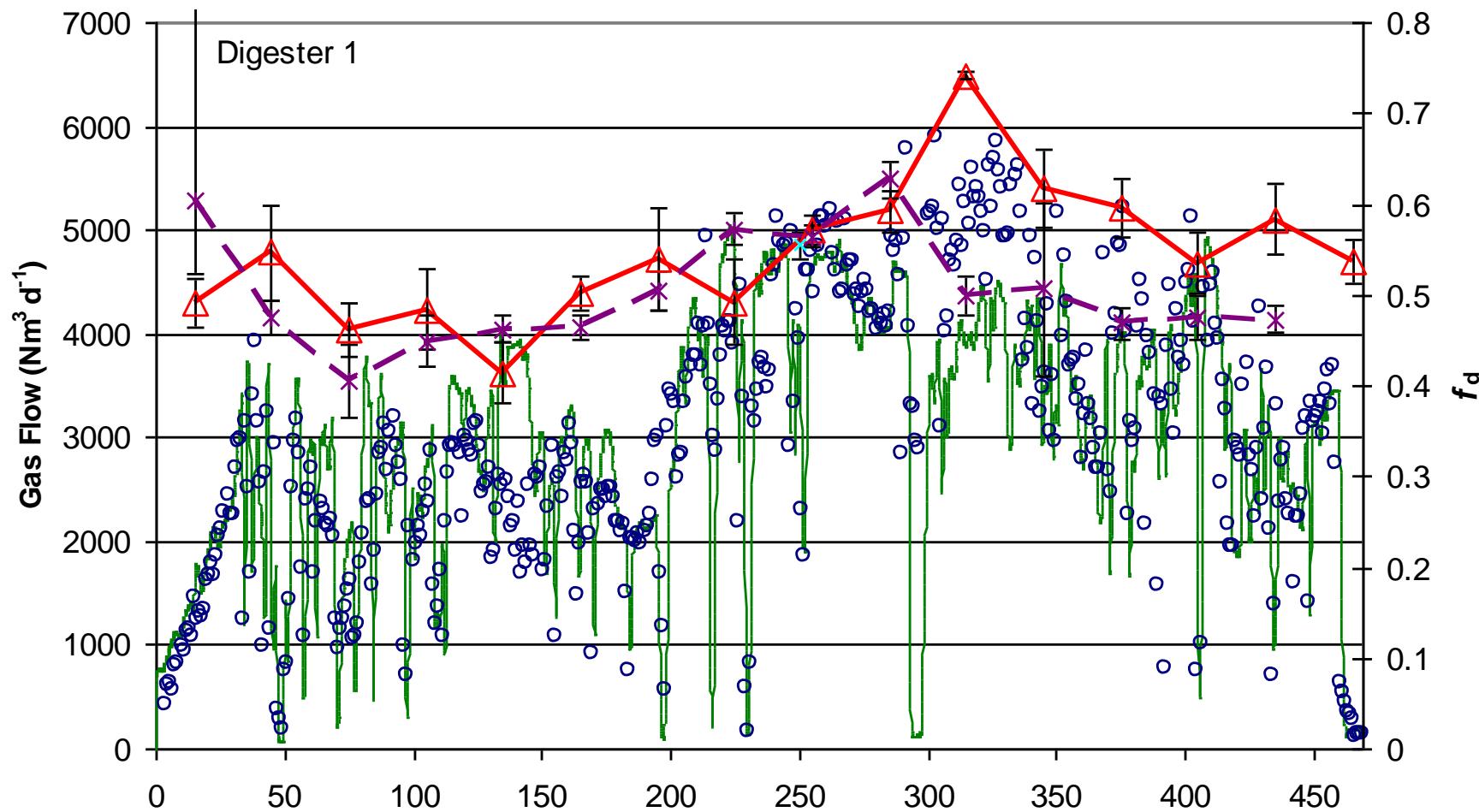
Key Outcome 2 – Neptune

Thermal hydrolysis greatly increases degradability, but there is still a basic dependency on sludge age.

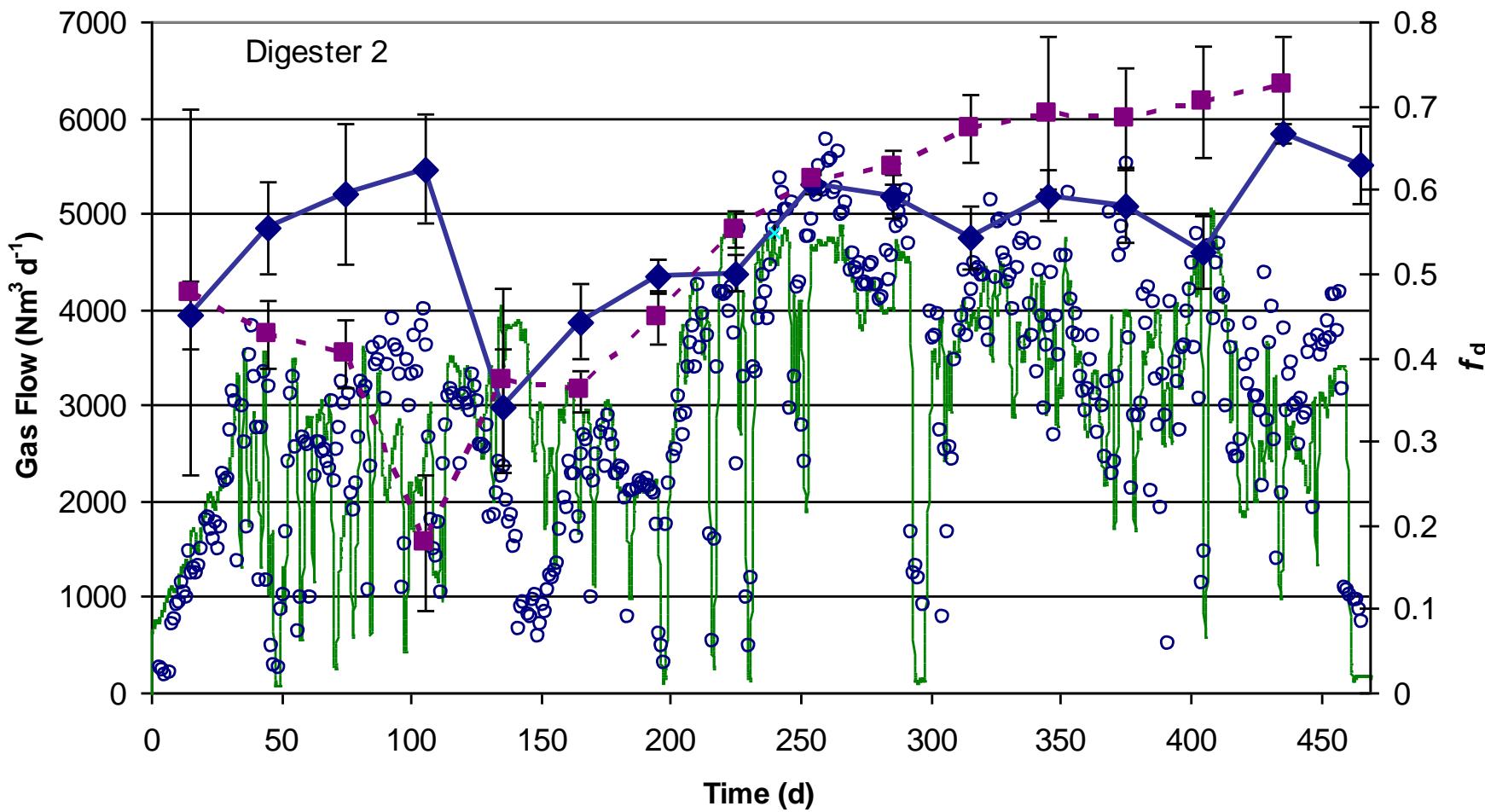
Batstone DJ, Tait S, Starrenburg D. (2009) Estimation of hydrolysis parameters in full-scale anaerobic digesters. Biotech. and Bioeng. 102(5): 1513-1520.

Batstone, DJ, Balthes, C., and Barr, K. (2010) “Model Assisted Startup of Anaerobic Digesters Fed with Thermally Hydrolysed Activated Sludge”. Submitted Wat. Sci. Tech Feb 2010.

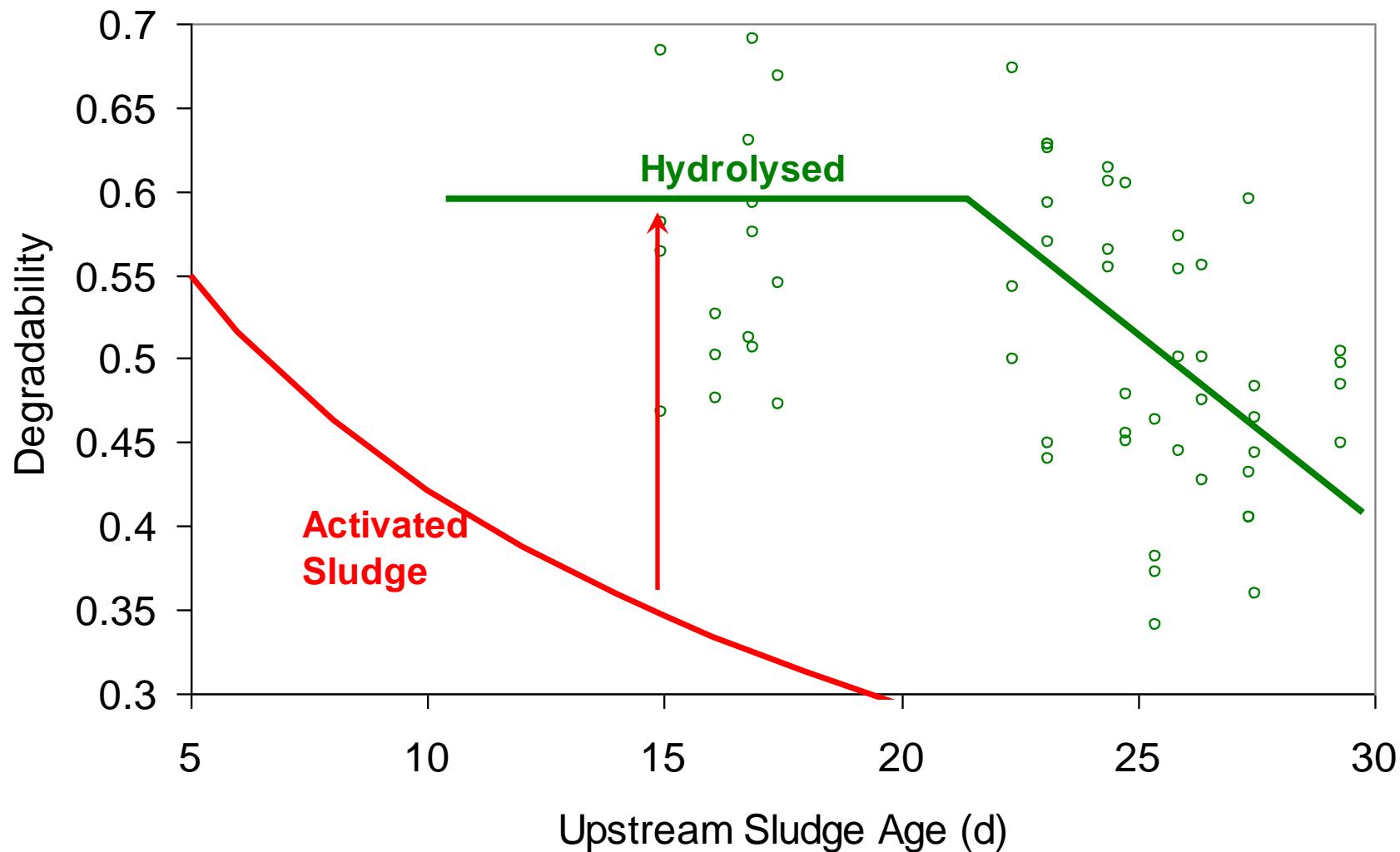
Model Based Analysis



On Both Digesters



Indicated a relationship



Conclusions

Thermal hydrolysis is cost neutral but greenhouse negative. Costs are shifted to capital expense instead of operating expense.

Thermal hydrolysis produces coloured compounds. Colour production is dependent on temperature. Anaerobic degradability is not.

Thermal hydrolysis greatly increases degradability, but there is still a basic dependency on sludge age.

Acknowledgements



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[ndustry, Science and Research]



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