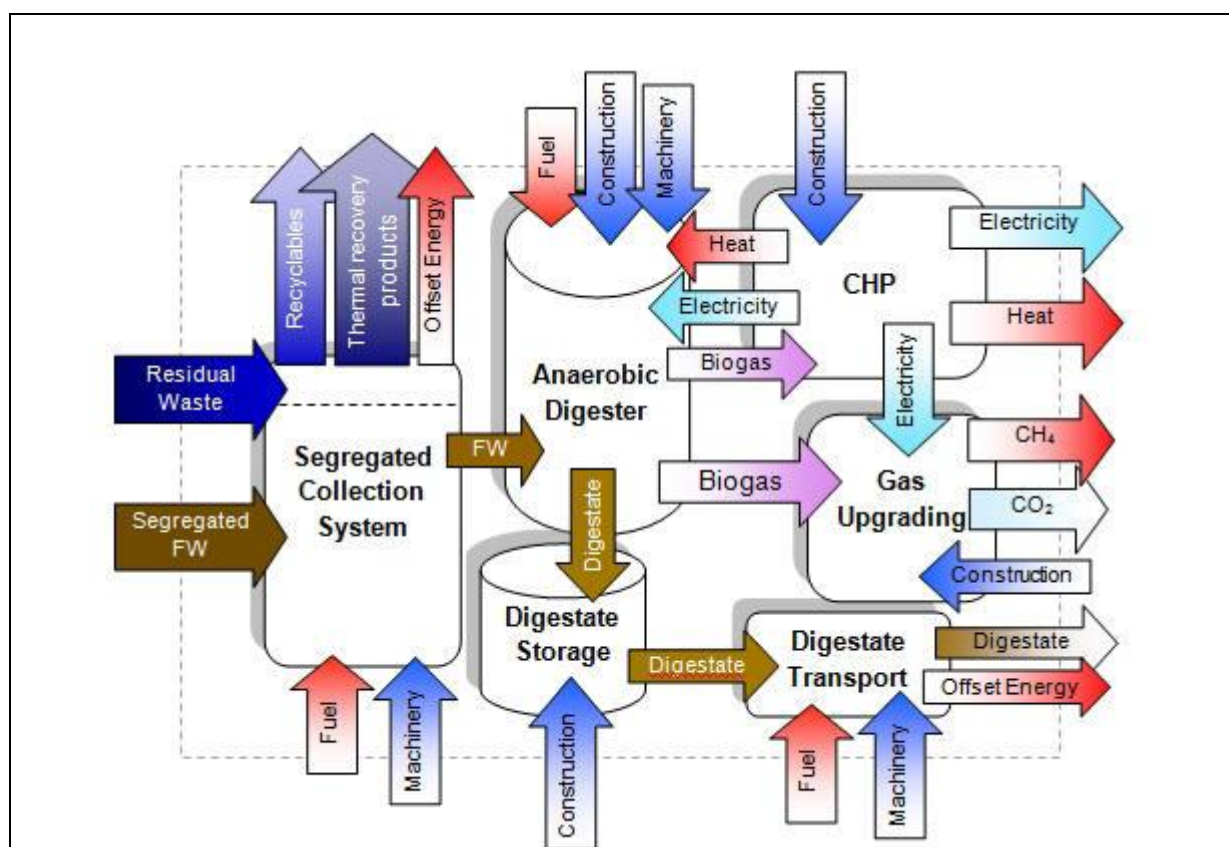




VALORGAS - Valorisation of food waste to biogas

Project Staff	Principal investigator:	Dr S Heaven
	Named investigator:	Dr Y Zhang
	Named investigator:	Prof. CJ Banks
	Researcher:	Dr L Gredmaier
Start year	2010	
Finish year	2013	
Funding body	EU FP7 Energy	
Related website	http://www.valorgas.soton.ac.uk/	



Food waste constitutes around 20% of the domestic waste stream in the EU, with approximately equal quantities arising from food manufacture and catering outlets: if food wastes from agro- and food industries are included an estimated total of 200 Mtonnes/year is available, at around 30% organic dry matter (ODM). Because of the high water content of this material, energy can only effectively be gained through biochemical conversion. The approach best suited to this is anaerobic digestion where yields of 400-450 m³ methane per kg ODM can be achieved. The research explores the ways in which this energy potential can be realised through effective collection, pre-processing and optimisation of the fuel

conversion technology, and considers how integration of these aspects with improving conversion efficiencies can maximise the net energy gains. It expands our rapidly-developing fundamental knowledge of syntrophic anaerobic microbial interactions, and applies this to the manipulation of reactor conditions in order to achieve stable operating conditions at high loading rates and volumetric efficiencies. It considers methods of upgrading the gaseous fuel product to extend the range of end user applications and the scales at which this technology can be exploited. It takes into account issues of biosecurity when using this material, and quantifies the environmental benefits associated with nutrient recycling which contribute significantly to indirect energy gains. The research combines techniques of waste audit, feasibility study, laboratory scientific investigation, technical-scale trials, plant monitoring, process modelling, life cycle assessment and energy footprinting in order to deliver recommendations for the valorisation with maximum benefit of this energy source as a second-generation biofuel.

Collaborators:

Università degli Studi di Verona
Università Ca' Foscari di Venezia
MTT Finland
IIT Delhi
Veolia Environmental Services (UK) Ltd
Valorsul SA
Andigestion Ltd
Aerothermal Group PLC
Eco-Solids International Ltd
Greenfinch Ltd
Metener Ltd, Finland (Metener)
Jyväskylän Yliopisto

Publications:

Banks, Charles J., Zhang, Yue, Jiang, Ying and Heaven, Sonia (2012) Trace element requirements for stable food waste digestion at elevated ammonia concentrations. *Bioresource Technology*, 104, 127-135. (doi:10.1016/j.biortech.2011.10.068).

Chinellato, G., Cavinato, C., Bolzonella, D, Heaven, S. and Banks, C.J. (2013) Biohydrogen production from food waste in batch and semi-continuous conditions: evaluation of a two-phase approach with digestate recirculation for pH control. *International Journal of Hydrogen Energy*, 38, (11), 4531-4360. (doi:10.1016/j.ijhydene.2013.01.078).

Jiang, Y., Heaven, S. and Banks, C.J. (2012) Strategies for stable anaerobic digestion of vegetable waste. *Renewable Energy*, 44, 206-214. (doi:10.1016/j.renene.2012.01.012).

Jiang, Ying , Zhang, Yue and Banks, C.J. (2012) Determination of long chain fatty acids in anaerobic digesters using a rapid non-derivatisation GC-FID method. *Water Science and Technology*, 66, (4), 741-747. (doi:10.2166/wst.2012.063).

Walker, Mark, Iyer, K., Heaven, S. and Banks, C.J. (2011) Ammonia removal in anaerobic digestion by biogas stripping: an evaluation of process alternatives using a first order rate model based on experimental findings. *Chemical Engineering Journal*, 178, (24), 138-145. (doi:10.1016/j.cej.2011.10.027).