Real-time autonomous remote biogas monitoring: Anaerobic Digestion at Loughborough University

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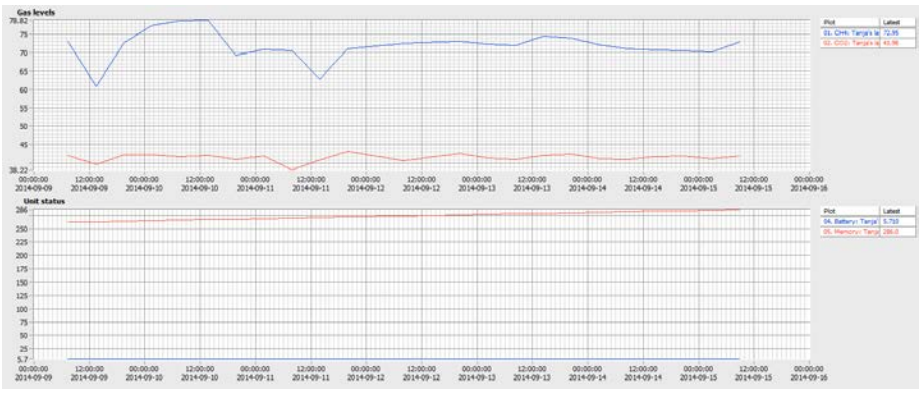
Rural Hybrid Energy Enterprise Systems (RHEES) is a research partnership between 6 UK and 7 Indian Universities. The aim of this project is to develop best practise at a smaller community scale which makes use of hybrid and combinations of biofuels. The idea is to improve rural energy availability, equity of cost and to generate an economic stimulus from the desire to provide greater energy security and reduced environmental impact.
Our part of the project is AD deployment. Here, we summarise how a novel gas monitoring device for remotely controlled, autonomous monitoring of AD might avoid shock loadings from heterogeneous feedstocks.

The main aim of the monitoring is to enable autonomous remote monitoring of: CH_4, CO_2, O_2, pressure, temperature and H_2S. These systems are to be coupled with solar panels which will have two roles: powering the monitoring system and hybrid solar-thermal heating of the digesters.
An existing landfill gas monitoring system developed by Ambisense Limited and Dublin City University have been identified as an excellent autonomous wireless gas sensing platforms with reliable long term performance and reduction in component cost. These platforms are fully developed and field deployable, several of which are already in use on various landfill sites. Sensing of CO_2 and CH_4 is achieved by high-accuracy infrared absorbance sensors, which have good long-term reliability. For pressure sensing, piezoelectric sensors are deployed. This is critical for monitoring and understanding gas flows. Autonomous operation is achieved by custom-programmed microcontroller circuitry, which also manages gas extraction, sampling, data logging and remote transmission (GSM communications). This provides adjustable sampling and reporting frequency. Monitoring data is being sent to the cloud via GSM transmissions, and fully accessible via an online portal for remote monitoring by the facility management.



Labscale AD		
CH4	62.95	%v/v
CO2	39.98	%v/v
Pressure	9.75	mBar
Battery	5.71	V
Memory	286.00	/1600
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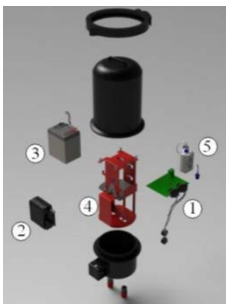
Screen shots of online software for real-time remote monitoring

SENSING/MONITORING

Autonomous remote monitoring of: CH_4, CO_2, O_2, pressure, temperature, H_2S

- **Using autonomous wireless gas sensing platforms- reliable long term performance and reduction in component cost**
- **The data sent to the cloud via GSM transmissions, and is accessible via an online portal for remote monitoring by the facility management**
- **CO_2 and CH_4 sensing: high-accuracy infrared absorbance sensors**
- **Pressure sensing: piezoelectric sensors (critical for understanding gas flows)**
- **Autonomous operation is achieved by custom-programmed microcontroller circuitry, which also manages data logging and remote transmission (GSM communications)**
- **Hybrid solar thermal heating of the digesters**



Autonomous landfill gas monitoring platform developed by Ambisense Limited, (left) exploded view, (right) as deployed on borehole well (with casing removed).
Components: (1) control board, (2) GSM module, (3) battery, (4) extraction pump, (5) sampling chamber and sensors, (6) protective casing

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