

6th May 2016, SUPERGEN Researchers Day, Glasgow

Renewable Energy Research at Loughborough University

Dr Tanja Radu

Loughborough University

Departments/ Research Centres

- School of Civil and Building Engineering
- School of Electronic, Electrical and Systems Engineering
- Centre for Renewable Energy Systems Technology (CREST)
- LoLo: The London-Loughborough EPSRC Centre for Doctoral Research in Energy

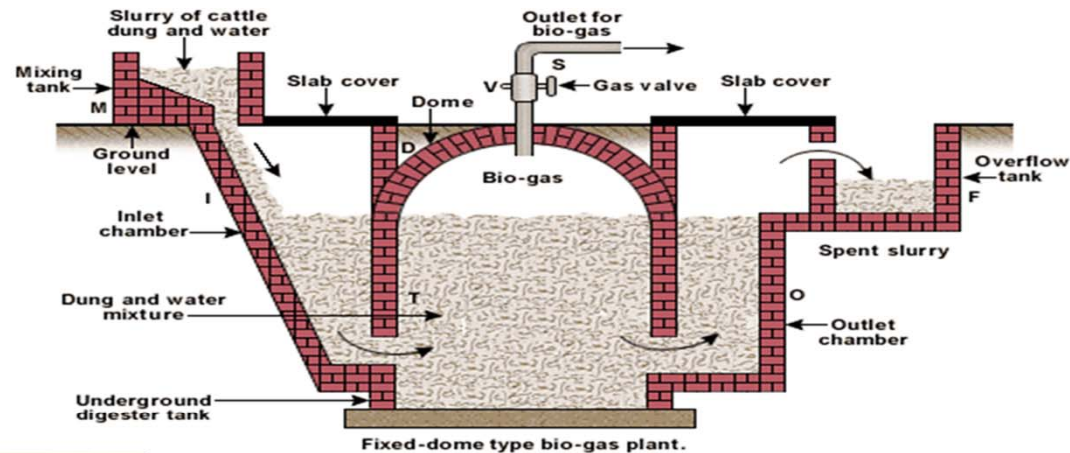
Main expertise: Anaerobic digestion

CREST: range of RE projects

About my previous project

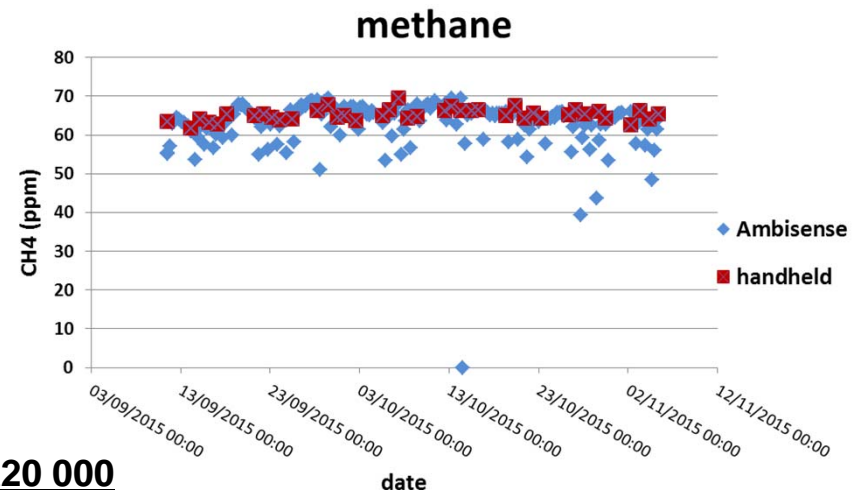
Rural Hybrid Energy Enterprise Systems (RHEES) 2012-1015 (£2.7M, EPSRC)

- **Project aim:** Supplying energy to the non-gridded rural communities (Europe, India) by the means of anaerobic digestion
- **Project collaborators:** University of Birmingham, University of Nottingham, MMU, University of Leicester, Liverpool Hope University, Indian partners (Pune, Nagpur, Bangalore, Mumbai)



Remote Monitoring of AD

- Using autonomous wireless gas sensing platforms- reliable long term performance and reduction in component cost
- The data is sent to the cloud via GSM transmissions, and it is accessible via an online portal for remote monitoring by the facility management
- CO₂ and CH₄ 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)



EPSRC/SUPERGEN Small Grant Fund EP/J017302/1 £20 000

UKIERI project: small scale AD on Campus

- Currently building small scale AD on campus
- 2m³ capacity
- Processing food waste from student canteen-
potential reduction in cost
- Remote monitoring



UKIERI Bioreactor status	
File Edit View Help	
Ambient temperature:	8.56 °C
Coils temperature:	54.44 °C
Bioreactor temperature:	38.06 °C
Flow temperature:	38.88 °C
Return temperature:	37.88 °C
Gas flow:	104.00 l/s
Barometric pressure:	1009.72 mBar
Relative humidity:	42.10 %
Dew point:	1.14 °C
Heater state:	OFF
Heater pump state:	OFF

11:59:49



Current project

- British Council/Newton Fund Institutional Links £250k/2 years project: “**Community scale, decentralised anaerobic digestion for energy and resource recovery**”
- Collaboration between Loughborough University and Asian Institute of Technology (AIT) Bangkok, Thailand

Motivation

- Strategic need for greater sustainability and resource recovery, e.g. N & P.
- Energy deprived communities are disadvantaged.
- Untreated waste is a health and climate hazard.
- Stimulate local investment, resilience and skills in infra structure.

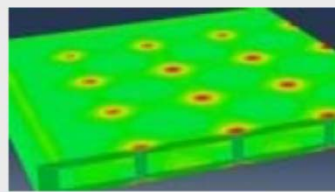
Objectives/deliverables

- Develop designs linked to feedstock characterisation.
- Optimise remote monitoring.
- Add to control and design models including finance and sustainability, mixing using CFD, remote machine monitoring and control.
- Establish a business model for small communities for waste, energy, fertilizer.
- Build long term exchange links and community impact.

CREST- RE research



APPLIED
PHOTOVOLTAICS



ENERGY
STORAGE



MULTI-SCALE
ENERGY



NETWORKS &
SYSTEMS



PV MATERIALS
& DEVICES



RE FOR
DEVELOPMENT



SUPERGEN



WIND AND
WATER POWER

Research Areas:

- Solar Photovoltaics
 - Materials and Devices
 - Applied Photovoltaics
- Energy Storage
- Renewable Energy for Development
- Wind and Water Power
- Networks and Systems
- Multi-Scale Systems Analysis

<http://www.lboro.ac.uk/research/crest/research/>

Solar Supergen Hub

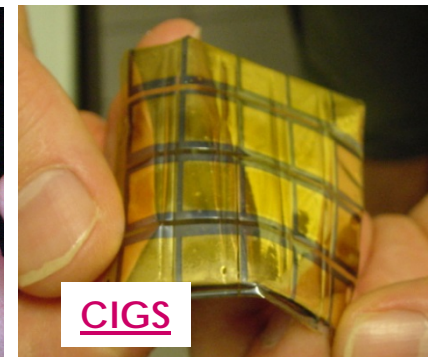
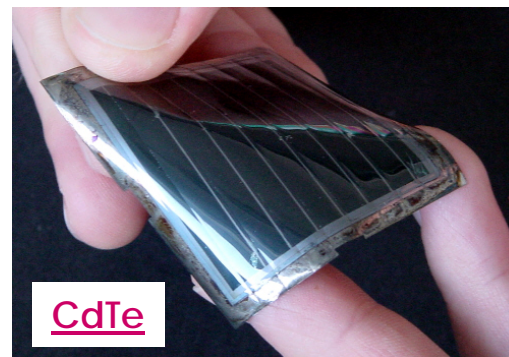
- £5 million 5 year project funded by EPSRC
- Aim to create the UK's first standards lab for solar cells.
- A research programme that aims to improve the efficiency of next generation photovoltaic devices.
- The Hub provides a training and networking programme for the photovoltaic research sector in both universities and industry.
- Partners include the Universities of Bath, Liverpool, Oxford, Sheffield, Southampton, Cambridge and Imperial College

Applied Photovoltaics

- Characterisation of PV cells & modules
- PV module production, durability and failure mode analysis
- Energy yield from PV systems
- Solar resource & PV performance monitoring



Thin Film Photovoltaic Research



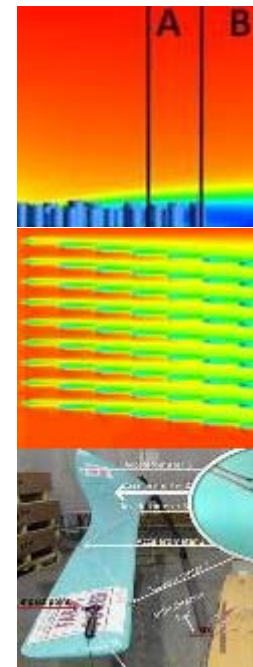
Energy Storage

- Increases in variable renewable energy technologies, such as wind, into the electricity supply network may require storage of energy.
 - IMAGES Integrated Market-fit & Affordable Grid-scale Energy Storage.
 - i-STUTE Interdisciplinary Centre for Storage, Transformation and Upgrading of Thermal Energy



Wind and Water Power

- Wind power is an established technology. However further research is needed.
 - Resource assessment: Improving wind resource modelling in complex terrains and offshore
 - Wakes: How clusters of wind turbines interact
 - Condition monitoring: the ability to prevent failure to reduce turbine downtime



**Thank you for your
attention!**

Questions?