Renewable energy research at Loughborough University

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Additional Information:

- These are conference presentation slides.

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Renewable Energy Research at Loughborough University

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• School of Civil and Building Engineering
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• 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)
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
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 infrastructure.

**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.
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/
- £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

- c-Si on glass
- CdTe
- CIGS
- Dye solar cells
Energy Storage

- Increases in variable renewable energy technologies, such as wind, into the electricity supply network may require storage of energy.
  - 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?