



## **POSTDOCTORAL & EARLY CAREER RESEARCHER EXCHANGE – REPORT**

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**Exchange to the Department of Energy, Tezpur University, Assam, India**

SAGES PECRE funds of £3600 facilitated two networking and scoping visits to Tezpur University in Assam, India in April 2016 and January 2017.

### **Objectives**

The main objectives of this exchange were to facilitate knowledge transfer and mutual learning of rural energy challenges between academics in India and Scotland and to identify research gaps and synergies in both countries. The focus was on the role of biogas on rural energy services and its impact beyond the 'energy silo' by exploring food, water and health interactions and its contribution to a local and circular economy. In particular, the challenges associated with human sewage biogas units in India and potential technology applications to rural UK septic tanks, as an innovative way of tackling issues of energy poverty and security, environmental pollution, sanitation and waste management, were investigated.

These objectives were addressed in two ways, by engaging with academics from different disciplinary backgrounds that have contributed to the understanding the challenges associated with biogas technologies in rural India and through a series of field visits to rural communities to better understand the community perspective. This funding has facilitated the development of a number of interdisciplinary research ideas that will hopefully be internationally beneficial in the future.

### **Structure of visits**

The focus of the first visit was twofold; to identify and build a network of potential partners from both the business sector and academics from different disciplinary backgrounds and to conduct a number scoping visits to local communities to identify potential challenges relating to the energy-water-food nexus. The second visit built upon the outcomes of the first visit and focused on the social and cultural challenges impacting on the acceptance of toilet-linked biogas technology. On both occasions I was accompanied by my colleague, Dr Richard Quilliam, an environmental biologist from the University of Stirling. Richard has research interests in agroecology, sustainable agriculture and aquaculture, and sustainable disease and waste management. He funded himself to join me as he was keen to expand his research networks in India; his presence proved very useful as we identified a number of cross-cutting and inter-linked research ideas with our Indian hosts.

**Visit 1:**

We started our visit to India in Trivandrum, Kerala, to meet with Dr. Saji Das, International Biogas consultant and Managing Director of a company called Biotech Renewable Energy. Biotech India has completed more than 30,000 installations of different models of anaerobic digesters (AD) for various applications, including toilet biogas technology. During the visit we were shown different types of technology the company has developed and were fortunate to be given the opportunity to visit a domestic property and a school where toilet-linked AD systems were installed (figures 1a and b). During the visit, we discussed many of the benefits and challenges of AD systems, particularly toilet-linked units and their relative success in Kerala. Dr. Saji Das and his Assistant Manager, Binu Sebastian were extremely helpful and are keen to be involved in the development of future projects.

Professor Deben Baruah, Head of Department of Energy at Tezpur University, hosted the second half of this visit. Professor Baruah is an expert in the field of renewable energy (particularly bio-energy) and energy management of rural farming and living. He is very well connected in this field and facilitated a number of networking activities with academics across relevant departments at Tezpur University, and other local research facilities. During our stay in Tezpur, we met Satya Sundar Bhattacharya, Assistant Professor of Soil and Agro-Bio Engineering and his research group in the Department of Environmental Science (figure 1d). We discussed vermiculture and soil nutrients in relation to sustainable agriculture and food security. We are currently looking funding opportunities to develop an interdisciplinary research project together.

Visits outwith the university included a trip to meet Prasanta Neog, Associate Professor of Agro-meteorology and his colleagues from the Department of Agricultural Engineering at Assam Agricultural University in Jorhat (figure 1c). During this visit we discussed a range of challenges facing small-scale farmers, particularly in relation to climate change and food security. Through these discussions we identified a number of ways in which GIS modeling and decision support tools could be used to tackle these issues. Following the meeting, we visited an organic tea estate to see how a traditional AD system was being used to support sustainable farming through energy and fertilizer production.

The final part to our first visit comprised community-based visits to look at traditional dung-fed, household and community-scale AD systems and explore local attitudes and perceptions of biogas production. In figure 1e, an AD owner in Amolapam is explaining how he is trying to fix his broken AD and figure 1f shows how Jhawani villagers are using AD digestate and straw to grow oyster mushrooms.



**Figure 1: a) Visit to Biotech b) Domestic toilet-linked AD in Trivandrum c) Visit to Assam Agricultural University in Jorhat d) Vermiculture research, Department of Environmental Science, Tezpur University e) AD unit in Amolapam f) Mushroom growing in Jhawani**

## Visit 2:

In January, I returned to Tezpur University for 10 days with the specific objective to develop a research project with Professor Baruah and his team on the social and cultural barriers to the uptake of toilet-linked biogas units. The potential benefits of these small-scale anaerobic digesters are four-fold; they provide a clean, cheap alternative fuel; they produce a marketable biofertiliser; they reduce gender divisions of labour by reducing the need for women and children to collect fuel wood and they have the potential to improve sanitation and reduce disease burden if linked to a toilet system. Yet whilst toilet AD technologies

exist, no toilet AD systems have been implemented in Assam to the best of our knowledge. To develop the research idea, I accompanied a team from Tezpur University on scoping visits to five local villages: Nabil Kachari Gaon, Nijbihugwie, Amolopam, Kwekani and Napaam (figure 2a-d). This scoping study provided an interesting insight into the complex reasons why villagers would accept or shun this type of system. The data collected during these visits was used to inform our discussions in Tezpur and is currently being used to develop a larger collaborative research proposal.



**Figure 2: Visit to local communities to discuss attitudes and perceptions of traditional and toilet-linked AD systems**

### **Outcomes**

The direct outcomes from the exchange visit are threefold: a PhD project on the socio-technical challenges of toilet-linked AD units has been co-designed with Tezpur University and funding is currently being sought from sources such as the University of Stirling's Impact Studentship scheme. A research paper, co-authored with Professor Baruah, on the cultural taboos of using human excreta as an AD feedstock is in preparation and a joint grant application with Tezpur University and Assam Agricultural University on the role of edible mushrooms as key drivers for conservation, sustainable livelihoods and poverty alleviation was submitted to the Darwin Initiative. A further proposal on the role of human excreta on in the energy-water-food nexus will be developed over the coming year.

Professor Baruah and his colleagues were very keen to explore further synergies between biogas energy research related to rural India and Scotland, particularly around the energy, water, food security and health nexus, and the role of biogas in developing a circular economy - an area that is gaining increasing importance in Scotland. There is still significant scope to learn from our international colleagues and for outputs from future research to contribute to wider Scottish Government policy on areas such as community and local energy economies, planning and infrastructure, investment in energy alternatives and technological developments. We will continue to develop further collaborative research proposals to sustain this successful and productive research visit.