UK-India Deep Dive Workshop: Anaerobic Digestion

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Anaerobic Digestion: UK-India common interest and future perspective

Gaps in the field

- **India-**Pretreament and storage challenges, centralised network management failure, supply chain, CBG, technology conversion, waste management; Agri waste is huge potential in rural India along with animal manure including cattle and poultry waste. nutrients recovery, currently protein content imported in poultry farms. Wastewater treatment; legal pressure on clean water. Co-digestion, possible AD based H_2 production from reformation of biomethane and also aviation fuel but currently tested at lab scale, LCA needed and policy tension.
- **UK-** issues include storage on farms, contamination of the waste, lack of local AD plants. No focus on nutrients recovery, co-digestion not being used in the UK either, but there is a potential. Optimising of co-digestion and Policy needed.

Key research area for UK-India Collaborations

- Resource assessment, data management and supply chain (India), Local/rural AD (UK-India), policy on co-digestion (UK-India) storage and pre-treatment challenges (UK-India), focus on nutrients recovery (UK-India), possible biohydrogen production (UK-India), Aviation fuel (UK-India), and social and cultural barriers in India.

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Bioenergy/Biogas India

- India is close to meeting its 2022 target for 10 GW of bioenergy capacity. The principal contributor is the use of **bagasse** in sugar mill co-generation plants.
- India is aiming to produce biogas from **agricultural and other waste**, and has set a target for the annual production of 15 Mt of compressed biogas (CBG) by 2023 under the policy of Sustainable Alternative Towards Affordable Transportation (SATAT).
- India has a large installed **gas power capacity**, but underutilised. Lower-than expected domestic natural gas production.
- Surprisingly, domestic gas production drops from ~120 mwh in 2009 to ~50 mwh (2018), leaving several power plants stranded, unable to afford higher-priced imported gas.

India 2020, Energy Policy Review

Co-digestion in AD

- Agri waste: huge potential but unbalanced C: N ratio, not suitable for efficient biomethane production
- **Potential option:** Co-digestion with **best AD practices**: the most important factors are pre-treatment, temperature, pH, Organic loading rate, Impact of additional feedstock (animal manure or food waste or microalgae), C:N ratio
- Major challenges: data management, expertise, waste management, collaboration and supply chain to support the business in AD.

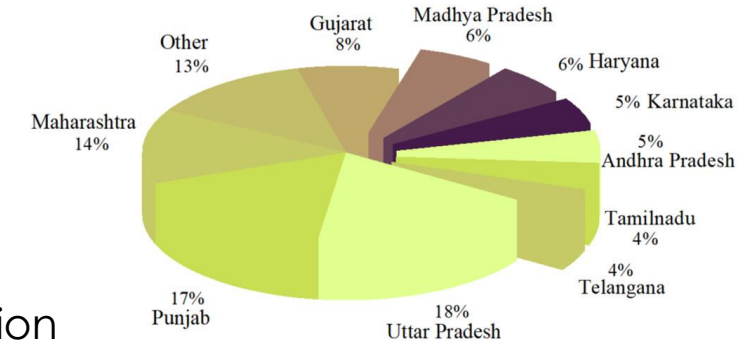

Fig 1. Percentage-wise major crop-producing states in India

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- **Solutions**:
  - Regional circular centers for agri waste management: the co-digestion process can be used as a core technology to supply biogas and biofertilizer if a supply chain is established to provide enough organic wastes (of all suitable feedstocks) in rural India.
  - Optimization strategies, including substrate pre-treatment, and system configuration and control.
  - Maximization of economic benefits of digestate utilization.
  - Consultant body and expertise to manage the data and support the business in AD (like NNFCC in the UK)

- Long term options; Aviation fuel, AD based H_2 production, nutrients recovery, electro co-digestion, but no conclusive evidences for technology development.

Social and cultural barriers in India

- **Small scale** (family based) ADs associated with major financial and economic barriers such as high transaction and installation costs, along with social and cultural barriers hinder the adoption of biogas technologies in the rural areas.
- **Medium scale** (community based) ADs have more financial and economic benefits, but needs effective collaboration between government, experts, socialists and local leaders in the community to break the social and cultural barriers.
- Develop strategy to spread the awareness in the rural communities as a concern to AD technology application to enhance their productivity from the land and ultimately increases the net income of the farmers and curb the burning of crop residue.
- Use most appropriate technology and win the trust of local community, because No AD technology can be used for all situations or feedstocks.
- Consider market availability, capital and operating costs, and potential revenue to determine the best use for biogas.
- Consider climate, health, soil, sustainable food supply, and odor control with best Maintenance practices.

Biogas plants adoption and their effects in India

Indication	Variable/expected factor
Indication Variable/expected factor Overall population	1.32 billion
Total homes (@ 4.8 persons per homes)	275 million
Rural homes (53% of the total homes)	159.5 million
The number of rural homes depends upon livestock (22%) 35.1 million	35.1 million
Biogas plant installation capacity (50% of livestock-dependent families)	17.5 million
Expected monthly savings on firewood and chips (000, ton) @ 5.78 kg per home	101.4 million
The monthly estimated value of the firewood and chips saved (Rs.)	257.6 million
Monthly kerosene savings expected (litres) @ 0.78 L per home	13.7 million
The estimated monthly value of kerosene saved (Rs.)	389.5 million

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