Opportunities for small scale AD systems - a global perspective

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Global Challenges

- Least Developed Countries (LDCs) must reduce the use of fossil fuels
  - Paris Climate Agreement
  - but more energy needed for development
  - use renewables, such as AD
- LDCs need fertilisers
  - from renewable sources, such as from AD
- LDCs want to process resources (crops) locally
  - crop residues used in AD

Technology

- Two approaches to AD:
  - European tank systems - used in sewage systems and processing of putrescible fraction of MSW
  - Asian domestic biogas systems - used with animal dung, biogas for cooking
    mainly underground, made of masonry,

Small-scale: ~ 4 m^3 TIV

Dung - 4 cows or 8 pigs

2 m^3 gas per day

£410 or £205 per m^3 d^{-1}

(adjusted for inflation in India)

Asian Technology

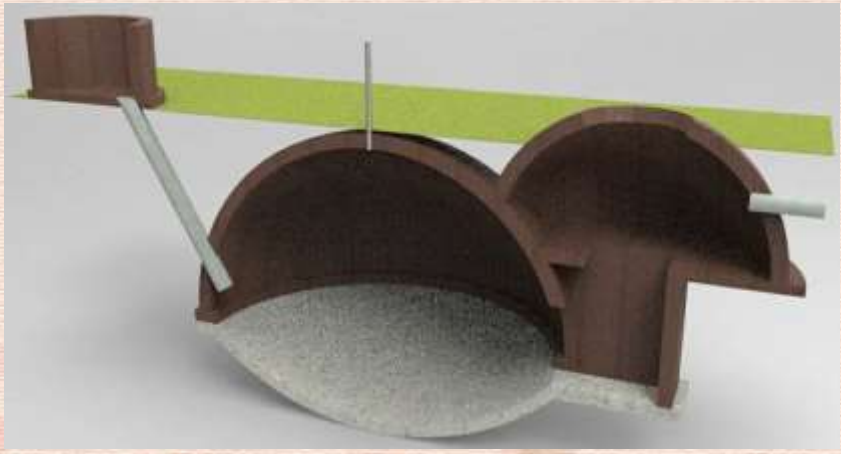
- Widespread:
  - 45 million plants in China
  - 5 million in India
  - 300,000 in Nepal
  - 400,000 in rest of Asia, including Bangladesh

  (estimates, based on reported figures 2011)
- Local technologies
- local skills
- low cost
- ambient local temperatures >28°C

Which Technology?

- Approach: increase scale of Asian systems for putrescible wastes
- Answer found in Africa: KIST, Rwanda and BTAL, Ghana (used for sewage)
- Hydraulic / Fixed Dome / Chinese Design

Janata (Cast-in-place)



/ Deenbandhu (non-mould rolling dome method)

Large Deenbandhu

- Deebandhu made from rings of bricks
  - KIST project in Rwanda for sewage from overcrowded prisons (10,000 inmates) 1,000 m^3 TIV = 10 x 100 m^3 units
  - BTAL project in Ghana for sewage from institutions: schools, colleges, hospitals etc

(see www.ashden.org/winners/list and www.biogasonline.com)

CMC Vellore Project

- Christian Medical Centre has a recycling centre for all wastes from three main sites
- Employs poor and disabled people
- Wanted a biogas system – gas for cooking
- KBE designed a system, built by SKG Sangha
- Deenbandhu (rings of bricks)
- 2 x 75 m^3 TIV
- 3 tonnes waste/day
- 300 m^3 gas/day estimate
- £48,000 estimate
  (= £160 per m^3 d^{-1})
  biogas only + stoves
  (adjusted for Indian inflation)

Construction

- Design based on KIST (Ainea Kimaro)
  - Key is a reinforced concrete ring at base of dome
  - No other reinforcement
  - SKG Sangha masons highly skilled
- Brick domes have long life 500,000 m^3
  - e.g. Golghur, Patna, built 1786 as granary (∅125 m)

Further research

- Aim to develop low cost system for Janata (cast-in-place)
  - Need moulds: earth, steel sections, inflatable
  - Good demand in Nepal (www.aepc.gov.np)
  - 112 companies making biogas plants in Nepal

Food Waste Digestion

- Aim to replace pulversiation of biomass with pre-digestion - seperate hydolysis stage
  - Remove indigestable matter after first stage
- Biotech Ltd in Kerala (see ashden.org/winners/biotech)
- BARC in Mumbai, Nisargruna process
- Liquor recycled
- Predigested matter can be composted
- Gas used in generator

25 m^3 plant cost ~£20,000

@ 19 m^3 d^{-1} = £1,050 per m^3 d^{-1}

(adjusted for inflation – HRT 85 d)

(based on SANDEC report)

Further Research

- CFLB (Counter-Flow Leach Bed) pre-digester

  Test at three different scales:
  - Laboratory tests at Birmingham City University, funded by a BIV grant from ADNet
  - Pilot plant, made from plastic drums in a shed near Wokingham
  - Full-scale at CMC Vellore, feeding the underground main digester in South India.

Future Plans

- Once there is a working design:

  Many possible applications, so field tests:
  - Institutions: schools, colleges, hostels, prisons
  - Food markets
  - Food processing: coffee, dried fruit
- Consortia being set up (ongoing discussions):
  - Group to look at larger cast-in-place concrete domes with Kathmandu University
  - Group to look at using AD system with pre-digester by food processing companies
  - Group to extend the CMC Vellore system for other institutions.

Questions?

For further information and sources, see:
www.kingdombio.com/resources.html
also: www.ashden.org