Animal Waste Management for Economic and Environmental Benefit

- A Virtuous Circle

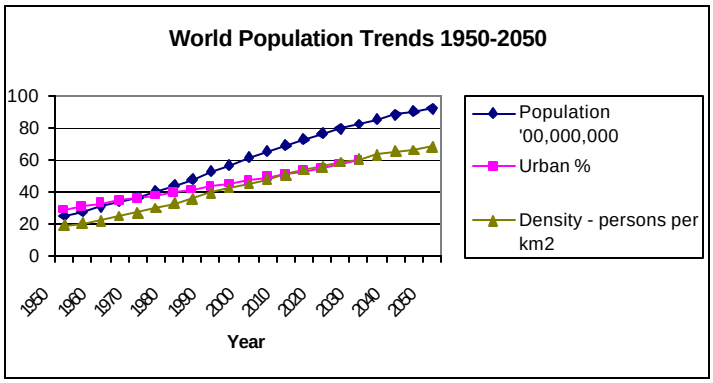
Landhi Cattle Colony, Pakistan

In this presentation

We shall look at the relevance of energy from animal waste mainly in the South and Western Asian region, and analyse:

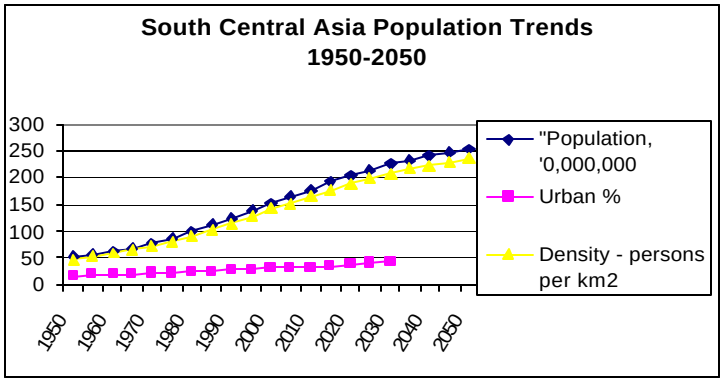
- Why this matters
- How to use animal waste beneficially
- What will result

Population growth, density and urbanisation - World



Data source: Department of Economic and Social Affairs, UNDP 2006 Statistics Revision

Population growth, density and urbanisation - South Central Asia



Data source: Department of Economic and Social Affairs, UNDP 2006 Statistics Revision

Implications

We need a new perspective on provisioning large agglomerated populations

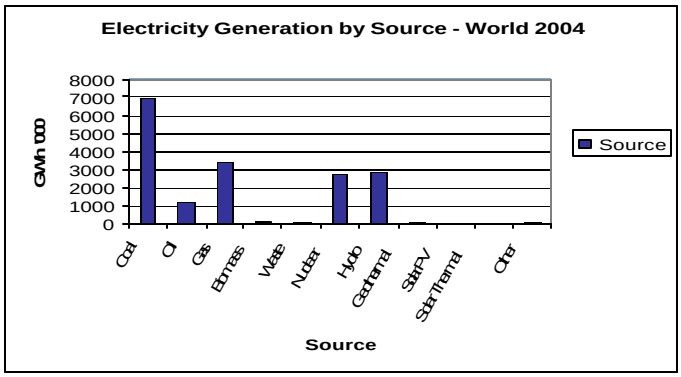
Energy

- Move from traditional biomass with inefficient conversion technologies to modern sustainable efficient energy

Food

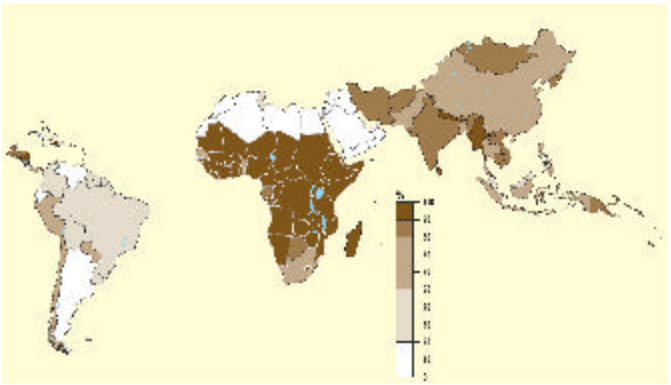
- Move from subsistence farming to commercial agro-industry and livestock farming techniques
- Minimise transportation of food stuffs to urban populations
- Better quality nutrition needed to avoid endemic poor health

Sources of Electricity



Data source: IEA Energy Statistics, http://www.iea.org/Textbase/stats/electricitydata

Share of Traditional Biomass in Residential Consumption



Data source: OECD/IEA World Energy Outlook 2006:Focus on Cooking Fuels, Teresa Malyashev, IEA, 4 May 2007

Summing up

- Populations have become much larger and moved much closer in the past fifty years:
  - World total from 2.5 to 6 billion
  - South Asia from 511 million to 1.5 billion
- Regional access to commercial energy especially electricity, is very constrained outside the oil and gas-rich region
- Most energy comes from non-renewable sources, so energy security is a pressing issue, especially as growth in demand will be exponential
- Post-green revolution, increases in food supply are slowing down
- This arid region has worse access to food in terms of calorific adequacy, quality and cost than in temperate zones
- Milk is a good source of protein, relatively cheap, and has high cultural and culinary values

Landhi Cattle Colony - high density peri-urban dairy farming

The waste is dumped in the monsoon drains

Impacts are visible from space – tragic waste or tremendous opportunity?

Options – the virtuous circle

The cattle at Landhi produce ~ 7,200 tonnes of manure per day, which could supply:

- 100,000m^3 of gas, ~ 65% methane
- ~ 20 MW electrical capacity, or up to 50 MW when combined with other biomass
- A CNG station, or LPG production
- 1,400 tonnes per day of pathogen-free organic manure
- Residual nutrient-rich liquid for hydroponics or "fertigation"

Why is this worth doing

- Country's primary energy deficit was 30% in 2006, and is increasing
- Electricity shortage especially in Karachi is leading to civil unrest
- Most energy supply at present is non-renewable and becoming unaffordable
- Biogas is a relatively easy and cheap energy source to manage; the cattle produce 24/7
- Impacts of the "green revolution" have run their course
- Production is falling relative to application of nitrogenous fertilisers
- Soil structure and fertility is in serious decline
- Agricultural run-off contributes to the coastal fringe's fame as one of the world's most polluted waterways

How?

Biogas Plant Process:

Collect dung

Deposit in collection tank, mix water and additives

Collect gas, scrub and send to generator/grid

Decompose in biodigester 2-30 days

Treat sludge; use as compost

Why has this not be done before?

- Policy and institutional incoherence
  - Poor articulation between energy, environment agriculture/fertiliser and social sectors
- High capital cost if viewed only as an energy project: ~ $4 to 5 million per MW investment
- Jurisdictional issues through institutional change; whose problem is the waste?
- International institutional issues
  - ADB has been strongly supportive, but international environmental agencies have unwittingly caused avoidable delays

Outcomes

Financial

- Investment ~US$120 million
- Revenue, US$ p.a:
  - Energy ~ 10 million
  - Organic fertiliser ~ 40 million
  - Carbon income at US10/tonne ~ 10 million

Indicative IRR 30.2%

Environmental Outcomes

- Abatement of ~ 1 million tonnes CO_2e/year
- Removal of cattle waste from open waterways ~ 2.5 million tonnes/year
- Reduction in ground water pollution
- Reduction in water use ~ 13 million m^3/year, 5,250 Olympic swimming pools full
- Greening of public spaces using waste water

Socio-economic Outcomes

- $50-60 million p.a. new business
- Will create 4-500 new jobs, almost all local, most available to the poorest, some targeted specifically to poor women
- Will create ~20 MW of new generation and save ~ US$10 million in forex for fuels
- Could save around US$ 5 million per year on chemical fertilisers
- Could support organic farming with much higher financial returns
- Indirect economic benefits in improved soil fertility and structure, better human and animal health and environment, returns to local economy through wages and CSR activities

The future for arid zone livestock farming

- Hygienic livestock farms
- Distributed generation
- Return of waste to the cultivations from which feedstock comes
- Financially viable enterprises–no more throwing Rupees in the rivers

The Virtuous Circle becomes a successful norm