



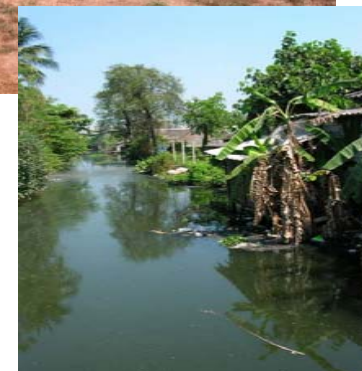
Livestock in East Asia Project

Pollution Control for Pig Waste



Kurt Roos
for

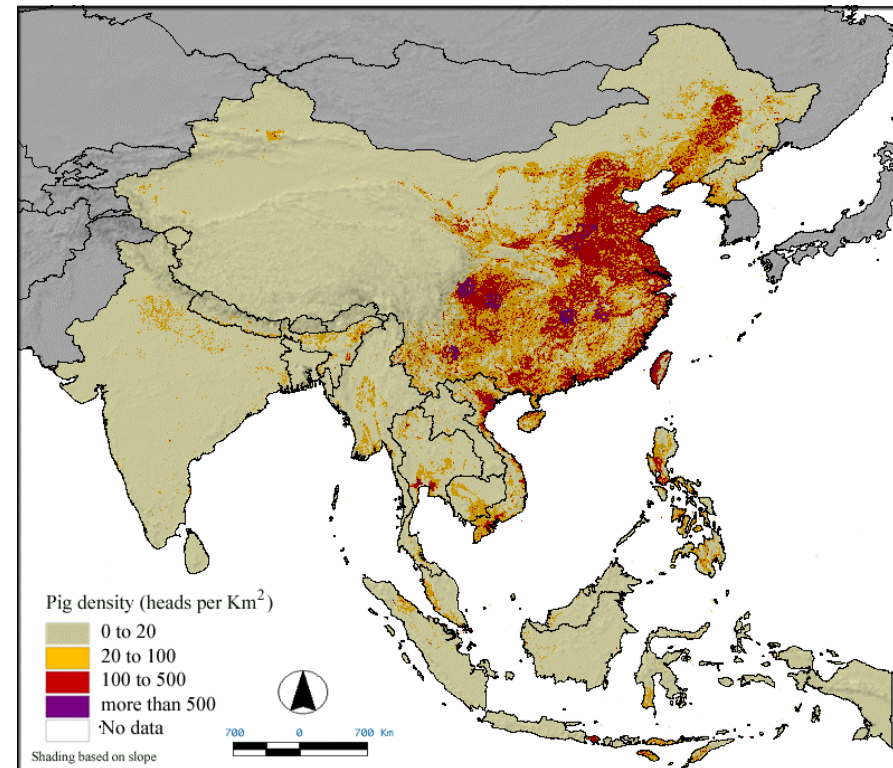
Weiguo Zhou – Team Lead
Rural Development & Natural Resources Sector Unit
East Asia and Pacific Region
The World Bank





Project Background

- Purpose: Reduce negative environmental and health impacts caused by confined livestock in region
 - Discharge to surface waters main issue
- Three country areas involved:
 - China, Guangdong Province
 - Thailand, Racthuburi and Chonburi province
 - Vietnam, Ho Chi Minh City and Hanoi
- Project implemented over a 5 year period
- Japan PHRD Grant Fund for Climate Change includes a Greenhouse Gas project component





Project Country Profiles

- Opportunities
 - Pig waste handled as liquids and slurries
 - Appropriate candidate for anaerobic treatment and gas recovery
 - All countries desire gas recovery technologies

- Project Benefits:
 - Organic (BOD) stabilization
 - Pathogen reduction
 - Nutrient conversion
 - Odor control
 - Greenhouse Gas reduction
 - Energy - adds additional revenue stream to farm

	Standing Pig Population (millions)	Methane Emissions (Gg)
China ⁺	47	1,197
Thailand	7	1,786
Vietnam	25	123
Total	79	3,106
as % of World	>50%	>25

⁺ China is a current *Methane to Markets* Participant



Large Range in Farm Scale

- Thailand
 - Very large corporate type farms >20,000 and very small family farms 10-50 pigs
- Vietnam
 - Very small family farms 10 – 200 pigs
- China
 - Moderate scale farm 100 – 2,000





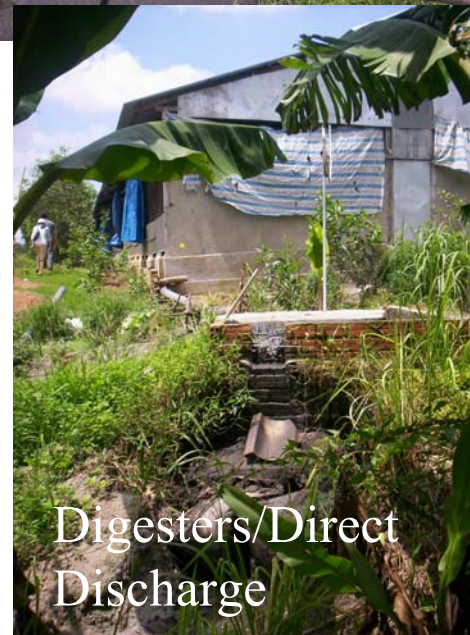
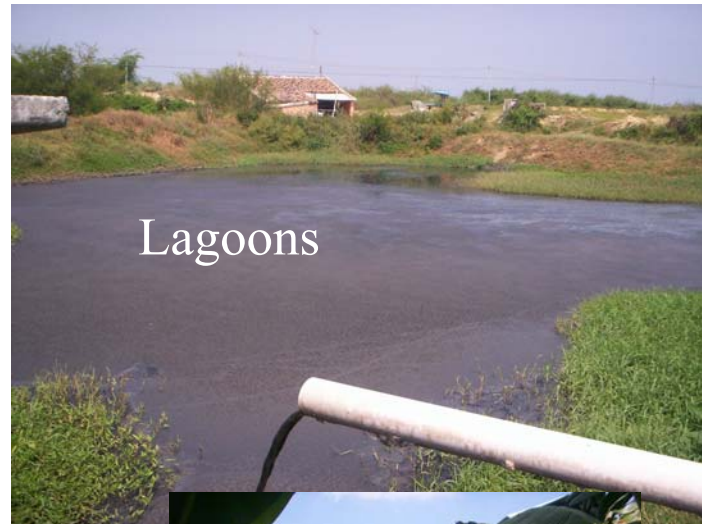
Waste Handling and Collection

All countries solids collection and hose flush





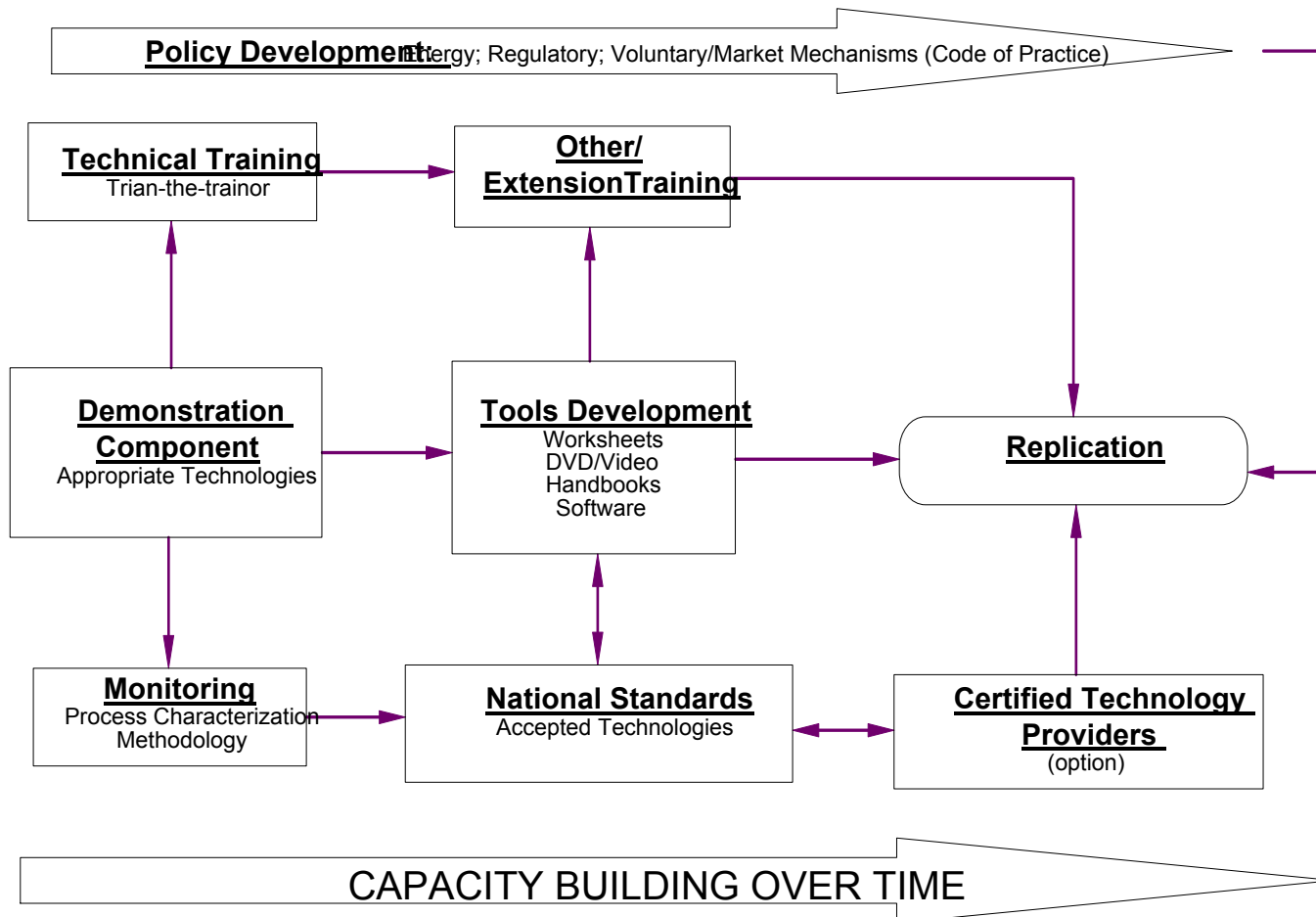
Waste Management



- 1) Land application of nutrients limited to solids fraction only
- 2) Have discharge standards
- 3) Pollution load is catastrophic



Project Design



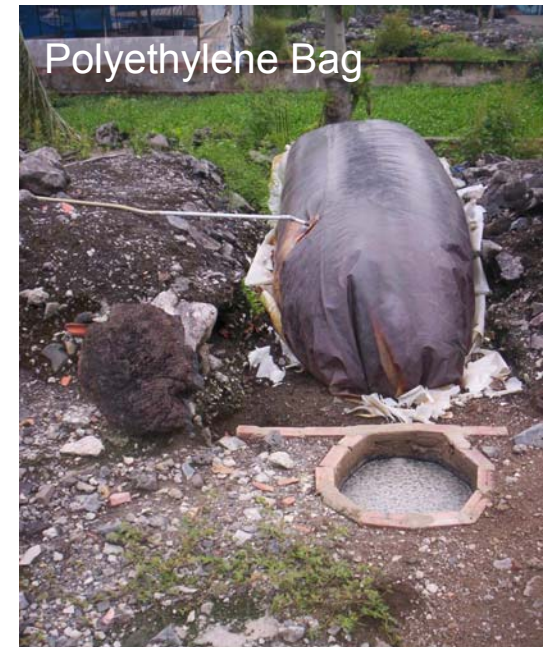


Demonstration Overview

- Purpose is to demonstrate an array of systems that prevent water pollution
 - Greenhouse gas and air quality are not primary project objectives
 - Systems must be affordable – gas recovery component does this
 - All countries desire systems with gas recovery
- Many system types
 - Cost implications
 - Gas use options vary
- Projects are on-farm and communal
- Other processes also in technology mix
 - Two cell open lagoons
- Land application and nutrient management planning approaches are being introduced.
 - Long term implications for project
 - Some countries limited opportunity i.e., fish pond feed resource



On-Farm Demonstrations





Communal Digester N. Vietnam

- Social structure allows for communal development, operation, and management of covered lagoon
 - 200 families
 - @1,500 pigs
- Village waste canal to be constructed
 - Designed for rainfall exclusion
- Gas purchased and used as cook fuel for families
 - Distributed and measured in refillable bags





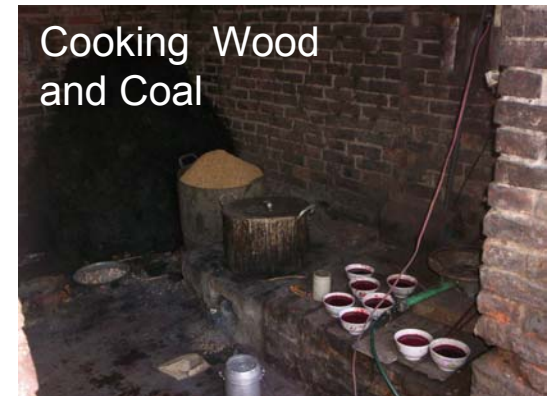
Gas Use Options



Heat lamps and light



Cooking Propane



Cooking Wood and Coal



Shaft Power



Electric/Cogen



Pumps



Flares



Nutrient Management – Tropical Climate Options

- Land application relative to crop need (N and P)
 - Most common approach includes temperate climate approaches – US, Europe
- Wetland
 - Aquatic crops remove nutrients
- Fish ponds
 - Waste used as fish feed resource – China, Vietnam, Thailand
- Treat and discharge - sewage
 - Livestock waste comparatively high strength very expensive
 - Understanding mass loading critical





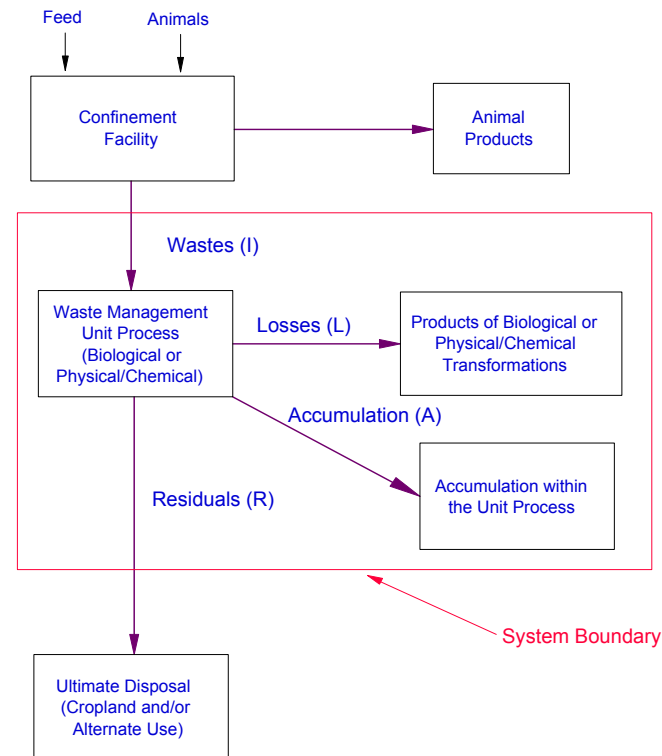
Affordability

- Demonstration has wide range in installed cost
 - \$7-15 per pig (covered lagoons, two cell lagoon, fixed dome)
 - China two phase system
 - \$60-100 per pig
 - Communal Project
 - \$55 pig (majority in village waste canal system)
- Cost will effect replication potential
- Policy component
 - Energy financial incentives
 - CDM
 - Code of Practice



Monitoring Component

- Measuring pollution mitigation needs credible basis
 - Baseline WMS
 - Direct discharge
 - Storage
 - Fishponds
 - Methods and Protocol
- Monitoring supports policy, technical, and tools elements



Performance Parameters
 Oxygen demand
 Nutrients - Nitrogen & Phosphorus
 Indicator Organisms
 Metals

Where : $L = I - (R + A)$
 (I and R are measured and L and A are estimated)



Next Steps

- Project still in development
- Negotiations – Dec. 8
- First phase demonstrations start construction Feb. 2006
- First Supervision Summer 2006

Gracias...

