

Potentialities
For Greenhouse Gas Emission Control
By Livestock Manure Treatment:
China Evaluation

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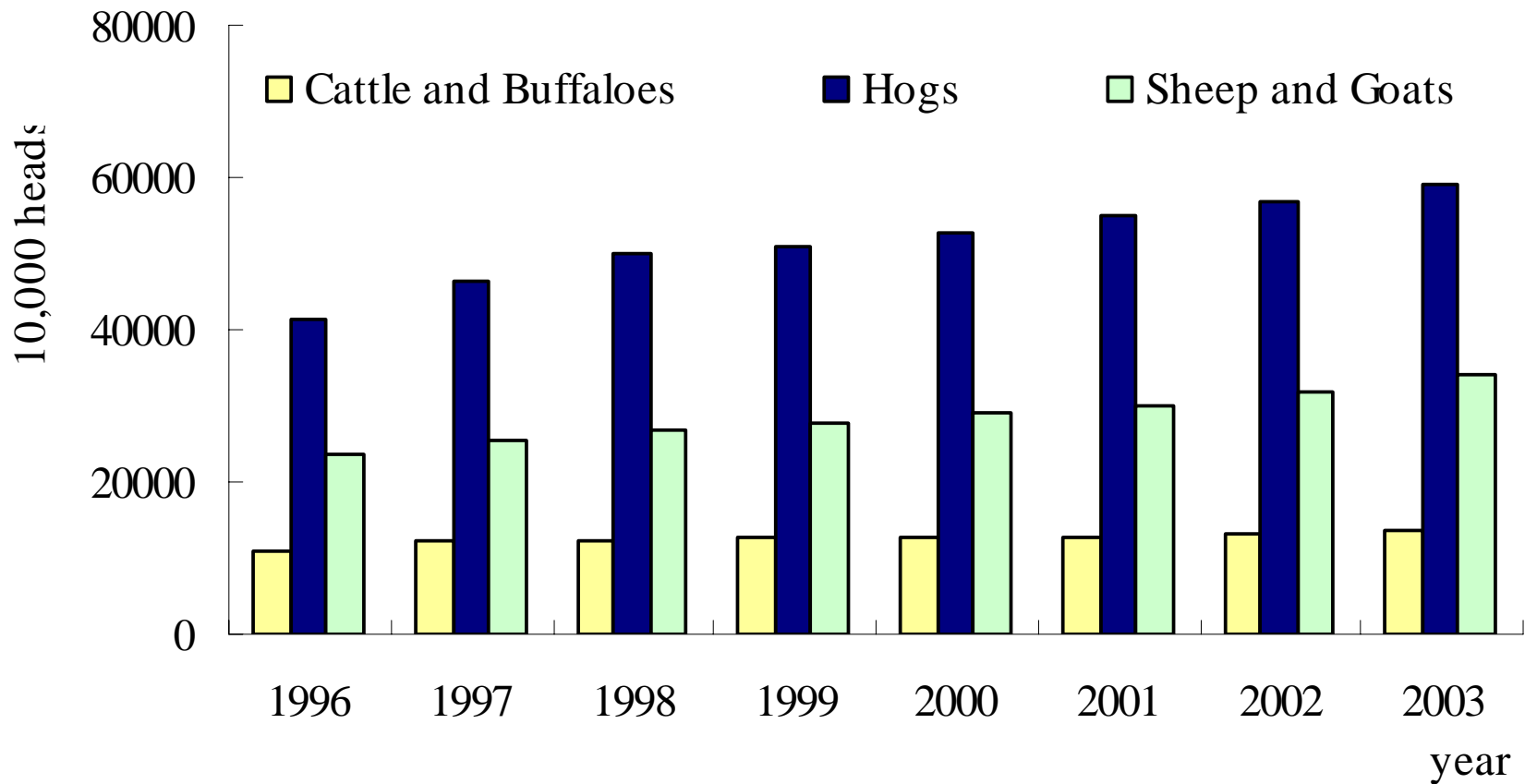
Agriculture Role in GHGs Emission

- Three kinds of GHGs: CO_2 , CH_4 and N_2O .
- Agriculture GHGs emission from farmland, ruminants and livestock wastes treatment and disposal.

Agriculture represents 40% for methane and nitrous oxide. contributes about 20% of the total anthropogenic GHGs.

- Intensive livestock operations account for approximately 50% of Agriculture-related GHGs emission.

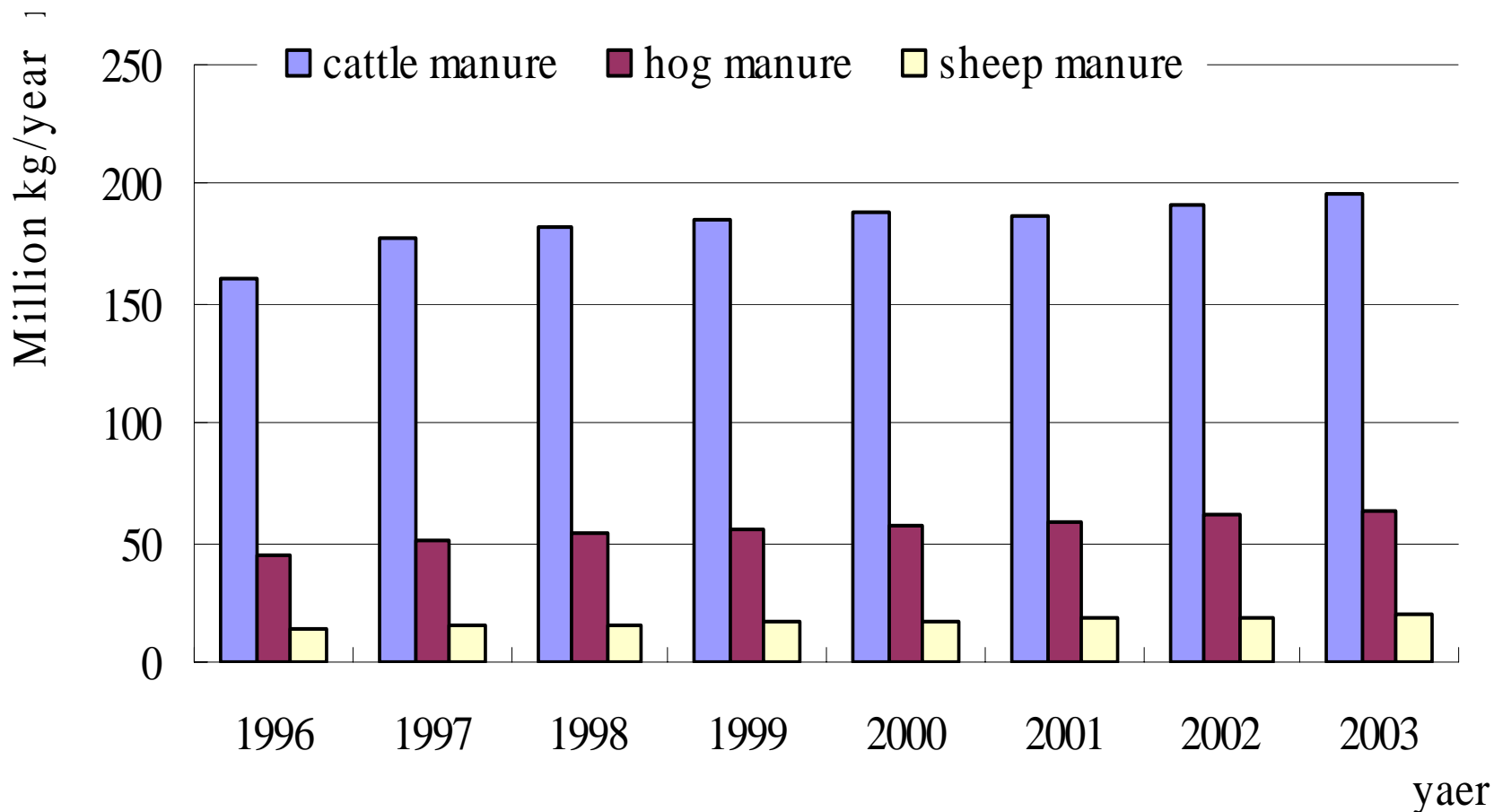
China: A Big Country for Livestock Production



Livestock manure generation

animal	Cattle	Hog	Sheep
1996	161.064	44.523	14.237
1997	177.860	50.202	15.345
1998	181.651	54.232	16.142
1999	185.395	54.809	16.755
2000	187.848	56.887	17.419
2001	187.233	59.332	17.895
2002	191.038	61.219	18.993
2003	196.621	63.937	20.432

Livestock manure generation



GHGs emission factor from different animals growing

kg per head per year

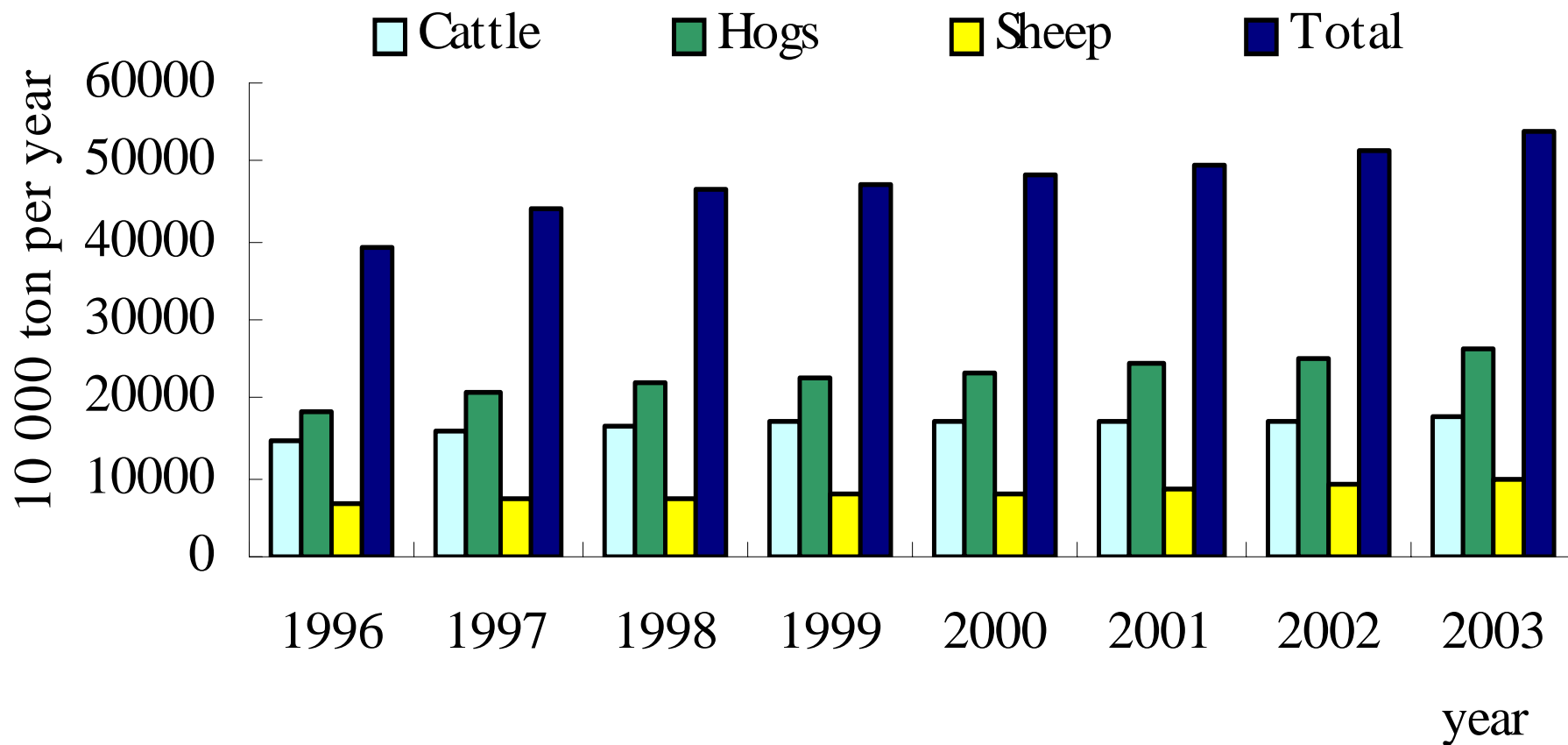
Animal	CH ₄	CO ₂	N ₂ O
Buffalo	5.928	1129.7	0.086
Cattle	15.854	1315.2	0.004
Chicken	0.110	18.2	0.002
Pig	12.164	430.1	0.057
Sheep	2.891	278.3	0.027

GHGs generation factor from anaerobic manure treatment

kg per head per year

GHG	Average temperature (°C)					
	<20		20-25		26-30	
	hog	cattle	hog	cattle	hog	cattle
CH ₄	1.393	5.398	0.462	4.802	0.449	4.495
CO ₂	1.279	4.222	0.443	4.253	0.421	4.116
N ₂ O	0.002	0.008	0.001	0.010	0.001	0.016

Estimation of GHGs emission



CH₄: the equivalent quantity of CO₂ is 21.

N₂O: the equivalent quantity of CO₂ is 310

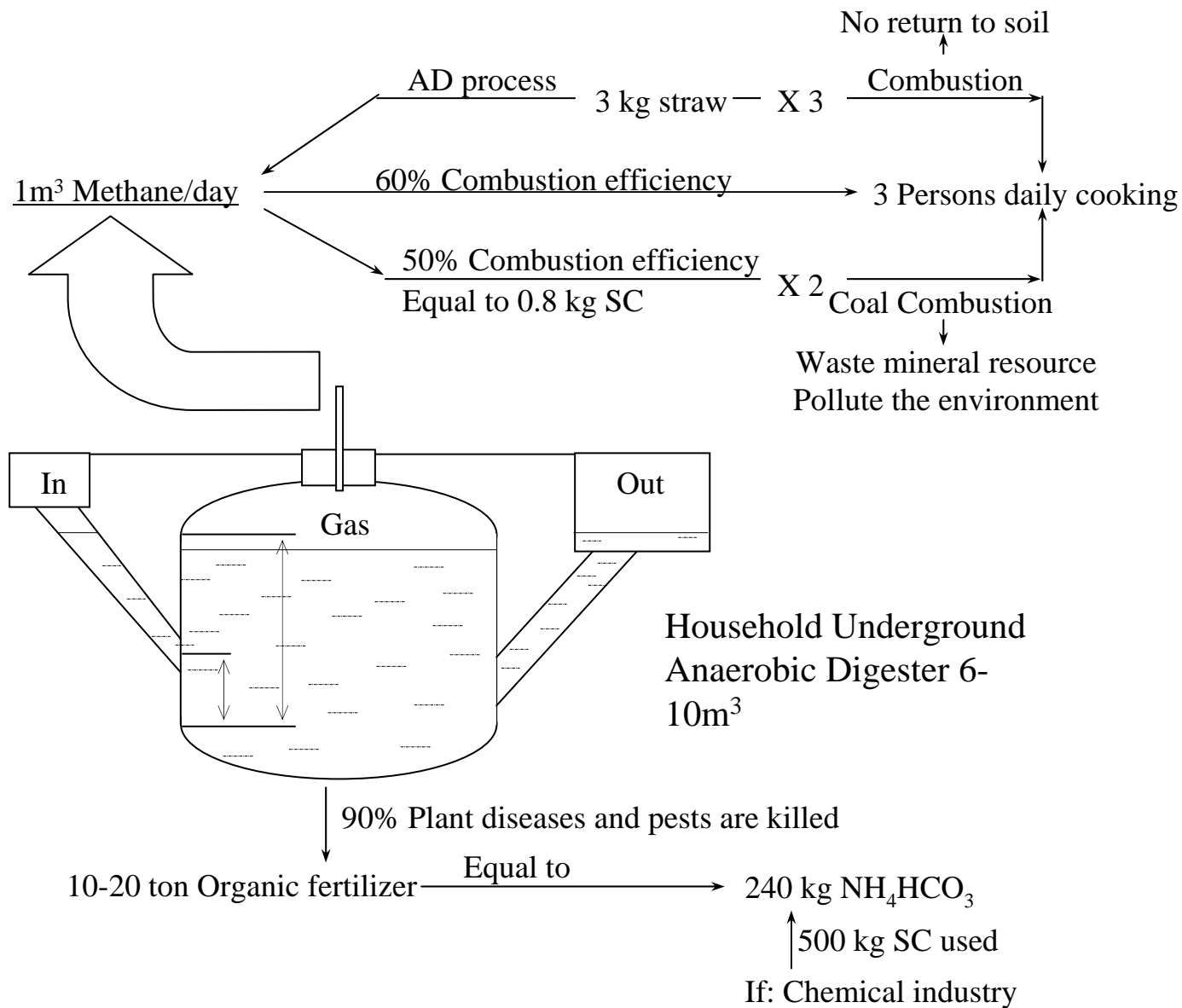
Livestock Manure Treatment: Practices in China

Solid-Liquid Separation/Solid Manure Dewatering	X by practice
Direct Utilization of Solid Manure as Fertilizer	X by farmers
Solid Manure Composting	Some useful
Anaerobic Treatment of Liquids	Huge potentiality

Scaled-up animal farming:
high-cost separation
farmers can not assume huge
amount of manure
**AD is necessary and solids are
energy-intensive**

Family animal growing:
hate to handle manure-either for
field use or for separation
**Family AD is so well developed
and useful**

The Benefit from Household AD

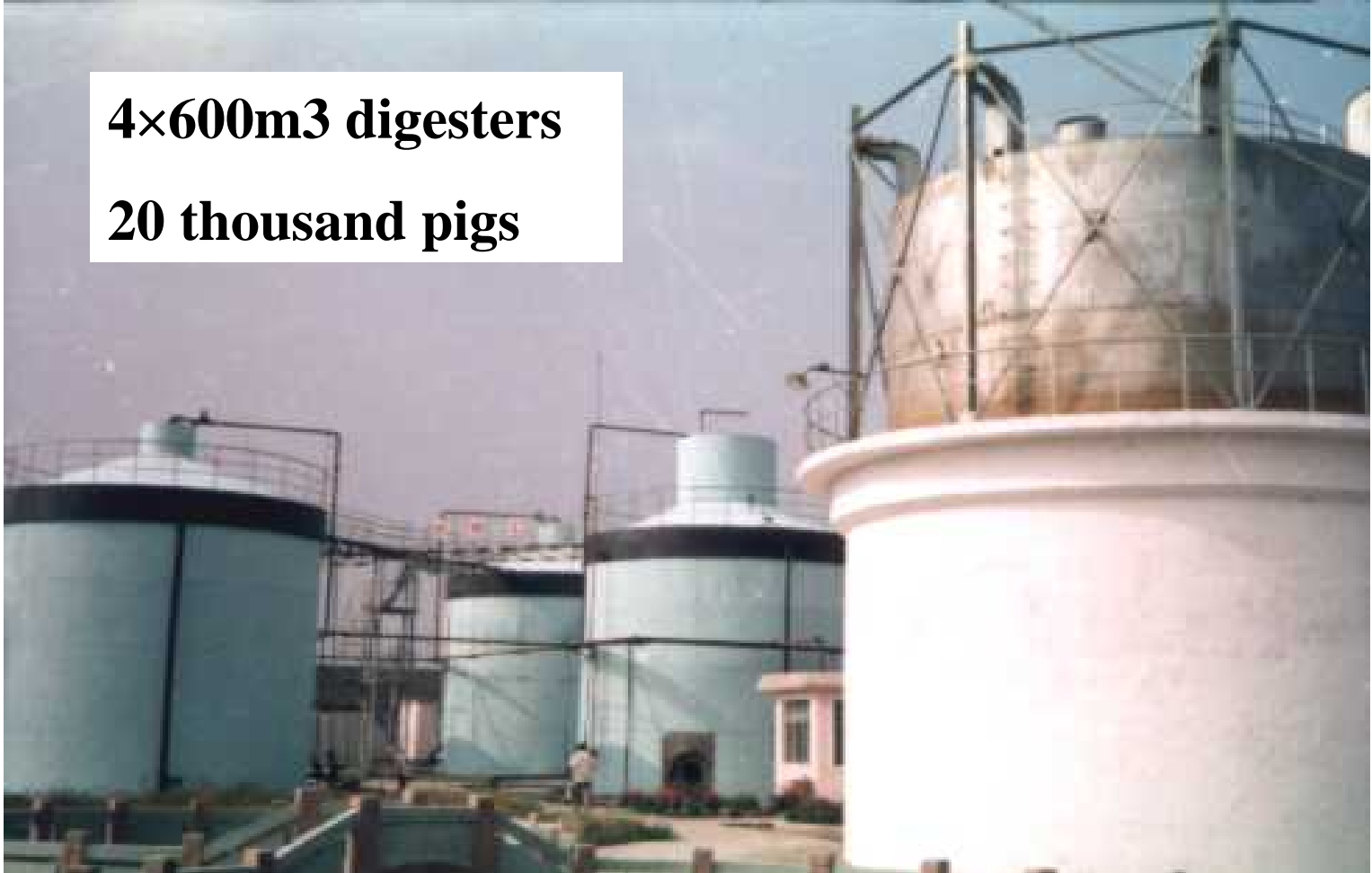


Biogas from Organic Wastewater Treatment

Ningbo Pig Farm Biogas Plant

4×600m³ digesters

20 thousand pigs

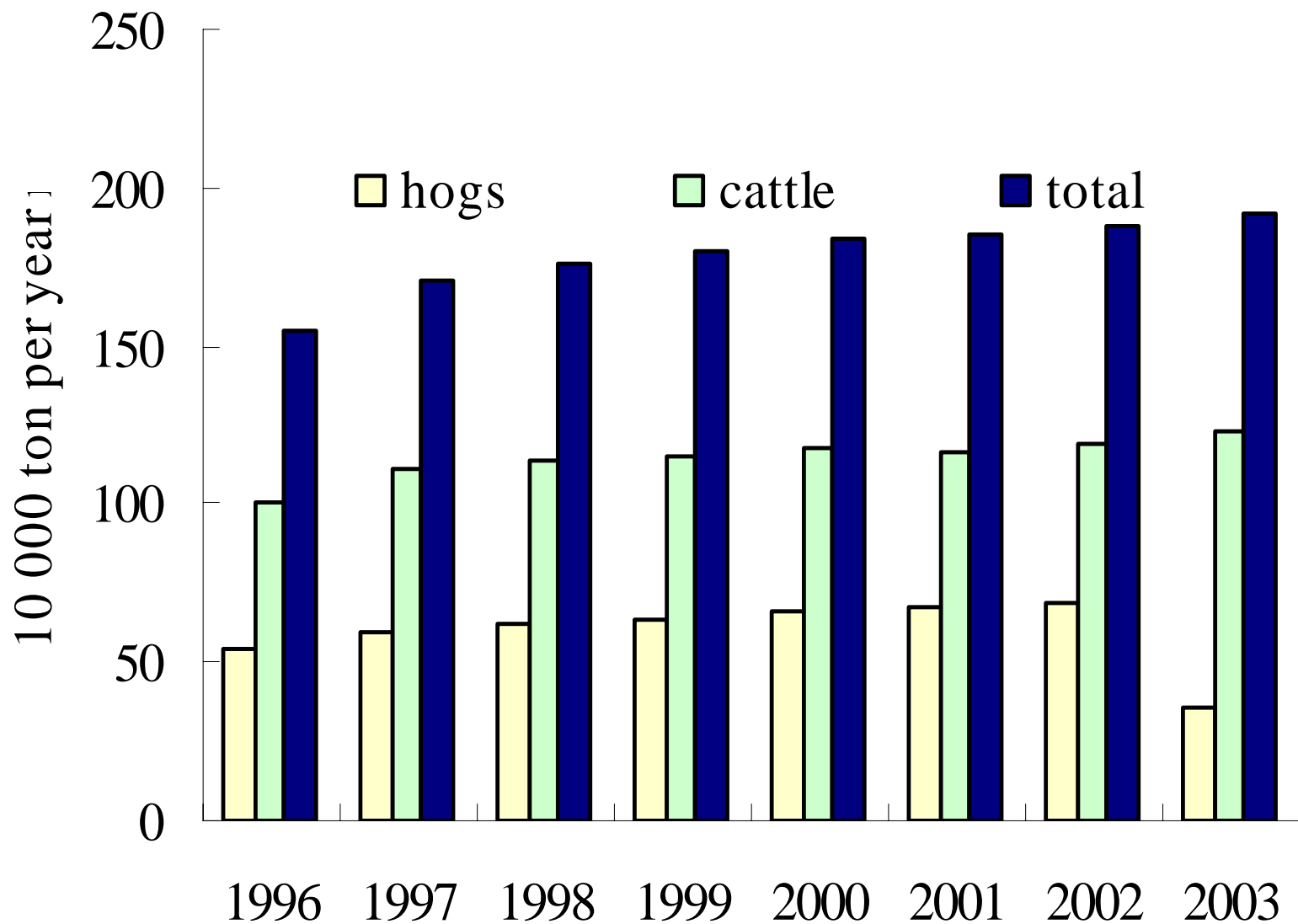


Biogas from Organic Wastewater Treatment

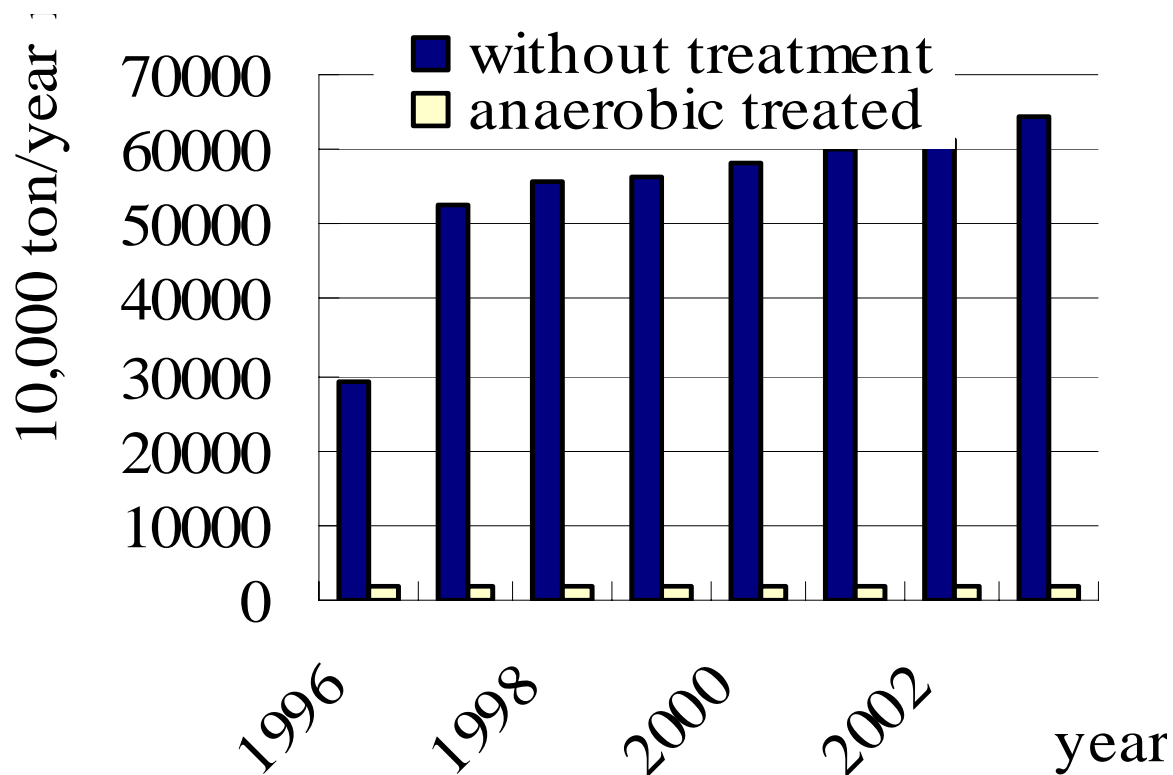
Middle Scale AD



GHGs Emission with Manure Treated by AD



Estimated GHGs emission Reduction Potentiality



Estimated GHGs emission Reduction Potentiality

Take the year 2003 as an example, the GHGs emission reduction would be as much as 6.2E8 ton of CO_{2e}, and the CDM based benefit can be expected to be 6.2 billion USD with 10\$ per ton of CO_{2e} emission reduction.

This is a huge market for both China and the developed countries.

Manure Untreated



Manure Untreated



Manure Untreated



Kyoto Protocol and CDM

The developed countries need to reduce GHGs emission by 8% until 2010 with the year 1990 as the comparison

However it is harder for the developed countries like Japan to go further on GHGs emission reduction because they have had applied energy-efficient technologies and they have had their organic waste treated in an environmental friendly way.

The CDM makes it possible for capital and technology transfer from the developed countries into developing countries, with mutual benefits: The developed gets CREs and the developing reaches better environment.

Global Villagers Responsibility

Besides the CDM benefits, to treat the livestock manure in an environmental friendly way is the responsibility of the global villagers.

AD technology helps human beings save natural resources like water and minerals.

AD effluent can be used for recycling after sterilization. For example a 6000 head capacity pig farm can save 22000m³ water if recycle all the effluent from AD. The AD will also save 160 tons of coal with the adaptation of AD for energy and fertilizer production.

Global Villagers Responsibility

Water is critical for China. Think that the sandy storm heat Japan and Korea in last years, we may have a better understanding of “Helping the neighbors is helping ourselves”.

Obstacles for AD Application

1. Awareness of AD and its benefits
2. Tackle the misunderstanding of AD: Psychrophilic or Mesophilic and Thermophilic
3. DemoSite
4. Advanced technology transfer

Suggestions for China-Japan Collaborations

1. China Animal Agricultural Situation Evaluation:
The Background Investigation
2. Livestock Manure Anaerobic Treatment and
Comprehensive Utilization DemoSite: Technology
Integration
3. Japanese Companies Come Up to Work Together
with Chinese Partners for Mutual Benefit Based on
CDM

Suggestions for New Concept

1. Animal Farm, Power Station — *Norman Scott* from Cornell University
2. Power generation for electricity and heat
3. Fuel cell application
4. AD heating system, mixing system, and insulation
5. AD effluent sterilization and recycling: ecological assesment
6. CDM based economic evaluation of AD application

Animal Farm, Power Station

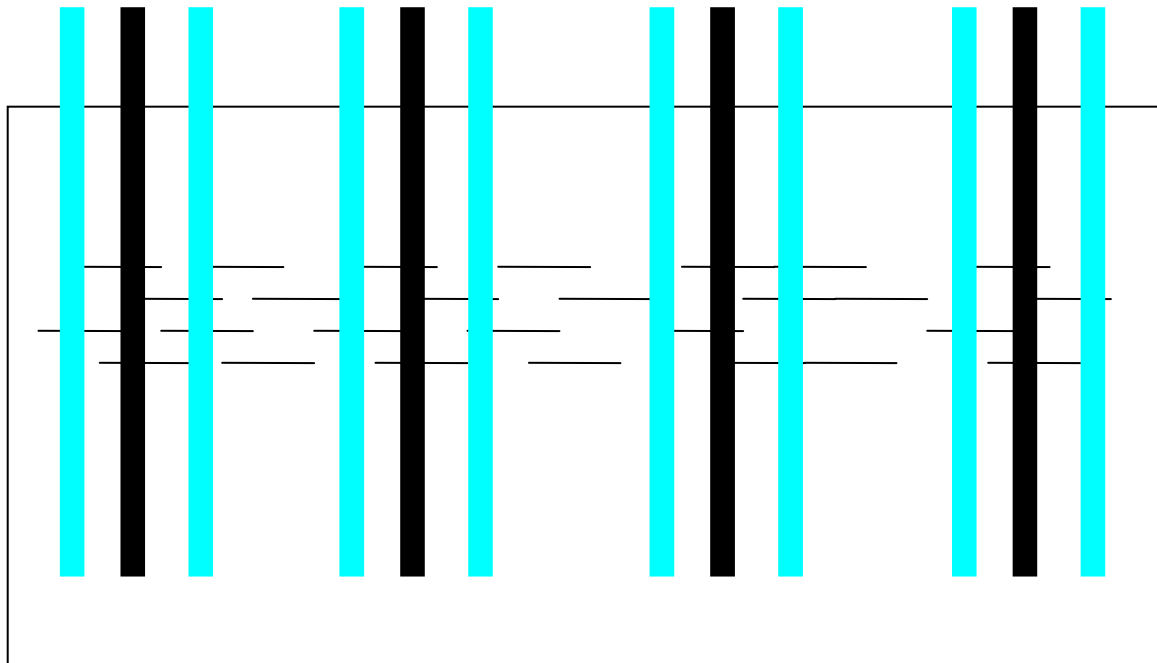


Animal Farm, Power Station



AD Effluent Sterilization

electrodes

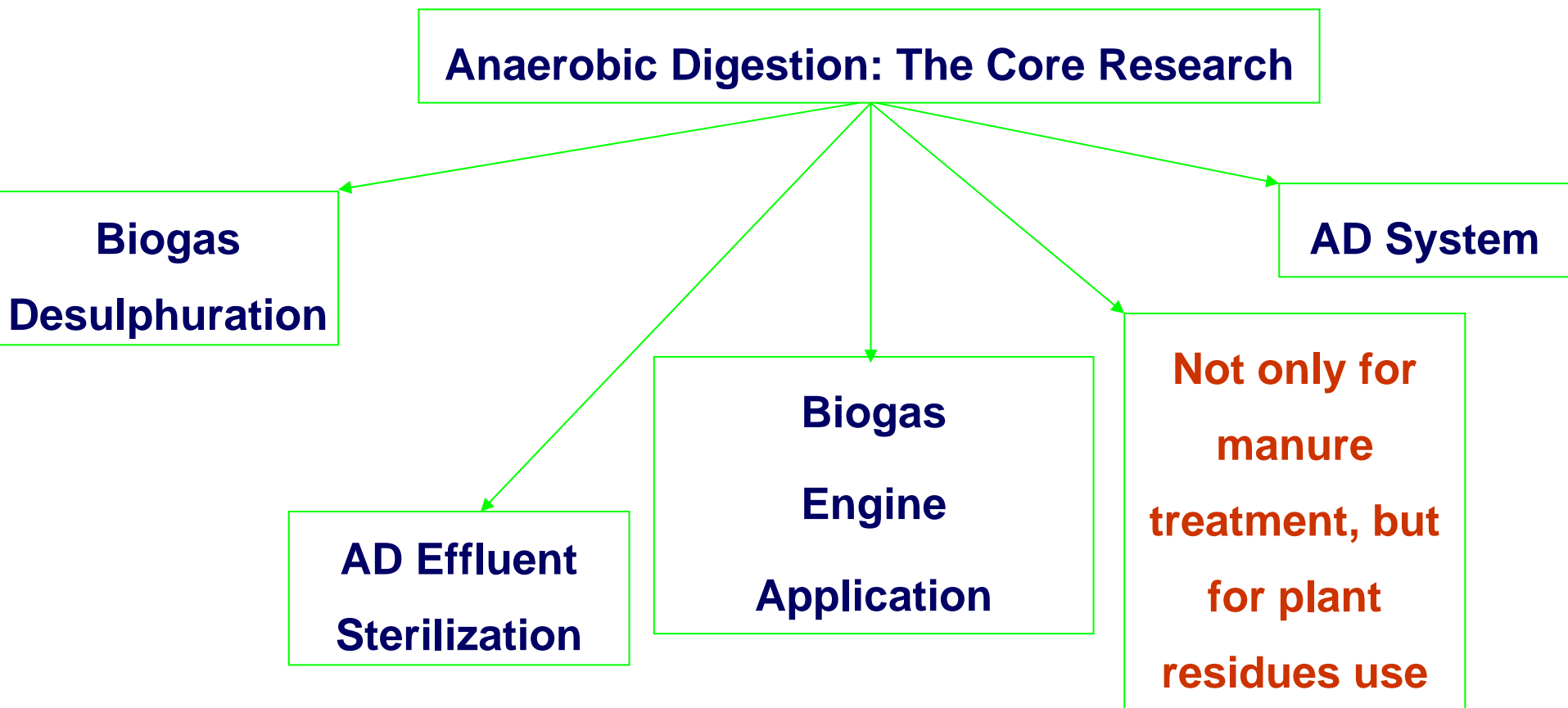


Renewable Resources Lab

1. Large scale AD for animal manure treatment – Year 1980s
2. First theoretical analysis on integration AD in the greenhouse: Four in One – Year 1994
3. First MW scale biogas engine development – Year 2004
4. Biogas development strategy – Year 2005
5. First research on AD effluent sterilization – Year 2004
6. First application of BioDesulphuration – Year 2003

1. Germany
2. Netherlands
3. Japan
4. US
5. UK
6. Korea
7. Africa

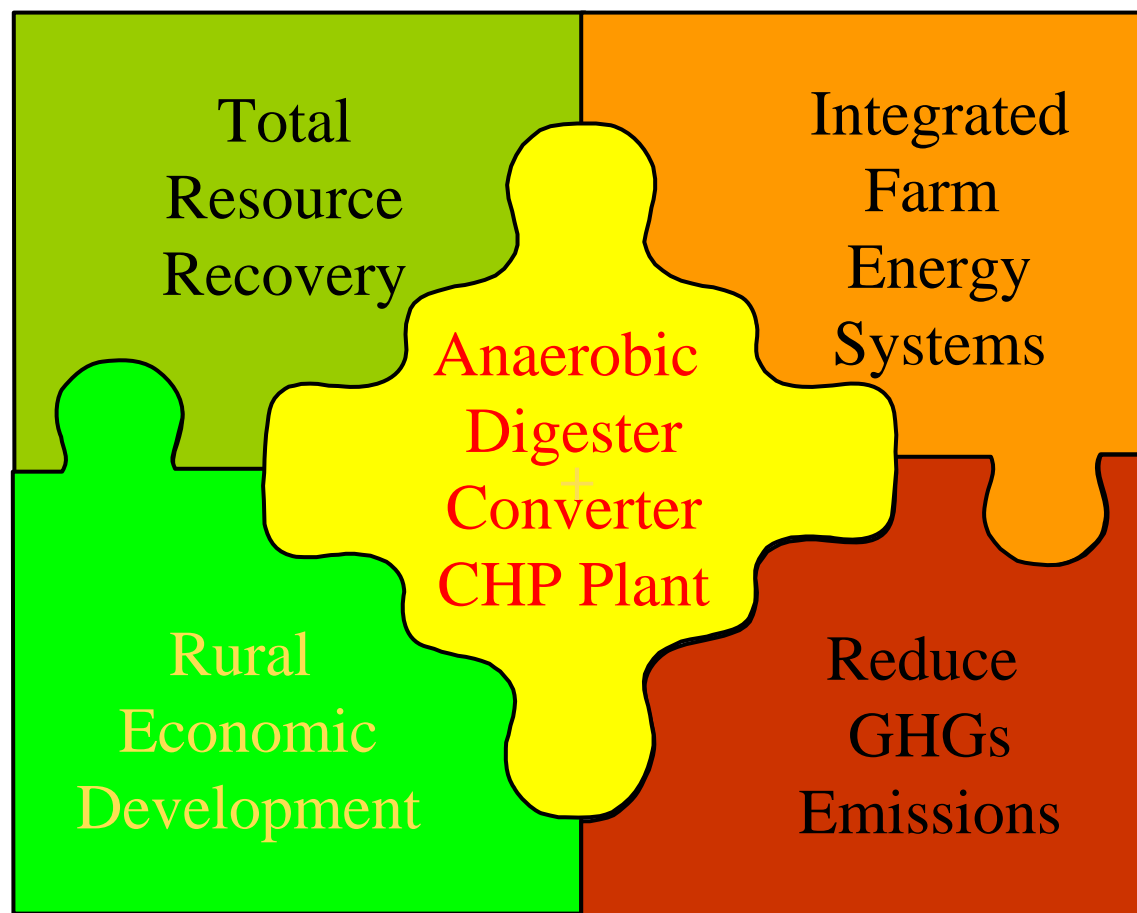
Renewable Resources Lab



Renewable Resources Lab

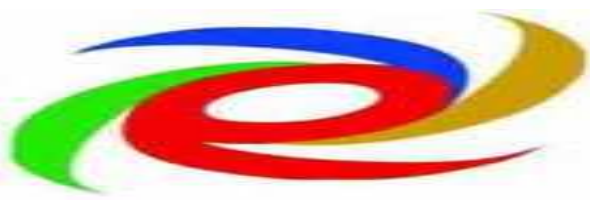
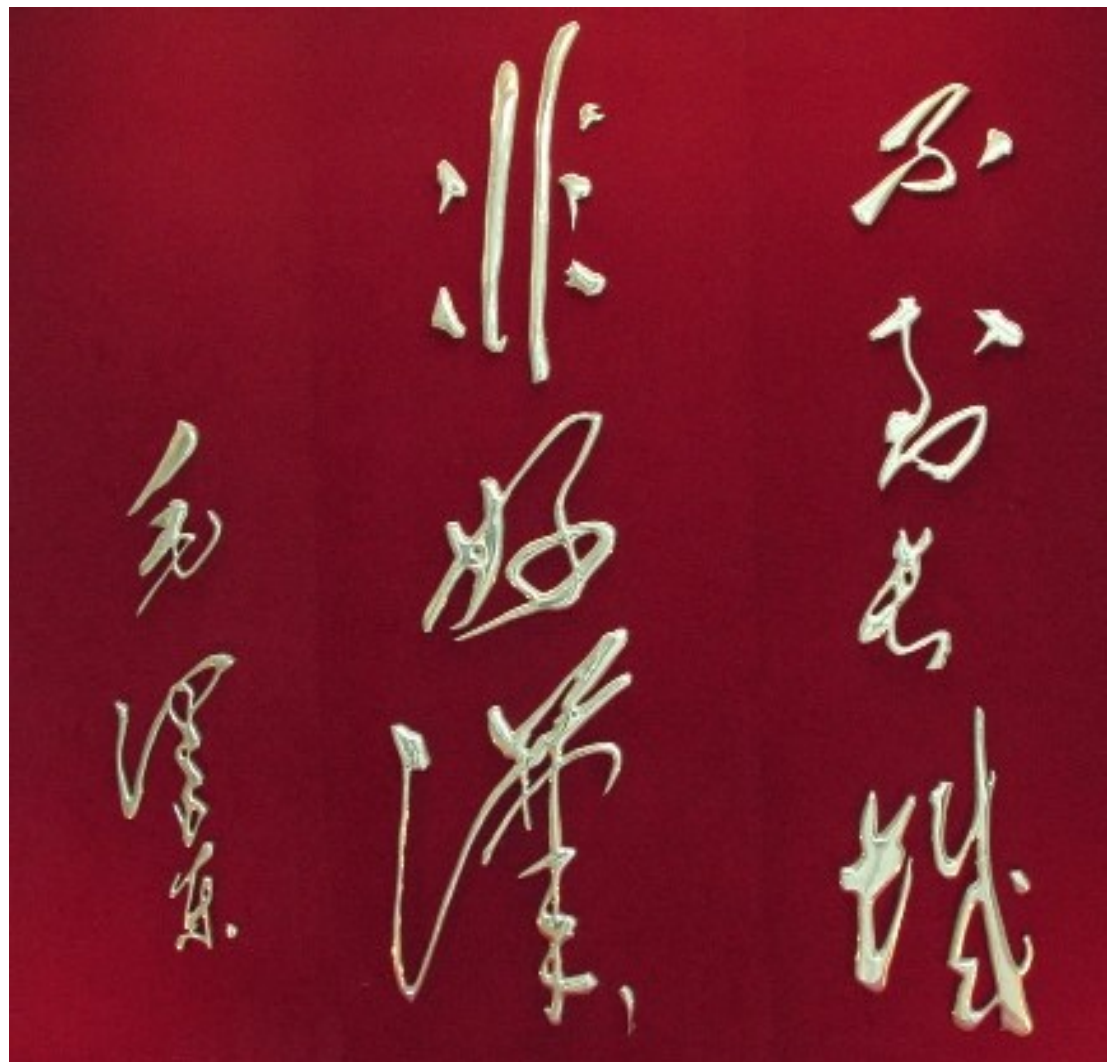


A Holistic Agriculture --Norman Scott



**Thanks and
Bye**

You will be a HERO if you touched the Great Wall



可再生资源研究室
Renewable Resource Laboratory
China Agricultural University