Methane to Markets

Sub-commitee Agriculture

Brazil Profile on Anaerobic Digestion

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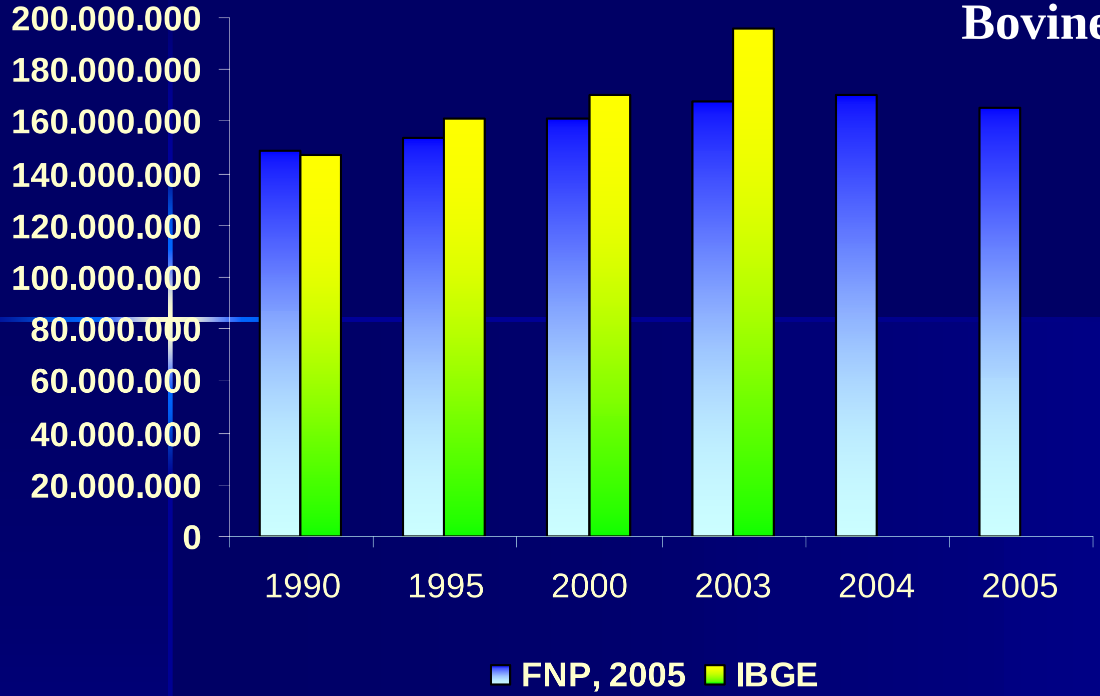
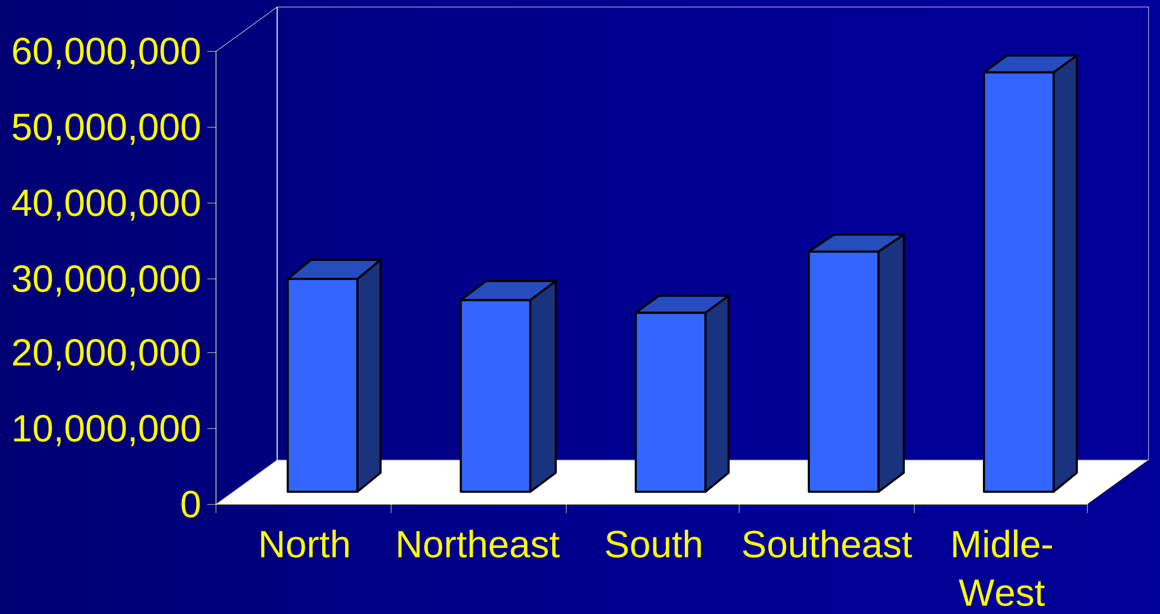
Livestock population statistics (FNP, 2005)

Herd	1990	1995	2000	2003	2004	2005
Buffalo	1.397.718	976.781	1.102.478	1.150.052	1.158.425	1.169.717
Bovine	148.760.866	154.058.176	160.764.649	167.463.141	170.153.901	164.959.946
Sheep	20.048.718	14.559.392	14.811.664	14.672.366	15.128.919	16.047.663
Goats	11.900.688	7.785.667	9.346.008	9.569.315	9.966.791	10.313.844
Swine	33.686.747	36.062.103	31.562.111	32.396.439	33.804.430	34.480.519

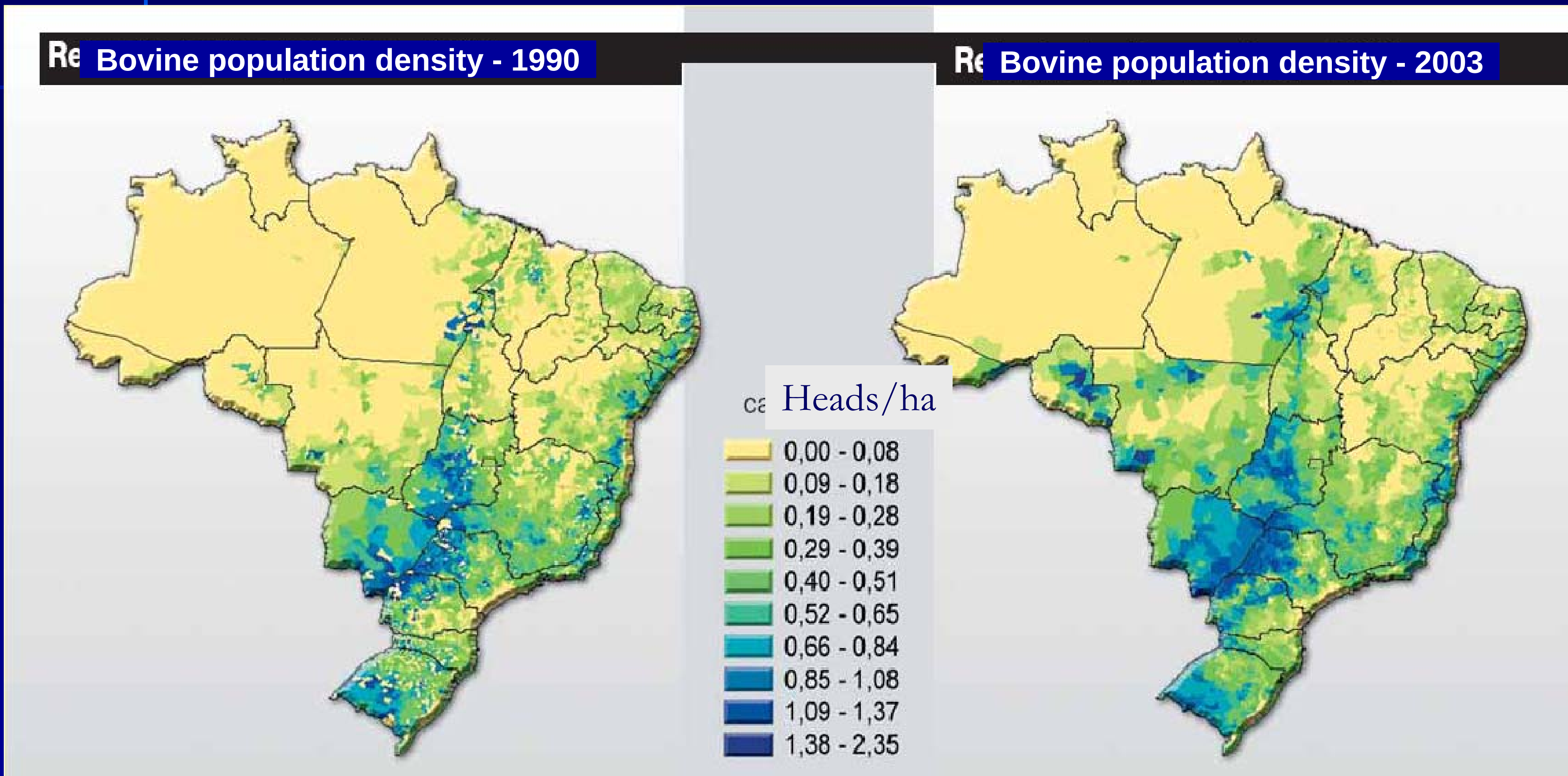
Bovine population statistics – IBGE, FNP



Bovine herd by region, in 2004



Regional distribution of bovine population (IBGE,2003)



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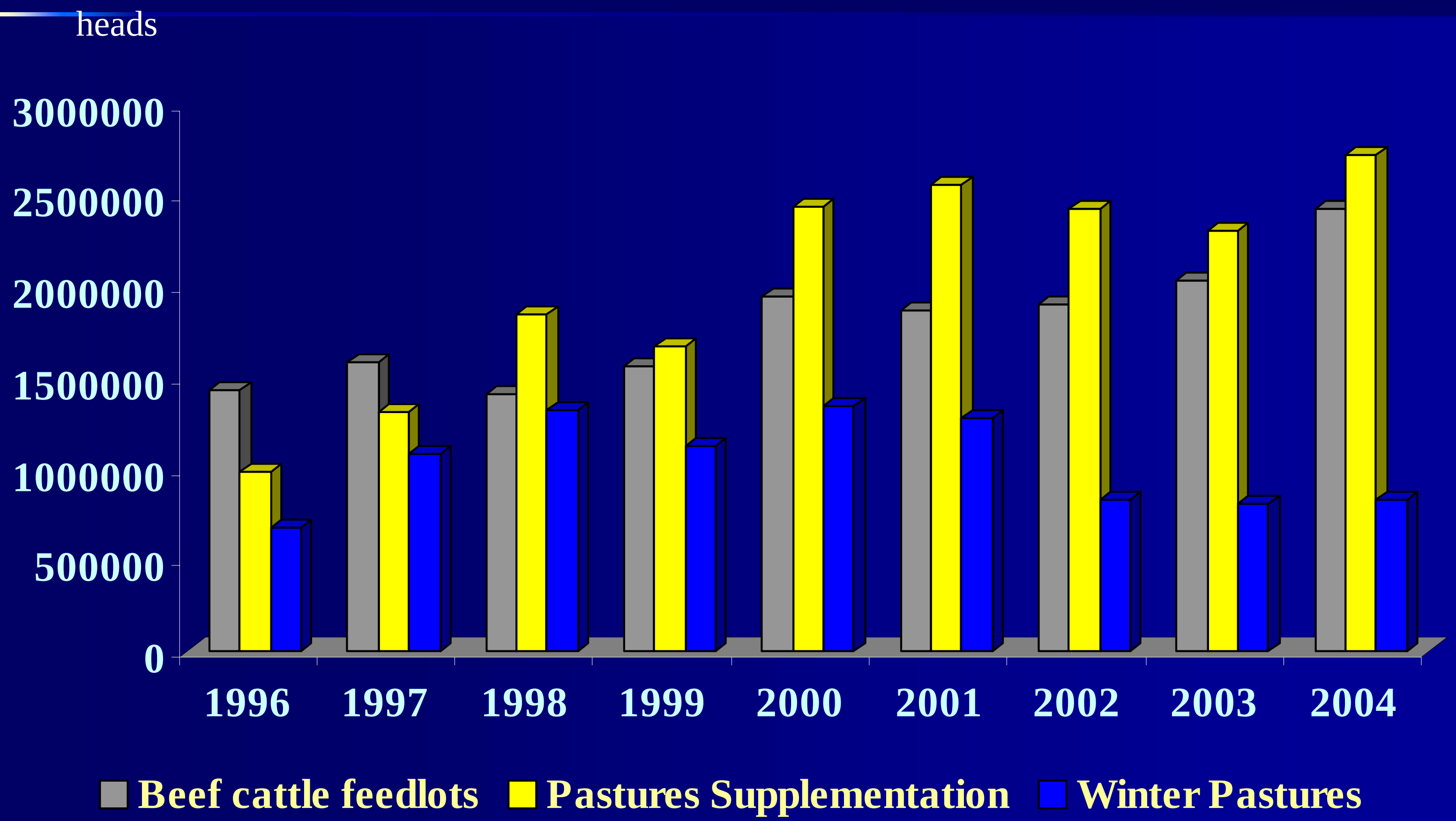
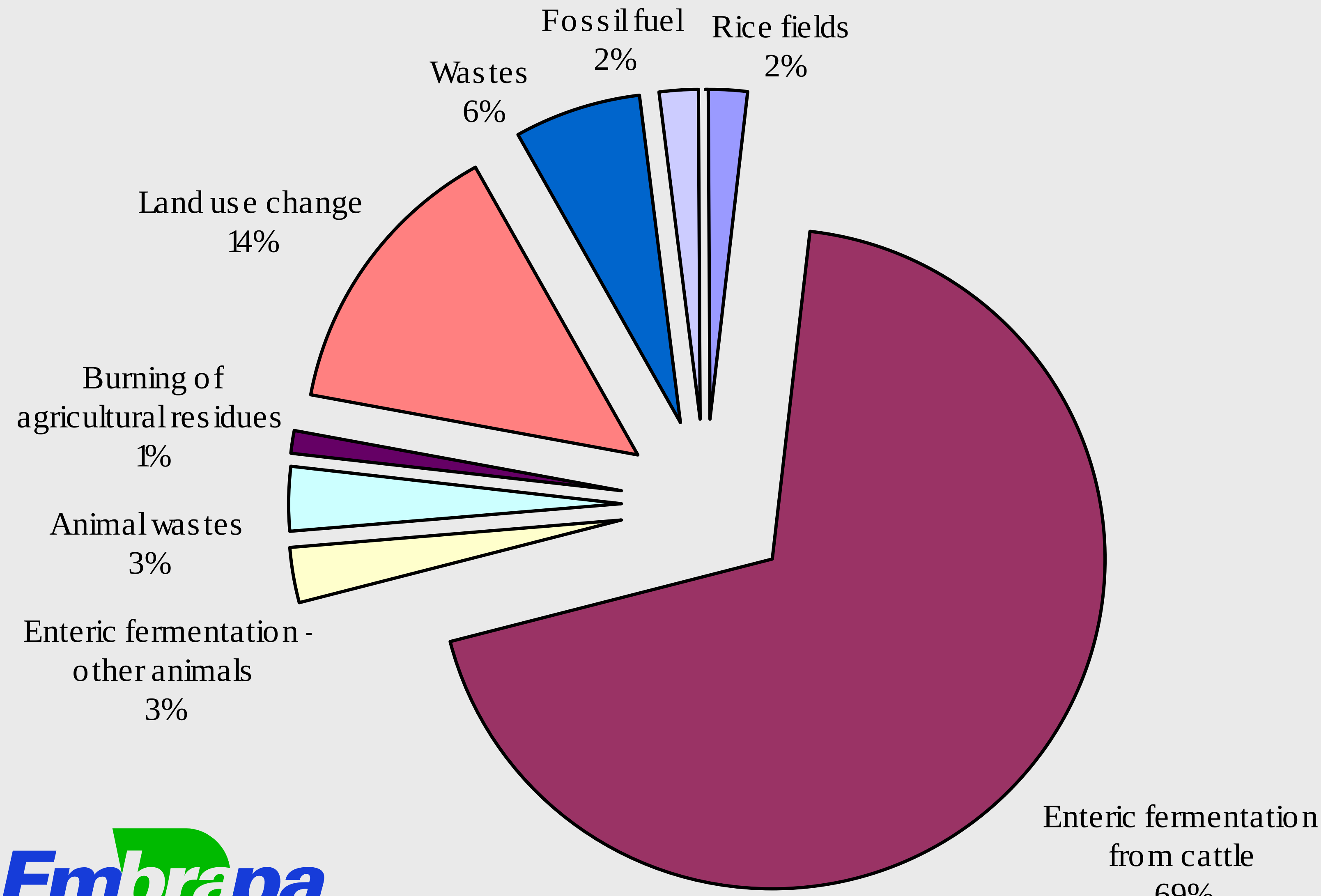
Bovine population in feedlots, pasture supplementation, and winter pastures (4,4% of beef cattle population in 2000 and 2004)



Methane emissions from economic sectors in Brazil, 1994



2. Methane emissions from agricultural sector

Anthropogenic sources	CH_4	N_2O
	Gg, in 1994	
Flooded rice crops	283 (2.1%)	-
Livestock		
Enteric fermentation	9,377 (71.2%)	-
Animal wastes	368 (2.8%)	20 (3.7%)
Burning of agricultural residues	133 (1.0%)	7 (1.2%)
Agricultural soils	-	
Grazing animals	-	219 (39.7)
Synthetic fertilizers	-	21 (3.8)
Aplication of animal wastes in soils	-	13 (2.4)
N biological fixation	-	26 (4.8)
Agricultural residues	-	43 (7.8)
Organic soils	-	23 (4.1)
Indirect emissions	-	132 (24.0)
Total of agricultural sources	**10,161 (77.1%)**	**503 (91.5%)**
Total of sources in the country	**13,173 (100%)**	**550 (100%)**

Brasil - Comunicação Nacional, 2004

Waste management systems according to type of animal, in 1994

Management System (M)	Region	Category of animal (T)					
		Dairy Cattle	Non – Dairy Cattle	Swine	Sheep	Poultry	Others
		Fraction ($AWMS_{(T)}$)					
Pasture	Brazil	0,45	0,97	0	1,00	0	0,99
Solid Storage	Brazil	0,20	0,03	0	0	0,20	0
Liquid system	South	0,05	0	0	0	0	0
	Brazil	0,03	0	0	0	0	0
Anaerobic lagoon	South	0	0	0	0	0	0
	Brazil	0,01	0	0	0	0	0
"Daily spread"	Brazil	0,20	0	0,20	0	0,80	0
Other systems	South	0,10	0	0,80	0	0	0,01
	Brazil	0,11	0	0,80	0	0	0,01

3. Information on methane recovery potential

- In 1995/1996 the use of digesters was registered only in less than 1% in São Paulo state, one of the most developed states in Brazil (LUPA, 1997)

- A new national agricultural census, to be carried out by IBGE (Brazilian Geography and Statistics Institute), has just started and will generate information on the use of animal wastes at farm level. This census will be probably published in the end of 2008.

4. Experience with Biogas

- Until 1996, in Santa Catarina State– swine manure destination: water bodies
- After 1996: swine waste treatment in the South region, mainly in Santa Catarina State
- Anaerobic lagoons – used by intensive swine industry
- After 2000: Re-start of the utilization of biogas
  - Biodigesters – planned to supply biogas to rural areas, replacing the use of GLP, gasoline, wood, and other sources, for heating chicken farms
  - Influence of CDM projects
  - Costs: Adaptation and development of equipment for using biogas, due to the presence of water vapor, CO_2 and corrosive gases (use of filters, devices for cooling, condensation and washing) for feasibility of biogas use

Types of biogas

- *Canadian* **model – mostly used in the south of Brazil**

Description: it has a digestor cavity of 150 m^3, made with a *manta* in PVC (0.8 mm), a hidraulic retention time about 30 days, a motor of internal agitation and gasmeter of PVC (1.0 mm) with capacity of 136 m^3 and capacity to treat wastes produced by a poultry farm of 50 matrix operated in a complete cicle. Gases are driven to a heat control device, for remotion of water vapors. Volatile sulfides are then removed, and compressed to supply an oven, where biogas is utilizes for heating poultry farm, domestic use, internal combustion motors, grain driers, etc.

- **Other biodigester models used: Indian and Chinese**

Aspects of biogas production

- CH_4 = 40-70% of volume of gas produced (average of 60%)
- CO_2 = 30-60% of volume of gas produced
- Calorific power of biogas = 6 kW/m^3 = 0,5 L of diesel
- 10m^3 of biogas =   50 kg of chicken manure, 120 kg of swine manure, 250 kg of bovine manure, 250 kg of rice straw, mayze straw
- Destination: electric energy (generators) for rural proprieties (heating of poultry farms, water, drying of grains, etc.
- Liquid residues (used as biofertilizers)

Capacity of generating biogas from wastes by animal category

Animal category	m^3 biogas/ kg manure	m^3 biogas/ animal/day
Bovines	0.038	0.36
Swine	0.079	0.24
Poultry	0.050	0.014

Source: Embrapa Suínos e Aves (2005).

Barriers for the use of biogas

- Feasibility of building biodigesters (required number of animals for a mean or big biodigestor)

  -> More concentrated farms, more industrialized production, high technology (3,000-4,000 animals – needed for energy co-generation)

- Other activities developed in the farm (cropland, poultry, etc.)
- Safety and supply conditions
- Maintenance of equipment (against corrosion, etc.)
- Depends on training, human capability and incentives

Potential use of biogas

- Main destination of biogas has been electric energy (generators) for rural proprieties (heating of poultry farms, water supply, drying of grains, etc.). Liquid residues are often used as bio-fertilizers.

- A study carried out by Hardoim et al. (2000) showed that 100 fedlot dairy cattle heads were able to produce 118 m^3 biogas/day (76,8m^3 of methane), using a Indian model digester, with a capacity to generate energy for several equipments in the farm.

Costs of digesters

- Compared costs: US$ 5,00 / m^3 (anaerobic lagoons) and US$ 50.00/ m^3 (anaerobic biodigestor)
- Cost of biodigestors:
  - **Mean scale (150m^3): US$ 12,839.82** (R$ 29.018,21) – production of 50-70m^3 of biogas (reference year: November 2004)
  - **Big scale (300m^3): US$ 17,699.11** (R$ 40.000,00)

Key stakeholders in the animal waste management sector

- Farmers
- Cooperatives
- Local environmental and sanitary organizations
- Environmental lawyers
- Researchers/academics (e.g. from Embrapa Swine and Poultry, UNESP-Jaboticabal), and consultants
- Agencies developing CDM projects (e.g. Agcert, Ecosecurities)

5 - CDM Projects – methane recovery

- The projects involving the capture of methane (from agriculture and landfills specially) still represent a minor part.

- The majority of the project activities developed in the country is in the energy sector, with CO_2 being preponderant in the Brazilian emissions reduction.

- According to MCT (2006), the scopes that will reduce more tons of CO_2e are landfill and reduction of N_2O, with a total of 111 million tCO_2e to be reduced during the first crediting period, representing 61% of the total emission reduction of Brazilian project activities.

CDM Projects – methane recovery

- The projects involving methane (17) recovery under Validation/Approval Process represent 5% of the total, being responsible for only 2% (553,111 tCO_2e) of the annual emission reduction provided by all the projects (24,9 million tCO_2e).

National Plan of Agroenergy – prepared by Embrapa to the Ministry of Agriculture and Food Supply (MAPA)

- *Strategies for biogas production:*
- - to develop systems to compress and stocking biogas,
- - to evaluate the use of biofertilizer as organic manure
- - to develop equipments for the use of biogas as source of heat
- - to develop equipments to the transport and distribution of biofertilizer
- - to improve equipments moved by biogas for the generation of eletric energy
- - to develop processes of biogas purification

6- Conclusions

- We have learnt some lessons from the errors o the past with the implantation of biogas (80's).

- Opening of more opportunities of using alternative energies, with new sources of fuels and energy generation from different types of biomass, although the main focus is the ethanol production.

- There are still barriers to the implementation of biogas plants in Brazil, starting by training and human capability, lack of subsidies and stimulus tools.   There is limited number of experts in animal waste management, and the R&D still is in progress.

Conclusions

- The effects of bio-fertilizers in the soils and crops are being tested by academics, and there is no definition about the future environmental impacts of their use in the different types of soil after permanent application.
- Other materials (beyond swine, dairy and beef cattle wastes) are being studied for generation of biogas, as the *vinhaça* (liquid waste from sugar cane cropping) and slaughter wastes

Thank you!