Italian Country Profile

Summary of emissions and characterization of the animal waste management sector

a. Briefly provide information on national and regional methane emissions for animal waste management systems by type of system and animal type.

Methane emissions in 2004 represent 7.2% of total CO_2 equivalent greenhouse gases, equal to 41.9 Mt in CO_2 equivalent and show an increase of approximately 0.2 Mt (0.5%) as compared to 1990 levels. Methane (CH_4) emissions in 2004 are mainly from the waste sector which accounts for 44.6% of total methane emissions. The agricultural sector (37.3%) and the energy sector (17.9%) are the other main sources of CH_4.

The agriculture sector in the Italian inventory includes four source categories: enteric fermentation, manure management, rice cultivation and field burning of agriculture residues, and it has been the dominant national source for methane emissions, accounting for 37.3% (743.2 Gg CH_4) of total national emissions in 2004. This represented a decrease of -7% compared to 1990 levels, mostly due to the decrease of CH_4 emissions from enteric fermentation (-11%), which account for 28%, and to a minor decrease from manure management (-8%).

Livestock production is widely practised throughout in the Po valley and consists mainly of:

- pigs: 4.700.000 animals (62% of the total Italian pig population);
- cattle: 3.200.000 animals (49% of the total cattle population).

Livestock farms are mostly located in six Provinces of the Lombardia and Emilia-Romagna Regions (Parma, Reggio Emilia, Modena, Cremona, Mantova, Brescia), where more than 50% of the Italian pig and cattle farms are located. Intensive farming practices are used in these Provinces and the animal stocking rate per ha is very high.

CH_4 SOURCE AND SINK CATEGORIES emissions/removals	**CH_4 (Gg)**
Total National Emissions and Removals	**1.916,25**
Agriculture	**739,17**
A. Enteric Fermentation	515,77
B. Manure Management	150,03
C. Rice Cultivation	72,71
D. Agricultural Soils	NA
F. Field Burning of Agricultural Residues	0,67

Summary of emission trends by source category and gas in CO2 equivalent (Gg)

	1990 base year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Source category	CO_2 equivalent (Gg)														
4. Agriculture	41,177	41,963	41,420	41,712	41,193	40,888	40,662	41,767	41,069	41,488	40,457	39,972	38,775	38,636	38,362
CH_4: Enteric fermentation	12,178	12,448	12,070	11,943	12,050	12,266	12,322	12,376	12,291	12,428	12,165	11,666	11,029	11,055	10,831
CH_4: Manure management	3,462	3,468	3,335	3,327	3,252	3,327	3,333	3,316	3,346	3,381	3,303	3,380	3,320	3,318	3,235
CH_4: Rice Cultivation	1,562	1,493	1,551	1,627	1,664	1,657	1,652	1,676	1,622	1,616	1,375	1,382	1,420	1,462	1,527
CH_4: Field Burning of Agricultural Residues	13	14	14	13	13	13	13	12	14	13	12	11	13	11	14

Trend of CH_4 from agriculture sector

Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CH_4	*Gg*														
4A. Enteric Fermentation	579.89	592.76	574.76	568.70	573.83	584.11	586.77	589.35	585.29	591.80	579.26	555.54	525.21	526.44	515.77
4B. Manure management	164.86	165.13	158.79	158.42	154.85	158.42	158.73	157.91	159.31	161.02	157.27	160.93	158.10	158.01	154.03
4C. Rice cultivation	74.39	71.09	73.86	77.48	79.23	78.90	78.65	79.79	77.22	76.95	65.46	65.80	67.63	69.60	72.71
4F. Field burning of agricultural residues	0.62	0.68	0.66	0.64	0.64	0.62	0.64	0.57	0.64	0.62	0.58	0.53	0.60	0.55	0.67
TOTAL	819.75	829.66	808.08	805.23	808.54	822.05	824.79	827.63	822.46	830.39	802.57	782.81	751.54	754.60	743.18

Enteric fermentation

Methane emissions from enteric fermentation are a major key source in Italy. In 2004, methane emissions from enteric fermentation were 515.77 Gg, which represents 69.4% of methane emissions for the agriculture sector (70.7% in 1990) and 25.9% for total methane emissions (29.2% in 1990).

Methane emissions from this source mainly consist of cattle emissions, with 204.92 Gg from dairy cattle and 206.57 Gg from non-dairy cattle, representing 39.7% (42.3% in 1990) and 40.1% (40.2% in 1990) of enteric fermentation category, respectively. For this source, all livestock categories have been estimated except camels and llamas, which are not present in Italy; methane emissions from poultry do not occur and emissions from rabbits are estimated.

Manure management

In 2004, methane emissions from manure management were 154.03 Gg, which represent 20.7% of methane emissions for the agriculture sector (20.1% in 1990) and 7.7% for total methane emissions (8.3% in 1990). Methane emissions come mainly from swine category, followed by cattle; emissions

are equal to 70.07 Gg and 62.20 Gg, respectively, representing 45.5% (41.4% in 1990) and 40.4% (47.3% in 1990) of manure management methane emissions, respectively.

CH_4 SOURCE AND SINK CATEGORIES (2004)	CH_4 (Gg)
Total Agriculture	**739,17**
A. Enteric Fermentation	515,77
1. Cattle	411,49
Dairy Cattle	204,92
Non-Dairy Cattle	206,57
2. Buffalo	14,38
3. Sheep	64,85
4. Goats	4,89
6. Horses	5,00
7. Mules and Asses	0,29
8. Swine	13,46
9. Poultry	NA
10. Other	1,42
Rabbits	1,42
B. Manure Management	150,03
1. Cattle	60,12
Dairy Cattle	26,73
Non-Dairy Cattle	33,38
2. Buffalo	2,70
3. Sheep	1,76
4. Goats	0,14
6. Horses	0,41
7. Mules and Asses	0,02
8. Swine	68,14
9. Poultry	15,27
10. Other livestock	1,45
Rabbits	1,45
C. Rice Cultivation	72,71
1. Irrigated	72,71
D. Field Burning of Agricultural Residues	0,67

1 . Cereals	0,67

CH_4 SOURCE AND SINK CATEGORIES (2004)	CH_4 (kg CH_4/head/yr)
1. Cattle	65,27
Dairy Cattle	111,47
Non-Dairy Cattle	46,25
2. Buffalo	68,39
3. Sheep	8,00
4. Goats	5,00
6. Horses	18,00
7. Mules and Asses	10,00
8. Swine	1,50
9. Poultry	NA
10. Rabbits	0,08

b. Briefly describe current animal waste management practices (e.g. land application, pasture/range, solid storage, liquid storage, lagoon) and livestock types (e.g. swine, dairy cattle, beef cattle, poultry).

Cattle are not evenly distributed in the Po Valley (in the north of Italy). Farms are located mainly in the Provinces of Torino and Cuneo of the Piedmont Region, in the whole plain area of the Lombardy and in the Western part of the Emilia-Romagna Region.

Dairy farms are concentrated mostly in the Provinces of Brescia, Cremona, Milano and Mantova, where 46% of the cows in the valley are managed. The Provinces of Cuneo, Torino, Parma, Reggio Emilia and Modena also contain substantial numbers of dairy cows.

Beef cattle are particularly important in the plain area of the Provinces of Brescia and Mantova, where 31% of the total of the valley are found. If the contribution of the Provinces of Cremona, Milano, Cuneo and Torino are included, the percentage increases to 64%. Pig production in the Po Valley is concentrated in the Provinces of Brescia, Mantova, Cremona, Bergamo, Milano (Eastern part), Reggio Emilia and Modena. In these areas, 80% of the total national of pig numbers are present.

The poultry sector consists of ca. 40,400,000 birdsheads, concentrated mostly in the Provinces of Brescia, Mantova, Bergamo, Verona, Cremona and Cuneo.

In 2004, livestock methane emissions from enteric fermentation have been 11.1% (515.77 Gg) lower than in 1990 (579.89 Gg), while from 1990 to 2004 cattle livestock have decreased by 18.7% (from

7,700,000 to 6,300,000 heads), with a decrease of 30.4% for dairy cattle (from 2,600,000 to 1,800,000) and 12.6% for non-dairy cattle (from 5,100,000 to 4,400,000). The decrease in cattle number is tending to drive down livestock emissions, particularly as emissions per head from cattle are 10 times greater than emissions per head of sheep or goat. In 2004 cattle contributes with 79.8% to the total methane emissions for enteric fermentation, sheep with 12.6% and the rest of livestock categories with 7.6%.

In the following tables, enteric fermentation emission trends and emissions from different waste management practise are presented.

Trend in methane emissions from enteric fermentation (Gg)

Year	Dairy cattle	Non-dairy cattle	Buffalo	Sheep	Goats	Horse	Other equines	Sows	Other swine	Rabbit	TOTAL
1990	245.11	232.95	5.83	69.91	6.29	5.18	0.84	0.98	11.63	1.16	**579.89**
1991	228.61	265.06	5.24	67.18	6.30	5.65	0.66	1.07	11.76	1.23	**592.76**
1992	216.49	257.48	6.44	67.68	6.78	5.69	0.57	1.04	11.33	1.27	**574.76**
1993	213.23	252.34	6.61	69.36	7.04	5.82	0.49	1.05	11.47	1.28	**568.70**
1994	207.94	251.18	7.10	79.71	8.29	5.83	0.43	1.02	11.02	1.31	**573.83**
1995	216.88	246.18	9.38	85.34	6.86	5.67	0.38	1.03	11.06	1.33	**584.11**
1996	220.10	241.75	10.71	87.55	7.10	5.62	0.34	1.09	11.17	1.35	**586.77**
1997	221.80	243.74	10.15	87.15	6.76	5.63	0.30	1.04	11.40	1.37	**589.35**
1998	225.18	235.34	11.54	87.15	6.66	5.22	0.34	1.06	11.42	1.38	**585.29**
1999	225.85	238.29	13.00	88.13	6.99	5.18	0.33	1.04	11.58	1.40	**591.80**
2000	217.40	234.45	12.61	88.71	6.88	5.04	0.33	1.06	11.40	1.39	**579.26**
2001	221.27	229.91	13.19	66.49	5.13	5.13	0.33	1.08	11.60	1.42	**555.54**
2002	208.45	213.92	12.32	65.11	4.94	5.00	0.29	1.13	12.62	1.44	**525.21**
2003	208.65	214.13	14.72	63.61	4.80	5.09	0.29	1.10	12.63	1.42	**526.44**
2004	204.92	206.57	14.38	64.85	4.89	5.00	0.29	1.09	12.37	1.42	**515.77**

Animal category	**Indicator**	**Climate region**	**Animal waste management system**						
			Anaerobic lagoon	**Liquid system**	**Daily spread**	**Solid storage**	**Dry lot**	**Pasture range paddock**	**Other**
Dairy Cattle	Allocation (%)	Cool	NO	35,49	NO	53,39	NO	4,68	NO
		Temperate	NO	2,44	NO	3,68	NO	0,32	NO
		Warm	NO	0,00	NO	0,00	NO	0,00	NO
	MCF[(b)]	Cool	NO	13,90	NO	2,00	NO	1,00	NA
		Temperate	NO	18,52	NO	4,00	NO	1,50	NA
		Warm	NO	NA	NO	NA	NO	NA	NA

Non-Dairy Cattle	Allocation (%)	Cool	NO	49,43	NO	36,87	NO	2,22	NA
		Temperate	NO	6,41	NO	4,78	NO	0,29	NA
	MCF[(b)]	Cool	NO	13,93	NO	2,00	NO	1,00	NO
		Temperate	NO	18,41	NO	4,00	NO	1,50	NO
Buffalo	Allocation (%)	Cool	NO	21,91	NO	44,42	NO	1,98	NA
		Temperate	NO	10,16	NO	20,61	NO	0,92	NA
	MCF[(b)]	Cool	NO	16,74	NO	2,00	NO	1,00	NA
		Temperate	NO	18,00	NO	4,00	NO	1,50	NA
Swine	Allocation (%)	Cool	NO	0,97	NO	NA	NO	NA	NA
		Temperate	NO	0,03	NO	NA	NO	NA	NA
		Warm	NO	NA	NO	NA	NO	NA	NA
	MCF[(b)]	Cool	NO	21,74	NO	NA	NO	NA	NA
		Temperate	NO	29,26	NO	NA	NO	NA	NA

c. Briefly provide information on methane recovery and practices in use.

There are about 40 codigestion plants in Italy including seven centralised co-digestion plants which treat animal manure + energy crops (or other organic waste from the food industry) + sewage sludge + biowaste. In addition, about 60 plants exclusively process animal manure. In recent years some biogas plants have also begun to treat energy crops.

Almost all the above plants are situated in North Italy. Experience of the anaerobic digestion of the municipal solid waste (MSW) organic fraction, from both source collection and mechanical selection, is still limited.

Investment costs for more complex plants range from 250 to 700 per cubic meter of anaerobic digester or 2,500-7,500 per kW installed electrical power in co-generation.

Describe the key stakeholders in the animal waste management sector

Key stakeholders may include: farmers, farm organizations, utilities, local and/or federal government agencies, non-governmental organizations, equipment providers, consultants, and other private sector representatives.

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Overview of methane recovery potential

EurObserv'ER estimated a biogas production of 376.5 ktoe, (about 4.3 million MWh) in 2005. About 80% of this biogas production comes from municipal solid waste (MSW) landfills.

At present, most (about 60) biogas plants in Italy deal exclusively with livestock manure and only about 40 plant treat mixtures of different kinds of waste: seven of the latter are centralised plants which also treat sewage sludge, agro-industrial wastewater, in particular from the olive oil processing industry, and biowaste . Some of the more recently constructed plants treat energy crops too. Almost all the plants are located in the northern regions, in Lombardia, Trentino-Alto Adige, Emilia-Romagna and Veneto. Several biogas plants also operate in the agro-industry field, particularly in distilleries, sugar refineries, the fruit juice and confectionery industries.

List of existing or planned methane capture and/or use projects (if available)

One anaerobic codigestion plant in a dairy cattle farm is located close to Bologna in the Emilia-Romagna region and it began to be operated in summer 2005 (monitored from CRPA). This co-digestion plant treats cattle manure from the farm with agricultural residues and energy crops (forages, maize silage, onions and potatoes residues, beet pulps and other seasonal biomasses). Initially cattle manure represented the 60% in weight of digester load; from the April 2006 when a second cogenerator was installed, the load input has been of 50% cattle manure and 50% biomass (110 and 250 kW of electric power, increase biomass load from 7 to 11-12 t/day). Electric energy production is partly used for farm and digestion plant requirements and the rest is sold to ENEL (Italian national electrical agency); the thermal power is used for the digestors heating (about 50%) and for farm requirements including the heating of the owner's house during the winter.

The plant is composted of two 1200 m^3 completely stirred tank reactors and two 1000 m^3 storage tanks without isolated and heating system. A storage tank is covered by an elastomeric membrane that captures and stores biogas. The other one is used as a digestate storage tank before its agronomic use. The plant had an investment cost of about 800.000 Euro.

Market assessment and reform issues

Describe key market issues related to project development. Key issues could include: end uses for methane, potential for on-site uses, prices and tariffs, competition, market access (e.g. access to electric utility grid, gas pipeline), renewable or green energy standards, and regulatory issues.

Regulations currently being drawn up in Italy concerning incentives for self-production of electric energy from renewable sources (green certificate) could lead to a renewed interested in biogas plants. Developments in environmental policy, for example the exploitation of biomass energy sparked off by the Kyoto Conference on the reduction of atmospheric pollution from greenhouse gases (methane being one of the principal ones), the recent Animal Byproducts EC Regulation n. 1774/2002, which recommends anaerobic digestion and composting as biological processes for recycling animal by-products as fertilisers and the new European Community Agricultural Policies, which offer energy crops incentives, all direct attention on recycling biogas energy.

However, for this to occur current authoritative procedures on realising biogas plants, inclusion in the national electric grid and the use of different matrices need to be simplified and made clearer; furthermore there must be guaranteed agronomic use of the digestate produced from co-digested animal manure, energy crops and organic waste.

Other issues related to animal waste management

Italy has not set up regulations to protect the environment from pollution due to mineral fertiliser application. The only action that has been taken is the adoption of a Code of Good Agricultural Practices for the protection of waters from nitrate pollution (MIPAF, 1998). The Code, published by the Ministry of Agriculture, gives recommendations taking in account the application techniques.

The uniformity of the fertiliser distribution is also recommended as well as the adoption of application methods that ensure a constant application rate across the entire area of land to be fertilised The Code also recommends particular care in areas surrounded by drainage ditches or located in close proximity to surface water bodies.

Italy has only recently transposed Directive 676/91 (Nitrate Directive) into the national Regulation (Decree n. 152, 11 May 1999);the implementation is only at the first phase. At the national level, the maximum amount of manure which can be applied to land is the annual production from 4 t of live weight per ha without regard to animal species. However, in the Northern Italy, the regions of the Po Valley, which represent only 18% of the utilised agricultural area, but account for the 49% of cattle, 62% of pigs and 63% of the poultry populations, have issued more stringent rules on animal manure disposal, each according to its legislative and regulatory autonomy (Bollettino Ufficiale Regione Emilia-Romagna, 1995; Bollettino Ufficiale Regione Lombardia, 1996; Bollettino Ufficiale Regione Veneto, 1993).

Source

- National Inventory Report 2006, Agency for the Protection of the Environment and for Technical Services (APAT)
- Document “Italy”, G. Bonazzi, Research Center on Animal Production CRPA, Reggio Emilia, www.crpa.it
- Document “Situation of anaerobic digestion in Italy”, S. Piccinini, Research Center on Animal Production CRPA, Reggio Emilia, www.crpa.it