CHAPTER IV
Policies and Measures

This chapter summarises the strategies, the measures and the interventions implemented or to be implemented by the Italian Government in order to achieve the objective of mitigating climate change. A detailed description of the existing measures, the measures already established or to be re-formulated or adopted ex-novo is given in this chapter. This chapter synthesises the information contained in the background papers used to prepare the CIPE deliberation "Revised guidelines for national policies and measures regarding the reduction of greenhouse gas emissions" (see Annex I).
In order to help the reading of this document, the mitigation objectives, options and strategies and any additional measure have been divided by sector: energy production and distribution, industry, residential and tertiary, transportation, agriculture, forestry and waste.
There are many subjects responsible for preparing the implementation measures, and they are scattered in many administrative offices; moreover in this document we underline the role of the Regions and other local administrations but it is not possible to define the leadership of all the described measures.
The mitigation potential of the implemented policies and measures is evaluated together with the forecasted impact on emissions of other measures already decided or still under discussion.

4.1 Summary of planned aimed measures almed at of achieving the objectives of the Kyoto Protocol

Law no. 120 of 1 June 2002, passed in ratification of the Kyoto Protocol, adopted on 10 December 1997 in Kyoto at the Third Conference of the Parties of the Convention on Climate Change, namely, article 2, paragraph 1, establishes that the Ministry for the Environment and Territoryshall present within 30 September 2002 to the Interministerial Committee for Economic Planning, a national action plan for the reduction of greenhouse gas emission levels and increase of their removals.
These additional policies have been arranged after a study on the emission trends quantified the surplus of emissions compared to the Kyoto targets – see chapter 5. Part of these policies, listed in table 4.1, have already been approved and they are included in the reference scenario. Another set of policies, still under discussion, is listed in table 4.2. They are mainly domestic policies and, together with sinks and flexible mechanisms, they will fill the the gap with the Kyoto target.
The achievement of the Kyoto target, in terms of size of necessary effort and extension of the sectors involved, requires the simultaneous implementation of more general policies, not necessarily of environmental nature. These policies deal mainly with:
• the country's upgrade with additional infrastructures : in the transportation sector they are badly needed to achieve the mobility shift to rail and to streamline road traffic;
• the construction of new combined-cycle plants and new import lines for natural gas and electricity, which may favour new operators, increase energy efficiency and create the necessary conditions to cut electricity and gas prices in the frame of the liberalisation of energy markets.
• the integrated management of territory and environment for the exploitation of renewable energy sources, through the establishment and efficient management of integrated industrial system; this mainly concerns the exploitation of wind energy

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TABLE 4.1 – Policies approved or established, included in the reference scenario

Use of energy sources	Regulatory tool	Monitoring tool	Emission reduction (2008-2012) ($MtCO_2$ eq.)	Investment (Mill. Euro)	NAV (when negative net cost) (1) (Mill. Euro)	Net cost (Mill. Euro/Mt CO_2) (2)
Electric industry			26.00			
Expansion of the CC for 3200 MW	Bill of Ministry of Productive Activities "Reorganisation of the energy sector", July 2002	GRTN data monitored by APAT	8.9	1,984	<0	<0
Expansion of import capacity for 2300 MW	GRTN Plan of 2002, Bill of MPA "Reorganisation of the energy sector", July 2002	Manager of the National Transmission Network (GRTN)	10.6	85.2	0 (2)	<0
Further increase of electricity generation from renewables of2800 MW	White Paper, Directive 2001/77/CE, Bill of MPA "Reorganisation of the energy sector"	GRTN data monitored by APAT and ENEA	6.5	4,950	<0	<0
Residential and tertiary			6.3			
Decrees on the efficiency of end use	Decrees of Ministry of Industry, Commerce and Craft 24/4/01	Authority for Electricity and Gas	6.3	6.3	<0	<0
Transportations			7.5			
Buses and private cars with low-carbon fuels (LPG, methane)	Protocols of the Ministry of Environment – Fiat–Oil Union, Ministry of Industry – Fiat – Consortium for LPG, Decree no. 256 of 17 July 1998, Decree of 27 March 1998	Data by the Ministry of Transport (CNT) elaborated by APAT,ENEA	1.5	880	-880	39
- Optimisation and collectivisation systems for private transportation (*car pooling, car sharing, jitneys*) -Reformulation of taxes on oils and realisation of computer-telematic systems	Decrees of Ministry of Environment Guidelines by the Commission of MPA, Ministry of Treasury	Data by the Ministry of Transport (CNT) elaborated by APAT ,ENEA	2.1	60	-60	3
Development of domestic infrastructures	Deliberation of 21 December 2001 Interministerial Committee for Economic Planning, "Target Law", PGT	Data by the Ministry of Transport (CNT) elaborated by APAT, ENEA	3.9	(not imputable to GHG reduction)	(not imputable to GHG reduction)	
Carbon credits from JI and CDM			12	920-2,650	230-663	1-3
TOTAL			51.8	7,994 - 8,224		

TABLE 4.2A - ADDITIONAL MEASURES (NOT ESTABLISHED)

Additional measures on the use of energy sources	Regulatory tool	Monitoring tool	Emission reduction (2008-2012) ($MtCO_2$eq.)	Investment (Mill. Euro)	ANV (when negative net cost) (1) (Mill. Euro)	Net cost (Mill. Euro/Mt CO_2)
Industry			**6.9-13**	**6,367-10,606**	**3,047-5,412**	
Replacement of industrial engines with high-efficiency engines with saving from 2-7,2 TWh, high-efficiency industrial engines			1-3.6	666-2,400	<0	<0
Implementation of COSFI standard with saving of 1TWh			0.5	<0	<0	<0
Replacement of transformers			1.0	900	<0	<0
Small/medium size cogeneration with production between 10-20 TWh	Integration of resolution AEEG 228/2001, extension of regulation l.79/99 and following articles for green certificates, extension of regulations under Ministerial Decree 24/4/01 on white certificates	Ministry of Productive Activities	0.8-1.5	1,100-2,100	48-90	3
Energy production from municipal waste and biogas, also with combined combustion in cement works equal to 750 – 1.300 MW			1.8-3.0	1,800-2,900	<0	<0
Increase of electricity generation from renewables 500-1200 MW			1.5-3.1	884-2,121	<0	<0
Diffusion of solar heating			0.2	800	160	40
Research and development in the photovoltaic sector with "niche" uses			0.1	1,125	220	110
Residential and tertiary			3.8-6.5	19-33	<0	
Extension decrees on the efficiency of the end use sector (MITC 24/4/01) and regional measures with savings between 1.5. - 2.9 Mtoe/year	MToe/year, extension regulation of Ministerial Decree 24/4/01	Regions/AEEG	3.8-6.5	19-33	<0	<0
Agriculture			0.28 – 0.34	0		
CO_2 reduction from energy consumption			0.28 – 0.34	0	<0	<0

TABLE 4.2B - ADDITIONAL MEASURES (NOT ESTABLISHED)

Additional measures from the use of energy sources	Regulatory tool	Monitoring tool	Emission reduction (2008-2012) ($MtCO_2eq.$)	Investment (Mill. Euro)	ANV (when negative net cost) (1) (Mill. Euro)	Net cost (Mill. Euro/Mt CO_2) (2)
Total transportation			11.3-15.6	2,855-5,155	655-4,855	
Transportation: technological/tax measures			9.1-12.1	1,415-2,415	15	
Replacement of circulating cars with cars at 120 g/KmCO2 with savings between 1,5-2,5 Mtoe	Programme agreement	Ministry of Transport Information processing by ENEA on CED data	3.5-6	1,400-2,400	<0	<0
Improvement of energy efficiency of heavy-transport means with savings between 0,1-0,3Mtoe	European Directives	Information processing by ENEA on CED data	0.3-0.8	0	<0	<0
Use of diesel-bio-diesel up to 5% of transportation grade diesel	Ministry of Transport Extension of programme agreement Min. Environment and OU	Data processing from APAT on MAP data	4	15	15	0,2
Revision of calculation method of vehicle property tax and its correlation with periodic tests	Ministerial Decree	Not necessary	1.3	0	0	0
Transportation: infrastructure measures			1.4	640	640	
Reorganisation of urban traffic	National and local regulations and incentives	Min. of Transport	0.8	610	610	38
Promotion of rail transport and connection to interchange parking areas	Programme agreements	Min. of Transport	0.6	30	30	3
Urban mobility plans (PUM)	Financing of research		1.5-3	85	85	2.83-1.42
Telematic solution for transports			0.5	30	30	9
Transportation: research (4)			0.8-2.1	800-2,100	1,600-4,200	
Realisation of pilot projects with hydrogen, cell and fuel-propelled systems for transport by rail, road, sea and river			0.1-0.3	100-300	200-600	100
Development and experimental use of materials enabling the reduction of vehicle and train masses			0.2-0.6	200-600	400-1,200	100
Realisation and diffusion of optimised engines using methane as mono-fuel and direct injection LPG as mono-fuel			0.5-1.2	500-1,200	1,000-2400	100
Sum of additional measures from the use of energy sources (a)			22.28-35.44	9,241-15,794	3,702-10,267	

TABLE 4.2C - ADDITIONAL MEASURES (NOT ESTABLISHED)

Additional measures to reduce emissions from other sources	Regulatory tool	Monitoring tools	Emission reduction (2008-2012) ($MtCO_2eq.$)	Investment (Mill. Euro)	NAV (when negative net cost) (1) (Mill. Euro)	Net cost (Mill. Euro/Mt CO_2) (2)
Industry			6.20	0.08	0.08	
Emission reduction from the production of adipic and nitric acid	Programme agreements	APAT from sectorial data	6.20	0.08	0.08	0
Agriculture			0.46	0	<0	
Reduction of CH_4 emissions from manure management	Technical regulations (IPPC) for new plants, regional financing for existing plants	APAT on data from the Ministry of Agricultural Policies	0.15-0.83	6.2-33.2	<0	<0
Reduction of N_2O emissions from agricultural soils	Programme agreements and regulations	APAT on data of the Ministry of Agricultural Policies	0.46	0	<0	<0
Waste		APAT / ENEA	0.64	900	900	70
Stabilization of the organic fraction	Waste regulations		0.64	900	900	70
Others (solvent, fluorinated gases)			0.76	50.4	50.4	
Reduction of PFC emissions through aluminium recycling			0.05	0	0	0
Installation of abatement devices and adoption of low GWP substances in the production of semiconductors			0.02	0	0	0
Reduction of HFC leaks from mobile air conditioners			0.65	50	50	4
Reduction of SF_6 leaks from electrical equipment			0.04	0.4	0.4	0.5
Sum of additional measures from other sources (b)			8.06	950.48	950.48	
TOTAL additional measures (a) + (b)			30.3-43.5	10,191-16,744	4,652-11,217	

(1) Current net value of investment for the duration of the plant updating the cash flows at the rate of 5%. When negative, the CNV indicates the amount of resources to be financed by means of incentives in order to accomplish the investment and, therefore, it is indicated as net cost of the investment.
(2) The ratio is calculated by bearing in mind the reduction of the emissions for the entire duration of the investment. (3) kep=0,22 kWh .

and waste management.
These policies, although they have been worked out several years ago, suffer from significant implementation delays, mainly due to the opposition by the local authorities in approving the industrial and infrastructure projects at basis of these policies. On one hand, the Kyoto target urge local authorities (whose powers have been strengthened still further by law of October 2001) to improve their authorization guidelines and, on the other, they are an opportunity to upgrade the country, cut energy prices through the energy market liberalisation and improve territorial management.

4.1.1 General guidelines on policies and measures
The elaboration of a climate change strategy requires the implementation of many measures in different economic and technological sectors. As a matter of fact, scientific research and technological development have not succeeded in providing economically competitive technologies capable of supplying the goods and services necessary to the economic production and consumption systems without generating greenhouse-gas emissions. It is not certain, moreover, that the technological research and development will succeed in solving the issue in

Table 4.3 - Measures implemented in the energy sector: production, processing and distribution and measures included in the trend scenario

Implemented measures	Description	Estimated reduction in 2010 ($MtCO_2$)
Decrees and various instructions	Supports in stock account aimed at increasing the efficiency of power plants, spread of co-generation plants and promotion of natural-gas use.	19.7
Legislative Decree no. 79 of 16 March 1999 (Bersani)	Liberalisation of the electric sector. Implemented by the Ministry of Productive Activities, Authority for Electricity and Gas and ENEL S.p.A..	-
Ministerial Decree no. 106 of 29 March 2001 Minister of the Environment, resolution no. 224/00 AEEG	"Programme for photovoltaic roofs" realises plants from 1 to 50 kWp connected to low-tension distribution network in Italy, from 2000 to 2002.	0.12*
Various decrees	Maintenance of the current progressive structure of domestic electric tariffs	10
Legislative Decree of 24 April 2001	1.6 Mtoe of energy saving from the efficient use of energy 1.3 Mtoe of saving of primary energy from the reduction of gas use	7-8
Voluntary agreement with Enel	The first VA being implemented, signed with Enel in 2000 12	12
Ministerial Decree of 11 November 1999 Minister of Productive Activities and Minister ofthe Environment	Decree supporting the regulation of electricity production from renewable sources (Legislative Decree no. 79 of 16 March 1999, art. 11, par. 1,2,3)	6
Ministerial Decree of 18 March 2002 Ministry of Productive Activities	Modifications and integrations to decree of the Minister of Industry, Trade and Craft in agreement with the Minister of Environment, 11 November 1999, concerning the "directives for the implementation of rules on the subject of the production of electricity from renewable sources as of paragraphs 1, 2 and 3 of art. 11 of Legislative Decree no. 79 of 16 March 1999.	-
Resolution of the Authority for Electricity and Gas no. 42/02	Conditions for the recognition of co-generation of electricity/heat in conformity with art. 2, paragraph 8, of Legislative Decree no. 79 of 16 March 1999	-
Several legislative decrees	Diffusion of the use of natural gas, enlargement and updating of transport lines and distribution	0.5

the short-medium term, even though the UN Agenda 21 and the Fifth Programme of Environmental Action of the EU have set sustainable development as a main objective.

Law no. 120 of 1 June 2002, passed in ratification of the Kyoto Protocol, identifies the following guidelines on policies and measures:

- increase the energy efficiency of the national economic system and foster the use of renewable sources of energy;
- increase carbon dioxide removals deriving from land use, changes of land-use and forestry, as established under article 3 paragraphs 3 and 4 of the Kyoto Protocol;
- full implementation of the JI and CD mechanisms established under the Kyoto Protocol;
- promotion of research and development aiming at introducing hydrogen as a main fuel in energy systems and in the transport sector; promotion of biomass based combined heat and power plants and solar thermal power plants; promotion of wind and photovoltaic power plants and waste and biogas based power plants.

4.2 Energy sector: production, processing and distribution

4.2.1 Measures implemented in the electric sector, including renewable sources

The policies already implemented can be grouped according to four main objectives:

- Upgrading of existing plants;
- Spread of co-generation plants;
- Promotion of renewable sources in the consumption of electricity;
- Reduction of electricity and gas demand.

Some major tools have been used to promote the aforementioned objectives: voluntary agreements with industries, mandatory renewable sources share (renewable obligation) in total electricity production and dispatching priority for energy produced in co-generation plants. Other incentives have been used in the past, particularly those aiming at recognising an additional price for energy produced by means of renewable or assimilated energy sources (CIP6).

The effects of these tools can be hardly evaluated; a summary of major measures adopted and the expected emission reductions is provided in table 4.3.

The ***voluntary agreement with Enel*** has the objective of reducing emissions of 22 $MtCO_2$ by 2006, compared to the emissions of 1990, by:

- increasing the efficiency of existing plants and converting 15.000 MW to combined-cycle plants; of the reduced 12 $MtCO_2$, only 10 $MtCO_2$ are to be attributed to the measures implemented after the Kyoto Protocol;
- increasing the use of renewable sources (2% obligation) capable of reducing emissions by 2 $MtCO_2$;
- reducing leaks from distribution networks by 0.1 $MtCO_2$;
- DSM measures: (Demand Side Management) by quantifying only the effects of the spread of most efficient electric technologies, it is possible to have a net reduction effect of 0.4 $MtCO_2$, which can be added to the effects of fewer leaks from the distribution networks of 0.1 $MtCO_2$;
- DSM measures: by quantifying the effects of the spread of more efficient electric technologies instead of fossil fuels, it is possible to have a net reduction effect of 0.4 $MtCO_2$;

According to the privatisation programme, Enel shall sell part of its production and distribution plants; the net effects of such voluntary agreement can be hardly quantified now, due to the uncertainties of the future ENEL production – distribution capacity.

The resolution establishing the ***2% production obligation from renewable source***, could promote an additional production capacity of 9.000 GWh, with a reduction effect of about 6 $MtCO_2$.

Legislative Decrees of 24 April 2001 provide for the reduction of electricity and gas consumptions through the implementation of measures adopted by distribution companies; these measures are expected to be fully adopted since non-compliance would incur financial penalties. The overall effect of such Decrees is expected to entail a reduction from 7 to 8 $MtCO_2$. Associated to this measure, it is important to mention the current progressive structure of domestic electric tariff, which, together with the 3 KW power limitation, contributes to keep electric domestic consumptions in Italy lower than European average.

The programme of ***10,000 photovoltaic roofs*** is expected to be partially implemented and, according to rough estimates, emission reduction should be around 0.12 $MtCO_2$ year.

As concerns electricity generated from ***waste by*** 2010 it is assumed that the burning capacity of the existing incinerators will increase by 220,000 tonnes every year, entailing a reduction of 1.6 $MtCO_2$.

The replacement of liquid and solid fossil fuels with natural gas is an option aimed at mitigating CO_2 emissions and overall greenhouse-gas emissions, given that the increase in methane leaks from networks, especially the distribution networks, and from end users seems to be negligible. Natural gas will continue to play a major role in the frame of national energy requirements. Its growth will have to occur in a period in which several supply contracts expire and in a climate of increasing competition on the international market determined by the strong resort to natural gas by all major consuming countries.

4.2.2 Measures implemented before and after 1998

Some of the aforementioned measures, were implemented before the Kyoto agreements, and others afterwards. Some of the measures in force, such as the voluntary agreement with Enel, include both pre-Kyoto and post-Kyoto measures. A detailed evaluation of the measures adopted before and after the Kyoto agreements is contained in Ecofys, 2001. A detailed analysis of all measures is also reported in the Second National Communication, chapter 5.

4.2.3 Trend scenario and interventions already established for the electric energy sector

In brief, by 2010 the electric system described in the trend scenario will be characterised by the following developments with reference to year 2000:

• growth electricity demand in the network for about 65 TWh;

• imports will increase to 60 TWh, about 16 more than 2000;

Compared to the trend scenario, the policies already established for the electric sector defining the reference scenario include:

• the construction of 3200 MW of additional combined cycles;

• the expansion of import lines for electricity for about 2300 MW;

• higher growth of renewable source capacity and development, from 3670 MW of the trend scenario to 5900 MW in 2010.

4.2.3.1 Additional combined cycles

An additional generating capacity from combined cycles has been assumed in the trend scenario with 20,000 MW, 14,000 MW of which in place of the existing plants and the remaining 6,000 MW completely new. In the reference scenario, a higher capacity of new combined cycles is assumed for additional 3,200 MW, implying an emission reduction equal to 8.9 Mt.

The hypotheses of an increase exceeding 3,200 MW, in addition to the 20,000 MW already anticipated in the trend scenario, seem to be hardly achievable and not compatible with the equilibrium required by the future electric market The investment analysis presents a positive current net value of investment, implying that such option does not require additional incentives. This measure virtually reflects the implementation of the resolutions foreseen by the bill for the Reorganisation of the Energy Sector, debated in September 2002, integrating the resolutions stipulated under law of 10 April 2002 (the so-called "plant-liberalisation decree"[1]).

4.2.3.2 Realisation of new import capacity

Only a slight increase is assumed in the trend scenario, that is to say, 5500 MW of the import capacity by 2010, aimed toward the completion of the Italy-Greece import line. Another measure included in the reference scenario is the additional expansion of 2.300 MW enabling:

- a remarkable emission reduction of 10.6 Mt, considering that the entire import capacity from abroad, supposedly from under-exploited plants, would cause a reduction in domestic emissions.
- an economic advantage on account of low wholesale prices of electric power abroad .

An import capacity exceeding 2.300 MW can be hardly created, also due to economic reasons linked to the necessary use of expanding national production capacities.

This measure calls for the implementation of part of the plan arranged by the Manager of the National Transmission Network (Transmission System Operator) and announced at the beginning of 2002[2], through the simplification of the authorisation procedures by the local authorities. In order to speed up the realisation of new import lines for electricity, the bill for the reorganisation of the energy sector, introduces a number of directives providing for the creation of several import lines for electricity by private operators as stipulated under article 10, whereas article 13 aims at streamlining the authorization procedures. These directives should be adequate to enable the expansion of the import capacity.

4.2.3.3 Additional expansion of renewable sources

According to the trend scenario to 2010, the increase of 10 TWh in the amount of contributions, which would reach a total amount of 64 TWh, from renewable sources is obtained for about 3 TWh by the expansion of the hydroelectric sector, for 1.6 by the increased wind capacity, for 1.3 by the thermo-valorisation of waste and for the remaining amount by biomass, biogas and photovoltaic energy. This scenario implements the 2% renewable obligation and the completion of the CIP 6/92 projects.

The policy aiming at spurring the expansion of renewable sources still further indicates as feasible an additional expansion by 2010, of 11 TWh, mainly on account of increased biomass, waste and wind contribution. This additional expansion requires an increase of 0.3% each year of the mandatory 2% obligation, from 2005 to 2012..

[1] Law no. 55 of 9 April 2002, "Conversion into law and following modifications of Legislative Decree no. 7 of 7 February 2002, establishing measures for guaranteeing the security of the national electric system", OG no. 84 of 10 April 2002.

[2] "Triennial programme for the development of the national transmission network", approved by the Manager of the National Transmission Network (GRTN) on 31 March 2002.

Moreover, the prospected scenario is in line with the terms of the White Paper aimed at valorising renewable sources, approved by the Interministerial Committee for Economic Planning on 6 August 1999.

The result of approximately 75 TWh anticipated in the reference scenario is also the objective indicated by the Italian Government upon approval of Directive 2001/77/CE on Renewable Sources. The table 4.4 shows the hypotheses of expansion for each renewable source.

The expansion of renewable obligation is not sufficient and it would require other side support policies. They are mainly norms aimed toward the integrated management of the waste cycle and the definition of new policies in the agricultural sector in order to supply, in a regular and inexpensive way, biomass energy both for electric and heat generation.

At the same time, it is necessary to foster the involvement of the Regions to simplify the authorization procedures through the definition of a series of policies aimed at strengthening renewable sources at local level. The exploitation of renewable sources compared to other sources mainly involves territorial management through the direct involvement of local authorities. The definition of policies for the achievement of the Kyoto targets should be seen as an occasion to work out and adopt local policies.

As far as biomasses are concerned, which, according to the reference scenario, are supposed to increase significantly, the creation of integrated industrial system – an objective which had already been sanctioned by article 23 of the Legislative Decree for the Reorganisation of the Energy Sector – calls for the application of the guidelines identified in the White Paper of 1999, approved by the Interministerial Committee for Economic Planning of 6 August 1999. Many projects based on the exploitation of biomass energy, authorised in the nineties, have never been realised due to a number of difficulties arisen during the fuel acquisition, selection and stocking stages.

In particular, the Ministry of Agricultural Policies and the Regions should take steps to:

• identify the districts that carry out wood processing activities capable of providing abundant amounts of rejects to be used as biomass energy;
• plan actions aimed toward the maintenance of wooded areas which may give rise to abundant amounts of biomass energy;
• start dedicated cultivations, also to the end of improving the exploitation of agricultural areas;
• foster the technological development in support of small-size plants;
• integrate projects for the production of electric power from biomass energy using heat through district heating;
• speed up the resort to biomass energies (particularly pellets), especially in mountain areas for heat generation in place of diesel oil and other fuels.

An important measure to aim to achieve such an objective is the promotion of simplified authorization procedures for plants with power capacity inferior to 10 MW, already proposed by some regional administrations. The second fundamental aspect is the availability of correct information. On one hand, today's investors find it difficult to know their obligations and rights on a recently instituted market; on the other, several administrations have not the adequate technical tools to evaluate properly the credibility and feasibility of

Table 4.4 - Capacity of renewable sources

SOURCE		Installed power by 2010 MW	Increase compared to 2000 MW	Annual production in 2010 GWh
hydroelectric	>10 MW	14,800	355	37,000
hydroelectric	<10 MW	3,100	903	12,400
wind		2,500	2,137	5,500
biogas		300	120	1,350
geothermal		700	74	4,900
biomass		1,500	1,282	9,000
waste		800	513	4,800
photovoltaic		100	94	130
		23,800	5,478	75,080

the investments proposed, forcing the proponents of the projects to start difficult negotiations.
The agricultural world seems willing to nourish a new market in the energy sector, but it requires continuity and clarity of intents to undertake adequate investments.
If adequate measures are adopted, the 75 TWh target is not a prohibitive goal and it represents an interesting opportunity for the Italian industrial system.

4.2.4 Additional measures for the electric energy sector

Increase in the production of energy from renewable sources for 500-1.200 MW
This is an option which, in any case, must take into account the strong development already hypothesised in the reference scenario, where the achievement of 75 TWh of renewable energy by 2010 is taken for granted, as indicated in the White Paper of 1999. Sectorial studies shows further projects with positive Net Present Value (NPV) of investment thanks to the inclusion in the valorisation of transferred electric energy of the green certificate, which is supposed to be at 5 cents of Euro/kWh. .

Research and development in the photovoltaic sector
This is a more expensive option than other renewable sources since it entails higher investment costs, that is to say, in the order of 7500 Euro/kW. The possibility of an additional expansion of about 150 MW with an investment of 1.125 million Euros and a negative NPV of 220 million Euros is identified. The unit cost is therefore equal to a 110 Mill. Euros/Mt.

4.3 Industry sector

4.3.1 Measures implemented in the industry sector
The measures implemented in the industry sector can be grouped into two typologies: voluntary agreements and direct or indirect financing in several specific sectors. A list of the measures and expected effects on emissions is shown in table 4.7. The two most important voluntary agreements are contracted with Montedison and Assovetro.
The ***voluntary agreement with Montedison,*** unfortunately, will not produce the expected effects, estimated at 10 MtCO2; some of these projects proposed a series of options for the production of electric energy and their potential have been already estimated in paragraph 4.2. Although the development of detergents for low temperatures to reduce CO_2 emissions has been estimated in the voluntary agreement, it is not reasonable to forecast a reduction of 4 $MtCO_2$. The effect of the new measure is therefore estimated between 0 and 0.3MtCO2 (Ecofys, 2001).
The realisation of a marine stocking terminal will certainly support the growth of gas demand in Italy and will help its expansion; but the terminal alone will not be adequate to produce such an increase in the use of natural gas as to entail 3 MtCO2 reduction in emissions.

4.3.2 Measures implemented before and after the Kyoto agreements
Some of the measures described and/or summarised in the previous paragraph have been put into operation before the Kyoto agreements, others have been implemented afterwards. A detailed evaluation of the measures adopted before and after the Kyoto agreements is contained in Ecofys, 2001. A detailed analysis of all measures is also reported in chapter 5 of the Second National Communication.

4.3.3 Additional interventions for the industry sector
The suggested interventions had been assumed following the indications and the documentation offered by the operating agents. They mainly concern the increase in the efficiency of electric motors, transformers and condensers, as well as cogeneration and the use of wastes.

4.3.3.1 Increase in the efficiency of electric motors
To the end of the application of this policy the following measures are necessary:
- co-financing for research and re-conversation activities for the production of last-generation engines (F1, high efficiency, including a total amount of investment of about 300-350 million Euros), to be determined in the voluntary agreement with ANIE;
- regulations establishing that all electric engines introduced on the market are of the F1 (high efficiency) type as from 2007
- decreasing incentive to the replacement of the existing engines with F1 engines (tax credit) toward a more rapid substitution of the stock, with tax credit equal to the amount of the investment relating to the anticipated substitution, which will decrease in the course of the years up to 2007, i.e. the last incentive year;
- a parallel information campaign in all businesses, through the application of the voluntary agreement with ANIE.

These measures are associated to energy savings between 2 and 7.2 TWh and to CO_2 emission reductions in a range between 1 and 3.6 Mt.

4.3.3.2 Increase in the efficiency of the transformers stock

In order to increase the average efficiency of the Italian stock of transformers currently in operation (about 430,000), it is expected that, as from 2008, all transformers with leaks exceeding the standard indicated in the rules CEI 14.13. will not be allowed to be sold. It must be noted that the additional investment return of a substitution producing efficiency recovery is of about 2 years, with evident advantages for end users.
The expected abatement to 2010 is negligible (the almost total market saturation with high efficiency transformers would have a reduction effect of 1 Mt of CO_2) also on account of the long life cycle of the transformers (20-40 years according to models).

4.3.3.3 Raising of the COSφ standard
The raising of the COSφ standard is envisaged from 0.9 to 0.95 (the same as the European average), with an aggravation of the tariff component connection to the reactive power.
The time-response of this measure for the interested subjects is of 6-10 months. The CO_2 abatement is 0.5 Mt and energy saving is 1 TWh.

4.3.3.4 Cogeneration in the industrial sector
Cogeneration has largely developed in Italy as a result of the CIP6 resolution of 1992, especially following the realisation of large-size plants. The thermal basin of the Italian industry sector, however, is represented by relatively small plants, which found it difficult to obtain an economic advantage from the ongoing market conditions.
With the new policy started in the electric sector under decree 79/99, the incentives for cogeneration plants have been reduced with respect to the previous situation under CIP 6/92. The advantages envisaged for cogeneration plants are dispatch priority and the exclusion from the obligation of covering 2% - production of the demand through renewable sources. Moreover, the plants connected in medium and low tension to the distribution network can benefit from the reduction of the transmission costs in virtue of the less amount of leaks caused on the network, according to the terms of Resolution no. 228/2001 of the Authority for Electricity and Gas.
A potential additional expansion of medium-size cogeneration plants in the industrial sector is estimated in the range of 10-20 TWh with a reduction in CO_2 emissions between 0.8 and 1.5 Mt.
The evaluation of the investments, between 1,100-2,100 million Euros, assumes that the transfer of electric power should be carried out taking into account wholesale prices, estimated around 5 eurocents/kWh; this implies a negative NPV in a range between 48 and 90 million Euros. This value also provides an estimate of the necessary additional incentives for the entire duration of the investments, which are supposed to last 20 years. Considering the overall emission reductions along the 20-year period, the unit cost ranges around 3 mill. Euro/Mt CO_2. Incentives to cogeneration shoud

Table 4.7 – List of measures implemented in the industry sector

Implemented measures	Description	Estimated reduction in 2010 ($MtCO_2$)
VA with Montedison (1998)	Voluntary agreement between the Italian Government and Montedison: different projects supported by means of subsidies. Reduction objective of 10 MtCO2 for 2010, but unclear annual target and geographical localisation.	0-0.3
VA with the glass industry	Voluntary agreement with the glass industry, programme of 10% emission reduction to 2005; potential reduction of 0.4 MtCO2eq/a	–
Public allocation	Allocation by the Italian Government of _ 7 millions for the adaptation of 4 steel plants to the EU standards.	–
Various	Increase in the use of methane in the industry	3.0
Law no. 10/91 Art. 19	Compulsory appointment of an energy manager in industrial plants consuming more than 10 000 tep year of primary energy and in the services companies consuming more than 1000 tep/ year. In 1997, about 2500 industries and 1000 service companies had appointed a manager.	–
VA between Enel (2000) and the Ministry of Productive Activities, Ministry of Environment.	Campaigns to increase the use of efficient light-bulbs and to reduce the size of electric engines. (It is estimated that if the size of all electric engines was adequate, a 2% saving in electric consumptions would be achieved).	–

be actuated through the following alternative options:
· the definition of a tariff scheme for the transfer of surplus amounts to distributors, for cogeneration plants with capacity lower than 50 MW - for instance, according to the size, similarly to the terms established under resolution 82/99 for small hydroelectric plants;
· extension to cogeneration plants with capacity lower than 50 MW of green certificates, for the part of energy saving defined under Resolution 42/02 of the Authority for Electricity and Gas;
· extension to the industrial users of regulations of Ministerial Decree issued by the Ministry of Industry, Trade and Crafts on 24 April 2001 on end use of energy: white papers from the production of energy for civil uses by cogeneration plants.

4.3.3.5 Production of energy from waste

An important reform of the waste sector has been started in Italy under decree no. 22 of 5 February 1997 (Ronchi Decree). The reform aims at decreasing the amount of waste which is landfilled and at increasing energy recovery through the combustion of dry fraction or through the transformation in Waste-Derived Fuels. Several regulatory impediments, especially at local level, however, have prevented the efficient spread of such projects to date. A solution to these problems at local level and the integration of a set of rules simplifying the realisation of such projects in the regulatory framework currently in force in Italy should imply, in the next future, an increase in energy recovery from the waste industry. Italy is still behind schedule compared to other European countries with regard to the use of waste for electricity generation, with a total use of waste lower than 7%, against the 20% European average, and the 50% peaks reached by several countries.

In particular, as far as the industrial sector is concerned, there is the case of the unsuccessful use of wastes in the cement sector, which, in Italy, suffers from extremely severe restrictions compared to other countries. The wastes used in the production of cement, the cost of which is often null or negative, would be withdrawn from the incineration or dumping processes, and would replace conventional and more expensive fuels.

In order to undertake the investments necessary to achieve this objective, a series of adequate resolutions, authorizing the employment of wastes in cement works, should be established to overcome the difficulties arising at local level. This measure does not require additional incentives.

Altogether, the investments on the use of heat from wastes both in the industry sector and for the production of electric energy are estimated in a range between 1.100 and 2.400 million Euros, with a NPV near to zero, proportionate to the tariffs of waste disposal which should be established in order to enable the investment return. Potential emission savings are estimated between 1.8 and 3 Mt.

4.4 Transport and mobility sector

4.4.1 Measures implemented in the transport sector

This sector is characterised by the number of initiatives undertaken and by the relatively moderate impact on emissions. From the administrative point of view, the jurisdiction falls under a large number of institutional entities and businesses, and, consequently initiatives need to be extremely specific. A list of all measures and estimated effects on emissions is referred to in table 4.8. The most significant measures are described in chapter 5 of the Second National Communication and they are briefly summarised hereafter.

The ***voluntary agreement with Fiat*** (integrated with agreement between the European Commis-sion and the car producers) foresee a reduction in specific car emissions from 164 gCO_2/Km to 145 gCO_2/km. This measure is estimated to enable a reduction of 6.8 $MtCO_2$ by 2010.

The increasing diffusion of ***methane, LPG and biodiesel vehicles*** will enable an additional reduction of 1 $MtCO_2$.

The direct effects of the measures promoting the use of ***collective transport means*** is limited to 0.5 $MtCO_2$.

A series of measures aim at increasing the **efficiency of goods transport**: the reduction achievable through the shift of 12 Gt/km from road to rail/sea traffic, is of about 1 $MtCO_2$; assuming that all other anticipated measures are achieved, the emission reduction will be in the range of 2.6 and 3.2 $MtCO_2$.

The panorama of the measures proposed in the ***General Plan for Transports*** could produce a reduction effect from 20 to 24 $MtCO_2$(including all measures described above) The actual implementation of these measures depends also on the decisions taken by the European Commission on the increase in the efficiency of cars, lorries and urban mobility. The anticipated measures are:
• use of low-carbon fuels;
• Increase in transport infrastructures in urban areas;
• Reduction/restrictions of car use in cities;
• Freight traffic from road to rail and sea.

4.4.2 Measures implemented before and after the Kyoto agreements

On the whole, most of the measures for this sector have been implemented before the Kyoto agreements, but some of them have been implemented afterwards. A detailed evaluation of the measures adopted before and after the Kyoto agreements is contained in Ecofys, 2001.

4.4.3 New initiatives already established for the transport sector

A great number of actions are foreseen for this sector, on account of the difficulty to carry out the necessary initiatives in a context characterised by a strong increase in consumptions and by the presence of more than 40 millions subjects, the owners of the vehicles, and a large number of businesses and institutional bodies whose relative jurisdiction falls under specific aspect of this sector.

The established measures incorporated in the reference scenario are described and classified into three categories as follows:

- measures aimed toward the shift to low-carbon fuels;
- optimisation of private transport systems and car pooling;
- infrastructures.

The Ministry of Transport shall provide to monitor the measures to the aim of estimating the expected greenhouse gas reduction.

4.4.3.1 Shift to low-carbon fuels (lpg, methane)

These measures should enable a reduction of 1.5 Mt of CO_2 by 2010 (standard value 2,0 Mt), and total investment up to 880 million Euros, 530 of which charged to the public sector.

The duration of the investment is supposed to be 15 years, implying a unit cost of 39 Euro/t.

Promotion of natural gas use. Protocol of the Ministry of Environment – Fiat – Oil Industries board

The Protocol potentialities are only partly exploited for the time being. The development of natural gas – which, in any case, gives positive results since it reduces CO_2 emissions – will produce the best results when "dedicated" engines will be available, that is to say, engines purposely devised and optimised for fuelling vehicles with natural gases. Natural gas, which is available in large quantities and which is expected to play a major role in the transport sector, is capable to fuel a fleet of 1÷1.5 million vehicles if adequate interventions are implemented. The actual fleet is strong of about 0.4 vehicles. The greatest difficulties concern the development of a more extensive and updated distribution network of natural gas with refuelling time in line with other fuels. Despite the number of difficulties, the potentialities of a greater development of methane-driven vehicles are still high, due to the fact that Italy is a leading country in this sector in terms of availability of methane-fuelled car fleet.

Natural gas-driven buses

Having considered the reassuring results of Law no.194/98 and following developments (MD 25 May 1999), a proposal is made to spur the local transport companies to replace, by means of Programme Agreements and local regulations, their outdated buses (registered more than 10 years before) with gas-driven buses or hybrids.

Promotion of LPG use Protocol of the Ministry of Industry– Fiat – LPG Consortium

The protocol was signed recently and it includes a series of financial incentives for the acquisition of LPG-fuelled vehicles or in favour of those subject who are willing to convert their vehicles into LPG-fuelled cars within 36 months from the registration date. A series of mutual commitments are also foreseen to the aim of improving the diffusion of this fuel. At the moment, the LPG-driven fleet amounts to 1.4 million vehicles.

The current distribution system of LPG would allow supporting a fleet of 3.5÷4 million vehicles without remarkable interventions. The availability of dedicated engines will act as a booster of the existing advantages offered by LPG fuelling. The cost of the intervention is 40 million Euros.

4.4.3.2 Systems aimed toward the optimisation of the private transport sector

These measures should enable a reduction of 2.1 Mt of CO_2 by 2010 (4.6 Mt when completed), energy saving equal to 0.8 Mtoe (2 at completion) and total investments amounting up to 60 million Euros, 49 of which charged to the public sector. The unit cost for the reduction of emissions is estimated around 3 euro/t.

Car pooling

Established under Decrees of Environment M. of 17 February 2000 and of 20 December 2000, the sharing of private means of transport among several users, co-ordinated by local mobility managers for the formation of car crews, could be implemented also through the signing of voluntary agreements with businesses with a number of employees exceeding a given threshold.

Car sharing

Established under Decree of Environment M. of 20 December 2000, proposes the organisation of operating units within local public transportation enterprises for the purpose of initiating the joint management of a vehicle available to a wide range of users while encouraging the use of vehicles that provide low environmental impact.

Collective taxis

Already contemplated Decree of Environment M. of 20 December 2000, proposes a transport offering that represents a middle road between public

Table 4.8 – List of measures implemented in the transport sector

Implemented measures	Description	Estimated reduction in 2010 ($MtCO_2$)
MD of 17 February 2000 Minister of the Environment	Financing plan called "Ecological Sundays" aimed at: realising, integrating or completing public means of transport producing zero or low emissions; regulations and restrictions to the access to central areas in several major cities through automatic control systems or implementation of a "road pricing" system; promotion of the use of low-impact fuels.	–
VA with FIAT (1988)	Reduction at 145g CO_2/km of control on CO_2 emissions from cars	6.8
Law no. 140 of 11 May 1999.	Rules concerning production activities: Art. 6: regulations on the re-financing and extension of incentives (for the acquisition of motorcycles and motor vehicles)	
Resolutions of the Interministerial Committee for Economic Planning of 20 November 1995 and 21 April 1999, l. no. 448/99, no. 488/99 and no. 388/00	3 series of financing decrees: a. 52 projects, total investment amounting to _7.3 billions, approved in 1999 b. 23 projects, total investment amounting to _2.2 billions, approved in 2000 c. 32 projects, total investment amounting to _1.9 billions, estimated but not approved yet.	2.6-3.2
MD 6.6.00 (financing deriving from Law no. 194 of 18 June 1998. art. 2, par. 5) Minister of Environment	Financing to the Regions for the replacement of buses for public transport in operation for more than 15 years.	
MD of 28 May 1999 Ministers of Environment, Transport and Treasury	Financial incentives to local authorities and private businesses for the acquisition of vehicles with zero or low emissions (hybrids, electric, methane, LPG cars) in urban areas with more than 150,000 inhabitants. (Law no. 426 of 9 December 1998)	1.0
MD of 20 December 2000 Minister of Environment	Incentives for the conversion to natural gas or LPG of non-catalysed vehicles.	
VA of 6 April 2001 Ministers of Environment, Productive Activities, Finance, Agricul-ture, ENEA, ANCI, Regions.	Promotion of "Bio-diesel" in the distribution networks and public means of transport.	
Law no. 403 of 14 October 1999 Minister of Foreign Affairs	Ratification and implementation of the Convention for the Protection of Alps of 1991; programme of measures in the sector of freight traffic from road to rail/sea	1.0
Law no. 27 of 18 February 2000 (conversion of Legislative Decree no. 484 of 20 December 1999, with modifications to Law no. 454 of 23 December 1997) Minister of Transport	Actions aimed toward the development of intra-modality systems, according to EU regulations, 1	
MD of 7 June 2000 (Ministers of Transport and Public Works)	Allocation to a Fund promoting the use of bicycles under Law no. 366/1998 and self-governing Regions and Provinces.	–
Resolution of the Interministerial Committee for Economic Planning no. 113 of 2 November 2000.	General Transport Plan including stabilisation proposals - on emissions to 2010 compared to 1990 levels.	–

Implemented measures	Description	Estimated reduction in 2010 ($MtCO_2$)
MD 20 December 2000 Minister of the Environment	Promotion of "Car sharing" – MD 20 December 2000	–
Minister of the Environment	Incentives for the planning of "mobility managers" in businesses, for the transport of passengers and goods.	–
MD 25 January 2000 Minister of the Environment	"Ecological Sundays"; co-financing of projects aimed at promoting public awareness to sustainable transport.	–
Circular no. 2708 of 30 June 1999. Ministry of Environment	Support to Ministerial Decree no. 163 of 21 April 1999 for the identification of health and environmental criteria according to which the Major must take steps aimed toward the reduction of urban traffic.	–
EU Directives	in application of Directive 2001/1/CE of the European Parliament and the Council of 22 January 2001, modifying Directive 70/220/CEE of the Council, concerning measures to be adopted against atmospheric pollution from motor-vehicle emissions. O.G. no.103 of 5 May 2001.	–
MD 1 June 2001 Ministry of Transport	Application of Directive 1999/96/CE of the European Parliament and the Council of 13 December 1999 concerning the rapprochement of the legislations of the Member States about the measures to be adopted against the emission of gaseous pollutants and polluting particulates generated by self-ignition engines for vehicle propulsion and against the emission of gaseous pollutants produced by spark-ignition engines fuelled by means of natural gas or liquefied petroleum gas for vehicle propulsion, modifying Directive 88/77/CEE of the Council.	–
MD 1 June 2001 Ministry of Transport	Application of modifications to Directive 1997/68/CE of the European Parliament and the Council of 16 December 1997 concerning the measures to be adopted against the emission of gaseous pollutants and polluting particulates generated by internal-combustion engines to be installed on non-road movable machines.	–
MD 25 July 2001 Ministry of Environment	Campaign "Ecological Days 2001" –	–
MD 2 April 2002 Ministry of Environment	Application of Directive 1999/30/CE of the Council of 22 April 1999 concerning limit values of ambient air quality for sulphur dioxide, nitrogen dioxide, particles and lead and of Directive 2000/69/CE concerning limit values of ambient air quality for benzene and carbon monoxide	–

buses and private taxis and contributes to lessening the congestion of routes where the demand for transport is high; this segment of transportation supply could be launched by incentives/tenders aimed at both public and private transport companies.

Informatic-telematic systems for freight transport

As has already been proposed in the PGT, given that considerable portion of the kilometres travelled by vehicles of heavy transport without working loads (10% - 25%), it is recommended that a voluntary agreement be reached with the Federtrasporto (industry board), providing incentives for the creation of one or more centres of coordination that can establish synergy among the initiatives already undertaken while assisting an increasingly large number of transporters to cover their "empty trips".

Reformulation of taxes on fuels

By the end of 2004 the Ministry of Finance should reformulate the excise taxes on fuels in such a way that, with the revenue flow remaining equal, fuels that cause less damage to human health and to the environment, as well as lower emissions of CO2, are promoted.

4.4.3.3 Infrastructures

The measures in question, already contemplated, and on a priority basis, under the "objective law" of 21 December 2001, should permit by 2010, when considered altogether, reductions of 3.6 Mt of CO2 (17.6 Mt at full operation), for energy savings of 1.1 Mtep (at full operation 2.0). The optimisation of the country's infrastructures is the primary justification for the investments.

Maritime transport. Implementation of the "Highway of the Sea" project

In light of Law no. 27/2000, as well as the voluntary agreement with the Confitarma, plus the impetus in this direction on the European-Community level, the investments made for the restructuring and modernisation of port structures will prepare Italy (which sits at the centre of the transport flows in the Mediterranean basin) to meet the growing demand for coastal shipping, making that mode of transport competitive even for voyages of less than 500 km .

Maritime transport. Reactivation and development of inland waterways.

The implementation of inland naval transport may be accomplished in a relatively brief period of time, and with significant levels of positive fall-out, with the investment priority being placed on the areas that lead to the market of Rome, to the "petrochemical rectangle" of Mantua – Marghera – Ferrara – Ravenna, as well as the Mestre – Treviso basin.

Completion of high-speed railway lines. Railway transportation – Extension of the local railway network.

Extension of the network is a measure needed to ensure balanced and sustained development. Particular attention is paid to the rail/road and rail/ship inter-modal connections, as well as to the reinforcement of passenger transportation on the commuter routes.

- *New lines and the extension of existing lines: subways and bus transport on dedicated lanes (urban*). Among the European countries, ours is the least equipped with public transport structures using dedicated (single occupancy) lanes. The programs approved and currently being implemented have made possible improvements in the structural facilities of a number of cities, but the overall needs would appear to be significantly greater than the initiatives undertaken.

- **Development of interconnectors and regional hubs**

The projects to improve interconnectors and regional hubs prove to be a strategic tool for the entire national transportation system (freight and passenger); thanks to the reduction in traffic congestion, there will also be positive side-effects in terms of emissions.

Work on medium and long-range roadway infrastructures.

Though it can be assumed that significant amounts of transport (passengers and, to an even greater degree, freight) shall be transferred from the roadway mode to rail and ship, the demand for roadway transport is bound to continue rising. The national roadway network, plus its interconnections with other European networks, have, for some time now, shown themselves to be inadequate. The development of the infrastructures will make possible shorter routes and improved criteria for the utilisation of vehicles, with positive consequences for emissions as well.

4.4.4 Additional initiatives planned for the transport sector

The additional measures regarding the transport sector have been grouped into three main categories:
- technological/tax-related
- infrastructure work
- research.

Technological/tax-related

These are measures designed to limit consumption and emissions of pollutants (not only CO_2) by improving the average efficiency of the vehicles in circulation and instilling in users, through taxation, environmentally beneficial forms of behaviour.

- *supplement to the Fiat-Acea agreement for the development of vehicles producing lower emissions* *of CO_2 and incentives in the form of subsidies for the replacement of existing automobiles with new vehicles providing consumption rates lower than 5 lt/100 km* (average CO_2 emissions equal to or lower than 120 g/Km); it is expected that a directive on the subject will be issued before the end of this year. Estimates show that this measure, should lead to reductions in CO_2 from 3.5 to 6 Mt, with energy savings of between 1.5 and 2.5 Mtoe following investments of from 1.4 billion and 2.4 billion euro and a decrease in external costs of approximately 1 billion euro.

- *Improvement in the energy efficiency of heavy transport vehicles*. The measure would make registration of vehicles used for transport dependent on compliance with more restrictive rules in terms of both consumption and emissions. At the same time, a voluntary agreement is to be reached with the industry involved. It is estimated that the measure would lead to reductions in CO_2 from 0.3 to 0.8 Mt, with energy savings between 0.1 and 0.3 Mtoe; there would be no cost, while a reduction of approximately 1 billion euro would be obtained in terms of external costs.

- *Bio-fuels.* There are plans for the blending of diesel fuel used in engines with bio-diesel (produced through the esterification of rape oil) up to a level of 5%. Within 4-6 years, the national industry could be capable of turning out an annual quantity of bio-diesel of between 1 and 1.3 Mt.. It is estimated that the measure in question would reduce CO_2 by 4 Mt, without any energy savings and with an overall cost of 15 million euro. Considering the time needed for the commercialisation of bio-diesel, it can be forecast that blending of the commercial product will begin in 2006 at levels of 1÷1.5%, reaching rates of 4÷5% in the year 2010. A similar measure would simultaneously lead to a annual decrease of approximately 1% in the national demand for oil. Plans call for a voluntary agreement with the companies involved in production and commercialisation, together with rules and regulations on the formulation of diesel oils sold to the public. There is the added possibility of a partial or total tax reduction for the bio-diesel fuel utilised.

- *Revision of the method for calculating the owner's tax on vehicles* so that it no longer reflects only the maximum horsepower of the vehicle, but also: a) the weight of the vehicle, in this way pointing users towards lower-weight vehicles, with significant advantages in terms of CO_2 emissions, lower consumption and less pervasive pollution; b) a return to annual vehicle inspections (see further on). It is estimated that this measure, in combination with the one that follows, would lead to a CO_2 reduction of 1.3 Mt and energy savings of 0.6 Mtoe, with a negligible overall cost and a reduction of 200 million euro in external costs.

- *Annual frequency of vehicle inspections,* including an inspection of the efficiency of the engine and the exhaust reduction devices.

- **Improvement of quality and standardisation of fuels** beginning in 2004:

- *Reduction of the maximum level of sulphur allowed in gasolines:* this measures is an irreplaceable precondition to the development of vehicles with low or extremely low levels of consumption.

- *Setting of Lpg commercial standards:* a normalised product that is free - or almost - of olefins is a precondition to the development of dedicated engine systems, as well as to the continued progress of today's most widely used post-conversion systems.

- *Setting of commercial standards for natural gas:* the "normalisation" of natural gas supplied for motor propulsion would appear to be an indispensable step towards achieving significant development of this fuel.

- **adjustment of excise taxes on fuels and financing of national sinks**. Given the difficulty of reducing emissions in the transport sector, it is proposed that the industry be assigned the absorption potential of the sinks, both domestic and abroad; a reformulation of the increases in excise revenues resulting from the carbon tax could make possible the financing of internal measures of forestation/reforestation and/or other measures relating to the sinks. The increases in the excise tax (or the allocation of a portion of the existing tax) for the financing of these costs amounts to 0.005 euro/unit of sale to the public.

- **promotion of campaigns to heighten awareness regarding methods of driving vehicles**
Given that no small percentage of wasted fuel and excess emissions is the result of the ways in which vehicles of individual transport are driven on a daily basis, campaigns designed to heighten awareness among roadway users would be able, even in relatively brief periods of time, to have extremely positive consequences on emission levels (and not only those of CO_2), as well as on fuel consumption and roadway safety. It is estimated that this measure would reduce CO_2 by 0.2 Mt, with energy savings of 0.1 Mtoe, an overall cost of 36 million euro and a reduction of 15 million euro in external costs.

Measures involving infrastructures

It is estimates that such measures would reduce CO_2 by 0.4 Mt, with energy savings of 0.2 Mtoe, overall costs of 610 million euro and reductions of approximately 80 million euro in external costs.

- **promotion and development of automobile transport on trains**. This service, which has been offered for many years now, offers interesting possibilities for reducing emissions and contributing to limiting fuel consumption. A measure that will have positive consequences for medium to long-range trips is the functional integration of the parking exchanges with the zones where the vehicles are loaded onto the trains. There are plans for a program agreement with the Trenitalia company. It is estimated that a similar measure would reduce CO_2 by 0.6 Mt, with energy savings of 0.2 Mtoe, overall costs of 30 million euro (of which 20 funded publicly) and a reduction of approximately 40 million euro in external costs.

- **reorganisation of urban traffic** by means of:

• *car pricing*: setting of a fee for entry of vehicles into metropolitan areas;

• *introduction of taxi-buses* into roads with the highest demand for traffic;

• *activation of computerised systems for traffic management and control of traffic lights*, which determine the fuel consumption for the distance travelled, as well as the related emissions;

• *restrictions on access to historic downtown areas* based on the emissions levels of motor vehicles.

Research efforts involving transport

Support for research into vehicles that are intrinsically more efficient and operated with fuels that contain lower levels of carbon is worthy of note among measures designed to reduce emissions of greenhouse gases, in addition to which it could contribute significantly to the modernisation of Italy's transport system as a whole and to roadway safety. The following topics deserve mention:

• Optimised single-fuel natural gas engines.

• Optimised single-fuel lpg direct-injection engines.

• Fuel-cell propulsion system for roadway transport.

• Fuel-cell propulsion systems for rail / maritime transport.

• Development of materials to reduce the mass of vehicles and trains.

• Production/Distribution of hydrogen from hydrocarbons.

It is estimated that the above research efforts can lead, by 2010, to reductions of between 0.8 and 2.1 Mt in CO_2, with energy savings of between 0.4 and 1 Mtoe (though, at full operation, the figures would be 24 Mt CO_2 avoided and 12 Mtoe saved), at overall costs varying from 1.6 billion to 4.2 billion euro, of which 1/3 would e paid by the public sector.

4.5 Residential, commercial and service sectors

4.5.1 Measures implemented in the residential and tertiary sector

The measures implemented can be classified under three categories: use of fuels with a lower carbon content, increased building insulation and promotion of more efficient equipment, both electric and thermal. A list of the measures adopted and their estimated effects on emissions is found on table 4.9.

The ***use of natural gas*** in residential units registered significant increases in the years following 1990 and is expected to continue growing in the years to come; this remains the most economical measure for reducing emissions. Tied to this measure is the increased use of more efficient equipment (boilers and components) to heat buildings.

The legislation developed for the ***implementation of Law 10/91***, and in particular art. 4C, points 1 and 2, has reduced energy consumption in new buildings by 10% within the last two years, compared to the 1990 levels. It has been estimated that annual residential and service-industry emissions, which total to 100 Mt CO_2, could be reduced by 3% through application of this law. Given the nearly 2% growth rate in the number of residential buildings, however, reaching this reduction objective would appear to be a difficult task.

Measures involving the labelling of home appliances, as well as more efficient electrical devices in general, also play an important role in reducing the consumption of electricity in buildings. In technical terms, an estimate of the impact of these measures on emissions is fairly straightforward, though framing the results in this type of study is rather complex, with one of the concerns being to avoid double evaluations of savings:

- in terms of overall trends, the impact of these measures is included in the estimate of growth in the consumption of electricity;
- regarding the current electricity consumption levels, as well as theoretical levels without the measures, reference should be made to chapter 2, indicators for the domestic sector. Establish a comparison with the average levels on other European countries, better than any other calculation, demonstrate the greater efficiency, on a national level, in this sector;
- the impact of further increases in the use of more efficient appliances/components is evaluated in the electricity sector (see paragraph 4.2) and included in an estimate on the potential for reducing emissions of the legislative decrees of 24 April 2001, described in paragraph 4.5.3., on energy efficiency.

4.5.2 Measures implemented before and after 1998

Some of the measures described and/or summarised in the preceding paragraph were implemented before the Kyoto accords and some afterwards. A detailed evaluation of the measures adopted before and after the Kyoto accords can be found in Ecofys, 2001. A detailed analysis of al the measures is also available in the SCN, chapter 5.

4.5.3 New initiatives already approved for the civil sector

4.5.3.1 Decrees on final uses (M. D. 24 April 2001)

As mentioned earlier, these decrees represent the

Table 4.9 – List of measures implemented in the residential and tertiary sector

Implemented measures	Description	Estimated reduction in 2010 ($MtCO_2$)
Various decrees	Increase in the use of natural gas in the residential and service-industry sectors	8.0
Implementation of Law 10/91	Reduction in heat consumption of new residential and service-industry buildings	3.7
Implementation of Law 10/91, Art. 4, Paragraphs 1-2	Reference criteria for the insulation of constructions. As of 1999 reduction of 10% in CO2 for new constructions built in last two years.	
Implementation of Law 10/91	Reduction in consumption of heat in restructured buildings.	
Law 449/97. Art 31	Income tax (IRPEF) deduction allowed for 41% of restructuring expenses. Only in force since 1998 and 1999	2.0
Resolution 137/98 of the Inter-Ministerial Committee on Economic Planning - AV	Introduction of a code of self-regulation in the energy-environmental sector for the buildings of the Public Administration	
AV with ENEL (2000)	Information campaign to increase use of high-energy-efficiency light bulbs, eliminate large-size, inadequate electric motors and promote heat pumps and microwave ovens.	–
EU Dir. EU	Standards for home appliances, labelling	–
MD of 10 July 2001, Ministry of Productive Activities	Endorsement of Directive 98/11/EC, passed by the Commission on 27 January 1998 to set the procedures for application of Directive 92/75/EEC of the Council regarding labels indicating the energy efficiency of light bulbs for use in the home.	–
EU Dir.	Application of Eco-labels in old constructions. Implementation planned for 2002.	–
Implementation Law 10/91	ENEA and FIRE courses and information on energy efficiency. DSM measures: heat pumps and cogeneration	–
		–
3 April 2001 National project	"Solar Town" program. Aimed at local government bodies and regional governments in central-southern Italy that want to install solar-energy systems for the production of hot water in public buildings. Also calls for young people to be trained for employment in the solar-energy sector.	–
3 April 2001 National project	"Solar Thermal" program: municipalities with more than 50,000 inhabitants and municipally owned gas distribution enterprises are able to present, starting from 3 April 2001, applications for financing to back the low-temperature production of heat.	–
June 2001 Inter-Ministerial Agreement Ministries of the Environment and Justice	National Program for Introducing Solar Energy in Italian Penitentiaries: shall result in the installation of 3,000 m2 of collectors in 5 years.	–
MD 26 March 2002 Ministry of Productive Activities	Implementation of Directive 2000/55/EC of the European Parliament and Council on the energy-efficiency prerequisites of the power-feeds for fluorescent lights.	

most important measure already approved for the sector. In terms of the accounting, their contribution has been entered under the electrical sector, paragraph 4.2, but their application is discussed in this context.
The decrees issued by the Ministry of Industry on 24 April 2001 set the national quantitative objectives for energy savings and the development of renewable sources, together with quantitative objectives for increasing the energy efficiency of final uses. The degrees translate into a wide variety of actions: for example, the use of more efficient boilers, of fluorescent lamps, of solar collectors for the production of hot water, of double-paned windows etc.. The objectives of the decrees are indicated in Mtoe of energy saved for each year of the period 2002-2006.
The subjects that must meet the obligations set under the decrees are distributors of electric energy and gas which, as of the end of the year 2001, served at least 100 thousand clients. In practical terms, the group consists of approximately 30 subjects that have been assigned a specific mandatory objective calculated as a part of the national objective, based on the proportion between the energy distributed by the individual distributor and the national total.
The projects are financed with the resources of the parties making the proposals, but also with other resources, such as financing from the State, the European Community or the regions, or from the beneficiaries of the energy savings (the so-called participating clients). Fee-coverage mechanisms can be introduced for the costs not covered by other resources (decision taken by the AEEG).

Based on initial estimates drawn up by a number of important regions in preparing their energy plans, the necessary investments are on the order of 10 euro/t of CO_2 reduction, a cost which results in a NPV of investment that is positive by a clear margin.

The decrees call for sanctions to be levied against distributors that fail to respect their annual objectives.
The projects for the promotion of energy savings consist of initiatives that result in the installation of highly efficient equipment (bulbs, motors, sources of heat and cooling), regulating devices to achieve more efficient final uses of energy or passive casings that decrease energy loss (double-paned glass, insulation).
The results produced by each project are valid for a maximum period of 5 years.

4.5.4 Additional initiatives planned for the residential and tertiary sector

4.5.4.1 Extension of effect of decrees on the efficiency of final uses

There are plans for the ministerial decrees of April 2001 to remain in effect beyond 2006, with the same annual increases as those set for the period 2002-2006: the result would be a further reduction – in addition to that estimated for the year 2006 – of from 3.8 to 6.5 Mt CO_2 from an investment that, as of 2010, would total between 19 and 33 million euro. The instrument of implementation and incentives would be the same as that proposed by the Authority for Electric Energy and Gas for the initial period of 2002-2006.
The presence in many regional energy plans (P.E.R.) of noteworthy measures and objectives for savings in the civil sector by 2010 serves as a guarantee of the effectiveness of this extension; for that matter, a parallel line of initiatives has already been identified on the regional level (see, for example, the provisions of the P.E.R. of Lombardy, Emilia Romagna and Liguria).

4.5.4.2 More extensive use of thermal solar energy

A major basin of energy demand that can be satisfied with renewable sources is represented by low-temperature thermal uses. Today there are a number of different technological opportunities for the use of thermal solar energy that prove worthwhile, in absolute terms, for certain types of consumption. It is important that energy policy initiatives not neglect these opportunities.
Solar energy is definitely better suited to the construction of small-scale plants than to that of large-scale facilities which prove difficult to operate.
It is predicted that investments can be made for potential energy savings of 70,000 t.o.e., which would result in reductions of approximately 0.2 Mt in CO_2 investments. Overall investments are estimated at 800 million euro, with a negative VAN of 160 million euro and a unit cost, assuming the investment will last for 20 years, of 40 million euro. The objective can be reached, given that the market for panels in 2001 showed an order of magnitude of roughly 40,000 m2, with constant growth in the last few years. There are examples of high levels of penetration of thermoelectric solar energy in the domestic sectors of other European countries, with percentages that rise as high as 70% of the homes in certain areas of the Mediterranean.

4.5.4.3 Regional measures in the residential and tertiary sector

Listed below are examples of regional initiatives that contribute to reaching the Kyoto target and are directed at the civil sector. The regional governments and the local government bodies shall play an increasingly important role in this sector, given that all the initiatives fall under their responsibility from 2002 on. At present there is a lack of sufficient information on the measures and guidelines adopted on the local level.

Lombardy (July 2002)

Lombardy is pursing an "objective scenario", with the aim of fulfilling its portion of the 6.5% reduction assigned to Italy; 1/3 of the efforts towards this objective involve internal measures, while 2/3 consist of flexible mechanisms. The overall estimates for the "objective scenario" point to: a reduction of 2.7 Mt of CO_2 in the residential sector as of 2010 on investments of 27,319,000 Euro (54.238 billion Lire); a reduction of 0.76 Mt of CO_2 in the sector of the services industries and the Public Administration on investments of 7,711,000 Euro (15.267 billion Lire).

Measures of implementation:

• Energy certification of buildings: supported by Law 10/91, Legislative Decree 112/98, transformed into regional legislation in Lombardy with Law 1/2000 and EU Directive proposal 2001/0098; objective: to develop and implement, eventually in a coordinated effort with other Italian regions, a procedure for the energy certification of buildings.

• Home appliances with high levels of energy efficiency: promote, possibly through voluntary agreements, the increased use of high-efficiency appliances by home consumers (refrigerators, washing machines, lighting and air-conditioning) and in the public-lighting sector.

• Integration of renewable energy sources in buildings: supported by Law 10/91, with the goal of achieving relevant use of renewable or comparable sources of energy in restructuring projects within the Public Administration while setting minimum requirements of energy efficiency and promoting bio-climactic construction.

• Promotion of Facility Management and Energy Manager efforts: supported by Law 10/91 and involving training initiatives, plus activities designed to heighten awareness and spread information on the role of Facility Management and the figures of the Energy Manager, with financial support as well.

• Energy-efficient technology in public procurement: art. 4, paragraph 7 of Law 10/91, with the issue of measures meant to achieve significant progress towards the goal of introducing rational energy use and the use of renewable sources among the criteria for awarding economically significant contracts for the supply of goods and services to the Public Administration;

• Energy audits in the service industries and in the Public Administration: promoting the increased use of methodologies of energy diagnostics in various sectors with forms of financial support.

• Third Parties Financing (TPF): recommended under EU Directive no. 93/76, the resolution of the Inter-Ministerial Commission for Economic Planning approving the PNSS in implementation of Agenda XXI, with increased use of the TPF within the Public Administration and among private parties with a significant level of energy spending, plus establishment of a fund, under the auspices of the regional government, for promotion of the increased use and exchange of guaranteed energy-savings certificates.

• The Ministerial Decrees of 24 April 2001: the regional quantitative objectives for energy savings estimate, as of 2006, cumulative EE savings of 4,750 GWh (400 ktoe) plus savings of gas (400 ktoe).

Emilia Romagna (March 2001)

The Emilia Romagna region has committed itself to reducing emissions of CO_2, starting from the 1990 level, by 2 Mt as of 2010; taking into consideration a scenario that points to a spontaneous growth trend, a reduction of 7 Mt in CO_2 emissions by 2010, compared to the 1990 level. For the building sector, the commitment is estimated at 1.40 Mt of CO_2, with energy savings of 550 ktoe on an investment of 3.357 billion Euro (6.5 trillion Lire).

• Promotion of Facility Management and Energy Manager: supported by Law 10/91 and involving training initiatives, plus activities designed to heighten awareness and spread information on the role of Facility Management and the figures of the Energy Manager, with financial support as well.

• Integration of renewable energy sources in buildings: supported by Law 10/91, with the goal of achieving relevant use of renewable or comparable sources of energy in restructuring projects within the Public Administration while setting minimum requirements of energy efficiency and promoting bio-climactic construction.

• Systems of thermal regulation and heat accounting

• Re-phasing at the final user

• Electric motors with high energy efficiency

• Lighting systems: automatic systems for turning lights on and off; increased energy efficiency in the sector of public lighting;

• Replacement of electric water heaters with natural-gas devices

• Appliances and office machinery with high levels of energy efficiency.

Liguria (2001)

The regional government intends to pursue stabilisation of emissions at the levels of the year 1990, a key objective in light of the projected growth trend of 2-4% in emissions in the transportation sector by 2010. With the following measures, the regional government intends to achieve, by 2010, overall savings of 10% of total regional energy consumption (344 ktoe).

• energy-related renovation of buildings: upgrading of buildings constructed before 1981 to bring them in line with Presidential Decree 412/93; the initiative would lead to a reduction of 3.4% in regional energy consumption (118.5 ktoe/year) and could be adopted, in part, through incentives;
• energy certification of buildings: must become obligatory for the sale and rental of real-estate units;
• insulation of the building shell: potential energy savings of 27% per residential unit;
• insulation of roof alone: potential energy savings of 12% per residential unit;
• replacement of existing boilers with modern gas boilers offering high levels of energy efficiency: potential energy savings of 13% per residential unit;
• thermal regulation systems: potential energy savings of 10% per residential unit;
• scheduled maintenance: contemplated under Presidential Decree 412/93, leads to energy savings of 3-5% on recent systems and 17% on old systems;
• development of Regulatory Plans and Cons-tructions Regulations: providing incentives for bio-architecture, solar energy, sustainable construction and energy savings;
• third party financing commitee: recommended under EU Directive no. 93/76, the resolution of the Inter-Ministerial Commetee for Economic Planning approving the PNSS in implementation of Agenda XXI, with increased use of the TPF and development of ESCO (Energy Service Companies).

4.6 Inter-sectorial strategies

The measures and commitments for which different sectors are responsible offer maximum effectiveness when appropriately coordinated and supported by actions that encompass more than one sector of economic activity. This section addresses measures involving sectors which were not directly discussed in the preceding sections.

Law 448/98, which introduced the carbon tax, mentioned that the Government would be able to draw on a portion of the resulting revenues for use as compensation for the measures taken in the different sectors and as subsidies for the reduction of emissions, for the promotion of energy efficiency and for the development of renewable sources.
The carbon-tax, for that matter, was supposed to have been gradually increased between 1999 and 2005; instead, on account of the high price of oil, it was frozen at the 1999 levels.

Law 388/00 proposes a number of different procedures for the reduction of emissions: specifically, lower taxation on products that permit decreases in emissions, such as bio-diesel, together with the promotion of energy efficiency and renewable sources.

4.6.1 Inter-sector measures implemented

The main inter-sectorial measures are summarised on table 4.10 below.
Estimates of the results obtained are not given in order to avoid counting the same reductions twice. In fact, nearly all the measures are either complementary to specific technological initiatives in the individual sectors or simply group together measures involving one or more sectors. The first example is the carbon tax, which should contribute to promoting more widespread use of automobiles with low levels of energy consumption, while the second example is provided by measures which regard the sectors of agricultural and forestry and which have already been evaluated, in terms of their effects, in the individual sectors.

4.7 Emissions from non-energy sources

The measures presented in the following paragraphs can be implemented without using any specific financial support or incentive, given the fact that they are characterised by negative emission-reductions costs. None of them are included in the trend scenario or in the reference scenario, despite the fact that many of these generally present excellent cost-benefit relations.

4.7.1 Industrial Processes

Reduction of N_2O emissions from the production of adipic acid and nitric acid

These two interventions can result in significant reductions in the emissions from industrial processes, with extremely limited reduction costs. In the case of adipic acid, the planned course of action calls for the adoption in Italy of the devices (thermal or catalytic) already used in the other European countries for the treatment of effluent gases. The measure referred to consists of a voluntary agreement with the only enterprise involved.
As for nitric acid, the most advanced technology calls for installation of SCR (selective catalytic reduction) systems for the treatment of process gases. The cost of reduction is relatively limited, amounting to less than 0.5 Euro for CO_2 equivalent ton. The proposed measure consists of a voluntary agreement with the respective industrial sector.

4.7.2 Agriculture

Energy consumption in agriculture

Organic agriculture is experiencing rapid growth, primarily as a result of the incentives provided

Table 4.10 – List of the inter-sectorial measures implemented

Measures implemented	Description
Law 448/98, Art. 8	"Carbon tax". Frozen at 1999 levels
Law 388/2000	Art 22: products that contribute to environmental protection exempted from taxes. Art 23: tax reductions for some sectors Art 110: fund for measures geared towards reducing emissions of CO_2 and increasing energy efficiency.
Legislative Decree no. 227 of 18 May 2001	Reorganisation and modernisation of the forestry sector, in accordance with article 7 of Law no. 57 of 5 March 2001. Regulates agricultural and forestry development in compliance with the objectives of sustainable development
MD of 21 May 2001	Distribution of financing to regional programs on the "Carbon Tax". Appendix 1 illustrates the break-down by region of the financing for the programs of
MD of 4 June 2001 Ministry of the Environment, Finance, Productive Activities	Programs of national importance involving emissions of greenhouse gases, in implementation of art. 3 of MD no. 337 of 20 July. Appendices 1 and 2 to the present decree identify the public entities responsible for implementation, as well as the presumed time period necessary for the performance of the national programs, plus the elements used to identify programs of national and international cooperation
Law no. 120 of 1 June 2002	Ratification and enactment of the Kyoto Protocol to the UN Framework Convention on Climate Change, established in Kyoto on 11 December 1997
Law no. 118 of 16 June 2002	Conversion into law, with modifications, of Legislative Decree no. 68 of 19 April 2002, containing urgent measures for the animal husbandry sector and for the fight against forest fires.

under EU Regulations no. 2078/92; the agricultural surface area on which the methods of organic agriculture are practiced, equal to 91,500 hectares in 1993, had already reached 1,069,339 hectares in the year 2000. Assuming that the specific level of energy consumption of organic agriculture is 30% lower than that of traditional agriculture, a projection through 2010 of current growth trends in the sector shows that the emissions avoided could total 0.337 Mt CO_2. This figure could be reduced to 0.28 Mt CO_2, taking into account the possible saturation of the sector, as well as the fact that the lower level of energy consumption in the production of fertilisers is considered under another item of the emissions inventory.

Emissions of nitrous oxide from agricultural soils

The emission reductions in question can result from a rationalisation of the use of fertilisers, with a subsequent limitation of the consumption and related emissions of nitrous oxide from agricultural soils. Of essential importance to achieving the above objective are:

- ongoing efforts to increase awareness of the practice, plus
- the adoption of codes of good agricultural practice.

On this subject, Italy has been one of the first countries of the European Union to draw up, under the provisions of EU Directive no. 676/91, a

Table 4.11 – Additional measures for industrial process emissions (not established)

Description	Estimated reduction in 2010 ($MtCO_2$)
Reduction of N_2O emission from the production of adipic acid	5.981
Reduction of N_2O emission from the productions of nitric acid	0.157

Table 4.12 – Additional measures in the waste sector (not established)

	Estimated reduction in 2010 (MtCO2)
Stabilisation of organic fraction, 50% of the biodegradable municipal waste as of 2010	*0.64*
Energy recovery from municipal waste, 30% of the municipal waste as of 2010 (+500 MWe)	*0.33*

"Code of Good Agricultural Practice for the Protection of Water from Nitrates", adopted under Ministerial Decree no. 86 of 19 April 1999. By combining these recommendations with others specifically aimed at protecting the atmosphere and the climate (such as the use of controlled-release formulas), additional, limited reductions could be achieved in the consumption of fertilisers, on the order of 5% as of 2010, compared to the levels of 1990, thus resulting in an estimated decrease of 0.46 CO_2 equivalent Mt.

Emissions of methane from manure management

The proposed initiative involves covering the holding tanks used to store liquid animal waste and then conveying the resulting biogas to combustion or cogeneration plants. The primary focus of the activities would be pigs (between 10% and 40% of the animals) and, to a relatively limited degree, cattle, with a reduction in methane emissions of between 7 and 39 kt of methane per year, at an overall cost of from 6.2 to 33.2 million Euro per year.

An analysis of the investment, taking into account the value of the electricity produced, generates a positive NAV, though the result is not sufficient to convince the operators involved to invest. The dimensions of the initiative would depend on:

- the level of incentives available for the production of electricity from renewable sources, and
- the availability of subsidies for the construction of the systems.

Another measure oriented towards this same objective is Directive 96/61/EC (Integrated Pollution Prevention and Control, or IPPC), which calls for the introduction of licensing processes based on the adoption of the best possible technology available for poultry farms with more than 40,000 birds and pig farms with more than 2,000 animals (heavier than 30 kg) or 750 sows. In terms of structural initiatives for existing facilities, financial incentives could be drawn from within the Rural Development Plans (PSR) financed by the FEOGA.

4.7.3 Waste: Stabilisation of the organic fraction and energy recovery

Two initiatives are proposed:

- fulfilment of the deadlines set for the reduction of the biodegradable fraction of the municipal waste in landfills, as stipulated under Directive 99/31/EC, which calls for a reduction of 50% as early as 2010, compared to the 1995 level, in the quantity of biodegradable municipal waste to be placed in landfills, making for a forecast decrease of 0,64 Mt;
- substantial respect of the objectives of Legislative Decree 22/97, in particular as regards the recovery of energy from waste: it is assumed that, by 2010, the portion of municipal waste sent to energy-recovery treatments shall be 30% (in line with the indications of the "White Book on the Energy Optimisation of Renewable Sources", ENEA, 1999), making for an additional increase of 500 MWe municipal electrical capacity from waste, compared to 2000, with a decrease in equivalent CO_2 of 0.33 Mt. The measures and incentives that shall hopefully be established are similar to those contemplated above for the renewable sources, and in particular for the energy use of waste.

4.7.4 Fluorinated gases

Four possible measures are currently being given consideration in this delicate sector:

• Aluminium. The recycling of aluminium not only generates the economic benefits due to reduced imports of the raw material and lower energy consumption, but also makes it possible to avoid emissions of PFCs from the processing of the raw mineral. We have assumed that, on the quantity of recycled aluminium will grow, between now and the year 2010, up to approximately 80% of the total consumption of this metal.

• Production of semi-conductors. A limited initiative consisting of the installation of abatement devices and the use in the etching process of fluids with a lower level of GWP is currently being studied. The European industry has voluntarily agreed to limit its emissions in 2010 to a figure 10% lower than 1995 levels.

• Mobile air conditioners. Reduction of from 10%

Table 4.13 – Additional measures for fluorinated gases (not established)

Description	Estimated reduction in 2010 ($MtCO_2$)
Reduction of PFC emissions through aluminium recycling	0.05
Installation of abatement devices and adoption of low GWP substances in the production of semiconductors	0.02
Reduction of HFC leaks from mobile air conditioners	0.65
Reduction of SF_6 leaks from electric equipment	0.04

to 5% in the rate of leaks from mobile air conditioners, to be obtained through adjustments made during the design phase of the systems and during the maintenance phase. These initiatives shall be promoted under the European framework-directive currently up for discussion.

4.8 Forestry sector

The measures contemplated in the sector "land use, land use change and forestry" for the generation and certification of carbon credits during the period 2008-2012 are summarised on table 4.14.

Table 4.14 – Maximum national potential for carbon removal

ACTIVITIES FOR CARBON REMOVAL CARBON WITHIN THE NATIONAL TERRITORY	Removal (Mt CO_2)	Investment (Millions of euro)
Art. 3.4 Forest management	4.1	10.0
Art. 3.3 Afforestation and Reforestation (old plantings)	1.0	6.0
Art. 3.3 Natural reforestation	3.0	6.5
Art. 3.3 Afforestation and Reforestation (new plantings)	1.0	200.0
Art. 3.3 Afforestation and Reforestation (new facilities in areas subject to hydro-geological imbalances – Law 183/89)	1	300
Art. 3.4 Agricultural land, pastures and re-vegetation	0.1	4.2
Total	**10.2**	**526.7**

• Electrical equipment. In addition to the results already achieved by manifacturers, the following assumptions have be en made: 1) stabilisation of manifacturing emissions at 2000 levels; 2) reduction of the leakage rate from installed equipment up to 0,5% by 2010; 3) reduction of the leakage rate from end-of-life equiment up to 1% by 2010. This will require the negotiation of an agreement between manifacturers and the Ministry for the Environment (also users shall be included as concerns the disposal of the systems).

Electrical equipment

In the case of the sulphur hexafluoride contained in electrical equipment, consideration was given to the effects of a scenario in which the leakage rate of installed equipment is reduced, by the year 2010, from 0.9 to 0.45%, while the leakage rate for equipment at the end of its life cycle falls from 3 to 1%.

A brief description is also given for each of the activities listed.

4.8.1 Forest Management (art. 3.4)

For Italy, the limit assigned by the UNFCCC was set at 0.18 Mt of C per year (the equivalent of 0.66 Mt of CO_2). The figure is clearly underestimated. There are two main causes for the underestimate:

1) The quantity considered by the FAO under the "Global Forests Resources Assessment 2000" and the "State of World's Forests 2001" regards the area of Italy's controlled forests (meaning those in which a multi-year management plan approved by the forestry authorities is in force), which is equal to approximately 10% of the total forest area; the area of Italy's managed forests, on the other hand, is much larger, given that Law no. 3267 of 1923 places all Italian forests under the Measures of General Operation and Forestry Policy;

2) The National Forestry Inventory has not been updated, and the system of forestry statistics is currently being revised;
The figure assigned to Italy can be modified, though, for this to be done, new and significant amounts of inventory data must be supplied to the Secretariat of the UNFCCC by June 2005, so that the figure can be corrected by 31 December 2006. From a technical perspective, the National Forestry Inventory of Carbon (INFOCARB) should be created by 2005. This inventory must then be updated every 5 years, corresponding to the end of the period of commitment under the Kyoto Protocol (meaning that the first update should be ready for 2012).

4.8.2 Afforestation and Reforestation activities (art. 3.3)
The condition that must be met in order for the planting to be considered valid for the purposes of generating carbon credits is that the reforested area have been free of forest since at least 1 January 1990.

There are no limits on the use of the carbon credits granted (RMU), and certification can be obtained for all the carbon accumulated in the biomass and in the dead material of the planted area (trunk, branches, leaves, roots, organic substance) from 1 January 2008 onwards.
Different categories of reforestation/afforestation activities can be considered under article 3.3:
a) the plantings performed (old plantings) under EEC Regulation 2080/92, which total 117,428 hectares. The lone cost to be sustained is their certification, which falls under the cost of the creation and management of the National Register of Agro-Forestry Carbon Storage pools. The carbon level for the first period of the commitment (2008-2012) is estimated at approximately 1.0 Mt CO_2;
b) so-called "natural reforestation", which includes the natural expansion of the forested area as a result of policies for the reduction of farming-pasture surface area and for the protection of the environment. Eligibility for carbon certification for the period 2008-2012 is tied to providing proof that these areas were the result of agricultural-environmental policies (human induced). The lone cost to be sustained is that of certification, which falls within the cost of creating and managing the National Registry of Agro-Forestry Carbon Storage pools. The levels of carbon set for the first period of commitment (2008-2012) is estimated at 3 Mt CO_2;
c) the new plantings to be made during the period 2003-2008, forecast at 40,000 hectares, for an average removal of 1 Mt CO_2 during the period 2008-2012 and of 20 Mt CO_2 at the maturity. These domestic plantings offer major advantages in term of the certification of carbon credits, and especially as regards reaping the full fall-out of the benefits generated by reforestations on Italy's economic and environmental systems. The planting operations require an average of 5,000 euro per hectare, including the cost of certification (which is completely absorbed by the National Registry of Agro-Forestry Carbon Storage pools) and the cost of occupying the terrain (which must either be zero or be compensated for by the sale of the property rights to the wood materials and by the sale of the contribution).
New plantings carried out in areas subject to hydrogeological imbalance (Law no. 183 of 18 May 1989) will present major advantages in terms of defence of the territory, prevention of hydro-geological risks and the reduction of damage due to imbalances. In fact, the tree cover, in addition to reducing the erosive action of the rain on the land is capable of sharply reducing the peak flows of floods (by as much as 90%) and increasing bank reinforcement times (by a factor of 2 to 7). It is estimated that planting operations cost an average of 10,000 euro per hectare, with the portion regarding the hydrogeological reclamation of the area being charged against he funds referred to under Law no. 183/89. The operating capacity of the Basin Authorities is approximately 6,000 hectares of reforestation per year for the period of 2003-2012, making for a total of 60,000 hectares. Average removal for this type of planting is estimated at 1 Mt CO_2 for the period 2008-2012 and at 10 Mt CO_2 at the maturity.

The type of planting shall be the same for all the afforestation and reforestation activities (art. 3, art. 6 and art. 12) carried out for the purposes of the Kyoto Protocol.
It has been deemed necessary to use two series of species in each planting: one featuring rapids growth and high rates of CO_2 removals but a low capacity for storage of the carbon in terms of both space (t/hectare) and time (meaning a low carrying capacity of the system, with rapid saturation), plus another set of species with slow initial growth but a capacity to ensure, for lengthy periods, high rates of growth and, most importantly, an elevated capacity for storing the carbon, in terms of both space (t/hectare) and time (meaning an elevated carrying capacity of the system, with slow saturation). A correct combination of the two groups of species makes it possible to obtain a planting that presents excellent initial rates of growth and, even more importantly, a high capacity for the storage of carbon.

4.8.3 Agricultural, land pastures and re-vegetation (art. 3.4)
The costs currently forecast for this activity involve the preparation of a special study-plan designed to

estimate the quantities of carbon absorbed/emitted by these activities, given the complete lack of data in the literature. This study-plan is necessary in order to arrive at a proper reporting within the framework of the Kyoto Protocol. Average removal of 0.1 $MtCO_2$/year is estimated.

4.8.4 National Register of Agro-Forestry Carbon Storage Pools

The National Register of Agro-Forestry Carbon Storage Pools is the tool for certifying the quantities of carbon removed by Italian agricultural and forestry system.

The registry provides an overview of the use made of Italian soil, placing within this picture the statistical data on the carbon contents of the different catgories of agricultural and forestry activities. Certification of carbon credits will be a direct consequence of the accounting of the variations in the carbon contents of the aforementioned categories. The Register must analyse variations in the flows of greenhouse gases for the activities referred to under articles 3.3 and 3.4. These activities (forestry; agricultural land and the pasturing of livestock; re-vegetation) differ from each other in terms of the procedures used to calculate the carbon credits generated.

4.8.5 Re-vegetation

The term re-vegetation refers to all vegetable categories with a minimum extension of 0.05 ha not falling under the definitions of afforest or forestation/reforestation. An evaluation must be carried out to determine which types of vegetables and wood crops should be taken into consideration, quantifying the increases. Based on an analysis of the data, it must be decided whether or not to include these activities among the supplementary initiatives referred to under art. 3.4 of the Kyoto Protocol. The procedures for the accounting of the carbon credits are the same as those used in the agriculture-pasturing sector.

The Register shall ensure the necessary annual monitoring of the agro-forestry storage sites (agricultural land; forest soil, biomass and dead matter) in order to up date the estimates of the flows on a constant basis while registering the carbon credits generated.

4.9 Flexible Mechanisms

The present section addresses the use of flexible mechanisms: Emissions Trading, Clean Development Mechanism (CDM) and Joint Implementation (JI) project. These mechanisms complement internal policies, often on account of their greater convenience in terms of the unit cost for reducing emissions.

On the subject of Emissions Trading, it is calculated that the market price of a share of emissions (mean-

The following table summarises the situation for domestic plantings:

Table 4.15 – Plantings of domestic forestation

	CO_2 removal rate		
	Low [1]	Average [2]	High [3]
Hectares reforested per million credits generated during life cycle (50 years)	4,000	2,000	1,300
Cost per carbon credit during life cycle (50 years)	20	10	6.5
Hectares reforested per million credits generated in 2008-2012	100,000	40,000	30,000
Cost per carbon credit in 2008-2012	500	200	150

1 Average removal of 5 t hectare/year of CO_2 is assumed for the life cycle of the planting (50 years), while a figure of 2 t hectare/year of CO2 is assumed for the period of 2008-2012

2 Average removal of 10 t hectare/year of CO2 is assumed for the life cycle of the planting (50 years), while a figure of 5 t hectare/year of CO2 is assumed for the period 2008-2012

3 Average removal of 15 t hectare/year of CO2 is assumed for the life cycle of the planting (50 years), while a figure of 7 t hectare/year of CO2 is assumed for the period 2008-2012

ing the right to emit an equivalent ton of carbon dioxide) should be placed inside a spread of between 20 Euro and 33 Euro (estimates of the PRIMES model). These prices must also be considered as prices that fall within the upper portion of a probable price spread, given that the political accord reached at the sixth conference of the parties to the agreement in Bonn, held in July of 2001, calls for a series of decisions that will probably lead to a lowering of the prices.

As regards the cost of the lowering of emissions achieved under the CDM and JI projects, it should be remembered that the complexity of their monetary evaluation is tied to the multiple array of possible initiatives. The monetary volume of the CER and the ERU generated can represent a proxy for the costs of lowering emissions.

Low costs for the lowering of emissions would lead, with all other factors being equal, to low prices for CER and ERU, and vice versa.

Implementation of the CDM and JI requires, on the part of the public sector, a series of activities that stimulate and favour the projects. Without such activities, the private sector would remain isolated, lacking the necessary information and assistance to aid in the efforts. On the one hand, the private sector benefits from the revenues of the CER and the ERU which the project generates; at the same time, is must sustain a series of transaction costs higher than those it would have to sustain were the projects not entered under the CDM and the JI.

It is extremely important that the public sector adopt specific programs to assist the CDM and JI projects, eventually under the coordination of a specific agency. These programs (or the agency) can provide guidelines, serve as a partner or provide consulting to companies in order to spread information on the projects and facilitate their performance, especially internationally, through international initiatives formulated on an ad hoc basis – taking advantage of the existing networks operated by the Ministry of Foreign Affairs and the Institute of Foreign Trade – for the CDM and JI projects. As part of such efforts, a rapid, preferential procedure could be established for the CDM and the JI, in order to exploit all the potential for reducing greenhouse gas emissions latent in projects not specifically designed for this purpose.

In the course of consultations with the operators, the following sectors were indicated as holding potential for CDM.

a) reduction of flaring gas and venting gas up to a maximum of approximately 20 MT CO2 in the countries in which the ENI corporation has mineral extraction interests.

b) the generation of electricity, which represents a basin of great potential for the JI and CDM projects for at least three reasons: i) it is showing strong growth, especially in the developing economies; ii) it lies at the origin of a significant portion of the CO2 emissions; iii) apart from the CDM and JI projects, major investments are planned by the Annex I countries.

   In concrete terms, JI and CDM initiatives in the electricity sector have been proposed and evaluated regarding:

- the construction of wind-power parks
- the transformation of coal-fed power plants into combined-cycle plants fuelled by gas
- the modernisation of coal-fed power plants through the renovation of burners and boilers.

It is estimated that the related investments per MW would be:

- wind power: 0.6 million euro
- transformation to the combined cycle: 0.4 million euro
- modernisation of coal power plant: 0.2 million euro

c) activities of land use, land use change and forestry, plus, in particular, projects of forestation and reforestation. Certification can be issued for all the quantities of carbon accumulated in the biomass and in the dead matter of the planted area (trunk, branches, leaves, roots, organic substances) since 1 January 2000, to or from which would be added or subtracted the carbon quantities of the baseline (meaning the flows of gas that would have occurred on that surface area without the planting) and of the leakage (meaning the variations in the flows of greenhouses gases that occur outside of the area of the planting as result of the planting itself). Both the plantings performed under JI and those carried out under CDM have such a high degree of variability in terms of economic and environmental parameters (given that they may be undertaken in countries with different economic structures and different environmental conditions) that estimating an average price for carbon credits proves impossible.