

REPUBLIC OF TUNISIA

MINISTRY OF AGRICULTURE,
ENVIRONMENT AND HYDRAULIC
RESOURCES

NATIONAL AGENCY
OF RENEWABLE ENERGIES

INFORMATION CENTER ON SUSTAINABLE ENERGY AND ENVIRONMENT

GREENHOUSE GAS EMISSIONS IN TUNISIA

With the financial support of the Project RAB/94/G31

October 2002

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UNITED NATIONS FRAMEWORK CONVENTION on CLIMATE CHANGE

Article 4-1-a

“ All parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall : **Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties;** ”

GHG Emissions in Tunisia

This GHG emissions' brochure has been created by the Information Center on Sustainable Energy and Environment (CIEDE) in Tunisia with the support of the Maghreb Project on Climate Change RAB/94/G31.

This brochure presents a statistics' data synthesis of :

- The GHG emissions' inventory of 1994 and 1997.
- The GHG emissions' prospects of evolution on the horizons of 2010 and 2020.
- The mitigation potential of the GHG emissions during the next two decades.
- The emissions' indicators between 1994 and 2020.

NATIONAL AGENCY OF RENEWABLE ENERGIES

The National Agency of Renewable Energies (ANER) is a public establishment created in 1985 under the name of AME (Agency of Energy Control).

Its role is to implement the state policy for energy conservation by promoting renewable energies, energy efficiency and clean technologies.

The intervention fields of the Agency are all those initiatives and actions which aim at economizing on energies and reducing the emissions of greenhouse gases due to the conventional energies' consumption.

This goal will be achieved by :

- Granting tax and financial incentives for using more and more renewable energies.
- Backing development and the spread of the energy conservation industry as well as encouraging private investment in this sector.
- Elaborating and carrying out national energy conservation programs.
- Carrying out prospective and strategic surveys.
- Launching sensitizing, information, educational and training campaigns.
- Elaborating regulations on energy conservation.

INFORMATION CENTER ON SUSTAINABLE ENERGY AND ENVIRONMENT

The Information Center on Sustainable Energy and Environment (CIEDE) was created within the ANER in April 2001. Its creation was supported by the GEF/UNDP through the Maghreb Project RAB/94 /G31 as part of the CCNUCC.

The CIEDE's current mission is to popularize and inform the citizens about climate change in general and sustainable energy in particular.

The objectives of the CIEDE are as follows to :

- Inform and sensitize the public and decision-makers on climate change problems.
- Accumulate and popularize knowledge of how energy contributes to sustainable development.

ABBREVIATIONS

ANER	:	National Agency of Renewable Energies.
CIEDE	:	Information Centre on Sustainable Energy and Environment.
LUC	:	Land Use Change.
CH₄	:	Methane.
CO	:	Carbon Monoxide.
CO₂	:	Carbon Dioxide.
NMVOCs	:	Non-Methanic Volatile Organic Compounds.
DNT	:	Tunisian Dinar.
GHG	:	Greenhouse Gas.
Kte-CO₂	:	Thousands Tons equivalent CO ₂ .
N₂O	:	Nitrous Oxide.
NO_x	:	Nitrogen Oxides.
GDP	:	Gross Domestic Product.
SO₂	:	Sulphur Dioxide.

SUMMARY

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- GHG Emissions due to Industrial Processes

I

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III

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- GHG Emissions' Indicators
- GHG Emissions' Indicators due to Energy

IV

GHG EMISSIONS' INVENTORY

The 1994 inventory of GHG emissions has been achieved during the elaboration of the first national communication of Tunisia. It's the first exhaustive inventory that was achieved according to the methodology of the IPCC/OEDC of 1996.

The inventory of 1997 was prepared in the framework of the mitigation works of GHG emissions.

1997 was considered as a basis year in order to establish a projection of the emissions of the GHG during the next two decades.

This inventory is extremely detailed for all sources, except the industrial processes where emissions have been estimated by a simple extrapolation.

Synthesis of GHG Emissions in 1994 (1000 TONS)

	Emissions of CO ₂	Removals of CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC	SO ₂
National emissions/removals	20 827,2	-5 503,5	180,151	13,744	72,619	373,565	111,345	77,855
1- Energy	14 257,4	-	44,043	0,222	72,035	359,147	65,087	76,357
2- Industrial processes	2 839,0	-	-	0,001	0,039	0,084	34,903	1,498
3- Solvents	0,0	-	-	-	-	-	11,355	-
4- Agriculture	0,0	-	95,078	12,973	0,545	14,334	-	-
5- Land Use Change and Forestry	3 730,8	-5 503,5	-	-	-	-	-	-
6- Waste	-	-	41,030	0,547	-	-	-	-
International bunkers (*)	776,4	-	0,007	0,021	3,745	1,440	0,605	0,720

Synthesis of GHG Gross Emissions/Removals in 1994 (1000 TE-CO₂)

	Emissions of CO ₂	Removals of CO ₂	CH ₄	N ₂ O	Total	%
National emissions/removals	20 827,2	-5 503,5	3 783,2	4 260	28 870	100%
1- Energy	14 257,4	-	924,9	68,8	15 251	52,8%
2- Industrial processes	2 839,0	-	-	0,5	2 839	9,8%
3- Solvents	-	-	-	-	-	-
4- Agriculture	-	-	1 996,6	4 021,6	6 018	20,9%
5- Land Use Change and Forestry	3 730,8	-5 503,5	-	-	3 731	12,9%
6- Waste	-	-	861,6	169,7	1 031	3,6%
International bunkers (*)	776,4	-	0,151	6,620	783,2	-

(*) Emissions non accounted in the total of Tunisian emissions

Synthesis of GHG Emissions in 1997 (1000 TONS)

	Emissions of CO ₂	Removals of CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC	SO ₂
National emissions/removals	22 860,3	- 6 696	209,42	14,834	76,351	386,024	69,819	78,684
1- Energy	15 643,3	-	61,628	0,234	76,351	384,024	69,819	78,684
2- Industrial processes	3 265,0	-	-	ND	ND	ND	ND	ND
3- Solvents	0,0	-	-	-	-	-	-	-
4- Agriculture	0,0	-	100,0	14,0	-	2,0	-	-
5- Land Use Change and Forestry	3 952,0	-6 696,0	-	-	-	-	-	-
6- Waste	-	-	47,800	0,6	-	-	-	-
International bunkers (*)	883,9	-	0,0071	0,025	3,970	1,419	0,652	0,720

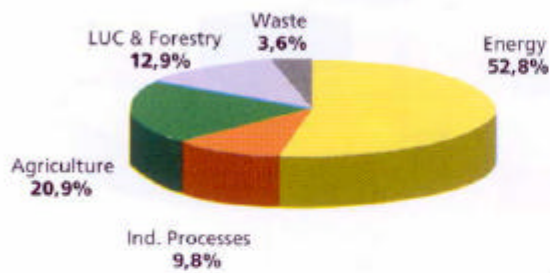
Synthesis of GHG Gross Emissions/Removals in 1997 (1000 TE-CO₂)

	Emissions of CO ₂	Removals of CO ₂	CH ₄	N ₂ O	Total	%
National emissions/removals	22 860,3	- 6 696	4 398,0	4 590,7	31 849,0	100%
1- Energy	15 643,3	-	1 294,2	72,5	17 010	53,4%
2- Industrial processes	3 265,0	-	-	ND	3 265,0	10,3%
3- Solvents	0,0	-	-	-	-	-
4- Agriculture	0,0	-	2 100,0	4 340,0	6 440,0	20,2%
5- Land Use Change and Forestry	3 952,0	-6 696,0	-	-	3 952,0	12,4%
6- Waste	-	-	1 003,8	178,0	1 182,0	3,7%
International bunkers (*)	883,9	-	0,15	7,750	891,8	-

(*) Emissions non accounted in the total of Tunisian emissions

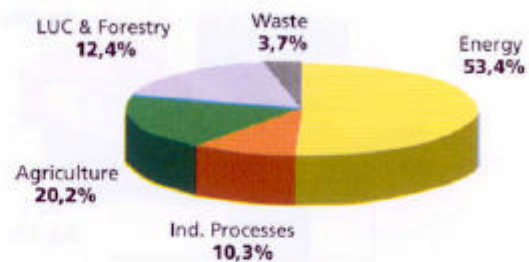
GHG GROSS EMISSIONS BY SOURCE

1994



28 870 Kte CO₂

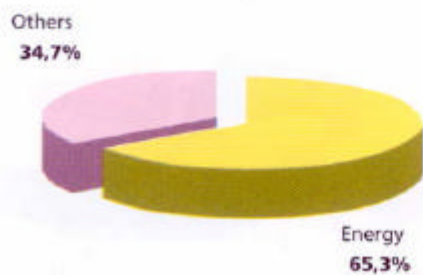
1997



31 849 Kte CO₂

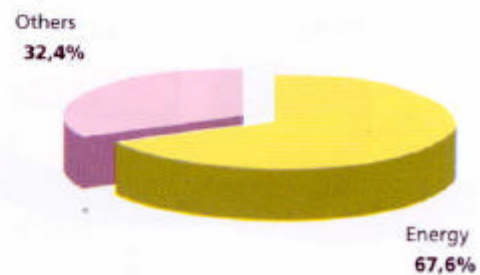
GHG NET EMISSIONS BY SOURCE

1994



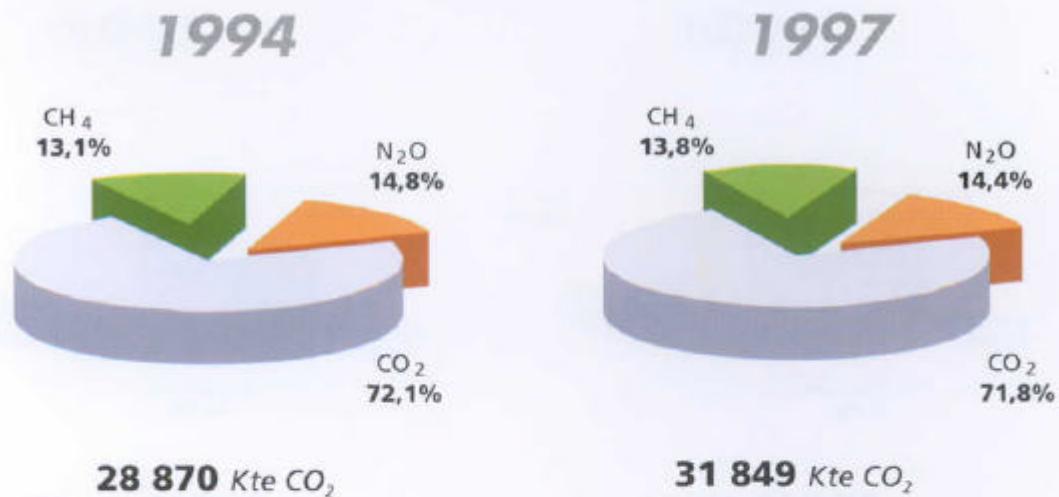
23 367 Kte CO₂

1997

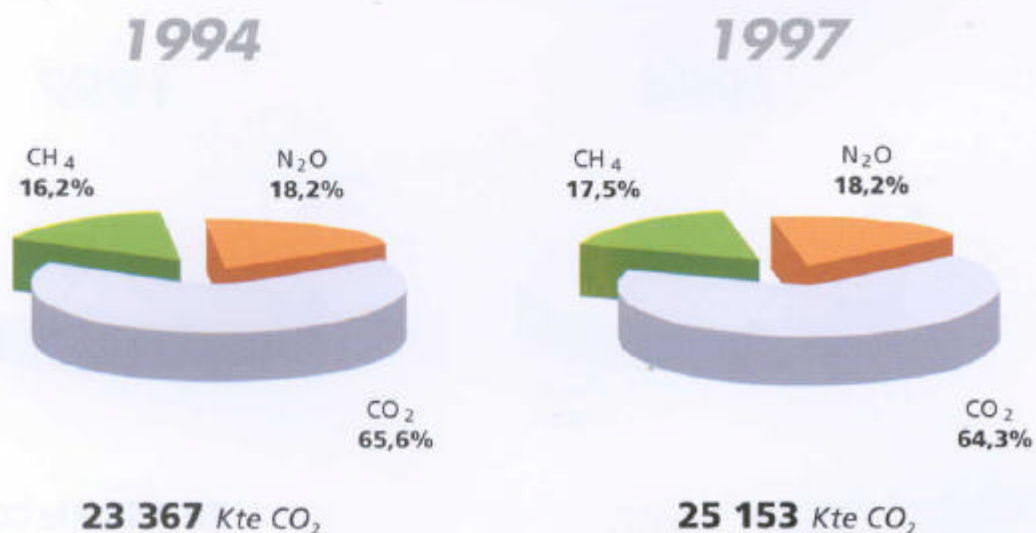


25 153 Kte CO₂

SHARES OF GROSS GHG EMISSIONS BY GAS

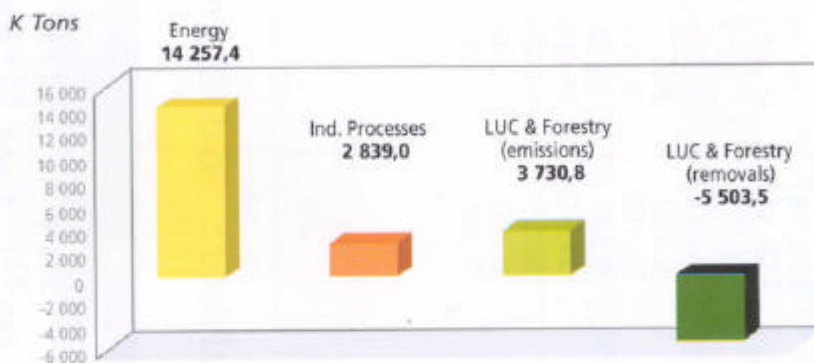


SHARES OF NET GHG EMISSIONS BY GAS

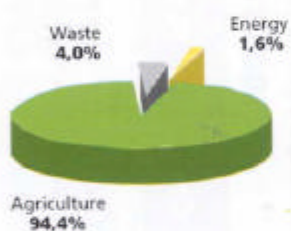


GHG EMISSIONS BY SOURCE AND BY GAS IN 1994

EMISSIONS / REMOVALS OF CO₂

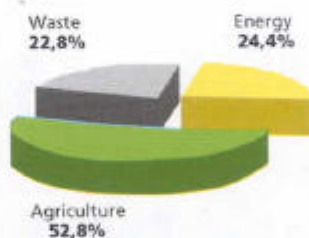


N₂O



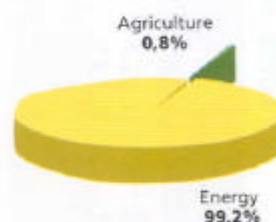
13,7 K tons

CH₄



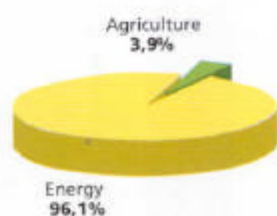
180,2 K tons

NO_x



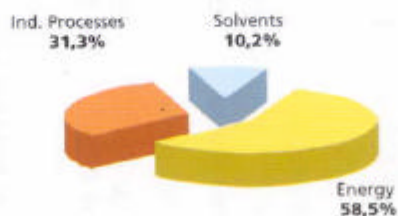
72,6 K tons

CO



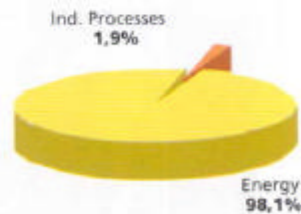
373,6 K tons

NM VOC



111,3 K tons

SO₂



77,9 K tons

GHG Emissions due to Energy Sector 1997

(1000 TONS)

	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC	SO ₂	TE-CO ₂
Total in original unit	15 643,3	61,628	0,234	76,351	387,024	69,819	78,684	17 010
I - Fuel combustion	15 182,1	15,374	0,234	76,351	387,024	69,819	78,684	15 577
1. Transformation	4 438,2	3,247	0,012	11,897	23,472	18,404	18,550	4 510,1
Electricity production	4 243,0	0,092	0,012	11,731	1,466	0,377	16,499	4 248,6
Petroleum refining	195,2	-	-	0,113	0,972	11,717	2,051	195,2
Charcoal production	-	3,155	-	0,053	21,033	6,310	-	66,3
2. Industry	3 508,3	0,206	0,027	10,260	1,277	0,314	33,163	3 521,0
3. Transport	3 924,3	0,468	0,029	39,139	153,659	29,120	5,142	3 943,3
4. Residential	1 568,6	11,165	0,151	6,062	199,710	20,625	9,590	1 849,9
5. Agriculture	881,2	0,090	0,007	7,783	6,107	1,227	8,765	885,3
6. Tertiary	861,5	0,198	0,007	1,210	2,800	0,129	3,473	867,9
II - Fugitive emissions	461,2	46,270	-	-	-	-	-	1 433
1. Oil	-	0,576	-	-	-	-	-	12,1
2. Natural Gas	-	33,384	-	-	-	-	-	701,6
3. Venting and flaring	461,2	12,300	-	-	-	-	-	719,5
Total Equivalent CO₂	15 643,30	1 294,2	72,500	-	-	-	-	17 010

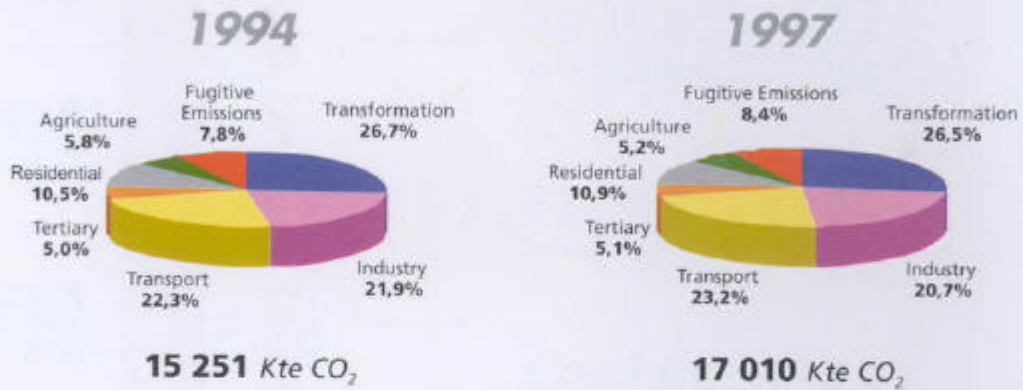
GHG Emissions due to International Bunkers and Biomass 1997

(1000 TONS)

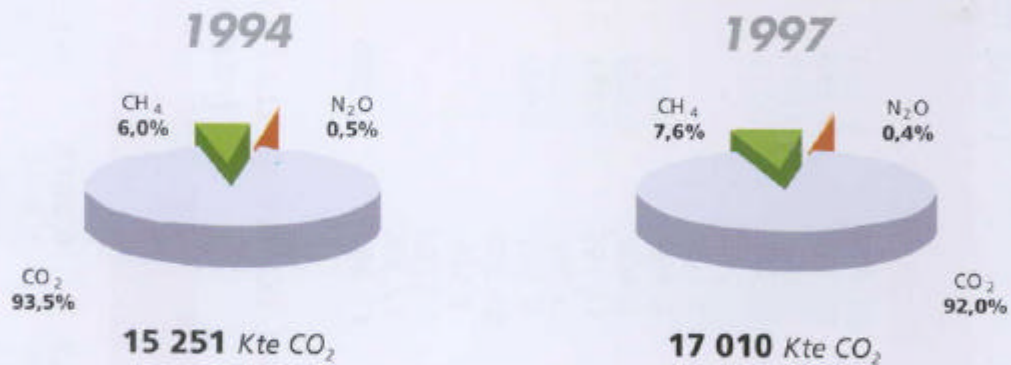
	CO ₂	CH ₄	N ₂ O	NO _x	CO	NMVOC	SO ₂
International bunkers	883,9	0,0071	0,0250	3,970	1,419	0,652	0,720
Marine	14,6	0,0010	0,0001	0,286	0,191	0,038	0,484
Aviation	869,3	0,0061	0,0246	3,684	1,228	0,614	0,236
CO₂ emissions due to biomass	3 393,10	-	-	-	-	-	-

GHG EMISSIONS DUE TO ENERGY

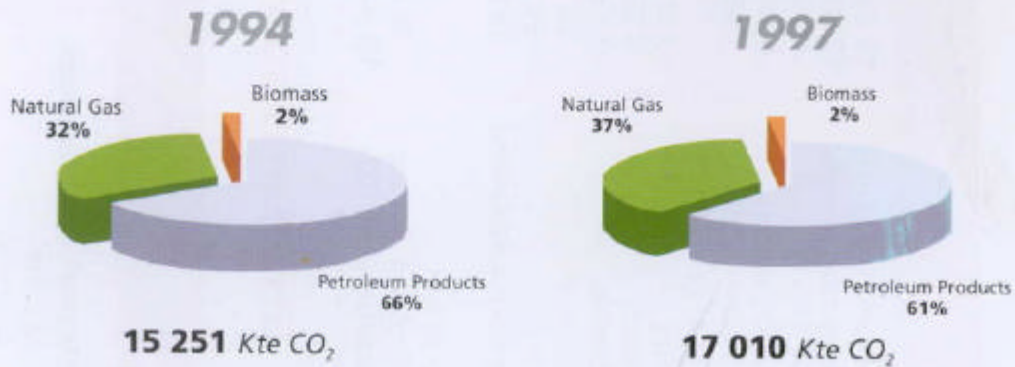
BY SECTOR



BY GAS

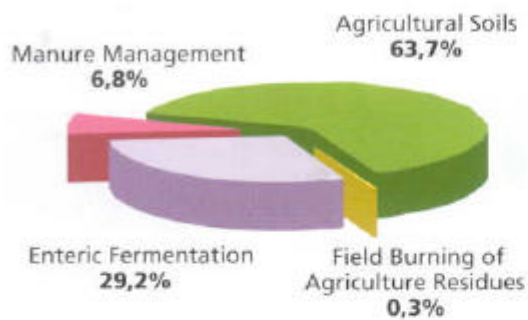


BY FUEL



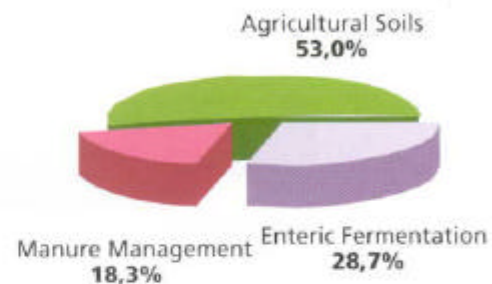
GHG EMISSIONS DUE TO AGRICULTURE

1994



6 018 Kte CO₂

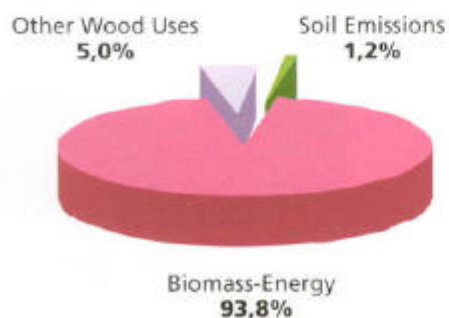
1997



6 440 Kte CO₂

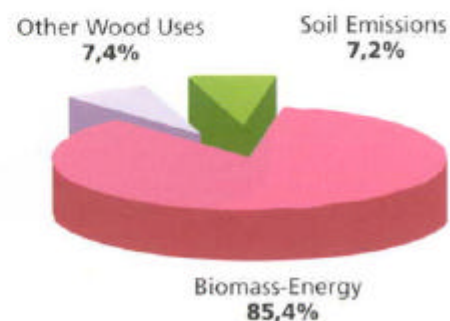
GHG EMISSIONS DUE TO LAND USE CHANGE & FORESTRY

1994



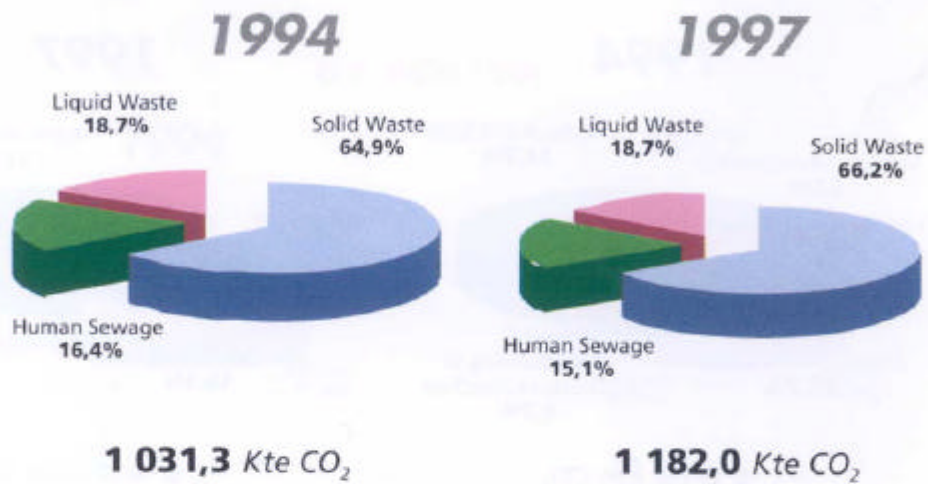
3 730,8 Kte CO₂

1997

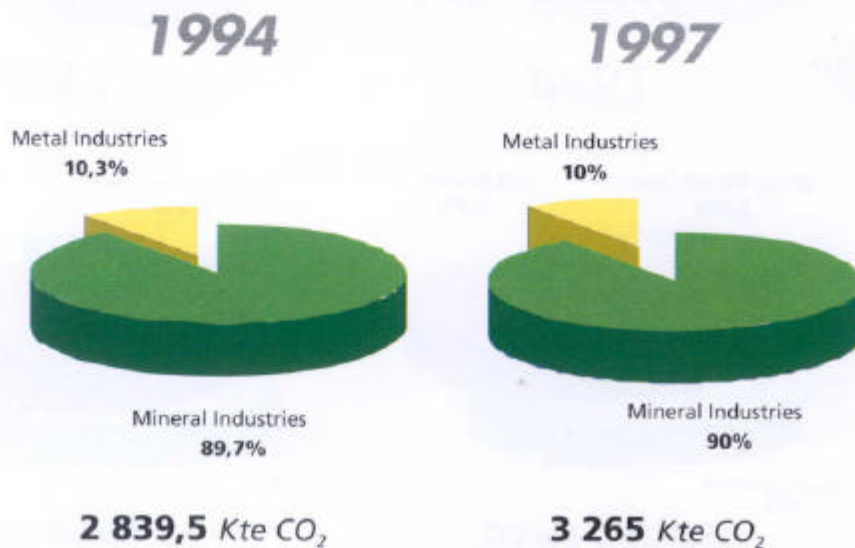


3 952,0 Kte CO₂

GHG EMISSIONS DUE TO WASTE



GHG EMISSIONS DUE TO INDUSTRIAL PROCESSES



EVOLUTION OF GHG EMISSIONS

The simulation of the future GHG emissions has been made during the elaboration of the first national communication.

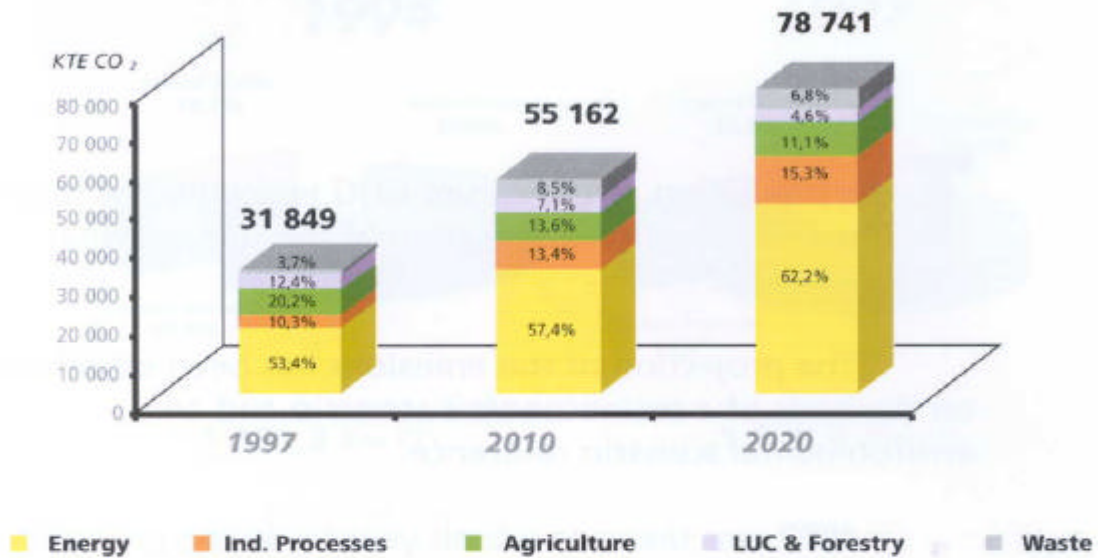
The projection of the emissions has been established on the basis of a socioeconomic scenario and an environmental scenario reference.

1997 was taken as a basis year to do the projection of the GHG emissions at the 2010 and 2020 horizons.

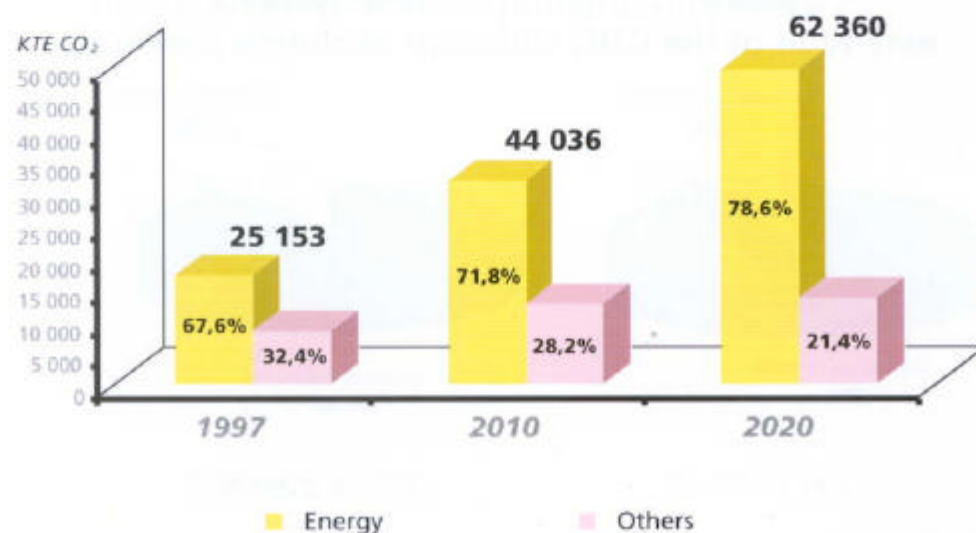
The socioeconomic scenario is itself characterized by the control of the demographic evolution and the sustainable growth of the Tunisian economy.

The environmental scenario reference is an extension of the GHG emissions evolution tendencies.

GHG GROSS EMISSIONS' TREND BY SOURCE

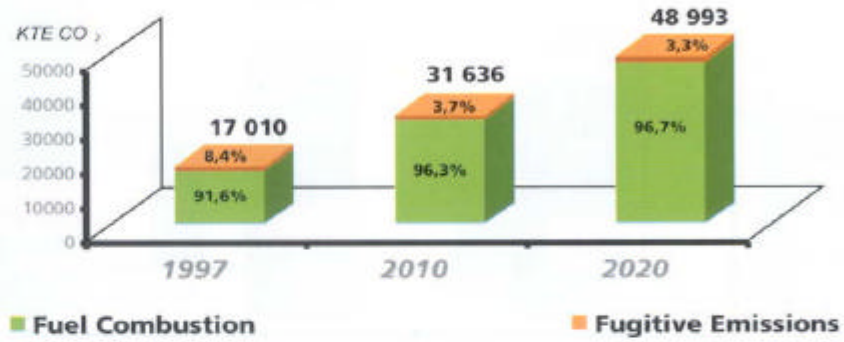


GHG NET EMISSIONS' TREND BY SOURCE

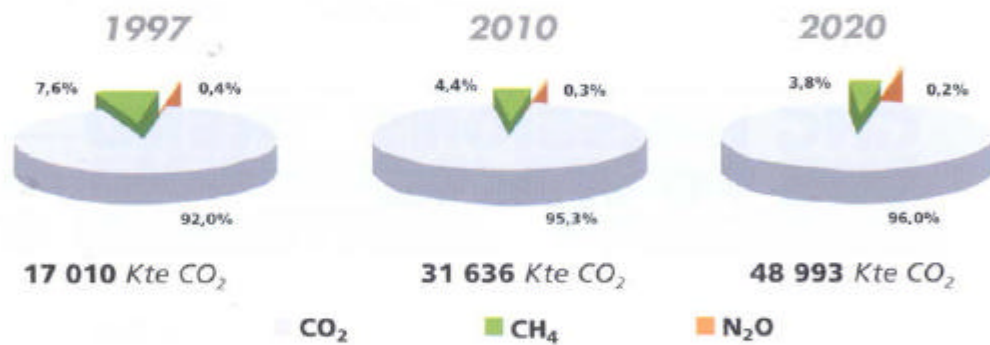


GHG EMISSIONS' TREND DUE TO ENERGY

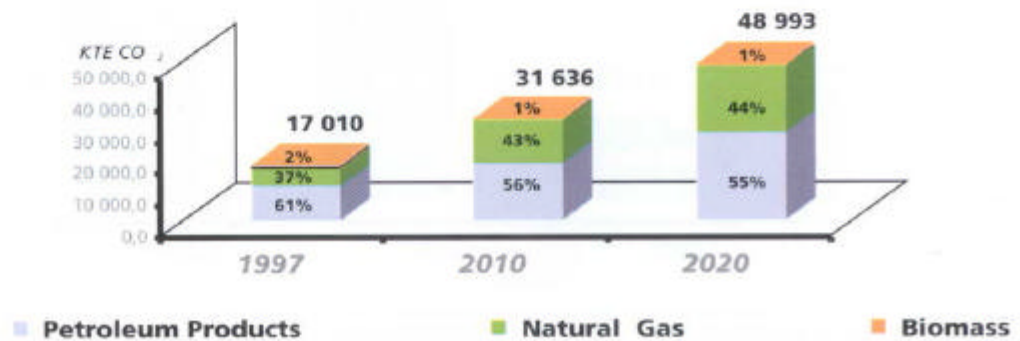
BY SECTOR



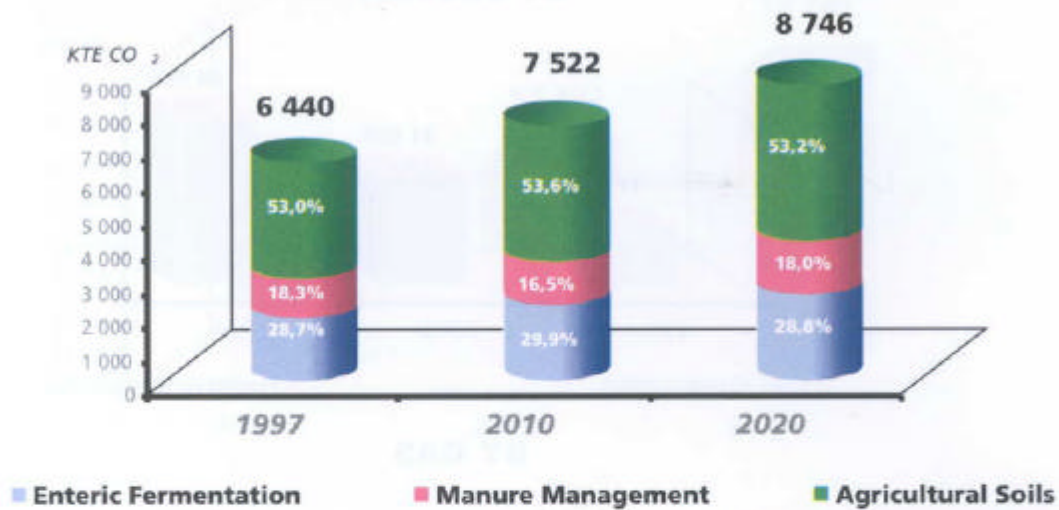
BY GAS



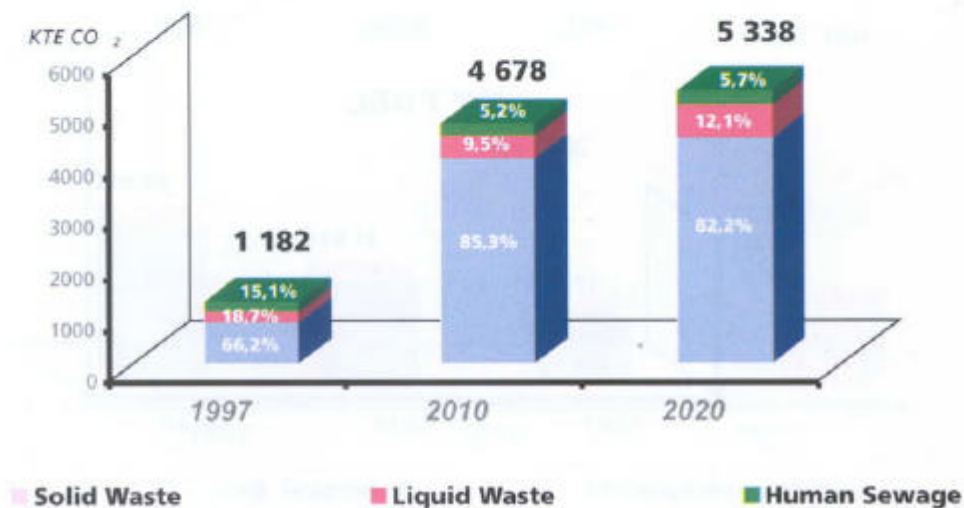
BY FUEL



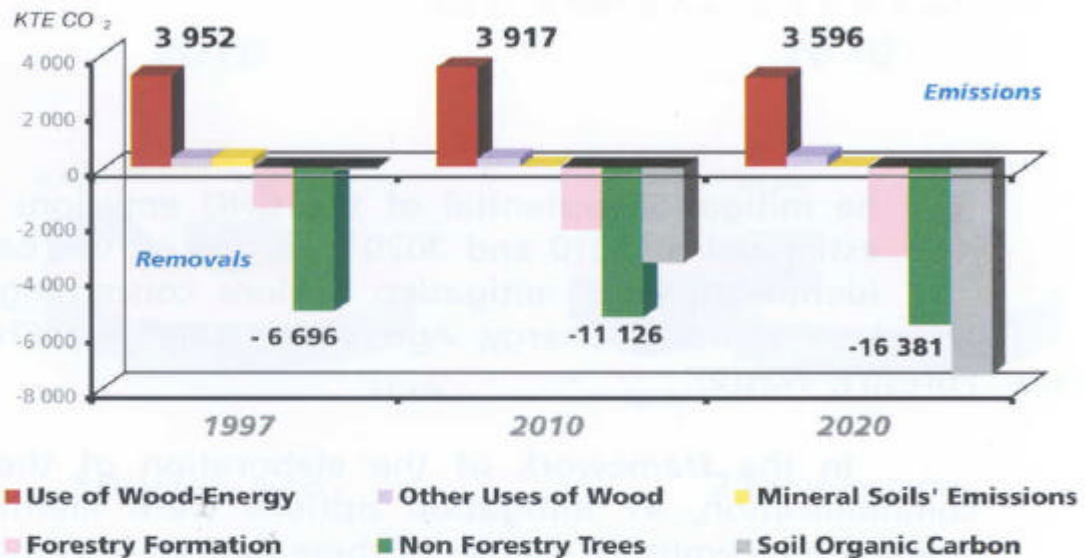
GHG EMISSIONS' TREND DUE TO AGRICULTURE



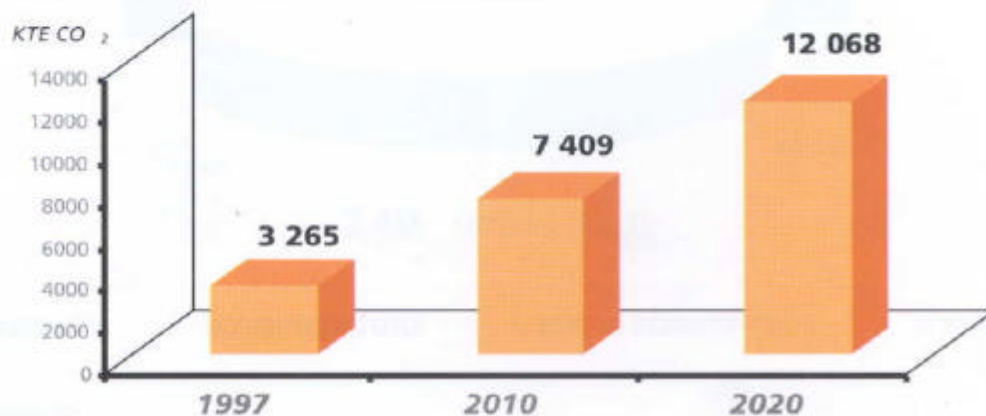
GHG EMISSIONS' TREND DUE TO WASTE



GHG EMISSIONS/REMOVALS' TREND DUE TO LUC & FORESTRY



CO₂ EMISSIONS' TREND DUE TO INDUSTRIAL PROCESSES



MITIGATION POTENTIAL OF GHG EMISSIONS

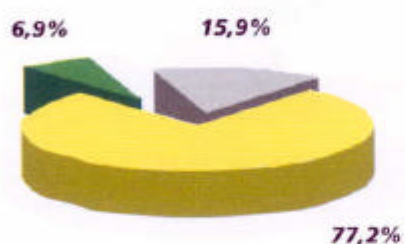
The mitigation potential of the GHG emissions has been estimated at 2010 and 2020 horizons on the basis of the identification of mitigation options concerning all main emissions' sources (Energy, Agriculture, Land Use Change and Forestry, Waste).

In the framework of the elaboration of the national communication, 47 mitigation options were identified. The spreading by emission sources of these options is as follows :

- Energy : 33 options.
- Agriculture: 4 options.
- LUC & Forestry : 6 options.
- Waste: 4 options.

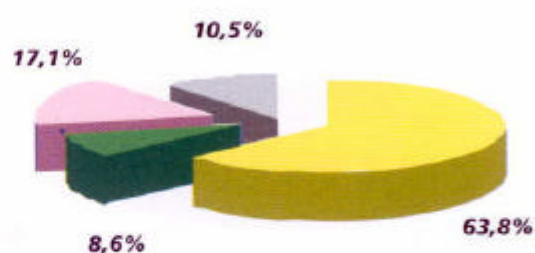
MITIGATION POTENTIAL OF GHG GROSS EMISSIONS BY SOURCE

2010



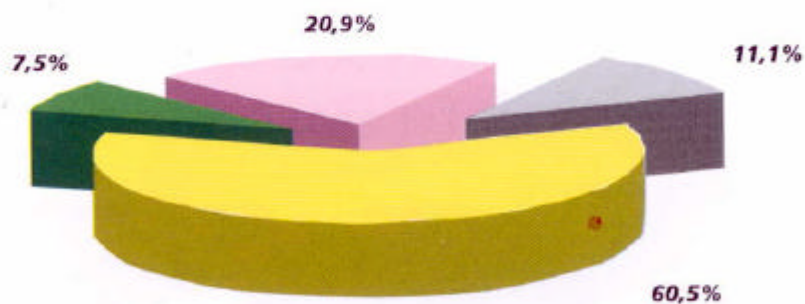
10 Millions Te CO₂

2020



21 Millions Te CO₂

TOTAL 2001 - 2020



240 Millions Te CO₂

■ ENERGY

■ AGRICULTURE

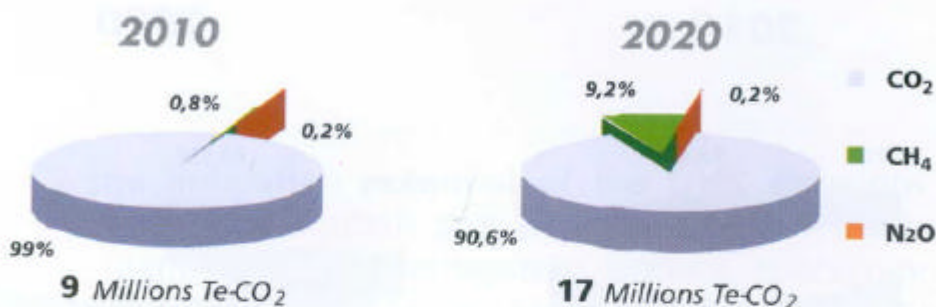
■ LUC & FORESTRY(*)

■ WASTE

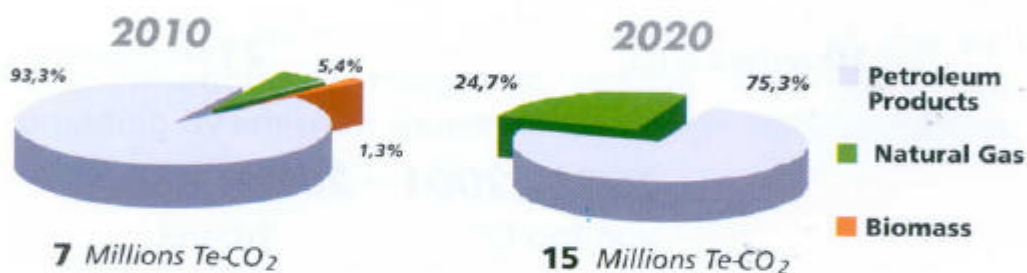
(*) Removals

MITIGATION POTENTIAL OF THE GHG EMISSIONS DUE TO ENERGY

BY GAS

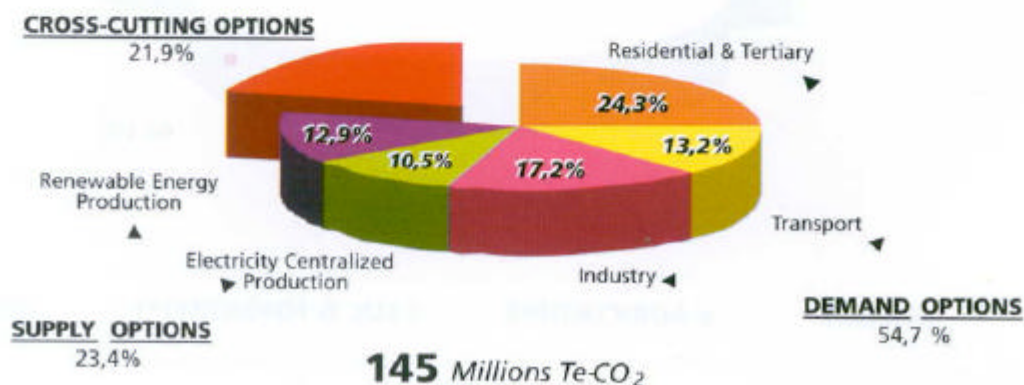


BY FUEL

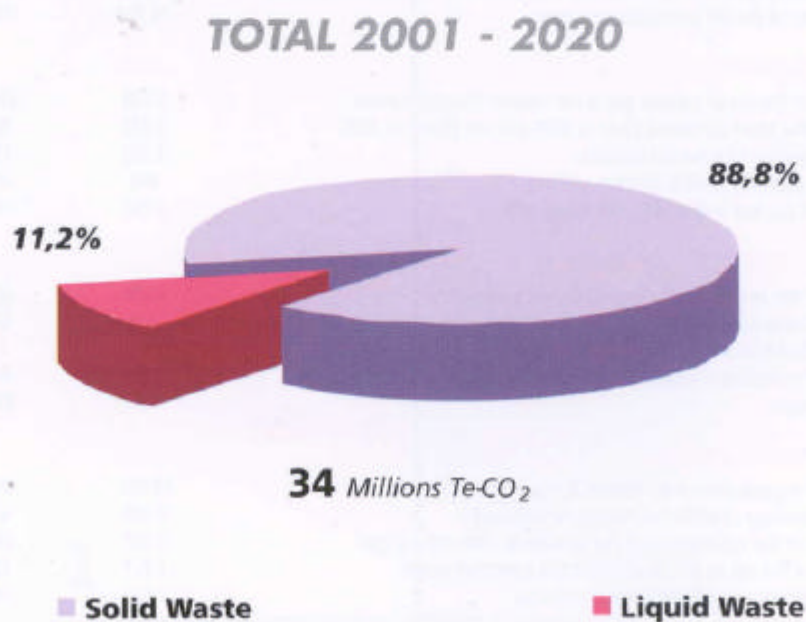
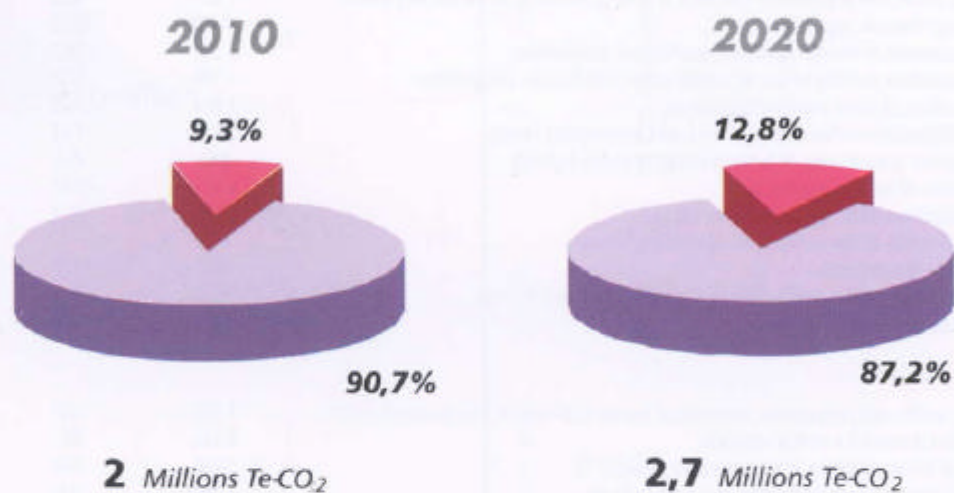


BY SOURCE

TOTAL 2001 - 2020



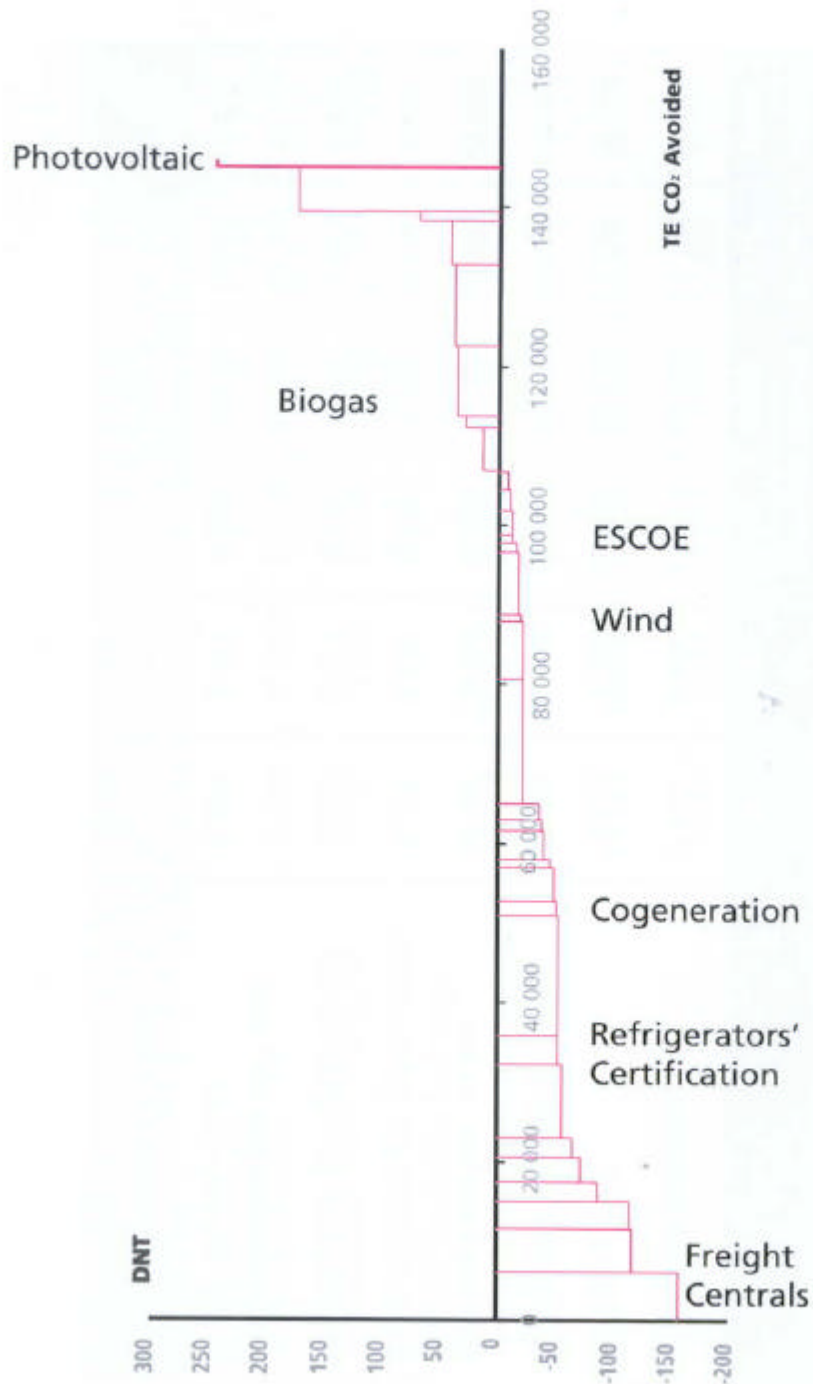
MITIGATION POTENTIAL OF THE GHG EMISSIONS DUE TO WASTE



MITIGATION POTENTIAL AND COST OF THE GHG EMISSIONS DUE TO ENERGY OVER 2001 - 2020

	1000 TE CO2 avoided	Actualized annual cost (millions TND)	Annualized unit cost (TND/TE CO2)
RESIDENTIAL AND TERTIARY			
Energy audits and programme contracts of energy economy in the tertiary sector.	35 269		
Buildings' thermic regulations.	1 855	-46,0	-25,0
Reinforcement of the refrigerators' certification programme .	10 306	191,0	19,0
The immediate starting of the air conditioners' certification programme.	3 595	-90,5	-25,2
Certification of other electrical appliances.	1 548	22,2	14,4
The distribution reinforcement of the Low Consumption Lamps.	3 024	-14,6	-4,8
Distribution programmes of Sodium Lamps in public lighting.	3 758	-71,3	-19,0
Promotion of solar water heaters.	940	-8,3	-8,8
Generalization of Tabouna's metallic lids.	5 401	463,5	85,8
Generalization of the distribution of improved houses to replace the old ones.	2 642	-10,4	-4,0
Generalization of the distribution of the metallic Tajines in order to reduce wood consumption.	981	-5,0	-5,1
	1 219	-9,0	-7,4
TRANSPORT			
Energy audits and programme contracts of energy economy in the transport sector.	19 192		
Diagnosis stations for motor vehicles.	1 283	-23	-18
Rational driving training in the transport sector.	5 323	40	8
Guiding plans of transport inside and outside towns.	2 426	-102	-42
Freight station establishment.	4 183	-97	-23
	5 977	-458	-77
INDUSTRY			
Energy audits and programme contracts of energy economy in the industry sector.	24 962		
The improvement of the EIP production processes.	9 234	-249	-27
	15 728	-159	-10
ELECTRICITY CENTRALIZED PRODUCTION			
Reinforcement of the use of natural gas in the Vapour Thermic Stations.	15 224		
Introduction of the third Combined Cycle in 2005 and the fourth in 2008.	5 588	-314,8	-56
Anticipated relegation of some old stations.	3 372	-188	-56
Stations energy economy (audits, guiding actions).	3 259	-114	-35
The reduction of the loss in line of the STEG network.	943	-21	-22
	2 062	-34	-17
RENEWABLE ENERGY PRODUCTION			
Development of the use of wind energy to produce electricity.	18 768		
Promotion of photovoltaic solar.	7 206	-206	-10
Promotion of Micro-hydraulics.	333	52	120
Strategy start of control and support of the charcoal field.	151	-1	-2
Promotion of Biogas.	2 235	-8,4	-3,8
	8 843	158	18
CROSS-CUTTING OPTIONS			
Development of cogeneration (ref. Tertiary & Industry).	31 738		
Promoting the creation of ESCO (ref. Tertiary & Industry).	15 012	-376	-25
Encouragement of the substitution of fuel and diesel with natural gas.	7 786	-63	-8
Reinforcement of the use of LPG and CNG in the transport sector.	5 307	104	20
Reduction of flaring on oil and gas production sites.	1 211	42	35
	2 422	-76	-31
TOTAL	145 153		

ANNUALIZED MITIGATION COST OF GHG EMISSIONS (DNT / TE CO₂ AVOIDED)



GHG EMISSIONS' INDICATORS

GHG Emissions' Indicators

	1994	1997	Reference scenario		Mitigation scenario	
			2010	2020	2010	2020
Population (Thousands)	8 815	9 243	11 124	12 507	11 124	12 507
GDP (MD of 1990)	12 774	13 046	29 945	48 778	29 945	48 778
GHG gross emissions (Kte-CO ₂)	28 870	31 849	55 162	78 741	45 806	61 353
GHG net emissions (Kte-CO ₂)	23 367	25 153	44 036	62 360	33 962	41 446
Gross emissions per capita (TE CO ₂)	3,275	3,446	4,958	6,296	4,118	4,905
Net emissions per capita (TE CO ₂)	2,650	2,721	3,958	4,986	3,053	3,314
Gross emissions per GDP unit (TE CO ₂ / Thousands dinars)	2,260	2,441	1,842	1,614	1,530	1,257
Net emissions per GDP unit (TE CO ₂ / Thousands dinars)	1,830	1,928	1,470	1,278	1,134	0,850

GHG Emissions' Indicators due to Energy

	1994	1997	Reference scenario		Mitigation scenario	
			2010	2020	2010	2020
GHG emissions due to energy (kte-CO ₂)	15 251	17 010	31 636	48 993	24 245	36 151
CO ₂ emissions due to energy (kt)	14 257	15 643	30 136	47 006	21 234	31 743
GHG emissions due to energy per capita (TE-CO ₂)	1,730	1,840	2,844	3,917	2,180	2,890
CO ₂ emissions due to energy per capita (tons)	1,617	1,692	2,709	3,758	1,908	2,538
GHG emissions due to energy per GDP unit (TE-CO ₂ / Thousand dinars)	1,194	1,303	1,056	1,00	0,809	0,741
CO ₂ emissions due to energy per GDP unit (tons / Thousand dinars)	1,116	1,20	1,00	0,963	0,709	0,650



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