

LEAP LOCAL ENERGY ACTION PLAN

Land Energy planning

Rosignano Marittimo

June 2011

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Premise

The existing legislation at Community level is geared to the promotion of energy saving and renewable sources of energy, which together serve to facilitate the reduction of the overall annual energy needs. The rational use of energy combined with the use of non-fossil sources of energy are the way to go for the achievement of energy savings and reduction of polluting emissions.

From many years science has highlighted the important responsibility of man as the cause of climate change in progress. Recently, the IPCC (Intergovernmental Panel on Climate Change) published the report Climate Change 2007 where he demonstrates how the global atmospheric concentrations of greenhouse gases have increased substantially as a result of human activity since 1750, and currently exceed the pre-industrial values. These concentrations are considered responsible for the increase in global temperatures of air and ocean temperatures, widespread melting of snow and ice and rising global sea level.

Among the first objectives to be pursued at the local level there is the containment of final energy consumption and the use of non-fossil sources of energy, promote energy production from renewable sources, while maintaining fuel consumption would be a contradiction.

Also for this reason the energy issue plays an important role in the political-administrative choices. More and more governments put the focus on the uses of energy resources in order to ensure a co-energy environment that is as sustainable as possible.

The Law 10 of 1991 s.m.i. provides that municipalities having a population greater than 50,000 inhabitants must include a specific plan for the use of renewable energy, and municipal administration of Rosignano M.mo, although exempted from the law, has decided to adopt an analysis tool of the territory, its energy consumption and associated emissions to the atmosphere.

The City of Rosignano is a partner of the European project called Sustainable Now, thanks to collaborations and experiences provided by the project, it was possible to develop the energy plan, though in his first preparation.

The main purpose is to try to standardize a method of processing data on the energy consumption of the entire territory, in order to assess the practical difficulties connected with a study of this kind, such as the availability of data, processing methods with the same shared at the international level, in order to create parallels with similar European cities.

Crucial was the contribution of the Province of Siena and APEA Agency of the Province of Siena, a partner in the project support Sustainable Now. The Province of Siena has many years experience in the preparation of the provincial registry of emissions (reges) and the Provincial Energy Plan.

The operational arm of the City of Rosignano is the Energy Agency of the Province of

Livorno (EALP), which processed the data contained in this document and has collaborated in the preparation.

The activity data retrieval is extremely difficult because there is a need to relate to different subjects, this first revision of the document has allowed us to identify the data required for the preparation of the inventory, the sources of their data and methodology processing. When the data is not available it adopts a policy development and higher safety for both the sources that the approximations used in the calculation are indicated in the document body, how anyone could be analyzed by adopting this step-by-step the calculation model verify the correctness of processing.

The Plan was developed on the model and in accordance with the guidelines drawn up by the European Union for the SEAP (Sustainable Energy Action Plan) in order to offer the opportunity to join the Mayor of Covenant (the Covenant).

The development of LEAP is consistent with the provisions of the legislation, especially with regard to the dictates of the Regional Energy Plan Address (PIER) and the Tuscan Regional Law No 39/05 as amended by Law No Regionale Toscana 71/09 (provisions on energy). Please refer to Attachment B: FRAMEWORK, as a collection of the main legislative instruments currently in force at European, national and regional energy efficiency and promoting renewable energy sources.

For the terminology adopted in the document, please refer to 'Appendix A: GLOSSARY.

Summary of the Local Energy Action Plan

The Local Energy Action Plan (LEAP, called Municipal Energy Plan), in its original formulation, should be the main planning document on energy and aims to be the promoter of the use of renewable sources and energy conservation by defining objectives, instruments, addresses, actions and expected results. The LEAP is the tool that, based on the current situation of the municipality, can find the broad energy sector development.

The Plan intends to follow a consistent line with current legislation and with the planning already. The introductory part of the Plan, therefore, is devoted to an overview of current legislation on energy, so as to create a reference to the legislature and at the same time, the need to unfold as an Energy Plan arises from a need to reduce global energy consumption through the rational use of energy and the use of renewable energy sources.

The drafting of the Energy Plan involves a major commitment both in terms of knowledge of the area and its data both in terms of goals, ambitious and realistic, to be pursued. It is with this multi-year path of continuous improvement and the development of the Energy Plan that includes this first revision of the plan, whose main aim is to photograph the status of the territory and define the method of calculation to use for the next revisions.

Description of the municipality

Spatial and geographical elements

With reference to the Plan, the following are the elements related to the municipal area. The City of Rosignano Marittimo, which extends over an area 12,082 hectares, is located on the Livorno coast about 25 km south of the capital.

Climate

The climate of the City of Rosignano Marittimo is classic Mediterranean with an average winters and hot summers and mild and rainy, but windy.

The climate is also characterized by a number of thunderstorms, especially autumn or spring. Rare, however, the fog, except for some cases of marine advection fog of radiation in the spring or at night in winter.

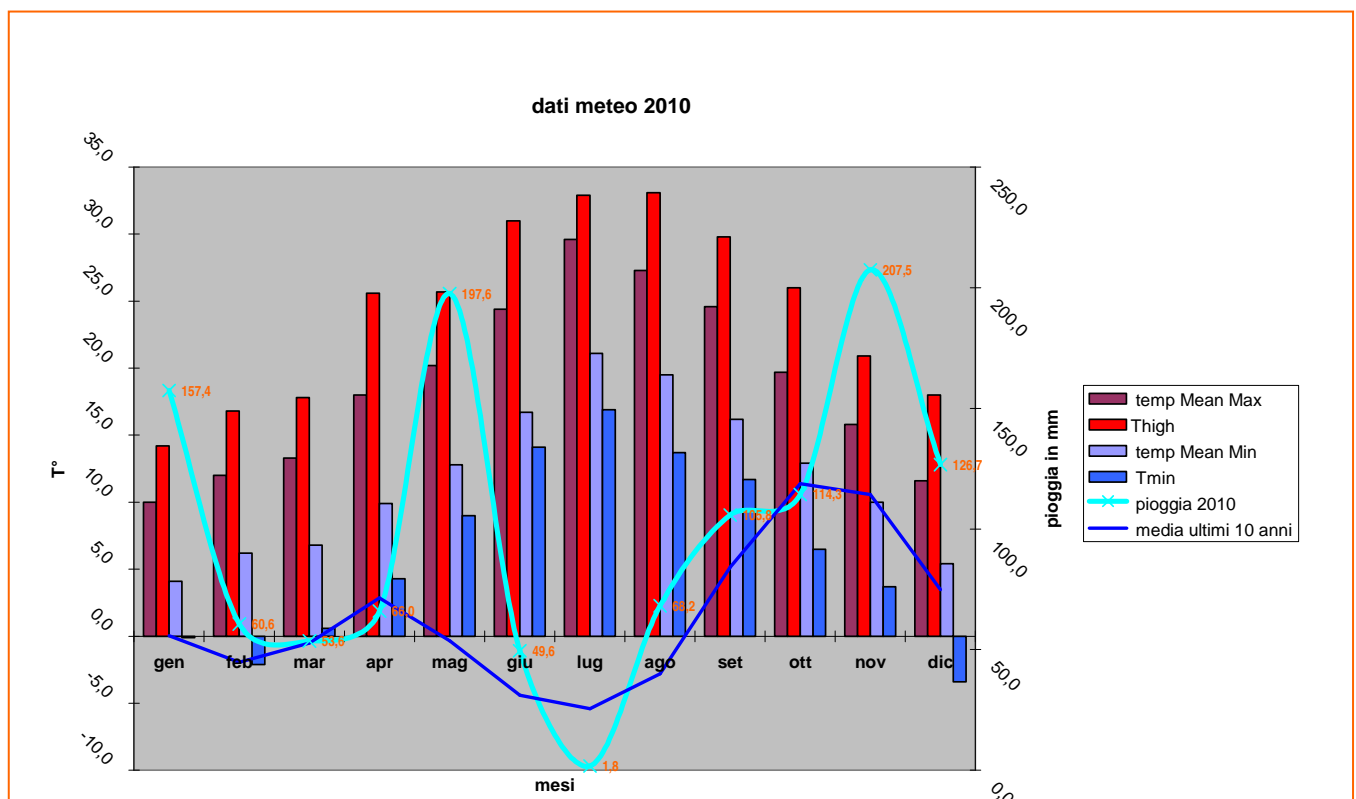


Grafico 1: In grafico sono riportate le Temperature e le Precipitazioni relative all'anno 2010 a Rosignano Solvay (Fonte DirettaMeteo.it – Stazione di Rosignano).

Land man-

The City of Rosignano Marittimo has a population of about 32,587 units in 15,620 males and 16,967 females (Source: Municipal registry - data updated to 31/12/2010) divided into various fractions as follows:

main-town Rosignano Marittimo:	3.346 (1.719 F - 1.627 M)
Rosignano Solvay:	16.705 (8.743 F - 7.962 M)
Vada:	5.027 (2.564 F - 2.463 M)
Castiglioncello:	3.901 (2.065 F – 1.836 M)
Castelnuovo M.dia:	1.452 (762 F – 690 M)
Gabbro:	1.375 (715 F – 660 M)
Nibbiaia:	781 (399 F – 382 M)

Production Territory

The most developed sectors, both in terms of employees of manufacturing employees are represented by the great industrial and commercial sector.

The industrial activity is dominated by the presence of the chemical group of the "Solvay Chemical Company Spa Italy", whose factories employ more than 320 ha of the township, amounting to about 2.4% .. Inside the plant they operate, in addition to the company Solvay, two gas turbines and combined heat and power co. INEOS Manufacturing SpA manufacturer of plastics, which also uses the dock and storage of Go for the supply of ethylene.

A Rosignano Solvay, in addition, there are numerous small and medium-sized enterprises, most of which arise as complementary activities to big industry. These companies are located in the craft known as "The Morellino", designed by the City Council in manufacturing plants that together have helped to promote the launch of the local economy.

It 'should also be noted the presence of companies arose in the last decade in the marine industry, computer services, social, and environmental testing of fish. Tourism is a major activity on which the economy of the City of Rosignano is particularly concentrated in the months of July and August, especially in the hamlets of Castiglioncello, Vada and Rosignano Solvay.

A Rosignano Solvay is a marina of 650 berths-Forte is, to date, the trend of the weekend commute to tourism, with arrivals, which often exceed the capabilities of the accommodation area.

In the inner city, largely covered by rural areas (agricultural and forestry), agricultural activities are directed toward both traditional products (tomatoes, lettuce, ...) and towards quality products (asparagus, spinach, ...), with niche crops biological, on the whole, achieve satisfactory levels of quality. The agricultural sector shows a positive trend over the past decade, supported by strong investment and a good presence of associated resources.

The territory has grown, the value of cattle (Chianina), consistent with the trend appreciation of the Italian once spoke of quality.

Protected areas

Based on the European classification of sites of special interest (SIC - Sites of Community Importance; SPA - Special Protection Areas; SIN - Sites of National Importance; SIR - Sites of Regional Importance) in the territory are two SIR: Bald Mountain and Tomboli Cecina.

In reality, the municipal area there is also the Provincial Park of Monti Livorno, which includes more distinct geographical areas and separated from each other, located in the municipalities of Collesalveti, Livorno and Rosignano M.mo. The most important,

including in the Municipality of Rosignano M.mo, is related to the area of the Park Poggetti. Due to its geographical location, the territory of Rosignano Marittimo, is characterized by a high biodiversity of flora and fauna, favored by a concatenation of different natural environments, but perfectly integrated.

Energy Balance

The energy balance of the City of Rosignano M.mo is prepared according to the IPCC international methodology, and also adopted by the Ministry of Economic Development for the preparation of the National Energy Balance, and the Province of Livorno for the preparation of the Provincial Energy Balance in being processed.

The energy balance for the period 2004-2008, shows the primary energy consumption, ie the amount of solid, liquid and gaseous fuels and renewable energy sources (as defined by Decree Law 387/2003 Art. 2 paragraph 1 letter a.) is used directly in various sectors of use (civil, industry, agriculture and transport), both in the production of electricity. The primary energy consumption represents the total amount of energy consumed at the municipal level.

The purpose of the energy balance is to represent the state of the energy sector of the City of Rosignano M.mo for each year in question, analyzing all actions aimed at saving energy and using renewable energy and process optimization achieved by the industrial and civil.

The tables following the voice of Electricity Production in TEP includes the values of the primary sources of energy used to produce electricity. The use of end-use energy derived or secondary sources, such as electricity, as obtained by the transformation of primary energy sources (natural gas and petroleum products), not included in the calculation of the total domestic consumption, unless it is directly using renewable sources such as biomass, solar, wind, hydro and geothermal or there are net imports (higher consumption of production) from other municipalities or provinces. Data on energy balance, presented later in this chapter and expressed in TEP, constitute one of the voices that make up the balance of CO2 emissions, described in the next chapter.

The methodology for calculating the energy balance is given in Annex D: **METHODOLOGY FOR CALCULATION OF ENERGY BALANCE.**

Reference sources for such data collection are:

- ASA Livorno - Environmental Services Company Spa for gas sales and losses in the transportation of natural gas;
- ENEL Production, ROS.EN. - Rosignano Energy, REA-Rosignano Energy and Environment, for the production of electricity;
- ENEL Distribution for distribution / sale of electricity and the losses in electricity transport
- Terna data for users connected directly to AT and AAT;
- SNAM Rete Gas for the distribution of methane from large consumers
- GSE - Manager of Energy Services
- Ministry of Economic Development (Oil Bulletin - quarterly publications), for the consumption (sales) of petroleum products in the Province of Livorno for use;
- ISTAT statistics from the census of population and industry (2001) and agriculture (2000);
- ACI Livorno

- City of Rosignano M.mo
- EALP - Energy Agency of the Province of Livorno
- PEP - Provincial Energy Plan of the Province of Livorno.

The following scenario represents the state of the energy sector of the City of Rosignano M.mo considered for years, influenced by the actions aimed at saving energy and using renewable energy adopted by the public and private citizens, and the processes optimization achieved by the energy industry and civil during the year, without evidence of individual actions or plans.

The unit of measurement used is the TEP, or tons of oil equivalent measure of energy equal to 1 TEP = 10⁷ kcal.

For the terminology adopted in the document, please refer to 'Appendix A: GLOSSARY.

3.1 Primary energy consumption

The calculation of primary energy consumption in the municipal area is made by type of energy source and sector of use.

For primary energy refers to the global energy found in nature before being transformed into other types of energy, and therefore net returns of the various processors.

ENERGY BALANCE OF COMMON ROSIGNANO M. MO (ANNO 2004) - TEP (tons of oil equivalent)

Primary energy consumption by sector

	Civil	Transportation	Agriculture	Industry	Production of electricity	Total
solid fuels	-	-	-	-	-	-
petroleum products	6.478	32.089	3.151	115.724	-	157.442
gas	9.595	199	-	60.211	591.046	661.051
renewables	4	-	-	-	2.488	2.492
Total primary energy consumption	16.076	32.289	3.151	175.935	593.534	820.985

Fonte: elaborazione EALP su dati ASA, SNAM Rete Gas, ENEL Produzione, ROS.EN, REA, Ministero Sviluppo Economico

ENERGY BALANCE OF COMMON ROSIGNANO M. MO (ANNO 2006) - TEP
 Primary energy consumption by sector

	Civil	Transportation	Agriculture	Industry	Production of electricity	Total
solid fuels	-	-	-	-	-	-
petroleum products	6.486	32.879	2.665	57.389	-	99.418
gas	9.226	289	0	53.854	514.413	577.782
renewables	6	-	-	-	1.931	1.937
Total primary energy consumption	15.718	33.168	2.665	111.243	516.344	679.137

ENERGY BALANCE OF COMMON ROSIGNANO M. MO (ANNO 2008) - TEP
 Primary energy consumption by sector

	Civil	Transportation	Agriculture	Industry	Production of electricity	Total
solid fuels	-	-	-	-	-	-
petroleum products	4.397	29.689	1.636	56.462	-	92.184
gas	9.147	498	-	52.372	920.381	982.398
renewables	19	-	-	-	2.176	2.195
Total primary energy consumption	13.564	30.187	1.636	108.834	922.557	1.076.778

Comparison of the total consumption of primary energy in different sectors:

Comparison 2004-2008	Civil	Transportation	Agriculture	Industry	Production of electricity
2004	16.076	32.289	3.151	175.935	593.534
2006	15.718	33.168	2.665	111.243	516.344
2008	13.564	30.187	1.636	108.834	922.557
% (04-08)	-16%	-7%	-48%	-38%	55%

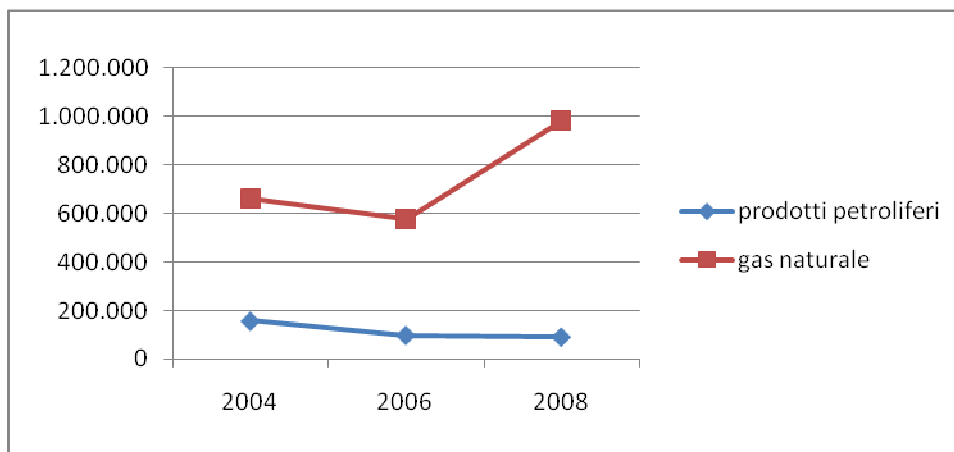
With the exception of the requirements for the production of electricity, the total primary energy consumption in the municipality of Rosignano M. mo decreased from 2004 to 2008. In particular, in the civil sector has increased from 16,076 in 2004 to 13,564 TEP

TEP in 2008, with a reduction of about 16%, higher than that recorded for the transport sector amounted to about 7% where it has fallen from 32,289 TEP supplies to 30,187. The most significant reductions in agriculture and industry, respectively, where it has gone from 3,151 to 1,636 TEP, with a reduction of 48%, and from 175,935 to 108,834 TEP by more than 38% less between 2004 and 2008. The increase in consumption of primary energy in electricity production sector, which saw an increase of 55%, from 593,534 to 922,557 TEP, is due mainly to the central function of the gas turbine Rosenelectra, launched between 2006 and 2007, a central type of combined-cycle cogeneration power of 385 MW. The plant gives heat to the district heating network, a power of about 8 MW, which serves some public utilities in the municipality. The increase in the total consumption of primary energy between 2004 and 2008 for the territory of the Municipality of Rosignano (from 820,985 to 1,076,778 TEP), due, as mentioned above, mainly to the function of the second plant to natural gas sees a reduction of the already low rate of use of renewable energy sources, this fact falls from 0.30% to 0.20%, although in absolute terms the use of RES in the year remains unchanged. In the City of fossil fuels Rosignano M.mo cover almost 100% of total consumption, mainly for natural gas from 2004 to 2008 rose from 80% to over 90% of employment.

The main area of use of natural gas is the production of electricity, which is also the area that most affects the total consumption of primary energy of the territory (over 85%).

% Share of renewable energy in primary energy consumption:

Energy sources 2004-2008	2004	2006	2008
solid fuels	0,00%	0,00%	0,00%
petroleum products	19,18%	14,64%	8,56%
gas	80,52%	85,08%	91,24%
renewables	0,30%	0,29%	0,20%



% quote on the sectors of energy use

Kind of sector 2004-2008	2004	2006	2008
Civil	1,96%	2,31%	1,26%
Transportation	3,93%	4,88%	2,80%
Agriculture	0,38%	0,39%	0,15%
Industry	21,43%	16,38%	10,11%
Production of electricity	72,30%	76,03%	85,68%

The increased incidence of the electricity production sector (from 72% to around 85%) contrasts with the slight decrease in the incidence of consumption in the civil, from 1.96% to 1.26% and the substantial reductions in agriculture (from 0.38% to 0.15%), transport (from 3.93% to 2.80%) and industry (from 21.43% to 10.11%) where the incidence has almost halved.

Energy consumption pro - capita

Consumption pro- capite	Energy consumption (kTEP)	consumption pro-capite ¹ (TEP)
Municipality 2004	821	26
Municipality 2006	679	21
Municipality 2008	1.077	33
Province 2008	3.166	9,4

In 2004 energy consumption per capita for the City of Rosignano M.mo TEP was 26, fell to 21 in 2006 before rebounding in the 2008 up to 33 TEP. The per capita consumption of the City of Rosignano M.mo is 3 times the per capita consumption in the province of Livorno, which in 2008 recorded a value of 9.4 TEP.

3.2 Final consumption of energy

Final consumption includes the energy used in end-use: solid, liquid, gas, electricity and renewable sources of energy that is considered net primary energy used to produce electricity in power plants fueled by renewable sources and renewable energy. The unit is still used in the TEP, or tons of oil equivalent measure of energy equal to 1 TOE = 10⁷ kcal.

¹ La popolazione residente nel Comune di Rosignano M.mo al 01.01.2005 era di 31.516 abitanti, al 01.01.2007 era di 31.786 abitanti e al 01.01.2009 era di 32.201 abitanti (Dati ISTAT)

3.2.1 Final consumption of energy in the territory

year 2004 (in TEP)

	Civil	Transportation	Agriculture	Industry	Total	%
solid fuels	-	-	-	-	-	-
petroleum products	6.478	32.089	3.151	115.724	157.442	41,86%
gas	9.595	199	-	60.211	70.005	18,61%
electricity ²	13.448	-	275	134.946	148.669	39,53%
renewables	4	-	-	-	4	0,00%
Total Energy final consumption	29.521	32.289	3.426	310.881	376.120	100%

year 2006 (in TEP)

	Civil	Transportation	Agriculture	Industry	Total	%
solid fuels	-	-	-	-	-	-
petroleum products	6.486	32.879	2.665	57.389	99.418	29,94%
gas	9.226	289	-	53.854	63.369	19,08%
Electricity ²	16.011	-	376	152.888	169.274	50,98%
renewables	6	-	-	-	6	0,00%
Total Energy final consumption	31.722	33.168	3.040	264.131	332.068	100%

year 2008 (in TEP)

	Civil	Transportation	Agriculture	Industry	Total	%
solid fuels	-	-	-	-	-	-
petroleum products	4.397	29.689	1.636	56.462	92.184	31,88%
gas	9.147	498	-	52.372	62.017	21,45%
Electricity ²	14.389	-	356	120.180	134.925	46,66%
renewables	19	-	-	-	19	0,01%
Total Energy final consumption	27.953	30.187	1.993	229.013	289.146	100%

² I consumi di energia elettrica nel settore civile non includono l'energia prodotta con le fonti energetiche rinnovabili (fotovoltaico e biogas), la quale si intende prodotta e consumata in loco.

The final energy consumption in the municipality of Rosignano M. m 2004 to 2008 fell by 23%. In particular, in the civil sector has increased from 29,521 in 2004 to 27,953 TEP in 2008, with a reduction of about 5%, similar to that recorded for the transport sector amounted to about 7% where it has fallen from 32,289 TEP supplies to 30,187. The most significant reductions in agriculture and industry, respectively, where it has gone from 3,426 to 1,993 TEP, with a reduction of 42%, and from 310,881 to 229,013 TEP in less than 26% between 2004 and 2008.

Comparison of final consumption in different sectors:

Confronto settori 2004-2008	Civil	Transportation	Agriculture	Industry	Totale
2004	29.521	32.289	3.426	310.881	376.120
2006	31.722	33.168	3.040	264.131	332.068
2008	27.953	30.187	1.993	229.013	289.146
% (04-08)	-5%	-7%	-42%	-26%	-23%

3.2.2 Consumption of the Municipal

The following table shows the consumption of energy related activities performed by the City of Rosignano for the years 2007 and 2008.

The energy consumption of the municipal constitute a portion of final energy consumption of the entire municipality.

Anno 2006

user	electricity (kWh)	Thermal energy			
		Methane (m ³)	Gas (l)	LPG (l)	petrol (l)
municipal buildings	1.770.960	117.090	65.411	126.000	-
public Lighting	4.678.693	-	-	-	-
Transportation	-	1.621	69.676	-	40.696

Anno 2008

user	electricity (kWh)	Thermal energy			
		Methane (m ³)	Gas (l)	LPG (l)	petrol (l)
municipal buildings	1.995.820	93.521	54.975	122.900	-
public Lighting	4.630.251	-	-	-	-
Transportation	-	4.227	49.856	406	36.202

For continuity with the methodology of calculation used in the Plan are reported consumption, broken down by year, including tons of oil equivalent (TEP)

Anno 2006 (TEP)

Kind of source	Thermal energy	electricity	transportation	Public lighting	Total
solid fuels	-	-	-	-	-
petroleum products	127,4	356,0	113,9	940,4	1.537,7
gas	96,6	-	1,3	-	97,9
renewables	-	-	-	-	-
Total	224,0	356,0	115,2	940,4	1.635,6

Anno 2008 (TEP)

Kind of source	Thermal energy	electricity	transportation	Public lighting	Total
solid fuels	-	-	-	-	-
petroleum products	116,6	401,2	89,4	930,7	1.537,8
gas	77,2	-	3,5	-	80,6
renewables	-	-	-	-	-
Total	193,8	401,2	92,8	930,7	1.618,5

3.4 Production of energy from renewable energy sources

The incidence of renewable energy production and final consumption in the municipality of Rosignano M.mo is, as noted above, entirely irrelevant.

They are small in the area of solar thermal systems for DHW (Domestic Hot Water) and heating at the household level, small photovoltaic systems and the system of landfill biogas disheveled. Below are details of the various RES in the city.

Solar Thermal

To quantify the installation of solar panels and the production of energy at the municipal level refers to what has been achieved under the agreement promoted by the Tuscany Region, since 2001, to promote the dissemination of solar systems with the granting of grants (managed, with information activities and training, EALP).

year	n. of installations	m ² installed	kWh saved
2004	8	49,48	43.464
2006	20	82,63	71.394

2008	58	256,93	226.093
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The more than 225,000 kWh/year saved in 2008 also take into account the contributions due to installations of previous years.

solar PV

The total number of installations of photovoltaic systems and the production of energy at the municipal level are calculated with reference to facilities and programs carried out under the national regulations and incentives that have encouraged this type of plant:

- National Programme "10,000 solar roofs"
- "Energy Bill" provided by the Ministerial Decrees of 28/7/2005 and 6/2/2006
- "Energy Bill" provided for by Ministerial Decree of 19/2/2007

year	n. of installations	kW saved	kWh saved ³
2004	0	0	0
2006	1	5,4	6.750
2008	38	259,3	324.125

The nearly 325,000 kWh/year saved are the sum of contributions from energy installations in previous years also.

biogas

The only biogas plant installed in the town of Rosignano M.mo SpA is the plant of REA disheveled at the landfill.

The systems installed are internal combustion engines to produce electricity using the biogas produced from landfill waste solids disheveled (Rosignano). Is recovered from these plants in small part, even heat.

Over the years a number of biogas engines are installed: 4 to present up to 2008, with a total capacity of 2.65 MW, he added another for which REA obtained the qualification IAFR (renewable sources plants) by GSE. This new facility is a co-generator of 1 MW of electricity.

		2004	2006	2008
Power (MW)		3,16	2,65	2,65
Net Production (GWh)		12,38	9,60	10,5
Total Operating Hours		22.912	17.115	
Fuel used (TEP)	Biogas	2.546	2.045	2.109
	Methane	380	-	-
	Total	2.926	2.045	
emissions (t/anno)	SO ₂	0,35	0,98	
	NO _x	11,50	14,41	

³ Si assume una produzione media di impianto pari a 1.250 kWh/anno/kW installato.

	MPT (dust)	0,23	0,01	
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Information by: REA S.p.A.

The following table compares the different RES are employed in the municipal area and highlights the impact of each of the total energy produced from renewable sources.

PRODUZIONE DI ENERGIA DA FONTI RINNOVABILI				
FER	2004	2006	2008	% nel 2008
solare termico	43,46	71,39	226,09	2%
solare fotovoltaico	0,00	6,75	324,13	3%
biogas	12.380,00	9.600,00	10.500,00	95%
Totale	12.423,46	9.678,14	11.050,22	100%

Value in MWh.

4. Emissions Inventory Basics

For the inventory of greenhouse gas emissions, please refer to the methodology described in ANNEX E: LIST OF BASIC METHODOLOGY FOR CO2 EMISSIONS. Below are summarized the values obtained by calculations according to this methodology.

The unit of measurement that compares the different types of greenhouse gas is CO2 equivalent (CO2eq), ie the CDE (Carbon Dioxide Equivalent). The CDE is expressed as the product of millions of tons of a greenhouse gas and the GWP (Global Warming Potential) of greenhouse gas itself.

The GWP is the factor that allows you to equate a greenhouse gas to CO2, therefore, is a typical value of each greenhouse gas and is defined as the ratio of the warming caused by the same in 100 years, greenhouse gases and the warming caused by the same amount of CO2. The table below shows the GWP of greenhouse gases listed above, as set out in the IPCC Fourth Assessment Report of 2007.

GHG	GWP after 100 years
Biossido di carbonio (CO ₂)	1
Metano (CH ₄)	25
Ossido di azoto (NO ₂)	298
Idrofluorocarburi (HFC) *	11.700
Perfluorocarburi (PFC) *	9.200
Esafluoro di zolfo (SF ₆)	23.900
<i>* valore massimo della classe di composti chimici</i>	

The total CO2 emissions are calculated from contributions made by individual sectors, the following are the emissions calculated in terms of CO2 equivalent.

4.1 Energy Sector

Emissions in the energy sector are calculated from data expressed in the previous chapter, and converted from TEP in tonnes of CO2 equivalent.

CO₂ emissions – year 2004 (in ton CO₂)

	Civil	Transportation	Agriculture	Industry	Electricity production	Total
solid fuels	-	-	-	-	-	-
petroleum products	19.537	98.478	9.816	375.124	-	502.954
gas	22.339	464	-	140.191	1.376.148	1.539.143
renewables	-	-	-	-	-	-
Total emissions	41.876	98.942	9.816	515.315	1.376.148	2.042.096

CO₂ emissions – year 2006 (in ton CO₂)

	Civil	Transportation	Agriculture	Industry	Electricity production	Total
solid fuels	-	-	-	-	-	-
petroleum products	19.523	101.213	8.299	186.030	-	315.065
gas	21.481	673	-	125.390	1.197.721	1.345.265
renewables	-	-	-	-	-	-
Total emissions	41.003	101.886	8.299	311.420	1.197.721	1.660.330

CO₂ emissions – year 2008 (in ton CO₂)

	Civil	Transportation	Agriculture	Industry	Electricity production	Total
solid fuels	-	-	-	-	-	-
petroleum products	13.261	91.462	5.096	183.024	-	292.844
gas	21.297	1.161	-	121.939	2.142.947	2.287.344
renewables	-	-	-	-	-	-
Total emissions	34.558	92.623	5.096	304.963	2.142.947	2.580.188

Comparison of total emissions in different sectors (in ton CO₂):

comparison 2004-2008	Civil	Transportation	Agriculture	Industry	Electricity production
2004	41.876	98.942	9.816	515.315	1.376.148
2006	41.003	101.886	8.299	311.420	1.197.721
2008	34.558	92.623	5.096	304.963	2.142.947
% (04-08)	-17%	-6%	-48%	-41%	56%

An analysis of energy requirements shown in paragraph 3.1 Primary energy consumption, it is noted that the City of fossil fuels Rosignano M.mo cover almost 100% of total consumption, mainly for natural gas. Since then renewable sources of energy, for which CO₂ emissions are void, a little accident on the territory of the primary energy demand, comparison of different emission sectors differs slightly from the comparison made for the energy balance.

To the exclusion of those due to the production of electricity, the emissions of the City of Rosignano M. mo decreased from 2004 to 2008. Overall, however, there was, as the energy demand, an increase of total CO₂ emissions between 2004 and 2008 for the territory (from 1,376,148 tons to 2,142,947 tons), due, as well said, mainly to 'entry into operation of the second plant to natural gas. The main area of use of natural gas is the production of electricity, which is also the area that most affects the total consumption of primary energy of the territory (over 85%) and CO₂ emissions into the atmosphere (+ 56% 2004 to 2008).

CO₂ pro – capita emissions

	emissions (ton)	per-capita emissions (ton)⁴
Municipality 2004	2.042.096	65
Municipality 2006	1.660.330	52
Municipality 2008	2.580.188	80
Province 2008	10.265.662	30,5

In 2004, emissions per capita in the municipality of Rosignano M.mo were 65 tons of CO₂ in 2006 fell to 52 tons of CO₂, but increased to 80 tons CO₂ in 2008, almost three times the value of emissions per capita estimated for the Province of Livorno, amounting to 30.5 tons of CO₂ in 2008.

⁴ vedi nota 5

Waste Sector

The waste sector is 5 to 20% of all anthropogenic emissions.

The IPCC method for the waste sector accounts for emissions of CO₂, CH₄ and N₂O emissions due to the following processes:

- Solid waste disposal
- Treatment of organic solid waste
- Wastewater treatment
- Incinerator : In the Municipality of Rosignano M.mo incinerators are not present, so the analysis continues through the first three areas listed.

4.3.1 Solid Waste Disposal

Waste disposal in the municipality of Rosignano Spa is managed by REA S.P.A. The landfill, opened in 1982, is located in disheveled and is classified as non-hazardous waste landfill, has a biogas collection system and a leachate treatment plant. The emissions are calculated according to equation (IPCC waste model) the decay of organic matter.

The biogas is composed of 50% CH₄ and 50% CO₂. The CO₂ emissions in the inventory is not counted in this case because of organic origin.

The IPCC method requires a historical reconstruction of methane emissions on the basis of data for the past 50 years plant life, in this case it was not possible to find this type of data. Only you can make an estimate on the basis of data on the management of the landfill (data provided by REA Spa).

The emissions of the landfill “Scapigliato” for 2008 are:

2008	m³ biogas	m³ metano	ton metano
Biogas prodotto	25.877.040	13.585.446	8.895
Biogas captato	10.251.001	5.381.775	3.254
Biogas emesso	15.626.039	8.203.670	5.372

For 2008 were produced 5,372 tons of CH₄, amounting to **134.300 ton CO_{2eq}**

4.3.2. Organic treatment of solid waste

The composting process is a source of emissions of CO₂, CH₄ and N₂O.

The CO₂ is biogenic origin that is not counted in the inventory of emissions, while methane emissions are considered, and nitrous oxide, and are evaluated in equivalent amounts of CO₂ according to their GWP.

The composting process is based on oxidative reactions that lead to degradation of organic matter for most producing CO₂ and CH₄ as in fermentation. With reference to the equation IPCC 4.1 (vol. 5) it was possible to calculate emissions of methane and nitrous oxide, by multiplying the amount of organic waste treated by the factors of CH₄ and N₂O:

$$Emissioni = Q_{kg\ trattati} \cdot FE$$

dove:

FE (CH₄) = 0,05 g/kg fattore di emissione del metano

FE (N₂O) = 0,30 g/kg fattore di emissione del protossido di azoto

Given a quantity of organic waste treated equal to 293,865 kg / year, according to the emission factors adopted, it appears that CH₄ emissions are equal to 0.368 kg to 14.7 tons CO₂ eq, while N₂O is 88 kg, corresponding to 26.224 ton CO₂ eq. Overall, the organic treatment of solid waste will then have 26.6 tons CO₂ eq.

4.3.3. Wastewater Treatment

The amount of CH₄ emitted in the treatment of wastewater depends on the amount of degradable organic matter present, the temperature of the process and the type of treatment (biological, chemical, physical or mechanical).

The organic load is evaluated in population equivalents, AE: organic biodegradable load having a biochemical oxygen demand (BOD) of 60 g / day.

The service of physical chemical treatment of wastewater and sludge of the municipality is managed by ASA Spa

CH₄ emissions are calculated from equation IPCC 6.1 (vol. 5):

$$Emissioni\ CH_4 = BOD_{trattato} * FE$$

dove:

FE = B_o * MCF emission factor of methane

B_o maximum capacity of methane production: 0,06 kg CH₄ (kg BOD)⁻¹ IPCC default value

MCF Methane correction factor: 0,1 (cautionary value assigned to aerobic treatment plant wastewater).

The organic load was calculated by multiplying the treated population equivalent to the organic load seen daily for 365 days.

Methane emissions from wastewater treatment for the City of Rosignano M.mo are as follows:

year	AE/year treated	BOD _{trattato} kg BOD/year	emissions kg CH ₄ /anno	emissions CO ₂ eq ton/year
2007	10.586	231.833	1.391	34,8
2008	40.262	881.737	5.290	132,3

Emissions of N₂O and refer to those that develop within the system and those that are generated where the effluent is discharged waters.

The calculation of emissions is done from the equation IPCC 6.7 (vol. 5):

$$Emissioni N_2O = N_{effluente} * FE_{effluente} * 44,0128/28,0134$$

The concentration of nitrogen in the effluent is calculated by multiplying the total concentration of precaution nitrate nitrogen, nitrous oxide and ammonia nitrogen for the volume of treated water.

$$N_{effluente} = C * V_{trattato}$$

dove:

- C concentrazione di azoto in uscita nell'effluente 12,41 g/m³
- V volume di acqua trattata 2.800.830 m³

N₂O emissions amounted to 273 kg, equivalent to 81.4 tonnes CO₂ eq.

Overall, as regards the field of wastewater treatment, the emission of green-house-gases in 2008 totaled 213.7 tons CO₂eq. Summing up the contributions of various sectors of disposal / treatment of waste emissions year 2008

WASTE SECTOR	ton CO ₂ eq
Solid Waste Disposal	133.175,0
Organic treatment of solid waste	26,6
Wastewater Treatment	213,7
Total	133.415,3

4.4 AFOLU Sector (Agriculture, Forestry and Other Land Use)

Change in carbon stocks

This field is accounted for the absorption of CO₂ from forests and perennial crops during the annual growth of biomass.

The change in carbon stocks is calculated by considering the exchange of CO₂ between the surface and atmosphere. A 'carbon stock increase is equivalent to a net removal of CO₂ in the atmosphere, on the contrary a reduction equivalent to a net emission to the atmosphere.

The IPCC methodology, "Gain-Loss" provides for the calculation of emissions by subtracting the increase in biomass over a period of time, loss of biomass (due to forest fires and use).

Due to the lack of data on the type of forest have been taken precautionary values, this is an underestimation of the potential for absorption.

$$\Delta C_B = \Delta C_G - \Delta C_L \text{ (eq. IPCC 2.7, vol 4)}$$

Aree a foresta

Carbon gain

L'incremento annuale della biomassa forestale viene calcolato in base all'equazione IPCC 2.9, vol 4:

$$\Delta C_G = \Sigma(A \cdot G \cdot CF)$$

dove:

A area totale superficie forestale

CF frazione di carbonio nella sostanza secca (valori di default Tabella IPCC 4.3)

G crescita media della biomassa totale:

$$G = \Sigma(I_V \cdot BCEF \cdot (1+R)) \text{ (eq. IPCC 2.10, vol 4)}$$

dove:

I_V incremento medio annuale della vegetazione (Inventario Forestale Regionale della Toscana)

BCEF fattore di conversione ed espansione utilizzato per stimare la biomassa radicale (Tabella IPCC 4.5)

R rapporto tra biomassa radicale e aerea di una specifica vegetazione (Tabella IPCC 4.4)

dati noti:

$$A(2007) = 4022,4472 \text{ ha}$$

$$A(2006) = 4030,6006 \text{ ha}$$

$$I_V = 1,5 \text{ m}^3/(\text{ha} \cdot \text{anno})$$

$$BCEF = 0,48 \text{ t}_{\text{biomassa}}/\text{m}^3$$

$$R = 0,2$$

$$CF = 0,51$$

$$G = 1,5 \cdot 0,6 \cdot 1,3 = 0,846$$

carbon gain calcolato

$$\Delta C_G(2007) = 4022,4472 \cdot 0,846 \cdot 0,51 = 1772,45 \text{ tC/anno}$$

$$\text{tCO}_2 = \Delta C_G \cdot (44,0095/12,0107) = 6494,6 \text{ t}$$

$$\Delta C_G(2006) = 4030,6006 \cdot 0,864 \cdot 0,51 = 1776,04 \text{ tC/anno}$$

$$\text{tCO}_2 = \Delta C_G \cdot (44,0095/12,0107) = 6507,76 \text{ t}$$

The change of absorption of CO₂ in the two reference years is equal to 0.2%.

Tabella-- . Confronto Carbon Gain 2006-2007

anno	ΔC_G t C/anno	Adsorption of t CO ₂ /year
2006	1776,04	6507,76
2007	1772,45	6494,60

Carbon loss

The biomass lost is calculated by adding the amount of biomass removed for use with the forest burned in fires, the latter can be neglected as there were in the last 10 years, significant phenomena.

The reference equation Eq. IPCC 2.11, Vol 4

$$\Delta C_L = L_{\text{wood removal}} + L_{\text{disturbances}}$$

dove:

$L_{\text{disturbances}}$ is the lost biomass due to fires, in our case is neglected

$L_{\text{wood removal}}$ is the removed biomass with forest harvesting

$$L_{\text{wood removal}} = Q \cdot CF \quad (\text{eq. IPCC 2.12, vol 4})$$

where:

Q biomass of forest harvesting (since recovered)

CF carbon fraction in dry matter (valori di default Tabella IPCC 4.3)

It was not possible to recover the data on the amount of biomass removed with the uses on forest land, also in the Municipality of Rosignano M.mo are not made substantial maintenance of the undergrowth. Therefore, for the purposes of this analysis, we assume a value of zero $L_{\text{wood removal}}$ (biomass removed with forest harvesting), although this assumption is not the best precaution. Overall, the absorption of CO_{2eq} are:

$$\begin{aligned} \Delta C_B (2008) &= \Delta C_G - \Delta C_L = 1.772,45 \text{ ton C} && \rightarrow \text{CO}_{2\text{eq}} = 6.494,6 \text{ ton CO}_{2\text{eq}} \\ \Delta C_B (2006) &= \Delta C_G - \Delta C_L = 1.776,04 \text{ ton C} && \rightarrow \text{CO}_{2\text{eq}} = 6.507,8 \text{ ton CO}_{2\text{eq}} \end{aligned}$$

	ΔC_B ton CO ₂
2006	6.507,8
2008	6.494,6

perennial crops

The amount of carbon absorbed by crops depends on the type, agricultural practices and soil type. The annual crops are not recognized because they are harvested every year, so there is no accumulation of carbon in biomass.

It is considered the accumulation of carbon in woody biomass of tree species planted: vineyards, olive groves and orchards by the following equation:

$$\Delta C_B = B \cdot CF$$

where:

Annual increase in biomass $B = A \cdot B_{SS}$

A= growing woody area

B_{SS} = dry biomass

CF = carbon fraction in dry matter (IPCC default value Table 4.3)

The biomass is calculated using the values of crop residues supplied by the Biomass Research Centre (University of Perugia).

These account for 80% of the total annual growth of the plant, 20% is the annual growth remains on the plant. This value is then multiplied by the average value of moisture of the wood to get tons of dry matter per hectare, this value is then multiplied by the hectares of crop and wood for the fraction of carbon.

The following are the calculations of absorption of CO₂ in the years 2006-2007 for the three woody crops considered:

ORCHARD

$$A_{(2007)} = 22,8117 \text{ ha} \quad A_{(2006)} = 22,9327 \text{ ha}$$

$$RC \text{ (residui colturali)} = 2,6 \text{ t/ha}$$

$$\text{Biomassa totale} = RC/80 \cdot 100 = 3,25 \text{ t/ha}$$

$$\text{Biomassa sulla pianta} = B_{\text{tot}}/100 \cdot 20 = 0,65 \text{ t/ha}$$

$$\text{Umidità} = 0,50 \%$$

$$\text{Biomassa } B_{SS} = B_{20\%} \cdot U = 0,33$$

$$\text{Incremento annuo della biomassa } B = B_{SS} \cdot A = 7,52 \text{ t (2007)} , B = 7,56 \text{ t (2006)}$$

$$CF = 0,5 \text{ tC}$$

$$\text{Totale C, } \Delta C_B = B \cdot CF = 7,52 \cdot 0,5 = 3,76 \text{ t (2007)} , \Delta C_B = 3,78 \text{ t (2006)}$$

$$\text{Assorbimento di CO}_2 = 3,76 \cdot 44,0095/12,0107 = 13,78 \text{ t CO}_2 \text{ (2007)} \quad \text{Assorb. CO}_2 = 13,8 \text{ t (2006)}$$

VINEYARD

$$A_{(2007)} = 99,9672 \text{ ha} \quad A_{(2006)} = 103,0882 \text{ ha}$$

$$RC \text{ (residui colturali)} = 2,9 \text{ t/ha}$$

$$\text{Biomassa totale} = RC/80 \cdot 100 = 3,63 \text{ t/ha}$$

$$\text{Biomassa sulla pianta} = B_{\text{tot}}/100 \cdot 20 = 0,73 \text{ t/ha}$$

$$\text{Umidità} = 0,35\%$$

$$\text{Biomassa } B_{SS} = B_{20\%} \cdot U = 0,25$$

$$\text{Incremento annuo della biomassa } B = B_{SS} \cdot A = 25 \text{ t (2007)} , B = 25,77 \text{ t (2006)}$$

$$CF = 0,5 \text{ tC}$$

$$\text{Totale C, } \Delta C_B = B \cdot CF = 25 \cdot 0,5 = 12,5 \text{ t (2007)} , \Delta C_B = 12,88 \text{ t (2006)}$$

$$\text{Assorbimento di CO}_2 = 12,5 \cdot 44,0095/12,0107 = 45,8 \text{ t CO}_2 \text{ (2007)} \quad \text{Assorb. CO}_2 = 47,2 \text{ t (2006)}$$

Alcuni ettari, rispettivamente 19,1039 ha nel 2006 e 18,6904 ha nel 2007 sono stati adibiti alla coltivazione sia di oliveti che di vigneti.

Cautelativamente sono stati sommati agli ettari coltivati a solo oliveto in quanto quest'ultimo assorbe meno CO₂

OLIVE GROVE

$$A_{(2007)} = 372,89 \text{ ha} \quad A_{(2006)} = 374,99 \text{ ha}$$

$$\text{RC (residui colturali)} = 2,2 \text{ t/ha}$$

$$\text{Biomassa totale} = \text{RC}/80 \cdot 100 = 2,75 \text{ t/ha}$$

$$\text{Biomassa sulla pianta} = B_{\text{tot}}/100 \cdot 20 = 0,55 \text{ t/ha}$$

$$\text{Umidità} = 0,40\%$$

$$\text{Biomassa } B_{\text{SS}} = B_{20\%} \cdot U = 0,22$$

$$\text{Incremento annuo della biomassa } B = B_{\text{SS}} \cdot A = 82,03 \text{ t (2007)} , B = 80,26 \text{ t (2006)}$$

$$\text{CF} = 0,5 \text{ tC}$$

$$\text{Totale C, } \Delta C_B = B \cdot \text{CF} = 82,03 \cdot 0,5 = 41,015 \text{ t (2007)} , \Delta C_B = 41,25 \text{ t (2006)}$$

$$\text{Assorbimento di CO}_2 = 41,015 \cdot 44,0095/12,0107 = 150,28 \text{ t CO}_2 \text{ (2007)}$$

$$\text{Assorb. CO}_2 = 151,14 \text{ t (2006)}$$

year 2006

kind	ΔC_B t C/year	CO ₂ adsorption t CO ₂ /year
Orchard	3,78	13,80
vineyard	12,88	47,20
Olive grove	41,25	151,14
Total		212,14

year 2008

kind	ΔC_B t C/year	CO ₂ adsorption t CO ₂ /year
Orchard	3,76	13,78
vineyard	12,50	45,80
Olive grove	41,01	150,28
Total		209,86

4.3.3 Field Emission AFOLU

Overall, the absorption of CO₂ resulting from the use of the area, both areas of farmland to forest, are:

AFOLU SECTOR	2006 ton CO_{2eq}	2008 ton CO_{2eq}
Forest and woodland areas	6.507,8	6.494,6
perennial crops	212,14	209,86
Total	6.719,94	6.704,46

4.4 Total Emissions

Based on the data listed above, the following is the overall balance of emissions, calculated in terms of CO_{2eq}.

	2004*	2006**	2008
Energy sector	2.042.096	1.660.330	2.580.188
Waste sector	n.a.	n.a.	134.540
AFOLU sector	n.a.	-6.720	-6.705
Total emissions	2.042.096	1.653.610	2.708.023

* Are not available the values of waste and AFOLU

** Values are not available in the industry waste

5. Objectives of the Municipal Energy Plan

The lack of national programming makes unclear the actual infrastructure needs in the energy sector.

At the regional and provincial energy planning tries to give an adequate response to meet the energy needs and, above all, the needs of environmental sustainability, social and economic setting of rules regarding the construction of power plants. In line with that provided by regional and provincial legislation, the first revision of the Energy Plan of the City of Rosignano which has as its primary objective to reconstruct what might be anticipated in the future of the area and outline the approaches aimed at achieving the targets for reducing emissions derived from fossil fuels and developing renewable sources.

The energy scenario for 2020 should be characterized by a mix of production and consumption of energy composed of methane and renewable energy, with a declining presence of petroleum products.

In the production of electricity in the town of Rosignano, unlike the rest of the province, is used exclusively natural gas (also in the central-type cogeneration with heat recovery for industrial and civilian), and less polluting fossil substance impacting oil which, as mentioned, is called upon to act as ferryman to the full development of renewable sources.

In March 2007 the Action Plan "An Energy Policy for Europe", the European Union has set itself three ambitious targets for 2020:

- 20% reduction in emissions of greenhouse gases,
- 20% improvement in energy efficiency,
- Produce 20% of energy through the use of renewable sources.

These objectives were endorsed by the national government in the "position paper" in September 2007 and approved by the PIER Regional Council on July 8, 2008.

The third objective is corrected by the Community Directive 2009/28/EC of 23 April 2009 on the promotion of energy from renewable sources. The Directive requires that Italy should ensure that the share of renewable sources in final energy consumption in 2020 is at least 17% (no longer refers, therefore, a target of 20% compared to the production of energy) . Final consumption of energy means the energy used in manufacturing, transportation, domestic uses, services, agriculture (including fisheries and forestry), including the consumption of heat and electricity in the energy sector for the production of heat and electricity, including distribution losses.

5.1 Reduction of energy consumption by 20%

The first objective to be pursued at the municipal level of containment is the final consumption of energy, particularly electricity: increasing production of renewable energy consumption, while maintaining it would make little sense.

The entry into force of regulations on energy conservation in civilian homes and the incentive system to encourage the substitution of electric motors in industry may limit the annual increase of energy demand. Energy efficiency, together with the spread of a

culture of savings, supported by information activities, education and training, is the main lever to act upon.

The goal there is the Local Action Plan for 2020 is to improve energy efficiency by at least 20%, following the directions laid down at Community level, national and regional levels, which translates into a reduction in final energy consumption of same percentage (without of course going to reduce the quantity and quality of products and services) in relation to final consumption for the year 2004 (first year for which good data are available consumption at the municipal level).

5.2 Impact of Renewable Energy Sources, 17% on final consumption

The second objective is to increase the production of energy from renewable sources contributing to the goal of 20% at regional level.

In order to achieve this objective requires:

- Meet the increased demand making plants that use renewable sources (solar thermal, solar photovoltaic, wind, biomass)
- Replace in the event of restructuring or processing, the traditional sources with renewable sources by using co-generation, except in cases where this proves to be inappropriate or not feasible.
- As required by the directive in the LEAP sets as a goal to be achieved by 2020 a percentage of renewable sources in final energy consumption by at least 17%.

5.3 Reduction of CO2 by 20%

For greenhouse gas emissions target for 2020 is to reduce by 20% compared to 1990, or at least get as close as possible to that level.

There are no data to 1990 so it will be necessary to quantify the emissions estimates for the year by the European Union taken as a reference on which to tailor the reduction in 2020.

The reduction targets are to be referred to areas where the municipal administration has a chance to intervene in either direct or indirect, through the instruments of territorial control and stimulation. Similarly, it appears to be very limited competence in terms of intervention in local industries to higher energy consumption, regulated by ministerial authorizations and discipline of the ETS (Emission Trading System).

6. Action Plan

6.1 Actions planned

The chapter provides information on policies and measures aimed at reducing CO2 emissions.

Construction industry

Buildings account for 40% of the total energy consumption in the EU and are often the main sources of CO2 and the biggest consumers of energy. It is essential, therefore, to devise effective policies to reduce energy consumption and CO2 emissions in this sector.

To reduce energy consumption in buildings is essential to build to the highest energy standards.

Improving the housing

The heating and cooling environments account for at least 70% of final energy consumption in buildings in Europe. Therefore, the key interventions to reduce energy inputs and losses affect significantly the reduction of CO2 emissions. The loss of energy through the outer casing can be reduced by implementing the following measures:

- Shape and orientation of buildings: the shape and orientation of buildings play an important role for heating, cooling and lighting. Appropriate guidance also reduces the use of traditional air conditioning or heating systems.
- Glass surfaces: an appropriate choice of the glass surfaces of a building is crucial, as the losses and energy inputs are from 4 to 5 times higher than the rest of the surfaces. This choice is based both on availability and on supplies of sunlight, and protection from the penetration of solar radiation. You can avoid replacing the glass surfaces, using a film with low emission (low-e) applicable to the window manually. This solution is cheaper than replacing the windows, but has a lower energy efficiency and durability.
- Frames of windows: windows in the new types of insulation, heat losses were reduced by integrating some elements in the construction, in order to eliminate cold bridges. Due to the high thermal conductivity of metallic materials, plastic and wood doors and windows are always a better thermal performance. However, the new metal frames designed with thermal break may be a good compromise in terms of costs.
- Wall insulation: thermal transmittance of walls can be reduced through proper thermal insulation. To do this, you would normally add another plate or a cover of insulating material. The most common insulating materials in the construction industry include: fiberglass, polyurethane foam, polystyrene foam insulation cellulose and rock wool. Often, in addition to thermal insulation systems using a vapor barrier and the thermal gradient produced by isolation, in fact, can create condensation that will damage the insulation and / or cause mold growth.
- Sunshades: shading systems can be used to reduce the loads of cooling energy requirements by reducing the penetration of solar radiation.

- To prevent air infiltration: the reduction of air infiltration can account for up to 20% of the potential energy savings in climates where heating is required most. Generally, doors and windows are the weak points and must be well designed. Therefore, it is advisable to carry out a tightness test to track and avoid drafts in the building. In addition, a well-controlled ventilation system is needed to ensure good indoor air quality.
 - Use of equipment to high efficiency use of energy saving lamps and lighting control systems manual switches located (sensors, timers, daylight sensors).
- Using low-power electrical equipment.

ICT

The use of information technologies and communication technologies (ICT) can help to optimize energy consumption in new buildings.

These systems control the heating, cooling, ventilation and lighting to suit the occupants and can manage a software that can turn off all computers and monitors when everyone went home. The BMS can also be used to collect data in order to identify further opportunities for improving efficiency.

PV systems and ST

Installation of photovoltaic and solar thermal production of electricity and hot water.

Here are some actions to promote strategies for improving energy efficiency in buildings:

- financial support for individuals and for the construction or purchase of energy-efficient, also involving local banks and financial institutions
- involvement of local businesses that may have economic interests in energy efficiency and renewable
- organizing information sessions and training aimed at engineers and designers, as well as sessions for citizens and administrative authorities
- organization of events aimed at raising awareness of the problem of emissions
- training sessions for schools
- taxation system for buildings that have an annual energy consumption of more than 70 kWh/m² (energy class C)

Field public lighting

The first action in the lighting industry is the replacement of old lamps with more efficient models (such as lamps, low / high pressure or LED).

The lamp replacement is the most effective way to reduce energy consumption. However, some improvements, such as the use of more efficient power supplies or adequate control techniques can avoid the excessive consumption of electricity. Using photoelectric switches to reduce lighting electricity consumption by reducing the hours of use at night (lighting later and off earlier).

Remote management system that allows the lighting system to react automatically to external factors as traffic density, level of daylight remaining, roadworks, accidents or weather conditions. Even if the remote system does not reduce the energy consumption for lighting can reduce traffic congestion or to detect anomalies. The remote control systems can be used to detect faulty lamps and know the position.

Replacing halogen lamps with LED bulbs to energy efficient and long lasting, in traffic lights.

Possible tools to promote the improvement of the public are:

- involvement of local businesses that may have economic interests in energy efficiency and renewable
- organizing information sessions and training aimed at engineers and designers, and administrative authorities

Transport sector

Car sharing

Service that allows you to use a car reservation, cropping it and returning it in a parking lot near the home, and paying due to the use made.

The advantages are: reduction in the number of cars parked on the road, recent use of self because they are used intensively, and then restarted at a frequency greater than the private car which leads to greater road safety (the newer cars tend to be technologically more secure); low environmental impact (we will enjoy the latest technological advances in terms of emissions and fuel consumption), the cars will be abandoned due to wear and not for aging, and so each can develop a better mileage during their useful result, to meet the same user population will be produced fewer cars. The tools to develop this service are the involvement of local businesses and information services to citizens.

Carpooling

Promoting the sharing of passenger cars between a group of people. One or more of the parties involved in providing the right vehicle, possibly alternating use, while others contribute with appropriate amounts of money to cover some of the costs incurred by drivers.

The City could promote this system through information events for the citizens.

Bike sharing

The bike sharing scheme involves the installation of stations in different parts of the city where you place the bikes. Users via electronic key or card, can use the service and return the bike at any station in the city.

The municipality may make agreements with advertising companies that would provide

bicycles free of charge in exchange for advertising, or involve the local bicycle repair shop removed and make them available to the service. This service can be promoted through information events for the citizens and the involvement of local companies.

Discourage car use

Promote the use of public transport through the following measures:

- to promote mass transit programs for schools and workplaces
- Improved service through lanes, real-time information, service information and ticket payment via mobile phone, free shuttle service for tourists and for all citizens on public holidays
- parking management: limitations of time and number of parking spaces in the city center
- planning of pedestrian infrastructure, creating green spaces and areas with low speed.

Moving by bike

The City can promote the use of bicycles in various ways:

- improve the image of cycling as a real means of transport;
- infrastructure: an integrated system of bike paths separated from vehicular traffic, connecting the starting points and destinations is essential to promote the use of the bicycle;
- information and route guides: Cycle paths are marked by numbers or colors and information on the distances are useful for cyclists;
- Safety: to approve the rules of safe driving and avoiding the mix of bicycles and heavy-duty vehicles;
- links with public transport to create parking spaces at railway stations and at tram and bus. Possibility to rent bikes at railway stations and other points of public transport;
- consider the financing plans for cycling infrastructure;
- Bicycle theft: theft deterrence by making it mandatory electronic identification of bicycles and / or the creation of a national register of stolen bicycles for police
- creation of Ciclofficina: workshops with specific equipment for the repair of bicycles, cycling provided by associations or collective, where everyone can repair their own bicycles thanks to collaboration with other users.

Clean vehicles

- Acquisition by the municipality of hybrid vehicles or fully electric
- Use of vehicles powered by biofuels
- Tax breaks for buying fuel-efficient vehicle, hybrid or electric.

Tertiary Sector

Urban planning

- Introduce energy criteria in planning (territorial, urban, mobility)

- Promote mixed use (housing, services and jobs)
- Planning to avoid urban sprawl:
 - Check the expansion of the built
 - Develop or revitalize industrial areas and disadvantaged
 - Place the new development areas within the scope of the existing public transport lines
 - Avoid shopping malls in the suburbs
- Plan areas without cars or limited traffic areas closed to traffic or by introducing a congestion charge system.
- Promote urban planning oriented to the sun.

Green Public Procurement

The energy-efficient procurement can improve the energy efficiency of the relevant criteria for considering the race and the decision-making processes relating to goods, services or works. They are applicable to the design, construction and management of buildings, purchase of equipment that consume energy, such as heating systems, vehicles and electrical equipment and also for the direct purchase of energy. It includes procedures such as life cycle cost, the definition of minimum standards of energy efficiency, use of energy efficiency criteria in the bidding process and measures to promote energy efficiency in organizations.

Acquiring buses and vehicles with low emissions of the park: the buses must be equipped with driving-style meters to monitor fuel consumption. Increase the share of electricity from renewable sources by going beyond the national support schemes. This measure can be completed with the purchase of energy efficiency services. For example ESCOs.

Purchase of computer products that are environmentally friendly and meet the highest EU standards for energy efficiency.

Provide training to users on how to save energy by using their computing devices. Impose high standards of efficiency that reduce energy consumption.

The interest in the development of green public procurement lies not only in their impact in terms of reducing CO₂ emissions, whose average is 25% ("Collection of statistical information on Green Public Procurement in the EU"), but also in terms of financial impact, which average 1.2% savings.

Purchase of green energy

The price differences between conventional electricity and green electricity depend on the state of liberalization, the characteristics of national support schemes and the existence of suppliers of green electricity. Green electricity is often more expensive, although the price differences are significantly reduced and in some cases the green electricity is also available at a cheaper rate. Green electricity has proven to be a group of product available for public contracts in a competitive way.

Rain water collection

Promotion of rainwater harvesting systems for garden irrigation, car washing, cleaning, sanitation and operation of the washing machine.

ICT

ICT has a key role in the dematerialization of the daily way of life.

The substitution of products and activities with high CO₂ emissions, low emission alternatives play a substantial role in reducing emissions. As electronic commerce, electronic public administration can have a significant impact in reducing greenhouse gas emissions.

The City could implement the following measures:

- Cooperate with the utility companies to ensure adequate promotion of the use of smart meters. Make sure that smart meters provide the right balance between added cost to the customer and potential benefits in terms of saving energy, or promote the spread of broadband infrastructure and collaborative technologies, enabling a large and efficient use of new technologies;
- Developing government-online
- Better fleet management: implementing eco-driving, the route optimization through real-time information on: weather and traffic alternate routes, fleet management and supervision;

Renewable Energy Sources

Promote the production of electricity and heat from renewable sources by way of incentives, information events, regulations

Summary table

ACTION	KIND OF ACTION	SECTOR	USER	INSTRUMENT
limite classe energetica C in nuove costruzioni	efficienza energetica	edilizio	amministrazione/ cittadini	supporto finanziario/ regolamenti/ informazione
obbligo FV e ST in nuove costruzioni	FER	edilizio	amministrazione/ cittadini	supporto finanziario/ regolamenti/ informazione
illuminazione a basso consumo	efficienza energetica	illuminazione	amministrazione	utilizzo lampade a basso consumo/

				regolazione flusso luminoso
promuovere car sharing/car pooling	riduzione consumi	trasporti	cittadini	informazione
incrementare piste ciclabili	spostamento in bicicletta	trasporti	amministrazione	regolamenti
disincentivare l'uso dell'auto	riduzione consumi	trasporti	cittadini	Regolamenti informazione/ supporto finanziario
semplificazione iter autorizzativo FER	FER		amministrazione	regolamenti
appalti pubblici verdi	FER	terziario	amministrazione	regolamenti
acquisto energia verde	FER	terziario/industrie	amministrazione/privati	Regolamenti/ informazione/ supporto finanziario
ICT	efficienza energetica	ict	amministrazione	regolamenti/ informazione/ supporto finanziario
pianificazione urbanistica verde	pianificazione urbana	terziario	amministrazione	regolamenti
raccolta acqua piovana	riduzione consumi	residenziale/terziario	amministrazione/cittadini	regolamenti/informazione/ supporto finanziario

We proceed in the first analysis, based on the information gathered so far, to formulate a list of activities carried out by the Municipality in the period 2008/2009 to contribute in reducing emissions of CO₂. He points out that the list is constantly updated and that the areas concerned are in different stages of development, will therefore be characterized by the voices “made”, “running” and “to perform”. The activities currently identified are:

Activities	State of activities
1. Schools switching to biomass Carducci - Rosignano M.mo	to perform
2. switching to biomass fraction of Nibbiaia	to perform
3. Novaro methane Schools - Vada	to perform
4. Replacement windows Factors Schools - Rosignano Solvay	made
5. Replacement windows Carducci Schools - Rosignano M.mo	made
6. Schools replacing fixtures Solvay - Solvay Rosignano	to perform
7. Schools replacing fixtures Alighieri - Rosignano Solvay	to perform

8. switching to district heating public facilities	running
9. implementation cycle paths	running
10. replace public lighting lamps Hg vapor lamps of Sodium	made
11. installing solar thermal Municipal Gym "Peaks" - Lillatro, Vada	made
12. installing solar thermal pool of Vada	made
13. installing fotovoltaic Villa Celestina - Castiglioncello	running
14. installing fotovoltaic Schools:	
- Carducci - Rosignano M.mo	made
- Ciari - Vada	made
- Europe - Solvay Rosignano	made
- Factors - Rosignano Solvay	made
- Novaro - Vada	made
- Pertini - Castelnuovo M.dia	made
- Solvay - Solvay Rosignano	made
- League - Gabbro	to perform

The table below shows the estimated reduction in greenhouse gas emissions resulting from the activities listed above:

n.	action	Extimation of CO _{2eq} reduction ton CO _{2eq}
4	Sostituzione infissi Scuola Fattori	14,7
10	Sostituzione lampade pubblica illuminazione *	
11	Solare termico Palestra Comunale	6,4
12	Solare termico Piscina Comunale	3,5
14 a	FV Scuola Carducci	3,6
14 b	FV Scuola Ciari	10,8
14 c	FV Scuola Europa	11,4
14 d	FV Scuola Fattori	13,0
14 e	FV Scuola Novaro	13,4
14 f	FV Scuola Pertini	3,8
14 g	FV Scuola Solvay	13,3
	Totale emissioni	93,9

* evaluation step

6.4 Monitoring of the actions

In order to assess the trend in CO2 emissions over time and therefore compliance to these objectives, the balance of emissions, as described in this document should be prepared annually.

The monitoring aims to determine the success rate of one share and how the objectives will be re-routed through:

- Continuity of institutional support local
- The relevance of the action within the framework of local priorities
- Measure the performance of actions, based on indicators (energy and environmental benefits, reduction of CO2, job creation, economic improvement and quality of life)
- Overall assessment of the program to reduce CO2 emissions, according to the state of progress and the degree of success of each action planned

7. Scenario to 2020

7.1 Reducing consumption

To achieve the goal of reducing energy consumption by 20% in 2020, will be involved all sectors of energy use.

The actions of the municipal administration can affect directly or indirectly with programs and planning, through awareness and dissemination of energy saving policies in the territories.

As described above, between 2004 and 2008, there were reductions in consumption in all sectors of final use of energy, for a total of 23%, from 376,120 to 289,146 TEP. We consider it plausible that the trend is maintained over the years and therefore can be achieved the goals of reduction of final consumption imposed at Community level.

7.2 Increase RES

The increase of 17% of renewable energy compared to final energy consumption in 2004 is more difficult to achieve a goal (equal to 63,940, or 17% of 376,120 TOE in 2004), since most of the final consumption of energy is not directly dependent on the political choices of the Municipal Administrative.

Assuming solely in the electricity sector and waste, a possible scenario could include:

- Biogas: there will be improvements to the system of collection of the landfill, which will lead to an increase in the percentage of biogas captured up to 80% in 2020, approximately 3,850 TEP
- PV: construction of plants for a total of 3 MW through installation of small, architecturally integrated into buildings and distributed within the municipal area (estimated production of 750 TEP of electricity);
- Wind: installing small wind turbines and distributed a total of 300 kW, 100 for the production of electricity TEP

With this scenario, the increase of renewable energy could reach 2% below 2004 levels. The breakdown of the use of renewable sources between the different needs of an assessment of consistency with regional strategies dictated at the municipal, provincial, regional and national level, so here is meant to express the possible applications that will need further evaluation for their viability.

7.3 Reduce emissions

For greenhouse gas emissions target for 2020 is to reduce by 20% compared to 1990, or at least get as close as possible to that level. In the absence of data to 1990, refers to the reduction in 2008, as did the reduction in consumption and the increase of RES. It highlights the fact that the industries of power generation in the territory of the Municipality of Rosignano M.mo are subject to national legislation on emissions, therefore, are not considered for the purposes of this calculation.

comparison CO₂ in several sector 2004-2008	Civil	Transportation	Agriculture	Industry	Total
2004	41.876	98.942	9.816	515.315	665.949
2006	41.003	101.886	8.299	311.420	462.608
2008	34.558	92.623	5.096	304.963	437.240
% (04-08)	-17%	-6%	-48%	-41%	-34%

One area where the administration has the possibility of a reduction in emissions is in the management of the landfill, assuming an improvement in the technique of biogas collection, is:

	Collection efficiency	CO₂eq emitted	ton CO₂ cut from 2008	Reduction from 2008	the estimated incidence for 2020 Municipal Achievement objectives
dato 2008	40%	134.300		0%	0%
Estimation to 2015	60%	66.826	-67.474	-50%	5%
Estimation to 2020	80%	20.117	-114.183	-85%	8%

Excluding emissions from electricity production in the territory of Rosignano M. mowere recorded from 2004 to 2008 emission reductions in all sectors of energy use, therefore, similar to the forecast reduction in final consumption, is considered likely that the trend is maintained over the years and therefore can be achieved the goals set at Community level.

Bibliography

- Assessment Report "Climate Change 2007"
- Action Plan "An Energy Policy for Europe" SEC (2007) 12
- Ispra Institute for Environmental Protection and Research
- Kyoto Protocol
- Directive 2009/28/EC on the promotion of energy from renewable sources

Appendix A: GLOSSARY

Free activities: is the installation of renewable sources or cogeneration small that is considered "free" under the building regulations and therefore does not require qualifying title (DIA, building permits, single authorization)

Autoproducer: natural or legal person shall, not less than 70% per annum, to cover its electricity needs through the use of its own generation plant

Authority for Electricity and Gas Authority (Authority): an independent body set up in Italy with the Law of 14 November 1995 No 481, with control functions and control of public services in the electricity and gas

Single authorization: the authorization procedure provided for by Legislative Decree 387/03, the competence of the Region or the Province, aimed at rationalizing and simplifying the authorization procedures for the construction and operation of plants producing electricity using renewable sources

Biofuels, liquid or gaseous fuel for transport produced from biomass

Biogas is the term used for the gas produced in anaerobic digestion and can be used as fuel. The "landfill biogas" is a byproduct of digestion by anaerobic bacteria of decaying matter in the waste in landfills. This gas is predominantly methane (65%) together with carbon dioxide (35%) and traces of other gases and vapors

Bioliquids means liquid fuel for energy purposes other than transportation, including electricity, heating and cooling products from biomass

Biomass means the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste

Power Exchange: sales system that determines which wholesale power generation systems or facilities are required to meet demand at any time and determines the price of energy at that particular moment

Calorie: the amount of heat that must be provided to one gram of water at atmospheric pressure, to raise the temperature from 14.5 °C to 15.5 °C

Green certificates: certificate issued to producers of energy from renewable sources, stating that the electricity is generated from plants previously approved by the Manager of Energy Services as plants using renewable sources (IAFR)

Combined cycle: coupling, in a plant producing electricity, the technology that uses the gas turbine with the steam turbine

CIP/6: provision of the Interministerial Committee on Prices 6 of 1992, which established the prices at which private individuals could sell electricity produced by renewable and assimilated. The mechanism of the CIP / 6 will be replaced by the fully operational system of Green Certificates

Cogeneration: any process of thermal generation is able to convert only part of the chemical energy of fuels into electrical energy. A good part of the primary energy it takes the form of heat that is normally dispersed. In systems with cogeneration waste heat is recovered in a form usable by civil or industrial users. In this way the total energy supplied (electricity and heat) becomes equal to the higher fuel consumed, compared to a plant without cogeneration. Law 239/2004 for the reorganization of the energy sector defines "plant a small generation plant for the production of electricity, including

cogeneration, with a generating capacity of not more than 1 MW", while "plant a plant micro- the production of electricity, including cogeneration, with a maximum capacity below 50 kWe. "

Gross final energy: means the energy commodities delivered for energy industry, transport, households, services, including public utilities, agriculture, forestry and fisheries, including the consumption of electricity and heat the electricity sector for the production of electricity and heat, including losses of electricity and heat in distribution and transmission

Primary energy consumption: the consumption of solid, liquid and gaseous fuels, along with the use of renewable energy used directly in the various fields of use in the production of electricity

Curves of load diagram that expresses a function of time required by a power grid Bersani Decree: Decree Law No. 79, March 16, 1999, entered into force on 1 April 1999 which transposed into national law the EU Directive 96/92/EC on common rules for internal electricity market and the liberalization of the electricity market

Complaint Home Activity (DIA): Tool for Public Administration (Technical office of Commons) to perform the role of supervision of construction taking place on its territory. And 'required by law for the construction of plants that use renewable sources up to a certain size

Dispatching: the activity is directed to issue instructions for the coordinated operation of production facilities, the national transmission network, networks connected to it and the auxiliary electrical system

Distribution: transport and transformation of electric energy distribution networks in high, medium and low voltage for delivery to end customers

Energy efficiency: the ratio between the results in terms of performance, service, goods or energy, and feed-

Energy: any form of commercially available energy, including electricity, natural gas (including LNG) and liquefied petroleum gas, any fuel for heating and cooling including district heating and cooling, coal and lignite, peat, vehicles (excluding fuel for the aviation and marine use) and biomass

Emission factor: The ratio of the amount of pollution produced and the amount of raw material processed or burned

Renewable energy sources (RES): category of energy sources which include the sun, wind, tides, waves, hydropower, geothermal resources and the biodegradable fraction of products, waste and agricultural residue (including vegetal and animal substances), forestry and related industries as well as the biodegradable fraction of industrial and municipal waste

GHG: greenhouse gases, which absorb the light radiation causing global warming, greenhouse gases are: carbon dioxide (CO₂), methane (CH₄), Nitrous oxide (N₂O), hydrofluorocarbons (HFCs) , perfluorocarbons (PFCs), sulfur hexafluoride (SF₆)

Distributed Generation: Generation of electricity in small units, from a few kW to several MW, located in several parts of the territory. The Distributed Generation (DG) is a new model of production and distribution of energy, which is based on integration in the electricity networks of small to medium plants and cogeneration from renewable sources (mostly natural gas) generally connected to the grid . They are often located

close to the end user, thus helping to reduce the need for investment and infrastructure to increase the transmission capacity of electricity transmission and distribution and at the same time allowing the reduction of network losses and distribution costs

Manager of Energy Services (GSE): established under Article 3 of Legislative Decree n.79/99, is the company whose shares are held by the Treasury, which provides incentives for the production of electricity from renewable sources and assimilated, and that deals with the classification of plants and their renewable electricity production

Global Warming Potential (GWP): typical of each greenhouse gas, is the ratio of the warming caused by the same in 100 years, greenhouse gases and the warming caused by the same amount of CO₂

kilocalorie (kcal): amount of energy needed to heat one degree Celsius the temperature of one kilogram (one liter) of water

kilowatt hour (kWh): units of energy, equivalent to the energy produced in 1 hour by a machine having the power of 1 kW

Line connection: any electricity line linking the plant with the delivery system user, or the delivery system with the train connection

Line interconnection: high voltage power line alternating current (AC) or direct current (DC) that connects two different networks, electrical transmission or distribution, or even two areas of generation

Transmission line: power lines high or very high voltage, air or cable, designed for the transportation of electricity from production to distribution networks or users
Megawatts (MW) unit of power equal to one thousand kilowatts

Obligation on energy: a national support scheme requiring energy producers to include a given proportion of energy from renewable sources in their production, requiring energy suppliers to include a given proportion of energy from renewable sources in their supply or requiring energy consumers to include a given proportion of energy from renewable sources in their consumption. This includes systems in which these obligations can be met through the use of Green Certificates

Peak power: it is the highest value of the electric power supplied or absorbed at any point of the system during an interval of time

Rated power: maximum apparent power an electric car that can operate continuously under specified conditions

Calorific value (PC): quantity of heat developed in the reaction of complete combustion of a unit quantity of fuel in a predetermined standard conditions. It is usually measured in kcal / kg for liquid and solid fuels, and Kcal/m³ for gases. It is distinguished in calorific value, which includes the latent heat of condensation of water vapor formed during combustion, and lower heating value (LHV), which excludes such heat

Production of electricity: power generation, however it is produced (fossil fuels, water sources, renewables, nuclear energy)

Gross production of electricity: the sum of the amount of electricity produced, measured at the terminals of electric generators

Net production of electricity: the sum of the amount of electricity produced, measured in output from the production plants

Energy efficiency: the amount of work performed or profit obtained per unit of energy resource used

Network: one or more external electrical manufacturing plant

Distribution network: every network with the obligation to connect third party except for the national transmission grid

National transmission grid: is the set of lines of a network used to carry electricity, usually in large quantities from the production centers to areas of distribution and consumption

Mains: set of facilities, lines and stations for the handling of electricity and provision of necessary auxiliary services

Energy saving: a technological intervention that can achieve the same output of goods and services with less energy consumption

Net metering (SSP) service provided by the GSE request of interested parties, enabling those who have the ownership or availability of a plant, offsetting the value associated to electricity produced and fed into the grid and the value associated to electricity withdrawn and consumed in a period different from that in which production takes place

Heating or cooling (heating): the distribution of thermal energy in the form of steam, hot water or chilled liquids, from a central source of production at a number of buildings via a network, for heating or cooling of spaces or processes

National electricity system: a combination of the production facilities, distribution networks and transmission and ancillary services and interconnection of devices located throughout the country and dispatching

TEP: tons of oil equivalent. Conventional unit of measure of energy equivalent to 107 kcal of energy obtained from burning one ton of oil. The conversion factors are: heat 1MWh TEP = 0.086, 1 MWh electricity = 0.201 TEP

Terna: the company responsible for transmission and dispatching of electricity on high and extra high voltage network across the country

Energy Efficiency Certificates (TEE) licenses issued to distributors of electricity and gas, to certification of achievement of primary energy required annually by law

Transmission: transport activity and transformation of electricity on the interconnected network of high and extra high voltage for delivery to customers, distributors and recipients of energy self-produced

Thermal transmittance: the global heat transfer coefficient (thermal transmittance) of a structure. Indicates the heat flow W through an area of 1 m^2 with temperature difference of $1 \text{ }^\circ\text{C}$ ($W/m^2 \text{ K}$)

Tri-generation: cogeneration systems, in addition to producing electricity, allow the use of thermal energy recovered from the transformation also produce cooling energy, or chilled water for air conditioning or industrial processes

Transmission: the use of the national transmission grid and distribution networks to transport electricity from a sampling point

Watt (W): unità di misura della potenza. I multipli del Watt più utilizzati sono il kiloWatt ($1 \text{ kW} = 10^3 \text{ W}$), il MegaWatt ($1 \text{ MW} = 10^6 \text{ W}$), il GigaWatt ($1 \text{ GW} = 10^9 \text{ W}$), il TeraWatt ($1 \text{ TW} = 10^{12} \text{ W}$)

Annex B: LEGAL FRAMEWORK

European regulatory scenario

According to the European Environment Agency is the energy source 80% of all greenhouse gas emissions in the European Union and is the basis of climate change and, most air pollution. The European Community is committed to address this issue with the goal of reducing emissions to bring them to a value that would limit the increase in global temperatures to 2 °C above pre-industrial levels. To do this it calls for a sustainable energy policy that sets goals, and provide concrete tools to achieve them. Are now the most cited legal references consulted in the preparation of this document, omitting the copious amount of texts that make up the European legislative framework.

KYOTO PROTOCOL

With the Kyoto Protocol implements the Framework Convention in 1992 approved by the United Nations on climate change. The Protocol was signed in 1997 and became effective on February 16, 2005; it commits developed countries and those undergoing economic transition to reduce greenhouse gas emissions by at least 5.2% in 2008-2012 compared to of 1990 (1995 for certain types of greenhouse gases). The share of Italy for the years 2008-2012 was fixed at 6.5% (equal to $483 * 10^6$ tons CO₂ eq) in less than 1990 emission values. (Editor's note in the period 2008-2010, Italy has accumulated a debt of € 0.7 million / day for failure to achieve the goal of the Kyoto Protocol - the source Kyoto Club).

Among the tools available to implement the Protocol signatory countries are:

- Clean Development Mechanism: the possibility of realizing in developing countries in projects that produce energy and environmental benefits;
- Joint Implementation: the possibility of achieving greenhouse gas reduction projects in other signatory countries, sharing with them the benefits;
- Emissions trading: the possibility to exchange emission credits between signatory countries (a country that has achieved a greater reduction of emissions can sell part of the "credit" to the country that has not yet reached the goal)

DIRECTIVE 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market
(Repealed by Directive 2009/28/EC)

DIRECTIVE 2009/28/EC on the promotion of energy from renewable sources and subsequent repeal of amending Directives 2001/77/EC and 2003/30/EC
With the European Community Directive 2009/28 embodies the goal of increasing the 20% renewable energy sources.

The Directive establishes a common framework for the promotion of energy from renewable sources and setting national targets required for the overall share of energy from renewable sources in final consumption and gross energy for the share of energy from renewable sources in transport. The mandatory national targets are consistent with

the objective of a share of at least 20% of energy from renewable sources in gross final consumption of energy in the Community in 2020.

According to the provisions of the Directive, Italy's goal for the share of energy from renewable sources in final energy consumption in 2020 amounted to 17% compared to 1990. In order to achieve the national objectives set, the Community guidelines on State aid for environmental protection recognizes the need to maintain national support mechanisms for the promotion of energy from renewable sources.

The Directive also called sustainability criteria for biofuels and bioliquids, and sets the percentage reduction in emissions of greenhouse gases through their employment. It is, in fact, defined a methodology for calculating emissions that also takes into account the characteristics of the production chain of biofuels and bioliquids.

DIRECTIVE 2006/32/EC on end-use efficiency and energy services and energy services and repealing Council Directive 93/76/EEC

The 2006/23/EC provides that Member States, in particular, must aim to achieve a national goal of energy savings, equivalent to 9% by the ninth year of its implementation to be achieved through energy services and other efficiency improvement measures energy.

The Directive provides the means for calculating the national indicative energy savings target, gives some examples of eligible energy efficiency improvement measures and defines a general framework for measuring and verifying energy savings.

20-20-20 climate-energy package

With the Action Plan "An Energy Policy for Europe", the European Union is committed to achieve three ambitious goals by 2020:

- Reduce by at least 20% of greenhouse gases compared to 1990;
- Increasing the share of renewable energy in overall EU energy mix to 20%;
- Improving energy efficiency by 20%.

National regulatory scenario

Nationally, the main legal references consulted in the preparation of this document are as follows.

Legislative Decree 387/2003 "Implementation of Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market"
The Legislative Decree No 387 of 2003 transposed and implemented at national level to European Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market.

The main purpose of the Decree is to promote a greater contribution of renewable energy sources in electricity production, promoting measures for achieving the national indicative targets under the Kyoto Protocol and encourage the development of micro systems - power generation (power \leq 1 MW electric) powered by renewable energy. With the Legislative Decree 387/03 provides the information about the authorization process required for the realization of the plants. The construction, operation,

associated works and infrastructure necessary for electric power plants fueled by renewable sources, according to the provisions of the Decree are subject to Single Authorization issued by the Region or Province delegates.

Legislative Decree 192/05 and Legislative Decree 311/2006 "Implementation of Directive 2002/91/EC on the Energy Performance of Buildings" As the transposition of European Directive 2002/91/EC on "Measures on Energy Efficiency in Buildings", in Italy the Legislative Decree 192/2005, which is issued later be amended by Decree 311/2006.

Through the Legislative Decree 192/05 and s.m.i. are fixed energy requirements of buildings and their components in order to reduce heat loss and, consequently, the consumption of primary energy in the building sector. It also introduced the concept of energy performance certificates, whose path of implementation has not yet fully concluded.

DM 05/05/2011 Fourth Energy Bill

DECREE No 216/2006 - Implementation of Directives 2003/87/EC and 2004/101/EC as regards the exchange of gas emission allowance trading within the Community, with reference to the project mechanisms of the Kyoto Protocol.

The decree, in addition to attribute the role of national authorities responsible for implementation of the directive to the "National Committee for management and implementation of Directive 2003/87/EC", also provides that:

- From 1 January 2005, no unit that falls within the scope thereof, can emit CO₂, which can continue to operate without appropriate authorization;
- Operators of installations that fall within the scope of the directive return annually to the National Competent CO₂ emission allowances equal in number to the actual emissions of CO₂ released into the atmosphere.
- CO₂ emissions actually released into the atmosphere are monitored, reported the National Competent Authority and be certified by an auditor accredited by the National Competent Authority.

Law n.136/2004

Conversion into law, with modifications, of Legislative Decree n.273, 12/11/2004, urgent provisions for the implementation of Directive 2003/87/EC relating to trading greenhouse gas emissions greenhouse gases in the European Community.

Law 120/2002

Ratification and implementation of the Kyoto Protocol to the United Nations Framework Convention on Climate Change, signed in Kyoto on December 11, 1997.

Legislative Decree n. 164 of May 23, 2000N.98/30/CE implementation of the Directive on common rules for the internal market in natural gas in accordance with Article 41 of Law 144 of May 17, 1999.

Legislative Decree n. 79 of March 16, 1999 Implementation of Directive 96/92/EC on common rules for the internal market in electricity.

Legislative Decree 115/2008 "Implementation of Directive 2006/32/EC on end-use efficiency and energy services" In implementation of Council Directive 2006/32/EC, the Italian government with the enactment of Decree No 115 of 2008 to intervene in end-use energy efficiency and energy services, addressing energy issues in various sectors. The main activities covered by the Decree 115/08 are:

- Adoption of measures to harmonize and distribution of functions between State and Regions regarding energy efficiency;
- Improvement of the mechanism of white certificates;
- Authorization and administrative simplifications (some renewable sources are treated as routine maintenance);
- Recognition of the public sector as an advocate of measures to improve efficiency and to promote actions in the area through technical, economic and financial;
- Definition of energy service contract and the contract plus energy service introduced by Presidential Decree 412/93;
- Defining criteria for persons authorized to energy certification of buildings, by requiring the absence of conflict of interest of the technician certification.

BUDGET LAW 2008

The Law 244/2007 (Finance Act 2008) introduces important aspects of energy policy to support the improvement of energy efficiency and use of renewable sources of energy. The budget extended the tax incentives provided by Law 296/2006 (Finance Act 2007) for expenses incurred for redevelopment energy of plants and buildings. Law 244/07 also invites municipalities to give a strong signal to citizens to reward the production of energy from renewable sources to cover the domestic needs, providing the possibility to reduce the ICI below 4 ‰ (four per thousand) in If the installation of technological systems powered by renewable sources in the service of real estate. In addition, the Act requires that the building permit from 2009 is subject to energy certification on the building, as well as water saving and reuse of stormwater, as well as installation of power plants from renewable sources.

Financial incentives are the same with renewable energy sources and forms of district heating from biomass. All-inclusive tariff is introduced, a form of incentive that the state recognizes the specific size of plants powered by renewable sources. The size of the net metering limit is raised to 200 kW of power and permits are simplified for the construction of renewable energy plants, in accordance with the provisions of Legislative Decree 387/2003.

DM 12/18/2008 Encouragement of the production of electricity from renewable sources, according to Article 2, paragraph 150, the Law of 24 December 2007, n. 244 In defining incentive systems, the 2008 Budget makes a distinction between small plants, ie less than 1 MW power (200 kW for wind turbines), and plants of larger size. The former can choose between two incentive mechanisms: an all-inclusive tariff (TO)

recognized each kWh produced, or participation in the Green Certificates (CV). The medium-large sized plants are excluded from all-inclusive tariff and must participate in the market for HP. Both incentive mechanisms are differentiated by source. The all-inclusive tariff assumes, in fact, different values for different renewable sources. Presidential Regulation 59/09 implementing Article 4, paragraph 1, letters a) and b) of Legislative Decree 19 August 2005, No 192, concerning the implementation of Directive 2002/91/EC on energy efficiency in buildings

The decision criteria are established for the design of buildings and for the design, operation, maintenance and inspection of heating systems, in particular on methods for calculating the energy requirements nationally recognized (to be coordinated at regional level) and the minimum requirements for buildings and facilities that ensure the achievement of energy efficiency jobs nationwide. Is then introduced, for new buildings or fully restored, a limit on the energy performance of the building in order to limit the use of facilities for summer cooling.

DM 26/06/2009 National Guidelines for Certification of Buildings
The guidelines for certification are an energy system that can provide information on the energy quality of buildings and contribute to a uniform application of energy certification of buildings.

Are also a way of connection, coordination and cooperation between the State and the regions through the following elements:

- Data information that must be contained in the energy
- Technical reference standards
- Methods of calculating the energy performance of buildings
- Job requirements and criteria to ensure the qualification and independence of those responsible for the energy certification of buildings.

DM September 10, 2010: Guidelines for the authorization to build and operate plants fueled by renewable sources and technical guidelines for these systems.
LAW 99/2009 "Measures for the development and internationalization of enterprises, as well as on energy"

The Law 99, in force since August 15, 2009, contains provisions for the development and internationalization of enterprises, and in the field of Energy. Schematically summarize the most salient points of law, energy policy will highlight the following aspects:

- Verification of subjection are excluded from the EIA Regional industrial plants for the production of non-thermal energy, steam and water power not exceeding 1 MW and wind power industrial plants not exceeding 1 MW;
- Municipalities with less than 20 000 inhabitants can use the service of net metering for systems with a power not exceeding 200 kW without obligation to coincide with the point of injection and withdrawal point energy exchanged with the network;
- Change the threshold percentage of release for consumption of fuel mixtures "diesel - biodiesel" from 5% to 7%;

- Have made changes to the values of all-inclusive tariffs and green certificates granted to equipment powered by renewable sources;
- Imposes the requirement of EIA state for wind turbines offshore for electricity generation;
- Have streamlined the permitting procedures for construction of facilities of micro- and small-scale cogeneration;
- Abolition of the obligation to acquire the building's energy performance certificate to qualify for the tax deduction for any replacements of air conditioning in winter;
- Are introduced in promoting aspects of nuclear energy.

Regional Scenario

REGIONAL LAW 1/05 "Rules for the Government of the territory" LR No 1 of 2005 provides the tools for spatial planning in order to ensure that the action of land transformation is made in compliance with the requirements of sustainability and urban quality, environmental and construction.

Through this Law regulates the functions of the region provinces, municipalities and the Region itself in the definition of territorial development plans, paying particular attention to the protection and enhancement of environmental and land resources. Planning tools are identified in the law:

- Regional Plan of Territorial Address;
- Provincial Territorial Coordination Plan;
- Municipal Structural Plan.

Law 1 of 2005 is also the instrument by which the State lays down guidelines to ensure a quality sustainable building both in terms of technical and construction and from that plant.

REGIONAL LAW AMENDED BY REGIONAL LAW 39/05 71/09 "Measures of energy" LR No 39 of 2005, which has undergone some changes with the approval of the Regional Law 71 of 2009, reports the provisions of the Tuscany Region in the field of energy, designed to meet the energy needs of the area according to criteria of economic efficiency, sustainable development and environmental protection and health. The Act provides for the issuing of the Regional Energy Plan Address (PIER), which was finally approved in July 2008, which lays down the basic choices of the energy programming and, in particular, defines the energy needs and goals of savings and efficiency energy, and development of renewable sources, and then identify the actions necessary to satisfy the needs and the achievement of the objectives set. LR 39/05 regulates energy activities, defining the authorization procedures for the realization of the plants and the role of institutions in management practices. As for the rationalization of production and consumption of energy, the law offers the energy efficiency requirements of buildings by promoting the installation of systems powered by renewable sources and that the criteria for energy efficiency in power generation plants.

PIER Address Regional Energy Plan

The Pier, which was approved by the Regional Council on 8 July 2008, establishes, among other things, that municipalities, even if associated, in a manner and time established by the PIT, the identification should be provided, in their planning instruments, in compliance PTC and the guidance in implementing the provincial energy planning, targeted areas to allow the installation of industrial plants powered by renewable energy sources, taking into account their vocations of the territories concerned.

The law has, in fact, that the competent administrations should follow the instructions in PIER regarding the location of production facilities, transportation and distribution of energy and prevention of light pollution.

In order to coordinate the activities of regional planning with the provincial, the PIER provides for the creation of a table of comparison between the Region and the Provinces, which will also be responsible for:

1. define actions and minimum, at the provincial level, needed to achieve the objectives assigned to the regional community, including the definition, for each province, a minimum amount of participation in achieving the objectives is divided between the regions at national level, both objectives set by the PIER;
2. explore forms of cooperation between the province and the region in terms of energy efficiency and energy production, through use of renewable energy sources;
3. ensure coordination of provincial energy agencies;
4. provide for initiating a process of rationalization of the same throughout the vast area and to identify mechanisms aimed at improving its efficiency.

The role of the provincial energy agencies is functional for achieving the objectives set by the PIER. In this regard will be evaluated by comparing the table to promote initiatives like the creation of a network of One Stop Shops for Energy, focused in the same agency, or establishment of a regional network of energy education and environmental protection, from promote the area and with the support of energy agencies. The table of comparison Region - Provinces will enable synergies with the provincial energy agencies, with the Tuscany Regional Agency for Promotion of local marketing operations, as well as with universities and research can promote and establish memoranda of understanding with the associations representation of economic categories, the world of cooperation with environmental associations and bodies representing users and consumers.

The Pier also provides for the revision of the standards referred to LR 39/2005 inserting provisions aimed at establishing a reasonable period, a year after the entry into force of the Pier itself, within which the provinces will be called to adapt their plans or programs for promoting renewable energy and energy end-use or, in the absence of such plans or programs, will be invited to define them by taking initiatives on their own expertise to help achieve the minimum targets shared with the region.

In case of default by the provinces or in the case of measures of the same provinces or impediments to the achievement of shared assigned, will assess the possibility of introducing the institution of subrogation in the event of repeated failure.

Annex D: METHODOLOGY FOR CALCULATION OF THE ENERGY BALANCE (primary energy)

SOLID FUELS

In the Municipality of Rosignano there are no production of energy from solid fuels.

PETROLEUM PRODUCTS

Civil Sector:

Consumption of petroleum products are calculated by adding the civilian consumption of diesel for heating residential and commercial properties with those of LPG. The consumption of diesel fuel for residential heating are calculated on the basis of global consumption of heating oil provided by the National Oil Bulletin at the provincial level and disaggregated at the municipal level according to the distribution of heating oil. The consumption of heating oil service sector, however, are calculated on the basis of global consumption of heating oil provided by the National Oil Bulletin at the provincial level and disaggregated at the municipal level according to the consumption of electricity.

The consumption of LPG for heating are calculated based on data provided by the global consumption of LPG Oil Bulletin National purged at the provincial level of consumption of LPG for the transport sector and disaggregated at the municipal level based on the distribution of heating systems LPG.

The consumer data supplied by the Oil Bulletin are expressed in tonnes of fuel and are converted into TEP through PCI - calorific value - the same fuel (10,210 kcal / kg for diesel fuel and 11,000 kcal / kg for LPG).

fuel prod. oil residential heating oil = civil + diesel + LPG heater heating the tertiary

where:

heating oil. Residential: Residential TEP Total Province * No common facilities / No plants Province

heating oil. Tertiary: Tertiary province TEP Total consumption * common / total provincial consumption

LPG heating.: * No Province Total TEP common facilities / No Total facilities Province

Transportation Sector:

The consumption of petroleum products in the transport sector are calculated by summing the consumption of gasoline, diesel and LPG.

The consumption of petrol, diesel and LPG are calculated based on the data of global consumption of these fuels provided by the National Oil Bulletin at the provincial level, disaggregated at the municipal level according to the diffusion transport, respectively, gasoline, diesel and LPG, the second data provided by ACI.

The consumer data supplied by the Oil Bulletin are expressed in tonnes of fuel and are converted into fuel TEP through the same PCI (10,500 kcal / kg for petrol, 10,210 kcal / kg for diesel fuel and 11,000 kcal / kg for LPG).

fuel prod. transportation sector petroleum = diesel + gasoline + LPG

where:

fuel: Total TEP Province * No common means of petrol / No Total transport fuel province

Diesel: No TEP Total Province * common means diesel / No Total transportation oil province

LPG: $TEP * N. \text{ totals Province common means of LPG} / \text{No Total LPG vehicles Province}$

Agriculture:

The consumption of petroleum products in the farming sector essentially reduce to those of diesel, which are calculated based on the data of global consumption of diesel for agriculture provided by the National Oil Bulletin at the provincial level, disaggregated at the municipal level based on work days of agricultural vehicles (as provided by ISTAT census).

Consumption data provided by the National Bulletin are expressed in tonnes of diesel and are transformed into TEP through its PCI (10,210 kcal / kg).

diesel consumption sector agriculture: $TEP \text{ Total working days} * \text{common} / \text{total working days province}$

Industry:

The consumption of fuel oil in industry are calculated based on the data of global consumption of fuel oil supplied by the Oil Bulletin at the provincial level, disaggregated at the municipal level based on consumption of electricity supplied by ENEL. Consumption data provided by the National Bulletin are expressed in tonnes of diesel and are transformed into TEP through its PCI (9840 kcal / kg).

fuel oil industrial sector: $TEP \text{ Total consumption} * \text{en province common electrical industry sector} / \text{industry sector total consumption province}$

Electricity Production Sector:

In the Municipality of Rosignano are not present electricity production from oil products.

GAS

Civil Sector:

The consumption of natural gas in the civil are calculated according to data supplied by natural gas consumption of ASA at the provincial level and disaggregated at the municipal level based on the number of CNG present.

Gas consumption civil sector: $\text{total TEP Province} * \text{No common facilities} / \text{No Total facilities Province}$

Transportation Sector:

The consumption of natural gas in the transport sector are calculated on the basis of natural gas consumption data provided by SNAM Rete Gas at a provincial level, disaggregated at the municipal level based on the number of vehicles to natural gas supplied by ACI.

Gas transportation sector consumption: $\text{Total TEP Province} * \text{No Common media} / \text{No Total provincial media}$

Agriculture

Are not registered natural gas consumption in agriculture in the territory.

Industry:

The consumption of natural gas in industry are calculated on the basis of methane consumption data provided by SNAM Rete Gas at a provincial level, disaggregated at the municipal level based on consumption of electricity supplied by ENEL, similar to what was done for the consumption of fuel oil.

industrial sector gas consumption: TEP Total consumption * electrical energy consumption of province. industry sector common / en tot consumption. Province Electric Industrial Sector

Power Generation Sector

The consumption of natural gas for electricity production are provided by two gas turbine inside the Solvay plant.

RENEWABLE

Civil Sector:

For the primary energy from renewable sources of energy in the civil means that produced by solar thermal. The values are calculated by summing the energy yield of each solar system installed, in terms of savings in conventional fuel to produce the same amount of energy.

Transport Sector, Agriculture Sector, Industrial Sector:

Non-renewable energy sources are used in these areas.

Electricity Production Sector:

For the sector of electricity production from renewable energy sources are considered the values of energy produced from biogas, supplied by the REA and those produced by photovoltaic systems installed on the territory, the latter assuming a value of unit output of 1,250 kWh / kW / year. The data on installed PV power is provided by GSE. en. electricity from renewable: biogas + * PV installed 1,250 kWh / kW / year

ANNEX E: LIST OF BASIC METHODOLOGY FOR CO2 EMISSIONS

In order to evaluate the reduction of CO2 emissions is necessary to establish a calculation method by which it is possible to quantify the emissions produced directly or indirectly in the territory.

For the composition of a methodology for calculating greenhouse gas emissions is taken as a reference tool for the method developed by the IPCC (Intergovernmental Panel on Climate Change), which was adopted nationally and internationally for the preparation of national greenhouse gas inventories of countries Parties to the Kyoto Protocol (Annex B) and consistent with the provisions of standard ISO 14064. Greenhouse gases are regulated by the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), per fluorocarbons (PFCs) and sulfur (SF6). In the assessment in question are neglected emissions of fluorinated gases (HFCs, PFCs, SF6), as nationally, according to a report by APAT (Agency for Environmental Protection and Technical Services) in 2008, they represent only less 1% of total emissions.

The unit of measurement that compares the different types of greenhouse gas is CO2 equivalent (CO2 eq), ie the CDE (Carbon Dioxide Equivalent). The CDE is expressed as the product of millions of tons of a greenhouse gas and the GWP (Global Warming Potential) of greenhouse gas itself.

The GWP is the factor that allows you to equate a greenhouse gas to CO2, therefore, is a typical value of each greenhouse gas and is defined as the ratio of the warming caused by the same in 100 years, greenhouse gases and the warming caused by the same amount of CO2. The table below shows the GWP of greenhouse gases listed above, as set out in the IPCC Fourth Assessment Report in 2007 (source: PEP Province of Siena).

The guidelines developed by the IPCC identified basically two approaches for estimating emissions: a top-down and bottom-up approach. The first is that the data collection takes place from the large scale (national or regional basis, for example) and the breakdown of them locally. The second approach is based instead on the collection of data directly on the territory, for each production category, until their marriage in general.

The City plans to adopt Rosignano both approaches, distinguishing the most suitable in each case based on the ease of obtaining the necessary data.

The assessment of CO2 adopt simplified method of calculating emissions from developed 'National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and below.

Each factor is associated with fossil fuel, said CO2 factor, which represents the amount of CO2 that is formed by the complete conversion of a unit of fuel. As regards the production of electricity is assumed a conversion factor of $0.65 \div 0.85$ CO2 kg / kWhe, data obtained by taking as the prevailing type of energy production on the Italian territory fired power plants, for which the ' electrical efficiency is 30 to 40%

CCP Inventory Toolkit

Its aim is to help municipalities to draw up an inventory of emissions, then describe the emission sources and methods to quantify.

The inventory is a collection of data for all greenhouse gas emissions caused by industry, agriculture and waste. Allows to give an overview of the town is on the air quality is adopted local policies.

Are counted both primary emissions from fuels such as coal, oil and natural gas is the secondary fuel, gasoline, diesel, lubricating oils, etc. .. in a year, emissions from waste is considered the period necessary for the calculation of the IPCC. The municipalities are responsible for more than 50% of greenhouse gas emissions. The methods and principles used to develop the inventory must be aligned to standards and guidelines, as required by international protocol, here are a few:

- ISO 14064 series of standards Greenhouse Gases
- GHG Protocol Initiative Corporate Accounting Standard and Project Protocols
- 2006 IPCC Methodological changes
- GRI Public Sector Supplement Agency.

The spreadsheet converts the input data, consumption of: fuel, waste energy, in greenhouse gas emissions based on national conversion factors. Values are in tonnes of CO₂ equivalent is the amount of greenhouse gas emissions equivalent to CO₂ according to conversion tables defined.

The inventory is divided into two parts: Administration and the territory divided into sectors each of which:

Municipality	Territory
buildings	civil
vehicles	commercial
pendular	Industrial
Public lighting	transportation
water/waste water treatment	Waste
waste	Agriculture

The data must be correlated with notes that highlight the problems of data availability, how and by whom they are acquired. You can estimate the values of missing data for previous years.

For buildings and structures that are not directly controlled by the municipality must refer to the International Protocol and the local supplement on the basis of: operational

control, financial control and equity of the parties, that is, if the municipality is responsible for the activities of the financial or or is it just co-owner of the structures. In order to compare various data structures of power consumption or emissions are disaggregai with other factors such as size of rooms, number of occupants, etc.

Who prepares the inventory is to do a report on the results and the methodology used. The inventory does not provide disaggregated data, but will be provided later:

- Emissions from primary fuels
- Emissions from secondary fuels
- Emissions from bodies out of the ordinary

Spreadsheet is included in a Local Energy Production, which is used to help estimate emissions from manufacturing activities of local energy.

If the municipality owns farms should be added to the Government section of the spreadsheet also for agriculture.

inventory Management

You must establish a base year for evaluating the benefits produced by the policy of reducing emissions, is often used, but 1990 is not a prerequisite.

Below is a table of hypothetical data that are needed

Sector	Data	source
buildings	Energy-kWh or given amount of fuel, hours of operation, number of occupants, the surface	Energy manager Finance manager accounting offices bills Dealer energy
veichles	Amount of fuel used, fuel type, fuel cost, number of vehicles, kilometers in a year	Finance Department Fleet managers Petrol Stations
Public lighting	Number of connections, kWh consumed, number of lights, type of lighting	Electricity supplier Department of finance bills bills
Water/waste water treatment	Number of connections, kWh used for pumping water, miles of piping	bills Service Manager waters Department of Finance
waste	Amount of landfill waste, number of employees	Operators of landfills Polls Waste
Pendular	Type of transport, fuel used, distance traveled, number of people in the middle	Polls of people and transport companies

All spreadsheets have a drop down menu where you can enter data in the first sheet will be placed on the general data of the country, the year of reference, surface, number of inhabitants.

In the paper of buildings and structures is the unit of energy measurement for each type of fuel and cost and usage data can be entered for each facility or to any structure, or set of structures (eg, all types elementary schools).

For each data set there are cards to write down important information (eg number of people, floor area) that will be used to compare the emissions between different structures.

In the vehicle fleet is the unit of energy measurement for each fuel type and data is inserted in the fuel consumption and cost data, or for any type of vehicle or vehicle groups (eg according to the fuel or the size of the motor).

In the field of public consumption data are included, cost and number of installations. In the paper there is also a section for entering data for off-grid installations of solar energy that are not counted in the emissions but are counted in the calculation of emissions avoided.

The water and sanitation sector is constantly changing technological and installation of high efficiency motors are a source of considerable energy saving and emissions. They included energy consumption and cost data over the administration of operations, and data useful for comparing various systems such as miles of piping and number of inhabitants.

The waste paper are counted quantity, in tonnes of waste landfilled. Finally there is a table summarizing all the data in the Administration section.

Inventory land

You choose a reference year based on available data do not necessarily coincide with that of "inventory management" and is determined based on statistics and censuses. Are placed in the residential sector energy consumption data for each source with its units and the number of residents and families if the information consumption are not divided by the residential, commercial and industrial values can be estimated. The commercial paper may include public facilities such as schools and hospitals, the data entries are the consumption of energy, the number of people occupying the building, the surface and the number of establishments.

In the industrial sector consumption data are entered and number of employees, size and number of establishments by sector of industrial activity. In this area you can have different issues that must be entered in a special form of the industrial sector. The transport sector has two methods of assessment: according to the sale of fuels, or the number of vehicles registered.

The fuels used in other sectors do not add up with the transport. Once the fleet should enter the data of distance traveled for each vehicle type, information on fuel efficiency and the percentage of types of vehicles.

The sheet of the agricultural sector is based on the number of animals, the amount of methane produced depends on the animal's age by the weight and the amount and quality of power. In this tab, there is also a section to record the number of green areas in the area.

The local energy production sheet records all the activities of energy production from renewable sources is that district heating systems and noting whether it is owned by the municipality and if so at what percentage.

In the Covenant of Mayors are not considered plants of large size (20MWth), because it already ETS Europe must be noted, however, the presence of these plants. Finally there is a summary sheet of fuel consumption and emissions in the territory.

APPENDIX F: FORMS OF ACTIVITY MONITORING

Replacing fixtures Schools “Fattori”

In 2008 occurred the replacement of the fixtures of the factors Schools Go. The redevelopment has affected all energy windows of the school building, for a total glass area of approximately 402 m².

The existing fixtures, made up of a single glass window in wood, were replaced with a type of double glazing and PVC frame. It is estimated that the transmittance of the old fixtures were equal to $U_{w_old} = 5,19 \text{ W/m}^2/\text{K}$, while that of new fixtures, as specified by the manufacturer, is equal to $U_{w_new} = 1,35 \text{ W/m}^2/\text{K}$; so, the transmittance of the transparent elements of the building is improved by approximately $\Delta U_w = 3,84 \text{ W/m}^2/\text{K}$.

Assuming an average of 0.85 overall performance for the existing heating system (boiler 350 kW natural gas), calculate the primary energy saved each year following the replacement of fixtures, according to the following formula:

$$\Delta E_p = 0,024 * \Delta U_w * \text{Sup} * \text{GG} / \eta = 71.480 \text{ kWh/anno}$$

dove: ΔE_p : riduzione di energia primaria
 0,024: fattore di conversione
 Sup: superficie vetrata totale
 GG: gradi giorno (per Rosignano M.mo sono 1.640)
 η : rendimento globale medio

Knowing the primary energy saved each year thanks to upgrading energy obtained by the replacement of the fixtures of the school complex and knowing the type of fuel used in thermal power plant, one calculates the resulting CO₂ reduction surgery.

Building	action	energy	CO₂ saved
Scuola Fattori	Replacement windows	71.480 kWh/year	14,7 ton/year

Solar Thermal Municipal Gym of Vada

At the Municipal Gym "Matthew Peaks", located in the village Lillatro Vada, was installed a solar thermal system in 2007/08 with the aim of integrating the production of hot water necessary for the sports facility.

The system is forced circulation consists of solar panels and vacuum type solar CPC with a total area of 36 m². The solar collectors are placed on the flat roof of the sport structure at an angle of 30° from horizontal and facing south. The solar system has a storage system that integrates the activities of the thermal power plant methane. Considering that the sports facility remains closed for the month of August, during the planning phase it was estimated that the plant characteristic data in terms of energy and CO₂ emissions avoided are the following:

Building	action	energy	CO₂ saved
Municipal Gym	Solar plant 36 m ²	31.200 kWh/year	6,4 ton/year

Go Solar Thermal Pool

At the municipal swimming pool located in La Mazzanta Vada, was installed a solar thermal system in 2007/08 with the aim of integrating the production of heated water for the pool.

The system is forced circulation and consists of solar panels SCHUCO, hybrid type of flat plate collector and vacuum manifold. The solar collectors are placed on the flat roof of the sport structure at an angle of 30° from horizontal and facing south. The total solar surface is 10 m². The solar system has no storage, so the contribution to the existing LPG boiler is given directly through a heat exchanger.

Installed the solar surface can not of course to cover the entire heat demand of the pool. The size of the system has depended on technical and economic factors. Considering that the sports facility will be closed for two summer months in the planning phase it was estimated that the plant characteristic data in terms of energy and CO₂ emissions avoided are the following:

Building	action	energy	CO₂ saved
Municipal swimming pool	Solar plant 10 m ²	15.000 kWh/year	3,5 ton/year

Photovoltaic Schools

In July 2009 they began the work on a No 7 as many solar systems on schools of the municipality. The total installed power is 102 kWp, divided as follows:

school building	address	power installed
1. Scuola Fattori	P.za Risorgimento – Solvay	19,32 kW
2. Scuola Solvay	V.le Solvay – Solvay	19,32 kW
3. Scuola Ciari	Via XX Giugno 1944 – Vada	16,56 kW
4. Scuola Pertini	Via del Chiappino - Castelnuovo M.dia	5,52 kW
5. Scuola Carducci	P.za Carducci - Rosignano M.mo	5,52 kW
6. Scuola Europa	Via del Popolo – Solvay	16,56 kW
7. Scuola Novaro	V.le Italia – Vada	19,32 kW

As elaborated in the design phase, as reported in the technical report, have been estimated annual production of electricity for each plant and the resulting environmental benefit in terms of CO₂ avoided. Below, for each plant, these values:

SCHOOL	POWER	ENERGY PRODUCTION	CO₂ SAVED
		PER YEAR	
1. Scuola Fattori	19,32 kW	23.565 kWh/anno	17,7
ton/anno			
2. Scuola Solvay	19,32 kW	24.200 kWh/anno	18,2
ton/anno			
3. Scuola Ciari	16,56 kW	19.685 kWh/anno	14,7
ton/anno			

4. Scuola Pertini ton/anno	5,52 kW	6.985 kWh/anno	5,2
5. Scuola Carducci ton/anno	5,52 Kw	6.625 kWh/anno	5
6. Scuola Europa ton/anno	16,56 kW	20.710 kWh/anno	15,5
7. Scuola Novaro ton/anno	19,32 kW	24.310 kWh/anno	18,2
<i>Totale</i> <i>ton/anno</i>	<i>102,12 kW</i>	<i>126.080 kWh/anno</i>	<i>94,5</i>

LIST OF INTERVENTIONS CARRIED OUT BY CITIZENSHIP IN THE MATTER OF ENERGY SAVINGS:

ENEA FOR OPERATIONS TO DEDUCT 55%
 EALP INSTALLED FOR SOLAR THERMAL
 GSE FOR PHOTOVOLTAIC SYSTEMS INSTALLED AND IAFR
 DIA COMMON TO HAVE A PLANT RES

It contains a summary of the amount of avoided CO₂ in the atmosphere, for the moment on only interventions, the City of Rosignano M.mo.

STRUTTURA	INTERVENTO	ENERGIA kWh/anno	CO₂ ton/anno
Scuola Fattori	Sostituzione infissi	71.480	14,7
Palestra Comunale	ST da 36 m ²	31.200	6,4
Piscina Comunale	ST da 10 m ²	15.000	3,5
Scuola Fattori	FV da 19,32 kW	23.565	17,7
Scuola Solvay	FV da 19,32 kW	24.200	18,2
Scuola Ciari	FV da 16,56 kW	19.685	14,7
Scuola Pertini	FV da 5,52 kW	6.985	5,2
Scuola Carducci	FV da 5,52 kW	6.625	5
Scuola Europa	FV da 16,56 kW	20.710	15,5
Scuola Novaro	FV da 19,32 kW	24.310	18,2
<i>Totale</i>		<i>243.760</i>	<i>119,10</i>

Public Lighting

In 2008, the lamps have been replaced public lighting, to Mercury, with lighting to sodium vapor.

The details of the intervention are available at the offices of the City of Rosignano M.mo and, for the moment not yet included in this report.