



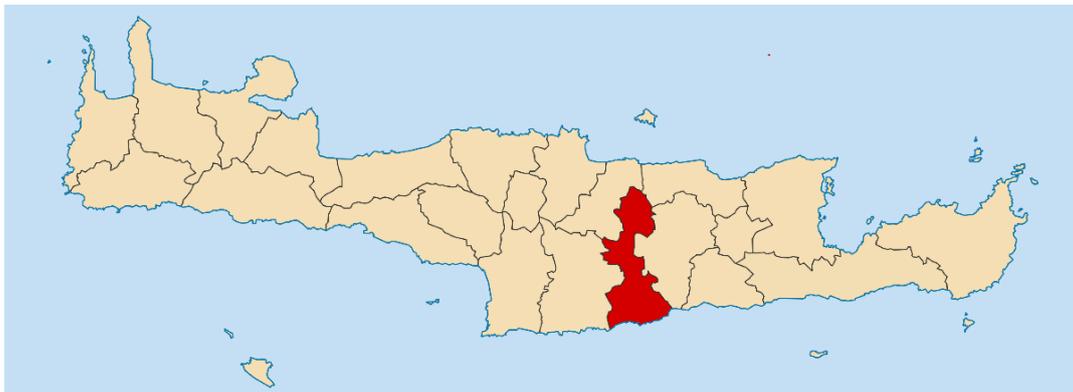
**MedStrategy Project
Integrated Strategy for Sustainable Development
of Mediterranean Rural Areas
Project reference no.: 2G-MED09-282**

**C3 – TERRITORIES AND INSTITUTIONS:
Diagnosis and ex ante evaluation**

**Phase 1 – Integrated Territorial Analysis in relation to
the three sustainability dimensions**

**“Framework Document of the
criticalities of local territorial context”**

**Pilot area: Archanon-Asterousion Municipality,
Prefecture: Heraklion, Crete (Greece)**



Archanon- Asterousion Municipality



**ΚΑΠΕ
CRES** | CENTRE FOR RENEWABLE
ENERGY SOURCES AND SAVING

May 2012

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1 INTRODUCTION

1.1 Characterization of the economic and territorial context

1.1.1 Total surface of the area

Greece is a relatively small European country with an area of 132.000 km² and a population of about 11,3 million inhabitants [*Eurostat, 2008, a new populations census is being currently conducted*].

Located in the South-East Mediterranean, at a strategic cross road between Europe, Africa and Asia (see **Fig. 1.1**), Crete is the largest Greek island and the fifth largest island of the Mediterranean [*Innovative Regions in Europe, RITTS Crete, 12 Aug 2009, www.wikipedia.org*]. The region of Crete is divided into four prefectures: the prefecture of Heraklion, the prefecture of Chania, the prefecture of Rethymnon and the prefecture of Lassithi. Heraklion is the capital and largest city of the island, followed by Chania. The total area of the island is 8.336 km² [*www.wikipedia.org*]. It is predominantly mountainous with three-fifths of its area lying 200m above sea level. A mountain range extends from east to west with peaks above 2000m [*H.Briassoulis, Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism? J. Sust. Tourism, 11:2, 97-115*].

The pilot area under examination used to be called **N.Kazantzakis Municipality**, named after the great Greek writer and philosopher Nikos Kazantzakis. It is only recently (Greek Government Gazette No. B1292, 11/08/2010) that its name changed to Archanon-Asterousion Municipality following the law on "the restructuring of local government bodies and decentralised administration – the Kallikratis Programme", which was adopted in the Hellenic Parliament in June 2010 (law 3852/2010) and made substantive changes to Greece's administrative structure. More specifically, the "new" Archanon-Asterousion Municipality was the result of the union of 3 former Municipalities, the N.Kazantzakis Municipality, the Asterousion Municipality and the Archanon Municipality (for that reason, many statistical data which follow are presented for each of the 3 former Municipalities).

The Archanon – Asterousion Municipality is located in the center of the Prefecture of Heraklion. It is crossed by the main roads of the Prefecture (Heraklion – Viannos, Heraklion – Pyrgos and Heraklion – Kastelli), and this fact, in combination with the rich rural production of the area, the magnificent environment and the mild climate conditions provide the area with a high development potential. The total area of the Archanon-Asterousion Municipality is **335,38 km²** [*www.dimos-archanon-asterousion.gr*].



Fig. 1.1 Location of Crete island [E.Michalena, V.angeon / *Energy Policy* 37(2009) 2018-26]

1.1.2 Resident population trend

The 603,000 inhabitants of Crete island account for 5.5% of the Greek population (census of 2001). In the municipality of Archanon-Asterousion the population is **18.022 inhabitants** [Hellenic Statistical Authority, *census of 2001*].

1.1.3 Population density

The population density of Greece is about 79 inhabitants /km², almost half of the EU average and can be explained based on the fact that a large part of the country consists of small-populated islands (over 100) and mountainous areas, with thousands of communities up to 200-300 inhabitants, while almost 50% of the population live in the 2 biggest cities, Athens and Thessaloniki [Waste management market in Greece: a phase of change, by Mavropoulos Antonios, Head of SWM Dept. of EPEM SA].

As mentioned before, the island of Crete is divided into four prefectures with the following population density:

- Heraklion (294.312 inhabitants)
- Lassithi (75.903 inhabitants)
- Rethymnon (81.871 inhabitants)
- Chania (149.163 inhabitants) [www.interkriti.org]

The population of the island grew by 31.65% between 1971 and 2001. The prefectures of Heraklion and Rethymnon exhibited the highest growth rates, 40.36% and 34.12% respectively. Population change resulted from natural increase and the reversal of outmigration trends that occurred in the 1950s and 1960s. Internal migration contributed to urbanization of its major towns. Migrants from the Middle East, Balkan and Eastern European

countries have also settled in the island [H.Briassoulis, *Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism?* *J. Sust. Tourism*, 11:2, 97-115]. In a graphic way, the population density in the different Municipalities of the island can be seen below:

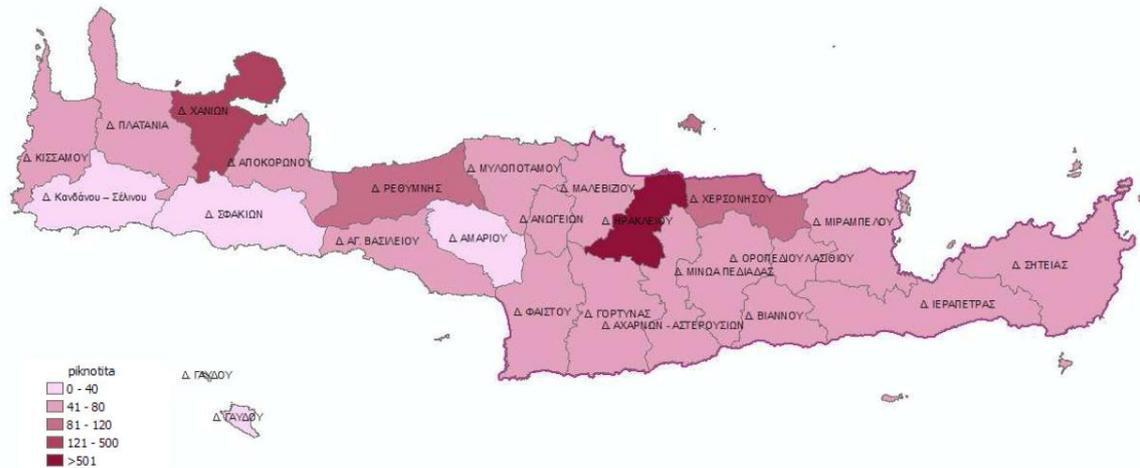


Fig. 1.2 Population density in the different Municipalities of Crete [V.Mpoura, Diploma Thesis, Topic “Determination of Water Resources Management Systems in Crete”, Supervisor: Professor Georgios Tsakiris, Athens, July 2010].

As it is obvious, the Archanon-Asterousion Municipality presents an average population density compared to the rest of the Cretan Municipalities, which corresponds to $\sim 71,5$ inhabitants/km² [V.Mpoura, Diploma Thesis, Topic “Determination of Water Resources Management Systems in Crete”, Supervisor: Professor Georgios Tsakiris, Athens, July 2010]. It should also be mentioned that 42.5% of the Cretan population is urban, 12.5% suburban and 45% rural (see **Fig. 1.3**) [www.interkriti.gr]. It should be noted that the urban-rural composition of Crete island’s population changed from 55.76% rural and 44.24% semi-urban and urban in 1971 to 46.2% rural and 53.8% semi-urban and urban in 1991. By the end of the 1990s, inequalities in the urban-rural composition among the four prefectures had diminished [H.Briassoulis, *Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism?* *J. Sust. Tourism*, 11:2, 97-115].

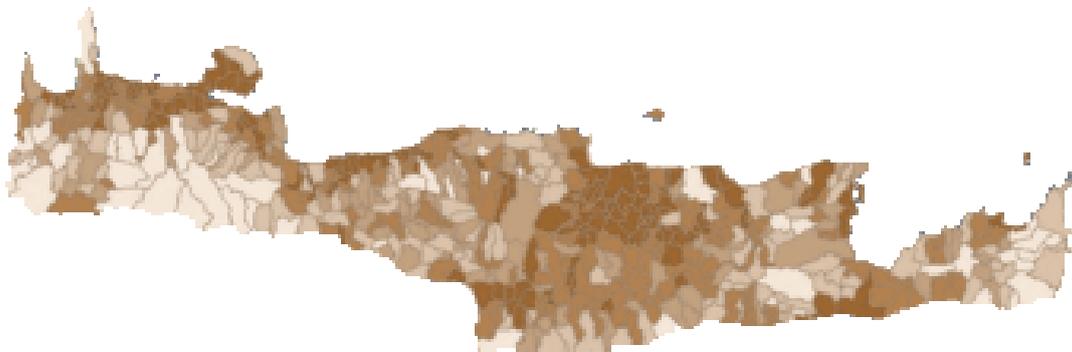


Fig. 1.3 Population density in the island of Crete (urban, suburban and rural) [www.interkriti.org].

The territory of Archanon-Asterousion Municipality includes 59 communities in the Prefecture of Heraklion. The main villages of the Municipality can be seen in the following graph:

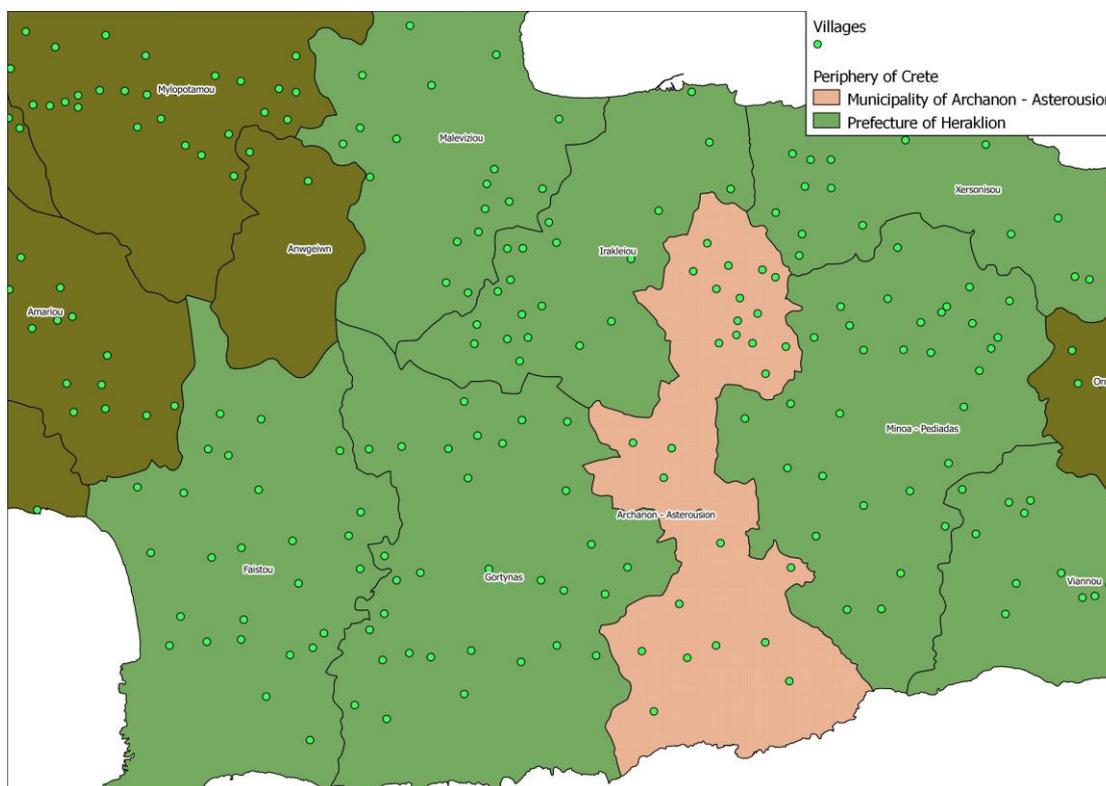


Fig. 1.4 Communities distribution in Archanon-Asterousion Municipality (GIS software used).

The distribution of population in the 59 communities of the Archanon-Asterousion can be seen in the following Table:

Municipal Department of Archanes	3.866
Epano Archanai	3.824
Vathypter	24
Karnari	18
Municipal Department of Kato Archanes	631
Kato Archanai	395
Ampela	60
Kera Elaioussa	15
Patsides	161
Municipal Department of Pyrgos	1.129
Pyrgos	1.087
Mournia	33
Prinias	9
Municipal Department of Achentrias	306
Achentrias	283
Aghia Paraskevi	12
Aghios Panteleimon	11
Municipal Department of Ethia	337
Rotassion	305

Aghia Anna	4
Ethia	28
Municipal Department of Kalyvia	407
Kalyvia	217
Kato Kalyvia	5
Neochorion	185
Municipal Department of Ligortynos	604
Ligortynos	458
Kefalados	37
Plakiotissa	109
Municipal Department of Messochorion	707
Messochorion	707
Municipal Department of Paranymfoi	312
Paranymfoi	214
Amygdalos	43
Platanias	15
Treis Ekkhsies	40
Municipal Department of Praitoria	196
Praitoria	196
Municipal Department of Tefelion	824
Tefelion	644
Aposelemion	26
Pyrathion	154
Municipal Department of Charakion	346
Charakion	254
Vorias	74
Made	18
Municipal Department of Charakas	847
Charakas	798
Aghia Fotia	18
Dorakion	31
Municipal Department of Aghiai Paraskiai	1.022
Aghiai Paraskiai	953
Kellia	69
Municipal Department of Aghios Vassileios	421
Aghios Vassileios	421
Municipal Department of Alagnion	250
Alagnion	250
Municipal Department of Astrakoi	228
Astrakoi	228
Municipal Department of Astritsion	359
Astritsion	359
Municipal Department of Damania	317
Damania	169
Arkadion	51
Melidochorion	97
Municipal Department of Kalloni	287
Kalloni	287
Municipal Department of Katalagarion	299
Katalagarion	299
Municipal Department of Kounavoi	855
Kounavoi	855

Municipal Department of Melesai	395
Melesai	302
Filisia	93
Municipal Department of Metaxochorion	674
Metaxochorion	509
Armanogeia	123
Moni Aghiou Georgiou Epanosifi	23
Parthenion	19
Municipal Department of Myrtia	640
Myrtia	640
Municipal Department of Peza	408
Peza	408
Municipal Department of Choudetsion	864
Choudetsion	864
TOTAL	17.531

Table 1.1(a), (b) and (c). Population distribution in the different communities of Archanon-Asterousion Municipality.

1.1.4 Resident population by ages

Being part of the aging phenomenon of Europe, the Greek population shows a rapid increase of the percentage of the elderly people (the percentage of 65+ inhabitants was 10.9% in 1961 and increased to 16.7% in 2001. on the contrary, the percentage of the 0-14 population had a total decrease of 10.2% between 1961 (25.4%) and 2001 (15.2%)) [www.wikipedia.org].

In the following table the population distribution by ages of the former N.Kazantzakis, Archanon and Asterousion Municipalities can be seen (census of 2001):

N.KAZANTZAKIS MUNICIPALITY			
Age groups	2001 Resident Population		
	Total	Men	Women
Total	7.019	3.566	3.453
0-4 y	291	134	157
5-9 y	312	173	139
10-14 y	373	204	169
15-19 y	432	217	215
20-24 y	538	322	216
25-29 y	479	298	181
30-34 y	465	243	222
35-39 y	365	202	163
40-44 y	383	193	190
45-49 y	389	169	220
50-54 y	471	241	230
55-59 y	424	194	230
60-64 y	486	234	252
65-69 y	505	248	257
70-74 y	499	238	261
75-79 y	278	126	152
80-84 y	201	73	128
> 85 y	128	57	71

ARCHANON MUNICIPALITY			
Age groups	2001 Resident Population		
	Total	Men	Women
Total	4.497	2.263	2.234
0-4 y	228	114	114
5-9 y	206	113	93
10-14 y	267	149	118
15-19 y	295	155	140
20-24 y	337	166	171
25-29 y	320	181	139
30-34 y	358	187	171
35-39 y	268	124	144
40-44 y	273	134	139
45-49 y	256	132	124
50-54 y	308	149	159
55-59 y	248	115	133
60-64 y	248	123	125
65-69 y	248	124	124
70-74 y	262	123	139
75-79 y	161	76	85
80-84 y	121	60	61
> 85 y	93	38	55

ASTEROUSION MUNICIPALITY			
Age groups	2001 Resident Population		
	Total	Men	Women
Total	6.015	3.109	2.906
0-4 y	277	149	128
5-9 y	271	138	133
10-14 y	317	180	137
15-19 y	328	175	153
20-24 y	387	219	168
25-29 y	420	263	157
30-34 y	320	178	142
35-39 y	276	147	129
40-44 y	306	163	143
45-49 y	308	142	166
50-54 y	404	203	201
55-59 y	404	201	203
60-64 y	478	215	263
65-69 y	509	254	255
70-74 y	416	205	211
75-79 y	277	137	140
80-84 y	175	75	100
> 85 y	142	65	77

Table 1.2(a), (b) and (c). Population distribution by ages of the former N.Kazantzakis, Archanon and Asterousion Municipalities which form Archanon-Asterousion Municipality today.

1.1.5 Resident population by level of education

The education and research institutions of Crete benefit from international recognition. During the last 2 decades, the University of Crete (in Herakleion and Rethymnon, founded in the 1980s) and various of its research institutes have experienced a rapid development. New high-tech firms have been set up and opportunities for new types of scientific services have also emerged. The University of Crete is active in technology transfer. The research institutes provide further technology support. The Foundation for Research and Technology Hellas (FORTH) is one of the largest research centers in the country with 5 institutes in Crete. FORTH runs the Science and Technology Park of Crete, which is a new tool for technology transfer and exploitation of research results. The region is one of the best endowed in Greece, outside the capital, in terms of rich and modern R&D infrastructure. Interaction between industry and research organizations is, however, very limited [*Innovating Regions in Europe, RITTS Crete, 12 Aug 2009*].

The resident population distribution by level of education to the 3 Municipalities which form the current Archanon-Asterousion Municipality can be seen in the following tables:

ARCHANON MUNICIPALITY			
Level of education and age groups	2001 Resident Population		
	Total	Men	Women
Total	4.063	2.036	2.027
Master-PhD holders	17	14	3
10-19 y	0	0	0
20-24 y	1	1	0
25-29 y	4	4	0
30-44 y	9	6	3
45-64 y	3	3	0
> 65 y	0	0	0
University Graduates	232	112	120
10-19 y	0	0	0
20-24 y	14	3	11
25-29 y	33	12	21
30-44 y	109	47	62
45-64 y	62	38	24
> 65 y	14	12	2
Technical School Graduates	67	23	44
10-19 y	0	0	0
20-24 y	2	1	1
25-29 y	19	4	15
30-44 y	37	15	22
45-64 y	8	3	5
> 65 y	1	0	1
Colleges Graduates	136	47	89

10-19 y	2	0	2
20-24 y	47	12	35
25-29 y	31	12	19
30-44 y	30	11	19
45-64 y	23	12	11
> 65 y	3	0	3
High school Graduates	748	359	389
10-19 y	76	31	45
20-24 y	150	64	86
25-29 y	105	58	47
30-44 y	281	130	151
45-64 y	98	57	41
> 65 y	38	19	19
Gymnasium Graduates	450	252	198
10-19 y	168	91	77
20-24 y	57	40	17
25-29 y	41	29	12
30-44 y	102	58	44
45-64 y	55	23	32
> 65 y	27	11	16
Elementary Education Graduates	1.730	912	818
10-19 y	220	128	92
20-24 y	61	41	20
25-29 y	81	56	25
30-44 y	317	171	146
45-64 y	662	325	337
> 65 y	389	191	198
They know how to read and write	481	240	241
10-19 y	96	54	42
20-24 y	2	1	1
25-29 y	2	2	0
30-44 y	8	3	5
45-64 y	113	47	66
> 65 y	260	133	127
Unlettered (they don't know how to read and write)	202	77	125
10-19 y	0	0	0
20-24 y	3	3	0
25-29 y	4	4	0
30-44 y	6	4	2
45-64 y	36	11	25
> 65 y	153	55	98

ASTEROUSION MUNICIPALITY			
Level of education and age groups	2001 Resident Population		
	Total	Men	Women
Total	5.467	2.822	2.645
Master-PhD holders	4	3	1
10-19 y	0	0	0

20-24 y	0	0	0
25-29 y	2	2	0
30-44 y	2	1	1
45-64 y	0	0	0
> 65 y	0	0	0
University Graduates	155	105	50
10-19 y	0	0	0
20-24 y	16	8	8
25-29 y	22	15	7
30-44 y	61	42	19
45-64 y	46	32	14
> 65 y	10	8	2
Technical School Graduates	63	33	30
10-19 y	0	0	0
20-24 y	10	5	5
25-29 y	19	14	5
30-44 y	22	9	13
45-64 y	11	4	7
> 65 y	1	1	0
Colleges Graduates	86	40	46
10-19 y	2	0	2
20-24 y	30	9	21
25-29 y	21	12	9
30-44 y	20	10	10
45-64 y	13	9	4
> 65 y	0	0	0
High school Graduates	716	408	308
10-19 y	82	38	44
20-24 y	160	92	68
25-29 y	128	73	55
30-44 y	236	132	104
45-64 y	84	55	29
> 65 y	26	18	8
Gymnasium Graduates	649	363	286
10-19 y	207	105	102
20-24 y	94	51	43
25-29 y	101	66	35
30-44 y	144	75	69
45-64 y	83	53	30
> 65 y	20	13	7
Elementary Education Graduates	2.499	1.393	1.106
10-19 y	242	148	94
20-24 y	69	50	19
25-29 y	120	78	42
30-44 y	395	208	187
45-64 y	1.088	532	556
> 65 y	585	377	208
They know how to read and write	793	359	434
10-19 y	110	62	48
20-24 y	4	2	2
25-29 y	2	1	1
30-44 y	9	3	6

45-64 y	178	59	119
> 65 y	490	232	258
Unlettered (they don't know how to read and write)	502	118	384
10-19 y	2	2	0
20-24 y	4	2	2
25-29 y	5	2	3
30-44 y	13	8	5
45-64 y	91	17	74
> 65 y	387	87	300

N.KAZANTZAKIS MUNICIPALITY			
Level of education and age groups	2001 Resident Population		
	Total	Men	Women
Total	6.416	3.259	3.157
Master-PhD holders	13	11	2
10-19 y	0	0	0
20-24 y	1	0	1
25-29 y	3	3	0
30-44 y	5	4	1
45-64 y	3	3	0
> 65 y	1	1	0
University Graduates	167	90	77
10-19 y	0	0	0
20-24 y	9	2	7
25-29 y	26	9	17
30-44 y	88	46	42
45-64 y	34	27	7
> 65 y	10	6	4
Technical School Graduates	101	63	38
10-19 y	0	0	0
20-24 y	19	11	8
25-29 y	24	15	9
30-44 y	39	26	13
45-64 y	14	7	7
> 65 y	5	4	1
Colleges Graduates	165	86	79
10-19 y	5	4	1
20-24 y	56	24	32
25-29 y	32	15	17
30-44 y	46	24	22
45-64 y	22	15	7
> 65 y	4	4	0
High school Graduates	1.021	569	452
10-19 y	99	40	59
20-24 y	213	118	95
25-29 y	188	118	70
30-44 y	333	175	158
45-64 y	157	95	62
> 65 y	31	23	8
Gymnasium Graduates	742	407	335

10-19 y	271	133	138
20-24 y	106	66	40
25-29 y	96	56	40
30-44 y	170	96	74
45-64 y	83	45	38
> 65 y	16	11	5
Elementary Education Graduates	2.918	1.511	1.407
10-19 y	286	165	121
20-24 y	124	94	30
25-29 y	103	77	26
30-44 y	494	240	254
45-64 y	1.173	552	621
> 65 y	738	383	355
They know how to read and write	922	422	500
10-19 y	142	78	64
20-24 y	6	5	1
25-29 y	1	1	0
30-44 y	13	9	4
45-64 y	204	73	131
> 65 y	556	256	300
Unlettered (they don't know how to read and write)	367	100	267
10-19 y	2	1	1
20-24 y	4	2	2
25-29 y	6	4	2
30-44 y	25	18	7
45-64 y	80	21	59
> 65 y	250	54	196

Table 1.3(a), (b) and (c). Population distribution by level of education of the former N.Kazantzakis, Archanon and Asterousion Municipalities which form Archanon-Asterousion Municipality today.

As expected based on the fact that the Archanon-Asterousion Municipality is a rural Municipality, most of the inhabitants are not highly educated (they are most of them gymnasium and/or high school graduates).

1.1.6 Gross Domestic Product

Greece is a developed country and its economy is ranked 24th by nominal GDP. During the past years (1996-2006) its GDP was increasing –despite some big fluctuations (see **Fig. 1.5**). In 2009 the reported value of GDP per head of population was USD 29 724

[<http://stats.oecd.org/Index.aspx?DataSetCode=DECOMP>].

In Crete the 1991 GDP was 3.48% up compared to 1981 at 23.610 million Drs, 4.77% of the national GDP and unemployment was 5.545% (8.805% national average). In 1997 unemployment dropped to 4.6%, well below the national average (10.3%). Herakleion produced 51.1% of the island's GDP (census of 2001).

However, following the recent economic crisis and latest data, the macroeconomic environment has deteriorated. In the 4th quarter of 2009, real GDP decreased by 2.6% in comparison to the 4th quarter of 2008 and the carry-over effect for 2010 is -0.9%. There is little doubt that the reduction of the disposable income of households –linked to the reduction

in wages and salaries of the public sector employees and the worsening macroeconomic environment, reduced employment opportunities, tight credit market conditions and deteriorating market sentiment- is likely to reduce real consumption expenditures in 2011 as well [Ministry of Finance, March 2010 Report to the implementation of the Hellenic Stability and Growth Programme and Additional Measures in response to Council Decision 6147/10].



Fig. 1.5 GDP Growth of Greece compared to the Eurozone between 1996 and 2006 (www.wikipedia.org).

The economic growth of Crete has been based almost exclusively on the island’s natural resources through agriculture and tourism [Innovating Regions in Europe, RITTS Crete, 12 Aug 2009]. The GRP (Gross Regional Product) of Crete residents comes to a percentage of 10.7% from the primary sector (agriculture), to a percentage of 11.1% from the secondary (industry-handicraft, SMEs), and the rest (78.2%) comes from the tertiary one (tourism, commerce, services) [N.Zografakis, Regional Energy Agency of Crete, RE-Islands Conference, Eur. Programme ALTENER “European Renewable Energy Islands, Brussels, 21/9/2005].

1.1.7 Employment and unemployment rates

Although employment grew by 5.79% to 199.475 persons between 1981 and 1991 in Crete, today unemployment rate keeps increasing in Greece because of the economic crisis (in December 2010 it was 14.7% compared to 10.2% in December 2009, see also **Fig. 1.6**). The number of employed amounted to 4,233,765 persons while the number of unemployed amounted to 733,645 and the number of inactive to 4,353,149 [Hellenic Statistical Authority, Press release, Labour Force Survey, December 2010].

In Crete, the primary sector is concentrated on agricultural products such as olive oil, fruits and vegetables, while manufacturing mainly concerns foods and drinks. As far as services are concerned, tourism is by far the key sector with the island receiving almost 3 million visitors per year [Innovating Regions in Europe, RITTS Crete, 12 Aug 2009]. The unemployment rate evolution in the period December 2005-December 2010 is as following:

Region	December					
Year	2005	2006	2007	2008	2009	2010
Crete	8.2	7.9	6.6	11.2	10.8	14.3

Table 1.4. Unemployment rate evolution in Crete [Hellenic Statistical Authority, Press release, Labour Force Survey, December 2010].

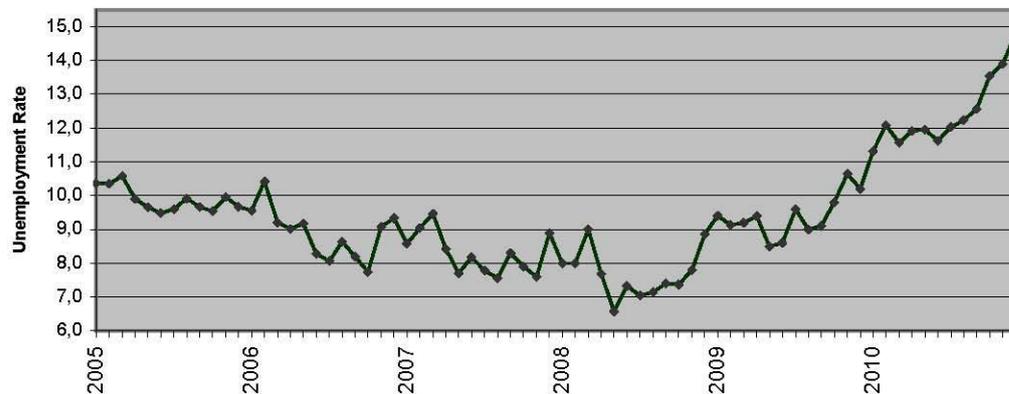


Fig. 1.6 Unemployment rate evolution in Greece by month (January 2005- December 2010)

The distribution of population in the 3 Municipalities forming the Archanon-Asterousion Municipality into economically active and inactive can be seen in the following 3 Tables:

N.KAZANTZAKIS MUNICIPALITY					
Sex and age groups	2001 resident population				
	Economically active population	Economically active			Economically inactive population
		Working	Unemployed	Young unemployed	
Total	2.932	2.707	85	140	3.484
Men	1.900	1.771	47	82	1.359
10-19 y	60	34	1	25	361
20-24 y	251	217	1	33	71
25-29 y	272	244	10	18	26
30-44 ετών	591	567	18	6	47
45-64 y	630	613	17	0	208
65+ y	96	96	0	0	646
Women	1.032	936	38	58	2.125
10-19 y	17	7	0	10	367
20-24 y	116	77	8	31	100
25-29 y	117	103	5	9	64
30-44 y	346	328	11	7	229

45-64 y	416	401	14	1	516
65+ y	20	20	0	0	849

Asterousion Municipality					
Sex and age groups	2001 resident population				
	Economically active population	Economically active			Economically inactive population
		Working	Unemployed	Young unemployed	
Total	2.972	2.777	56	139	2.737
Men	1.867	1.743	36	88	1.083
10-19 y	58	32	1	25	320
20-24 y	186	151	3	32	44
25-29 y	264	232	9	23	17
30-44 y	522	504	10	8	13
45-64 y	693	680	13	0	103
65+ y	144	144	0	0	586
Women	1.105	1.034	20	51	1.654
10-19 y	22	12	0	10	289
20-24 y	107	77	3	27	82
25-29 y	126	119	1	6	55
30-44 y	334	317	9	8	122
45-64 y	482	475	7	0	367
65+ y	34	34	0	0	739

Archanon Municipality					
Sex and age groups	2001 Resident population				
	Economically active population	Economically active			Economically inactive population
		Working	Unemployed	Young unemployed	
Total	2.098	1.990	11	97	2.012
Men	1.258	1.209	4	45	805
10-19 y	33	24	0	9	272
20-24 y	136	115	1	20	37
25-29 y	177	164	2	11	11
30-44 y	437	431	1	5	17
45-64 y	444	444	0	0	82
65+ y	31	31	0	0	386
Women	840	781	7	52	1.207
10-19 y	18	11	0	7	251
20-24 ετών	103	69	1	33	71
25-29 y	100	89	2	9	42
30-44 y	336	330	3	3	119
45-64 y	276	275	1	0	264
65+ y	7	7	0	0	460

Table 1.5(a), (b) and (c). Resident population distribution to economically active and inactive.

1.1.8 Archeology, architectural and cultural heritage

Taking into account the profile of the area, which combines some special characteristics (strategic geographic location, highly productive land and a landscape of special natural beauty) two large cities called Eltina and Diatonion, thrived during the ancient times. Very important monuments that came into light through archaeological excavations revealed the importance of the area during the ancient and prehistoric periods. Nikos Kazantzakis (1883-1957), arguably the most important Greek writer and philosopher of the 20th century, was born here. His novel *Zorba the Greek* was adapted into a successful film in 1964 as well as a musical, *Zorba*, in 1968. The Nikos Kazantzakis Museum, in the central square of the historical village of Varvari, pays tribute to the important author. The Museum has quite literally become a site of worldwide interlectual pilligram [<http://www.agrieliavilla.gr/nikos-kazantzakis.php>]. Moreover, based on the study «*Investigation of past archaeological landscapes using remote sensing and GIS: a multi-method case study from Mount Ida*», the importance of the area in ancient time can be depicted in the following graph:

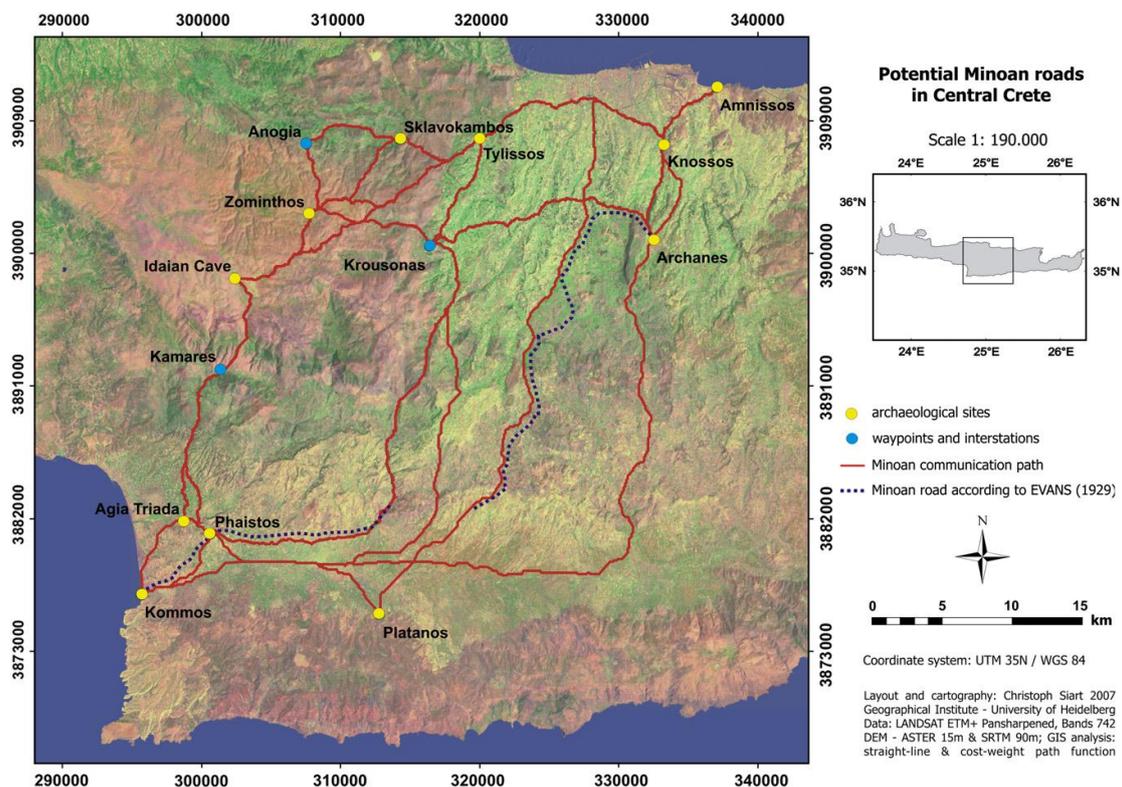


Fig. 1.5. Potential Minoan roads in Central Crete.

It is clear that the so called "Minoan Highway" leading from Knossos to Kommos passes through Archanes.

2 SETTLEMENT SYSTEM

2.1 Introduction

Preface / Preliminary remarks

2.1.1 Land take

In the absence of previously implemented planning legislation, most of post-World War II urban development in Greece was uncontrolled. More recently, in the period 1990-2000, the increase in artificial areas (+13.8%) was the most significant land cover change in Greece, corresponding to increased urban areas. However, in 2000, dense urban areas still occupied a small portion of the whole Greek territory (just over 2%).

The extension of urban activities beyond designated urban zones, illegal construction in coastal areas, on burned forest land and along major highways remain persistent concerns, causing problems such as traffic congestion, urban sprawl, a lack of communal and green space, and damages to sensitive natural areas. The economic drivers that can be mentioned are the development of services, the development of tourist destinations (including summer houses) and the modernisation and extension of transport infrastructures. The changes mostly occurred at the expense of agricultural and pasture land close to urban centre and coastal areas [http://www.eea.europa.eu/soer/countries/gr/soertopic_view?topic=land].

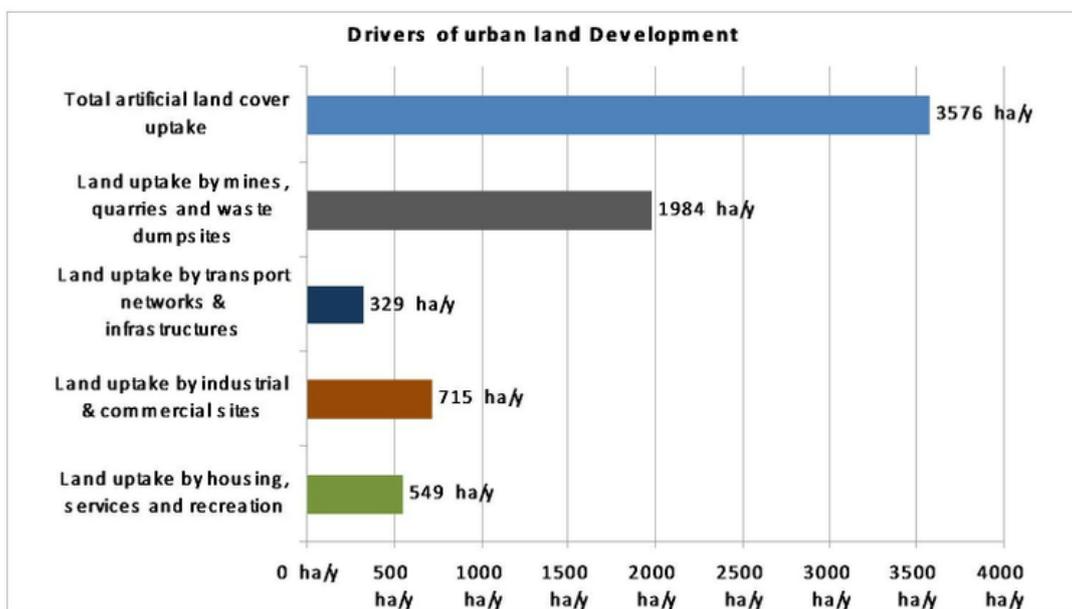


Fig. 2.1 Annual land take by several types of human activity in Greece (Data source: LEAC DB, EEA, 2010a, b).

2.1.2 Local tools and plans on urban and territorial planning

In Greece, it was not until the second half of the 20th century when spatial planning was developed as a distinct speculation and an independent topic. In 1949 the first four-year Growth Plan was designed (1949-1952). Beyond the particular plan, the pressure of the housing problem

contributed to the promotion of investments in construction. In the period 1950-1963 some basic infrastructure works were carried out. In parallel (1958-65) services with clearly programmatic responsibilities were created in the Ministry of Coordination and the first special regional programs were prepared. The Direction of Spatial Planning of the Centre of Planning and Economic Research was founded in 1964 and the first 5-year programs for economic growth of the country were worked out. After 1963 the Ministry of Coordination assigned to private offices the first Urban Master plans and in 1965 the Special Department for the Study of the Master plan of Athens was founded. In the '60s an extensive production of important studies and proposals about urban and regional growth took place, introducing the concepts of regional growth, spatial planning and regulatory plans of urban complexes.

However, despite these efforts, the institutional background on which the governmental practices were based upon, continued to be characterized by the minimal presence of measures for the application of special planning and the perception of fragmentary regulation of space, in a local urban level. All efforts were interrupted during the period of the septennial dictatorship, where even more fragmentary measures, based on the satisfaction of small land owners, were adopted.

The end of dictatorship (1974) found the Greek territory, urban centres and countryside, in a new urban and regional situation. ***In the revised Constitution of 1975, concepts of spatial and urban planning were presented for the first time.*** The first main Law for spatial planning was voted within the Law 360/1976 and Law 947/79 about "Residential Areas", replaced by 1337/83 (Extension of Urban Plans, residential development and related regulations) followed. In 1980 the Ministry of Spatial Planning, Housing and Environment was founded, renamed to Ministry for the Environment, Physical Planning and Public Works in 1985. In 1983, the elaboration of General Urban Plans began for almost all the big Greek cities. The planning of places for residential houses began as well a little later, and at the same time the regulation of smaller cities was also attempted.

At the end of the '80s, the development of Special Spatial Planning Studies began and was the only form of active small scale spatial planning in Greece. During the period 1987-1990, the development of 17 Special Spatial Planning Studies for the whole country was assigned by the Ministry of Environment, Physical Planning and Public Works, and after 1990 the second generation of Special Spatial Planning Studies followed (roughly 30), financed via the ENVIREG Program.

In the '90s and '00s powerful institutional frameworks for urban and spatial planning were established. During that period, new, strong pressures arose, because of the transition from a basically rural model to a multidimensional urbanisation model. The current situation of many regions of the country can not satisfy the modern enterprising and environmental requirements. In 1999, with the Law 2742/00 (Spatial Planning & Sustainable Development) a comprehensive modern institutional framework for spatial planning came to force in Greece, establishing authorities, bodies, processes and means of applying spatial planning, aiming at the promotion of sustainable and balanced development, social cohesion, protection of the environment and the

empowerment of the country's position in the international and European environment. In 2002-2003 the Regional Frameworks of spatial planning for all the regions of the country (except Attica-Athens) were enacted, after public consultation and their approval by the regional councils [*Spatial planning and regional development of Greece by Evangelos Baltas*].

2.1.3 Housing stock

In Greece the average household-dwelling surface is about 80m² and is inhabited by 2.8 persons. Buildings which are not being used as residents represent 5% of the total buildings and 26% of the total surface of the building stock. The uses of non-residential buildings are as following: about 57% are office buildings and/or buildings of commercial use, 19% educational buildings, 16% hotels and about 8% hospitals and clinics [<http://www.ecofinder.gr/news>]. Latest statistics (2001) have revealed the following numbers at national level:

- Total dwellings: 4,381,317
- Vacant household dwelling units in urban areas: 1,439,041
- Vacant household dwelling units in rural areas: 762,962
- Inhabited household dwelling units in urban areas: 2,643,500
- Inhabited household dwelling units in rural areas: 881,605
- Temporarily absent in urban areas: 421,126
- Temporarily absent in rural areas: 69,617
- Largest group of occupants per household: 2 per household at 743,761 dwellings followed by 3 member and then 4 member households
- Largest category of dwellings in surface area in urban areas: 75-99 m²
- Largest category of dwellings in surface area in rural areas: 50-74 m²

The next census is about to start (3/2011)

[www.statistics.gr/portal/page/portal/ESYE].

2.1.4 Local rules on the energy certification of buildings

In Greece, building codes and regulations are produced centrally by the responsible Ministry and are applied at a national level. The first legislative step towards energy efficient buildings was made in 1979 with the enforcement of the Thermal Insulation Regulation (Official Hellenic Journal – OHJ 362/4-7-79). A few additional laws and regulations aiming to promote the rational use of energy and reduce harmful emissions were introduced in the following years (OHJ 143/A/2-9-93, OHJ A114/7-7-94). In 2008 the law 3661 (OHJ 89/A/19.5.2008), "Measures for the reduction of energy consumption in buildings" was voted, aiming at the implementation of the Energy Performance of Buildings EU Directive (EPBD) in Greece. Law 3661 gives an outline of the measures planned in order to monitor and reduce energy use in buildings. Its follow up and the most important step towards sustainable buildings, is the "Regulation for the Energy Performance of Buildings" (REPB) which became official in April 2010 (OHJ 407/9-4-10) and includes –among others- a specific methodology for the energy inspection of buildings and the issuing of energy certificates. The regulation applies for all typologies of new buildings (with a few exceptions like worship spaces, monuments, etc) as well as for existing buildings that undergo extensive renovation. All new

buildings will be inspected and issued an energy certificate while existing buildings will also need to be certified in order to be sold or rented in the near future (from summer 2011 onwards) [*internal information provided by CRES staff*].

2.1.5 Urban green

The absence of substantial green spaces is characteristic of most contemporary Greek cities, falling considerably below the European average.

Athens, the capital city can function as a beacon for the rest of the cities as it is a reflection of the urban growth and overall social developments in the country over the previous decades.

Athens has grown rapidly since the end of the civil war that followed the World War II, the rate of increase of the population reaching an average of 28% between 1950 and 1980 with the northern capital of Thessaloniki following the same pattern, despite its smaller size.

The ramifications of these migrations on the urban environment were enormous, accounting for the incredible boom of the construction sector. As a result, Athens is presently a sprawling city whose area is approximately 412km² of largely concrete surfaces.

Sustainability and "good living" conditions of a city are measured by a number of indicators amongst which are included a ratio of green area/inhabitant. According to the last measurement taken for Athens the area of green per inhabitant was 2.55m² (in Thessaloniki it was 2.15m²), considerably lower than other EU cities which range from 9m²/inhabitant in Rome to 27m² per inhabitant in Amsterdam with an even higher ratio for Scandinavian countries.

During and immediately after WWII the peri-urban areas of Athens were destroyed, stripped of vegetation (primarily Mts. Hymettus and Aigaleo); reforestation campaigns were launched, in the ensuing decade, and although Mt. Hymettus was reclaimed and the 2,000 hectares surrounding the Monastery of Kaisariani were protected as a wildlife refuge, Mt Aigaleo on the other side of Athens was never restored. Conversely, the city spread toward the west and the area around its foothills rapidly developed into a heavy industrial zone thus contributing largely to the reduction of green areas and the increase of the heat island effect and CO₂ emissions within the Attica basin.

Although there have been several attempts at reclaiming areas within the Athens city limits and greater urban area, for the creation of urban parks and recreational areas, local political and business interests largely prevented these plans from coming to fruition. Furthermore, failure of the state to enforce planning regulations led to non compliance by many builders and has allowed for the continual reduction of private as well as public open urban areas.

Recently, several proposals have been made for greening the city; these include a "green roofs" campaign, the unification and transformation of open spaces of apartment buildings into closed parks for the residents of city blocks. Furthermore, the Ministry of Environment, Energy and Climate Change is beginning the implementation of a program called "Green Neighbourhoods" which foresees the application of energy efficiency measures to buildings in two of the more degraded areas of the city, as well as the development of urban spaces in an attempt to improve the

overall living conditions of the neighborhoods [*Green and free spaces in the City, WWF Hellas, Guide for the environment, Athens 2009*].

Near the territory under study is situated Heraklion, the biggest city in Crete (and 5th in Greece) with a population in excess of 120.000 [www.interkriti.org].

2.1.6 Mobility management

Greece happens to have one of the worst safety records in the European Union for many years now, though significant positive steps have taken place since 2000. Aggressiveness of Greek drivers is considered to be one of the main causes for this undesirable situation, both in urban and rural areas [*Papaioannou, P. Driver behaviour, dilemma zone and safety effects at urban signalised intersections in Greece, Accident Analysis and Prevention 39 (2007), 147-158*]. The large number of old vehicles is an important characteristic of the Greek Road Traffic System and should be given special attention from a safety point of view.

One significant difference between the Greek Road network conditions and those of other countries' road networks is the presence of motorcycles and mopeds, whose number is very high (their rate of increase got extremely high, especially after 1980, because of the congestion of urban areas and the limited parking facilities). The number of pedestrians is significantly high, as in all Mediterranean countries, due to the fine weather conditions prevailing almost throughout the year. However, there is still a lack of adequate sidewalks along semi-urban roads and an extremely big lack of cycling paths and lanes [*Assimakopoulos, V.; Stergiou, B.; Konida, A. Trends in Road Safety Process: The Greek Traffic System, Journal of Safety Research, Vol. 23, pp. 171-180, 1992*]. In general, more safety policies and measures, more parking places and more cycling spaces are needed.

2.1.7 Transport infrastructures

Greece is in the process of implementing several infrastructure projects, most of them with EU funds support. As a result, every level of transport and communication is being upgraded, while the liberalisation of energy and telecom markets leads gradually to the modernization of the existing network [www.athensinfoguide.com]. The Ministry for Infrastructure, Transport and Networks is the government body responsible for transport infrastructures in Greece. Traveling to Greek islands is mostly accomplished by water, with the Port of Piraeus in Athens receiving millions of passengers every year (21,000,000 passengers were reported to have gone through the port in 2007). There are 16 airports in the country that cover international routes, while 25 other airports support domestic flights. Greece's roadways cover an area of 117,000 km with seven major highways. Over the last decade, the road systems of Greece have been in a state of constant repair. Concerning the Greek railway system is 2,500 kilometers long covering a large part of the mainland and reaching some remote villages, but it is now in a transition phase, halting several destinations, as it has been affected by the economic situation in the country and because of the debts of Greek railways to creditors [<http://www.takingupresidence.com/greece/transport/greek-infrastructure-overview.2.html>]. Near the territory under study, Archanon-Asterousion Municipality, Heraklion is the main port of entry to Crete and its airport, named after the Cretan writer Nikos Kazantzakis, receives approximately 15% of the

total tourist traffic of Greece. Heraklion's airport is about 5km east of the city and major car-rental companies have desks at the airport. Taxi and public bus are available for transfer to Heraklion [www.interkriti.org].

2.2 Sources and available data

The sources are incorporated in the text.

2.3 Description of the indicators -Calculated indicators

Concerning the Settlement system indicators, unfortunately most indicators' values could not be determined. Based on our findings, some numbers related to the Settlement system indicators are the following ones:

- The total area of the Archanon-Asterousion Municipality is **335,38** square kilometres
- The number of dwelling units was **2.863** in 2000

Moreover, in the following graph the distribution of public buildings in the Municipality under study can be seen:

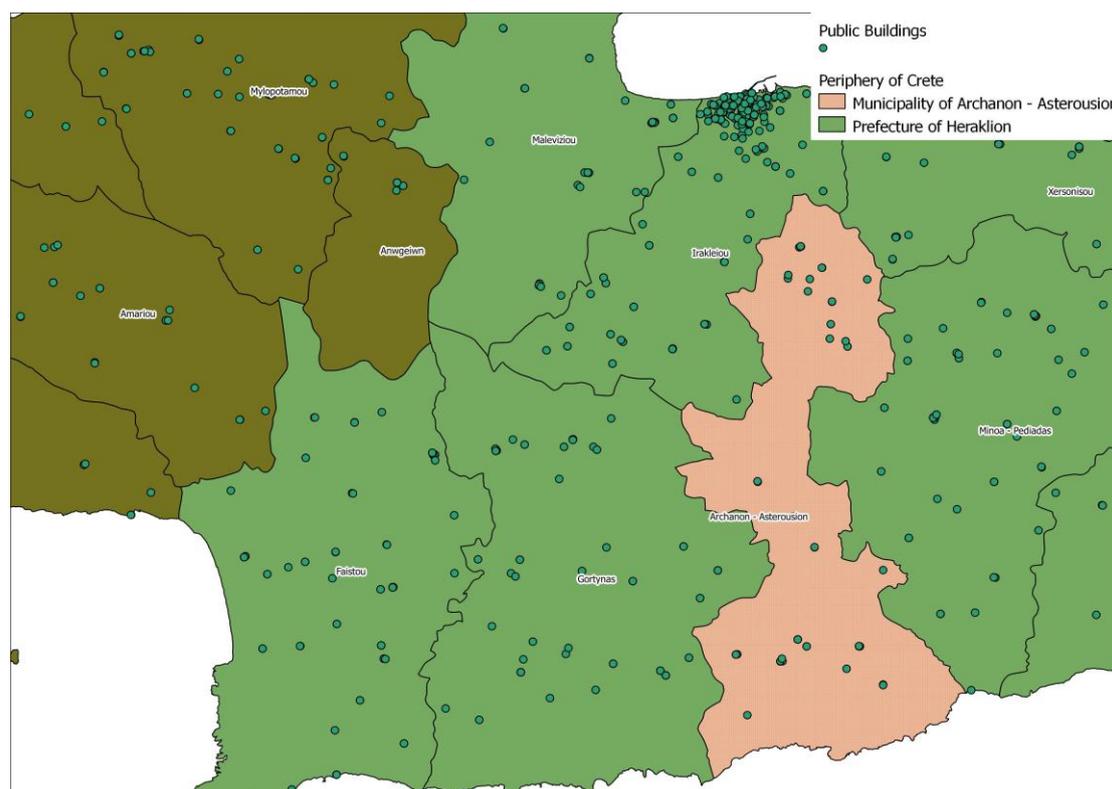


Fig 2.2. Distribution of public buildings in the Archanon-Asterousion Municipality.

In the following tables the distribution of residential buildings in the 3 Municipalities forming the Archanon-Asterousion Municipality under study can be seen:

N.KAZANTZAKIS MUNICIPALITY

	2001 Resident population	
	Households	Members
Total	2.444	6.729
1 room	24	
2 rooms	173	
3 rooms	473	
4 rooms	849	
5 rooms	615	
> 6 rooms	310	
Households with 1 member	535	535
1 room	13	
2 rooms	83	
3 rooms	179	
4 rooms	163	
5 rooms	65	
> 6 rooms	32	
Households with 2 members	748	1.496
1 room	9	
2 rooms	56	
3 rooms	175	
4 rooms	292	
5 rooms	158	
> 6 rooms	58	
Households with 3 members	406	1.218
1 room	2	
2 rooms	21	
3 rooms	59	
4 rooms	155	
5 rooms	128	
> 6 rooms	41	
Households with 4 members	431	1.724
1 room	0	
2 rooms	8	
3 rooms	34	
4 rooms	145	
5 rooms	151	
> 6 rooms	93	
Households with 5 members	226	1.130
1 room	0	
2 rooms	2	
3 rooms	22	
4 rooms	64	
5 rooms	84	
> 6 rooms	54	

Households with 6+ members	98	626
1 room	0	
2 rooms	3	
3 rooms	4	
4 rooms	30	
5 rooms	29	
> 6 rooms	32	

ASTEROUSION MUNICIPALITY

	2001 Resident populations	
	Households	Members
Total	2.161	5.765
1 room	24	
2 rooms	162	
3 rooms	408	
4 rooms	747	
5 rooms	572	
> 6 rooms	248	
Households with 1 member	436	436
1 room	16	
2 rooms	89	
3 rooms	128	
4 rooms	127	
5 rooms	57	
> 6 rooms	19	
Households with 2 members	833	1.666
1 room	5	
2 rooms	60	
3 rooms	179	
4 rooms	311	
5 rooms	189	
> 6 rooms	89	
Households with 3 members	343	1.029
1 room	1	
2 rooms	3	
3 rooms	49	
4 rooms	133	
5 rooms	106	
> 6 rooms	51	
Households with 4 members	283	1.132
1 room	2	
2 rooms	8	
3 rooms	29	
4 rooms	101	

5 rooms	106	
> 6 rooms	37	
Households with 5 members	148	740
1 room	0	
2 rooms	2	
3 rooms	17	
4 rooms	47	
5 rooms	55	
> 6 rooms	27	
Households with 6+ members	118	762
1 room	0	
2 rooms	0	
3 rooms	6	
4 rooms	28	
5 rooms	59	
> 6 rooms	25	

ARCHANON MUNICIPALITY

	2001 Resident population	
	Households	Members
Total	1.550	4.401
1 room	22	
2 rooms	73	
3 rooms	239	
4 rooms	522	
5 rooms	470	
> 6 rooms	224	
Households with 1 member	292	292
1 room	18	
2 rooms	32	
3 rooms	89	
4 rooms	80	
5 rooms	48	
> 6 rooms	25	
Households with 2 members	420	840
1 room	3	
2 rooms	24	
3 rooms	75	
4 rooms	167	
5 rooms	110	
> 6 rooms	41	
Households with 3 members	321	963
1 room	1	
2 rooms	10	
3 rooms	31	
4 rooms	121	

5 rooms	105	
> 6 rooms	53	
Households with 4 members		
	353	1.412
1 room	0	
2 rooms	5	
3 rooms	19	
4 rooms	108	
5 rooms	146	
> 6 rooms	75	
Households with 5 members		
	116	580
1 room	0	
2 rooms	2	
3 rooms	16	
4 rooms	32	
5 rooms	44	
> 6 rooms	22	
Households with 6+ members		
	48	314
1 room	0	
2 rooms	0	
3 rooms	9	
4 rooms	14	
5 rooms	17	
> 6 rooms	8	

Tables 2.1 (a), (b) and (c). Distribution of persons and rooms in residential buildings of the 3 Municipalities which form the Archanon-Asterousion Municipality.

3 CONSUMPTION AND LIFESTYLE CHOICES

3.1 Introduction

Preface / Preliminary remarks

Because of its location and good weather, Crete is a very popular island to visit or live. Its great touristic activity is also due to its big size and variety of landscapes (mountains, towns, villages, beaches). Cretans are well known for their friendliness and great hospitality, while they have adopted a relatively relaxed living speed. Cretans are proud and independent people and their behaviour reflects their long history and their struggles against occupying forces. Many traditions are preserved, especially in the villages of the island. Dancing, eating, drinking and shooting guns into the air during Cretan weddings and baptisms are part of these traditions.

Concerning the different consumption sectors, some preliminary remarks concerning Greece are the following:

3.1.1 Use of freshwater resources

Greece is characterized by an adequate freshwater supply per inhabitant ($5.9 \times 10^3 \text{ m}^3/\text{y}/\text{inhabitant}$), as compared with other Mediterranean countries. Concerning the available resources, in Greece there is a large number of relatively small water bodies, distributed unevenly throughout the country (precipitation is much more intense in the western than the eastern part of Greece), rather than few important water bodies, and most importantly there are no water bodies of significant size in any of the islands. An uneven distribution pattern is also observed in country's water demand: peak demands for the greatest water consumer, the agriculture, occur during the summer period, together with increased drinking water consumption during the same period because of tourist activity.

During the last three decades, the surface freshwater resources of the country had to meet growing demands and environmental pressures. More specifically, after the sixties, in many water bodies situated near urban areas or in regions with increased agricultural and industrial activity, signs of pollution have become apparent. Environmental pressure on surface freshwater ecosystems are almost entirely anthropogenic (urban wastewater discharge, industrial wastewater discharge, pollution from agricultural activities, f.ex. use of fertilizers, use of pesticides and insecticides, excessive water withdrawal for water supply, irrigation or other uses, drainage for agricultural purposes, eutrophication, dam construction, river flow diversions, sand and clay abstraction, excessive fishing, pollution from aquaculture, nuisance from building activities, nuisance from mining activities) It should be emphasized that agricultural

runoff presently constitutes the major pollution factor, due to its heavy pollution loads and its non-point source nature. At the same time, the growing demand for drinking water supply and irrigation resulted in an intense and frequently unreasonable exploitation of water resources. To conclude, it is critical to face and resolve all the problems mentioned above urgently, because even though most water bodies presently have a good quality status, there is a clear trend towards ecological degradation.

Finally, it should be mentioned that surface water management is a responsibility shared by a large number of public institutions, fact which causes problems. It is also maybe worth mentioning that Greek freshwater fish fauna is one of the richest in Europe [Tsouni, A.; Zervos, N.; Hadjibiros, K.; Andreadakis, A.; *An environmental database for the status of freshwater in Greece, Global Nest: the Int. J. Vol. 4, No 1, pp. 1-14, 2002*].

In Crete the natural lake Kournas, located in the western part of the island, is the only freshwater lake in Crete [www.cretanbeaches.com].

Nowadays, the availability of water resources restricts agricultural production, and desertification is gradually expanding on the island. Moreover, sea, coastal and water pollution, water shortages during peak seasons, water conflicts for domestic, agricultural and tourist uses are some of the negative environmental and physical impacts caused by the unbridled, urban and ex-urban tourism and tourism-induced development [H.Briassoulis, *Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism?*, *J. Sust. Tourism*, 11:2, 97-115].

3.1.2 Energy consumption

Energy is the main intermediate good for socio-economic development in any country and a critical factor for the competitiveness and economic growth of the EU [Tolon-Beccera, A.; Lastra-Bravo, X.; Botta, G.F. *Methodological proposal for territorial distribution of the percentage reduction in gross inland energy consumption according to the EU energy policy strategic goal, Energy Policy 38 (2010), 7093-7105 / National Strategic Reference Framework 2007-2013, Ministry of Economy and Finance, General Secretariat of Investments and Development, Athens, October 2006*].

Urban areas depend on commercial sources of energy, while rural areas on non-commercial resources (e.g., firewood and agricultural waste). In the period 1976-2007 the energy consumption trends in the EU-27 have been very heterogeneous, whereas Greece was among the countries where energy consumption grew the most, together with Spain, Luxembourg, Ireland, Cyprus and Portugal (31.4%).

If the energy consumption per capita is considered, again wide differences are observed among the EU-27 countries in 2007. In the case of Greece, the consumption per capita constantly increases every year, with maximum increase observed between years 2006 and 2007. It is maybe

also worth mentioning that Greece and Latvia are the only countries that have a clear trend toward an increase in per capita consumption from 2.47(1999) to 3.00(2007) and from 1.57(2000) to 2.09(2007) toe per inhabitant.

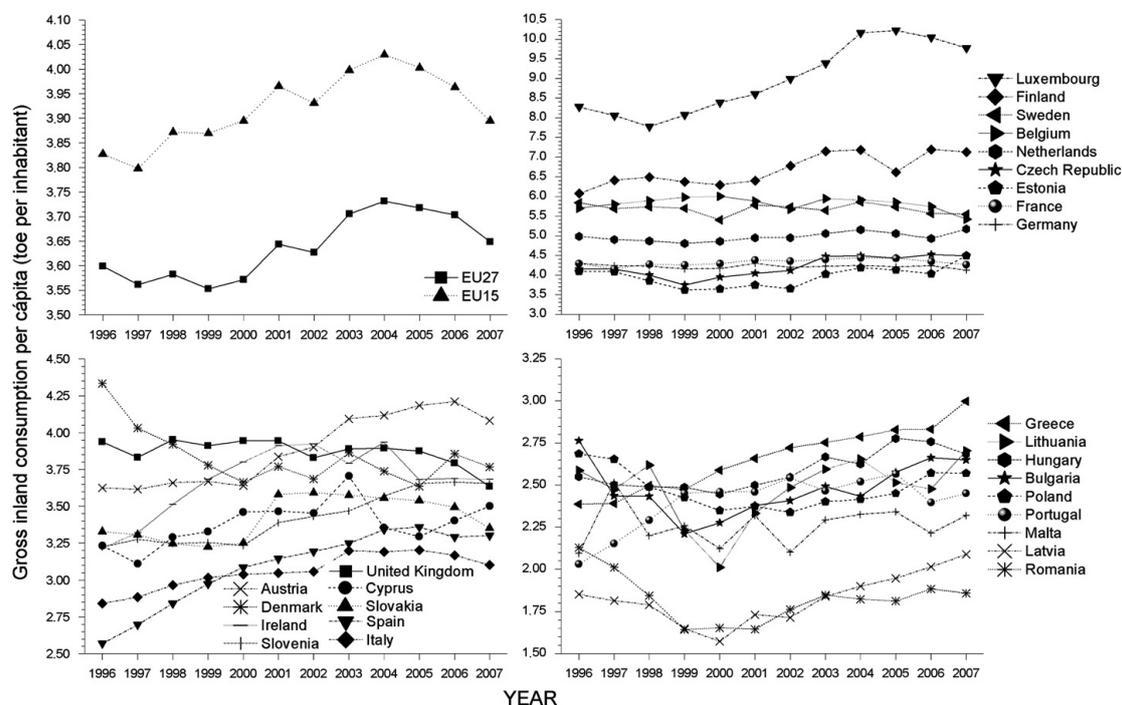


Fig 3.1. Gross inland consumption of primary energy per capita in the MS of the EU-27, 1995-2007 (toe per inhabitant)

In Crete the oil dependence amounts for 86% (compared to 61% which is the national average). Despite the high potential of RES and the high potential of Rational Energy Use of the island, the electricity and power demand increase at high rates and the problem of sufficient electric power needs to be dealt through an integrated regional energy policy [N.Zografakis, *Regional Energy Agency of Crete, RE-Islands Conference, Eur. Programme ALTENER “European Renewable Energy Islands, Brussels, 21/9/2005*].

3.1.3 Municipal waste generation

Solid waste management in Greece has reached in our days a very critical point. Unsatisfactory waste management practices, aggravated by public opposition, increasing waste volumes and high rates for the consumers have come to a point at which changes have to be made [SAGE journals online. *Waste management & research*. <http://wnr.sagepub.com/content/16/3/244.short>]. The waste produced increased from 302 kg/person in 1995 to 408 kg/person in 2000 to reach 437 kg/person in 2005 and 455 kg/person in 2006 [Hellenic Solid Waste Management Association, www.eedsa.gr].

Concerning agricultural waste, **Crete** is among the areas where they are produced in vast amounts, together with Thessaly, East Macedonia and Peloponnesus. The main production of agricultural waste in Greece comes from agricultural and farming activities in the fields (**Fig. 3.2**).

Concerning animal waste, in Greece animals produce a substantial amount of waste, as animal breeding activity is highly developed. The animal waste spreading in Greek rural areas come mainly from medium- and large-scale animal farms and are placed all over the country. Currently there is not an organized way of dealing with agricultural and animal wastes in Greece, and as a result, their exploitation is still a problem [Skoulou, V.; Zabaniotou, A. *Investigation of agricultural and animal wastes in Greece and their allocation to potential application for energy production, Renewable and Sustainable Energy Review, 11 (2007), 1698-1719*]. In Crete, Creta Farm in Rethymnon Prefecture is the largest meat-producing and processing company and at the same time one of the largest in Greece, with an annual pig manure production of about 3000 tons [Manios, T.; *The composting potential of different organic sold wastes: experience from the island of Crete, Environmental International 29 (2004), 1079-1089*].

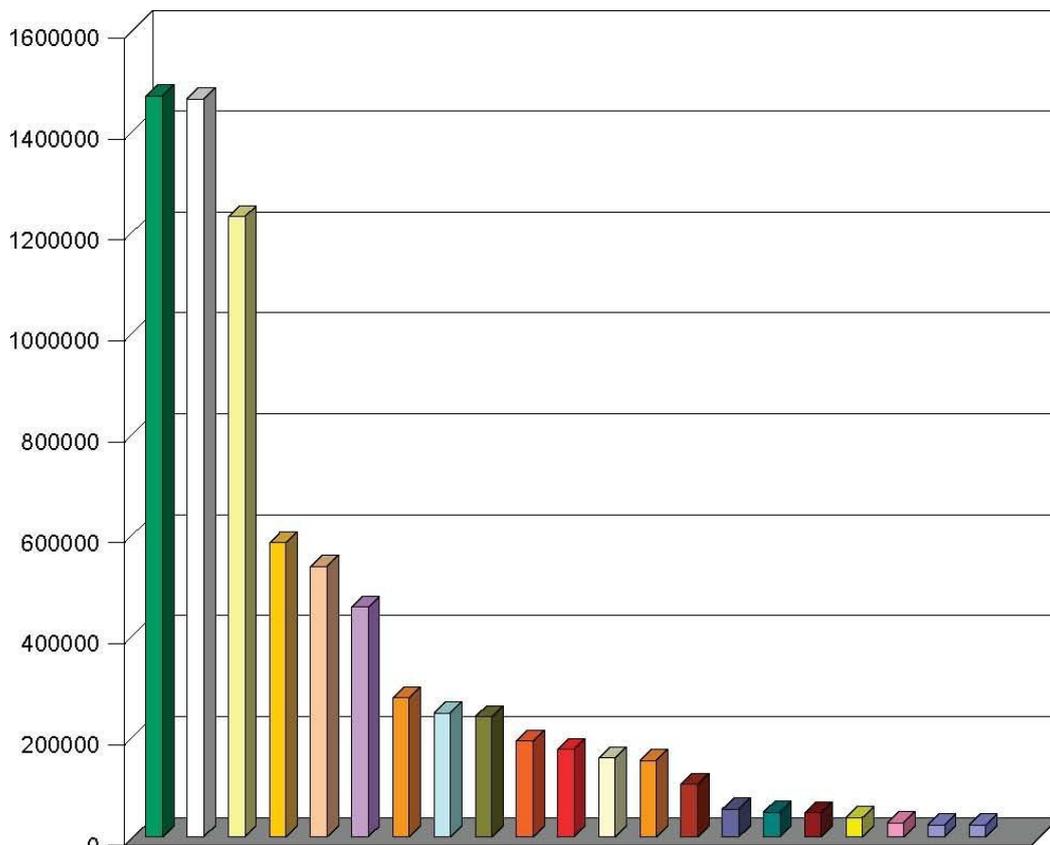




Fig 3.2 Basic agricultural wastes in Greece (Dry tons/y) [Skoulou, V.; Zabaniotou, A. *Investigation of agricultural and animal wastes in Greece and their allocation to potential application for energy production, Renewable and Sustainable Energy Review*, 11 (2007), 1698-1719].

Unfortunately, large quantities of animal and agricultural waste are currently disposed of in landfills, resulting in rapid exhaustion of landfill capacity, or they are burned on-site creating an important fire hazard that has been responsible for the complete destruction of large forestry areas.

Extracted olive press cake (EOPC) is the major organic solid waste from the olive oil industry and it has been used extensively as a fuel source. Olive tree leaves (OTL) accumulate as a waste at olive oil mills and are one of the most important organic waste residues on the island of Crete. Olive tree branches are also one of the most abundant agricultural organic residues on Crete, and the majority are burned immediately after harvesting the olive fruit and tree pruning operations (between November and March). Vine branches (VB) are also an abundant organic residue on Crete, which is also disposed of mainly by burning after pruning of the vineyard. Large quantities of pressed grape skins (PGS) are generated during wine production by industrial wineries and produced in smaller amounts at the vineyard itself.

Concerning urban waste, in most cities and areas of tourist development in Crete, urban wastewater is treated at centralized facilities, producing sewage sludge. The latter is currently disposed in landfills with municipal solid waste, after it has been partially treated through anaerobic digestion [Manios, T.; *The composting potential of different organic solid wastes: experience from the island of Crete, Env. International* 29 (2004), 1079-1089]. According to the Operational Program for the Energy and the Environment of the Ministry of Environment, Energy and Climate Change, the landfill of N.Kazantakis is currently being expanded [Hellenic Solid Waste Management Association, www.eedsa.gr].

Overall, based on research results of the past 25 years, all organic wastes of Crete could be composted in a satisfactory manner.

3.1.4 Road vehicle fleet

As it is well known, the average age of the vehicle fleet in the European Union has increased during the years (f.ex. from 6.1 years in 1980 to 7.6 years in 1999 for passenger cars). In Greece the average age of passenger cars is quite high (11 years) and should be related to the general economic conditions (it is the highest in Europe together with Finland and Sweden (10 years)) [*European Environment Agency, Indicator fact sheet, TERM 2002 33 EU – Average age of the vehicle fleet*].

3.1.5 Environmental quality of road vehicles

Total emissions for Greece are estimated to be 182,219 metric tons for the base year 2003, out of which 6.4% are due to road transport (**Fig 3.3**). Passenger ship emissions are higher over the Ionian Sea routes to Italy and the sea routes connecting Piraeus port to Crete and Cyclades. Important emission shares are also attributed to the diesel powered agriculture and industrial machinery (**Fig. 3.4**). Traffic emissions are responsible for approximately 6.4% of the yearly nationwide PM_{10} totals, with diesel vehicles emissions dominating. The main contributors of the diesel vehicles are the heavy duty vehicles (nearly 67%) and taxis (nearly 18%) due to the high emission factors of the former and the high mileage driven for the latter. Gasoline vehicles produce 15% of toad traffic emissions, with two-wheeled vehicles representing 80% of that amount. [*Markakis, K.; Poupkou, A.; Melas, D.; Zerefos, C.; A GIS based anthropogenic PM_{10} emission inventory for Greece. Atmospheric Pollution Research 1 (2010) 71-81*].

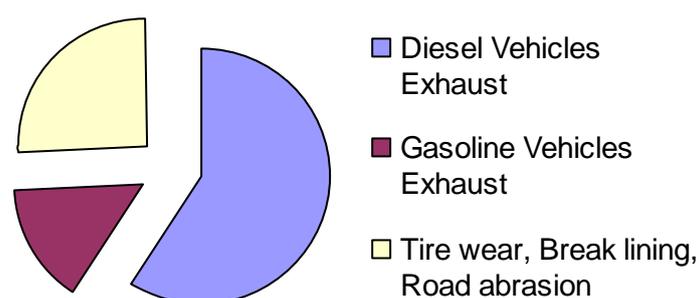


Fig 3.3. Annual sectoral and sub-sectoral contribution to road transport emissions.

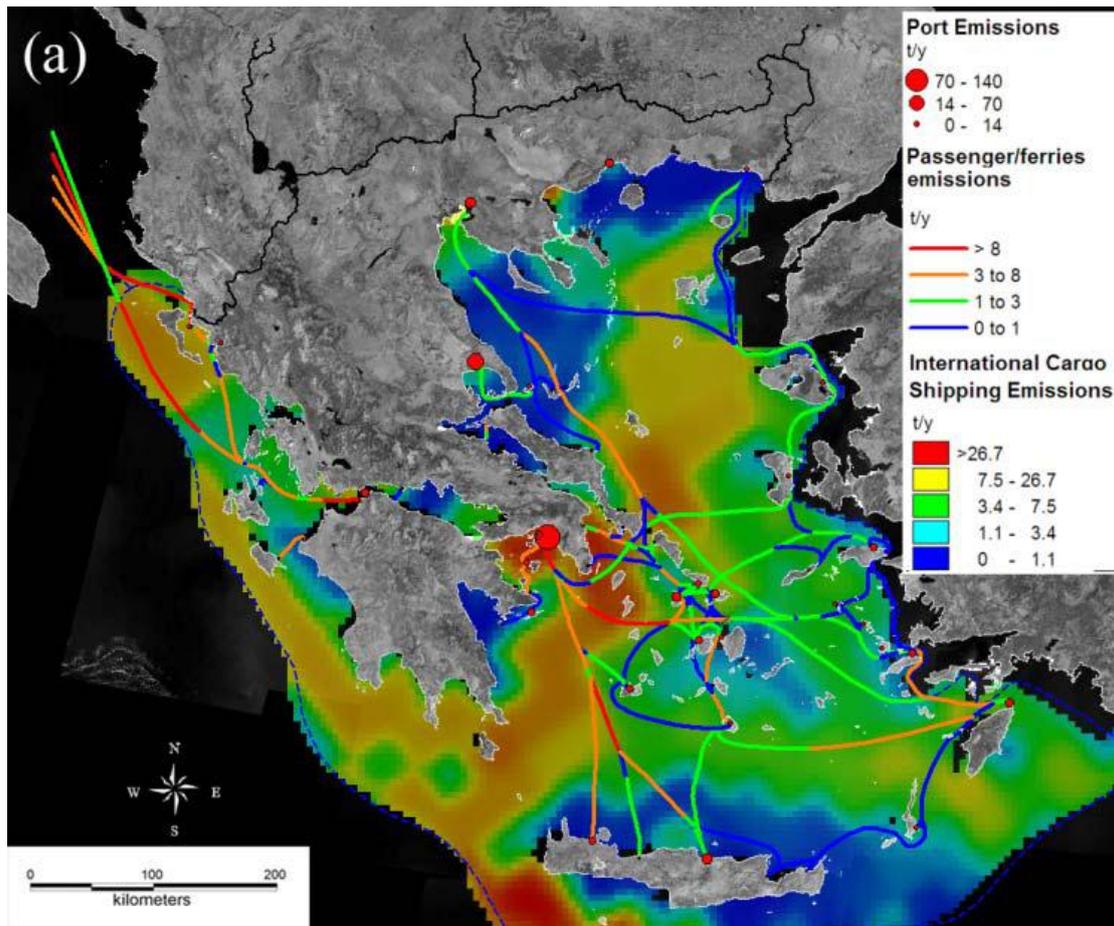


Fig 3.4. Spatial distribution of annual emissions from the maritime sector.

3.2 Sources and available data

The sources are incorporated in the text.

3.3 Description of the indicators -Calculated indicators

3.3.1 Use of freshwater resources

Thematic area:	1. Consumption and lifestyle choices
Indicator:	1.1a Use of freshwater resources: use of fresh water per capita
Indicator description and calculation method:	
<p>This indicator values the pressure practiced on water resources by domestic per-capita water consumption. It is also useful to value the efficiency in the water supply network management that affects water consumption.</p> <p>The calculation includes the comparison between data concerning "recorded" water consumption (water's volumes) and resident population. The "recorded" water volume is that measured by the official domestic counters. The "not recorded" water volume is instead the one deriving from the consumption of non invoiced users.</p>	
Unit of measurement:	<p>m³/year/inhabitant (100, assumption for whole Greece)*</p> <p>m³/year/inhabitant (4800 for Crete)**</p> <p>m³/year/inhabitant (5900 for Crete)***</p>
Indicator typology (DPSIR model):	Pressure
Time period :	Data concerning the year 2010
Territory :	Archanon-Asterousion Municipality
Desirable environmental objective :	To promote technological innovation, improve the resource management system, activate sensitization actions directed to consumers in order to favour the reduction of water consumptions and wastes.

*In order to calculate the domestic per-capita water consumption, we assume that each inhabitant consumes about 200l/d, and that the efficiency rate of the network is 0.70, so:

Consumption = $(365 * 200) / 0.70 / 1000 = 104 \text{ m}^3/\text{inhabitant} / \text{year} \approx 100 \text{ m}^3/\text{inhabitant} / \text{year}$. For the whole Municipality the fresh water consumption will then be $1.608.865 \text{ m}^3/\text{year}$ [Vassiliki Mpoura, *Diploma Thesis, Topic "Determination of Water Resources Management Systems in Crete", Supervisor: Professor Georgios Tsakiris, Athens, July 2010*].

** This refers to the water availability per capita, which is relatively high in Crete compared to that of Greece (2389(WWF) 6700m³/inh yr) [Chartzoulakis, K.S.; Paranychianakis, N.V.; Angelakis, A.N. *Water resources management in the Island of Crete, Greece, with emphasis on the agricultural use, Water Policy 3(2001), 193-205*].

*** [Tsouni, A.; Zervos, N.; Hadjibiros, K.; Andreadakis, A.; *An environmental database for the status of freshwater in Greece, Global Nest: the Int. J. Vol. 4, No 1, pp. 1-14, 2002*].

In the following graph, the underground water sources in the territory under study, Municipality of Archanon-Asterousion, and Crete in general can be seen:

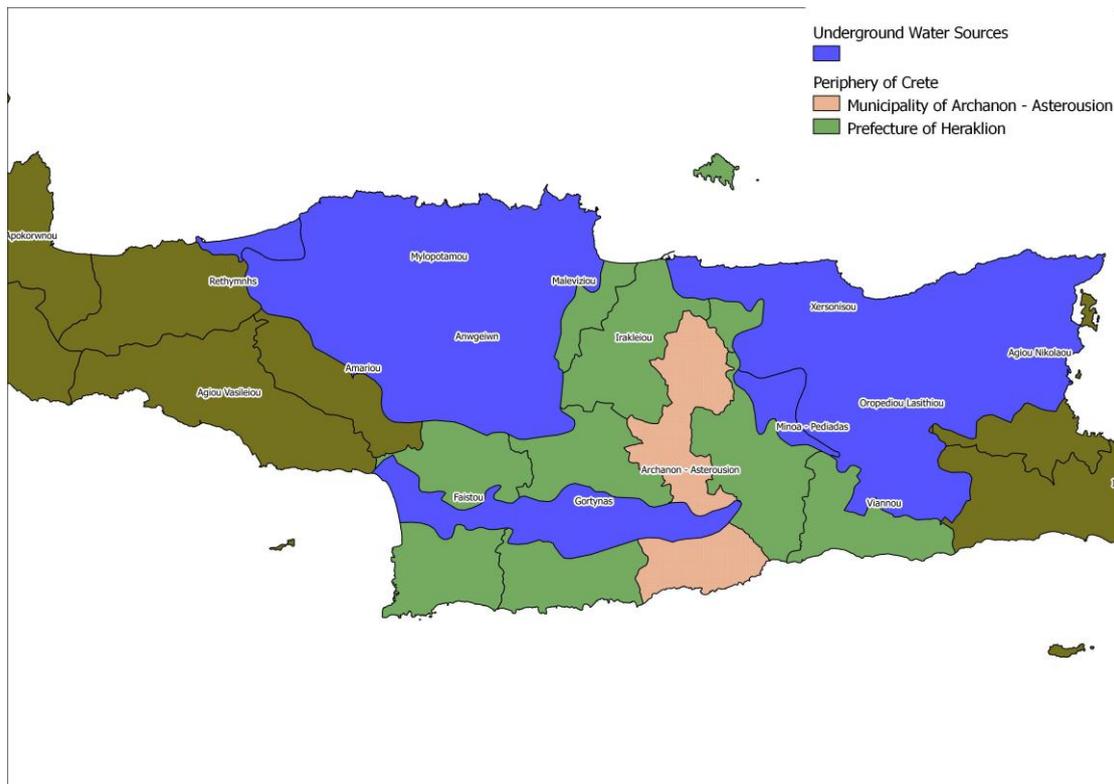


Fig 3.5. Underground water resources in Crete, including with red colour the Municipality of Archanon-Asterousion under study.

In the following pie chart we can also see the water consumption in the different Municipalities of the Heraklion Prefecture:

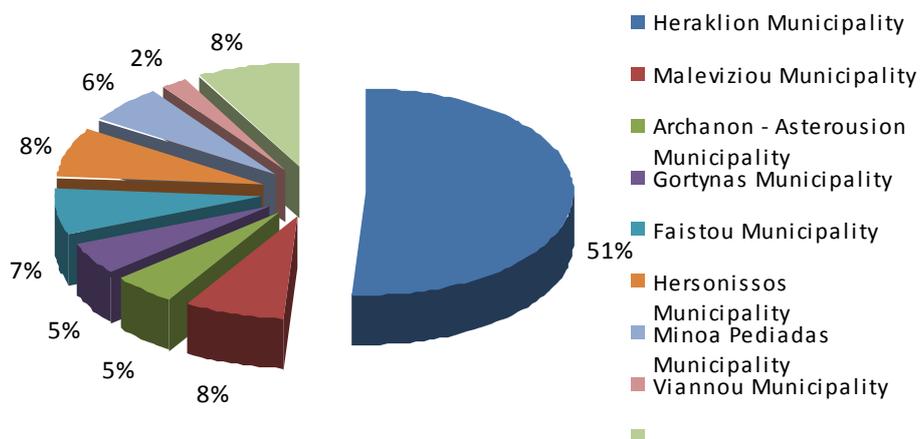


Fig 3.6. Water consumption in the different Municipalities of the Heraklion Prefecture [V. Mpoura, Diploma Thesis, Topic "Determination of Water Resources

Management Systems in Crete”, Supervisor: Professor Georgios Tsakiris, Athens, July 2010].

We can see that the Archanon-Asterousion Municipality participates with the second highest percentage, 8%, equal to the Hersonissos Municipality which presents high seasonal variability in population due to tourism and Malevizou Municipality [V. Mpoura, *Diploma Thesis, Topic “Determination of Water Resources Management Systems in Crete”, Supervisor: Professor Georgios Tsakiris, Athens, July 2010*].

Thematic area:	1. Consumption and lifestyle choices
Indicator:	1.1b Use of freshwater resources: use of fresh water by sector
Indicator description and calculation method:	
This indicator values the pressure applied on water resources by water consumption in the different sectors (civil, agricultural, industrial, transports, services). It is calculated comparing the recorded water consumptions in the different sectors (civil, agricultural, industrial, transports, services) to the total recorded water consumptions.	
Unit of measurement:	84,5% for agriculture 12% for domestic use 3.5% for other uses (for Crete as a total) *
Indicator typology (DPSIR model):	Pressure
Time period :	Data reported in 2001*
Territory :	Archanon-Asterousion Municipality / Crete
Desirable environmental objective :	To promote technological innovation, improve the resource management system, activate sensitization actions directed to consumers in order to favour the reduction of water consumptions and wastes.

*In general Crete is considered as a semi-arid region. The average annual precipitaton is estimated to be 900mm, the potential renewable water resources 2650 and the real water used about 485 million m³/yr. The major water use in Crete is in irrigation for agriculture (84.5% of the total consumption) while domestic use is 12% and other uses 3.5%. Tourism (domestic and international) is another sector, which is related to the water use. The total number of tourists in Crete in 1999 exceeded two millions, and this number may double in 2025. The tourism industry requires huge quantities of water supply, with peak consumption during the high season and excess capacity in the low season. Furthermore, most of the tourists come from northern European humid countries and are not prepared to encounter water scarcity. [Chartzoulakis, K.S.; Paranychianakis, N.V.;

Angelakis, A.N. *Water resources management in the Island of Crete, Greece, with emphasis on the agricultural use, Water Policy 3(2001), 193-205*].

It should be mentioned that the project "Master plan for the sustainable management of water resources in the Municipality of N.Kazantzakis" was run together by the Ministry of Public Works and Environment of Greece and the Municipality of N.Kazantzakis during the period 1997-1999. The project's budget was 1 million ECUs given by EU and the Greek state. The aim was the establishment of a system enabling the Municipality to manage the scarce water resources of the area effectively and have control over them through a central system. This was a pilot project in Crete where water is a key factor governing its development [CIHEAM – *Options Méditerranéennes, Rural Development Agencies in the EU Framework, Greg Charalambakis*].

3.3.2 Energy consumption

Thematic area:	1. Consumption and lifestyle choices
Indicator:	1.2a Energy consumption: energy consumption per year
Indicator description and calculation method:	
The aim of this indicator is to measure the annual variation of the per-capita electric consumption. The specific calculator is calculated on an annual basis comparing the recorded energy consumption to the resident population.	
Unit of measurement:	~2800 GWh/year / 1183,968 GWh/year
Indicator typology (DPSIR model):	Pressure
Time period :	Data concerning the last 16 years / 2005
Territory :	Crete island / Heraklion
Desirable environmental objective :	To reduce consumption through energy efficiency measures adopted by households' owners / tenants (f.ex. using low consumption light bulbs, purchasing electric appliances that bear the Energy Star label , etc).

Crete as the largest (population and area) island of the Hellenic Democracy with a high development potential has increased energy consumption needs. Situated at a strategic crossroads between Europe, Africa and Asia attracts more than 20% of the total Greek tourist activity

and during this time the high electricity demand challenges the existing electric system.

Electric Demands tend to rise by 6.0% annually; very similar to the rate in which economy grows (6.8%). Based on the logistic forecast methodology presented in the study of *Georgios P. Giatrakos et. all, 2009, Sustainable Power Planning for the island of Crete*, the future electric demands projections are presented in the following Figure :

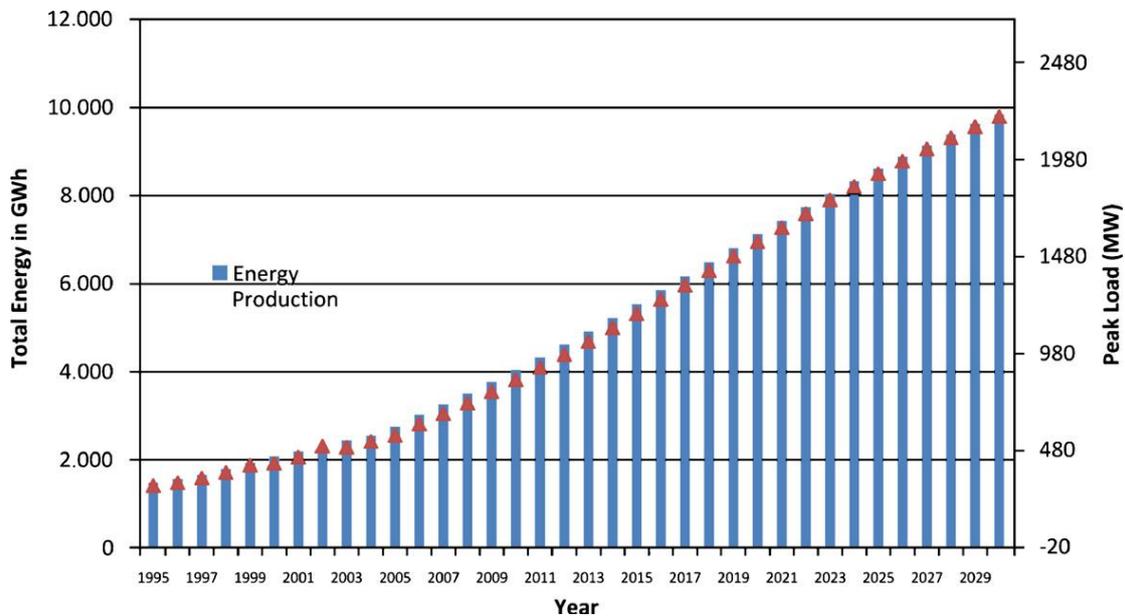


Fig. 3.7. Past and future electric demands for the island of Crete [*Georgios P. Giatrakos et. all, 2009, Sustainable Power Planning for the island of Crete*].

The annual increase of electricity demand in the island is approximately 9% (a high percentage in relation to the 5% of the continental Greece). Furthermore it is clear that the domestic and tertiary sectors are the most important ones, representing over 70% of the total electricity consumption in the island as it can be depicted in the following table and diagram. [*E.Michalena, V.Angeon, Local challenges in the promotion of renewable energy sources: the case of Crete, Energy Policy 37(2009), 2018-26*].

Electric energy consumption by category of use for the year 2005.

Prefecture	Domestic use	Commercial use	Industrial use	Agricultural use	Public authorities	Street lighting	Total
Heraklion	392.879	467.619	134.358	85.041	89.354	14.737	1183.988
Lassithi	110.096	130.198	12.165	49.631	21.588	9.540	333.218
Rethimnon	96.172	122.779	32.621	16.505	25.346	5.036	298.459
Chania	217.774	233.155	47.941	30.649	56.260	11.013	596.792
Crete total	816.921	953.751	227.085	181.826	192.548	40.326	2412.457

Table 3.2. Electric energy consumption by category of use for the year 2005 in Crete.

Electric Energy Consumption by Category of use for the year 2005

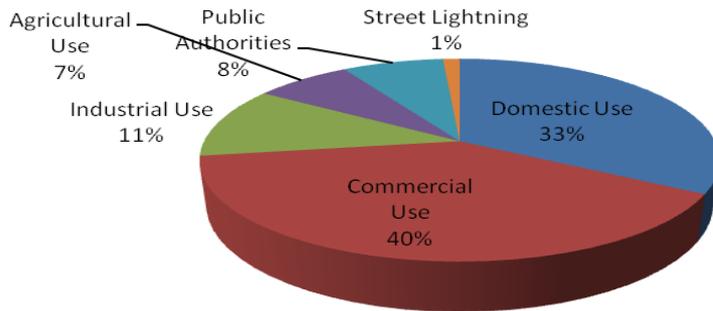


Fig. 3.8. Electric Energy Consumption by Category of use for the year 2005 in Crete.

However, electricity loads fluctuate over the years. For example, during 2002, the maximum electricity peak in Crete reached 513.1MW and the minimum 121.8MW, while the electricity consumption was of 2.341 GWh [Evanthia Michalena, Valerie Angeon, 2009, *Local challenges in the promotion of renewable energy sources: The case of Crete*].

4 ENVIRONMENTAL AND TERRITORIAL RESOURCES

4.1 Introduction

Preface / Preliminary remarks

4.1.1 Land use

The land use in Greece in terms of percentages is as following: 20.45% arable land, 8.59% permanent crops and 70.96% other (other: any land not arable or under permanent crops, including permanent meadows and pastures, forests and woodlands, built-on areas, roads, barren land etc) (2005) [CIA World Factbook (http://www.indexmundi.com/greece/land_use.html)].

The state is the largest landowner in Greece (65%), while the percentage of the forest land is high (43.6%) and also state-owned (65.5%). The establishment of the Natura 2000 network in Greece has inevitably influenced land use and led to socioeconomic-environmental conflicts, especially in places of high tourist value, like Elaphonisi in Crete [Papageorgiou, K.; Vogiatzakis, I.N. *Nature protection in Greece: an appraisal of the factors shaping integrative conservation and policy effectiveness*, *Environmental Science & Policy* 9 (2006), 476-486]. The artificial, natural and seminatural and agricultural areas of the territory under study can be seen in the Figure below.

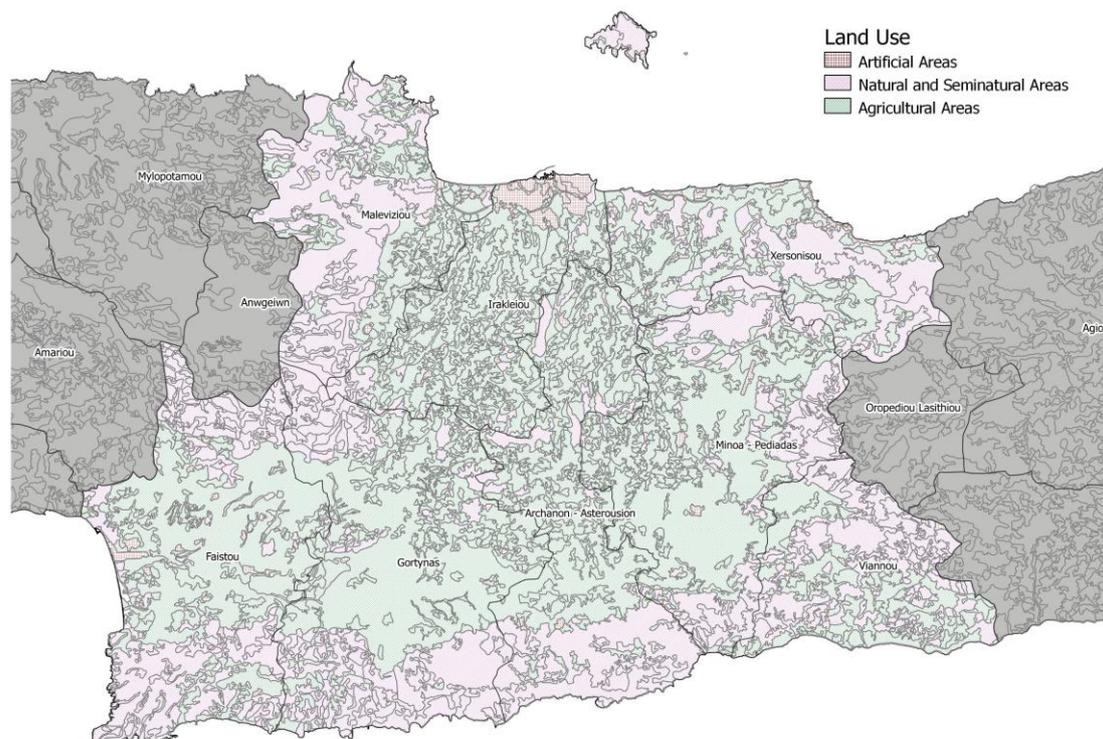


Fig. 4.1. Land use distribution in Archanon-Asterousion Municipality (division to artificial, natural and seminatural, and agricultural areas).

4.1.2 Landscape constraints: areas subject to landscape protection

The recent socio-economic changes in Greece (exodus from rural areas, urbanization, holiday homes) and the consequent modernization in all fields of activities (mainly in agriculture, transport networks and infrastructures, tourism) have caused radical changes in Greek landscapes. Traditional urban and rural areas have been deeply transformed by thousands of legal or illegal constructions. New public works –especially transport infrastructures– have had a great impact on the large scale physical environment. These changes posed new challenges and criticalities that must be responded in an appropriate way [Beriatos, E. *Landscape protection and management in Greece: problems, perspectives, and policies*. WIT eLibrary (<http://library.witpress.com/pages/PaperInfo.asp?PaperID=1938>)]. Sectoral policies such as agriculture and forestry, offering a more biodiversity sensitive planning need to be developed [Papageorgiou, K.; Vogiatzakis, I.N. *Nature protection in Greece: an appraisal of the factors shaping integrative conservation and policy effectiveness*, *Environmental Science & Policy* 9 (2006), 476-486].

4.1.3 Local tools and plans aimed at protection and enhancement of landscape

The development of local tools and plans aimed at protection and enhancement of landscape on all decision levels comprise the following three stages:

1. recognition of impacts degrading the environment,
2. assessment of future sources of danger,
3. development of sustainable land use systems.

The complexity of management in the Greek public sector is one of the major criticalities having to do with the protection and enhancement of landscape in Greece [Piorr, Hans-Peter, *Environmental policy, agri-environmental indicators and landscape indicators. Agriculture, Ecosystems and Environment* 98 (2003), 17-33]. Nature conservation policy in Greece should follow the new trend and become more rational and democratic, better coordinated and oriented towards the wider landscape, by involving all relevant actors and interconnecting policy networks, instead of the traditional technocratic policy planning appointed to the state.

To be more concrete, it was only during the 1980s when the policy of nature conservation was given higher priority after the Law 1650/86, which gave more power to a new state conservation actor, the Ministry of Environment, Planning and Public Works to deal with policy development and planning for the protected areas. Despite the multitude of actors interested in nature and landscape conservation, in Greece there was no legal basis for public participation in the stages of planning and

implementation, which led to fear and mistrust from the indigenous population. The critical point for the future is whereas managing authorities will be able to appropriate represent a matrix of different interests between national – local levels as well as between socioeconomic- environmental dilemmas [Papageorgiou, K.; Vogiatzakis, I.N. *Nature protection in Greece: an appraisal of the factors shaping integrative conservation and policy effectiveness, Environmental Science & Policy* 9 (2006), 476-486].

4.1.4 Protected areas

As it is well-known, in 1992 EU moved towards an integrated approach, the **Natura 2000** network of protected areas, fact which made efficient protected areas management in Greece a more demanding and challenging task (it was the first time in the history of conservation of Greece that scientific criteria have been applied for site designation). Before the creation of the specific network, the protected area system was established in a rather opportunistic and ad hoc basis. The operationalization of this network was facilitated in the form of new laws and an increasing declaration policy. **Today the network accounts for 359 areas extending to 18% of the total landmass.** As a consequence of the proliferation of designated areas, a considerable overlap of protected areas and objectives was noticed. Moreover, the Natura 2000 designations put current management practices at stake by increasing friction and land-use conflicts [Papageorgiou, K.; Vogiatzakis, I.N. *Nature protection in Greece: an appraisal of the factors shaping integrative conservation and policy effectiveness, Environmental Science & Policy* 9 (2006), 476-486].

Nature conservation was first initiated in Greece in 1937 in the form of national parks (Law 856/37). The legislations proposed the designation of extensive mountainous forested areas as national parks, each not less than 3.000 ha. Seven parks were created between 1937 and 1966 covering a total of 18.600 ha of public land. The next significant proliferation of protected areas came in 1971 (Law 996/71), which complemented Law 856/37 and led to the designation of 5 more national parks within 1962 and 1974. By 1974 there had been 10 national parks listed, covering a total land area of 74,403 ha (0.56% of the total land area or 7.4ha/1000 people). *It should be emphasized that designation procedures did not take into account any issues relating to social and economic welfare of local residents, but only to protected area itself.* The Law 996/71 has also added protection for aesthetic forests (AF) and protected natural monuments (PNM) (51 PNM have been designated between 1975 and 1985 and 19 AF established between 1973 and 1980 with the primary aim to provide recreation and aesthetic enjoyment to the public, 0.24% of the landmass). All the above categories of protected

areas in Greece are located on state land, which is not surprising since the state is the largest landowner in Greece (65%). The Ramsar international convention led to the designation of eleven sites. Finally, there are 500 areas declared as game refuge under hunting law but only a few of them are important to nature conservation. The next significant change to the protected area system came with law 1650/86 which introduced changes in site designation procedure, as well as five new categories of protected areas, including also marine parks. However, its implementation has been limited (only two marine parks were founded in 1985). In the more recent years and in partial fulfilment of EC law for the establishment of Natura 2000 network, 296 sites were identified in Greece, for which biodiversity and other relevant information was collected during 1994-1996. The final site selection was carried out by the Ministries of Environment and Agriculture following the advice of a group of national experts (all funding was received from central government). The issuing of special operating regulations setting rules and land-use restrictions led to a restrictive management regime.

From a geographical point of view, the high number of protected sites in South Aegean and Crete reflects the biogeographical importance and the presence of unspoiled natural and semi-natural areas. When designated sites include coastal areas of high value for tourism, like in the case of Crete, policy implementation is an even harder task to accomplish and greater efforts are needed to coordinate forest, agricultural and tourism sectors [Piore, Hans-Peter, *Environmental policy, agri-environmental indicators and landscape indicators. Agriculture, Ecosystems and Environment* 98 (2003), 17-33].

The Greek list of Natura 2000 sites includes 241 Sites of Community Importance (SCI) and 202 Special Protection Areas (SPA). The total area of the network, when overlapping between the areas of the above types of sites is excluded, rises to 4.294.960,14 ha, of which 3.603.354,61 ha are land (27,2% of terrestrial part of Greece) and 691.605,53 ha are marine areas (6,12% of territorial waters). The Natura 2000 sites are mostly wide areas and are scattered throughout the country [Greek Ministry for the Environment, Energy and Climate Change, <http://www.ypeka.gr/Default.aspx?tabid=235&language=en-US>].



Fig. 4.2. Natura Greek site on the island of Crete.

In the Municipality of Archanon-Asterousion the areas protected by Natura Network are visible in the following graph:

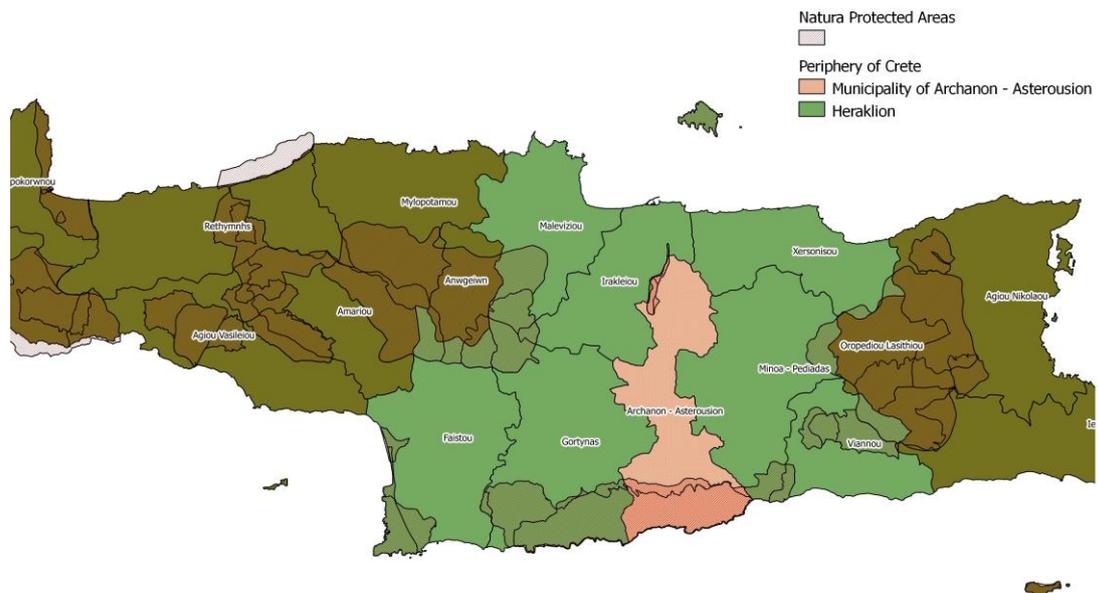


Fig. 4.3. Natural protected areas in the Municipality of Archanon-Asterousion.

4.1.5 Local tools and plans aimed at biodiversity conservation and protected areas management

In Greece, like in the entire Mediterranean Basin, the rich biodiversity, the complex biogeography and the changing political culture are common issues that render nature conservation a difficult task.

The total land parts of the Natura sites cover 23.07% of the territory. Approximately 100 special environmental studies have been drawn up in respect of these sites, as well as some individual management plans, however, the protection and management regime of most of these areas presents significant weaknesses and delays [*National Strategic Reference Framework 2007-2013, Ministry of Economy and Finance, General Secretariat of Investments and Development, Athens, October 2006*].

In Greece, nature conservation planning effort **during the period 1938-1882** was characterized by an attraction to pristine nature and a lack of scientific planning. With the exception of national parks, which extent to larger areas (mean size 7440 ha), the rest of statutory areas cover a significantly smaller surface and exhibit an increased variability in size, which may lead to enhanced fragmentation and reduced consistency of management practices.

Concerning the biodiversity objectives, unfortunately their pursuit has remained largely rhetorical. Organizational and institutional weaknesses, ineffective policy coordination, a rather limited political commitment to conservation have been identified as major causes of the poor performance. In general, from the beginning of the nature conservation movement in Greece, conservation policy was clearly within the mandate of the Ministry of Agriculture, dominated by professional expertise recruited from the forest science, and a strict professional bureaucratic, forestry-based approach was adopted.

Law 2742/1999 led to the establishment of **managing authorities** as conservation bodies, legally entitled to take over the administration and management of the Natura sites' from the formal direct state control of forest service and the ministry of Environment, Planning and Public Works. Their boards comprise, according to the law, 7-11 members representing a variety of sectoral organizations (Forest Directorates, local government), local environmental organizations (NGOs) and private interest groups (forest cooperatives, hunting groups and timber industry), and they have no executive powers. All members are appointed by the minister of Environment, Planning and Public Works. Today there are 26 managing authorities in charge 27 Natura sites. Although few in number, they are considered key actors for the evaluation of administrative and managerial efficiency of the new conservation policy since they contain

the most biologically diverse and threatened designated areas. Undoubtedly managing authorities constitute a supporting factor to integrative nature conservation in the years to come. However, many issues related to the designation and future management having to do with the effectiveness of the selection, the functionality of the Natura 2000 network at the landscape scale, the possible effects of climate change on species distribution and the ecosystems, the little history of working together with the local communities and developing park strategies, the absence of a common clear integrative vision, remain unresolved and have to be seen in the future if we want to shift towards a more integrated conservation policy [Papageorgiou, K.; Vogiatzakis, I.N. *Nature protection in Greece: an appraisal of the factors shaping integrative conservation and policy effectiveness*, *Environmental Science & Policy* 9 (2006), 476-486].

Passing now to the solid waste management problem, although emphasis has been given to it the last 15 years, it has not yet been possible to establish an integrated solid urban waste treatment scheme, while there are significant deficits regarding the treatment and disposal of industrial and hazardous waste [Beriatos, E. *Landscape protection and management in Greece: problems, perspectives, and policies*. WIT eLibrary (<http://library.witpress.com/pages/PaperInfo.asp?PaperID=1938>)].

The problem is greater in abandoned areas of previous industrial activity. The delay in the implementation of the regional solid urban waste treatment planning has mainly resulted from the absence of social acceptance in determining the location of the necessary infrastructures.

The problems in respect of soil resources are extended to a progressive degradation of the soil systems due to erosion and salination, which, among other consequences, results in reduction of the soil's productive capacity and in the visible danger of quantitative and qualitative deterioration of the water resources.

In the case of Crete island, a number of negative impacts resulted because of unbridled tourism development, among them sea, coastal and water pollution, water shortages during peak seasons, uncontrolled solid waste disposal, ecosystem destruction, urban and rural landscape degradation, the loss of high productivity agricultural land, noise, land fragmentation, high building densities, congestion and overuse of infrastructure and proliferation of small tourist units [H.Briassoulis, *Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism?* *J.Sust. Tourism*, 2009, 11:2, 97-115].

4.1.6 Quality of water resources

The water resources quality in Greece is generally at quite good levels. The indicator of total consumption per available reserves is also at

satisfactory level, however with significant variations in certain parts of the country (tourist areas, urban centres). 30% of the country's surface waters spring from neighbouring countries making even more imperative the need to promote actions for jointly addressing problems in connection with cross-border water resources. There is insufficient record of the uses and users of water and coordination between the appropriate bodies. There are some occasional holdings, while there is absence of a package of incentives-disincentives for water saving, particularly in agriculture, which consumes more than 85% of the drinking water.

In relation with the treatment of urban waste water, there are deficits in treatment plants and mainly in collecting systems. Nevertheless, it must be stressed that there has been significant progress over the last years.

In Crete, the problem of poor water quality is a serious one (to give an idea of the magnitude of the problem, about 51.4% during the dry period and 48.6% during the wet period of the water samples studied during a 5-year survey conducted in the Municipality of Aghios Nikolaos, Lassithi were polluted by bacteria like TC, E.coli and streptococcus) [*Ch.Panoulis, Unit of Foods, Water and Environmental Microbiology, Laboratory of Bacteriology, Parasitology, Zoonoses and Geographical Medicine, Faculty of Medicine, University of Crete*].

The pollution of water resources by urban and industrial waste but also by residues of pesticides and fertilizers are some of the reasons.

It is no wonder that Crete Region is the Region with the highest consumption of bottled water in Greece. Only in Heraklion Prefecture there are 6 out of the 9 bottling units present on the island. In a recent survey conducted in the whole island, 69% of the participants answered that they do buy regularly bottled water [*Fragkiadaki, I. Marketing of bottled water in Crete, final thesis, Athens 2008*].

Ensuring water quality and water resources is therefore a key factor for the socio-economic life of the island, directly related to natural protection measures and an adequate long-term strategy should be in place [*www.ecocrete.gr*].

4.1.7 Quality of the air

The biggest problems in respect of air pollution are identified in the country's major urban centres as well as in lignite power production areas. Air pollution problems also exist in some industrial areas. Effort must be concentrated on the most dangerous pollutants (particulate matter, benzene, ozone) and actions must be intensified mainly for integration of environmental care in transport policy.

The quality of the acoustic environment in our country has deteriorated over the last years, with the most significant problems identified in major urban centres but also in almost all tourist areas in the country. As a consequence, the quality of the tourism services and of the population's life deteriorates as well. Deterioration problems have also occurred due to the constantly increasing exposure of the population to radiations, mainly from energy transport lines and mobile telephony aeriars.

Civil protection refers to the development and implementation of plans for preventing, addressing and restoring disasters which may be caused by natural and technological hazards. In this field, there are significant deficits in infrastructures mainly of flood control and fire protection. A major deficit is also the delay in the development and full commissioning of a single information management and coordination system, which is a prerequisite for timely warning and intervention.

Fig. 4.4 presents the emissions from road transport in a 20 km grid, in Greece. This map shows the hourly emissions from all the vehicle types. In **Fig. 4.5** the yearly NO_x emissions are shown from passenger ships and ferries. Finally **Fig. 4.6** shows the railway network in Greece and also the total annual emissions aggregated to the prefectures. The emissions from railway activities in Greece are very low, although all the trains still use diesel fuel [Symeonidis, P.; Ziomas, I.; Proyou, A. *Development of an emission inventory system from transport in Greece. Environmental Modelling & Software* 19 (2004), 4130421].

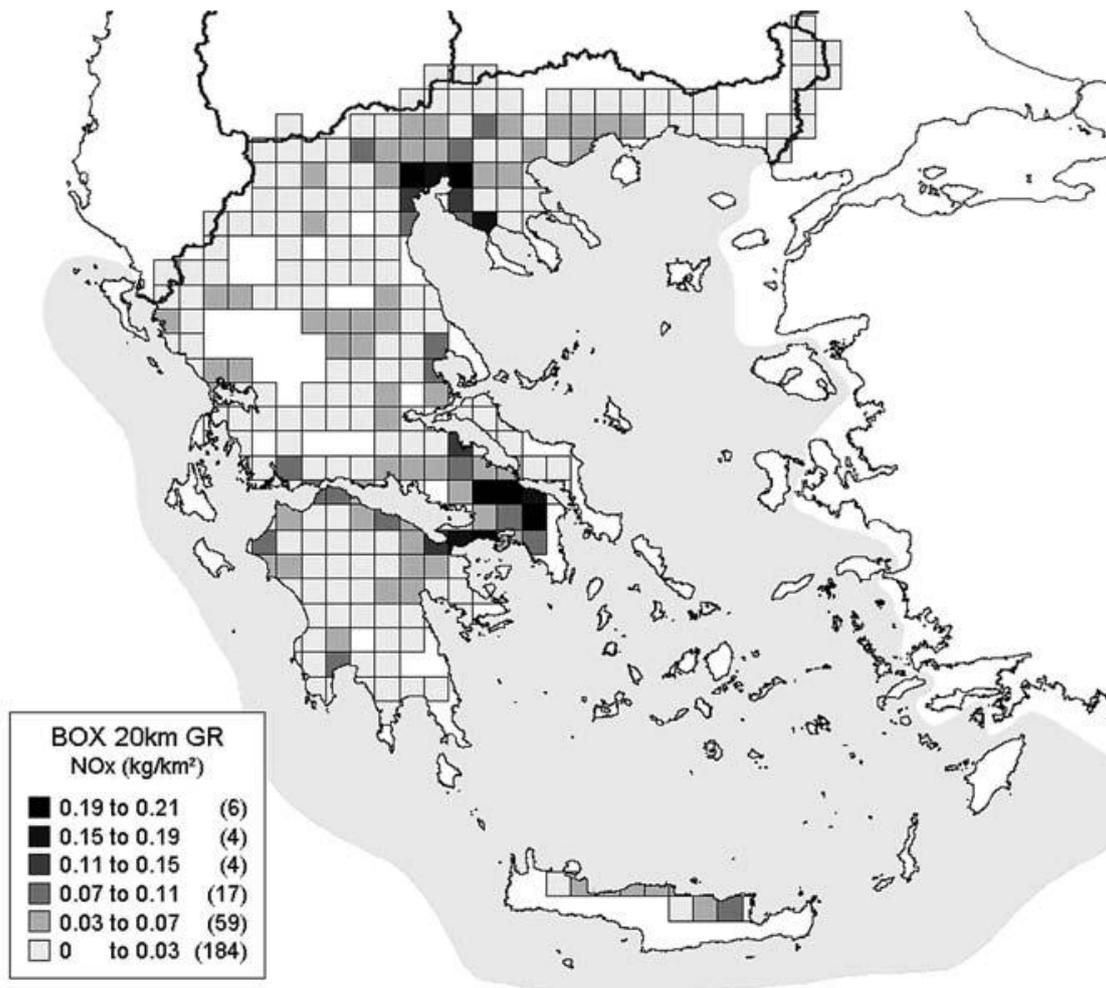


Fig 4.4. Hourly NO_x emissions (kg/km²/h) from traffic, in a 20 x 20 km grid, in Greece.

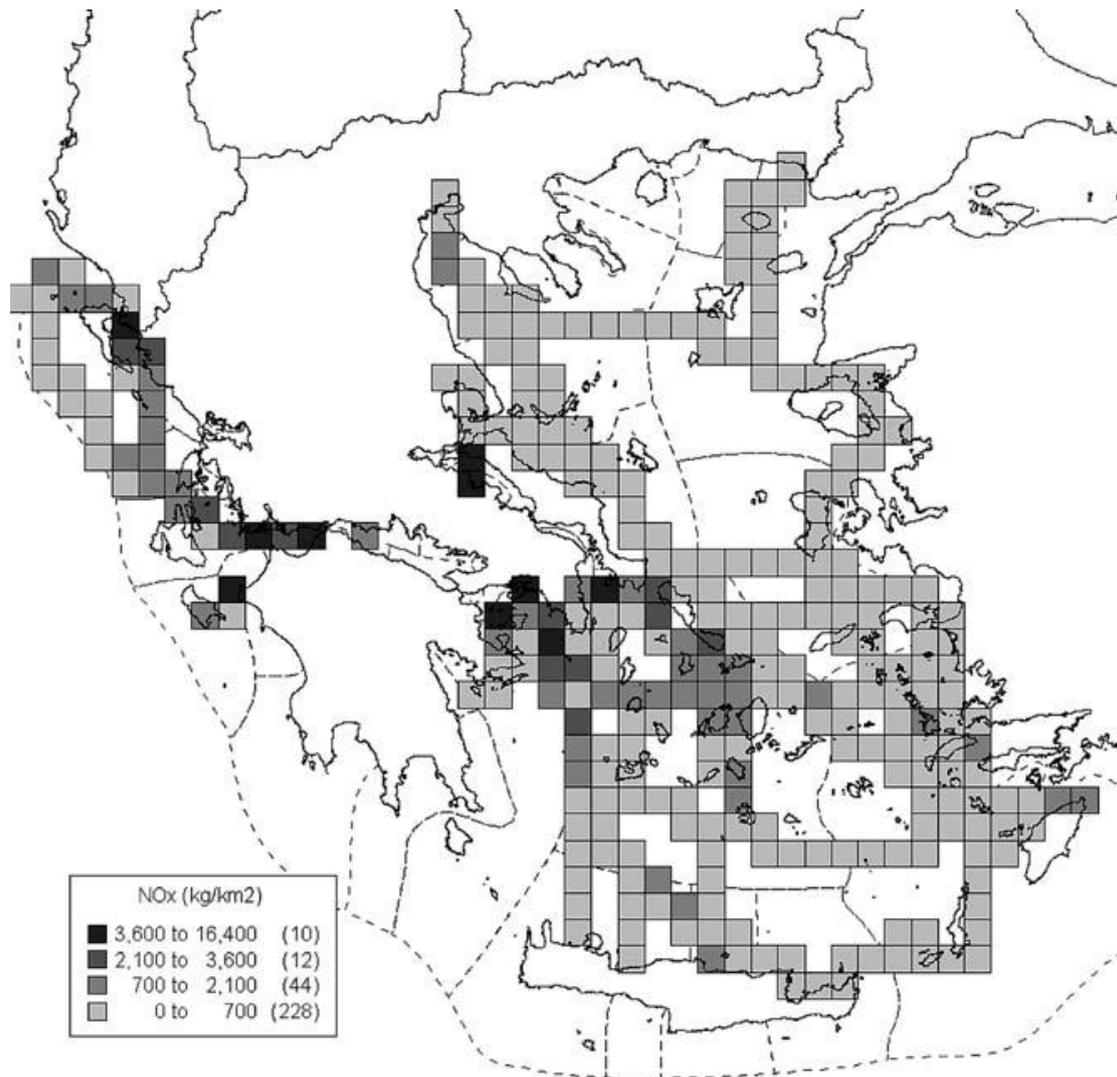


Fig 4.5. NO_x emissions (kg/km²/year) from passenger ships and ferries, in a 20 x 20 km grid, in Greece.

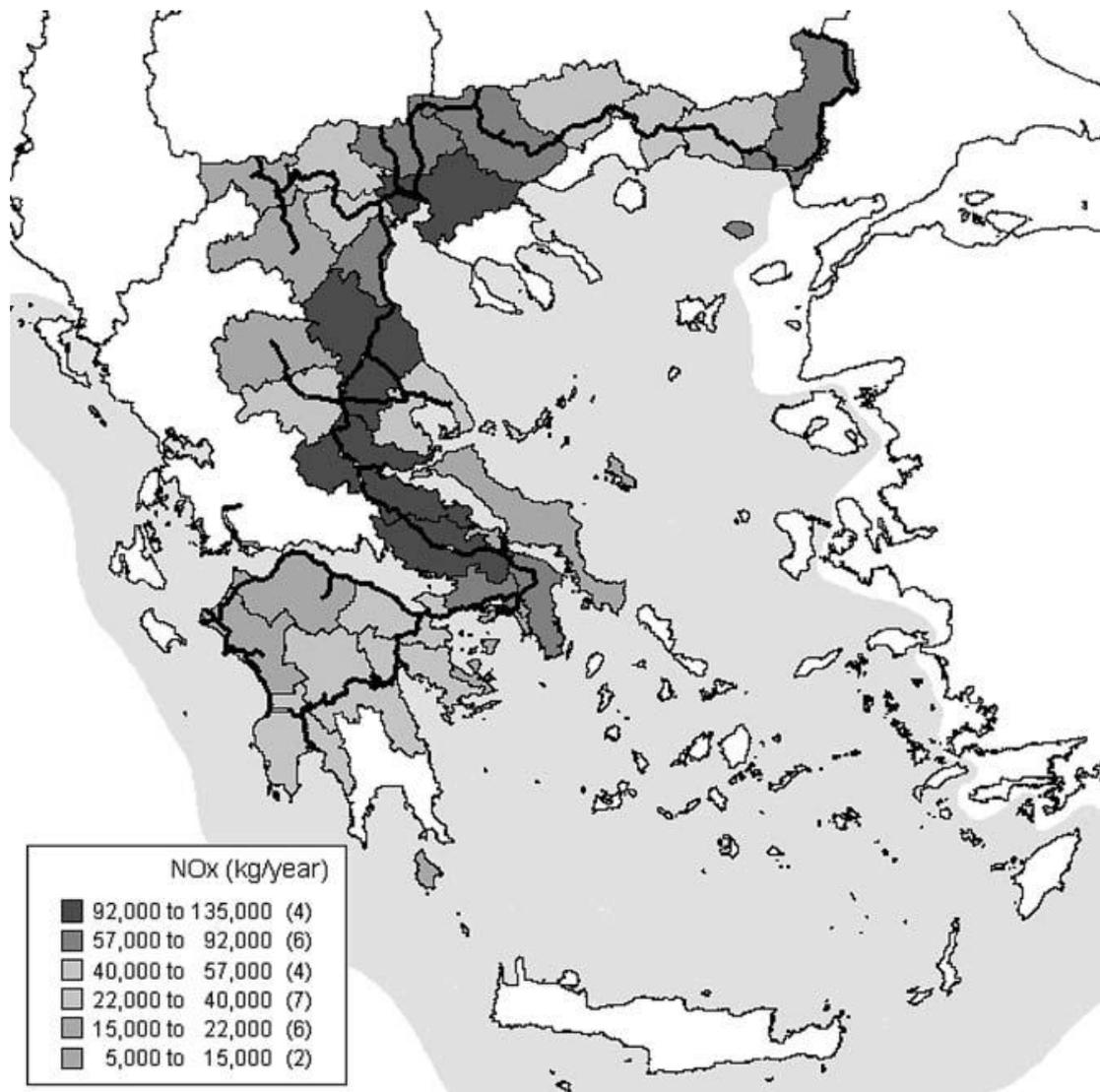


Fig 4.6. Aggregated to the prefectures NO_x emissions (kg/ year) from rail transport in Greece.

4.1.8 Energy produced from renewable sources

Under Directive 2009/28/EC on the promotion of the use of energy from renewable sources, 18% of the gross final energy consumption should be derived from RES by 2020.

Greece has recently adopted a National Renewable Energy Action Plan in the scope of Directive 2009/28/EE and the Law L3851/2010 concerning the promotion of RES.

The national targets for the R.E.S. until the end of 2020, based on Directive 2009/28/EC (EEL, 140/2009), are set as follows:

- a) Contribution of the energy produced from R.E.S. to the gross final energy consumption by a share of 20%.
- b) Contribution of the electrical energy produced by R.E.S. to the gross electrical energy consumption to a share of at least 40%.
- c) Contribution of the energy produced by R.E.S. to the final energy consumption for heating and cooling to a share of at least 20%.

d) Contribution of the electrical energy produced by R.E.S. to the gross electrical energy consumption in transportation to a share of at least 10%."

A decision of the Minister of Environment, Energy and Climate Change which is issued within three (3) months from the date this law goes into effect and is published, determines the desired proportion of installed capacity and its distribution in terms of time among the various R.E.S. technologies. This decision is reviewed every two years or less, if there are important reasons related to achieving the goals of Directive 2009/28/EK.

The National Renewable Energy Action Plan (NREAP) that was submitted to the European Commission specifies further sectoral targets as shown in **Table 4.1.**

	Share in 2005		Share in 2020	
	MW	GWh	MW	GWh
Hydro				
<1MW	26	106	39	150
1MW-10MW	63	218	216	833
>10MW	3018	4693	4276	5593
Geothermal			120	736
Solar				
Photovoltaic	1	0.9	2200	2891
Concentrated Solar			250	714
Wind				
Onshore	491	1267	7200	16125
Offshore			300	672
Biomass				
Solid			40	364
Biogas	24	94	210	895
TOTAL	2923	5786	13271	27269

Table 4.1. Sectoral targets of the Greek NREAP.

The current status of RES in Greece according to statistics from the Hellenic TSO is also depicted in **Table 4.2.**, where it is evident that wind is the dominant RES (apart from large hydro) while PV are growing at a high rate mainly due to favorable tariffs.

	Installed Capacity in Dec 2010 (MW)	Annual Produced Energy (GWh)
Wind	1039	2061
Small hydro	197	753
PV	153	132
Biogas	41	194

Table 4.2. Status of RES in Greece.

More than 50% of all RE projects situated in Greek islands are found in Crete, mainly in the form of wind parks. According to data

of the Regulatory Authority for Energy provided on May 2008, 134.750 MW of wind energy are installed and operation in Crete, 0.17MW of biomass, 0.567 of PV and 0.477 MW of small hydroelectric plants. In terms of electricity produced, some 335 GWh are produced by wind energy, 0.48 GWh by biomass, 0.2GWh by hydraulic energy and 2.569 GWh by oil (data of 2006). Crete is considered to have an additional wind electricity potential of more than 900 GWh/yr, Archanon-Asterousion Municipality included in the areas of high speed winds (see **Fig. 4.7**).

The available potential on the island for the electricity generation by the solar energy is approximately estimated to 16.5 GWh/yr. Regarding hydraulic resources, they are considered sufficient for domestic, industrial, agricultural and tourism needs, but they are far from being considered as "abundant". Biomass potential (currently, agricultural residues) is mainly used on the island to produce heat. Electricity generation from biomass products could potentially reach 360 GWh/yr: this creates new horizons for the energy mix of Crete. RES importance for Crete is being reinforced by the high annual increase of electricity demand in the island (9% in relation to 5% of the continental Greece).

Moreover, there is a strong interest from investors in Crete [E.Michalena, V.Angeon, *Local challenges in the promotion of renewable energy sources: The case of Crete, Energy Policy 37 (2009) 2018-26*, info provided by CRES staff].

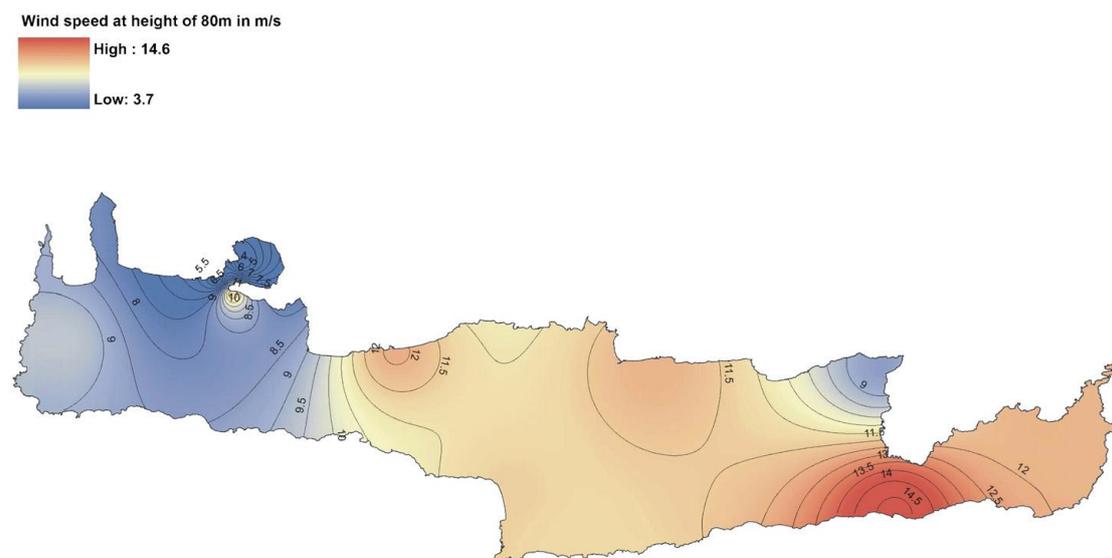


Fig. 4.7. Wind potential in Crete (2007) [E.Michalena, V.Angeon, *Local challenges in the promotion of renewable energy sources: The case of Crete, Energy Policy 37 (2009) 2018-26*].

4.2 Sources and available data

The sources are incorporated in the text.

4.3 Description of the indicators -Calculated indicators

Some relevant indicators can be seen below:

Thematic area:	3. Territorial and environmental resources
Indicator:	3.8 Energy produced from Renewable Energy Sources (RES)
Indicator description and calculation method:	
Purpose of the indicator is to measure the energy's quota produced from the different RES. The indicator defines the number of the plants and the quantity of energy produced by the aforesaid plants in relation to the total energy consumption.	
Unit of measurement:	<p>Wind energy: 16 wind parks of total installed power of 95.21 MW / Electricity >9% - 9 more parks under construction of total installed capacity 50.05MW</p> <p>Biomass: (Thermal uses: olive oil mills, bakeries, green houses, hotels, dwellings): 8.5% of the total energy consumption / Biogas: 2 combined heat/electricity installations (CHP): Waste water treatment of Heraklion and Chania</p> <p>Solar thermal collectors: Central/house solar heating systems > 190.000 m2 (thermal energy producing ~ 730 TJ ~3% of the total energy demand) – 20 new pilot central solar heating systems for hotels and SMEs of 8.450 m2 total surface</p> <p>PV systems: lighthouses, small hotels of ecological tourism, hotels and dwellings, 30 installations of 0.2MW / Under construction 20 new installations of total power of 1.2MW (1900 MWh)</p> <p>Passive solar systems – bioclimatic dwellings: houses, schools, research institutes etc. 20 operating installations</p> <p>Small hydro: 2 installations of 0.6 MW / Total potential: 6MW</p>
Indicator typology (DPSIR model):	Pressure
Time period :	Data concerning 2005
Territory :	Crete island
Desirable environmental objective :	The adoption of politics and measures directed to increase energy quota produced from RES.

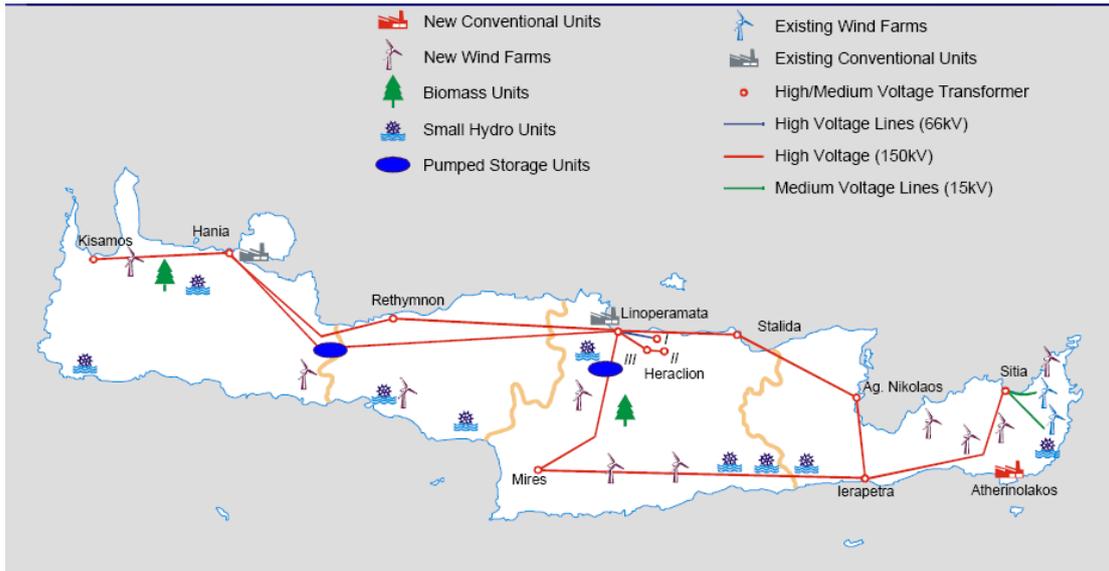


Fig. 4.8. Existing and future electricity production units and the electrical grid of Crete (2005) [N.Zografakis, *Regional Energy Agency of Crete, RE-Islands Conference, Eur. Programme ALTENER “European Renewable Energy Islands, Brussels, 21/9/2005*].

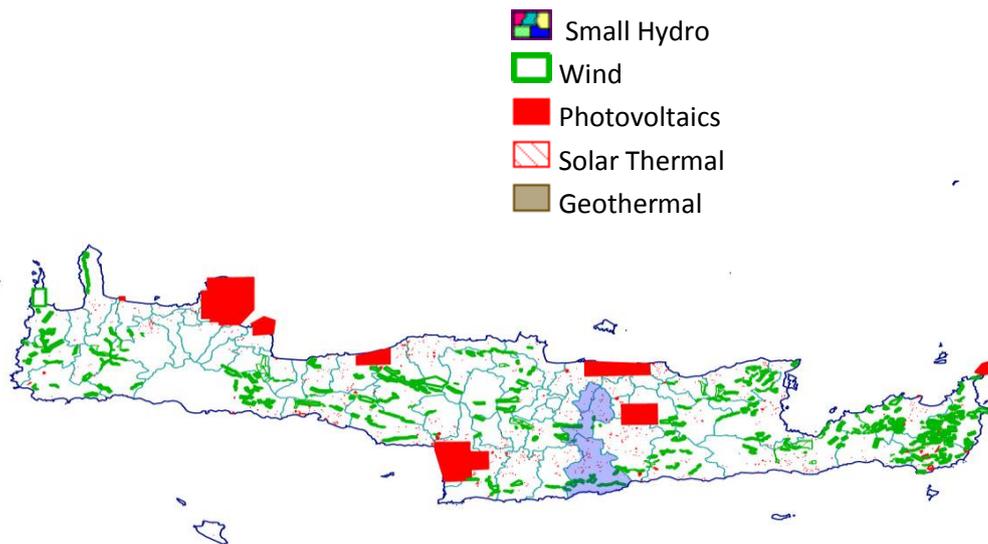


Fig. 4.9. Applications for Energy Production in Crete Island (the Archanon-Asterousion Municipality is depicted in light blue color) [on-line map of the Regulatory Authority for Energy (RAE), www.rae.gr].

5 TERRITORIAL SERVICES

5.1 Introduction

Preface / Preliminary remarks

Greek territory is still characterized by negative conditions for institutional, organisational and productive support as well as large-scale financial and in the broad sense development initiatives.

With the exception of the two metropolitan centres of Athens and Thessaloniki, and perhaps of areas close to them, the rest of the country's regions do not possess even the minimum level of the critical mass as to spatial, population, productive and technological factors required, on the basis of comparative performance benchmarks at prosperity and employment level, to tackle effectively a multitude of challenges and problems.

The intense regional disparities that exist, as well as the growth performance of the Regions of the country, are also linked to the regional policies implemented in the different programming periods. These policies displayed an important deficit with regard to the mobilisation of private and direct investments, which could have contributed to the lifting of important structural weaknesses in the productive pattern of the country and of its Regions. Such investments could have led to an increase in employment, and compensate for lost jobs due to low competitiveness, and to enterprises relocation –towards countries with low-wage labour force [*National Strategic Reference Framework 2007-2013, Ministry of Economy and Finance, General Secretariat of Investments and Development, Athens, October 2006*].

5.1.1 Availability of public and private services

In 1983, a national health-service (IKA) was introduced in common with many other countries of southern Europe. However, although medical training is of a high standard, the health services' level is one of the lowest in Europe, largely because of under-funding (health care costs per head in Greece are the lowest in the EU and the country spends a relatively small percentage of its GDP on health). Public hospitals are inundated with patients, although standards of hygiene are high. Public and private medicine operates alongside each other in Greece and complement each other, although public health facilities are limited in some areas, particularly on isolated islands.

The growth of private health care in Greece in the last 15 years is evident (private health expenditure has reached 3.9% of the country's GNP (43%

of the total expenditure in health in 2000), especially through the increase of private doctors and private diagnostic centres [Tountas, Y.; Karnaki, P.; Pavi, E.; Souliiotis, K. *The “unexpected” growth of the private health sector in Greece, Health Policy 74 (2005), 167-180*]. The government is currently trying to introduce new laws and improve the health system [<http://www.justlanded.com/english/Greece/Greece-Guide/Health/The-National-Health-Service>].

In Greece there is a national organization responsible for school buildings, the School Building Organisation (SBO), established in 1962 to design and construct new buildings and provide educational equipment. SBO works with the government agencies that construct school buildings (i.e. regional, prefectural governmental and local authorities). Between 1996 and 1999 the amount of public finances invested in educational infrastructure has more than tripled, from 22 866 million drachmas to 74 970 million.

Regarding social welfare services, in 1980, Portugal, Italy, Spain and Greece were starting from substantially lower social protection levels than the other European countries. At that time Greece specifically invested 1/5 of the Community average, while at the end of the 90s, the percentage of GDP going towards social protection costs was the lowest one in the whole Europe (16%).

Focusing to the Mediterranean welfare systems, data show various threats to its maintenance and quality, especially the consequences of an ageing population (in Greece the population aged 65+ was 17.1% in 2000, higher than the European average of 16.2%, and is expected to reach 20.6% in 2020), the consequences of an increase in dependent persons (an ever smaller group of workers must maintain a greater number of people), and the consequences of a crisis in the informal support provided by families (in Greece the institution which used to be the main source of welfare was traditionally the family, but we are now witnessing the *defamilisation* as a consequence of women’s growing economic independence). The obvious consequence of all this is increased demand for social and health care (family services, state nursery coverage or home help for the elderly among others) [Garcés, J.; Ródenas, F.; Sanjosé, V. *Towards a new welfare state: the social sustainability principle and health care strategies. Health Policy 65 (2003), 201-215*].

Concerning financial services, the main supervisory authority of Greek banks is the Bank of Greece, a state-controlled limited company. The supervision of insurance companies and of the capital markets are the responsibility of different authorities. Insurance companies are supervised by the Ministry of Commerce, while investment funds by the Capital Market Committee. In general this multiplicity of supervisory authorities in the financial sector does not make the standardization of procedures easy,

no need to mention the great financial crisis under which the country is, which forces the whole world of finance to reshape and go under major changes [Frangakis, M. *Globalization and Structural Change. The Challenge to Regulation and Supervision. The case of Greek Banking. 2000*].

Greece has risen to prominence in a number of sporting areas in recent decades, like football (the Greek national football team won the 2004 UEFA European Football Championship, basketball, wrestling, water polo, athletics, weightlifting, with many of them becoming international stars inside their sports. The successful organization of the ATHENS 2004 Olympic and Paralympic Games led also to the further development of many sports and has led to the creation of many World class sport venues all over Greece and especially in Athens [http://en.wikipedia.org/wiki/Sport_in_Greece].

5.1.2 Public transport supply

The transport facilities of Greece include:

- Greece Flights - There are several domestic as well as international flights that operate to and from Greece. It is one of the most popular transportation services in the country. There are 44 airports located all over the country.
- Ferries in Greece – The ferries are the best possible means to reach the beautiful Greek islands. It is probably the most popular transport of the country. There are numerous ferries that operate regularly within the island and from other countries.
- Trains in Greece – The entire national and international train route networks in Greece are run by OSE. These services are limited within the mainland of the country. It is one of the cheapest modes of transport in Greece.
- Metro in Greece – The underground railway transport is one of the fastest and popular transports systems of the country. It is available only in Athens so far but will soon be available in the second largest city as well, Thessaloniki.
- Buses in Greece – The bus network in Greece is very developed operating within the mainland as well as to and from the Greek islands. It is a popular means of transport in Greece.
- Cars, Taxis and Bikes are other mode of transportations that are available in the country. The internal and external communication system of the country depends entirely on these well-developed Greece transportation systems [<http://www.mapsofworld.com/greece/travel/transportation.html>].

Besides, the heavy vehicles transportation burdens especially the prime road network of the country and, especially, those parts of the motorways with continuously increasing traffic. The average number of heavy vehicles

in several parts of the national road network, as this is estimated in several studies, has been increased from 15% of the total traffic load during the 1980's to 20-25% in 2000 and is estimated to be around 30% in 2015 for the most motorways of Greece. According to the Operational Framework of Road Safety of the Hellenic Ministry for the Environment, Physical Planning and Public Works, heavy vehicles are involved at 29% (average estimate in a 5 years horizon) of the total number of accidents that are recorded in the national road network [*Greek Technology & Science Initiative (GSTI) in Transport. Vision Paper and Basis for a Strategic Research Agenda for Transport, An Initiative of the Greek Research Centre*].

5.1.3 Local tools, plans and initiatives aimed at enhancement (improvement) of public transport and the promotion of innovative modes of transport

There is a series of significant ITS projects implemented already in Greece, mostly focused on the big urban areas of Athens and Thessaloniki or big motorways, whereas, on the other hand, there is a **lack of such initiatives in the rural areas**. Another area where the application of telematics in the transport sector has been relatively successful are the navigation and infomobility services applied in taxi fleets. Radio taxi fleets are equipped with devices that permit the dispatch center to see their location and send them information on what rides are available. It must be pointed out that the development of these services for radio taxis first in Heraklion, then in Thessaloniki and in Athens has been the result not of large research projects, but of private companies, some of which with limited budget (Pythia consortium and e-taxi in **Crete**).

With respect the use of traffic simulation models, there is no extensive research conducted in Greece, only some stand-alone studies.

With respect to AVL systems, there are presently several companies in Greece offering such systems. The characteristics of these systems is that they permit the tracking of the vehicles and also the transmission of information gathered from sensors with respect to some critical parameters (excess speed, temperature in the container, etc.). The systems are mainly used for reporting and do have any facilities for rerouting of lorries in case of traffic, or to pick up new orders.

Regarding the driver simulators, only few of them can be found in Greece and are used either for training purposes or for research purposes. The research for passive safety systems is also limited in Greece.

Providing traffic information on the web has been implemented by the National Technical University of Athens (NTUA) and also by FORTH-IACM for Athens and Chania. The NTUA site displays "typical average traffic

conditions" in Athens and also permits users to download data on a PDA and get SMS notifications.

With respect to parking management a research project has been implemented in the past by NTUA (PARKMAN) but currently no system exists that permits travellers to make reservation for parking spots before arriving at a parking. In general, there is a growing number of parking lots, most of them underground in which smart parking management solutions are implemented, thus permitting travellers to check space availability before hand, make reservations in advance, etc.

A project that resulted in a service that could be potentially exploited is the ENOSIS project. As part of the project a web site has been developed that could be used for providing information to a traveller on what means of public transport to use for reaching various destinations in Greece. Many of the research projects funded by the General Secretariat of Research and Technology or Ministries have resulted into pilots that could be used at the operational level. However, this is not occurring for various reasons.

There are only a few transport and infomobility services addressing People with Special Needs (PSN), which are provided, up to a limited extent, by Municipalities and other stakeholders.

Finally, several seminars have been conducted, aiming at the further education and/or awareness of drivers, young persons, researchers, actors and several social groups with regard to road safety.

In general, more technological solutions that will result in a safer, "greener", more intelligent and as personalised as possible transport system [*Greek Technology & Science Initiative (GSTI) in Transport. Vision Paper and Basis for a Strategic Research Agenda for Transport, An Initiative of the Greek Research Centre*].

5.1.4 Waste management

The waste disposal in Greece until 1994 was characterised by the thousands of dumpsites (4850), 70% of which were uncontrolled (corresponding to 35% of the total waste quantities). The proportion of the population served by regular collection system was around 70%, while in numerous small islands and isolated communities collection was rarely organized. Between 1994 and 2000, around 300 million euros have been spent for Solid Waste Management activities, in more than 40 prefectures and urban areas of the country [<http://www.investingreece.gov.gr/default.asp?pid=41&la=1>].

The same situation was met also in Crete where it was only after 1995 that the first regional solid waste management strategy was designed and started being implemented in the region of Chania [*E.Gidarakos et al. Waste Management 2005*].

Today Greece produces more than 5 million tons of residential and commercial urban waste annually, equivalent to 455 kilograms per person. The region of Attica produces almost 39% of Greece's urban waste, followed by the region of Central Macedonia (16%) and the city of Thessaloniki (9%).

It is now well established that new technologies need to be applied in our country to deal with an ever increasing burden of waste and that meet the demand for disposal, energy generation, recycling, and new, closed-loop systems that will limit waste generation.

According to EU Directives, all MS should recycle 55-80% of packaging material by 2011 and decrease organic urban waste by 25% through composting processes at source by 2010. This percentage should increase to 50% by 2013 and 65% by 2020. In Greece it is predicted that the evolution of diversion and disposal rates will result for both rates at a value of 50% around year 2020.

Although many municipalities adopted recycling programmes with increased participation and promising results, the demand for more comprehensive and effective programs remains. In 2008, 525.000 tons of packaging material were recycled / recovered from a total production of 1,050,000 tons. A total of 19 centres for sorting and recovery were established in Athens, Thessaloniki, **Heraklion**, Chania, Kalamata, Patras, Zakynthos, Schimatari, Lamia, Karditsa, Corfu, Katerini, Magnesia and Ioannina.

The ten recycling systems throughout Greece today deal in packaging material, vehicles, tires, lubricants, batteries, and electrical and electronic equipment. Currently, 15 companies deal in the management of hazardous waste.

Currently, Greece operates two waste to energy facilities, one in Athens, the capital of Greece, at the Ano Liosia Hygenically Controlled Landfill and one in Thessaloniki, the second largest city of the country, at the Tagarades Hygenically Controlled Landfill. The Ano Liosia facility produces heat and power from biogas and has an installed capacity of 23.5 MW. The Tagarades power plant produces electricity from biogas and has an installed capacity of 5 MW, capable of covering the energy needs of 80,000 residents.

The authority responsible for the planning and implementation of alternative waste management in Greece is the National Organization for

the Alternative Management of Packaging Materials and Other Products (EOEDSAP) of the Ministry of the Environment, Energy and Climate Change [<http://www.investingreece.gov.gr/default.asp?pid=41&la=1>].



Fig. 5.1. Growth of recycling in Greece on a yearly base [*Ministry of the Enviroment, Energy and Climate Change*]

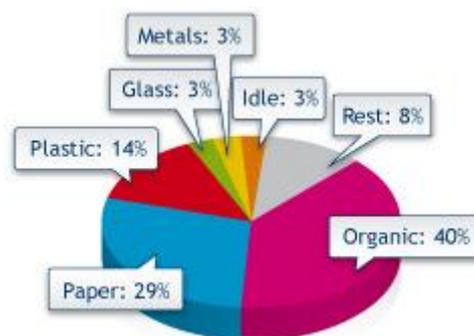


Fig. 5.2. Composition of Urban Waste in Greece [*Ministry of the Enviroment, Energy and Climate Change*]

From the study of *E. Gidaracos et. all, 2006: Municipal solid waste composition determination support in the integrated solid waste management system in the island of Crete* the following information regarding Municipal Waste in Crete are available:

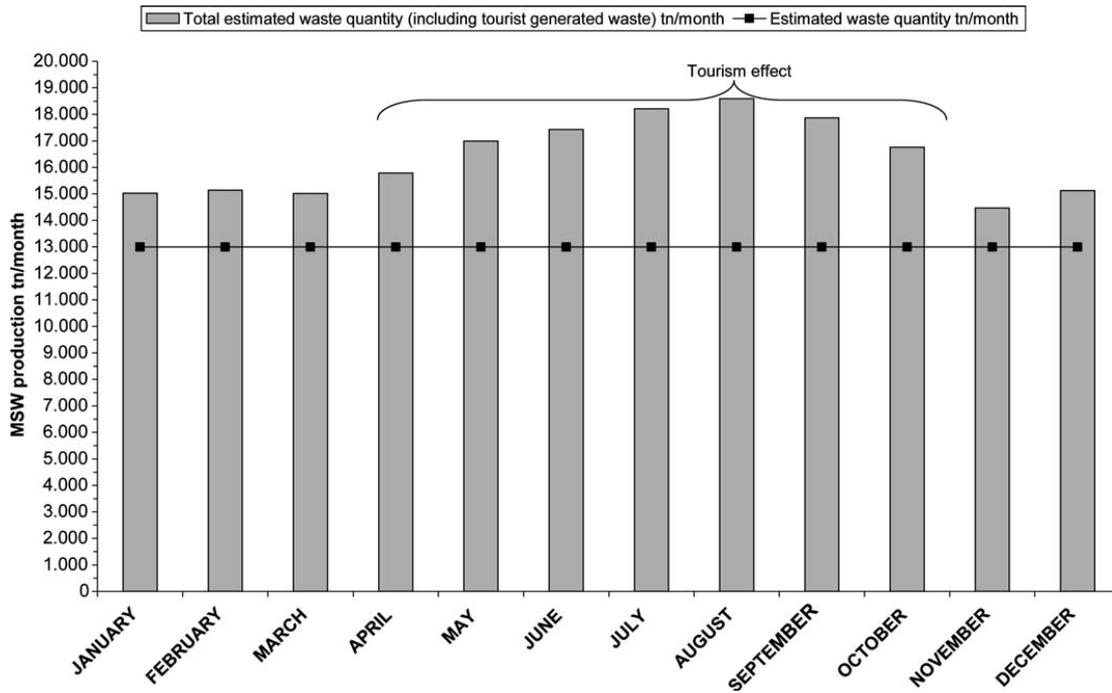


Fig. 5.3. Total estimated waste quantity per month in Crete.

In the figures below the results of the waste composition analysis for the period 2003 – 2004 for the specific areas of Crete are presented. Three main waste categories can be identified: Putrescible Papers and Plastics (P3 Dominance), which share about 76% of total MSW. Putrescibles represent 39%, while plastics and paper are second with 17% and 20%, respectively. The share of glass (7%) is also considerable, mainly consisting of disposable (not refillable) bottles. In the second figure we can see data from the Kazantzakis Landfill located in the Archanon – Asterousion Municipality.

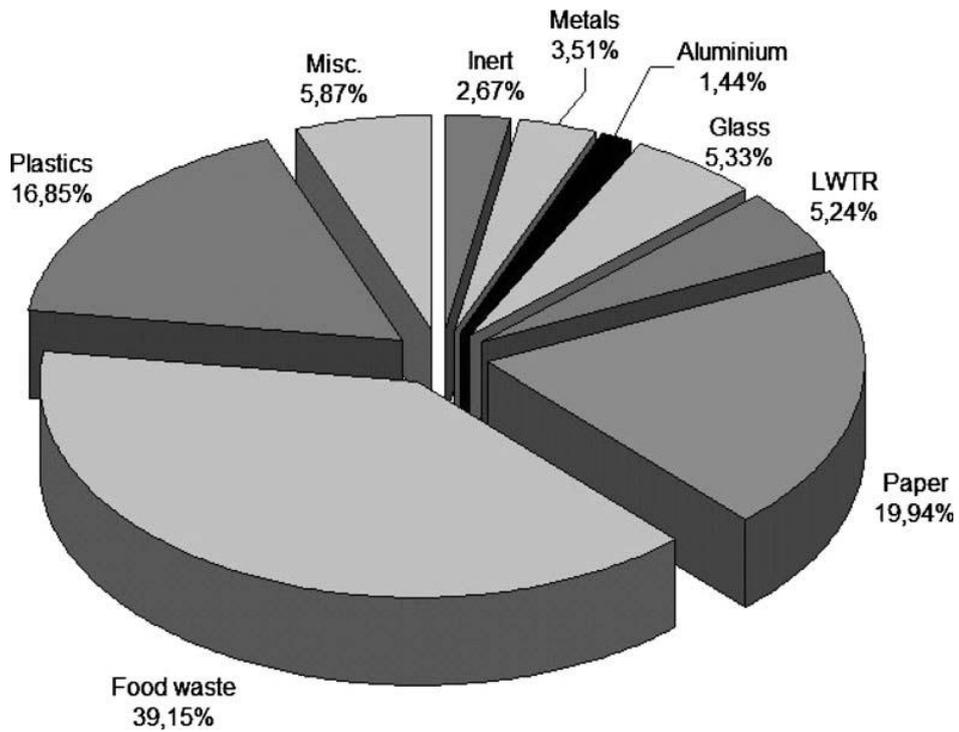


Fig. 5.4. Waste composition analysis in Crete.

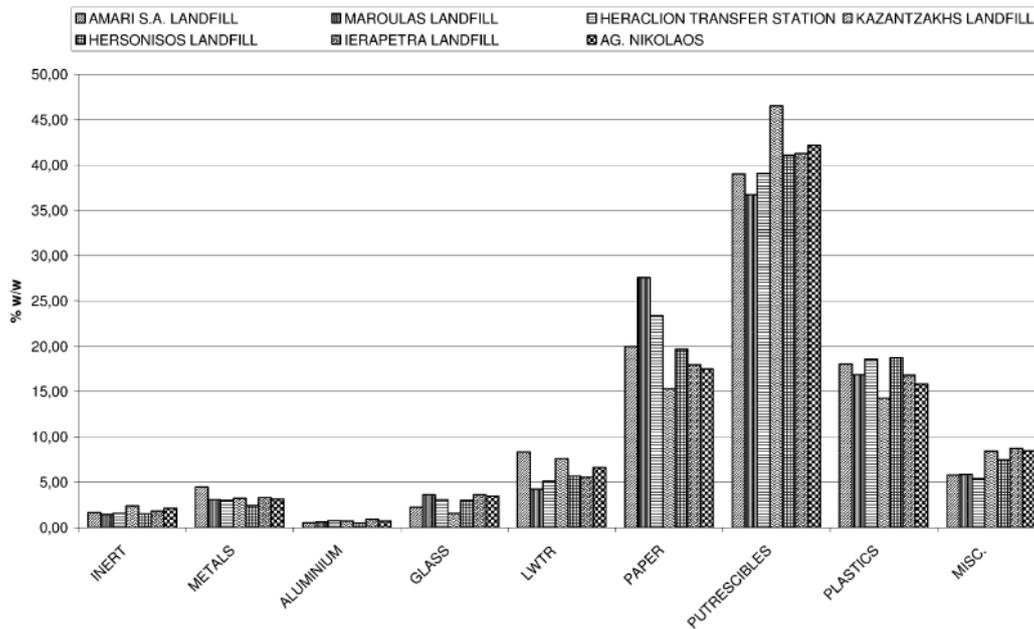


Fig. 6. Waste composition analysis (spatial, annual variation), wet weight.

Fig. 5.5. Waste composition from different landfills located in Crete, among them the Kazantzakis landfill as well.

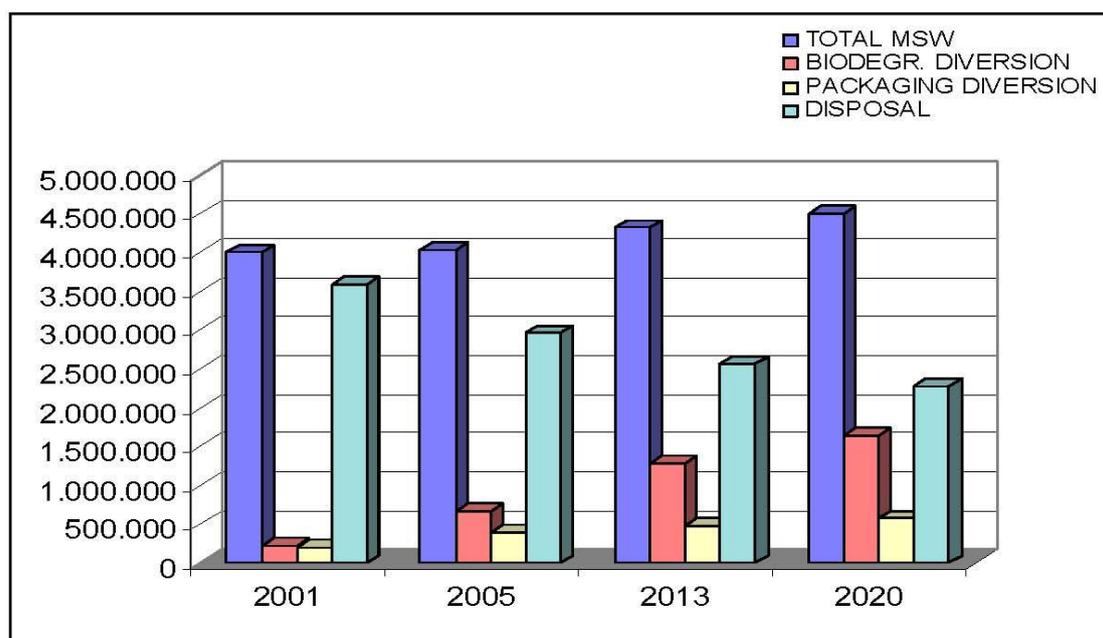


Fig. 5.6 Waste composition predictions for 2020.

5.1.5 Management of waste water

Greece had to comply with the directive EEC/271/91 on urban wastewater treatment (CEC, 1991). This has proven to be quite difficult because of problems in either construction or operation. The current status of municipal wastewater treatment plants (MWTP) is quite problematic, with 13 MWTP falling under the “failure” category (they failed before they even started operation), 54 falling under the “under construction” category, 12 falling under the “incomplete” category, 35 falling under the “completed but not in operation category” and 71 falling under the “in operation category”. The extent of delays is remarkable with the consequences of long-term periods out of operation being also very serious (economic, technical consequences, thefts and vandalisms). The main causes that caused the MWTP to fail or to stay out of operation are the following:

- Incomplete/inadequate sewerage system (refers to those almost fully constructed)
- Lack of money (refers to those stopped because of insufficient funds for construction or operation and maintenance)
- Legal matters (including people’s reactions and financial disagreements that led to court actions)
- Discharge structure missing
- Design failure and bad construction
- Other.

Villages and small towns are usually subject to central prefectural administration for technical projects, as smaller communities are not always able to sustain technical services. Thus, construction of a MWTP is supervised by prefecture engineers. Projects are mainly subsidised from national or EU funds, but O & M is mainly financed from the community's budget. The weak point here is that one organisation is responsible for choosing the system and supervising construction, while another is responsible for operating and managing it. Accounting is the only service that small municipalities can support with their existing personnel. What happens in most cases is that a local technician or unskilled employee is trained for some months to operate the plant. Previous experience has shown that this is not adequate if there is no engineering and scientific supervision.

Additional contracts with consulting companies are required, but rarely entered into force [Tsagarakis, K.P.; Mara, D.D.; Horan, N.J.; Angelakis, A.N. *Institutional status and structure of wastewater quality management in Greece, Water Policy* 3 (2001), 81-99].

5.1.6 Efficiency of water distribution system (network/service)

Greece has a long tradition in water distribution systems (WDSs) since one of the milestones in the development of ancient WDSs was the tunnel of Eupalinos on Samos Island, built by the Greeks circa 530 B.C., the first deep tunnel in history whose construction started from two different openings. Aqueducts and terracotta pipes were common infrastructure of Greek cities, indicating that water supply was an essential aspect of the welfare of those communities [Water Distribution Systems, F.A.Bombardelli, Department of Civil and Environmental Engineering, University of California].

However, in our days the efficiency of the waster distribution system is not satisfactory. The major water use in Greece is for rural usage (86%) whereas the urban, energy and industrial uses are 11%, 1% and 2% respectively. More specifically, 96% of the rural consumption is allocated to irrigation -80% of which is wasted in the hydrologic circle or other losses. The water needs can not always be covered and water imbalance is often experienced, especially in the coastal and south-eastern regions, due to temporal and spatial variations of precipitation (Eastern Greece, along with the islands of Aegean and Crete have considerably small rainfalls than Western Greece) (see also **Fig. 5.7**).

The problem is directly related to the increased water demand during the summer months and to the difficulty to transport water due to the mountainous terrain. It is exactly during the dry seasons of spring and summer tourist mobility is a peak, putting substantial pressure on good quality water reserves and irrigation is also required mostly [A.Karamanos, S.Aggelides, P.Londra, *Water Use Efficiency and Water Productivity in Greece, OPTIONS mediterraneennes, Series B, no 57*].

On the other hand, the evapotranspiration is an important hydrological loss that takes place both from the surface and the upper territorial layers. The value of evapotranspiration is quite high, especially in the dry Eastern regions of the country, and affects especially South-eastern Greece and the islands of Aegean, along with the severity of drought. Unfortunately proper action of the water deficiency in the Eastern parts of the country is taken only when these phenomena become extreme and they significantly affect the consumers. However, even these mobilisations are usually based on fire-fighting or repressive measures, while it is obvious that similar situations can only be dealt with a long-term policy of integrated rational management both of the water resources and the water uses.

The situation has to be confronted immediately in the direction of equitable estimation, reliable planning and rational management. Among the actions to be taken, actions to limit the polyarchy in the sector of water should be included. The water uses should be regarded with a more balanced and rational sharing of the available resources and for the rural use in particular, a rural national water policy should be immediately planned, at least concerning the proper choice for cultivation of land based on the region's water availability, the observance of laws regarding exploitation and pollution of underground waters, the vital reduction of water losses and water consumption for irrigations and the briefing and guidance of citizens and farmers on these subjects [*M.A.Mimikou, Water resources in Greece: present and future, Global NEST Journal, Vol. 7, No 3, pp. 313-322, 2005*].

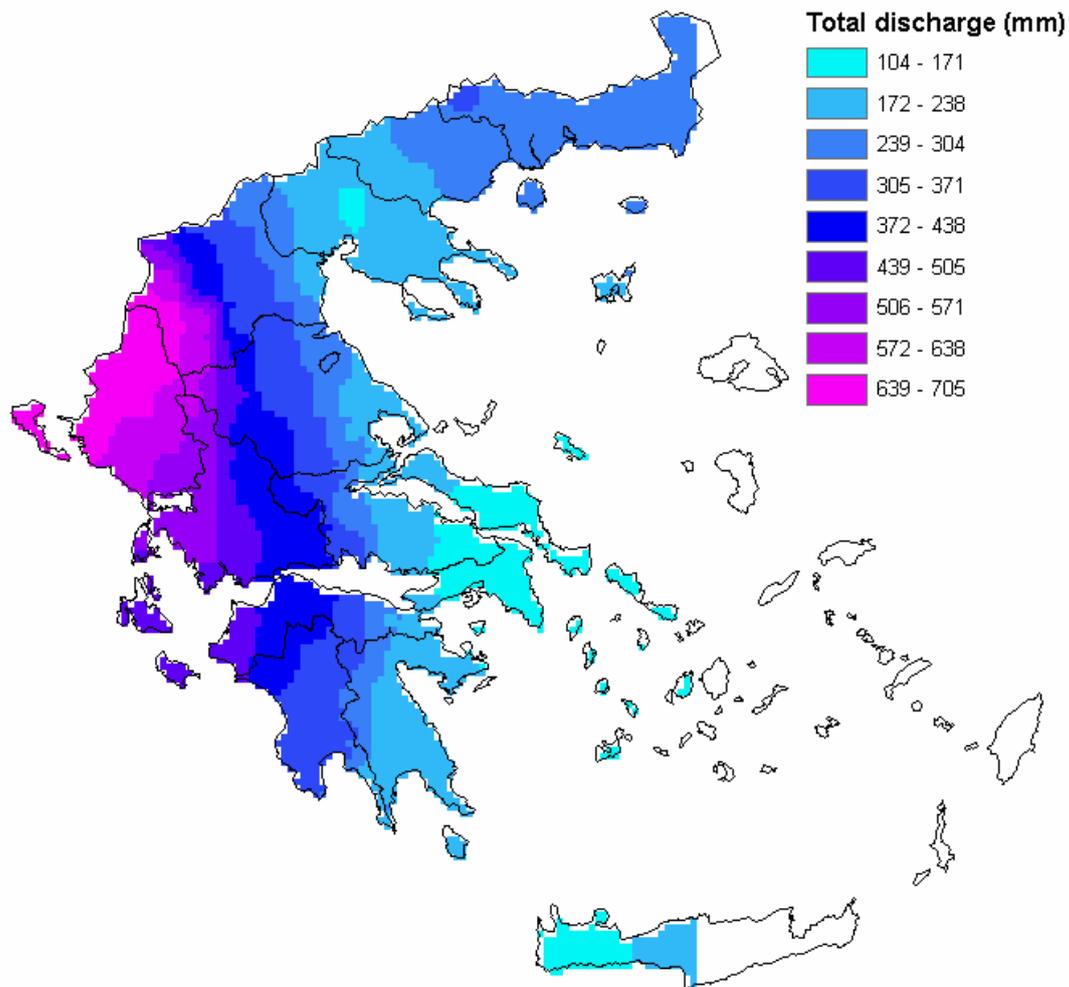


Fig. 5.7. Runoff distribution in Greece (distribution proportional to the rainfall) [M.A.Mimikou, *Water resources in Greece: present and future*, *Global NEST Journal*, Vol. 7, No 3, pp. 313-322, 2005]

5.2 Sources and available data

The sources are incorporated in the text.

5.3 Description of the indicators -Calculated indicators

All data located concerning the Archanon-Asterousion Municipality are given above.

6 ECONOMIC ACTIVITIES

6.1 Introduction

Preface / Preliminary remarks

6.1.1 Local units of enterprises and workers by sector

In Greece, enterprises employing 50 persons and below form about 99.55% of the total number of enterprises and they employ 74% of the work force of the private sector. Moreover, it should be mentioned that the SMEs provide 70% of the new jobs (SMEs are defined as the enterprises which employ up to 100 salaried workers on average in the last three years and have an average turnover up to 2,4 million Euro, unless the SMEs are capital intensive, in which case the maximum number of employees is limited to 50). Based on the above mentioned limits, the number of SMEs in Greece exceeds 733.000. In total the SMEs employ 1.695.000 people, from which 712.000 on average are salaried. The big enterprises with over 250 employees cover only the 13,5% of employment with 230.000 salaried. As a result the proportion of the employment in SMEs on one hand and in the big enterprises on the other is 87,5% to 13,5% and as far as salaried work is concerned is 75% to 25% or 3 to 1. The main volume of employment is of salaried work and is found in SMEs with 1 to 20 employees. [www.eommex.gr].

Greece has the largest agricultural sector (7% of GDP) in relation to other EU countries, which reflects the importance of agriculture for the Greek economy. The processing sector accounts for 22% of total GDP, relatively low compared to other EU MS. As regards services, Greece ranks seventh which shows that in Greece, services are much more significant than industry, reaching 71% of GDP. In the period 1995-2004 there is a continuous and strong employment drop in the primary sector, and a gradual one in the secondary sector, while the tertiary boasts a major employment increase. In 2005, total employment breaks down as follows: primary sector 12.4%, secondary sector 22.4% and tertiary sector approx. 65% [*National Strategic Reference Framework 2007-2013, Ministry of Economy and Finance, General Secretariat of Investments and Development, Athens, October 2006*].

The Cretan soil is very fertile and some of the products growing in it are olives, citrus fruits, figs, grapes, apricot, watermelon, avocado and bananas. Grape-gathering, wine-making and tsikoudia-making (tsikoudia or raki is a grape-based spirit from the island of Crete, very similar to tsipouro, made from the distillation of pomace, i.e. the pieces of grapes that were pressed for the winemaking process) are traditional Cretan activities. In 1970s greenhouse cultivation was introduced in southern

Crete and since then it gradually became very competitive. After 1981 greenhouse cultivation spread further, becoming an important export sector (the island possesses around 50% of the country's greenhouses). Agriculture benefited from EU subsidies but these were frequently diverted to other uses, such as the construction of tourist facilities and purchase of urban apartments. Between 1981 and 1991 mainly, the primary sector employment decreased, giving its share to the tertiary sector employment due to tourism and public sector growth (local and regional administration, universities, army, etc) and so, the tertiary sector took the lead in the economy (50% of the total employment). In the same period Greek and foreign entrepreneurs erected luxurious tourist complexes and now control significant proportions of the tourist accommodation and services. In terms of number of firms, family-based businesses still dominate but some of them have been transformed into corporate-based businesses that have extended their operations beyond the island. It is unofficially estimated that foreign tour operators control 70% of the available tourist beds through various arrangements. Unregistered tourist accommodation has increased considerably. Diverse recreation facilities, such as car rental services, golf courses, marinas, ports, water parks and miscellaneous tourist services are now available.

In general it should also be mentioned that the hinterland remains largely underdeveloped touristically [*H.Briassoulis, Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism? J.Sust.Tourism, 11, 2, 97-115, 2009*].

6.1.2 Utilised Agricultural Area in relation to Total Agricultural Area

Following the farm structure survey of 2007, about 711.100 agricultural holdings in Greece had an economic size of at least one European size unit, and made use of 4.00 million hectares (ha) of utilised agricultural area. Within the period 2005-2007 for which statistical data are available, there was an increase in fallow land (73%).

[http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure_in_Greece]

6.1.3 Agricultural holdings

In 2007, about 711 100 agricultural holdings in Greece had an economic size of at least one European size unit (ESU), compared to 678.100 in 2005 (a 4.9% increase). These holdings of an average size of 5.6 ha, employ 548 000 annual workers per year. Among the sole holders 29% were women, 55% were aged 55 or more and 8% were younger than 35 years, while 20% had another gainful activity. There was an increase in fallow land (73%) from 2005 to 2007, while it should be stressed that 29% of agricultural holdings in Greece are specialised in olives, which is often the case also in Crete.

[http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure_in_Greece]

6.1.4 Farms

In 2007, Greek farms contained 2.6 million livestock units, 6.1% more than in 2005. The distribution of livestock by farm size is shown in **Table 6.1** and **Fig 6.1**. It should also be mentioned that 10% of the agricultural holdings are specialised in various crops and livestock combined.

[http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure_in_Greece]

In the following table heads per livestock type for the Municipality under study are shown:

Bovine				Ovine		Caprines	
total		female					
exploit	heads	exploit	heads	exploit	heads	exploited	heads
1	50	0	0	233	20.630	166	691
Pigs		Equidae and donkeys		rabbits		poultry	
exploited	heads	exploited	heads	exploited	heads	exploited	heads
28	184	4	4	293	7314	588	28893
Beehives							
exploited	Number of cells						
2	47						

Table 6.1. Data for Municipality Archanon-Asterousion from basic research of agricultural and livestock exploitations for year 1999/2000 [Hellenic Statistical Authority].

6.1.5 Organic farming

In Greece the area farmed under organic production tends to increase (it increase by 166% between 2005 and 2007). In 2007 it counted for 5% of the utilised agricultural area while in 2005 only for 2%. The average area of organic holdings was 7.1 ha

[http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure_in_Greece]

Over the last five years the market has shown tremendous growth, both in the number of hectares being used for organic cultivation and in the quantities of organic products being produced and exported.

Organic farming in Greece began during a time when regulations—national or European—did not exist. The first organic production in Greece began in 1982 in Aigialeia when a small group of local farmers began the production of organic Corinthian grapes with the intent to export them to Holland.

In the 1990s the industry was boosted by the passage of several European Community Regulations which called for regulatory bodies for organic production and provided subsidies to organic farms.

A significant increase in organic production was seen after 1996 due to the application of Community Regulation 2078/92. Among other things, the Regulation calls for giving subsidies in order to support organic agriculture. This incentive is credited with nearly doubling the organically cultivated land in less than a year.

Organic farms go through several phases before their products can be considered truly organic. In 2004, 54.4 percent of organic farms in Greece were considered to be in the fully organic phase, up from 35.7 percent in 2003.

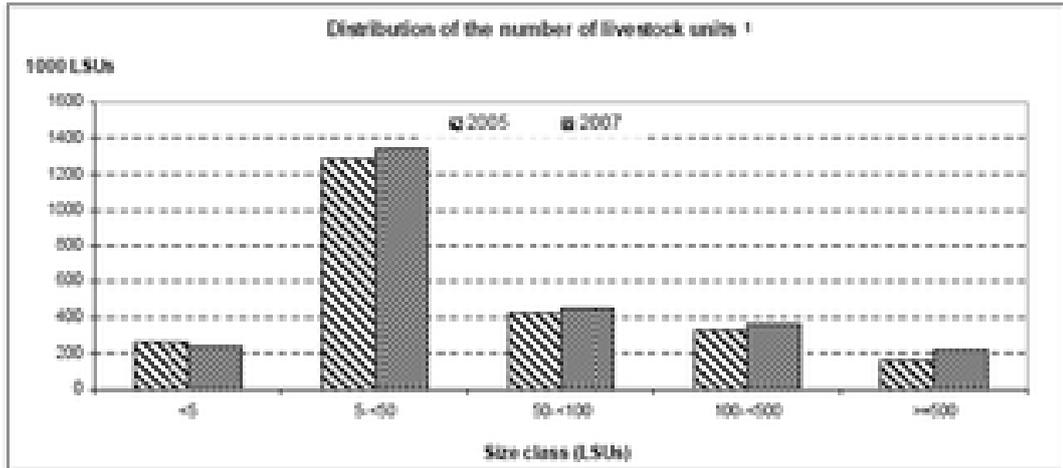
Business working in the organic farming sector can be separated into three categories: producers, processors, and importers. According to the Ministry of Agriculture, the number of businesses working in the organic farming sector in Greece reached 9,002 in 2004, up from 6,642 in 2003.

The number of stores selling organic products has increased dramatically over the last few years. The first stores opened in 1993. By 1998 the number of organic stores had reached 30 and today there are over 130 stores selling organic products. Recently, major super market chains have joined the movement and have begun selling organic produce. There are also farmers markets throughout the country that specialize in organically cultivated fruit and vegetables.

Most organic olive oil produced in Greece is exported (71-73 percent of the total yearly production). This is a rapidly growing market. In 1999, 765 tons of oil were exported, compared with 1,900 tons in 2004. Approximately 16 percent of organically produced Greek wine is exported. Organic know-how in vine cultivation has reached a high level. The increase in organic viticulture is also a consequence of the high hectare subsidy and restrictions on conventional wine production. 64 percent of organic grain produced in Greece is exported. Although much of what is produced organically in Greece is exported, there is great demand for organic products in the domestic market. In 2004, the Greek market for organic goods was estimated to be 30.7 million EURO, a 304 percent increase from the 7.6 million EURO market of 1999.

In Crete is located the head office of the national IFOAM group (IFOAM: International Federation of Organic Agriculture Movements) at the Mediterranean Agronomic Institute of Chania (MAICh).

The current interest in organic production coupled with rapid growth in the sector over the last two to four years indicates that organic farming in Greece can look forward to years of growth [<http://www.investingreece.gov.gr/newsletter/newsletter.asp?nid=491&id=517&lang=1>].



¹LSUs = Livestock Unit

¹Holdings of at least 1 ESU (see page 1)

Fig 6.1. Distribution of the number of livestock units, Greece 2005 and 2007.

Greece – 2007

Table 4 – Livestock by size of the farm ¹

"-" not available "0" less than a half of the unit or nil Differences between totals and sub items can appear due to rounding.

Size of the farms		Agricultural area (ha)				All farms	Livestock (LSU)			
		<20	20-<50	50-<100	>=100		0	>0-<50	50-<100	>=100
Total livestock	(1000 LSU)	1941.2	419.7	180.4	71.0	2612.2	0	1587.3	445.1	579.9
	(%)	73.7	90.5	93.4	90.8	78.2	:	89.3	91.0	38.0
Grazing livestock	(1000 heads)									
Equidae		26.3	3.2	1.4	0.5	31.5	0	25.5	2.2	3.7
Bovine animals		548.7	126.9	34.3	21.5	731.4	0	263.7	250.1	217.6
Under 1 year		163.2	38.0	12.2	7.5	221.0	0	94.4	68.9	57.7
From 1 to less than 2 years		93.6	26.4	5.7	4.0	129.7	0	44.3	43.8	41.6
Dairy cows		119.4	29.8	6.1	2.1	157.4	0	55.9	45.5	55.9
Other cows		146.2	26.9	8.9	6.6	188.7	0	58.7	80.4	49.5
Other bovine animals 2 years and older		26.3	5.7	1.4	1.2	34.7	0	10.3	11.5	12.9
Sheep		6810.2	2055.6	933.0	242.8	10041.7	0	8375.7	1300.1	365.9
Goats		3380.3	814.9	507.2	253.0	4955.4	0	3789.2	952.6	213.5
Granivores										
Pigs	(1000 heads)	950.9	113.4	35.3	10.9	1110.5	0	274.2	88.3	748.1
Piglets < 20 kg		324.2	42.9	12.3	3.2	382.6	0	123.5	38.7	220.5
Breeding sows		146.5	17.5	6.2	2.8	172.7	0	55.9	19.4	97.4
Other pigs		480.2	53.0	16.8	5.1	555.2	0	94.7	30.1	430.3
Poultry	(million heads)	31.0	1.2	0.4	0.3	33.0	0	9.0	2.2	21.8
Broilers		23.2	0.6	0.3	0.1	24.3	0	3.8	1.8	18.7
Laying hens		7.3	0.6	0.1	0.2	8.1	0	4.7	0.4	3.0
Other poultry		0.5	0.1	0	0	0.6	0	0.4	0.1	0.1
Rabbits, breeding females	(1000 heads)	202.0	10.3	2.0	0.5	214.9	0	212.2	2.0	0.7
Beehives	(1000)	842.6	29.3	4.6	1.4	878.0	476.9	396.7	3.3	1.1
Average size of herds*	(head/holding)									
Equidae	(head/holding)	2.0	2.0	2.3	3.9	2.0	:	1.7	3.7	23.9
Cattle	(head/holding)	31.3	44.4	49.8	99.9	34.3	:	15.4	82.6	184.0
Dairy cows	(head/holding)	18.0	26.7	30.8	41.8	19.7	:	8.8	41.7	103.9
Other cows	(head/holding)	19.1	21.6	22.5	50.3	20.1	:	8.5	43.4	80.8
Sheep	(head/holding)	61.4	159.8	274.7	380.5	78.6	:	67.9	350.3	485.9
Goats	(head/holding)	36.5	91.8	175.3	320.7	47.1	:	37.5	283.1	343.2
Pigs	(head/holding)	33.8	32.9	40.3	58.9	34.0	:	8.9	68.7	1113.2
Breeding sows	(head/holding)	16.5	11.3	14.9	24.1	15.8	:	5.9	22.7	161.2
Other pigs > 20 kg	(head/holding)	23.0	20.2	25.3	35.5	22.9	:	4.2	31.4	696.2
Rabbits, breeding females	(head/holding)	5.3	6.4	6.0	6.3	5.4	:	5.4	5.8	7.9
Laying hens	(1000/holding)	0	0	0	0.4	0	:	0	0.1	3.8
Broilers	(1000/holding)	0.2	0.1	0.2	0.8	0.2	:	0	1.1	24.9
Beehives	(hive/holding)	88.5	59.2	37.2	48.4	86.3	123.8	63.7	49.0	38.0

*LSU = Livestock unit

¹ Holdings of at least 1 ESU (see page 1)**Table 6.2.** Livestock by size of the farm, Greece, 2007.

6.1.6 Typical products

Greece has guaranteed 84 names as PDO (Protected Destination of Origin) and PGI (Protected Geographical Indication), from which 61 concern products PDO and 23 concern products PGI. In 84 Protected Names among others are included 25 olive oils, 20 cheeses, 20 fruits / vegetables / dry fruits and 10 table olives [<http://panos-oliveoil.gr/pages/regulations.aspx>]. Feta is probably, a brined curd cheese traditionally made in Greece, is probably the most famous PDO of the country. The most typical product of the Heraklion Prefecture is wine. The main agricultural products of the island are olive oil, grapes and dairy products.

6.1.7 Manufacturing activities

Greece still uses small businesses as a means to preserve cultural tradition. In Greece innovative technologies are not the prime concern: instead, the emphasis is placed on assisting artisans and craftsmen as

they are seen as a mean of regional and local development. The importance of the tourist sector for the Greek economy should also be mentioned at that point.

In 1977, in the Prefecture of Heraklion where the Archanon-Asterousion Municipality is located, there were 307.000 acres of vineyards, thus an important centre of wine production of the country. Winemaking is a traditional manufacturing activity and participates in shaping the income of farmers in the region, contributing at the same time to the aesthetic development of the rural landscape. Especially in the inland area of the Prefecture, stretching from the area of Malevizi, Archanes, Peza and Episcopi through the valley of Messara, the wine-growing and wine-making activity maintained over the years has been the main economic activity for residents region. Today within the boundaries of this area operate some of the most important and dynamic wine companies of the whole island. [*info provided by the Municipality staff*]. The wine roads of Heraklion Prefecture can be seen in the following Figure, from which it is obvious that most wineries are located in the Archanon-Asterousion Municipality:

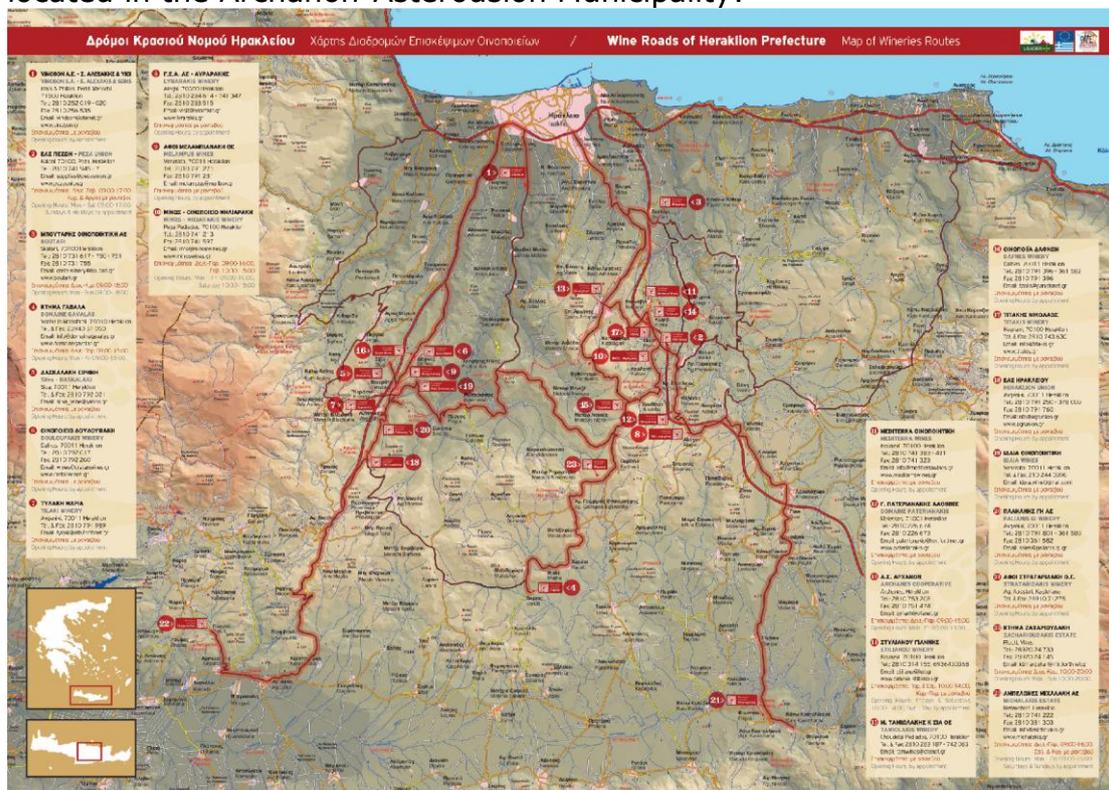


Fig 6.2. Map of wineries routes in Heraklion Prefecture.

A special role in the area's economy plays also the olive oil, which is being produced in large quantities. The Union of Agricultural Cooperatives of Peza, plays a very important role in the development of the area. It constitutes a dynamic economic factor of the Municipality. The Municipality has also two feminine rural cooperatives, manufactures of soft harmful effect that respect the environment, and laboratories of ceramics and pottery.

6.1.8 Tourism

Greece ranked 12th in terms of receipts and 16th in terms of international tourist arrivals among 165 countries surveyed in 2008 by the UN World Tourism Organization. The number of people directly or indirectly involved in Greek tourism economy in 2008 exceeded 800.000 while one out of five employees in Greece is directly or indirectly occupied by the tourism industry. Up to 360.000 jobs could be added to the tourism industry by 2018, almost equivalent to the number of unemployed Greeks in 2008. In 2009 tourism contributed by 15.2% to the GDP and by 18.5% to the total employment. There are 9.554 hotels corresponding to 726.546 beds. The country is ranked 16th regarding arrivals (2009) and 15th regarding receipts from tourism.

Currently, due to the crisis, Greece has decided to adopt the following measures for the tourism sector:

- Increase by 50% of advertising budgets,
- Cut of municipal taxes for a period of one to two years (e.g. Uniform Property Tax on buildings and land)
- Support to the tourism businesses through capital guarantee in collaboration with the Guarantee Fund for Small and Very Small Enterprises (T.E.M.P.M.E.)
- Strengthening domestic tourism by increasing the number of state-subsidized "social tourism" tickets
- Covert of the seasonal unemployment benefit into an employment benefit
- Elimination of fees in regional airports from early April until the end of September [*Association of Greek Tourism Enterprises*, www.sete.gr].

Crete, the largest Greek island, attracts about 20% of the total Greek tourist activity [*Michalena, E., Angeon, V. Local challenges in the promotion of renewable energy sources: the case of Crete, Energy Policy 37 (2009), 2018-2026*].

The main increase in tourist demand in Crete was noted in the period 1972-1982 where the average annual growth rate was 32.5% due to mainly foreign tour operators and international tourists arriving by charter in the island. Overnight stays in 1981 increased three-fold over 1975 reaching 6,042,583, 14.72% of the country's total. By 1981 the number of hotel beds per 1000 inhabitants had almost tripled in the island. So after the mid-1980s, Crete had become an established tourist destination. Between 1981 and 2001 international tourist arrivals by charter to Crete grew by 9.08% annually, reaching 2.575.010 in 2001, this being about 30% of the national total. In Herakleion the overnight stays equalled the sum of stays in the other three prefectures [*H.Briassoulis, Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism? J. Sust. Tourism, 11:2, 97-115*].

In 2006 flights with destination Heraklion were equal to 20% of the total flights to Greece and more than 2.000.000 tourists visited Crete. The number of beds in the hotels has increased by 53% between 1986 and 1991, while in the rest of Greece the increase was of the order of 25% [*V. Mpoura, Diploma Thesis, Topic "Determination of Water Resources Management Systems in Crete", Supervisor: Professor Georgios Tsakiris, Athens, July 2010*]. Crete disposes 3 airports situated in Chania, Heraklion and Sitia. The Heraklion airport is a purely touristic destination. For the year 2010 in the airport of Heraklion there have taken place 7400 domestic flights and 13000 flights from abroad, while 1500 flights were privatized [www.endoxora.gr].

6.1.9 Sustainable management of the local authority and local enterprises

In Greece, sustainable development has not been a national priority while it is generally accepted that the holistic nature of sustainable development does not match with the fragmented and sectorised institutions established to deal with them. There are about 50 agencies involved in the planning and implementation of environmental programmes and more than 150 pieces of legislation. Until the early 1990s 65 Greek industries (38.3%) had adopted some type of environmental standards, 70 industries (41.2%) believed that there was no need to take any measure because they considered their activities harmless for the environment and only 14 industries (8.3%) admitted that they had not established any standards

[*P.Fousekis, J.N.Lekakis, Sustainable Development in Western Europe: Coming to Terms with Agenda 21 (book), edited by Tim O'Riordan and Heather Voisey, Greece's Institutional Response to Sustainable Development, first published in 1997*].

Based on the data of the Greek Ministry of Environment, only 10 companies were EMAS certified in Greece by December 2003. By the same time point, there were 126 companies certified under EN/ISO 14001, while the Greek Law 2965/2002 for the sustainable development of the Region of Attica, where Athens is located, states that the certification and registration of an EMS (Environmental Management System) is compulsory for any industrial or SME business that operates in Attica [*K.Abeliotis, A review of EMAS in Greece: is it effective? Journal of Cleaner Production 14 (2006), 1644-1647*]. It has been observed that most of the Greek enterprises implementing EMS (more than 70%) are concentrated in the two big urban areas of Greece, Athens and Thessaloniki and are big firms (more than 49 employees). The main factor that hinders the EMS implementation seems to be for the time the great amount of time needed and the lack of skilled personnel. [*Z.Dimadama, Knowledge, innovation and sustainability: The implementation of voluntary environmental policies in Greece: The case of environmental management systems, Journal of US-China Public Administration, Jul.2010, Vol,7, No,7*]. To conclude, an augmented environmental consciousness is observed in enterprises in the last years, but still a lot of work has to be done.

SA 8000 is an international certification standard created in 1997 which encourages organizations to develop, maintain and apply socially acceptable practices in the workplace [*www.sgs.com*]. By the end of 2005 there were 881 companies certified according to SA 8000 and 1200 by the end of 2006. The countries with the highest number of SA 8000 certifications are China, Italy, India and Brazil [*Pavlos Kotsidis, diploma thesis "Unifying the management systems ISO 9001, ISO 14001 and OHSAS 18001 – Problems and Opportunities" Thessaloniki, University of Macedonia, September 2009*] while in Greece, although there are many companies active in the fields of social offer and environmental protection, only few of them use CSR systems. In 2000 the "Hellenic Network for Corporate Social Responsibility (HNCSR)" was registered to the Athens Court of First Instance as a Non-Profit Private Company having as main objective the sensitisation and commitment of the business community but also of individual social teams towards the promotion of social cohesion in our country. According to one of its relevant surveys in 2006, in Greece the total degree of adoption of SCR best practices by SMEs is low. Most of the practices taking place are

related to equal opportunities provision regardless of gender, religion, etc, followed by training and supplementary benefits (f.ex. medical insurance) [www.csrhellas.org, *Hellenic Network for CSR*].

6.1.10 Industrial and transportation activities at major accident risks

In late September 2005, the Corps of Labor Inspectors (SEPE) published a series of statistical data on accidents at work in Greece during the period between 2000 and 2005 (**Table 6.3**). As it can be seen, accidents at work (by region) reported to SEPE have risen within the period 2000-2005. The latter is partially due to the efforts to complete necessary infrastructure works related to the Olympic Games, which necessitated an intensified pace of work. Despite stepped-up inspections by the Corps of Labour Inspectors aimed at preventing different work accidents (f.ex. falls, crush injuries, electrocution, miscellaneous) and more systematic attempts to record them, the problem of counting work accidents and coordinating the competent bodies still remain. The conditions that unfortunately still prevail in the construction industry (high proportion of undeclared foreign and domestic workers, violations of labour and social insurance legislation, infringement of normal working hours, etc.) make it even more difficult to record and prevent accidents at work. Fear of dismissals usually prevent workers from demanding safe working conditions.

[<http://www.eurofound.europa.eu/eiro/2005/11/inbrief/gr0511101n.htm>]

Region	2000	2001	2002	2003	2004	2005
Athens-Crete	973	1242	1579	1823	1847	1830
Piraeus - S.Aegean	244	285	289	378	370	363
E.Attiki-N.Aegean	426	521	643	649	715	651
W.Greece - Epirus	380	406	394	425	437	483
W. Attiki - Peloponnese	440	520	570	514	629	585
Macedonia-Thrace	728	1183	1498	1529	1423	1239
Central Greece	841	998	1048	918	912	833
Total	4032	5155	6021	6235	6333	5984

Table 6.3. Total accidents reported to SEPE

Region	2000	2001	2002	2003	2004
Athens-Crete	27	38	36	35	35
Piraeus - S.Aegean	11	23	12	6	6
E.Attiki-N.Aegean	15	12	25	14	8
W.Greece - Epirus	22	11	7	11	12
W. Attiki - Peloponnese	8	22	14	27	14
Macedonia-Thrace	23	51	35	37	38
Central Greece	21	31	24	15	14
Total	127	188	153	145	127

Table 6.4. Fatal accidents reported to SEPE

Concerning car accidents, unfortunately Greece has the highest car accident rate in Europe. [<http://gogreece.about.com/cs/carrentals/a/drivinggreece.htm>] Central Greece, the Peloponnese and western Greece are the three European regions with the most victims in traffic accidents, according to data by the EU's statistical service Eurostat

[<http://maillists.uci.edu/mailman/public/mgsa-l/200-February/007862.html>]. There were 150.000 victims and a million and a half wounded in the years from 1965 to 2008. Each year 3.650 people lose their lives, the injured are more than 10.000 and about 2.500 children are with permanent disabilities due to car accidents in the country. Most of the fatal accidents are due to aggressive driving and inattention.

[http://www.grreporter.info/en/car_accidents_take_most_people%E2%80%99s_lives_greece/3722].

The car accidents in the Municipality under study can be seen in the following Table:

Total		Mortal					Causing injuries			
accidents	victims	accidents	dead	total	heavy	light	accidnets	Total	heavy	light
5	8	3	4	2	1	1	2	2	0	2

Table 6.5. Road accidents in the Municipality Archanon-Asterourion [Hellenic Statistical Authority, 2006].

6.2 Sources and available data

The sources are incorporated in the text.

6.3 Description of the indicators -Calculated indicators

Some indicators are reported below:

Tourism:

Arrivals and stays in hotels and other accommodation: over 3 millions arrivals

Nights spent in hotels and similar establishments by a resident or non-resident person: average staying = 2 weeks,

2.944 hotels: 460.750 beds – 1160 apartments to rent: 73.321 beds

[N.Zografakis, Regional Energy Agency of Crete, RE-Islands Conference, Eur. Programme ALTENER “European Renewable Energy Islands, Brussels, 21/9/2005].

7 ECOMANAGEMENT

7.1 Introduction

Preface / Preliminary remarks

In the island of Crete, tourism has become a leading economic sector but also has also caused several unwanted economic, environmental and sociocultural impacts and, currently, it appears to threaten the island's sustainability. Adequate measures are necessary. One interesting proposal could also be the creation of new poles of tourist attraction, including mountainous areas, integrated tourist packages and alternative forms of tourism, like agrotourism (which fits very well to the case of Archanon-Asterousion Municipality), alliances among tourist and non-tourist businesses, local government bodies, corporations and associations, the modernisation and improvement of tourist facilities and businesses, improved education and training of personnel, the provision of consulting services for tourist SMEs, infrastructure improvement, the protection and enhancement of natural and cultural resources, and a focused promotion of the island for particular types of tourists [*H.Briassoulis, Crete: Endowed By Nature, Privileged by Geography, Threatened by Tourism? J.Sust.Tourism, 11:2, 97-115, 2009*].

7.1.1 Policies towards sustainability

The Greek Government prepared the National Strategy for Sustainable Development (NSSD) to respond to the European Council's recommendations in Gothenburg 2001 and based on the adopted Community's sustainable development strategy, which should be implemented before 2010. Moreover, Greece follows up closely and contributes regularly to the development of international and EU environmental policies as it participates to all relevant processes and submits annual national reports to the Committee for Sustainable Development of the UN (CSD) in relation to the implementation of Agenda 21.

The NSSD sets the basic principles for the country's sustainability policy:

- The precautionary principle: it necessitates the timely and effective confrontation of environmental impacts, especially the irreversible impacts on ecosystems and human health.
- The "polluter pays" principle: it integrates the cost of environmental impacts in market mechanisms and prices.
- The equity and shared responsibility principle: it distributes the burden responsibility among parties and takes into account their potential to contribute towards the confrontation of environmental problems.

These principles have been specified and complemented by a number of rules, which briefly are the following:

Decoupling economic growth from environmental degradation,

- Sectoral integration providing for environmental considerations to be included in the objectives and priorities of sectoral policies,
- Prioritise avoidance and not management of environmental pressures aiming at minimising the risks and reducing the cost of end-of-pipe solutions,
- Problem solving at the source recognising that local solutions are more efficient and have relatively lower cost.
- Identification and management of carrying capacity as sustainable management prerequisites the identification of exploitation limits of natural resources and ecosystems.

The main targets are the confrontation of climate change, the reduction of air pollutants, the reduction and rational management of solid waste, the rational water resources management, the confrontation of desertification and the protection of biodiversity and ecosystems [Hellenic Republic, Ministry for the Environment, Physical Planning and Public Works, National Strategy for Sustainable Development, Greece, Executive Summary, May 2002].

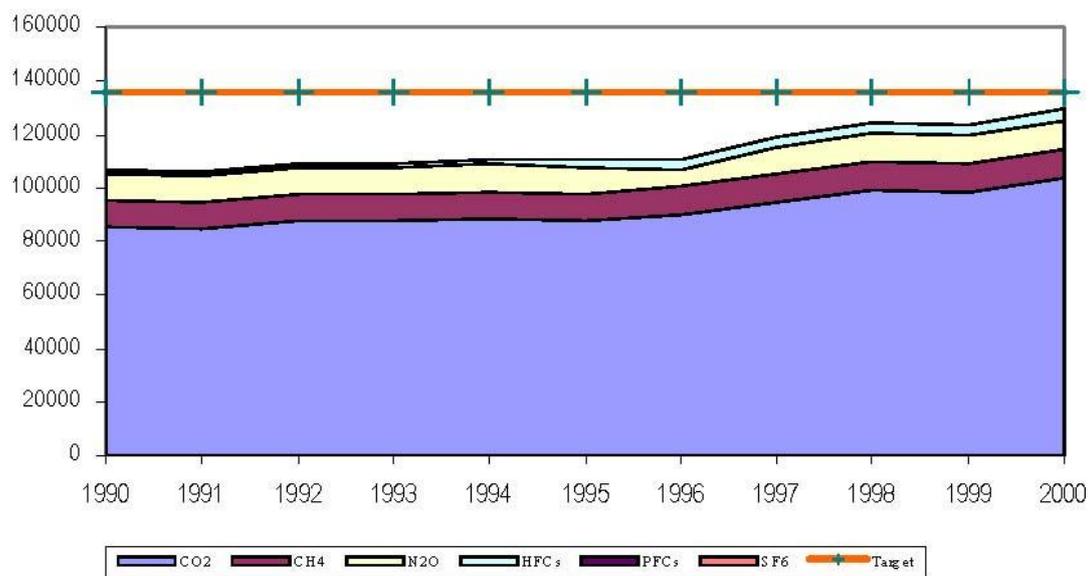


Fig. 7.1. Trends of greenhouse gas emissions and Kyoto target for Greece (National Observatory of Athens).

7.1.2 Initiatives aimed at community participation in decision-making

In general, citizens in Greece have few opportunities for direct participation in decision-making outside the elections held every four years. Beyond national referendums that may be called for critical issues, citizens cannot request local referendums. The only other possibility for direct input by citizens is if the local municipality establishes district councils or if the community president calls a people's assembly to discuss

issues of concern. The organization of these public opportunities, however, is so solely at the discretion of the community or municipal leadership [http://en.wikipedia.org/wiki/Municipalities_and_communities_of_Greece].

However, Greece was affected eventually by the trend observed at the end of the 1970s in Western Europe and North America, of introducing qualitative management methods into public services -similar to management methods for businesses- in the mid-1980s. At the beginning of the 1990s legislative initiatives were taken which combined planning and implementation of programmes to improve relations between the state and citizens. In 1998, following a decision of the Cabinet, an integrated programme to introduce quality methods into all sectors of public economy and social life has been set up and a programme entitled "Quality for the Citizen" was prepared aiming at the preparation of better, more effective, rapid provision of services to citizens. Main results comprised the reduction in the time required and the "journeys – stops" involved in administrative procedures for providing services to citizens.

In 2000 a new programme was launched, entitled the "Politeia" (in English the "State") Operational Programme on administrative reform aiming again at the improvement of the quality of administrative services, but at the same time laid down guidelines and priorities that marked a qualitative difference in relation to the planning and implementation mechanisms and citizen participation in them. A major outcome of "Politeia" Programme was an "e-government" tool ("e-Politeia") whose aim was to ensure access by all European citizens to all public services, as well as networking between those services. The main objective of the State which operates 'online' is to create channels of access which are citizen-friendly, so as to ensure participation in decision-making processes and the implementation of public policy.

Another good example of this form of citizen participation is the e-business forum [www.ebusinessforum.gr] where aspects of the e-business sector are presented and several communications between the forum's members and the Ministry of Development (now integrated in the Ministry for Environment, Energy and Climate Change) take place [*Citizen's Participation in Decision-Making Processes in Greece, by Giola Valatsou and Stella Kyvelou*].

One last initiative to be mentioned here which aims to enforce community participation in decision-making and in which Greece participates is the EUROMED project MARE NOSTRUM (*A Heritage Trail along the Phoenician maritime routes and historic port-cities of the Mediterranean Sea, duration > 15/01/2009 – 15/07/2012*). Project partner from Greece is the Medieval city of Rhodes and the project will contribute to public awareness-raising of the preservation and promotion of the Mediterranean port-cities sites and its archaeological sites along the Phoenician ring-thread routes in a past-present continuum [MARE NOSTRUM project sheet]. MED Strategy can also be seen as a similar positive initiative.

7.1.3 Green purchasing of local authority

As public procurement amounts to over 1,000 billion every year across the European Union (around 14% of EU GDP), « greening » purchases can undoubtedly contribute substantially to sustainable development. In Greece there are some examples of successful actions to achieve increased benefits from public purchasing, as f.ex. the Municipality of Amaroussion in Athens which won the Green Public Procurement (GPP) Best Practice Award in 2006. To do so, this relatively big Municipality of Athens (90.000 inhabitants) had to change the specifications of particular products (f.ex. recycled paper, the first such action undertaken by Greek public and semi-public authorities at local level) and reduced the cost by increasing the demand through joint procurement activities with other public and semi-public authorities. The underlying aim was to stimulate demand for sustainable products and services. The joint procurement action aforementioned was a pilot activity carried out within an EU-funded project, namely the Local Authority Environmental Management and Procurement (LEAP) project. Also Kalithea Municipality of Rhodes island, Municipality of Holagos and of Neo Psychiko in Athens and Municipality of Ancient Olympia in Peloponnesus took part. The Municipality is considered by many as being among the few Greek local authorities with the best performance in GPP issues.

One challenge that was faced and that all public administrations in Greece face is the restrictive national legislation for public procurement. According to the legislation, the criteria used for awarding a contract is the lowest quoted price, regardless of the environmental impact. It is recommended, however, that the environmental impact of a product purchased be considered when designing the award criteria for a contract and not just the price of the product. The latter uses criteria that are strongly favored by the EC that is, opting for the “most economically advantageous option”. Hopefully in the future, after the successful experience of Amaroussion, carrying out green GPP in Greece will be easier and more expanded, the administrative cost will lower and there might even be some financial gains. [*Procura+ : Sustainable Procurement Campaign, Coordinating actions to achieve increased benefits from public purchasing – a Greek example*].

7.2 Sources and available data

The sources are incorporated in the text.

7.3 Description of the indicators -Calculated indicators

All data located concerning the Archanon-Asterousion Municipality are given above.

ANNEX
Synthetic Table of Indicators

Label	Indicator typology (DPSIR model)	Data source	Territorial coverage	Time period	Time trend	Criticality	Responses/actions
Use of freshwater resources	P	<i>H.Briassoulis, Crete: Endowed by Nature, Privileged by Geography, Threatened by Tourism?, J. Sust. Tourism, 11:2, 97-115</i>	Crete	Last 10 years	↓ The availability of water resources decreases, restricting agricultural activities and gradually expanding desertification.	 Water shortages during peak seasons, water conflicts for domestic, agricultural and tourist uses.	Long-term, carefully designed water resources management strategy.
Energy consumption	P		Crete	1995-2030	↑ The electric demand for the island of Crete is constantly increasing with an exponential rate and is expected to reach 10.000 GWh/y by 2030.	 There is a critical situation and ways to ensure that the increased needs will be covered must be researched.	Need to promote RES use through local municipalities (social acceptance) and cooperation with the Hellenic Government (long-term energy planning)
Energy produced from RES	R		Crete	2000-2010	↑ Increase of installed capacity was expected by: wind farms (89.3 - > 250), biomass (20-> 60), PV	 The situation is positive: both historically and in the present, Crete occupies a specific	An improvement of the situation could be achieved by providing support on information for European and

					installations (0.2->4) and thermal units (469-> 585) [MW].	position with the development of RES and can be considered as a “success Greek story”.	national funding possibilities for the research and the installation of RES, as well as dissemination of results of research and a constant communication between governmental and local authorities + a promotional RES strategy
Solid waste generation	P	<i>Hellenic Solid Waste Management Association,</i> www.eedsa.gr	Greece	1995-2005	↑	 A crisis point	Recycling of biodegradable agroindustrial residues and the organic fraction of municipal solid waste (after source separation) and composting could help reduce the problems related to the increasing production of waste and the difficulties of locating new landfill sites, especially in islands, like Crete.

Residents population		EL. STAT.	Greece	1991-2001	↑	 The situation is positive. Although the growth rate is small, almost 2%, there are incentives for it to be increased. Quantitatively, there has been a 40.36% population increase in the Prefecture of Heraklion between 1971 and 2001.	
Energy consumption	P	<i>Tolon-Beccera, A.; Lastra-Bravo, X.; Botta, G.F. Methodological proposal for territorial distribution of the percentage reduction in gross inland energy consumption according to the EU energy policy strategic goal, Energy Policy 38 (2010)</i>	Greece	1997-2007	↑	 The energy consumption per capita has increased from 2.47 to 3.00 toe per inhabitant. The peaks are observed during the high tourist summer season. + The annual increase of electricity demand in the island is approximately 9%.	

Waste production	P		Greece	1995-2006	↑	 The waste produced increased from 302 kg/person in 1995 to 408 kg/person in 2006. The prediction is that the total amount of municipal solid waste will keep increasing until 2020.	The solution is to use waste to generate energy and composting methods of waste disposal. Based on research results of the past 25 years, all organic waste of Crete could be composted in a satisfactory manner.
Private services	S	<i>Tountas, Y.; Karnaki, P.; Pavi, E.; Souliiotis, K. The “unexpected” growth of the private health sector in Greece, Health Policy 74 (2005), 167-180</i>	Greece	1990-2005	↑ Increase of private health care. The private health expenditure has reached 3.9% of the country’s GNP		The State should – despite the crisis- try to improve the public health system.
Waste management	R	<i>Ministry of the Environment, Energy and Climate Change</i>	Greece	2004-2008	↑ Increase by 10% in only 4 years.		A very positive sign, it seems that recycling has become part of the average Greek every-day life. More efforts to establish this good habit should take place.

Organic farming	R	<i>Ministry of Agriculture</i>	Greece	2003-2004	↑ Increase of businesses working in the organic farming sector from 6.642 to 9.002. More than 130 stores available and recently, super market chains have joined the movement.	😊 Organic farming is beyond doubt a rapidly growing market with high export potential for our country and Crete specifically.	
Tourism	D		Crete	1981-2001	↑ International tourist arrivals by charter flights grew by 9.08% reaching 2.575.010 in 2001, this being about 30% of the national total.	😊 The island has experienced rapid tourism development and tourism is today a leading economic sector. Attention should though be paid to unwanted environmental and sociocultural side-effects.	