

# Sustainable Energy Action Plan

# LARNAKA MUNICIPALITY - CYPRUS



5 September 2011



# Brief Summary

The "Pact of Islands" (ISLE-PACT project) is committed to developing Local Energy Action Plans, with the aim of achieving European sustainability objectives as set by the EU for 2020, that is of reducing  $CO_2$  emissions by at least 20% through measures that promote renewable energy, energy saving and sustainable transport.

The Cyprus Energy Agency is a participating partner in the ISLE-PACT project and has invited Cyprus local authorities to demonstrate their political commitment by signing the "The Pact of Islands"; agreement in order to achieve the EU sustainability targets for 2020.

Cyprus participation involves 12 Municipalities and 2 Communities, including Larnaka Municipality.

Larnaka is a municipality located on the southeastern coast of Cyprus. It is the third largest city of the island, with a population of 62997 inhabitants according to the Census of 2001 (including Aradippou and Livadia Municipalities).

The year 2009 was designated as the year of referencing/recording energy consumption and  $CO_2$  emissions in the Municipality's territory. According to actual consumption data collected by the Electricity Authority of Cyprus (utility), the oil companies, the Statistical Service of Cyprus, etc, the total energy consumption in 2009 in Larnaka was 1.098.495 MWh. The largest consumer of energy in the municipality is transport with 702.610 MWh, followed by the tertiary sector with 191.296 MWh and households with 175.624 MWh.

The  $CO_2$  emissions in 2009 attributable to the overall energy consumption in the municipality are 421.489 tons.

For the forecast of  $CO_2$  emissions in the period 2010 to 2020, the scenario of expected evolution was established, where it was estimated that without taking any measures emissions will amount to 442.853 tons.

The Sustainable Energy Action Plan that was prepared for the Municipality includes additional measures / actions to achieve at least the European goal of combating climate change. That is, the measures that will be taken by the Municipality in addition to national measures in order to overcome the goal of reducing  $CO_2$  emissions by at least 20% by 2020 with respect to the reference year 2009.

| Description  | Number |
|--|--------|
| Energy Saving in Municipality public buildings       | 5      |
| Energy Saving via informational campaigns            | 11     |
| Energy saving in transport                           | 4      |
| Energy saving in street lighting                     | 1      |
| Municipality investments in renewable energy sources | 1      |
| Development of green spaces                          | 1      |

The proposed measures are split into the following categories:

The estimated annual emissions reduction for 2020 by applying the above measures amounts to 32.531tons. In addition, it was estimated that the impact on Larnaka



Municipality from the implementation of the national measures taken to reduce carbon dioxide emissions will result to an additional decrease of 74.223 tons.

Therefore, with the implementation of the Sustainable Energy Action Plan and a total reduction of 106.754 tons, annual emissions for 2020 will be limited to 336.099 tons. That is **20.2 % lower** with respect to those in the reference year 2009.

The budget of the Action Plan for the period 2011 to 2020 amounts to **€3.364.300**. Funding for the implementation of the Energy Action Plan is expected to be taken from the following resources:

- Municipality budget
- Savings that will result from energy reduction measures in buildings, vehicles and street lighting in the Municipality.
- Revenues originating from Municipality investments on Renewable Energy technologies.
- Funding from the Grant Scheme of the Ministry of Commerce, Industry and Tourism for the promotion of Renewable Energy and Energy Conservation
- Potential funding from the structural funds.
- Potential funding from the Fund created for Emissions Trading Scheme.
- Potential funding from other European programs.
- Potential funding from the sustainable development and competitiveness program of the Planning Bureau.



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# 1. THE ISLE-PACT PROJECT

# 1.1. Introduction

The main objective of the ISLE-PACT project is the development of Local Sustainable Energy Action Plans, aiming at achieving European sustainability objectives as defined by the EU for 2020, namely a reduction of  $CO_2$  emissions by at least 20% through measures promoting renewable energy, energy savings and sustainable transport. The duration of the project is set at 30 months, from 1<sup>st</sup> February 2010 until 31<sup>st</sup> July 2012.

The project coordinator is the organization Comhairle nan Eilean Siar (CnES) – The Outer Hebrides of Scotland. The project is funded by the European Commission, Directorate General for Energy.



Project participants are invited to demonstrate their political commitment by signing the "The Pact of Islands", a three-page document detailing all aspects and targets that will be set by the authorities of the islands in order to achieve the EU sustainability goals for 2020.

# **1.2.** Commitments from signing the Covenant of Islands

The Covenant of Islands is a binding instrument on which the competent island authorities will adopt political commitments in order to achieve the Project objectives. The Covenant is a three-page text and is formatted in a similar way as the Covenant of Mayors, where the specificities of European island communities are taken into account. It signifies the start of a number of important objectives such as:

- Further implementation of EU targets for 2020, reducing  $CO_2$  emissions by at least 20% in areas of implementation,
- The preparation of the Sustainable Energy Action Plan, which includes the original recording of emissions data (Baseline Emission Inventory), and outlines the methods for achieving the objectives,
- The preparation and submission of implementation reports at least every 2 years after the delivery of the final Sustainable Energy Action Plan for evaluation, monitoring and verification of individual goals,
- To organize Energy Days, in collaboration with the European Commission and other stakeholders (e.g. Cyprus Energy Agency), providing an opportunity for citizens to have direct contact with the subject and also to benefit directly from sustainable energy use, as well as informing the local media for individual developments in local action plans,
- Participation in various conferences and workshops organized by various European institutions in connection with the Covenant of Mayors and the Pact of Islands,
- Further implementation of energy investment in the project areas.





## **1.3.** Participating Municipalities and Communities in Cyprus

In Cyprus, twelve (12) Municipalities and two (2) Communities have signed the Pact of Islands and therefore participate in the ISLE-PACT project:

| Strovolos Municipality         | Latsia Municipality    |
|--------------------------------|------------------------|
| Agios Athanasios Municipality  | Paralimni Municipality |
| Lakatamia Municipality         | Idalion Municipality   |
| Aglantzia Municipality         | Lefkara Municipality   |
| Larnaca Municipality           | Geri Municipality      |
| Aradippou Municipality         | Ergates Community      |
| Polis Chrysochous Municipality | Psimolofou Community   |



Figure 1 Signing ceremony of the Pact of Islands on the 20<sup>th</sup> January 2011 in Nicosia

# 1.4. Signing Ceremony of the Pact of Islands

The signing ceremony of the Pact of Islands was performed in the building of the Committee of the Regions in Brussels on 12th April 2011. The event was part of the European Sustainable Energy Week, 11-15 April 2011, which brings together over 5000 participants each year in Brussels and many others elsewhere in Europe with multiple conferences, exhibitions and specialized conferences.



**Figure 2** Representatives of the EU islands, mayors of island communities and representatives of the island authorities along with Mercedes Bresso, President of the Committee of the Regions and Helen Mariano, General Secretary of CPMR (Conference of Peripheral and Maritime Regions)



Figure 3 The Mayor of Agios Athanasios Kyriakos Chadjittofis (left) and the Mayor of Aglantzia Andreas Petrou (right)



Figure 4 The Mayor of Aradippou Christakis Liperis (left) and the Mayor of Idalion Leontios Kallenos (right)







Figure 5 The Mayor of Lakatamia Loukas latrou (left) and the Mayor of Larnaca Andreas Moyseos (right)



Figure 6 The Secretary of Latsia Municipality Michalis Sokratous (left) and the Mayor of Paralimni Andreas Evaggelou (right)



Figure 7 The Mayor of Polis Chrysochous Aggelos Georgiou (left) and the Mayor of Strovolos Savvas Iliofotou (right)



Figure 8 The Secretary of Ergates Community Kyriakos Christodoulou (left) and the President of Geri Community (Municipality) Argyris Argyrou (right)





Figure 9 The President of Psimolofou Community Ioannis Lazarides



# 2. CYPRUS

Cyprus is the largest island in the eastern Mediterranean and is located south of Turkey. The two main mountain ranges are Pentadactylos in the north and Troodos in the central and south-western part of the island. Between them lies the fertile plain of Mesaoria.

Cyprus has always been a crossroads between Europe, Asia and Africa and bears traces of many successive civilizations: Roman theatres and houses, Byzantine churches and monasteries, castles from the era of the crusades and prehistoric settlements.

The main economic activities of the island are tourism, clothing and craft items exports and merchant shipping. Traditional crafts include embroidery, pottery and bronze.

Traditional specialties include *mezedes* - appetizers served as a main course - *halloumi* cheese and the drink of *zivania*.

After the Turkish invasion in 1974 and the occupation of the northern part of the island, the Greek and Turkish communities of Cyprus have been divided by the so-called Green Line.

Cyprus is known as the island of Aphrodite, the goddess of love and beauty, as according to legend, Cyprus is the birthplace of the goddess.

In modern literature the names of Costas Montis (poet and writer) and Demetris Gotsis (writer) stand out, while Evagoras Karageorghis and Marios Tokas are distinguished composers.





Year of EU entry: Political system: Capital: Total area: Population: Currency 2004 Democracy Nicosia (Lefkosia) 9.250 km<sup>2</sup> 0,8 million euro Source: http://europa.eu

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# 3. LARNAKA MUNICIPALITY

# 3.1. Introduction

Larnaka is a city located on the southeastern coast of Cyprus. Larnaka is the successor city of ancient Kition, one of the most important kingdoms of ancient Cyprus, birthplace among others of the ancient philosopher Xenon. Nowadays, Larnaka is the third largest city of the island with a population of 62.997 inhabitants according to the Census of 2011 (including Aradippou and Livadia Municipalities). The International Airport, which is the main airport of Cyprus, is located in Larnaka.

# 3.2. History

### 3.2.1. Antiquity

Kition, founded by Greek settlers during the 14<sup>th</sup> century BC, was in later years a significant colony of the Phoenicians. It is known, among other, from the campaign of Kimonas the Athenian, who died while besieging it. By the 1<sup>st</sup> century AD, Kition was beginning to Christianize and St. Lazarus, Christ's friend, became the first bishop of the city. St. Lazarus escaped to Cyprus after his resurrection by Christ and lived in Kition until his second death. The most important church of today's Larnaka is that of St. Lazarus was built around 900 AD and it is believed that it was erected on the tomb of St. Lazarus. The city name of Larnaka comes from the *larnaka*, namely the ancient stone sarcophagus (two sarcophagi found in the sanctuary of St. Lazarus during excavations). Many sarcophagi were in the city, where excavations have brought to light the ruins of the ancient city of Kition. The Ancient city was enclosed since ancient years, but the walls were demolished by the Romans. The recently discovered port of the ancient city is indicative of the fact that during the ancient years the sea was inward.

### 3.2.2. Medieval Period

During medieval years, Larnaka was called *Salines* due to the fact that close to the city is a large lake containing seawater. The lake dries up during the summer producing plenty of salt. This saltlake was known since ancient years and is reported by Plinios.

During the Frankish period (1192-1489), Larnaca was not particularly an important city but had begun to develop as a port after 1373, when the main port of Cyprus until then, Famagusta, was occupied by the Genoese.

### 3.2.3. Ottoman Period

Larnaka remained the most significant port of Cyprus even during the Ottoman Period (1570-1878), when part of the city was known as *Scala* (station) as this was the location where the ships used to station. Several Cypriots, Greeks and foreign merchants stayed in Larnaka during the Ottoman Period. Many of them served as consuls and vice and as commercial representatives of various countries (England, France, Russia, America, Austria and other). In those times, Larnaka was the city of consulates and of traders and therefore was the most developed of all Cypriot cities.





### 3.2.4. Independence - Invasion

Larnaka, like the rest of Cyprus, began developing rapidly since the Independence of Cyprus (1960) and forthward. After the Turkish invasion in 1974, the development of Larnaka was most rapid and impressive. The International Airport of Niicosia closed down due to the invasion, which lead to the establishment of the International Airport of Larnaka, in the saltlake area, which is nowadays the main and largest of Cyprus airports and is a vital air node in the area of Near annd Middle East. After all, the loss of the main commercial port of Cyprus, namely Famagusta, due to the Turkish invasion and occupation, resulted to the significant upgrading of the port of Limassol and secondarily of the port of Larnaka. Lastly, the loss of the traditional touristic areas of Cyprus Famagusta, Kyrenia) resulted in the touristic  $\alpha$ { $io\pioin\sigma\eta$  of other areas in Cyprus including Larnaka, at which many modern and luxury hotels were built. Close to the city stand the main oil tanks of Cyprus. For all these reasons, Larnaka city today knows a new edge. [Source: Wikipedia.org]

### 3.3. Larnaka Local Plan

Until 1990 the control of development in Cyprus was based on the Law on regulating Streets and Buildings and relevant regulations (or amendments). This legislation did not provide sufficient opportunities for effective control of urban development nor the means to allow the exercise of spatial planning policy, or indirect interference in the processes of land purchase. The role of the public sector was essentially regulatory and somewhat negative in character, since it was only possible to respond to private sector initiatives.

In view of the strong growth of development pressures caused by the natural population growth, urbanization and the development of industry, commerce, tourism and services, the Cyprus State has decided to implement urban and spatial planning legislation, to ensure rationalization of physical development. For this purpose, the Law on town and spatial planning of 1972 and subsequent amendments were voted, which became fully operational for the first time on December 1, 1990.

The Larnaka Local Plan was prepared in accordance with the relevant provisions of the Law on Town and Spatial Planning, was first published on the 1<sup>st</sup> December 1990 and was finalized after studying the appeals in two phases (1992 and 1994). The first amendment of the Local Plan was published on 4<sup>th</sup> October and the Plan was finalized after the study of appeals in two phases (1999 and 2000). During the study of that revision consultations were performed with the Joint Council of Larnaka which was established in accordance with the provisions of Article 12(1) of the Town and Country Planning Act.

Larnaka Local Plan specifies the general principles on which development in the area under the Local Plan will be promoted, monitored and regulated. It is expected that through the implementation of the Local Plan provisions a balanced development and town planning rationalization of the wider area of Larnaka will be reached gradually

The area under the Local Plan includes areas of Larnaka and Aradippou Municipalities, the areas of the Community Councils of Voroklini and Pyla and a small area of the Community Council of Kalo Chorio as shown on Figure 10 (*Local Plan of Larnaka*).

The Local Plan extends over an area of 11547.4 hectares. According to the report of Statistics Census of Population (*Population Figures by District, Municipality and Community*) and an estimation for the areas of Voroklini and Pyla included in the Local Plan, the population amount up to of 70.049 people in 2001.

[Source: Local Plan of Lanaka]





Figure 10 Local Plan of Larnaka

### **3.4. Structure Development in the Local Plan**

The structure of the area under the Local Plan was influenced determinatively by several factors such as the seashore, the Saltlake, the Refinery and Oil Tanks, the Port, the Marina and the Airport. The structure of development in the Local Plan was greatly influenced by the timeless evolvement of the city and its outskirts without a town planning scheme and especially its evolution as "siamese", consisting of the two distinctive modules of Scala and Larnaka, the speculation in land, the turn of the touristic flows to the sea and the construction of Governmental Settlements for the accommodation of refugees.

The factors mentioned above had a direct impact in the gradual modulation of the current structure development in the area under the Local Plan, which concisely consists of:

(a) The formation of a radial road network converging towards the Central Business District, the format of which is determinatively influenced by the features of the area.

(b) The gathering of most of the urban operations and activities in the Central Business District, while in parallel, mainly during the last years, centrifugal tendencies developed towards the placement of urban land uses and operations longwise essential radial roads and to a lesser degree in the city outskirts and the precinct. These tendencies resulted among other to the interference of incompatible land uses and the traffic burden of some roads beyond their objective limitations.

(c) The random expansion of the city and the precinct, especially after the intensive building activities that followed the Turkish invasion.

These areas expanded horizontally and vertically without any substantial town planning scheme, thus creating a group of miscellaneous elements, building intermixtures and dispersed developments.



(e) The construction of the Port and the International Airport.

(f) The construction of Governmental Housing Settlements and Self–Help Housing of Refugees in the city outskirts and the precinct.

[Source: Local Plan of Larnaka]



Figure 11 Municipal Library



Figure 13 Old Aqueduct (Kamares)



Figure 12 Saltlake area of Larnaka



Figure 14 Finikoudes Promenade



Figure 15 Larnaka International Airport



Figure 16 Larnaka Beach



Figure 17 Water Sports in the Marine Area of Larnaka



Figure 18 Larnaka Central Business District



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Figure 19 The Marina of Larnaka



Figure 21 Finikoudes Seashore



Figure 23 RES Developments in the greater area of Larnaka District



Figure 20 St. Lazarus Church



Figure 22 Larnaka Medieval Castle



Figure 24 RES Developments in the greater area of Larnaka

[Source: www.larnaka.com]

### 3.5. Larnaka Municipality Environmental Management Sector

Early in 2010, Larnaka Municipality's CEO, Mr. Eleftherios Embedoklis, suggested that the environmental management subjects and training within the limits of Larnaka Municipality are administered by one pertinent body. The Municipal Council vote in favor of the suggestion and therefore, on the 1<sup>st</sup> March 2010 Larnaka Municipality Environmental Management Sector was formed.

The Sector consists of 4 members from various departments who additionally to their everyday responsibilities are also occupied with the environmental matters of the municipality. Nominally the members of the Environmental Management Sector are the following: Mr. Kostas Kokkinos and Mr. Kostas Landos who are Officers of the Public Health Department, Mrs. Christiana Kouzari who is the Manager of Larnaka Urban Environmental Observatory and Mr. Michalis Sialaros, officer of the Administrative and Personnel Department.

The Environmental Management Sector takes action in the following fields:





- Promotion and implementation of the decisions of the Municipal Council on environmental affairs.
- Management of coastal waters and implementation of the Blue Flag Program.
- Preparation of several environmental awareness campaigns and events (Environmental Week, European Mobility Week, "Introduction to the Salt Lakes" Program, cleaning campaigns etc.) and publication of informational material and annual magazines.
- Enlightenment of the citizens, schools, organized groups and close collaboration with Ecological Schools of Larnaka.
- Monitoring and promotion of the recycling system in Larnaka.
- Participation in meetings concerning the environmental matters of Larnaka
- Collaboration with Governmental Departments in incidents of environmental pollution (sea water, saltlakes, soil, atmosphere) in Larnaka.



# 4. CURRENT STATUS AT LARNAKA MUNICIPALITY

### 4.1. Description of Larnaka Municipality Buildings

### 4.1.1. Summary

- Working hours for all City services are 7:30 to 14:00 for the summer season (1<sup>st</sup> June 31<sup>st</sup> August) and 7:30 to 14:30 for the remaining months plus every Wednesday until 18:00.
- There is no central heating system therefore any consumption of oil, gas, etc but split units are used in each office for both heating and cooling.
- All municipality buildings utilise solar panels for water heating. No building has a photovoltaic system installation.

| A/A | BUILDING/ USE   | NUMBER OF<br>PERSONNEL | YEAR OF<br>CONSTRUCTION | NUMBER<br>OF<br>FLOORS | TYPE OF<br>CONSTRUCTION    | BUILDING<br>STATUS |
|-----|---|------------------------|-------------------------|------------------------|----------------------------|--------------------|
| 1   | Town Hall<br>Municipality<br>Central Offices            | 50                     | 2001                    | 5                      | Reinforced<br>concrete     | Very<br>good       |
| 2   | Nikolaidio<br>Archontiko<br>Public Health<br>Department | 15                     | 2007                    | 2                      | Existing wall<br>(Masonry) | Very<br>good       |
| 3   | Larnaka<br>Cultural Center                              | 6                      | 1995                    | 1                      | Existing wall<br>(Masonry) | Very<br>good       |
| 4   | Municipal<br>Theatre                                    | 3                      | 1997                    | 1                      | Reinforced<br>concrete     | Very<br>good       |
| 5   | Pattichion<br>Amfitheatre                               | 15                     | 1989                    | 1                      | Reinforced<br>concrete     | Very<br>good       |
| 6   | Municipal<br>Library                                    | 2                      | 1972                    | 2                      | Reinforced<br>concrete     | Moderate           |
| 7   | Elderly Nursing<br>Home                                 | 14                     | -                       | 1                      | Reinforced concrete        | Moderate           |
| 8   | Multi-storey<br>parking                                 | 10                     | 1993                    | 1                      | Reinforced<br>concrete     | Very<br>good       |

#### Table 1 Description of Buildings in Larnaka Municipality



| Table 2 Energy Consumption at the Larnaka Municipality Buildings |         |         |  |  |  |
|--|---------|---------|--|--|--|
| Energy Consumption (kWh)   | 2009    | 2010    |  |  |  |
|  |         |         |  |  |  |
| Town Hall  | 116.268 | 121.599 |  |  |  |
| Municipal Theatre  | 71.724  | 68.467  |  |  |  |
| Nikolaidio Archontiko  | 30.079  | 31.597  |  |  |  |
| Elderly Nursing Home   | 33.814  | 33.909  |  |  |  |
| Municipal Library  | 30.948  | 32.896  |  |  |  |
| Multi-storey parking   | 54.312  | 66.873  |  |  |  |
| Pattichion Amphitheatre  | 42.966  | 50.637  |  |  |  |
| Cultural Center  | 43.609  | 44.402  |  |  |  |
| TOTAL  | 423.720 | 450.380 |  |  |  |
|  |         |         |  |  |  |

#### 4.1.2. Lamps

The central offices of Larnaka Municipality (Town Hall) utilize 288 lamps, 67% of which are fluorescent lamps with average power of 35 W (154 lamps -58 W for the offices, 40 lamps 11 W for the corridors).

The Public Health Offices (Nikolaidio Archontiko) utilize 110 lamps, 70% of which are fluorescent lamps with average power of 35 W (40 lamps -58 W for the offices, 38 lamps 11W for the corridors).

#### 4.1.3. Air Conditioning Systems

The heating and cooling systems of the Central Offices (Town Hall) of the municipality consist of:

- ➢ 14 units x 16 KW
- > 5 Split Units x 3,5 KW

The heating and cooling systems of the Public Health Department (Nikolaidio Archontiko) consist of:

- > 2 Split Units x 5,78 KW
- 2 units x 22,4 KW

### 4.2. Larnaka Municipality Street Lighting

According to data collected from the Cyprus Electricity Authority (CEA), the number of street lamps in Larnaka comes up to 7.547.

The total energy consumption in 1009 for street lighting was equal to 4.131.000 kWh.

The lamp type and power are shown in the table below:



| Table 3 Larn | aka Municipality Lamp Types |        |
|--------------|-----------------------------|--------|
| LAMP TYPE    | LAMP POWER                  | NUMBER |
| HPS*         | 250 W                       | 1082   |
| HPS          | 150 W                       | 260    |
| HPS          | 70 W                        | 6175   |
| Compact      | 21 W                        | 30     |

\* High Pressure Sodium

Street lighting operating Hours: According to the EAC, the bi-monthly tariff of street lighting is Code 35. Based on this tariff electricity for the lamps will be provided daily from half an hour after sunset until half an hour before sunrise.

The period of power supply can be increased from sunset to sunrise if requested by Larnaka Municipality.

The cost of the street lighting maintenance in 2012 was € 34 000.

## 4.3. Lighting of Parks and Public Spaces in Larnaka **Municipality**

- There are 43 parks within the limits of Larnaka Municipality, 4 more are other construction while the construction of 2 more parks is cyrrently being planned.
- 215 lamps are utilized for the parks in Larnaka Municipality (5 in each park).
- HPS lamps are mostly utilized and their power is 150 W.

Lamp operating hours: electricity is provided daily from half an hour after sunset until half an hour before sunrise.

| Energy Consumption(kWh)                             | 2009    | 2010    |
|---|---------|---------|
| Old Aqueduct (Kamares) Illumination                 | 14.372  | 14.278  |
| External illumination of Terra Santa Church         | 2.458   | 2.847   |
| Fountain on Artemidos Avenue                        | 85.520  | 88.733  |
| Electroluminescence of the castle on Agkyras Street | 5.844   | 6.210   |
| Lighting of the Sonia Park                          | 3.099   | 3.124   |
| Lighting of the park on Trikouppi Street            | 802     | 826     |
| Lighting and fountain on Europe Square              | 55.669  | 75.122  |
| TOTAL   | 167.764 | 191.140 |

Table 4 Er ntion for lighting c . . 1.11 . . 



## 4.4. Stadium Lighting at Larnaka Municipality

There are three large football stadiums and fields in Larnaka Municipality; Antonis Papdopoulos located on Papanikoli Avenue, New G.S.Z. on Georgios Christodoulides Avenue and Ammochostos Stadium on Alexandros Ragkavis Avenue.

#### ANTONIS PAPADOPOULOS

Total electricity consumption in 2010: 231.947 kWh

Number and power of spotlights: **158 lamps** (54 on the western pylons, 48 on the eastern and 56 on the sheds of the grandstand ) and their power is 1500 W each.

#### New G.S.Z.

Total electricity consumption in 2010: 218.010 kWh

Number and power of spotlights: **120 lamps** (30 on each pylon) and their power is 2000 W each.

#### **AMMOCHOSTOS**

Total electricity consumption in 2010: 167.026 kWh

Number and power of spotlights: **80 LAMPS** (20 on each pylon) and their power is 2000 W each.

Energy consumption is higher for all the stadiums but no sufficient data are available. That happens because according to the people responsible, when football matches are carried out electricity provision is succeeded by utilizing generators the operation of which requires oil.

## 4.5. Building Permits in Larnaka Municipality

The Table that follows, presents data regarding the building permits of new residences and blocks of flats and data on the transformation of buildings/ residences into blocks of flats.

| Table 5 Building Permits in Larnaka Municipality |            |                        |  |  |  |
|--|------------|------------------------|--|--|--|
| YEAR   | RESIDENCES | <b>BLOCKS OF FLATS</b> |  |  |  |
| 2005 – 2006                                      | 65         | 153                    |  |  |  |
| 2007   | 32         | 131                    |  |  |  |
| 2008   | 24         | 43                     |  |  |  |
| 2009   | 26         | 26                     |  |  |  |
| 2010   | 26         | 10                     |  |  |  |

According to data collected from the Cleaning Department of Larnaka Municpality, there are 22.915 households in Larnaka.





- The vehicle fleet of Larnaka Municipality is composed by 51 vehicles.
- The municipality holds 27 machinery of various types, uses and engine capacity, such as individual scavengers, digger, etc, which utilize oil.
- The transportation of 8 Public Health Officers is carried out by their private vehicles and they receive a standard monthly payment to cover their fuel costs.
- Measurements on fuel consumption of the vehicle fleet of Larnaka Municipality began in March 2011 and the indication for that month was 24.727 liters.

| Table 6 Vehicle fleet of Larnaka Municipality |                       |   |                    |      |  |
|---|-----------------------|---|--------------------|------|--|
| NUMBER OF<br>VEHICLES                         | VEHICLE MODELS        | USE   | ENGINE<br>CAPACITY | FUEL |  |
| 1   | MERSEDES              | Transportation of the<br>Mayor                      | 2200               | OIL  |  |
| 1   | VOLVO                 | Transportation of the<br>CEO and other<br>employees | 1984               | GAS  |  |
| 1   | VOLVO                 | Transportation of employees                         | 1600               | OIL  |  |
| 10  | TOYOTA HILUX          | Transportation of<br>employees<br>(ministration)    | 2494               | OIL  |  |
| 3   | ΤΟΥΟΤΑ                | Transportation of employees                         | 2494               | OIL  |  |
| 8   | HINO                  | Garbage Collecting<br>Truck                         | 9419               | OIL  |  |
| 3   | MERSEDES              | Garbage Collecting<br>Truck                         | 11946              | OIL  |  |
| 5   | IVECO                 | Garbage Collecting<br>Truck                         | 10308              | OIL  |  |
| 3   | MITSUBISHI PICK<br>UP | Transportation of<br>employees                      | 2477               | OIL  |  |
| 2   | NISSAN PICK UP        | Transportation of<br>employees                      | 2494               | OIL  |  |
| 1   | NISSAN TERRANO        | Transportation of<br>employees<br>(ministration)    | 2663               | OIL  |  |
| 1   | IVECO                 | Scavenger   | 5880               | OIL  |  |
| 1   | IVECO                 | Truck   | 5880               | OIL  |  |
| 1   | HINO                  | Truck   | 9419               | OIL  |  |
| 1   | LEYLAND               | Truck   | 10308              | OIL  |  |
| 1   | SCANIA                | Truck   | 11700              | OIL  |  |



| 1 | JCB           | Digger   | 5900  | OIL |
|---|---------------|--|-------|-----|
| 1 | HINO          | Truck with Hook                                  | 9419  | OIL |
| 1 | ISUZU PICK UP | Transportation of<br>employees                   | 2771  | OIL |
| 1 | NISSAN LORRY  | Water tank truck                                 | 10308 | OIL |
| 1 | HINO          | Water tank truck                                 | 9838  | OIL |
| 2 | FORD PICK UP  | Transportation of<br>employees<br>(ministration) | 2402  | OIL |
| 1 | NISSAN        | Truck for SKIPs                                  | 10308 | OIL |

## 4.7. Road Traffic within Larnaka Municipality Limits

In Larnaca it is observed that there is excessive road traffic and the last few years serious efforts are made by the Municipality to upgrade the road network by widening the roads, improving the lighting, adding evident signings, coating roads, etc and to promote measures using new methods of approaching the traffic issue, like creating roundabouts instead of traffic lights, one-way streets, etc.

Within the framework of the European Programme SMAP, two separate surveys were carried out; the first in 2003 and the second in 2004. Both surveys dealt with road traffic within Larnaka Municipality limits and they resulted in the LARNACA Mobility Master Plan Diagnosis elements of which are presented below:

### 4.7.1. Vehicle Type

The following chart presents the types of vehicles moving in the Municipality in the years 2003 and 2004:





### 4.7.2. Age of Vehicles

The following chart presents the age of vehicles moving in the Municipality in the years 2003 and 2004:



### 4.7.3. Number of Passengers Per Car

The following chart presents the number of passenger per vehicle moving in the Municipality in the years 2003 and 2004:



The results of the survey show that in average 75% of the vehicles only carry one passenger, 20% carry 2 passengers, 5% carry 3 passengers and only 1 of the vehicles carry 4 passengers or more.



### 4.7.4. Destination Purpose of the Vehicle Movement

The following chart presents the destiation purpose of vehicle movement in the Municipality in the years 2003 and 2004:



### 4.7.5. CO<sub>2</sub> Emmisions per Vehicle Type

The following graph presents the  $CO_2$  emmisions per vehicle type in the Municipality in the years 2003 and 2004:

CO2 emission (%)



### 4.7.6. Public Transport

Public transport within Larnaka Municipality limits is carried out by the local bus company Zenon and there are 20 default bus routes which cover all the important areas of the city but also movements from and to other cities and villages.

The policy followed is based on significantly improving the efficiency of the public transport system, which will help to gradually reduce traffic congestion and reduce emissions of  $CO_2$ .

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Figure 25 Larnaka road network

# 4.8. Cycle Path Network of Larnaka Municipality

The cycle and pedestrian path networks in Larnaka Municipality are considered to be insufficient and the Municipal Services direct their efforts towards upgrading them in order to encourage the citizens to move with enviornmental friendly means of transprtation, especially when it comes to short distances. The pedeestrian nd cycl path networks are not hoogeneous, in the sense that the network incorporates various flexible solutions to achieve network continuity and security of the corridors.

During 2010 approximately 4.5 km of cycle paths were constructed. The table that follows presents the planned works for new cycle paths within Larnaka Municipality limits:



**Table 7** New cycle paths in Larnaka Municipality

| Area                                    | New Cycle Paths (km) |
|---|----------------------|
| Panagouli Avenue                        | 4                    |
| Christodoulidi Avenue                   | 2                    |
| Gregori Afxentiou – Griva Digeni Avenue | 4                    |
| Narlaka – Dhekelia Road                 | 7                    |
| Works forcycle path conections          | 3                    |
| TOTAL                                   | 20                   |

The cycle path network provided in the Local Plan of Larnaka is shown in the map below:



Figure 26 Main cycle path network of Larnaka



## 4.9. Planned Works at Larnaka Municipality Road Network

Te planned works that are provided in the Locall Plan o Larnakafor the municipality's road network but also in the perimeter, are expected to alleviate the traffic problem presented and to promote travel by eco-friendly means and are shown below:

#### - Main road – Primary road network

(i) Completion of the construction works regarding the formation of Stratigou Timagia Avenue and some of its extensions.

(ii) Completion of the construction works of Alexandros Panagoulis Avenue, two of its byroads towards the seafront Avenue and the by-road towards Larnaka – Famagusta motorway.

(iii) Improvement and upgrade of the Larnaka - Dhekelia Avenue and its two by-roads towards Voroklini and Pyla.

(iv) Construction and improvement of the westward expansion of Artemidos Avenue and construction of the southern section of the motorway, towards the planned new premises of the Airport.

(v) Improvement of the eastern part of the main road linking Larnaca to Nicosia (Gregori Afxentiou and Griva Digeni Avenues).

(vi) Improvement of the northern section of Faneromenis Avenue and parts of its by-roads.

(vii) Construction of the northern section of E. Zapata Avenue.

(viii) Improvement of the western section of Stratigou Timagia Avenue (Kyriakos Matsis Avenue).

- Main road - Secondary Road Network

(i) Construction and improvement of Touz Hane Street.

- (ii) Improvement of Piale Pasia Avenue.
- (iii) Construction of the extension to the north of the coastal road of Finikoudes.

According to data of the year 2010 provided by the Technical Services, the length of the roads is 253.48 km, while for the length of the sidewalks there are no exact figures. Nevertheless it is estimated that the sidewalks' length is 15-20% shorter than the length of the roads and that is about 200 -208 km.

### 4.10. Solid Waste Management at Larnaka Municipality

The collection of solid waste is carried out from Larnaca Municipality services and the disposal since April 2010 is performed in Koshi landfills. Due to the weighing of waste that is carried out there, there are more precise data on the quantities of waste collected in Larnaka Municipality.

The waste collection program is divided in 20 areas, the collection is carried out three times a week (except for Sunday) and each day of waste collection the garbage trucks carry out 10 routes.

The quantities of solid waste that were collected and resulted in landfills are indicated in detail in the following table:



| Table 8 Solid waste collection | able 8 Solid waste collection in Larnaka Municipality |  |  |  |  |  |
|--------------------------------|---|--|--|--|--|--|
| MONTH/YEAR                     | WEIGHT (Kg)   |  |  |  |  |  |
| 4/2010                         | 2 553 750   |  |  |  |  |  |
| 5/2010                         | 2 825 280   |  |  |  |  |  |
| 6/2010                         | 3 066 053   |  |  |  |  |  |
| 7/2010                         | 3 290 170   |  |  |  |  |  |
| 8/2010                         | 3 090 040   |  |  |  |  |  |
| 9/2010                         | 2 848 980   |  |  |  |  |  |
| 10/2010                        | 2 672 790   |  |  |  |  |  |
| 11/2010                        | 2 575 860   |  |  |  |  |  |
| 12/2010                        | 2 726 160   |  |  |  |  |  |
| 1/2011                         | 2 611 980   |  |  |  |  |  |
| 2/2011                         | 2 277 580   |  |  |  |  |  |
| 3/2011                         | 2 652 045   |  |  |  |  |  |
| 4/2011                         | 2 632 011   |  |  |  |  |  |

### 4.11. Recycling Program at Larnaka Municpality

- The recycling system in Larnaka is performed by a contractor of the non profit organization Green Dot Cyprus, since 1<sup>st</sup> October 2010.
- The recycling system performed in Larnaka is "door to door", namely collection trucks of Green Dot pick up recyclables from outside every residence and premises.
- The recycling system is being carried out 3 days a week , from Monday to Wednesday and a different area is served every day. For the purposes of the system, two collection trucks are used; one for the collection of PMD and another for the collection of paper.
- Apart from the recycling system, cycling bins have also been placed for each category of recyclables (blue bin for PMD, brown bin for paper and green bin for glass). The recyclables from blue and brown bins are collected during the "door to door" collection accordingly. The glass containers are picked when fully filled.

| Table 9 Recycle bins in Larnaka Municipality |        |  |  |  |  |
|--|--------|--|--|--|--|
| TYPE OF RECYCLE BIN                          | NUMBER |  |  |  |  |
| PMD (blue)                                   | 400    |  |  |  |  |
| PAPER (blown)                                | 25     |  |  |  |  |
| GLASS  | 65     |  |  |  |  |

The quantities of recyclable materials that were collected from the first day of the application of the system until today are presented in the following table:



| MONTH/YEAR | PMD (kg) | PAPER (kg) | GLASS (kg) | TOTAL (kg) |
|------------|----------|------------|------------|------------|
| 10/2010    | 104      | 850        | 10 500     | 115 350    |
| 11/2010    | 45 136   | 114 136    | 10 950     | 170 900    |
| 12/2010    | 46 278   | 149 909    | 11 000     | 207 187    |
| 1/2011     | 48 910   | 108 516    | 13 570     | 170 996    |
| 2/2011     | 43 665   | 97 185     | 16 580     | 157 430    |
| 3/2011     | 49 359   | 113 884    | 16 620     | 179 863    |
| 4/2011     | 50 316   | 112 941    | 17 690     | 180 947    |
| 5/2011     | 50 859   | 117 072    | 22 955     | 190 886    |

## 4.12. Number of Industries and Factories in Larnaka Municipality

The industries and factories operating in the Municipality of Larnaca, are located in the Industrial Area of Larnaka and their number in 2010 was 33.

### 4.13. Number of Hotels in Larnaka Municipality

According to the survey that was conducted in 2010 by the Larnaka Tourism Development Company there are 33 accomodation units and 2.316 beds.

### 4.14. Green wastes

The collection of Green Wastes (prunings, mown grass, etc.) from public green spaces and parks, is carried out by City Services and their disposal is performed in the ols rubbish dump of Larnaka, in the area of Klavdia that is located outside the municipal limits.

The only available data regarding the volume of prunings, is for two weeks only, 14/02/2011-27/02/2011 and their quantity rises up to 60 000 Kg.

## 4.15. Larnaka Municipality Population

The population of Larnaka according to the Census of 2001 came up to 71.000 and it is estimated that by 2011 it will rise up to 82.000.

### 4.16. Environmental Awareness Campaigns

Larnaka Municipality inaugurated its environmental awareness campaigns in 2002 by organizing for the very first time the *Environmental Week* which has since been established as an annual spring event. Following the suggestion of the Municipality's CEO early in 2010, the environmental matters and education are now performed by the Environmental



Management Sector of the Municipality. The Envrionmental Management Sector constists of four members who additionally to their responsibilities as municipal officers, they are responsible for the environmental matters as well.

Over the years, the Municipality of Larnaca enhances the activity of informing the public about issues concerning the environment and since 2010 there is official recording of the participants in the events, as shown in the following table:

| Table 11 Environmental Events in Larnaka Municipality |   |  |  |  |  |
|---|---|--|--|--|--|
| EVENT   | NUMBER OF SCHOOLS/<br>ORGANIZED GROUPS<br>WHO PARTICIPATED  | NUMBER OF<br>PARTICIPANTS  |  |  |  |
| Environmental Week 2010                               | 32  | 1250   |  |  |  |
| "Introduction to the saltlakes" program               | 20  | 1000   |  |  |  |
| World Environment Day 2010                            | 2   | 800 - 1000   |  |  |  |
| European Mobility Week 2010                           | 3   | 250  |  |  |  |
| Informational Campaigns on recycling<br>2010          | 2   | 500  |  |  |  |
| Cleaning of beaches 2010                              | 5   | 200  |  |  |  |
| European Sustainable Energy Week<br>2011              | 7   | 600  |  |  |  |
| Environmental Week 2011                               | 34  | 1700   |  |  |  |
| World Environment Day 2011                            | 9   | 200  |  |  |  |
| Cleaning of beaches 2011                              | 4   | 250  |  |  |  |
| Earth Hour  | The municipality participality participality fights on the municipal bup plazas. The citizens are more as well through a Press R the number of participants | ates by shutting the<br>ildings and in central<br>otivated to participate<br>elease. Exact data on<br>are not available. |  |  |  |

During the environmental awareness events, Larnaka Municpality distributes informational material prepared by municipal officers and disseminates material produced by the European Union and several respective state services and organisations. At the offices of the Public Health Department (Nikolaidio Archontiko) there is an informational corner where one can gather environmental information material for free.

In February 2011, the Environmental Management Sector prepared and published the first issue of an annual magazine with the title "Environmental News" with articles exclusively in environmental matters. The first issue was printed in 2.000 copies that were distributed to organized groups and citizens. The same issue was uploaded on the official internet page of the municipality along with other environmental information.



## 4.17. Green Procurements

Larnaka Municipality promotes Green Procurements in areas such as purchasing energyefficient computers, recycled paper, etc.

# 4.18. European and International Projects

Larnaka Municipality participates in the following European and International Projects, some of which are co-funded:

| URBACT – SURE Network which deals with<br>mobility in cities  |  | http://urbact.eu |
|---|--|------------------|
| ENPI – USUDS, MARIE Programme which deals with coastline management   |  |                  |
| <b>Ceramus</b> Greece – Cyprus  |  |                  |
| Covenant of Mayors  |  |                  |
| A European Committee initiative for the<br>creation of a permanent collaboration<br>network between European Cities to<br>combat climate change.  | Σίμφωνο                                |                  |
| The municipalities are bound to achieve<br>the European objectives for a reduction of<br>CO2 emissions by at least 20% through<br>measures promoting renewable energy,<br>energy savings and sustainable transport.   | Υπέρ της Τοπικής<br>Βιώσιμης Ενέργειας | /                |
| <b>Covenant of Islands</b><br>ISLE-PACT aims at developing Sustainable<br>Energy Action Plans in Islands, in order to<br>achieve the European objectives for a<br>reduction of CO2 emissions by at least 20%  | SUSTAINABLE ENERGY ACTIONS FOR ISLANDS | www.islepact.eu  |
| Medeea  | • • •                                  | www.interregmede |
| The general scope of Medeea Project is to<br>achieve the European goal "20-20-20" in<br>the Mediterranean, through the<br>involvement of local authorities in energy<br>related matters by applying the energy<br>planning tool, European Energy Award-<br>eea® | medeed                                 | <u>ea.eu</u>     |

# 5. INVENTORY OF ENERGY CONSUMPTION IN LARNAKA MUNICIPALITY

# 5.1. Residential Sector

| Table 12 Energy Demand in MWh in the Residential Sector in 2009 |             |          |       |        |            |         |         |
|---|-------------|----------|-------|--------|------------|---------|---------|
| Description   | Electricity | Fuel Oil | LPG   | Solar  | Geothermal | Biomass | Total   |
|   |             |          |       |        |            |         |         |
| Hot water   | 3.064       | 2.681    | 191   | 12.446 | 96         | 670     | 19.147  |
| Heating and cooling   | 73.524      | 43.857   | 5.160 | 387    | 258        | 6.449   | 129.635 |
| Lighting  | 4.085       | -        | -     | -      | -          | -       | 4.085   |
| Kitchen   | 3.064       | -        | 1.313 | -      | -          | 0       | 4.376   |
| Electrical appliances   | 18.381      | -        | -     | -      | -          | -       | 18.381  |
| Total   | 102.117     | 46.537   | 6.664 | 12.832 | 354        | 7.120   | 175.624 |

## 5.2. Primary Sector

| Table 13 Energy Demand in MWh in the Primary Sector in 2009 |             |          |        |     |         |       |
|---|-------------|----------|--------|-----|---------|-------|
| Description   | Electricity | Fuel Oil | Diesel | LPG | Biomass | Total |
| Agriculture, Forestries and<br>Fisheries                    | 239         | 56       |        | 73  | 96      | 463   |
| Mining and Quarrying  | 11          | 3        | 17     | 3   |         | 33    |
| Total   | 250         | 59       | 17     | 76  | 96      | 496   |

# 5.3. Secondary Sector

| Table 14 Energ                                       | Table 14 Energy Demand in MWh in the Secondary Sector in 2009 |          |       |       |         |        |
|--|---|----------|-------|-------|---------|--------|
| Description  | Electricity   | Fuel Oil | LPG   | Solar | Biomass | Total  |
| Processing   | 9.051   | 2.106    | 2.757 | 399   | 133     | 14.447 |
| Water supply, wastewater treatment, waste management | 8.352   | 1.944    | 2.544 |       |         | 12.840 |
| Construction   | 768   | 179      | 234   |       |         | 1.181  |
| Total  | 18.171  | 4.229    | 5.535 | 399   | 133     | 28.467 |



### 5.4. Tertiary Sector



| Table 15 Final Energy Consumption in MWh in the Tertiary Sector for the Year 2009 |             |          |        |       |         |         |
|---|-------------|----------|--------|-------|---------|---------|
| Description   | Electricity | Fuel Oil | LPG    | Solar | Biomass | Total   |
| Wholesale and Retail trade,<br>repair of motor vehicles and<br>motorcycles        | 43.629      | 10.154   | 13.290 | 1.870 | 623     | 69.565  |
| Hotels and restaurants  | 24.829      | 5.778    | 7.563  | 1.064 | 355     | 39.589  |
| Public administration and social insurance  | 6.642       | 1.546    | 2.023  | 285   | 95      | 10.591  |
| Defence, Justice, Police and<br>Fire stations/departments                         | 1.254       | 292      | 382    | 54    | 18      | 1.999   |
| Education   | 5.297       | 1.233    | 1.614  | 227   | 76      | 8.446   |
| Human Health and social care  | 10.441      | 2.430    | 3.180  | 447   | 149     | 16.648  |
| Other Services  | 25.291      | 5.886    | 7.704  | 1.084 | 361     | 40.326  |
| Public Lighting   | 4.131       |          |        |       |         | 4.131   |
| Total   | 121.514     | 27.318   | 35.756 | 5.031 | 1.677   | 191.295 |

# 5.5. Transports

| Table 16 Final Energy Consumption in MWh in Transports for the Year 2009         |             |         |          |         |         |  |  |
|--|-------------|---------|----------|---------|---------|--|--|
| Description  | Electricity | Diesel  | Gasoline | Biomass | Total   |  |  |
| Urban and suburban passenger transports  | 107         | 5.502   | 8.278    |         | 13.887  |  |  |
| Other passenger transportation<br>services (taxi, tourism, school buses,<br>etc) | 0           | 88.031  | 132.443  | 4.409   | 224.884 |  |  |
| Commercial ground transportation services and removable services                 | 0           | 0       | 0        | 0       | 0       |  |  |
| Private Vehicles   | 0           | 181.564 | 273.164  | 9.095   | 463.823 |  |  |
| Total  | 107         | 275.114 | 413.885  | 13.504  | 702.593 |  |  |


### 5.6. Total Final Energy Consumption in the Municipality of Larnaka

| Sector      | 100         |          |         | onsumptie |        | 2005   |            |         |           |
|-------------|-------------|----------|---------|-----------|--------|--------|------------|---------|-----------|
|             | Electricity | Fuel Oil | Diesel  | Gasoline  | LPG    | Solar  | Geothermal | Biomass | Total     |
| Residential | 102.117     | 46.537   | -       | -         | 6.664  | 12.832 | 354        | 7.120   | 175.624   |
| Primary     | 250         | 59       | 17      | -         | 76     | -      | -          | 96      | 498       |
| Secondary   | 18.171      | 4.229    | -       | -         | 5.535  | 399    | -          | 133     | 28.467    |
| Tertiary    | 121.514     | 27.318   | -       | -         | 35.756 | 5.031  | -          | 1.677   | 191.296   |
| Transports  | 107         | -        | 275.114 | 413.885   | -      | -      | -          | 13.504  | 702.610   |
| Total       | 242.159     | 78.143   | 275.131 | 412.885   | 48.031 | 18.262 | 354        | 22.530  | 1.098.495 |

Figure 27 Share of Final Energy Consumption by Sector in 2009



Figure 28 Share of Final Energy Consumption by Energy Source in 2009





# 6. INVENTORY OF CARBON DIOXIDE (CO<sub>2</sub>) EMISSIONS AT LARNAKA MUNICIPALITY

### 6.1. Introduction

Carbon dioxide emissions were calculated using standard emission factors on consumption based on the energy source and use. According to these factors Renewable Energy Sources (RES) are considered to have zero carbon emissions.

|                          | Energy Source | IPCC emission factors |
|--------------------------|---------------|-----------------------|
|                          | Fuel oil      | 0,279                 |
|                          | Diesel        | 0,267                 |
| FOSSIL FUELS             | Gasoline      | 0,249                 |
|                          | Natural Gas   | 0,202                 |
|                          | LPG           | 0.240                 |
|                          | Electricity   | 0,874                 |
|                          | Wind          | 0                     |
|                          | Hydro         | 0                     |
| RENEWABLE ENERGY SOURCES | Solar         | 0                     |
|                          | Geothermal    | 0                     |
|                          | Biomass       | 0                     |

#### Table 18 Coefficients for Calculating CO<sub>2</sub> Emissions

### 6.2. Residential Sector

Table 19 CO<sub>2</sub> Emissions in tones in the Residential Sector of Larnaka Municipality in 2009

| Description           | Electricity | Fuel Oil | LPG   | SOLAR | Geothermal | Biomass | Total   |
|-----------------------|-------------|----------|-------|-------|------------|---------|---------|
| Hot water             | 2.678       | 748      | 46    | -     | -          | -       | 3.471   |
| Heating and cooing    | 64.260      | 12.236   | 1.238 | -     | -          | -       | 77.734  |
| Lighting              | 3.570       | -        | -     | -     | -          | -       | 3.570   |
| Kitchen               | 2.678       | -        | 315   | -     | -          | -       | 2.993   |
| Electrical appliances | 16.065      | -        | -     | -     | -          | -       | 16.065  |
| Total                 | 89.250      | 12.984   | 1.599 | -     | -          | -       | 103.833 |



### 6.3. Primary Sector

Table 20 CO<sub>2</sub> Emissions in tones in the Primary Sector of Larnaka Municipality in 2009

| Description                               | Electricity | Fuel Oil | Diesel | LPG | Biomass | Total |
|---|-------------|----------|--------|-----|---------|-------|
| Agriculturee, Forestries and<br>Fisheries | 209         | 16       | 0      | 17  | -       | 242   |
| Mining and Quarring                       | 10          | 1        | 4      | 1   | -       | 16    |
| Total                                     | 219         | 17       | 4      | 18  | -       | 257   |

### 6.4. Secondary Sector

Table 21 CO<sub>2</sub> Emissions in tones in the Secondary Sector of Larnaka Municipality in 2009

| Description  | Electricity | Fuel Oil | LPG   | Solar | Biomass | Total  |
|--|-------------|----------|-------|-------|---------|--------|
| Processing   | 7.911       | 588      | 662   | -     | -       | 9.160  |
| Water supply, wastewater treatment, waste management | 7.300       | 542      | 611   | -     | -       | 8.453  |
| Construction   | 671         | 50       | 56    | -     | -       | 777    |
| Total  | 15.881      | 1.180    | 1.328 | -     | -       | 18.390 |

### 6.5. Tertiary Sector

Table 22 CO<sub>2</sub> Emissions in tones in the Tertiary Sector of Larnaka Municipality in 2009

| Description  | Electricity | Fuel Oil | LPG   | Solar | Biomass | Total   |
|--|-------------|----------|-------|-------|---------|---------|
| Wholesale and Retail trade,<br>repair of motor vehicles and<br>motorcycles | 38.132      | 2.833    | 3.190 | -     | -       | 44.154  |
| Hotels and restaurants   | 21.701      | 1.612    | 1.815 | -     | -       | 25.128  |
| Public administration and social insurance                                 | 5.805       | 431      | 486   | -     | -       | 6.722   |
| Defense, Justice, Police and<br>Fire stations/ departments                 | 1.096       | 81       | 92    | -     | -       | 1.269   |
| Education  | 4.630       | 344      | 387   | -     | -       | 5.361   |
| Human health and social care   | 9.125       | 678      | 763   | -     | -       | 10.567  |
| Other services   | 22.104      | 1.642    | 1.849 | -     | -       | 25.595  |
| Public lighting  | 3.610       | -        | -     | -     | -       | 3.610   |
| Total  | 106.203     | 7.622    | 8.581 | -     | -       | 122.406 |

### 6.6. Transports

Table 23 CO<sub>2</sub> Emissions in for Transports in Larnaka Municipality in 2009

| Description  | Electricity | Diesel | Gasoline | Biomass | Total   |
|--|-------------|--------|----------|---------|---------|
| Urban and suburban passenger transports  | 94          | 1.469  | 2.061    | -       | 3.624   |
| Other passenger transportation<br>services (taxi, tourism, school buses,<br>etc) | -           | 23.504 | 32.978   | -       | 56.483  |
| Commercial ground transportation services and mobile services                    | -           | -      | -        | -       | -       |
| Private vehicles   | -           | 48.478 | 68.018   | -       | 116.495 |
| Total  | 94          | 73.451 | 103.057  | -       | 176.602 |

### 6.7. Total CO<sub>2</sub> emissions in Larnaka Municipality

 Table 24 Total CO2 emissions in Larnaka Municipality in 2009

| Sector      |             |          |        |          |        |       |            |         |         |
|-------------|-------------|----------|--------|----------|--------|-------|------------|---------|---------|
|             | Electricity | Fuel Oil | Diesel | Gasoline | LPG    | Solar | Geothermal | Biomass | Total   |
| Residential | 89.250      | 12.984   | -      | -        | 1.599  | -     | -          | -       | 103.833 |
| Primary     | 219         | 17       | 4      | -        | 18     | -     | -          | -       | 257     |
| Secondary   | 15.881      | 1.180    | -      | -        | 1.328  | -     | -          | -       | 18.390  |
| Tertiary    | 106.203     | 7.622    | -      | -        | 8.581  | -     | -          | -       | 122.406 |
| Transports  | 94          | -        | 73.451 | 103.057  | -      | -     | -          | -       | 176.602 |
| Total       | 211.647     | 21.803   | 73.455 | 103.057  | 11.526 | -     | -          | -       | 421.488 |











### 6.8. Forecasting/ Projection Scenario of CO<sub>2</sub> Emissions

For the forecasting/projection of CO<sub>2</sub> emissions in the period 2010 to 2020, a scenario of expected evolution was compiled, which includes the following main assumptions:

- 1. Use of annual growth rates of energy consumption per sector based on the statistics available during the preparation of the Energy Action Plan (see Table 25)
- 2. Use of annual growth rates of energy efficiency at the end-use due to the improvement of existing technologies (see Table 26)
- 3. Estimation of the coefficient of performance of Cyprus Power Plants in subsequent, years, taking into account the technology improvement and the modernization of the existing equipment (see Table 27).
- 4. The gradual introduction, use and integration of natural gas into the power generating system.

| Table 25 Growth Rates of Energy Consumption per Consu | umer used in the expected evolution |
|---|-------------------------------------|
|---|-------------------------------------|

| Sector Descripion                     | Estimated annual energy consumption rate |
|---------------------------------------|--|
| Residential                           |  |
| Hot water                             | 3,5%                                     |
| Heating and Cooling                   | 3,5%                                     |
| Lighting                              | 3,5%                                     |
| Cooking                               | 3,5%                                     |
| Refrigerators and freezers            | 3,5%                                     |
| Washing and drying machines           | 3,5%                                     |
| Dishwashers                           | 3,5%                                     |
| Televisions                           | 3,5%                                     |
| Other electrical appliances           | 3,5%                                     |
| Primary Sector                        |  |
| Agriculture, forestries and fisheries | 1,0%                                     |

scenario





| Sector Descripion   | Estimated annual energy<br>consumption rate |
|---|---|
| Mining and quarring   | 0,5%  |
| Secondary Sector  |   |
| Processing  | 1,5%  |
| Water supply, wastewater treatment, waste management and remediation activities | 1,5%  |
| Construction  | 2,0%  |
| Tertiary Sector   |   |
| Wholesale and retail trade, repair of motor vehicles and motorcycles            | 3,0%  |
| Accommodation services activities and food services                             | 4,5%  |
| General public administration and social insurance                              | 1,5%  |
| Defense and justice services, police and fire stations/ departments             | 1,5%  |
| Education   | 1,5%  |
| Activities related to human health and social care                              | 2,0%  |
| Other servics   | 1,0%  |
| Municipal/ Public lighting  | 3,0%  |
| Transports (vehicles)   |   |
| Private transports  | 3,5%  |
| Urban and suburban passenger transports   | 1,0%  |
| Other road transport services (taxi, tourism, school buses, etc.                | 1,0%  |
| Freight road transports and removal services                                    | 2,0%  |
| Secondary energy production   |   |
| Solar energy for electricity generation   | 3,0%  |
| Wind energy for electricity generation  | 1,0%  |
| Solar energy for heating and cooling  | 2,0%  |
| Geothermal energy for heating and cooling                                       | 2,0%  |

 Table 26 Increased Efficiency in Energy End-use (Reducing the Final Energy for the same Useful

Energy)

| Sector Description          | Estimated annual growth rate of end-use energy |
|-----------------------------|--|
| Residential                 |  |
| Hotwater                    | 0,5%   |
| Heating and cooling         | 0,5%   |
| Lghting                     | 0,5%   |
| Cooking                     | 0,5%   |
| Refrigerators and heaters   | 0,5%   |
| Washing and drying machines | 0,5%   |
| Dishwashers                 | 0,5%   |
| Televisions                 | 0,5%   |
| Other electrical appliances | 0,5%   |
| Other services              | 0,5%   |
| Municipal/ Public lighting  | 0,5%   |
| Transports (Vehicles)       |  |
| Private transports          | 0,5%   |



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| Table 27 Coefficients of Energy Performance of Electricity Generation |      |      |      |      |      |      |      |      |      |  |
|---|------|------|------|------|------|------|------|------|------|--|
|   | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |  |

|             | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|-------------|------|------|------|------|------|------|------|------|------|------|------|
| Fuel Oil    | 32%  | 32%  | 32%  | 33%  | 34%  | 35%  | 35%  | 35%  | 35%  | 35%  | 35%  |
| Diesel      | 25%  | 25%  | 25%  | 25%  | 25%  | 26%  | 27%  | 28%  | 29%  | 30%  | 31%  |
| Natural Gas | -    | -    | -    | -    | -    | 43%  | 43%  | 43%  | 44%  | 44%  | 44%  |

#### Table 28 Expected Evolution Scenario for Forecasting CO2 Emissions for the Period 2009 - 2020

| Year | Fuel Oil | Diesel | Gasoline | LPG    | Natural<br>Gas | Total   | Percentage<br>increase<br>based on<br>2009 |
|------|----------|--------|----------|--------|----------------|---------|--|
| 2009 | 229.828  | 77.076 | 103.057  | 11.527 | 0              | 421.489 | 0%   |
| 2010 | 236.049  | 78.884 | 105.457  | 11.821 | 0              | 432.211 | 3%   |
| 2011 | 242.458  | 80.741 | 107.921  | 12.124 | 0              | 443.244 | 5%   |
| 2012 | 249.062  | 82.648 | 110.452  | 12.436 | 0              | 454.598 | 8%   |
| 2013 | 248.855  | 84.608 | 113.051  | 12.757 | 0              | 459.272 | 9%   |
| 2014 | 248.896  | 86.621 | 115.721  | 13.089 | 0              | 464.326 | 10%  |
| 2015 | 249.319  | 88.525 | 118.463  | 13.431 | 0              | 469.737 | 11%  |
| 2016 | 241.847  | 90.489 | 121.279  | 13.783 | 8.417          | 475.814 | 13%  |
| 2017 | 219.841  | 92.514 | 124.172  | 14.147 | 25.365         | 476.038 | 13%  |
| 2018 | 182.898  | 94.601 | 127.143  | 14.522 | 50.966         | 470.129 | 12%  |
| 2019 | 133.787  | 96.751 | 130.196  | 14.908 | 83.503         | 459.145 | 9%   |
| 2020 | 72.164   | 98.965 | 133.332  | 15.307 | 123.084        | 442.853 | 5%   |



Figure 31 Expected Evolution Scenario for Forecasting CO<sub>2</sub> Emissions for the Period 2009 -2020

Sustainable Energy Action Plan Larnaka Municipality - Cyprus





# 7. LARNAKA MUNICIPALITY SUSTAINABLE ENERGY ACTION PLAN FROM 2011 TO 2020

### 7.1. Introduction

The Sustainable Energy Action Plan that has been prepared for Larnaka Municipality includes additional measures/actions so as to achieve at least the European goal of combating climate change. This includes measures taken by the Municipality, in addition to national measures, to overcome the goal of reducing  $CO_2$  emissions by at least 20% by 2020 compared to the reference year 2009.

| Emissions<br>Reference Year<br>2009 | Expected annual<br>emissions in<br>2020 | Average growth<br>rate in<br>Emissions | Minimum<br>emissions<br>target in 2020 | Desired<br>minimum (20%)<br>emissions<br>reduction |  |
|-------------------------------------|---|--|--|--|--|
| (tn CO <sub>2</sub> /year)          | (tn CO <sub>2</sub> /year)              | (tn CO <sub>2</sub> /year)             | (tn CO <sub>2</sub> /year)             | (tn CO <sub>2</sub> /year)                         |  |
| 421.489                             | 442.853                                 | 1.942                                  | 337.191                                | 105.662  |  |

Although the contribution of national measures is estimated and included in the Sustainable Energy Action Plan, the municipality cannot determine the achievement of National Goals. However, several of the measures proposed to be implemented at a local level, will support and complement national measures, in order to enable the achievement of the main objectives.

The measures are divided in the following main areas:

- Energy saving in public buildings
- Energy saving through awareness raising campaigns
- Energy saving in transports
- Energy saving in street lighting
- Investments in Renewable Energy Sources (RES)
- Development of green spaces



### 7.2. Energy Saving in Public Buildings

#### **ENERGY EFFICIENCY – Measure 1:** Thermal Insulation

The indirect cost of the application of this measure is not particularly important, as the following requirements must first be fulfilled: (a) preparation of terms for receiving tenders, (b) evaluation of the offers by technical and financial criteria.

Measure implementation period: 2012-2015

| A/A | BUILDING/<br>USE                   | CONSTRUCTION<br>YEAR | CONSUMPTION<br>IN 2010 (KWH) | PROPOSED<br>INTERVENTION | SAVING RATE | ENERGY<br>SAVING<br>(KWh) |
|-----|------------------------------------|----------------------|------------------------------|--------------------------|-------------|---------------------------|
| 1   | Municipality<br>Central<br>Offices | 2001                 | 121.599                      | Roof insulation          | 20%         | 24.320                    |
| 2   | Municipal<br>Theatre               | 1997                 | 68.467                       | Roof insulation          | 30%         | 20.540                    |
| 3   | Municipal<br>Library               | 1972                 | 66.873                       | Roof insulation          | 30%         | 20.662                    |

| Measure code                                       | ENEF 1          |            |   |                            |                                |              |
|--|-----------------|------------|---|----------------------------|--------------------------------|--------------|
| Measure name                                       | Insulation Inte | erventio   | ons   |                            |                                |              |
|  |                 |            |   |                            |                                |              |
| APPLICATION COST                                   |                 |            |   |                            |                                |              |
| Investment cost                                    | Cos             | st (€/m² a | oplication surfac   | e)                         |                                |              |
| Insulation Intervention                            | ons             |            |   |                            | 15                             |              |
| Operation cost                                     |                 |            |   |                            |                                |              |
| Insulation Intervention                            | ons             |            | 0€  |                            |                                |              |
| Indirect cost                                      |                 |            |   |                            |                                |              |
|  |                 |            | 🗌 – High  |                            |                                |              |
|  |                 |            | 🗌 – Average   |                            |                                |              |
|  |                 |            | 🖄 – Low   |                            |                                |              |
| APPLICATION BENEFITS                               |                 |            |   |                            |                                |              |
| Energy   |                 |            | E   | Energy Sav                 | ving (kWh/year)                |              |
|  |                 |            |   | e                          | 54.922                         |              |
| Financial  |                 |            | Energy Saving   | Average electricity and Sa |                                | Saving       |
|  |                 |            | (kWh/year)  | fuel oil price (€/kWh)     |                                | (€/year)     |
|  |                 |            | 64.922  |                            | 0,18                           | 11.686       |
| Environmental                                      |                 |            | Em  | hissions Sa                | iving (kg <sub>co2</sub> / yea | r)           |
|  |                 |            |   | 5                          | 56.742                         |              |
| RESULTS – EVALUATI                                 | ON              |            |   |                            |                                |              |
| Estimated Unit Cost (€/kg CO <sub>2</sub> ) 1 €/ k |                 |            | kg <sub>CO2 annual saving</sub> Proposed for Implementation |                            |                                | plementation |
| MEASURE TO IMPLE                                   | n Interventions |            |   |                            |                                |              |
| Estimated Total Cost Saving                        |                 |            | Emissions Reduction Depreciation                            |                            |                                | ciation      |
| 55.000 €   | 11.686€         | [          | 56.742 Kg <sub>co2</sub> / year 5                           |                            |                                | ears         |



#### **ENERGY EFFICIENCY – Measure 2:** Voltage Rectifier Installation

The indirect cost of the application of this measure is not particularly important, as the following requirements must first be fulfilled: (a) preparation of terms for receiving tenders, (b) evaluation of the tenders by technical and financial criteria.

#### Measure implementation period: 2014

| A/A | BUILDING/ USE                   | CONSTRUCTION<br>YEAR | SAVING IN 2010<br>(KWH) | PROPOSED<br>INTERVENTION          | SAVING RATE |
|-----|---------------------------------|----------------------|-------------------------|-----------------------------------|-------------|
| 1   | Municipality<br>Central Offices | 2001                 | 121.599                 | Voltage Rectifier<br>Installation | 15%         |

| Measure Code  | ENEF 2          |         |  |          |                        |           |
|---|-----------------|---------|--|----------|------------------------|-----------|
| Measure Name  | Voltage Rectifi | er Inst | allation   |          |                        |           |
|   |                 |         |  |          |                        |           |
| APPLICATION COST  |                 |         |  |          |                        |           |
| Investment Cost   |                 |         | C  | Cost (€) |                        |           |
| Voltage Rectifier Inst                                    | allation        |         |  | 2        | 20.000                 |           |
| Operation Cost  |                 |         |  |          |                        |           |
| Voltage Rectifier Inst                                    | allation        |         | 0€   |          |                        |           |
| Indirect Cost   |                 |         |  |          |                        |           |
|   |                 |         | 🗌 – High   |          |                        |           |
|   |                 |         | 🗌 – Average  |          |                        |           |
|   |                 | ∐ – Low |  |          |                        |           |
| APPLICATION BENEFITS                                      |                 |         |  |          |                        |           |
| Energy  |                 |         | Ene  | ergy Sav | ving (kWh/yea          | r)        |
|   |                 |         |  | :        | 18.240                 |           |
| Financial   |                 |         | Energy Saving  | Avera    | Average electricity Sa |           |
|   |                 |         | (kWh/year)   | pri      | ce (€/kWh)             | (€/year)  |
|   |                 |         | 18.240   |          | 0,18                   | 3.283     |
| Environmental   |                 |         | Emissions Saving   |          |                        |           |
|   |                 |         |  | (kg      | <sub>202</sub> / year) |           |
|   |                 |         |  | -        | 15.941                 |           |
| <b>RESULTS - EVALUATION</b>                               | NC              |         |  |          |                        |           |
| Estimated Unit Cost (€/kg CO <sub>2</sub> ) <b>1,25 €</b> |                 |         | €/ kg <sub>CO2 annual saving</sub> Proposed for Implementation |          |                        |           |
| MEASURE TO IMPLEM   | AENT: ENEF 2 Vo | oltage  | Rectifier Installatior   | ı        |                        |           |
| Estimated Cost  | Saving          |         | Emissions Reduction Depreciation                               |          |                        | reciation |
| 20.000 €  | 3.283€          |         | 15.941 Kg <sub>co2</sub> / year 6 years                        |          |                        |           |



The indirect application cost of this measure is not particularly important as lamps purchase and replacement is required by technical and financial criteria.

| A/A | BUILDING/ USE                   | CONSTRUCTION<br>YEAR | SAVING IN 2010<br>(KWH) | PROPOSED<br>INTERVENTION | SAVING RATE |
|-----|---------------------------------|----------------------|-------------------------|--------------------------|-------------|
| 1   | Municipality<br>Central Offices | 2001                 | 121.599                 | Lamps replacement        | 15%         |

| Measure Code                                       | ENEF 3        | ENEF 3 |  |                     |                         |           |  |
|--|---------------|--------|--|---------------------|-------------------------|-----------|--|
| Measure Name                                       | Lamps Replace | ment   |  |                     |                         |           |  |
|  |               |        |  |                     |                         |           |  |
| APPLICATION COST                                   |               |        |  |                     |                         |           |  |
| Investment Cost                                    |               |        | C  | Cost (€)            |                         |           |  |
| Lamps Replacement                                  | (100)         |        |  |                     | 500                     |           |  |
| Operation Cost                                     |               |        |  |                     |                         |           |  |
| Lamps Replacement                                  | (100)         |        | 0€   |                     |                         |           |  |
| Indirect Cost                                      |               |        |  |                     |                         |           |  |
|  |               |        | 🗌 – High   |                     |                         |           |  |
|  |               |        | 🗌 – Average  |                     |                         |           |  |
|  |               |        | 🖂 – Low  |                     |                         |           |  |
| APPLICATION BENEFITS                               |               |        |  |                     |                         |           |  |
| Energy   |               |        | Ene  | ergy Sa             | ving (kWh/yea           | r)        |  |
|  |               |        |  |                     | 6.000                   |           |  |
| Financial  |               |        | Energy Saving  | Average electricity |                         | Saving    |  |
|  |               |        | (kWh/year)   | price (€/kWh) (ŧ    |                         | (€/year)  |  |
|  |               |        | 6.000  |                     | 0.18                    | 1.080     |  |
| Environmental                                      |               |        | Emissions Saving   |                     |                         |           |  |
|  |               |        |  | (kg                 | <sub>icoz</sub> / year) |           |  |
|  |               |        |  |                     | 5.244                   |           |  |
| RESULTS - EVALUATIO                                | NC            |        |  |                     |                         |           |  |
| Estimated unit cost (€/kg CO <sub>2</sub> ) 0,10 € |               |        | €/ kg <sub>CO2 annual saving</sub> Proposed for Implementation |                     |                         |           |  |
| MEASURE TO IMPLEMENT: EENEF 3 Lamps Replacement    |               |        |  |                     |                         |           |  |
| Estimated Cost Saving                              |               |        | Emissions Reduction Depreciation                               |                     |                         | reciation |  |
| 500€   | 1.080 €       |        | 5.244 Kg <sub>co2</sub> / y                                    | ear                 | 0,5                     | 5 years   |  |





#### **ENERGY EFFICIENCY- Measure 4:** Maintenance of air conditioning systems

The indirect application cost is considered small as it includes the maintenance equipment and the required spare parts for the air conditioning systems. It is required to attribute responsibilities to the technical staff of the municipality regarding the maintenance of heating and air conditioning of municipal buildings, every 6 months.

| A/A | BUILDING/<br>USE  | CONSTRUCTIO<br>N YEAR | SAVING IN<br>2010 | PROPOSED<br>INTERVENTION                     | SAVING RATE | A/A   |
|-----|---|-----------------------|-------------------|--|-------------|-------|
| 1   | Municipality<br>Central Offices                           | 2001                  | 121.599           |  | 6 %         | 7.296 |
| 2   | Nikolaidio<br>Archontiko<br>(Public Health<br>Department) | 2007                  | 31.597            | Maintenance of<br>air conditioning<br>system | 6 %         | 1.896 |
| 3   | Municipal<br>Theatre                                      | 1997                  | 68.467            |  | 6 %         | 4.108 |
| 4   | Municipal<br>Library                                      | 1972                  | 32.896            |  | 6 %         | 1.974 |

#### Measure implementation period: 2012 - 2020

| Measure Code                                      | ENEF 4            |          |  |                                   |              |          |  |
|---|-------------------|----------|--|-----------------------------------|--------------|----------|--|
| Code Name   | Maintenance o     | of Air C | onditioning System   | s                                 |              |          |  |
|   |                   |          |  |                                   |              |          |  |
| APPLICATION COST                                  |                   |          |  |                                   |              |          |  |
| Investment Cost                                   |                   | Co       | st (€)   |                                   |              |          |  |
| Maintenance of air c                              | onditioning syste | ems      |  |                                   | 0            |          |  |
| Operation Cost                                    |                   |          |  |                                   |              |          |  |
| Maintenance of air c                              | onditioning syste | ems      | 1000 €/year  |                                   |              |          |  |
| Indirect Cost                                     |                   |          |  |                                   |              |          |  |
|   |                   |          | ☐ – High<br>☐ – Average<br>⊠ – Low                             |                                   |              |          |  |
| APPLICATION BENEFITS                              |                   |          |  |                                   |              |          |  |
| Energy  |                   |          | Ene  | ergy Savi                         | ng (kWh/yeai | r)       |  |
|   |                   |          |  | 15                                | 5.273        |          |  |
| Financial   |                   |          | Energy Saving  | Energy Saving Average electricity |              | Saving   |  |
|   |                   |          | (kWh/year)   | price (€/kWh)                     |              | (€/year) |  |
|   |                   |          | 15.273   |                                   | 0.18         | 2.750    |  |
| Environmental                                     |                   |          | Emissions Saving   |                                   |              |          |  |
|   |                   |          | (kg <sub>co2</sub> / year)                                     |                                   |              |          |  |
|   |                   |          |  | 13                                | 3.350        |          |  |
| RESULTS - EVALUATIO                               | N                 |          |  |                                   |              |          |  |
| Estimated unit cost (€/kg CO <sub>2</sub> ) 0,07€ |                   |          | E/ kg <sub>CO2 annual saving</sub> Proposed for Implementation |                                   |              |          |  |
| MEASURE TO IMPLEM                                 | IENT: ENEF 4 M    | ainten   | ance of Air Conditio   | oning Sys                         | tems         |          |  |
| Estimated Cost                                    | Saving            |          | Emissions Reduction Depreciation                               |                                   |              |          |  |
| 1000€   | 2.750€            |          | 13.350 Kg <sub>co2</sub> / year 0.4 years                      |                                   |              |          |  |



**ENERGY EFFICIENCY – Measure 5:** Renewable Electricity from Photovoltaic Systems on Municipal Buildings

The installation of electricity generating systems with Photovoltaic panels was studied. The total power from the PV installation will be 3\*20 kW and will cover an area of approximately  $3*200 \text{ m}^2$ .

The indirect cost of the measure application is not particularly important, as the following requirements must first be fulfilled: (a) preparation of call for tenders, (b) evaluation of the tenders by specific technical and financial criteria, (c) completion of form (application) to ensure the subsidy from the 2009-2013 Grant Scheme of the Ministry of Commerce, Industry and Tourism. Additionally, the process of connecting the PV systems with the electricity network grid of EAC should be performed. Photovoltaic Systems receive a subsidy on the sold kWh (selling price is 0,35)

Measure implementation period: 2012 - 2015

| Measure Code  | ENEF 5                                       |  |  |                                  |   |                            |
|---|--|--|--|----------------------------------|---|----------------------------|
| Measure Name  | Renewable Electricity on Municipal Buildings |  |  |                                  |   |                            |
|   |  |  |  |                                  |   |                            |
| APPLICATION COST  |  |  |  |                                  |   |                            |
| Investment Cost   |  |  | Total (€)  |                                  |   |                            |
| 3*Photovoltaic System   | s 20 kW                                      |  | 150.000  |                                  |   |                            |
| Operation Cost  |  |  |  |                                  |   |                            |
| 3*Photovoltaic System   | 20 kW  |  | 0 € (negligible cost for the periodical cleaning of the frames)    |                                  |   |                            |
| Indirect Cost   |  |  |  |                                  |   |                            |
|   |  |  | <ul> <li>☐ - High</li> <li>△ - Average</li> <li>☐ - Low</li> </ul> |                                  |   |                            |
| APPLICATION BENEFITS  |  |  |  |                                  |   |                            |
| Energy  |  |  | Power<br>(kW)  | E<br>G<br>(kW                    | lectricity<br>eneration<br>/h/kW.year)            | Green Energy<br>(kWh/year) |
| 3*Photovoltaic Systems 20 kW  |  | 60   |  | 1500                             | 90.000  |                            |
| Financial   |  | Green Energy<br>(kWh/year)                                   | Subsi<br>electr  | dized price of<br>ricity (€/kWh) | lncome<br>(€/year)                                |                            |
| 3*Photovoltaic Systems 20 kW  |  | 90.000   |  | 0.35                             | 31.500  |                            |
| Environmental   |  | Emission<br>Reduction Factor<br>(kg <sub>co2</sub> /kW.year) |  | Power<br>(kW)                    | Emissions<br>Saving<br>(kg <sub>co2</sub> / year) |                            |
| 3*Photovoltaic Systems 20 kW  |  | 1.183  |  | 60                               | 71.010  |                            |
| RESULTS - EVALUATION  |  |  |  |                                  |   |                            |
| Unitary Cost (€/kg CO2)2,1 €/ kg3*Photovoltaic Systems 20 kW              |  | CO2 annual saving Proposed for Implementation                |  | nplementation                    |   |                            |
| MEASURE TO IMPLEMENT: ENEF 5 Renewable Electricity on Municipal Buildings |  |  |  |                                  |   |                            |
| Total Cost<br>150.000 €   | Inco<br>31.50                                | me<br>00 €   | Emissions ReductionDepreciation71.010Kgco2/ year4.8 years          |                                  | reciation<br>3 years                              |                            |



### 7.3. Energy Saving through Awareness Raising Campaigns

**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 1:** Organization of an annual seminar on Renewable Energy Sources

The organization of an annual seminar on Renewable Energy Sources (RES) in Larnaka Municipality was examined. The all-day seminar will be held at the Town Hall, annually for a total of 3 years.

The indirect cost for the application of this measure can be considered high as apart from the organization of the seminar (speakers, invitations, space, catering etc), interested parties will have to bear the costs of implementing RES at home on their own.

Measure implementation period: 2012 - 2014

| Measure Code                    | ESAC 1  |                             |  |
|---------------------------------|---|-----------------------------|--|
| Measure Name                    | Organization of an annual seminar on Renewable Energy Sources |                             |  |
| APPLICATION COST                |   |                             |  |
| Cost of Measure                 | 3.000 €   |                             |  |
| Indirect Cost                   | 🔀 – High  |                             |  |
|                                 | 🗌 – Average   |                             |  |
|                                 | – Low   |                             |  |
| APPLICATION BENEFITS            |   |                             |  |
| Energy                          | 270.000 kWh/year  |                             |  |
| Financial (Green Energy €/year) | The financial benefits for interested parties                 |                             |  |
|                                 |   |                             |  |
|                                 |   |                             |  |
| Unitary Cost (€/kg CO₂)         | 0.014€/ kg <sub>CO2 annual saving</sub>                       | Proposed for Implementation |  |

#### Equation: ES=v\*ε\*n\*vδ\*GEPP

ES: Energy Saving (kWh)

- v: participation number
- ε: application years
- n: Awareness Percentage (0-100%)
- vδ: number of diffuse influence
- GEPP: Green Energy per person (kWh)

#### Calculation:

ES= 100\*3\*0.3\*3\*1000kWh/year= 270.000 kWh/year



**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 2:** Organization of annual seminar on Energy Saving

The organization of an annual seminar on Energy Saving in Larnaka Municipality was examined. The all-day seminar will be held at the Town Hall, annually for a total of 3 years.

The indirect cost for the application of this measure can be considered high as apart from the organization of the seminar (speakers, invitations, space, catering etc), interested parties will have to bear the costs of implementing energy saving technologies at home on their own.

Measure implementation period: 2012 - 2014

| Measure Code                           | ESAC 2  |                             |  |
|--|---|-----------------------------|--|
| Measure Name                           | Organization of annual seminar on Energy Saving |                             |  |
| APPLICATION COST                       |   |                             |  |
| Cost of Measure                        | 3.000€  |                             |  |
| Indirect Cost                          | ⊠ – High<br>□ – Average<br>□ – Low              |                             |  |
| APPLICATION BENEFITS                   |   |                             |  |
| Energy                                 | 157.500 kWh/year                                |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties   |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 101.917 kg <sub>co2</sub> /year                 |                             |  |
| RESULTS - EVALUATION                   |   |                             |  |
| Unitary Cost (€/kg CO₂)                | 0,029€/ kg <sub>CO2 annual saving</sub>         | Proposed for Implementation |  |

#### Equation: ES=v\*ε\*n\*vδ\*ESPP

- ES: Energy Saving (kWh)
- v: participation number
- $\epsilon \text{: application years}$
- n: Awareness Percentage (0-100%)
- $\nu\delta$  : number of diffuse influence
- ESPP: Energy Saving per person (kWh)

Calculation:

ES= 100\*3\*0.25\*3\*700kWh/year= 157.500 kWh/year



**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 3:** Organization of "Renewable Energy Sources (RES) and Energy Saving (ES)" Day

The organization of an annual day of Renewable Energy Sources and Energy Saving in Larnaka Municipality was examined. The measure will apply for a period of 10 years.

The indirect cost for the application of this measure can be considered high as apart from the organization of the seminar (speakers, invitations, space, catering etc), stakeholders will have to bear the costs of implementing energy saving technologies or renewable energy sources at home, on their own.

Implementation on 12 March 2012 (and every following year for 10 years)

| Measure Code                           | ESAC 3  |                             |  |
|--|---|-----------------------------|--|
| Measure Name                           | Organization of "Renewable Energy Sources (RES) and Energy Saving (ES)" Day |                             |  |
| APPLICATION COST                       |   |                             |  |
| Cost of Measure                        | 10.000 €  |                             |  |
| Indirect Cost                          | 🖂 – High  |                             |  |
|  | - Average   |                             |  |
|  | – Low   |                             |  |
| APPLICATION BENEFITS                   |   |                             |  |
| Energy                                 | 6.144.000 kWh/year  |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties                               |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 4.734.000 kg <sub>co2</sub> /year   |                             |  |
| RESULTS - EVALUATION                   |   |                             |  |
| Unitary Cost (€/kg CO₂)                | 0.002€/ kg <sub>CO2</sub> annual saving                                     | Proposed for Implementation |  |

| Equation: ES=v*ε*n*vδ*ESPP  |
|---|
| ES: Energy Saving (kWh)<br>v: participation number<br>ε: application years<br>n: Awareness Percentage (0-100%)<br>vδ: number of diffuse influence<br>ESPP: Energy Saving per person (kWh) |
| Calculation:  |
| ES= 640*10*0.4*3*800kWh/year= 6.144.000 kWh/year  |



**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 4:** Organization of educational presentations to students

The organization of educational presentations to students on renewable energy sources and energy saving was examined. The measure includes a set of six (6) presentations.

The indirect cost of the measure can be considered as high as apart from the organization of the presentations, the interested party (who will become aware of the measure through their children) should bear the costs of implementing energy saving measures or renewable energy sources in their home, on their own.

Measure implementation period: 2010-2020

| Measure Code                           | ESAC 4  |                             |  |
|--|---|-----------------------------|--|
| Measure Name                           | Organization of educational presentations to students |                             |  |
| APPLICATION COST                       |   |                             |  |
| Cost of Measure                        | 1.800€  |                             |  |
| Indirect Cost                          | ⊠ – High<br>□ – Average<br>□ – Low                    |                             |  |
| APPLICATION BENEFITS                   |   |                             |  |
| Energy                                 | 2.016.000 kWh/year                                    |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties         |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 1.000.000 kg <sub>c02</sub> /year                     |                             |  |
| RESULTS - EVALUATION                   |   |                             |  |
| Unitary Cost (€/kg CO₂)                | 0.002€/ kg <sub>CO2 annual saving</sub>               | Proposed for Implementation |  |

#### Equation: ES=v\*ε\*n\*vδ\*ESPP

- ES: Energy Saving (kWh)
- v: participation number
- $\epsilon \text{: application years}$
- n: Awareness Percentage (0-100%)
- v $\delta$ : number of diffuse influence
- ESPP: Energy Saving per person (kWh)

Calculation:

ES= 350\*6\*0.4\*3\*800kWh/year= 2.016.000 kWh/year



**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 5:** Organization of "Day without lighting"

The organization of an annual day without lighting in Larnaka Municipality was examined. The measure will apply for a period of 10 years.

The indirect cost of the measure application can be considered as low.

Implementation on 30 March 2012 (and every following year for 10 years)

| Measure Code                           | ESAC 5  |                             |  |
|--|---|-----------------------------|--|
| Measure Name                           | Organization of "Day without lighting"        |                             |  |
| APPLICATION COST                       |   |                             |  |
| Cost of Measure                        | 5000€   |                             |  |
| Indirect Cost                          | 🗌 – High                                      |                             |  |
|  | – Average                                     |                             |  |
|  | 🖂 – Low                                       |                             |  |
| APPLICATION BENEFITS                   |   |                             |  |
| Energy                                 | 3.600.000 kWh/year                            |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 2.329.537 kg <sub>c02</sub> /year             |                             |  |
| RESULTS - EVALUATION                   |   |                             |  |
| Unitary Cost (€/kg CO₂)                | 0.002€/ kg <sub>CO2</sub> annual saving       | Proposed for Implementation |  |

#### Equation: ES=v\*ε\*n\*vδ\*ESPP

- ES: Energy Saving (kWh)
- v: participation number
- ε: application years
- n: Awareness Percentage (0-100%)
- vδ: number of diffuse influence
- ESPP: Energy Saving per person (kWh)

#### Calculation:

ES= 5000\*10\*0.20\*3\*120kWh/year= 3.600.000 kWh/year



ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 6: Information about energy in the Municipality website and newspaper

The posting of information on Renewable Energy Sources (RES) and Energy Saving (ES) in the Municipality of Larnaka website was examined. In addition, there will be a special article on energy in the Municipality quarterly newspaper. The measure will apply for a period of 10 years.

The indirect cost of the measure application can be considered as high as the interested party should bear the costs of implementing energy saving measures or renewable energy sources at home, on their own.

| Measure Code                           | ESAC 6   |                             |  |
|--|--|-----------------------------|--|
| Measure Name                           | Energy Information in the Municipality website and newspaper |                             |  |
| APPLICATION COST                       |  |                             |  |
| Cost of Measure                        | 0€   |                             |  |
| Indirect Cost                          | ⊠ – High<br>□ – Average<br>□ – Low                           |                             |  |
| APPLICATION BENEFITS                   |  |                             |  |
| Energy                                 | 4.100.000 kWh/year   |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties                |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 2.000.000 kg <sub>c02</sub> /year                            |                             |  |
| RESULTS - EVALUATION                   |  |                             |  |
| Unitary Cost (€/kg CO <sub>2</sub> )   | 0.00 €/ kg <sub>CO2 annual saving</sub>                      | Proposed for Implementation |  |

Start of Implementation: 2010 (and every following year for 10 years)

| Equation: ES=v*ε*n*vδ*ESPP           |
|--------------------------------------|
| ES: Energy Saving (kWh)              |
| v: participation number              |
| ε: application years                 |
| n: Awareness Percentage (0-100%)     |
| vδ: number of diffuse influence      |
| ESPP: Energy Saving per person (kWh) |
|                                      |
|                                      |

Calculation:

ES= 2000\*10\*0.15\*3\*455kWh/year= 4.500.000 kWh/year



**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - Measure 7:** Free consulting services to citizens from Municipality Officers

The possibility of providing free consulting services to the citizens from Municipal Officers was examined. The measure will apply for 3 years.

The indirect cost of the measure application can be considered as high as the interested party should bear the costs of implementing energy saving measures or renewable energy sources at home, on their own. The number of people interested in this service will be relatively smaller than the number of participations in other events.

| Measure Code                           | ESAC 7   |                             |  |
|--|--|-----------------------------|--|
| Measure Name                           | Free consulting services to the citizens from Municipal Officers |                             |  |
| APPLICATION COST                       |  |                             |  |
| Cost of Measure                        | 18.000€  |                             |  |
| Indirect Cost                          | 🖂 – High   |                             |  |
|  | - Average  |                             |  |
|  | 🗌 – Low  |                             |  |
| APPLICATION BENEFITS                   |  |                             |  |
| Energy                                 | 3.098.250 kWh/year   |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties                    |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 1.555.000 kg <sub>co2</sub> /year                                |                             |  |
| RESULTS - EVALUATION                   |  |                             |  |
| Unitary Cost (€/kg CO <sub>2</sub> )   | 0.011 €/ kg <sub>CO2 annual saving</sub>                         | Proposed for Implementation |  |

Start of Implementation: 2012 (and every following year for 3 years)

#### Equation: ES=v\*ε\*n\*vδ\*ESPP

- ES: Energy Saving (kWh)
- v: participation number
- $\epsilon \text{: application years}$
- n: Awareness Percentage (0-100%)
- vδ: number of diffuse influence
- ESPP: Energy Saving per person (kWh)

Calculation:

ES= 255\*3\*0.75\*3\*1800kWh/year= 3.098.250 kWh/year



ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - MEASURE 8: Organization of "Cycling Day"

The organization of an annual "Cycling Day" in Larnaka Municipality was examined. The measure will apply for 10 years.

The indirect application cost of this measured is considered to be low as apart from the organization of the event, the participants will not be burdened with further costs.

Start of Implementation: September 2012 (and every following year for 10 years)

| Measure Code                           | ESAC 8  |                             |  |
|--|---|-----------------------------|--|
| Measure Name                           | Organization of "Cycling Day"   |                             |  |
| APPLICATION COST                       |   |                             |  |
| Cost of Measure                        | 2000€   |                             |  |
| Indirect Cost                          | <ul> <li>☐ - High</li> <li>☐ - Average</li> <li>⊠ - Low</li> </ul>    |                             |  |
| APPLICATION BENEFITS                   |   |                             |  |
| Energy                                 | 994.680 kWh/year  |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties in terms of fuel saving |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 258.000 kg <sub>co2</sub> /year                                       |                             |  |
| RESULTS - EVALUATION                   |   |                             |  |
| Unitary Cost (€/kg CO₂)                | 0.008€/ kg <sub>CO2</sub> annual saving                               | Proposed for Implementation |  |

#### Equation: ES=v\*ε\*n\*vδ\*ESPP

ES: Energy Saving (kWh)

v: participation number

- ε: application years
- n: Awareness Percentage (0-100%)
- vδ: number of diffuse influence
- ESPP: Energy Saving per person (kWh)

#### Calculation:

ES= 180\*10\*0.2\*3\*921kWh/year= 994.680 kWh/year



ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - MEASURE 9: Organization of "Eco-cars Day"

The organization of "Eco-cars Day" in Larnaka Municipality was examined. The measure will be held annually for 9 consecutive years.

The indirect application cost of the measure can be considered as average as, apart from organizing the event the interested party should bear their own cost of an eco-car purchase.

Start of Implementation: June 2012

| Measure Code                           | ESAC 9  |                             |  |
|--|---|-----------------------------|--|
| Measure Name                           | Organization of "Eco-cars Day"  |                             |  |
| APPLICATION COST                       |   |                             |  |
| Cost of Measure                        | 4500€   |                             |  |
| Indirect Cost                          | ☐ – High<br>∑ – Average<br>☐ – Low                                    |                             |  |
| APPLICATION BENEFITS                   |   |                             |  |
| Energy                                 | 1.243.350 kWh/year  |                             |  |
| Financial (Energy saving. €/year)      | The financial benefits for interested parties in terms of fuel saving |                             |  |
| Environmental (kg CO <sub>2</sub> -eq) | 321.000 kg <sub>co2</sub> /year                                       |                             |  |
| RESULTS - EVALUATION                   |   |                             |  |
| Unitary Cost (€/kg CO₂)                | 0.014€/ kg <sub>CO2 annual saving</sub>                               | Proposed for Implementation |  |

#### Equation: ES=v\*ε\*n\*vδ\*ESPP

ES: Energy Saving (kWh)

v: participation number

- ε: application years
- n: Awareness Percentage (0-100%)
- vδ: number of diffuse influence
- ESPP: Energy Saving per person (kWh)

#### Calculation:

ES= 100\*9\*0.05\*3\*9210kWh/year= 1.243.350 kWh/year



**ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - MEASURE 10:** Raising awareness through informational leaflets and messages

The preparation of information material to be used for the updating, the information and public awareness was examined.

The indirect application cost of this measure can be considered high, as apart from the preparation and distribution of informational material the interested party should bear their own cost for any investment or saving they proceed to.

Measure Implementation Period: 2012-2020

| Measure Code                                   | ESAC 10   |                  |          |           |  |  |
|--|---|------------------|----------|-----------|--|--|
| Measure Name                                   | Informatio  | nal leaflets and | messages |           |  |  |
|  |   |                  |          |           |  |  |
| APPLICATION COST                               |   |                  |          |           |  |  |
| Measure Cost                                   | Ολικό (€)   |                  |          |           |  |  |
| (a) Leaflets on RES and ES                     | 10.000€   |                  |          |           |  |  |
| (b) Leaflets on sustainable mobility           | 10.000 €  |                  |          |           |  |  |
| (c)Articles in the Municipality's<br>Newspaper | 0€  |                  |          |           |  |  |
| (d) TV Spots                                   | 5000€   |                  |          |           |  |  |
| (e) Radio Spots                                | 3000€   |                  |          |           |  |  |
| Indirect Cost                                  |   |                  |          |           |  |  |
|  | <ul> <li>□ – High</li> <li>□ – Average</li> <li>□ – Low</li> </ul>  |                  |          |           |  |  |
| APPLICATION BENEFITS                           |   |                  |          |           |  |  |
| Energy   | Number/         Awareness         Energy Benefit         Energy Sa           receivers         Percentage         (kWh/person.vear)         (kWh/ye |                  |          |           |  |  |
| (a) Leaflets on RES and ES                     | 50.000  | 5%               | 1100     | 2.750.000 |  |  |
| (b) Leaflets on sustainable mobility           | 50.000  | 5%               | 2210     | 5.526.000 |  |  |
| (c)Articles in the Municipality's<br>Newspaper | 100.000   | 2%               | 900      | 1.800.000 |  |  |
| (d) TV Spots                                   | 10.000  | 4%               | 1100     | 569.442   |  |  |
| (e) Radio Spots                                | 10.000  | 3%               | 1000     | 388.256   |  |  |
| Financial                                      |   |                  |          |           |  |  |
|  | The financial benefits for interested parties in terms of energy saving   |                  |          |           |  |  |
| Environmental                                  | Emissions   | Saving           |          |           |  |  |
|  | (kg <sub>co2</sub> / yea  | r)               |          |           |  |  |
| (a) Leaflets on RES and ES                     | 1.779.507   |                  |          |           |  |  |
| (b) Leaflets on sustainable mobility           | 1.395.868   |                  |          |           |  |  |
| (c)Articles in the Municipality's<br>Newspaper | 1.164.768   |                  |          |           |  |  |
| (d) TV Spots                                   | 497.692   |                  |          |           |  |  |
| (e) Radio Spots                                | 339.335   |                  |          |           |  |  |



| RESULTS - EVALUATION  |  |                                    |                   |  |  |  |
|---|--|------------------------------------|-------------------|--|--|--|
| Unitary Cost (€/kg CO₂)   |  | Proposed for Implementation        |                   |  |  |  |
| (a) Leaflets on RES and ES  | 0.006 €/                                 | kg <sub>CO2</sub> annual saving    | $\boxtimes$       |  |  |  |
| (b) Leaflets on sustainable mobility                              | 0.007 €/                                 | kg <sub>CO2</sub> annual saving    | $\boxtimes$       |  |  |  |
| (c)Articles in the Municipality's<br>Newspaper                    | 0 €/ kg <sub>co</sub>                    | 2 annual saving                    | $\square$         |  |  |  |
| (d) TV Spots  | 0.01 €/ kg <sub>CO2 annual saving</sub>  |                                    | $\boxtimes$       |  |  |  |
| (e) Radio Spots   | 0.009 €/ kg <sub>CO2 annual saving</sub> |                                    | $\boxtimes$       |  |  |  |
| MEASURE TO IMPLEMENT: ESAC 10 Informational leaflets and messages |  |                                    |                   |  |  |  |
| Total Cost  |  | Em                                 | issions Reduction |  |  |  |
| 28.000 €  |  | 5.177.170 Kg <sub>co2</sub> / year |                   |  |  |  |



ENERGY SAVING THROUGH AWARENESS RAISING CAMPAIGNS - MEASURE 11: Organization of annual seminar on "Energy Saving in Industry"

The organization of an annual seminar on "Energy Saving in Industry" in Larnaka Municipality was examined. The all-day seminar will be held in the Town Hall for 3 consecutive years.

The indirect cost for the application of this measure can be considered high as apart from the organization of the seminar (speakers, invitations, space, catering etc), stakeholders will have to bear the costs of implementing energy saving technologies in industry on their own.

| Measure Code                         | ESAC 11                                       |                                    |  |  |  |  |  |  |
|--------------------------------------|---|------------------------------------|--|--|--|--|--|--|
| Measure Name                         | Organization of an annual semi                | nar on "Energy Saving in Industry" |  |  |  |  |  |  |
| APPLICATION COST                     |   |                                    |  |  |  |  |  |  |
| Cost of Measure                      | 3.000 €                                       |                                    |  |  |  |  |  |  |
| Indirect Cost                        | 🗌 – High                                      |                                    |  |  |  |  |  |  |
|                                      | 🖂 – Average                                   |                                    |  |  |  |  |  |  |
|                                      | - Low   |                                    |  |  |  |  |  |  |
| APPLICATION BENEFITS                 |   |                                    |  |  |  |  |  |  |
| Energy                               | 1.512.000 kWh/year                            |                                    |  |  |  |  |  |  |
| Financial (Energy saving. €/year)    | The financial benefits for interested parties |                                    |  |  |  |  |  |  |
|                                      | 1.104.000 kg <sub>C02</sub> / year            |                                    |  |  |  |  |  |  |
| <b>RESULTS - EVALUATION</b>          |   |                                    |  |  |  |  |  |  |
| Unitary Cost (€/kg CO <sub>2</sub> ) | 0.003€/ kg <sub>CO2 annual saving</sub>       | Proposed for Implementation        |  |  |  |  |  |  |

Measure Implementation Period:2013-2015

| Equation: ES=v*ε*n*vδ*ESPI  |
|---|
| ES: Energy Saving (kWh)<br>v: participation number<br>ε: application years<br>n: Awareness Percentage (0-100%)<br>vδ: number of diffuse influence<br>ESPI: Energy Saving per industry (kWh) |
|   |
| Calculation:  |

ES= 70\*3\*0.8\*1.5\*6000kWh/year= 1.512.000 kWh/year



### 7.4. Energy Saving In Transport

**ENERGY SAVING IN TRANSPORT – MEASURE 1:** Energy saving in transports by promoting eco-cars (hybrid and electric)

The possibility of the promotion of vehicles with low  $CO_2$  emissions by providing facilities was examined. Two cases were examined: (a) free parking space and (b) charging points for electric vehicles. The facilities should be provided for 5 years.

The indirect application cost of this measure can be considered low since interested parties would bear the cost of purchasing an eco-car on their own.

Measure Code EST 1 Measure Name Promotion of vehicles with low CO<sub>2</sub> emissions **APPLICATION COST** Cost of Measure Total (€) 70.000 € \*loss of income (a) Free Parking Spaces (20 spaces) (b) Charging points for electric vehicles (5 points) 5000€ Indirect Cost 🗌 – High - Average 🖂 – Low **APPLICATION BENEFITS** Number of Traffic ES per visit + ES from Energy Saving Energy diffuse information (kWh/year) spaces (5 years) (kWh/year) (a) Free Parking Spaces (20 spaces) 20 73.000 70 5.110.000 (b) Charging points for electric 5 18.250 80 1.460.000 vehicles (5 points) Financial The financial benefits for interested parties in terms of energy saving Environmental **Emissions saving** (kg<sub>co2</sub>/ year) 1.290.786 (a) Free Parking Spaces (20 spaces) Charging points for electric 368.796 (b) vehicles (5 points) **RESULTS - EVALUATION** Unitary Cost (€/kg CO<sub>2</sub>) **Proposed for Implementation** 0.054 €/ kg<sub>CO2 annual saving</sub>  $\boxtimes$ (a) Free Parking Spaces (20 spaces)  $\square$ (b) Charging points for electric vehicles (5 0.014 €/ kg<sub>CO2 annual saving</sub> points) **MEASURE TO IMPLEMENT: EST 1 Promotion of vehicles with low CO2 emissions Total Cost Emissions Reduction** 1.659.582 Kg<sub>co2</sub>/ year 75.000€

Measure Implementation Period: June 2012 – 2017



#### ENERGY SAVING IN TRANSPORT - MEASURE 2: Energy saving in the Municipality's Fleet

The possibility of purchasing to vehicles with low CO<sub>2</sub> was examined.

The indirect application cost of the measure is not particularly important, as the following requirements must first be fulfilled: (a) preparation of the call for tenders (b) Evaluation of offers by specific technical and financial criteria (c) completion of form (application) to ensure the subsidy from the 2009-2013 Grant Schemes of the Ministry of Commerce, Industry and Tourism.

The purchase of low emissions vehicles is sponsored by the Scheme of the Ministry of Commerce, Industry and Tourism; €700 for low emissions vehicle and €1200 for a hybrid.

Measure Implementation Period: 2013 – 2020

| Measure Cost  | EST 2              |   |   |                             |  |  |  |
|---|--------------------|---|---|-----------------------------|--|--|--|
| Measure Name  | Energy saving in t | Energy saving in the Municipality's fleet |   |                             |  |  |  |
|   |                    |   |   |                             |  |  |  |
| APPLICATION COST  |                    |   |   |                             |  |  |  |
| Cost of measure   |                    | Total                                     | (€)   |                             |  |  |  |
| Purchase of 5 eco-cars  |                    | 60.00                                     | 0€  |                             |  |  |  |
| Indirect Cost   |                    |   |   |                             |  |  |  |
|   |                    | <u> </u>                                  | High  |                             |  |  |  |
|   |                    |   | Average                                     |                             |  |  |  |
|   |                    | <b>⊠</b> −1                               | Low   |                             |  |  |  |
| APPLICATION BENEFITS  |                    |   |   |                             |  |  |  |
| Energy  |                    | Energ                                     | Energy Saving (kWh/year)                    |                             |  |  |  |
| Purchase of 5 eco-cars  |                    | 46.05                                     | 46.050                                      |                             |  |  |  |
| Financial   |                    | Savin                                     | Saving (€/year)                             |                             |  |  |  |
| Purchase of 5 eco-cars  |                    | 5000                                      | 5000  |                             |  |  |  |
| Environmental   |                    | Emiss                                     | Emissions saving (kg <sub>co2</sub> / year) |                             |  |  |  |
| Purchase of 5 eco-cars  |                    | 11.63                                     | 11.632                                      |                             |  |  |  |
| <b>RESULTS - EVALUATIO</b>  | N                  |   |   |                             |  |  |  |
| Unitary Cost (€/kg CO <sub>2</sub>                                    | )                  |   |   | Proposed for implementation |  |  |  |
| Purchase of 5 eco-cars 5.158 €/ kg                                    |                    |   | kg <sub>CO2</sub> annual saving             | $\boxtimes$                 |  |  |  |
| MEASURE TO IMPLEMENT: EST 2 Energy saving in the Municipality's fleet |                    |   |   |                             |  |  |  |
| Total Cost  |                    |   | Emissions Reduction                         |                             |  |  |  |
| 60.000 €  |                    |   | 11.632 Kg <sub>co2</sub> / year             |                             |  |  |  |



**ENERGY SAVING IN TRANSPORT – MEASURE 3:** Energy saving in transports by promoting the use of bicycles (Bicycle Rental System)

The possibility of promoting bicycle use by installing a bicycle rental system was examined.

The indirect application cost of the measure can be considered low as interested parties (to be aware of bicycle use) would have to bear the minimal cost of bicycle rental.

Start of Implementation: 2014 (for 6 years)

| Measure Code                                      | EST 3                              |                   |                      |  |             |                  |               |
|---|------------------------------------|-------------------|----------------------|--|-------------|------------------|---------------|
| Measure Name                                      | Measure Name Bicycle Rental System |                   |                      |  |             |                  |               |
|   |                                    |                   |                      |  |             |                  |               |
| APPLICATION COST                                  |                                    |                   |                      |  |             |                  |               |
| Cost of measure                                   |                                    |                   | Total (              | (€)  |             |                  |               |
| 5 spaces and 100 bicy                             | cles                               |                   | 200.00               | )0€  |             |                  |               |
| Indirect Cost                                     |                                    |                   |                      |  |             |                  |               |
|   |                                    |                   | 🗌 – H                | ligh   |             |                  |               |
|   |                                    |                   | □ - A                | vera   | age         |                  |               |
|   |                                    |                   | <b>⊠</b> – L         | .ow  |             |                  |               |
| APPLICATION BENEFIT                               | S                                  |                   |                      |  |             |                  |               |
| Energy  |                                    | Nur               | nber of              | f  | Traffic per | ES per bicycle + | Energy Saving |
|   |                                    | Bicycles          |                      |  | year        | ES from diffuse  | (kWh/year)    |
|   |                                    |                   |                      |  |             | (kWh/year)       |               |
| 5 spaces and 100 bicyc                            | les                                |                   | 100                  |  | 1095        | 40               | 4.380.000     |
| Financial   |                                    |                   |                      |  |             |                  |               |
|   |                                    | The f             | financia             | cial benefits for interested parties in terms of fuel saving |             |                  |               |
| Environmental                                     |                                    | Emis              | sions s              | avin   | g           |                  |               |
|   |                                    | (kg <sub>co</sub> | <sub>02</sub> / year | r)   |             |                  |               |
| 5 spaces and 100 bicyc                            | les                                | 1.10              | 6.388                |  |             |                  |               |
| <b>RESULTS - EVALUATIO</b>                        | N                                  |                   |                      |  |             |                  |               |
| Unitary Cost (€/kg CO <sub>2</sub> )              |                                    |                   |                      |  |             | Proposed for in  | nplementation |
| 5 spaces and 100 bicycles 0.18 €                  |                                    |                   | 0.18 €               | 8 €/ kg <sub>CO2 annual saving</sub>                         |             |                  |               |
| MEASURE TO IMPLEMENT: EST 3 Bicycle Rental System |                                    |                   |                      |  |             |                  |               |
| То  | tal Cost                           |                   |                      | Emissions Reduction  |             |                  |               |
| 20  | 0.000€                             |                   |                      | 1.106.388 Kg <sub>co2</sub> / year                           |             |                  |               |



**ENERGY SAVING IN TRANSPORT – MEASURE 4**: Energy Saving in Transport by Upgrading the Cycle Path Network in Larnaka

The upgrade of the cycle path network in Larnaka aiming to promote bicycle use was examined.

The indirect application cost is considered low.

Start of Implementation: 2014 (for 6 years)

| Measure Code   | EST 4                         |                        |  |                    |                  |               |  |
|--|-------------------------------|------------------------|--|--------------------|------------------|---------------|--|
| Measure Name   | Upgrade of Cycle Path Network |                        |  |                    |                  |               |  |
|  |                               |                        |  |                    |                  |               |  |
| APPLICATION COST   |                               |                        |  |                    |                  |               |  |
| Cost of measure  |                               | Total                  | (€)  |                    |                  |               |  |
| Upgrade of Cycle Path                                    | Network                       | 200.0                  | 00 \$  | E                  |                  |               |  |
| Indirect Cost  |                               |                        |  |                    |                  |               |  |
|  |                               | <u> </u>               | Higl   | h                  |                  |               |  |
|  |                               |                        | Ave  | rage               |                  |               |  |
|  | - 🗵                           | Low                    | 1  |                    |                  |               |  |
| APPLICATION BENEFIT                                      | S                             |                        |  |                    |                  |               |  |
| Energy   |                               | New Cyc                | le   | Traffic per        | ES per Km + ES   | Energy Saving |  |
|  |                               | Paths (kr              | n)   | Year<br>(Number of | from diffuse     | (kWh/year)    |  |
|  |                               |                        |  | routes)            | (kWh/year)       |               |  |
| Upgrade of Cycle Path                                    | Network                       | 20                     |  | 73.000             | 20               | 29.200.000    |  |
| Financial  |                               |                        |  |                    |                  |               |  |
|  |                               | The fina saving        | e financial benefits for interested parties in terms of fuel<br>ving |                    |                  |               |  |
| Financial  |                               | Emission               | s Sa   | ving               |                  |               |  |
|  |                               | (kg <sub>co2</sub> / y | ear)   | 1                  |                  |               |  |
| Upgrade of Cycle Path                                    | Network                       | 7.375.92               | 0  |                    |                  |               |  |
| <b>RESULTS - EVALUATIO</b>                               | N                             |                        |  |                    |                  |               |  |
| Unitary Cost (€/kg CO <sub>2</sub> )                     |                               |                        |  |                    | Proposed for imp | lementation   |  |
| Upgrade of Cycle Path Network 0.03 €                     |                               |                        | D.03 €/ kg <sub>CO2 annual saving</sub>                              |                    |                  |               |  |
| MEASURE TO IMPLEMENT EST 4 Upgrade of Cycle Path Network |                               |                        |  |                    |                  |               |  |
| То   | otal Cost                     |                        | Emissions Reduction  |                    |                  |               |  |
| 20   | 0.000€                        |                        | 7.375.920 Kg <sub>co2</sub> / year                                   |                    |                  |               |  |



### 7.5. Energy Saving in Street Lighting

#### ENERGY SAVING IN STREET LIGHTING – MEASURE 1: Energy Saving in Street Lighting

The possibility of energy saving in street lighting was examined. Street lighting is one of the major expenses of the Municipality. The electricity consumption for street lighting in Larnaka Municipality in 2009 was 4.131.000 kWh.

Two cases were examined: (a) replacement of current lamps with economic LED lamps and (b) optimization study of street lighting operating hours.

The indirect application cost can be considered low.

Year of Measure Implementation: 2013

| Measure Code  | ESSL 1                |                      |               |                                       |                                      |                               |   |                             |
|---|-----------------------|----------------------|---------------|---------------------------------------|--------------------------------------|-------------------------------|---|-----------------------------|
| Measure Name  | Energy Saving in Stre | et Light             | ing           |                                       |                                      |                               |   |                             |
|   |                       |                      |               |                                       |                                      |                               |   |                             |
| APPLICATION COST                                    |                       |                      |               |                                       |                                      |                               |   |                             |
| Cost of measure                                     |                       |                      | Tota          | al (€)                                |                                      |                               |   |                             |
| (a) Replacement of co<br>LED lamps                  | irrent lamps with eco | nomic                | 1.60          | € 00.000                              |                                      |                               |   |                             |
| (b) Optimization of<br>hours                        | Street Lighting oper  | ration               | 8.00          | € 00                                  |                                      |                               |   |                             |
| Indirect Cost                                       |                       |                      |               |                                       |                                      |                               |   |                             |
|   |                       |                      |               | – High<br>– Average<br>– Low          | 2                                    |                               |   |                             |
| Maintenance Cost                                    |                       |                      |               |                                       |                                      |                               |   |                             |
|   |                       |                      |               | – High<br>– Average<br>– Low          | 9                                    |                               |   |                             |
| APPLICATION BENEFIT                                 | S                     |                      |               |                                       |                                      |                               |   |                             |
| Energy  |                       | Numb                 | ber           | Electrici<br>consum<br>per<br>(kWh/ye | ty<br>ption<br>lamp<br>ear)          | ES per lam<br>per year<br>(%) | р | Energy Saving<br>(kWh/year) |
| (a) Replacement of<br>economic LED lamps            | current lamps with    | 8000                 | 0             | 80                                    | 0                                    | 50                            |   | 3.200.000                   |
| (b) Optimization contraction of the operation hours | f Street Lighting     | 8000                 | 0             | 80                                    | 0                                    | 5                             |   | 320.000                     |
| Financial   |                       | Ene<br>(kV           | rgy S<br>Nh/y | aving<br>ear)                         | Average Electricity<br>Price (€/kWh) |                               |   | Saving<br>(€/year)          |
| (a) Replacement of<br>economic LED lamps            | current lamps with    | 3.                   | 200.          | 000                                   | 0.13                                 |                               |   | 416.000                     |
| (b) Optimization of operation hours                 | f Street Lighting     | 3                    | 20.0          | 00                                    |                                      | 0.13                          |   | 41.600                      |
| Environmental                                       |                       | Emissi               | ons           | Saving                                |                                      |                               |   |                             |
|   |                       | (kg <sub>co2</sub> / | / yea         | r)                                    |                                      |                               |   |                             |
| (a) Replacement of<br>economic LED lamps            | current lamps with    | 2.524.               | 800           |                                       |                                      |                               |   |                             |



| (b) Optimization of Street operation hours                       | Lighting   | 252.480  |                                   |                  |                            |  |  |
|--|--|--|-----------------------------------|------------------|----------------------------|--|--|
| RESULTS - EVALUATION   |  |  |                                   |                  |                            |  |  |
| Unitary Cost (€/kg CO <sub>2</sub> ) Proposed for implementation |  |  |                                   |                  |                            |  |  |
| (a) Replacement of current lar<br>economic LED lamps             | 0.500 €/ kg <sub>CO2 annual saving</sub>                     |  |                                   |                  |                            |  |  |
| (b) Optimization of Street Lighting 0.02<br>operation hours      |  |  | / kg <sub>CO2</sub> annual saving |                  |                            |  |  |
| MEASURE TO IMPLEMENT ESSL 1                                      | MEASURE TO IMPLEMENT ESSL 1 Energy Saving in Street Lighting |  |                                   |                  |                            |  |  |
| Total Cost<br>1.608.000 €  | Sav<br>457.0   | ving Emissions Red<br>600 € 2.777.280 Kg <sub>co</sub> ; |                                   | uction<br>/ year | Depreciation<br>3.51 years |  |  |



### 7.6. Investments of Larnaka Municipality in RES

#### **INVESTMENTS IN RES – MEASURE 1:** Investments of Larnaka Municipality in Renewable <u>Electricity</u>

The creation of two Photovoltaic Parks was examined. The indirect application cost is not particularly important as the following requirements must first be fulfilled: (a) preparation of the call for tenders (b) Evaluation of offers by specific technical and financial criteria (c) completion of form (application) to ensure the subsidy from the 2009-2013 Grant Schemes of the Ministry of Commerce, Industry and Tourism. Additionally, the process of connecting the Photovoltaic Parks with the electricity network grid of EAC should be performed. Photovoltaic Systems (Parks) receive a subsidy on the sold kWh (selling price is €0,31)

Measure Implementation Period: 2014-2016

| Measure Code                         | RES 1  |  |  |                            |                    |  |  |
|--------------------------------------|--|--|--|----------------------------|--------------------|--|--|
| Measure Name                         | Measure Name Renewable Electricity with Photovoltaic Systems |  |  |                            |                    |  |  |
|                                      |  |  |  |                            |                    |  |  |
| APPLICATION COST                     |  |  |  |                            |                    |  |  |
| Investment Cost                      |  | Total (€)                                  |  |                            |                    |  |  |
| 2 x Photovoltaic Park 1              | 50 kW  | 900.000                                    |  |                            |                    |  |  |
| Operational Cost                     |  |  |  |                            |                    |  |  |
| 2 x Photovoltaic Park 1              | 0 € (negligible co<br>frames)                                | st for                                     | the periodical   | cleaning of the            |                    |  |  |
| Indirect Cost                        |  |  |  |                            |                    |  |  |
|                                      |  | ☐ – High<br>⊠ – Average<br>☐ – Low         | <ul> <li>□ – High</li> <li>△ – Average</li> <li>□ – Low</li> </ul> |                            |                    |  |  |
| APPLICATION BENEFITS                 |  |  |  |                            |                    |  |  |
| Energy                               | Power<br>(kW)  | Electricity<br>Generation<br>(kWh/kW.year) |  | Green Energy<br>(kWh/year) |                    |  |  |
| 2 x Photovoltaic Park 1              | 50 kW  | 300  | 1500   |                            | 450.000            |  |  |
| Financial                            |  | Green Energy<br>(kWh/year)                 | Subsidized price of electricity (€/kWh)                            |                            | Income<br>(€/year) |  |  |
| 2 x Photovoltaic Park 1              | 50 kW  | 450.000                                    | 0.31   |                            | 139.500            |  |  |
| Environmental                        |  | Emissions Saving                           |  |                            |                    |  |  |
|                                      |  | (kg <sub>co2</sub> / year)                 |  |                            |                    |  |  |
| 2 x Photovoltaic Park 1              | 50 kW  | 355.050                                    |  |                            |                    |  |  |
| <b>RESULTS - EVALUATIO</b>           | N  |  |  |                            |                    |  |  |
| Unitary Cost (€/kg CO <sub>2</sub> ) |  |  | Proposed for In  | mplementation              |                    |  |  |
| 2 x Photovoltaic Park 1              | 2.535 €/ kg <sub>CO2 annual s</sub>                          | saving                                     | $\square$  |                            |                    |  |  |
| MEASURE TO IMPLEM                    | ENT RES 1 Renewable E  | ectricity with Photov                      | oltaic S   | Systems                    |                    |  |  |
| Total Cost                           | Income   | Emission Reduction Depreciation            |  |                            |                    |  |  |
| 900.000 €                            | 139.500 €  | 355.050 Kg <sub>co2</sub> / <sub>y</sub>   | /ear   | 6.5 years                  |                    |  |  |



### 7.7. Development of Green Spaces in Larnaka Municipality

# **DEVELOPMENT OF GREEN SPACES IN LARNAKA MUNICIPALITY – Measure 1:** Development of green spaces

Regarding the development of green spaces in Larnaka Municipality, two cases were examined: (a) planting of trees and (b) care of green spaces.

The indirect application cost can be considered low.

| Measure Code   | DGS 1            |   |                            |                                |  |  |  |
|--|------------------|---|----------------------------|--------------------------------|--|--|--|
| Measure Name   | Development of g | Development of green spaces in Larnaka Municipality |                            |                                |  |  |  |
|  |                  |   |                            |                                |  |  |  |
| APPLICATION COST   | APPLICATION COST |   |                            |                                |  |  |  |
| Cost of measure  |                  | Total   | (€)                        |                                |  |  |  |
| (a) Planting of trees (5   | 000 trees)       | 7500  | €                          |                                |  |  |  |
| (b) Care of Green Spac   | es               | 8000  | €                          |                                |  |  |  |
| Indirect Cost  |                  |   |                            |                                |  |  |  |
|  |                  | <u> </u>  | 🗌 – High                   |                                |  |  |  |
|  |                  |   | 🗌 – Average                |                                |  |  |  |
|  |                  | <b>⊠</b> − I  | 🔀 – Low                    |                                |  |  |  |
| APPLICATION BENEFIT  | S                |   |                            |                                |  |  |  |
| Environmental  |                  | Emiss   | Emissions Saving           |                                |  |  |  |
|  |                  | (kg <sub>coz</sub>                                  | (kg <sub>co2</sub> / year) |                                |  |  |  |
| (a) Planting of trees (5   | 000 trees)       | 150.0   | 150.000                    |                                |  |  |  |
| (b) Care of Green Spac   | es               | 60.00   | 60.000                     |                                |  |  |  |
| <b>RESULTS - EVALUATIO</b>   | N                |   |                            |                                |  |  |  |
| Unitary Cost (€/kg CO <sub>2</sub>   | )                |   | Proposed for Implen        |                                |  |  |  |
| (a) Planting of trees (5000 trees) 0.05 €/ kg <sub>CO2 annual</sub>            |                  |   | <b>B</b> CO2 annual saving | $\boxtimes$                    |  |  |  |
| (b) Care of Green Spaces 0.13 €/ kg <sub>CO2 annual s</sub>                    |                  |   | BCO2 annual saving         | $\boxtimes$                    |  |  |  |
| MEASURE TO IMPLEMENT DGS 1 Development of green spaces in Larnaka Municipality |                  |   |                            |                                |  |  |  |
| Total Cost   |                  |   | Emission Reduction         |                                |  |  |  |
| 16.500 € 210.000 Kg <sub>co2</sub> / year                                      |                  |   |                            | 0.000 Kg <sub>co2</sub> / year |  |  |  |



### 7.8. Summary of Measures of Larnaka Municipality

**Table 29** Brief Presentation of Measures Taken by Larnaka Municipality and Included in theSustainable Energy Action Plan

| Measure/ Action   | Application   | Cost<br>(€) | Emissions<br>Reduction<br>(Kg <sub>co2</sub> /<br>year) | Depreciation<br>(years) |
|---|---------------|-------------|---|-------------------------|
| Energy Saving in Public Buildings   |               |             |   |                         |
| ENEF1 – Insulation Interventions  | 2012-2015     | 55.000      | 56.742  | 5                       |
| ENEF2 – Voltage Rectifier Installation  | 2014          | 20.000      | 15.941  | 6                       |
| ENEF 3 – Lamps Replacement  | 2012          | 500         | 5.244   | 0,5                     |
| ENEF4 – Maintenance of Air<br>Conditioning Systems  | 2012-2020     | 1.000       | 13.350  | 0,4                     |
| ENEF5: Renewable Electricity from<br>Photovoltaic Systems on Municipal<br>Buildings       | 2012-2015     | 150.000     | 71.010  | 4,8                     |
| Energy Saving through Awareness Rai   | sing Campaigr | IS          | ſ   | r                       |
| ESAC1 – Organization of an annual<br>seminar on Renewable Energy<br>Sources               | 2012-2014     | 3.000       | 213.030   | -                       |
| ESAC2 – Organization of an annual seminar on Energy Saving                                | 2012-2014     | 3.000       | 101.917   | -                       |
| ESAC3 – Organization of "Renewable<br>Energy Sources (RES) and Energy<br>Saving (ES)" Day | 2012-2020     | 10.000      | 4.734.000   | _                       |
| ESAC4 – Organization of educational presentations to students                             | 2010-2020     | 1.800       | 1.000.000   | -                       |
| ESAC5: Organization of "Day without lighting"   | 2012-2020     | 5.000       | 2.329.537   | -                       |
| ESAC6: Information about energy in the Municipality website and newspaper                 | 2010-2020     | 0           | 2.000.000   | -                       |
| EKEN7: Free consulting services to citizens from Municipal Officers                       | 2012-2020     | 18.000      | 1.555.000   | -                       |
| ESAC8: Organization of "Cycling Day"  | 2012-2020     | 2.000       | 258.000   | -                       |
| ESAC9: Organization of "Eco-Cars<br>Day"  | 2012-2020     | 4.500       | 321.000   | -                       |
| ESAC10: Raising awareness through informational leaflets and messages                     | 2012-2020     | 28.000      | 5.177.170   | -                       |
| ESAC11: Organization of an annual seminar on Energy Saving in Industries                  | 2013-2015     | 3.000       | 1.184.000   | -                       |

#### Sustainable Energy Action Plan Larnaka Municipality - Cyprus

| Measure/ Action  | Application | Cost<br>(€) | Emissions<br>Reduction<br>(Kg <sub>co2</sub> /<br>vear) | Depreciation<br>(years) |
|--|-------------|-------------|---|-------------------------|
| Energy Saving in Transports  |             |             |   |                         |
| EST1: Energy saving in transports by promoting eco-cars (hybrid and electric)                    | 2012-2017   | 75.000      | 1.659.582   | -                       |
| EST2: Energy saving in the<br>Municipality's fleet   | 2013-2020   | 60.000      | 11.632  | -                       |
| EST3: Energy saving in transports by<br>promoting the use of bicycles<br>(Bicycle Rental System) | 2014-2020   | 200.000     | 1.106.388   | -                       |
| EST4: Energy Saving in Transport by<br>Upgrading the Cycle Path Network in<br>Larnaka            | 2014-2020   | 200.000     | 7.375.920   | -                       |
| Energy Saving in Street Lighting   |             |             |   |                         |
| ESSL1: Energy saving in street<br>lighting   | 2013        | 1.608.000   | 2.777.280   | 3.5                     |
| Investments of Larnaka Municipality in RES   |             |             |   |                         |
| RES1: Investments of Larnaka<br>Municipality in renewable electricity                            | 2014-2016   | 900.000     | 355.050   | 6.5                     |
| Development of Green Spaces in Larnaka Municipality  |             |             |   |                         |
| DGS: Development of green spaces in Larnaka Municipality   | 2012-2020   | 16.500      | 210.000   | -                       |
|  |             |             |   |                         |
| IOIAL  |             | 3.364.300   | 32.531.793  |                         |




# 7.9. Contribution of National Measures on the Sustainable Energy Action Plan of Larnaka Municipality

Energy saving and carbon dioxide emissions reduction for 2020 from the contribution of national measures, were calculated and are presented in the tables below.

| NATIONAL MEASURES FOR ENERGY EFFICIENCY |   | Energy Saving (MWh/year) |          |          |            |
|---|---|--------------------------|----------|----------|------------|
|   |   | Residential              | Tertiary | Industry | Transports |
| 1                                       | Legislation on Energy Building Performance<br>(Equation 1)  | 3.717                    | 3.491    | 450      | 0          |
| 2                                       | Legislation for the inspection of air conditioning and heating systems (Equation 1)                 | 1.784                    | 1.676    | 216      | 0          |
| 3                                       | Grant Schemes for the installation of solar thermal systems (Equation 1)                            | 624                      | 587      | 76       | 0          |
| 4                                       | Grant Schemes for the installation of geothermal systems (Equation 1)                               | 446                      | 419      | 54       | 0          |
| 5                                       | Legislation on energy efficiency of appliances (Equation 1)   | 2.646                    | 3.223    | 467      | 0          |
| 6                                       | Grant Schemes for the installation of Photovoltaics Systems (Equation 2)                            | 2.455                    | 2.046    | 4.091    | 0          |
| 7                                       | Legislation for mandatory integration of solar water heaters (Equation 1)                           | 331                      | 370      | 55       | 0          |
| 8                                       | Legislation on energy efficiency of buildings with area larger than $1000 \text{ m}^2$ (Equation 1) | 0                        | 3.491    | 180      | 0          |
| 9                                       | Grant Schemes for cogeneration in Industry (Equation 1)   | 0                        | 0        | 1.025    | 0          |
| 10                                      | Plan of single urban transport system (Equation 3)  | 0                        | 0        | 0        | 97.230     |
| 11                                      | Mandatory inspection of Vehicles MOT (Equation 3)   | 0                        | 0        | 0        | 64.964     |
| 12                                      | Withdrawal Plan of old vehicles (Equation 3)  | 0                        | 0        | 0        | 15.591     |
| 13                                      | Grant Schemes for hybrid vehicles and vehicles with low $CO_2$ emissions (Equation 3)               | 0                        | 0        | 0        | 8.315      |
| 14                                      | Discounts on vehicles registration for vehicles with low $CO_2$ emissions (Equation 3)              | 0                        | 0        | 0        | 10.394     |
|   | TOTAL PER SECTOR  | 12.003                   | 15.303   | 6.614    | 196.494    |
|   | GRAND TOTAL   | 230.414                  |          |          |            |

Table 30 Brief Presentation of Energy Saving from National Measures



## Table 31 Brief Presentation of CO2 Emissions Reduction from National Measures

| NATIONAL MEASURES FOR ENERGY EFFICIENCY |  | Emissions Reduction (t CO <sub>2</sub> /year) |          |          |            |
|---|--|---|----------|----------|------------|
|   |  | Residential                                   | Tertiary | Industry | Transports |
| 1                                       | Legislation on Energy Building Performance<br>(Equation 1)   | 2.636   | 2.568    | 328      | 0          |
| 2                                       | Legislation for the inspection of air conditioning and heating systems (Equation 1)                  | 1.265   | 1.233    | 157      | 0          |
| 3                                       | Grant Schemes for the installation of solar thermal systems (Equation 1)                             | 443   | 431      | 55       | 0          |
| 4                                       | Grant Schemes for the installation of geothermal systems (Equation 1)                                | 316   | 308      | 39       | 0          |
| 5                                       | Legislation on energy efficiency of appliances (Equation 1)  | 1.877   | 2.370    | 341      | 0          |
| 6                                       | Grant Schemes for the installation of Photovoltaics Systems (Equation 2)                             | 1.741   | 1.505    | 2.984    | 0          |
| 7                                       | Legislation for mandatory integration of solar water heaters (Equation 1)                            | 234   | 272      | 40       | 0          |
| 8                                       | Legislation on energy efficiency of buildings with area larger than 1000 m <sup>2</sup> (Equation 1) | 0   | 2.568    | 131      | 0          |
| 9                                       | Grant Schemes for cogeneration in Industry (Equation 1)  | 0   | 0        | 747      | 0          |
| 10                                      | Plan of single urban transport system (Equation 3)   | 0   | 0        | 0        | 24.560     |
| 11                                      | Mandatory inspection of Vehicles MOT (Equation 3)  | 0   | 0        | 0        | 16.410     |
| 12                                      | Withdrawal Plan of old vehicles (Equation 3)   | 0   | 0        | 0        | 3.938      |
| 13                                      | Grant Schemes for hybrid vehicles and vehicles with low $CO_2$ emissions (Equation 3)                | 0   | 0        | 0        | 2.100      |
| 14                                      | Discounts on vehicles registration for vehicles with low $CO_2$ emissions (Equation 3)               | 0   | 0        | 0        | 2.626      |
|   | TOTAL PER SECTOR   | 8.512   | 11.255   | 4.822    | 49.634     |
|   | GRAND TOTAL  | 74.223  |          |          |            |



 Table 32
 Equations Used for the Estimation of the Contribution of the National Measures to Energy

 Saving

## (1) ES=EC\*np\*nc\*ns

ES: Energy Saving (MWh)

EC: Energy Consumption (MWh)

np: Number of Participation (0-100%)

nc: Consumption rate per consumption category (0-100%)

ns: Saving Percentage by applied measure (0-100%)

## (2) GE=N\*P\*np

GE: Green Energy (MWh)

N: Population

P: Production per application (MWh)

np: Participation percentage (rate) (0-100%)

## (3) EOS=(N\*FO\*np)+( $\Delta$ O\*FO\*np)

EOS: Energy Saving in terms of Fuel (MWh)

N: Population

FO: Fuel Saving per person (MWh)

np: Participation percentage (rate) (0-100%)

ΔO: Passing Vehicles



# 7.10. Description of Achieving CO<sub>2</sub> Emission Reduction by 2020

The overall goal of reducing carbon dioxide emissions achieved by implementing the action plan for 2020 is 20.2 % reduction compared to the reference year 2009. The achievement of this objective is presented in the table below.

| Emission inventory for reference year 2009 (tn CO <sub>2</sub> /year)                   | 421.489 |
|---|---------|
| Expected emissions for 2020 – Expected Development Scenario (tn $CO_2$ /year)           | 442.853 |
| Estimated emission reduction from national measures for 2020 (tn CO <sub>2</sub> /year) | 74.223  |
| Estimated emission reduction by the Municipality for 2020 (tn $CO_2$ /year)             | 32.531  |
| Total estimated emission reduction for 2020 (tn CO <sub>2</sub> /year)                  | 106.754 |
| Estimated emissions for 2020 through the application of the Action Plan                 | 336099  |
| (tn CO <sub>2</sub> /year)  |         |
|   |         |
| Emission reduction percentage by 2020 compared with 2009                                | 20,2%   |
|   |         |

Figure 32 Schematic of the Expected Evolution Scenario of  $CO_2$  Emissions in Larnaka Municipality and the Reduction Target for 2020 by 20.2 %



Therefore by implementing the Sustainable Energy Action Plan, the Municipality of Larnaka will reduce carbon dioxide emissions by **20.2%** compared to 2009 (reaching 336.099 tons of  $CO_2$ ), thus exceeding by 0.2% the overall objective of the project to reduce emissions by 20%.



# 7.11. Financing the Sustainable Energy Action Plan

Funding for Energy Action Plan implementation is expected to be derived from the following resources:

- Municipality budget
- Savings that will result from energy reduction measures in buildings, vehicles and street lighting in the Municipality
- Incomes form the investments of the Municipality in Renewable Energy Sources
- Funding from the Grant Scheme of Ministry of Commerce, Industry and Tourism for Renewable Energy Sources and Energy Saving promotion.
- Possible funding from the Sustainable Development and Competitiveness Program of the Planning Bureau.
- Potential funding from the Fund created for Emissions Trading Scheme.
- Possible funding from other European Programmes.



#### Sources of energy data

▶ Consumption of fuels and heating fuels from oil companies within the administrative limits of Larnaka Municipality.

▶ LPG consumption from the Statistical Service of Cyprus (Reduction at local level based on the population) [www.mof.gov.cy/cysta]

Annual growth rates from the Statistical Service of Cyprus and estimates of scholars [www.mof.gov.cy/cysta]

▶ National Action Plan for reducing CO<sub>2</sub> emissions from the Department of Environment [<u>http://www.cyprus.gov.cy/moa/agriculture.nsf</u>]

▶ National Action Plans for the share of RES from the Energy Service. [http://www.mcit.gov.cy/mcit/mcit.nsf]

National Action Plans for Energy Saving at end-use from the Energy Service. [http://www.mcit.gov.cy/mcit/mcit.nsf]

▶ Grant Schemes for RES and ES from the Energy Service

[http://www.mcit.gov.cy/mcit/mcit.nsf]

Development of Public Transport Plans from the Department of Road Transport [www.mcw.gov.cy/mcw/rtd/rtd.nsf]

► Electricity Consumption data in the Municipality of Larnaka from the Electricity Authority of Cyprus [<u>www.eac.com.cy</u>]

- Energy consumption data in municipal buildings in Larnaka
- ► Information concerning the installation of more efficient electricity generators (combined cycle) from EAC [www.eac.com.cy]
- Information about the advent of Natural Gas from the Energy Service [http://www.mcit.gov.cy/mcit/mcit.nsf]

#### Note:

This report is based on all the available data at the date of its preparation (September 2011).

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## Financial support:



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