Beyond Energy Action Strategies

BEAST

D.3.1.c – Business Plan of Cyprus Energy Agency

Title of the project: Energy efficiency measures and penetration of RES to the Municipal Swimming Pool of Lakatamia Municipality

Location: Lakatamia Municipality, Cyprus

Cyprus Energy Agency

Submission date: 10 September 2015

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Contents

1 Summary of the Project/Project at a Glance

The municipal swimming pool of Lakatamia in Cyprus is constituted by three uncovered pools which used from the public for training during the year or pleasure and party during the summer. In order the swimming pool to operate during the winter is necessary to meet predefined water temperature levels according to the guidelines of the Cyprus Sports Association. For this reason, auxiliary heat is produced by a pair of oil boilers. As a result, the municipality has to allocate an important amount from their budget to cover the energy expenses for the operation of the swimming pool.

The municipality joined the initiatives of the Pact of Islands in 2011 and the Covenant of Mayors in 2012 aiming to overcome the EU objectives for the climate by 2020. Therefore, Inventories for the energy consumptions and the CO_2 emissions elaborated within their territory. Emphasis was given also to the energy expenses for the municipal buildings and facilities. The inventories prove that the swimming pool is one of the bigger energy consumers along the municipal facilities.

With the completion of the baseline inventories, the Sustainable Energy Action Plan was followed which was prioritized actions for the swimming pool. The municipal council agreed that an energy audit and a business plan are needed in order to decide about the future of the swimming pool. The first thoughts were among others, the closure of the swimming pool during the winter, the increase of the entry fee for the citizens, the improvement of the energy efficiency of the swimming pool or to leave the private sector to operate the pool.

An energy audit carried out to the swimming pool by the Cyprus Energy Agency and the high potential for energy savings was identified.

The final list of measures proposed ranked from the most important to the less important are:

- Optimization of pool operation (temperature set points)
- Optimization of pumps operation
- Installation of biomass boiler
- Solar thermal system for contribution to hot water demand
- Installation of photovoltaics

2 Details of the Proposed Project

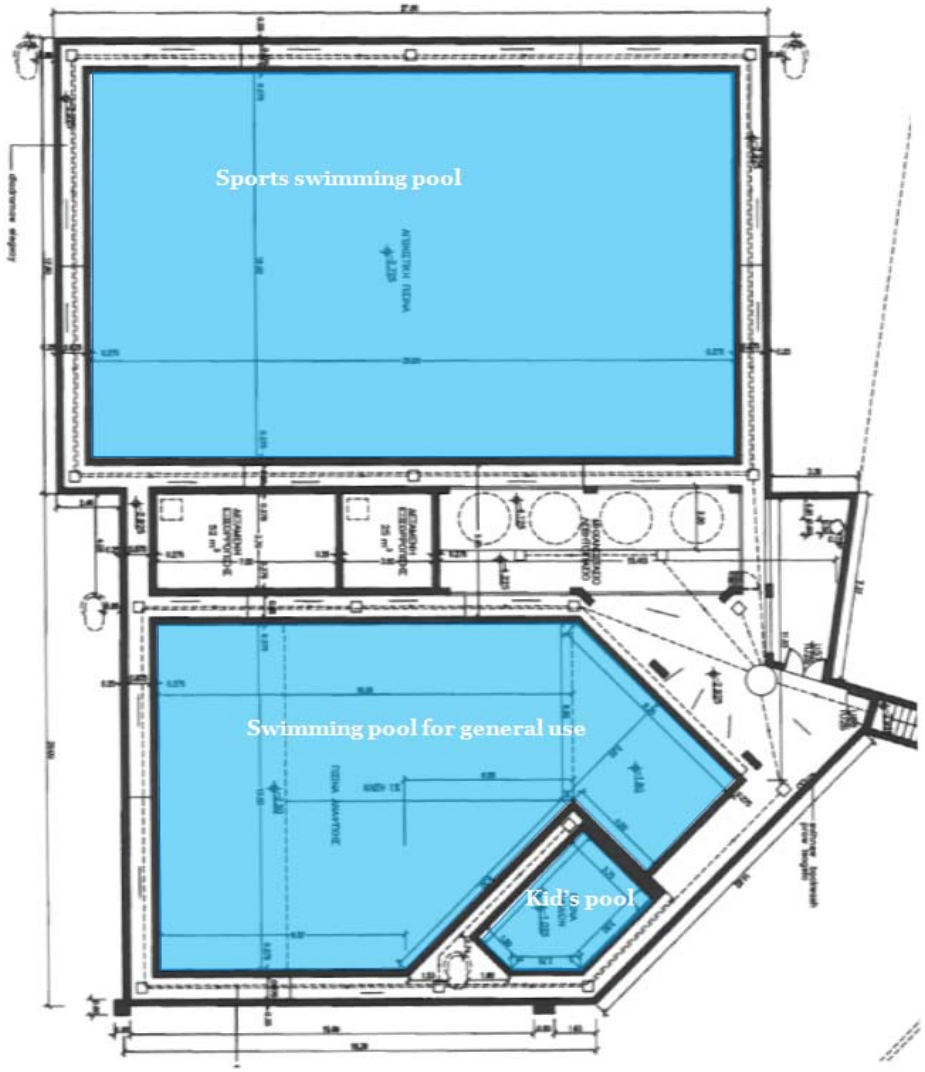
2.1 Existing situation

The municipal swimming pool is constituted by three pools which used for training during the year or pleasure and party during the summer. One out of three is suitable for games according the Olympic standards.

Table 1. Characteristics of the swimming pools

	Sports swimming pool	Swimming pool for general use	Children's swimming pool
Surface (m^2)	400	208	20
Average depth (m)	2.00	1.50	0.50
Volume (m^3)	800	400	10
Operation (days)	All seasons	Summer	Summer

Picture 1. General plan of the swimming pools



Picture 2. Municipal swimming pool

The swimming pool operates since 2001 for swimming school classes, for the public and for pool parties during the summer. The average number of pool guests is 300 persons per day.

The use of the swimming pools varies during the year, the week and the days. The usage profile of the swimming pool is presented below in two tables, one for the summer season and one for the winter season.

Table 2. Operation hours of the swimming pool during the summer and the winter

	M	T	W	T	F	S	S	M	T	W	T	F	S	S
	SUMMER							WINTER						
08:00-09:00														
09:00-10:00														
10:00-11:00														
11:00-12:00														
12:00-13:00														
13:00-14:00														
14:00-15:00														
15:00-16:00														
16:00-17:00														
17:00-18:00														
18:00-19:00														
19:00-20:00														
20:00-21:00														
21:00-22:00														

From the operational costs listed below for the years 2011-2013, could easily exact the conclusion that the energy expenses are about the 50% of the total operating costs which is considerably high.

Table 3. Operational costs of the swimming pool for the period 2011-2013

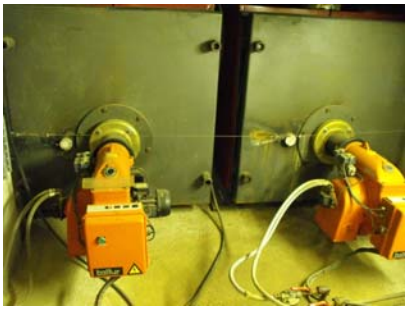
Operational costs	**2011**	**2012**	**2013**
Heating diesel	103,006 €	86,763 €	39,900*
Electricity	26,040 €	44,556 €	33,461 €
Maintenance	12,601 €	3,675 €	645 €
Staff cost	23,000 €	24,797	28,760 €
Staff cost (overtime)	22,353 €	-	-
CKC Services Ltd	23,000 €	26,973 €	27,119 €
Cleaning	200 €	986 €	782 €
Rescue guards	18,372 €	17,969 €	18,306 €
Chemicals	10,686 €	9,444 €	9,310 €
Other costs	4,283 €	2,708 €	2,054 €
TOTAL	**245,028 €**	**208,427 €**	**160,337 €**

For its operation, the pools use 2 diesel boilers of 815 kW each, 2 smaller boilers for the Shower's hot water demand, 5 basic circulation pumps 7.5 kW each, and additional smaller pumps for water circulation within the pipes network.

The big diesel boilers run 24 hours per day during the winter and their operation is controlled by thermostats that are trying to keep the outdoor pool water temperature to the set point of 28-29 degrees Celsius.

Two circulation pumps run 24 hr per day during the whole year and one during the summer season. The other two pumps remain in standby mode to cover peak demands or failures of the basic pumps.

Picture 3. Boilers

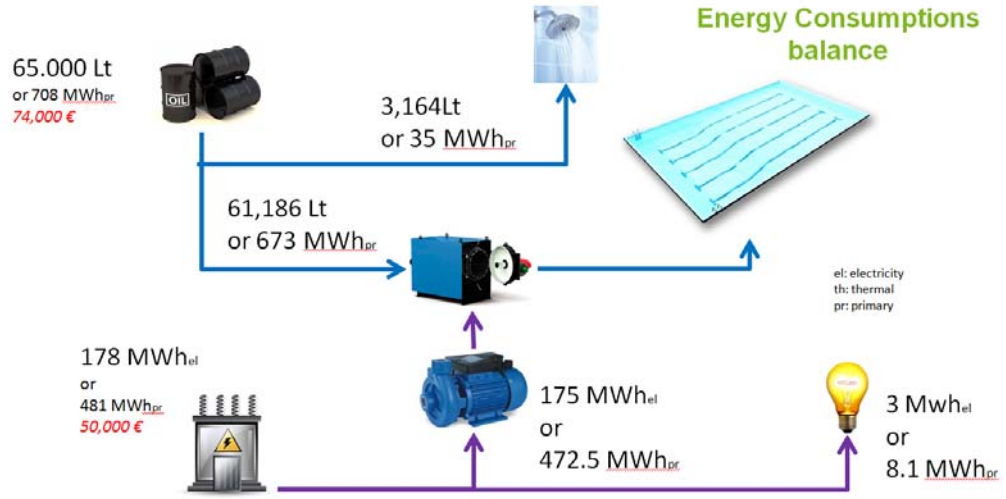


Picture 4. Boiler's room

Picture 5. Pumps

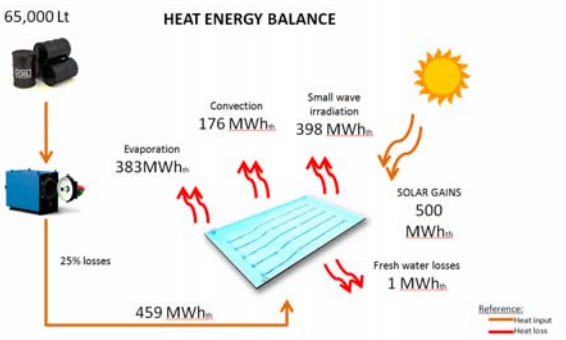
According the results of the energy audit, the most important consumers are the boilers for the heating of the swimming pool and the circulations pumps. Other consumptions like lighting and hot water for the showers contribute with much lower percentage. An overview of the swimming pool's energy consumption balance is presented to the picture below.

Picture 6. Energy consumptions balance

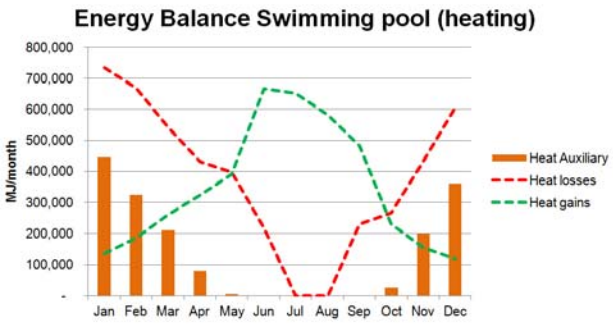


In depth analysis and modelling elaborated for the heat balance of the pool, the heat losses, the solar gains as well as the seasonality of the demand.

Picture 7. Heat balance



Picture 8. Seasonal heat balance



The most important observations from the energy audit are that boilers are oversized, the set points for the water temperatures are very high and the operation hours of circulation pumps is more than needed.

2.2 Proposed actions / The project

Various scenarios were analysed and discussed in order to increase the energy efficiency of the swimming pool and reduce the annual energy costs. The final list of measures proposed ranked from the most important to the less important are:

- Optimization of pool operation (temperature set points)
- Optimization of pumps operation
- Installation of biomass boiler
- Solar thermal system for contribution to hot water demand
- Installation of photovoltaics

The main objectives of the project are to:

- Decrease the energy costs for the operation of the municipal swimming pool.
- Improve service quality.
- Implement an energy action from the Sustainable Energy Action Plan.
- Receive governmental grand for the implementation of the actions.
- Reduce Municipality's carbon footprint.
- Exploitation of municipal green wastes to cover the heat demand of the swimming pool.

The project is expected to contribute to achieve the targets of the SEAP as well as the reduction of the annual energy costs of the swimming pool. In a yearly base the project is estimated to reduce energy costs by 52 %.

The financial resources currently committed by the municipality for paying energy cost, could be used to finance the rest of the energy SEAP actions as well as to cover other social needs of the community.

The expected results in detail are:

- Installation of Solar thermal panels 120 m2.
- Pumping system optimization by reducing the operation hours and power use
- Optimization of pool operation temperature from 29 to 27^{o}C
- Photovoltaics 20 kW as covered parking space

- Biomass boiler installation to cover the heat demand of the swimming pool and the showers

The proposed project is a holistic approach aiming firstly to reduce the energy demand of the swimming pool and secondly to utilize renewable energy sources to cover an important share of the demand. The main target areas are the energy demand for heating the pool water and the operation of pumps and other supporting mechanical equipment

2.3 Technological solutions description

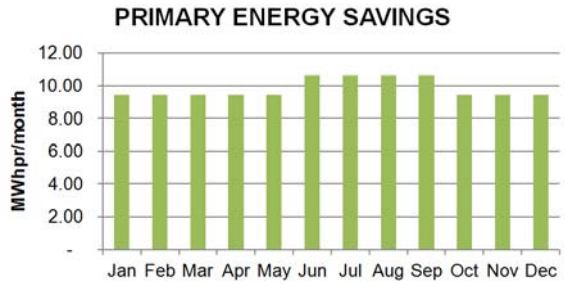
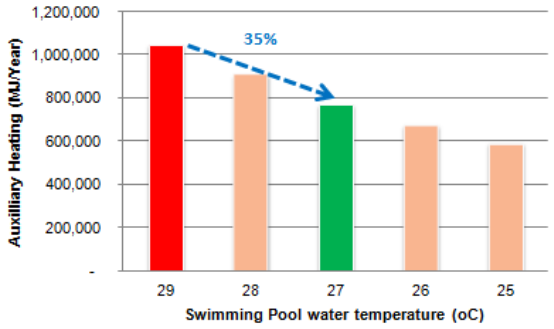
Biomass boiler: Boilers may be design to burn coal, wood, various grades of oil, waste oil, various types of fuel gas, or to operate as electric boilers. Biomass boilers offer an environmentally sound heating solution. Burning biomass such as wood pellets or wood chips emit the same amount of carbon dioxide as is absorbed by the plants while growing. Therefore, biomass is classed as carbon neutral renewable energy. Biomass boilers burn biomass fuel very efficiently and use the heat produced to provide heating to water. The exploitation of green wastes as burning fuels increase the bankability of the installation and at the same time considered as a waste treatment.

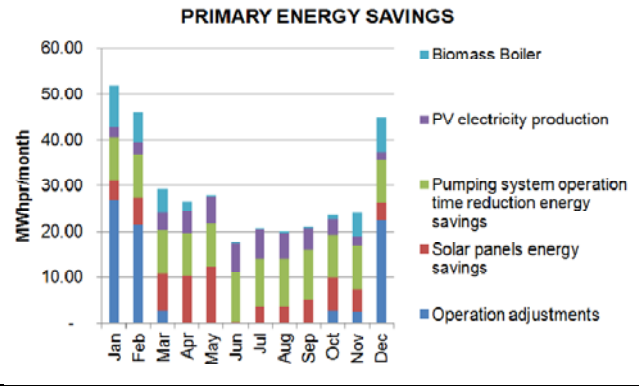
Solar thermal panels: A solar water heater includes a solar collector that absorbs solar radiation and converts it to heat, which is then absorbed by a heat transfer fluid (water, a nonfreezing liquid, or air) that passes through the collector. The heat transfer fluid's heat is stored or used directly. Solar pool heaters do not require a separate storage tank, because the pool itself serves as storage. In most cases, the pool's filtration pump forces the water through the solar panels or plastic pipes. In some retrofit applications, a larger pump may be required to handle the needs of the solar heater, or a small pump may be added to boost pool water to the solar collectors. Automatic control may be used to direct the flow of filtered water to the collectors when solar heat is available; this may also be accomplished manually. Normally, solar heaters are designed to drain down into the pool when the pump is turned off; this provides the collectors with freeze protection.

Photovoltaic panels: Photovoltaics (PV) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels composed of a number of cells containing a photovoltaic material. Materials presently

used for photovoltaics include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium gallium selenide/sulfide.

2.4 Expected results

Solar thermal system for contribution to hot water demand	130 m² solar collectors Savings: 11.632 litres diesel/year	
Optimization of pumps operation	Proposed only one pump to operate 24 hours and the second one to start only during the hours with pool visitors Savings: 43,750 kWh/year	
Optimization of pool operation (temperature set points)	Reduce the water temperature set point from 29 to 27 °C Savings: 7.112 litres diesel/year	
Installation of photovoltaics	Covered parking places with 20 kW photovoltaic panels Savings: 32.000 kWh/year	

Installation of biomass boiler	Biomass boiler 300 kW Savings: 42.000 kWh/year	
Combined scenario	1. Solar panels 120 m2. 2. Pumping system optimization 3. Optimization of pool operation from 29 to 27oC 4. Photovoltaics 20 kW 5. Biomass boiler Savings: 352,000 kWh primary/year	

3 Internal aspects

STRENGTHS

- The municipality owns the swimming pool
- The municipality is responsible for the maintenance of the swimming pool
- Technical expertise is available within the municipal staff
- Experienced staff in the public procurement procedures
- Good administrative structures
- The municipality has the technical support by the Cyprus Energy Agency
- The swimming pool has a significant number of guests and nautical clubs
- No competitors
- Political commitment for saving energy and reduce CO2 emissions
- Energy audit completed

WEAKNESSES

- Lack of in-depth knowledge of EPC contracts
- Lack of funds to implement the project through purchase contract
- Regulations for air pollution are very strict for biomass burning boilers
- The market for biomass fuels is not mature
- Public procurement rules

4 External environment

OPPORTUNITIES

- Shining example for citizens and other local authorities
- Implementation of project through EPC contract and not the capital investment of a local authority
- New technological challenge
- Training of the local authorities' staff in the EPC contracting
- CO2 emission reductions, achievement of the SEAP targets
- Exploitation of municipal green wastes for producing biomass fuel and feeding the boilers with own fuel resources
- High potential for energy savings

THREATS

- The Global Financial Crisis might cause low interest by international ESCO companies
- In Cyprus the ESCO market is very new. No EPC contracts were signed yet
- Availability of good quality biomass fuel sources
- Public procurement rules
- Time consuming procedures

5 Market Potential

5.1 Sports facilities in Cyprus

General information

With the term sport facilities in Cyprus we refer to individual buildings or groups of structures designed for exercising, sports training and practice and competition in various sports. According to the definition used by international coding Nace, the special subcategory "93 - Sports activities and amusement and recreation activities" is linked to buildings for Sports activities , operation of sports facilities, activities of sport clubs, fitness facilities, other sports activities, amusement and recreation activities, activities of amusement parks and theme parks and other amusement and recreation activities. Based on this coding, for 2013 we count 1617 electricity consumers which reflect to a number of sport facilities in Cyprus around 1600. The majority of the sport facilities are private owned by individuals or sport clubs; but also there are a significant number of sport facilities owned by the government or local authorities.

There are limited statistics available for this sector of constructions as well as for the people employed or directly involved for sport facilities. The Cyprus Sport Organisation is a semi-governmental organisation enacted by the 1969 – 1996 laws upon the Cyprus Sport Organisation acting as the Supreme Authority in the Republic of Cyprus. This organization is own and manage some public sport facilities but also is the most important competent authority related with sport activities in Cyprus.

Relevant policies

Sport facilities as constructions; have to comply with the existing regulations for issuing town planning permits and building permits. The competent authorities dedicated to the control and evaluation for building permits of sport facilities are the respective local authorities and the Town planning and Housing Department. Furthermore, sport facilities has to comply with the regulations of the Energy Performance of Buildings which went into partial effect on December 21st 2007, with the 2006 Law on Regulation of Energy Efficiency in Buildings (N.142(I)/2006). On the same day, ΚΔΠ.429/2006 on Roads and Buildings (Energy Efficiency in Buildings) went into effect.

The provisions of the Energy Performance of Buildings Directive (2010/31/EU) were transposed by the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism of Cyprus, into the national legislation in order to improve the energy efficiency of the buildings in Cyprus through the implementation of several measures.

Most important measures are listed below:

- Public buildings of useful area larger than 500 m2 should issue an energy performance certificate
- Energy renovations of sport facilities and buildings (more than 1.000 m2) in general should meet the minimum requirements for the energy performance of

buildings (building envelope, U-values, lighting, energy efficiency requirements for heating, cooling, ventilation and hot water)

- Regarding the energy inspection of the heating equipment (heating boilers), these have to be regularly inspected (for heating boilers with installed capacity more than 100kW, inspections have to take place every 2 years, except gas boilers which have to be inspected every 4 years).
- From 1st January 2019 onwards 'all the new buildings occupied and owned by public authorities are nearly zero-energy buildings' (nZEB) and from 1st January 2021 'all new buildings are nearly zero- energy buildings'.

Energy use

Sports facilities use typically electricity from the national grid and fossil fuels (heating diesel and liquid petroleum gas) for heating and hot water. Moreover, it is mentionable that in Cyprus approximately 50% of the sport facilities use solar water heaters

Sport facilities main energy source is electricity from the grid. Nevertheless, to cover the energy demands on heating and hot water, several sport facilities use fossil fuels and only few use solar thermal collector or geothermal pumps. The following table presents the number of the sport facilities in Cyprus and the total electricity consumption for the years 2010-2013. The final electricity consumption of the sport facilities represent the 1,5% of the final electricity consumption in Cyprus.

Table 4. Electricity Consumption of Sport Facilities in Cyprus (2010-2013)

Year	Electricity Consumption (kWh)	No. of Consumers
2010	38,709,067	1,459
2011	36,873,499	1,526
2012	36,577,003	1,580
2013	33,550,117	1,617

Technical aspects and previous experience

The detailed monitoring of the energy consumptions of sport facilities could not be easily achieved for the following reasons.

1. The electricity consumption meter is usually installed for the whole building of the sport facilities,
2. The majority of the sport facilities, electricity consumption bills are available per 2 months consumption (central meter) and records usually are kept for the fossil fuels and water consumption.
3. Only a few sport facilities have installed Energy Management Systems.
4. Usually it is necessary to manually control temperature, humidity and other parameters of the sport facilities.

Moreover, the following energy efficiency measures have been installed in only few sport facilities in Cyprus:

1. Building automation systems including presence control detectors / absence control detectors
2. Integrated solutions in the building
3. Heat recovery ventilation
4. Solar Panels on the roofs
5. Geothermal heat pumps

Finally, it is mentionable that lot there are many examples of sport facilities with aged and inefficient electrical and mechanical systems and equipment, especially in rural areas.

Financing opportunities

The National Policy for the promotion of renewable energy sources and energy efficiency involves the adoption and implementation of support schemes (including subsidies and grant schemes). The grants/subsidies of the National Support Scheme on RES and Energy Savings for 2014 in Cyprus are supported by the National RES Fund and the Structural Funds. The relevant grants/subsidies of the National Support Scheme on RES and Energy Savings for 2014 in Cyprus are given in details in the tables 5 and 6.

Table 5. Governmental Grant Scheme SOLAR ENERGY for ALL

Description of the measure	**Capacity**	**Type of grant**
Application self-producers using photovoltaic systems in commercial and industrial units (up to 500kW)	15MW	Category B (with out grant)
1. Stand alone photovoltaic systems up with capacity up to 7kW, which will be installed by individuals or municipalities and communities or other non-profit organizations that are not economically active. 2. Stand alone photovoltaic systems up with capacity up to 20kW, which will be installed by organizations that are economically active	0,3 MW 0,7MW	Category C1 Grant 30% Maximum grant amount €6.000 Category C2 Grant 40% Maximum grant amount €12.000

Table 6. Governmental Grant Schemes (for energy renovations of buildings – commercial)

Scheme	**Funding**

Category B – Energy refurbishment of enterprises (building permit before 21/12/2007)	Grant 50% Maximum grant amount €200.000 for buildings that will achieved a B Energy Performance Certificate Category Grant 75% if Nearly Zero Energy Building standards achieved

Ownership and management

Typical owners and managers of the sport facilities are the central government, local authorities and private organisations. Public Sport Facilities have to follow the financing procedures of the Cyprus Sports Organizations Laws and Rules, as well as the public procurement rules for all kind of measures or supplies.

The Cyprus Sport Organisation is a semi-governmental organisation enacted by the 1969 – 1996 laws upon the Cyprus Sport Organisation acting as the Supreme Authority in the Republic of Cyprus.

A nine-members Board of Administration runs the Cyprus Sport Organisation with a President, a Vice-president and seven Members. Operational Manager of the Organisation is its Director General.

5.2 ESCO Market

The harmonization of Cypriot legislation with that of the European Union regarding energy end-use, efficiency and energy services, took place on May 10, 2012 at the Plenary of the House of Representatives. In line with Directive 2006/32/EC of the European Parliament and the Council of April 5, 2006, the national legislation specifies that the energy services provided for the purpose of saving energy are only carried out by specialized energy service companies licensed by the competent authority. Also, the new Cyprus Law states that energy audits are carried out only by energy auditors who have secured permission from the competent authority in accordance with the provisions of the regulations on energy efficiency in end use efficiency and energy services (energy auditors).

The ESCO market in Cyprus is at the very early stages of development. The operation of the ESCOs companies is regulated by the Regulatory Administrative Act KDP 2010/2014. The same Act regulates also the operation of foreign ESCO companies in Cyprus. Until today (10 July 2015) 10 local ESCOs companies have been registered in Cyprus. Moreover 47 licensed energy auditors have been registered by the competent authority until today (10 July 2015). From 2012, all licensed engineers who are members of the Cyprus Technical Chamber can apply to become energy auditors if they attend the obligatory training course and pass the exams. The greatest potential for energy services are in the private non-residential sector and public buildings. Rising

electricity prices, public campaigns and financial incentives, have contributed to increased interest in energy efficiency.

The strongest barriers for the development of an ESCO market are the lack of awareness of the ESCO concept, mistrustful and unstable clients and the small size of projects compared to the high transaction costs. Furthermore, the financial crisis has lowered the priority of energy efficiency investments. More dissemination of information about the importance of energy savings in combating climate change is needed.

The development of expertise in the provision of outsourced energy services is not only beneficial for increased energy efficiency and lower costs; it is also contributing to the economic recovery, stimulating investment and job creation.

5.3 Environmental commitments of Local Authorities

Local authorities in Cyprus have already signed either the "Covenant of Mayors" or the "Pact of Islands" or both. All the local authorities have developed in collaboration with the Cyprus Energy Agency their Sustainable Energy Action Plans (SEAPs) aiming to implement actions for achieving their carbon emissions reduction targets by 2020. The increase of the energy performance of municipal buildings and facilities in order to save both energy and carbon emissions, but also to reduce their energy costs is one of the top priorities in the authorities' agenda towards their 2020 targets.

5.4 Biomass fuel market

Approximately 20 companies are today dealing with the commerce of fire places and wood burning boilers. However, only 6 out of the 20 have wood burning boilers either firewood, woodchips or pellets.

The biomass fuel sources are limited in Cyprus but there some companies importing pellets, woodchips and firewood from other European countries.

The limited availability of biomass fuel resources, affects the further introduction of biomass burning boilers. According to the statistics by Customs Department in Cyprus, 22 companies were dealing with the import of biomass fuels in 2012.

Table 7. Number of companies importing biomass fuels in Cyprus

	2010			2011			2012*		
	Number of companies	Imports (tn)	Number of employees	Number of companies	Imports (tn)	Number of employees	Number of companies	Imports (tn)	Number of employees
	5	171.8	5	3	59,6	3	20	488,3	22

	4	33	4	1	**	1	2	125,9	11
	**	55.3	**	**	**64.4**	**	**	150.6	**

**Since October 2012*

*** Missing information*

The retail prices for pellets are 6 €/15 kg including VAT (approx. 400 €/tn). The wood chips are not that popular in Cyprus and their prices vary from 170 to 250 € per tn.

However it is expected that the demand for biomass fuels will be increased the following year because households, industries and commercial buildings are searching for alternative and cheaper fuel sources.

Table 8. Comparison of different burning fuels in Cyprus

	Energy Content (MWh/ton)	**Boiler efficiency (%)**	**Fuel price (€/ton)**	**Cost per MWh (€/MWh)**
Heating oil	11.2	82-92	1.274	124 - 139
Liquefied petroleum gas	13,1	85-93	850	69-76
Pellet	4.7-5.2	81 - 91	320	68-84
Wood chips	3.8-4	81 - 91	200	55-65

6 Risk analysis

6.1 Local administration reform

The troika of international lenders have given Cyprus just two more months to enact legislation on reforms of the local government. The main objective is to reduce the operational costs of municipalities of which there are far too many offering identical services. Instead of having each of the nine municipalities in the Nicosia district having a department issuing building permits, under the new plan, the single Nicosia district complex would be providing this service.

While the proposed arrangement makes sense economically, as it would reduce local authority costs, it would also diminish their powers in violation of the EU directive on ceding more powers to local government. District complexes would be another tier of local authority more powerful than municipalities. In addition to this, the reform would further impoverish the cash-strapped municipalities which would see revenue fall and be unable to offer new services to residents or pay for any projects.

The above mentioned reform might affect during the reform period, the monthly payments to the ESCO. The Local Authorities are currently not considered the most reliable party to sign a contract with, as administrative reforms might take place in the forthcoming years.

6.2 Introduction of Natural Gas in the electricity production system

Currently the electricity production system of Cyprus is based on fuel imports (93%) as the contribution of RES-e is still low and limited to 7%. The Cyprus government has taken decisions related with the introduction of natural gas to the electricity production system by 2016, which means that the estimated starting production period is 2020-2021. This might affect the electricity pricing system in Cyprus.

6.3 Possible change in the electricity tariffs and oil prices

Under the road map agreed by the government and Cyprus' international creditors, the Electricity Authority of Cyprus (EAC) is to be transformed into a corporation governed by private law by the end of 2015, with all of the company's shares held by the state. Full privatisation of the EAC – however this is implemented – must be completed by 2018.

Taking the above into consideration, as well as the future introduction of natural gas to the electricity system of Cyprus, possible changes in the pricing system are expected. However, according to formal estimates, the electricity prices are not expected to be decreased.

The current imposed commercial tariff is considered high if it is to be compared with those of other EU countries. Within the framework of the current reforms, the Cyprus Energy Regulatory Authority will be asked to approve the new tariffs.

Thus the possible bidders of the contract – the ESCOs – should take into account the above explained changes.

7 Financial Analysis

7.1 Cost

There is a preparation cost from the municipality's side. Studies are necessary to be carried out in order to evaluate the important parameters with the project such as identification of suitable technological solutions and elaboration of business plan and feasibility study. Then, all the data acquired should be processed to be included in the tender documents. The total cost of studies is estimated at 8.000 euros (VAT included).

This project is related with the installation, replacement and maintenance of new technological equipment. The capital cost for the project is given in the table below:

Table 9. Project's capital cost

	Description	Capital cost
1	Solar thermal system for contribution to hot water demand	53,300 €
2	Optimization of pumps operation	0
3	Optimization of pool operation (temperature set points)	0
4	Installation of photovoltaics	28,000 €
5	Installation of biomass boiler	32,000 €
		113,300 €

7.2 Income

The implementation of energy saving measures listed above, it is expected to have important savings to the energy expenses of the swimming pool.The measures divided in 2 categories, those that they have no capital cost and proposed to implement by the municipality and those that have an important initial cost and it is proposed to implement through Energy Performance Contracting.

In the first category are the soft actions like the optimization of the pumping system operation and the set points for the water temperatures in the pool. Even if they have no cost, the expected results in savings according to the energy audit, amounts to approximately 20,500 €/year (17%). In the second category, the solar thermal panels estimated to contribute by covering an important percentage of the hot water demand. The energy costs savings were calculated to 13,600 €/year (11%). The biomass boiler will be used as alternative equipment for covering the hot water demand. The potential utilization of the available municipal green wastes sources makes its installation very viable. It is expected that the savings will be up to 38,700 €/year (31%) of the total energy costs. Also photovoltaics proposed as action to cover an important share of the electricity demand for the operation of pumping system. It was calculated that the

savings will be 8,960 €/year (7%) of the total energy costs. The combined scenario it is expected to result savings up to 81,900 €/year (66%).

7.3 Feasibility assessment

The baseline scenario presents the forecast of the energy expenses if nothing changes to the swimming pool and follow the business as usual.

Table 10. Business as usual scenario

Year	Business as usual oil consumption	Oil price	Cost for oil	Business as usual electricity consumption	Electricity price	Cost for Electricity	Total Energy cost
	Lt/year	€/Lt	€/year	kWh/year	€/kWh	€/year	€/year
	(a)	(b)	(c)=(a)*(b)	(d)	(e)	(f)=(d)*(e)	(g)=(c)+(f)
1	64,350	1.17	75,483	178,048	0.28	49,853	125,336
2	64,350	1.20	76,992	178,048	0.29	50,851	127,843
3	64,350	1.22	78,532	178,048	0.29	51,868	130,400
4	64,350	1.24	80,103	178,048	0.30	52,905	133,008
5	64,350	1.27	81,705	178,048	0.30	53,963	135,668
6	64,350	1.30	83,339	178,048	0.31	55,042	138,381
7	64,350	1.32	85,006	178,048	0.32	56,143	141,149
8	64,350	1.35	86,706	178,048	0.32	57,266	143,972
9	64,350	1.37	88,440	178,048	0.33	58,411	146,851
10	64,350	1.40	90,209	178,048	0.33	59,579	149,788
TOTAL	**643,502**		**826,516**	**1,780,480**		**545,881**	**1,372,396**

7.3.1 Measures 2 and 3 by Municipality

Table 11. Savings from measures 2 and 3

Year	Savings from optimization of pumping system operation		Savings from water temperature adjustments		Total savings for the municipality	CUMULATIVE CASH FLOWS	PRESENT VALUE OF SAVINGS
	kWh/year	€/year	Lt/year	€/year	€/year	€/year	€/year
	(h)	(i)=(h)*(e)	(j)	(k)=(j)*(b)	(L)=(j)+(k)		
1	43,750	12,250	7,112	8,342	15,454	15,454	14,049
2	43,750	12,495	7,112	8,509	15,621	31,074	12,910
3	43,750	12,745	7,112	8,679	15,791	46,865	11,864
4	43,750	13,000	7,112	8,853	15,964	62,829	10,904
5	43,750	13,260	7,112	9,030	16,141	78,971	10,023
6	43,750	13,525	7,112	9,210	16,322	95,293	9,213
7	43,750	13,795	7,112	9,394	16,506	111,799	8,470
8	43,750	14,071	7,112	9,582	16,694	128,493	7,788
9	43,750	14,353	7,112	9,774	16,886	145,379	7,161
10	43,750	14,640	7,112	9,970	17,081	162,460	6,586
TOTAL	**437,500**	**134,134**	**71,117**	**91,343**	**162,460**	**878,618**	**98,967**

Net Present Value:	98,967 €
Capital cost:	0 €
Beneficiary of savings:	Municipality of Lakatamia
Payback period:	Not applicable

7.3.2 Measures 1, 4 and 5 by an ESCO

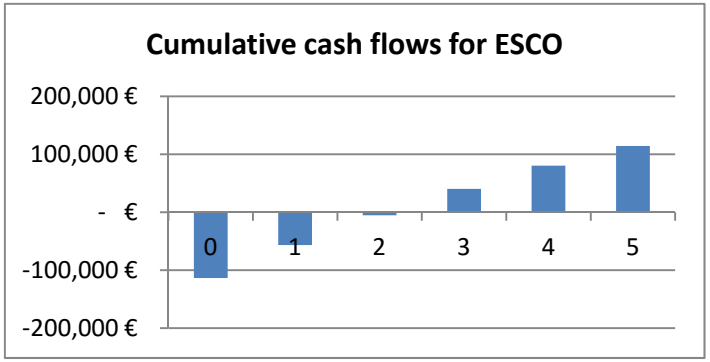
Table 9. Savings from measures 1, 4 and 5

Year	Savings from Solar thermal panels Savings from Solar thermal panels		Savings from Photovoltaic installation Savings from Photovoltaic installation		Wood chips price	Wood chips demand	Wood chips cost	Savings from Biomass boiler installation	Total savings	Maintenance cost	Net savings
	Lt/year	€/year	kWh/year	€/year	€/tn	tn/year	€/year	€/year	€/year	€/year	€/year
	(m)	(n)=(m)*(b)	(o)	(p)=(o)*(e)	(q)	(r)	(s)=(q)*(r)	(t)=(c)-(s)	(u)=(t)+(p)+(n)	(v)=5% of the capital cost	(w)=(u)-(v)
1	11,632	13,644	32,000	8,960	250.00	147	36,785	38,697	61,301	5,665	55,637
2	11,632	13,917	32,000	9,139	256.25	147	37,705	39,287	62,343	5,665	56,679
3	11,632	14,196	32,000	9,322	262.66	147	38,647	39,884	63,402	5,665	57,737
4	11,632	14,480	32,000	9,508	269.22	147	39,614	40,488	64,476	5,665	58,812
5	11,632	14,769	32,000	9,699	275.95	147	40,604	41,100	65,568	5,665	59,903
6	11,632	15,065	32,000	9,893	282.85	147	41,619	41,719	66,676	5,665	61,012
7	11,632	15,366	32,000	10,090	289.92	147	42,659	42,345	67,802	5,665	62,137
8	11,632	15,673	32,000	10,292	297.17	147	43,726	42,979	68,944	5,665	63,280
9	11,632	15,987	32,000	10,498	304.60	147	44,819	43,620	70,105	5,665	64,440
10	11,632	16,306	32,000	10,708	312.22	147	45,940	44,268	71,283	5,665	65,618
	116,321	**149,403**	**320,000**	**98,110**		**1470**	**412,122**	**41,439**	**661,905**	56,650	605,255

Table 10. Savings from measures 1, 4 and 5 sharing base on an Energy Performance Contract

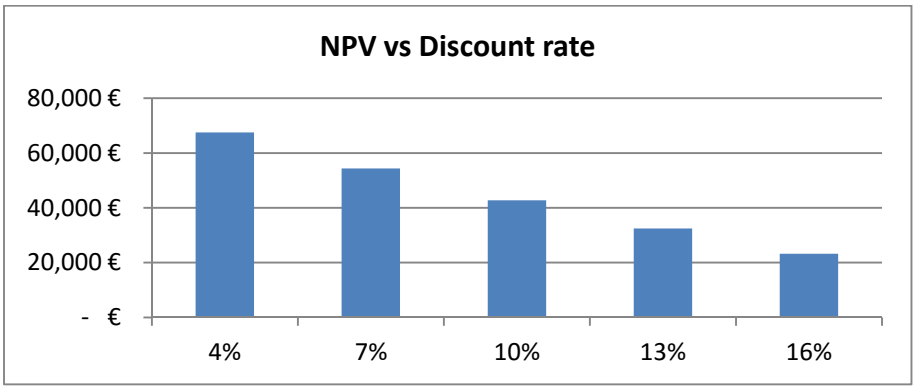
Year	Net savings	% to ESCO	Cash flows for municipality	Cumulative cash flows for municipality	Net savings for municipality Present values	Cash flows for ESCO	Cumulative cash flows for ESCO	Net Income for ESCO Present Values
	€/year	%						
	(w)=(u)-(v)							
0						-113,300	- 113,300	- 113,300
1	55637	90%	5,564	5,564	5,058	50,073	-63227	45,521
2	56679	80%	11,336	16,899	9,368	45,343	-17884	37,474
3	57737	70%	17,321	34,221	13,014	40,416	22532	30,365
4	58812	60%	23,525	57,745	16,068	35,287	57819	24,102
5	59903	50%	29,952	87,697	18,598	29,952	87771	18,598
6	61012	0%	61,012	148,709	34,440	-		-
7	62137	0%	62,137	210,846	31,886	-		-
8	63280	0%	63,280	274,126	29,521	-		-
9	64440	0%	64,440	338,566	27,329	-		-
10	65618	0%	65,618	404,184	25,299	-		-
	605,255			**NPV**	**210,579**		**NPV**	**42,759**

For the ESCO		**For the Municipality**	
Net Present Value:	42,759 €	Net Present Value:	210,579 €
IRR:	25%	IRR:	-
Capital cost:	113,300 €	Capital cost:	0
Beneficiary of savings:	ESCO	Beneficiary of savings:	Municipality
Payback period:	2.5 years	Payback period:	Not applicable

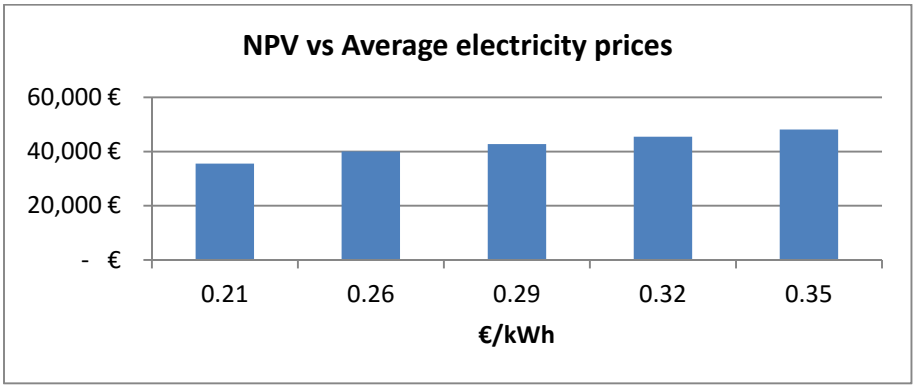


7.4 Sensitivity analysis

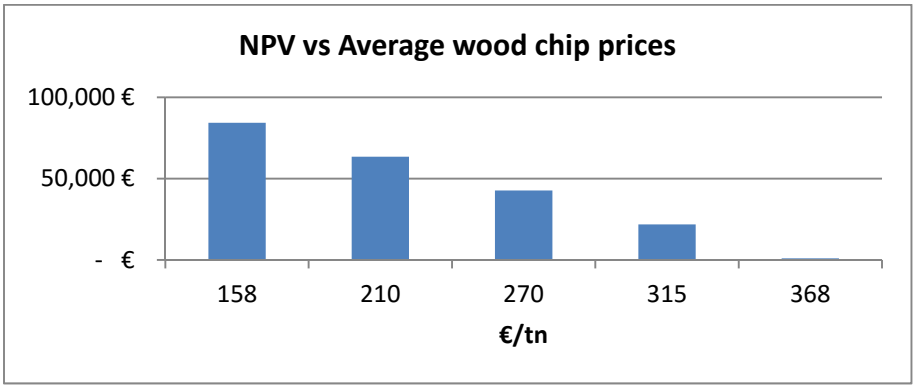
Scenario 1. Fluctuations of Discount rate



Scenario 2. Fluctuations of electricity prices



Scenario 3. Fluctuations of oil prices



7.5 Social benefits and Public support

The high potential for energy saving makes the project viable without the need for governmental support. The public private partnership through an ESCO solves the problem of the Municipality to allocate a significant amount of money for the implementation of measures proposed. This project is also supportive for the 2020 objectives and will be a good example to replicate to other sport facilities.

It is also estimated that 12 direct and 4 indirect Person Months will be the result of the project during the construction phase.

8 Implementation roadmap

	M1	*M2*	*M3*	*M4*	*M5*	*M6*	*M7*	*M8*	*M9*	*M10*	*M11*	*M12*
Presentation to the Municipal Council	*X*											
Approval by the council		*X*										
Optimization of pumps operation			*X*									
Optimization of pool operation (temperature set points)			*X*									
Preparation of tender documents				*X*	*X*							
Launch call for tenders for ESCO					*X*							
Contract signed with ESCO							*X*					
Solar thermal system for contribution to hot water demand								*X*	*X*	*X*	*X*	*X*
Installation of photovoltaics								*X*	*X*	*X*	*X*	*X*
Installation of biomass boiler								*X*	*X*	*X*	*X*	*X*

9 Conclusion

The move to energy efficient technologies and the exploitation of renewable energy sources has been gathering pace over the last five years with the technology improving rapidly and costs falling quickly. Price and product are now at the point where Local Authorities should be developing “spend to save” business cases.

Significant overall savings will come from reduced energy demand, protection against rising energy prices. Although the municipality lack budgets for capital investment in comprehensive renovation projects, EPC purchasing options through accredited ESCOs enable energy-efficiency projects with no upfront costs and include guaranteed payback and results. An ESCO can undertake the implementation of this project, due to its short payback time, good IRR and NPV. Especially this project which is very promising for both sides, investor (ESCO) and the Municipality. The high potential for energy savings should be exploited and the public private cooperation seems to be the most suitable model. The total energy savings if all the measures implemented calculated to be up to 81,900 €/year (66%). Out of the 5 measures listed in the energy audit outcomes, the most important are the actions 2 and 3 that cause important savings without capital needed.