CYPRUS

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1 OVERVIEW OF THE REGION

Characteristics of the Region
Cyprus is the third largest Mediterranean island with a surface area of 9,251 square kilometres. It lies in the north-eastern corner of the Mediterranean Sea, approximately centred on latitude 35° N and longitude 33° E.
The population of the Republic of Cyprus is 952,100 (2012) of whom 681,000 belong to the Greek Cypriot community (71.5%); 90; 100 (9.5%) to the Turkish Cypriot community (estimate) and 181.000 (19.0%) are foreign citizens residing in Cyprus (Statistical Service of the Republic of Cyprus, 2012a).

Cyprus is an independent sovereign Republic with a presidential system of government. The President, who is both the Head of State and Government and of a multi-party system, is elected by universal suffrage for a five-year term of office. Executive and legislative power is exercised through a Council of Ministers appointed by the President, who has the right of final veto on decisions of the Council of Ministers and laws or decisions of the House of Representatives concerning foreign affairs, defence or security. The Judiciary is independent of the executive and the legislature.

Cyprus has been a divided island since 1974. Currently the Government of the Republic of Cyprus controls only of the southern part of Cyprus, while the Turkish Republic of Northern Cyprus that is only officially recognised by Turkey, has control of the northern part of Cyprus. The Government of the Republic of Cyprus is the sole internationally recognised authority on the island though in reality its power extends only to the southern part of Cyprus (Aspects of Cyprus website, 2013).

Cyprus is divided into six districts; Nicosia, Larnaca, Limassol, Famagusta, Paphos, and Kerynia, of which each has its own municipalities and communities. However, the central Government is the sole administrator of executive and legislative power, which finances the municipalities and communities for the implementation of tasks.

The economy of Cyprus can generally be characterised as small, open and free market, with services constituting its engine power. In fact the services sector is the fastest growing area and accounts for about 81% of GDP. During the past 30 years, Cyprus has exhibited rising living standards and the GDP per capita of the country has reached €20,500. It is ranked 23rd in the world in terms of Quality of life Index (Countryeconomy.com website, 2013; Economist Intelligence Unit, 2005). This development reflects the gradual restructuring of the Cypriot economy from an exporter of minerals and agricultural products in the period from the Republic of Cyprus establishment in 1960 up to the Turkish invasion in 1974, to an exporter of manufactured goods from the latter part of the 1970s up to the early 1980s, to the current international tourist, business and services centre since the 1980s.

However, the international economic recession has seen the Cyprus economy contract since 2009. The recession primarily affected the construction, real estate and tourism sectors, while the employment rate as a percentage of the population of ages 20 – 64 dropped to 67.4% from 70.9% in 2008 (Statistical Service of the Republic of Cyprus. 2012b).

Energy demand and supply of the Region
Cyprus has no indigenous hydrocarbons nor is interconnected with other energy networks (oil, natural gas or electricity). Consequently,

the country's small energy system operates in isolation and heavily relies on imported fuels for electricity generation (Fokaides and Kylili, 2014). In 2010, the final energy consumption and the electricity consumption have reached 1,909 ktoe and 4,881 GWh respectively (CIE, 2012; CERA, 2011). This observable increase can be attributed to the major increase of electricity consumption and also to the increase in road transport fuels for private vehicles, since public transport is not well developed in Cyprus and there are no trains. The shares in the energy balance of 2010 are: transport 56%; of which 15% for aviation and 41% for road transport; 17% households; 12% services; 13% industry; 2% agriculture; and are shown in *Figure 1* (CIE, 2012).

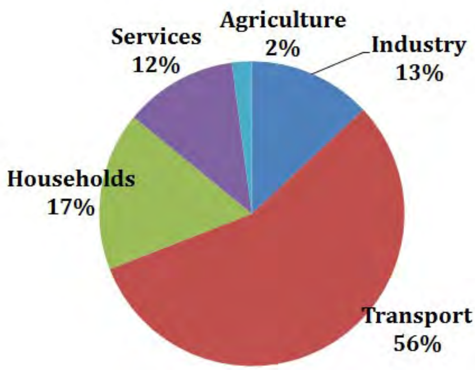

Figure 1 – Energy consumption per sector of Cyprus in 2010

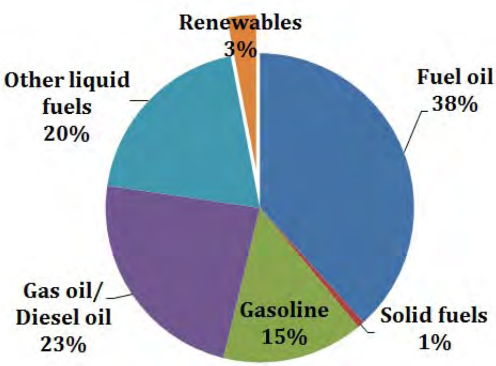

Figure – 2 Energy consumption per fuel of Cyprus in 2010

While there are currently no deposits of fossil fuels to be found on the island the dominant energy source of final consumers is imported oil. The country's energy needs, totalling to 2685 ktoe, are satisfied primarily through fuel oil (38%), gas and diesel oil (20%), gasoline (15%) and other solid and liquid fuels (21%). The contribution of renewable energy sources (RES) to the overall energy consumption still remains at very low levels (3%) (*Figure 2*).

The electricity production in Cyprus reached 5,272.365 MWh in 2010 (CERA, 2011). Currently, the country's electricity generation relies on imported heavy fuel oil (HFO) and gasoil. Cyprus power generation system consists of three thermal power stations at Moni, Dhekelia, and Vasilikos, with a total installed capacity of 1438M We (prior to the Mari naval base explosion in July 2011 that destroyed 60% of the island's power generating capacity (Zachariadis and Poullikkas, 2012) that generate 5,204.897 MWh, or the 98.7% of the total electricity production (Fokaides and Kylili, 2014).

Steam units at Vasilikos are used for base load generation, while the steam units of Dhekelia are used for base and intermediate load generation. The steam units at Moni as well as the gas turbines are mainly used during system peak loading. All stations use HFO for the steam turbine units and gasoil for the gas turbine units.

Exploration, research and exploitation of hydrocarbons in the Exclusive Economic Zone (EEZ) of Cyprus have shown significant reserves of natural gas. The Government and foreign energy institutes estimate that there may be up to 200 trillion cubic feet (tcf) or (5,67 trillion cubic meters) of natural gas recoverable in the Cyprus EEZ (CIT, 2012). Thus the combined cycle units will use gasoil as fuel for their first few years of their operation until the arrival of natural gas in Cyprus, which is expected to be available on the island in 2015. All three power stations are owned and operated by the Electricity Authority of Cyprus (EAC) which currently is the sole producer of electricity from conventional fuel on the island.

Regarding the share of RES in electrical energy generation, it amounted to 62,958 MWh or 1.2% of the total electricity production in 2010. The same year wind parks generated 33,286 MWh, while 647 small rooftop PV systems and PV parks generated another 4,840 MWh. The total production of electricity from biomass / biogas fed into the grid in 2010 amounted to 24,802 MWh. Despite the very low penetration level of RES in Cyprus, a large amount of licenses have been recently granted by CERA pertaining to electricity generation from wind parks, PV parks and, to a smaller extent, biomass plants.

The generating system efficiency in Cyprus, based on the total units generated by the EAC's three power stations, reached only the 36.1% in 2010 (EAC, 2011), so that the GHG emission factor for electricity from grid is calculated at 0.8 kgCO_2eq/kWh. The assumption for this calculation takes into consideration the end to primary energy conversion factor of HFO, 2.7. (Infotrend Innovations/BRE – MCIT, 2009). The primary energy is considered to include the delivered non-renewable fossil-fuelled energy plus an allowance for the energy "overhead" incurred in extracting, processing, and transporting a fuel or other energy carrier to the building. Hence, the primary energy factors denote kWh of primary non-renewable fossil fuelled energy per kWh of the building's delivered energy.

2. CURRENT SITUATION: TARGETS RELATED TO ENERGY POLICY

Through its energy related legislation and policies, the European Union (EU) is not only targeting to contribute to the global effort to tackle climate change, but also aspires to offer its Member States a more secure, competitive and affordable energy supply that is less vulnerable with regard to the global fuel market. The EU also promotes technological development and innovation, as well as economic growth. As a result the EU has set a number of challenging goals to be achieved by 2020 under the Directive 2009/28/EC on renewable energy, also known as the '20/20/20 goals'. These include:

- raising the share of EU energy consumption produced from renewable resources to 20%;
- a 20% improvement in the EU's energy efficiency;
- a 20% reduction in EU greenhouse gas emissions from 1990 levels.

Like any other of the EU Member States, Cyprus has also adopted these stringent targets and integrated them into its own legislation. In particular the National Renewable Energy Action Plan (NAP) of Cyprus sets out the Governments roadmap for fulfilling the legal obligation towards the EU policies. The NAP aims to install 192MW of solar PVs, 75MW of concentrated solar power, 300MW of wind turbines and 17MW of biomass by 2020 (The Republic of Cyprus – MCIT, 2010). The binding targets for Cyprus for the 2020 milestone relating to the energy demand and supply in buildings and mobility include:

- achieving at least a 13% share of the RES contribution to the final use of energy;
- achieving at least a 10% share of RES contribution to the road transport consumption.

The policies and measures that have been adopted to facilitate the achievement of the above mentioned targets are:

- mandatory solar system installation to satisfy the Domestic Hot Water requirements on every new residential building, according to the Technical Guide of Solar Systems and according to the terms of the competent Building Authority;
- installation of provisions for use of power generation systems using RES on every new building. Installation of these provisions must be in consultation with the electricity supplier and must include;
- Installation of larger electricity meter boxes in the building in order to provide additional available space for installation of the RES system meter;
- Installation of the appropriate conduit starting from the meter box and ending at the possible future RES system installation location;
- The revision of legislation on the energy performance of buildings and the Action Plan for buildings with almost zero energy consumption are expected to introduce obligations for the minimum quantity of energy from RES on all new buildings;
- Subsidies, tax decreases and reduced

circulation fees to Hybrid Vehicles, Fuel Flexible Vehicle (FFV)/ Dual Propulsion Vehicles, Electric Vehicle, and low carbon emission vehicles (≤120 g CO_2/km);
- discounts in the registration tax and circulation fees for vehicles other than gas or petrol driven vehicles and dual propulsion vehicles;
- obligation of the conventional fuel suppliers to mix in biofuels so that the average annual energy content of biogas in conventional fuel amounts to at least 2% of the total energy content of conventional fuel placed in the market.

Additional broader measures taken to increase the national energy security and the RES utilisation for electricity generation include:
- the diversification of energy sources through implementation of the strategic goal for introduction of natural gas into the country's energy mix;
- increasing the country's energy self-sufficiency and strengthening of its geostrategic role in the greater area through the development of research actions related to the island's fossil fuel energy potential;
- the maximisation of efficient utilisation of renewable energy sources aiming to replace energy from imported sources;
- energy saving both in the primary form and its final use;
- ensuring sufficient electric power supply potential;
- the development of the country's self sufficiency in relation to the import of primary fuels by maintaining sufficient security stocks;
- the adoption of an ambitious plan to install 192MW of solar PVs, 75MW of concentrated solar power, 300MW of wind turbines and 17MW of biomass by 2020;
- the adoption of a number of regulatory measures for the promotion and regulation of RES electricity generation;
- establishment of a number of organisations, including the Cyprus Institute of Energy, the Special Fund, the Cyprus Energy Agency, the Cyprus Regulatory Authority (CERA), and the Cyprus Transmission System Operator;
- the obligation of the Electricity Authority of Cyprus (EAC) to purchase RES generated electricity;
- the determination of the areas where RES development is allowed;
- the definition of clear terms for connection of photovoltaic systems, electricity generation systems using biomass and other RES systems with the grid;
- adoption of the Law on the Promotion of Combined Heat and Power and the prioritisation to energy produced with combined RES power generation from the Transmission System Operator;
- simplification and acceleration of the RES licensing procedures through the adoption of principles such as the "One Stop Shop";
- the organisation of information campaigns, day events, seminars and expositions on the developments in RES technologies;
- the adoption of a number of financial measures for the promotion and regulation of RES electricity generation;
- support Scheme Plans;
- the facilitation of small scale RES developments through reduced application charges and faster, non-dissuasive supporting procedures for licensing;
- reduced fees for connection of RES plants with the grid.

The EU commitment towards the Kyoto Protocol for a reduction of the GHGs to at least 80% below the benchmark 1990 levels by 2050 is the driving force of the its energy strategy. While the current total GHG emissions of Cyprus stand at 9,154 thousands of tonnes of CO_2 equivalent, the NAP outlines for the achievement of at least 5% reduction of GHG emissions from 2005 (9,311 ktCO_2eq) by 2020, for categories outside the scope of the Greenhouse Gas Emission Allowance Trading Scheme.

Other Regional targets, barriers and drivers
An additional target regarding the built environment set by the EU to its Member States is outlined in the Directive 2006/32/EC on energy end-use efficiency and energy services, applicable since 2006. The directive aims to achieve 9% overall energy savings until the ninth year of its application through energy services and other energy efficiency improvement measures.

The promotion of RES utilisation, as well as energy consumption minimisation efforts are not only driven by the national policy obligations. Additional drivers include the RES market development and competiveness, the technological advancements of the energy-related field such as smart grids, the thrust of the local research foundations for the development of this field, as well as the interest of engineers and architects to transform the building sector into a more environment friendly one.

The observable slow pace of the transformation of the built environment and RES development in Cyprus can be attributed to a number of barriers:

- the bureaucracy conditions that prevail in the country make the licensing procedures for RES projects very slow;
- the conflict of the developers and investors to keep their personal earnings high;
- the technology immaturity and the associated high costs of the technologies;
- the lack of know-how and public awareness of the technologies and the energy related measures.

Among the aspirations of Cyprus is large scale application of net metering. A pilot net metering program has been applied since 2012 to selected governmental buildings and a few communities. The target of the program is to gain significant experience and know-how on the net metering for its application to the whole country. Also the Cyprus Energy Agency has developed and put in operation Sustainable Energy Action Plans for 14 municipalities and communities that include proposed measures regarding the energy savings, RES utilisation and carbon emissions reductions of the built environment, as well as the increase of the public and the private sector's awareness concerning these aspects.

Regarding the co-generation of heat and electricity and the efficient usage of heat, no policies or measures have been adopted. This is primarily due to the fact that the climate of Cyprus consists of hot summers and mild winters, leading to reduced total heating demands.

Additionally, the reduced size of the cities and the country itself does not encourage the development of mass transport communication systems. However, the municipality of Nicosia has identified the benefits of the development of a mass transport system and is currently making efforts for the establishment of rail lines in Cyprus.

3. CASE STUDY: ENERGY UPGRADING OF THE REFUGEE SETTLEMENTS

The case study to be presented involves the upgrading of the refugee settlement in Yeri to a smart energy region. The settlement is located at 35° 6'9.53"N latitude and 33°24'54.07"E longitude and covers an area of $2km^2$ (*Figure 3*). Yeri is located 10 km south east of the capital Nicosia. The population of Yeri before 1974 and the displacement of 200,000 Greek-Cypriots from the northern to the southern part of Cyprus, was only a few hundreds. In an effort to house the displaced families, the Government of Cyprus developed refugee settlements in several municipalities and communities in the southern part of Cyprus, among of which was Yeri. Consequently, by 1982, Yeri's population reached 2,500 and by the 2011 census it had a total population of around 6500 (Wikipedia, 2013).

Figure 3 – Location of the refugee settlement in Yeri

The following aspects will be quantified by means of specific scenarios, and the impact of the implementation of these activities will be examined:

- energy upgrade of the buildings' envelope;
- enhancing the energy efficiency on the demand side;
- raising of the awareness of the residents towards reducing energy consumption;

- reduction of fossil fuel use and CO_2 emissions aiming to the utilisation of renewable energy technologies;
- promotion of smart grids and rationalisation of energy management practice;
- promotion of green transportation.

The expected outcomes target the social, economic, environmental, and technical upgrading of the region, and are given below:

- reduction of GHG emissions through the promotion of low carbon practices;
- economic upgrading through achieving cost savings;
- technical upgrading for improving the primary energy factors of the community's energy system.

The measures to be applied to the case study for the achievement of the main objective regarding the energy performance upgrading of the refugee settlement in Yeri to a smart energy region are the following:

- improvements of the building envelopes and thermal bridges to achieve reduced heat losses/ gains;
- employment of more energy and cost efficient systems, appliances, equipment, and other building services to achieve reduced energy consumption;
- employment of solar thermal for domestic hot water; and/or biomass boiler for domestic heating and/or a 7 kW PV installation to provide electricity for increase the share of renewables generating energy.

The methodology employed in the case study considers the evolution of the buildings in Yeri, considering energy consumption, through a number of scenarios. Also, the upgrading of the settlement's buildings is based on a theoretical model and was implemented using the Simplified Building Energy Model (SBEM) software (Infotrend Innovations/BRE – MCIT, 2009).

Background and current conditions

The municipality of Yeri and the residents of the refugee settlement are the key stakeholders for the realisation of the energy upgrading of the dwellings within the settlement to smart energy buildings. The local authorities are responsible not only for the initiation of this action, but also for its promotion and transfer of knowledge and awareness amongst the members of the settlement. The Town Planning Authority is another main stakeholder of this study case. The Town Planning Authority is directly involved with the urban and spatial planning, while the Housing Section of the department undertakes the planning, design and management of public housing, almost exclusively serving displaced refugees. Other stakeholders involved include the Energy Service and the Electricity Authority of Cyprus (EAC). The Energy Service is responsible for monitoring and coordinating the supply and availability of sufficient energy capacity for domestic needs, the preparation and implementation of programmes promoting energy conservation and utilisation of RES according to the European Policy, as well as the development of the national policies and guidelines regarding energy issues. The EAC is the major generator and distributor of power of Cyprus, and therefore is directly involved with this case study regarding the infrastructure of power delivery for domestic purposes.

The dwellings of the refugee settlement in Yeri have been built according to the standards of construction of the 1970's. According to Fokaides et al. (2011), the building stock of the settlement presents the following characteristics:

- the average building area per habitant in Cyprus is 52.3 m^2;
- the primary energy consumption of dwellings per total area is 200 kWh/m^2year;
- the wall average overall heat transfer coefficient (U Value) is 1.51 W/m^2K;
- the exposed roof average U Value is 3.3 W/m^2K;
- the glazed surfaces average U Value is 3.9 W/m^2K.

The primary energy consumption of dwellings is mainly attributed to heating ventilation and air-conditioning (HVAC) systems, lighting, and other building services. The two dominant heating systems used in Cyprus are the heating oil boiler and air conditioning. The heating boilers have an average efficiency of 80%. Whereas A/Cs average coefficient of performance (COP) equals to 2. It is also worth mentioning that the cooling demands exceed the heating demands due to the local climatic conditions of the island. Particularly in Cyprus cooling degree days (CDD) sum up to 2000 days per year whereas heating degree days (HDD) are less than 1000. Additionally the lighting needs of the dwellings are typically satisfied by incandescent light bulbs, while solar heaters provide domestic hot water (DHW) to the dwelling.

The residents of the settlement typically move outside of the borders of the community on a daily basis for their everyday activities, such as occupation, shopping etc.. The Yeri community does not host any significant business activities.

For this reason in terms of the case study, the aspect of transportation was not considered, as transport activities are rather limited within the boundaries of the community.

Case study scenarios
The business as usual scenario (BAU) assumes the adoption of all the provisions given in the Energy Performance of Buildings Directive (EPBD) 2002/91/EC by the dwellings of the settlement. Using a matrix of scenarios the effect of different development paths for the building stock were investigated. The matrix was based on two variables, namely the potential consumption of a building and the potential contribution of on-site renewable energy technologies. Regarding the first variable, the three possible cases that were examined were:

1. Consumption of buildings in 2020 at the same levels as the typical levels in the BAU scenario, but considering the end to primary energy conversion factor to be 2.27 (SC1);
2. Consumption reduced by 10% compared to SC1 (SC2);

Table 1 – Investigated scenarios considering the energy consumption and the RET penetration in Cyprus by 2020

	Table 1 Energy Consumption scenarios			
		SC1: 2020 dwelling energy consumption same as typical buildings	SC2: 2020 dwelling energy consumption reduced by 10% compared to SC1	SC3: 2020 dwelling energy consumption reduced by 20% compared to SC1
Renewable penetration scenarios	RET1: Use of solar thermal for domestic hot water	SC1-RET1	SC2-RET1	SC3-RET1
	RET2: Use of solar thermal for domestic hot water and biomass boiler for domestic heating	SC1-RET2	SC2-RET2	SC3-RET2
	RET3: Use of solar thermal for domestic hot water, biomass boiler for domestic heating and a 7 kW PV installation for electricity	SC1-RET3	SC2-RET3	SC3-RET3

3. Consumption reduced by 20% compared to SC1 due to more stringent minimum requirements regarding the thermal performance of buildings (SC3).

Regarding the possible contribution of on-site renewable energy technologies, three scenarios were considered:

1. Contribution of RES in existing buildings in 2020 in the same levels as the typical, which includes solar thermal systems that satisfy the 80% of the domestic hot water demands (RET1);
2. Installation of solar thermal heater for domestic hot water and of a biomass boiler to satisfy 100% of the demands for space heating (RET2);
3. Installation of solar thermal heater for domestic hot water, of a biomass boiler to satisfy 100% of the demands for space heating and of a 7 kW nominal power solar PV on-site system (RET3).

It is also worth mentioning that the matrix scenarios assume that the end to primary conversion factor will be reduced to 2.27 in 2020 from today's 2.7, according to the assumption that Cyprus will reach its 2020 targets as described in its NAP that anticipates a share of 16% by renewable energy technologies (RET) by 2020 (Infotrend Innovations/BRE – MCIT, 2009; The Republic of Cyprus – MCIT, 2010). This assumption is considered realistic, based on the progress of RET installations in Cyprus few years after the adoption of Cyprus' NAP (2009). The matrix scenarios are summarised in *Table 1*.

Long term focus

The types of buildings within the refugee settlements are similar and constitute a large percentage of the existing building stock of Cyprus - around the 20%. Accordingly, upgrading these areas into smart energy regions will contribute significantly into achieving the national 2020 targets. The long term focus of this Case Study is to encourage the local Government for the development and implementation of an action plan for the transformation of the all the refugee settlements in Cyprus into a smart energy regions, using energy simulation software including SBEM integrated with additional design tools.

4. RESULTS

Business as usual (BAU) scenario:
The BAU scenario assumes the adoption of all the requirements given in the EPBD, and *Table 2* indicates the changes to the structure of the buildings that are obligatory to occur according to the relevant legislation. *Figure 4* presents the significant improvement that is achieved in the energy consumption of the buildings after the implementation of the EPBD –71 KWh/m²year reduction of the building's energy consumption. This reduction can be mainly attributed to the reduction of the end to primary energy conversion factor from 2.7 to 2.27, as well as to the decrease of the average U Values for masonry, roof and glazes elements to 0.50 W/m²K, 0.5 W/m²K and 3.1 W/m²K respectively (Fokaides et al., 2011).

Matrix scenarios
The energy consumption of the buildings in the settlement for the 9 investigated scenarios is presented in *Figure 5* in the form of a bubble chart. The radius of the bubble and the vertical axis represents the magnitude of the energy consumption; and the horizontal axis indicates the examined scenarios with regard to the potential energy consumption reduction.
The case study has resulted to the following findings:

- the promotion of energy efficiency measures and RES utilisation within the settlements can reduce the energy consumption of the buildings of the settlement in the range of 107 kWh/m²year to – 22 kWh/m²year, where the negative sign is indicative of excess energy generation;
- in the case of the business as usual scenario the building energy consumption will be reduced to 107 kWh/m²year by 2020, however this can be mainly attributed to the reduction of the end to primary energy conversion factor.

	Prior to the EPBD adoption	After the EPBD adoption (BAU scenario)
Construction element	Thermal transmittance (U- Value) [W/m2K]	
Masonry	1.5	0.5
Roof (tiles)	3.3	0.5
Glazing	3.9	3.1

Table 2 – Typical thermal transmittance values of the buildings in before and after the adoption of the EPBD

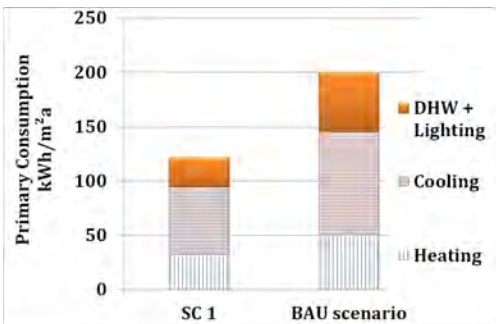

Figure 4 – Typical buildings' primary energy consumption in kWh/m²a compared to the primary energy consumption in the business as usual scenario (Fokaides et al., 2011)

- the employment of RET to cover the heating demands of the buildings can reduce the primary energy consumption up to 61 kWh/m² year;
- the fact that space cooling requires a large percentage of the energy demands in Cyprus increases the significance of the RET that are generating electricity. Since the only abundant renewable energy source in Cyprus is the sun, it is recommended solar technologies, in particular solar PV, should be mainly promoted for the buildings of the settlement;
- given that the domestic hot water demands are satisfied by a solar thermal system and the heating demands by a biomass boiler, the installation of a 7 kW solar PV system can transform a building into a nearly zero energy building (ZEB).

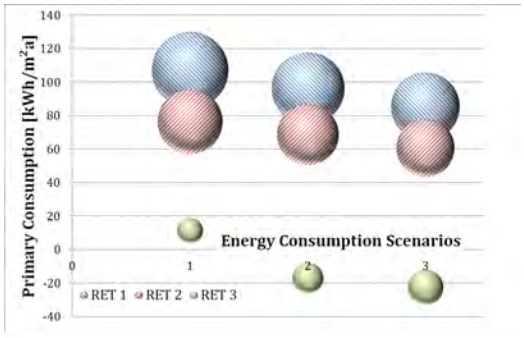

Figure 5 – Primary energy consumption in kWh/m²a of investigated scenarios

Outcomes

The achieved outcomes of the Case Study regarding the transformation of the refugee settlement in Yeri into a smart energy region are enlisted as follows:

- considering the fact that Cyprus has an extremely high electricity retail cost of 0.16–0.24 €/kWh, cost savings of at least 19.0 €/m2a (Poulikkas, 2013) can be achieved through the transformation of their area into a smart energy region;
- the benefits from reducing the energy consumption and employing RES have been scientifically proven to the local authorities through the case study, encouraging them to continue to the implementation of the case study to the settlement of Yeri;
- the knowledge regarding the energy improvement of the building and the significance of upgrading of the settlement into a smart energy region has been developed.

The added value of the outcomes of this case study is indicative as the findings can be related to other regions in Europe as well. According to the Buildings Performance Institute Europe (BPIE) report (2011), a substantial share of the European existing building stock is older than 50 years. Also, many of hundreds of years old buildings exist across Europe, many of which are still in use. In fact, more than 40% of the European residential buildings have been constructed before the 1960s. Countries with the largest shares of old buildings include the UK, Denmark, Sweden, France, Czech Republic and Bulgaria. Thereafter, the building stock of these European countries should be facing similar energy challenges and can be related to the settlement presented in this case study.

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The COST Action TU1104 Smart Energy Regions brings together over 70 researchers from European institutions to investigate the drivers and barriers that may impact on the large scale implementation of low carbon technologies in the built environment. The book "Smart Energy Regions" is the outcome of the Working Group 1 of the Action and collects analysis and case studies from 26 European countries. For more information about the Action and COST please visit www.smart-er.eu and www.cost.eu.

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COST DESCRIPTION

THE ORGANISATION OF COST

COST - European Cooperation in Science and Technology is an intergovernmental framework aimed at facilitating the collaboration and networking of scientists and researchers at European level. It was established in 1971 by 19 member countries and currently includes 35 member countries across Europe, and Israel as a cooperating state.

COST funds pan-European, bottom-up networks of scientists and researchers across all science and technology fields. These networks, called 'COST Actions', promote international coordination of nationally-funded research.

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Through its inclusiveness, COST supports the integration of research communities, leverages national research investments and addresses issues of global relevance.

Every year thousands of European scientists benefit from being involved in COST Actions, allowing the pooling of national research funding to achieve common goals.

As a precursor of advanced multidisciplinary research, COST anticipates and complements the activities of EU Framework Programmes, constituting a "bridge" towards the scientific communities of emerging countries. In particular, COST Actions are also open to participation by non-European scientists coming from neighbour countries (for example Albania, Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Lebanon, Libya, Moldova, Montenegro, Morocco, the Palestinian Authority, Russia, Syria, Tunisia and Ukraine) and from a number of international partner countries.

COST's budget for networking activities has traditionally been provided by successive EU RTD Framework Programmes. COST is currently executed by the European Science Foundation (ESF) through the COST Office on a mandate by the European Commission, and the framework is governed by a Committee of Senior Officials (CSO) representing all its 35 member countries.

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