European Commission

JRC TECHNICAL REPORTS

Final Report

Long-term strategy for mobilizing investments for renovating Cyprus national building stock (D1.8)

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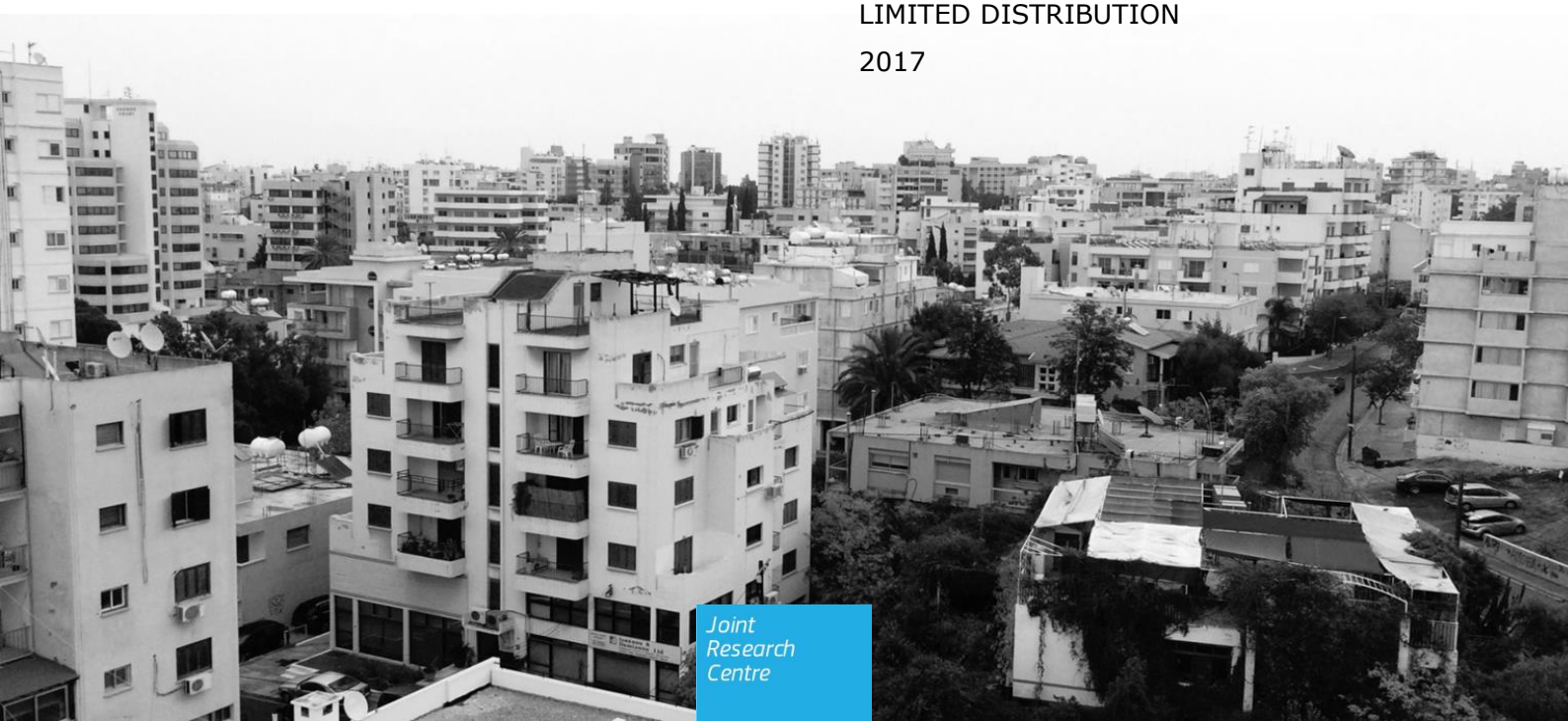
2017



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Ispra: European Commission, 2017

How to cite this report: M. Economidou, P. Zangheri, D. Paci, Long-term strategy for mobilizing investments for renovating Cyprus national building stock, European Commission 2017

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JRC.C.2
Structural Reform Support Service (SRSS)
Cyprus Ministry of Energy, Commerce, Industry and Tourism (MECIT)

Contents

Abstract

European governments, with the right policy tools, can play a crucial role in promoting energy efficiency and leveraging more investments in the building sector, especially for the renovation of the existing stock. In Cyprus the current policy mix supporting energy efficiency improvements in buildings largely relies on the provision of government-supported grants to households, businesses and public sector. Cyprus has also put in place a series of energy efficiency legislations, including requirements for new constructions and renovations which are expected to reduce its energy consumption and overall energy dependence in the years to come.

This final report collects and summarises the findings of the research carried out within the framework of the Administrative Arrangement no. SI2.211494, and available as separate JRC Technical reports (see 1. Overview and background). As foreseen in this project, JRC identified priorities and activities to support the Cypriot authorities in the preparation of a long-term strategy for mobilizing investments in renovating Cyprus national building stock.

The report reviews the Cypriot landscape with regards to energy efficiency investments in the building stock. It provides an analysis of existing financial incentives provided by the government and suggests recommendations on how the Cypriot government can support the unlocking of the energy saving potential of the building stock. To improve the financial landscape for energy efficiency investments in buildings in Cyprus, a comprehensive package of economic policy measures is proposed, with the ultimate goal is to streamline commercial financing into energy efficiency.

The presence of split incentives, between tenants and owners, in the Cypriot building sector is also investigated. We propose ways to overcome the barrier based on good practices identified in the EU and beyond. It is found that around 60 % of all dwellings in Cyprus may face one or a combination of different types of split incentives. The owner-occupied multi-family sector representing one third of the entire dwelling stock of Cyprus typically faces a multiplicity of challenges. Energy efficiency improvements in the rental sector (represented by 24.4% of the total Cypriot dwelling stock) may be hindered by the fact that investments paid for by the building owner are typically reaped by the tenants.

Energy Service Companies (ESCOs) can also play a critical role in promoting energy efficiency at the market level. Despite the theoretical appeal of low-capital energy saving opportunities and the recently adopted policy framework, the energy services market in Cyprus is underdeveloped, with numerous barriers blocking the full development of the market. This report assesses the current market status in Cyprus, the use of Energy Performance Contracts (EPCs) in the public sector and current bottlenecks to its development. It draws recommendations from the experience in the promotion of EPC in other countries with similar climatic and energy market structures.

The importance of a large variety of stakeholders in the building sector is recognized and measures to involve them in the process of defining policies to renovate the building stock are also proposed. This proposal goes along with suggestions and recommendations on targeted information and communication campaigns.

Finally the results of simulations based on a characterisation of the actual building stock in Cyprus (including the major energy consumption sectors and end-uses) and a quantitative forecast of how this demand will change in the next 15 years (by 2030) are presented. A simplified building stock model has been specifically developed and applied for this purpose..

Based on our building stock model and scenarios agreed with Cyprus Ministry of Energy, Commerce, Industry and Tourism (MECIT), the structural effects (growing GDP, population and buildings) are expected to lead to an increase of the current final energy consumptions of the residential sector. This can be limited by the implementation of appropriate policy measures. In the Scenario 1, the first results related to the selected

policies will be visible in 2030 (-4% respect to Scenario 0) and will pave the way to a deep renovation of the current building stock by 2050.

1. Overview and background

The JRC has provided technical assistance to SRSS within the framework of the Administrative Arrangement no. SI2.211494. As part of this wider project, we identified priorities and activities to support the Cypriot authorities in the preparation of a long-term strategy for mobilizing investments in renovating Cyprus national building stock.

This activity was aimed at providing an in-depth analysis of the current building stock and of the major barriers for deep retrofit. Based on these analysis policy and financial are proposed as part of a coherent strategy to improve the energy performance of the buildings.

To achieve this goal, we identified some key sub-activities:

— 1. Analysis of existing financial incentives for the renovation of buildings.

— 2. Analysis of the split of incentives between the owner and the tenant in renovating buildings with a view in upgrading energy efficiency will be investigated, including the size of the rented space.

— 3. Assessment of the current Market for Energy Services and Performance Contracting (EPC). Recommendation of measures to promote the use of EPC in the public sector and service sectors.

— 4. Identification of the relevant stakeholders and specific information and communication material and tools to involve and target them.

— 5. Identification and set up of appropriate financing options to foster investment by private citizens, public bodies and business in the refurbishment of buildings to complement possible incentives, especially from the private sector.

— 6. Analysis of the current building stock for the three main sectors (residential, public, service) with regard current status of energy performances, potential for energy efficiency and adoption of building related renewable technologies (solar thermal, PV, geothermal heat pump, etc.), and its evolution for the period 2015-2025.

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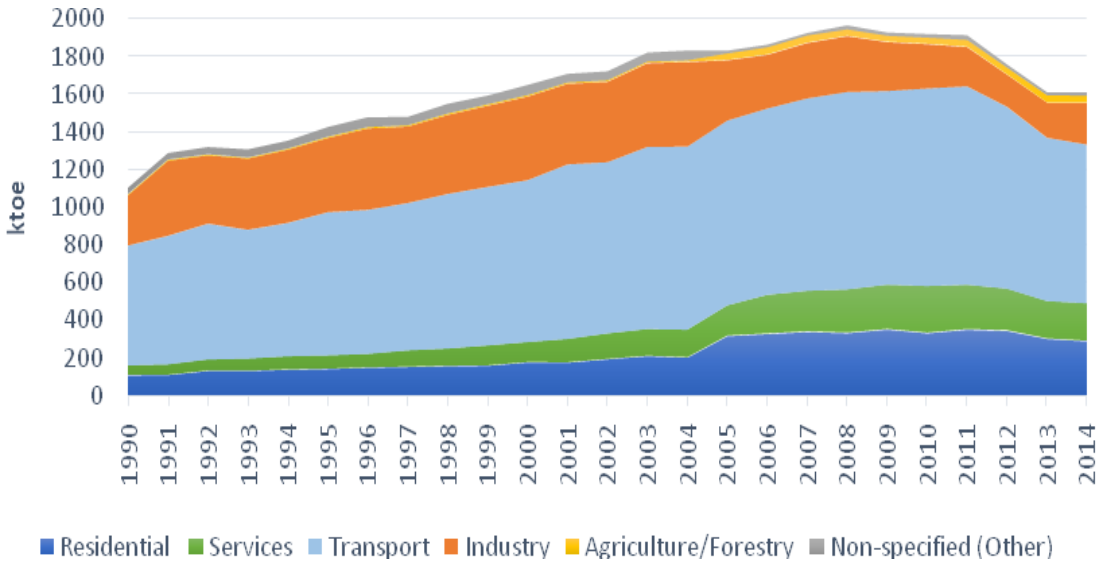
This Final Report consists of a unified collection of all the deliverables, publishes as JRC Technical Reports, prepared for each of the abovementioned research topics. In particular, Chapter 2 reflects the analysis developed in JRC Technical Report "Financing energy efficiency in buildings in Cyprus"; Chapter 3 presents the findings of JRC Technical Report " Split incentives and energy efficiency in Cyprus "; Chapter 4 reflects JRC Technical Report "Report on the current status of the Energy services market and proposal for measures to promote EPC in the public and private sector"; Chapter 5 is based on JRC Technical Report "Involvement of key building sector stakeholders, including customers, in transforming the Cyprus building stock - Energy Efficiency in buildings Cyprus: communication tools for the information of consumers and stakeholders"; Chapter 6 is based on the JRC Technical Report: " Measures to promote the offer of financial products for the renovation of buildings by the commercial banking sector, including the design of innovative financial schemes" , and Chapter 7 contains the findings of the JRC Technical Report " Building stock in Cyprus and trends to 2030".

2. Financing energy efficiency in buildings in Cyprus

2.1 Introduction

With its energy dependence[1] amounting to 93.4% in 2014, Cyprus ranks the third most energy dependent EU Member State. While the share of renewable energy in gross final energy consumption has experienced at three-fold increase over the past 10 years (from 3% in 2004 to 9% in 2014), its energy needs have been on a rising trend (**Error! Reference source not found.**).The downward trend observed in 2008, which is largely attributed to the impact that the financial crisis has had on the real economy, is expected to reverse as final energy consumption is projected to increase from 2016 onwards under the Cypriot baseline scenario[2] presented in the Cypriot National Energy Efficiency Action Plan 2014.

Figure 1 – Cyprus final energy consumption by sector



[Source: Eurostat]

The residential and services sectors collectively remain the second largest energy consuming sector in Cyprus (after transport)at 289.7 ktoe and 199.8 ktoe, respectively, and are associated with a significant energy saving potential[3]. In their bottom-up analysis carried out for the Cyprus residential building stock as part of the EPISCOPE project, it was found that the final energy demand for heating and cooling of typical houses could be reduced by up to 84% through ambitions energy renovations (Serghides, Dimitriou, Katafygiotou, & Markides, 2015). Indeed, statistical data published by the Cyprus Energy Agency show that that less than 10% of the residential building stock are equipped with wall, roof or basement insulation, while over 50% of the buildings remain without any insulation. Passive cooling techniques and efficient cooling equipment are essential for reducing cooling demand which is particularly high in Cyprus due its hot climate[4]. While the extensive usage of solar thermal systems for the production of domestic hot water (DHW) makes Cyprus one of the worldwide leaders in

[1] Defined by Eurostat as net imports divided by the sum of gross inland energy consumption plus maritime bunker (the EU28 energy dependence amounted to 53.4% in 2014).
[2] Referred to as reference scenario without natural gas (NEEAP 2014)
[3] To be supported with JRC calculations in a separate report
[4] Cooling energy demands account for 51% of the total energy demands in residential buildings in Cyprus as opposed to heat demands which are responsible for 23% of the total (Menicou, Exizidou, Vassiliou, & Christou, 2014)

this area (Panayiotou, et al., 2010), no other renewable energy technologies are widely diffused in the building stock in practice.

Realising the potential associated with the Cypriot building sector requires addressing both new and existing buildings. With the right set of policy tools, it is generally accepted that European governments can play a crucial role in promoting energy efficiency and leveraging more investments in the building sector, especially in the existing stock. Cyprus has put in place a series of energy efficiency legislations, including requirements for new constructions and renovations (Box 1) which are expected to reduce the energy consumption and overall energy dependence of the country in the years to come.

While new buildings built today are more energy efficient than ever before, the ageing part of the stock, which was not built with energy performance in mind, presents a great challenge. Although this theoretically offers an opportunity to incorporate energy saving measures, actual energy renovations taking place today neither meet the scale nor the quality aligned with their overall potential. Economic instruments, offering government-supported incentives towards energy renovations in buildings, can help kick start the market for energy renovations. At the same time, the need for more market action, enhanced private sector involvement and a smooth transition towards mainstream construction of nearly zero energy buildings (nZEBs) are increasingly highlighted.

Box 1- ***Energy Performance Requirements in Building Codes in Cyprus***

The first mandatory energy performance requirements in building codes in Cyprus were introduced with the adoption of the 2007 Decree on the Minimum Energy Performance Requirements for Buildings (Decree 568/2007). The 2007 Decree, which was adopted as a result of the implementation of the EU's Energy Performance of Buildings Directive (EPBD), introduced prescriptive requirements expressed as minimum heat transfer coefficients for the building envelope for all new buildings. The same prescriptive requirements also applied to buildings over 1000m^2 undergoing major renovation. Major renovation was defined as renovation, addition or modification works undertaken in a building whereby the total cost of the works on the building shell and/or technical systems for heating, hot water, air conditioning, ventilation and lighting is higher than 25% of the value of the building – excluding the value of the land – or in cases where the works cover more than 25% of the building envelope (Decree 429/2006).

The minimum requirements were revised in 2009 and performance-based requirements in the form of minimum energy class B under the Cypriot EPC system were introduced for new buildings and buildings over 1000m^2 undergoing major renovation. Energy class B is achieved if the primary energy consumption for heating, cooling, DHW, lighting of the building in question is the range of 50-100% of the equivalent consumption of a reference building. Prescriptive requirements for the building envelope still applied for all buildings and the requirement for solar thermal system for domestic hot water in new residential buildings was introduced. Following a revision in 2013, a new Decree came into force with more stringent heat transfer coefficients (U values were reduced by 15%) as well as additional requirements. For example, a requirement for external shading for existing buildings, regardless of their side, was put in place as well as requirements on building elements replaced or retrofitted. All requirements are presented in Table 1.

Table 2

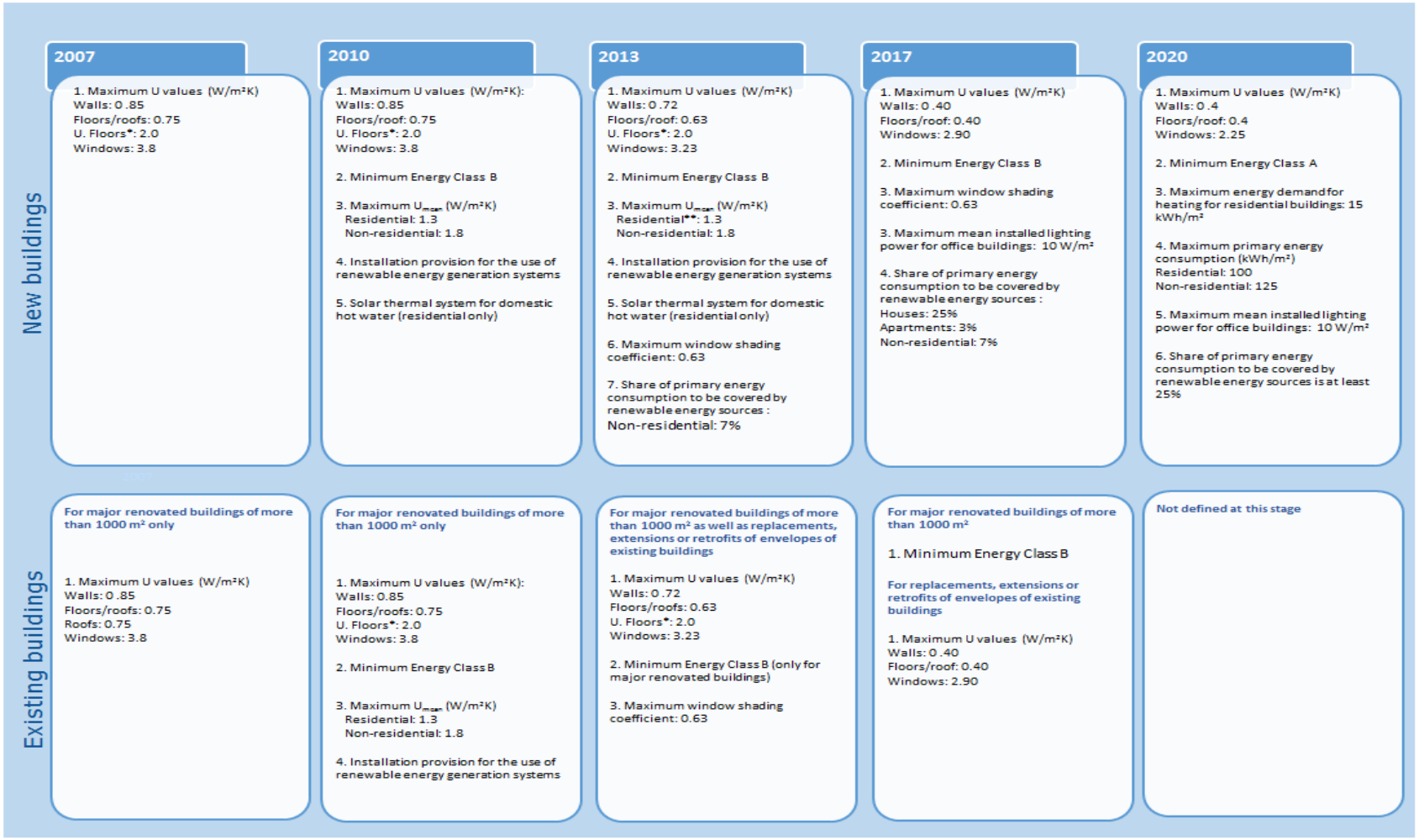
– Main energy performance requirements in the building sector for (a) new and (b) existing buildings

Based on information provided in Decrees 568/2007, 446/2009 and 432/2013, 366/2014, 119/2016

Footnotes:

* U. Floor refers to floors overlying closed unheated spaces which form part of the building envelope

** This does not apply for apartments



2.2 Cyprus financial instruments for energy efficiency in buildings

Over the last decade, financial support for investments in energy efficiency and renewable energy technologies has been made available to Cypriot households, commercial companies and public sector through the following government-supported schemes:

1. Grant Scheme for the promotion of renewable energy and energy conservation (2004-2013)
2. Grant Scheme "I save – I upgrade" (2014-2020)

These schemes are considered an important pillar of the energy efficiency policy in Cyprus, and have generated and expected to generate important energy savings that contribute to both ESD and EED energy efficiency targets in Cyprus (Table 3).According to calculations presented to the European Commission by the Cypriot authorities, these schemes are expected to significantly contribute to the Article 7 target under the Energy Efficiency Directive, whereby collectively they are estimated to reach 48% of the cumulative final energy savings target of Cyprus. Important design and implementation differences are noted between the two schemes, which are discussed in more detail below.

Table 3 - Energy savings (TOE per year) of financial incentive schemes in Cyprus

	Residential	Tertiary	Public
Grant Scheme for the promotion of renewable energy and energy conservation (2004-2013)			
Renewable energy technologies (Part 1 out of 2)			
2012 (achieved)	13443.1	1 177.4	110
2016 (expected)	13628	1 177.4	110
2020 (expected)	1011.1	84.7	0
Energy conservation measures (Part 2 out of 2)			
2012 (achieved)	10523.8	10 331.6	
2016 (expected)	11089.2	10 293.45	
2020 (expected)	1137.2	768	
Grant Scheme for installing photovoltaic systems using the NET-METERING method (2013-2016)			
2012 (achieved)	0		
2016 (expected)	47.62		
2020 (expected)	47.62		

(Source: Cyprus NEEAP 2014)

2.2.1 Grant Scheme for the promotion of renewable energy and energy conservation (2004-2013)

A Special Fund for renewable energy sources and energy conservation was established by the 2003 Law on Encouraging and Promoting the Use of Renewable Energy Sources and Energy Saving (Law 33(I)/2003) with the aim to subsidise:

- Generation or purchase electricity from RES;
- Energy saving installations, equipment or activities;
- Programmes for promoting RES, energy-saving, including cogeneration of heat and power, and providing the public with information.
- Energy conservation in transport sector

The Fund was financed through the implementation of an energy fee equal to EUR 0.50 cent per kWh[5] on electricity consumption for all final consumers. Up to 2012 the fee was 0.224 cent per kWh. The Fund is managed by the Special Fund Managing Committee, comprising members from the Ministry of Energy, Commerce, Industry and Tourism (MECIT), Ministry of Finance, Planning Bureau (currently renamed DG for European Programmes, Coordination and Development), Cyprus Scientific Technical Chamber (ETEK) and General Accountant of the Republic of Cyprus. It used a simple grant-based financial model to support investments in renewable energy, co-generation and energy conservation measures made by natural or legal persons and bodies of the public sector. The scheme run in the period 2004-2013 and allocated a budget of around 100 million for investments in, inter-alia, building envelope improvements, technical building systems, renewable heat and power generation systems.

Under the scheme, financial support covering 30-55% of the purchase and installation costs was provided for various interventions on the building envelope, technical systems and generation of heat and power through renewable sources. The subsidy rate and funding cap varied according to the type of intervention measure, but not according to the intervention ambition (level of energy savings) or household income. Eligible measures included roof insulation in houses with a building permit before 2008[6] in urban and rural areas as well as wall insulation and window replacement for houses in mountainous areas (an altitude above 600m). These were provided only if minimum energy requirements for building elements in new buildings were to be achieved. For technical building systems, a subsidy was given to house owners with a building permit before 2003 to replace their old solar heater for DHW with a new one, and to install solar assisted central heating systems or biomass systems for space heating. For non-residential buildings, a subsidy was given for building envelope improvement and/or technical systems if energy savings of least 10% were to be achieved. Subsidies were also available for installing solar heaters for heating and/or cooling, central solar systems for hot water and geothermal pumps for building types. In 2013, a condition for accessing subsidies for renewable heat generation systems was put in place. Under this condition, a subsidy for renewable heat generation could only be provided if roof insulation, meeting at least the minimum energy performance requirements, was installed.

[5] Compared to electricity prices in 2013, this corresponds to around 2% of the total price for households and industry

[6] Same year which thermal insulation became mandatory for new buildings

In summary, the following eligible intervention measures in the **tertiary sector** were covered:

1. Any energy efficiency technology, which can achieve a 10% primary energy savings;
2. Central solar thermal systems for domestic water;
3. Central solar thermal systems for space heating/cooling;
4. Geothermal heat pumps;
5. Biomass investments;
6. Combined heat and power systems for non-profitable organizations;
7. Geothermal heat pumps for space heating/cooling for non-profitable organizations.

For the **domestic sector** the technologies covered were:

1. Thermal insulation and double glazing;
2. Off grid connected PV systems up to 30 kW;
3. Replacement of solar thermal systems for domestic water;
4. Solar thermal systems for space heating or space heating & cooling;
5. Geothermal heat pumps.

Table 4 – Criteria for receiving subsidies by scheme recipients

Energy-related criteria (holistic)	None
Energy-related criteria (prescriptive)	Prescriptive (only for heat insulation)
Financial-related criteria	Household income (only for subsidies for PVs in households)
Other criteria	Building permit year (only for building envelope interventions and solar water heaters)

The Cyprus Institute of Energy was appointed to examine all the technical parameters of the applications. This examination included an inspection after the completion of the works. While no overall target (e.g. overall energy savings or number of buildings to be renovated) was set by the instrument, a large number of applications (nearly 50,000) have been accepted by the programme over its implementation period. Of the total number of applications, nearly 90% corresponded to residential, 5% non-residential and remainder unknown[7]. In terms of grants disbursed, 52% were allocated for residential buildings and 17% for non-residential buildings and remainder unknown. Due to the popularity of the scheme, the budget was gradually increased over its implementation period to accommodate the growing interest from the public. Overall, the residential building stock was the main beneficiary of the programme and energy efficiency

7 The distinction between residential and non-residential buildings was not possible for these applications

investments constituted the most popular interventions. Assuming that one application corresponds to one dwelling, it can be concluded that nearly 10% of Cypriot residential building stock benefitted from the scheme.

More than 50% of the budget was disbursed for energy efficiency investments, which mainly covered heat insulation measures for residential buildings (**Error! Reference source not found.**). The remaining budget was mainly allocated for renewable energy technologies: solar thermal (25%), solar power (PV) (13%), geothermal (3.25%) and biomass (4.68%). Wind power and co/tri-generation measures were the least popular interventions, covering only 0.0045% and 0.16% of the total disbursed budget, respectively. The most popular measures in terms of accepted applications have been the installation of insulation in residential buildings in non-mountainous areas followed by solar thermal systems for DHW (domestic hot water) in residential buildings. These intervention measures were among the cheapest to finance (EUR 1,275 and 598 on average, respectively). All other measures attracted much lower interest (less than 3000 applications) over the duration of the scheme. The largest financial support per application was provided for geothermal heat pumps (EUR 20,839 per application) followed by PV systems connected to grid (EUR 13,647 per application). For energy efficiency interventions in non-residential buildings, applications were mainly for building envelope insulation (56%), lighting systems (7%), electrical equipment (23%), air-conditioning systems (10%), energy management systems 2% and other.

While the programme has been overall successful in terms of its uptake rate, the following drawbacks are noted:

- The scheme has generally been weak in terms of promoting comprehensive retrofit projects, as the design was based on individual measures. Buildings benefiting from the scheme were exposed to a risk of "locking in" energy savings for years to come due to the lack of holistic approach adopted during renovation works.
- Some technologies have attracted much less interest from target recipients (e.g. cogeneration, geothermal pumps), which raises questions regarding the suitability of this type of financial model to promote some more capital-demanding measures. Low hanging fruits linked to short payback times were instead favoured (e.g. solar thermal systems).
- The scheme's impact on the non-residential building stock has generally been limited. Reasons behind weak participation need to be further examined (e.g. lack of capital, short-term perspective by commercial actors, adversity to long payback investments, etc.) so that appropriate financial models are designed for this segment of the building stock (e.g. stimulation of third-party financing or use of ESCO model).
- Unclear results in terms of wider benefits in terms of financial savings, job creation, etc. The lack of an impact assessment aggravates how the scheme has impacted the wider renovation market.
- While it is difficult to establish how many measures would have been pursued in the absence of the grant scheme (i.e. how high the free rider rate is), it is generally expected that the scheme has been susceptible to many free riders. Largest recipient group are residential owner occupiers, who traditionally have a strong purchasing power.
- Low impact on vulnerable groups, low income households, SMEs and multi-family buildings. Rented buildings were excluded from the scheme all together.

Figure 2 - Total disbursed budget by type of investment (for period 2004-2015)

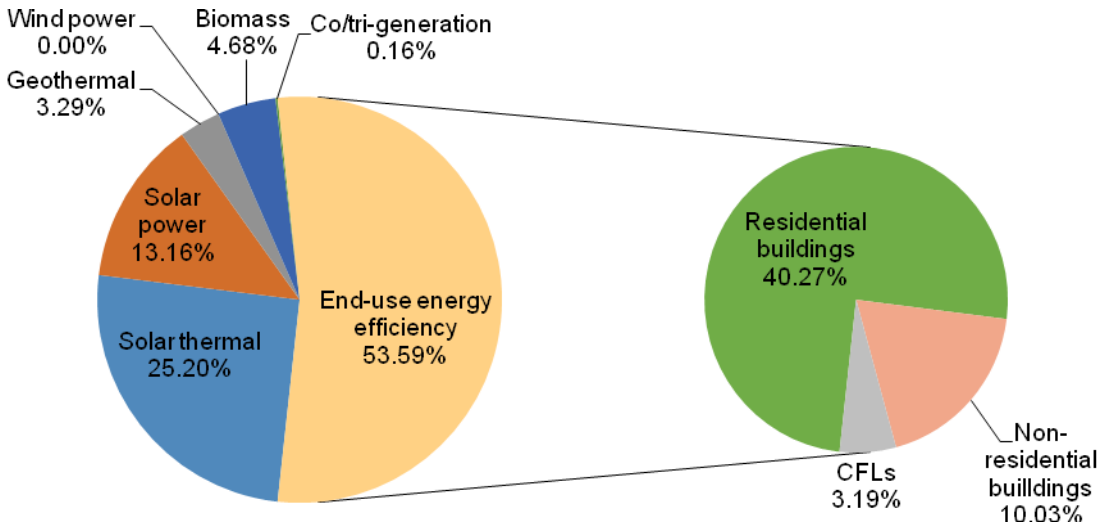


Figure 3 - Applications and average disbursed budget per application (in EUROs) by type of intervention measure

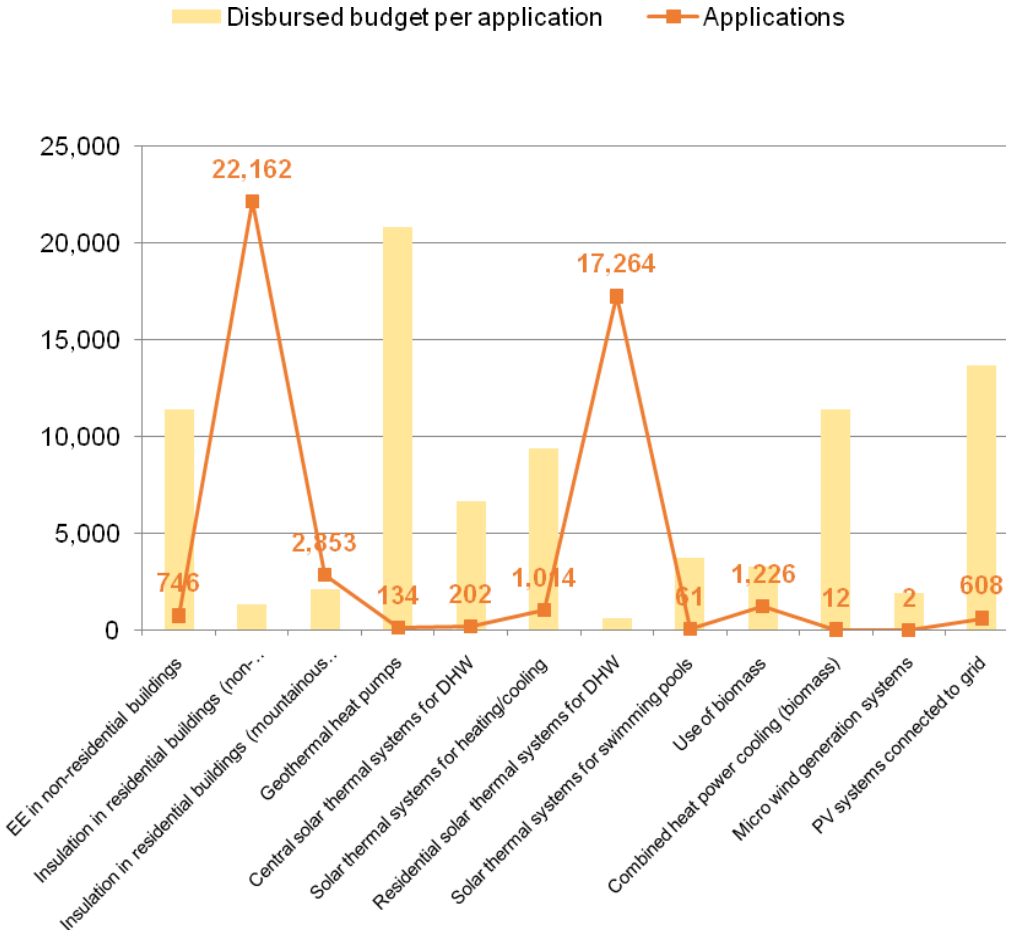


Table 5 - Maximum available funding and average funding spent for various intervention measure types

Measure	Maximum available funding (EUR)	Average funding in practice (EUR)
Energy saving measures in enterprises and non-for-profit organisations	50,000	11,410
Heat insulation measures for residential buildings	2,500	2,073 (mountainous); 1,275 (non-mountainous)
Combined heat, power and cooling systems	160,000	14,473
Geothermal heat pumps	20,000 (residential) 50,000 (non-residential)	20,839
Utilisation of biomass	400,000	3,243
PV system	9,500	3,124
Central solar thermal systems for DHW (non-residential)	10,000	6,664
Solar thermal systems for DHW (residential)	525	598
Solar thermal systems for heating/cooling	50,000	9,361

2.2.2 Grant Scheme "I save – I upgrade" (2014-2020)

With the end of the popular grant scheme in 2013, a new grant scheme was put in place in 2014 in order to encourage households, businesses, SMEs and public sector to adopt energy efficiency and renewable energy measures. The scheme, entitled "I save – I upgrade", is the follow-up of the completed scheme ran in 2004-2013 and is based on the same financial model: provision of grants for direct investments partly covering the purchase and installation costs of various technologies. It targets renovations of existing buildings, with a budget of EUR 15.3 million for the period 2014-2020 for SMEs and EUR 16.5 million for households. The new scheme is co-financed by the EU Cohesion Fund under the Operational Programme Competitiveness and Sustainable Development. In contrast to the first scheme, the responsibility of implementation and management lies with the Ministry of Energy, Commerce, Industry and Tourism which is in charge of information dissemination, application evaluation process, progress monitoring, site-visit verification etc.

In contrast to the previous scheme supporting individual intervention measures, the new scheme provides financial support for packaged measures that meet certain energy performance conditions (e.g. class B on the energy performance certificate or 40% of energy savings after renovation). It therefore requires the assessment of buildings by independent experts (e.g. energy auditors, specialised experts and inspectors[8]) prior to the adoption of measures. Support for renovations that reach nearly-zero energy levels is also available and enhanced support to vulnerable[9] consumers through increased grant rates is provided. Support for energy efficiency upgrades of individual building elements is only available to vulnerable groups. The Scheme also includes grants for energy audits[10] if the recommended measures of the energy audit are implemented.

In summary, the scheme is divided in three categories:

(a) Financial incentives for energy performance upgrade of **residential buildings** for which the building permit was granted prior to the 21st December2007 (first call was opened March 2015);

(b) Financial incentives for energy performance upgrade of **non-residential buildings** owned or rented by a small or medium size enterprises (SMEs) for which the building permit was granted prior to the 21st December2007 (first call was opened in December 2014);

(c) Financial incentive plan for the energy performance upgrade of **public sector buildings** with useful floor area over 250m^{2}built prior to 2008[11];

Under category A, the scheme provides the following financial support:

1. Grant intensity of 50% (75% for vulnerable groups) for comprehensive energy upgrades of residential buildings or building units that achieve at least EPC class B or save at least 40% of their energy consumption levels compared to pre-upgrade levels. The funding cap of EUR 15,000 for buildings or EUR 10,000 for building units applies. A single application should be made by apartment buildings.
2. Grant intensity of 75% for comprehensive energy upgrades of residential buildings to nZEB levels[12] with a funding cap of EUR 25,000.

[8]A qualified expert is always needed to issue an Energy Performance Certificate and recommendations. If the building is above 1000 m2 additionally an energy audit is required.

[9] These are defined as recipients of (a) public assistance, (b) severe motor disability allowance (c) benefit for low income pensioners (d) paraplegic and tetraplegic care allowance, (e) grant to blind as well as large families and low-income families (Decree 218/2013)

10 The energy audit is subsidized only if the measures are implemented. For buildings above 1000m2, the energy audit is mandatory.

[11] This action is not included in the scheme. There is different budget of 20 million that is secured from ERDF for upgrading buildings of the central government

3. Grant intensity of 75% for individual energy efficiency measures (insulation of building envelope, window replacement, and solar thermal systems for DHW) in buildings or building units used as permanent residency by vulnerable consumers with funding cap of EUR 2500, except for solar thermal systems where cap amounts to EUR 750.

An EPC must be issued before and after the completion of the works for buildings benefitting for investments that correspond to groups 1 and 2 only described previously. Prescriptive criteria for individual measures that form part of the comprehensive energy upgrades also apply.

The total budget (public expenditure) in the implementation period 2014-2020 amounted to EUR 16.5 million, with an allocated amount of EUR 8 million for the first call. This budget can be amended and number of calls will depend on the interest in the first call and budget availability. The first call which was opened in March 2015 was recently closed (February 2016) as great interest was received and the allocated budget was terminated.

Under category B, support is provided in the following format:

1. Grant intensity of 50% for comprehensive energy upgrades of non-residential buildings owned or rented by SMEs that achieve at least EPC class B or save at least 40% of their energy consumption levels compared to pre-upgrade levels with funding cap of EUR 200,000
2. Grant intensity of 75% for comprehensive energy upgrades to nZEB levels with funding cap of EUR 200,000

Table 6 – Criteria for receiving subsidies by scheme recipients under second phase scheme

Energy-related criteria (holistic)	Yes, Energy class B or 40% energy savings to be achieved. Grant intensity is higher for more ambitious projects
Energy-related criteria (prescriptive)	Prescriptive (U values)
Financial-related criteria	Higher grant intensity for vulnerable consumers
Other criteria	Building permit year

[12] As indicated in Table 1 -

Table 7 - Main differences between grant schemes run in the period (1) 2004-2013 and (2) 2014-2020

	Grant scheme 2004-2013	Grant scheme 2014-2020
Funding structure	Fund financed by a fee of EUR 0.50c/kWh on electricity consumption for all final consumers	Co-financed with EU Structural Funds
Total available funding	EUR 100 million (corresponding to around 10 million/year)	EUR 31.8 million (corresponding to around 4-5 million per year)
Targeted buildings	Owner-occupied residential buildings; Public sector buildings that exercise economic activity; Commercial buildings; Buildings of non-for-profit organisations	Residential buildings or building units part of an apartment building; Buildings owned or rented by SMEs
Energy upgrade target	-	Class B, 40% energy savings, nZEB renovation
Factors determining financial support level	Technology type	Household income; Ambition of energy upgrade
Main Intervention measures	**Residential**: Building envelope insulation; Solar thermal systems; PV systems **Non-residential**: Recovery of waste energy; Reduction of non-productive energy consumption and energy losses; Energy management systems; Automation; CHP system, Solar thermal systems; PV systems	**Residential/Non-residential:** Building envelope insulation; Window replacement; Energy efficiency boilers for space heating/DHW; Geothermal heat pumps; Solar thermal systems; Biomass boilers; Efficient light bulbs; waste energy recovery systems; CHP systems; Smart meters; External removable or fixed shading; Energy efficient air conditioning systems(split units)
Implementation body	Cyprus Institute of Energy	Ministry of Energy, Commerce, Industry and Transport

An EPC before the energy upgrade and a techno-economic study including the net present value and payback time of investment as well as expected energy savings after the implementation of all measures are obligatory for both groups. The study should be signed either by the energy auditor or qualified expert. Moreover, for buildings with useful floor area above 1000m^2 an energy audit or energy management system must be established for both groups. For group 1, prescriptive criteria for the building envelope elements (U-value) apply, as defined in building codes.

Table 8 - Applications received and approved so far under the first call of the new grant scheme for residential buildings

	Comprehensive renovations (all groups)	Single measures (vulnerable groups)
Total applications	1076	62
└ Evaluated applications	593	62
└ Approved applications	422	47
└ for vulnerable groups	21	47
└ Rejected applications	49	9
└ Extra info is needed	95	6

Table 9 - Results achieved so far under the first call of the new grant scheme

	Approved applications	Average Energy Savings (kWh/year)	Average investment (EUR)[13]	Average allocated grant (EUR)
nZEB renovations	35	77049	39633	-21800
40% savings renovations	111	47199	20857	8505
Class B renovations	297	48376	23773	9595
Single measures	47		4081	1887

While it is too early to draw conclusions on the success of the scheme, several observations can be made:

1. The scheme has been successful at linking financial support and energy performance certificates. The minimum class to be achieved on the EPC scale, together with the mandatory pre- and post- upgrade submission of EPC documents provide a boost to the EPC market, raising awareness about its benefits among the public and harnessing its market potential as a driver for energy efficiency upgrades.
2. The list of technologies has expanded to include technologies such as smart meters and passive solar cooling measures (solar shading) that were not supported by the previous scheme. PV systems are no longer supported by the scheme (these are instead covered by the net-metering scheme – see page 19).

[13] VAT is not included

3. In contrast to the previous schemes, the new scheme involves the indirect participation of important actors of the energy efficiency supply chain, e.g. energy auditors and certifiers. The participation of ESCOs however is not promoted at this stage (even though it is theoretically allowed to finance the renovation from a third party).
4. Apartment owners can participate for the first time in the scheme. While the scheme is open to collective upgrades of several units of a single apartment building through a single application represented by the management committee of the building, it is not clear how practical obstacles associated with renovating an apartment building will be overcome in practice.
5. The large number of submitted applications for financial incentives for energy performance upgrade of residential buildings (Category A) meant that the first call was completed within its first year of implementation. The participation of SMEs however has been so far low despite the first call for Category B being open for more than two years.
6. A large interest in comprehensive upgrades has so far been received. Approved applications for packaged measures versus single measures are at the ratio 5:1 (Table 8).
7. Equivalence between the ambition of an energy upgrade of energy class B and that of 40% savings is not always ensured. Buildings of energy class G, F, E and lower band of class D which undergo energy upgrades corresponding to 40% energy savings do not reach energy class B after the renovation (see Box 2 for more details).
8. Rented residential buildings are in practice difficult to be addressed as the scheme does not help align incentives between landlords and tenants. That is, while landlords can, in theory, apply for an upgrade of their rental properties, in practice the split incentive barrier remains an important hurdle. Moreover, each beneficiary can submit only one application. The design of the scheme is such that vulnerable groups do not receive any information on the EPC of their building throughout their participation in the scheme nor do they receive the extra incentive for nZEB renovations.
9. Bureaucracy issues mean that steps such as checking of applications, disbursing money and administrating fund can be quite long. Complex procedures and limited infrastructure/capacity are causing delays.
10. Dissemination channels remain the same as before, with no special information tools in place. The ministry website remains the principal source of information, although since the beginning of 2016 the information aspect of the scheme was dedicated to Cyprus Energy Agency. Weak outreach to vulnerable groups or SMEs could be one of the reasons behind low participation by these groups.

2.2.3 Scheme for photovoltaic systems using the net-metering method (2013-2016)

The scheme for photovoltaic systems using the net-metering method was established in 2013 with the aim to promote the use of PV systems originally in owner-occupied residential buildings, and since December 2015 in all buildings. By participating in the net-metering scheme, electricity consumers of any type of building can deduct the electricity produced by photovoltaic systems on the roofs of their buildings with a capacity of up to 5KW (before December 2015 the limit was up to 3kW) from their consumption every two months or every month based on the consumer type. The production can excess demand from the grid up to a certain amount. The purchase and installation fees are fully covered by the domestic electricity consumers. Access of electricity from renewable energy sources to the grid is granted according to the principle of non-discrimination. With regard to the use of the grid, renewable energy is given priority.

The installation of PVs is subsidised only for sensitive and vulnerable groups (e.g. low income families).These beneficiaries, who can also participate in the net-metering scheme, can receive a grant up EUR to 900 /kWp, with a maximum amount of 2700 euro before VAT, for the purchase and installation of photovoltaic systems on the roofs of their buildings with a capacity of up to 5kW. The funds used to pay out the grants were extracted from the Special Fund for Renewable Energy Sources and Energy Efficiency.

The measure aimed to gradually install more than 8000 domestic photovoltaic systems with a capacity of up to 3kW, of which more than 2000 correspond to vulnerable groups. Alongside the grant scheme, the installation of 45 000 photovoltaic systems is planned. So far, grants amounting to EUR 5,486,360 were allocated to 2,040 applications by vulnerable groups, exceeding the target. For the period 2015-2016, the target is to install PV systems under the net metering scheme with a total installed power of 20MW (1.2 MW for domestic vulnerable groups, 8.8 MW for all other domestic groups and 10 MW non-residential customers).

2.2.4 Commercial programmes

Commercial banks in Cyprus do not currently offer any dedicated credit lines specific to energy efficiency investments in Cypriot households, businesses and wider public sector. Support provided to energy efficiency investments by banks are currently offered in the form of traditional loans, which are not tailor-made to energy efficiency investments. This is mainly the case with the biggest financial institution of Cyprus, Bank of Cyprus. The recent banking crisis and, in particular, large share of non-performing loans in the Cypriot banking system, however creates unfavourable conditions towards the market development.

JEREMIE loan scheme

JEREMIE (Joint European Resources for Micro to Medium Enterprises) is a joint initiative of the Commission and the European Investment Fund (EIF) with the European Investment Bank. It aims to improve access to finance for medium, small and micro enterprises, in particular through the supply of venture capital, loans, guarantees, micro-credit and other forms of repayable assistance. This is a funded risk sharing product which is implemented in the framework of the EU JEREMIE Initiative with the support of the European Regional Development Fund (ERDF).

In 2011, the EIF signed two guarantee agreements with the Bank of Cyprus, allowing the bank to provide up to EUR 50 million of new loans to Cypriot Micro and Small enterprises

("MSEs"). Under the JEREMIE, a Holding Fund co-financed with EU structural funds is managed in Cyprus. The EUR 100 million of initial capital is matched by equal contributions from EIF's selected financial intermediaries, translating into EUR 200million of finance to the benefit of Cypriot SMEs. The Cyprus Entrepreneurship Fund (CYPEF) has been developed to tackle specific access to finance constraints experienced in Cyprus and will profit from the experience gained under the JEREMIE initiative. It particularly aims to enhance bank financing for smaller and riskier SMEs, under which the Bank of Cyprus to offer EUR 60 million of loans at favourable conditions.

Loans of amounts of up to EUR100,000 are made available to small and micro enterprises through this programme, for the support of the expansion, development and strengthening of these businesses. The JEREMIE loans are attached to favourable terms, in relation to the pricing policy, the repayment period, the grace period, as well as the collateral required. The loans aim to support investment projects involving tangible and intangible assets. This may cover upgrade of company infrastructure or machinery, extensions to existing offices/warehouses and other existing premises, meeting costs relating to R&D, costs relating to the setting up of a new company, etc.), as well as provision the necessary working capital related to the establishment, strengthening or expansion of new or existing business activities of the customer (such as purchase of raw materials, stocks and other manufacturing inputs, services, salary payments and other operating costs).A clear link with energy efficiency, however, has not been made clear.

2.3 Economic instruments promoting building energy efficiency improvements across the EU

Economic instruments in the form of tax incentives, grants, subsidies, soft loans, direct investments, etc. are used by many EU countries as a means of fostering the market of energy efficiency. A review of conventional financial incentives targeting new and existing buildings across the EU is presented here. Given the decision of the Cypriot government to opt for the alternative approach for the implementation of the EED Article 7 requirements, we focus on financial and fiscal instruments, such as loans, grants and income tax credits (see Table 10). Energy efficiency obligations and white certificate schemes are therefore not within the scope of this report.

Good practices across the EU have been identified by selecting measures that are based on one or more of the following criteria:

1. **Significant impact**: Measures with demonstrated significant quantifiable results. This includes measures that reach a wide recipient group, contribute to large energy savings and deliver significant multiple benefits (e.g. job creation etc.).
2. **Ambitious energy upgrades**: Measures that support comprehensive energy upgrades and/or encourage state of art constructions and renovations (beyond minimum requirements prescribed in building codes).
3. **Funding sustainability**: Measures that make use of innovative funding mechanisms (e.g. revolving funds), diversify funding sources (e.g. blend national sources with EU Funds and other international sources), earmark funds from taxation of fossil fuel use to clean sources and sustain low pressure on public finances.
4. **Continuity**: Measures that offer continuity based on lasting commitment by the government, which in turn provide confidence and motivate market actors to engage in long-term investments.
5. **Outreach to vulnerable and difficult-to-address groups**: Measures designed to support vulnerable groups of the society (e.g. low income households),

alleviate fuel poverty or tackle segments of the building stock facing severe barriers (e.g. condominiums, multi-tenure or rented properties).

Table 10 - Types of conventional economic policy instruments

Financial instruments	Grants; Concessional/soft loans, revolving funds; guarantee funds
Fiscal instruments	Energy taxation; Income tax credit or deduction; Accelerated depreciation; VAT reduction; Property taxation; Tax rebates
Market-based instruments	Energy efficiency obligations; White certificate schemes

2.3.1 Grant schemes

Grant schemes can be a useful instrument at kick-starting the energy efficiency market by subsidising the cost of energy efficiency projects (e.g. through a fixed payment or percentage of the total value of the investment) for households and businesses. Many EU countries have opted for this type of incentive mechanism in order to support energy efficiency investments as they can fill an immediate financial gap by partly helping overcome the upfront cost barrier thus enabling a temporary shift in the market. Although grants generally score low on the continuity and funding sustainability criteria (Table 11), they constitute the most popular mechanism that governments use to encourage energy efficiency improvements in the building stock to-date. These mainly serve as direct investment subsidies which may cover the entire renovation costs including acquisition of material/equipment, advice, certification and installation. Across EU Member States, grants are offered for projects with investment size ranging from a few thousand to over EUR 1 million(Economidou & Bertoldi, 2014). This reflects the varying nature and scope of the eligible projects. Financial support provided can be expressed as a percentage of the total investment– with reported grant intensities in the range of 15%-100%– or as a subsidy expressed as EUR/m^2. Any remaining costs are either self-financed or covered by a loan. The grant intensity (subsidy level) may vary with the following parameters:

- **energy performance**–e.g. subsidy is linked to amount saved in energy or energy costs meaning more support is provided for more ambitious projects;
- **household income**–special conditions may apply for low income households or customers subject to fuel poverty;
- **specific target group**–e.g. condominiums or rented properties may have access to higher grant intensity;
- **type of intervention measure**– e.g. some harder-to-implement interventions such as insulation may be associated with higher intensity;
- **innovativeness of technology**–new, emerging technologies receive more support to help their entry to the market

In European countries, funding mostly originates from national and regional budgets but other sources such as EU funds and sale of assigned AAU units can be used. National governments form the main implementing bodies of grant schemes, while dedicated funds, energy efficiency agencies and public banks (e.g. Kommunalkredit Public Consulting, KPC and KfW) can also be in charge of gathering and dispersing funds to target groups. Funding continuity remains a key issue, which is aggravated by the on-going financial crisis in some countries. Restrictions on the public budget in some countries in certain cases have led to the discontinuation of such programmes (e.g. Belgium).

Although grant schemes are typically associated with high uptake rates, even the most prominent instruments cannot offer a real widespread implementation. For example, the Austrian programme in the years of 2009-2011, resulted in interventions of residential buildings in the order of 200,000 dwellings, corresponding to around 1.6% of annual renovation rate of their residential building stock. Other schemes have been found to have a much smaller effect. In addition, grant schemes often attract recipients who would have carried out the investments even without the incentive, the so-called free riders. A more careful design of grant schemes can reduce the effects of free ridership. For example, the eligible interventions can be restricted to renovations leading to state-of-art energy performance or it can be limited only to a specific target group, e.g. low income households, tenants and small and medium enterprises.

Table 11 - Overview of grant schemes as a vehicle for financing energy efficiency investments

Advantages	Disadvantages
• Can support the initiation of a new market (e.g. energy renovations) • Can be used to provide financial assistance to vulnerable groups or low-income households • Can support the diffusion of new promising technologies • Can support energy efficiency projects that normally would be too small to get attention from commercial banks	• Can be costly for the public budget • Budget restrictions may threaten its continuation and reduce predictability of future investments for market actors • Strong evidence of high number of free riders • Not a sustainable financial model in the long-term; Cannot offer massive uptake • Typically more suitable for single measure financing which can lead to locking in energy savings • Associated with significant paperwork or other application processes, which can discourage beneficiaries • May have a negative impact on the market by leading to an increase in the cost of equipment, as a result of manufacturers or contractors raising their prices in anticipation

Below some good EU practices are selected which can provide valuable insights that can be used to further improve the on-going Cypriot incentive schemes. The Austrian housing subsidy has been successful at providing continuity to the market as well as supporting investments for ambitious energy efficiency projects for both new buildings and renovations that reach energy performance levels beyond current code levels. The Belgian scheme promotes exemplary construction and renovation projects by providing financial help to both the designer and the building owner. This could be a great tool for demonstrating how various zero energy building concepts can be applied in Cyprus at a cost effective way using integrated design principles. Ireland's Better Energy programme is an umbrella scheme which provides useful lessons on how to effectively run various grant schemes and facilitate a streamlined application process that can help reduce delays.

Austria

Instrument name	Housing subsidy (German: "Wohnbauforderung")
Target buildings	Residential buildings
Intervention type	New constructions and renovations of existing buildings
Implementation period	1990-
Target groups	Households; Low income households; Housing associations
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Connection to district heating
Grant intensity	Depends on project ambitiousness (more energy savings, higher grant rate)
Av. renovation depth	60-70% of energy savings
Eligible buildings/households	At least 20 years old; limited income households
Energy criteria	At least current energy building code levels
Total disbursed budget	EUR 1,690,000,000 (2009-2011)
Enrolled buildings	216,264 dwellings (2009-2011)
Total investment made	NA

The housing subsidy is the longest-running and most important incentive system for households and businesses for the reduction of energy consumption in Austria. Originally dating back in 1968, housing subsidies started as a means of facilitating the access to modern dwellings for people with low income. In the late 1990s, the programme was transformed and became the main instrument to support the energy and climate strategy efforts. The programme has been successful in supporting ambitious energy efficiency investments in both new and existing buildings. The programme absorbs large amounts of public funds and is implemented at regional level. Some regions also offer the possibility of loans.

Private households can receive subsidies for new constructions and renovations that may cover insulation of outer walls, ceilings, replacement of windows and doors and installation of renewable heat generation systems. For renovations, the criteria to be fulfilled in order to be eligible for the subsidies include the age of the building (over 20 years) and energy performance levels to be achieved after the intervention. The financial support is provided as percentage of the investment, where more support is provided for more ambitious buildings. The subsidy rates have been altered several times over the years due to different political and financial framework conditions. Additional subsidies are foreseen for insulation material based on regenerative natural resources and for the issuance of energy performance certificates, while the subsidy rate increases for projects that generate higher energy savings. Low income families can access special subsidy.

The energy performance certificates before and after renovation are controlled, while monitoring for multi-storey buildings is mandatory. It is estimated that around140 kWh/m^{2}of final energy savings are achieved are on average per building renovation.

Table 12 - Financial support provided under the scheme for new constructions in the Province of Styria according to the energy efficiency level (for area to volume A/V ratio of at least 0.8)

	Specific heating demand	**Financial support provided**
Renovation	75 kWh/m^2a	45% of annuity of bank loan for 15 years
New construction	45 kWh/m^2a	45% of annuity of bank loan for 15 years

The subsidy scheme is implemented at regional level whereby regional programmes share the same "concept" in terms of design. Differences exist however, e.g. in terms of strictness of EP level after renovation or the system used to evaluate the level of subsidy to be granted (e.g. "step" system VS "point" system). Table 12 shows the financial support provided under the scheme for new constructions in the Province of Styria according to the energy efficiency level. Deep energy renovations covering renovation work on the building envelope and/or the technical systems is also supported as long as it includes at least three intervention measures[14] and the heating demand does not exceed 75 kWh/m²a at a minimum surface to volume ratio of 0.8 and 35 kWh/m²a at a maximum surface to volume ratio of 0.2. The subsidy takes the form of either a non-repayable 30 % interest subsidy on a bank loan with a term of 14 years or a one-off non-repayable contribution of 15% of the approved total subsidised construction costs up to a maximum of EUR 30 000 per dwelling.

The government is responsible for gathering and disbursing funds to the target group. Some provinces collaborate with banks, but this was expected to change back to provincial/regional government control. The communication channels used to disseminate information about the instrument to the relevant target groups include internet, brochures, information campaigns etc. The source of funding is through national taxation, but this can differ from one province to another.

According to the Austrian NEEAP 2014, the scheme is expected to generate 73 000 TJ of cumulative energy savings in the period 2014–2020, which corresponds to32% of the EED Article 7 target set by Austria. In 2013, 24,028 renovation projects were supported and triggered investments of EUR 847 million. The average subsidy amounted to approximately 4,900 EUR.

[14]Window areas, Roof insulation or top floor ceiling, Facade surface, Basement ceiling, Energy-relevant building services systems

Table 13 - Subsidies given at national level under "Sanierungscheck" programme for renovation of private households (for area to volume A/V ratio of at least 0.8)

Specific heating demand after renovation	**Grant provided (EUR)**
40 kWh/m^2a	8000
50 kWh/m^2a	5000
69 kWh/m^2a	4000
50% reduction	3000

Belgium

Instrument name	The "Exemplary Buildings" call for projects (BatEx programme)
Target buildings	Residential, commercial and public buildings
Intervention type	New construction and renovation of existing buildings
Implementation period	2007-
Target groups	All applicants (households, public authorities, NGOs, enterprises, promoters) who are constructing or renovating in the Brussels Region
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Renewable electrical power generation systems; Other energy-related measures; Non-energy related measures
Grant intensity	100 EUR /m^2
Av. renovation depth	30-40% energy savings
Eligible buildings/households	Any building as long as project meets 4 types of criteria: (1) energy efficiency; (2) sustainability (3) cost-benefit + reproducibility and (4) architectural quality + visibility
Energy criteria	Energy performance must be exemplary
Total disbursed budget	EUR 28,437,135 (5 project calls)
Enrolled buildings	193 buildings of 521,836 m^2 (5 calls of projects)
Total investment made	EUR 677,006,888

Since 2007, the Brussels-Capital Region has organised calls for "exemplary building projects" in order to promote exemplary construction and renovation projects in terms of energy and environmental performance as well as demonstrate the technical and economic feasibility of these projects. The exemplary building project programme has a two-fold goal: stimulate the supply for eco-construction and increase the market demand of more energy-efficient buildings.

The call for projects is open to all developers who build or renovate in Brussels: individuals, public authorities, public institutions, private companies (real estate developers, contractors), non-profit-making associations, etc.). Given the wide scope of the programme, the size of eligible buildings can range from 120 m^2 to 10,000 m^2.Applicant projects vary in terms of building type (individual housing, collective housing, schools, crèches, offices, commercial, etc.), owners (households, public sector, non-market sector and private sector) and construction phase (new buildings or renovations).

Each applicant project undergoes in-depth technical analysis by external experts before being presented to a jury, which selects projects on the basis of four criteria: (1) energy performance, (2) sustainability (water management, ecological materials, etc.), (3) technical reproducibility, viability and cost-effectiveness and (4) visibility and architectural quality of the project. Successful candidates must sign a contract with

Brussels Environment, which outlines commitments and obligations. The Brussels Capital Region then provides the following technical, financial and outreach support:

- financial assistance for the design and execution of the buildings(paid out after the inauguration of the project);
- technical assistance to help beneficiaries achieve project objectives;
- public visibility for buildings and their designers

The financial help (EUR 100/m^2 subsidy) is distributed between the designer and the client (building owner), as shown in Table 14. The amounts granted must be justified by eligible expenses. For the designer, these involve costs for development of the architectural concept and development of the energy and environmental performance of the project (PHPP calculation, dynamic simulation, etc.). For the contracting client, any expense related to meeting the commitments with regard to energy and environmental performance of the building (special materials, technical facilities, renewable energies, etc.) is taken into account.

Approved projects are given a 4-year period for completion, after which an inspection is carried out to evaluate the energy efficiency of the building, and the site is officially labelled an exemplary building. All projects must be completed within fixed deadlines, and are monitored at the building site and in terms of their real consumption (for five years) to check whether the performances indicated are achieved. During this period, the owners are obliged to submit regular energy consumption reports to Brussels Environment Administration in order to verify their real energy performance.

Table 14 – Financial assistance provided under the Belgian scheme

	Financial assistance
Contracting client	EUR 90/m²with maximum grant support of EUR 500,000 per project
Designer designated by the contracting client (architect, consulting firm, etc.)	EUR 10/m²with grant support ranging from EUR 5,000-100,000 per project

A total budget of EUR 33 million in 6 calls for projects has been administered in the period 2007-2013, supporting 243 buildings of total floor area 621,000 m^2. For the period 2007-2012, the total investments amounted to EUR 677,006,888, which correspond to EUR 1297 per m². The scheme has had a notable impact on the promotion of passive building designs since its implementation, before which there were no passive house constructions. The most economically disadvantaged municipalities are among the most active applicants and statistics show that the BatEx programme is better known in low-income neighbourhoods. The main reason behind its success is the combined technical and financial assistance, constant follow-up by experts, significant financial results and increase of technical autonomy via better understanding and self-management of the systems. By reaching critical mass of energy efficient buildings, the scheme has managed to demonstrate the replicability of energy efficiency designs.

Ireland

Instrument name	Better Energy Homes scheme
Target buildings	Residential buildings
Intervention type	Renovations of existing buildings
Implementation period	2009 -
Target groups	General public; Households; Low income households; Housing associations; Landlords; Owner occupiers
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems
Grant intensity	Average grant is 30% of total works. Grant levels were reduced since the scheme started as market competition provided lower prices for most works
Av. renovation depth	N/A
Eligible buildings/households	Built before 2006
Energy criteria	State-of-art (beyond current standards) - at least 25% better than standard
Total disbursed budget	EUR 159,000,000 in the period March 2009 - End of October 2013
Enrolled buildings	151,228 buildings (377,188 measures) in abovementioned period
Total investment made	EUR 441,000,000

The Better Energy Programme, launched in 2011, brought three existing programmes under one umbrella: Home Energy Saving Scheme (HES), Warmer Homes Scheme (WHS) and Greener Homes Scheme (GHS). With the launch of the programme, the Home Energy Savings scheme was incorporated into the residential retrofit scheme 'Better Energy Homes'. The Programme is administered by the Sustainable Energy Authority of Ireland on behalf of the Department of Communications, Energy and Natural Resources (DCENR).

The Better Energy Homes Scheme was designed to stimulate energy efficiency actions and reduce energy usage by homeowners and the general public. It forms part of Ireland's efforts to deliver energy savings under their National Energy Efficiency Action Plan (NEEAP). The Sustainable Energy Authority of Ireland (SEAI) grant-aids householders who want to make their homes more energy efficient by providing incentives towards the implementation of energy efficiency measures including attic and wall insulation and heating controls with efficient boilers. The average grant rate is 30% of total works but has been reduced since the scheme started as market competition provided lower prices for most works. The minimum grant of EUR400 requires combination of at least two measures if either attic or cavity wall insulation is a measure.

The scheme is managed by the Sustainable Energy Authority of Ireland. A user-friendly website available to the general public provides information on all stages of the process, with useful video material and easy-to-follow application process steps. Beneficiaries can

send their applications online and must complete several steps in a 6 month timeframe in order to be eligible to receive the grant payment. This ensures that the timely procedures are followed. An official Building Energy Rating (BER) is completed on each home which receives an energy upgrade detailing all energy efficiency measures carried out on the house. Inspections are carried out on a sample of homes completed to ensure that standards are maintained.

Expected energy savings based on stated Government commitment to achieve a total of 8,000 GWh from retrofit of domestic and non-domestic buildings and services. Better Energy Homes represents 75% of the total effort. Measurement and verification of savings are developed as part of the supplier obligation scheme delivered from 2011 onwards.

In 2014, EUR 20million has been allocated to the scheme. It is anticipated that this will lead to approximately 70 GWh (24 ktCO2) in energy savings, supporting an estimated 928 jobs. Over EUR 162.7 million has been granted to homeowners, which enabled 155,283 homes to undertake 387,870 energy efficiency measures. Over EUR 60 million in grants were paid by the end 2010, leveraging over EUR 140 million from the private sector.

Funding is allocated for energy efficiency improvements of homes experiencing fuel poverty, through the Better Energy Warmer Homes under the Better Energy programme. The scheme targets low-income housing retrofits and delivers measures free of charge to the customer. The Government has committed significant funding of EUR 20 million to the Better Energy Warmer Homes scheme in 2014 which will support the delivery of energy efficiency measures to approximately 12,000 energy poor homes, resulting in energy savings of 23 GWh, corresponding to monetary savings of EUR 1.5 million (6 kt CO2) and supporting 417 jobs.

2.3.2 Tax incentives

Tax incentives can increase demand for energy efficiency projects by reducing the cost of the energy efficiency improvement through reduced taxes for households and businesses. They can be less costly than grant schemes and are considered a popular instrument promoting energy efficiency in certain EU countries. They may work well alongside a taxation scheme, whereby the tax loss attributed to the tax incentive scheme is offset by revenues from taxation for energy intensive industries. They are effective if the tax collection rate is sufficiently high and can be useful at promoting new technologies that lack profitability at current stage. They can take various forms, such as accelerated depreciation, tax exemptions, income tax or VAT reduction (Table 15). As in the case of grant schemes, tax incentives are susceptible to free ridership issues and therefore careful design of this policy is needed.

Table 15 – Types of tax incentives (Hilke & Ryan, 2012)

Tax deduction	Eligible investment costs relating to energy efficiency measures can be deducted (fully or in part) from income or revenues liable to taxation
Tax credit	Similar to tax deductions but investment costs are deducted (fully or in part) from respective taxes due to be paid
Tax reduction	Purchase taxes or sales taxes are reduced for qualifying equipment or services, e.g. reduced value added taxes for insulation material and installation services. This is either done directly at the point of sale (tax reductions) or applications for tax refund must be filed after the purchase (tax rebates);
Accelerated depreciation	It allows purchasers to depreciate the costs of their energy efficiency investments more rapidly than standard investments, thus effectively reducing the after tax total cost of the equipment;
Tax or customs duty exemptions	They relieve purchasers from paying customs duties or import taxes on qualifying imported equipment or excise tax on consumption or purchase of specified products, e.g. highly efficient appliances.

Income tax credits or deductions form the most common type of tax incentive scheme across the EU. Tax schemes directed towards energy renovations of buildings are currently favoured in Belgium, Denmark, Netherlands, France, Italy and Greece. The schemes are often designed with a specific technology focus, which mean that they are designed to stimulate investments in specific technologies/measures rather than set overall energy performance criteria. An exception is the Italian tax credit scheme which offers the option of a comprehensive retrofit package in addition to their list of individual measures. France, in its recently enacted Energy Transition for Green Growth has announced rebates for home renovations, whereby taxpayers will receive a tax credit corresponding to 30% of renovation costs incurred to make their homes more energy efficient. In the Netherlands, the Dutch Energy Allowance investment scheme offers innovators a stimulus to develop new technologies that have a better energy efficiency performance than reference technologies. By allowing for frequent updates of the eligible measure list, the schemes can facilitate the market introduction phase of new technologies. Selected schemes are described in more detail below, as they can provide examples of how to effectively design a potential tax incentive scheme in case this type

of instrument is to be considered in the future by the Cypriot authorities. While tax incentives can be expensive due to reduced government income as a result of lowered collected tax, these should be considered in conjunction with new tax revenues as a direct impact of the scheme. The latter has been possible in the case of the French and Italian schemes.

Table 16 - Overview of tax incentive schemes as a vehicle for financing energy efficiency investments

Advantages	Disadvantages
• Can work well if the tax collection rate is sufficiently high • Can be useful at promoting new technologies that lack profitability at current stage • In certain cases, they can increase tax revenues to the government ○	• Usually have a poor performance in an economy in recession or in transition • Less effective if tax evasion is easy high or tax collection rates are low • Can be subject to the problem of the "free rider" • Tax savings to households and businesses typically mean reduced tax revenue to the government

Italy

Instrument name	Tax credit for energy efficiency improvement measures in the residential sector
Target buildings	Residential buildings
Intervention type	Renovations of existing buildings
Implementation period	2007-
Target groups	Households; Small and medium enterprises
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems
Tax relief	Income tax credit of up to 65%
Av. renovation depth	NA
Eligible buildings/households	All
Energy criteria	Specific technical requirements according to intervention type; 20% primary energy demand reduction for heating compared to current building code levels
Total budget	EUR 8.5 billion (2007-2011)
Enrolled buildings	1,250,000 dwellings (2007-2011)
Total investment made	EUR 15.5 billion (2007-2011)

The Budget Law 2007 first introduced this fiscal incentive to provide direct support to energy efficiency measures in existing buildings. It provides tax credits to households for comprehensive or single retrofit energy efficiency measures, such as thermal insulation, installation of solar panels, replacement of heating and air-conditioning systems or comprehensive refurbishments. The scheme also offers the option of a comprehensive retrofit package in addition to their list of individual measures. The package requires a minimum 20% primary energy demand reduction for heating compared to current building code levels. The total deductible amount is then distributed over a period of ten years. For interventions made in 2007 the deduction was spread over 3 years; in 2008 from 3 to 10 years; in 2009-2011 over 5 years. Tax credit can cover 55% of the energy-related cost, but cannot exceed a maximum value that is determined by the type of measure taken. From June 2013, the tax credit has been increased from 55% to 65%.Tax credits are reimbursed over the 10 year period, beginning with the completion of work.

For some interventions (e.g. building envelope), energy certification is required. Legislative Decree 63, 4 June 2013, raised to 65% the tax deduction and extended to 31/12/2013 the incentives (30/06/2014 for renovations carried out on the common parts of residential buildings). Law n.147/2013 extended the 65% tax deduction to 31/12/2014 (30/06/2015 for renovations carried out on the common parts of residential buildings) and foresee a 50% tax deduction from 01/01/2015 to 31/12/2015 (30/06/2016 for renovations carried out on the common parts of residential buildings).

The Italian Energy Efficiency Agency (ENEA) is responsible for the implementation. The mechanism is renewed year by year through the National Finance Act. A large informative campaign through workshops and training courses was carried out by ENEA,

together with the continuous updating of the aforementioned dedicated website and an annual report provided to the Ministry of Economic Development. Fiscal checks are widely implemented by the Italian Revenue Agency on the basis of the technical and fiscal documentation sent to access the incentive procedure. The single measures with the highest uptakes for the Italian scheme include window replacement, replacement of heating systems and thermal solar installations.

The scheme is "self-funded" as the tax returned by authorities is recuperated by the tax paid by the construction companies/installers who would otherwise not declare their revenue.

France

Instrument name	Reduced VAT on works in residential buildings
Target buildings	Residential buildings
Intervention type	Renovations of existing buildings
Implementation period	1999-
Target groups	Households; Low income households; Building professionals; Housing associations; Landlords; Owner occupiers; Tenants
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Renewable electrical power generation systems
Tax relief	VAT reduction. For the year 2013, the reduced VAT was 7% instead of 19.6%. In 2014, the new reduced VAT should be 5% instead of 20% (new VAT rate too).
Av. renovation depth	NA
Eligible buildings/households	Only on residential buildings built at least 2 years before the time of implementation of measures
Energy criteria	No energy-related criteria.
Total budget	EUR 5 billion (Open 2011)
Enrolled buildings	6 million dwellings (Open 2011)
Total investment made	EUR 38.5 billion (Open 2011)

The VAT reduction has been implemented for the first time in 1999. Its level has been modified over time. Until 2014, this reduced VAT applied for all types of works in residential buildings. From 2014, this reduced VAT will only apply to energy refurbishment works (and induced works). For the year 2013, the reduced VAT was 7% instead of 19.6%. In 2014, the new reduced VAT should be 5% instead of 20% (new VAT rate too).

Loss of earnings for the State budget corresponded to a VAT loss of 7-19.6%. This includes all residential buildings works. The measure was not specifically targeted at energy savings and it estimated that 49% of these have resulted in energy performance improvements. In the period 1999-2004, it has been estimated that financial savings of 0.5 billion Eur/year have been actually achieved due to reduced unemployment, while an estimated 52800 jobs were created per year in the same period.

Netherlands

Instrument name	Energy Investment Allowance
Target buildings	Commercial buildings
Intervention type	Renovation of existing buildings
Implementation period	1997-
Target groups	Commercial companies; ESCOs; Energy providers; Small and medium enterprises; Housing associations
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Renewable electrical power generation systems; Connection to district heating; Other energy-related measures
Tax relief	Income tax deduction of41.5% of investment costs from pre-tax profit
Av. renovation depth	NA
Eligible buildings/households	Only cost of corporate asset and energy investment requirement
Energy criteria	Various prescriptive and performance criteria (e.g. Energy Class B)
Total budget	EUR 151 million
Enrolled buildings	NA
Total investment made	Total investment cost in 2012 is 1.256 million euro (2012)

The Energy Investment Allowance (EIA) is a tax deduction scheme giving a direct financial advantage to Dutch companies and entrepreneurs investing in energy efficiency equipment and sustainable energy. The scheme allows companies to deduct 41.5% of these investments costs from their pre-tax profit, reducing thereby their income or corporate taxes. In order to be eligible for EIA support, the cost of a corporate asset must be at least EUR 450, and the total amount of the energy investments per calendar year must be at least EUR 2,300. Companies may report the investment costs, up to a maximum of EUR 118 million per calendar year.

By allowing for frequent updates of the eligible measure list in the so-called the Energy List, the scheme can facilitate the market introduction phase of new technologies by offering innovators a stimulus to develop new technologies that have a better energy efficiency performance than reference technologies. These investors can propose their new inventions to be added in the Energy List, which in turn would likely increase sales and profitability of these new investments in the future ((Ruijs & Vollebergh, 2013).

The scheme provides financial support for two intervention options:

1. Generic measures. Under this option, any measures can be chosen (even if they are not included in the energy list) as long as an overall target is met (see below)
2. Specific measures. The specific measures are enlisted in the Energy list document. The list contains an option of overall energy performance improvement (code 210000) and all individual measures (210102-211001).

Examples of the energy-related criteria that apply as part of the tax incentive scheme include:

1. Minimum energy label B, where the energy index is at least 1.15
2. An improvement by at least two label steps, a jump in energy index equivalent to at least 0.30
3. Increase of heat resistance of building envelope by at least 1.50 m^2K/W compared to before
4. Energy improvement of at least 0,2 Nm^3 but no more than 1,0 Nm^3 natural gas equivalent per euro invested compared to the historical consumption of the building

The government, and in particular the NL Agency, is responsible for the implementation of the scheme. The scheme attracted around 10,000 applications per year instead of the expected 3,000 in its early years of implementation (Ruijs & Vollebergh, 2013). Regular monitoring and evaluation of the scheme is carried out once every 5 years by an external agency. According to the data published by the NL Agency, CO_2 savings of 765 Kilotons per year are achieved together with an estimated fiscal profit of 94 million euros. Comprehensive retrofits accounted for 3% of the total claims and popular invententions included energy efficient heating or air-exchange systems, ligthing and thermal insulation.The net EIA benefit is about 10% of the investment (see Table 17).

Table 17 - Results of the EIA scheme in 2004-2012

Year	Claimed investments (million €)	Approved investments (million €)	Net benefit (million €)	Budget (million €)
2004	1.398	1.144	205 (18%)	169
2005	1.199	835	112 (13%)	137
2006	3.710	1.681	214 (13%)	139
2007	2.023	1.457	160 (11%)	139
2008	1.483	1.112	112 (11%)	139
2009	942	787	78 (11%)	145
2010	1.191	893	98 (11%)	150
2011	1.455	1.164	116 (10%)	151
2012	1.256	942	94 (10%)	151

2.3.3 Loan schemes

As financial incentives offered by governments rely on limited resources, they can neither offer a sustainable solution nor support massive market uptake programs. Debt financing in the form of loans can be a more sustainable means of up-scaling energy efficiency investments as they can provide liquidity and direct access to capital. They can be more relevant for energy efficiency measures attached to high upfront costs, especially in deep renovation projects. Private debt finance supporting energy renovations is limited as financial institutions are typically unfamiliar with these investments and perceive energy efficiency loans as high risk investments. High transaction costs for relatively small projects and failure to offer financing for terms long enough to support deeper measures are all factors hindering market uptake.

To address some of these issues, international financing institutions, public and national governments can intervene to fill the debt gap where local and traditional banking sector actors are not active. This can be done through various financial mechanisms. For example, a public bank can be established to provide loans at preferential rates for, inter-alia, energy efficiency projects. Public-private partnerships can be set up in order to stream public funds in dedicated credit lines for preferential rate loans delivered by local banks. Third party finance, where funds are raised from private capital markets, may also be used to fund energy efficiency programmes. Risk-sharing facilities can reduce the high risk perception of banks that are not yet familiar with financing energy efficiency measures in buildings.

Table 18 - Overview of loan schemes as a vehicle for financing energy efficiency investments

Advantages	Disadvantages
• More sustainable means of financing energy efficiency project as capital is preserved(it can be re-lent as soon as loans are partly or fully repaid) • Can be combined with a revolving fund mechanism which ensures that loan funds are cycled back into the fund for more energy efficiency projects • Can be easily implemented by banking institutions, reducing long bureaucratic processes linked with government incentive schemes	• Householders and other target recipients may be unwilling to take on any debt • Lack understanding of the value of energy efficiency projects by financial institutions remains a key barrier • Acquiring a second loan (e.g. on top of existing mortgage) may be complicated • Not suitable for vulnerable groups as credit worthiness of certain target groups would make them less attractive candidates • Small projects may not be favoured by bankers

Various public international financing institutions and national governments in the EU have begun experimenting with loan programmes with attractive terms to kick-start the market. In most cases, preferential loans are delivered through public-private

partnerships where the government provides a financial support to the bank, which in turn offers a preferential interest rate to its customers. They can be an alternative to interest rate subsidies or a complementary measure to incentivise commercial banks to explore this new market segment. Low interest rates are common feature of most of national loan schemes in the EU targeting energy efficiency investments. In certain cases, zero interest rate loans are available such as in Belgium, Croatia and France, typically usually directed towards the most vulnerable groups such as low income households. In the case of France, the cost difference between the normal- and zero-rate loans is paid by the government through a tax credit scheme offered to participating banks. The combination of loans and grants in order to offset some of the project cost are also a common practice. For example, the Bulgarian Energy Efficiency and Renewable Source Fund offers an incentive payment of 20-35% with a funding cap of EUR 9,000. The Bulgarian scheme also provides ESCO portfolio guarantee, and thereby undertakes some of the risk of the ESCO associated with disruptions in the flow of receivables of the ESCO. The Estonian Renovation loan for apartment buildings, which is designed based on the concept of revolving fund, also provides guarantees. In Germany, German public bank KfW receives a subsidy from the government to lower the interest rate at which it lends to the commercial banks, which can thus propose energy efficiency loans to homeowners under market rates.

Some of the above schemes, which are described in further detail below, can serve as examples of how similar financial schemes can be introduced in the existing financial landscape for energy efficiency in Cyprus, which currently only relies predominantly on the grant-based financial model.

France

(1) Social housing eco-loan (éco-prêt logement social - éco-PLS)

Instrument name	Social housing eco-loan (éco-prêt logement social - éco-PLS)
Target buildings	Residential buildings
Intervention type	Renovations of existing buildings
Implementation period	2009-2020
Target groups	Housing associations
Loan terms	Soft loans of total loan amount of EUR 18,000 at 1.9-2.35% interest rate
Grant combination possibility	No
Av. renovation depth	30-40% energy savings
Eligible buildings/households	Existing social housing dwellings of energy class D, E, F and G
Energy criteria	See above
Total disbursed budget	EUR 110 million per year
Enrolled buildings	151,000 dwellings (2009-2013)
Total investment made	NA

The social housing eco-loan scheme (éco-prêt logement social - éco-PLS) was launched in February 2009 to provide financial support to energy upgrades of social dwellings in the framework of the Grenelle de l'environnement Law. It aims to retrofit the most energy-demanding social housing complexes with an overall goal of financing around 70,000 renovations per year until 2020. The social housing eco-loans are managed by the Caisse des dépôts et Consignations (CDC), financed from the funds saved by French households on the Livret A - tax free savings accounts with an estimated budget of around EUR 110 million per year.

The soft loans, which can range from EUR 9,000 to EUR 16,000, are accessible to social housing lessors and operators as well as companies which are mainly publicly owned. The loan amount can increase by EUR 2000 per apartment, if the planned renovation work is accompanied with the issuance of the energy performance label. The loan is provided at an interest rate of 1.90% or 2.35%, with a 15- or 20-year repayment time respectively.

In total, 800,000 "energy-hungry homes" in the French social rental housing sector have been identified in France. The social union for housing targets to renovate these energy inefficient social dwellings by 2020, i.e. 800, 000 dwellings must be thermally renovated until 2020. Energy-hungry homes have been defined as homes with an energy performance class of E, F or G and priority was given to buildings that fall under these classes. However, since September 17, 2010, the first version of the loan scheme was also open to energy class D, but with a limit of 20,000 housing units from a total of 100,000. The inclusion of class D continues in the new loan scheme (as of December 2011), but with a limit of 14,000 housing units per year. In addition, to qualify for the loan, the borrowing organisation must commit to a renovation that yields energy savings of at least 30% for class E, F, and G dwellings.

To benefit from the loan programme dwellings of energy class E, F or G must fulfil the following pre- and post-upgrade criteria:

- Primary energy consumption prior to upgrade works $\geq$230kWh/m²/year;
- Primary energy consumption after upgrade works[15] $\leq$ 150 kWh/m²/year;

This loan targets aims to grant loans for the renovation of a total of 50,000 D-class dwellings per year, which fulfil the following criteria:

- Primary energy consumption prior to works in the range of 151-230 kWh/m²/year;
- Energy savings in primary energy conventional consumption of 85 kWh/m²/year, or
- Primary energy consumption after works < 80/kWh/m²/year

The first generation of Eco-PLS scheme has led to 95,000 social dwellings refurbishments until June 2011 whereas the second generation has led to 56,000 refurbishments until the end of 2013. Energy saved generated by this measure has been assessed to 0.35 Mtoe in 2013 from the SceGES1 tool of the French General Direction for Energy and Climate (DGEC) using a bottom-up approach. It represents 0.9 % of the final energy consumption in the residential sector in 2013 which was about 39.6 Mtoe according to CEREN2.

Table 19–Target (in terms of number of renovated social housing dwellings)distributed over the duration of the Social housing eco-loan

	2014	2015-2017	After 2017
Number of renovated social housing dwellings	90,000	Between 90,000 and 120,000 per year	120,000 per year

[15]This condition can fluctuate with climatic zones and altitude

(2) Zero-rate eco-loan (prêt à taux zero)

Instrument name	Zero-rate eco-loan (prêt à taux zero)
Target buildings	Residential buildings
Intervention types	Renovation of existing buildings
Implementation period	2009-2018
Target groups	Owner-occupiers
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems
Loan terms	Soft loans of total loan amount of EUR 30,000 at 0% interest rate
Grant combination possibility	No
Av. renovation depth	Deep renovation
Eligible buildings/households	Existing residential buildings constructed before 1990
Energy criteria	See above
Total disbursed budget	NA
Enrolled buildings	287693 loans in 2009-2014
Total investment made	NA

The zero-rated eco-loan scheme (eco-prêt à taux zéro) has been introduced by the "Finance Law 2009"to allow owner occupiers and landlords to get a loan to fund energy efficiency works (insulation, heating or water heating using renewable energies) for their main residence (if built before January, 1st1990).The scheme offers soft loans of up to of EUR 30,000, refundable over a 10 or15 year period for deep renovation projects, targeting measures on the building envelope, equipment and other (including energy audits, consultancy costs, education and training activities, etc.) The scheme can also support co-owners in the limit of EUR 10,000 per flat (or until EUR 30,000 if the co-owners union launches 3different works).

To benefit from the zero-rated eco-loan, households must either:

- **implement a package of different intervention measures that** fall under at least two of the following categories: outdoor walls insulation; roof insulation; outdoor window and door insulation; installation or replacement of heating or hot water equipment; installation of heating or hot water equipment, relying on renewable energy source;
- **achieve a minimum level of energy performance**: 150 kWh/ m² of annual primary energy consumption for dwellings consuming over 180 kWh/m² per year before works and 80 kWh /m²r for dwellings consuming less than 180 kWh/m² per year before works.

The loans are granted by banks which have concluded specific agreement with the French State under conditions fixed in the General Taxes Code (Code Général des impôts). The loans were available until the end of 2015 but the Finance Law 2016 has planned its extension until December, 31st 2018.

It is estimated that around 30,000 dwellings/year on average benefit from this soft loan for an average of EUR 19,000. The public cost in the period 2009-2011 was around EUR 75 million.

Germany

Instrument name	KfW energy efficiency renovation programme
Target buildings	Residential and public buildings
Intervention type	Renovation of existing buildings
Implementation period	2001-
Target groups	General public; Households; Public authorities; Housing associations; Landlords; Owner occupiers
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Renewable electrical power generation systems; Connection to district heating; Other energy-related measures
Loan terms	low-interest loans with up to 17,5 % subsidy or direct subsidy up to 25 %
Grant combination possibility	Yes
Av. renovation depth	NA
Eligible buildings/households	New constructions and renovations of existing buildings constructed before 1995
Energy criteria	The renovation package need to reach KfW-own energy labels (at least 25% better than building code levels)
Total disbursed budget	NA
Enrolled buildings	3 Million dwellings (including new buildings)
Total investment made	EUR 135 billion (2006-2012)

The German development bank, KfW, is the main financing institution implementing policies in buildings and other energy-related sectors in Germany. Since 1996, KfW has gained substantial experiences with incentivizing thermal retrofit investments in the residential sector through preferential loans and grants. The bank has two main programs designed specifically for energy efficiency investment in the residential buildings sector: "Energy Efficient Renovation" and "Energy Efficient Construction".

The level of funding available in the form of either loans or grants for retrofit or construction projects is determined by the targeted energy standard. Loans can cover total project costs for a value of up to EUR 100,000 per residential unit. The publicly subsidized interest rates for retrofit loans can be as low as between 1% and 2%. These can be combined with repayment bonuses (grants). Grants are defined as a share of total project cost, and range between 7.5-27.5% depending on the ambition of the project (i.e. Efficiency House Standard). They cannot exceed EUR 27,500 for comprehensive retrofits (corresponding to KfW Efficiency House standard 55)and 3,750 for single measures per residential unit. The repayment period for loans can range from 4-30 years.

To be eligible for the programme, certain efficiency standards which are more stringent than the requirements as set out in the German Energy Savings Ordinance achieved by the project are. Eligibility is based on two key parameters:

1. the annual primary energy demand compared to the demand of a new building (the so-called "reference building") and

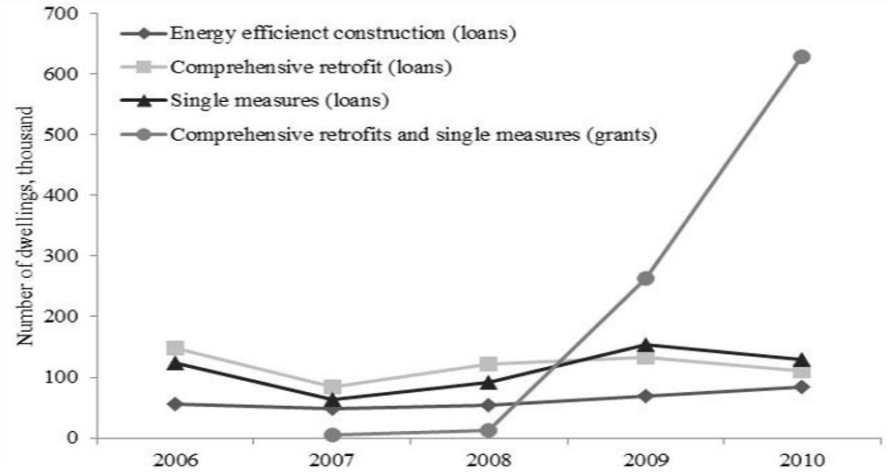
2. the structural heat insulation (specific transmission heat loss) compared to the reference building.

There are three levels of promotional incentives for energy efficient construction activities expressed as Efficiency House Standards 40, 55 and 70. This means that the primary energy consumption of the housing unit in question corresponds to 40%, 55% or 70%, respectively, of what the reference building is allowed to consume according the Energy Efficiency Ordinance. For all levels, the promotional interest rate is the same. The difference pertains to the level of partial debt relief (in percent), in the form of a repayment bonus, which is granted to the borrower (in addition to the favourable interest rate) once the targeted efficiency level has been reached and verified by an energy expert. KfW 55 retrofit standard requires achieving reduction of primary energy requirement to 55% of new built standard, KfW 70 to 70%, KfW 85 to 85% of new built standard, and so on.

The majority of financial sources for KfW loans originate from the capital markets. Due to federal guarantees for KfW commitments and funds from the Federal Government, KfW receives good credit rating on the market and thus can secure the finance at low interest rates for high volume. The total funds spent on energy efficiency in 2012 were EUR3.6 billion (KfW, 2012). This scheme provides simpler access to capital and makes the loans attractive to borrowers, by addressing one of the main financial barriers. Credit guarantees provided by the state is a very important form of 'strategic niche management' to promote an emerging sector and to maintain attractiveness for lenders, especially when there is little willingness to lend across sectors, high-yielding investments are rare and the economic climate is relatively instable. The main question is, however, whether this sector can sustain financing without the need for guarantees, e.g. to what extent funds can be recycled as loans are repaid and whether investors become familiar enough with energy efficiency refurbishments so that these schemes can participate in credit markets.

The KfW programmes have been modified several times; the last significant change was implemented in 2009, with the introduction of grant support for single measures as opposed to comprehensive packages. This led to a significant increase in the uptake rate of grants (**Error! Reference source not found.**).It has been estimated that through the KfW bank programme of financing energy-efficiency investments in buildings, for every one euro spent by the state in subsidies, it gets back 4.3 euros (3 euros from additional tax revenues and 1.3 euros from saving in employment benefits). The multiplier effect is estimated at 18, i.e. 18 euros investment generated by 1 euro of public subsidies (World Energy Council, 2013).

Figure 4 -Number of residential units financed by the KfW programme in the period 2006-2011



(Source: KfW Forderreport,2011)

Bulgaria

Instrument name	Energy Efficiency and Renewable Energy Fund
Target buildings	Residential, commercial and public buildings
Intervention type	Renovation of existing buildings
Implementation period	2005-
Target groups	Households; Public authorities; ESCOs; Small and medium enterprises; Housing associations
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Other energy-related measures
Loan terms	4.5-9% depending on the target group with a maturity of maximum 5 years
Grant combination possibility	No
Av. renovation depth	10-20%
Eligible buildings/households	None except that a payback time of up to five years is required
Energy criteria	None
Total disbursed budget	EUR 24.37 million (22.43 on loans and 1.94 on guarantees) in 2005-2013
Enrolled buildings	185 projects (153 loans and 32 guarantees) in 2005-2013
Total investment made	EUR 44.84 Million in 2005-2013

The Energy Efficiency and Renewable Sources Fund (EERSF) was established through the Energy Efficiency Act adopted by the Bulgarian Parliament in February 2004. The initial capitalization of EERSF was entirely with grant funds, its major donors being: the Global Environment Facility through the International Bank for Reconstruction and Development (the World Bank) - USD 10 million; the Government of Austria - EUR 1.5 million; the Government of Bulgaria - EUR 1.5 million and several private Bulgarian companies. These funds were used to provide first investment capital for EERSF, to cover start-up and operating costs and energy efficiency capacity building until the Fund reached financial self-sufficiency.

EERSF has the combined capacity of a lending institution, a credit guarantee facility and a consulting company. It provides technical assistance to Bulgarian enterprises, municipalities and private individuals in developing energy efficiency investment projects and then assists their financing, co-financing or plays the role of guarantor in front of other financing institutions.

Project costs can range between BGN 30,000 and BGN 3,000,000 although exceptions are possible if strongly justified. Financial support for various energy efficiency investments is provided through the following ways:

- Loans: interest rates between 4.5-9% depending on the target group with a maturity of maximum 5 years are offered. For municipalities, the interest rate is 4.5-8%, while for corporate clients and private individuals 5-9%. The loan can be co-financed with a commercial bank, with minimal equity contribution ranging from 10-25%. If co-finance with a commercial bank is chosen, the minimum equity contribution is 10%, while if stand-alone finance is preferred, the minimum equity contribution is 25%.

- Partial credit guarantees: two options are possible: (1) 80% on a pari passu basis and (2) 50% on a first-loss basis after the bank-creditor. The annual fee is 0.5-2% and maximum maturity (tenor) is 5 years. Individual (per project) guarantee commitments shall not exceed BGN 800 000. Portfolio guarantees are categorised as follows:

(a) ESCO portfolio guarantee - to attract more ESCO companies into this business and to make ESCOs more comfortable by guaranteeing the risk of their counterparties - the project beneficiaries.

(b) Residential portfolio guarantee - to kick-start the market of EE investments in the residential sector, by providing market products that overcome the lack of legislation in the country.

The funding has been used to create a revolving fund which by the end of 2014 has contributed BGN 45.8 million(EUR 23.4 million) to 170 projects with a total value of over BGN 67.6 million(EUR 34.6 million).The Fund has gained international recognition for its innovative approach to EE financing and consulting.

Table 20 - Results in terms of projects and investment volumes associated with approved credits and credit guarantees as part of the EERSF

	Number of projects	**Value of projects (EUR million)**	**Size of financing (EUR)**	**Expected annual energy savings (MWh/y)**
Credits				
Municipalities	91	17.5	11.5	46,857
Corporate clients	50	8.7	6.2	27,729
Others (Residential, hospitals, universities)	19	6.3	4.6	20,789
Credit guarantees				
Portfolio guarantees on ESCO projects	29	8.8	0.3	
Partial credit guarantees (on credit contracts)	3	2.9	.1.6	

Estonia

Instrument name	Grants and renovation loans for single family and apartment buildings		
Target buildings	RES	Implementation period	2009-2013
Intervention type	Renovation of existing buildings		
Implementation period	2009-2013		
Target groups	Housing associations		
Intervention measures	Building envelope; Technical building systems; Renewable heat generation systems; Renewable electrical power generation systems; Other energy-related measures		
Loan terms	Interest rate 3.5-4.0%, loan period up to 20 years, self-financing is at least 15% (which can be covered by reconstruction grant), minimum Kredex loan of EUR 6400 per apartment building		
Grant combination possibility	Yes		
Av. renovation depth	38% of energy savings		
Eligible buildings/households	Buildings with at least 3 apartments constructed before 1993		
Energy criteria	Yes		
Total disbursed budget	EUR 72, 000,486 (2009-2013)		
Enrolled buildings	552 dwellings of total floor area of 1,328,960 m2 (2009-2013)		
Total investment made	NA		

The KredEx scheme was designed based on the German federal bank (KfW) model and is a pioneer in the use of a revolving fund to finance energy efficient building renovation. Backed with political support, the KredEx scheme managed to raise a considerable amount of funding from the EU Structural Funds, a first in Europe for this type of program. KredEx is a state-owned credit and export guarantee fund (not a public bank), created in 2001 by the Ministry of Economic Affairs and Communications as a not-for-profit entity. Sureties and guarantees issued by KredEx are fully backed by a state guarantee. It was established as a body governed by private law, operating in the public interest according to State policies.

KredEx works as a revolving fund that, among other activities, supports financing of energy efficiency projects. It has received loans from the Council of Europe Development Bank (CEB) to undertake measures aimed at complying with the Council's Directive 2002/91/EC on the energy performance of buildings. KredEx also receives funding from the European Regional Development Fund (ERDF) and works in cooperation with some international bodies, in particular other state-owned financial institutions: in 2007, it signed a Memorandum of Understanding with KfW Bankengruppe (Germany), BGK (Poland), and Hipotēku Banka (Latvia), on the structuring and implementation of large financing programmes to promote energy efficiency in housing, for which KfW provided advice.

Under the Kredex scheme, the following energy-efficiency related products are offered:

1. Renovation loans for multi-apartment buildings(2009-2013)

The renovation loan is designed for the reconstruction and improvement of energy efficiency of apartment buildings constructed before 1993. The renovation loan can be applied for by apartment associations, building associations in buildings with at least 3 apartments. As an ordinary bank loan has a too short repayment period and higher interest rate for an apartment building, the renovation loan provides a more favourable interest rate and a longer repayment period for apartment buildings. The interest rate is from 3,5 to 4,0 % and it depends on the risk level of the building in question. The risk level for every specific building is evaluated and set by the bank. The loan period can extend to 20 years and self-financing of at least 15% can be obtained, which can be covered by reconstruction grant. The reconstruction grant is offered by Kredex (see below) and may be combined with the Kredex loan or own collected funds or other bank loan in case of buildings constructed after 1993. The minimum Kredex loan amount is 6400 euros per one apartment building.

2. Reconstruction grant for multi-apartment buildings(2010-2014)

The grant is designed for associations and communities wishing to reconstruct their apartment buildings. The grant may be combined with the renovation loan of KredEx to decrease the share of required self-financing, as well as with collected own funds. Apartment buildings constructed since 1993 that do not belong in the renovation loan target group of KredEx may combine the grant with regular loan. The grant may be applied for in the amount of 15%, 25% and 35% of the total project cost depending on the level of integration in the reconstruction of the relevant apartment building. There is no maximum amount of support.

To apply for the grant, a relevant application shall be submitted to the bank issuing the renovation loan with an application for renovation loan. The grant may be applied for in the amount of 15%, 25% and 35% of the total project cost depending on the level of integration in the reconstruction of the relevant apartment building. It applies for buildings with at least three apartments and constructed before 1993. In order to be eligible for the grant, energy savings of at least 20% shall be achieved. The level of support varies with the post-renovation energy label class - 15% support is given if energy class "E" is reached, 25% for class "D" and 35% support for class "C".

3. Grant for single family houses (2012-2013)

Around 25% of the Estonians live in detached houses. In Estonia there are approximately 166 000 detached houses and around 70% of them are built before 1970. The building and energy efficiency standards and norms were at that time very low. Most of the owners of older houses are of low and medium income group who need support and encouragement to carry out the upfront investment in energy efficiency. Thermal insulation of roof, walls/façades, cellar ceilings, replacement of windows / staircase windows, upgrade of heating/ventilation systems and installation of solar heating, photovoltaic and wind energy systems are all eligible intervention measures. The grant allocation is in the range EUR1,000 - EUR30,000 which covers the reconstruction works, purchase of renewable energy equipment and installation costs. Grants are divided into two packages: (1) support for renovation works and (2) renewable energy support. One individual can simultaneously apply for both renovation and support for renewable energy grants, but not more than 30 000 per dwelling. The grant rate is: 25% (energy label "D") or 40% (energy label "C") of eligible costs related to the renovation. For solar domestic hot water production 60% is foreseen and PV-panel or windmill for electricity production 70%.

Important other stakeholders in the program include the commercial banks Swedbank and SEB, which get favourable funding from KredEx and make loans to apartment building associations. Their main motivation to take part in the program was to get access to more clients, especially at the beginning of the financial crisis. They have also had very good experiences with financing energy refurbishment of buildings prior to 2009.

In the period 2014-2020, the same combined loan and grant scheme shall apply. The loan is used in parallel with the separated applicant's contribution to cover part of the down payment will help speed up the process of reconstruction of apartment buildings.

Table 21 - Results of the Kredex schemes

	(1) Renovation loans for apartments	(2) Grant for apartments	(3) Grant for single family houses
Time period	2009-2013	2010-2013	2012-2013
Disbursed budget	72 000 486	26 767 825,60	2842449
Enrolled buildings	552 dwellings (1 328 960 m^2)	10877 dwellings/314 buildings (734330 m^2)	68 buildings (14262 m^2) for 2012 only

2.4 Conclusions and recommendations

The current economic policy mix supporting energy efficiency improvements in buildings in Cyprus largely relies on the provision of government-supported grants to households, businesses and public sector. More than EUR 100 million[16]has been made available by the government, allowing the various participating target groups to upgrade the energy efficiency of their existing buildings. These upgrades have primarily taken place in the residential sector (89% applications in first scheme corresponding to 52% of grants provided) where insulation measures and solar thermal systems for DHW have been the most commonly implemented measures. The first scheme, ended in 2013, has been successful in terms of its uptake rate, whereby up to 10% of Cypriot residential building stock is believed to have accessed grants in the period 2004-2013. The first call of proposals for households under the second scheme was also quickly completed.

It should be noted that some shortcomings associated with the first scheme are now addressed with the re-design of the current scheme. For example, the current scheme now provides financing for comprehensive retrofit projects, which means that buildings participating in the current scheme are not exposed to the "lock-in" risk of energy savings. The list of eligible energy efficiency interventions supported by the grants has expanded to include a wider range of technologies. Apartment buildings can also benefit from the scheme through the submission of a single application by the building's management committee. The participation of energy auditors and EPC experts provides a boost in the energy efficiency market, while it ensures that a holistic cost-effective approach is adopted when intervention measures of each building are chosen.

Various weaknesses, however, have been identified which perpetuate in the current design of the scheme. The grants have been weak at attracting substantial interest from the commercial sector. Only 5% of applications (corresponding to 17% of total grant volume) approved in the first scheme came from applicants of non-residential buildings (and another 5% from mixed residential and non-residential buildings).Applications made for the first call of proposals for grants specifically targeting SMEs have been low compared to the equivalent call for residential buildings, which was completed only within its first year of implementation. While the financial crisis may have been a detrimental factor deterring SMEs to make any noncore-business investments, a more detailed assessment investigating the reasons behind low participation and suitability of this financial model is necessary. Despite the scheme being open for investments in apartment buildings, there are no clear guidelines on how practical barriers linked to multi-ownership covering, inter-alia legal issues, can be overcome. Rented residential buildings are in practice difficult to be addressed as the scheme does not help align incentives between landlords and tenants, while only one application can be submitted by each beneficiary. Although no quantitative data exist, free-ridership continues to be an issue given that the largest recipient group are residential owner occupiers, who traditionally have a strong purchasing power, and that many of the supported intervention measures are linked with low payback times (e.g. solar thermal systems for DHW).The use of ESCOs and energy performance contracting are not currently part of the process. Finally, the administrative burden of checking of applications, disbursing money and administrating fund has been relatively high, causing delays and thereby having a negative impact on the overall satisfaction of participating beneficiaries.

To improve the financial landscape for energy efficiency investments in buildings in Cyprus, the following recommendations are drawn:

[16]The government has invested EUR 85 million in the first scheme, while in the second one EUR 32 million have been committed

STEP 1: Conduct detailed assessment of completed scheme

A detailed impact assessment study of the grant scheme can provide insights on the impact of the scheme, its environmental, social and economic benefits as well as areas of improvements. The results of such assessment will provide invaluable insights to be fed back in the planning and design stage of new policies including inputs to the development of new financial products dedicated to energy efficiency in Cyprus. A study can be contracted to:

- Develop an ex-post evaluation, determining the impact in terms of energy savings, CO_2 emission reduction and financial savings. The evaluation should also consider wider economic benefits, e.g. on job creation, in particular in the construction sector as well as energy certifiers and auditors. Multiplier and free-rider effects should also be examined.
- Conduct a feedback survey with a small, random sample of beneficiaries from the various target groups to determine experience and customer satisfaction level with regards to the application process, project implementation and overall outcomes after instalment of intervention measures
- Collect data on investment costs and performance indicators of real-life energy efficiency investments carried out in Cyprus which can help increase visibility on the market and thereby reduce high risk perception linked to energy efficiency by financiers, etc.

STEP 2: Improve effectiveness of on-going scheme

- Increase staff capacity involved in the every-day running of the scheme. The involvement of a public body agency or private sector to support the processing of applications shall be considered in case that increase of internal staff resources is not feasible.
- Improve effectiveness of the implementation stage of the scheme as well as outreach by:
    - Optimising application process and developing easy-to-follow process steps, several of which can be digitalised (e.g. submission of applications) in order to reduce delays.
    - Applying strict deadlines to be met between various steps of the application process in order to ensure smooth running of the application and measure installation process.
    - Developing a dedicated website with easy-to-access information material on application process, various measures and their benefits, experiences of participating beneficiaries and benefits of energy efficiency in general.
    - Developing a simple calculation tool to help households and businesses quantify how implementation of various packaged measures will impact their future energy bills (this shall be made available on the ministry's website).
    - Improving outreach to groups of low participation. This could include use existing dissemination channels that are used to reach out to these groups.
- Set up a monitoring and evaluation phase in order to review the progress on a regular basis, identify weaknesses, draw lessons and incorporate redesign changes if considered necessary, thus allowing for constant programme improvements(e.g. readjust grant rate for low participating target groups, etc.).

- Provide more support for apartment buildings by developing a step-by-step guidebook on how to address various multi-ownership issues.

STEP 3: Develop a comprehensive package of economic policy measures

While the ultimate goal is to streamline commercial financing into energy efficiency (step 5), the energy efficiency market still faces various obstacles which require further government interventions. Moving forwards, a transition from grant-based to a more diverse portfolio of economic policy measures is necessary if market transformation is to be achieved. More sustainable financial models are necessary to upscale energy efficiency improvements and appropriate models for the Cypriot context that can cover all segments of the building sector must be considered. Figure 5 shows how the economic policy framework in Cyprus can be transformed to fill existing gaps and offer appropriate sustainable financing methods across the entire building sector. To do so, all main economic actors in residential buildings shall be targeted: (1) owner-occupiers of single family houses, (2) occupants of multi-ownership or multi-tenure apartment blocks, (3) tenants and (4) vulnerable groups. Non-residential actors (owner-occupiers and tenants) shall also be covered.

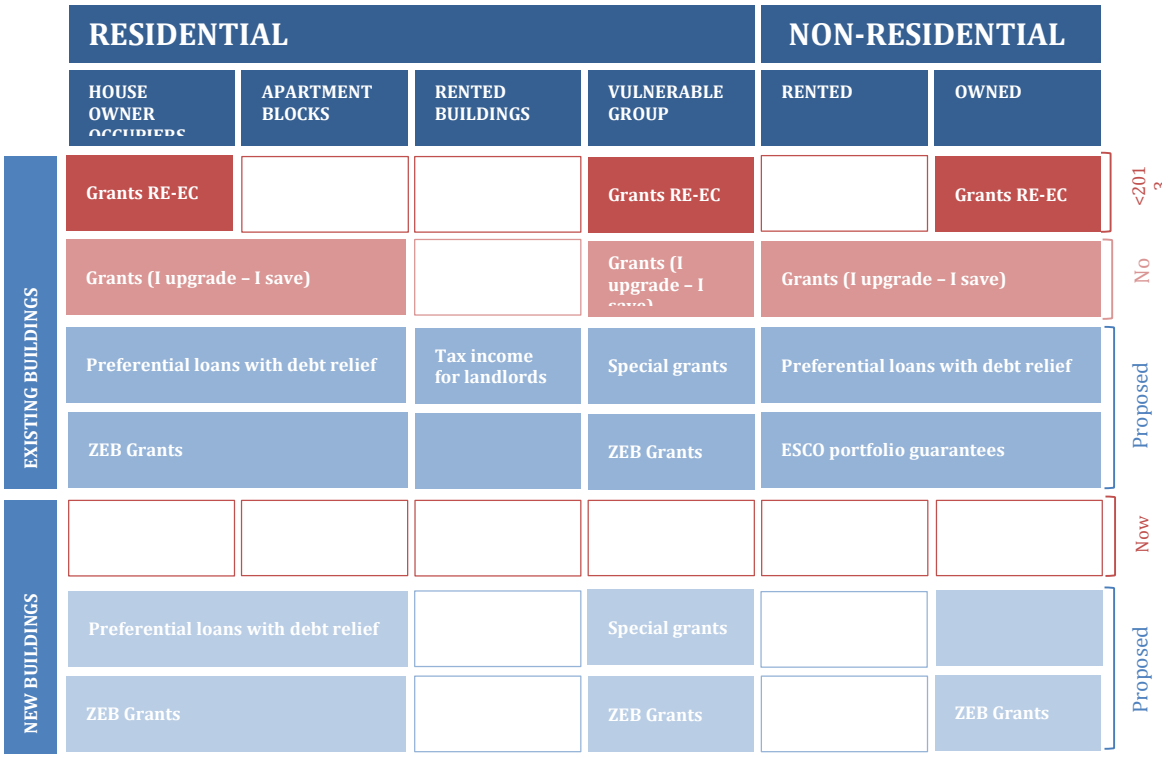
To develop a comprehensive package of economic policy measures in Cyprus, the following recommendations are made:

- Introduce a gradual phase-out of grants or limit their access to specific target groups (e.g. vulnerable groups) or specific actions (e.g. ZEB - Zero Energy Buildings or Positive Energy Buildings – see below). An exit strategy from grants should be defined once their role as an initiator of market transformation is fulfilled following relevant studies (see Steps 1 & 2)
- Develop energy efficiency credit line for private households and businesses through a public-private partnership. As the banking sector in Cyprus starts to recover, new financial products with the backup and support of the government as well as international financial institutions can be considered to tap into the significant energy saving potential of the Cypriot building stock:
    - The involvement of such international institutions, in particular in the form of technical assistance, is particularly important given that Cyprus is currently among the EU countries with the highest share of outstanding residential loans to GDP.
    - The set-up of guarantee fund should be considered in order to establish a risk-sharing mechanism which lowers the risk to the lender by substituting a portion of the risk of the borrower, including ESCOs.
    - Experiences with involvement of International financial institutions (e.g. EBRD) with local banks in other countries can be drawn in order to develop a similar programme tailored to the Cyprus's needs and particularities.
    - A revolving fund mechanism can be considered to ensure that loan funds are cycled back into the fund which can then be used for more energy efficiency projects. Debt relief option could make the loan more attractive for certain ambitious upgrade levels or specific target groups
- Provide financial support (in the form of grants) for exemplary ZEB projects supporting designers and owners to come up with innovative designs that demonstrate the practical application of various affordable ZEB concepts

(exceeding building regulation) suitable for the Cypriot climate. Performance monitoring should be also included. These can serve as a dissemination tool on how in practice ZEB can be applied in Cyprus.

- Upon the successful completion of the ESCO pilot projects in the public sector, consider the promotion of ESCOs to increase the involvement of ESCOs with a special focus on the non-residential sector. This could be in the form of ESCO portfolio guarantees - to attract more ESCO companies into this business and to make ESCOs more comfortable by guaranteeing the risk of their clients.
- Consider the adoption of tax credits or deduction to incentivise landlords to engage in energy efficiency upgrades in residential rented buildings, which could raise tax revenues for government by ensuring that the work is declared to the authorities.
- Consider the modification of current property tax system to incorporate the efficiency level of the building into property tax paid by owners, which will incentive property owners of very inefficient buildings to invest in energy efficiency upgrades in order to reduce their tax burden

Figure 5 -Proposed portfolio of economic policy instruments in Cyprus



STEP 4: Reinforce Cypriot energy efficiency policies for buildings

In addition to the proposed economic policies above, several actions can be taken to improve and strengthen the current Cypriot energy efficiency policy framework:

Building codes

The introduction of EPBD in Cyprus has had a significant impact in the energy efficiency policy framework of Cyprus. Incorporating energy-related requirements during the design or renovation phase of a building is a key driver for installing energy efficiency intervention measures in the Cypriot building stock. The following further actions can be considered by the Cypriot authorities to strengthen the impact of these policies:

- Strengthen compliance with minimum energy performance requirements for new and existing buildings. A poor compliance system can significantly reduce the impact of this policy. This is a particular problem for the compliance in renovation phase as the system of renovation permits is poorly implemented in Cyprus. The establishment of tax incentives for renovation work could be a starting point.
- Ambitious tightening of minimum energy performance of nZEB levels for new buildings prescribed by building codes. Studies have shown that current nZEB levels are not ambitious (Serghides D. K., Dimitriou, Katafygiotou, & Michaelidou, 2015). This could be done in a gradual phase.
- Consider setting specific requirements in rented and or apartment buildings.

Information and education

- Strengthen the role of Energy Performance Certificates as an information tool. This involves the establishment of independent control systems, creation of publicly available EPC database, penalties for non-compliance, improvements in

the methodological framework as well as implementation of accreditation schemes for installers and EPC assessors.

- Roll out information campaigns to increase awareness of benefits of energy efficiency for households, businesses, financiers. The development of a tool quantifying financial savings of various packaged measures (as suggested previously) can help this process.
- Develop local "one-stop shops" for energy renovation, providing owners with a single contact point for impartial information on how to plan and realise step-by-step energy renovation projects. This will help the public assess different interventions and technologies, gather information on the benefits of various renovation packages, find out about financing options including available public support, information on contractors, ESCOs, etc.The Cyprus Energy Agency can lead this initiative and involve various actors ranging from academia to the scientific and technical chamber of Cyprus.

Training and capacity building

- Set qualification programmes for construction workers with the aim to improve skillset of Cypriot workforce and familiarise them with various new technologies, in light of demand increase for energy efficiency projects and in particular for the construction of nZEBs. Given that training needs for the construction sector will grow this is of key importance.

STEP 5: Involvement of private finance

Scaling up investments will ultimately require the involvement of more private finance and the establishment of market-based solutions. This will require that various criteria necessary to ensure bankability of energy efficiency investments are met, standardized procedures are established and financiers become fully familiar with a new type of product. A ladder on how to move from financing options that rely on public financing to private financing is presented in Figure 6. This is discussed further in the Deliverable D1.6 5 on measures to promote the offer of financial products for the renovation of buildings by the commercial banking sector.

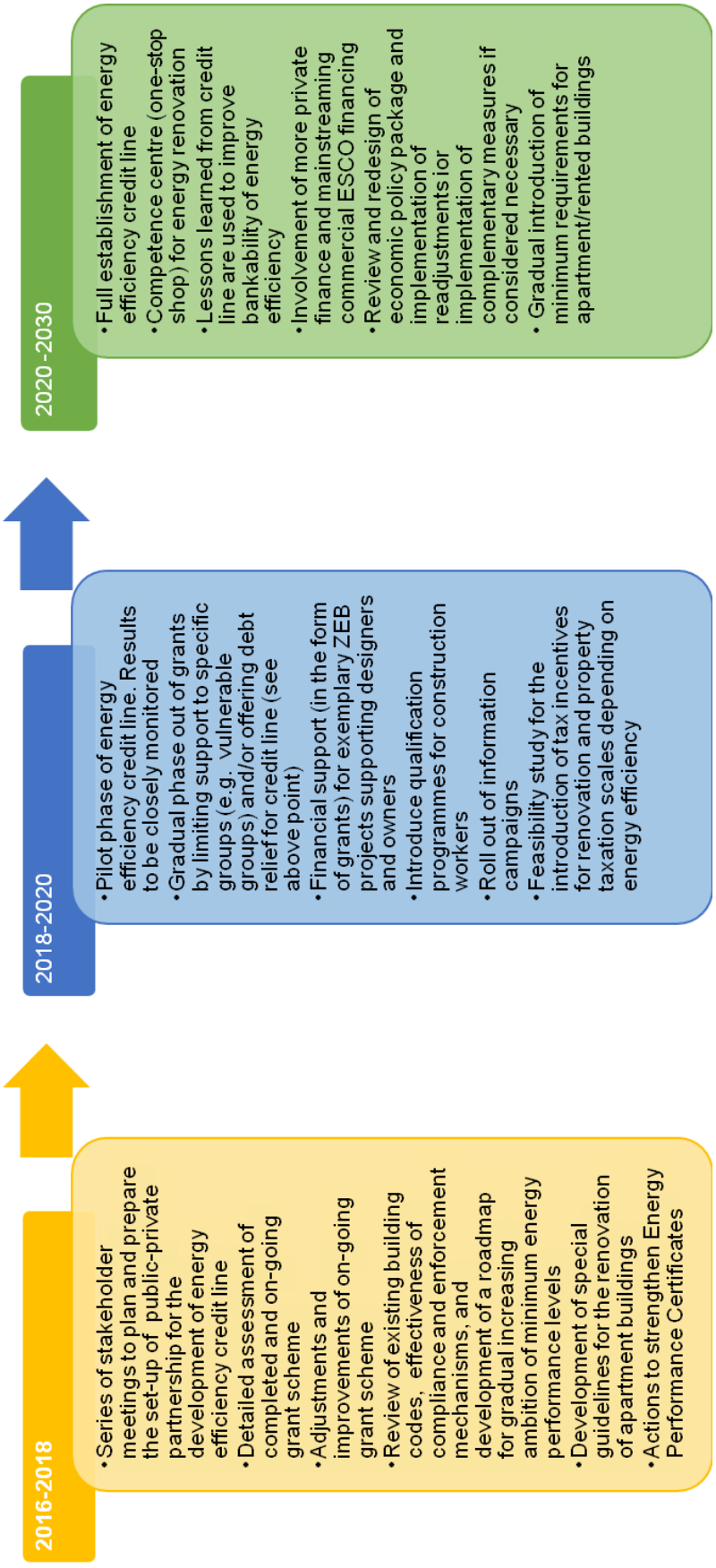
Figure 6 - Financing options moving from public to commercial financing

(World Bank, 2014)

2.4.1 Recommended road map

Based on the above recommendations, a (draft) roadmap laying out recommended actions and respective timelines from now until 2020 and beyond is presented in **Error! Reference source not found.**. This will be readjusted as more findings from the various deliverables under the JRC administrative arrangement are made available.

Figure 7 - Proposed roadmap for actions in order to improve the policy and financial landscape for energy efficiency in buildings in Cyprus



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3. Split incentives and energy efficiency in Cyprus

3.1 Introduction and Background

Split incentives are typically regarded as a major barrier to investments in energy efficiency upgrades in the building sector. The presence of split incentives, in particular, inhibits the deployment of energy efficiency upgrades in various building segments such as privately rented homes, multi-apartment buildings, social housing units and leased commercial or public premises. It stems from the misplacement of incentives between different actors (e.g. landlords and tenants), which discourage energy efficiency improvements to come into effect in reality. Despite this long-lasting barrier, little attention has been drawn on how to resolve it and current public policy interventions have made relatively little progress towards providing effective solutions that align incentives between concerned actors.

In order to help overcome this issue, the Energy Efficiency Directive (Directive 2012/27/EU) includes a provision in its Article 19(1)(a), which calls Member States to evaluate and if necessary take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency. In particular, it requests Member States to address the split of incentives between the owner and the tenant of a building or among owners, with a view to ensuring that these parties are not deterred from making efficiency-improving investments. Measures may include rules for dividing the costs and benefits between them and measures regulating decision-making processes in multi-owner properties.

Split incentives refer to any situation where the benefits of a transaction do not accrue to the actor who pays for the transaction. In the context of energy efficiency in buildings, split incentives are linked with cost recovery issues related to energy efficiency upgrade investments due to the failure of distributing effectively financial obligations and rewards of these investments between concerned actors. If the actor who invests in energy efficiency measures (i.e. actor in charge of capital expenses) is not the same as the actor who reaps the subsequent financial benefits (i.e. actor in charge of operational expenses), split incentives can arise. Typically, investment costs of energy efficiency upgrades are part of the capital expenses, while its financial benefits, in the simplest form, are seen as reduced energy bills in the operational expenses side. Despite the fact that many of these upgrades are of positive net present values, this barrier can ultimately result in inaction from either actor's side.

Split incentives are present in various segments and transactions within the building sector and appear in many end-uses (IEA, 2007), (Murtishaw & Sathaye, 2008). Table 21 summarises how different types of split incentives can affect the building sector according to building type (single- or multi-unit buildings) and tenure (owner-occupied or rented) status and are described in more detail below. Owner-occupied single-family/single-unit buildings can be exposed to temporal split incentives, while all other cases may be exposed to one or a combination of them. For rented buildings, the lease type plays a critical role. All buildings can be exposed to temporal split incentives (TSI).

Table 22 - Split incentives (SI) classification according to building type and tenure, where E stands for efficiency-related, U: Usage-related, M: Multi-actor and T: Temporal

	Owner-occupied	Rented
Single unit buildings	TSI	USI, ESI, TSI
Multi-unit buildings	MSI, TSI	MSI, USI, ESI, TSI

Efficiency-related split incentives (ESI): These refer to situations where the end user is in charge of the energy bills but cannot choose the technology needed to improve the energy efficiency of their property and thereby has limited power in reducing their energy bills or negotiating an energy efficiency upgrade. The landlord-tenant dilemma in rental housing and commercial leasing cases based on 'net' or 'cold' type of lease is the most typical example (see Table 22). In these cases, the landlords lack incentives for investing in energy efficiency upgrades as they do not directly reap the benefit and often cannot capitalise these upgrades into higher rents due to the uncertainty over the impact of the upgrade on the property value and lack of experience on rent premiums. Efficiency-related split incentives are also a concern in new properties, whereby the new owner is not involved in the selection of energy-related features during construction, while the property developer's main concern is to reduce the construction costs.

Usage-related split incentives (USI): These have also been referred to as the "reverse" split incentives in the literature (Bird & Hernandez, 2012). They occur when occupants are not responsible for paying their utility bills and thereby have little or no interest to conserve energy. In other words, the occupants do not face the marginal cost of their own energy use and are not given any incentives in using energy efficiently. They occur under "warm rent" and gross rent structures where utility costs for heating, other operating and capital expenses are all borne by the landlord. Evidence exist that tenants, under such rent structures, tend to consume more energy, e.g. several studies have provided empirical evidence showing higher indoor temperatures during winter periods in the case of heat inclusion in the rent (e.g. (Levinson & Niemann, 2004)). This type of incentives is also present in the hotel industry.

Multi-actor split incentives (MSI): Multi-tenant and multi-ownership buildings face an additional challenge associated with collective decision making between various actors. Energy efficiency projects in these buildings can only be realised if consensus is reached by all decision-making parties. Current decision structures act as a barrier in collective agreements between owner-occupants of many existing buildings such as condominiums (Matschoss, et al., 2013). In both multi-tenant and multi-owner buildings, the benefits and costs of an energy efficiency upgrade may vary from apartment to apartment, which further complicates the situation. For example, the occupant of mid-roof apartment will typically not benefit from a roof retrofit project to the same extent as a top-floor apartment.

Temporal split incentives (TSI): This refers to situations where the energy efficiency investment does not pay off before the property gets transferred to its next occupant/owner. In this situation, the occupant (tenant or owner-occupier) does not have a clear idea of how long they will live in their property or simply plan to move relatively soon. An energy efficiency upgrade attached to a high upfront capital cost will not be an appealing investment in this situation and may be perceived as risky (Bird & Hernandez, 2012).

Table 23 - Lease structures and implications on split incentives

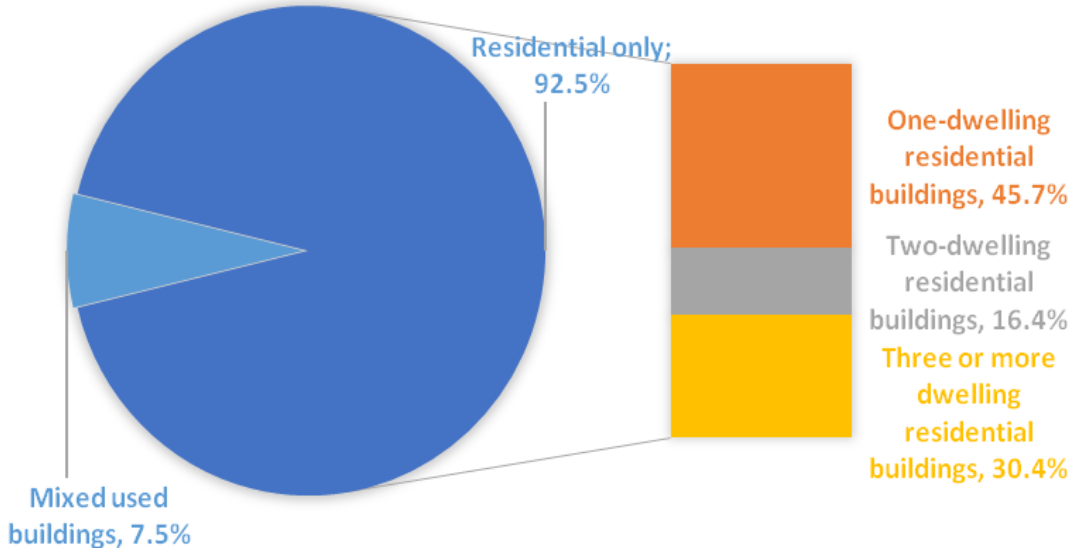
	Cost structure	**Advantages**	**Disadvantages**	**Possible presence of split incentives?**
Gross warm rent	All operating expenses incl. heating are covered in the rent.	Allows the tenant to take into consideration all costs in the choice of apartment. Landlords have an interest in keeping expenses low.	Tenant is not motivated to save energy.	USI
Gross cold rent/ **Net cold rent**	Heating costs must be paid separately. In the case of gross cold rent, all other operating expenses are included in the rent.	Tenant has an incentive to save energy.	Energy efficiency is not visible to tenant. Landlord is not motivated to upgrade the energy efficiency of the rented unit.	ESI

3.2 The split incentive barrier in Cyprus

This section presents evidence for the extent to which the building sector is exposed to the split incentive barrier in Cyprus. Due to data availability restrictions, we primarily focus on the presence of split incentives associated with residential buildings. However, it should be acknowledged that the split incentive barrier is expected to be dominant in the commercial and public sectors, whereby common features include leasing, multi-tenure and multi-ownership.

Based on Eurostat data originating from the 2011 Census, 92.5% of the Cypriot residential dwellings are located in residential-only buildings, while the remaining 7.5% in mixed-used buildings. Nearly half (45.7%) of the entire residential dwelling stock in Cyprus is represented by single family dwellings. The multi-family dwellings are divided into two-dwelling buildings (16.4% of all dwelling stock) and three or more dwelling buildings (30.4% of all dwelling stock).

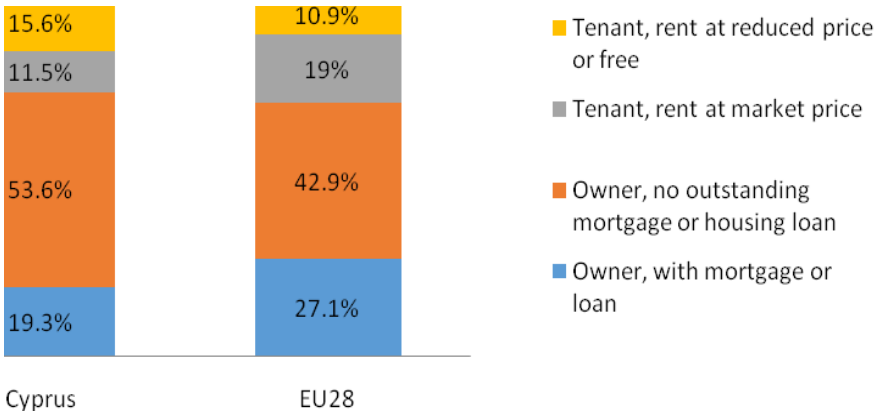
Figure 8 - Residential building stock in Cyprus in 2011



(Source: Eurostat – latest available data)

The Cypriot tenant population has remained relatively unchanged over the past years, with an around 5% increase over the past 7 years. Around 27% of the Cypriots are tenants today, a figure close to the EU-average of 29.9% The majority of Cypriot tenants (57.6%) rent at reduced prices or free, while the remaining tenant population at market prices. Owners, accounting for the remaining 73% of the population, have, by majority, no outstanding mortgage or housing loans, with only one quarter of the owner population having a mortgage or loan.

Figure 9 - Shares of owner and tenant populations in Cyprus and EU28 in 2014



(Source: Eurostat– latest available data)

A breakdown of the residential dwelling stock according to the type of tenure and building type is summarised in Table 24. Based on this, it can be concluded that around 60% of the residential dwellings may be exposed to one or more types of split incentives: efficiency, usage and multi-actor split incentives. No evidence can be drawn on the existence of the temporal split incentive barrier in Cyprus as no information was found on the average length of lease or ownership in Cyprus. Among the building sector segments with the most problematic situation is the owner-occupied multi-family sector (33.1% of all dwellings), followed by rental sector (24.4%). The rented single family houses comprise a small segment of the residential dwelling stock (6.9%).It should be noted that the share of the residential stock that falls under the other categories are not within the scope of this report.

Table 24 - The residential dwelling stock in Cyprus in 2011 (Compiled using latest available CyStat data)

	Owner-occupied	**Rented** (rent or other way of rent)	**Other** (free rent or not reported)
Single family buildings (Single family buildings, auxiliary houses)	35,9%	6,9%	2,9%
Multi-family buildings (2-dwelling houses, terrace houses, apartment blocks, mixed-used buildings)	33,1%	17,5%	3,7%
Other (Other type of building)	0,0%	0,1%	0,0%

Energy performance of the residential stock

In terms of the energy performance characteristics, data generated by the Cyprus Energy Agency have found that less than 10% of the residential building stock was equipped with wall, roof or basement insulation, while over 50% of the buildings remained without any insulation. It is not clear what differences exist between owner-occupied and rented dwellings with respect to building envelope insulation. In general, it has been found that rented dwellings have been found to be of smaller size (**Error! Reference source not found.**(a)), while the use of renewable energy technologies in both owner-occupied and rented dwellings follow similar patterns. In particular, most residential buildings are equipped with thermal solar systems for warm water (93% for owner-occupied and 88% for rented dwellings), while the use of solar energy for electricity generations significantly limited in all dwellings despite the significant potential that exists in Cyprus (**Error! Reference source not found.**(b)). That is, around 5% of owner-occupied dwellings do not use any type of solar energy technology as opposed to 10%rented buildings. Small differences are noted on age profile of the owner-occupied and rented dwelling stock are noted (**Error! Reference source not found.**(c)), where the vast majority of the dwelling stock (78% of rented dwellings and 82% of owner occupied dwellings) were constructed before any energy performance requirements were put in place.

Condominium and tenancy laws

According to Article 38K of the Immovable Property (Tenure, Registration and Valuation) Law[17], the responsible actors of a jointly-owned building must appoint a management committee for the regulation and management of its affairs. The Management Committee has to, inter-alia, control, operate and manage direct the jointly-owned property, perform any necessary act to enforce regulations and maintain the property in good condition and functionality. No specific provisions regulating the management of energy efficiency upgrades and the associated role of the committee are included in the Law. It should be noted that the scheme "Save Upgrade" is open for applications of energy upgrades of apartment buildings. In these cases, a single application should be submitted by the Management Committee acting on behalf of all building owners. The owners of the building need to authorise the Management Committee to act on their behalf as beneficiary. Of the 1100 applications received under the "Save Upgrade" scheme, there are only 7 applications submitted by management committees of multi-apartment buildings. It is therefore expected that the impact of the scheme on multi-ownership properties will be therefore low.

With regards to the Cypriot Tenancy Law, no relevant information has been found on the possibility of passing through costs of energy efficiency investments to tenants or other provisions on how to manage energy efficiency upgrades in rented dwellings.

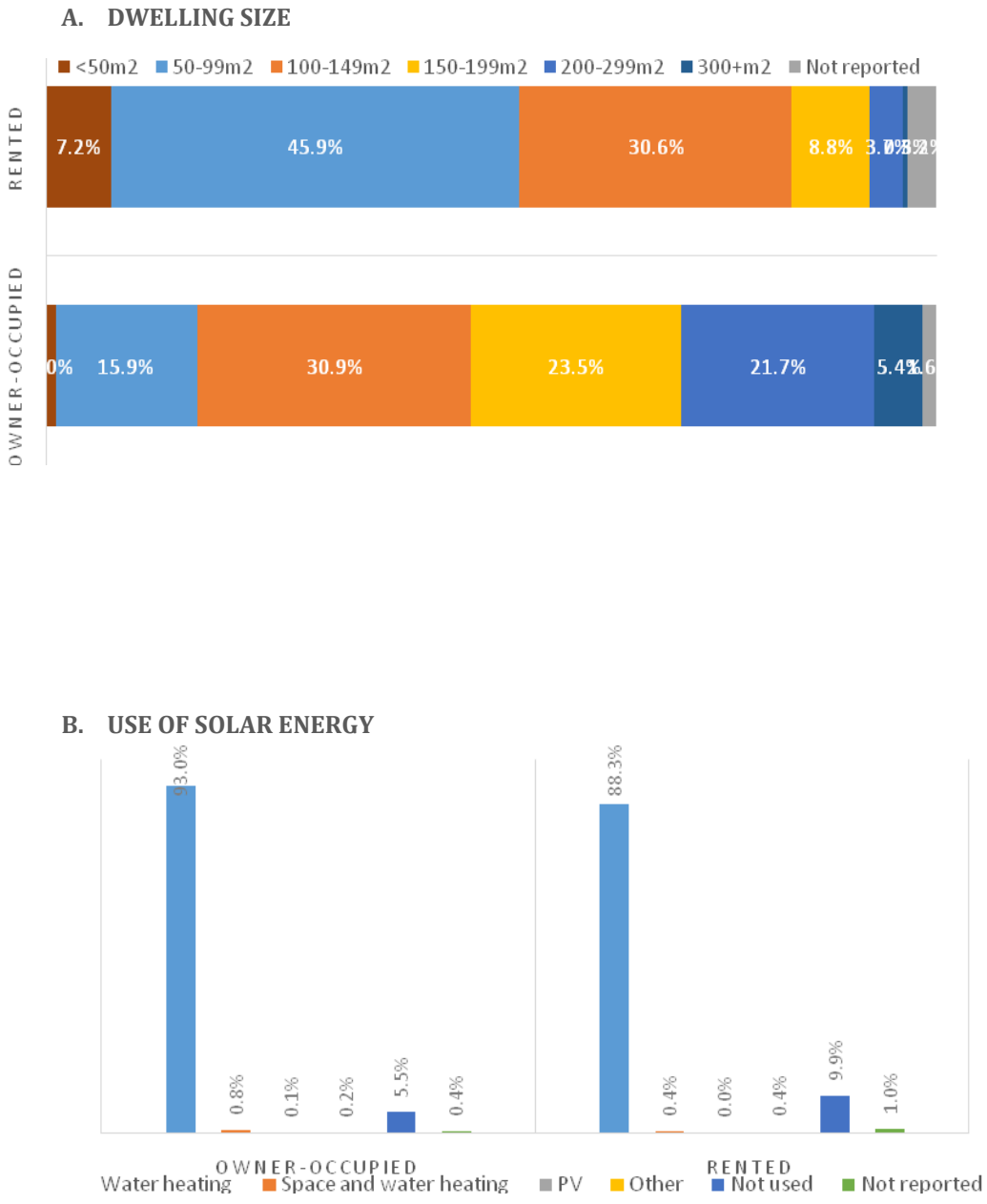
Individual metering

Article 9 of the Directive 2012/27/EU, requires, inter alia, the provision of individual meters to the end users of district heating, cooling and hot water for domestic use, provision of consumption meters at the distribution point as well as with individual meters for buildings or mixed-use building blocks with central cooling and heating. The Amending Law on Energy Efficiency in End Use and Energy Services (N149(I)/2015) and the amending Law on Regulating the Electricity Market (N206(I)/2015) harmonise the national legislation with the provisions of Article 9 of the Directive 2012/27/EU. It should be noted that MECIT have requested technical assistance on the implementation of the provisions of Article 9, paragraph 3 of the Directive 2012/27/EU Directive. The study will be finalised by 31 December 2016.

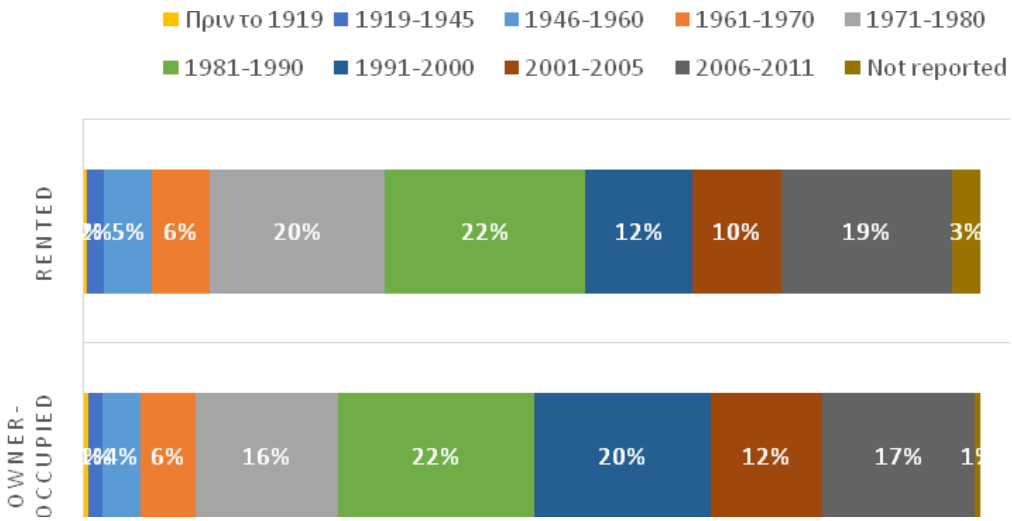
[17] http://www.cylaw.org/nomoi/indexes/224.html, http://www.cylaw.org/nomoi/enop/non-ind/0_224/division-ddd22b2718-a81a-7c43-7dd5-d3e0b1ec728e.html, http://www.moi.gov.cy/moi/DLS/dls.nsf/All/200AFB360D3DAEAEC225701B0024AA1A?OpenDocument

The Electricity Authority of Cyprus (EAC) which is the only supplier as well as the Distribution System Operator in Cyprus has completed an Economic Analysis for the Introduction Smart Meters in Cyprus. According to the findings of the Economic Analysis, the net present value of this project is positive, however the uncertainties are very high and small changes in input parameters could result in different business case. The consultants therefore suggested that in order to minimize these uncertainties, all input parameters must be revised following the implementation of a pilot Advanced Metering Infrastructure (AMI) application project. The pilot AMI project includes the installation of 3000 smart meters in order to further evaluate the technical and economic viability of a possible full scale roll out.

Figure 10 - Differences noted between owner occupied and rented properties in terms of: (a) size of dwellings and (b) use of renewable energy technologies and (c) age of buildings



C. AGE PROFILE



(Compiled using 2011CyStat data)

3.3 Energy Efficiency Directive

Article 19(1)(a) of the Energy Efficiency Directive (Directive 2012/27/EU) recognises the importance of addressing the barrier of split incentives in the building sector. It states:

> *Member States shall evaluate and if necessary take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency, without prejudice to the basic principles of the property and tenancy law of the Member States, in particular as regards:*
>
> *(a) the split of incentives between the owner and the tenant of a building or among owners, with a view to ensuring that these parties are not deterred from making efficiency- improving investments that they would otherwise have made by the fact that they will not individually obtain the full benefits or by the absence of rules for dividing the costs and benefits between them, including national rules and measures regulating decision- making processes in multi- owner properties*

The first National Energy Efficiency Action Plans, submitted by Member States in 2014, inter-alia include information on how Member States planned to implement the provisions of Article 19. This was covered with a varying level of detail by Member States. Among the reported measures, Denmark, France and Germany have undertaken or plan to undertake revisions in ownership and/or tenancy laws in order to address legal issues with regards to the split incentive barrier. Other measures in this area include minimum energy efficiency standards for private rented housing and non-residential buildings from 2018 in the UK and roof insulation requirement for rented properties in the Flanders Region of Belgium. A summary of the main measures compiled by the Coalition for Energy Savings (Wardal, Petroula, Bruel, & Bean, 2015) are presented in Table 25.

Under the Article 19 reporting requirements, Cyprus has notified the existence of the Special Fund for Renewable Energy Sources (RES) and Energy Savings (ES)', established under the 2003 Law on Encouraging and Promoting the Use of Renewable Energy Sources and Energy Saving (Law 33(I)/2003). The grant schemes offered under the Special Fund support renewable energy and energy conservation measures available to

households, public authorities and commercial companies. No specific design parameters for groups that face issues related to the split incentive barrier are currently offered by the grant schemes, so it is not possible to evaluate how successful they have been in practice in tackling split incentive issues. Although landlords can, in theory, apply for an upgrade of their rental properties, in practice the split incentive barrier remains an important hurdle. Moreover, each beneficiary can submit only one application, which means that landlords will likely choose to upgrade their owner-occupied property before upgrading their rented one. In terms of SMEs, a subsidy can be given to SMEs to upgrade a building that they either own or rent. It should be also noted that the policy measures presented under the Renovation Strategy (Annex F of Cypriot NEEAP) have no particular focus on how to address split incentives.

Table 25 - Examples of measures reported in the NEEAPs by Member State with reference to Article 19 of the Energy Efficiency Directive (Wardal, Petroula, Bruel, & Bean, 2015)

Barriers aimed to be addressed by measures	**Measures**	**Member State**
Split incentives between owners and tenants	Housing regulation / programmes aimed at dividing financial contribution or gains from energy saving actions among tenants and owners	France, Denmark, Belgium
	Requirements for dividing financial contribution between tenants and landlords depending on who has a direct agreement with an energy supplier	UK
	Provisions to take into account energy efficiency aspects in property management / lease contracts	Finland, Luxembourg, Slovakia[18], Netherlands
	Considering minimum thermal efficiency performance standards in properties offered for rent or lease in residential and commercial sectors	Ireland, UK
Split incentives between co-owners	Amendments to the housing regulations: voting rules on energy efficiency measures/ loans for renovation projects between co-owners	France, Spain, Austria
Split incentives in social housing	Encouraging energy efficiency investments based on the energy label: an energy-efficient dwelling receives more points under the Housing Value system than a dwelling that is not energy efficient and this forms the basis for the amount of the rental price. Investments in improving the energy efficiency of the dwelling leading to a reduced need for energy can thus lead to an increase in the rental price.	Netherlands

[18]Slovakia listed more measures in its Building Renovation Strategy (EED Article 4) which is not a part of the NEEAP.

Split incentives/Financing issues	Introduction of an accelerated tax write-off of investments in energy renovations	Luxembourg
Split incentives between owners and tenants in the public sector/ Barriers related to annual budgeting for public bodies	Solving funding issues in EE improvements between tenants and owners in public buildings, through amending legislation: introducing an exception that allows actual users of public buildings to use energy efficiency funds for public buildings.	Lithuania
Barriers to energy efficiency services including Energy Performance Contracting (EPC)	Promoting energy efficiency services (EES) including Energy Performance Contracting (EPC) in private and public sectors, providing definitions of EPC and information about EES contracts and clauses as provided by the Energy Efficiency Directive (2012/27/EU), improving legislative framework for EPC: removing legal obstacles, improving housing regulation, using programmes funded by the EU	Spain, Lithuania, Latvia, Czech Republic, Greece, Romania, Germany
Lack of personalised information/necessary qualifications	Dedicated information campaigns, professionals' training, providing support and advice on improving energy efficiency: training courses, networks and regional projects, exchanging experience	UK, Belgium, Romania, Sweden
Barriers related to rules on public procurement and purchasing	Removing legal barriers to considering energy efficiency and broader environmental aspects in public procurement and purchasing and to being able to take up long-term energy savings contracts (more than 3 years) in public sector	Austria, Lithuania
Barriers related to accounting rules and annual budgeting of public bodies	Provision of a consideration of savings from energy efficiency measures not to be returned to the state budget, but to the body that took the measures	Lithuania
Lack of financing	Implementation of targeted programmes for third party financing, a dedicated fund	Belgium, Bulgaria,

	providing financing, co-financing, guarantees to other financing institutions, state aid regulation for improving energy efficiency at local authorities and county councils	Sweden

3.4 Solutions to overcome the split incentive barrier

Various policy actions (regulatory measures, information tools, financial models, voluntary approaches) can be taken by governments to help unlock the energy efficiency potential of the building segments affected by the split incentive barrier. Table 26 presents an overview of various solutions which are classified according to the measure type, type of split incentives that they address, eligible sectors and relevant experience acquired for each solution to date. Examples of solutions which are most relevant for the Cypriot context are discussed in more detail below.

Table 26 – Examples of Solutions for addressing split incentives in the building sector

	Measure type	**Split incentives addressed**	**Eligible sectors**	**Experience to-date**	**Case study**
Minimum energy performance	Regulatory	ESI	Rented residential dwellings; Multi-ownership buildings: Commercial spaces	Low	UK, Flanders, Belgium
Revised rent acts & condominium laws	Regulatory	MSI, ESI	Rented dwellings; Owner occupied and rented multi-family units	Low	France, Germany
Energy labelling	Information/ regulatory	ESI, USI	All	High (mandatory EPCs in EU28)	US, Australia
Green leases	Voluntary	ESI, USI	Leased commercial and public spaces	Low(Mainly outside EU)	Brussels, Belgium
Financial and fiscal incentives	Financial	MSI, ESI, USI	All, with special focus on hard-to-reach target groups	Medium	
On-bill finance model	Financial model	TSI, ESI	All	Low	

3.4.1 Minimum performance levels in rented and multi-tenure buildings

Regulatory action

Mandating minimum standards for rented properties (or a specific segment of rented properties) is a powerful measure which can address the problem of widespread energy inefficiency typically associated with this sector. This can primarily protect social tenants or tenants facing efficiency-related split incentives, who would otherwise have no power to negotiate an energy efficiency upgrade in their rented properties. Under such regulation, the responsibility rests with the owners, who are called to ensure a reasonable level of energy efficiency in rental units, thereby sending a clear signal to the market.

Minimum performance levels in rented or multi-tenure buildings may apply to both residential and commercial properties, target specifically vulnerable groups or can extend to both social and private landlords. The measure can complement existing requirements set in the building codes for minimum energy performance levels which currently apply only for new and major renovated buildings[19]. To ease the burden of compliance by landlords, the availability of financial incentives or the use of models that overcome the barrier of the upfront costs can be considered alongside this regulation (see section on Financial incentives & models).

This practice is not yet widespread in Europe as it is not currently mandated by EU legislation. A few noteworthy examples, which are described in more detail below, are however frontrunners in tackling split incentive barriers in rented (United Kingdom) and multi-tenure buildings (Flanders region of Belgium).

Case study 1– Minimum Energy Class E for rented properties in United Kingdom

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The private rental sector in England contains some of the least energy efficient properties in the country and houses more vulnerable households than any other sector (Ambrose, 2015).It accounts for around 30% of all dwellings and 50% of all commercial properties. Due to the absence of minimum energy efficiency standards within the private rental sector, the UK adopted the Energy Act 2011[20]which, inter-alia, introduces legislation to drive up energy performance in the sector. It states that:

(a) From April 2016 landlords will be unable to refuse requests from tenants for 'reasonable' energy efficiency improvements

(b) From April 2018 all private rented dwellings must achieve a minimum EPC rating of E (where this is physically and economically possible).

That is, no landlord can let out a commercial or residential property with an energy performance label F or below by 2018. While sale transactions of buildings with label F or below can still be undertaken after 2018, these properties can only be owner-occupied. With a 7 year period between its adoption and enforcement, the legislation provides a sufficient window of opportunity for landlords to take measures before the law is in effect. A push during this transitional period is anticipated by the enforcement of additional measures, including a new tax break (with a dedicated annual budget of £35 million) designed to target residential landlords in the period July 2014 to March 2017.According to expert opinion, the measure has already had some impact in the

[19] As required by Directives 2002/31/EC and 2010/91/EU on the energy performance of buildings
[20] http://www.legislation.gov.uk/ukpga/2011/16/contents/enacted

commercial sector, which can be partly attributed to the fact that commercial leases are of longer duration so early action is expected. In addition, property agents have been supportive of the measures introduced by the Energy Act 2011 as they have viewed it as a market opportunity.

Case study 2– Roof insulation requirement in Flanders, Belgium

The Flemish Housing Law, which was created in order to realise the fundamental right on housing, stipulates that everyone is entitled to affordable and good quality housing. By setting minimum housing standards, it aims to ensure safe and healthy housing with minimum basic comfort levels across the region. In accordance with the Law, a housing quality inspection can be carried out in a dwelling and a technical report is prepared, assessing various defects identified in the property. By using a point-based penalty system to determine compliance with the minimum standards (see

Table 27), the technical report identifies safety and health risks as well as cases whereby dwellings are deemed "unsuitable for habitation" (above 15 penalty points).When a rented dwelling is found to be unsuitable for habitation, an administrative procedure is followed in collaboration with the responsible municipality which results in an annual tax bill. For certain cases, a criminal procedure is initiated. For less severe cases (less than 15 points), improvements to the dwellings are encouraged through, e.g. participation in available grants targeting extensive renovation, grants for vulnerable groups as well as various tax incentives.

Table 27 - The point system used in the technical report

1-3 points	Minor defect (e.g. insufficient lighting or humidity in the basement)
9-15 points	Serious defect (e.g. fire or explosion risk, or serious humidity problems)
Above 15 points	Unsuitable for living

The minimum housing standards in the Flemish Housing Code have been recently revised to include an obligation for roof insulation. This came into force in 2015. The new roof insulation requirement is included in the inspection and stipulates that R value for roof insulation shall be at least 0.75m² K/W, corresponding to insulation thickness of around 3-4 cm. In apartment buildings this rule considers that the roof is a common part of the building so the obligation applies to all residents, including those who do not occupy the top floor. The obligation, which also covers non-rental units, envisages a phased introduction of roof insulation standards. Penalty points for non-compliance are expected to be gradually increased from 2015 to 2020 (Table 28) and it is foreseen that dwellings with roofs larger than $16m^2$ with $R<0.75m^2K/W$ will be automatically deemed unsuitable for habitation.

Table 28 - Roof insulation requirement added in the inspection

Penalty points	Roofs<16m^2 with R<0.75m^{2}K/W	Roofs>16m^2 with R<0.75m^{2}K/W
1.1.2015-31.12.2017	1	3
1.1.2018-31.12.2019	3	9
From 1.1.2020	9	15

Following its first year of implementation, the measure has gathered political and social support and there is now consideration for the inclusion of minimum glazing requirements in the list of minimum standards. It is therefore likely that penalty points for single glazing will be introduced by 2020.

The government has concluded the following findings one year after including the roof insulation requirement in the housing quality inspections:

- Wide spread communication and a supporting policy (end-of-life grants, focus on vulnerable target groups) are crucial;
- The pressure on the small private rental market increases, but remains limited due to the phased introduction and low minimum requirement;
- Remaining bottlenecks include issues related to inspecting roof insulation on-site as well as sanction procedures in mixed tenure buildings (apartment buildings with both owner-occupants and tenants).

3.4.2 Revised rent and condominium acts

Regulatory action

Lifting regulatory barrier that inhibit energy efficiency investments in rented and multi-ownership buildings is essential. This includes revision of condominium laws, which need to clearly define the obligations with regards to necessary maintenance of common parts of the buildings, the democratic rules and process with which maintenance work is undertaken as well as the roles of involved actors. In many cases across Europe, a single owner should not be allowed to stand in the way of the improvements, and majority-based rules should be adopted (Table 29). Moreover a requirement to carry out energy efficiency upgrades at the same time as maintenance work can stimulate energy efficiency upgrades as well as improve the cost effectiveness of the combined work due to lower combined costs for scaffolding, access to pipes and wires, re-decoration etc. In Scotland the Climate Change Act considers insulation as a maintenance measure rather than an 'improvement'[21], which means that agreement to install insulation in multi-occupancy (tenement) buildings can be approved via a majority rather than unanimously (in buildings in which it applies). In Denmark, condominiums must maintain a fund for building refurbishment that contains at least 4% of the building's value[22]. The Netherlands has a law obliging the owners of apartments to set up a fund for long term

[21] See section 69 in Climate Change Act 2009: http://www.legislation.gov.uk/asp/2009/12/pdfs/asp_20090012_en.pdf

[22] http://www.euroace.org/EuroACEActions/Projects/HighRise/FindingaWayForward/Opportunitiesandbarriers/legal.aspx

maintenance, with differences made between normal maintenance and extra energy investments[23].

For rented properties, flexibility that would enable the tenant and landlord to come to an agreement for an energy efficiency upgrade in the rented property should be introduced in rent acts. This would require laying out legal framework and specific conditions for the redistribution of investment cost and energy cost savings of an energy efficiency upgrade between the landlord and the tenant or between multiple owners. Additional issues that need to be addressed include extent to which the rent can be increased and conditions under which the tenants can reject rent rises. In addition to the example of France (described below), other examples include the Italian region of Emilia Romagna, where a law was approved in December 2013 that permits the use of energy cost savings for investment repayments of energy efficiency interventions. In addition, an amendment in the rent act aimed to make energy efficiency upgrades more attractive for landlords and tenants is foreseen in Denmark. In particular, the benefits of the upgrade will be divided between landlords and tenants without changing the overall housing costs for the tenant. This principle is also applied in the Netherlands, through a bill approved in March 2011, which incorporates energy performance in the rental price evaluation system used in the social housing sector (see Case study 7). The rental price evaluation system, which is used to determine the rental price for houses and apartments in the social housing sector, offers landlords the opportunity to increase the rent if the score on the energy label improves, thus incorporating energy efficiency in the evaluation criteria. The decrease in energy costs due to energy efficiency measures should outweigh the rental price increase in order to ensure lower living expenses.

[23] http://urbact.eu/sites/default/files/import/Projects/CASH/news_media/CASHminiguide2_nov2011.pdf

Table 29 - Required majority for decisions related to renovations in multi-ownership dwellings [Source: (Heiskanen, et al., 2012)]

	Type of ownership[24]	Required majority for decisions on renovations, %	Other factors influencing renovations
AT	Unitary system	>50% of shares, but minority rules	The minority rules. Mandatory renovation fund usually not big enough. Joint loans possible, but administratively complex.
BG	Condominium ownership/ unregulated	>67% (of area)	All buildings do not have a homeowners' association. When no homeowners' association is established, each owner needs a separate loan for the renovation.
CZ	Condominium ownership	>75% of votes	Banks usually require that all apartment owners mortgage their apartments for the loan.
DE	Condominium ownership	>75% of shares	Mandatory renovation fund (1% of value of building). Taking out a loan can require a mortgage by all residents.
FI	Housing company, similar to unitary system	>50% of shares	The housing company can take out a loan of its own, once the majority of owners have agreed to It.
FR	Condominium ownership	>50% of shares	Taking out a loan can require a mortgage by all residents.
IT	Condominium ownership	>50% of shares (for energy investments)	Dissenters can move to delay the implementation of decisions with significant financial consequences.
RO	Condominium ownership	>67%	Taking out a loan can require a mortgage by all residents.
ES	Condominium ownership	>50%	Can be less for renewable energy (1/3), but those voting against cannot be charged. Taking out a loan can require a mortgage by all residents.

[24] Based on Lujanen (2010).The unitary system refers to an undivided apartment building/block of flats, of which owners own shares. Condominium ownership refers to a system where the owners own their dwelling and all owners jointly own the common parts and the land.

Case Study 3 –Tenancy and Energy Transition Laws in France

The French government has launched various measures to support energy efficiency in rental and condominium sectors:

1. Tenancy law (Law n°323)

The French tenancy law was amended in 2009 to facilitate the redistribution of the financial benefits of an energy efficiency upgrade between concerned actors. Under this amendment, a landlord has the right to ask the tenant to make a contribution to an energy efficiency investment by participating in the cost recovery of the work. The contribution is separate from the rent paid by the tenant and cannot exceed 50 % of the cost of energy savings. This contribution can however only be asked if substantial work has been done or if the dwelling reaches a minimum level of energy performance. The participation, limited to a maximum 15 years, is specified in the rent agreement. A consultation between the landlord and tenant regarding the nature and advantages of the renovation has to be first initiated and should be followed by the agreement of the tenant for the redistribution arrangement. If the tenant changes during the contribution period, the landlord then has to justify the energy saving renovation made and the maintenance of this contribution until the agreed deadline before concluding a new rent contract with a new tenant. It is not clear how successful these amendments have been in reality in incentivising landlords and tenants to engage in projects that improve the energy efficiency of the rented dwellings.

2. Energy Transition for Green Growth Law

The new Energy Transition Law, published in August 2015[25] has introduced various far-reaching measures to encourage, inter-alia, energy performance improvements in condominiums and rented dwellings. It is designed to give France the means to diversify its energy mix and enhance its actions contributing to tackling climate change. It covers a large scope of economic activities and brings in binding energy targets for transport, housing sector and renewable energy. The provisions of the Law include:

- Outdoor wall and roof energy renovation works that do not respect urban planning rules may be allowed (Article 7);
- The requirement that lessors rent dwellings that meet minimum energy performance levels (Article 12);
- Minimum energy requirements applicable to social housing are extended from collective dwellings to individual housing (Article 13)
- The publication of a decree forcing co-owners to take into account energy performance when performing important restoration works including roof rehabilitation(Article 14-I);
- Simplified administrative procedure for energy upgrades of communal parts of buildings by recognising simple majority voting among tenants (Article 14-IV);
- The requirement that owners of a multi-unit building or the condominium management agent assess the individual heating and hot water provided to each individual unit (in case of common heating system).Individual billing for heating and electricity consumption are required in all buildings fitted with a collective

[25]A summary of the law (in English) can be found on the website of the French Ministry of Ecology, Sustainable Development and Energy at http://www.developpement-durable.gouv.fr/Energy-transition-for-Green-growth and full law text (in French)at https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031044385&categorieLien=id#JORFARTI000031044464

heating and/or hot water system. The implementation of this requirement is expected within March 2016 (Article 26);

- The specification of the authorities in charge of offence recording and sanctions when individual measurement is not operational, and introduction of financial penalty per dwelling for owner or management agent that do not respect their obligations (Article 27)

The adoption of the Law (which contains 215 articles in total) is expected to create more than 75,000 new jobs in the housing sector through energy renovations. The Law also sets minimum energy consumption requirements for public buildings and, where possible, requires them to be energy positive.

3. Other

The Law "Grenelle 2", put into force in 2010, requires that mandatory energy audits are carried out in multi-ownership buildings of minimum 50 units that benefit from a common heating installation. In addition, Article 241-9 of the French Energy Code has made mandatory the individual measurement of heating and hot water consumption in condominium having a common heating system since 2011.

Case Study 4 - Tenancy Amendment Act in Germany

The German Federal Government has adopted a comprehensive action plan for national energy efficiency including measures to tackle remaining obstacles to its effective implementation. Adopting amended tenancy law as well as federal legislation on the energetic quality of buildings and the provision of energy services form an integral part of the German national energy efficiency action plan. The Tenancy Amendment Act of 2013 implemented rather far reaching provisions for housing and commercial leases alike. In particular, a concept of energy upgrade was introduced (i.e. refurbishment of a building or apartment that results in less consumption of end-use energy). Tenants' legal powers to oppose such refurbishment and/or to reduce rent on statutory grounds have been curtailed, thus, minimising the landlords' cost risks in connection with energy upgrades. Notably, a statutory rent-raise of up to 11 per cent of the refurbishment costs has become available to the landlord after successful completion of works.

The law furthermore provides that shifting to energy contracting in an existing lease does not require tenant's consent, even if the tenant pays the contracting fees under the lease as operating costs. The amended tenancy law now reflects the legal prerequisites in greater detail than the judiciary have previously approved already, hence, affording more legal certainty to landlords who consider energy contracting. The tenancy law provisions introduced have over-all been well received. From a practitioner's point of view the new law is "practice approved". However, potential for legal dispute still lies with the distinction between (recoverable) refurbishment costs and (non-recoverable) maintenance and repair costs.

3.4.3 Energy labels

Information tool

Building energy labelling is a powerful disclosure tool which provides potential buyers, tenants, financiers and other real estate actors with information on a property's energy performance. It offers the possibility to make more informed decisions during sale and lease transactions and overcome, to a certain extent, information asymmetry issues, which typically exacerbate the split incentive barrier. Through this information, the actor can make comparisons with other similar properties of interest, gain a better understanding of the holistic costs associated with a property, and identify where and how to invest in energy efficiency upgrades.

Energy Performance Certificates

In the EU, the main policy framework through which this information tool has been introduced is the Energy Performance of Buildings Directive (EPBD, Directive 2002/31/EC). Under this Directive, all Member States were required to set up the mechanisms and establish systems of certification of the energy performance of buildings which make it possible for owners and tenants to identify the energy class of their building together with recommended improvement measures on how to further increase its energy performance. These mandatory Energy Performance Certificate (EPCs) schemes set up by the Member States were further strengthened with additional requirements, introduced with the recast of the EPBD (Directive 2010/31/EU). EPCs are currently among the most important sources of information on the energy performance of buildings, which, historically, has been very hard to obtain. Available at the point of lease or purchase, they can guide a potential owner or tenant during their decision making process, can be used as a tool for calculating the pre and post-performance of a renovated building and predict energy cost savings as a result of an energy efficiency upgrade.

Although these schemes have been in place for more than a decade, various areas of improvement have been identified. For example, the value of energy efficiency in the certificates (through lower energy bills) is not clearly displayed to prospective building tenants and purchasers, while Issues related to their public acceptance and practical use have been raised. The need for proper implementation which can reinforce the quality assurance process has also been recognised. Another shortcoming of the EPCs is that it is based on energy performance calculations which assume a standard occupant usage. While this allows for a level playing field comparison of various properties during transactions, the impact of the tenant on the overall energy consumption is not captured by the certificates (see section below).

A link between good energy ratings and properties attracting greater sale and rental prices has been made in some countries (e.g. France and the Netherlands), highlighting the role of EPCs as a driver for energy efficiency improvements. To strengthen their impact on the market, the following recommendations are made:

- establishment of independent control systems and penalties for non-compliance
- improvements in the methodological framework, software tools and quality of energy saving calculations
- introduce further requirements on the qualifications of the certifiers and implement accreditation schemes for installers and EPC assessors
- maintain a publicly available database of all EPCs

A link between the energy class of a building and access to financial incentives can further strengthen the visibility of the EPC. In a study carried out by (Economidou & Bertoldi, 2014), it was found out that 18% of the examined economic instruments supporting energy renovations made a link between the economic incentive and the energy class of the buildings. Moreover, incorporating the building energy class in the property tax, which currently mostly depends on the real estate value of the building, can give an incentive to property owners to invest in energy saving measures in order to reduce their tax burden. Bürger (2013) propose that the adjustment can be revenue-neutral – i.e. tax levels are increased for inefficient buildings and decreased for efficient ones– or revenue-generating where taxes are increased for inefficient buildings only. The generated revenue of the latter could feed a public support fund which would provide incentives to groups with low creditworthiness or limited capital to invest (e.g. low income households or SMEs).

Tenant-focused energy ratings

The measurement of energy efficiency is particularly complex and a distinction between building- and user-related energy consumption, where the responsibility of the first lies with the landlord and the second with the tenant, is increasingly needed. The use of both building and tenancy ratings can be particularly beneficial for the cost or benefit sharing models of energy efficiency upgrades.

Case study 5: National Australian Built Environment Rating System

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The National Australian Built Environment Rating System (NABERS) for offices is an example, which can be used to differentiate the performance of a tenancy, the base building or the whole building. The National Australian Built Environment Rating Scheme (NABERS) has been introduced in 1999 and is a national rating system that measures the environmental performance of Australian buildings, tenancies and homes. It is operated by government with industry consultation and it measures the energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy and its impact on the environment. It does this by using measured and verified performance information, such as utility bills, and converting them into an easy to understand star rating scale from one to six stars[26].

Under this system, base building rating covers the performance of the building's central services and common areas – usually managed by the building owner, while the tenancy rating includes only the energy or resources that the tenant controls. A whole building rating covers both the tenanted spaces and the base building, and is typically used in an owner-occupied building, or where there is inadequate metering to obtain a base building or tenancy rating. NABERS are aligned to procurement boundaries, whereby tenant and landlord are assessed separately. Electricity metering are well split between tenant and landlord.

In case of office energy ratings, the Key Performance Indicator (KPI) is the following:

$$KPI = f\ \frac{\sum Energy\ use \times Emission\ factor}{Occupied\ area \times Hourd\ of\ service \times Climate\ factor}$$

The KPI are benchmarked against real building data: e.g. 2.5 stars correspond to the market median, 7 stars to "carbon neutral".

[26]Where 1 star means building or tenancy has considerable scope for improvement and 6 stars demonstrates market-leading performance

The National Green Leasing Policy (GLS) for office buildings stipulates minimum design and operational energy and water performance standards. The NABERS ratings were chosen as they focus on building energy and water efficiency, are nationally recognised and are relatively simple and cost effective compared to other indicators. While some systems rate design performance benchmarks, NABERS rates the operational performance and can be complimentary to design. The National GLS requires annual accredited NABERS ratings to be undertaken to demonstrate progress and compliance. The following performance targets are outlined in the Policy and supporting GLS:

- 4.5 stars NABERS Energy base building (or whole building if a base building rating is not possible);
- 4.5 stars NABERS Energy tenancy; and
- 4 stars NABERS Water whole building.

Case study 6: Tenant Star, USA

In the US, the Better Buildings Act – a bill amending federal law aimed at improving the energy efficiency of commercial office buildings – requires the Environmental Protection Agency (EPA) to develop a voluntary Tenant Star programme within the Energy Star programme to recognize tenants in commercial buildings that voluntarily achieve high levels of energy efficiency in separate spaces. The Tenant Star programme will certify tenants operating commercial office spaces and encourage them to team up with landlords in order to design, construct and operate within leased spaces in commercial buildings that achieve high levels of energy performance. The motivation behind it lies with the fact that while building systems such as boilers and chillers are getting more efficient, tenant spaces may offset savings by ignoring efficiency in their space design and occupant behaviour. Plug and process loads, which include tenant space items such as refrigerators, computers and printers, are widely considered the fastest-growing category of energy use in office buildings. The establishment of Tenant Star could provide greater motivation for many owners and managers to develop a tenant engagement plan that tackles reducing energy use. For many owners and managers, the establishment of Tenant Star could provide greater motivation for many owners and managers to develop a tenant engagement plan that tackles reducing energy use.

The programme is currently under development and is expected to have a significant impact on the market.

3.4.4 On-bill finance

Financial models

On-bill financing is a mechanism of obtaining access to capital to fund building energy efficiency upgrades, where repayments are made through the energy bill. On-bill financing allocates the financing responsibility to the utility and maintains the loan attached to the property, thereby offering an appropriate solution to overcome temporal split incentives. It can also avoid the need to obtain upfront capital to cover the cost of buying energy efficient equipment, which can be beneficial to the landlord. The energy utility will typically aim to make the monthly payments equal to or less than the energy

savings achieved through the upgrade, which means that the tenant will be no worse off financially.

The UK has been the first European country which adopted an on-bill finance scheme, designed to address, inter-alia, the split incentive barrier. The Green Deal, which came into force in the beginning of 2013, allows owners to install measures at no upfront costs and enables repayments to be made through a charge on the occupants' utility bills. The repayment stays with the utility bill rather than the occupier and gets transferred to whoever is the electricity supplier. The scheme has so far failed to attract sufficient participation as it contains a number of weaknesses, the main one being the high interest rate attached to the Green Deal loans of at least 7 % plus add-ones (references).

While an on-bill finance scheme can address both owner-occupied and rented properties, Bird & Hernandez (2012) stressed the need for a careful design of such schemes specifically targeting rented properties. A successful on-bill finance programme should create incentives for all stakeholders: tenants (savings), landlords (savings/investment), utilities (protection/decoupling) and by extension, banks. As high transaction costs linked to the realisation of investments deter landlords from upgrading their rented property, the authors proposed a small incentive to be considered for landlords of rented properties in the private and/or social housing sectors. If landlords are allowed to get an incentive in the form of a small share of savings, covering the transaction costs attached to the upgrade, this could trigger participation in on-bill programmes on behalf of landlords.

3.4.5 Incentive schemes

Financial and fiscal incentives

Energy-efficiency incentives offered by governments, energy suppliers and other bodies are intended to overcome upfront costs barriers. They are however not designed to meet the unique challenges faced by multi-unit buildings or rented properties. A survey carried out by the JRC in 2013 showed that a large share of financial instruments targeted homeowners, while many schemes whose eligible recipient list included multi-apartment or rented units, did not use financing options that were carefully designed to meet the specific needs of these segments of the building sector (Economidou & Bertoldi, 2014).

Various financial and fiscal incentive schemes can be designed to support specific segments of the building sector in which involved parties would refrain from improving the energy efficiency of the building under normal circumstances. In the UK, a tax break scheme (with a dedicated budget of £35 million) has been designed to support residential landlords in the period 2014 to March 2017. Its intention is to provide support to private landlords before the legislation on minimum energy efficiency levels for rented properties come into force in 2018. The Landlords Energy Saving Allowance, a tax break scheme which has been in existence for many years, also gives the opportunity to landlords to deduct the cost of acquiring and installing certain energy saving measures against their income tax. The Government has also already taken action to encourage the installation of energy efficient measures in rented properties, with the implementation of the Green Deal scheme, which allows repayments to be passed through bill savings.

In the Netherlands, the state plans to make available a €400 million subsidy for landlords in the rental social housing sector for investments in energy efficiency for the period 2014–2017 with the aim of contributing to the objectives of the Energy Saving Agreement for the Rental Sector. Under this agreement, housing corporations have set an energy saving target of 33 % between 2008 and 2020, which corresponds to an average energy label B by the end of 2020. Housing corporations in the Netherlands own around 2.3 million homes, which correspond to 30 % of all Dutch housing stock The Flanders region of Belgium will provide a grant of €23 per m2 as an additional incentive for rental dwellings occupied by vulnerable tenants.

In France, the zero-rated eco-loan scheme has been introduced in by the "Finance Law 2009" enabling landlords to get a loan to fund energy efficiency works (insulation, heating or water heating using renewable energies) for their main residence (if built before January, 1st 1990). This loan is granted by banks which have concluded specific agreement with the French State under conditions fixed in the General Taxes Code. From January 2015, this loan may be granted to co-ownership in the limit of €10,000 per flat over 10 years (or up to €30,000 over 15 years if the co-owners perform 3 different works). Contrary to individual zero-rated eco-loan, there is no obligation for co-owners to perform a bunch of works to benefit from this scheme. Works improving energy performances or enabling to reach a minimal global energy performance threshold or renovating water treatment system are eligible. The SGFGAS agency (Society of Management of Funds for Guarantee of home purchasing), which manages both traditional 0% rate loans to support households in purchasing housings and the 0% eco-loan from the French State, has collected since 2009 different statistics data. While the last figures show that the direct beneficiaries of this scheme are mostly owners, the proportion of tenants interested by this scheme is slowly increasing.

Other financial incentive programmes specifically designed to provide grants to multi-apartment buildings include the National Renovation Programme for Residential Buildings in Bulgaria and Latvian Improvement of Heat Insulation Programme. In the Flanders region of Belgium, the procedures for energy grants were reformed in 2011 to simplify applications from multi-owner apartments.

3.4.6 Green leases

Voluntary actions

Traditional forms of lease create asymmetries in the relationship between landlords and tenants and therefore do not set the ground for energy efficiency investments. Green leases can play an important role in establishing a dialogue between tenants and landlords which can enable both parties to minimise adverse environmental impact in areas such as energy, water and waste

The following proposed definition describes the content and the target of a green lease (CMS, 2013):

> *A green lease is a lease agreement which is intended to ensure that a leased property is used and managed in a manner which fosters sustainability. The tenant and the landlord thus mutually undertake to conserve natural resources and energy with regard to the leased property. The parties may also document the sustainability of the leased property by acquiring or receiving certification and creating the conditions for the environmentally friendly use of resources.*

In practical terms, green leases can take the form of different types of documents such as a lease agreement, a memorandum of understanding or declaration and can cover different types of environmental obligations. In some cases, a Memorandum of Understanding, annexed to the lease, is used instead of a lease which provides a flexible mechanism enabling collaboration between negotiating parties. Green leases set compulsory or voluntary provisions that require or encourage the landlord and the tenant to reduce the environmental impacts of the leased premises. Green leases may have a wide scope: energy efficiency, water management, waste management, use of sustainable material for reparation and alternations, green transport related to the building ((Van Calster, et al., 2015)). If the necessary legislative foundations exist, green leases can bridge the differences between landlords and tenants in a way that both parties can gain from an energy efficiency upgrade. They can include a clause or separate agreement made between the concerned actors that allow a property owner to raise the rent to finance energy efficiency improvements to a property. The green lease

should regulate the recording and calculation of operating costs based on consumption (especially heating, refrigeration, electricity, water, etc.); in some countries this has already been prescribed by law. Tenant should be obliged by contract to accept the measures undertaken by the landlord (in particular refurbishment) to improve energy efficiency in the building and to promote environmental protection. Lease should grant landlord the right to pass an appropriate amount of the costs of improving energy efficiency and observing environmental principles onto tenant or to increase the rent by a reasonable amount. If a building has been certified as "green", tenant should undertake to observe the certification conditions and act accordingly, e.g. only install elements in the building which are made of energy-efficient and eco-friendly materials. The parties should agree to act in such a way as to save energy and promote environmental protection (e.g. correct conduct as regards heating or refrigeration, water consumption or recycling waste). Landlord should inform tenant about possible ways to save energy and be environmentally responsible.

As in the case of on-bill financing model, green leases assume that energy cost savings should exceed finance charges, and should be set at a percentage of monthly energy cost savings to the tenant. An agreement to allow the landlord to increase the monthly rent to cover the cost of investing in energy efficiency upgrades to the building needs to be made. If the monthly rent increase is less than the monthly energy savings of each tenant, then the tenants are able to save on overall monthly expenditures, while the landlord is able to realize a return on his investment. In order for a green lease to be agreeable to all parties, energy savings must be guaranteed (e.g. through an energy performance contract with an ESCO). The cost recovery, typically done by amortisation, can be based on the actual or predicted energy savings. In New York City, recovering the cost based on predicted energy savings is considered risky by tenants in case energy upgrades underperform. For this reason, the owners' capital expense that can pass through can be up to 80 % of predicted savings in a given year. This is based on industry's experience which showed that actual savings are generally within ±20 % of predicted savings. Tenants are therefore protected from underperformance by a 20 % "performance buffer" (performance corrector factor).

This type of leases has gained increasing popularity in the past few years in the U.S. and Australia and is mainly practised in large, commercial buildings rather than small units such as houses[27]. Despite their potential, green leases are not yet widely used in Europe. In Finland, some contracts in the public sector with positive results have taken place. In the Netherlands, sustainable leases are currently investigated by the Platform for Sustainable Housing. A survey carried out by European Property Federation highlighted that there are still various regulatory and non-regulatory hurdles that inhibit a wider use of green leases in Europe (Hordijk, 2013). In the UK, the Better Building Partnership (BBP), an initiative of the London Climate Change Agency consisting of commercial and public property owners, published a Green Lease toolkit which contains a set of best practice recommendations, case studies, principles, a model form MoU and model form of green lease clauses[28].

[27] The use of green leases is mainly driven by the commercial sector. Reasons why green leases in the commercial sector are currently more popular include the facts that commercial tenants are more conscious of their accumulated costs (e.g. energy costs) and residential tenants have little bargaining power compared to commercial ones. Transaction costs are expected to be higher in smaller, residential buildings, which can be an additional discouraging factor.

[28] This can be downloaded at http://www.betterbuildingspartnership.co.uk/green-lease-toolkit.

Table 30 - Available guides on how to draft a green lease across the world

Green Lease Clauses in Europe - A practical approach, CMS	Belgium
Green Lease Toolkit and Memorandum of Understanding, Better Buildings Partnership	United Kingdom
Energy Efficiency Lease Guidance, Natural Resources Defence Council	United States
Commercial Lease: Guide to Sustainable and Energy Efficient Leasing for High-Performance Buildings, Buildings Owners and Managers Association	United States
Various Green Lease Guides, Real Property Association of Canada	Canada
Lease forms and case studies, Green Lease library	United States
Tenant's Guide to Green Leases, Council of Australian Governments	Australia

While no regulation concerning green leases exists at the EU level, in France there is a requirement[29] to attach an environmental appendix to leases of properties used as offices or for commercial purposes with an area greater than 2,000 m². This obligation applies to any type of lease signed or renewed as from 1st January 2012. The environmental annex shall set out the information which are mutually due by the tenant and the landlord, namely:

- energy characteristics of the existing equipment within the building/demised premises and relating to the waste treatments, heating system, cooling system, ventilation and lightning as well as to any other system which is linked to the specificities of the building or of the demised premises;
- real energy consumptions of the equipment and systems which are operated (i.e. energy bills) at a yearly basis;
- yearly water consumption of the premises, equipment and systems which are operated; yearly quantity of waste generated by the building and/or the premises if the landlord or the tenant is in charge of the treatment thereof and, as the case may be, the quantity of such which it has yearly collected via third parties in view of a valorisation or a specific treatment

The annex must also reflect the obligation made to develop an action plan in order to improve the energy and environmental performance of the building and demised premises. In general, the parties organise for a committee to be created between tenant and landlord in order for this committee to determine objectives.

[29] The requirement is stipulated in Article L 125-9 of the French environmental code ("Grenelle II"). The Decree 211-2058 dated 30 December 2011 details the content of this environmental annex.

Case study 7 – Green lease in Belgium

The Brussels Environment Agency (BIM/IBGE) has launched a project aiming at setting up a new technique for the financing of energy renovation works. It consists of two phases: (1) technical, financial and legal analyses relating to possible actions in this field and (2) preparation of a lease template aimed at organizing the landlord/tenant relationship in the framework of a live test.

Selected lease relationship is the residential lease entered into in respect of a property that does not make part of a co-ownership. Under the proposed system, both landlord and tenant must benefit, whereby the landlord carries out the energy saving works at own costs, but can recharge a part of those costs to the tenant through a monthly energy service charge. The tenant will however benefit from a part of the energy saving. The landlord will recover 75% of his net investment, while the remaining 25% will be regarded as a capital gain for the property. The net cost of the investment shall be equal to the cost of the investment less any subsidies, grants, tax reductions. Deductions that are borne by the landlord (e.g. in order to comply with certain statutory requirements) are also considered. IBGE prepared a list of authorized/qualifying investments and has created a calculator that evaluates the energy savings for a given investment, taking the lifetime of the investment into account.

3.4.7 Innovative rent structures

The Energy Efficiency Directive includes a set of articles (namely Articles 9-11) on metering and billing which can potentially have a profound impact on the market. It, specifically, calls on Member States to impose metering requirements on district heating, district cooling and communal heating/hot water systems (Articles 9 (1) & (3)), implement a set of requirements for the roll-out of smart meters (Article 9 (2)) and introduce individual metering in multi-apartment buildings. All these requirements are a pre-requisite for the establishment of detailed energy monitoring of apartments in multi-family buildings. This can enable, tenants and owners to become more aware of the monetary implications of energy consumption and savings based on metered data.

Individual metering is particularly important for overcoming the usage-related split incentives and can offer the possibility of more innovative rent structures to be considered. The gross lease model coupled with direct energy consumption feedback to the tenant (adjusted warm rent – see Table 31) can potentially align incentives for both parties (landlords and tenants). While landlords can charge higher rent to recoup the cost of making energy efficiency improvements under such rent structure, tenants can be more aware of their own impact on the energy consumption. Consumption feedback means that tenants can receive compensation, if they consume less encouraging them to adopt a more energy efficiency behaviour. Conversely, if tenants exceed the pre-set consumption levels, the additional energy costs are borne by the tenants. The functionality of real-time information on consumption for the users offered by smart meters can further strengthen this feature and indeed align incentives between landlords and tenants.

An empirical study performed at the Centre for Energy Policy (CEPE), ETH Zurich, on the preferences and willingness to pay of tenants and landlords for energy saving renovation of buildings has shown that tenants are willing to pay more for the rent (between 3 and 13%) if an energy-saving renovation is carried out. Specifically they are willing to pay 3% for an enhanced insulated façade and 13% for a general insulation of the buildings,

including natural ventilation. A similar study could be carried out for Cyprus in order to investigate how Cypriot tenants would respond to such a rent increase and how innovative rent structures that can partly cover energy efficiency upgrade costs would in practice align incentives between owners and tenants.

Table 31- Difference between traditional (Gross warm, gross cold, net rent) and innovative rent structures (adjusted gross warm rent)

	Cost structure	Presence of split Incentives
Gross warm rent	All operating expenses incl. heating are covered in the rent.	ESI
Gross cold rent/ Net cold rent	Heating costs must be paid separately. In the case of gross cold rent, all other operating expenses are included in the rent.	USI
Adjusted gross warm rent	Tenant gets "refund" if they consume more energy, or pay additional charge if they exceed pre-set consumption	-

Case study 8 – Rent evaluation system in Netherlands

Energy saving and sustainability are high on the agenda of Dutch social housing organisations. The updated National Covenant on Energy Saving in the rental sector aims at an average energy label B by the end of 2020. This represents an energy saving target of 33% between 2008 and 2021 and concerns building- and installation-related energy consumption for space heating, hot water and ventilation. The present rate and depth of energy renovations are, however, not sufficient to meet this target.

Rent setting in the Dutch solar housing sector is based on a 'home points system', in which various features like space and facilities add points. The points system set a ceiling of the maximum rent social landlords can charge and it takes into account various criteria such as the dwelling quality, location and size. A bill, which was approved in March 2011, enabled the incorporation of the energy performance of the dwelling in the criteria list used in the evaluation. This change now offers landlords the opportunity to increase the total rent if the energy label improves and thereby an opportunity to recuperate part of the investment costs for energy efficiency upgrades. The total rent covers both base rent and utility costs (i.e. gross lease), so while the landlord benefits from higher total rent, the tenant benefits from cheaper running costs which balance out the total rent.

3.5 Conclusions and recommendations

Market barriers, such as split incentives, have been a long-lasting impediment to energy efficiency improvements in the building sector. Traditionally used to describe the misplacement of incentives between landlords and tenants, this barrier manifests itself in different ways and various segments of the building sector.

In Cyprus, around 60 % of all dwellings may face one or a combination of different types of split incentives. The owner-occupied multi-family sector representing one third of the entire dwelling stock of Cyprus typically faces a multiplicity of challenges. This includes different levels of understanding, motivation and priorities among co-owners,

organizational issues linked with collective decision making process, financial complications due to variety in credit worthiness and owner income levels, etc. Energy efficiency improvements in the rental sector (represented by 24.4% of the total Cypriot dwelling stock) may be hindered by the fact that investments paid for by the building owner are typically reaped by the tenants. This is largely located in multi-family buildings (75% of rented dwellings), a sector whereby efficiency-, usage- and multi actor split incentives may all be present. While data on the commercial sector is lacking, leasing retail, office buildings and other non-residential space are widespread practices in Cyprus and various aforementioned types of split incentives are expected to hinder the uptake of energy efficiency improvements in this sector as well.

Several current policy responses and case studies designed to tackle split incentive issues across Europe and beyond have been identified. These range from regulatory measures, such as minimum standards for rented properties, revisions to tenancy laws, energy labelling to the use of financial models that remove upfront costs and pass some costs through to tenants.

For the Cypriot context, priority actions include the removal of specific barriers for the uptake of energy efficiency investments in the multi-family owner-occupied stock. The set-up of majority-rules in multi-ownership buildings are required as well as the clear definitions of the obligations and/or procedures to be followed by management committees in apartment buildings with regards to energy efficiency upgrades. The democratic rules and process with which maintenance work is undertaken should be clearly defined as well as roles of involved actors. This includes responsibilities for common space maintenance. The inclusion of energy efficiency upgrade in routine maintenance work could help bring down costs and hassle associated with the execution of works (e.g. scaffolding etc.). Simple rules that deem certain parts of the building, e.g. roof as a common space, thus shared responsibility among all building owners, can help align incentives between the owners (e.g. top and mid floor apartment owners). Some useful examples are given for Denmark, Scotland and Netherlands (see page 75).

The role of EPCs as a means of guiding energy efficiency upgrade decisions of homeowners and tenants can be further strengthened through a range of actions. These include the establishment of independent control systems, penalties for non-compliance, improvements in the methodological framework, implementation of accreditation schemes for installers and EPC assessors etc. Individual metering in all apartment buildings are a pre-requisite for increasing the ability of building owners to measure energy consumption and assess the financial benefits of energy efficiency investments.

In practice, energy efficiency upgrades of multi-family buildings is generally less common than of single-family houses across Europe and the participation of the former in financial incentives (loans, grants etc.) is significantly low(Economidou & Bertoldi, 2014).In addition to legal and organisational actions mentioned above, a way around this is to offer more attractive terms for these segments of the building sector, or design specific incentive schemes that offer clear pathways to financing for multifamily building owners. In some Baltic and Eastern European countries financial schemes (e.g. loans) targeting exclusively apartment building owners have been in place for a number of years. A common feature of these schemes is the role of housing associations, which have the legal status allowing them to receive financial support (e.g. through loans) and have the decision-making power so that individual owners cannot block decisions.

For rented properties, split incentives can be addressed by attaching the loan to the property itself rather than the tenant. The introduction of phased minimum energy performance requirements for rented dwellings could act as a powerful driver for the acceleration of energy efficiency improvements in such buildings. The removal of legal barriers inhibiting owners from passing costs to tenants or entering into a green lease should also be reviewed. The promotion of green leases in commercial spaces (e.g. through pilot schemes) can increase awareness among interested parties of the benefits of such agreements between owners and tenants. Municipalities and public institutions can lead by example by entering into green leases for their rented premises, while the

publication of standard templates, common green lease language and clauses can guide and encourage others to consider this approach.

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4. Current status of the Energy services market and proposal for measures to promote EPC in the public and private sector

The scaling up of energy efficiency projects in Cyprus is critical in order to move towards a more sustainable energy future. Energy Service Companies (ESCOs) can play a critical role in promoting energy efficiency at the market level. They have the necessary know-how to provide turnkey services and solutions achieving significant energy cost reductions while addressing various market related barriers on the ground. ESCOs can handle projects, manage or mobilize financial resources, undertake installation and maintenance work as well as collaborate with other market players. Most importantly, they assume performance risks by linking their compensation to the performance of their implemented projects, thus incentivising them to deliver savings-oriented solutions. Energy Performance Contracts (EPCs) deployed by ESCOs help lift the barrier of upfront costs of energy efficiency investments, through a contractual arrangement between the project promoter and the ESCO. Through this arrangement, costs (including financing costs) are paid in accordance to a contractually agreed level of energy consumption savings.

Despite the theoretical appeal of low-capital energy saving opportunities and the currently supportive policy framework, the energy services market in Cyprus is underdeveloped, with numerous barriers blocking the full development of the market. This Chapter assesses the current market status in Cyprus, its use in the public sector, current bottlenecks to its development and possible ways forward. It also draws good practices in the promotion of EPC from other countries and provides a series of recommendations tailored for the Cypriot EPC market.

4.1 Terminology

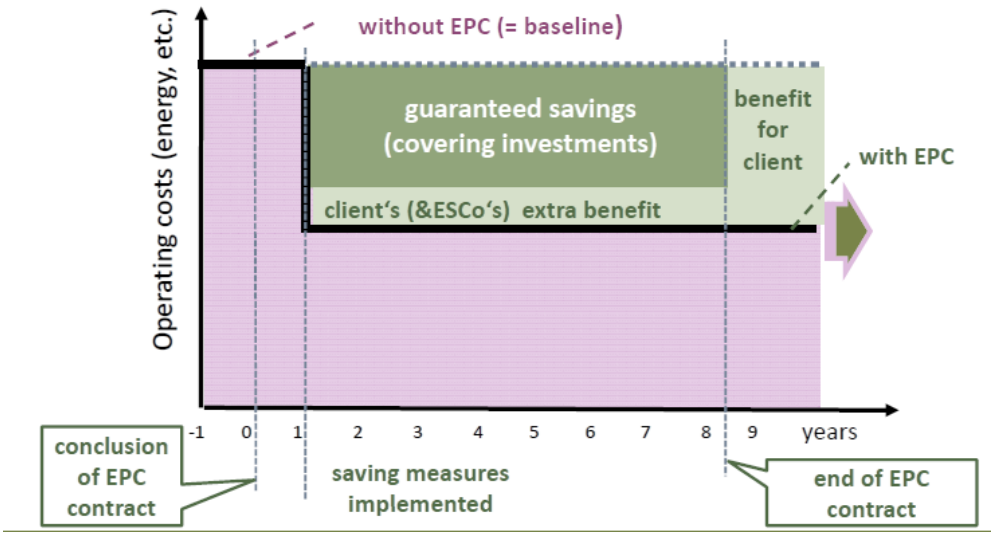
The following ESCO-related terms are used in this section.

Energy Service Company (ESCO): A natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria (Directive 2006/32/EC)

Energy performance contract (EPC): Under an energy performance contract, an ESCO undertakes a project to deliver energy efficiency improvements in the premises of the client, and uses the stream of income from the cost savings to repay the costs of the project. Following the end of the contract the energy savings get transferred to the client (Figure 11).

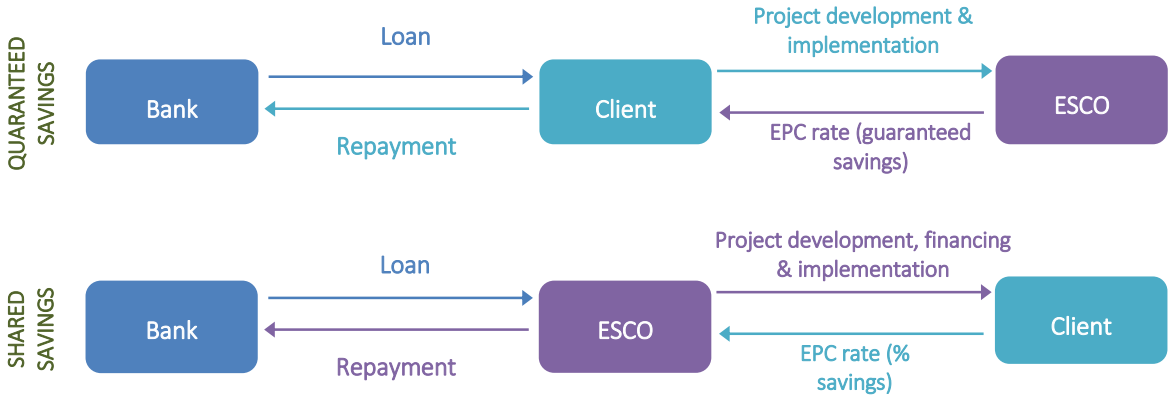
- **Guaranteed savings**: The ESCO guarantees a certain level of energy savings and in this way shields the client from any performance risk. The loan goes on the client's balance sheet and the ESCO assumes full project performance risk (Figure 12a).
- **Shared savings**: The savings are split in accordance with a pre-arranged percentage between the client and the ESCO, i.e. the loan goes on the ESCO's balance sheet. The ESCO finances the project and assumes debt obligation on balance sheet. The ESCO assumes both (partial) project performance and credit risks (Figure 12b). There is no standard split of the share of the ESCO vs. the client, as it will depend on the length of the contract, the payback time and the risks taken.

Figure 11 - The timeline and the savings expected in an Energy Performance Contracting scheme.



Source: Szomolanyiova & Sochor, 2013

Figure 12 - Guaranteed and shared savings energy performance contracts



Energy supply contract (ESC): Under an energy supply contract, an ESCO plans, builds, finances and maintains an installation for the supply of energy and the client purchases the energy under stipulated conditions. The efficiency measures of the contractor are thus targeted as the optimisation of the installation itself (e.g. optimisation of the heating system, production of electricity from cogeneration plants).

Build-own-operate-transfer (BOOT): Under a build-own-operate-transfer contract, an ESCO designs, builds, finances, owns and operates the equipment for a defined period of time and then transfers the ownership to the client. Clients enter into long term contracts and are charge accordingly for the service delivered (the charge includes capital and operating cost recovery and project profit).

Table 32 – Comparison between EPC and ESC

	Energy performance contract (EPC) - Guaranteed savings	Energy performance contract (EPC) - Shared savings model	Energy Supply Contracting (ESC)
Service provider	ESCO/EPC provider	ESCO	Energy Supply Provider Company (ESPC)
Key elements	Implementation of energy saving measures with on-going monitoring &verification services to provide guaranteed energy savings.	Implementation of energy saving measures (mainly demand side) to provide cost savings associated with the overall energy/utility bill.	Efficient supply of useful energy such as heat, steam or electricity is contracted, measured and delivered in physical units.
Energy savings to be achieved	High - comprehensive and detailed approach covering both supply and demand side.	High - primary focus and incentive is for cost savings with technical operation requirements as secondary.	Usually low - limited to the supply side (boilers, chillers, etc.) without regard to demand-side equipment.
Guarantees	Yes. The ESCO guarantees the performance related to the level of energy saved throughout the contract life (i.e. to energy cost savings inconstant prices).	Not as standard. However, the ESCO may guarantee a minimum performance related to cost of energy saved in current prices throughout the contract life.	May include incentives related to energy use reduction on the supply side, but without assuming any risk in case the expected efficiency improvement is not reached.
Payment	Payment derived from the energy savings achieved inconstant prices of the base year.	Payment linked to the achieved change in energy costs.	Payment of a fixed rate/tariff, normally without energy performance requirements.
Provider's risk	Assumes technical design, implementation and performance guarantee risks.	Assumes performance risk, risk of energy price change (depends on current prices) and customer credit risk.	Usually does not assume technical or financial risk.

Energy savings transparency	The energy consumption is measured before and after the measures is implemented. The transparency depends on the quality of measurement & verification. In general the more independent M&V, the more transparent are the energy savings.	Depends whether and what quality M&V is provided. In general, the more independent M&V, the more transparent are the energy savings.	Low - a specific energy bill reduction is established (in monetary, not physical units). Usually the contract does not take into account the measurement of the energy efficiency.

Source: Transparense

4.2 Financing options for EPCs

ESCO projects can either be financed through internal funds of customers or ESCOs, or alternatively through third-party financing. While financing is not supposed to be part of the key ESCO activities, the contractor may often provide or arrange for the financial terms of the project. As explained above, the ESCO provides financing for the investments in the shared savings EPC model. In **ESCO financing** the energy service provider participates with its internal funds and pre-finances the investment and other costs. In the **customer financing** model, the ESCO does not participate in the financial solution of the project, but instead its role is restrained to the technical and managerial aspects. **Third-party financing (TPF)** refers to debt financing. In this solution, project financing comes from a third party, typically a finance institution, and not from internal funds of the ESCO or of the customer. Below the main financing options for EPCs are briefly explained.

4.2.1 Credit financing

Credit (or loan) financing option refers to situations in which investors lend a certain amount of money on credit in exchange for repayment plus interest (debt service) over a fixed period of time. This is known as third-party financing, whereby the borrower can be either the real estate owner or ESCO. The credit can typically cover up to 90% of the capital needed, while the remaining 10% is requested as equity capital. This is an on-balance sheet financing option, where the investment is capitalised on the balance sheet of the borrower (investment owner).

4.2.2 Leasing financing

Leasing is the energy market’s common way of dealing with initial cost barriers. It is a way of obtaining the right to use an asset. Finance leasing can be used for EE equipment, even when the equipment lacks collateral value. Leasing companies, often bank subsidiaries, have experience with vendor finance programs and other forms of equipment finance that are analogous to EE. Leasing is the most common form of equipment manufacturers' vendor financing, which is often applied in the case of CHP equipment. Leasing is often done as part of a SPV.

4.2.3 Project financing

Unlike conventional debt financing that relies on an individual company's credit-worthiness, project financing relies on a project's cash flow expectations and spreads the risk between the different actors. Project finance (PF), by contrast to balance sheet financing (loans, debt and equity), bases its collateral on a project's cash flow expectations rather than on individuals' or institutions' creditworthiness. It is therefore an off-balance sheet financing option. A typical PF is divided between debt and equity financing.

4.2.4 Cession and forfeiting

Cession is a transfer of future receivables (here contracting rates) from one party (ESCO) to another (financial institution). The original creditor (ESCO) cedes/sells their claims after implementation of the saving measures and the new creditor (financial institution) gains the right to claim future contracting rates from the debtor (the client). The customer typically repays the instalments stipulated in the contract directly to a bank, while the ESCO guarantees the level of savings and consequent decrease in operational costs. The varieties of cession used are:

- Cession: A cession is used in addition to a credit or lease financing agreement. The ceded contracting rates serve as (additional) security for the financial institution and the clients pay the rates (or parts of them) directly to the financial institution.
- Forfeiting: if a cession is applied without an underlying financing agreement (credit or leasing), it is called forfeiting. The financial institution buys the future contracting rates and pays (one time) a discounted present value directly to the ESCO.

4.3 EU legislative framework

The value of ESCOs in unlocking the energy saving potential in the market is recognized by various EU directives and initiatives in the European context. The principal EU legislation is the Energy Efficiency Directive (2012/27/EU; EED), which provides key definitions for energy performance contracting, energy services and energy service providers and sets explicit requirements to promote the market of energy services. These requirements are briefly described below.

Article 18

The main article promoting energy services is Article 18which calls for Member States to take actions to strengthen the energy services market, including:

- dissemination of information about available energy service contracts and clauses as well as financial measures supporting energy efficiency service projects (Article 18(1)(a));
- encouraging the development of quality labels (Article 18(1)(b));
- publishing of EPC model contracts and list of available energy service providers;
- disseminate information on best practices for EPCs;
- provide a qualitative review of the current and future development of the market;
- identify and publicise contact points for final customers;

- consider putting in place an independent mechanism for handling complaints and disputes;
- enable independent market intermediaries.

Other EED articles

Additional basis to further support the development of the energy services market is provided in Articles 5, 6, 7, 8, 19 and 20. For example, Article 5 calls for renovation of at least 3% of the national central government building stocks, which can, inter-alia, promote the use of energy services in the public sector. Article 6 of the Directive titled 'Purchase by public bodies' establishes, inter alia, the obligation of Member States to ensure that central purchase only products, services and buildings with high energy-efficiency performance. Through the implementation of energy efficiency obligation schemes (Article 7), additional actors such as ESCOs may contribute towards meeting the end-use target imposed on the energy companies. The obligation for large companies to do mandatory energy audits (Article 8) offers a boost for the uptake of energy consultations, a key segment of the energy services market. The call for Member States to evaluate and, if necessary, take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency (Article 19) shall take into account barriers to the uptake of energy performance contracting in the public sector with regards to public purchasing, annual budgeting and accounting. Finally, the establishment or use of existing financial facilities including the set up an Energy Efficiency National Fund (Article 20) may also include dedicated streams of financing to support the uptake of energy services projects.

4.4 Status of Cypriot ESCO market

4.4.1 ESCO market potential

The potential for the market development of energy services in Cyprus has been described as promising given the substantial energy saving potential in buildings. Poor performance levels of the Cypriot building stock due to lack of energy codes prior to 2008, high energy intensity of the economy and high energy supply product costs are all favourable factors. The prospects for the market development in the public sector are deemed high, where sectors of interest include street lighting, large hotels, hospitals and generally large commercial buildings or office buildings belonging either to the public sector or large enterprises (Maxoulis, 2012).

Table 33 – Summary of non-residential building stock in Cyprus (buildings addressable by ESCOs are assumed to have a floor area of at least 1000 m^2)

	Total Floor Area [m^2][1]	Number of establishments[1]	Average floor area [m^2][1]	Specific final energy consumption [kWh/m^2][1]
Hotels	2,094,134	766	2,734	239.17
Secondary schools	613,546	144	4,261	70.72
Primary schools	453,755	325	1,396	64.91

Nurseries	96,376	419	230	77.24
Tertiary education	222,404			304.33
Public buildings	1,886,370	1,087	1,735	74.84
Airports	119,600	2	59,800	283.70
Supermarket and malls	280,396	67	4,185	319.06
Healthcare institutions	485,898	83	5,854	386.30
Restaurants	179,360	2,242	80	1,300.00
Private offices	1,665,000	11,100	150	223.04
Retail shops	1,080,000	18,000	60	226.47

[1] Data from JRC Petten report

To estimate the ESCO market potential in the building sector, data on existing buildings typically addressable by ESCOs were sought. Given that ESCOs often target facilities of large size in order to reduce the impact of transaction costs involved in energy performance contracting, we considered only building types whose average floor area exceeds 1,000 m^2 to be ESCO-addressable. The ESCO market penetration so far is assumed to be zero given that the market is believed to be only at its initial phase. Table 33 provides a summary of non-residential buildings with information of their total floor area, number of establishments, average floor area and specific final energy consumption. In total, around 64.7% of the total non-residential floor area is assumed to be addressable by ESCOs with total final energy consumption over half (52%) of that of the non-residential building stock in Cyprus. It should be noted that while street lighting and large residential complexes can also be addressed by ESCOs, the focus remains on large non-residential buildings.

4.4.2 Legal framework

A number of direct and indirect regulatory measures supporting energy services are currently in place in Cyprus. Indirect measures include energy building codes for new and majorly renovated buildings covering inter-alia the public sector, energy performance certification, energy efficiency target in the public sector and energy efficiency product procurement. Direct legislative and regulatory measures include law on energy efficiency and regulations on energy audits and energy services. A list of Cypriot EU legislations related to ESCOs is presented in Table 34.

ESCO-enabling legislation

The Amending Law on energy efficiency in end-use efficiency and energy services and Regulation 210/2014 on energy service providers are the main legislative measures put in place to address various regulatory barriers to the ESCO market growth. Through this legislative framework, a number of standard procedures and supporting elements are now in place, covering the following main points:

(a) The operating conditions and the registration terms of energy service providers in the registry of energy service providers and the issuance of the relevant licence by the competent authority (Energy Department of the MECIT).

(b) The duties of the Energy Auditors Committee in relation to energy service providers.

(c) The type of energy services provided to final consumers through energy efficiency contracts and the minimum provisions to be included in such contracts.

(d) The stages to be followed by energy service providers to confirm increasing energy and financial benefits.

(e) The way in which the competent authority must perform the audit and evaluation of the energy services provided.

The Cypriot NEEAP 2014 stated that the preparation of template tender documents for the selection of energy service providers and template documents for Energy Performance Contracts falls under the responsibility of the Electrical and Mechanical Services Department. The department organised a public consultation process in July 2014 and finalised the relevant documents in October 2014 (Thomas, 2014). The EPC template documents, presented in November 2014, include the legal framework, EPC definition, methodologies (shared or guaranteed savings, variable contract term), applications, details on the technical & financial capacities of operators, main provisions of contracts etc. (Department of Electrical and Mechanical Services, 2014). The template documents for energy performance contracts under the guaranteed and shared savings models have been prepared by the ministry and are available on their website. The templates are expected to be used by other bodies wishing to use energy service providers for the implementation of energy efficiency measures.

Table 34 - List of legislations in Cyprus related to ESCOs

	Law/regulation name	Details
1	Laws on energy efficiency in end-use efficiency and energy services of 2009 and 2012	Compliance with the provisions of Directive 2006/32/EC
2	Law 53(I)/2012: 2012 Law on energy efficiency in end-use efficiency and energy services (Amending Law)	Amendment of Articles 2,5,8,9 of the Basic Law
3	Law 56(I)/2014: 2014 Law on energy efficiency in end-use efficiency and energy services (Amending Law)	Amendment of Articles 2,6,9,10,11 and Annex of the Basic Law
4	Law 149(I)/2015: 2015 Law on energy efficiency in end-use efficiency and energy services (Amending Law)	Amendment of Articles 2,3,4,5,8,9,11,13,14,15,16,17,18, 19 and Annex II, III, IV, V of the Basic Law
5	Regulation 184/2012: 2012 Regulation on energy efficiency in end-use efficiency and energy services (energy auditors)	Regulation of issues concerning the training and authorization of **energy auditors** in buildings, industry and transport
6	Regulation 210/2014: 2014 Regulation on energy efficiency in end-use efficiency and energy services (energy service providers)	Regulation of issues concerning the licensing terms for **ESCOs** and setting of minimum issues to be regulated through EPCs
7	Decree 437/2015: 2015 Decree establishing the methodology and other obligations on energy audits	Specifies the implementation of CYS standards EN 16247 parts 1, 2 & 3 in carrying out **energy audits** in buildings and industries
8	Decree 436/2015 – 437/2015: 2015 Decree establishing the methodology and other obligations on energy audits (transport)	Sets requirements and technical standards in 'Technical Guidelines' to be met by the **Energy Auditor** in energy audits in transport

9	Decree 435/2015: 2015 Decree on inspectors of energy services	Authorizes Energy Service officers as inspectors for the implementation of the Law
10	Decree 438/2015 for setting conversion factors	Publication of table of conversion of energy content of selected fuels for end use

Source: (Thomas & Piripitsi, Regulatory requirements for Energy Service Providers and Energy Performance Contracts, 2016)

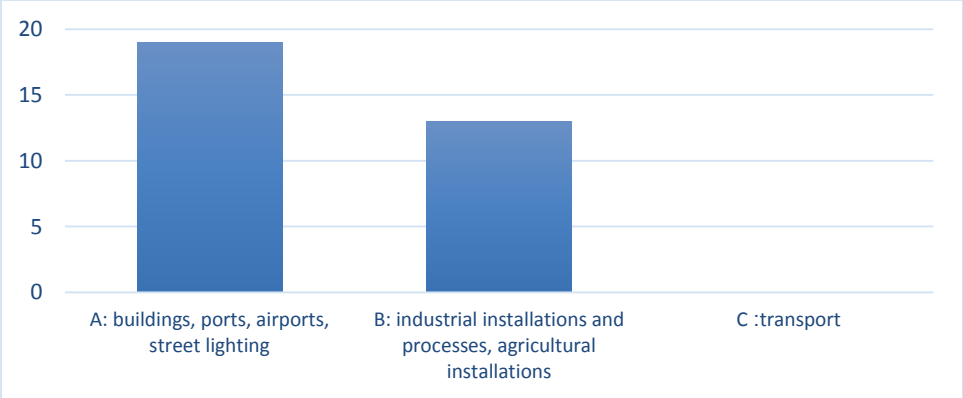
Public procurement

According to the Cypriot NEEAP 2014, steps to ensure that the central public administration complies with the EED Article 6 requirements have been taken which include the amendment of main law and addition of Article 15 on purchasing by public bodies. This stipulates that the central governmental authorities shall purchase only products, services and buildings with high energy efficiency. The requirement applies to the contracts for the purchase of products, services and buildings by central government authorities, insofar as the value of such contracts is equal to or exceeds the thresholds laid down in Article 19(1) of the 2006 Coordination of Public Procurement, Works and Services Contracting Procedures and Relevant Matters Law, which are occasionally revised as laid down in Article 92 of that Law.

4.4.3 Market players

In total, there are now 19 ESCO companies[30] officially registered in the country. The creation of the registry is seen as positive development, before which there were no officially active ESCOs. These ESCOs are mainly SMEs.

Figure 13 - Number of ESCO companies that specialise in categories A, B and C as defined by Cyprus legislation



[30] Based on the ministerial registry of energy service companies dated 07 October 2015

4.4.4 Energy performance contracting in the public sector

A contract notice was expected to be launched in 2015 for the energy upgrading of two public buildings through energy performance contracting. The two chosen buildings are the Central Offices of the Department of Public Works and the Central Offices of the Department of the Electrical and Mechanical Services, which are of G and D energy class, respectively. In the next years, there is a possibility that a number of energy efficiency contracts will be signed by public authorities in the context of Cyprus' commitment to an annual energy upgrade of 3% of the useful floor space of buildings owned by the central government. At this stage, it is impossible to make any estimations on the number of contracts (Piripitsi, K; Stougianis, E; Thomas, G; Kakouris, M, 2014).

4.5 Barriers for development of the ESCO business in Cyprus

Possible explanations behind the absence of ESCO activities in Cyprus include the lack of trust of end-users with regards to the procedure and lack of expertise and experience of ESCOs. In addition, the relatively small market, high interest rates, lack of access to finance — especially under current economic conditions– and lack of specialized expertise, are also important factors which hinder the development of the market (Maxoulis, 2012). Verifications of savings – and safeguards – are also regarded as important (Charalambous, 2013).The recent unfavourable conditions created by the economic downturn in the country are expected to have negative impacts on the market development.

A summary of general barriers related to the ESCO market is shown in Figure 14 . These are divided into: information & awareness, institutional & legislative, financial, market & external, technical & administrative and behavioural. With more projects taken off the ground, it is expected that several entry-level barriers will be overcome.

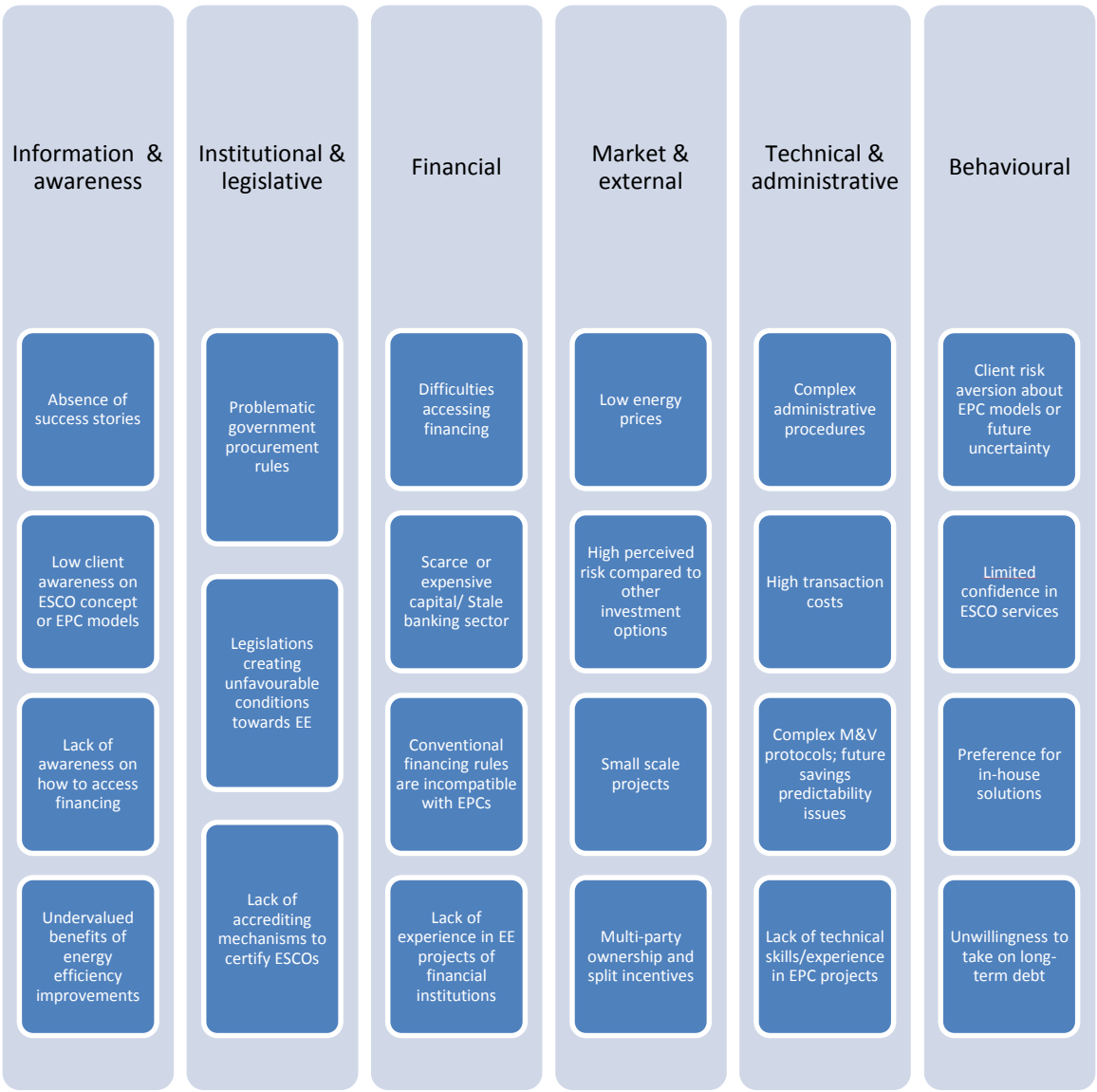
The absence of positive examples and success stories is often an obstacle in markets with little experience in these new concepts. The lack of knowledge among end-consumers of the economic potential for energy savings continues to impede the uptake of energy contracting projects on the market. Partly as a result of the lack of trusted information, the energy efficiency benefits are often regarded as less certain and energy efficiency is undervalued relative to other investment options. Despite various efforts at different levels, many enterprises find it difficult to recognise opportunities for energy savings, procedures, various options and available products etc. and are thus not able to fully assess the benefits of an energy efficiency investment. Concrete advice (e.g. through targeted, tailor-made information on potential measures and their benefits), cost-effective measuring and metering systems and qualified providers of energy efficiency measures can all help alleviate knowledge-related barriers.

The legal aspects related to off-balance sheet investments may affect the ability of the public sector. The ambiguity of legal aspects pertaining to service contracts such as title to the installed equipment, procurement procedure rules and legislation relating to the activities of municipal energy companies have been cited as a major barrier. Alongside these challenges, legal issues with tenancy laws may also inhibit the use of energy services in the rented sector.

Users, clients and investors are faced with the complexity of certain markets and contracts. For example, energy performance contracting is a relatively risky business for energy suppliers and service and requires clear framework conditions and well-defined user behaviour in order to provide sufficient confidence that the investment will be recouped. While this is generally the case with commercial and public service customers, residential end-users represent a higher risk associated with an unpredictable element of user behaviour. Client distrust of energy services has been cited by Estonia, which may be connected to general client risk aversion about EPC models or future uncertainty. Limited confidence in ESCO services (a feature of markets at development phase) or preferences for in-house solutions are also additional behavioural factors that can act as

barriers to market maturation. The latter could be the case for major energy consumers have long since established internal structures and responsibilities to ensure a cost-effective supply of energy. In such cases, energy management systems are already in place and the potential for optimisation is regularly examined.

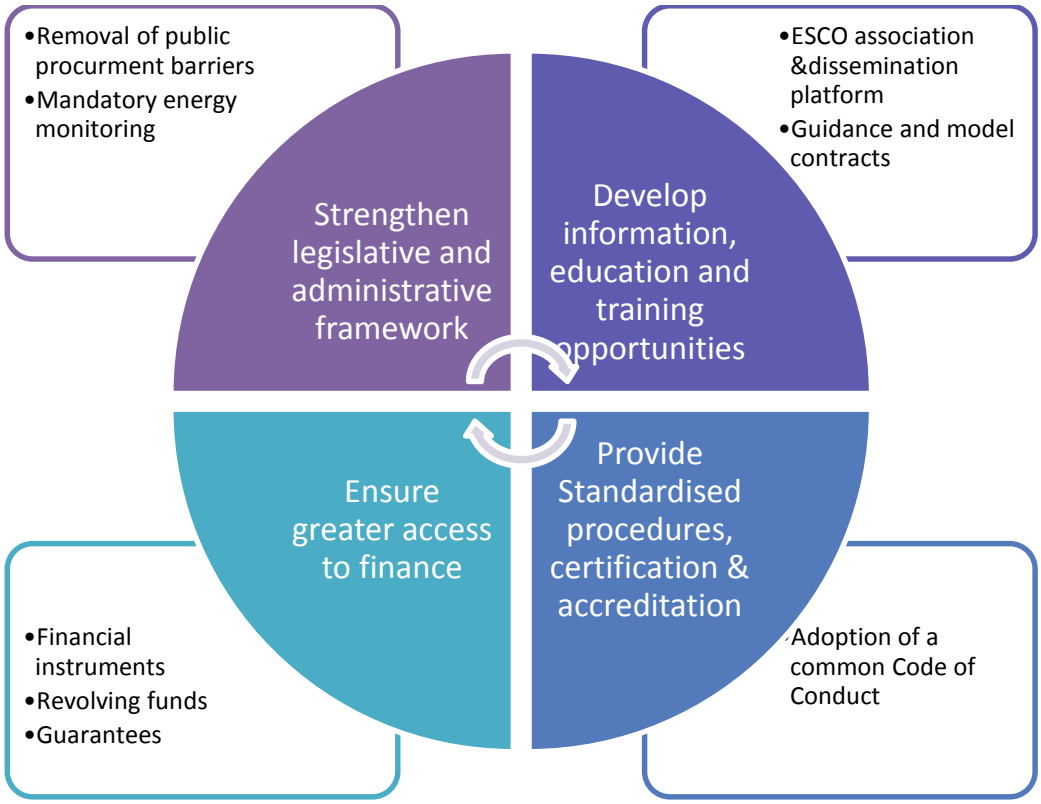
Figure 14 – Mapping of ESCO-related barriers



4.6 Recommendations for a strategy to foster the ESCO development

A number of key elements, deemed as key drivers for a kick-start of the ESCO market, are now in place in the Cypriot framework. A supportive legislative framework, a prerequisite for the development of an ESCO market, has now been developed, addressing, inter-alia, the licensing of ESCOs, their operating conditions registration terms, minimum provisions in contracts, etc. A registry of ESCO companies is also made available and efforts to publish a template for EPC contract are underway. The two pilot projects involving ESCOs in the public sector are expected to showcase the benefits of the ESCO concept in practice. Moreover, recent building regulatory developments are expected to encourage potential clients to seek energy efficiency improvements and subsequently help of ESCOs. Despite these developments, the Cypriot market is still at an initial stage of development. The full development of the Cypriot ESCO market requires strong and continuous government commitment along with the active involvement of various stakeholders including the banking sector. Figure 15 presents the various steps of a proposed strategy to boost the EPC Market in Cyprus, (1) namely further support of legal framework, (2) focus on information, education and training, (3) enable access to financing and (4)increase awareness on standardised procedures, certification & accreditation. These are discussed in more detail below with examples and guidance from other countries.

Figure 15 - Steps towards establishing a functioning Energy Services Market in Cyprus



4.6.1 Strengthen legislative and administrative framework

Removal of public procurement hurdles

As energy savings are a central focus of an EPC, it is important that obstacles related to public procurement and accounting are removed to allow the public sector to engage in energy performance contracting and promote the use of ESCOs to other sectors by showcasing the benefits through real examples in their own premises. Rigid and long procurement and budgeting policies may be a hurdle for the use of ESCOs in the public sector. The government should ensure that public procurement procedures take into account the specifics of energy service provisions and are supportive to ESCO concepts. Barriers to public procurement of energy efficiency services should be removed by taking the following actions ((Limaye, Singh, & Hofer, 2014)):

- Allow public agencies to sign multiple-year contracts
- Allow retention of energy cost savings to pay ESCOs
- Change procurement rules to select most value
- Exclude ESCO payments from public debt
- Require consumption-based billing for DH
- Allow public agencies to engage in PPPs and EE equipment leasing
- Encourage public agencies to use simple ESCO business models

With regards to public debt, the recent Eurostat Guidance Note on the impact of EPCs on government accounts published in 2015[31] is generally perceived counter-productive as it restricts off-balance accounting and increases the bureaucratic burden for starting new projects (EESI2020 project, link). The need to ease bureaucratic burdens for energy efficiency projects should be kept high on the agenda. As the potential contribution of EPC projects to public debt levels is statistically almost irrelevant, more flexibility in the application of the rule (e.g. via exceptions) could already help a lot to ease the market uncertainty, which has been created. The need to ease bureaucratic burdens for energy efficiency projects should be kept high on the agenda. As the potential contribution of EPC projects to public debt levels is statistically almost irrelevant, more flexibility in the application of the rule (e.g. via exceptions) could already help a lot to ease the market uncertainty, which has been created.

[31] http://ec.europa.eu/eurostat/documents/1015035/6934993/EUROSTAT-Guidance-Note-on-Energy-Performance-Contracts-August-2015.pdf/dc5255f7-a5b8-42e5-bc5d-887dbf9434c9

Box 2 – Public Administration Energy Efficiency Programme (ECO.AP), Portugal

In January 2011, as part of the National Energy Strategy (ENE2020) and the National Energy Efficiency Action Plan (NEEAP), the Portuguese Government launched the Energy Efficiency in Public Administration Programme (ECO.AP). This programme aims to achieve a 30% increase in energy efficiency by 2020 in all public services and public administration bodies, particularly through the procurement of energy service companies (ESCOs). The goal is to achieve this target without increasing public spending while allowing the stimulation of the energy service companies sector.

ECO.AP covers a set of measures from the appointment of energy managers by all public bodies to the implementation of energy efficiency management contracts between those bodies and ESCOs, as well as, the establishment of a public administration energy efficiency barometer and the definition of a national White Certificates Scheme. The first phase of the program (2012-2015) is planned to cover the ESCO-facilitated renovation of around 300 buildings with a total of 700 GWh/year baseline energy consumption, reflecting a €75 million/year energy bill (MARIE project 2012). The potential savings from these projects are around €14 million per year. The ESCOs are required to guarantee savings, and take a certain degree of financial risk. Contract periods are expected to vary between 6 and 16 years.

Decree-Law n. º 29/2011 from February 2011 created the legislative framework for drawing up and implementing energy efficiency management contracts between the State and other public bodies with ESCOs. Contract models and ESCOs qualification procedures are being developed to facilitate the implementation of the initiative.

Box 3– Regional Plan on Air-Climate-Energy (PACE) in Brussels Capital Region, Belgium

The PACE programme (Regional Plan on Air-Climate-Energy) in Brussels Region targets the most emitters of greenhouse gases and air pollutants sectors (construction, transport, consumption, etc.), encourages the production of renewable energy, and also aims to integrate air thematic, climate and energy policies in all of Brussels. The plan proposes 64 measures and 144 actions that are intended to enable the region to reduce its emissions by 30% by 2025 (compared to 1990), which aim to help the region to meet its air-climate-energy targets. It introduces new measures to accelerate the rate of renovation and investments in energy efficiency including regional bank guarantee and plans to change the property tax review to consider, inter-alia, energy performance

It promotes, inter-alia, the use of ESCO for owners of offices and companies. Through PACE, it is planned to appoint a public operator that will offer assistance for tenders to launch on groups of buildings, assist in specifications of writing and conclusion of third-investor contracts with ESCOs that finance and carry out work in homogeneous buildings on the basis of contracts with the owners.

Box 4– Federal Property Contracting programme, Austria

In March 2001, the Austrian Energy Agency led an initiative for a ministerial order, laying the foundation for a "Federal Contracting Campaign ("Bundescontracting Offensive").This is a state contracting campaign encompassing around 300 federal buildings in the period 2001 to 2012.As part of this programme, more than 600 buildings (bundled in 19 pools of buildings) have now been optimised and modernised in terms of energy efficiency, making the programme one of Europe's largest contracting authorities for energy performance contracts. The Federal Property Contracting programme has been central to ESCO development in Austria.

The programme is managed by the federal building agency "BIG" in cooperation with the Ministry of Economics. The programme´s operation is supported by 22 so-called "Energiesonderbeauftragten" (special representatives for energy issues).The average annual saving potential for these buildings is around 20%. Taking into account this average saving potential, it is expected that the CO_2 emission will be reduced by 40,000 Tons CO_2/year and the energy costs will be declined by EUR 6.9 Million /year for 300 buildings (BMWFW, 2015). The buildings are grouped into different "pools". Some pools cover heat and electricity, some only heat. Savings up to 30% are achieved for heat, whereas for electricity only 4-5%. Most EPCs in the public sector are concluded with local authorities, then with public schools and public buildings (Windsprenger, Windsprenger, & Schoener, 2014).

Mandatory energy monitoring

Detailed energy monitoring data (e.g. monthly/daily/hourly energy consumption) are often not available, but this would be necessary to carry out a detailed analysis. All public buildings and large buildings of private companies should be obliged to operate appropriate monitoring programmes in order to secure a sufficient data basis, necessary to define an appropriate baseline and thereby calculate expected energy savings. Possible monitoring obligations could be the recording of monthly data for small buildings, hourly recordings for larger buildings as well as recordings via sub-meters in the building.

In Germany, the General Administrative Regulation on the procurement of energy-efficient products and services (AVV-EnEff) obliges all Federal Government departments to carry out an energy-related analysis, evaluate their energy consumption and examine the aspects of the most EE solutions (Government of Germany, 2014).

4.6.2 Information, education and training

There is a need to communicate and disseminate the ESCO business model, the provision of EPC services as well as the need to train all relevant actors. The need to increase knowledge and awareness of the need for energy efficiency among the households, businesses, public agencies, financiers etc. in Cyprus is identified. This could be facilitated by organising workshops involving public agencies and ESCOs to publicize EPC models and facilitate interaction between them, enabling the development of ESCO platform and others. These are given in more detail below.

Development of ESCO association and dissemination platform

The government should encourage the creation of an ESCO association, with the purpose to increase the transparency and raise the truthfulness in the EPC market. This is a first and decisive step for the stimulation of the supply of information, education and networking to the ESCO actors and wider public. This process will be stimulated by the expected rapid growth of the market in the following years and the pressing need for standardization of EPC and collaboration between ESCO's. The ESCO association must play a major role for overcoming the scepticism, provide information and guidance and facilitate training courses not only targeting government and ESCO's, but also to private consumers, financiers, facilitators. It can play an important role as the voice for energy efficiency in decision-making processes and discussions between public entities, legislation, companies etc.

Table 35 - Examples of national ESCO associations

	Association name	Website	Established in	Useful website information
AT	AT Energy Contractors	www.contracting-portal.at	2005	Search engine for contractors
BE*	BELESCO	www.belesco.be	2010	Project database
CZ	APES	www.apes.cz	2011	Map of EPC projects
FR*	FEDENE	www.fedene.fr	2009	
DE*	BEMD	www.bemd.de	2007	Market studies; Working groups
IT*	ASSOESCO	www.assoesco.org		Technical committees
NL	ESCoNetwerk	www.esconetwerk.nl		Project database; Code of Conduct for EPCs; Videos
PT	APESEnergia	www.apese.pt	2011	Technical and legal information
ES	ANESE	www.anese.es	2010	Online training courses; success stories
SE	EEF	www.eef.se	2009	Search engine and map of EPC projects

*More than one association exist in these countries.

The development of an online platform can also play an important role in disseminating information about EPCs, organising trainings and seminars as well as facilitating networking opportunities. It can provide support for EPC clients with information about EPCs and their benefits including information on how they work. A database on completed projects, publication of model contracts and searchable information on ESCOs and their qualifications can also help enhance market transparency. In addition to clients, the existence of such a platform can be particularly useful for companies which have been active in the energy sector and see energy performance contracting as a potential business to add in their range of activities. The platform can host a project database, search engine for contractors, etc.

Further guidance and model contracts

Several countries have now developed model contracts for EPCs with the aim to guide public and private bodies carry out an energy efficiency project through energy performance contracting. An information brochure on the benefits of energy performance contracting targeted for public and private building owners can help familiarise potential clients with the EPC concept. An example of such a brochure was developed by the IEE funded project EESI 2020[32].

[32] http://eesi2020.eu/wp-content/uploads/2014/11/EESI2020_EPC_Marketing_Brochure.pdf

Table 36- Examples of energy performance contract models developed by various countries/regions

Country/Region	Developed by	Reference	Language
EU	EUROCONTRACT	Link	EN
US	Department of Energy, USA	Link	EN
IE	Sustainable Energy Authority Ireland	Link	EN
UK	Department of Energy & Climate Change	Link	EN
AT	BMWFW		DE
DE			DE
EL	Ministry of Environment and Energy	Link1; Link2	EL
FR	Ministry of Environment	Link	FR
LU	Ministry of Industry and Trade	Link	FR

Box 2 – National Energy Services Framework, Ireland

To develop and support the uptake of energy performance contracting in Ireland, the Irish authorities developed its National Energy Services Framework in 2013, a three-pronged approach to deliver energy performance contracting. Focusing on the non-domestic sector through the country, the Framework aims to (Confrey, 2014):

Enable new contracting and project development processes at scale

Standardise project development processes, which have buy-in from the market, to build capacity and reduce transaction costs

Ensure that energy performance criteria form part of every energy project, along with robust measurement & verification

Under the National Energy Services Framework, the Exemplar programme is developing 21 demonstration projects to test and provide feedback on the Framework documentation/process, tools and structures, and offers examples of projects in action – 11 in the public sector and 10 in the private sector (SEAI, 2015). In addition, technical assistance is available for organisations and projects to help determine the best route for project development and to procure projects on the basis of energy contracting including EPCs. For EPCs, technical assistance is available up to 75% of eligible costs to a maximum of €15,000 (€20,000 total costs) for Product, Service or Works Identification & Viability.

In addition to EPCs, the National Energy Services Framework provides guidance and support for energy supply contracts. Guidance on how to develop local energy supply contracts focuses on the local supply of sustainable energy such as wind, solar, biomass or CHP projects and/or retrofitting plant or equipment for the use of a renewable form of fuel (e.g. switch from oil-fuelled to biomass fuelled heating plant).

4.6.3 Access to affordable finance

Issues with securing finance for energy efficiency investments and services are an important obstacle that needs to be addressed. Measures to reduce the cost of capital, lower or share risks, financial mechanisms supporting EPC projects, guarantee funds, facilitation of pooling, etc. are discussed. A more detailed discussion on ways on how to ensure greater access to financing and examples is presented below.

Traditional financial instruments supporting EPCs

In the absence of readily available private streams of funding, publicly-funded financial schemes can support energy contracting projects through the use of subsidies, increase awareness of financial benefits EPC projects, reduce perceived risks and thus enhance confidence of financial actors. Only a few existing European financial schemes for energy efficiency investments are currently available for ESCO projects or support private third-party financing for EPCs. This could be explained by administrative complications of ESCOs applying for a subsidy in place of clients, timing considerations, EPC project preparation etc. The structure of typical financial schemes is therefore not formulated to meet the needs of EPC projects.

Box 3– Regional investment subsidy scheme for energy contracting projects, Austria

The state of Upper Austria provides investment subsidies for energy contracting (EPC and ESC) projects. The sum depends on the type of contracting (EPC or ESC) and on the duration of the contract. The fund is managed by the OÖ Energiesparverband (www.esv.or.at). Projects with an investment sum of EUR 50,000 to 500,000 are eligible, where the maximum share of support is 20% for EPC projects and 13.5% for ESC projects. In addition, subsidies covering 50% of pre-analysis costs are also available based on a ceiling of EUR 1,000. Contracting projects with longer payback periods receive higher subsidy rates than those with short payback periods. This system supports the implementation of comprehensive EPC projects with high energy saving rates (ESV, 2013).

Box 4– KfW Programme for Energy Efficient Rehabilitation in Municipalities, Germany

The KfW Programme for Energy Efficient Rehabilitation in Municipalities aims at improving the energy efficiency of buildings of municipal and social infrastructure by providing loans and sub-loans for the renovation of schools, school sports halls, day nurseries and other municipal buildings to generate energy savings. The KfW bank offers this programme on behalf of the Federal Ministry for Economic Affairs and Energy (BMWi), using funds from the CO2 Building Rehabilitation Programme.

In particular, he KfW programme supports the financing of investments and planning costs via special interest rates and repayment bonus for energy efficiency upgrades of the building envelope, replacements of fixtures, installation of solar protection devices and ventilation facilities and the fitting of the lighting system and the heating systems. Eligible applicants include municipalities, public and charitable organizations, cultural organisations and churches. The programme is applicable for EPC projects, as investments financed by ESCOs can also benefit from the programme. The amount for repayment bonus depends on the achieved energy efficiency standard and it may vary from 2.5-12.5% of the agreed credit volume. Funding is provided, inter alia, for renovation work at the level of the KfW Efficient House Standard 100 and 85, 70 and 55, and for energy-efficient individual measures. The programme may also cover energy efficiency upgrades of public urban lighting.

Box 5 – EFEKT Programme, Czech Republic

State-supported subsidies have been granted to energy service providers in the Czech Republic since 1999. Following a strategy revision in 2006, subsidies were channelled to contracting authorities seeking energy service providers for the preparation of EPC projects and organisation of public procurement tendering procedures, while in 2012, support was renewed under the EFEKT Programme in the form of subsidies for the identification of projects suitable for clients of the public administration. The EFEKT 2013 Programme, operated by the Ministry of Industry and Trade as a supplementary programme to EU Structural Funds programmes, had a budget of EUR 1.2 million, with support for investment activities accounting for about a third of this amount.

A total of 11 types of activities have been supported with available coverage amounting to 20-80% of eligible costs. These include street lighting in municipalities and regions (with minimum energy savings of 20%), retrofitting of heating systems, installation of facilities for use of heat or pressure waste energy and preparation of EPC projects. The latter is applicable only for municipalities, city quarters, regions and companies 100% owned by a municipality or city quarter. The subsidy funds – covering 80% of eligible costs – could be used for the preparation of detailed analysis of the actual conditions, potential savings in individual buildings and recommendations on buildings suitable for EPC projects. The main selection criteria for all areas of support include energy savings, decrease of CO2 emissions, simple period of return on investment, realistic period of return on investment, expected public benefit and the overall number of buildings addressed (in the case of preparation of EPC projects). It should be noted that the subsidies have been used to cover the preparatory phase of the EPC projects but not for the coverage of investment costs of energy efficiency projects due to limited budget of the investment part of the programme.

Box 6 – Municipal Finance Facility of Energy Efficiency, Slovakia

The Municipal Finance Facility of Energy Efficiency (MunSEFF) is an initiative of the European Bank for Reconstruction and Development (EBRD) and the European Commission (EC) to develop and stimulate commercial bank financing to municipalities and their utility companies in Slovakia. The programme, firstly launched in 2011, aims at stimulating implementation of energy efficient rehabilitation of municipal infrastructure. Given the increased demand for support, the EBRD has launched a second phase of the Facility, MunSEFF II, is designed to reach an even larger variety of municipal projects, covering different target segments as follows:

Municipal infrastructure (excluding buildings) energy efficiency: Sub-projects with incentive payment to Sub-borrowers of up to 20%;

Municipal/Residential building energy efficiency: Sub-projects with incentive payment to Sub-borrowers of up to 15%;

Municipal infrastructure and/or municipal building renewable energy: Sub-projects with incentive payment to Sub-borrowers of up to 15%.

Eligible borrowers for MunSEFF II are: municipalities, housing associations, public or private companies providing municipal services as well as ESCOs implementing energy efficiency investments in co-operation with one or more municipalities. The maximum project size is EUR5 million. The type of support and procedures of MunSEFF II are identical to the first phase meaning that technical assistance, low-cost loans and financial grants will be provided to the approved projects, should they fulfil all Facility conditions. Up to EUR90 million will be invested through the loans compared to the EUR10 million paid out in MunSEFF I. The money will be allocated to eligible projects through the local commercial banks – SlovenskáSporitel'ňa and VÚB.

Revolving Funds and guarantees

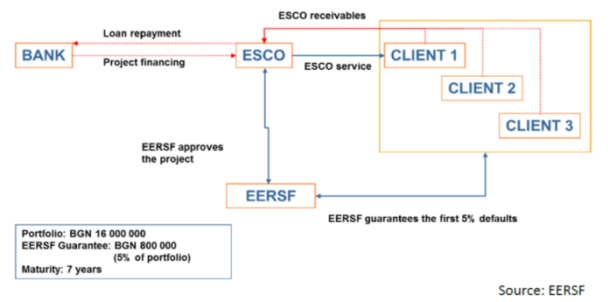
For the public sector, energy efficiency revolving funds offer viable options for governments to stimulate an ESCO market. An example is the UK Salix Finance programme, established to provide loan financing exclusively for public sector projects. It has worked with 138 public agencies and financed over 11,000 projects, many of which are implemented by ESCOs – see more details in Box 7. The establishment of a Partial Risk Guarantee Fund for ESCOs can help alleviate many issues inhibiting banks from supporting energy efficiency projects (e.g. lack the technical knowledge to evaluate energy cost savings, perceived riskiness etc.).This has been practiced in Bulgaria with the development of the Energy Efficiency and Renewable Fund (Box 8).

Box 7 – Salix Finance, United Kingdom

The Salix Finance programme was established by the UK's Department of Energy and Climate Change in 2005 with the aim to offer energy efficiency loan schemes in the public sector targeting energy efficiency improvements and carbon emission reduction. It was established as an independent, publicly funded company. The Salix revolving fund is a ring-fenced fund with capital provided by Salix, and matched by the partner organisation, to be spent on energy efficiency projects that pay for themselves within five years through lower energy bills. The financial savings delivered by the projects are returned to the fund allowing further spending on front line services. Salix projects include insulation, lighting and heating upgrades, IT improvements, swimming pool covers, voltage reduction or better boilers. The programme has so far funded 14,436 projects with a total value of GBP462.9 million and annual financial savings equivalent to GBP 116.2 million (Salix, 2016).

Box 8– Energy Efficiency and Renewable Fund (EERSF), Bulgaria

The Bulgarian Energy Efficiency and Renewable Fund (EERSF) were established through the Energy Efficiency Act in 2004. Its initial capitalization is entirely with grant funds, its major donors being: the Global Environment Facility through IBRD (the World Bank) - USD 10 million; the Government of Austria - Euro 1.5 million; the Government of Bulgaria - Euro 1.5 million and several private Bulgarian companies. The fund is a public-private partnership with independent management and self-sustaining capacity (EERSF, 2013). Among the other financial products, the Fund offers portfolio guarantee for ESCOs. Through this innovative product, the Fund guarantees the first 5% of defaults in the portfolio of projects. In that way, by undertaking some risk, EERSF helps ESCOs to guarantee the receivables from their clients. This guarantee is an instrument of average financial risk and un-collateralized, thus appropriate also for new ESCOs. A small guarantee covers large number of projects (e.g. guarantee for 0.8 million euro can cover 16 million euro portfolio). The operation of this guarantee is illustrated in below. As of 31.12.2014 EERSF provided ESCO portfolio guarantees for 29 projects with total project size of about 8.5 M EUR, where EERSF financing amounts to about 0.3 M EUR (EERSF, 2015).



Box 9– SUSI Energy Efficiency Fund, Switzerland

The SUSI Energy Efficiency Fund, managed by the specialized investment firm SUSI Partners AG, offers solutions for financing energy efficiency projects, with a total investment portfolio of approx. EUR 240 million across the Eurozone countries. Energy efficiency financing includes retrofits of buildings, manufacturing facilities and public infrastructure.

Together with an Energy Service Company (ESCO), the fund identifies projects that meet the investment requirements. The ESCO assesses the energy savings potential achievable through retrofitting lighting, heating, cooling, building management systems, etc. Once the project is approved, the fund will conduct Due Diligence and assess the investment. Depending on the contractual structure, the fund signs a contract with the owner/client receiving typically 50-90% of the energy savings over a 4-12 year period. Technology risks are mitigated by the ESCO, which issues a minimum savings guarantee SUSI finances energy efficiency projects larger than €2m, which fulfil the following criteria:

Proven tangible and intangible EE retrofit solutions

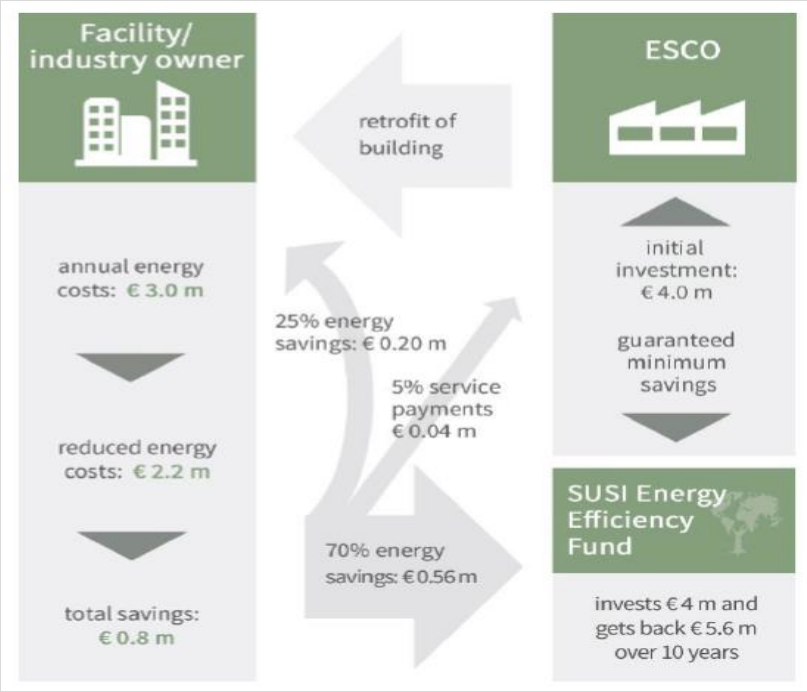
Solid overall risk profile, both public sector and private companies

Financing terms of 5-11 years

Eurozone countries (geographical scope)

Positive environmental impact

Typical financeable retrofits include electric motors, pumps, heat recovery, cogeneration in industrial processes, heating, ventilation and air conditioning, building management systems, lighting systems in buildings and other public infrastructure (e.g. street lighting, hospitals, universities, public facilities).



Source: Susi Partners

4.6.4 Standardised procedures, certification & accreditation

Certification and accreditation are essential to ensure transparency, credibility and trust in the operation and performance of ESCOs. By accrediting and certifying ESCOs, potential clients or financial institutions will have greater confidence in the competencies and capabilities of the energy service providers. Certification processes, which should not

create barriers to market entry, must be carried out by an independent accredited organisation, which remains compliant with the requirements of the national accreditation body. To reduce and mitigate the perception of technical risk in EES projects, local financial institutions should promote and request bankable projects from ESCOs certified by an accredited third party organisation. This will help to qualify the market and ESCOs track record of successfully implemented projects. EPC from certified ESCOs should reduce the time and costs required to analyse and approve the lending to EE projects. By doing this banks can build up their knowledge so that they better allocate resources and develop appropriate lending products and services for ESCOs.

Standards and M&V

Standards need to be supported by third party certification from an independent accredited organisation to ensure that ESCOs share the same understanding, have the same capability to carry out an EPC and apply the same procedures to manage projects. Austria and Germany have adopted this practice with successful results. For the quality assurance of contracting projects in Austria, the Ministry of Agriculture, Forestry, Environment and Water offers the Energy Performance Contracting Eco-label (guideline UZ 50)[33]. This certificate formulates the requirements on the contractor, the course of the project and the energy performance contract necessary for awarding of the 'Energy Performance Contracting' ecolabel.

A standardised method for monitoring and verification (M&V) is considered key for strengthening client confidence in ESCOs and the energy services market in general. A poor basis for M&V can create problems such as an unfair allocation of performance risk and savings calculations being unclear or taken for an inappropriate baseline. M&V can be, however, complex since variable factors, such as weather or building occupancy, need to be taken into account during the life of the contract. The International Performance Measurement and Verification Protocol (IPMVP), which was developed by the US Department of Energy at the end of 1990s to provide guidance to ESCO, can serve as an example. In general, an M&V plan should include:

- A clear delineation of the M&V standard selected
- Technical competences of M&V planner
- Deadlines: for M&V plan implementation, M&V equipment installation, M&V reports, et cetera
- Energy saving measures: a description of measures implemented that generates the savings
- Baseline definition: reference period, and parameters for adjustments, et cetera
- Methodology for savings calculation: equations defined, hypothesis considered, data sources for energy consumption (meters, invoices, et cetera) among other considerations
- Measurement specifications: sampling needed parameters to be monitored and the measurement interval

Adoption of a common Code of Conduct

The adoption of Code of Conduct can serve as a quality standard of EPC projects, raise potential clients' confidence in the business model and ultimately lead to higher demand for the EPC projects. The Transparense project, an Intelligent Energy Europe funded project, has developed a European Code of Conduct for Energy Performance Contracting in cooperation with clients and various European ESCO associations. It sets a number of

[33] http://www.umweltzeichen.at/cms/home/produkte/gruene-energie/content.html?rl=33

values (i.e. efficiency, professionalism and transparency) and principles that are considered fundamental for the successful preparation and implementation of energy performance contracting projects within European countries. The EPC Code of Conduct defines the principles of the behaviour primarily of the EPC providers and is an EPC quality indicator for clients on what they should expect and require from EPC providers and which principles they themselves should adhere to in order to achieve expected energy savings and related benefits. This can be downloaded here. Austria, the Netherlands, Romania and Hungary are among the EU countries which have already adopted this code of conduct.

4.7 Conclusions

In recent years, the Cypriot authorities have taken a number of steps to help kick-start the ESCO market. These include a supportive legislative framework, addressing, inter-alia, the licensing of ESCOs, their operating conditions registration terms, minimum provisions in contracts, etc. A registry of ESCO companies is also made available and efforts to publish a template for EPC contract are underway. The two pilot projects involving ESCOs in the public sector are expected to showcase the benefits of the ESCO concept in practice. Moreover, recent building regulatory developments are expected to encourage potential clients to seek energy efficiency improvements and subsequently help of ESCOs.

Despite these developments, the Cypriot market is still at an initial stage of development. The full development of the Cypriot ESCO market requires strong and continuous government commitment along with the active involvement of various stakeholders including the banking sector. Various further steps to boost the EPC Market in Cyprus have been identified: (1) additional legal support, (2) information, education and training, (3) access to financing and (4) awareness on standardised procedures, certification & accreditation. The removal of public procurement hurdles and need of mandatory energy monitoring can help further strengthening of the existing legal framework. In terms of information, education and training, ideas such as the development of ESCO association and dissemination platform have been discussed as well as the need of further guidance and model contracts. Access to affordable finance through traditional financial instruments supporting EPCs, revolving funds and guarantees are key aspects for fostering the market and good practices from other countries showcasing the benefits of such instruments are provided. Finally, a well-functioning ESCO market can benefit from standardised procedures, certification & accreditation schemes.

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5. Involvement of key building sector stakeholders, including customers, in transforming the Cyprus building stock. Communication tools for the information of consumers and stakeholders

A stakeholder is any individual, group or organisation, who can affect or are affected by, a project and its implementation (Freeman et al., 2010). This includes citizens, as well as business firms, public authorities, NGOs, technical experts and special interest groups.

The involvement and active contribution of stakeholders has emerged as a key issue to the success of building energy renovation strategies. The development of patterns, structures and buildings that prove to be sustainable and energy efficient should aim at including all parties affected.

Stakeholders can help policy-makers and administrators concentrate on the key problems, understand the issues at stake, evaluate and anticipate the rate of success of a measure, identify the challenges.

Furthermore effective implementation ultimately relies on the delivery of projects and other actions by stakeholders. Involving them at an early stage in the elaboration of policies and programs can increase the possibilities of successful implementation.

This is in line with a view of the policy-making process, seen as a circular flow (multi-actor cycle), rather than a top-down initiative. Therefore, effective stakeholder participation is a two way process where both policy makers and stakeholders benefit from more effective policies, targeted to real needs.

One of the well-recognized barrier to the adoption of energy-savings technologies and the transition to energy efficient buildings is the contrasting priorities among stakeholders (de Blois et al. 2011). An example of this is the low interest of the builders to invest in energy–saving technologies (Albino and Berardi, 2012), because the main benefits of the adoption are for the end-users of the buildings and almost no gains are realised by the building promoter (Pinkse and Dommisse 2009).

The inclusion of stakeholders is difficult for various reasons. Besides the highly fragmented nature of the building sector, the complexity of stakeholder interactions, different professional approaches of actors, varying interests and the challenge to the status quo by the new energy efficiency and building standards requirements, it may be difficult to motivate stakeholders to take part in the process of change also because of weak tools for participation.

Starting from the assessment of the Cyprus case, this chapter proposes a framework for the inclusion of the many different stakeholders involved in the national building energy renovation strategy to implement the necessary changes to transform the building stock, suggesting measures to improve this key aspect.

We decided to illustrate the steps of a generic stakeholders' engagement framework, based on available literature and international practices, in order to suggest an open and flexible guide to accommodate Cyprus policy-makers' needs in the process.

5.1 Assessment of the Cyprus case

Through a series of meetings and interviews the JRC collected the views and roles of different stakeholders and reviewed the actions adopted to involve them in the definition and implementation of policy measures to stimulate the transition to a more energy efficient building stock.

MECIT, the Ministry responsible for the development and implementation of the building renovation strategies in Cyprus, adopted from the beginning a positive and proactive approach in stakeholders' engagement and consultation by the establishment of the Advisory Committee for Monitoring the Implementation of the Laws Regulating the Energy Efficiency of Buildings.

A specific sub-committee was set up and involved in the definition of the strategy for encouraging investments in the sector of building renovation (Annex to the NEEAP 2014 – Art. 4 EED) in Cyprus.

This group met several times to discuss proposals and drafts of the strategies and specific measures.

5.1.1 Stakeholders

The main stakeholders involved are:

- Engineers and architects (ETEK – Technical Chamber of Cyprus)
- Land developers
- Real estate agents
- Manufacturers and building constructors (Building Constructors Association)
- Local and national government bodies (e.g. Ministry of Interior)
- Energy Service Companies (ESCOs)
- Public agencies (Cyprus Energy Agency)
- Public and private universities (University of Nicosia; Cyprus University of Technology; University of Cyprus; The Cyprus Institute)

The Advisory Committee counts on an active involvement and contribution of universities to the debate, which is considered a very positive point.

The inclusion and participation of other government departments and ministries (e.g. ministry of Interior) is also seen as a very positive point as building policies are a horizontal issue which affects many different policies and goes beyond mere energy savings achievements (security, safety, employment and growth).

Though the Cyprus case is considered a good practice in terms of stakeholders' involvement, also in comparison with other Member States building renovation strategies (Castellazzi et al., 2016), we identified room for improvement and challenges highlighted and discussed hereafter.

5.1.2 Challenges identified

A number of issues and challenges have been identified. They are not independent from each other and they are mainly linked to the intrinsic nature and characteristics of the building sector.

Although these challenges apply for the construction sector in general, in the specific case of Cyprus, they result emphasized because of the country's still little background and experience in the topic of energy efficient buildings.

High fragmentation

Buildings are the result of a complex process and, they typically have a long life-cycle and involve many stakeholders. One aspect to be aware of is that there are limited interaction between these stakeholders.

Besides the time component (building life-cycle), the different aspects of the building sector (e.g. architecture, engineering, building management, occupant behaviour) are often poorly coordinated. As a consequence, any player in the construction sector perceives dependence only on those players with whom they have a direct contact, while they are mostly unaware of any dependence on other players or of the overall picture. As such, there seems to be no incentives for stakeholders to cooperate to maximize the overall long-term goals of energy efficiency renovation.

Different professional approaches

The fragmented process in construction creates a decentralized system which is strongly influenced by professional codes. Since every "niche" of the construction sector has its own dynamics, regulations, interests and possibilities, a key challenge is to combine them in ways that, when well-articulated, avoid conflicts and favour a positive dialogue towards a win-win result. Expertise in working in cross-disciplinary processes is a requisite to meet this challenge.

Complexity of stakeholders' interactions

Impacts and risks and associated with construction activities are often difficult to identify and measure because of the interactions between many different variables (e.g. geographic, cultural and economic factors). There is also no one-size-fits-all solution, method, tool or model to determine the social, environmental and economic impact of construction activities due to the complexity and interconnectedness of different activities and stakeholders involved.

Variety of interests and values

In every decision-making phase, energy efficiency construction raises a set of issues that should be shared by all stakeholders: use natural resources; financial issues, energy savings; social issues, knowledge; well-being and lifestyle, among others. However, the interests of stakeholders often vary significantly and can be highly conflicting.

Difficulties in the involvement of specific stakeholders

Due to several factors (lack of specific information / knowledge; lack of incentives and interests or fragmentation) some stakeholders are difficult to involve and engage.

In the specific case of building renovation strategy for Cyprus, citizens and building owners/end-users are resulted as passive and not participating in the definition and discussion of the policy.

5.2 Possible strategies

5.2.1 Making the approach to stakeholders' engagement more systematic

The strategy for Cyprus stakeholders' engagement can benefit from a more robust and systematic approach. For example, specific guidelines for the different phases of

stakeholders' involvement could be developed and adopted (e.g. the EU stakeholders' consultation guidelines, adopted under the better policies framework).

Furthermore the actions taken so far did not include a formal "stakeholder analysis" which would help identifying the priorities and stakeholders' role and objectives.

Finally, the involvement of stakeholders should be continuous, including monitoring, evaluation and follow-up activities.

5.2.2 More efforts should be dedicated to the engagement of end-users / citizens and financial institutions

A very low participation from building owners /end-users to the stakeholders' consultation roundtables (Advisory Committee for Monitoring the Implementation of the Laws Regulating the Energy Efficiency of Buildings and its sub-committee) is highlighted.

On the reasons we can lists:

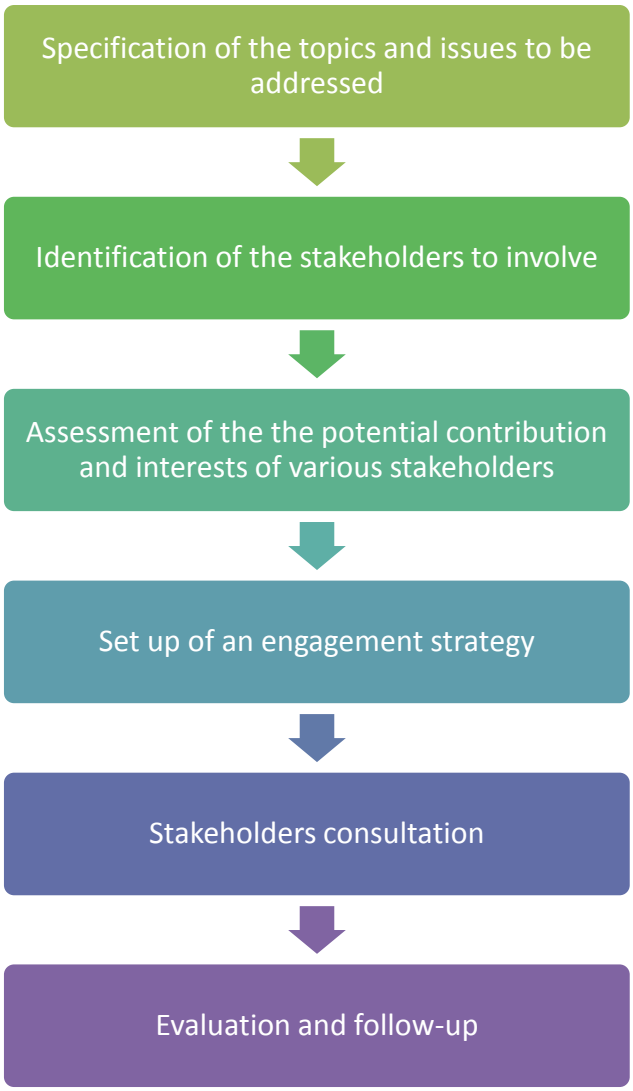
- Lack of tradition of energy efficiency in buildings in the general public; little awareness and knowledge;
- Low importance, perceived low interest in the topic, also because of the high initial investment required;
- Fragmented structure of ownership (large share of multi-apartment blocks, where it is difficult to reach a common agreement);
- Lack of a specific consumer association.

Also investors and financial institutions do not always actively participate and contribute. However, it is important to include also them in the process, as it is necessary to find adequate solutions to finance energy renovations with the help of all actors (See JRC Report D1.6 on the measures to promote the offer of financial products for the renovation of buildings).

5.3 A framework for stakeholders' engagement

We provide here a general framework for the engagement of stakeholders, which could be adapted and applied to building renovation strategies in Cyprus in order to improve the current approach and to meet the challenges identified in the previous chapter. The framework, described by other authors in the relevant literature, can be seen as a stakeholders' involvement plan and it is composed by six steps (see Figure 16).

Figure 16 - Stakeholders' involvement plan



The first three steps represent what is sometimes called "stakeholders' analysis", in a wide sense (Varvasovszky and Brugha, 2000). In the following chapters a description of each step and some recommendations for the context of Cyprus are provided.

5.3.1 Specification of the topics and issues

Defining the objectives of the engagement process goes hand in hand with determining the topics to be addressed. It is important to understand and specify if the focus is on a specific/narrow target or topic (e.g. the NZEB definition).Or rather on more generic issues such as social issues related to housing. The extent to which stakeholder consultation is feasible and how to implement it will depend on the topic selected. In doing so some preliminary questions could guide the policy makers: How new and how complex is the topic? Is there knowledge of the topic?

In the case of many stakeholder groups involved, stakeholder engagement should start with a focus on information giving and awareness rising. To understand the controversy

around a topic is also important. If the debate has already become polarised, for instance a viable approach could be to focus on each interest group separately to identify the conflicting points. It may then be easier to identify points of agreement as well.

Different aspects of a problem or project may require consultation with different stakeholders. It is important to notice that stakeholders, including citizens, can play an important role in this first step of defining the issue. A careful analysis of the issue can prevent ineffective action. The different viewpoints of stakeholders can thus be a very valuable resource in the process of problem specification.

After the meetings between the JRC team and some key stakeholders in Cyprus, some relevant topics related to the transformation of the building stock can be resumed by the following questions:

1. How to increase the general awareness of citizens about the convenience of retrofit measures?
2. Are the ongoing policy measures bringing the desired results?
3. How the regulatory framework can be strengthened in the future?
4. How to gather financial resources for the renovation of public buildings?
5. How the capacity of ESCOs to finance big renovation projects can be increased?
6. What types of new obligations may be introduced?
7. How the split incentive issue can be solved?
8. How can be better integrated the professional competences related to inspections, certifications and audits?

It is important also to include a "time" dimension of the topic. Is the issue expected to have an impact in the long-term or only in the short? What is the time-frame of the policy decision and stakeholder's consultation?

5.3.2 Identification of the stakeholders

As mentioned earlier, the building sector involves a large number of stakeholders from different backgrounds and with different goals[34]. They range from the client/user side to the design and construction side, to the public and regulatory side. Stakeholders' identification and "mapping" is thus a complex and sensitive task.

There are many different ways to select the relevant stakeholders and to categorise them: for instance they could be classified as internal or external stakeholders (Freeman et al., 2010). Other categories used in the literature are between business and non-business (public or private) stakeholders or between primary and secondary stakeholders; or again key actors vs intermediaries (Newcombe, 2003; Winch, 2010). There is not a standard one: the most effective way depends on the topic and issue to treat.

With regard to the topics listed above, the characteristic time-frames and a list of key stakeholders is provided in Table 36.

[34]See, among others, Anumba et al. (2005).

Table 36 - Preliminary identification of time-frames and key stakeholders for the topics relevant for Cyprus.

Topic	Time-frame		Key Stakeholders
	Impact	Policy decision	
1. General awareness of citizens	Long-term	by 2020	Municipal Administrators, Owner/Customer Associations, Environmental Organizations, building Administrators and property Managers, Real Estate Agents
2. Ongoing policy measures	Short-term	by 2018	Cyprus Energy Agency, Engineers and Architects Association
3. Future regulatory framework	Long-term	by 2020	Cyprus Energy Agency, University and Research centres, Engineers and Architects Association, Associations of building contractors, Municipal Administrators, Environmental Organizations
4. Financial resources for public buildings	Long-term	by 2018	Municipal Administrators, Cyprus Energy Agency, Banks
5. Capacity of ESCOs	Long-term	by 2018	ESCOs, Cyprus Energy Agency, Banks
6. New obligations	Middle-term	by 2020	Municipal Administrators, building Administrators and property Managers
7. Split incentive	Long-term	by 2018	Owner/Customer Associations, building Administrators and property Managers, Municipal Administrators
8. Professional competences	Long-term	by 2020	Engineers and Architects Association, Chamber of Commerce and Industry, Associations of building contractors, Cyprus Energy Agency, University and Research centres

As a general rule, policy-makers should list all potential stakeholders, deciding whom to involve before the start of the decision-making process, rather than at a later stage. However stakeholder identification is not a "static" exercise: the process should be repeated in the light of changing circumstances (including a reassessment of the involvement of already selected stakeholders). Also, as policies and implementation options are selected, new stakeholders might emerge.

5.3.3 Assessment of the potential contribution and interests of various stakeholders

This step aims at carefully assessing and the identified stakeholders:

- What is their main focus and what are their objectives (or hidden agendas)?
- How much influence and power do they have?
- Are they available/willing/able to participate and to contribute?

Very important is the good assessment and understanding of these aspects. In doing so it is usually recommended to create groups of stakeholders with similar interests, capacities and/or relevance for the topic. This can help in the appreciation of potential conflicts or shared benefits (Buhrmann et al. 2009), and it also shows possible gaps in the stakeholder selection.

To define the Cyprus context the classification proposed in Table 37 is recommended.

Table 37 - Main interest and drivers of the principal stakeholders in Cyprus.

Category	Stakeholders	Main interests	Main drivers
Government and Society	National Government	Environment, planning, innovation, citizens' safety, public buildings	Political consensus, social development
	Municipal Administrators	Land use, planning, public buildings	Political consensus, social development
	Environmental Organizations	Environment, citizens' safety	Social development, public visibility
Owners, Managers and Occupants	Owner/Customer Associations	Energy supply, operation and maintenance, energy supply, retrofit, sale or lease	Own profit, social development, public visibility
	Building Administrators and property Managers	Operation and maintenance, energy supply, retrofit	Own profit
	Real Estate Agents	Sale or lease, operation and maintenance	Own profit, economic growth
Technical Providers	Energy Agency	Environment, planning, dissemination and training, innovation	Social development, economic growth
	Engineers and Architects Associations	Design, construction, operation and maintenance, retrofit, demolition	Own profit, public visibility
	University and Research centres	Dissemination and training, innovation, planning	Social development, public visibility

	Chamber of Commerce and Industry	Construction, operation and maintenance, retrofit, innovation	Own profit, economic growth, public visibility
	Associations of building contractors	Construction, operation and maintenance, retrofit, innovation	Own profit, economic growth, public visibility
Financial Providers	ESCOs	Retrofit, energy supply, operation and maintenance, construction	Own profit, economic growth
	Banks	Sale or lease, construction, retrofit	Own profit, economic growth
Utilities	Energy Utilities	Energy supply, operation and maintenance, retrofit	Own profit, economic growth, public visibility

One of the most commonly used tool for mapping stakeholders is a power-interest matrix that categorises stakeholders according to their stake in the building topic, as well as their power. Table 38 shows a possible classification of Cyprus stakeholders depending on the importance of their role in the implementation of 5 categories of policy measures:

- Development of Codes and Standards on the building performance;
- Definition of energy efficiency targets (i.e. reductions in energy use with consideration for making them specific, measureable, actionable, realistic, and time-bound);
- Application of financial incentives (e.g. grants and rebates, loans, tax Incentives);
- Energy certification of existing buildings;
- Information on energy use in buildings and training of workforce.

Table 38 - Preliminary assessment of the role of Cypriot stakeholders in the policy implementation.

Stakeholder	Codes	Efficiency targets	Financial incentives	Certifications	Information and training
MunicipalAdministrators					
EnvironmentalOrganizations					
Owner/CustomerAssociations					
Building Administrators and property Managers					
Real Estate Agents					
Energy Agency					
Engineers and ArchitectsAssociations					
University and Research centres					
Chamber of Commerce and Industry					

Associations of building contractors	
ESCOs	
Banks	
Energy Utilities	

Importance:	**Low**			**High**

Stakeholders' influence can be considered as a combination of power and interest. According to the level of power and interest different categories of stakeholders can be identified: stakeholders with high power and high interest are considered the key players (Freeman et al. 2010).

It to be notice that the classification of stakeholders can change over time and it depends on the topic at stake.Many other classifications exist and can be used: they may represent better the situation of the specific case/sector[35].

5.3.4 Involvement strategy

The involvement strategy is the detailed plan which should specifies:

— when and how stakeholders will be involved;

— the way in which involvement will be undertaken (tools);

— the roles and responsibilities of each stakeholder groups;

— resources (skills required to manage the process; time; budget);

— reporting procedures.

To make the most efficient use of resources and time, and to ensure the best results, it is crucial to select the right level of involvement for each stakeholder. The participation can be deliberative but also interactive, in the sense that the outcome of the involvement is intended to feed directly into policy-making processes.

The most basic form of interaction with stakeholders is to provide them information, even if this is not usually considered a "real" involvement, which supposes a two-way communication. However, the level of interaction varies along a spectrum which goes from providing information to giving final decision making authority to stakeholders. In between many possible options are feasible: collecting inputs, working together, involvement of stakeholders in developing alternative solutions, implementing feedbacks.

The choice of consultation tools should also be specified (web-based tools, on-line surveys, workshops, focus groups, roundtables) and specific guidelines developed (or adopted) and followed.

The appropriate level of involvement for each stakeholder depends on:

— the objectives of the engagement process as a whole;

— the specific topic;

[35]See, for instance, Fletcher et al. (2003); Murray-Webster and Simon (2005); Bourne (2007). For a comprehensive review of methodologies see also Brugha and Varvasovszky (2000).

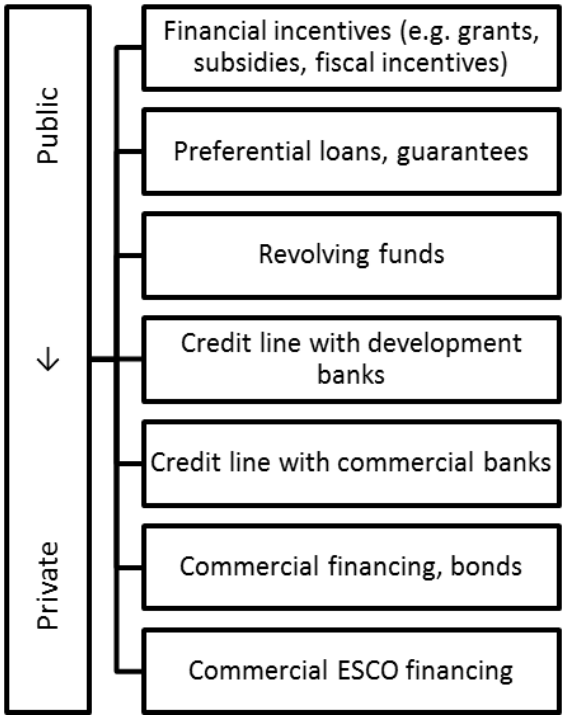
— the availability and willingness to contribute and the capacities of the stakeholder;

— the timing and budget;

— the level of experience of the actor.

Because in Cyprus one of the main barriers to renovation is the lack of economic resources, it is interesting to provide an applicative example on the definition of a new financing model. As discussed in a previous report (Economidou, 2016), a transition from grant-based to a more diverse portfolio of economic policy measures is necessary. The gradual phase-out of grants can be realised by limiting their access to specific target groups or specific actions and, in parallel, energy efficiency credit-lines for private households and businesses have to be developed through a public-private partnership.

Figure 17 - Options moving from public to private financing



Source: World Bank

In this context, when creating a new financial scheme it is crucial to involve stakeholders in the process. Stakeholders may include:

— the potential beneficiaries: i.e. Owner/Customer Associations, Building Administrators and property Managers, Real Estate Agents, Municipal Administrators;

— financial institutions or utilities interested in providing program funding: i.e. ESCOs, banks and Energy Utilities;

— organisations or individuals that provide the renovation services: Engineers and Architects Associations, Associations of building contractors;

— technicians that can support the initiative: Energy Agency, University and Research centres.

Within and beyond these categories, it should be strategic to select also key actors with specific characteristics. For instance:

— an owner association that in the past has utilised a financial mechanism and is able to share the benefits achieved (e.g. Cyprus Land Development Corporation);

— a professional organization that conducts energy audits or provides green job training (e.g. Cyprus Civil Engineers and Architects Association);

— a real estate organization that encourages businesses to take energy efficiency measures in order to increase their marketability at sale;

— a bank which is supplying special products for building retrofit (e.g. European Investment Bank);

— a technical entity that can share scientific evidences on the energy savings related to optimised retrofit techniques (e.g. Cyprus Energy Agency, Cyprus University of Technology).

The strategy has to be clear also on timing, setting clear deadlines (for example with respect to receiving and responding to stakeholders' feedback) and resources. Timing and budget constraints might prevent from evaluating every aspect, strategy development means prioritising and choices have to be made and possibly made explicit and motivated.

Finally a methodology has to be defined to evaluate the experience. What is considered the most important indicator of success? The number of participants? The number of ideas generated? The diversity of citizens consulted? Answering these questions before the start of the consultation phase will increase the probability of collecting the right and most relevant information along the process.

5.3.5 Stakeholders consultation

A number of options exist to involve different groups of stakeholders at various stages of the project or decision-making process. The previous steps (goals, topics, stakeholders' analysis and involvement strategy) all contribute to determine which techniques are most suitable to be used.

A quick overview of the three main options for stakeholder consultation (surveys, bilateral meetings and multi-stakeholder consultations) is provided in Figure 18. There is not a one-size-fits-all solution: the most effective tool depends on many factors including the number and type of stakeholders, the topic, time and budget available. Moreover usually a mix of different consultation methods can assure the adequate level of stakeholders' engagement.

Many ways of consulting stakeholders exists, but in any case it is always recommended to follow some established guidelines (or quality standards, when available) in order to be sure that the selected tools are set up and implemented correctly.

Figure 18 - Stakeholder consultation options.

Survey

- It allows for collecting information on a large sample of individuals in a systematic way.
- A standardised set of questions allows for statistical analysis of the information gathered.
- The cost of this consultation tool is generally relatively low.
- Representativeness of the sample of respondents and the response rate are issues to be taken into account when creating a survey.
- inconsistency and ambiguity should be checked beforehand, as normally the tools allow little room for subsequent adjustments and clarifications.
- Large-scale surveys can provide an interesting outlook on what different stakeholders think and feel, but it is not always easy to translate this information into action.

Bilateral meeting

- It is an interview with a limited set of people, often chosen for their expertise or for their knowledge of, and ability to represent, a given stakeholder group .
- This is a more open-ended and qualitative approach than conducting a survey, and it requires more time and resources and the interviewer can explain and clarify some points to respondents.
- It is important to make clear to the respondents how their input will be used and how many other opinions will be heard.
- In-depth interviews with key respondents can help to gain a detailed understanding of the viewpoints and reasoning of the target groups and to establish a closer relationship with the stakeholders increasing their sense of ownership of the issue.
- It is important to plan sufficient time to process the information gathered .

Multi-stakeholder consultation

- It is a workshop that bring together various stakeholders to share ideas and develop solutions together.
- The consultation can have the form of a focus group or a roundtable where stakeholders are asked about their perceptions, opinions, beliefs and attitudes in relation to the topic under discussion in an interactive group setting.
- Normally participants are encouraged to talk with other group members by a moderator.
- Focus groups are relatively inexpensive to organise and results are achieved relatively quickly. One of the strengths of focus group methodology is that it enables the researchers to learn from the participators of the group, while they are communicating with each other.
- Focus group conversations can also provide a valuable addition to survey results.

Continuing with the example introduced above, the preliminary consultation for developing a new financing scheme could be articulated by the following steps:

- Definition of the problem, including a description of the actual situation about retrofit financing and the identification of the needs and barriers seen by the different actors involved.
- Definition of the horizon, focused on the explication of long-term targets (about energy efficiency of buildings, but also effects of climate changes, development of society, etc.).
- Development of future images, where the emphasis should be placed on providing qualitative illustrations of how society might be like for different targets and scenarios. Guiding questions help the stakeholders for selecting the measures which need to be taken to achieve the desired scenario, and for identifying a first portfolio of tools.
- Realisation of the images, where the stakeholders make explicit their role in relation to the measures selected. They are inspired by exemplary best practices and a common innovative thinking is stimulated by the discussion.

Appropriate consultation tools and the specific role of each participant have to be defined for each step. A first proposal is shown in Table 39.

Table 39 - Consultation strategy for developing a new financing model: preliminary definition of steps, tools and actors' role.

Step of the preliminary consultation process	Consultation tool	Role of actors				
		Government	Potential beneficiaries	Financial providers	Service providers	Technical expert
Definition of the problem	Discussion in a focus group	Mediator	Participant	Participant	Participant	Participant
Definition of the horizon	Survey[36]	Promoter	Participant	Participant	Participant	Questionnaire developer
Development of future images	Multi-stakeholder consultation	Organizer	Participant	Participant	Participant	Mediator
Realisation of the images	Bilateral meeting	Interviewer	Interviewed	-	-	Supporter
	Bilateral meeting	Interviewer	-	Interviewed	-	Supporter
	Bilateral meeting	Interviewer	-	-	Interviewed	Supporter
	Discussion in a focus group	Mediator	Participant	Participant	Participant	Participant

[36]Based on future scenarios and trends from available studies.

5.3.6 Evaluation and follow up

This step is usually neglected but is considered essential in order for stakeholders' engagement to remain effective throughout the policy process and beyond and to create a culture of communication and feedback. This means keeping all stakeholders informed of how their views, concerns and suggestions have been considered in the process, informing them of any progress and also of any significant delays and trying to be consistent and to act, as much as possible, on the results of the stakeholder consultation.

This continuous follow-up should also be carefully planned as a systematic evaluation of the stakeholder consultation process. A monitoring and evaluation framework should be designed for engagement activities.

A complete evaluation covers both the process and the outcomes of the stakeholder consultation, compared against the goals initially set.

A list of indicators and descriptors should be used to structure the evaluation process. The level of details of the evaluation framework will depend on the expected outcomes and objectives of the evaluation itself. This is also a point to be addressed already in the planning phase.

The choice of methods for collecting information on result indicators depends on the factors and criteria described in earlier sections. These include the level of participation and the type of engagement you aim to achieve; the identified stakeholders; and the number of participants. Commonly used monitoring methods are: analysis of documents, reports and used media; structured questionnaires for stakeholders groups; roundtables (especially for smaller groups); and personal interviews with key stakeholders. Typically, process evaluation is carried out through an evaluation meeting with the key actors.

In the Cyprus context, the creation of a web portal is recommended (e.g. within the MECIT website). This tool should include a forum with restricted access for the stakeholders involved in the consultation, but also an open register (also translated in English) summarising the process to all citizens. With this tool most of the information will be readily available to the organiser and to the participant of the stakeholder consultation, and it would help to determine whether the various steps in the consultation flow have been taken (regardless of whether or not the goals have been achieved). Moreover the portal could be used to spread out the survey proposed above (definition of the horizon), or other similar initiatives, and to provide material for preparing the stakeholders to the focus discussions.

Finally, output (results) and impact (influence on decision making) should be assessed against the consultation goals and objectives. To carry out a proper evaluation, the objectives should be: specific, measurable, attainable and ambitious, relevant and timely (the so-called SMART approach).

5.4 Communication tools for the information of consumers and stakeholders

Actions to increase public awareness and, in turn, to favour stakeholders' engagement and to induce behaviour change, constitute an important element of policies and programmes to support energy efficiency building renovation measures. These policies and programmes can be targeted at individuals, at communities and organisations[37].

[37]In this line, the Energy Efficiency Directive (2012/27/EU) includes specific provisions regarding consumer information and training in Articles 12 and 17

Member States are required to implement information, awareness-raising and training measures regarding specific areas and tools. The energy efficiency improvement and the related market transformation requires conscious and informed consumers and high awareness among all segments of society as well as tailored information, education and training for selected stakeholders. Energy efficiency in buildings campaigns aim at changing habitual energy behaviour or investment behaviour of individuals or organisations.

Concerning the impact of existing policy measures focusing on information and training in energy efficiency, the literature shows significant variability, from negative impacts to over 20% savings, (Karlin et al., 2015). The success factors are linked to the quality of the measures: their characteristics, implementation al follow-up. Indeed what emerged from the studies available is that providing information is not enough. The development of knowledge and awareness depends very much on the way the information is provided. Policies reach their goals if they are able to correctly identify the action point and the susceptibility of their information targets[38].

It is usually recognised and supported by behaviour studies (e.g. Steg, 2008, S. Van der Linden et al., 2015), that even if money could be a good motivation, it is far more efficient to address and appeal to peoples' intrinsic motivations.

However, also raising awareness on environmental issues could not be always sufficient to trigger behavioural change. Studied showed, for instance, that people perceive climate change as a non-urgent and psychologically distant risk[39]: Van der Linden (2015) suggested translating information about environmental risks into relatable personal experiences.

Once basic awareness goals are reached, the subsequent step would be to provide targeted and specific information on the potential measures. It is essential to understand and study the targeted audience. Cost-effective planning, as well as monitoring and measurement are a key part of this process.

Several measures targeting consumer information and training in energy efficiency are in place in Cyprus (Rivas et al., 2016). These include:

- Appointment of Energy Savings Officers in all public buildings: the aim is to appoint at least one ES Officer in each building (owned or leased), which is used by the services of the public or broader public sector. ES Officers ensure that energy-saving measures are implemented in the building as much as possible, especially zero-cost measures. In addition, they draw up an annual Report on Energy Consumption and Actions in relation to the building under their responsibility. An event and training meetings of ES Officer groups are organised on an annual basis by the Energy Department, for the training and information of ES Officers.

- Pupil competition and presentations in schools of all levels: the competition includes research projects by pupils and/or experimental/laboratory applications, which are directly related to RES or energy saving. Projects must focus on smart and functional ways to save energy, as well as on ways or technologies which may be used to improve energy efficiency. The best three projects from Secondary Schools and the best three projects from High Schools/Technical Schools are awarded pecuniary prizes in an official ceremony held at the end of each school year.

[38]According to Ajzen and Fishbein (2005) there is a direct and rational relationship between behaviour and intentions and they place attitude in front of intentions as a background for it. Intentions are derived from beliefs that develop according to background factors. In general, the more favourable the attitude and subjective norm and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question. While rationality is a characteristic of the intention-behaviour step, the preceding steps may be flawed, biased or even irrational. Egmond et al. (2005) also place intentions as the central input for human behaviour, but they focus on the determinants. Intention to save energy was found to be formed by some "predisposing factors" (awareness, knowledge, norms, attitude, self-efficacy) and further influenced by so called "enabling factors" (financial resources, technical resources, new skills) and intensified or weakened by "reinforcing factors" (feedback from peers, advice from experts, subsidies and regulations from authorities).
[39]See, among others, Harries, (2012).

- Training seminars on energy management and RES held on an annual basis, in cooperation with the Human Resources Development Authority of Cyprus (HRDA), the Productivity Centre and the Energy Institute. Four (4) seminars were held in 2013 in Nicosia, Limassol, Larnaca and Paphos, with duration of 60 hours each. The seminars were addressed to unemployed engineers of all specialisations.

- Information dissemination through leaflets, information days, annual state fair etc.

However, they are only marginally focused on buildings, one example being the 'Technical guide on nearly zero-energy buildings'.

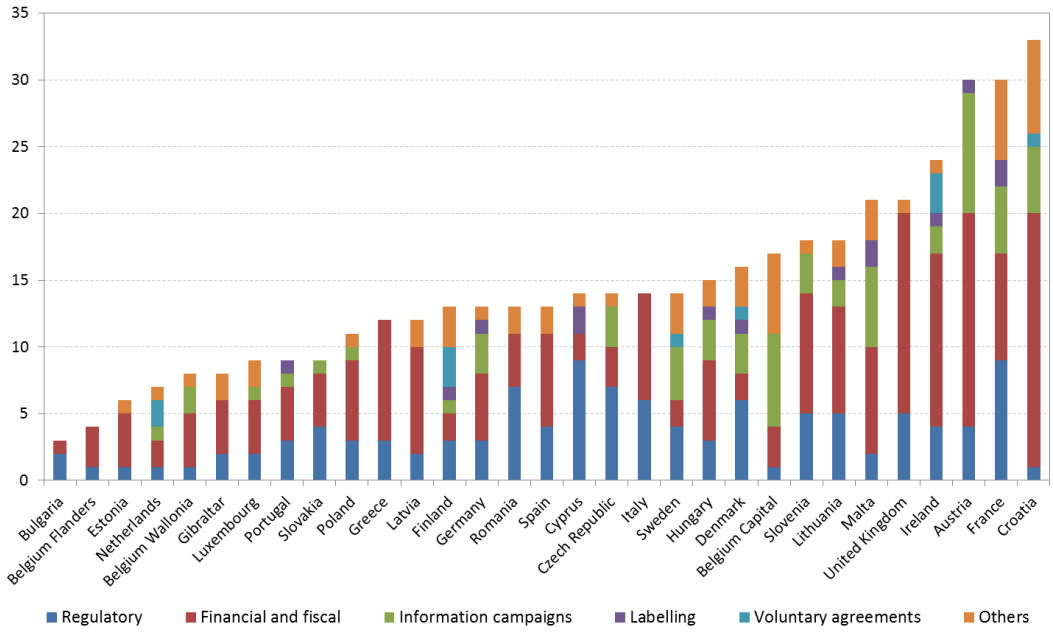
Among the measures in place in Cyprus it is worth mentioning information days held in Nicosia, Limassol and Paphos addressed mainly to engineers members of the Cyprus Scientific and Technical Chamber (ETEK), the Cyprus Employers and Industrialists Federation (OEB), the Cyprus Chamber of Commerce and Industry (KEBE), hotel owners, entrepreneurs, credit institutions, municipalities and communities, contractors and the general public. Information days focused on energy audits, the energy efficiency of buildings, energy labelling, energy-saving and RES technologies used for heating and cooling purposes.

Information is mainly provided through the websites of bodies active in the energy sector (e.g., MECIT Energy Department, Energy Institute, Cyprus Energy Agency, EAC, CERA, TSO, etc.).

In order to provide examples and best practices, we reported hereafter observations and findings starting from on the JRC assessment of EED Art 4 national building renovation strategies (Castellazzi et al. 2016) and, more in general from the review of the EED implementation in EU Member States.

As show in Figure 19 below, information strategies and campaigns accounts for a minor, but still relevant part of the policies to promote and accelerate the energy efficient renovation of the building stock.

Figure 19 - Number of all the measures in the building sector (implemented and planned) by country and type



Source: Castellazzi et al. 2016

A number of measures on information and awareness-raising have been mentioned for residential and service sectors in national energy renovation strategies.

They reach end users through many different tools: media campaigns (TV, press,social media), brochures, guides, conferences and events, web sites, contest, exhibitions, selected training etc.). Regarding training purposes, three main audience sectors are covered by the MS's: general public, students and professionals on energy efficiency in buildings.

The Member States' main measures which can be identified include web sites and portals (sometimes jointly with market actors), mass media (TV, radio, newspaper advertisement, printed materials as leaflets, mail and electronic newsletters), datasets, general information and events, networks of consultation centres, modal shift promotion, education and generic awareness.

Training is only rarely mentioned in the strategies, but it represents an important vehicle for specific technical information which can have a direct and immediate impact on the energy improvement of the building stock.

To provide some examples, in Austria, the main information and awareness raising measure is the **Klimaaktive programme** which represents an umbrella measure by the Austrian Climate Initiative, consisting of a large number of programmes aiming at promoting the topics of climate protection, energy efficiency and renewable energy sources, in the personal, commercial and public spheres, by means of information, advice, education, training, quality standards and networking.

France set up 450 **Renovation Information Service Points (PRIS)** with the aim to help owners make decisions through the implementation of a national **one-stop approach** and a local network for the energy renovation of private dwellings. This is a genuine local public service, which provides independent technical, financial, fiscal and regulatory information and gives advice, free of charge and objectively, to the enquiring home-owner on the design of the energy renovation project.

In Denmark, a relatively new information campaign (**BedreBolig, Better Homes**) was introduced in 2014, offering comprehensive expert advice throughout the energy renovation process. In connection with the launch of BedreBolig, DKK 15 million has been allocated to the launch of a special information program. This focuses, inter-alia, on developing cooperation and dialogue between home owners, banks, mortgage institutions and energy advisers.

Malta is implementing a pilot project (conducted with the help of the Institute for Sustainable Energy, the Malta Intelligent Energy Management Agency and the National Statistics Office), carried out on a stratified sample of about 10,000 households to model consumer behaviour and their response to a knowledge diffusion initiative. This is considered very important as it includes from the beginning the direct measurement and evaluation of the campaign's impact.

Other relevant information and awareness-raising measures in the building sector include the large-scale Latvian information campaign **"Dzīvosiltāk!"**(**"Living warmer!"**), which encourages apartment owners to participate in the management of common property and upgrading of the energy performance of buildings

The campaign stimulated the upgrading of the energy performance of buildings also through demonstration projects for large-scale energy saving measures in existing residential buildings in Latvia.

This measure is considered particularly innovative at it counts on an extensive and active presence on modern social media, using different communication channels (in addition to its official website, the campaign has a strong presence on all main social networking sites, from Facebook and Twitter to YouTube and Vimeo) and a strong branding strategy are among the innovative aspects of the measure and contributed to its success.

Over 186 informative events of different type had been organised, attracting more than 8,500 participants, (a number of these broadcast live online). In addition, an annual competition to find 'The Best Energy Efficient Building' assures adequate coverage in mainstream and specialist print.

In 2013 the Latvian campaign "Let's Live Warmer" received the EU Sustainable Energy Week Winner Award in the category "Communicating".

5.5 Conclusions and Recommendations

The assessment of the state of play as regards the energy renovation of the building stock in Cyprus showed some open challenges, such as the high fragmentation of the building sector with poor coordination of the main actors, the peculiarities of different professional and their difficult interactions, the complexity of social, environmental and economic variables impacted by the construction activities, the variety and variability of specific interests entering in the decision-making process and last but not least the difficulty in reaching and involving stakeholders and customers and in particular the involvement of some important stakeholders as well as the active and continuous participation of building end-users and owners, and financing institutions is still missing.

But Cyprus has already implemented some positive actions in involving stakeholders in the process of defining and implementing policy measures to foster the energy efficiency of national building stock. MECIT, the Ministry for Energy, Commerce, Industry and Tourism, has adopted a proactive approach by the establishment of the Advisory Committee for Monitoring the Implementation of the Laws Regulating the Energy Efficiency of Buildings and setting up a specific sub-committee for the definition of the strategy for encouraging investments in the sector of building renovation (as per the Annex to the National Energy Efficiency Action Plan, under Article 4 of the Energy Efficiency Directive).in Cyprus. This group includes most of the main stakeholders and met several times to discuss proposals and drafts of the strategies and specific measures.

Two possible strategies have been identified and proposed to fill this gap: a more systematic approach to stakeholders' engagement should be adopted and more efforts in awareness-rising and information campaigns should be made. Complementarily, specific tools for communication and consultation should be planned and implemented, thus ensuring knowledge dissemination and the diffusion of a positive culture towards energy efficiency and environment sustainability. An approach which includes demonstration projects, specifically targeted to building end-users and owners could also be an important tool in this respect. Best practices and examples of information and awareness raising measures have been brought from current experiences in France, Denmark, Malta and Latvia.

In addition, establishing an overall framework for a complete and coherent strategy would create the best conditions for a positive implementation of a strategy. In this chapter we suggested a methodological framework for stakeholders' engagement, based on the available literature and international practices, which includes six steps: from the specification of the issues, the identification of the relevant stakeholders, the evaluation of the interests and potential for contribution by the stakeholders, the deployment of an involvement strategy, the consultation with the stakeholders and the evaluation of the results. Implementing each of the steps in a systematic way, could additionally support MECIT in developing and implementing effective policies and assure building sector stakeholders inclusion and involvement in the decision-making process.

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6. Measures to promote the offer of financial products for the renovation of buildings by the commercial banking sector, including the design of innovative financial schemes

It is generally recognised that public-supported incentive schemes cannot result in widespread adoption of energy efficiency investments and scaling up investments is necessary in order to meet the energy efficiency potential of buildings. While public subsidies can create economic stimulus towards energy renovation projects, they are unlikely to form a major driver for large-scale investments, especially in cases of limited fiscal budgets. Moreover, various market actors such as banks are not familiarised with the energy efficiency fundamentals, while traditional appraisal methods such as simple payback calculations hamper the development of attractive financial products tailored for energy efficiency projects. The set-up of appropriate financing options to foster investment by private citizens, public bodies and business in the refurbishment of buildings to complement government incentives are therefore critical.

This chapter examines various innovative solutions which could help the mobilisation of further energy efficiency investments in the Cypriot building stock. These are categorised into (a) traditional instruments and (b) innovative financial mechanisms. The set-up of possible guarantee funds and innovative financing schemes such as municipal bonds and on-bill financing are discussed. Good practices for the training for building owners, ESCOs and other actors on how to prepare bankable projects are drawn. Ways to raise awareness in the financial sector for energy efficiency refurbishment of buildings are identified as well as recommendations for training of the commercial banks on the appraisal of energy efficiency projects.

6.1 Traditional financial mechanisms

Various financial mechanisms can be set up to provide finance for energy efficiency investments, which can be supported by private funds, public funds, or a combination of both. Conventional mechanisms include debt, private equity, project and leasing financing.

6.1.1 Credit lines

Dedicated credit lines can provide the necessary liquidity necessary to up-scale energy efficiency upgrades, especially for capital-intense investments such as deep renovation projects. As private debt finance dedicated to energy efficiency upgrades is generally limited, international financial institutions, public and national governments can intervene to fill the debt gap where local and traditional banking sector actors are not active (see Deliverable 1.1).

International financial Institutions have been active with energy efficiency lending activities for many years. Examples include the European Bank for Reconstruction and Development (EBRD) which has provided loans and equity through its Sustainable Energy Finance Facilities model (SEFF) for several energy efficiency projects in the EU since 2002. The European Investment Bank (EIB) also provides support through traditional lending facilities while it is involved in several initiatives together with the European Commission such as EEEF, JESSICA, ELENA and EPEC (Kovacheva, 2013). Another active international financial institution is the Council of Europe Development Bank (CEB) which

has approved a total of EUR 1.9 billion for energy efficiency since 2002 (European Commission, 2013).

A number of loan schemes have been described in more detail in Deliverables 1.1 and 2.1. An example of EBRD-supported credit line is described below. This entails a successful financing mechanism for energy efficiency investments which combines commercial loans with technical cooperation (TC) and performance-based incentive systems.

Bulgaria

Name	Residential Energy Efficient Credit Line Facility (REECL)
Participating banks	Procreditbank; Dskbank; Piraeusbank
Target groups	Households; Housing associations
Building types	Residential
Implementation period	2005-2014

The Residential Energy Efficient Credit Line Facility (REECL) was established by the EBRD to develop a credit line to participating banks in Bulgaria for on-lending to individuals, associations of apartment owners and privately-owned service providers for energy efficiency projects in the residential sector. The credit line is combined with intense technical cooperation and financial incentives for both partner banks and sub- borrowers. This provides assistance in energy efficiency related capacity building (among banks and households) and increases financial intermediation. Any borrower who takes a REECL loan is entitled to receive an incentive payment toward the cost of the energy efficiency upgrade project once it has been completed. The grant intensity ranges from 20-35% depending on various conditions. For grants, the intensity of the grant is 20% for dwelling-type projects and 30% of building-type projects, where:

- Building-level projects are implemented in multi-storey apartment buildings and applied to common structures and/or common engineering systems.
- Dwelling-level projects are implemented in family houses and/or individual apartments.

Building-level projects are implemented in multi-storey apartment buildings and applied to the whole building envelope and/or common engineering systems while dwelling-level projects are implemented in family houses and/or individual apartments. Grants covering up to 35% of costs are given for building-level projects undertaken by Associations of Apartment Owners and encompassing measures on both building envelope and building service systems. The 20% incentive grant can be coupled with the REECL loans, whereby the incentive payment toward the cost of the energy saving project is paid once the project has been completed.

The REECL programme has provided EUR 40 million in the form of credit lines with an additional EUR 14 million grant financing. The total number of energy efficiency home improvement projects to be financed under the REECL facility is expected to be in the range of 30,000. The EBRD is now considering a second extension of the REECL programme in order to continue the momentum gained and address the need for further energy efficiency improvements in the Bulgarian residential sector. It is envisaged that

EBRD credit lines of up to EUR 20 million will be made available as well as grant funding in the amount of EUR 4.4 million.

6.1.2 Risk Sharing Facilities

Risk-sharing arrangements can be pivotal in addressing the risks and uncertainty of energy efficiency investments perceived by the private sector. These can be set up by the public sector by developing a guarantee mechanism to reduce the risk of energy efficiency project financing to the private sector, which is willing to consider financing energy efficiency but is concerned about the potential risks of such projects. Under the risk-sharing facility, the public agency provides a partial guarantee that covers a portion of the loss due to loan defaults. By sharing the risk, the public sector reduces the risk to the private banks, thereby motivating banks to increase lending to energy efficiency projects. This can thereby encourage greater amounts of private sector capital to be deployed, making energy efficiency investing attractive to larger numbers of banks. They cover part of the risk of payment default by lenders and can be combined with dedicated credit lines.

The three types of partial guarantees are (IEA, 2011):

- Pro-rata guarantee: the loss is shared between the LFI and the public agency according to a pre-specified formula. Typically the percentage share of the public agency is between 50% and 80%.
- First-loss guarantee: pays for losses from the first losses incurred until the specified amount of the first-loss facility is exhausted; the lender incurs losses only when the total loan loss exceeds the first-loss guarantee amount. By covering a large share of first losses and defining first losses to be a reasonable proportion of the loan portfolio (usually higher than the estimated default/loss rate), a first loss portfolio guarantee can provide very meaningful risk coverage to the lender.
- Second-loss guarantee: pays for losses that exceed the non-guaranteed portion of the loan. The main idea of such a guarantee is to cover incremental losses beyond the LFI's normal loss rate. For example, suppose the LFI has an average loss rate of 1% of its loan portfolio. When asked to move into a new business segment that it perceives to have higher risk (such as EE loans), the LFI would expect the average loss rate to be higher. Because the guarantee is partial, the second loss coverage starts at a percentage loss at or somewhat below 1%.

As mentioned in Deliverables 1.1 and 2.1, the Energy Efficiency and Renewable Energy Fund in Bulgaria offers partial credit guarantees through 80% on a pari passu basis or 50% on a first-loss basis after the bank-creditor. The annual fee is 0.5-2% and maximum maturity (tenor) is 5 years. Individual (per project) guarantee commitments shall not exceed BGN 800 000. Portfolio guarantees are divided into ESCO portfolio guarantees and residential portfolio guarantees. Other examples include IFC's CEEF programme in Hungary, Czech Republic, Estonia, Latvia, Lithuania and Slovakia), European Energy Efficiency Fund (EEEF) and the Bulgarian Energy Efficiency and Renewable Energy Fund.

6.1.3 Revolving funds

Revolving funds are especially designed to deal with a lack of liquidity in a specific area, such as energy efficiency (Rezessy and Bertoldi, 2010). The advantage of revolving funds is that they present a sustainable, long-term and stable source of funds which is less dependent on external investor. Repayments are kept to finance future loans, which means that funds can be used again and again over time and benefit many recipients (Kats et al., 2011; IEA, 2011). Revolving funds require a significant initial investment but

are subsequently self-sustaining if operated successfully. Systematic monitoring is necessary for these kinds of funds to ensure timely loan repayments and keep the balance between out-flowing and in-flowing funds. In Europe, examples of such funds include the KredEx Revolving Fund set up in Estonia in 2009 and the more recent Dutch Revolving Fund set up in 2013.

Estonia

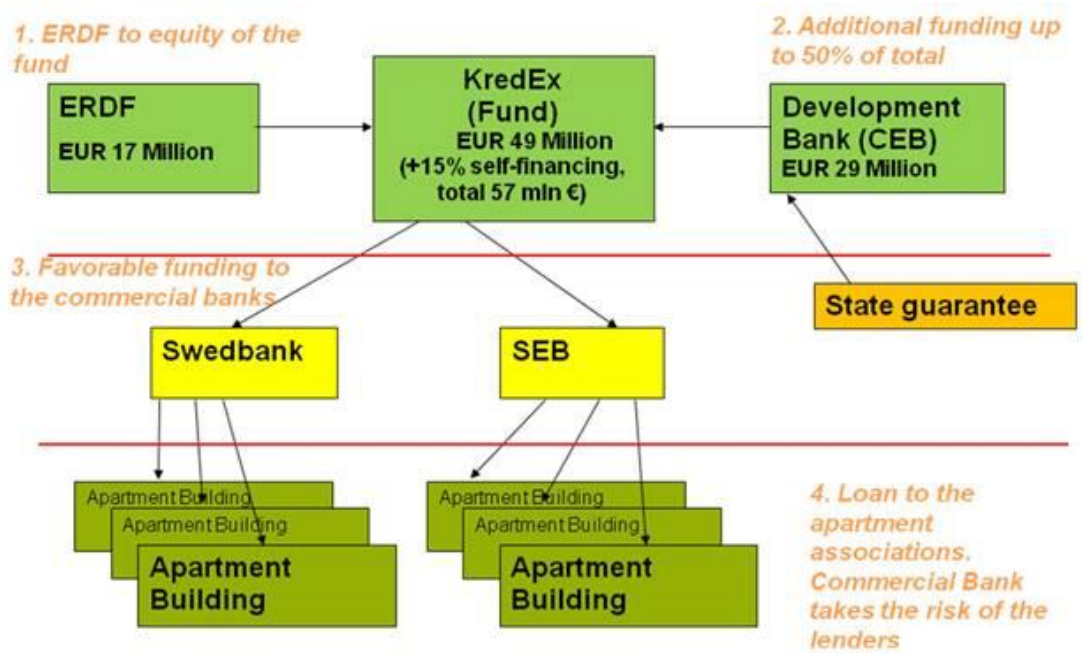
Name	KredEx Revolving Fund
Participating banks	Swedbank; SEB
Target groups	Housing associations (apartment associations and building associations) and communities of apartment owners of buildings constructed before 1993 and local authorities (owners of social housing)
Building types	Residential
Implementation period	2009 -

The KredEx Revolving Fund is a revolving fund established by the KredEx Foundation in 2009, an Estonian government owned non-profit provider of financial services. The fund provides long-time, low interest loans for multifamily apartment building owners who wish to reduce energy consumption and increase energy efficiency of their homes. In particular, it targets apartment associations, building associations (incl. previous housing associations) and communities of apartment owners. The aim of the renovation loan is to support the renovation of apartment buildings and to raise their energy efficiency by at least 20%.

The KredEx Revolving Fund has been supported by the European Regional Development Fund (ERDF), the Government of Estonia, the Council of Europe Development Bank (CEB) and by the KredEx Foundation, with the initial capital of EUR 49 million in 2009. In 2013, the capital was increased up to EUR 72.6 million. Based on its self-sustaining nature, the loan instalments return back to the fund, whereby the CEB and State loans have to be paid back first

.

Figure 20 - Business model behind Kredex financing scheme



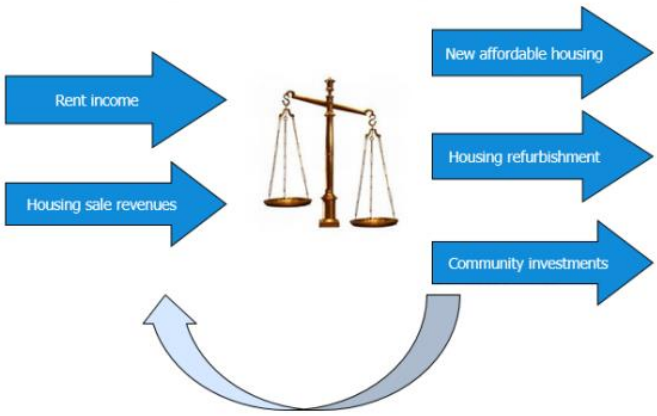
Source: Kredex website

Netherlands

Name	Revolving fund for energy savings
Participating banks	
Target groups	Homeowners, landlords and owner associations
Building types	Residential
Implementation period	2013 -

The Netherlands has recently created a Revolving Fund for Energy Saving with the aim to encourage investments in energy efficiency in existing buildings. Under the Housing Agreement (Parliamentary Papers II, 2012/2013, 32 847 No 42), the cabinet took the decision to contribute a total of EUR 150 million in 2013 and 2014 to the revolving fund. The expenditure of the fund will be returned to the fund over time in the form of interest and repayment. This revolving fund is aimed at energy saving for tenants and homeowners and is supplemented with funds from the market, to achieve a total investment of EUR 600 million. The fund for owner-occupiers has been operational since 21 January 2014. The fund for landlords and the fund for owners' associations are also expected to be operational in 2014.

Figure 21 - Dutch Revolving fund principle



Source: Hoekstra (2013)

In the European context, the first PAYS®-inspired scheme was implemented in the UK in 2013 with the introduction of the Green Deal, which enables owners and occupants to install energy efficiency improvements at no up-front cost using a similar concept, the so-called "Golden Rule". The Golden Rule simply states that the repayments must be less than the savings on the energy bill. The scheme however, has not yet performed as originally expected and only a small share of the total Green Deal assessments[40] undertaken have so far led to signed agreements. Much criticism has accrued since its inception (primarily due to its uncompetitive interest rate) and the scheme was closed in July 2015. In Ireland, a new scheme Better Energy Finance is an initiative of the Irish government and industry actors, which is based on the idea of a market-based PAYS® residential retrofit scheme. The scheme is expected to apply the lessons learned so far from the experience with similar programmes.

6.2 Innovative financial mechanisms

Below, we concentrate some of the most promising mechanisms in terms of new ideas on how to overcome some of the key barriers associated with energy efficiency finance. For example, these may be based on funding structures permitting a loan to be repaid from energy savings and thus eliminating the need for upfront capital. They can take the form of energy performance contracting, property assessment clean energy and on-bill finance. As debt financing typically needs to be compatible with restrictions associated with existing mortgages, energy mortgages can also offer an attractive option. These are also discussed in this section.

6.2.1 On-Bill finance

On-bill financing is a mechanism that reduces first-cost barriers by linking repayment of energy efficiency investments to the utility bill and thereby allowing customers to pay back part or all costs of energy efficiency investments over time. The funds can originate from utilities, the state or third parties. Energy savings which accrue from the installed

[40] A Green deal assessment is an upfront survey carried out in a building with the aim to identify cost-effective EE measures and financial savings as well as outline payments and an advice report

measures can be large enough so that the total post-renovation utility bill does not exceed the pre-renovation bill. They can be particularly useful for small businesses with limited capital to spend as well multi-family or rented properties where split incentive deter such investments. On-bill finance programmes can be categorised into: (1) *on-bill loans* and (2) *on-bill tariffs*. The main difference between the two is that on-bill loans must be paid off in case of ownership transfer while on-bill tariffs assign the obligation to the property, thus allowing for a transfer of the repayments to the next tenant or buyer.

Utility on-bill financing programmes have been used in the U.S. for many years. In 2011, 20 U.S. states implemented or were in the process of implementing utility on-bill financing programmes (Bell, Nadel, & Hayes, 2011). The capital in these cases can be usually raised through public benefit funds and utility funds, which can also be used to create loan loss reserves and guarantees to hedge against default risk. Alternatively, they can be used to buy down interest rates to make these programmes more attractive and minimise investor's risk by enhancing the credit quality of the financial product. Other capital sources may include bond issues, public loan funds, revenue from cap and trade programmes, banks, credit unions and capital markets (Bell, Nadel, & Hayes, 2011). They can be administrated by utilities although in certain cases other actors (such as government, energy agency, non-profit or service companies) can assume this responsibility. The US experience shows that while on-bill financing is associated with elements which overcome important barriers such as upfront cost and split incentives, issues such as the need to modify billing systems, role of utilities as financial institutions, risks of no payment, handling transfer of property, diversifying sources of capital, non-utility and differing fuels need to be addressed.

It should be noted that on-bill tariff programmes are based on a similar concept with PAYS® model which was first developed by the Energy Efficiency Institute in 1999 in search of a market-based response at a time of diminishing national funding. The PAYS® model allows the tenants/owners to benefit from the savings of installed energy efficiency measures through a tariffed charge on their utility bill, but only for as long as they occupy the location where the measures are installed. The monthly charge needs to be lower than the measure's estimated savings and it remains on the bill for that location until all costs are recovered. In the U.S., the PAYS® model was first introduced as a pilot programme in New Hampshire while programmes in 5 states exist today (EEI, 2013). Some examples of such programmes are shown in Table 40.

Table 40 - Key features of PAYS® schemes in the United States

Name	Projects completed	Period	Investment size	Examples of measures
Public Service of New Hampshire	59 municipal projects	2009	$866,879 ($31,208 programme fees)	Street lighting, lighting upgrades, HVAC improvements
Midwest Energy How$mart® (Kansas)	858 locations (716 homeowners, 114 rental properties, 28 businesses)	2007-2012	$5,000,000	Heating systems, geothermal loop projects, air sealing and insulation
3 Hawaiian pilot	513 applications	2007-2009	-	Solar water heaters

programmes				
How$SmartKY™ (Kentucky)	90 customers	2012	$687,517	Insulation, duct/air sealing, heat pump upgrades

Source: EEI (2013)

6.2.2 Green Bonds

Green bonds could provide a way of financing a portfolio of energy efficiency projects by aggregating a large number of smaller projects that otherwise may be difficult to finance individually (IEA, 2012a). Bonds offer an alternative to bank debt, providing instead the opportunity to borrow directly from the capital markets. They have a fixed repayment period (maturity) and a fixed or variable rate of interest (the coupon) is usually paid along with the repayment of the principal. They differ from regular bonds mainly in that the funds raised are exclusively used for specified environmental and sustainable development purposes. They could have great potential for stimulating large-scale investment, as they provide a financing structure which is potentially interesting to institutional investors and debt capital markets and they benefit from using a well-known and proven mechanism (Caldecott, 2010).

So far green bonds have been mainly issued by the United States government, multilateral development and investment banks and a few private companies. Most of the bonds are dedicated to renewable energies, but there exist also bonds specifically for energy efficiency projects, as well as for both areas (Della Croce, Kaminker and Stewart, 2011).

Table 41 - Existing green bonds for energy efficiency

Size Rank	Issuer	Year(s)	Type	Amount USD Mio.	Notes
1	US government agencies and utilities	2009-2012	Qualified Energy Conservation Bonds (QEBS) program	3,200.00[1]	Originally tax credit enhanced bonds for EE, changed in 2010 to direct subsidy bonds
4	European Investment Bank	2007-2010	Climate Awareness Bonds	1,630.00	For investment in renewable energy and energy efficiency, 3-8 year term
14	Asian Development Bank	2010	Clean Energy Bond	243.00	4-7 year tranches for renewable energy and energy efficiency investment
15	Destiny USA	2007	Energy Efficiency Green Bond	228.00	For the construction of a green retail complex, 30 year term
18	Nordic Investment Bank	2010	Environmental Support Bond	200.00	For financing its CLEERE lending facility on climate change, energy efficiency and renewable energy, 3 years maturity
29	Georgetown Special Taxing District	2006	Energy Efficiency Green Bond	14.50	For the construction of a green multi-use complex
30	US municipal governments	2009-2010	Property Assessed Clean Energy Bonds	9.70	To fund residential and commercial energy efficiency and renewable energy installations
31	Novacem	2010	Energy Efficiency corporate bond	1.50	To fund the construction of a semi-commercial green cement plant

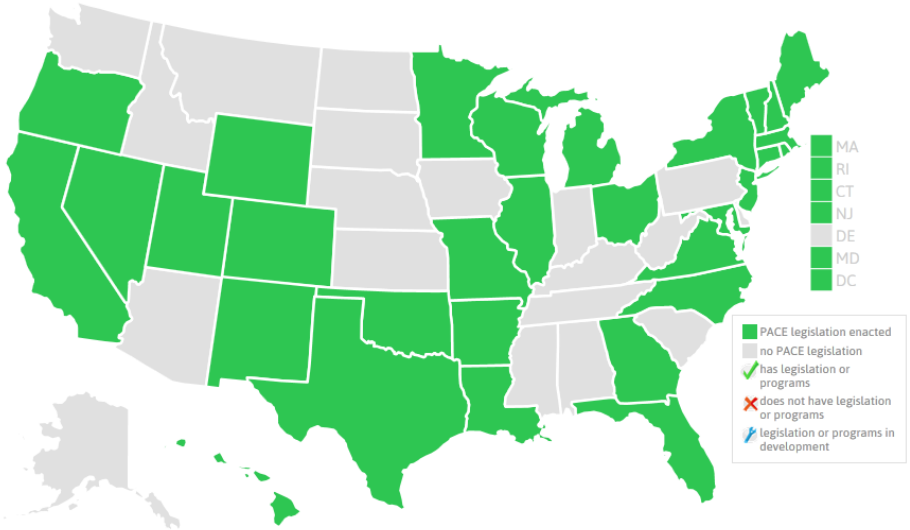
Note 1: upper limit of bond volume authorised, but according to the HSBC, nearly 20% of the maximum volume had been issued by the middle of 2012 (Robins and Knight, 2012)

Source: adapted from Della Croce, Kaminker and Stewart, 2011

6.2.3 Property Assessed Clean Energy financing

Property Assessed Clean Energy (PACE) is a means of financing energy renovations through the use of specific bonds offered by municipal governments to investors. The governments use the funds raised by these bonds to loan money towards energy renovations in residential or commercial buildings. The loans are repaid over the assigned term – typically 15 or 20 years – via an annual assessment on their property tax bill. The long repayment term attached to PACE programmes allows for investments with long payback times to be considered in the renovation. This additional tax assessment is placed on the property rather the property owner which means that PACE assessments are also transferable. In other words, it is possible to recoup the investment upon sale thereby reducing the concern about investment recovery during sale transactions. PACE programmes are secured by a senior lien on the owner's property, which avoids repayment security to be attached to the borrower's creditworthiness and is therefore more attractive to financiers.

Figure 22 - PACE legislations and programmes in the US



Source: www.pacenow.org

PACE programmes are mainly implemented in the United States with a reported $150 million in federal grant funds initially allocated (LBLN, 2011). Currently, there are 31 US states with PACE enabling legislation, 12 with active programmes and others in the process of programme development (Figure 22). It should be noted that PACE programmes were suspended in 2010 due to the fact that U.S. mortgage authorities Freddie Mac and Fannie Mae refused to finance mortgages with PACE liens. This occurred because PACE loans are generally assigned first lien status; that is, in cases of default, they are paid off to the municipality before the main mortgage is paid to the lender (Bird & Hernàdez, 2013).

Despite this issue, there is still growing interest around the PACE mechanism. The California Statewide Communities Development Authority (CSCDA) has recently announced that a PACE programme (the so-called CaliforniaFIRST) will be launched in 17 California counties and 167 cities in the second half of 2014. Under this programme, homeowners in the targeted cities will be able to contract for energy and water efficiency projects and pay for the projects through a special tax assessment in their property tax bills over a period of up to 20 years. Key actions have also been taken in order to create

a PACE mortgage loss reserve program which address concerns raised by mortgage providers. Administered by the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA), the loss reserve program will refund mortgage holders from losses associated with a PACE lien on the property.

6.2.4 Energy Services Agreement (ESA)

An Energy Services Agreement (ESA) is a contract that packages energy efficiency measures as a service which building owners pay for through their actual energy savings without having to provide the upfront cost. It is analogous to power purchase agreements (PPAs) which have been utilized to finance solar power projects over the last years. The difference is that ESA payments are based on actual energy units saved rather than energy units generated.

Error! Reference source not found. Depicts how the ESA model works and what the main similarities and differences are with the EPC model. In an ESA arrangement, a project developer arranges for the installation of energy efficiency measures by an ESCO and coordinates the capital investment in the project. The project developer then operates and maintains the energy efficiency measures during the term of the ESA, while the customer pays for the energy saved as a service. The advantage of ESAs is that they allow customers to finance these improvements "off-balance sheet" which can be useful for tax purposes or in cases where existing mortgage are attached to restrictive terms. The ESA is similar to the shared savings EPC model, in which an ESCO funds the energy efficiency project and the owner agrees to repay an agreed percentage of measured and verified savings.

6.2.5 Energy mortgages

Preferential loans for energy efficiency can also be delivered through mortgages; for example, preferential mortgage terms may be offered to efficient homes, or existing mortgages can be extended in order to finance efficiency improvements. Energy mortgages give the opportunity to obtain better borrowing terms, finance upgrades as part of a single mortgage, increase debt-to-income qualifying ratios and allow consumers to qualify for a larger loan amount. Energy mortgages can be differentiated into:

(1) Energy Efficient Mortgage (EEM), which is a mortgage that credits a home's energy efficiency in the mortgage itself and thereby increases the home buying power of consumers and capitalizes the energy savings in the appraisal.

(2) Energy Improvement Mortgages (EIMs), which are used to purchase or re-finance existing homes that will undergo energy efficiency upgrades. They allow borrowers to include the cost of energy-efficiency improvements to an existing home in the mortgage without increasing the down-payment by using the money saved in utility bills.

In the Netherlands, Triodos, a sustainable bank concerned with social and environmental impacts, has introduced sustainability aspects in its home mortgage underwriting process, and partly bases its mortgage interest rates on these criteria. The mortgage interest rate falls 0.1 percent for every increase in the energy efficiency label[41], while homes with an A++ label are allowed to have €8,000 more financing as compared to regular homes. In Germany, Bayerische Landesbank has incorporated the sustainability

[41] That means if the G-rated building is renovated to class A, a reduction by 0.6% will apply to the mortgage rate

of (commercial) properties into its mortgage acceptance terms by offering more favourable financing terms if the bank's sustainability criteria are met. It offers support in the certification process of buildings through its subsidiary Bayern Facility Management. Bayerische has also created a service called LBImmoWert that helps to establish the value and risk effects of the sustainability (or lack thereof) of their clients' properties, and provides advice concerning building improvements that improve value and reduce risk in this regard (Eichholtz & Kok, 2013).

6.3 Conclusions

Various solutions which could help the mobilisation of further energy efficiency investments in the Cypriot building stock have been identified in this chapter. Traditional instruments include credit lines, risk sharing facilities and revolving funds such as the KredEx Revolving Fund have been discussed. New ideas on how to overcome some of the key barriers associated with energy efficiency finance through promising new mechanisms have also been identified. For example, the concept of green bonds which can provide a way of financing a portfolio of energy efficiency projects by aggregating a large number of smaller has also been described. PACE programmes, which are mainly implemented in the United States, offer an attractive means of financing energy renovations through the use of specific bonds offered by municipal governments to investors. Energy mortgages give the opportunity to obtain better borrowing terms, finance upgrades as part of a single mortgage, increase debt-to-income qualifying ratios and allow consumers to qualify for a larger loan amount. Finally, examples of on-bill finance programmes which are based on a mechanism that reduces first-cost barriers by linking repayment of energy efficiency investments to the utility bill and thereby allowing customers to pay back part or all costs of energy efficiency investments over time.

6.4 References

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7. Building stock in Cyprus and trends to 2030

7.1 Introduction

The final energy consumption of the Cypriote building stock increased considerably in the late 1990s and 2000s, but the economic crisis of recent years had a weighty effect, reducing the internal energy uses in year 2013. The energy mix has changed in favour of electricity consumption whereas the oil consumption has decreased and the share of renewables (mainly solar thermal water heaters) has also increased significantly. Electricity consumption has increased during the last 10-15 years, mainly due to the installation of air conditioners and the increasing number of electric appliances. The share of space cooling has gone up over the years.

Policy measures implemented during the last decade in Cyprus started to improve the quantity of the national building stock. In new buildings, the implementation of minimum energy performance requirements is estimated to reduce consumption by at least 50% compared with the same building built prior to the EPBD. The gradual tightening of minimum requirements based on the calculation of cost-optimal levels will eventually lead to NZEBs.

About the existing building stock (built before the implementation of EPBD and EED), it is recognised that it has a big energy savings potential. Although some improvement has been done in the recent past (due to firstly financial incentives and secondly regulatory measures), the full potential is far from being materialised. In order to accelerate renovations, in 2015 the MECIT started the scheme "Save – Upgrade" which is focused on all existing buildings, and it is designed to promote the most cost-effective measures able to reach energy class B or achieve at least 40% in energy savings. The scheme is subsidising thermal insulation of the building's envelope, energy-efficient windows, external shading, highly energy efficient technical systems, metering and automatic controls, and RES for heating and cooling.

While it is clear the entity of public funds put in place (around 30 Million up to 2020, co-financed by the European Social Fund and the European Regional Development Fund), there are not estimations about the possible effects on the energy demand of the Cyprus building stock.

This chapter reports the findings of the JRC Technical Report: "Building stock in Cyprus and trends to 2030" where more details on the methodology, calculations, and discussion on results can be found.

7.2 Overview of the CY building stock

In order to provide the forecast requested, it was necessary to identify the main actual characteristics of the CY building stock.

Year 2013 has been selected as the base year of this analysis and as main references the following data sources have been considered:

- Statistical data provided by the CY Statistical Service[42];
- Databases provided by JRC-Petten, summarised in the internal Reports "Development of Residential heatmap" and "Cyprus: Energy demand of the tertiary sector";
- Integrative data collected by the TABULA/EPISCOPE[43] and ODYSSEE/MURE[44] projects;
- Additional references used in the calculation done by MECIT for setting the minimum Energy performance requirements at cost optimal levels.
- Overview of the CY building stock included in the "Strategy for encouraging investments in the renovation of buildings".

The lack of some data was overcome through the some assumptions. In particular we considered the same age distribution and the same tenure status distribution for all climatic zones. Moreover the age distribution of service buildings has been assumed proportional to that one characterising the residential stock.

The main data collected are provided in the following sub-chapters, both for the residential and the service/public building stocks. It is to be noted that we are considering here only the occupied dwellings, grouped in 4 residential building types. They have been obtained aggregating the "row houses" to the "semi-detached or duplex", the "conventional dwellings in partly residential buildings" to the "apartment blocks" and the "back-yard house" to "other type of building". About the age characterisation, 3 age bands were considered for residential (before 1981, 1981-2006, after 2006) and 2 for service/public buildings (before 2006, after 2006). Moreover the distinction per type of area (rural or urban) has been taken into account for the residential sector.

[42] http://www.mof.gov.cy/mof/cystat/statistics.nsf/index_en/index_en?OpenDocument
[43] http://episcope.eu/building-typology/country/cy/
[44] http://www.indicators.odyssee-mure.eu/

Figure 23 - Climatic classification of the Cyprus territory

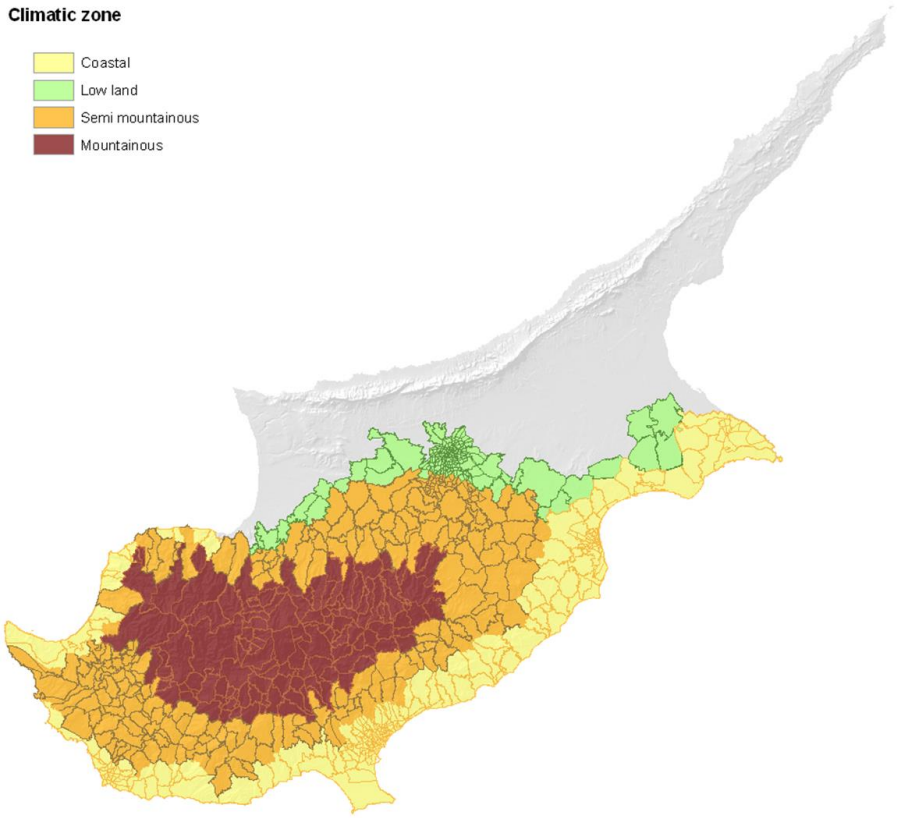
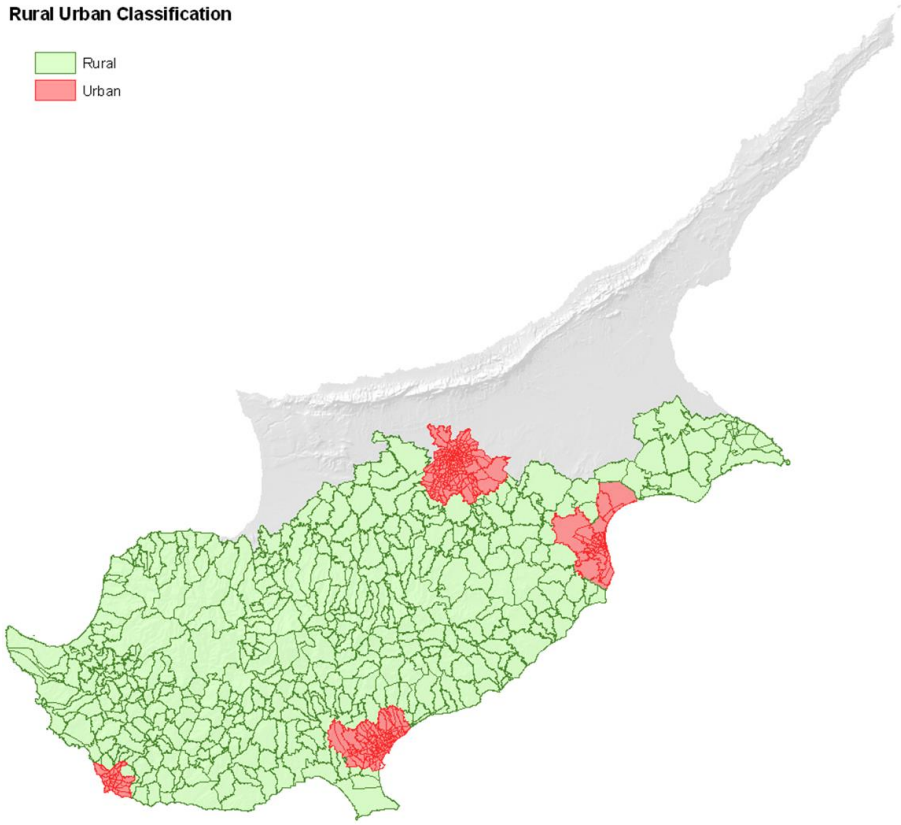


Figure 24 - Rural-Urban classification of the Cyprus territory



7.2.1 Residential building stock

In 2013 the permanent occupied dwelling stock was about 3 hundred thousand of which: around 120 thousand of single houses, 65 thousand of semi-detached and row houses, 110 thousand apartments and 8 thousand of other building types (mainly back-yard houses). In Cyprus the majority of dwellings (67%) are occupied by their owners and large part (78%) is located in the coastal and low land areas. The 40% was built before 1981 and the 54% between 1981 and 2006, before the first normative energy requirements.

Figure 25 - Number of dwellings in urban context per building types and climate conditions.

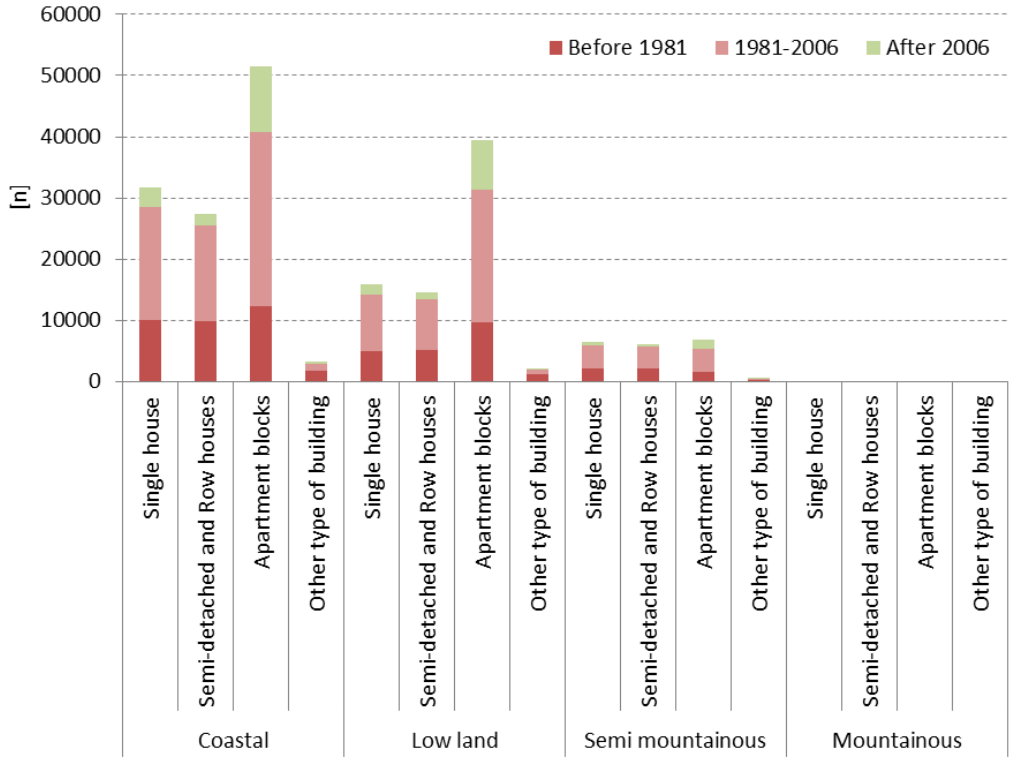


Figure 26 - Number of dwellings in rural context per building types and climate conditions.

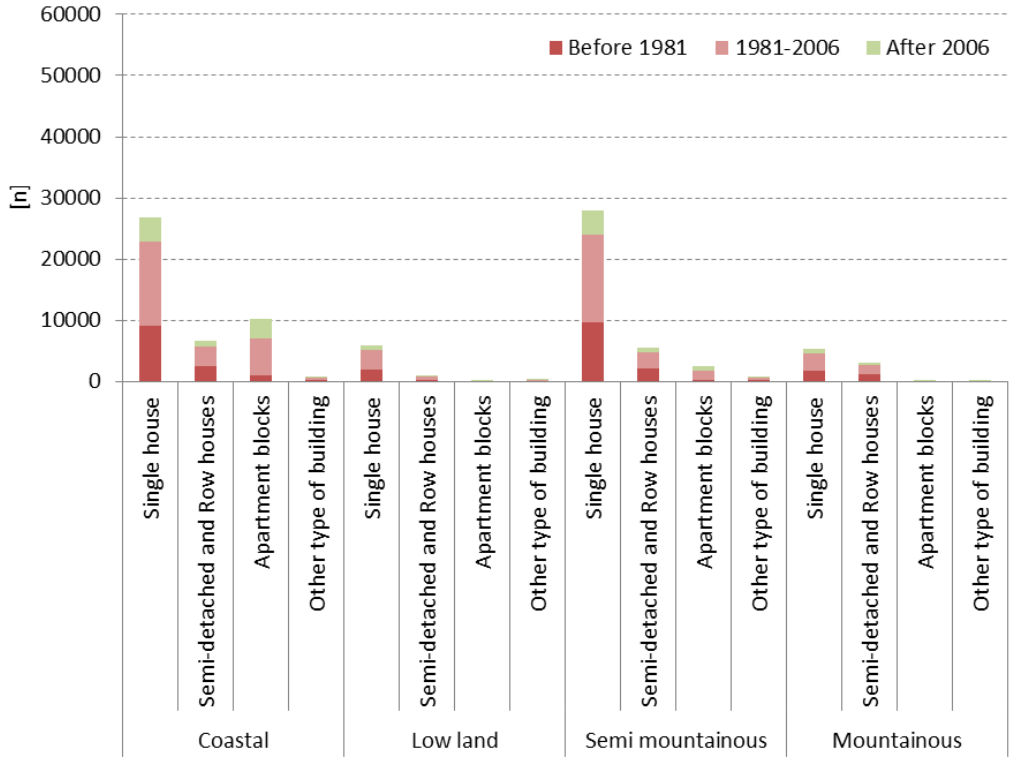


Figure 27- Floor area in urban context per building types and climate conditions

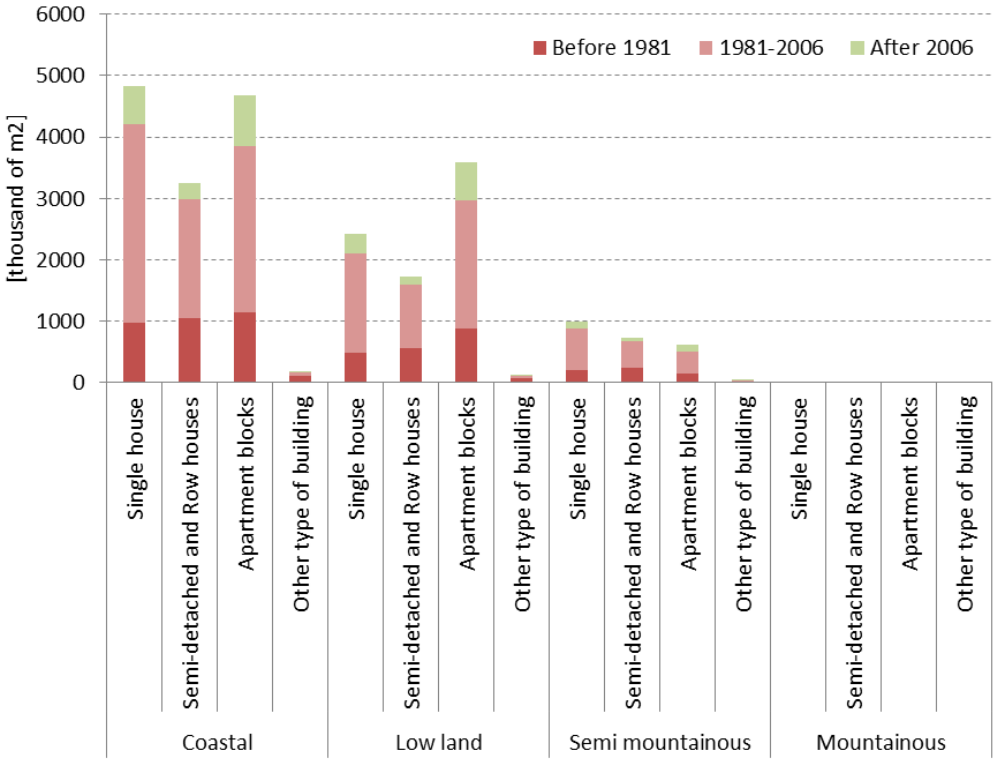


Figure 28 - Floor area in rural context per building types and climate conditions.

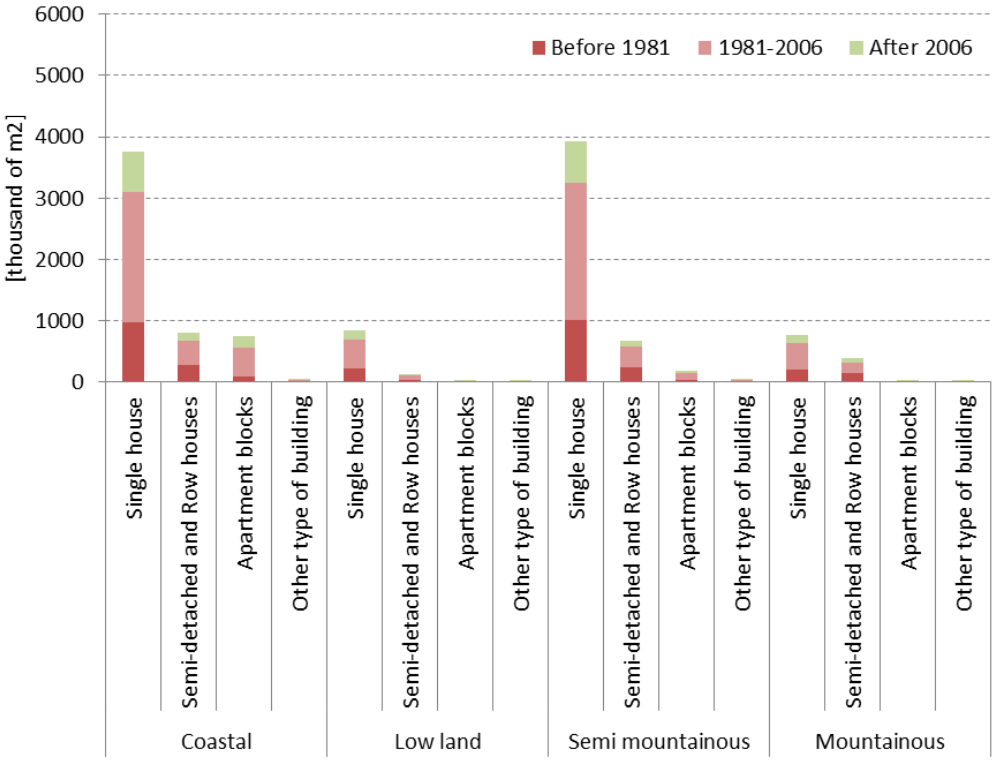


Table 42 – Average net floor area [m2] for different building typologies.

Context	Building type	Age	Average Area [m2]
Urban	Single house	Before 1981	95
		1981-2006	177
		After 2006	191
	Semi-detached and Row houses	Before 1981	105
		1981-2006	125
		After 2006	132
	Apartment blocks	Before 1981	92
		1981-2006	95
		After 2006	79
	Other type of building	Before 1981	59
		1981-2006	44
		After 2006	44
Rural	Single house	Before 1981	105
		1981-2006	156
		After 2006	169
	Semi-detached and Row houses	Before 1981	105
		1981-2006	127

		After 2006	133
	Apartment blocks	Before 1981	76
		1981-2006	77
		After 2006	63
	Other type of building	Before 1981	59
		1981-2006	51
		After 2006	48

Table 43 – Energy needs [kWh/m2] for different building typologies and energy uses.

Building type	**Age**	**Space Heating**	**Space Cooling**	**Water Heating**	**Lighting**	**Appliances**	**Cooking**
Single house	Before 1981	54	72	23	8	20	6
	1981-2006	40	54	18	7	15	4
	After 2006	36	50	15	6	14	4
Semi-detached and Row houses	Before 1981	59	58	23	9	21	6
	1981-2006	43	44	18	7	16	4
	After 2006	39	40	15	6	15	4
Apartment blocks	Before 1981	45	105	23	8	19	6
	1981-2006	33	84	18	6	15	4
	After 2006	30	76	15	6	13	4
Other type of building	Before 1981	56	53	23	4	8	0
	1981-2006	41	41	18	3	8	0
	After 2006	37	38	15	3	7	0

Table 44 – Type of heat generators installed in the urban areas per building types.

Heating system	fuel	Single house	Semi-detached and Row houses	Apartment blocks	Other type of building
Central heating (kerosene): standard	oil	41%	35%	17%	23%
Central heating (kerosene): condensing	oil	0%	0%	0%	0%
Room stoves (kerosene)	oil	2%	2%	2%	1%
Central heating (gas): standard	gas	3%	1%	0%	0%
Central heating (gas): condensing	gas	0%	0%	0%	0%
Room stoves (gas)	gas	11%	11%	9%	28%
Central heating (electric): standard HP	electricity	4%	4%	5%	0%
Central heating (electric): geothermal HP	electricity	0%	0%	0%	0%
Room fixed units (hot air): standard	electricity	17%	23%	35%	14%
Room fixed units (hot air): efficient	electricity	4%	6%	9%	4%
Room stoves (electric)	electricity	8%	9%	11%	20%
Room storage heaters (EAC)	electricity	2%	3%	6%	0%
Room Fireplace	biomass	4%	3%	1%	1%
Room solar heating system	-	0%	0%	0%	0%
No or other heating facilities	-	3%	2%	5%	7%

Table 45 – Type of heat generators installed in the rural areas per building types.

Heating system	fuel	Single house	Semi-detached and Row houses	Apartment blocks	Other type of building
Central heating (kerosene): standard	oil	27%	25%	5%	9%
Central heating (kerosene): condensing	oil	0%	0%	0%	0%
Room stoves (kerosene)	oil	2%	2%	1%	2%
Central heating (gas): standard	gas	3%	2%	1%	1%
Central heating (gas): condensing	gas	0%	0%	0%	0%
Room stoves (gas)	gas	17%	19%	13%	21%
Central heating (electric): standard HP	electricity	3%	2%	2%	2%
Central heating (electric): geothermal HP	electricity	0%	0%	0%	0%

Room fixed units (hot air): standard	electricity	17%	19%	42%	19%
Room fixed units (hot air): efficient	electricity	4%	5%	11%	5%
Room stoves (electric)	electricity	10%	12%	15%	29%
Room storage heaters (EAC)	electricity	1%	1%	1%	0%
Room Fireplace	biomass	13%	12%	2%	3%
Room solar heating system	-	0%	0%	0%	1%
No or other heating facilities	-	2%	2%	8%	9%

Table 46 – Type of cooling systems installed in the urban areas per building types.

Cooling system	fuel	Single house	Semi-detached and Row houses	Apartment blocks	Other type of building
Central cooling (electric): standard HP	electricity	4%	4%	5%	0%
Central cooling (electric): geothermal HP	electricity	0%	0%	0%	0%
Room fixed units (cold air): standard	electricity	62%	62%	61%	65%
Room fixed units (cold air): efficient	electricity	16%	16%	15%	16%
No or other cooling facilities	-	18%	18%	18%	18%

Table 47 – Type of cooling systems installed in the rural areas per building types.

Cooling system	fuel	Single house	Semi-detached and Row houses	Apartment blocks	Other type of building
Central cooling (electric): standard HP	electricity	4%	4%	5%	0%
Central cooling (electric): geothermal HP	electricity	0%	0%	0%	0%
Room fixed units (cold air): standard	electricity	62%	62%	61%	65%
Room fixed units (cold air): efficient	electricity	16%	16%	15%	16%
No or other cooling facilities	-	18%	18%	18%	18%

Table 48 – Type of Domestic Hot Water systems installed in the urban areas per building types.

DHW system	fuel	Single house	Semi-detached and Row houses	Apartment blocks	Other type of building
Solar collectors (only)		84%	86%	81%	64%
Electric heaters combined with solar collectors	electricity	7%	7%	7%	6%
Gas heaters combined with solar collectors	electricity	3%	2%	4%	5%
Electric heaters (only)	electricity	3%	3%	3%	2%
Gas heaters (only)	gas	3%	2%	4%	5%
No or other DHW facilities	-	0%	0%	0%	18%

Table 49 – Type of Domestic Hot Water systems installed in the rural areas per building types.

DHW system	fuel	Single house	Semi-detached and Row houses	Apartment blocks	Other type of building
Solar collectors (only)		82%	78%	80%	65%
Electric heaters combined with solar collectors	electricity	7%	7%	7%	6%
Gas heaters combined with solar collectors	electricity	4%	6%	5%	13%
Electric heaters (only)	electricity	3%	3%	3%	2%
Gas heaters (only)	gas	4%	6%	5%	13%
No or other DHW facilities	-	1%	1%	0%	2%

7.2.3 Service/public building stock

We estimate that in 2013 the occupied service building stock was composed of about 30 thousand buildings with a total floor area greater than 9 Million of m2. The office buildings (public and private) represent the 39% of the total and the hospitality sector (accommodation, restaurants and taverns) the 25%. Large part (83%) was built before the first normative energy requirements.

Figure 29 - Number of buildings in coastal and low land climates per building types

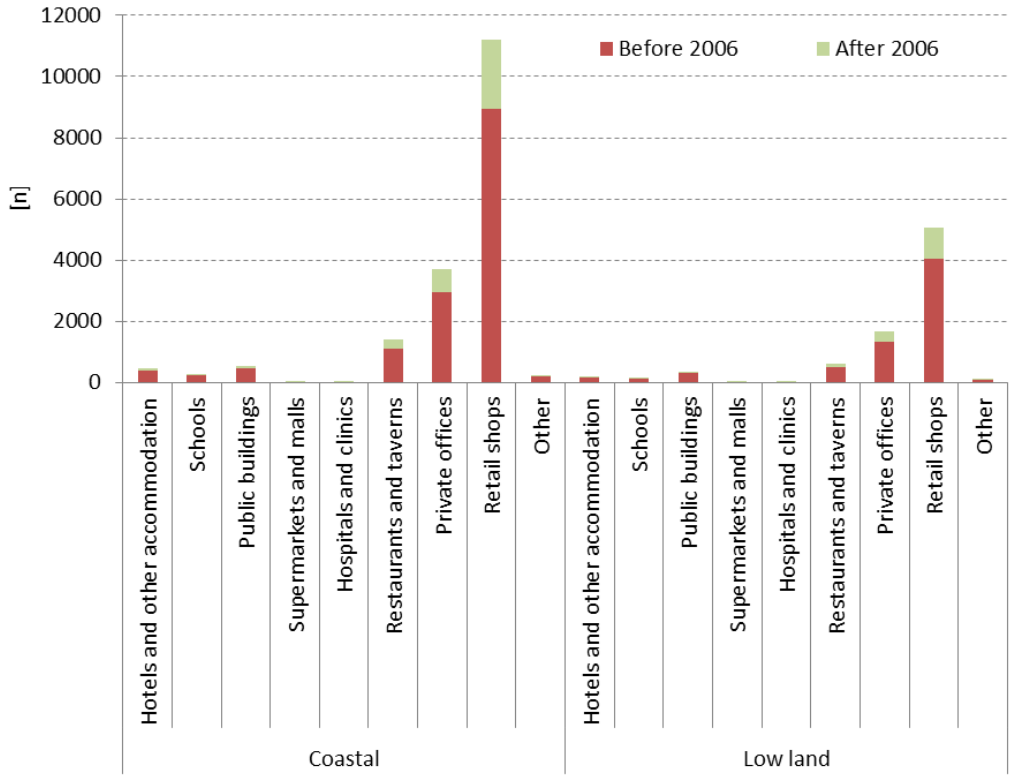


Figure 30 - Number of buildings in semi-mountainous and mountainous climates per building

Figure 31 - Floor area in coastal and low land climates per building types–

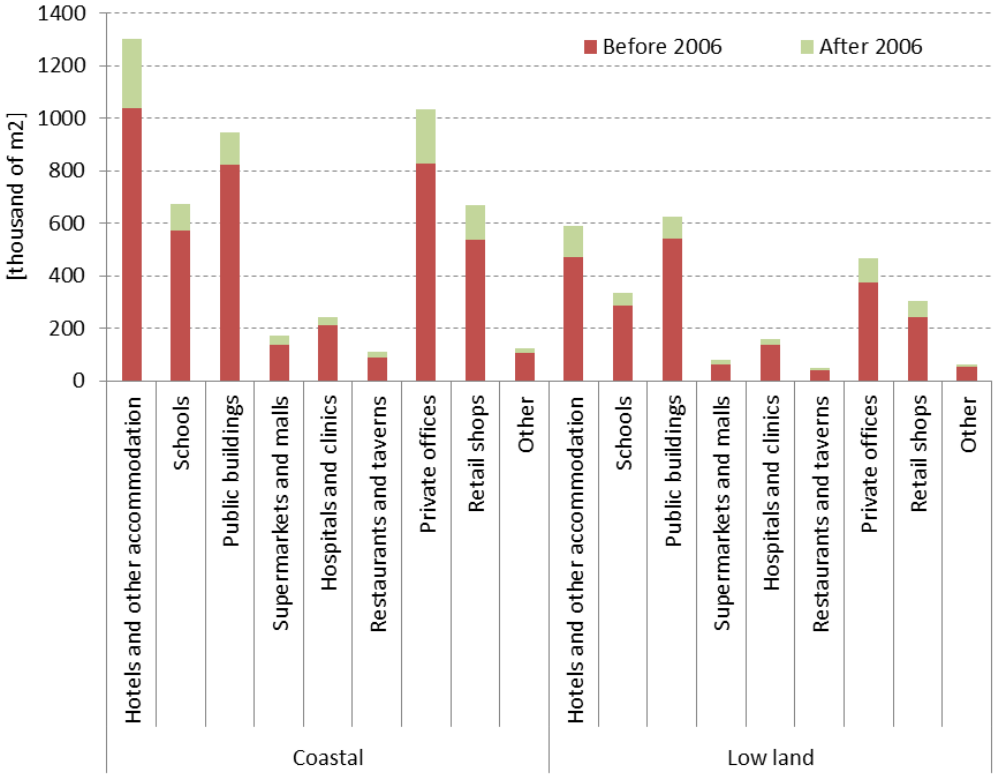


Figure 32 - Floor area in semi-mountainous and mountainous climates per building

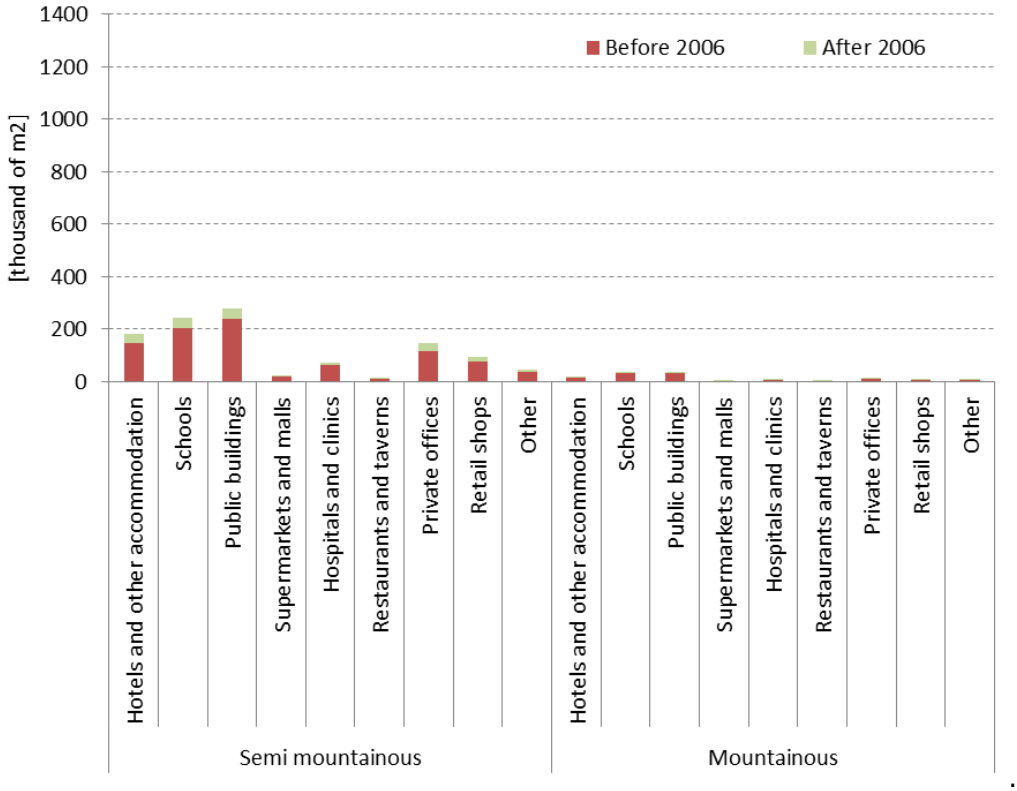


Table 50 – Average net floor area [m2] for different building typologies.

Building type	Average Area [m2]
Hotels and other accommodation	2734
Schools	2474
Public buildings	1735
Supermarkets and malls	4185
Hospitals and clinics	17354
Restaurants and taverns	80
Private offices	279
Retail shops	60
Other	548

Table 51 – Energy needs [kWh/m2] for different building typologies and energy uses.

Building type	Age	Space Heating	Space Cooling	Water Heating	Lighting
Hotels and other accommodation	Before 2006	65	268	40	55
	After 2006	45	183	28	50
Schools	Before 2006	35	55	7	35
	After 2006	24	37	5	30
Public buildings	Before 2006	49	44	5	42
	After 2006	34	30	4	37
Supermarkets and malls	Before 2006	33	470	1	105
	After 2006	23	321	1	95
Hospitals and clinics	Before 2006	96	181	121	70
	After 2006	66	123	83	65
Restaurants and taverns	Before 2006	142	285	214	85
	After 2006	97	194	146	80
Private offices	Before 2006	87	203	5	45
	After 2006	59	138	4	40
Retail shops	Before 2006	41	194	5	105
	After 2006	28	132	4	95
Other	Before 2006	197	358	137	70
	After 2006	134	244	93	65

Table 52 – Type of heat generators installed per building types/1.

Heating system	fuel	Hotels and other accommodation	Schools	Public buildings	Supermarkets and malls
Central heating (kerosene): standard	oil	43%	86%	41%	11%
Central heating (kerosene): condensing	oil	1%	2%	1%	1%
Room stoves (kerosene)	oil	0%	0%	0%	0%
Central heating (gas): standard	gas	10%	3%	4%	1%
Central heating (gas): condensing	gas	1%	0%	0%	0%
Room stoves (gas)	gas	0%	0%	0%	0%
Central heating (electric): standard HP	electricity	40%	5%	44%	81%
Central heating (electric):	electricity	0%	0%	1%	2%

geothermal HP					
Room fixed units (hot air): standard	electricity	3%	2%	6%	0%
Room fixed units (hot air): efficient	electricity	1%	0%	1%	0%
Room stoves (electric)	electricity	0%	0%	0%	0%
Room storage heaters (EAC)	electricity	0%	0%	0%	0%
Room Fireplace	biomass	0%	0%	0%	0%
Room solar heating system	-	0%	0%	0%	0%
No or other heating facilities	-	1%	2%	2%	4%

Table 53 – Type of heat generators installed per building types/2.

Heating system	fuel	Hospitals and clinics	Restaurants and taverns	Private offices	Retail shops
Central heating (kerosene): standard	oil	31%	28%	41%	12%
Central heating (kerosene): condensing	oil	1%	0%	1%	0%
Room stoves (kerosene)	oil	0%	0%	0%	0%
Central heating (gas): standard	gas	4%	3%	4%	2%
Central heating (gas): condensing	gas	0%	0%	0%	0%
Room stoves (gas)	gas	0%	0%	0%	0%
Central heating (electric): standard HP	electricity	61%	36%	44%	75%
Central heating (electric): geothermal HP	electricity	1%	0%	1%	0%
Room fixed units (hot air): standard	electricity	0%	18%	6%	8%
Room fixed units (hot air): efficient	electricity	0%	5%	1%	1%
Room stoves (electric)	electricity	0%	3%	0%	0%
Room storage heaters (EAC)	electricity	0%	0%	0%	0%
Room Fireplace	biomass	0%	0%	0%	0%
Room solar heating system	-	0%	0%	0%	0%
No or other heating facilities	-	2%	7%	2%	2%

Table 54 – Type of cooling systems installed per building types/1.

Cooling system	fuel	Hotels and other accommodation	Schools	Public buildings	Supermarkets and malls
Central cooling (electric): standard HP	electricity	62%	34%	58%	88%
Central cooling (electric): geo HP	electricity	0%	0%	1%	2%
Room fixed units (cold air): standard	electricity	24%	5%	18%	0%
Room fixed units (cold air): efficient	electricity	4%	1%	3%	0%
No or other cooling facilities	-	10%	60%	20%	10%

Table 55 – Type of cooling systems installed per building types/2.

Cooling system	fuel	Hospitals and clinics	Restaurants and taverns	Private offices	Retail shops
Central cooling (electric): standard HP	electricity	68%	42%	54%	75%
Central cooling (electric): geo HP	electricity	1%	0%	1%	0%
Room fixed units (cold air): standard	electricity	9%	28%	22%	8%
Room fixed units (cold air): efficient	electricity	2%	5%	3%	1%
No or other cooling facilities	-	20%	25%	20%	16%

Table 56– Type of Domestic Hot Water systems installed per building types/1.

DHW system	fuel	Hotels and other accommodation	Schools	Public buildings	Supermarkets and malls
Solar collectors (only)		85%	85%	85%	60%
Electric heaters combined with solar collectors	electricity	5%	5%	5%	5%
Gas heaters combined with solar collectors	electricity	10%	10%	10%	35%
Electric heaters (only)	electricity	0%	0%	0%	0%
Gas heaters (only)	gas	0%	0%	0%	0%
No or other DHW facilities		0%	0%	0%	0%

Table 57 – Type of Domestic Hot Water systems installed per building types/2.

DHW system	fuel	Hospitals and clinics	Restaurants and taverns	Private offices	Retail shops
Solar collectors (only)		85%	85%	85%	60%
Electric heaters combined with solar collectors	electricity	5%	5%	5%	5%
Gas heaters combined with solar collectors	electricity	10%	10%	10%	35%
Electric heaters (only)	electricity	0%	0%	0%	0%
Gas heaters (only)	gas	0%	0%	0%	0%
No or other DHW facilities	-	0%	0%	0%	0%

7.3 Calculation methodology

The calculation model proposed here can be considered as a simplified dynamic bottom-up approach with an endogenous decision-making algorithm.

As other archetype engineering-based bottom-up models, our model aims to divide a larger set of buildings into clusters of typical buildings. Each cluster represents buildings with similar characteristics such as primary building usage, construction period, building size, efficiency classes (related to the existing heating and cooling system) and climate zones.

The energy demand of the building stock is then assessed based on a defined set of reference buildings. The specific energy needs of the building stock are based on different sources, and are not calculated within the model. The efficiencies of the different heating systems are defined by the overall efficiency of the technical building systems. While the construction and demolition rates are not within the scope of the model (input data), the renovation activities are modelled by a simplified decision-making algorithm. It considers economic attributes of different types of building occupants to calculate the propensity to invest in prearranged refurbishment options and subsequently the renovation rates are derived, both for single measures (minor renovations) and measure combinations (moderate and deep renovations).

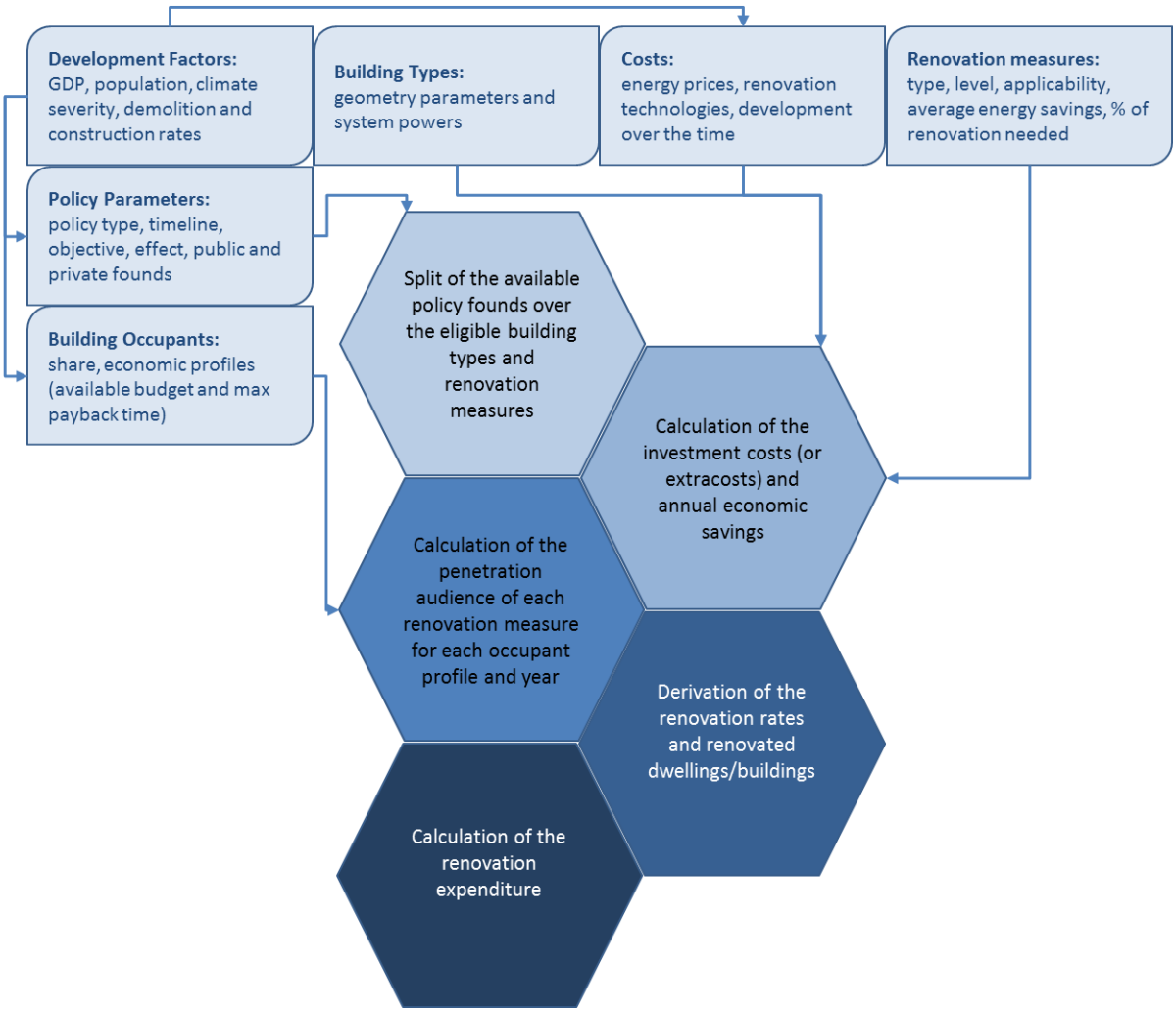
As dynamic method able to consider the effect of different type of policies, this model allows the development of preliminary scenario-based analysis for the national energy demand of the residential and service/public building sector.

Table 58 – Endogenously and exogenously defined central input parameters of the model.

Exogenously defined	Endogenously calculated
Population, GDP and their development **Existing building stock**	Renovation rates and replacement rates of heating/cooling system
Building demolition and construction rates	Share of competing refurbishment options
Geometry of buildings	General awareness about EE cost-effectiveness
Energy need of buildings	Agreement between estimated and real consumptions
Comfort demands	Final energy consumptions per fuels and end-uses

Energetic properties of components of existing building stock	
Reference energy prices and their development	
Available technologies, their energetic properties and costs	
Climate factors	
Availability of energy carriers per region	
Investor preferences (in terms of available founds and maximum payback time)	
Policy measures: financial and regulatory instruments	

Figure 33– Schematic representation of the method for the estimation of the renovation parameters.

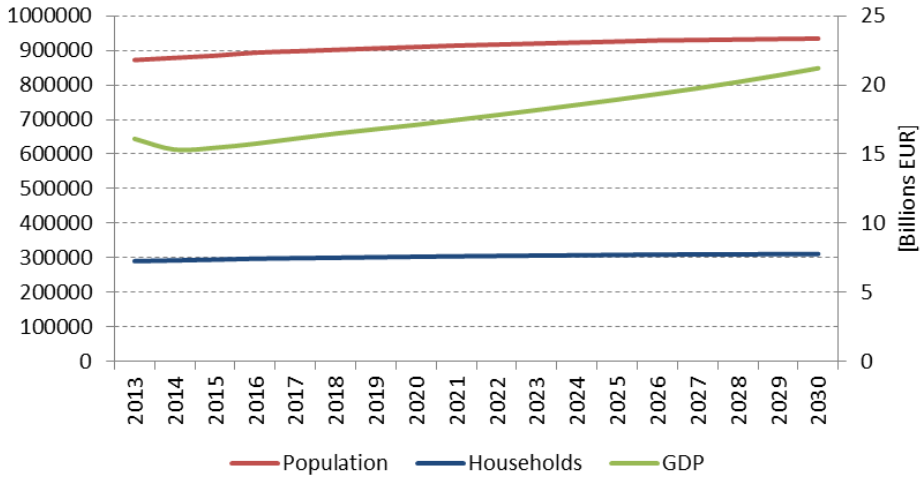


The following sub-chapters present the main input parameters (exogenously defined).

Development factors

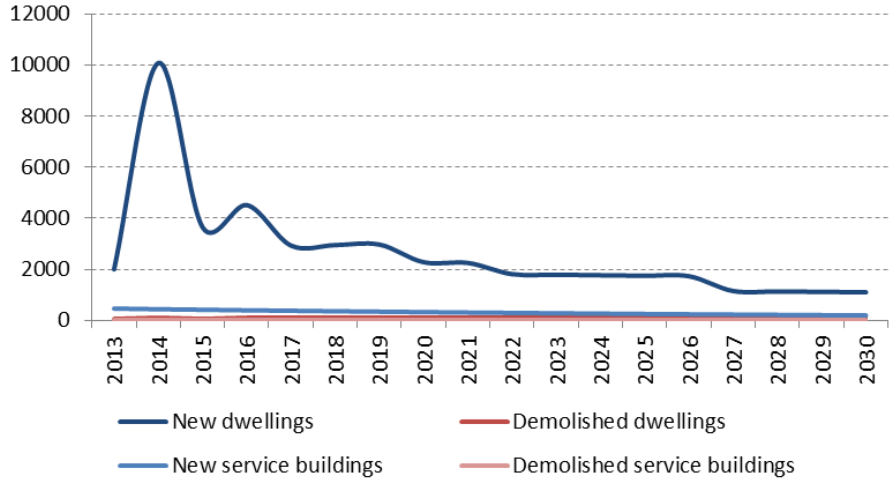
The following graphs show the contextual factors considered by the model.

Figure 34 – Population and number of households over the period 2013-2030



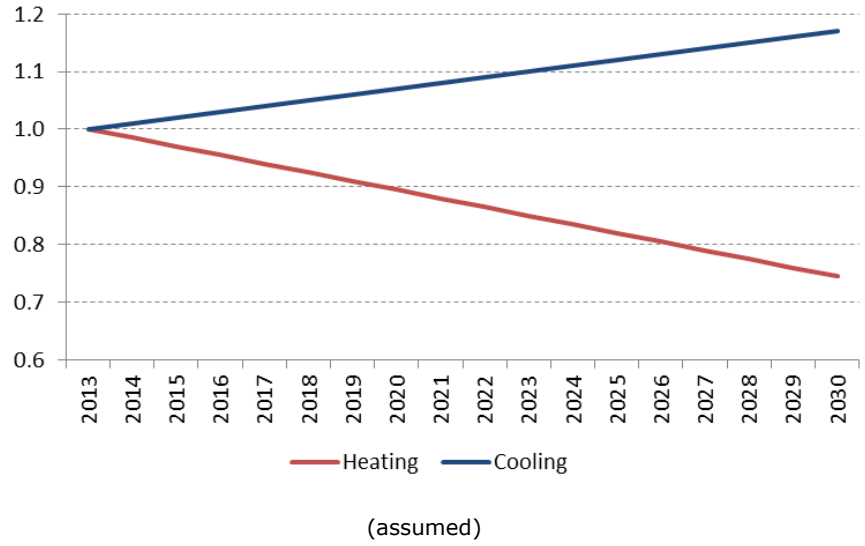
(Source: JRC-Petten).

Figure 35 – Building demolition and construction rates over the period 2013-2030



(Source: JRC-Petten)

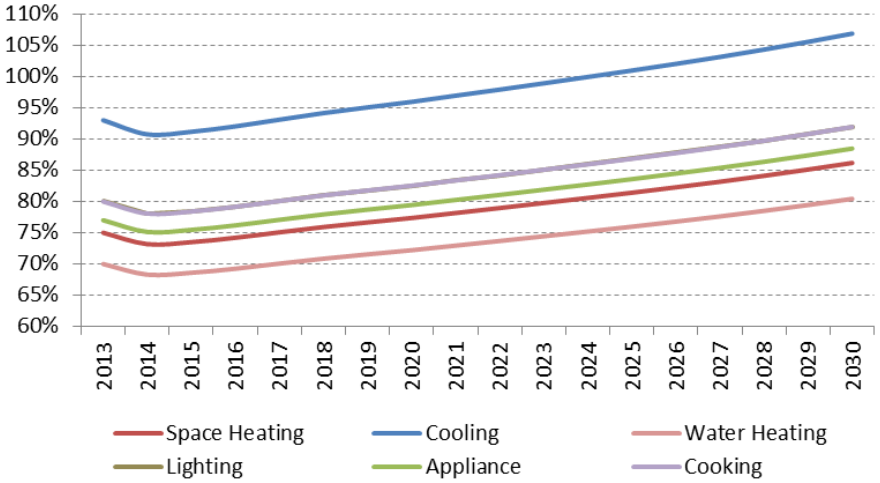
Figure 36 - Climate severity factor during the heating and cooling season over the period 2013-2030



(assumed)

Moreover the calculation includes some comfort demand parameters. They have been defined for the starting year (2013) by calibrating the residential final energy demands on the statistical figures and their development over the calculation period has been linked to the GDP trend. The graph below shows the figures considered by the model.

Figure 37 – Development of the comfort demand parameters over the calculation period.



Climatic factors

According to the official classification, Cyprus is split in 4 climatic zones: coastal, low-land, semi-mountainous and mountainous area. While the energy demand of dwellings located in the three first zones doesn't differ substantially, the mountainous area is characterized by significant differences. Following the approach already used by JRC-

Petten (simulations with the JRC-EU-TIMES model), correction factors were used to modify the energy needs of buildings in different climatic zones.

Table 59 – Correction factors of energy need for the Cypriote climatic zones.

Climatic zone	Space Heating	Cooling	Water Heating	Lighting	Appliances
Coastal	1	1	1	1	1
Low Land	1	1	1	1	1
Semi mountainous	1.2	0.7	1	1	1
Mountainous	3	0.3	1	1	1

Building types

The model refers to 42 building types: 24 residential and 18 of the service/public sector. The main characteristics are presented in the tables below.

Table 60 – Main characteristics of the residential building types.

Area	Building type	Age	A [m^2]	V [m^3]	N° floors	N° dwellings	S/V	window area [m^2]	external walls [m^2]
Urban	Single house	Before 1981	95	286	1	1	1.09	17	103
		1981-2006	177	496	1	1	1.02	23	127
		After 2006	191	536	1	1	1.00	28	128
	Semi-detached and Row houses	Before 1981	105	630	2	2	0.72	26	221
		1981-2006	125	750	2	2	0.69	32	236
		After 2006	132	739	2	2	0.71	35	223
	Apartment blocks	Before 1981	92	2401	3	9	0.47	107	475
		1981-2006	95	2480	3	9	0.47	104	487
		After 2006	79	1996	3	9	0.50	101	429
	Other type of building	Before 1981	59	178	1	1	1.24	14	87
		1981-2006	44	124	1	1	1.49	16	80
		After 2006	44	124	1	1	1.52	19	81

Rural	Single house	Before 1981	105	315	1	1	1.06	18	107
		1981-2006	156	437	1	1	1.04	23	118
		After 2006	169	472	1	1	1.03	27	120
	Semi-detached and Row houses	Before 1981	105	630	2	2	0.72	25	220
		1981-2006	127	759	2	2	0.69	32	238
		After 2006	133	742	2	2	0.70	35	223
	Apartment blocks	Before 1981	76	851	2	4	0.68	51	226
		1981-2006	77	866	2	4	0.68	49	231
		After 2006	63	711	2	4	0.72	49	209
	Other type of building	Before 1981	59	177	1	1	1.24	14	87
		1981-2006	51	143	1	1	1.41	17	82
		After 2006	48	134	1	1	1.47	19	82

Table 61 – Main characteristics of the service/public building types.

Building type	Age	Area [m2]	Volume [m3]	N° floors	S/V	window area [m2]	external walls [m2]
Hotels and other accommodation	Before 2006	2734	7381	4	0.34	259	881
	After 2006	2734	7655	5	0.31	350	962
Schools	Before 2006	2474	7918	2	0.43	228	728
	After 2006	2474	7423	3	0.36	342	712
Public buildings	Before 2006	1735	5206	4	0.36	301	703
	After 2006	1735	4859	5	0.36	418	628
Supermarkets and malls	Before 2006	4185	25110	1	0.40	246	1312
	After 2006	4185	25110	2	0.25	410	1794
Hospitals and clinics	Before 2006	17354	55531	4	0.22	850	2551
	After 2006	17354	52061	5	0.20	1243	2309
Restaurants and	Before	80	256	1	1.08	17	98

taverns	2006						
	After 2006	80	240	1	1.12	17	91
Private offices	Before 2006	279	837	2	0.68	87	204
	After 2006	279	753	3	0.67	144	176
Retail shops	Before 2006	60	210	1	1.09	14	95
	After 2006	60	192	1	1.15	14	86
Other	Before 2006	548	1753	2	0.56	106	319
	After 2006	548	1644	3	0.52	147	342

Costs

The table below collects the main economic data used as input to the simulations.

Table 62 – Main cost data (Source: MECIT+Ecofys).

General	**Real interest rate**	**3.0%**
	Annual variation of cost of EE technologies	-0.5%
Energy	Electricity from the grid	0.15 €/kWh
	Heating oil	0.063 €/kWh
	LPG	0.072 €/kWh
	Pellets for heating	0.065 €/kWh
	Electricity cost yearly increase rate	1.5%
	Heating oil and LPG yearly increase rate	1.2%
Renovation measures	Soft general restyling including minimal EE measures	10 €/m2
	Soft general restyling excluding minimal EE measures	6.5 €/m2
	Insulation of roof A	40 €/m2 + 2 €/(cm*m2)
	Insulation of roof B	30 €/m2 + 2 €/(cm*m2)
	Insulation of external walls A	55 €/m2 + 2 €/(cm*m2)
	Insulation of external walls B	48 €/m2 + 2 €/(cm*m2)
	Window with single glazing	110 €/m2
	Window with double glazing and frame with thermal break	220 €/m2
	Window with double glazing (low-e) and frame with thermal break	240 €/m2
	Window with triple glazing and frame with thermal break	300 €/m2

	External movable shading	220 €/m2
	Standard boiler (gas/oil)	1900 € + 25 €/kW
	Condensing boiler (gas/oil)	2500 € + 30 €/kW
	Standard room split units (rev)	600 € + 23 €/kW
	Efficient room split units (rev)	900 € + 25 €/kW
	Standard room split units (cooling only)	2750 € + 23 €/kW
	Efficient room split units (cooling only)	3250 € + 25 €/kW
	Heat pump air-to-air (rev)	7000 € + 100 €/kW
	Ground source heat pump (rev)	12500 € + 450 €/kW
	Standard lamp bulb (50W)	3 €/piece
	LED lamp bulb (ass. 50W)	15 €/piece
	Standard Appliances set (refrigerator + washing + TV)	845 €
	Efficient Appliances set (refrigerator + washing + TV)	1100 €
	Installation of solar water heater (flat panels)	401 €/m2
	Installation of central solar water heater (vacuum tubes)	637 €/m2
	Photovoltaic system	1500 €/kW
	Exhaust air system (without HR)	1000 € + 7 €/(m3/h)
	Ventilation system (with HR)	4500 € + 15 €/(m3/h)

Renovation measures

The renovation options have been selected taking into account the results of the available studies, as well the advices and recommendations of key Cypriote experts.

Table 63 – Summary of renovation options considered by the model for the residential building types.

Renovation measures		Description
Minor renovation	option m1-1	General restyling including soft renovation
	option m1-2	Thermal insulation of roof (8cm)
	option m1-3	Thermal insulation of roof (15cm)
	option m1-4	Thermal insulation of external walls (5cm)
	option m1-5	Thermal insulation of external walls (10cm)
	option m1-6	Window with double glazing and frame with thermal break
	option m1-7	Window with double glazing (low-e) and frame with thermal break
	option m1-8	Window with triple glazing and frame with thermal break
	option m1-9	External movable shading
	option m1-10	Condensing boiler

	option m1-11	Efficient Split Unit Rev (heating and cooling)
	option m1-12	Efficient Split Unit (cooling only)
	option m1-13	Ground Source Heat Pump Rev (heating and cooling)
	option m1-14	Efficient lighting
	option m1-15	Efficient appliances
	option m1-16	Solar thermal water heater
	option m1-17	Solar PV system
Moderate renovation	option M1-1	Roof+Walls insulation + double glazing + external shading
	option M1-2	Roof insulation + PV system
	option M1-3	New efficient thermal systems + Lighting + Appliances + PV system
Deep renovation	option D1-1	Roof+Walls insulation + double glazing (low-e) + external shading
	option D1-2	Roof insulation + double glazing + external shading + PV system
	option D1-3	Roof+Walls insulation + double glazing + external shading + new efficient thermal system + lighting + appliances + PV

Table 64 – Summary of renovation options considered by the model for the service/public building types.

Renovation measures		**Description**
Minor renovation	option m1-1	General restailing including soft renovation
	option m1-2	Thermal insulation of roof (8cm)
	option m1-3	Thermal insulation of roof (15cm)
	option m1-4	Thermal insulation of external walls (5cm)
	option m1-5	Thermal insulation of external walls (10cm)
	option m1-6	Window with double glazing and frame with thermal break
	option m1-7	Window with double glazing (low-e) and frame with thermal break
	option m1-8	Window with triple glazing and frame with thermal break
	option m1-9	External movable shading
	option m1-10	Condensing boiler
	option m1-11	Efficient Split Unit Rev
	option m1-12	Efficient Split Unit
	option m1-13	Ground Source Heat Pump Rev
	option m1-14	Efficient lighting
	option m1-15	Heat recovery plant
	option m1-16	Solar thermal water heater
	option m1-17	Solar PV system
Moderate renovation	option M1-1	Roof+Walls insulation + double glazing + external shading
	option M1-2	Roof insulation + PV system
	option M1-3	New efficient thermal systems + Lighting + PV system
Deep renovation	option D1-1	Roof+Walls insulation + double glazing (low-e) + external

		shading + Heat Recovery
	option D1-2	Roof insulation + double glazing + external shading + PV system
	option D1-3	Roof+Walls insulation + double glazing + external shading + new efficient thermal system + lighting + PV

The average savings related to the measures (distinguished per end-uses) were derived from the available bibliography and simplified calculations. Examples are provided in the figures below.

Figure 38 – Energy savings related to the renovation options applied to the single houses built before 1981.

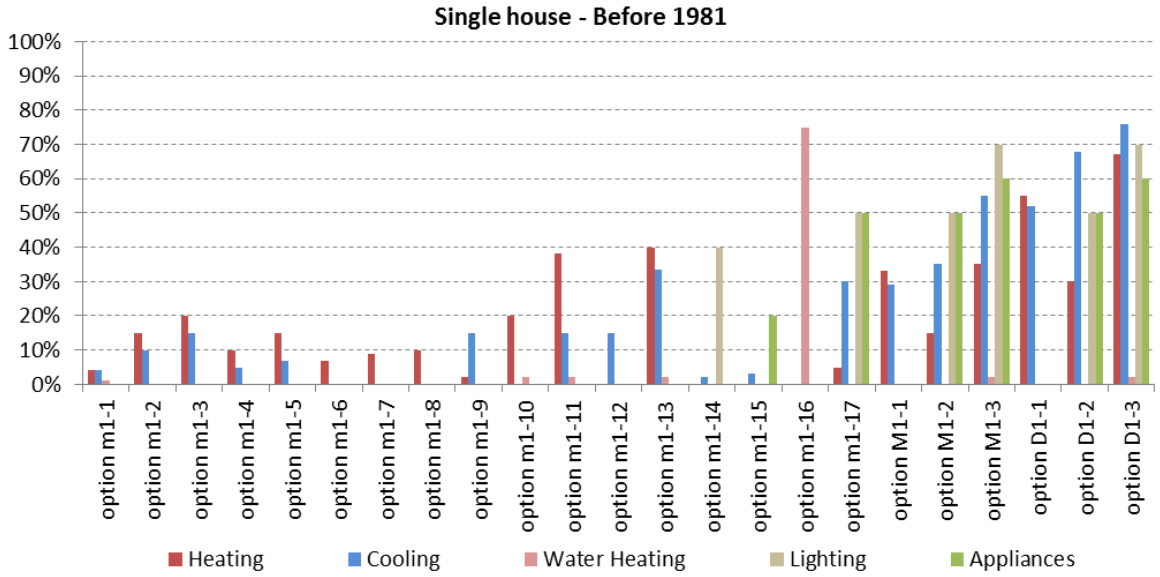


Figure 39 - Energy savings related to the renovation options applied to apartment blocks built in 1981-2006

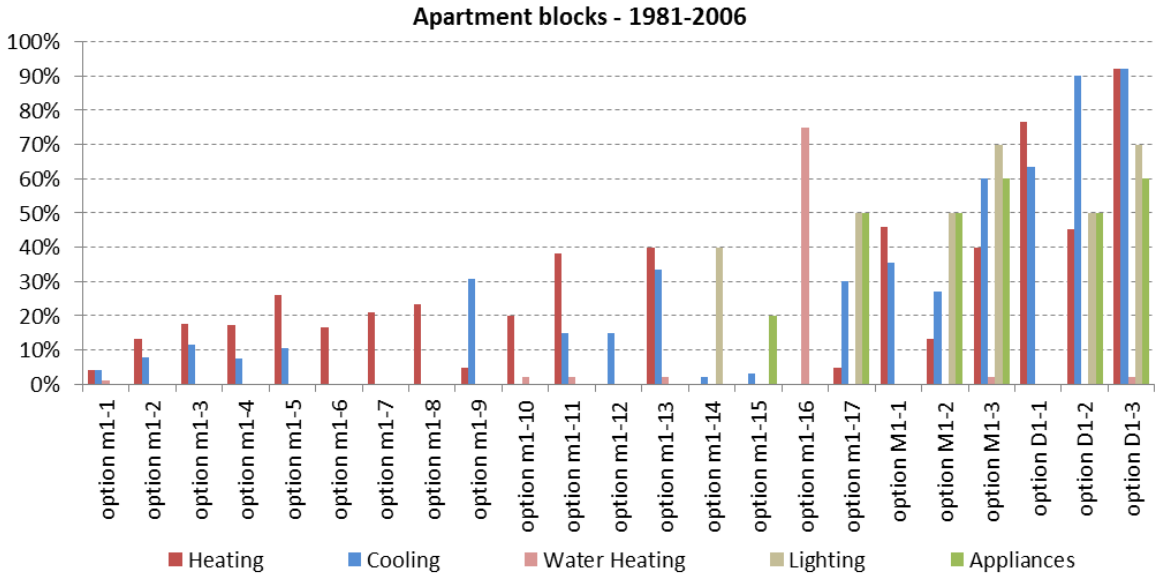
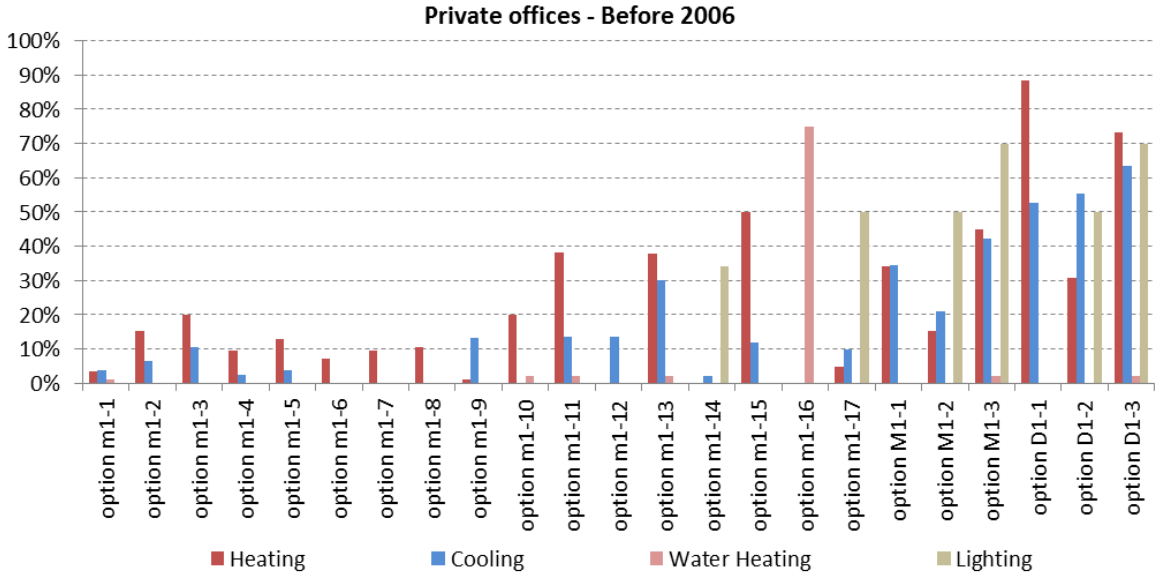


Figure 40 - Energy savings related to the renovation options applied to private offices built before 2006



It is to be noted that we consider that every year a certain part of the building stock (about needs renovation works and system substitutions. To these cases the same options have been applied, but their costs have been calculated as extra-costs respect predefined base refurbishment levels.

Table 65 – Assumed rates of renovation needed yearly per building types.

Bulding types		General restyling	Envelope	Thermal systems	Lighting	Appliances
Residential	Before 1981	10%	5%	7%	8%	6%
	1981-2006	5%	2%	5%	8%	6%
	After 2006	2%	1%	3%	8%	6%
Service-Public	Before 2006	10%	4%	5%	8%	-
	After 2006	3%	1%	3%	8%	-

Building occupants

Both for residential and service sectors 5 occupant profiles have been selected. The occupation shares for every building type and the investment attitudes are summarised in the following tables.

Table 66 – Share of occupant profiles per residential building types

Area	Building type	Age	Low income	Building tenant	Standard building owners	Wealthy building owners	Environmental friendly building owners
Urban	Single house	Before 1981	11%	21%	58%	7%	3%
		1981-2006	11%	4%	72%	9%	4%
		After 2006	11%	2%	74%	9%	4%
	Semi-detached and Row houses	Before 1981	13%	20%	57%	7%	3%
		1981-2006	13%	10%	65%	8%	4%
		After 2006	13%	11%	64%	8%	4%
	Apartment blocks	Before 1981	19%	34%	40%	5%	2%
		1981-2006	19%	28%	45%	6%	3%
		After 2006	19%	32%	42%	5%	3%
	Other type of building	Before 1981	23%	40%	31%	4%	2%
		1981-2006	23%	42%	30%	3%	2%
		After 2006	23%	48%	26%	2%	1%
Rural	Single house	Before 1981	16%	12%	61%	7%	4%
		1981-2006	16%	2%	69%	8%	4%

		After 2006	16%	4%	68%	8%	4%
	Semi-detached and Row houses	Before 1981	19%	19%	53%	6%	3%
		1981-2006	19%	13%	58%	7%	4%
		After 2006	19%	15%	56%	7%	3%
	Apartment blocks	Before 1981	27%	44%	24%	3%	2%
		1981-2006	27%	38%	29%	4%	2%
		After 2006	27%	32%	34%	4%	2%
	Other type of building	Before 1981	43%	17%	34%	4%	2%
		1981-2006	43%	28%	26%	3%	1%
		After 2006	43%	30%	24%	2%	1%

(Source: CYSTAT + assumptions).

Table 67 – Characterisation of the residential occupant profiles (assumed).

Occupant profiles	Money available for energy renovations per dwelling [€]	Max payback time [years]
Low income	500	2
Building tenant	2500	5
Standard building owners	7500	10
Wealthy building owners	25000	15
Environmental friendly building owners	12500	20

Table 68 – Share of occupant profiles per service/public building types (assumed).

Building type	Age	Public	Tenant	Standard private owners	Wealthy private owners	Environmental friendly private owners
Hotels and other accommodation	Before 2006	0%	10%	75%	10%	5%
	After 2006	0%	10%	75%	10%	5%
Schools	Before 2006	85%	2%	11%	2%	1%
	After 2006	78%	2%	17%	2%	1%
Public buildings	Before 2006	100%	0%	0%	0%	0%
	After 2006	100%	0%	0%	0%	0%
Supermarkets and malls	Before 2006	0%	10%	75%	10%	5%

	After 2006	0%	10%	75%	10%	5%
Hospitals and clinics	Before 2006	70%	3%	23%	3%	2%
	After 2006	63%	4%	28%	4%	2%
Restaurants and taverns	Before 2006	0%	10%	75%	10%	5%
	After 2006	0%	10%	75%	10%	5%
Private offices	Before 2006	0%	10%	75%	10%	5%
	After 2006	0%	10%	75%	10%	5%
Retail shops	Before 2006	0%	10%	75%	10%	5%
	After 2006	0%	10%	75%	10%	5%
Other	Before 2006	35%	7%	49%	7%	3%
	After 2006	30%	7%	53%	7%	4%

Table 69 – Characterisation of the occupant profiles of service/public buildings (assumed).

Occupant profiles	Money available for energy renovations per 50 m^2 [€]	Max payback time [years]
Public	1000	20
Building tenant	150	3
Standard building owners	1500	7
Wealthy building owners	6000	10
Environmental friendly building owners	3500	15

It is important to observe that the investment attitudes are not constant over the simulation period. The model adapts the economic attributes of occupant profiles in function (weighted linear dependency) of the yearly variations of the national GDP.

Policy parameters

The model allows to describe the national policy context by defining several types of measures belonging to three categories:

— existing buildings:
  - investment grants for energy efficiency;
  - credit line for energy efficiency;

— new buildings:
  - minimum energy performance requirements;

— transversal measures:

- roll out of information campaigns;
- information centres for energy renovations;
- workforce education.

The incentive policies have to be described by the starting year, the total duration, the target (building type, renovation level and occupant profile), the public (and private for credit line) annual budget, the coverage of the investment costs and the repayment period (for credit line only).

The minimum energy performance requirements are defined by: starting year, duration, building type and energy level (choosing between: Standard (Class B), nearly Zero Energy and Net Zero Energy). The definition (in terms of primary energy consumption and % of RES) of nZEB for residential and non-residential can be modified.

The main parameter describing the transversal measures is the annual budget allocated. Under modifiable assumptions, the model translates the founds of the information measures to an increase of the general awareness about EE cost-effectiveness and the investments in workforce education to an increased compliance level between estimated and real consumptions.

7.4 Scenario Results

The model has been tested for 2 policy scenarios. The first one ("Scenario 0") includes the policy measures already in force; "Scenario 1" adds integrative policies recognized as particularly appropriate to the Cyprus context. We refer to JRC Technical Report "Financing energy efficiency in buildings in Cyprus - Status, experiences across the EU & recommendations" for further information.

Detailed maps representing both the building stock in Cyprus and the results on the scenario analysis are provided in the Report: "GIS-based maps of Cyprus building stock" (Bodis and Zangheri 2016)

7.4.1 Scenario 0 (BAU)

The following tables show the policy parameters used to define the Scenario 0.

Table 70 – Scenario 0: definition of the policies focused on the existing buildings.

Existing buildings	**Policy 1**	**Policy 2**
Type	Investment Grants for Energy Efficiency	Investment Grants for Energy Efficiency
Starting year	2014	2014
Duration [years]	6	6
Building type	Residential	Residential
Renovation level	Moderate and Deep	Minor
Occupant profile	All	Low income
Pubblic annual budget [Million €]	2.5	0.5
Coverage of investment costs	25%	25%

Table 71 – Scenario 0: definition of the policies focused on the new buildings.

New buildings	**Policy 1**	**Policy 2**
Type	Minimum energy performance requirements	Minimum energy performance requirements
Starting year	2013	2021
Duration	8	10
Building type	All	All
Energy level	Standard (Class B)	nearly Zero Energy
primary energy requirement [kWh/m2/y]		100
RES requirement		25%

The results achieved for Scenario 0 are presented below. The graphs show: i) the trends of the main final energy consumption over the period 2015-2030 for residential and

service sectors; ii) the evolution of the composition of the building stocks; iii) the estimated investments in refurbishment measures.

Unlike the residential sector, the picture of the final energy consumptions of the service/public building stock does not include the (electric) consumptions of appliances that for the moment have been excluded from the analysis.

Figure 41 – Scenario 0: forecast of the main non-renewable final energy consumptions of the residential sector.

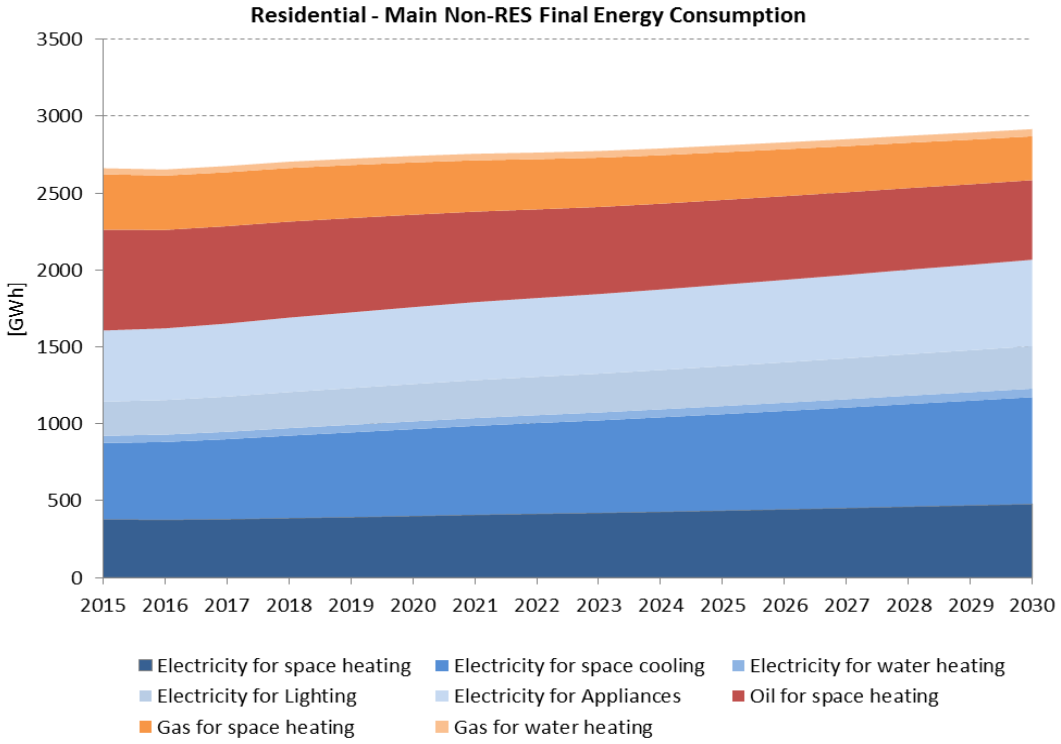


Figure 42 – Scenario 0: forecast of the main non-renewable final energy consumptions of the service/public sector.

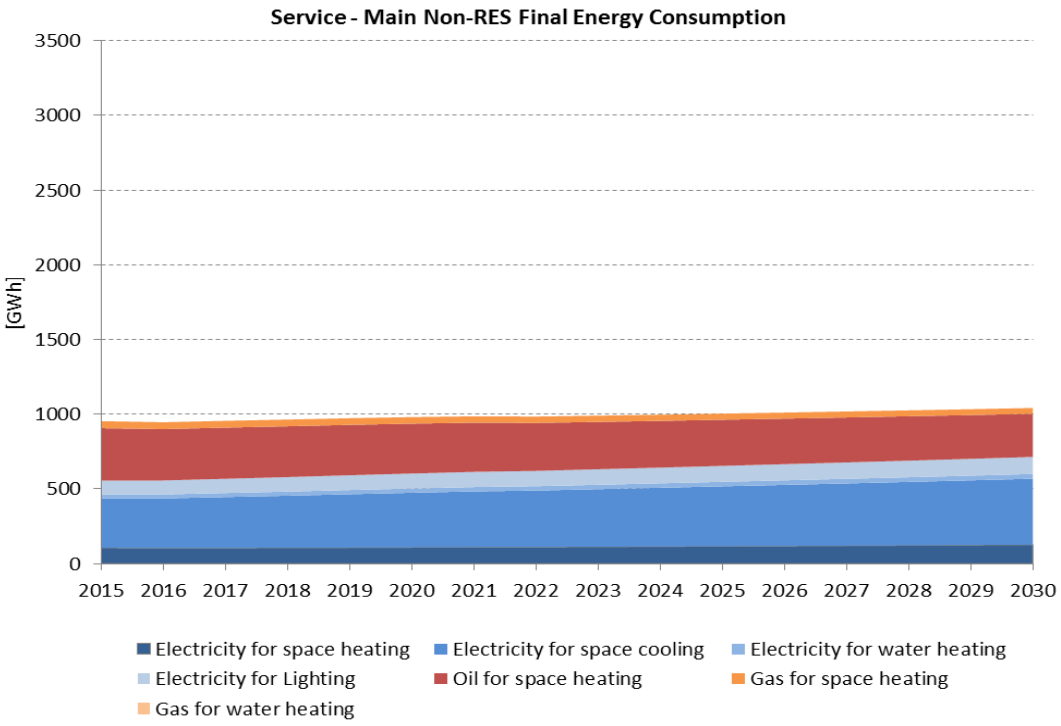


Figure 43 – Scenario 0: development of the composition of the residential building stock.

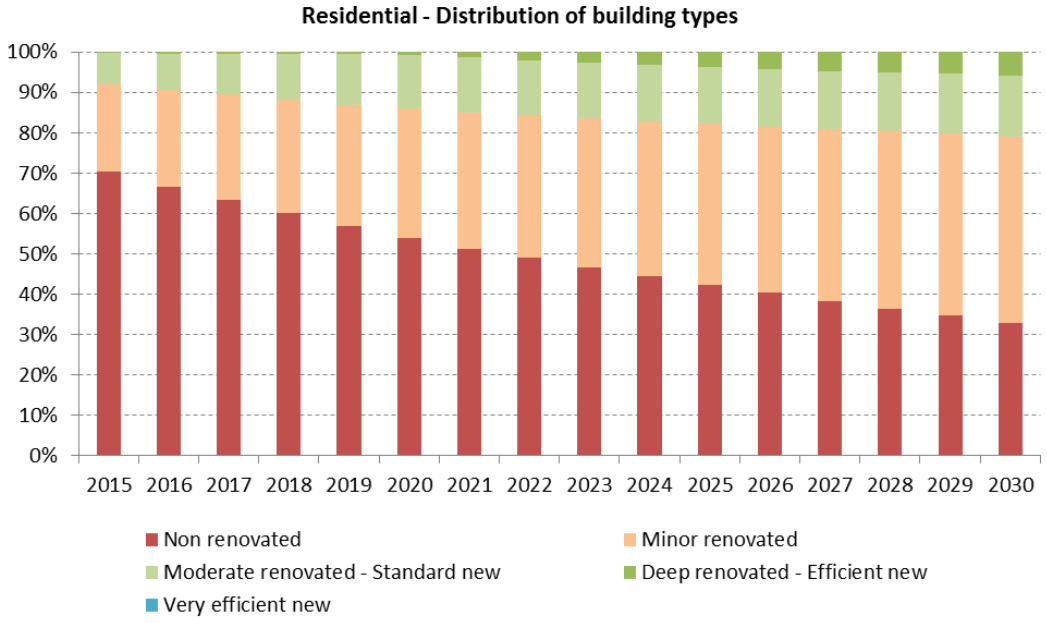


Figure 44 – Scenario 0: development of the composition of the service building stock.

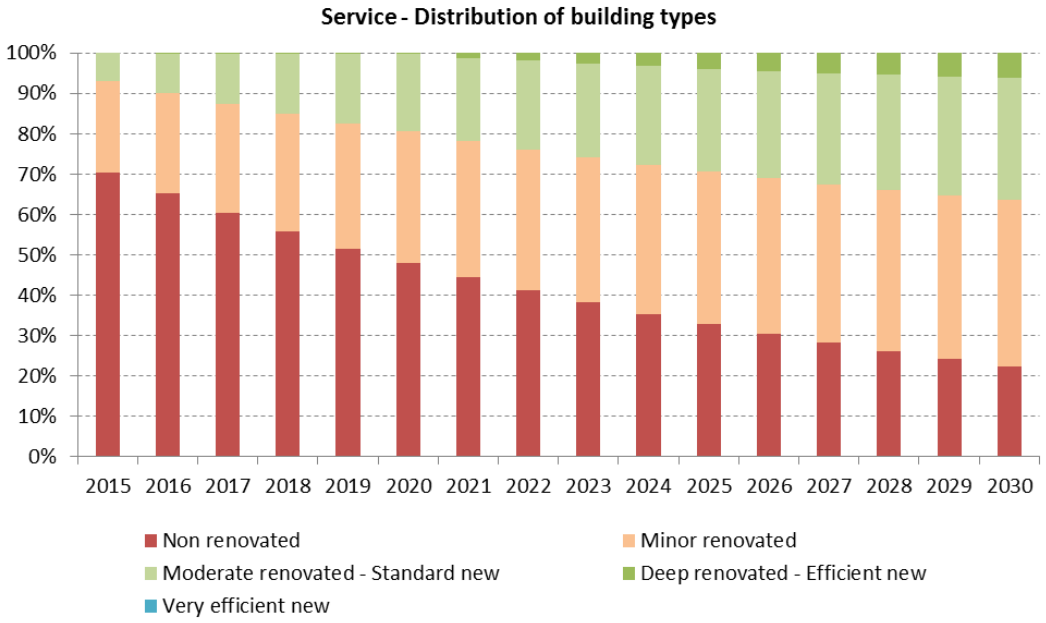

Service - Distribution of building types
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Non renovated
Minor renovated
Moderate renovated - Standard new
Deep renovated - Efficient new
Very efficient new

Figure 45 – Scenario 0: annual expenditure in refurbishment activities on the residential building stock per renovation levels.

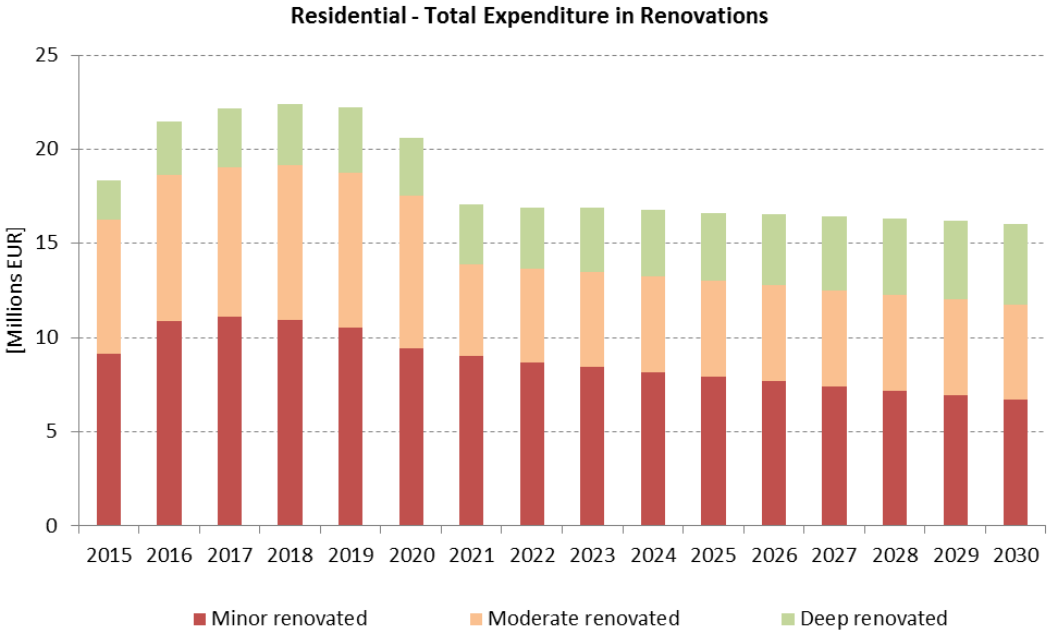
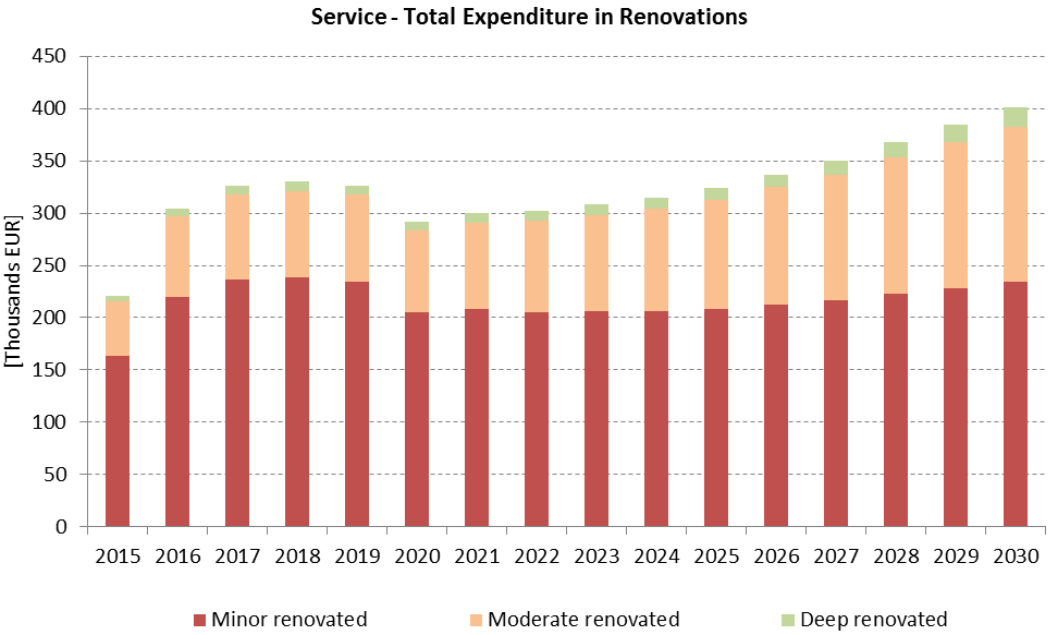


Figure 46 – Scenario 0: annual expenditure in refurbishment activities on the service building stock per renovation levels.



7.4.2 Scenario 1

The following tables show the policy parameters used to define the Scenario 1.

Table 72 – Scenario 1: definition of the policies focused on the existing buildings.

Existing buildings	**Policy 1**	**Policy 2**	**Policy 3**
Type	Investment Grants for Energy Efficiency	Investment Grants for Energy Efficiency	Credit line for Energy Efficiency
Starting year	2014	2021	2021
Duration [years]	7	5	5
Building type	Residential	Residential	Residential
Renovation level	Moderate and Deep	Minor and Moderate	Moderate and Deep
Occupant profile	All	Low income	All building owners
Pubblic annual budget [Million €]	10	2.5	7.5
Bank annual budget [Million €]			20
Coverage of investment costs [%]	25%	50%	75%
Repayment period [years]			20

Table 73 – Scenario 1: definition of the policies focused on the new buildings.

New buildings	**Policy 1**	**Policy 2**	**Policy 3**
Type	Minimum energy performance requirements	Minimum energy performance requirements	Minimum energy performance requirements
Starting year	2013	2021	2026
Duration	8	5	5
Building type	All	All	All
Energy level	Standard (Class B)	nearly Zero Energy	Net Zero Energy
primary energy requirement [kWh/m2/y]		100	
RES requirement		0.25	

Table 74 – Scenario 1: definition of the transversal policies.

Transversal	**Policy 1**	**Policy 2**	**Policy 3**
Type	Roll out of information campaigns	Information centres for energy renovations	Workforce education
Starting year	2018	2020	2014

Duration	12	11	7
Annual budget [Million €]	0.1	0.5	0.25

The results of the Scenario 1 simulation are presented below.

Figure 47 – Scenario 1: forecast of the main non-renewable final energy consumptions of the residential sector.

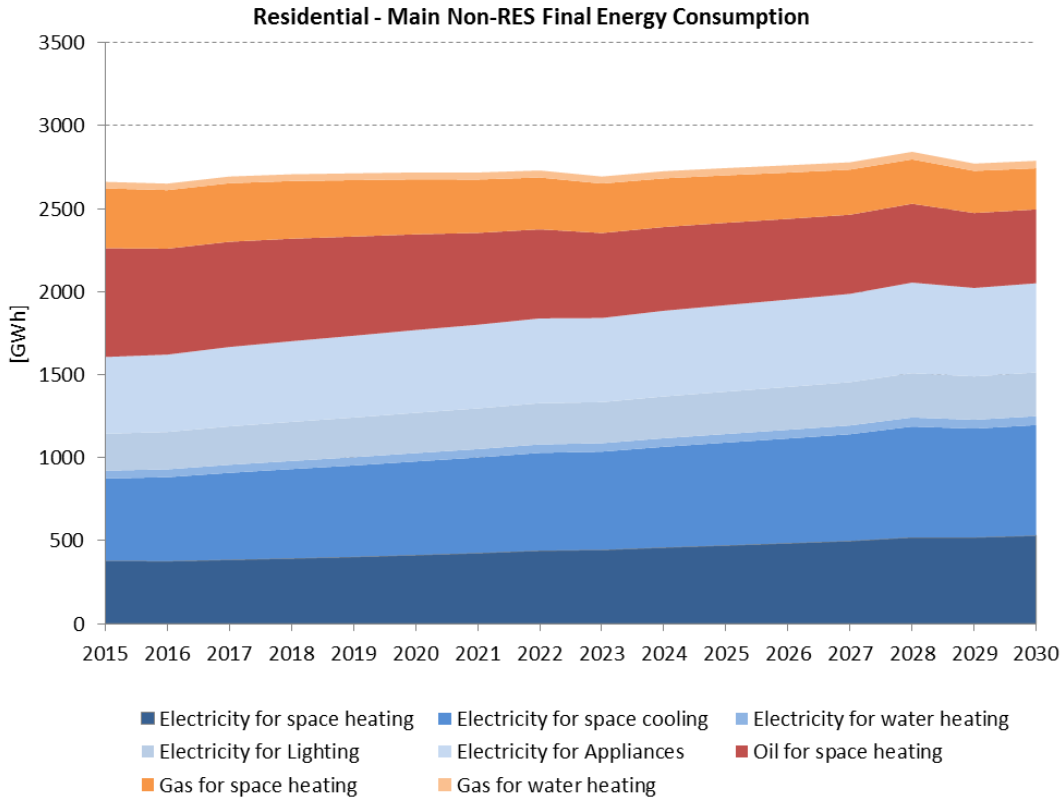


Figure 48 - Scenario 1: forecast of the main non-renewable final energy consumptions of the service/public sector

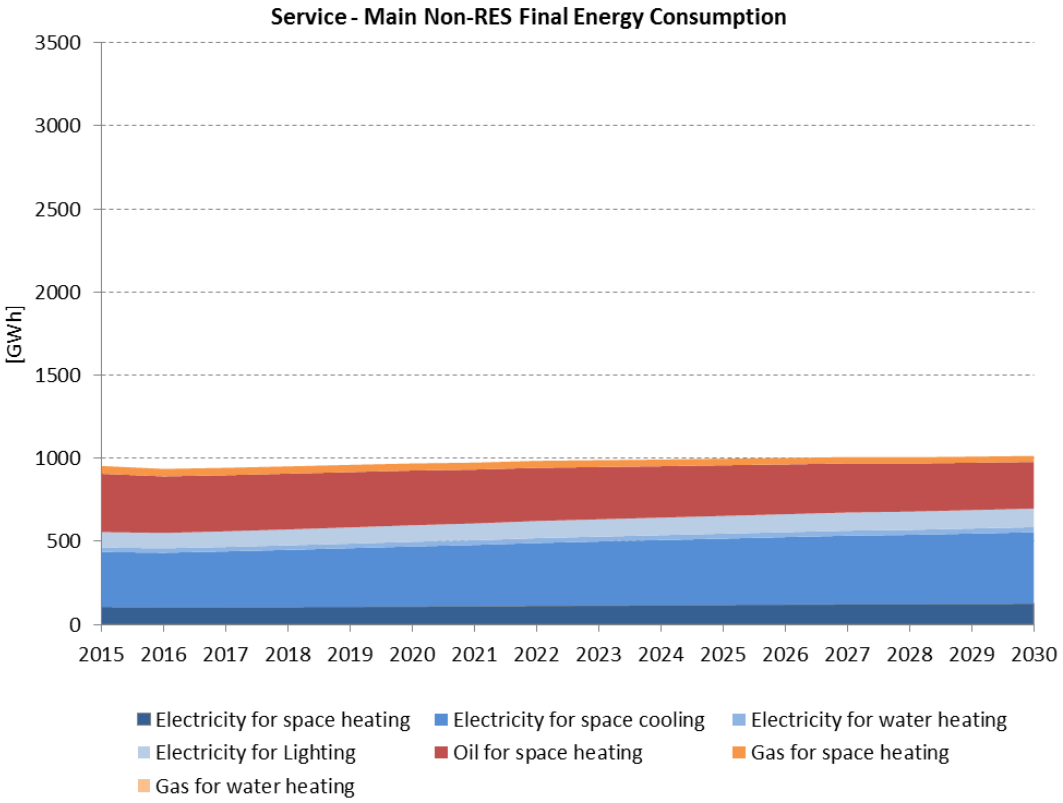


Figure 49 – Scenario 1: development of the composition of the residential building stock.

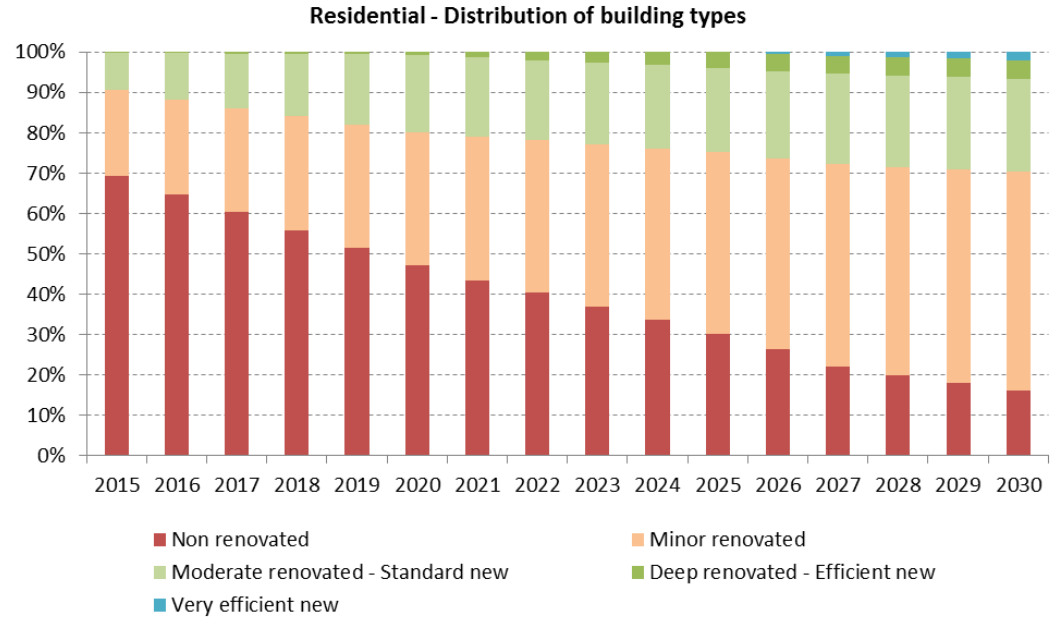


Figure 50 – Scenario 1: development of the composition of the service building stock.

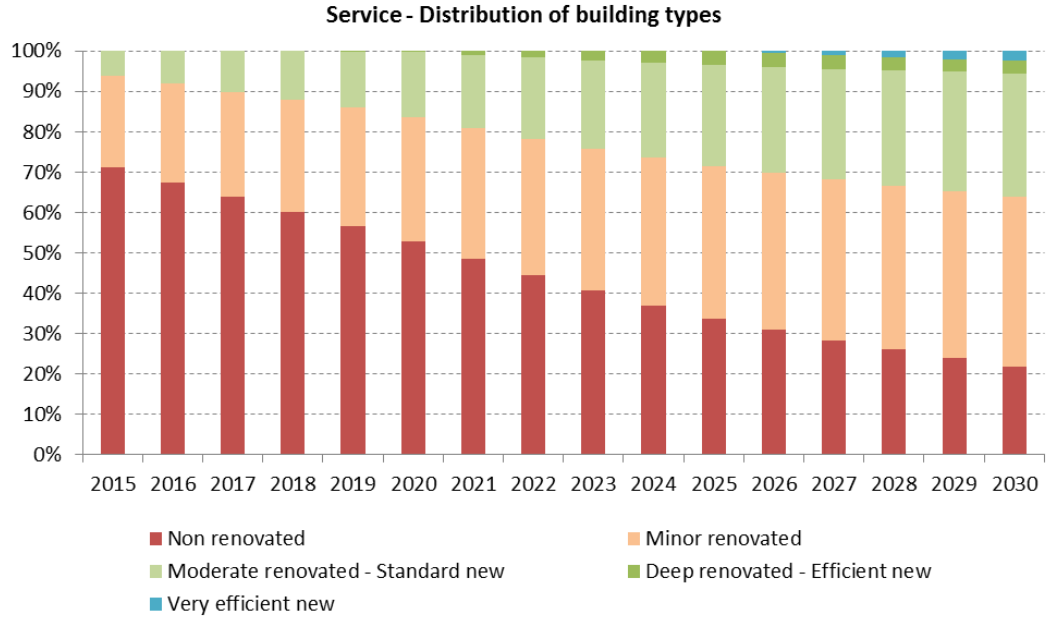


Figure 51 – Scenario 1: annual expenditure in refurbishment activities on the residential building stock per renovation levels.

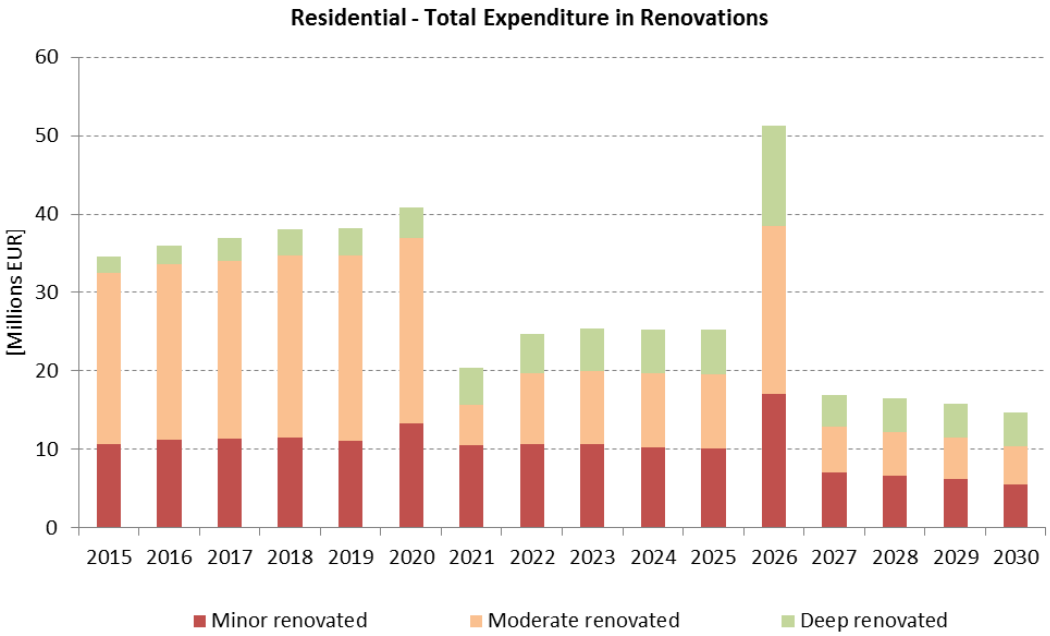
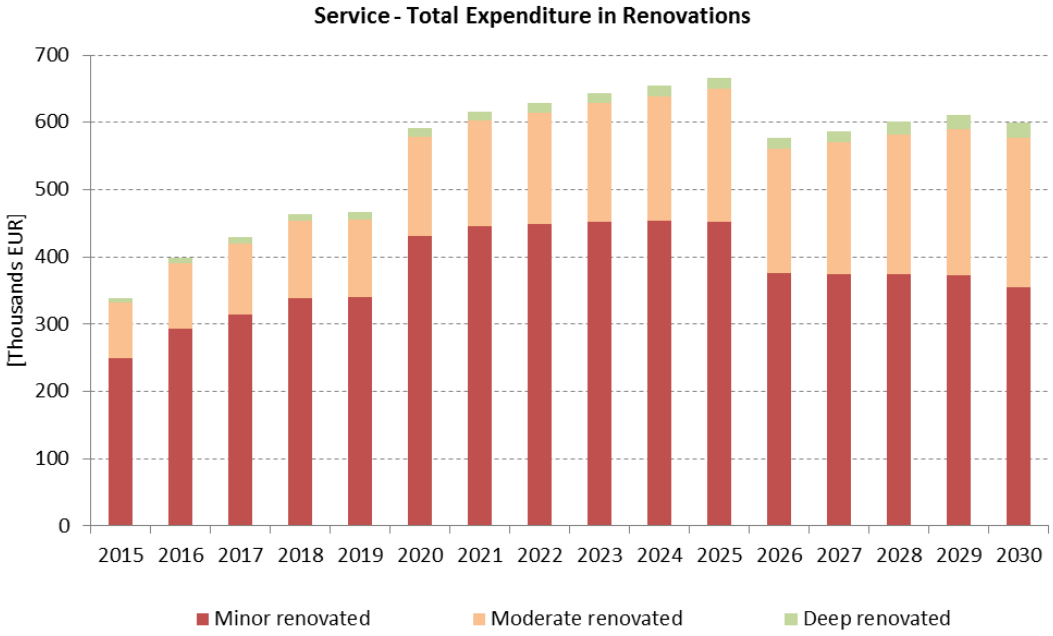


Figure 52 – Scenario 1: annual expenditure in refurbishment activities on the service building stock per renovation levels.



7.5 Conclusions

The present analysis represents a first attempt to forecast the development of the energy demand of the Cyprus building stock. A dynamic engineering-based bottom-up model was developed and tested for two different policy scenarios, which represent the actual context and a suggested evolution.

Starting from the analysis of the results obtained, the following preliminary considerations can be derived:

- Like to the other South-European building stocks, the Cypriote one is characterised by high inertia, due to low demolition, construction and renovation rates. In this context the role played by the new buildings is marginal (especially for the residential stock).
- Despite the policy measures already in force, it is foreseen an increase of the final energy consumptions, especially due to the expected growth of GDP, population and comfort demand (especially for cooling).
- The model esteems that the policies in force will have a limited impact without further implementations after 2020.
- The measures included in our reinforced scenario (Scenario 1) may reverse the trend of consumption growth before 2030 and reduce to about 10% the number of non-renovated dwellings in 2030 (20% less than the reference scenario).
- Under the assumptions made and the calculation approach used, the competition between the different levels of renovation proves as a crucial aspect. For instance our decision-making algorithm doesn't consider the foresight of building occupants, who (if well informed and timely about the evolution of the regulatory environment) may decide to wait an incentive measure to renovate more deeply their building.

We aim to continue the development of the tool, refining the overall structure and including other policy options. MECIT will be informed of future updates.

7.6 References

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List of boxes

List of figures

List of tables

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