

Ex-ante evaluation for residential building sector in the Lisbon Metropolitan Area

Contributions for the market assessment of financial instruments for urban energy rehabilitation in greater Lisbon sub-region



Authors:

Vera Gregório- Lisboa E-Nova, Energy and Environment Agency
Carlos Raposo - Lisboa E-Nova, Energy and Environment Agency
Vasco Abreu - Lisboa E-Nova, Energy and Environment Agency

Lisbon, July 2018

Lisboa E-Nova is a private non-profit association whose purpose is to promote the sustainable development of Lisbon and its metropolitan area, supporting integrated approaches towards a low carbon and more energy efficient city. (www.lisboenova.org)

This project has received funding from the Interreg Sudoe Programme under grant agreement SOE1/P3/EO294 REHABILITE.

The content of this report reflects solely the author's view and the European Commission, EASME Agency, is not responsible for any use that may be made of the information it contains.

Index

1. Introduction	2
2. Context analysis	4
2.1 The Lisbon Metropolitan Area (NUTS II) within the national context	4
2.2 Characterisation of the building stock.....	7
2.3 Energy performance in residential buildings	10
2.4 Thermal comfort in residential buildings.....	15
3. Political goals and commitments	17
4. Demand-side characterization	20
4.1 Rehabilitation needs.....	20
4.2 Sub-optimal investment and level of investment required.....	22
5. Supply-Side - main financial instruments	24
5.1 IFFRU 2020	24
5.2 PORTUGAL 2020	27
5.3 Reabilita para Arrendar	28
5.4 Fundo Nacional de Reabilita do Edificado	29
5.5 CASA EFICIENTE	29
6 SWOT Analysis.....	33
7 Market Failures Analysis.....	37
8 Conclusions	41
Acknowledgements.....	42
References.....	43

1. Introduction

The ex-ante evaluation for residential building sector in the Lisbon Metropolitan Area (LMA) aims to contribute for the market assessment of financial instruments for urban energy rehabilitation in greater Lisbon sub-region. This study is developed under the REHABILITE project and covers one of the five regions¹ studied in the project. The purpose of this study is to evaluate the current market gaps in the LMA in terms of rehabilitation of its building stock and in what extent dedicated financing instruments (FI) can overcome it. The study is framed on the current requirements from European regulation that defines the need to develop an ex-ante assessment to support the implementation of measures through a FI and follows the approach defined in *SUDOE Methodology – Guide to prepare an ex-ante assessment focused on energy renovation in building sector* (Gregório, et al., 2018). The four main methods used for the development of the current study were the following : 1) documental collection and analysis, with the purpose to deep the knowledge about the existent reports, best practices, national and regional policy and existent funds and financial instruments, that could support the current study, 2) data collection and analysis, consisted in the treatment of quantitative data, among other sources from national statistics, and public entities, 3) benchmarking, it was focused on the goal of collecting information about best practices that could be incorporated in the ex-ante study², 4) Focus group and workshop with stakeholders, both methods were used to understand the existent barriers to the implementation of innovative financial instruments in LMA and to disseminate and create awareness about the role of FI for cover market failures and boost private and public investment in urban rehabilitation.

The current study used as a starting point, the present scenario in Portugal and in LMA regarding the existent portfolio of financing programs dedicated to urban rehabilitation. It was given a special emphasis to *IFRRU 2020 - Financial instrument for Urban Rehabilitation and Regeneration* – a financial instrument designed to support investments in urban rehabilitation, in the whole Portuguese territory. IFRRU 2020 was publicly released in April 2018 and it is a revolving fund that brings together various sources of financing to boost investment, both European funds from PORTUGAL 2020 and funds from other entities such as the European Investment Bank and the Council of Europe Development Bank, combining them with commercial banking resources. Given the characteristics of this innovative FI and the methodology used to diagnosis the market failures faced by urban regeneration policies in Portugal, the main conclusions of its ex-ante assesment were incorporated in the current study. Considering the existence of this dedicated FI for urban rehabilitation in Portugal and due to its characteristics and its broad scope of intervention³, we focused this study on understanding in what extent IFRRU 2020 would cover the main energy rehabilitation market

¹ REHABILITE project developed five exante studies, for three regions in Spain, Extremadura, Navarra and Murcia, Aquitaine-Limousin-Poitou-Charentes in France and Lisbon in Portugal.

² In this context it is important to highlight the work carried out under the REHABILITE project that allowed to collect more than 100 best practices to identify innovation models in policies, regulations and technical systems that could support the design of innovative financial instruments (FI).

³ IFRRU covers several types of interventions (including buildings with 30 years or more, abandoned industrial spaces, and private units in social housing buildings) and is extensive to the entire national territory.

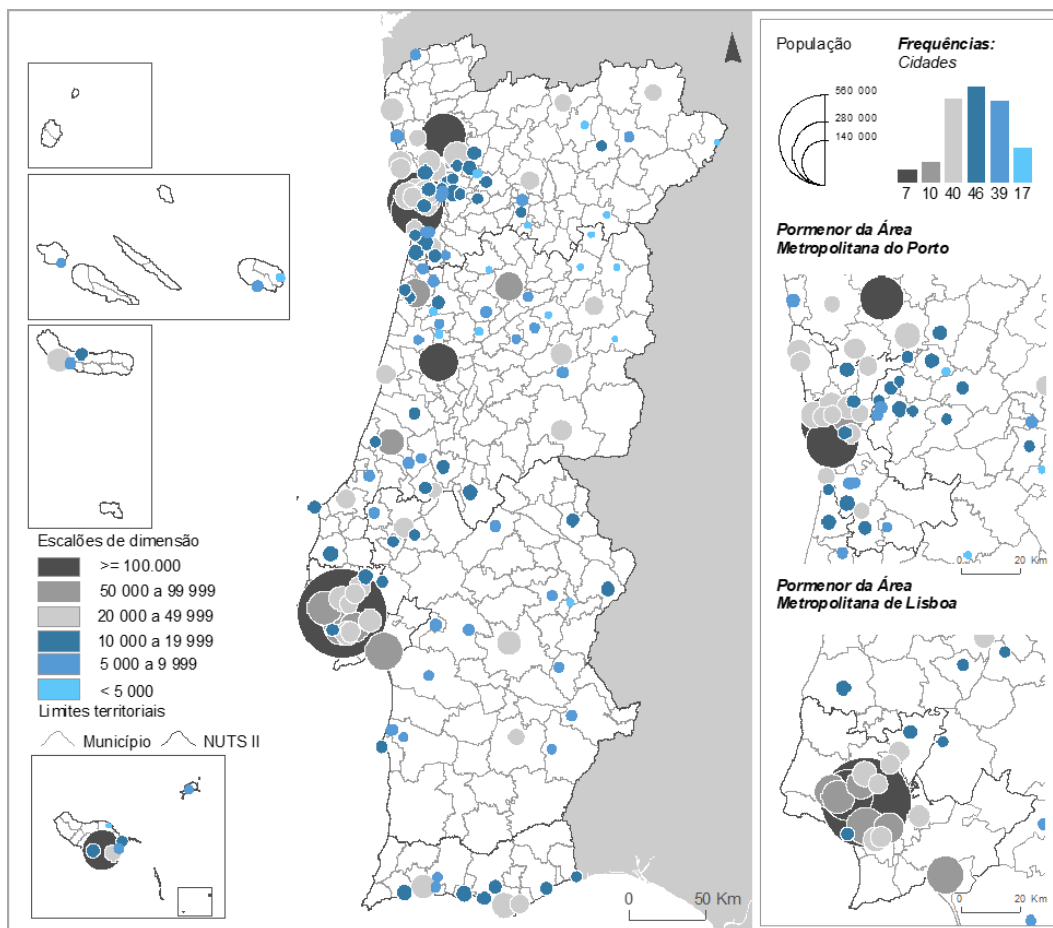
failures in LMA and what would be the main barriers to its implementation. A funding gap calculation it was not developed since we understood from the analyse carried out that IFRRU 2020 have the right structure and characteristics to cover the most important current market failures.

This *ex-ante evaluation for the residential building sector in the Lisbon Metropolitan Area* is structured in seven chapters beside this introductory first chapter. The chapter two aims to develop the context analysis of the situation in LMA and its relative position when compared with the national performance in what concern the socio-economic and demographic profile, the building stock characteristics, the energy performance as well as the thermal comfort evaluation. The chapter three frames the current study in what concern the international and national political goals and commitments and identifies the main national strategies and programmes that structure the new national integrated policy regarding buildings energy renovation clearly expressed in National Programme Territorial Planning Policy 2018 (NPTPP). Chapter four diagnosis the demand-side in what concern the rehabilitation needs and evaluates the sub-optimal investment. Chapter five is dedicated to the supply-side evaluation emphasising the main national funds and programmes oriented to urban energy rehabilitation covering the LMA region and in most of the situations covering the whole national territory. In the chapter six it was developed a SWOT analysis dedicated to analysing the main barriers and the opportunities to implement IFRRU 2020. The SWOT analysis present and systematize the results of the focus group organized in Lisbon under REHABILITE project with the purpose to evaluate “Innovative tools to support energy efficiency in urban rehabilitation in Lisbon”. The chapter six analysis the market failures and was mainly based on the rehabilitation gaps assessed during the current study and complemented by the results obtained from the market failures analysis developed during the ex-ante assesement of financial instruments from Portugal 2020 programs. The last chapter highlights the main conclusions of the study and explores further measures for a fruitful implementation of the ongoing FI dedicated to urban energy rehabilitation.

2. Context analysis

2.1 The Lisbon Metropolitan Area (NUTS II) within the national context

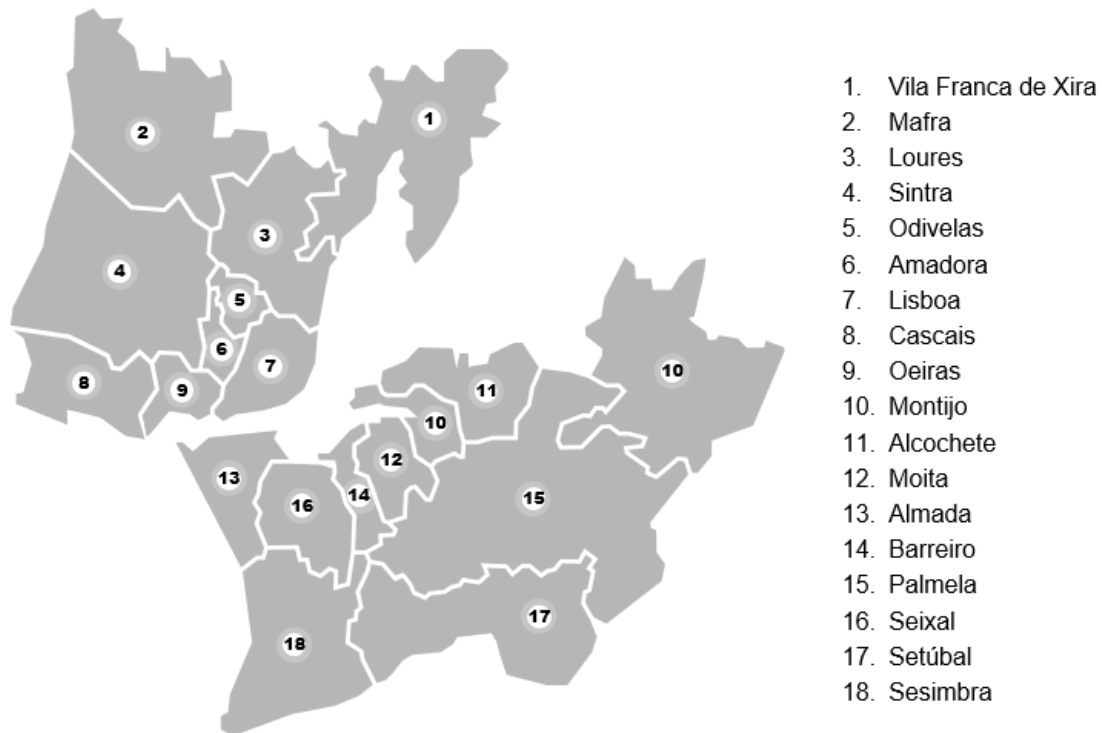
This analysis covers the classification of territorial units for statistics - NUTS II – Lisbon Metropolitan Area (LMA), home to 2.8 million inhabitants live, representing 27% of the Portuguese population (INE , 2011). The LMA region has become more developed over the last 40 years as a result of a suburbanization process centred around the city of Lisbon. This suburbanization process is captured in Map 1 showing a concentration of satellite cities around the city of Lisbon. 52% of the population in LMA lives in cities while on average the Portuguese population living in cities is 42%. The size of the cities varies between 20,000 and more than 100,000 inhabitants. Compared to the national context, the size and concentration of cities in the LMA represents an imbalance and asymmetry compared to the overall Portuguese urban system.



Map 1 - Population resident in cities.
Source: (INE , 2011)

The LMA is the Portuguese region with the highest density of population (932 inhabitants/km²) and accounts for 27% of the resident population of the country. The region represents 26.2% of national employment and 47.5% of national business production. In 2011, the region had a

considerably higher average purchasing power per capita (140) than the national reference level (100) and accounted for 37.2% of the national gross value added (P2020, 2014).



Map 2 - NUTS II Metropolitan Lisbon Area divided by Municipalities.
Source: (AML, 2017)

Despite LMA's importance to the national economy, there are meaningful socio-economic differences within this region. The LMA is divided into two sub-regions, the wider areas of Lisbon and Setubal, spanning 9 different municipalities each, north and south of Tagus River respectively (Map 2). The region of Setubal covers an area of 1,624 km² and the region of Lisbon 1391 km². However, Lisbon has the higher population density, with 1,463 inhabitants/km² against 482 inhabitants/km² in Setubal, which is explained by the higher concentration of population living in cities in the sub-region of Lisbon.

Over the last 15 years both Lisbon and Setubal sub-regions have seen an increase of aging of their population achieving in 2016 an index of 127 and 123 respectively⁴. Although this trend, the aging of the population in LMA is below the national average aging index which was 149 in 2016, mainly due to the "capital city effect" which tends to attract younger people seeking work. urban characteristics (Table 1). Regarding the education of the population, both sub-regions have increased their levels during the period between 2001 and 2011. However, in 2011 the sub-region of Lisbon stands out from Setubal and from the national average with 22% of their population with higher studies, against 14% for the latter two.

The unemployment rate more than doubled from 7% to 15% between 2001 and 2011 due to the 2008 financial crisis, which deeply affected the Portuguese labour market. During this period

⁴ The ageing index is calculated on an annual base and represents the number of people with 65 years or more for each one hundred people with less than 15 years ((PORDATA, 2017).

and at the sub-region level, Setubal was more affected reaching an unemployment rate of 17% while the sub-region of Lisbon registered 14%. Since then until recently in 2016, it lowered again and now stands at around 11% at national level (Table 1).

The purchasing power per capita, which is an indicator of how the region compares to the national average, shows values over 120 for every year under analysis in Lisbon, against values ranging from 99 to 110 for Setubal (being 100 the national average). The gap between the purchasing power from the sub-region of Lisbon and the sub-region of Setubal is very significant. While the former concentrated 26% of national purchasing power in 2016, the latter only accounted for 7%. Although these differences have been reducing during the last 26 years, the current gap between both regions shows the strong influence of the Portuguese capital city, Lisbon, to attract businesses and create wealth.

Table 1 - Demographics in Portugal, LMA sub-regions, Lisbon and Setubal.

		Population	Purchase power	Purchasing power per capita	% population higher w/ studies	Aging index	Unemployment rate
Lisbon	1981	2,069,467	//	//	//	//	//
	1991	2,052,787	35%	125	//	//	//
	2001	1,948,426	30%	140	14%	100	7%
	2011	2,043,444	28%	127	22%	113	14%
	2016	2,034,765	26%	122	//	127	//
Setubal	1981	658,326	//	//	//	//	//
	1991	712,594	7%	99	//	//	//
	2001	716,786	8%	110	8 %	95	10%
	2011	781,462	8%	102	14%	105	17%
	2016	782,249	7%	99	//	123	//
LMA	1981	2,727,793	//	//	//	//	//
	1991	2,765,381	42%	163	//	//	//
	2001	2,665,212	38%	148	12%	102	8%
	2011	2,824,906	35%	131	20%	119	15%
	2016	2,817,014	34%	125	//	133	//
Portugal	1981	9,833,041			//	//	//
	1991	9,862,540			//	//	//
	2001	10,362,722			8%	102	7%
	2011	10,557,560			14%	126	15%
	2016	10,325,452			//	149	11%

Source: (PORDATA, 2017), (INE , 2011)

2.2 Characterisation of the building stock

Over the past decades, meaningful changes have taken place in the Portuguese housing market which are determinant to evaluating the potential market size for the LMA. The demographic dynamic and the concentration of population in cities along the Portuguese coastline region mentioned above, has influenced the spatial distribution of the building stock and its occupation. In 2011, 58% of the Portuguese buildings and 68% of the dwellings were concentrated in coastal regions. Another national trend between 1981 and 2011 is the increasing discrepancy between the number of dwellings and the number of households, with the former registering 73% growth and the latter 38%. In 2011, this difference was reflected at the national level in 5.9 million dwellings and 4 million households. Considering the last two censuses, 2001 and 2011, dwellings increased by 19% in the LMA, below the national average rate (21%), while households increased 15% also below the national average rate of 17% (INE, LNEC, 2013). These trends suggest the existence of a housing market more oriented to new constructions and a mismatch with household demand for primary residence purposes.

In order to find a new equilibrium between the supply of dwelling and the needs of the households, it is important to consider changes in the structure of Portuguese households in the last decades, which have become more diversified and smaller. According to Statistics Portugal, at the national level, the average number of individuals per household in 1970 was 3.7 and decreased to 2.6 in 2011. In addition to the typical nuclear family (father, mother and one child), the diversity of families has increased since 1991, with an increase in single-person households, couples without children and single parent families.

Regarding the LMA, according to Table 2, 1 or 2 people households represent 31% of the national total, some 670,000 households, while households with 3 or more people account for about 477,000. In sum, there are about 1.14 million households in the LMA, as compared to about 1.12 million dwellings for primary residence (broadly comparable figures, as would be expected), 180,000 vacant dwellings and 170,000 dwellings for non-primary residence, as shown in Table 3. In line with the previous analysis, the total number of households and dwellings in the LMA is bigger than the number of households, with 1.1 million households and 1.5 million dwellings - in line with the national trend.

Table 2 - Household sizes in Lisbon, Setubal, LMA and Portugal regions in 2011.

	1 or 2 people	3 or 4 people	>4 people
<i>Lisbon</i>	494,198	295,762	45,693
<i>(national %)</i>	23%	18%	17%
<i>Setubal</i>	175,977	120,583	15,562
<i>(national %)</i>	8%	7%	6%
<i>LMA</i>	670,175	416,345	61,255
<i>(national %)</i>	31%	25%	23%
<i>Portugal</i>	2,144,385	1,636,847	262,494

Source: (INE , 2011)

It is worth mentioning the changes observed in the last decades regarding the type of dwellings occupancy. Growth in primary residences slowed during the period between 1991 and 2011. The major growth was in non-primary residential dwellings which increased by 40% between

1991 and 2001, while the vacant housing grew by 35% between 2002 and 2011 (INE, LNEC, 2013). The national numbers from the census indicate that in 2011 the share of primary residences was 68%, non-primary residence (secondary or seasonal) was 19% and the vacant dwellings accounted for 13%. In the LMA the form of dwellings' occupancy follows the national trend although with a high share of 76% of dwellings occupied for primary residence and 12% shares for non-usual residence and vacant dwellings (2011). Overall it is important to highlight that LMA supplies 28% of national dwellings for primary residence and 25% of vacant dwellings (Table 3).

Table 3 - Dwellings' occupancy status in Lisbon, Setubal, LMA and Portugal regions in 2011.

	Dwelling for primary residence	Vacant dwelling	Dwelling for non-primary residence
<i>Lisbon</i>	822,235	135,887	108,746
<i>(%)</i>	77%	13%	10%
<i>Setubal</i>	307,554	49,022	64,414
<i>(%)</i>	73%	12%	15%
<i>LMA</i>	1,129,789	184,909	173,160
<i>(%)</i>	76%	12%	12%
<i>(national %)</i>	28%	25%	15%
<i>Portugal</i>	3,997,724	735,128	1,145,904

Source: (INE , 2011)

Another important factor that affects the decisions about investment on energy efficiency is the type of dwellings' occupancy. The discrepancy between who owns the building and who occupies the building is known as the landlord-tenant dilemma⁵ due to their different level of motivation to invest in energy efficiency measures. In the national context, a large majority of houses are occupied by the owner (79%) which mitigates this dilemma. A similar prevalence of dwellings occupied by the owners is verified for the sub-region of Lisbon and Setubal, with 69% and 78%, respectively (Table 4). Although this trend, the LMA sub-region of Lisbon due to their high capacity to attract new residents, accounts with 31 % of national rental house market.

Table 4 - Owner-occupied vs rental dwellings in Lisbon, Setubal, LMA and Portugal regions in 2011.

	Owner-occupied	Rented
<i>Lisboa</i>	529 341	243 134
<i>(%)</i>	69%	31%
<i>(national %)</i>	18%	31%
<i>Setubal</i>	224 424	64 810
<i>(%)</i>	78%	22%
<i>(national %)</i>	8%	8%
<i>Portugal</i>	2 923 271	794 465
<i>(%)</i>	79%	21%

Source: (INE , 2011)

⁵ This barrier is also known as "the split-incentives barrier", "investor/user barrier", "principal/ agent barrier"

Due to the high growth rates of the Portuguese housing stock in recent decades, in 2011 a significant part of the buildings was recently constructed. Considering the total national building stock in 2011 (3,544,389), buildings constructed after 1971 accounted for 63% of the total building stock. The buildings constructed between 1946-1970 represented 23% of the national building stock and older buildings constructed before 1945 represented the remaining 14% (INE, LNEC, 2013). The regional distribution of buildings according to their period of construction reveals differences among regions. The index of aging of buildings used by the Statistics Portugal (weight of buildings constructed before 1960 in the total number of buildings constructed after 2001) allows for a comparison across regions. The LMA region registered an index value of 225 within a range of values, where the region of Cavado (NUTS III) has the more recent building stock with an index of 76 and Baixo Alentejo (NUTS III) has the oldest building stock registering an index of 388 For Portugal, the index of aging of buildings shows that the buildings constructed before 1960 are higher than the buildings built after 2011, representing by an index value of 176.

As depicted in Table 5, the distribution of buildings by period of construction reveals that 48% of building stock was constructed between 1961 and 1990 and 23% was built before 1960. There isn't a strong regional effect on these shares as the percentages are quite similar for each discrete region of Lisbon and Setubal. The same follows for the country as a whole.

Table 5 - Buildings by period of construction in Portugal, LMA, Lisbon and Setubal areas as of 2011.

	Before 1945	1946-1960	1961-1990	1991-2011
<i>Lisboa</i>	38,152	36,643	133,511	69,081
<i>(%)</i>	14%	13%	48%	25%
<i>Setubal</i>	13,100	17,363	82,288	58,819
<i>(%)</i>	8%	10%	48%	34%
<i>LMA</i>	51,252	54,006	215,799	127,900
<i>(%)</i>	11%	12%	48%	29%
<i>Portugal</i>	512,039	387,340	1,576,534	1,068,476
<i>(%)</i>	14%	11%	45%	30%

Source: (PORDATA, 2017)

The most common type of buildings in Portugal are detached houses, as is the case in the two studied sub-regions (Table 6). It is important to highlight that Lisbon represents 30% of all national buildings with more than three households and 10% for Setubal, a total of 40% of the national building stock, naturally related to the fact that Lisbon is the capital city, more densely populated and thus requiring taller and more compact buildings. The refurbishment of multi-apartments buildings is normally more challenging than single apartments, since it requires a strong coordination between all the owners. Under these conditions it is important to raise a set of policy and financial instruments able to support building wide energy renovation measures.

Table 6 - Types of buildings in Portugal, LMA, Lisbon and Setubal areas.

	1 or 2 dwellings per building			>3 dwellings	Others
	Detached	Semi-det.	Terraced		
<i>Lisbon</i>	98,302	42,874	43,799	87,583	4,829
<i>(national %)</i>	5%	8%	6%	31%	12%

Setubal	77,160	28,484	31,984	29,831	4,111
(national %)	4%	5%	4%	11%	10%
LMA	175,462	71,358	75,783	117,414	8,940
(national %)	9%	13%	10%	41%	22%
Portugal	1,946,604	542,393	730,794	283,879	40,719

Source: (INE , 2011)

Table shows that the bulk of dwellings in Portugal are located within the 50 to 200m² range representing 83% of the total building stock. However, when we observe the LMA, there is a predominant trend for a majority of dwellings within 50 and 100m². In other words, dwellings are smaller than the Portuguese average as we look closer into the LMA sub-regions. Also, the smaller the size of dwelling, the higher the share of total dwellings, meaning there is a bigger concentration of dwellings with a smaller surface area within the reference regions, particularly in Lisbon, with 28% of national dwellings with less than 50 m².

Table 7 - Dwelling size in Portugal, LMA, Lisbon and Setubal areas. (Source: BGRI data, INE, 2011)

	< 50 m2	50 - 100 m2	100 - 200 m2	> 200 m2
Lisbon	108,927	414,427	263,664	34,018
(national %)	28%	25%	16%	11%
Setubal	33,726	153,814	104,231	14,904
(national %)	9%	9%	6%	5%
LMA	142,653	568,241	367,895	48,922
(national %)	37%	34%	22%	16%
Portugal	395,010	1,656,650	1,630,491	308,961

Source: (INE , 2011)

2.3 Energy performance in residential buildings

According to the *domestic sector energy consumption inquiry* (INE, DGEG, 2010), in 2010, the domestic use of energy in Portugal was distributed according to Figure 1:

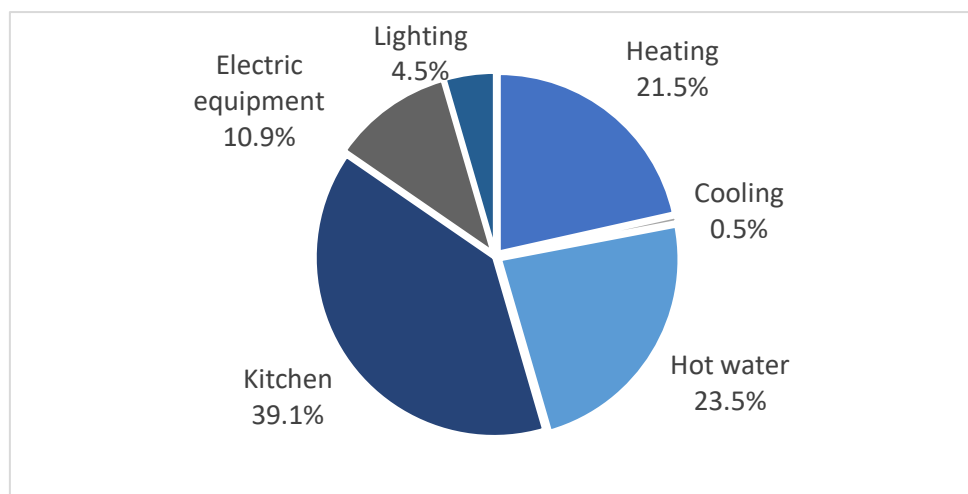


Figure 1 - Final user domestic energy consumption distribution in Portugal, 2010.

Source: (INE, DGEG, 2010)

There is a clear predominance of kitchen appliances as a main final use, corresponding to 39.1% of the total, in the reference period. Hot water and heating also make an important contribution with a consumption share of 23.5% and 21.5%, respectively. On the other side, cooling (0.5%) and lighting (4.5%) accounted for the smallest share of domestic consumption.

In terms of expenses, the distribution was similar to consumption, with kitchen appliances once again the final use type with which the biggest domestic energy spending share (40%) is associated (INE, DGEG, 2010).

In order to characterize the energy needs for cooling, heating and domestic hot water at the LMA level Energy Performance Certificates (EPC) data from ADENE (Portuguese Energy Agency) was used. The average cooling and heating needs and the average domestic hot water consumption per building in LMA, Setubal and Lisbon are presented in Figure 2.

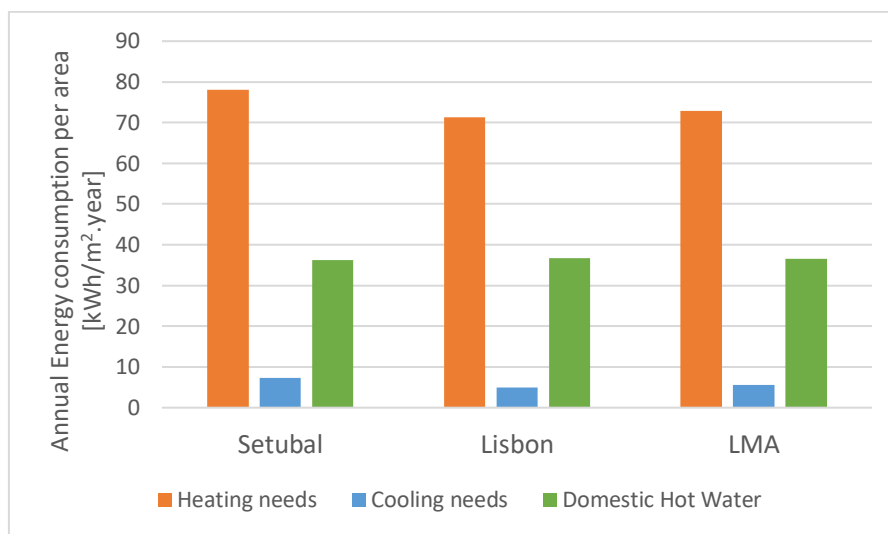


Figure 2 – Average of annual heating, cooling and domestic hot water needs in Lisbon Metropolitan Area
Source: (ADENE , 2017)

The energy needs from Setubal and Lisbon area are similar, leading to a representative average for LMA. In the LMA heating needs are more important in existing buildings than cooling needs and this need has fallen significantly over the past years as we can see in Figure 3.

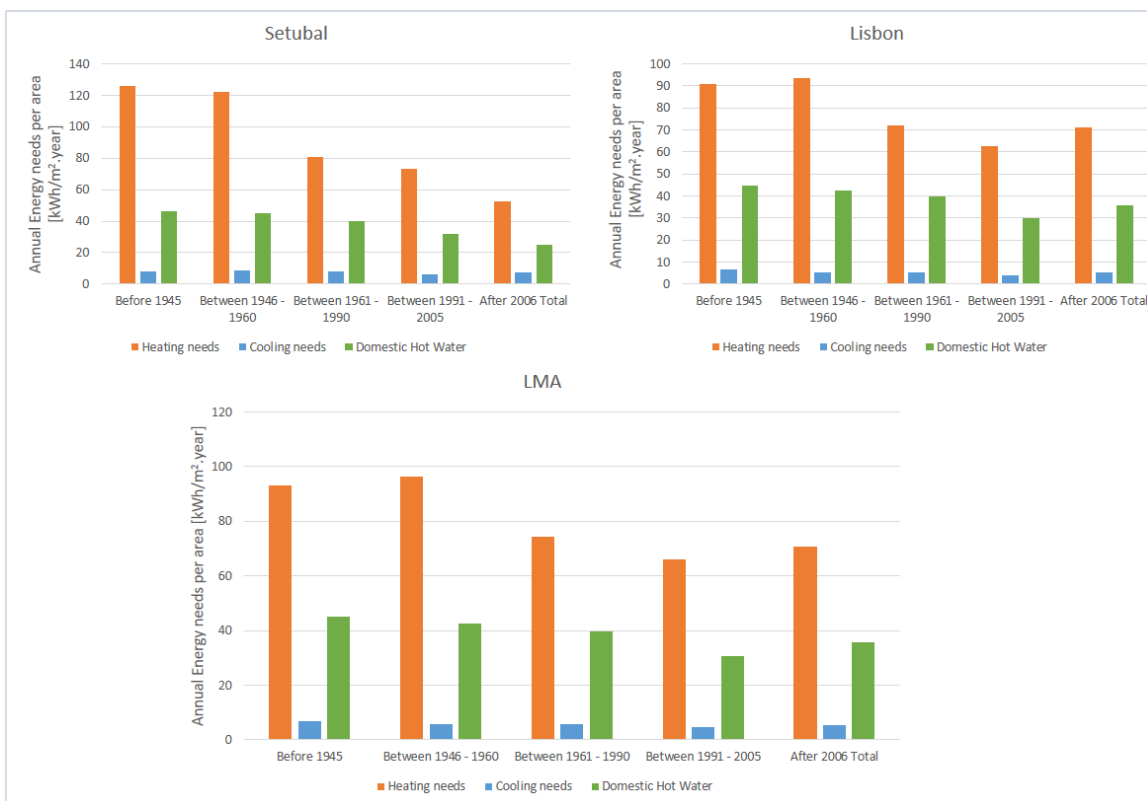


Figure 3 - Annual heating, cooling and domestic hot water needs in Setubal, Lisbon and LMA
Source: (ADENE , 2017)

Regarding the energy sources that are being used in homes in the LMA, Figure 4 and Table 8 shows each primary source’s contribution to the total consumed energy for domestic purposes.

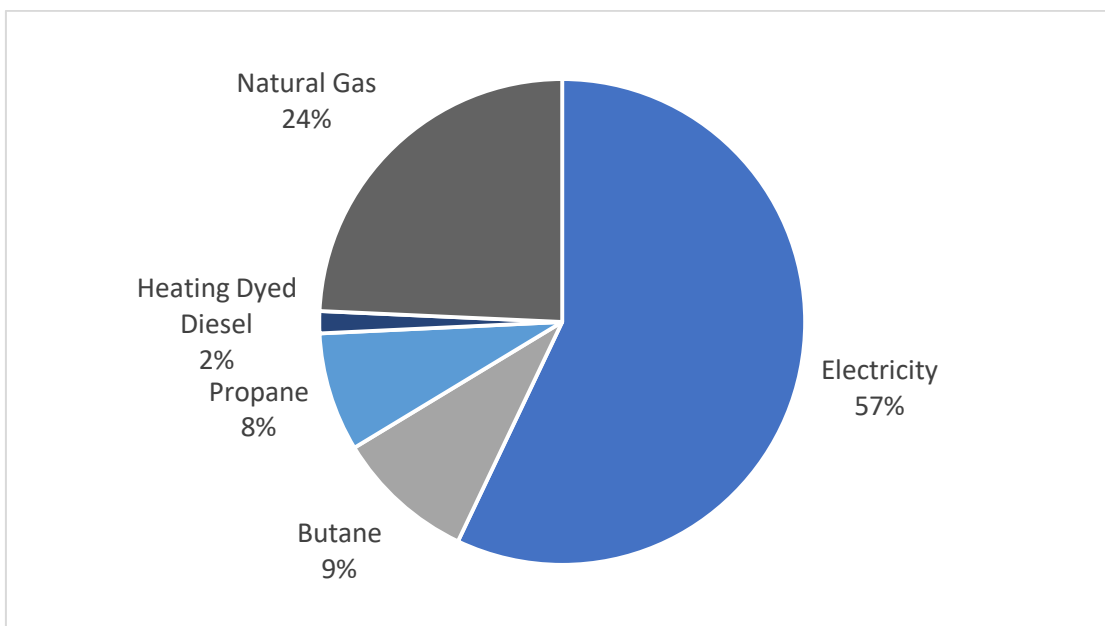


Figure 4 - Domestic consumption of energy per source, in the LMA, 2015.
Source: (INE, DGEG, 2010)

Table 8 - Domestic consumption of energy per source, in the LMA, Setubal and Lisbon areas, 2015.

	Electricity (tep)	Butane (tep)	Propane (tep)	Heating Dyed Diesel (tep)	Natural Gas (tep)
Setubal	79,959	12,687	9,661	3,501	24,705
Lisbon	207,214	34,009	30,158	3,904	97,497
LMA	287,172	46,697	39,819	7,404	122,202

Source: (DGEG, 2015)

Clearly, electricity has the most important share in domestic consumption, accounting for more than half of total consumption. This reflects the increasing “electrification” of the domestic context. Natural gas follows, with around one quarter of total consumption and finally smaller contributions from butane, propane and diesel for heating.

The Portuguese building stock presents a poor thermal performance and most of the dwellings are dependent on active climatization to guarantee minimum comfort conditions. According (Lopes & Joanaz de Melo, 2012), there is an enormous climatization energy saving potential through residential buildings rehabilitation that was estimated in 71% of the actual energy consumption. As depicted in Figure 5, the major energy consumption is verified in winter to satisfy heating needs and its distributions is heterogeneous among Portuguese regions, presenting a higher concentration in the regions with high density of population as it is the case of the region of Lisbon (LxLitO) and the urban areas in the coastal north of Portugal (LitN). The regions from the interior of Portugal (TransN and NE) where the climatic conditions in winter are more severe are also regions with significant energy heating needs.

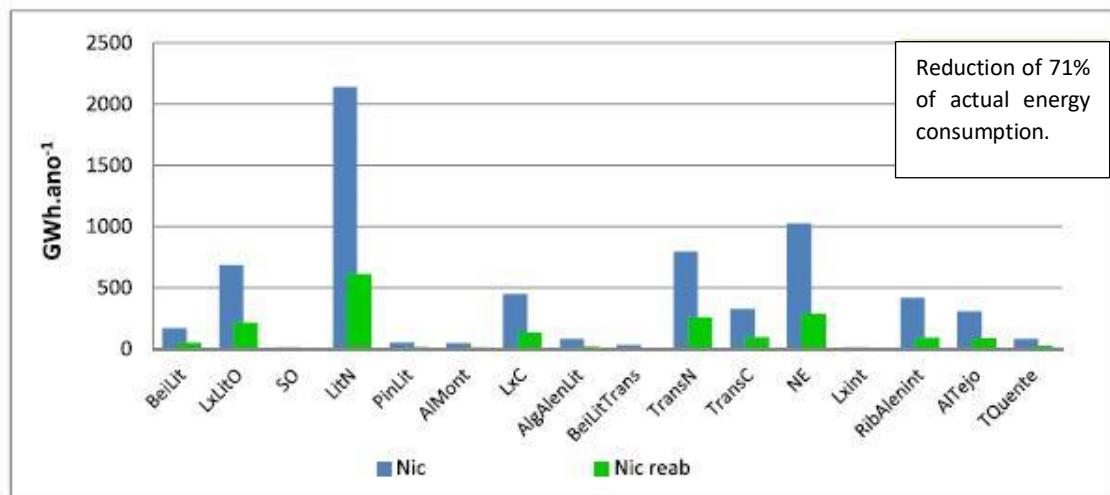


Figure 5 – Regional distribution of energy needs for heating, 2012
Source: (Lopes & Joanaz de Melo, 2012)

The same study reveals that urban energy rehabilitation would improve drastically the energy performance of the buildings. The number of buildings in 2012 that was estimated to be above the energy efficiency patterns were just 22% of the national building stock. If energy renovation measures were applied, 57% of the national building stock would improve their energy classification and therefore 79% of the buildings would be classified according the required energy efficiency patterns (energy efficiency class B and B-). However, these improvements are variable among regions and for the case of the LMA region, classified in this study as LxLitO, 25

% of their buildings would move to the energy efficiency classes B and B-, representing a share total of 87% of buildings with higher energy performance (Figure 6).

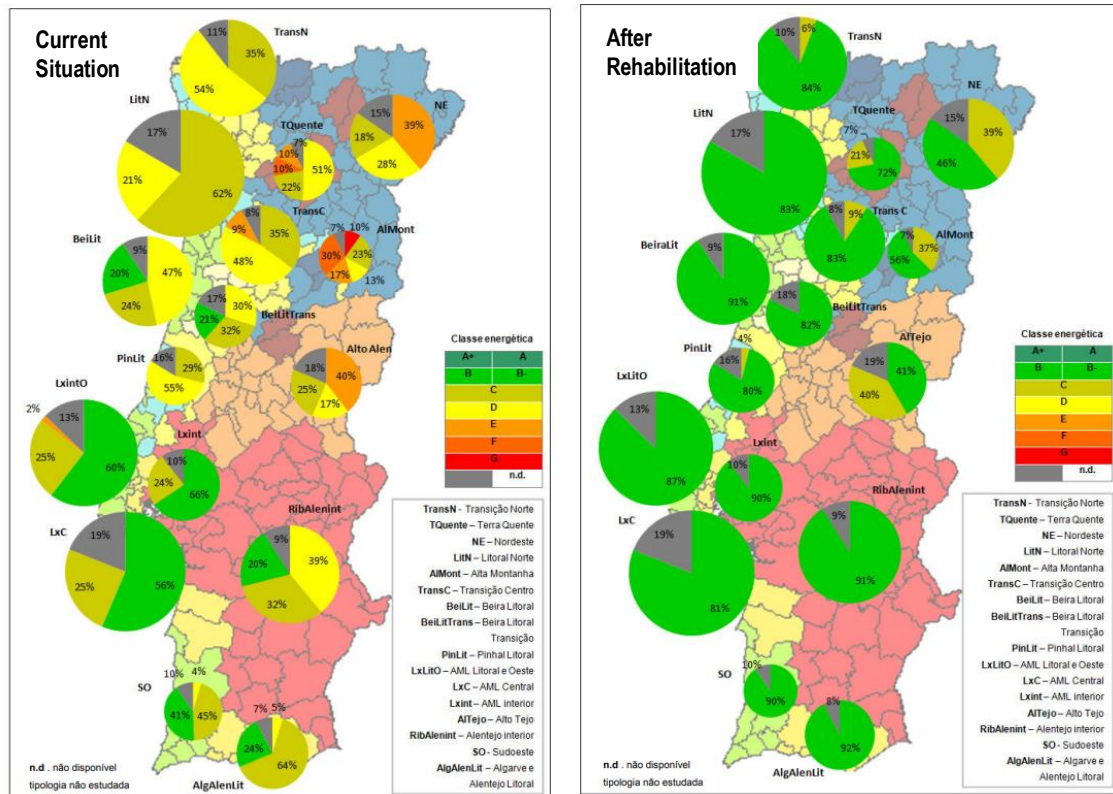


Figure 6 – Regional distribution of energy needs for heating, 2012
Source: (Lopes & Joana de Melo, 2012)

The Energy Performance Certificates (EPCs) as an integral part of Energy Performance of Buildings Directive (2002/31/EC1; 2010/91/EU2) is an important instrument to increase the energy performance of buildings and a useful tool to target incentives for thermal refurbishment activities (BPIE, 2015). In Portugal, until the implementation of the recast EPBD (December 2013), the number of issued EPCs exceeded 600,000 certificates and more than 672,000 certificates have been produced since 2014 to 2017. The annual average number of certificates issued from 2007 and 2013 was about 89,000 and from 2014 to the current year the annual average increased to 168,000 certificates (ADENE, 2017). The increase in the certification activity is mainly due to the obligation requiring buildings to have an energy class when being advertised for rent or sale.

Looking at the LMA region, Figure 7 presents the number of Energy Performance Certificates (EPC) in dwellings located within this region, while also specifying values for Lisbon and Setubal areas.

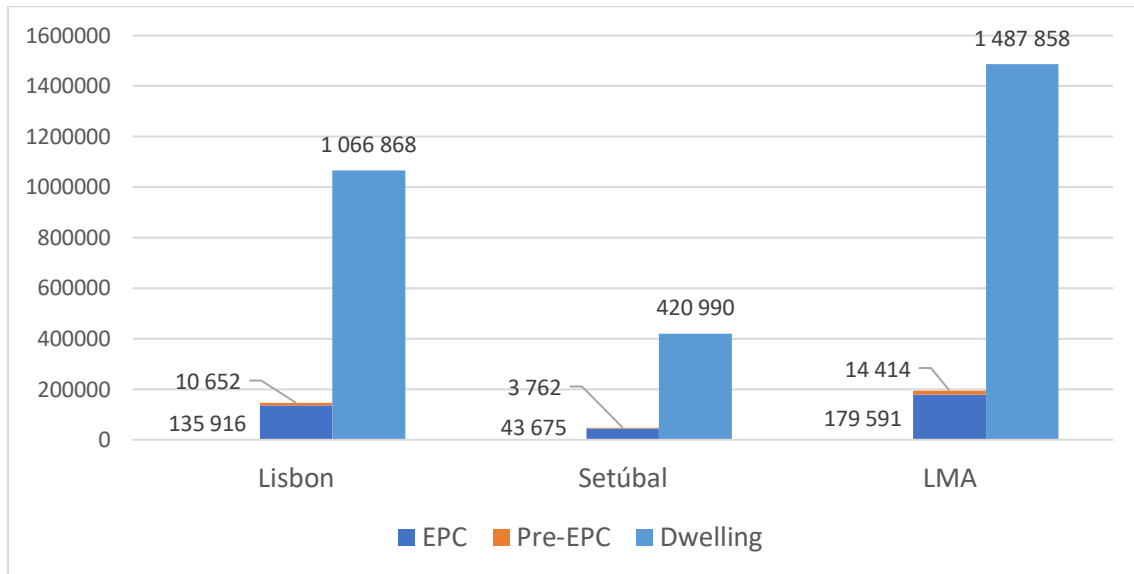


Figure 7 - Energy Performance Certificates in dwellings of the LMA, Lisbon and Setubal areas, 2017.
Source: (ADENE , 2017)

As seen above, only about 15% of the total dwellings in the LMA are either certified or will become soon. Assessing the energy performance of the dwellings is critical to ensuring information is available to address the real depth of the energy consumption related issues and to roll-out appropriate policy and support instruments.

2.4 Thermal comfort in residential buildings

Thermal comfort is an important factor that cannot be disregarded in urban energy renovations interventions due to its impact on human health and because it is a relevant driver of decisions about owners and tenants' investments. Thermal comfort is strictly connected with environmental factors such as air temperature and humidity and with personal factors like clothing insulation and metabolic heat. Nevertheless, thermal comfort inside the buildings specially related with high temperature and draught could be often improved through measures introduced to improve energy efficiency in buildings. It is therefore very important to ensure that indoor air quality is treated with the same level of importance as energy efficiency, since investments in energy renewal and in improving comfort reinforce each other (BPIE, 2015)

Thermal comfort conditions in Portuguese residential buildings were assessed using a hybrid methodology that includes a bottom-up approach based on key building characteristics (e.g. area, type of walls, bearing structure) to estimate the heating and cooling needs for thermal comfort, while also applying a top-down approach based on statistical data for energy use for each civil parish in the country (Palma, 2017). The gap between the two indicators assesses the level of energy needs satisfaction for standard thermal comfort conditions. For a reference scenario, in which 100% of the households' area and 24-hour climatization was considered, every civil parish had an energy gap higher than 60%, for both heating and cooling. The country's global gap for heating and cooling corresponded to respectively 92% and 96%. Regarding the

municipalities from LMA region, their thermal comfort gap is below the national average registering average values of 83% for heating and 94% for cooling (Figure 8).

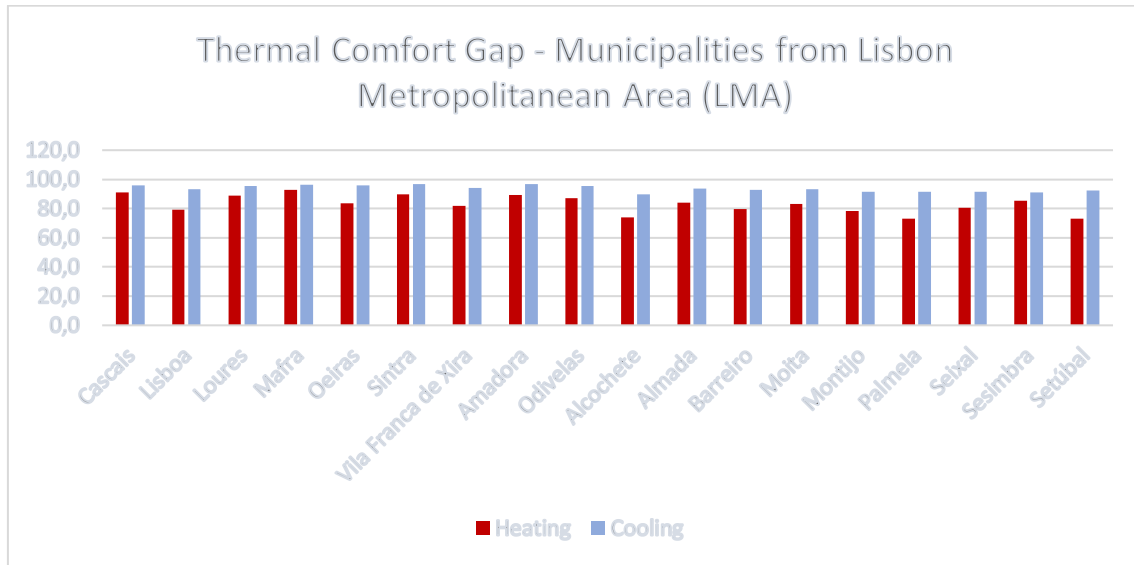


Figure 8 - Thermal comfort gap and energy needs - Municipalities from Lisbon Metropolitan Area (LMA,) 2017.

Source: (Palma, 2017)

The results obtained from this assessment, shed a light on a real problem facing the Portuguese population, especially in the interior lands, where the climate is less mild, with colder winters and bigger temperature ranges. In the actual national context, an analysis is required on policies and actions to reduce the thermal comfort gap.

3. Political goals and commitments

The Energy Union and Climate Action is one of the ten priorities from the EC (Comission, 2016) and one of the most important EU's vector for the implementation of EU Paris Climate Change commitments since two thirds of greenhouse gas emission results from energy production and use. The Energy Union provides an integrated approach supported by a legislation package that pursues three main goals, the prioritization of energy efficiency, the achievement of a global leadership in renewable energies and the empowerment of consumers to enable them to be more in control of their choices.

17

From the perspective of buildings energy renovation, one of the most important initiative within the Energy Union package is the Smart Financing For Smart Buildings. This initiative is focused on the more effective use of public funding through financial instruments addressing market failures, on the aggregation and assistance for large-scale project development and the de-risking of small scale projects to make them more accessible to private finance.

The Energy Union also includes the amendment of the Energy Performance of Buildings Directive (EPBD) (Directive 2010/31 EU, s.d.) that reinforces and integrates the provisions on long-term building renovation strategies considered in article of 4 Energy Efficiency Directive (EED) (2012/27/EU, s.d.), supporting the mobilisation of financing and creating a clear vision for a decarbonised building stock by 2050. The amendment considers measures to support private sector investors with more reliable information including improvements on buildings energy performance certificates, the collection on energy performance consumption data of public buildings and further development of long-term renovation roadmaps to orient investment decisions. The implementation of this legislation will contribute for the acceleration of buildings renovation rates and to provide higher comfort levels and wellbeing for their occupants. The improvements on energy performance of buildings also has a major impact on affordability of housing and energy poverty.

Framed by the European energy and climate policy, the Portuguese goals and commitments in terms of buildings energy renovation, are expressed in several programmes and initiatives. The National Programme Territorial Planning Policy 2018 (NPTPP) is the top instrument of the territorial management system, that defines objectives and strategic options for territorial development and establishes the model of organization of the national territory. The NPTPP constitutes the reference framework for other territorial programs and plans and is a guiding tool for strategies with a territorial impact.

The development of an integrated policy regarding buildings energy renovation is clearly expressed in NPTPP, through measure for the promotion of an integrating housing. This measure is directly linked to two of the six main territorial management problems identified in the programme regarding the need to improve energy efficiency and reduce carbon intensity as well as to the need to reduce failures in the access to housing (DGT, 2018). In this context, NPTPP establishes the links to national strategies and programmes references, highlighting the following:

National Energy efficiency Action Plan (NEEAP) (2017-2020):

NEEAP is a triannual plan that reports to the European Commission the expected and achieved results regarding energy efficiency at the level of energy supply, transport and distribution and its end-use in order to achieve the national energy efficiency objectives referred in EED, number

1, article 3. The action plan for energy efficiency in buildings is identified considering different measures for public buildings and residential buildings. For the residential buildings it was elaborated a detailed diagnosis of the national building stock and it is currently ongoing an updated version of National Strategy for Buildings Renovation according article 4º EED. The focus of energy rehabilitation of existing buildings should lie in the following aspects: 1) rehabilitation of passive components of buildings, improvement of comfort conditions and reduction of energy poverty, 2) replacement of inefficient equipment and maintenance of new equipment, 3) promotion of renewable energies to reduce costs with energy consumption and improve energy independence. As a way of operationalizing and monitoring these measures, stands out the important role of the legal framework in force, namely with the Energy Performance Certificate System and the energy performance regulation of residential buildings and of commerce and services (República Portuguesa, 2017).

National Plan of Climate Change (NPCC) (2020):

NPCC is a second-generation plan which is central for the integration of climate change policy mitigation into sectorial plans ensuring compliance with national and international commitments in terms of climate change goals. This policy instrument was developed in articulation with Commitment to Green Growth (CGG)⁶ and its main goals are: 1) the promotion of a transition for a low carbon economy, 2) ensure a sustainable path to reduce national greenhouse gas emissions in order to reach between 18% and 23% in 2020 and 30% to 40% in 2030, based on 2005, 3) promote the integration of mitigation policies into sectorial policies. One of the three strategic vectors of the NPCC are the building stock alongside with mobility and public procurement.

Since the NPCC is a plan that results from the compilation of other plans, for the case of buildings, the NPCC and the CGG are adopted as the main documents of reference regarding energy efficiency measures for buildings and the use of renewable energies. In terms of land use planning and urban planning, the document of reference is Sustainable Cities 2020⁷, taking into account the promotion of urban rehabilitation associated with the introduction of renewable energy in buildings and the use of construction solutions that promote greater energy efficiency and improve thermal comfort (Resolução Conselho de Ministros nº56/2015, s.d.).

New Generation of Housing Policies (NGHP-April 2018):

NGHP is the new legislative package approved in April 2018, that aims to ensure everyone's access to adequate housing and to create the conditions for rehabilitation to go from exception to rule. To pursue this goal, it is intended to eradicate the most serious shortages, to enlarge the public support to the building stock as well as the universe of beneficiaries, to reduce the percentage of tenants in situation of overload with the housing costs, to promote the full use of the building stock.

⁶ CGG, is a national strategy based on a development model that promotes economic growth associated with sustainability and competitiveness. The commitment establishes Green House Gas (GHG) emission reduction of 30% to 40% compared to 2005.

⁷ Sustainable Cities 2020 is a national strategy that defines the main lines of sustainable urban development for the period 2014-2020. This document recognizes the important role of cities for the development of the national territory and integrates a set of operationalization and evaluation tools.

For NGHP one of the four strategic objectives is to make rehabilitation the main form of intervention in building and urban development. Therefore, NGHP adopts several policy instruments (Resolução Conselho de Ministros 50-A/2018, s.d.):

- *1ª Direito* is dedicated to the promotion of housing solutions for people living in undignified housing conditions who do not have the financial capacity to afford the cost of access to adequate housing.
- *Reabilitar para arrendar*, aims at the rehabilitation financing in conditions favourable to the market.
- *Financial Instrument for Urban Rehabilitation and Revitalization (IFRRU 2020)*, which supports integral rehabilitation of buildings, including residential buildings and the public rental park, within Urban Rehabilitation Areas defined by the municipalities or framed in an Integrated Action Plan for the Disadvantaged Communities.
- *Casa Eficiente 2020*, which involves financing, in favourable conditions to the market, operations that promote the improvement of the environmental performance of buildings or fractions of housing.
- Strategic Urban Development Plans / Urban Rehabilitation Action Plans (they support the contracting of municipalities with financial support for interventions).
- Program of Urban Rehabilitation of Social Neighbourhoods in the Energy Efficiency Strand, which supports interventions aimed at increasing energy efficiency and the use of renewable energies for self-consumption in social housing buildings.

4. Demand-side characterization

4.1 Rehabilitation needs

The 2012/27/UE Parliament and Council directive, from the 25 October 2012, related to energy efficiency, establishes through its fourth article the necessity for a “long-term strategy to mobilize investment in the renovation of the national building stocks, private or public, commercial or residential”. That strategy is included in a wider strategy which aims to promote the energy efficiency and renewable energy increase, as found in the Portuguese Minister Council Resolution 20/2013, from the 20th August 2013, which is based on the following pillars (DGEG, 2014):

- Supply safety;
- Economical sustainability;
- Environmental sustainability.

In 2012, Portugal’s building stock grew on the basis of new buildings, with the relative weight of rehabilitation within the construction sector representing just 8%, a small percentage when compared to the EU-28 average of 26% (EGIFRRU, 2017). Nevertheless, about 900,000 buildings (about 27% of total stock) presented rehabilitation needs, with more than 380,000 needing mild to deep interventions, on a country wide basis (INE , 2011).

There is a clear lack of regeneration in urban areas in Portugal, with a high percentage of buildings with needs for repair works. Some of the main reasons for this situation are listed below:

- Abandonment of historic centres;
- Obsolescence of ‘central’ dwellings;
- Lack of infrastructure and in particular parking and public space;
- Central areas of cities out of the housing markets;
- Urban planning prioritizing new construction over rehabilitation.

As mentioned previously in section 1.2, 70 % the Portuguese building stock was built before 1990 which is a period with no Portuguese thermal building codes. In this context, there are significant repair needs, due to a lack of conservation measures and the advanced state of degradation. The reduced investment in buildings’ maintenance and conservation leads to a regeneration need in urban areas, to fix the abandonment of historic centres’ and the lack of infrastructure in those areas (INE, LNEC, 2013).

Table 9 introduces some more detailed data on the conservation state of the building stock in Portugal and the respective regions of interest for the current analysis. As seen in Table 9, a significant 30% of the total building stock in the LMA needs some level of repair intervention, with the majority requiring light repairs (19%). The scenarios are comparable in Lisbon and Setubal, with the same shares for each repair need level, changing only the absolute number of buildings, as there are more buildings in Lisbon, as was seen in previous sections.

At a national level, in 2011 about 1 million buildings needed intervention within the Portuguese building stock, due to their poor state of conservation. From within this universe, 400,615 buildings required moderate or deep repair interventions or were very degraded, constituting thus a privileged object for rehabilitation interventions.

Table 9 - Buildings' conservation state in Portugal, LMA, Lisbon and Setubal regions.

	No need for rehabilitation	With need for rehabilitation			Very degraded
		Light repair	Moderate repair	Deep repair	
<i>Lisbon</i>	192,456	54,023	19,790	6,849	4,269
<i>(%)</i>	69%	19%	7%	2%	2%
<i>Setubal</i>	123,010	31,804	10,612	3,788	2,356
<i>(%)</i>	72%	19%	6%	2%	1%
<i>LMA</i>	315,466	85,827	30,402	10,637	6,625
<i>(%)</i>	70%	19%	7%	2%	2%
<i>Portugal</i>	2,519,452	624,322	244,303	97,157	59,155
<i>(%)</i>	71%	18%	7%	3%	2%

Source: Census, INE, 2011.

Another relevant data that should be taken in consideration when addressing the rehabilitation needs of the building stock is the Energy Performance Certificates (EPC). In Portugal, until January 2018, the total amount of EPCs emitted is over 760,000 and 74% of those are below current European energy efficiency standards according to ADENE's data. In the LMA this percentage is even higher reaching 80% of the building stock in a total of 251,249 certificates emitted, as shown in table 10.

Table 10 – Number of certificates emitted in the Lisbon Metropolitan Area until January 2018 disaggregated by BER.

LMA	Energy Performance Certificates	Energy efficiency classification	
		A+ to B-	C to F
Buildings	32,814	10,362	22,452
Dwellings	218,435	29,123	178,649
TOTAL	251,249	39,485	201,101
%	100%	16%	80%

Source: ADENE, 2018.

In the table above, it is also possible to see that dwellings are the neediest of intervention with over 178,000 certificates below B- rating in a total of 218,435 (82%). In comparison, in a total of 32,814 buildings this percentage is lower (68%), although it is still a high number.

Regarding the difference between households and services in LMA the gap in energy efficiency is notorious in household's certificates. In fact, this sector is the one contributing for the highest percentage of certificates with low energy performance emitted (83% of a total 219,153 certificates) as shown in below table.

Table 11 – Number of certificates emitted in the Lisbon Metropolitan Area until January 2018 in Households and Services, disaggregated by BER.

Households	Certificates	Energy Rating		Services	Certificates	Energy Rating	
		A+ to B-	C to F			A+ to B-	C to F
Buildings	29,565	8,662	20,903	Buildings	3,249	1,700	1,549
Dwellings	189,588	18,856	160,069	Dwellings	28,847	10,267	18,580
TOTAL	219,153	27,518	180,972	TOTAL	32,096	11,967	20,129
%	100%	13%	83%	%	100%	37%	63%

Source: ADENE, 2018.

4.2 Sub-optimal investment and level of investment required

The results and conclusions presented in this subchapter are based on the ex-ante study developed for IFRRU (Sociedade de Consultores - Augusto Mateus & Associados, 2015). The sub-optimal investment in urban regeneration that justified the intervention and the implementation of an innovative financial instrument – IFRRU- was assessed taking into consideration several indicators. It was analysed the level of investment in the construction sector that shows a reduction of more than 40 % between 2000 and 2014 while in the euro zone it increased 20% for the same period. In nominal terms, for the period 2000-2014 and using as reference index the year 2000, gross formation of fixed capital in the construction sector, decreased by 60% in Portugal while in the Euro zone, despite fluctuations over the period, has increased by 20% in 2014 (Figure 9). This negative variation shows the fragility of construction sector in Portugal with a decrease in production capacity naturally associated with a loss of investor confidence.

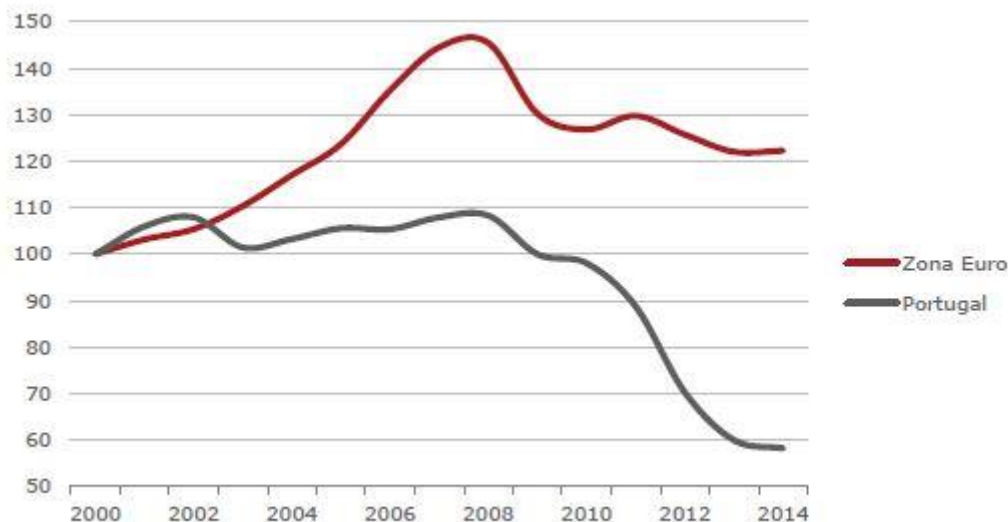


Figure 9: Evolution of gross fixed capital formation GFCF in the construction sector in nominal terms (2000 = 100), between 2000 and 2014

Source: (Sociedade de Consultores - Augusto Mateus & Associados, 2015)

Concerning the relevance of the urban rehabilitation segment in the construction sector, according to AECOPN, although there has been an increase in the number of interventions in recent years, its weight is only 7% of the total gross value in the construction sector. At European level, the *Euroconstruct* estimates that the average weight of housing rehabilitation in all the countries that comprise it, is 27.7%.

The sub-optimal level of investment in urban renewal in Portugal is evaluated in three studies that deserve to be highlighted ((Sociedade de Consultores - Augusto Mateus & Associados, 2015):

- “O Parque habitacional e a sua reabilitação – Análise e Evolução” (INE e LNEC);
- “Estudo prospetivo do mercado da reabilitação urbana e guia de boas práticas” (AICCOPN);
- “Fazer acontecer a regeneração urbana” (CIP).

In these studies, are identified several factors that justify the existence of a sub-optimal level of investment in urban regeneration in Portugal:

- an inefficient and complex regulatory framework, leading to a downturn of potential investors in urban rehabilitation. This situation is verified both for the execution of the options and in terms of the legal framework of the lease.

- difficulty in financing operations. Urban rehabilitation projects are usually perceived as having a higher risk and with a lower rate of return, either because renovation costs are higher than in new construction, or because interventions are more complex in terms of safety and comfort. investors, such as banks in general, perceive the risk as superior to the financing of new construction.

- Structural quality of the interventions. The renovation market is composed by small businesses that invest in shallow renewals and lower risk. As urban rehabilitation operations are perceived as being at greater risk, investors tend to be available only for small-scale operations with less quality and thus less financially risky.

- difficulty in the access to credit by the owners, due to the high interest rates and the collateral demanded by the bank.

In this context, it is justified the need to diversify funding sources and find new models of sharing the risk.

The information analysed reveal that the investment in urban rehabilitation in Portugal shows sub-optimal levels when compared with the other countries of the European Union (Sociedade de Consultores - Augusto Mateus & Associados, 2015).

5. Supply-Side - main financial instruments

Financial Instruments (FI) form an efficient way to manage resources in cohesion policy, contributing to the delivery of the Europe 2020 objectives. Financial Instruments provide support to investment through loans, guarantees, capital and other risk covering mechanisms, possibly also combined with technical assistance, interest rate subsidies or subsidies on guarantee fees.

24

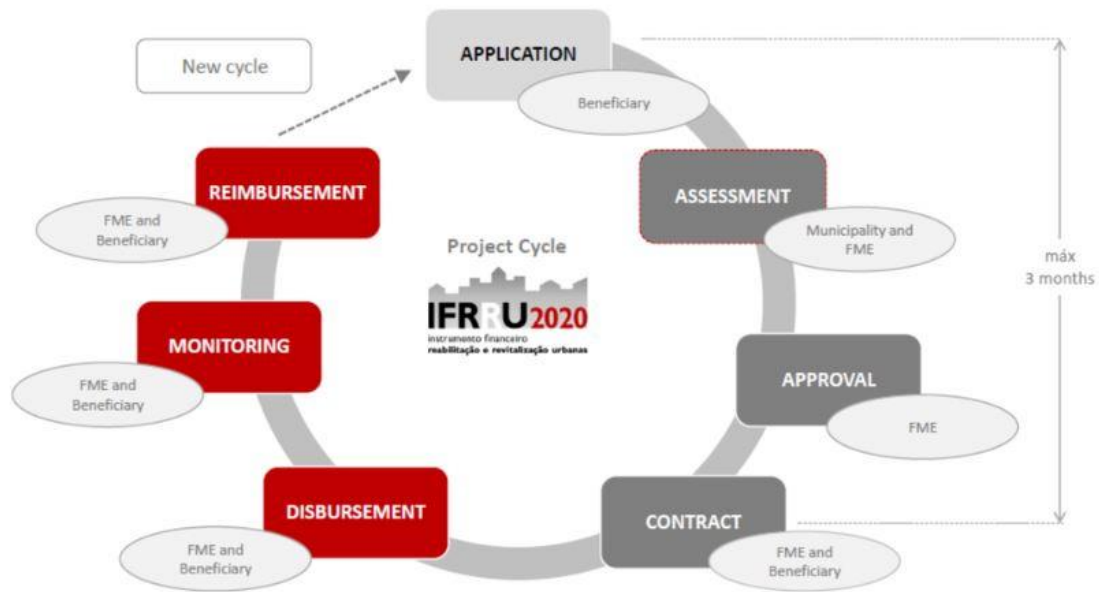
However, beyond the advantages from the possible recycling of long-term funds, FI should help mobilise increased public or private co-investment aimed at addressing market failures. In this regard, the structural design of financial instruments necessitates new experience and knowledge from the traditional skills required for managing EU funds. The goal is to ensure that the assignment of resources is efficient and generates incentives to improve performance, including greater financial discipline in the projects being financed.

Given these requirements, European regulation in this new programme period requires that decisions to finance support measures through Financial Instruments be based on an ex-ante assessment. This assessment should demonstrate the existence of market failures and the estimated level and scope of public investment needed.

Regarding the current situation in Portugal, and in Lisbon in particular, there are 5 FI's available to the owners to help them invest in the rehabilitation of their buildings or dwellings.

5.1 IFRRU 2020

IFRRU 2020 is a financial instrument designed to support investments in urban rehabilitation, in the whole Portuguese territory. IFRRU 2020 brings together various sources of funding to boost investment, both European funds from PORTUGAL 2020 and funds from other entities such as the European Investment Bank and the Council of Europe Development Bank, combining them with commercial banking resources (Figure 9).



* FME = Financial Managing Entity (i.e. Banks and the entity responsible for managing the Guarantee product)

Figure 9 – IFRRU project cycle, including the decision process, the financing, and the reimbursement.
Source: www.portaldahabitacao.pt/pt/portal/reabilitacao/ifrru/index.html.

Any entity, whether natural or collective person, public or private (including condominiums), with a title that gives her/it the power to carry out the intervention, can apply to this FI. The support is provided through financial products of two types (not cumulative):

- Loans - provided by the financial entities selected to manage IFRRU 2020 support, with maturities of up to 20 years, grace periods equivalent to the investment period + 6 months (max. 4 years), and interest rates below market rates;
- Guarantees - associated with loans provided by the same selected financial entities, for projects that do not have sufficient guarantee.

Tax benefits already foreseen in the Portuguese law associated to the location and nature of the intervention may be also applicable, namely related to estate taxes and VAT.

The selected types of interventions that can be financed are:

- Overall rehabilitation of buildings aged 30 years or more (or in the case of younger buildings, with a conservation level of 2 or less, according to Decree-Law no. 266-B/2012, of 31st December);
- Rehabilitation of abandoned industrial spaces or units;
- Rehabilitation of private units integrated in an overall rehabilitation of a social housing building;

In the same funding application, IFRRU 2020 supports energy efficiency measures complementary to urban rehabilitation interventions. The renovated buildings can be used for any purpose, such as housing, economic activities and equipment for collective use.

All expenses related to the urban rehabilitation intervention and the energy efficiency measures are eligible. There are other factors to be taken into account in order to have an application eligible:

- If the building use is intended for housing: must be located in the territory defined by the Municipality in *Plano de Ação de Regeneração Urbana (PARU)*, which is an Urban Rehabilitation Action Plan that covers historic centres, riverside areas or abandoned industrial areas, or similar plan in the Portuguese autonomous regions;
- If the building use is not intended for housing: it has just to be located in an Urban Rehabilitation Area (ARU) delimited by the Municipality;
- If it is a private unit integrated in a social housing building: must be located in the area delimited by the Municipality in *Plano de Ação Integrado para as Comunidades Desfavorecidas (PAICD)*, which is an action plan that covers the most unfavoured communities.

In order to prepare an application for financing, 3 steps are needed:

1. Request for the opinion of the Municipality of the location of the property

Since every project has to be located in an Urban Rehabilitation Area (ARU) and additionally (to be supported by European Funds) be located in the area defined in "*Plano de Ação de Regeneração Urbana (PARU)*" or "*Plano de Ação para as Comunidades Desfavorecidas (PAICD)*" – plans that are approved by each Municipality-, all projects must be assessed by the Municipality services where the project is located.

Thus, it is required to contact the respective Municipality, in order to obtain their binding opinion related to the framework of the project.

2. Energy Certificate of the property before the intervention by an expert

All projects supported by IFRRU 2020 must contribute for increasing the energy performance of the renewed building. In order to assess this, it is necessary to carry out an energy certification before and after the intervention. Qualified experts are instructed to do so. Thus, you only have to inform the expert that you intend to apply for IFRRU 2020.

Therefore, prior to the request for funding, the candidate must either certify the building/units or update an existing energy certificate, through one of the experts qualified by ADENE.

The audit carried out by the expert this certification will identify the current energy performance of the building and, specifically for housing buildings, the measures that result in the best balance between cost and benefits in energy efficiency. Expenditure on energy certification is an eligible expenditure under IFRRU 2020.

3. Request for financing from the financial entity

The application for IFRRU 2020 is submitted directly to the selected banks:

- Banco Santander Totta
- Banco BPI
- Banco Comercial Português (Millennium BCP)
- Banco Popular Portugal

Applications shall be submitted to the selected banks through their commercial network at any time, that is, without prior application periods and without limits to the number of applications per candidate.

5.2 PORTUGAL 2020

PORTUGAL 2020 is a partnership agreement signed by Portugal and the European Commission, that gathers the action of 5 European Structural and Investment Funds - ERDF, Cohesion Fund, ESF, EAFRD and EMFF - in which the programming principles are set out to mark the economic, social and territorial development policy to be promoted in Portugal between 2014 and 2020.

These programming principles are aligned with the Smart, Sustainable and Inclusive Growth pursued by *Europe 2020 strategy*.

Portugal shall be awarded 25 thousand million euros until 2020 and for this it set out the thematic goals to stimulate the growth and the creation of employment, the necessary interventions to execute them and the undertakings and the outputs expected as a result of these funding.

Portugal 2020 programming and implementation are developed around four thematic domains: - Competitiveness and Internationalization; - Social Inclusion and Employment; - Human Capital; - Sustainability and the Efficient Use of Resources. The Agreement also takes into account the cross-cutting dimensions related to public administration reform and an integrated intervention approach at the territorial level.

The main policy goals of *Portugal 2020* are the following:

- To boost the economy through the promotion of tradable goods and services as well as incentivizing the exports;
- To reinforce the connection between the scientific system and the productive system;
- To improve social condition, decreasing early school leaving levels, integrating people at risk of poverty and combating social exclusion;
- To promote sustainable development in terms of resource use efficiency and strengthening territorial cohesion;
- To modernize and empower Public Administration.

At the Portuguese authorities' initiative an ex ante assessment of the partnership agreement, was undertaken, based on an interactive process that strengthened the scrutiny of the major strategic choices.

In terms of eligibility to the European Investment Funds (ERDF, Cohesion Fund, ESF, EAFRD and EMFF), the 7 regions of Portugal are sub-divided in:

- Less developed regions (GDP per capita < 75% EU average): North, Center, Alentejo and Algarve. Azores - Funds Co-Funding Rate: 85%
- Regions in transition (GDP per capita between 75% and 90%): Algarve Funds Co-Funding Rate: 80%
- More developed regions (GDP per capita > 90%): Lisbon and Madeira Funds Co-funding Rate: 50% (Lisbon) and 85% (Madeira)
- Less developed regions (GDP per capita < 75% EU average): North, Center, Alentejo and Azores

Portugal 2020 shall be operationalized through 16 Operational Programmes plus the Territorial Cooperation Programmes in which Portugal shall participate together with the other Member-States. For the whole country will be allocated 25 thousand million euros until 2020 for the

totality of the funds which shall be allocated within the scope of each of the 16 Operational, thematic and regional programmes. In Lisbon region the total amount is 833 million euros.

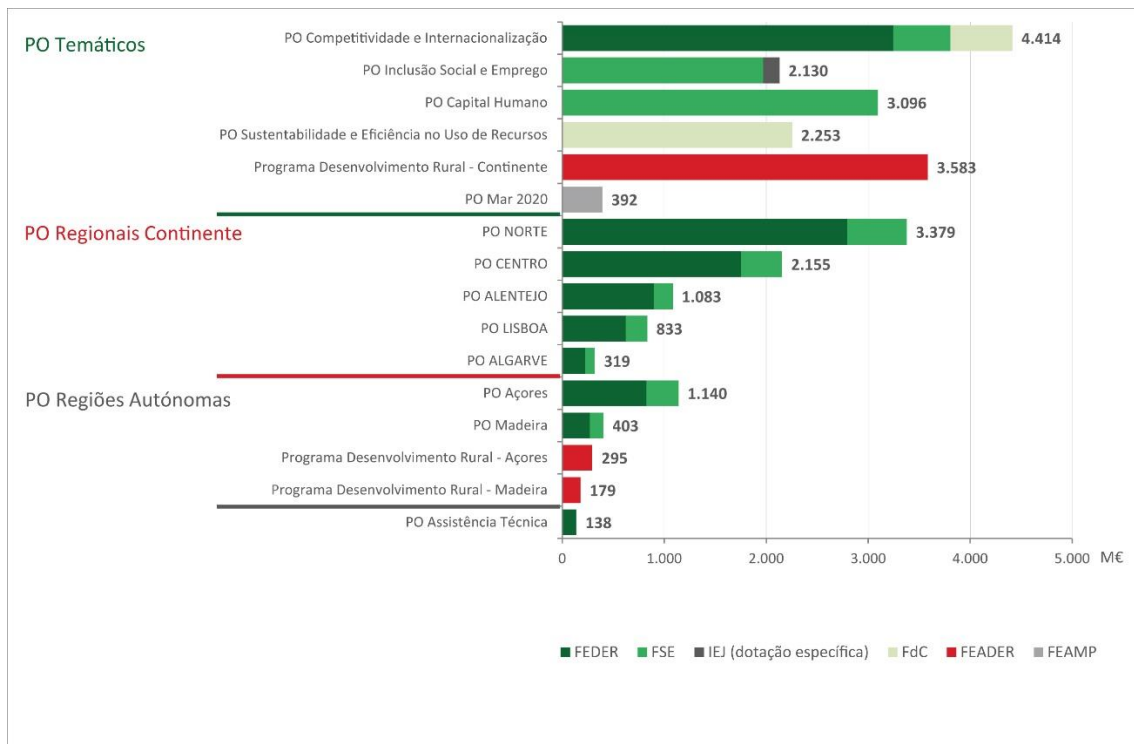


Figure 10 – Portugal 2020 - Funds distribution by 16 operational programmes.
Source: <https://poseur.portugal2020.pt/en/portugal-2020/>

5.3 Reabilitar para Arrendar

The "Reabilitar para Arrendar" program ("Rehabilitate for Lease - Affordable Housing" in English) (IHRU, 2012), aims to finance the rehabilitation of buildings with an age equal to or greater than 30 years, which, after rehabilitation, should be destined predominantly for housing purposes. These fractions are intended for rent under a conditional income regime.

This program has an initial allocation of € 50 million, with the financial support of the European Investment Bank and the Development Bank of the Council of Europe. Natural or legal persons, whether private or public, who are owners of buildings, or parts of buildings to be rehabilitated, or who demonstrate that they have rights and powers over it to enable encumber them, may apply for this program and act as contractors in the scope of works contracts.

All building over 30 years old, preferable located within rehabilitation urban areas and destined to conditional rental market are eligible to apply, since they are free of debts and the proposed measures are viable and sustainable.

The total loan may reach 90% of the total investment and may be repaid up to 15 years in 180 monthly payments of equal amount. In addition, there is 20% of advance in the loan if required. During the amortization period the interest rate is fixed since the first day, and the building is the only guarantee necessary for the loan. The total amount per square meter must not exceed 700 €.

5.4 Fundo Nacional de Reabilitação do Edificado

The National Fund for Building Rehabilitation (FNRE) - the first Portuguese fund to be constituted by funds - is a Government commitment (República Portuguesa, 2017), being one of the programs that make up the New Generation of Housing Policies. It was released more than a year ago, in April 2016, but has not yet started operating. Its constitution, however, is in an advanced state.

It aims to recover real estate in the city centres and place them in the rental market with more affordable rents than those practiced on average. This always guarantees profitability to the institutions and individuals that will subscribe the FNRE, recalls *Publico* newspaper.

One of the institutions that will invest in the FNRE is the Social Security Financial Stabilization Fund (FEFSS), which had planned to invest 50 million euros this year.

According to the publication, which is based on information collected from *Parpública*, *Fundiestamo*, which will be the managing company of the FNRE, has identified properties with the potential to integrate the sub funds, in collaboration with public entities, local authorities and institutions Individuals of Social Solidarity.

"In addition, it has already selected real estate appraisers as well as companies that will draft business plans and a pool of technicians who will care for the quality of rehabilitation projects. Likewise, the auditor and the depositary entity are also chosen", a source linked to *Parpública* revealed.

When the fund will be available, it is expected to mobilize around 1,400 million euros and rehabilitate 1,000,000 m² in households (8,000 m²) and services (200,000 m²).

5.5 CASA EFICIENTE

"CASA EFICIENTE" project provides funding for the environmental improvement of private housing in the fields of energy efficiency, water efficiency and urban waste management (República Portuguesa, 2018). The interventions cover the envelope of the building as well as its systems. The program could be applied by owners of buildings or dwellings, as well as their condominiums, covering all the national territory.

The Program is promoted by the Portuguese State and co-financed by the European Investment Bank and several commercial banks acting as financial intermediaries between the EIB and the beneficiaries. "CASA EFICIENTE" is run by CPCI - Portuguese Confederation of Construction and Real Estate. Its execution has the technical support of APA - Portuguese Environment Agency, EPAL – Portuguese Company of Water (who provides several Municipalities of LMA and around Tagus river) and ADENE - Energy Agency.

During the period 2018-2020, the total amount of funding for the program is € 200 million, of which 50% is from the EIB and the remaining 50% from commercial banks.

The expected results integrate environmental and economic objectives.

At the environmental level, it is expected:

- Improve the energy efficiency of the housing stock;
- Promote the use of renewable energies;

- Improve the water efficiency of the housing stock;
- Optimize the management of solid urban waste;
- Remove materials harmful to health and the environment;
- Increase the quality of the building and its habitability;
- Encourage environmentally responsible behaviour.

At the economic level, it is expected:

- Dynamize the construction industry;
- Promote all construction line;
- Create more jobs opportunities.

The following table summarizes the five FI described above showing the main features of each one. For all five programs, it was identified characteristics such as the fund size, who are the promoters, beneficiaries and managers of each fund and the target/intervention sector. The large scope of interventions covered by IFRRU 2020 and complemented by the other programs, as it is the case of CASA EFICIENTE and REABILITAR PARA ARRENDAR, covers the six major situations that were identified as market failures in urban rehabilitation.

The study of the above programs scope and also the SWOT analysis about the impact of innovative Financial Instruments on urban energy rehabilitation in Lisbon, described in next chapter, are relevant for the conclusions of this document.

Table 12 – Main characteristics of each FI available in Portugal for rehabilitation and energy efficiency

PROGRAM	IFRRU 2020	Portugal 2020	Reabilitar para Arrendar	Fundo Nacional de Reabilitação do Edificado	Casa Eficiente
CHARACTERISTICS					
Fund Size	1,450 M€	25,000 M€ (2014 to 2020)	50 M€ (initial)	1,400 M€	200 M€
Target	Buildings	Buildings	Housing	Housing	Private Housing
Intervention Sector	Rehabilitation and energy efficiency measures	Sustainability and efficiency in resources use; Social Inclusion and Employment	Rehabilitation	Rehabilitation	Sustainability and efficiency in resources use; renewable energy use, urban waste management
Geographical Area Covered	Whole Portuguese territory	Whole Portuguese territory (divided in 7 Regions)	Whole Portuguese territory, preferably in Urban Rehabilitation Areas (URA)	Urban centres	Whole Portuguese territory
Beneficiaries	Any public or private entity	Depends on which fund is financing the project	Any public or private entity	Any public or private entity	Any public or private entity
Promotor	Portuguese State (Ministry of Environment)	Partnership between Portuguese State and the European Commission	Portuguese State	Portuguese State	Portuguese State

Funding	PORTUGAL 2020 + European Investment & Council of Europe Development Banks through commercial banking resources	5 European Structural and Investment Funds: ERDF, Cohesion Fund, ESF, EAFRD and EMFF	European Investment Bank + Development Bank of the European Council	FEFSS + other entities	EIB + private banks
Type of FI	Loans + Guarantees (not cumulative)	Co-funding (until 85% depending of the assigned Fund/Region)	Loans (may reach 90% of total investment)	Through Participation Units	Loans
Market Failures Covered	Rehabilitation of buildings in horizontal property	Rehabilitation for the installation of activities in social neighbourhoods and Urban Rehabilitation Areas (URA)	Housing rehabilitation at controlled costs	Housing rehabilitation at controlled costs	Improving energy efficiency in housing
Manager	IFRRU 2020 Management Commission	Depends on the region	IHRU	Fundiestamo	CPCI

6 SWOT Analysis

In this chapter a SWOT analysis is developed in order to better understand the rehabilitation status in Lisbon and the impact of innovative FI. The SWOT analysis systematize the results of a focus group attended by 30 stakeholders covering local entities, banks, associations of condominiums, municipality of Lisbon, private entities, social housing entities, universities, and public administration. The focus group entitled “Innovative tools to support energy efficiency in urban rehabilitation in Lisbon” was held in Lisbon in February 2018 and it was funded by two European projects, the REHABILITE and the SHAPE Energy. The main goal of the focus group was to identify constraints and opportunities for the successful implementation of innovative FI. The 30 participants were challenged to tell a story about the past and another about the future of with respect to the above themes. The positives and negatives aspects were discussed in group resulting in the main topics identified below:

Table 13 - SWOT analysis about the impact of innovative Financial Instruments on urban energy rehabilitation in Lisbon

	INTERNAL FACTORS	EXTERNAL FACTORS
POSITIVE FACTORS	<p>STRENGTHS</p> <ul style="list-style-type: none"> • Existence of Financial Instruments for rehabilitation such as IFRRU and new financial lines in the banks • Tax benefits for those who improve housing EPC • New legislation with mandatory installation of solar panels in new houses • New generation more aware of EE, its importance and how to be more efficient • Awareness raising among tenants in social neighborhoods 	<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • To rent a house it is mandatory to have an EPC which encourage the owners to rehabilitate to reach a better standard • Municipalities are reducing their property taxes • With the increase of social media usage there is an opportunity to better spread the knowledge regarding FI's available and to share ways to better improve EE • The large number of old buildings indicates a big opportunity to improve EE and to improve thermal comfort • Entities who manage FI's should simplify the rules to apply to facilitate the connection between investors and owners • Governmental entities should establish more laws to benefit EE, like

		<p>reducing the VAT on that investments</p> <ul style="list-style-type: none"> • Social science should play an active role in raising public awareness of EE • One stop shop on building' energy retrofitting might be a solution to reduce barriers between buildings' owners and the adoption of innovative FI.
NEGATIVE FACTORS	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Lack of information on available support lines and difficult to understand the regulations to apply • Architects and designers with little knowledge or not available to reach more efficient conditions at the expense of design • Few good projects for service buildings, one of the largest electricity consumers • Existence of energy poverty • High level of bureaucracy to get financing and to get the projects going • Very old buildings which need deeply rehabilitation, that is very expensive and don't have a viable payback period • Low budget from the owners to pay for rehabilitation of their buildings/dwellings 	<p>THREATS</p> <ul style="list-style-type: none"> • Private investors look to rehabilitation only for a way of profit • Designers need to overcome architecture restrictions to implement their ideas • There is a possibility of non-compliance with the law due to a lack of supervision • Rehabilitation in building's façade threatens the identity of neighborhoods • Focus in EE must not forget security. Either seismic or due to fire

The existence of innovative FI (IFRRU) was recognized by the stakeholders as a major strength for urban rehabilitation given the tax benefits obtained. The bidding requirement to monitoring the EE improvements of these investments through the EPC system is also a very positive aspect. Although there are weaknesses that need to be overcome, such as the case of the lack of

information and its dispersion about how to access new forms of financing and it is also mentioned the difficulty of local authorities in what concern the preparation of applications in the field of EE. The high level of bureaucracy to get financing and to get the projects going it was also another issue that require further measures of improvement. In terms of socio economic constraints stakeholders emphasized the existence of energy poverty and insufficient budget from the owners to pay for rehabilitation of their buildings.

The critical threatens identified by the stakeholders were related with the risk of non-compliance with the rules due to a lack of supervision and the risk of carried out low quality rehabilitation interventions that put in danger the buildings' façade and lately the neighborhoods identity.

Overall the opportunities created by new FI are quite positive. The existence of a large number of old buildings indicates a huge opportunity to improve EE and to improve thermal comfort. The implementation of innovative FI should be supported with new incentives from public administration to benefit EE, like reducing the VAT on that investments.

At the local level it was identified the opportunity to develop energy services more integrated, as it is the case of the energy management model - *one-stop shop on building energy retrofitting* - that might be a contribute to reduce barriers between buildings' owners and the adoption of innovative FI.

As a sum-up of the conclusions gathered on the focus group we highlight that the existence of innovative FI at the national level (e.g. IFRRU) helps to remove barriers to investment in urban renewal and to the enhancement of public funds, although the local-level initiatives are also needed to stimulate demand for these instruments and to ensure that landowners of the buildings have the correct support for the implementation of their renovation projects.



Figure 11 – Focus group organized in Lisbon to evaluate “Innovative tools to support energy efficiency in urban rehabilitation in Lisbon”

7 Market Failures Analysis

The market failures analysis presented in this chapter is mainly based on the rehabilitation gaps assessed during the current study and complemented by the results obtained from the market failures analysis developed during the *ex ante assessment of financial instruments from Portugal 2020 programs* (Sociedade de Consultores - Augusto Mateus & Associados, 2015).

37

Urban regeneration policies in Portugal face several market failures which impede the proper functioning of markets. As previously diagnosed the sub-optimal investment in urban rehabilitation in Portugal when compared with other European countries is maladjusted with the rehabilitation needs evidenced by the Portuguese building stock characteristics. Some of the main reasons that pervert the functioning of rehabilitation markets in Portugal are the desertification of historic centers, the increased obsolescence of downtown housing that no longer meets the needs of the residents, the lack of infrastructures for particular parking and in public spaces, as well as the urban planning policies which until very recently have privileged the construction of new buildings instead of the rehabilitation of the existent buildings. According to the results obtained in the focus group organized under REHABILITE project to evaluate “Innovative tools to support energy efficiency in urban rehabilitation in Lisbon”, this situation has been aggravated by the increase of energy poverty, the difficulty to carry out deep rehabilitation of very old buildings due to long term investment payback period, the lack of capital from owners to invest in the rehabilitation of their buildings.

Considering that urban regeneration is the main engine to revitalize cities in what concern their building stock, the modernization of their infrastructures, the requalification of public space, the reconversion of economic activities as well as the empowerment of local communities, it was systematized several types of situation that requires specific approaches (Sociedade de Consultores - Augusto Mateus & Associados, 2015):

- Historical centers of cities, affected by a complex set of processes that led to the exit of residents, the degradation of the building and the devitalization of their urban functions;
- Social neighborhoods, publicly owned - mainly by the State and municipalities - that over the decades have suffered from inefficient management and sometimes inadequate use and have not benefited from the necessary conservation and maintenance works, rehabilitation investments;
- Urban areas of illegal origin, with deficiencies in planning, infrastructure and construction, which have been the subject of recovery and legalization processes, but several situations remain, probably the most complex;
- Housing complexes in horizontal property, mainly located in the suburban (but not only) suburbs, often with buildings suffering from various deficiencies, in particular in terms of energy efficiency, often resulting from public or cooperative initiatives and often social homogeneity of the population aged and of low resources, acquired 30 or 40 years ago with public support (interest subsidy) by individuals who today do not have the resources or conditions of access to credit for the rehabilitation works;
- Buildings and industrial sites, mostly from large decommissioned companies, which are either unoccupied or occupied by poorly qualified or undue uses, and sometimes with problems of soil contamination that make it unusable;

- Spaces of urban excellence - riverside fronts, storage areas at old entrances to the cities, requiring qualification interventions to take advantage of its urban development potential.

The above-mentioned ex-ante assessment indicates a value of intervention needs considering the types potentially supportable by FIs in the order of 2 to 3 billion euros over the next 7 years seems to be a reasonable value ((Sociedade de Consultores - Augusto Mateus & Associados, 2015).

The role of a FI will be ineffective if a market does not exist. In fact, the main function of a FI is the leverage of private capital in order to help overcoming market failures. Therefore, the FI should be geared to segment markets where there is a potential demand that can provide the effective stimulus to the rehabilitation market. In this context the metropolitan areas will have an advantage in the demand for housing and at the same time a greater number of properties to rehabilitate, which, for example, contradicts the scarce resources of the ESI Funds that are allocated in the Lisbon region. As this problem is very relevant, a hypothesis to alleviate this contradiction is to obtain national holdings for the FI, at the level of the holding fund, specifically for LMA. This participation could be from the State / IHRU and / or the municipalities. As it is intended for a lending mechanism, it could be treated as a financial asset. And since this has a long time, the mobilization of this contribution could be spread over several years. Another possibility could be to reserve the few available LMA resources for intervention through the guarantee instrument which has a greater multiplier effect, but this could create a very great discrimination by not allowing other support in the LMA and would have the potential of not responding with levels of maturity required for these interventions. A third alternative, if not possible at this time, would be to apply LMA's resources in a different logic, from equity participation in investment funds that could involve private investors or resources with other sources that will be more willing to participate in operations that would allow a higher multiplier effect (Sociedade de Consultores - Augusto Mateus & Associados, 2015).

The market analysis developed for *ex ante assessment of financial instruments from Portugal 2020 programs*, identified six use cases for which there is no available financing solutions that could be solely supported by rehabilitation market, due to several causes such as lack of profitability, time or risk of the operation:

- 1- Rehabilitation of buildings in horizontal property – This is a market composed by the owners and residents of the buildings that very often requires rehabilitation interventions and energy efficiency improvements. The condominiums as the entity representing this group of owners face several legal barriers to get access to credit or to promote the required interventions. The IFRRU market analyses suggests a bonus mechanism (possibly interest-free in the case of needy households) associated with a loan guarantee mechanism to be granted to homeowners' associations (or an association of condominiums in the case of neighborhood-wide interventions. This solution would address a market failure of funding to identified potential demand, creating simultaneously a market of micro and small enterprises.
- 2- Housing rehabilitation at controlled costs – This housing segment is normally managed by private companies or cooperatives that are dedicated to the rehabilitation of residential buildings in historic centers or located in other areas of the city where normally lives low-income or middle-income families.

The Program "Reabilitar para Arrendar" (IHRU) cover this segment market since it is dedicated to support the rehabilitation of affordable houses that are placed on the rental market at controlled costs. The program intends to suppress the financing needs of buildings' owners that intends to rehabilitate their old buildings located in urban rehabilitation areas with the purpose to place them in the rental market.

However, the *ex ante* assessment of financial instruments in Portugal points out to the need to develop specific financing lines for housing cooperatives, companies or real estate investment funds for rental housing for the acquisition and rehabilitation of real estate, intended to be leased to low-income or middle-income families, preferably young people. It would contribute to revitalizing historic centers, promoting social diversity and counteracting the trends towards gentrification that is often associated with urban rehabilitation operations (Sociedade de Consultores - Augusto Mateus & Associados, 2015).

- 3- Regeneration of urban areas of illegal origin - Financing of the partnership between municipalities and landowners, for planning, infrastructure and equipment in urban areas of illegal origin, with the reimbursement / compensation of the capital insured by the owners' payments due to the capital gains generated by the process. The large investments needed in these areas require long-term financing and in highly favorable conditions. The selection of areas should take into account urban, environmental, economic and social criteria.

- 4- Regeneration of public owned land or buildings - European experience shows that this is a privileged field for public-private partnerships. Public property is leverage for private investment, often in large-scale operations. It is vulgar the figure of the concession of urbanization, mixed capital company, real estate investment fund. In other situations, the regeneration operation is segmented, with the public entity regenerating the soil (cleaning, decontamination, infrastructure) and selling it to private.

- 5- Rehabilitation for the installation of activities in social neighborhoods and Urban Rehabilitation Areas (URA) – This use case, covers the local rehabilitation initiatives from municipalities with the purpose of boost local economy and support social cohesion. These rehabilitation initiatives intend to regulate processes caused by gaps in the housing market. This is the case of historical centers, when become attractive for the rehabilitation, the trend is to increase the price of commercial leases and therefore activities with less profitability are expelled from these urban areas. Another situation that often requires intervention is the need to create employment in social neighborhoods and diversify uses and functions in order to promote social integration.

In both situations the intervention of local authorities is important to provide spaces at low price that allow the coexistence of different commercial activities and to support the development of social facilities that will serve those populations. These kinds of initiatives could be promoted by municipal public entities or private non-profit entities, in partnership or not with private investors, in order to provide location spaces at low prices to strengthen the economic functions of these urban areas.

- 6- Improving energy efficiency in housing - This is an area where existing potential demand will not become effective spontaneously, requiring proactivity and innovative intervention and financing solutions, and the creation of specialized and accredited actors of financing and implementation.

8 Conclusions

The ex-ante evaluation for residential building sector in the Lisbon Metropolitan Area (LMA) aims to contribute for the market assessment of financial instruments for urban energy rehabilitation in greater Lisbon sub-region. The new Generation of Housing Policies (NGHP) in Portugal is the new legislative package approved in April 2018, that propose to change drastically the former housing policies based on the new construction. The new legislative package adopts an approach focused on ensuring the access to adequate housing to everyone where the urban rehabilitation is a priority. In this context, the new policy mechanisms are oriented to eliminate the most severe housing shortages, to increase the public support to urban rehabilitation, to reduce the financial burden of tenants in certain conditions and to promote the full use of the building stock. One of the mechanisms designed in this new policy context is IFRRU 2020, the Financial Instrument for Urban Rehabilitation and Revitalization that supports integral rehabilitation of buildings, including residential buildings and the public rental park, within Urban Rehabilitation Areas.

41

The current study used, as baseline, the present scenario in Portugal and in LMA regarding the existent portfolio of financing programs dedicated to urban rehabilitation and special attention was given to *IFRRU 2020 - Financial instrument for Urban Rehabilitation and Regeneration*. We assessed in what extent IFRRU 2020 and the other funding programmes included in the NGHP would cover the main energy rehabilitation market failures in LMA and what would be the main barriers to its implementation. With this purpose it was organized a focus group to identify those barriers and untap potential opportunities. The existence of innovative finance mechanism was broadly recognized as an important way of boost urban rehabilitation and create financial conditions to certain building owners that will have easier access to financing. Although there are weaknesses that need to be overcome, such as the case of the lack of information and its dispersion about how to access new forms of financing and it is also mentioned the difficulty of local authorities in what concern the preparation of applications in the field of energy efficiency. The high level of bureaucracy to get financing and to get the projects going it was also another issue that require further measures of improvement. In terms of socio economic constraints stakeholders emphasized the existence of energy poverty and insufficient budget from the owners to pay for rehabilitation of their buildings.

At the local level it was identified the opportunity to develop energy services more integrated, as it is the case of the energy management model - one-stop shop on buildings' energy retrofiting - that might be a contribute to reduce barriers between buildings' owners and the adoption of innovative FI.

Overall, we conclude that IFRRU 2020 and its integration in the New Generation of Housing Policy give the right context for the development of urban rehabilitation in LMA. The large scope of interventions covered by IFRRU 2020 and complemented by the other programs as it is the case of CASA EFICIENTE and REABILITAR PARA ARRENDAR, covers the six major situations that were identified as market failures in urban rehabilitation. This innovative financial mechanisms and financial programmes would help to remove barriers to investment in urban renewal and to the leverage public funds, although the local-level initiatives are also needed to stimulate demand for these instruments and to ensure that landowners of the buildings have the correct support for the implementation of their renovation projects.

Acknowledgements

The authors acknowledge the work developed by AFI Consultants during REHABILITE project and their support regarding the definition of a common project methodology for the calculation of the suboptimal investment situation and analysis of market failures.

References

2010/31 EU, *EU of the Parliament and Council of 19 May 2010 on the energy performance of Buildings (recast) OJ L 153/13*

2012/27/EU, Directive 2012/27/EU, of the European Parliament and Council of 25 October 2012 on energy Efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC

ADENE, 2017. *ADENE-- Portuguese Energy Agency*.
Available at: www.adene.pt

AML, 2017. *AML - Área Metropolitana de Lisboa*.
Available at: <https://www.aml.pt/>

BPIE, 2015. *Indoor Air Quality, Thermal Comfort and Daylight*.
Available at: <http://bpie.eu/>

Commission, E., 2016. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, *Clean Energy For All Europeans*.
Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016DC0860>

DGEG, 2014. *Estratégia Nacional para a Renovação de Edifícios*

DGEG, 2015. DGEG- *Direção de Energia e Geologia*.
Available at: <http://www.dgeg.gov.pt/>

DGT, 2018. *PNPOT - Uma Agenda para o Território*
Available at:
http://pnpot.dgterritorio.gov.pt/sites/default/files/PNPOT_ProgramaAcao_20Julho2018.pdf

Directive 2010/31 EU, n.d. *Directive 2010/31 EU (EPBD), of the Parliament and Council of 19 May 2010 on the energy performance of Buildings (recast). OJ L 153/13.*

Directive 2012/27/EU, of the European Parliament and Council of 25 October 2012 on energy Efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC

EGIFRRU, 2017. *Programa de Ação do IFRRU 2020, Lisbon*
Available:
<https://www.portaldahabitacao.pt/openscms/export/sites/portal/pt/portal/reabilitacao/ifrru/documentos/Programa-de-acao-IFRRU2020.pdf>

Gregório, V., Raposo, C. & Abreu, V., 2018. *Guide to prepare an ex-ante assessment focused on energy renovation in building sector, Lisboa: Lisboa E-Nova*

INE, 2011. *Census -Statistics of Portugal*.
Available at: www.ine.pt

INE, DGEG, 2010. *ICESD - Inquérito ao Consumo de Energia no Sector Doméstico 2010, Lisbon*
Available at: www.ine.pt

INE, LNEC, 2013. O Parque Habitacional e a sua Reabilitação - Análise e Evolução 2001-2011, Lisbon

Available at: www.ine.pt

Lopes, T. P. & Joanaz de Melo, J., 2012. Potencial de poupança de energia na climatização de edifícios habitacionais.

Available at: <https://run.unl.pt/handle/10362/5014>

P2020, 2014. Programa operacional ao abrigo do objectivo de investimento no crescimento e no emprego, Lisbon

Available at: <https://www.portugal2020.pt/Portal2020>

Palma, P., 2017. Mapeamento das necessidades de energia para aquecimento e arrefecimento ao nível das freguesias em Portugal: implicações para a análise do conforto térmico nas habitações, Lisbon

Available at: <https://run.unl.pt/handle/10362/30791?locale=en>

PORDATA, 2017.

Available at: <https://www.pordata.pt/en/>

República Portuguesa, 2018. CASA EFICIENTE 2020.

Available at: <https://casaeficiente2020.pt/>

República Portuguesa, 2017. Fundo Nacional de Reabilitação do Edificado.

Available at: <https://www.portugal.gov.pt/download-ficheiros/ficheiro.aspx?v=dfea25a3-a4ca-4a5d-ae8e-9d8d22d5140b>

República Portuguesa. (2017). PNAEE - Plano Nacional de Ação Para a Eficiência Energética (2017-2020)

available at : https://ec.europa.eu/energy/sites/ener/files/documents/pt_neeap_2017_pt.pdf

Resolução Conselho de Ministros 50-A/2018

available at: <https://dre.pt/application/conteudo/115211109>

Resolução Conselho de Ministros nº56/2015, n.d.

Available at: https://www.apambiente.pt/_zdata/DMMC/RCM%2056_2015.pdf

Sociedade de Consultores - Augusto Mateus & Associados. (2015). Avaliação ex ante dos instrumentos financeiros de programas do Portugal 2020. Lote4 - Instrumentos Financeiros para a regeneração e revitalização física, económica e social em zonas urbanas. Relatório final.

Available at:

https://www.portugal2020.pt/Portal2020/Media/Default/Docs/AVALIACAO/Avaliacao_ExAnte_Instr_Financ_Lote%204_RelatorioFinal.pdf