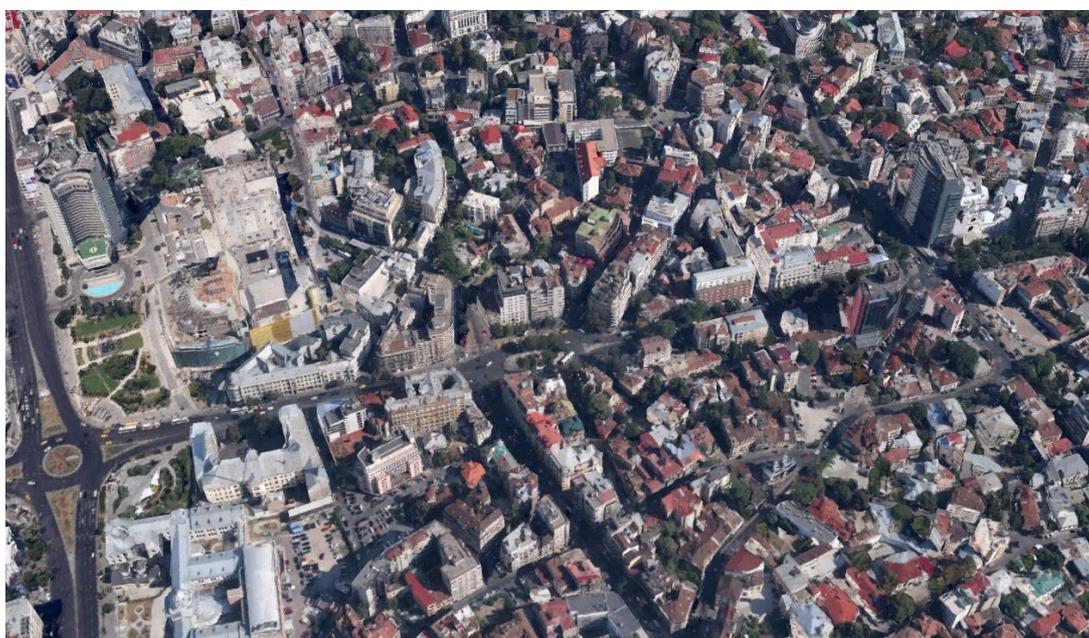# EXECUTIVE SUMMARY:

PRELIMINARY ASSESSMENT OF THE PUBLIC BUILDING STOCK

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RePublic_ZEB Project

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Website: www.republiczeb.org

Project consortium

	BME	WP3 Leader
	BRE	WP6 Leader
	BSERC	WP2 Leader
	CRES	Partner
	CTI	WP1-WP7 Leader Coordination
	EIHP	Partner
	URBAN-INCERC	Partner
	IREC	Partner
	LNEG	WP5 Leader
	MACEF	Partner
	POLITO	WP 4 Leader
	ZRMK	Partner

Project overview

The RePublic_ZEB project is focused on the energy and CO_2 emissions associated with existing public buildings and their refurbishment towards nZEB.

The **core objective** of the project is to:

- Define costs-benefit optimized "packages of measures" based on efficient and quality-guaranteed technologies for the refurbishment of the public building stock towards nZEB that are standardized and adopted by builders and building owners.

From this stems three **basic objectives:**

(i)   State-of-the-art assessment of the public building stock through a country-specific evaluation of the energy consumption and CO_2 emissions;

(ii)   Define reference buildings; and;

(iii)   Develop a common framework and a harmonized methodology for the definition of a nZEB concept for public buildings.

Acknowledgement

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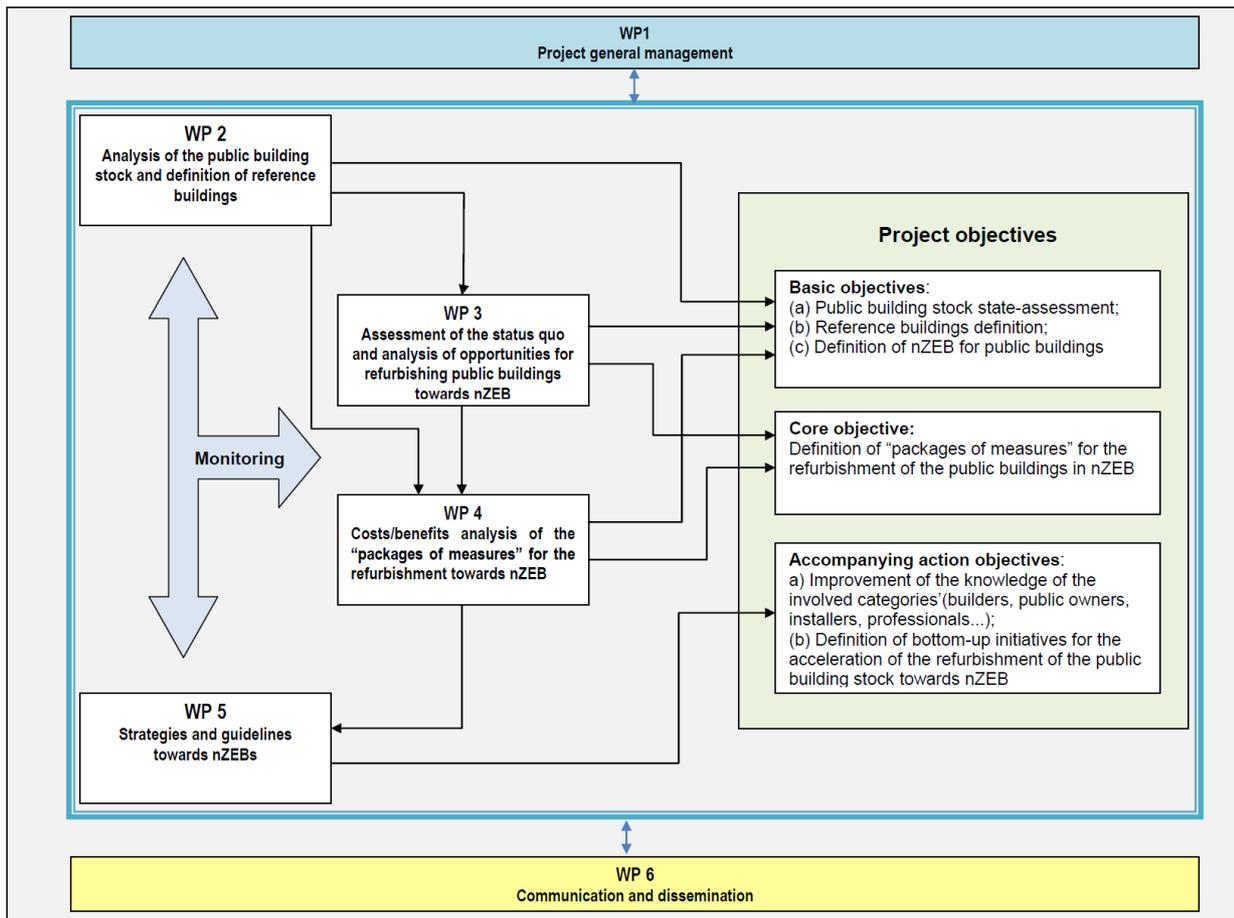
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Executive Summary

This document is one of a series of executive summary of the core deliverables of the RePublic_ZEB project. This is a summary of the first deliverable in Work Package (WP) 2. The flow chart below shows its context in the overall project.

1. Objective

The objective of this report is to analyse the existing public building stock in the countries or regions covered by the project consortium, with the view to assess key data concerning the general features and the total energy consumption of public buildings, in order to define public building classes as a basis for subsequent project work packages.

2. Scope

Article 5 of the Energy Efficiency Directive (EED) sets a 3% annual renovation target on buildings owned and occupied by central government. The analysis undertaken here is wider as it is concerned with the whole public building stock by assessing available data for buildings owned and/or occupied by central and local authorities. Thus, taking into account the exemplary role that public buildings should have in transforming the existing building stock to a high energy performance one (targeting the nearly zero energy level), the analysis also addresses educational and health care buildings

which in some countries are under local government administration. The work was undertaken in the period March-November 2014 and the report was originally published in December 2014.

3. Data sources

The starting point of the analysis was to collect useful data from European and Regional projects, publications and technical bibliography on this topic as well as other sources of statistical data or summarised information, with the aim to build a realistic picture of the public building stock and its performance in the selected countries. Among these sources, the most useful ones were the BPIE Data Hub, BUILD UP Skills reports and national EPC databases. EUROSTAT and statistical offices in each country lacked relevant data on the non-residential building stock in general and the public building stock in particular. This emphasises once more the need to develop viable tools to collect and process data to facilitate the production of specific and robust databases to support the development of strategies in the building sector.

Other relevant sources of information used were previous studies performed at national level and inventories of existing central government building stock recently undertaken in some participant countries.

4. Limitations

The collection of data in each country participating in the RePublic_ZEB project was designed starting from a comprehensive template which included detailed data required to evaluate the energy performance of the existing public building stock. The effective gathering of data showed that available data sources and the knowledge about the public building stock varied considerably between countries.

From country to country, different numbers of buildings and various categories (total non-residential, public/non-public, central/local administration) were found. It was a challenge to select or aggregate relevant appropriate building categories, due to the lack of a clear common basis for analysis. Not all partners have available data according to the defined requirements and to the EPBD building categories. Various types of data were still missing in some countries (e.g. age of buildings for different categories, constructive structure, height/shape factor, systems, fuel/energy agent etc.), making it difficult to clearly define reference buildings. Moreover, the specific energy consumption [kWh/m².year] was given either in primary or final (end-use/delivered) energy and the split of the energy performance indicator between each type of service - to reflect the requirements of Annex I of the EPBD (heating, cooling, ventilation, DHW, lighting and appliances) - is not sufficiently clear or consistent between countries in order to transform energy performance into comparable values. In some countries the energy performance data came from the simulation of predefined reference buildings (e.g. from cost optimal reports), while in others the available data from central EPC registers was not always statistically representative due to the small sample of buildings in each category.

Although these aspects could constitute limitations in the assessment of existing building stocks in the group of 11 countries, the findings can be considered as sufficient for the scope of the study, i.e. the selection of classes of buildings in each country with the highest share of total floor area and with the highest impact in terms of energy performance (measured as primary energy consumption).

5. Results

The key findings of the preliminary cross country analysis undertaken on the available data collected are given in Figures 1 and 2. Figure 1 shows the total number of public buildings analysed in each

country and the total analysed floor area, and Figure 2 shows the total primary energy consumption with the specific primary energy (minus appliances).
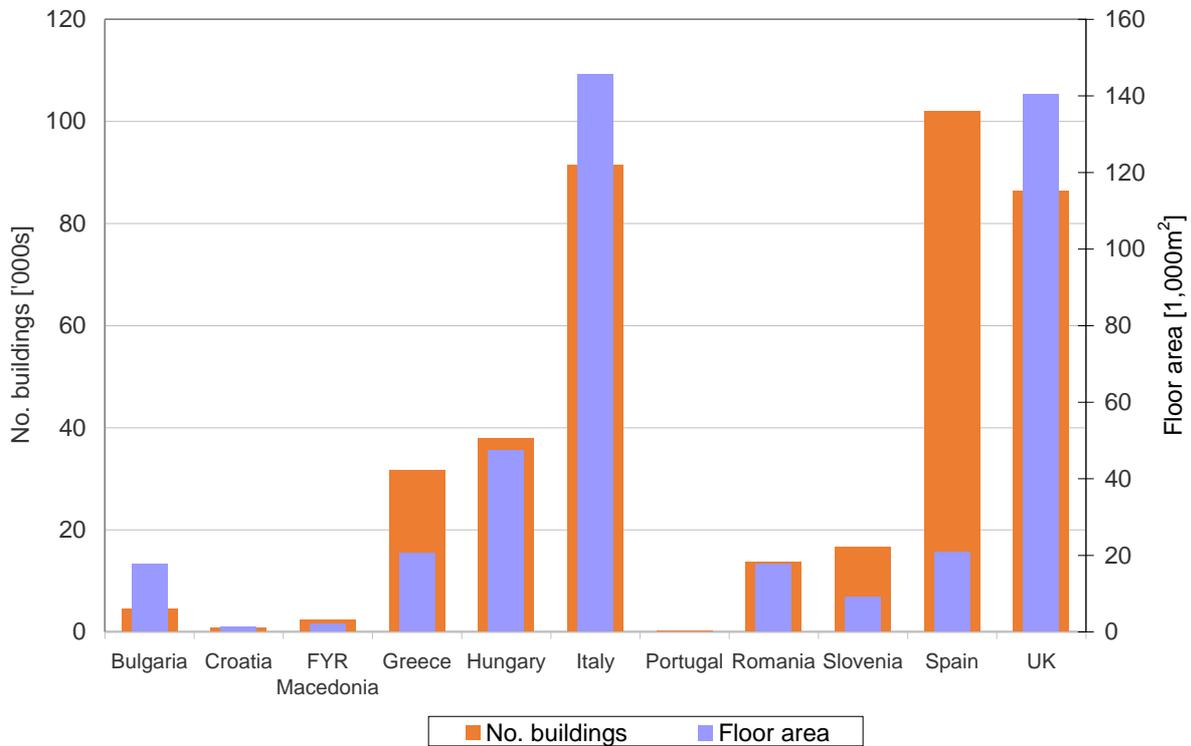

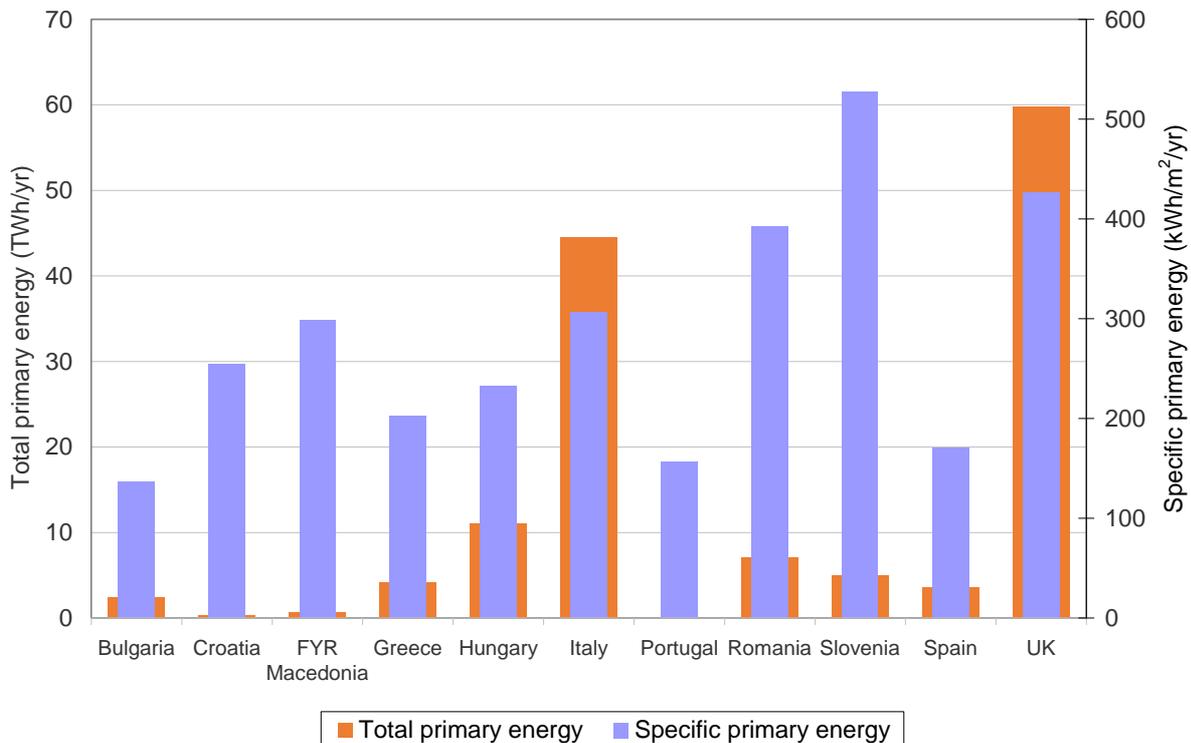Figure 1: Total number of buildings and floor area

Figure 2: Total and specific primary energy consumption

Italy and the UK have the biggest share of the analysed building stock in terms of total floor area and primary energy consumption due to the size of their building stocks and also partially due to the building categories found in private and public ownership/occupation. This could also be the case for Slovenia. On the other hand, the low values reported for Portugal (339 buildings with a total floor area of 83,000m^2 and a total primary energy consumption of 0.01 TWh/yr) can be explained by the lack of reliable data for the overall building stock, as only a limited sample of public buildings are available in the inventory of existing buildings through the National Energy Certification System (SCE).

At country level, the total floor area per building category is shown in Figure 3 and the primary energy consumption per building category is given in Figure 4, which enable a preliminary evaluation of representative classes for further analysis.
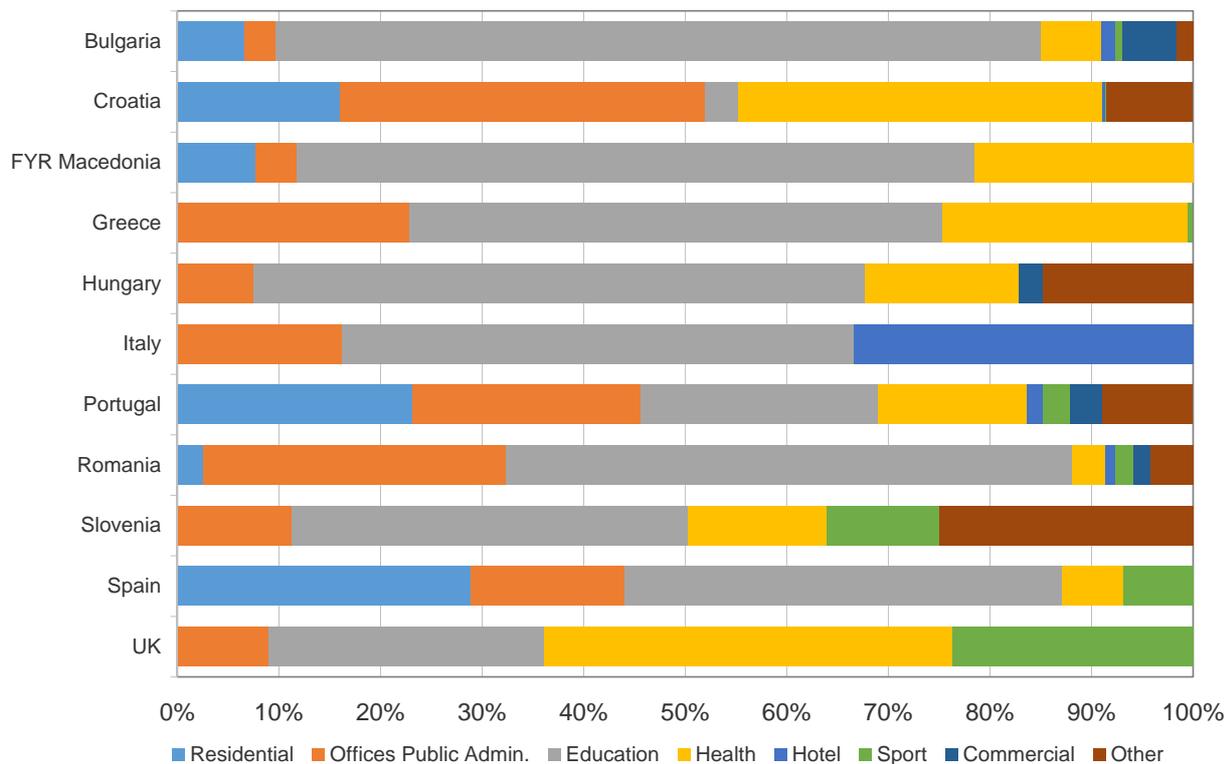

Figure 3: Distribution of total floor area for preliminary selection of reference buildings
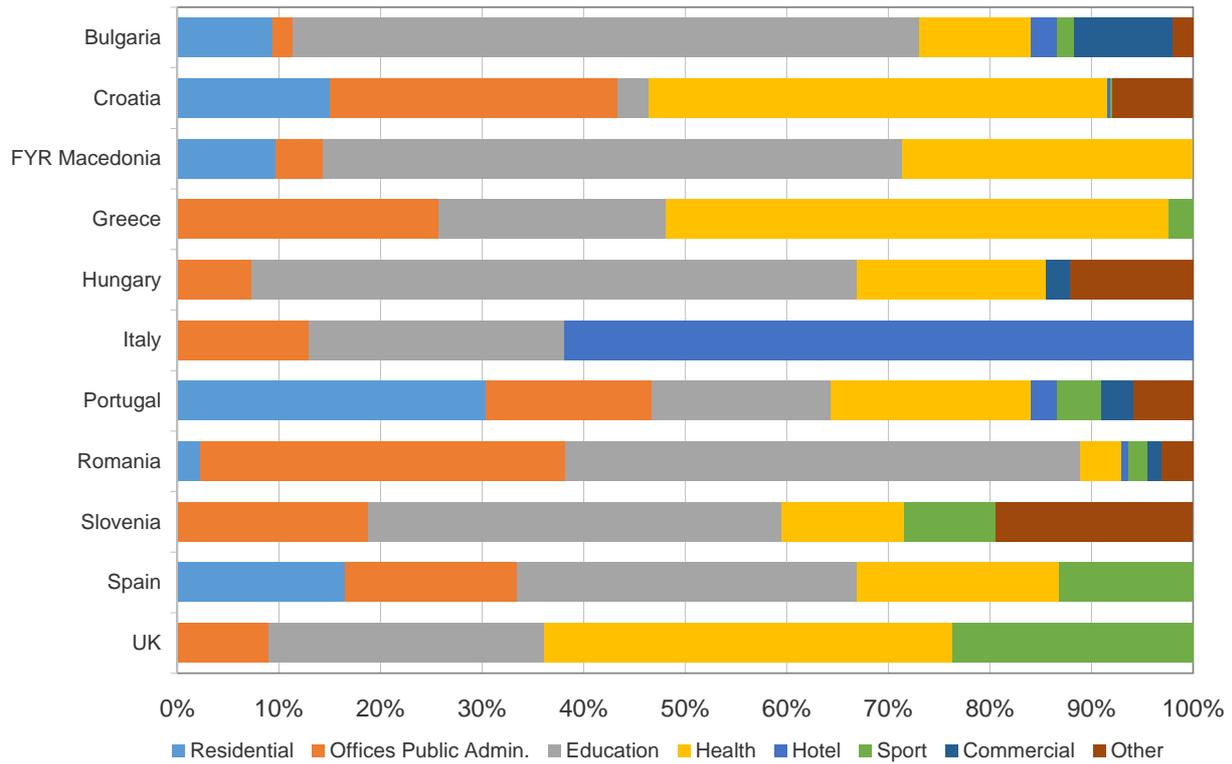
Figure 4: Distribution of total primary energy consumption for preliminary selection of reference buildings

In terms of CO$_2$ emissions and saving potential, the most interesting classes of buildings those with the highest specific primary energy consumption; however the selection of building categories for which reference buildings will be defined is strongly influenced by the impact that major renovation will have in that section of the building stock. Figure 5 shows primary energy both as specific consumption (kWh/m²/year) and overall consumption (TWh/year) as total values for all the countries within each building category.
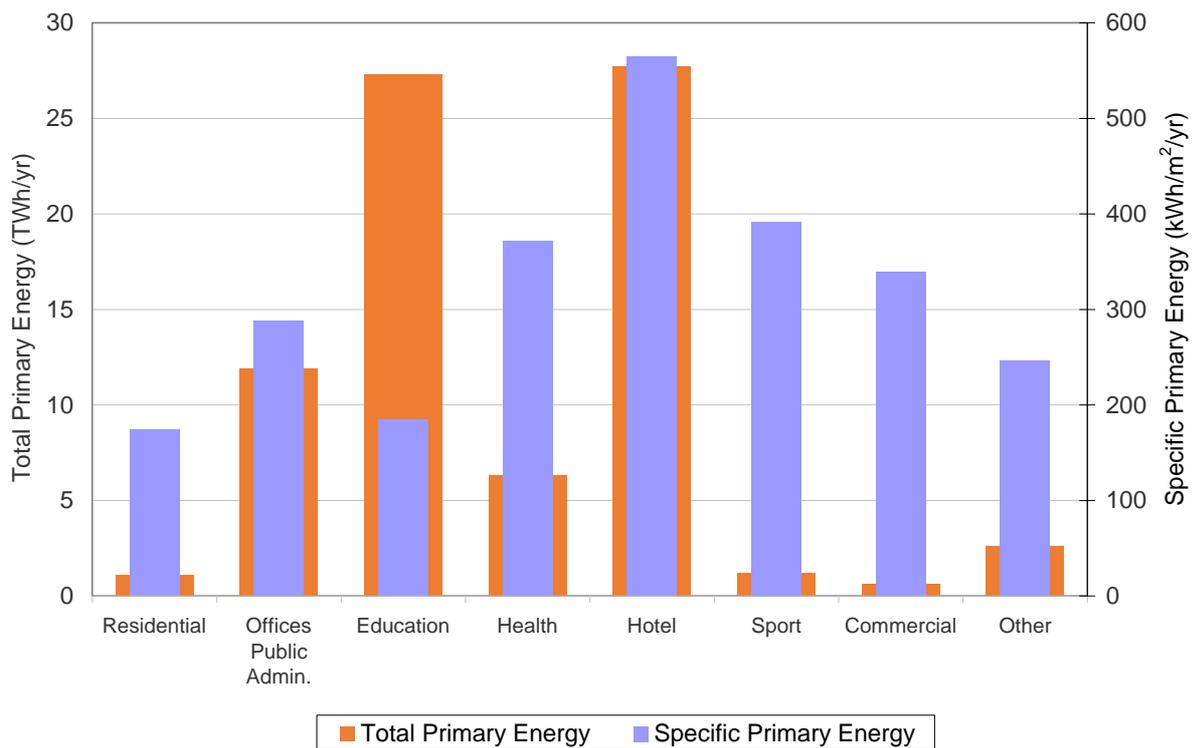
Figure 5: Total and specific primary energy consumption in analysed countries

6. Recommendations for reference buildings

Taking into account the values of total floor area and primary energy consumption and the potential impact on the public building stock in each country, a preliminary selection of reference buildings is given in Table 1.

Table 1: Buildings with impact on public building stock in each country – preliminary selection of reference buildings

Country	Residential	Offices Public Admin.	Educa-tion	Health	Hotel	Sport	Com-mercial	Other
Bulgaria	●	○	●	●	-	-	○	-
Croatia	○	●	○	●				
FYR Macedonia	○	○	●	●	-	-	-	-
Greece	-	○	●	●	-	-	-	-
Hungary	-	○	●	●	-	-	-	○
Italy	-	●	●	-	○	-	-	-
Portugal	○	●	●	○			-	○
Romania	-	●	●	○	-	-	-	-
Slovenia	-	●	●	●	-	○	-	○
Spain	○	●	○	●	-	○	-	-
UK	-	●	●	●	-	○	-	-

Key

● - Should be considered taking into account a significant impact in terms of building floor area and energy consumption at the building stock level

○ - Could be considered taking into account the impact in terms of building floor area and energy consumption at the building stock level

The objectives of this report have been achieved, by defining the classes of buildings as the most relevant (in terms of major renovation impact) to be analysed further in subsequent work packages of the project. The report offers sufficient information to select building categories and sub-categories (e.g. education buildings – school). It also provides, for most countries, detailed information which could be considered either as construction indicators of 'statistical representative buildings', or as indicators to verify a selected building as a reference building for a specific category/sub-category (e.g. average conditioned area, compactness ratio, number of floors, EP indicators, age, systems, fuel type etc.).

For the selected reference buildings in each country the corresponding necessary geometrical data, building energy use, base heat supply regime (i.e. type of the heating system, energy resource/carrier etc.) should be detailed, allowing the energy consumption to be simulated and the impact of different major renovation strategies and packages of solutions to be estimated. This report together with the defined reference buildings will be presented to the national stakeholders and submitted for their validation.