



*Energy Efficiency Improvement Program (PMEE)  
for public buildings owned by the municipality of Agnone*

*Alterenergy Molise - WP4 activities:*  
**Task 4.3 - Energy Assessment**  
**Executive Summary Report D 4.3**

*October 2014*

RAGGRUPPAMENTO TEMPORANEO DI IMPRESE



**IZI** METODI, ANALISI  
E VALUTAZIONI ECONOMICHE

*Technical support service of*



Consorzio Zero Energy Building

PROJECTS, CONSULTING, TRAINING SERVICES



## Introduction

**ALTERENERGY** (Energy Sustainability for Adriatic Small Communities) is a Strategic Project funded within the cross-border Cooperation Programme IPA-Adriatic 2007-2013.

Launched in September 2011, with a 12,5 Mln Euro total budget and with a duration of 4 years (completion of work in August 2015), ALTERENERGY aims to promote Energy sustainability through the ever- wider use of renewable energy sources and through the diffusion of interventions to increase efficiency and energy saving, thereby seeking to contribute to the achievement of the Europe 2020 objectives.

In particular, this Strategic Project promotes **sustainability within small Adriatic communities** (having a population of less than 10.000 inhabitants ) through an integrated approach for the efficient use of energy and its production from renewable sources.

The specific aim of the project is to develop replicable management models of sustainable energy resources within small Adriatic municipalities, thus improving their ability to plan and manage integrated actions of energy saving and production from renewable sources.

In this context, the **region Molise** (Partner of the Strategic Project ALTERENERGY<sup>1</sup>) has identified **Agnone** as the community where to conduct the experimental activities of the Project (Memorandum of Understanding between Region and Municipality signed on 17/12/2013).

By public tender, region Molise has designated a Temporary Firms Association (formed by IZI spa, EdilNEZ consortium, CRESME Consulting Srl, AFORIS Srl) to provide all the necessary technical support to accomplish its tasks for the Alterenergy Project.

One of these task is the development of an “Energy Efficiency Improvement Program” (in Italian PMEE ) for public buildings to be tested in Agnone municipality. The task was performed with the support Planergy™, a web application specifically designed to monitor public real estate from the energy consumption point of view.

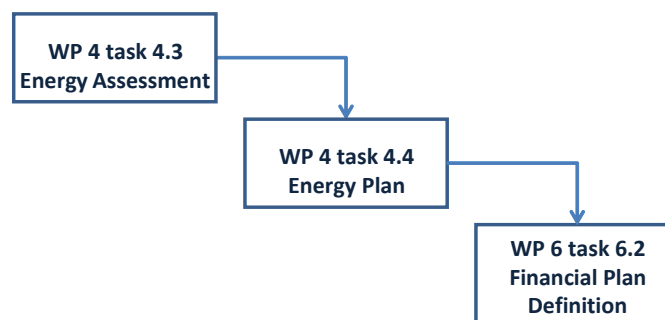
The performed activities are fully consistent with those included in the SEAP issued by Agnone municipality on May 2013 which are organized into the following three phases.

1. **Energy Assessment:** after a site survey in each public building, collection and analysis of data related to energy consumption and structure performance (ref. WP4 activities - Task 4.3);

<sup>1</sup> ALTERENERGY relies on a partnership of 18 organizations, regions, ministries and energy agencies belonging to all the countries of the Adriatic area: Italy (7 Adriatic Regions- Puglia, Abruzzo, Emilia Romagna, Friuli Venezia Giulia, Marche, Molise, Veneto), Albania, Bosnia Herzegovina, Croatia, Greece, Montenegro, Serbia and Slovenia.



2. **Energy plan:** after a technical desk analysis and a quantitative / qualitative assessment of results achieved in the first phase, identification of candidate Energy Efficiency Improvement<sup>2</sup> measures (such as technical interventions on building envelope or systems), estimation of their expected cost-benefit ratios, selection of the package of applicable technical solutions which maximizes the expected revenues at the entire real estate stock level i.e. PMEE (ref. WP4 activities -Task 4.4);
3. **Definition of a convenient Financial Plan** which can support PMEE procedures according to a building Monitoring and Verification approach (ref. WP6 activities -Task 6.2)



This document is an executive summary of **Report D 4.3** concerning Energy Assessment activities (phase I), carried out on 8 properties of Agnone municipality.

<sup>2</sup> In Italian: “Misure di Efficienza Energetica” MEE



## An energy monitoring system for municipal buildings

Energy Assessment of Agnone test properties has been conducted using *Planergy™* a system by CRESME Consulting specifically designed to monitor energy consumption and performance of municipal buildings.

This system is provided through a web platform (see [www.Planergy.it](http://www.Planergy.it)) and is an operational tool through which a Public Administration can fulfil that “pilot role”, assigned by Europe 2020, of effectively promoting energy sustainability within its area of jurisdiction. As specified by SEAP Guidelines<sup>3</sup> *Planergy™* :

- “*identify all buildings and facilities owned/managed by the local authority*” by providing the location in the plant, the articulation in structures and in indoor and outdoor functional spaces, the configuration and the consistency of plants;
- “*within those buildings and facilities, identify all energy delivery points (electricity, natural gas...)*” by recording the supplies and the location and characteristics of the counters;
- “*for all those energy delivery points, identify the person/department receiving the invoices and energy data*” allowing the reconstruction of the previous and the insertion incremental of consumptions periodic;
- “*organise a centralised collection of these documents/data*” through applications APP and web of *Planergy™*;
- is a “*specialized and commercially available software to store and manage the data*”;
- allows “*the data collection*” also on a daily basis being compatible and complementary to the common telemetry systems;
- allows to “*initiate a real energy management process*”;
- allows to “*identify buildings which consume most energy and select them for priority actions*”;
- achieves “*daily/weekly/monthly monitoring of energy consumption allowing to identify abnormalities and take immediate corrective actions*”.

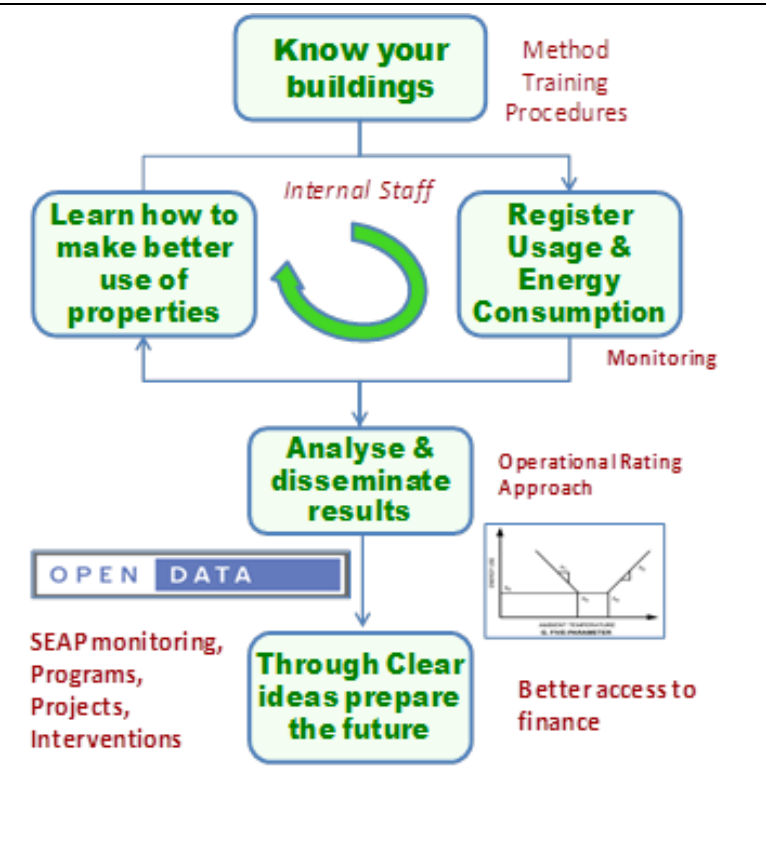
<sup>3</sup> European Commission report “How to develop a Sustainable Energy Action Plan” SEAP- Guidebook, Luxembourg Publications Office of the European Union, 2010 - Part II, section 4.2.1-a: Buildings, equipment/facilities and industries.



### Characteristics of energy monitoring service

Following the Planergy™ approach, an Institution would be able to start monitoring usage and energy behaviour of all its properties in a few weeks. The goal is achieved through simple internal procedures on energy management and after a specific short training of internal staff.

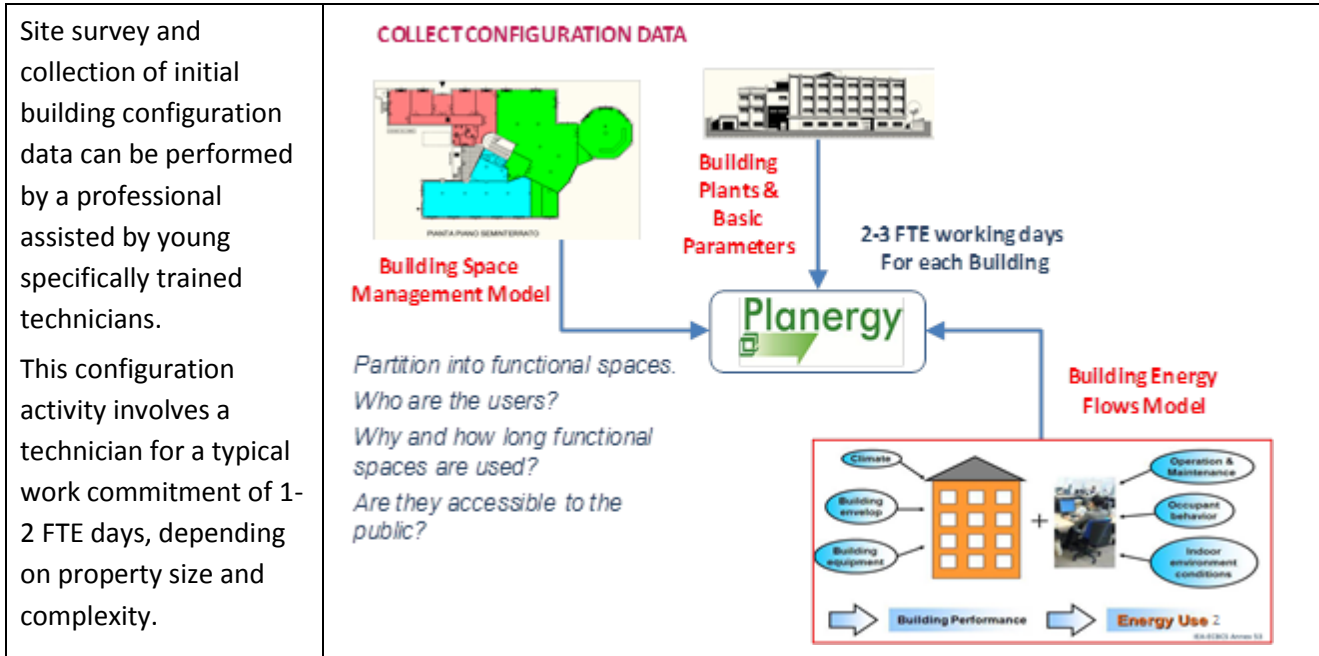
The knowledge of phenomena and the availability of measured data allow technicians to plan, design and test actions, interventions and programs to improve energy efficiency.



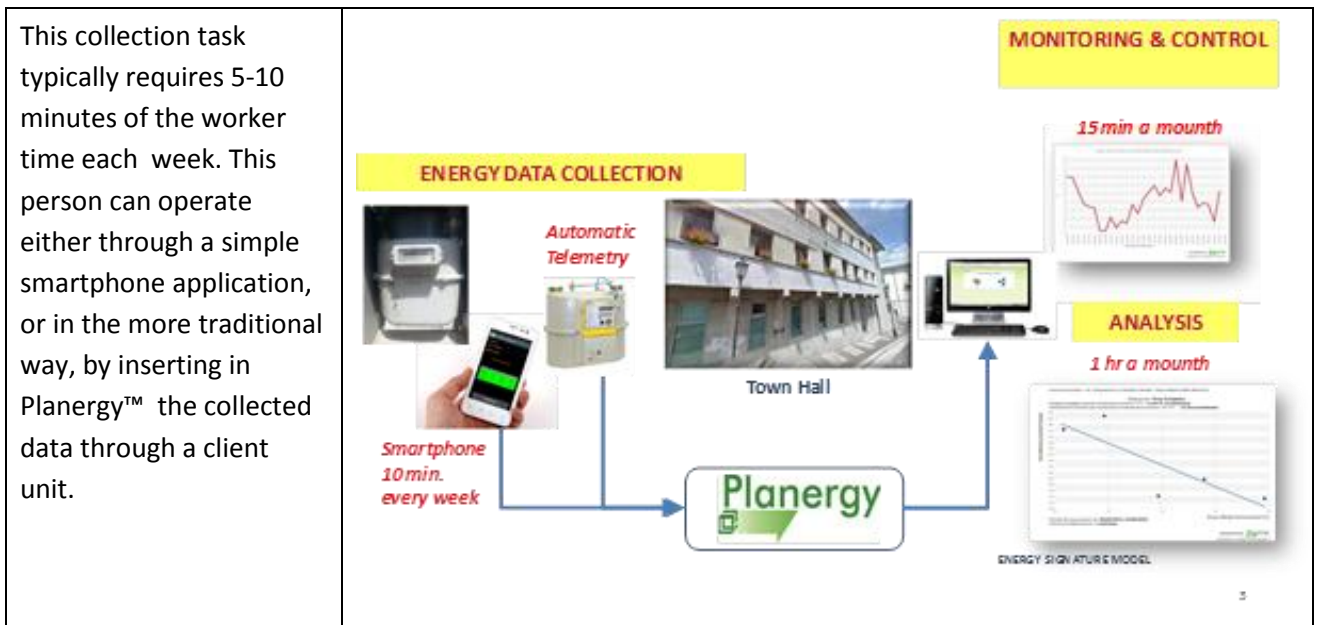
During the preliminary installation and configuration phase, Planergy™ requires the building basic parameters and a partition of the property into functional spaces. For each space unit it is indicated who are the users, why and how long functional spaces are used, and if they are available to the public.

Planergy™ adopts a building model of energy flows which takes into account indoor and external climatic conditions, building envelope and equipment characteristics, occupant behaviour operation and maintenance events.





Once the property comes under Planergy control, a stable worker is in charge of the periodical data collection on energy consumption and space utilization, through simple and quick operations.



On a monthly basis, the technical body responsible for Energy Management examines the correctness of collected data and the overall system behavior. A workload of about 15 minutes for each monitored property is typically required to do this task. Through analysis and processing of the collected data it is therefore possible to define and take corrective actions involving both technicians and users.

#### Planergy™

- uses applications built in the mode Web Application (CLOUD solution), through which it provides an information framework on all the public real estate (schools, public offices, sports centres, etc.) and on its building systems (building envelop and equipment);
- monitors the utilization and energy performance of buildings (consumption and production, climate, uses) simply and without expensive equipment;
- uses an inedited domain ontology for the production of Linked Open Data Set.

The energy model supporting the *Planergy*™ analysis algorithms follows the “Operational Rating” approach (Italian norm UNI/TS 11300 and UNI EN ISO 15603).

Through Planergy a public Administration can:

- build a data base of the buildings qualitative and quantitative characteristics which are related to their energy behavior;
- gradually put under control the use and energy performance of monitored buildings, thus obtaining an overall framework which allows to identify possible sources of inefficiency and to compare similar properties of different owners;
- issue of technical information necessary to set up one or more improvement Programs in a standardized, consistent and open form;
- publish data on buildings usage and consumption to involve professionals, firms and users and to educate the community on energy saving and environmental protection, thus spreading concrete and effective practices.



The publication of the usage rate and the energy efficiency of each public building represents a democratic instrument for a confrontation between different interests and professionalisms.

Table 1 summarizes the information content of the Open Dataset provided by Planergy™.

In practice, the information listed below are usually traceable in the context of different procedures performed by various organizational units of the Agency, each with a different task (e.g. Bookkeeping and maintenance). The adoption of the service allows to sort and process data in an organic manner ensuring their quality and regularity of publication.

## Planergy information & answers

<b>Building stock</b>	How many buildings and where? Why and how they are used?
<b>Building characteristics</b>	Configuration, parameters and constructional features; main ordinary usage.
<b>Building installations</b>	How many installations? which building areas are served by each plant? Main features of each system.
<b>Maintenance activities</b>	New installations; technological measures adopted for energy efficiency. Changes in space utilization.
<b>Property usage</b>	To what extent were employed the available spaces for a given period? Extraordinary events. Unavailability due to faults or degradation.
<b>Climate</b>	Climatic conditions in a given period
<b>Energy flows</b>	Energy consumed / produced by property plants in a given period?
<b>Energy and socio-environmental balance</b>	Primary energy consumptions (kWh). CO <sub>2</sub> avoided emissions. Improvements and trends.

Table 1: Main information items available in Planergy as Open Data Sets





## Field test experience

During the activities of Energy Assessment, Planergy™ has been tested to monitor 8 properties of Agnone municipality (Molise Region, population: 5,028 inhabitants, altitude: 830 m a.s.l.), which joined the Covenant of Majors in 2011 and whose municipal SEAP (approved in May 2013)- regarding the municipal built heritage- provides the target for 2020 of reducing CO<sub>2</sub> emissions by 55%.



n.	Code	Complex	Address
1	AGN_CM_01	Palazzo del Comune	Salita G. Verdi, 9
2	AGN_CM_02	Palazzo San Francesco	Via B. A. Lucci
3	AGN_CM_03	Palazzo dei Filippini	Corso G. Garibaldi
4	AGN_CM_04	Palazzo Bonanni	Via Martisciano
5	AGN_CM_05	Palazzo Nuova Pretura	Piazza Dante Alighieri 49
6	AGN_CM_06	Scuola Elementare	Piazza del Popolo 31
7	AGN_CM_07	Asilo Nido	Piazza del Popolo 117
8	AGN_CM_08	Scuola Materna	Via Pietro Micca 4

In particular, the carried out activities were related to:

- The selection of eight municipal buildings and of a reference meteorological station;
- A site survey for each selected building;
- The collection of buildings data and characteristics (drawings, dimensions, equipment data, space utilization etc.);
- *Planergy Information System* installation and roll out;
- Periodic energy data collection (one person employed to weekly register measurements from energy meters and the local meteorological station);
- Recorded data analysis and processing.



The results of these activities- synthesized into an overview of the characteristics, energy consumption and performance of the real estate in object – are exposed in more detail in 8 dossiers submitted, one for each building complex, each of which is made public and available on the website <http://www.alter-energy.eu/> (in section Target Communities) and is divided into the following sections information:

- PART I CHARACTERIZATION AND SIZING OF THE BUILDING SYSTEM
  - general data of the real estate and territorial framework
  - functional and dimensional characteristics
  - plant configuration
  - energy supplies
  - photo report
- PART II - ENERGY PERFORMANCE OF THE BUILDING COMPLEX
  - energy consumption
  - utilization level (of space and of air conditioning systems)
  - energy signature
  - primary energy and CO<sub>2</sub> emissions

In the following, are indicated the types of 8 properties object of analysis (please refer to the annexes for more technical details).

<b>Municipio</b>	The town hall is a fairly modern building (1940) that houses the offices of the municipality and of the municipal police.
<b>Palazzo San Francesco</b>	The original Franciscan monastery dates back to 1343 and in 1866 it was transferred to the municipality. Restored in the first half of the 90s, it is currently the representative office of the municipality; in the sixteenth-century refectory takes place the City Council and the mezzanine floor houses the libraries with media room.
<b>Palazzo dei Filippini</b>	It dates back to 1500 and is a former convent restored, with a beautiful chapel and a cloister. It hosts events and exhibitions especially during the summer and for the “ndocciata”- traditional event, which takes place on December 24 and consist in a parade of huge torches built by hand with fir trunks along the course of the municipality.
<b>Palazzo Bonanni</b>	It dates back to the twelfth century and is one of the best preserved palaces of Agnone. In 1881 it was used as a boarding school for the students of the Royal Technical School, at the time considered one of the best in Italy. Subsequently used as a nursery, currently is a multi-purpose cultural center.



<b>Palazzo Nuova Pretura</b>	It has been recently built (1984) and also houses the offices of the local INPS office.
<b>Scuola elementare Capoluogo Marinelli</b>	The elementary school is housed in Palazzo Maiella, 1950's building recently renovated.
<b>Scuola Materna</b>	The kindergarten Pietro Micca, built in 1989, is located in the east of the municipality as the nursery and the primary school.
<b>Asilo nido Ape Maia</b>	It is a building of 1983 used as a nursery by the end of 2013.

## Preliminary usage and energy consumption results

Table 2 outlines some preliminary usage and energy consumption results.

Code	Property	Main Use	USE				ENERGY CONSUMPTION		
			Total available area (in & out) (m <sup>2</sup> )	Available Int. Area (m <sup>2</sup> )	Used int. area (m <sup>2</sup> )	Usage rate (%) (3)	Primary Energy (kWhp) (mean 2011-13)	Energy Perf. Index kWhp/m <sup>2</sup> (mean 2011-14)	CO <sub>2</sub> emission (kg CO <sub>2</sub> ) (mean 2011-2014)
1	Town Hall	Office	1.818	1.490	1.490	81,5%	166.258	112	70.707
2	Palazzo San Francesco	Culture	2.940	1.823	1.570	81,5%	95.297	61	37.605
3	Palazzo dei Filippini		643	459	0	0,0%	3.845	0	2.097
4	Palazzo Bonanni	Office	1.738	1.532	485	72,2%	50.294	104	22.950
5	Palazzo Nuova Pretura	Office	1.350	1.350	1.350	46,3%	84.289	62	30.776
6	Scuola elementare Capoluogo Marinelli	Education	2.020	1.500	1.500	96,3%	245.876	164	85.911
7	Scuola Materna	Education	908	608	608	83,3%	85.238	140	33.498
8	Asilo nido Ape Maia	Education	470	220	220	83,3%	10.818	49	3.323

Table 2: Sample municipal buildings: observed data on usage and energy consumption.

Among the indicators relating to the use, the table shows for each property the main use, the measurements in square meters of the available internal and external surfaces, of usable interior surface and of the area actually used, the usage rate. The *usage rate indicator* is conventionally referred to a

weekly opening time of 54 hours. The full utilization of a building is usually the result of multiple property management measurements and interventions.

As regards the energy consumption, the table shows directly- on average from 2011 to 2013- the amount of primary energy consumed annually. The last column on the right shows the primary energy consumed translated into equivalent amounts of CO<sub>2</sub> emissions. The penultimate column shows the energy consumption per square meter used from each building.

The situation of each building of the sample is shown in *Figure 1*.

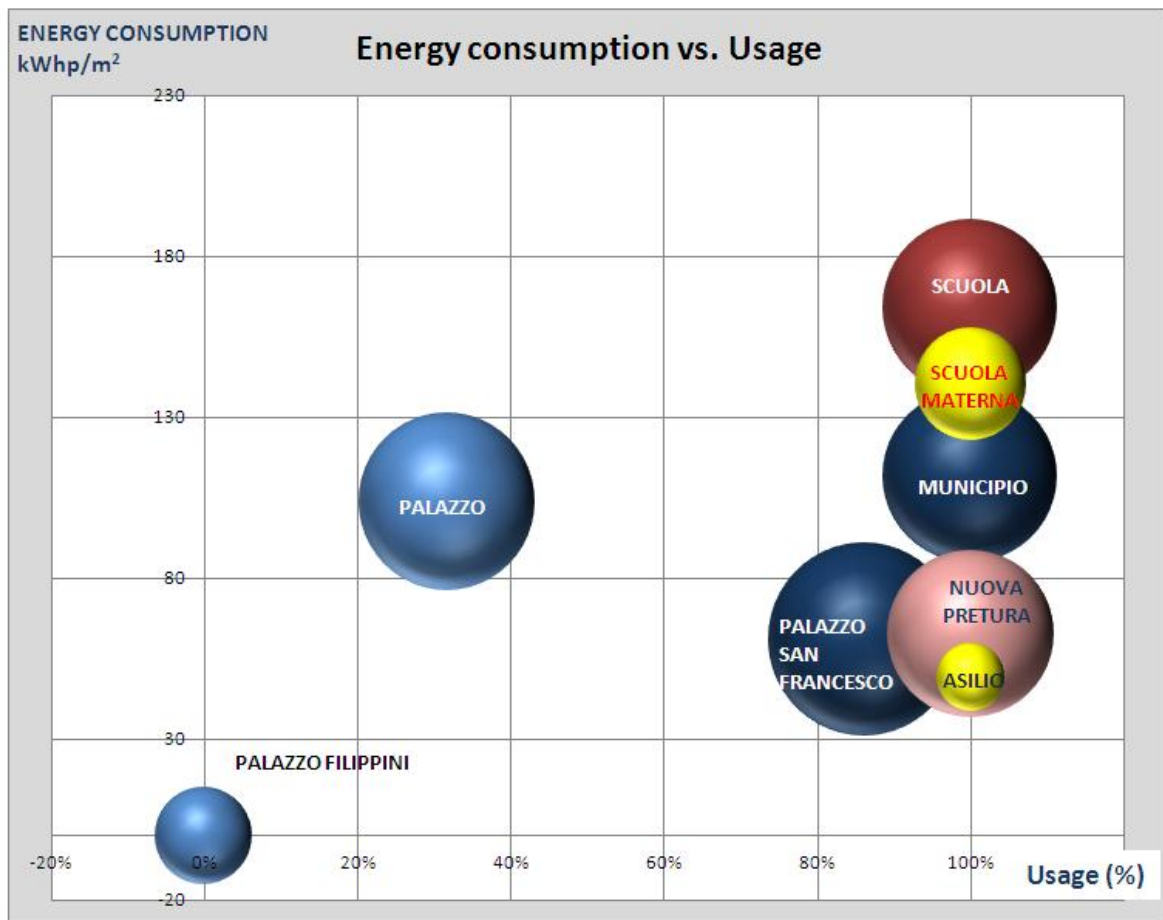


Figure: Sample municipal buildings: Percentage of Utilization versus Specific Energy Consumption.  
 The radii of the bubbles are proportional to the surface area of the buildings.

The arrows denote the impacts expected from some possible projects of intervention aiming at the full utilization and at the energy efficiency improvement of each building.

