Project co-financed by the European Regional Development Fund

**STEPPING - Supporting The EPC Public Procurement IN Going-beyond**

**D. 3.2.1**

# EPC Best practices collection

**May 2017**

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# *Introduction*

The MED Area is significantly different regarding climate, idiosyncrasy, and other factors to Central and Northern Europe, where the EPC market is more developed.

STEPPING general objective is to increase the adoption of EPC investment schemes in the elaboration of Energy Efficiency plans for public building in the MED area, raising the knowledge of MED institutions in designing, implementation and managing of energy efficiency plans for public buildings through:

- Analysing past and ongoing EPC projects in MED area carried out by partners and other MED institutions, in order to identify barriers and designing specific solutions for their overcoming.
- Checking and validating the efficacy of identified measures and designing guidelines for EPC in MED area.
- Adapting the application of EPC investment for public buildings scheme to MED specific context.
- Developing and testing new EPC investment plans in public buildings inside 7 MED countries including island's communities, in which the new EPC designed solutions will be tested. The Investment plans will be tested through the launch of tenders calls aimed at verifying plans' reliability.
- Transferring of results into ordinary tender procedures of partners.

The aim of this report is a critical review of the best practices used in MED area in implementing EPC for building.

All partners are involved in the collection and sharing of past experiences and best practices regarding the implementation of EPC for buildings in MED area.

Using a common scheme for data collection, all partners have been contacted national , regional, sub regional and local authorities at MED and EU level that have tested this scheme in buildings refurbishment.

All info collected has been the subject of a critical revision by the partners, in order to select those methodologies, technical approaches tactics and deployment methods that better fit with the MED conditions and that will serve as baseline for the elaboration of methodologies being tested and applied inside pilot actions of STEPPING project.

## *Objective of evaluation*

The objective of this evaluation of EPC Best Practices (BPs) in Mediterranean area (MED) is to find some common factors to help us defining and design a particular Energy Performance Contract (EPC) model adapted to MED Area.

To this end, a series of consensual parameters has been sent to all partners to collect and analyse the data.

Even if do not having data that typify EPC contracts in non-MED territories, the correlations or common factors found in the analyzed BPs will give us an idea of such contracts characterization in the MED Area.

More information about EPC framework in all European countries can be found in other H2020 projects as Transparense and EPC+ .

## *Structure of the BP collection information*

Information about Best Practices gathered from all STEPPING project partners is divided into ten sections: Basic information, Buildings' data, Technical parameters, Contracted measures, Contract related figures, Contracting models applied, Funding approaches, Types of buildings included in the contracts, Tender approaches and Awarding procedure.

***Description of the sections***

- Basic information is related to the country and general description.
- Buildings' data includes information about the facilities and building environment.
- Technical parameters are a description of the installed technical measures.
- Contracted measures describe all actions included in the contract.
- Contract related figures include quantitative and qualitative information about the above measures as the amount of investment and achieved savings.
- Contracting models applied
- Funding approaches provide us financial details
- Types of buildings included in the action.
- Tender approaches and Awarding procedure states about issues of procurement procedure.

The structure of parameters for gathering data is as shown below:

**Basic Info**

- Name
- Country
- General description

**Buildings' data**

- No. of buildings (bundled EPC)
- Usable area ($m^2$)
- Heated volume ($m^3$)
- Building year
- Last refurbishment date
- Owner
- Location
- Occupants (daily Average)
- Yearly hours of use (Hr)
- Climate zone (Average global horizontal radiation: kWh/$m^2$/yr)

**Technical parameters**

- Initial situation (Baseline consumption kWh/yr)
- Final situation (Consumption kWh/yr)

- Occupation efficiency of the building kWh/per/$m^2$/yr
- Energy saving (kWh/yr)
- Energy produced (self-consumed/ grid) (kWh/yr)
- Energy efficiency initial class
- Energy efficiency final class

**Contracted measures**

- Energy Conservation Measures(ECM)
- Refurbishment of thermal envelopes
- Replacement of outdoor windows and/or doors
- Replacement or Renovation of HVAC units
- Installation/replacement of thermostatic valves on radiators
- Water heating solar collectors
- Compensation of reactive energy
- Renovation of indoor lighting
- Building management system
- Renovation of water supply system
- RES Installation
- Energy monitoring system
- Use of district heating/cooling
- Combined heat and power(CHP)
- Passive elements (Trombe wall, green roof, etc...)
- Measurement &Verification Plan
- Maintenance Service
- Initial Energy Audit
- Upfront investment of owner (%-€)
- Costs assumed in EPC
- Standard of comfort
- Tried-and-tested method for baseline and savings.
- Training of building users
- Other Legal obligations

**Contract related figures**

- Investment grade proposal
- Investment Grade Audit

- Contract duration: years
- Total investment: EUR
- Simple Return period On Investment(ROI): yr
- Payback period: years
- Internal Rate of Return(IRR)
- The city ‘s shares in investment cost: EUR
- Avoided $CO_2$ emissions: $kgCO_2/y$ (guaranteed)
- Initial energy costs (baseline): EUR/yr
- Initial energy consumption (baseline): kWh/yr
- Energy consumption for energy vectors (methane gas, electricity, oil, biomass, etc)
- Money savings: EUR/yr
- Guaranteed energy savings: %/yr
- Guaranteed water savings: $m^3/yr$
- Shared savings: %

**Contracting models applied:**

- Energy performance contracting (EPC)
- Energy supply contracting (ESC)
- Chauffage EPC

**Funding approaches**

- Self-financed
- Supplier arranged financed (Private/public ESCO)
- Third party financed
- Grants, loans, fiscal incentives received...etc.
- Leasing/Renting
- Mix

**Types of buildings included in the contracts**

- Office
- Educational
- Sports
- Residential
- Museum/Libraries
- Medical/Laboratories
- Accommodation
- Industrial/commercial
- Other

**Tender approaches**

- Individual tender
- Bundled tender

**Awarding procedure**

- Competitive dialogue
- Direct award of contract
- Negotiated procedure
- Open tender procedure
- Restricted tender procedure

## *List of EPC best practice examples*

The list below is the result of gathering best practices by the countries and partners participating in STEPPING project, in alphabetical order of countries. A summary of all BPs can be found in Annex I - Table I.

***France***

RAEE

1. BP5. Small EPC on a primary School. Pouilly les Nonains
2. BP6. EPC for several buildings. Montluçon
3. BP7. EPC for refurbishment of a Media library. Montmélian

4. BP8. EPC on boiler replacement for 5 buildings. Annemasse

***Greece***

AEA

1. BP18. EPC in Bank buildings (35-50)
2. BP19. EPC in a public office building. Pikermi, Attiki.

***Italy***

ENVIPARK

1. BP9. EPC in 5 buildings. Volvera
2. BP10. EPC in a Primary school. None
3. BP11. EPC in 57 buildings. Padova

REGPIE

1. BP12. EPC in 5 buildings: Townhall, schools and gym. Bruino
2. BP13. EPC in 4 buildings: Schools and gym. Orbassano
3. BP14. EPC in 3 buildings: Nursery and Junior High schools. Piossasco

AESS

1. BP15. EPC in 161 buildings: Modena municipality.
2. BP16. EPC in 30 buildings: Province of Modena.
3. BP17. EPC in 100 buildings: Province of Modena.

***Malta***

MIEMA

Malta does not provide any own best practice given that currently there are no EPC models in force in the country. However the Maltese Energy & Water Agency within the Office of the Prime Minister is presently undertaking a consultation process to collect feedback on the suitable Energy Performance Contracting model for the Maltese Islands. The results will serve as input for the drafting of the relevant policies on EPC.

MIEMA has contributed to the output by selecting best practices from other countries with a similar climate (Croatia and Bulgaria).

1. BP25. EPC in Educational and Rehabilitation Facility. Ravda (Bulgaria)
2. BP26. EPC in a Primary school. Rakovica (Croatia)
3. BP27. EPC in Students' dormitory blocks. Sofia(Bulgaria)

***Portugal***

AREANATejo

1. BP24.

At the moment there are no best practice EPC examples. Right now, the public entities have all the tools to implement an EPC on their buildings but only a few projects in public lighting was studied (not implemented yet), but anything related to public buildings.

***Slovenia***

BSC Kranj

1. BP20. EPC in 9 buildings: Town hall and elementary schools. Municipality of Kranj
2. BP21. EPC in a Sport complex with Olympic pool. Kranj
3. BP22. EPC in a Hospital. Brežice
4. BP23. Deep renovation of town Hall. Brda

***Spain***

DPH

1. BP1. EPC in a sports high performance centre. Sant Cugat del Vallés
2. BP2. EPC in Agri-food Laboratory in Cabrils
3. BP3. EPC in Grand Theater El Liceu, Barcelona
4. BP4. Catalan Institute of Oncology, Hospitalet de Llobregat

In total, there were gathered information and data about 26 best practices examples.

## *EPC best practices summary*

As a result of the initial best practices analysis, the EPC projects profiling in public buildings located in MED area are very diverse:

- The most often owners of buildings are municipalities, being educational and sports centres the most commonly found buildings (See Annex I - Table V and Table VI).
- The most used model of contracting (53,85%) is Multi-Type buildings, compared to 46,15 % of One Type buildings (See Annex I - Chart II).
- As expected, and in accordance with MED region, climate zone of actions receives a solar irradiation of around 1500 kWh/$m^2$/year.
- The average age of buildings is around 50 years, ranging from 3 to 156 years.
- Standard type of EPC is the most frequently model of contracting applied, guaranteeing the achieving of energy savings for the contract duration with a range between 7-69 % and an average of 36,42 % of achieved savings.
- The initial Investment costs which range is between 40000 and 19942886 € are mainly provided by the ESCOs. The average of such investments is 1544582 € and the total avoided $CO_2$ emissions are more than 11400 Tm per year.
- Regarding funding approaches most of the undertaken actions (80%) have been financed by ESCOs having also received other grant funding 46 % of them and third part financing the 34%. A mixed scheme has been applied by 15% of the actions .
- 38% of procedures followed the grouping methodology while 34% were Individuals, most of which (70%) were awarded by open tender. No data about tender typology of 26% BPs.
- We find HVAC renovation, windows/glazing, building management system, Energy monitoring system, Initial energy audit, Training of users and M &V Plan as the most frequently implemented technical measures (See Annex I - Table VII).
- The method of awarding providers is mostly represented by negotiated procedure. In several cases, there is used the competitive dialogue for awarding the contract.

# *Key findings*

### *Introductory comments*

The analysis is aimed to a characterisation of the sample. Some of the data included in contracts as annual fee paid to the ESCOs are not included due to the difficulties to obtain them. Although not all the investments follow a typical pattern of an EPC - based on achieved savings- their inclusion show us that the aim of all investments not always are the savings.

As shown by Transparense project survey (2013), the main barriers to the EU EPC market are regulatory ("regulation / lack of support from the government", "subsidy / policy uncertainty"); structural ("lack of trust in the ESCO industry", "complexity of the concept / lack of information") and financial ("financial crisis", "raising affordable finance"). As a result of this and as preliminary finding, we see that in MED countries, examples of EPC best practices in public buildings do not abound.

### *Correlations among parameters*

Some fundamental parameters such as Contract duration, Total investment, Simple Return period On Investment(ROI), Guaranteed energy savings, Usable area and Energy savings/Investment are compared to obtain any correlation and visual information (see Annex I - Chart I) in order to draw initial findings.

The choice of these parameters is made bearing in mind those are actions carried out in public buildings above all municipal.

When an investment is undertaken in a municipal building the first four parameters are those that the local authority needs to analyse to see if it should be carried out (annual fee should also be included) and the last ones- usable area and Energy savings/Investment - give us an idea of the building size and the efficiency of the invested amounts.

A previous screening of the sample excludes of such analysis those BPs which ROI are greater than 20 years, or if there are very notable differences between contract duration and ROI, considering that from the financial point of view does not make sense to accept that such actions will have an investment recovery much greater than the duration of the contract.

ROI could be greater than contract duration or than 20 years when the objective of the municipality is not only energy savings but global building refurbishment (heritage preservation, comfort, security,

adaptation of the usage, accessibility, normalisation...). Then EPC would be just a part of a bigger refurbishment project and a short ROI wouldn't be the priority.

The Chart I (Annex I) shows us at first glance the information of best practices and how good they are. Some examples are outlined below:

- For a sound contract between ESCO and public authority, and to avoid economic detriment to any of the parties, Blue column (Contract duration years) should be slightly higher than yellow one (ROI) if we consider that we are dealing with Energy Performances Contracts, payed with part of the achieved savings. (Except in the cases described in paragraph above)

In the case the blue column is much higher than yellow one, the benefit is for the ESCO and the detriment for the building owner and vice versa in the opposite situation.

Besides, it would also be interesting to compare the relationship of the different kind of implemented measures with the achieved savings and its influence on ROI (see Annex I - Table IX), but due to the quantity of variables, such comparison could only be done in One-type buildings .

We firstly made a linear regression analysis between ROI and % of savings (Annex I - Chart VI) seeking to find positive matching before to analyze the relation of savings with implemented measures. This comparison shows that data does not match in any correlation ($R^2$= 0,00352) indicating that there are no relations between ROI and % of savings. In any case there would be a slight inverse correlation, which may lead us to think that the higher percentage of savings, the higher ROI, which, apart from having no meaning, leads us to the conclusion that projects analysed in BPs either are not correctly designed since financial point of view or some of the measures included as investments are not based on energy savings.

After this preliminar analysis we don't see much point to compare every measure with the savings, since we don't know to what extent a defined saving percentage comes from a given measure.

We also find after the Sample characterization -and with the reservations imposed by the statistical constrictions of the sample- that in “northern” zone tenders is more common to include multi type buildings in one or various buildings (See Annex I - Chart IV).

Italian tenders (due to the fact of being northern Italy) are mostly multi-type with several buildings as northern countries and southern countries best practices are more focused in one type building (See Annex I - Chart V).

# ANNEX I – Tables and charts

Source: All tables and charts made by the authors based on data supplied by STEPPING partners (2017).

***Sample characterization.***

| PARTNER | Country | Acronim | Name |
|---|---|---|---|
| DIPH | Spain | BP01 | EPC in a sports high performance centre in Barcelona |
| | | BP02 | EPC in Agri-food Laboratory in Cabrils (Barcelona) |
| | | BP03 | Liceu of Barcelona |
| | | BP04 | Catalan Institute of Oncology |
| RAEE | France | BP05 | Small EPC on a primary School (SIEL) |
| | | BP06 | EPC for several buildings (Montluçon) |
| | | BP07 | EPC for refurbishment of a Media library (SPL OSER)Montmélian |
| | | BP08 | EPC on boiler replacement for 5 buildings- Annemasse |
| ENVIPARK | Italy | BP09 | "2020Together" project Volvera |
| | | BP10 | "2020Together" project Scuola materna Rubiano |
| | | BP11 | "3L - Less Energy, Less Cost, Less Impact" Padova |
| REGPIE | Italy | BP12 | "2020Together" project Bruino |
| | | BP13 | "2020Together" project Orbassano |
| | | BP14 | "2020Together" project Piossasco |
| AESS | Italy | BP15 | Modena Municipality 2005-2014 |
| | | BP16 | Province of Modena EPC 2005-2011 |
| | | BP17 | Province of Modena EPC 2013-2020 |
| AEA | Greece | BP18 | EPC for a Bank (ZEB SA - ESCO) |
| | | BP19 | Centre for Renewable Energy Sources & Saving (CRES) |
| BSC (SLOVENIA) | Slovenia | BP20 | Municipality Kranj |
| | | BP21 | Sport complex with Olympic pool |
| | | BP22 | General Hospital Brežice |
| | | BP23 | Deep renovation of Brda Municipal Hall |
| AREANATEJO | Portugal | BP24 | - |
| MIEMA (MALTA) | Bulgaria | BP25 | Educational and Rehabilitation Facility of UNWE in Ravda |
| | Croatia | BP26 | Primary school Eugen Kvaternik in Rakovica |
| | Bulgaria | BP27 | Students' dormitory blocks at Sofia University |

Table I: Best Practices by Partner and country.

| Acronim | No. of buildings | Multi Type | One Type |
|---|---|---|---|
| BP02 | 1 | | X |
| BP03 | 1 | | X |
| BP04 | 1 | | X |
| BP05 | 1 | | X |
| BP07 | 1 | | X |
| BP10 | 1 | | X |
| BP19 | 1 | | X |
| BP22 | 1 | | X |
| **Subtotal** | - | - | **8** |
| BP14 | 3 | | X |
| BP09 | 5 | | X |
| BP01 | 8 | | X |
| BP18 | 35-50 | | X |
| **Subtotal** | - | - | **4** |
| BP13 | 4 | X | |
| BP08 | 5 | X | |
| BP12 | 5 | X | |
| BP20 | 9 | X | |
| BP16 | 30 | X | |
| BP11 | 57 | X | |
| BP06 | 93 | X | |
| BP17 | 100 | X | |
| BP15 | 161 | X | |
| BP21 | - | X | |
| BP23 | - | X | |
| BP25 | - | X | |
| BP26 | - | X | |
| BP27 | - | X | |
| **Subtotal** | - | **14** | - |
| **Total general** | **26** | **14** | **12** |

Table II: BP characterization with one or various buildings and One-type or Multi-type buildings

| Country | No. of B.P. | Multi Type | One Type | |
|---|---|---|---|---|
| | | | Several Building | One Building |
| Bulgaria | 2 | 2 | - | - |
| Croatia | 1 | 1 | - | - |
| Slovenia | 4 | 3 | - | 1 |
| France | 4 | 2 | - | 2 |
| Greece | 2 | - | 1 | 1 |
| Italy | 9 | 6 | 2 | 1 |
| Spain | 4 | - | 1 | 3 |
| **Total General** | **26** | **14** | **4** | **8** |
| **%** | 100,00% | 53,85% | 15,38% | 30,77% |
| **%** | 100,00% | 69,23% | | 30,77% |

Table III: Analysis of BP typologies by country

| Country | No. of B.P. | Multi Type | One Type | |
|---|---|---|---|---|
| | | | Several Building | One Building |
| Bulgaria | 2 | 2 | - | - |
| Croatia | 1 | 1 | - | - |
| Slovenia | 4 | 3 | - | 1 |
| **Total General** | **7** | **6** | **-** | **1** |
| **%** | 100,00% | 85,71% | - | 14,29% |

| Country | No. of B.P. | Multi Type | One Type | |
|---|---|---|---|---|
| | | | Several Building | One Building |
| France | 4 | 2 | - | 2 |
| Greece | 2 | - | 1 | 1 |
| Italy | 9 | 6 | 2 | 1 |
| Spain | 4 | - | 1 | 3 |
| **Total General** | **19** | **8** | **4** | **7** |
| **%** | 100,00% | 42,11% | 21,05% | 36,84% |
| **%** | 100,00% | 63,16% | | 36,84% |
| **%** | | 42,11% | 57,89% | |

Table IV: Split between northern-colder/ southern-warmer countries.

| Acronim | Type of Use | | | | | | | | | No. of buildings | No of Use |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Office | Educational | Sports | Residential | Museum /Libraries | Medical / Laboratories | Accommodation | Industrial /commercial | Other | | |
| BP13 | | X | X | | | | | | | 4 | 2 |
| BP20 | X | X | | | | | | | | 9 | 2 |
| BP21 | X | | X | | | | | | | - | 2 |
| BP23 | X | | | | | | | | X | - | 2 |
| BP26 | | X | X | | | | | | | - | 2 |
| BP27 | | X | | | | | X | | | - | 2 |
| **BP12** | **X** | **X** | **X** | | | | | | | **5** | **3** |
| **BP16** | **X** | **X** | **X** | | | | | | | **30** | **3** |
| **BP17** | **X** | **X** | **X** | | | | | | | **100** | **3** |
| BP25 | | X | X | | | | X | | | - | 3 |
| BP11 | X | X | X | | X | | | | | 57 | 4 |
| BP15 | X | X | X | X | X | | | | | 161 | 5 |
| BP08 | X | X | X | X | | | X | | X | 5 | 6 |
| BP06 | X | X | X | X | X | | X | X | X | 93 | 8 |

Table V: Analysis of Multi Type building BPs to compare. Comparative analysis could be done in highlighted BPs (Similar typology).

| Acronim | Type of Use | | | | | | | | | No. of buildings |
|---|---|---|---|---|---|---|---|---|---|---|
| | Office | Educational | Sports | Residential | Museum /Libraries | Medical / Laboratories | Accommodation | Industrial /commercial | Other | |
| **BP02** | | | | | | **X** | | | | 1 |
| BP03 | | | | | | | | | X | 1 |
| **BP04** | | | | | | **X** | | | | 1 |
| **BP05** | | **X** | | | | | | | | 1 |
| BP07 | | | | | X | | | | | 1 |
| **BP10** | | **X** | | | | | | | | 1 |
| BP19 | X | | | | | | | | | 1 |
| **BP22** | | | | | | **X** | | | | 1 |
| **BP14** | | **X** | | | | | | | | 3 |
| **BP09** | | **X** | | | | | | | | 5 |
| BP01 | | | X | | | | | | | 8 |
| BP18 | X | | | | | | | | | 35-50 |
| **Total General** | **2** | **4** | **1** | **0** | **1** | **3** | **0** | **0** | **1** | **12** |
| % | 16,67% | **33,33%** | 8,33% | 0,00% | 8,33% | **25,00%** | 0,00% | 0,00% | 8,33% | 100,00% |

Table VI: Analysis of One-Type building BPs to compare. Comparative analysis could be done in highlighted BPs.

| Acronim | Refurbishment of thermal envelopes | Replacement of outdoor windows and/or doors | Replacement or Renovation of HVAC units | Installation /replacement of thermostatic valves on radiators | Water heating solar collectors | Compensation of reactive energy | Renovation of indoor lighting | Building management system | Renovation of water supply system | RES Installation | Energy monitoring system | Use of district heating/cooling | Combined heat and power(CHP) | Passive elements (Trombe wall, green roof, greenhouse,green wall...) | No of type of measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BP03 | | | | | | | | X | | | | | | | 1 |
| BP19 | | | | | | | X | | | | | | | | 1 |
| BP08 | | | X | | | | | X | | | X | | | | 3 |
| BP21 | | | X | | X | | | | X | | X | | | | 4 |
| BP10 | | | X | X | | | | X | | | X | | | | 4 |
| BP18 | | | X | | | | | X | | | X | | | X | 4 |
| BP20 | | | X | X | | | X | | | | X | | | | 4 |
| BP02 | | | X | | | | X | X | X | | X | | | | 5 |
| BP04 | | | X | | | | X | X | X | | X | | | | 5 |
| BP06 | | Windows/glazing | X | | X | | | | | | X | X | | | 5 |
| BP22 | | | X | X | | | | X | X | | X | | | | 5 |
| BP26 | X | Both | X | | | | X | | | Biomass (3) | | | | | 5 |
| BP05 | | Windows/glazing | X | | | | X | X | | | X | | | X | 6 |
| BP07 | X | Windows/glazing | X | | | | X | | | | X | | | X | 6 |
| BP17 | X | Windows/glazing | X | X | X | | | X | | | X | | | | 7 |
| BP23 | | Windows/glazing | X | X | | | X | X | | | X | | | | 6 |
| BP25 | X | Windows/glazing | X | | X | | | | X | Geothermal (4) | | | | | 6 |
| BP27 | X | Windows/glazing | X | | X | | X | X | | | | | | | 6 |
| BP01 | | | X | | X | | X | X | X | PV(X) | X | | | | 7 |
| BP12 | X | Windows/glazing | X | X | | | | X | | PV(X) | X | | | | 7 |
| BP13 | X | Windows/glazing | X | X | X | | | X | | | X | | | | 7 |
| BP16 | X | Windows/glazing | X | X | X | | | X | | Geothermal (4) | X | | | | 8 |
| BP09 | X | Windows/glazing | X | X | X | | | X | | PV(X) | X | | | | 8 |
| BP11 | X | Windows/glazing | X | X | | | X | X | | PV(X) | X | | | | 8 |
| BP14 | X | Windows/glazing | X | X | X | | | X | | PV(X) | X | | | | 8 |
| BP15 | X | Windows/glazing | X | X | X | X | X | X | | PV(X) | X | | X | | 11 |
| otal genera | 12 | 15 | 24 | 12 | 11 | 1 | 12 | 19 | 6 | 9 | 21 | 1 | 1 | 3 | |
| % | 46,15% | **57,69%** | **92,31%** | 46,15% | 42,31% | 3,85% | 46,15% | **73,08%** | 23,08% | 34,62% | **80,77%** | 3,85% | 3,85% | 11,54% | |

Table VII: Characterization by technical measures implemented

| | Name | Contract duration: years | Total investment: EUR (X $10^6$) | Simple Return period On Investment(ROI): yr | Guaranteed energy savings: %/y(X10) | Usable area ($m^2$)(X $10^3$) | Energy saving/ Investment (kWh/€ year) |
|---|---|---|---|---|---|---|---|
| BP01 | Sports centre in Barcelona | 10 | 13 | 3,93 | 3,9 | 2,80 | 2,67 |
| BP02 | Laboratory (Barcelona) | 5 | 0,4 | 2,49 | 1,5 | 0,35 | 2,36 |
| BP03 | Liceu of Barcelona | 6 | 13 | 3,94 | 4,4 | 0,90 | 3,38 |
| BP04 | Catalan Institute of Oncology | 6 | 7 | 1,69 | 2,2 | 6,42 | 6,14 |
| BP06 | EPC for several buildings (Montluçon) | 10 | 17,6 | 10,00 | 1,7 | | 0,20 |
| BP08 | EPC on boiler replacement for 5 buildings-Annemasse | 9 | 3,28 | 9,00 | 2,5 | 1,65 | 0,00 |
| BP10 | "2020Together" project Scuola materna Rubiano | 13 | 0,42648 | 8,52 | 6,2 | 0,14 | 1,91 |
| BP12 | "2020Together" project Bruino | 13 | 4,67209 | 12,01 | 6,2 | 0,70 | 1,36 |
| BP13 | "2020Together" project Orbassano | 13 | 8,35728 | 11,09 | 5,8 | 1,36 | 1,48 |
| BP14 | "2020Together" project Piossasco | 13 | 4,64284 | 17,05 | 6,3 | 0,52 | 0,96 |
| BP16 | Province of Modena EPC 2005-2011 | 7 | 16,30662 | 7,00 | 0,0 | 26,01 | 3,31 |
| BP17 | Province of Modena EPC 2013-2020 | 7 | 8,00344 | 7,00 | 0,0 | 27,17 | 3,65 |
| BP20 | Municipality Kranj | 15 | 3,2 | 6,49 | 5,6 | 3,33 | 3,62 |
| BP21 | Sport complex with Olympic pool | 10 | 7,8 | 7,58 | 5,6 | 2,20 | 2,62 |
| BP22 | General Hospital Brežice | 15 | 5,32048 | 5,14 | 2,5 | 0,75 | 1,53 |
| BP23 | Deep renovation of Brda Municipal Hall | 15 | 3,74038 | 7,53 | 0,0 | 0,05 | 0,68 |
| BP25 | Educational and Rehabilitation Facility of UNWE in Ravda | 6 | 2,605 | 7,23 | 5,3 | 0,45 | 1,76 |
| BP26 | Primary school Eugen Kvaternik in Rakovica | 12 | 3,092 | 17,74 | 5,3 | 0,15 | 0,40 |
| BP27 | Students' dormitory blocks at Sofia University | 5 | 11,84964 | 6,94 | 6,9 | 3,27 | 0,14 |

Table VIII: Data of compared parameters (See Chart I)

| Acronim | Simple Return period On Investment(ROI): yr | Guaranteed energy savings: %/y | Refurbishment of thermal envelopes | Replacement of outdoor windows and/or doors | Replacement or Renovation of HVAC units | Installation /replacement of thermostatic valves on radiators | Water heating solar collectors | Compensation of reactive energy | Renovation of indoor lighting | Building management system | Renovation of water supply system | RES Installation | Energy monitoring system | Use of district heating/cooling | Combined heat and power(CHP) | Passive elements (Trombe wall, green roof, greenhouse,green wall...) | No of type of measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BP10 | 714,29 | 7,00% | | | X | X | | | | X | | | X | | | | 4 |
| BP07 | 93,24 | 50,00% | X | Windows/glazing | X | | | | X | | | | X | | | X | 6 |
| BP09 | 31,79 | 19,69% | X | Windows/glazing | X | X | X | | | X | | PV(X) | X | | | | 8 |
| BP05 | 26,01 | 35,00% | | Windows/glazing | X | | | | X | X | | | X | | | X | 6 |
| BP06 | 10,00 | 17,00% | | Windows/glazing | X | | X | | | | | | X | X | | | 5 |
| BP16 | 24,70 | 63,70% | X | Windows/glazing | X | X | X | | | X | | Geothermal (4) | X | | | | 8 |
| BP08 | 9,00 | 25,00% | | | X | | | | | X | | | X | | | | 3 |
| BP26 | 17,74 | 53,00% | X | Both | X | | | | X | | | Biomass (3) | | | | | 5 |
| BP11 | 17,05 | 63,40% | X | Windows/glazing | X | X | | | X | X | | PV(X) | X | | | | 8 |
| BP22 | 5,14 | 25,00% | | | X | X | | | | X | X | | X | | | | 5 |
| BP01 | 12,01 | 61,50% | | | X | | X | | X | X | X | PV(X) | X | | | | 7 |
| BP12 | 11,09 | 58,20% | X | Windows/glazing | X | X | | | | X | | PV(X) | X | | | | 7 |
| BP02 | 2,49 | 15,00% | | | X | | | | X | X | X | | X | | | | 5 |
| BP19 | 9,00 | 64,50% | | | | | | | X | | | | | | | | 1 |
| BP21 | 8,52 | 61,80% | | | X | | X | | | | X | | X | | | | 4 |
| BP23 | 7,23 | 53,00% | | Windows/glazing | X | X | | | X | X | | | X | | | | 6 |
| BP20 | 7,58 | 56,00% | | | X | X | | | X | | | | X | | | | 4 |
| BP18 | 6,49 | 56,00% | | | X | | | | | X | | | X | | | X | 4 |
| BP27 | 3,93 | 39,00% | X | Windows/glazing | X | | X | | X | X | | | | | | | 6 |
| BP25 | 6,94 | 69,00% | X | Windows/glazing | X | | X | | | | X | Geothermal (4) | | | | | 6 |
| BP03 | 3,94 | 43,80% | | | | | | | | X | | | | | | | 1 |
| BP04 | 1,69 | 22,00% | | | X | | | | X | X | X | | X | | | | 5 |
| BP13 | 7,00 | - | X | Windows/glazing | X | X | X | | | X | | | X | | | | 7 |
| BP17 | 7,53 | - | X | Windows/glazing | X | X | X | | | X | | | X | | | | 7 |
| BP14 | 7,00 | - | X | Windows/glazing | X | X | X | | | X | | PV(X) | X | | | | 8 |
| BP15 | 9,00 | - | X | Windows/glazing | X | X | X | X | X | X | | PV(X) | X | | X | | 11 |
| **Total general** | | | **12** | **15** | **24** | **12** | **11** | **1** | **12** | **19** | **6** | **9** | **21** | **1** | **1** | **3** | |
| % | | | 46,15% | **57,69%** | **92,31%** | 46,15% | 42,31% | 3,85% | 46,15% | **73,08%** | 23,08% | 34,62% | **80,77%** | 3,85% | 3,85% | 11,54% | |

Table IX. Relation between the different typologies, achieved savings and ROI in One-Type buildings. (See Chart VI)

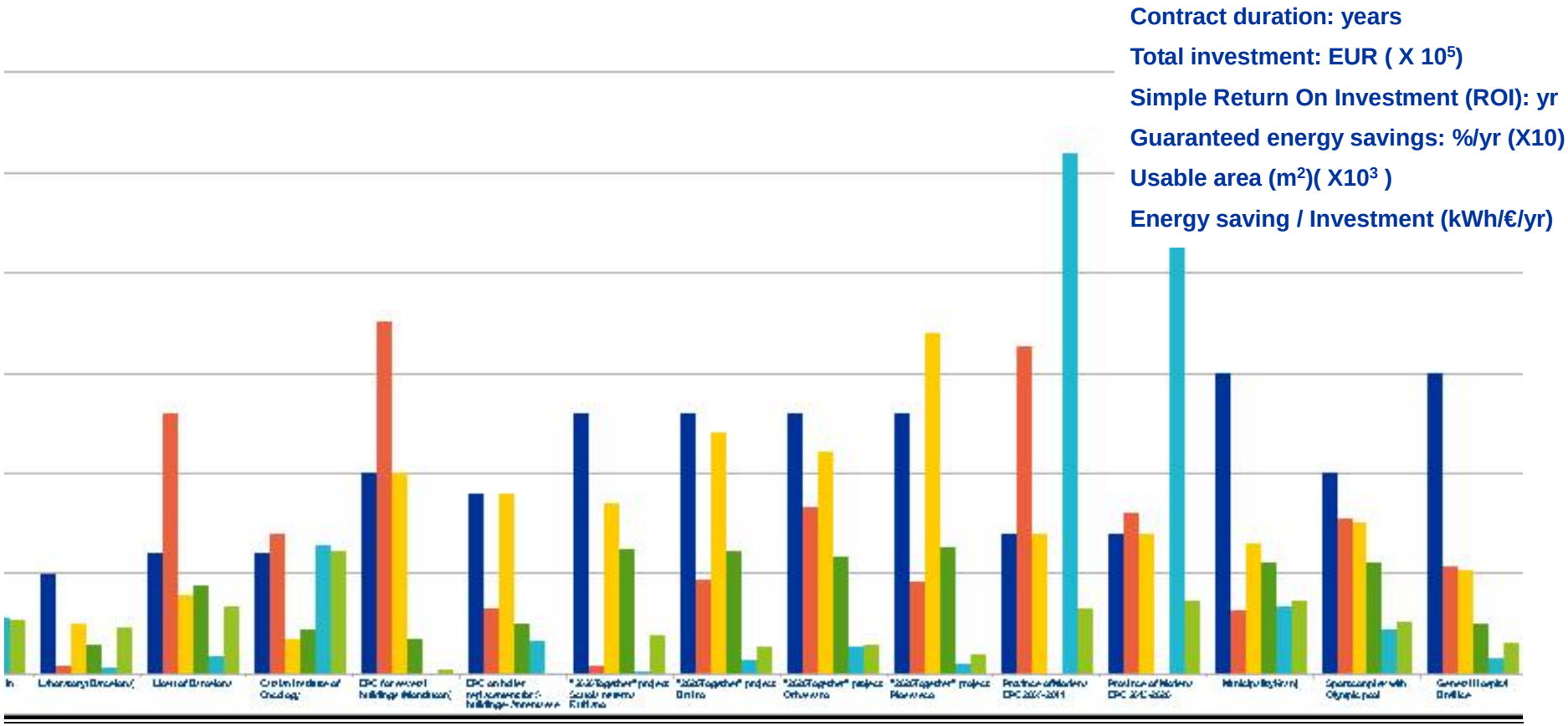


Chart I. Core parameters analysis

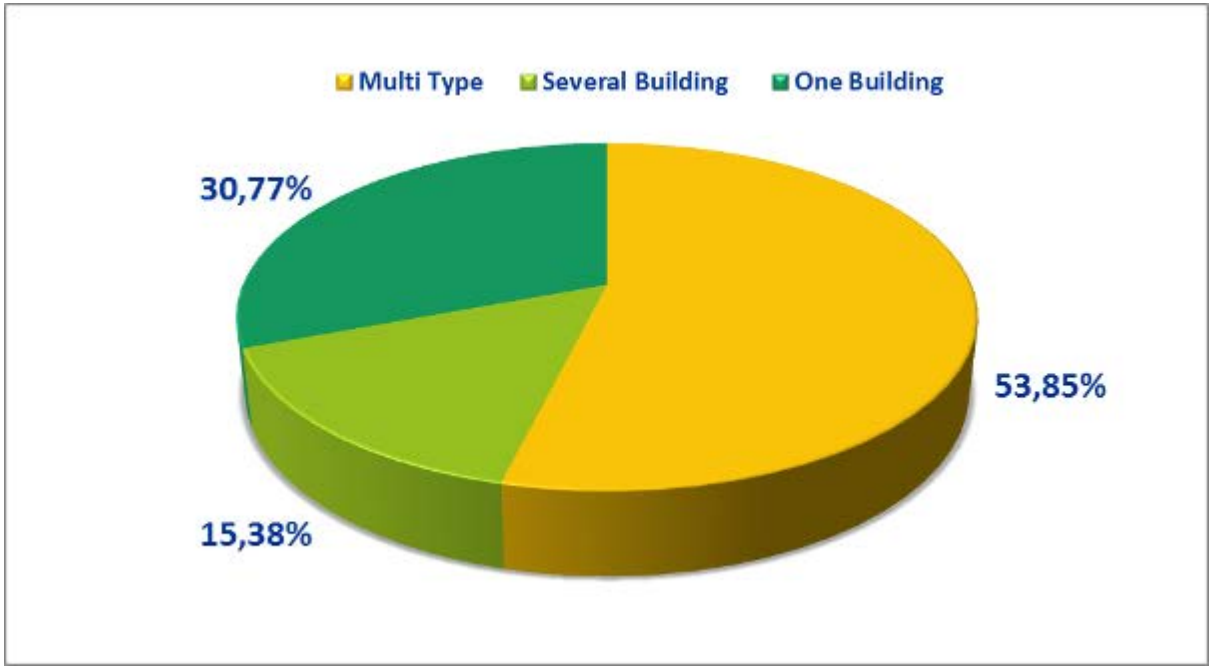


Chart II. Sample distribution in % by building tipologies

***Analysis by countries***

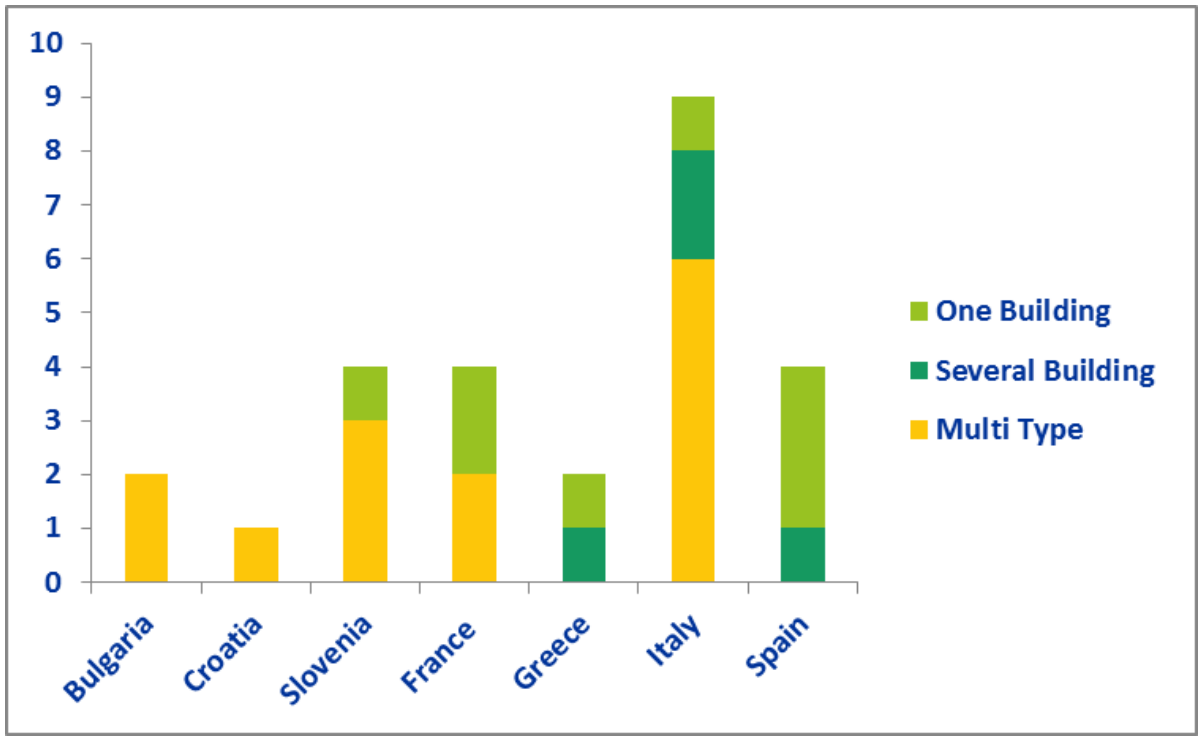


Chart III. Whole sample

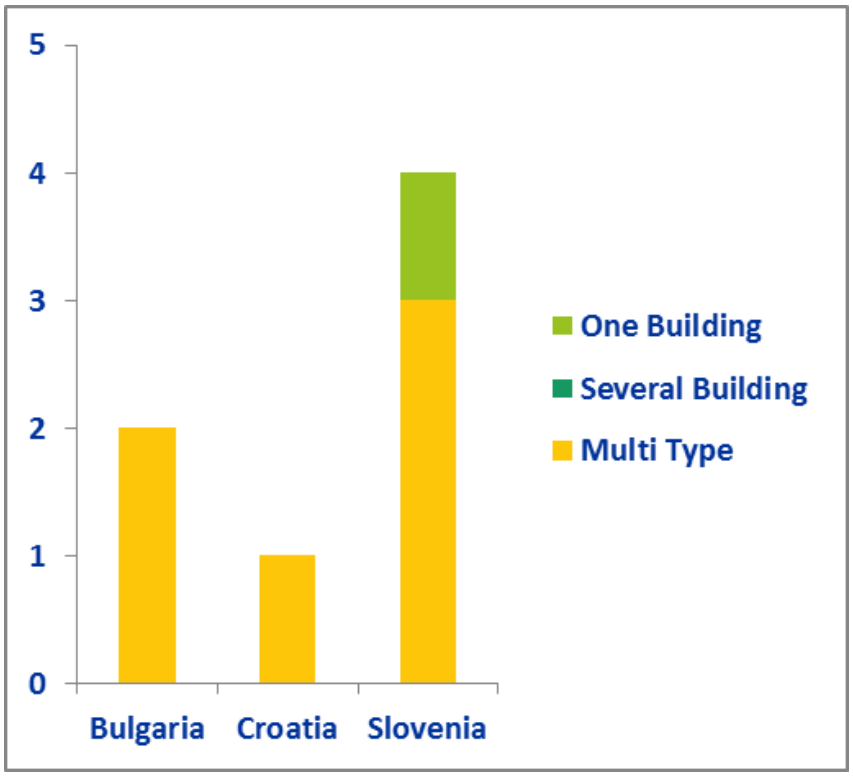


Chart IV. “Northern” countries

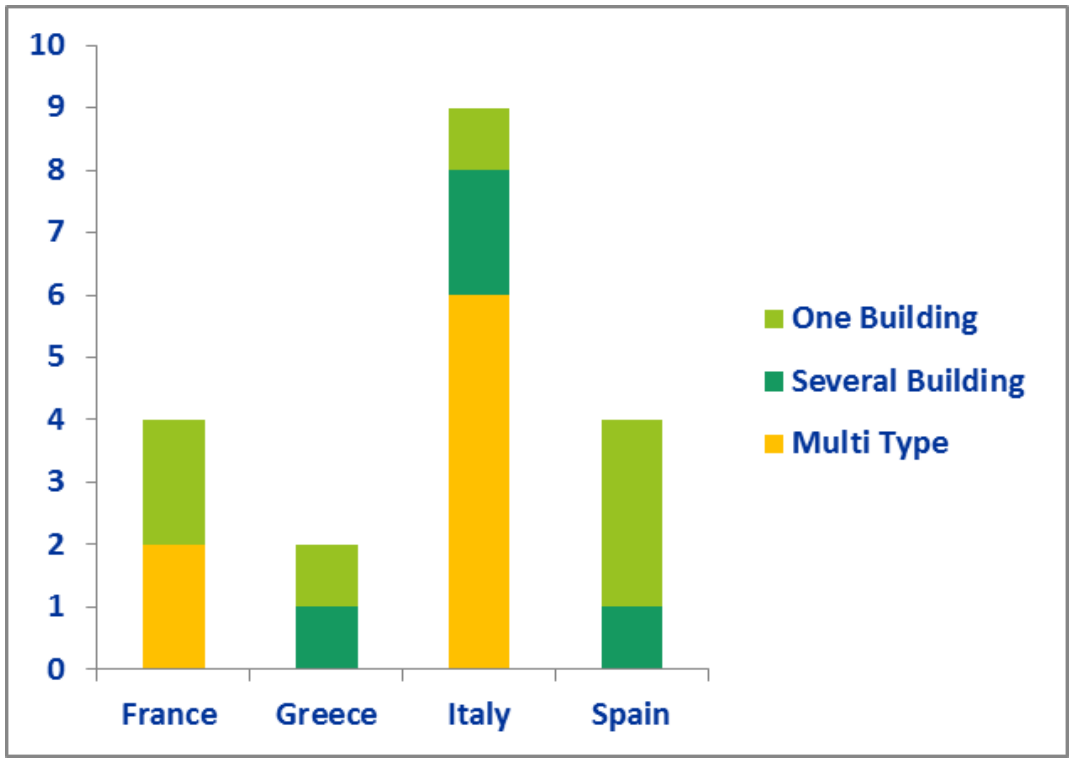


Chart V. “Southern” countries

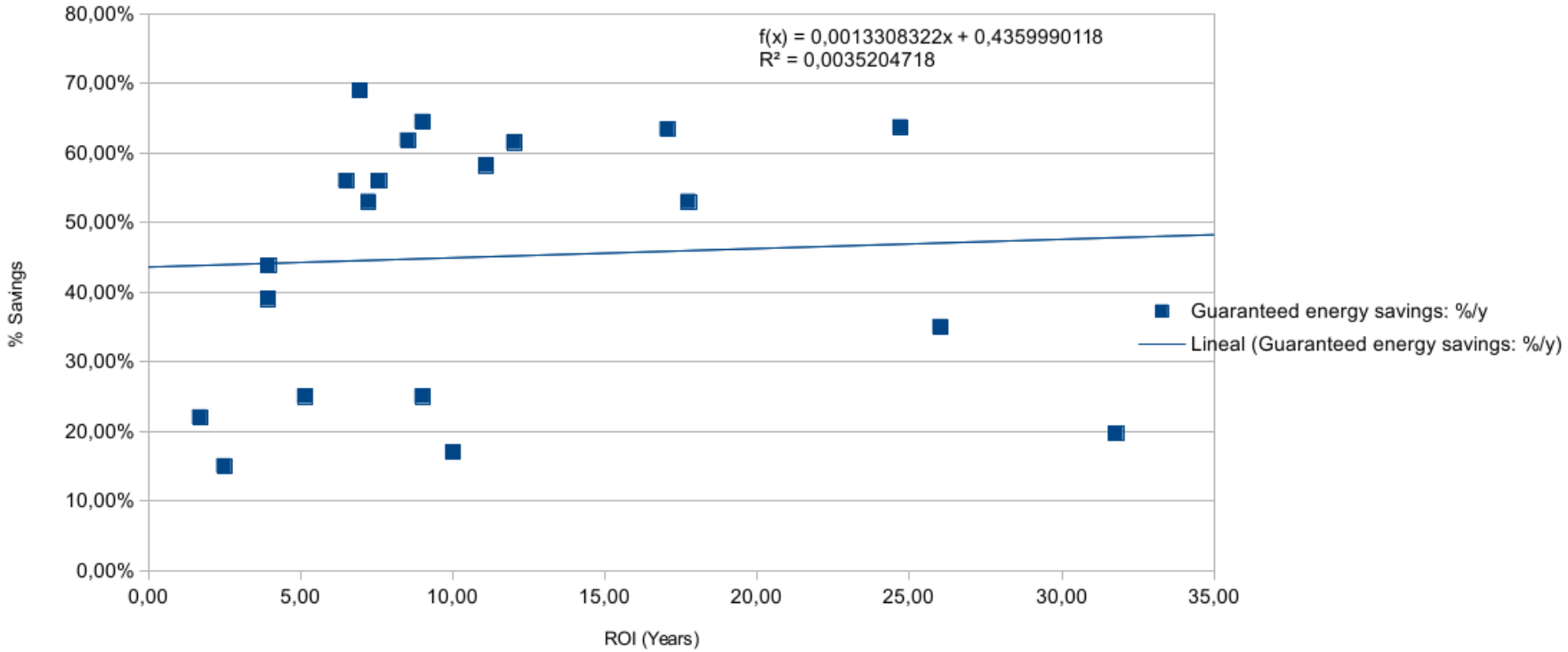


Chart VI. Linear correlation between achieved savings and ROI in One-Type buildings.

# ANNEX II – BP pictures

In alphabetical order of countries*:*

- In BPs which include several buildings, the picture represent an example of such buildings.

- BPs' links take you to the Google Maps location where the building/s is/are.

***France***

- BP5. Small EPC on a primary School. Pouilly les Nonains

- BP6. EPC for several buildings. Montluçon

- BP7. EPC for refurbishment of a Media library. Montmélian


- BP8. EPC on boiler replacement for 5 buildings. Annemasse

***Greece***

- BP18. EPC in Bank buildings (35-50)
- BP19. EPC in a public office building. Pikermi, Attiki.

***Italy***

ENVIPARK

- BP9. EPC in 5 buildings. Volvera

- BP10. EPC in a Primary school. None

- BP11. EPC in 57 buildings. Padova

REGPIE

- BP12. EPC in 5 buildings: Townhall, schools and gym. Bruino

- BP13. EPC in 4 buildings:  Schools and gym. Orbassano

- BP14. EPC in 3 buildings: Nursery and Junior High schools. Piossasco

AESS

- BP15. EPC in 161 buildings: Modena municipality.
- BP16. EPC in 30 buildings: Province of Modena .

## School buildings

| BEFORE | AFTER |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |

- BP17. EPC in 100 buildings: Province of Modena

***Malta***

- BP25. EPC in Educational and Rehabilitation Facility. Ravda (Bulgaria)

- BP26. EPC in a Primary school. Rakovica (Croatia)

- BP27. EPC in Students' dormitory blocks. Sofia (Bulgaria)

***Slovenia***

- 20. BEPC in 9 buildings: Town hall and elementary schools. Municipality of Kranj
- BP21. EPC in a Sport complex with Olympic pool. Kranj
- BP22. EPC in a Hospital. Brežice
- BP23. Deep renovation of town Hall. Brda

***Spain***

- BP1. EPC in a sports high performance centre. Sant Cugat del Vallés

- BP2. EPC in Agri-food Laboratory in Cabrils

- BP3. EPC in Grand Theater El Liceu, Barcelona

- BP4. Catalan Institute of Oncology, Hospitalet de Llobregat