TRIPLE-A

Enhancing at an Early Stage the Investment Value Chain of Energy Efficiency Projects

Deliverable 5.3:
Lessons learnt from the identification of Triple-A Investments

February 2022

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Preface

Triple-A has a very practical result-oriented approach, seeking to provide reliable information answering on three questions:

- How to ***assess*** the financing instruments and risks at an early stage?
- How to ***agree*** on the Triple-A investments, based on selected key performance indicators?
- How to ***assign*** the identified investment ideas with possible financing schemes?

The Triple-A scheme comprises three critical steps:

- ***Step 1 - Assess:*** Based on Member States (MS) risk profiles and mitigation policies, including a Web based database, enabling national and sectoral comparability, market maturity identification, good practices experiences exchange, reducing thus uncertainty for investors.
- ***Step 2 - Agree:*** Based on standardised Triple-A tools, efficient benchmarks, and guidelines, translated in consortium partners' languages, accelerating and scaling up investments.
- ***Step 3 - Assign:*** Based on in-country demonstrations, replicability and overall exploitation, including recommendations on realistic and feasible investments in the national and sectoral context, as well as on short and medium term financing.

Who We Are

	Participant Name	Short Name	Country Code	Logo
1	National Technical University of Athens	NTUA	GR	
2	ABN AMRO Bank N.V.	ABN AMRO	NL	
3	Institute for European Energy and Climate Policy Stichting	IEECP	NL	
4	JRC Capital Management Consultancy & Research GmbH	JRC	DE	
5	GFT Italy srl	GFT Italy	IT	
6	CREARA Consulting SL	CREARA	ES	
7	Adelphi Research Gemeinnützige GMBH	adelphi	DE	
8	Piraeus Bank SA	PB	GR	
9	University of Piraeus Research Center	UPRC	GR	
10	SEVEn, The Energy Efficiency Center	SEVEn	CZ	
11	Public Investment Development Agency	VIPA	LT	
12	National Trust Ecofund	NTEF	BG	

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1 Executive summary

The Triple-A project has a practical result-oriented approach, seeking to identify which investments can be considered as Triple-A investments, fostering sustainable growth, while also having an extremely strong capacity to meet their commitments, already from the first stages of investments generation.

The Triple-A methodology focuses on answering three questions:

- How to assess the financing instruments and risks at an early stage?
- How to agree on the Triple-A investments, based on selected key performance indicators?
- How to assign the identified investment ideas with possible financing schemes?

In particular, the Triple-A scheme is introduced to identify Triple-A energy efficiency investments, aiming to reduce the respective time and effort required at the crucial phase of the investments conceptualisation and to increase transparency and efficiency of respective decision making.

In order to better understand the characteristics of what a Triple-A project could be, a process for identifying and analysing Triple-A investments in the 8 case study countries has been one of the key tasks of the Triple-A project.

The identification and verification of the Triple-A investments have been supported by the development of the Standardised Triple-A Tools. The latter assists the identification procedure by benchmarking the collected projects based on a Multi-Criteria Decision Analysis that deploys financial and sustainability Key Performance Indicators, pointing out and verifying the Triple-A ones. Thanks to this process, which has involved not only Triple-A partners and project developers that provided projects but also public employees, energy efficiency experts and other stakeholders, highly relevant information has been obtained.

This process began with a national search for EE projects at different stages of development that could be financially attractive for their technical quality and ability to meet their economic commitments. At its conclusion, a pipeline of more than 100 financially attractive projects was generated. A study of the trends in this group of projects was carried out, and their main characteristics were identified.

Once the first phase was completed, the search was narrowed down to those projects that were certified as Triple-A by the Triple-A Tools. At this point, the collaboration of the project promoters was crucial in providing the necessary information to characterise the projects in depth.

To enhance communication between the Tripe-A partners and the project developers and ensure a homogeneous collection of information among the different countries, a standard project fiche template with technical and economic information was distributed.

2 Introduction

One of the objectives set out in the Triple-A project is the identification of Triple-A energy efficiency projects and robust financing programs/models answering the needs and priorities of financing market actors. With the aim of characterising what could be a Triple-A project in today's energy efficiency market, a search and identification campaign was launched to identify projects with the potential to receive the Triple-A status on the platform. This campaign has been carried out in all Triple-A participating countries in several phases.

In the first phase, a pipeline of at least 100 Energy Efficiency financially attractive project ideas was collected among the participating countries. Within this analysis, a pre-evaluation of the projects was made for each case study country to ensure that they were aligned with the EU Taxonomy. As a next step, the selection of 4-10 Triple-A energy efficiency projects and robust financing programs/models per case-study country was commissioned (Bulgaria, Czech Republic, Germany, Greece, Italy, Lithuania, Spain and the Netherlands) through peer-to-peer communications with all engaged target groups and key actors. The selected projects are benchmarked with the assistance of the Triple-A Tools, which facilitate energy efficiency stakeholders by evaluating the risks and maturity of their investment ideas, benchmarking them and identifying the most bankable ones while matching them with state-of-the-art green financing schemes. In order to standardise the collection of project data and the proper upload of the collected projects to the Triple-A Tools, while also being able to draw uniform conclusions from the projects provided by each partner, a consistent data collection fiche was provided to all case study countries.

Figure 1: Task structure

According to the Triple-A methodology, the partners used their network of contacts in the sector to search for projects of acceptable technical and economic quality. This information was submitted using the provided fiches, the data obtained was homogenised and the trends of the Triple-A projects collected were identified and represented. Once each project was confirmed as Triple-A, several meetings were arranged, in which the project developers provided technical and economic data on the project, as well as general impressions of the sector and lessons learned from their activity.

Furthermore, to meet the requirement of the task of finding robust financing programmes for energy efficiency found in each country, a consultation process was carried out among all the Triple-A partners on which mechanisms or schemes were most widely implemented and developed in their respective countries. This survey was based on the list of the most frequently used mechanisms for EE financing previously generated in the project. The partners had to rank them by preference of use, with country-specific observations when required.

The present report introduces the main findings and lessons learnt obtained from the whole process of identifying Triple-A projects in each case study country. The report is available to the public in order to

exploit and deliver to the energy efficiency stakeholders (policymakers, project developers, financer) valuable information and lessons learnt regarding energy efficiency financing possibilities, project design parameters and best practices, supporting

2.1 Responsibilities

CREARA – **WP5 and Task leader**: overall task coordination, revision of country leads input, drafting and finalisation of deliverable 5.2, Country lead: Identification of key projects for Spain

Piraeus Bank (PB) - **Country lead**: Identification of key projects in Greece

ABN AMRO - **Country lead**: Identification of key projects in the Netherlands

JRC - **Country lead**: Identification of key projects in Germany

GFT - **Country lead**: Identification of key projects in Italy

SEVEn - **Country lead**: Identification of key projects in the Czech Republic

VIPA - **Country lead**: Identification of key projects in Lithuania

NTEF - **Country lead**: Identification of key projects in Bulgaria

3 Cross-country comparison of Triple-A projects

In previous chapters, the information provided by the partners has been collected and analysed individually in order to identify the main characteristics of the projects collected at a national level. From this information it has been possible to draw conclusions and identify trends of Triple-A project conditions in each case study country.

In the following subsections, comparative charts and general results are presented in order to give an overview of the conclusions drawn from the process of identifying Triple-A projects in the 8 case study countries.

3.1 Projects sector

At this point, the standardisation of the fiches used to collect the information from each country is of crucial significance, as it allows for a accurate comparison and avoids distortions in the overall view of the sector. In the following chart, the overall sector distribution can be visualised, regardless of the country:

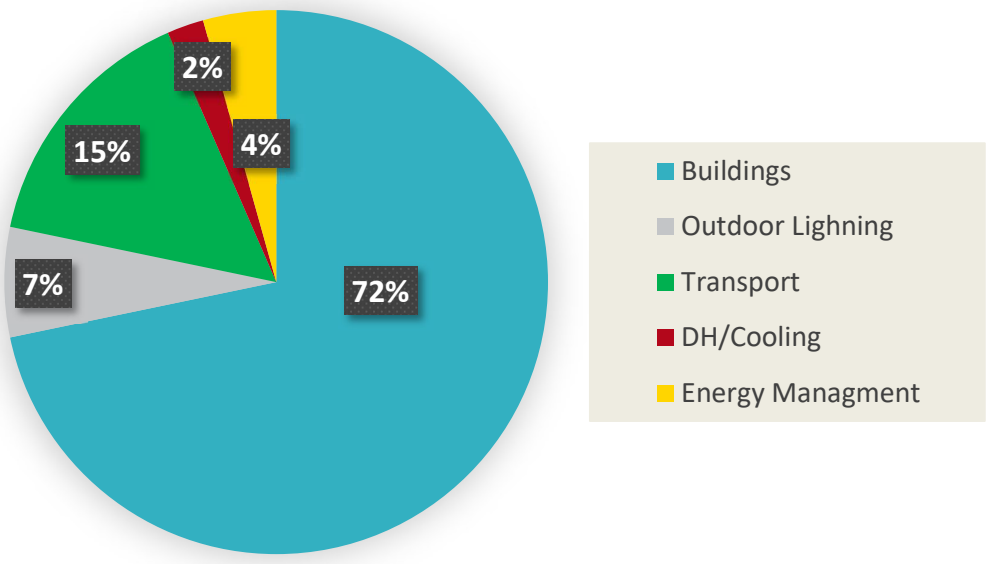

Figure 2: Sector presence in the project pipeline

Based on the Triple-A sample of projects collected through the Triple-A Tools, it can be concluded that three-quarters of the projects collected in the case study countries belong to the building sector. The remaining project sectors in order of abundance among those collected by this task are Transportation, Outdoor Lighting and the District Energy Networks (DH/Cooling).

This graph demonstrates what has been identified throughout the Triple-A project identification process in all participating countries. The dominance of projects related to the building sector is overwhelming and is not marked by a single group of countries, but, with the exception of Bulgaria, it is the predominant sector in the remaining 7 countries.

Despite this conclusion, there is not a sufficient statistical sample to extend this conclusion to the entire energy efficiency sector.

This trend can be seen in the graph showing the project sector on a country-by-country basis:

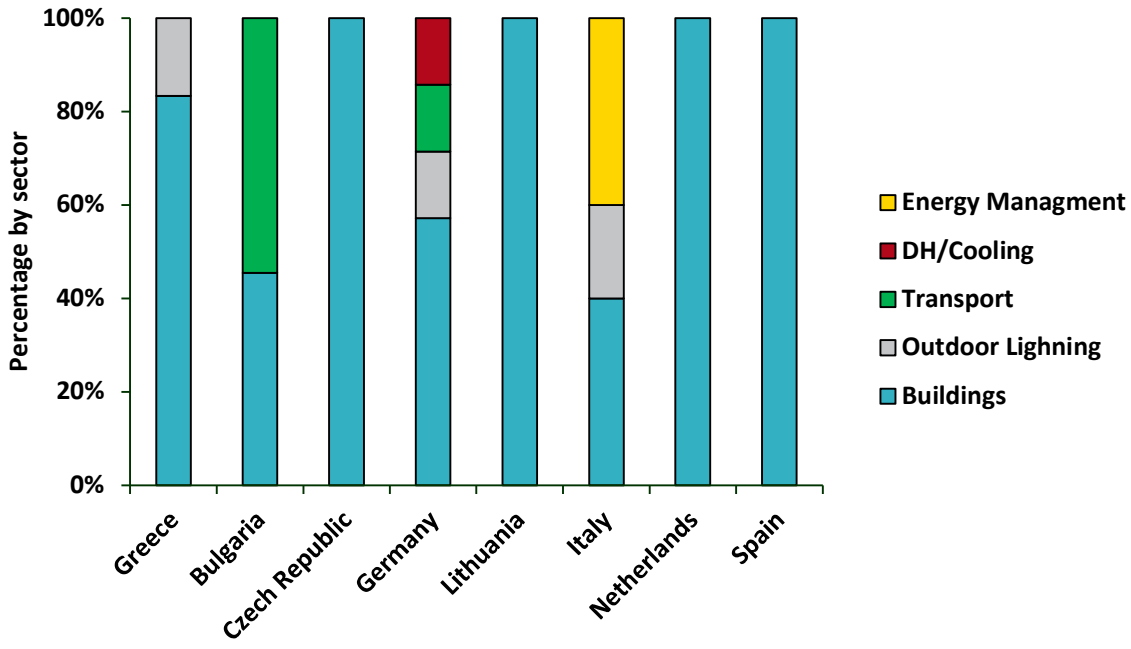

Figure 3: Sector of the projects by countries

As it could be easily observed, there is an absolute predominance of projects oriented towards the building sector. These projects are mainly related to extensive refurbishments of residential buildings, hospitals, institutes, headquarters of public bodies etc.

3.2 Projects investment

The following analysis focuses on the volume of financing required for energy efficiency projects across the 8 European countries of the Triple-A project. The information collected has been separated into investment ranges (0-75K, 75k-500k, 500k-1M, Over 1M) and represented in the following graph for the complete set of projects collected in this task.

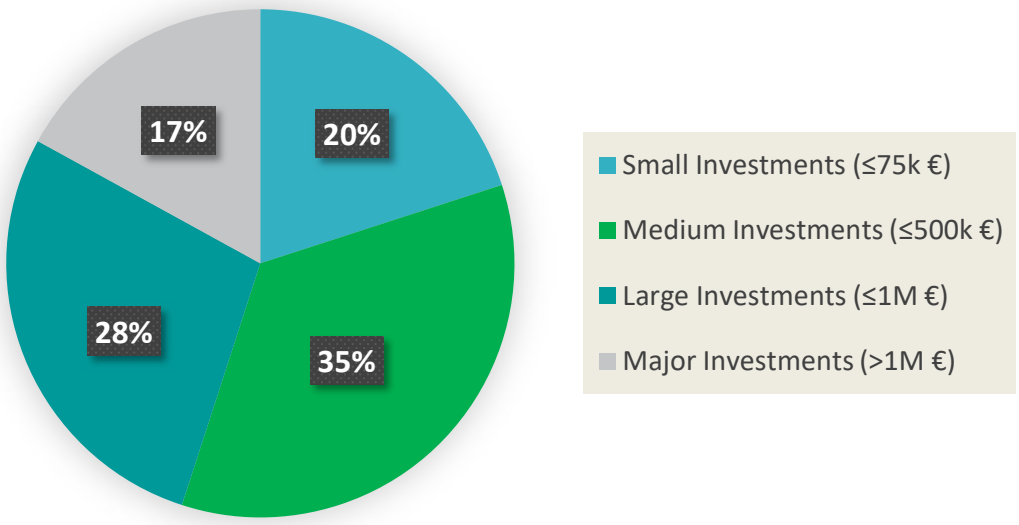

Figure 4: Investment ranges of the project pipeline

An unequal breakdown of money ranges was chosen in order to mark the differences between small and large projects and to study how the fact that projects have to pass the filter of the Triple-A platform can lead to smaller or larger projects being picked up.

As it can be observed, the distribution of the project groups is relatively even. The largest group is the Medium Projects group (with an investment of up to half a million euros) which represents 35% of the projects reported by the partners. The remaining groups are all close to 20-25%. The distribution is therefore relatively stable.

If we extract the mean and median of all investments collected in the scope of this task, we obtain the following data table:

Table 1: Quantitative investment data of the project pipeline

Lowest Investment	**14,000 €**
Highest Investment	**40,000,000 €**
Average investment	**600,253 €**
Median Investment	**681,409 €**

It is also interesting to provide a comparative view among the participating countries, so that relevant comparisons can be made. The graph below does not show the balanced trend of the aggregated data so well, this is due to the diverse origin of the Triple-A projects collected by each partner, which largely determines the volume of funding required. The data is shown below:

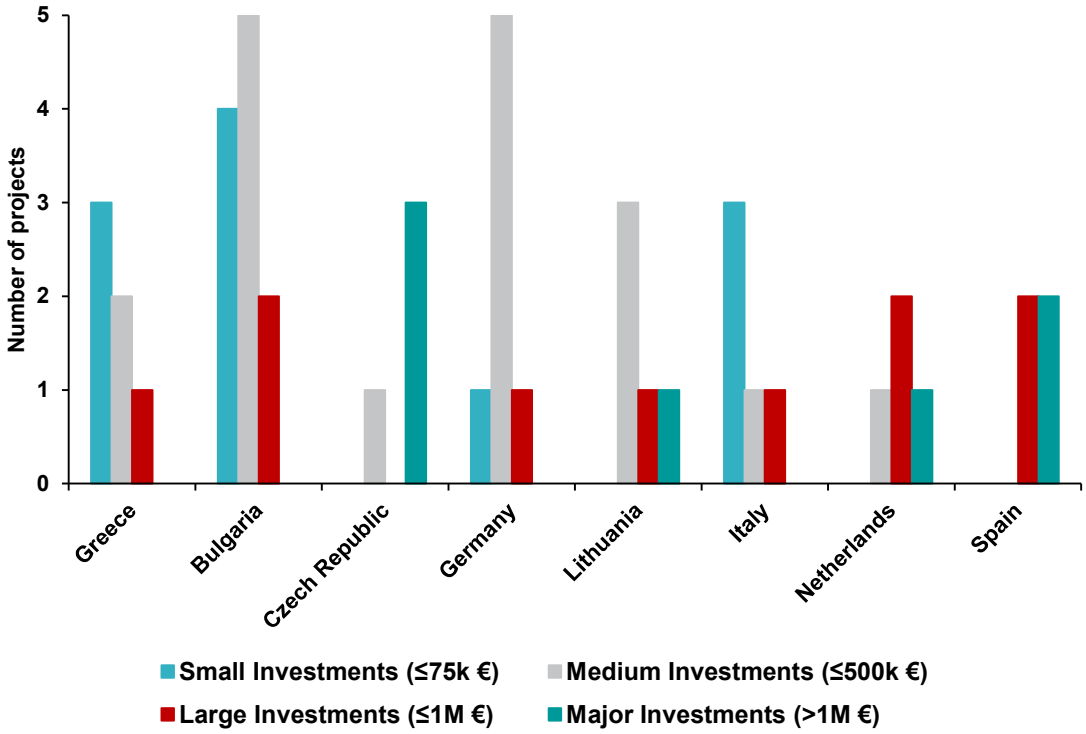

Figure 5: Investment ranges by countries

3.3 Payback period

The last financial indicator to be analysed is the payback period. This indicator is highly dependent on the source from which the projects have been collected and the scope of these projects. Projects have been collected for payback periods as short as 2 years and as long as almost 20 years.

The distribution by country in terms of 5-year segments is given below:

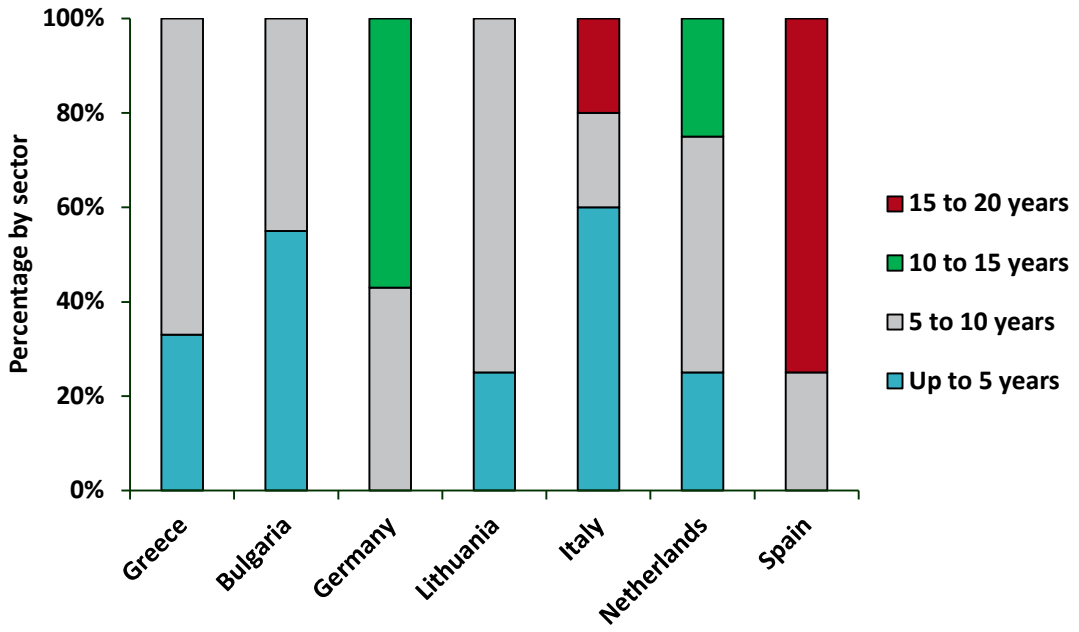

Figure 6: National payback periods by segments

In other words, it can be observed that Triple-A projects aimed at the complete refurbishment of public buildings or housing have much higher payback periods than other types of projects, such as those aimed at public lighting or purchasing electric vehicles. This is mainly due to the short life span of luminaires or electric vehicles, compared to a complete refurbishment of a building, where the installed measures can be exploited for a more extended period of time.

The main conclusion that can be drawn from this section is that there is no clear trend showing that projects with a certain payback period are more likely to be rated as Triple-A.

Instead, there are projects with very short payback periods, such as those oriented to outdoor lighting, and also very long payback periods, such as those oriented to deep energy retrofitting of buildings.

In order to provide a comparison among partner countries, a table of data with the average payback periods of the collected projects is provided.

Table 2: National average of Triple-A payback periods

National average of Triple-A payback periods (years)	
Greece	5.2
Bulgaria	3
Czech Republic	No data
Germany	8.5
Lithuania	7.2
Italy	6.3
Netherlands	13.5
Spain	14.1
Total	**5.5**

Finally, with a joint average of **5.5 years**, the differences between countries can be observed, mainly due to the variety of the projects collected.

4 Lessons learnt

4.1 Lessons learnt for Greece

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in Greece.

The Triple-A projects identified and analysed by the Greek project partner, Piraeus Bank, are primarily in the building sector. As established in the Triple-A project identification procedure, interviews were held with the project developers of the selected projects. In these interviews, which were conducted via online meetings due to the Covid-19 pandemic, the interviewees were asked for their impressions of the energy efficiency sector in the Greek context.

Based on the statements of the project developers, specific lessons learnt of the process of identifying Triple-A investments were extracted:

- Replication of projects, either in terms of financing or/and technical solutions, is highly desired. Having similar projects allows project developers to demonstrate the proof of concept, promote them as a product, and minimise development costs.
- The lower electricity cost (due to the competition of the energy providers) positively affects the replacement of fossil fuel systems.
- The lower electricity cost (due to the competition of the energy providers) negatively affects the adoption of high energy efficiency solutions.
- The Energy Efficiency market tends to become money intensive due to the low expected profit margin.
- Aggregation of projects seems to be more critical than other issues, as it has a positive impact on risk assessment and could provide economies of scale.
- Replication of projects, either of financing or/and technical solutions, is highly desired.
- Building confidence is critical for the implementation – decision making for EE projects

If we synthesise these statements, it can be concluded how energy price fluctuations can affect the EE sector for several reasons and even in opposite directions at the same time. If the energy price rises, the energy savings achieved will be transformed into higher economic savings; therefore, energy efficiency projects will significantly reduce payback periods and increase profitability indicators. On the other hand, the increase in the general price of energy may make fossil fuels more competitive and delay the implementation of cleaner and more innovative systems.

It is also essential that the projects are similar, or at least the metrics that characterise them. This way, the replication and aggregation of similar projects would lead to a significant reduction in analysis effort and development costs for the ESCOs. This also would have a positive impact on the risk analysis processes of financial institutions, reducing transaction costs and risks when financing packages of similar projects.

In addition, the most critical barriers and problems that could be faced in identifying Triple-A investments were also extracted:

- The small size of investments or projects
- Improvement of energy performance is not a priority for most the customers
  Customers are not aware of the breakdown of their own energy consumption

- The market assumes that EE projects don't provide acceptable financial performance and that have a high technical risk.
- The lack of knowledge or interest of customers, who do not entirely realise the potential of this sector for either of these two reasons.

4.2 Lessons learnt for Bulgaria

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in Bulgaria.

The Triple-A projects identified and analysed in Bulgaria are strongly characterised by the country's economic development situation as a post-soviet economy. In this line, most of the projects identified are energy retrofits of public buildings, such as hospitals, schools or town halls. Projects related to sustainable mobility have also been identified, in particular the acquisition of fleets of electric vehicles for municipalities and other public bodies.

As it could be concluded from the data gathered, Bulgarian Triple-A projects are promoted by the public sector, which has a significant presence in the country. Despite the profound economic transformation that has taken place in this country, where a powerful market economy has developed in just a few years, there are still marked traces of its Soviet heritage, such as the large number of strategic public companies operating in the country. This characteristic is reflected in the interviews conducted in the Triple-A project identification process. The interviewees are predominantly public officials, mayors or other elected officials, but also energy experts, consultants and other professionals from the private sector.

In the analysis of the lessons learnt and barriers encountered in identifying Triple-A projects in Bulgaria, a distinction will be made between those related to the building sector and those targeting electric vehicles.

The lessons learnt from the process of identifying buildings related to Triple-A projects in Bulgaria are:

- Although some types of buildings with particular purposes show outstanding potential for using innovative market models for financing energy efficiency, it is better to implement them with public resources with strict rules for spending funds and enhanced control over the implementation of the investment.
- For projects (buildings) for which this is a subsequent (additional) deeper renovation, it is challenging to achieve a satisfactory result (Triple-A). The reasons are that some of the main ESMs have been implemented in a previous stage, as a result of which the new savings are more modest.
- Better results will be obtained if a complete deep renovation is carried out and a complex solution for the building management system is applied.
- Despite the good economic indicators shown, this type of project would be difficult to reach status (Triple-A).
- Installing renewables will also improve results.

The lessons learned to highlight the ease of developing energy efficiency projects in public buildings compared to private clients. The implementation of innovative financing schemes for energy efficiency projects could balance the situation in this respect.

Difficulties in obtaining Triple-A status have been detected for projects where the measures implemented do not achieve huge savings because the initial energy status of the building was not too critical. Despite this, these projects have positive energy indicators and the capacity to be profitable in the medium to long term. Finally, the advantages of implementing innovative technologies in these EE projects in buildings, such as renewable technologies or energy management systems for buildings, are highlighted.

The main barriers and problems detected in the process of identifying Triple-A investment related to buildings are:

- For special-purpose sites (owned by the Ministry of Defense or the Ministry of Interior), access to information is very complicated.
- Loss of valuable time due to irrevocable procedures.
- Decisions are highly dependent on the specific political situation.
- Preliminary control (verification) of the calculations for the baseline is crucial.
- The lack of a standardised (unified approach) model for handling the source data creates complications and distorts the information about the project.
- Attitude towards avoiding the risks of applying market mechanisms in the financing of EE in municipal and state property.
- Preliminary control (verification) of the calculations for the baseline is crucial.
- Attitude towards avoiding the risks of applying market mechanisms in the financing of EE in municipal and state property.

Limited access to information, bureaucracy, dependence on the political situation and the refusal of public entities to implement innovative financing models are identified as the primary external barriers in the Bulgarian energy efficiency sector. here are also technical or organisational barriers, such as the lack of standardisation in project data and the method of calculating and verifying the baseline.

The lessons learnt of the process of identifying EVs related Triple-A projects in Bulgaria are focused on the process to achieve Triple-A status for these projects. The qualification criteria are based on:

- Type and purpose of the new vehicles.
- Type and the year of manufacture of the vehicles replaced.
- The older the replaced vehicle, the better the results

On the other hand, the main barrier to the mass implementation of the electric vehicle as a sustainable and energy-efficient approach is the lack of a comprehensive assessment of EVs' environmental and energy efficiency impact. Mainly in their construction, the production and recycling of their batteries and the dependence on each country's energy mix.

4.3 Lessons learnt for the Czech Republic

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in the Czech Republic.

The Triple-A projects identified in the Czech Republic are distinguished by the uniformity of their characteristics. All investments belong to the public sector and aim to renovate public buildings, such as government buildings, schools or kindergartens. This country has one of the most active energy efficiency sectors in Europe, and, thanks to public support, EE projects are often easily financed.

Based on the statements of the project developers, specific lessons learnt of the process of identifying Triple-A investments were extracted:

- Low capacity of energy specialists and civil engineers to identify suitable technical opportunity
- There are at the moment more prepared projects than available funds from the Operational Programme Environment.
- The usefulness of bilateral negotiations with tender participants on the project's technical solutions.
- Until recently, financing the EE projects has not been an issue in the Czech Republic. Many subsidy programmes are available, low-interest rates and excess supply of loans on the side of the banks
- The necessity for consideration of greater financial reserve for unexpected market price changes.

The lessons learnt point to a lack of technical expertise in identifying opportunities as well as the need for guaranteed funds to provide more security to investors.

The interviews identified a number of barriers or problems that hinder the identification of Triple-A projects in the Czech Republic:

- In the last three months, a decrease in construction capacity (exodus of foreign workers/craftsmen) along with a dramatic increase in material prices has been witnessed. The construction sector is now facing heavy inflationary pressures.
- Outcomes in the mid-term are uncertain – inflation may stop many projects – financial tools may change (ineffective ones may become effective)
- There is a lack of funds allocated for project subsidies from the Operational Programme Environment.
- Insufficient information about the building prevents the proper technical design of some energy-saving solutions.
- The recent rise in the prices of construction works and materials has resulted in the expected price of the project being exceeded.
- Time demands of the public contract due to the project's large scope.
- Lack of funding for proposed measures within the project. (Caused by the sharp rise in prices for building materials recently.)
- Low subsidy for the architectural solution of the ventilated facade by the subsidy programme.
- More demanding and less effective communication over email.

- The delay in resolving queries is due to lack of information, participants' workload of participants or time off work.
- Lack of clarity of contractual relations with architects with regard to the author's rights to the architectural design of the building.

Several external barriers have been identified as a market drag, including inflation, significantly increasing the project's budget. Lack of public funds, slow public procurement processes and lack of human resources have also been identified as significant barriers. Other technical aspects impeding Triple-A investments have been indicated, such as lack of information on buildings or clarity in contractual arrangements.

4.4 Lessons learnt for Germany

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in Germany.

The Triple-A projects gathered in Germany have a good diversity of characteristics in their source, budget and implemented technology. In addition, individual interviews were carried out for each organisation, obtaining valuable conclusions.

The identified lessons learnt of the process of identifying Triple-A investments in Germany were:

- How can investors combine the 3 Tools to their projects
- The importance of check if any project idea is compliant with EU Taxonomy
- The linking of Assign Tool and Green Bonds is not clearly defined yet
- The concept of the Assign Tool, including the unique interfaces for bankers, investors, funds and projects
- Fitting funding strategies (Green Bonds, EE Auctions) that better matches the examined investments and respective beneficiaries
- Difficulty in attracting stakeholders in Germany
- No response on new ideas but only more details on the current project and projects to be published in 2021
- The importance of the Triple-A Tools series (Assess, Agree, and Assign Tools) and how to use them.
- A part of stakeholders can't wait to use the tools and test the tools
- They have referred us to their online site in order to take more info regarding the ongoing project
- Invite them via email to participate in our webinar and to do a register in the Triple-A newsletter
- Many of them want to know further details about the Triple-A project, next steps and the progress of the project
- Company policy not to disclose information to persons outside the company
- Many of the details of the project are private and under discussion; no further information regarding the total budget-CAPEX refers to the energy efficiency part of the project

In the interviews conducted among German project developers and EE professionals, certain conclusions have been drawn on several topics. Firstly, some impressions were gained on the

functionality and features of the Triple-A platform, such as the importance of adequately integrating financing options like green bonds or EE auctions.

On the technical side, the confidentiality requirements of the companies have made it difficult to obtain specific information on each project and the challenge of attracting interested stakeholders to the project was noted.

The main barriers and problems detected in the process of identifying Triple-A investments are:

- Furthermore, other questions included in the questionnaire are which energy efficiency actions are considered necessary by building owners.
- Development of o common surveys and polls.
- Aim to organise more bilateral meetings towards the establishment of synergy.
- More promotion of the already developed Triple-A Questionnaires through targeted stakeholders
- The Project maturity status: Negotiations or ongoing
- No response on new ideas but only more details on the current project and projects to be published in 2021
- Many of the details of the project are private and under discussion
- Many of the stakeholders are not available for a meeting
- Emails to potential stakeholders without response, feedback
- Difficulty in attracting stakeholders in Germany
- The possibility to delete a test project into the tools
- Someone who is not an Energy efficiency expert may find it challenging to understand the concept of EU Taxonomy
- The misunderstanding that CAPEX refers to the energy efficiency part of the project
- Many of the details of the project are private and under discussion; no further information regarding the total budget-CAPEX refers to the energy efficiency part of the project
- Company policy not to disclose information to persons outside the company

When analysing the barriers and problems in the identification of Triple-A projects, the confidentiality requirements of the companies developing the projects are particularly noteworthy. Companies are reluctant to provide technical and economic data on the projects they develop, which complicates the process.

4.5 Lessons learnt for Italy

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in Italy.

In Italy, some very interesting Triple-A projects have been collected; in-depth interviews were carried out, which allowed getting to know the projects in detail. Projects include proposals for industrial self-consumption, smart grids, public lighting, building energy retrofits or energy data exchange systems. This helps to reach robust conclusions on the adaptability of the triple-A platform to various types of projects, in addition to the specific technical comments for each project.

Below are some statements about lessons learned for the Triple-A projects collected in Italy:

- In a smart grid for a municipality, different typologies of energy are requested for various purposes. The municipality needs large amounts of both electricity and heat, with very different demands along the day and the year.
- Installing a RES-based plant is essential for the sustainability of a smart grid, but it's not sufficient to guarantee complete efficiency. Batteries or combinations with co-generation could be a solution to this issue.
- Only through deep data analysis, the administration or the energy network managers will be able to understand where and how the energy consumption can be reduced, thus paving the way to the next energy efficiency actions.
- For the project regarding the smart platform for public illumination, extensive diffusion of the platform usage is needed to amplify the benefits. A spotted or isolated diffusion would not guarantee significant output
- The technical reliability of a self-consumption installation is more critical than absolute and permanent carbon neutrality, e.g. a hospital cannot suffer a power outage at any time.
- In the energy refurbishment of a complex installation, the energy needs of each section must be managed independently and according to its activity.
- It is not possible to edit the data already inserted in the Agree Tool. You can only resubmit the data from scratch.
- The "print" option creates a pdf with a report not containing all the information previously inserted.

Beyond a few comments about minor incidents in the use of the platform, most of the lessons learnt are focused on specific aspects of each project presented. The biggest challenges and their potential solutions for the presented projects on smart grids, self-consumption installations in complex facilities or public lighting management systems, for example, have been presented.

Some definitions were also obtained as to what would be the most important barriers and problems faced by the identified Triple-A project developers:

- Despite being an EE project with good economic indicators, the project is not compliant with the EU Taxonomy
- The high needed investment represents the main problem due to the exceptionally long payback period that is envisaged.

- The first barrier for an Administration in installing a new infrastructure is logistical. Such an intervention could take some temporary drawbacks in terms of comfort for inhabitants, thus creating a bad feeling against the implemented solution.
- Secondly, the money to be invested represents a potential problem.
- The high number of stakeholders involved with different needs and requirements.

Some of the problems mentioned by interviewees point to the large investment required for some projects, which extends the payback period and makes the project less attractive. Logistical and financing problems in public administrations or the large number of stakeholders that have to be coordinated in a major energy refurbishment project of a large building are also mentioned.

4.6 Lessons learnt for Lithuania

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in Lithuania.

In Lithuania, the collected projects come from a single developer or financier. These projects focus only on major refurbishments of administrative or office buildings located in the capital city or other cities. They are characterised by a wide scope and large investment needs.

In the meetings held, various topics concerning the current state of the national energy efficiency market were discussed. Based on the statements of the project developer, specific lessons learnt of the process of identifying Triple-A investments were extracted:

- Faster project implementation provides faster positive impact of investments (savings)
- EE projects are unattractive for investment due to long payback and high risk

The main barriers and problems detected in the process of identifying Triple-A investment related to buildings are:

- Projects require additonal investments that do not save energy
- Very complicated projects integration to the Triple-A tool
- Minor tool design problems.

4.7 Lessons Learnt for the Netherlands

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in the Netherlands.

The predominance of building renovation projects in the EE sector is again demonstrated by the projects identified in the Netherlands. These are ambitious projects for comprehensive energy refurbishment and are implemented in complex facilities, such as hospitals. In addition, some of them incorporate measures related to energy self-consumption through photovoltaic installations.

Among the lessons learnt during the study of Triple-A projects in buildings developed in the Netherlands are the following:

- Decisions of future energy plans are complex and involve multiple stakeholders.
- Risk management is essential, especially considering the context of a medical hospital. Access to energy 24/7 is always more important than carbon-neutral energy.
- Energy savings measures have to be linked with the building maintenance plans in order to optimise the investment costs.
- In most cases, the investment of energy-saving measures was already budgeted in the maintenance plans, so there were no main barriers other than the ones described above.

The conclusions drawn from interviewees' responses in the Netherlands have been somewhat specific and focused on significant building refurbishment projects. They emphasise the importance of risk management, both technical and economical, and the relevance of integrating maintenance plans into the initial planning of the intervention.

Main barriers and problems identified of the process of identifying the Triple-A investment:

- Technical issues, such as the practical implementation of energy-saving measures
- Investment choices, especially regarding the long term exploitation costs of the energy production plant.
- Altogether, there are more than 100 energy-saving measures to be considered. All in the context of financial impact and technical impact.
- The Decision-making process is slow and inefficient due to multiple companies involved in the project
- The EPC methodology was significantly changed in the Netherlands in 2021. Therefore current EPC improvement plans had to be updated after the maintenance plans were finished.

Barriers to the identification of Triple-A projects in the Netherlands include technical problems and complications in planning projects with a large number of measures. Other problems identified are the slow decision-making process due to multiple stakeholders and the change in the national EPC methodology.

4.8 Lessons learnt for Spain

This section presents the main results that arose from the project collection and benchmarking procedure and the stakeholder consultation and bilateral communication with investors and project developers in Spain.

The Triple-A projects in Spain follow the trend observed in the rest of the countries and are oriented towards the energy renovation of buildings. They also stand out for undertaking in-depth interventions in large-scale housing complexes.

The lessons learnt from the process of identifying buildings related to the Triple-A projects in Bulgaria are:

- The reasoning behind selecting a project and how to sell it to investors on a private basis is different from the one used by the Triple-A platform. This can cause controversy because well-positioned projects and about to achieve investment from various sources are classified as rejected by the Triple-A Tools. This is mainly due to the approach and calculation
- EU taxonomy is not known by the market, and there is still a long way to go in terms of applying it to the decision-making process in the Spanish market
- Required privacy of the project makes it difficult to share data without knowing the final user or potential financial party
- For PV installations, the input requested is not too relevant. Mainly focused on building refurbishments within the building section.

Among the comments received, the complications arising from the confidentiality requirements of the companies were highlighted, as well as the current lack of dissemination of EU Taxonomy in Spain, which continues to make it meaningless in the Spanish EE sector. One project developer also pointed out that some of his projects have been rejected by the Triple-A platform, despite being of high quality and having very interesting funding options.

In addition, the most important barriers and problems that could be faced in identifying Triple-A investments were also extracted:

- Language barriers
- Technical details and energy breakdowns when the Tool is used by the financial team and vice versa
- Difficulty to detach the financial value of the EE measures from the execution value in order to obtain reasonable payback periods in the Tool and therefore be accredited as a Triple-A project
- Difficulty to understand the reasoning behind the Tool as sometimes with minor changes, there were considerable differences in the scoring and outcomes
- Not very practical to insert all the information again each time you need to update or change a number
- There is no option to identify partial financing in case the project has already achieved part of it through funds or private equity.
- Considering the process timeline, it seems to be more relevant for early-stage projects than for mature ones. By the team, the assignation is done with the Tool; the project could be already implemented or have found alternative financing.
- There is no visibility of the financial parties, including the data in the Tool. This makes it less appealing to participate and upload confidential data in the Tool

Among the barriers identified, those related to the use of the triple-A platform were highlighted, the availability of more languages would be appreciated, and minor technical problems or inconveniences in its operation were mentioned. Also cited are the inconvenience of having to insert all the information each time a project is updated and the fact that there is no visibility of the funding parties until late in the process.

5 Robust financing programs or models

5.1 Introduction

The certification of projects as Triple-A by the project platform is the optimal result that can be achieved in the "Agree" step. However, obtaining the highest certification in this step does not guarantee the funding of that project, this must be managed in the third and final step of the tool, the "Assign" step.

In this step the projects submitted by the project developers are presented within the tool so that funding bodies can submit financing proposals. It is important to characterise what these financing proposals may consist of and which ones are used in each country. Therefore, the partners have been asked to carry out a market study on the predominant financing options for energy efficiency interventions in each case study country. The following 8 financing methods [1]in EE that are widely spread in Europe have been proposed to facilitate the partners' work:

- Energy Service Contracts (EPCs)
- Efficiency-as-a-Service (ESAs, MESAs)
- Third-party FinanciNG
- Soft LoanS
- On-Bill Financing (OBF) & Repayment (OBR)
- Property Assessed Clean Energy (PACE)
- Energy Efficiency Mortgages
- Crowdfunding and Cooperatives
- Public grants and subsidies

5.1.1 Energy Service Contracts (EPCs)

This method has been in operation for several years now and has been widely studied and promoted by the European authorities. The EPC[2] involves an Energy Service Company (ESCO), which provides various financial and guaranteed energy savings services. The remuneration of the ESCO depends on the achievement of the guaranteed savings. The ESCO stays involved in the measurement and verification process for the energy savings in the repayment period. ESCO and energy performance contracting are primarily found in the public sector and to a lesser extent in the industrial and commercial building sectors.

[1] Deliverable 3.2: Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology (https://www.aaa-h2020.eu/results)

[2] https://www.industrialenergyaccelerator.org/brazil/a-report-for-financial-intermediaries-in-brazil/

There are two types of structures for organising an EPC depending on how the funding of the intervention is organised, the Guaranteed Savings Model and the Shared Savings Model. Its basic structure is defined in the following figure:

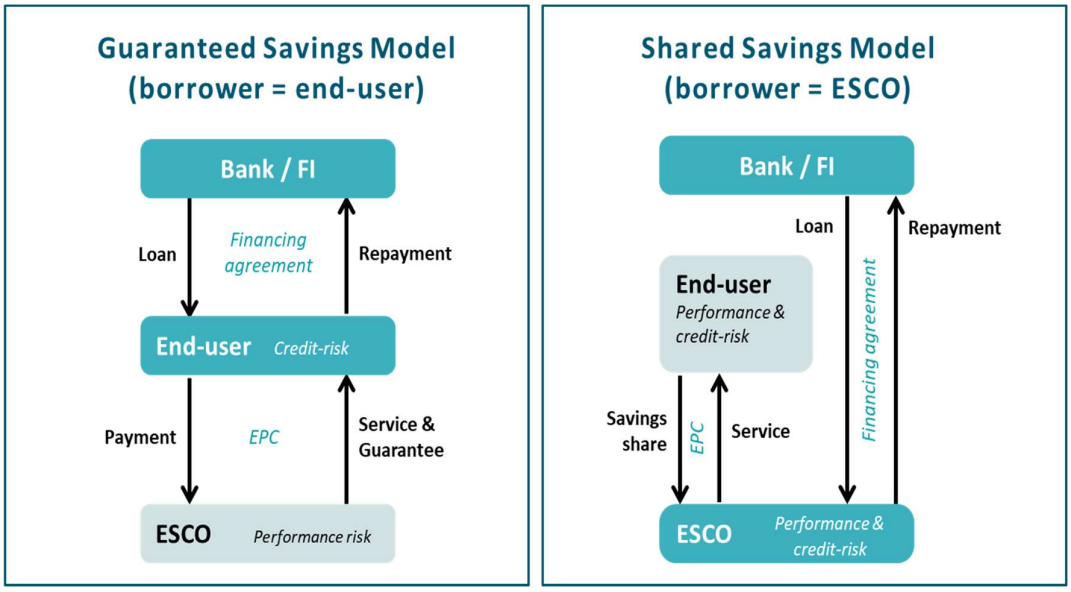

Figure 7: Structure of the EPC model

5.1.2 Efficiency-as-a-Service (ESAs, MESAs)

This method implements the trend towards "servitisation" that is being applied in the market. This approach is based on substituting the supply of products by services.

This means that instead of acquiring a physical product that provides you with a service, such as a printer, and bearing the costs of consumables, maintenance, disposal of equipment beyond its useful life, etc. As an alternative, you could hire a company that provides the same service as the equipment and charges you only for the service you receive. In the case of the printer, the company would charge you per photocopy made, and they would bear all the costs mentioned above.

There are many specific schemes for the "as a service" model: pay-per-use, leasing, renting, etc. Within the energy efficiency sector, "energy as a service[3]" has been developed, based on the creation of a Special Purpose Vehicle (SPV) that organises the financing structure through two possible channels (ESAs and MESAs).

The difference between ESA (Energy Service Agreement) and MESA (Managed Energy Service Agreement) is mainly the calculation method for the repayment instalments. In the case of ESA, it is based on savings and in the case of MESA, it is based on historical energy consumption. They also differ in the involvement of a utility in the MESA structure that is responsible for energy supply.

[3] Deliverable 3.2: Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology (https://www.aaa-h2020.eu/results)

The structures for both approaches are shown below:

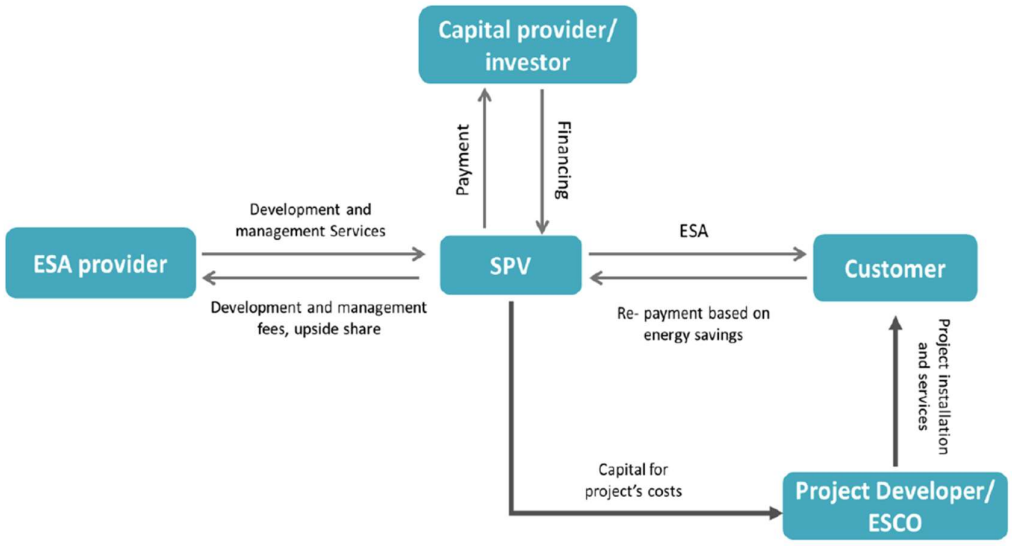

Figure 8: ESA structure

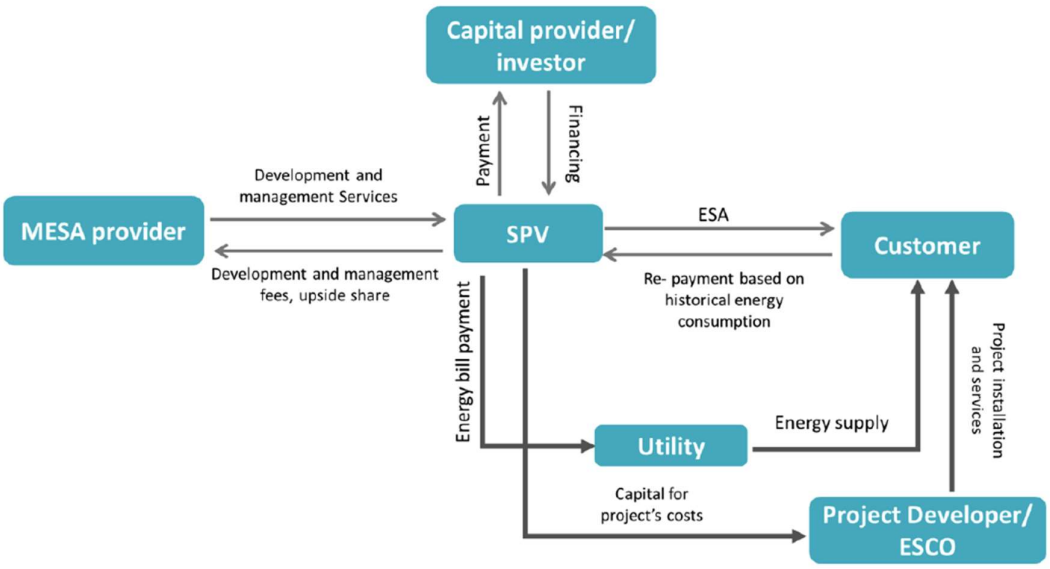

Figure 9: MESA structure

5.1.3 Third-party Financing

This method of third-party financing[4] is oriented towards the search for funding to carry out an EPC contract. These are straightforward structures where the applicant for the loan and therefore the party responsible for making the repayments can be the end customer or the ESCO. Its general structure is shown in the two diagrams below:

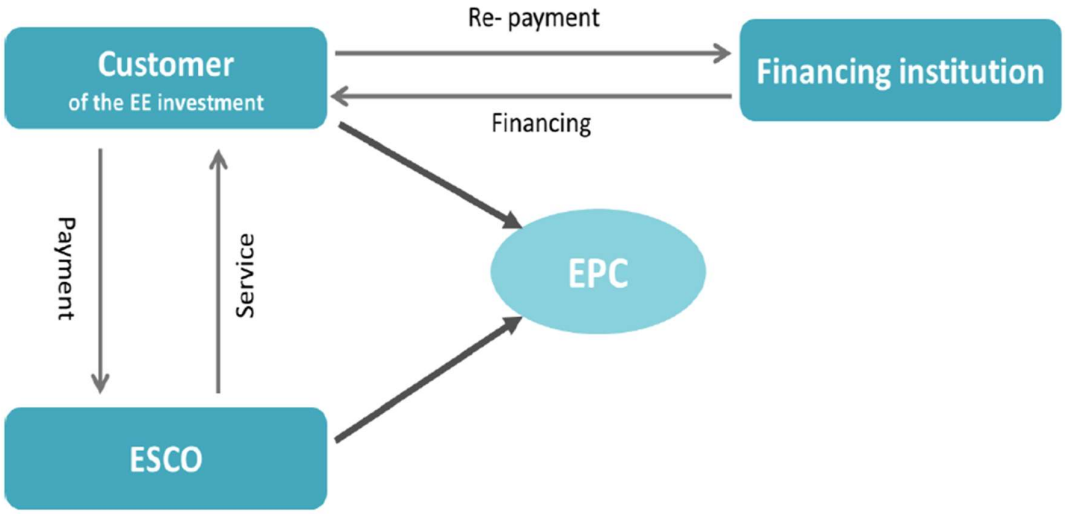

Figure 10: Third-party financing through the customer

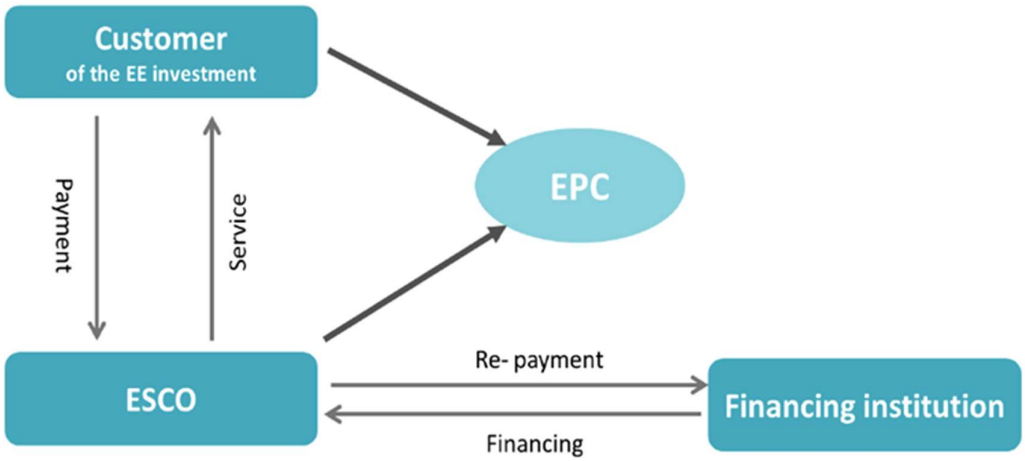

Figure 11: Third-party financing through the ESCO

[4] Deliverable 3.2: Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology (https://www.aaa-h2020.eu/results)

5.1.4 Soft Loans

Soft loans are granted by recognised institutions (e.i. EIB) and have relatively favourable conditions compared to commercial loans. They aim to promote energy efficiency interventions in communities or public institutions that do not have the financial resources to afford the necessary investment.

This scheme has several advantages, such as its flexibility and the possibility of synergies with other financing mechanisms.

5.1.5 On-Bill Financing (OBF) & Repayment (OBR)

This financing scheme is based on the fact that the repayment for the energy efficiency intervention takes place through the energy bills issued by a utility. In the case of On-bill repayment[5], it may include a private investor who provides the initial financing to the utility. The basic structure of these two types of operation is shown below:

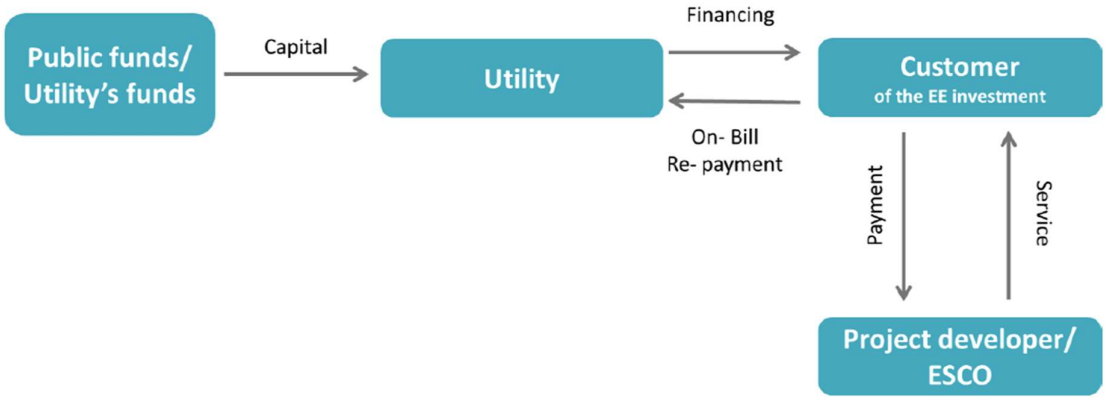

Figure 12: On-bill Financing (OBF)

[5] Deliverable 3.2: Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology (https://www.aaa-h2020.eu/results)

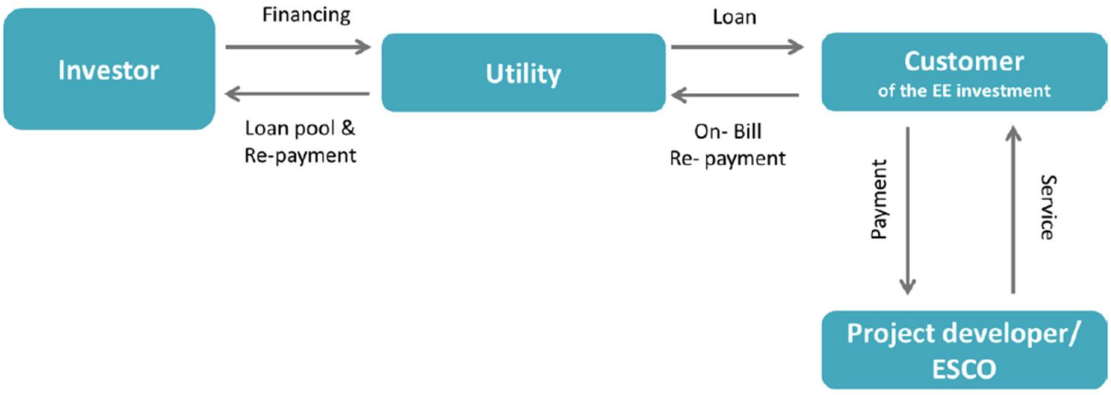

Figure 13: On-bill Repayment (OBR)

5.1.6 Property Assessed Clean Energy (PACE)

The property assessed clean energy[6] (PACE) model is an innovative mechanism for financing energy efficiency improvements on private property. It allows loan repayment through the property tax bill. PACE relates to the property where an EE investment is implemented and not the individual who implements it. The advantage of this feature lies in the transferability capability, i.e., in case the property is sold, the remaining repayments will be transferred to the next owner.

The capital needed for implementing the EE investment is provided either by municipalities or other local administrators, or investors in the form of loans that will be repaid through property taxes. The duration of this scheme could be over 20 years, resulting in long payback periods.

There are two main models of PACE programs. The first is the **"Municipal Bond Funded"** model, in which municipalities or governments issue bonds to raise the required capital that will be afterwards turned into loans for EE projects. Then, the payback of the loans is made through property tax repayments of the customers. The main structure is presented below:

[6] Deliverable 3.2: Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology (https://www.aaa-h2020.eu/results)

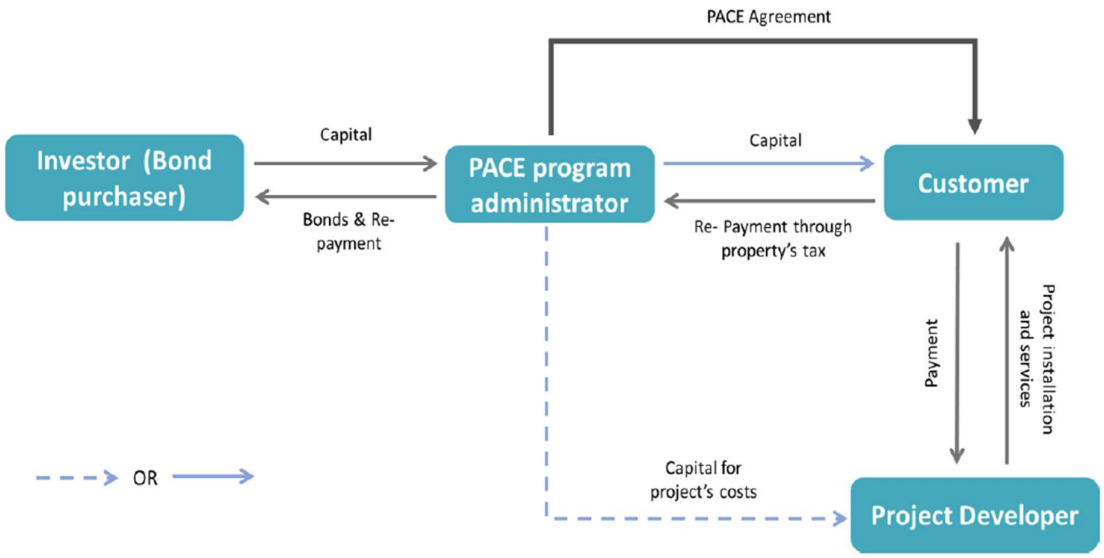

Figure 14: PACE (Municipal Bond Funded model)

The second is the **"Privately Funded model**" in which capital providers are financing the projects directly and the repayment is conducted through the property's tax. The basic scheme is presented here:

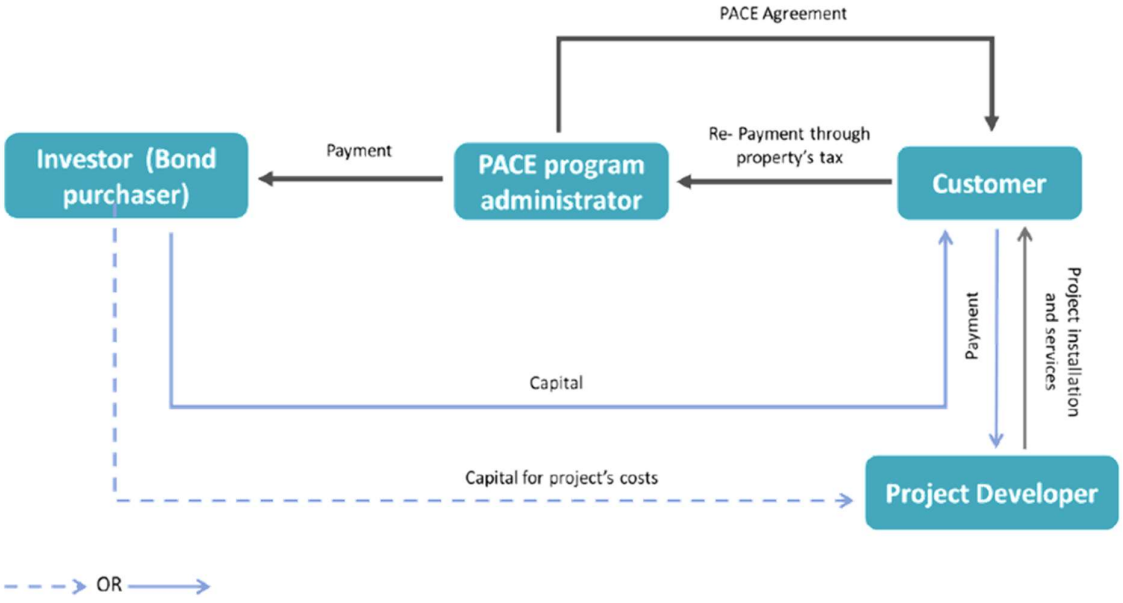

Figure 15: PACE (Municipal Bond Funded model)

5.1.7 Energy Efficiency Mortgages

These financing models do not have any uniform structure; their sole purpose is to facilitate investments in energy efficiency. Lenders can present different alternatives to the borrowers. These are usually preferential term offers for mortgages for the purchase of EE properties or the extension of existing mortgages in case the borrower undertakes an EE intervention. Additionally, EE Mortgages can be used to finance the purchase of houses that will undergo EE renovations.

The idea behind EE Mortgages is that after the investment, the borrower's monthly expenditures for energy will be reduced, so their monthly capacity to repay the loan will increase. Established savings in utility bills increase borrowers' income, making them eligible for larger loans because of the decreased debt-to-income ratio. Furthermore, due to the reduced risk of default of the borrower, lenders can offer lower interest rates.

5.1.8 Crowdfunding and Cooperatives

Crowdfunding has been growing in the market recently due to the development of specialised crowdfunding platforms and the facilities it provides for the participation of small investors. There are four types of crowdfunding depending on the type of return the investor receives: donation and reward-based crowdfunding, which are non-financial crowdfunding models, and debt and equity crowdfunding, which are financial crowdfunding models.

This type of scheme can provide financing opportunities for actors who cannot access commercial credit or other forms of financing. Legislative changes are currently being implemented at national and European levels to regulate this type of operations.

5.1.9 Public grants and subsidies

This last financing model gathers all types of aid, subsidies, tax deductions, grants, etc. that European countries are implementing with the aim of promoting and facilitating energy efficiency interventions. Due to the lack of investment and promotion in this sector, these financing methods are one of the significant drivers of energy efficiency initiatives in many European countries.

Why are subsidies one of the main drivers of energy efficiency initiatives in many European countries?A number of factors determine the importance of this method for financing EE projects, (e.g. Political commitments in the field of energy efficiency and reduction of greenhouse gas emissions, relatively easy and mass inclusion of public sector facilities, especially buildings).

These factors, together with a general misunderstanding of the Energy Efficiency business of financial institutions and the lack of transparency, lead to negative trends such as: overestimation of the risks for this business, reduced or lack of control over energy audits, selection of inappropriate key indicators for analysis, implementation of the simplest technological solutions, underestimation of the complexity of the problem of "energy efficiency", lack of interest in investment by banks and investment intermediaries, lack of promotion of innovative financing methods etc.

5.2 Robust financing programs in partners countries

5.2.1 Greece

The results of the market research carried out by the Greek project partner show that Energy Efficiency Mortgages, Soft Loans and Third-party financing are the most used financing methods for EE at the national level.

Table 3: Most widely used robust financing programs in Greece

Widely used	Not widespread	Not used
Energy Efficiency Mortgages Soft Loans Third-party Financing	Energy Service Contracts (EPCs) Crowdfunding and Cooperatives On-Bill Financing (OBF) & Repayment (OBR) Grants & Public funding	Efficiency-as-a-Service (ESAs, MESAs) Property Assessed Clean Energy (PACE)

5.2.2 Bulgaria

In Bulgaria, public grants have been identified as a major driver of the national energy efficiency market. In addition, they have specified which financing methods are usually applied depending on the end-customer.

Table 4: Most widely used robust financing programs in Bulgaria

Widely used	Not widespread	Not used
Grants & Public funding Energy Service Contracts (EPCs) Energy Efficiency Mortgages	Soft Loans Third-party Financing	Efficiency-as-a-Service (ESAs, MESAs) Property Assessed Clean Energy (PACE) Crowdfunding and Cooperatives On-Bill Financing (OBF) & Repayment (OBR)

5.2.3 The Czech Republic

The Czech partners noted that, as in Bulgaria, public subsidies are also very important in the energy efficiency sector. Soft loans and EE Mortgages are also important. The most innovative schemes such as the as-a-service models, PACEs and On-bill financing haven't been found in the Czech Republic.

Table 5: Most widely used robust financing programs in Czech Republic

Widely used	Not widespread	Not used
Grants & Public funding Soft Loans Energy Efficiency Mortgages	Third-party Financing Energy Service Contracts (EPCs) Crowdfunding and Cooperatives	Efficiency-as-a-Service (ESAs, MESAs) Property Assessed Clean Energy (PACE) On-Bill Financing (OBF) & Repayment (OBR)

5.2.4 Germany

Germany stands out with EPCs as the most widespread method, among those provided by market research. Third-party financing and Grants & Public funding also feature prominently.

Table 6: Most widely used robust financing programs in Germany

Widely used	Not widespread	Not used
Energy Service Contracts (EPCs) Third-party Financing Grants & Public funding	Soft Loans On-Bill Financing (OBF) & Repayment (OBR)	Efficiency-as-a-Service (ESAs, MESAs) Property Assessed Clean Energy (PACE) Energy Efficiency Mortgages Crowdfunding and Cooperatives

5.2.5 Italy

In Italy, a public subsidy is once again noteworthy, this scheme allows 110% of the value of an energy efficiency project to be deducted in tax credits. In addition to this scheme, the Italian partner's experience indicates that as-a-service contracts are pretty widespread in Italy, followed by third-party financing.

Table 7: Most widely used robust financing programs in Italy

Widely used	Not widespread	Not used
Grants & Public funding Efficiency-as-a-Service (ESAs, MESAs) Third-party Financing	Soft Loans Energy Service Contracts (EPCs)	Property Assessed Clean Energy (PACE) Energy Efficiency Mortgages Crowdfunding and Cooperatives On-Bill Financing (OBF) & Repayment (OBR)

5.2.6 Lithuania

In Lithuania, the common trend is that Grants & Public funding are the most common energy efficiency financing schemes. Soft loans and Third-party financing are also well established in the market.

Table 8: Most widely used robust financing programs in Lithuania

Widely used	Not widespread	Not used
Grants & Public funding Soft Loans Third-party Financing	Energy Efficiency Mortgages Energy Service Contracts (EPCs)	Property Assessed Clean Energy (PACE) Efficiency-as-a-Service (ESAs, MESAs) Crowdfunding and Cooperatives On-Bill Financing (OBF) & Repayment (OBR)

5.2.7 The Netherlands

In the Netherlands, EE loans have been identified as the most common method of financing EE. Third-party financing and public subsidies are also among the most commonly used schemes.

Table 9: Most widely used robust financing programs in Netherlands

Widely used	Not widespread	Not used
Energy Efficiency Mortgages Third-party Financing Grants & Public funding	Energy Service Contracts (EPCs) Efficiency-as-a-Service (ESAs, MESAs)	Soft Loans Property Assessed Clean Energy (PACE) Crowdfunding and Cooperatives On-Bill Financing (OBF) & Repayment (OBR)

5.2.8 Spain

Market research in Spain has shown that third-party financing and soft loans are the most widely used methods of financing EE interventions. EPCs are also fairly widespread method.

Table 10: Most widely used robust financing programs in Spain

Widely used	Not widespread	Not used
Third-party Financing Soft Loans Energy Service Contracts (EPCs)	Efficiency-as-a-Service (ESAs, MESAs) Energy Efficiency Mortgages Grants & Public funding	Property Assessed Clean Energy (PACE) Crowdfunding and Cooperatives On-Bill Financing (OBF) & Repayment (OBR)

5.3 Conclusions on robust financing models

The following graph represents the number of times a financing model for EE interventions has been ranked among the top three most widespread for a particular country:

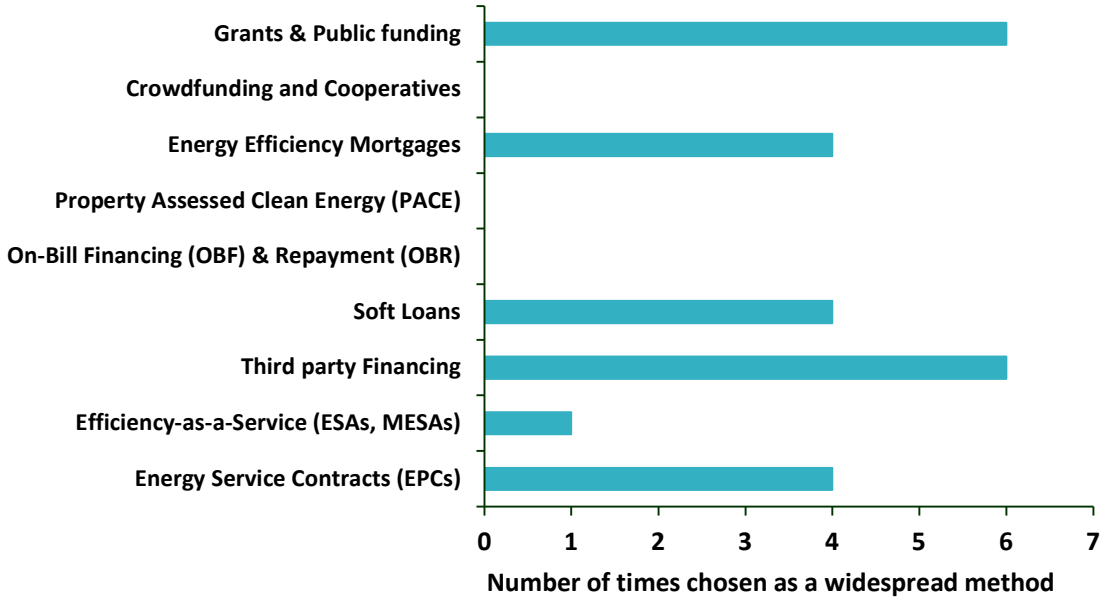

Figure 16: Robust financing systems most widely used among partner countries

One of the key conclusions from this cross country comparison is that public support and financing are fundamental drivers in the financing of EE activities; the public role in this sector continues to be decisive. Third-party financing also has a strong presence and can be associated with the more traditional methods of financing that are still predominant in the sector.

Many EE projects are not commercially viable, especially in some social facilities (kindergartens in regions with low economic potential or housing of socially disadvantaged groups) in order to reduce public investment and increase the interest of private investors in some countries pilot financial models are being implemented to combine small grants with ESCOs or soft loans.

Soft loans and energy efficiency mortgages are also widely available in many countries Institutions have widely promoted these financing methods at all levels and, in some cases, even involve the direct participation of public financial institutions.

Other, more innovative systems with less public involvement are also emerging. These are as-a-service systems and energy performance contracts (EPCs). These models have innovative procedures; the impediment remains the general public's lack of knowledge.

There are also three proposed systems that no partner has indicated as being widespread in their country. Crowdfunding models, PACE and On-bill schemes are still at an embryonic stage in most European energy efficiency sectors. This may again be due to a general lack of awareness, lack of legislation or the existence of other methods with lower financial costs.

6 Main conclusions

Most of the technical-economic information collected by the partners and analysed to obtain the data presented in this report is confidential. That is why no company names or references to specific projects have been provided in this deliverable. In fact, confidentiality issues have been one of the main obstacles identified by the partners in the development of this task.

A key part of the data collected for further analysis and public distribution were the conclusions, lessons learnt, and barriers detected in the Triple-A investments identification process. This has been proven to be valuable information collected in a collaborative and trusting environment and coming from industry professionals from each participating country.

With regard to the indicators studied individually for each project, which were then studied at national level and finally at European level (covering the 8 Triple-A member countries), the following conclusions can be drawn in a very synthetic way:

- **Project sector**: Absolute dominance of projects aimed at deep energy renovations of buildings, with 74% of the total.
- **Project Sector**: Projects aimed at Dh/Cooling[7], transport or urban lighting were also found.
- **Investment volume**: The average and median investment of the Triple-A projects collected was around 300k euros.
- **Payback Period**: The average payback period of the entire volume of the collected projects is approximately 5.5 years, although it is highly dependent on the sector of origin of the project.

On the other hand, some common trends have been identified in terms of lessons learned and barriers identified in interviews with project developers:

- Reports were received from almost all participating countries that the project developers' confidentiality requirements have impeded the progress of this task.
- The importance of the impact of fluctuating energy prices on the profitability of EE investments was highlighted by several partners.
- The Triple-A Tools have been proven to be beneficial and reliable despite some minor problems of user-friendliness that was delivered to NTUA as Tools developers and were resolved accordingly.
- Triple-A Tools may promote the EU Taxonomy, since it is not widely used, and its real impact on the market is still minimal.

[7] District Heating & Cooling