TRIPLE-A

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

Deliverable 4.6:

Triple-A Benchmarking and Evaluation - final

May 2022

The Triple-A project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 846569.

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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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Glossary

DEEP:	Derisking Energy Efficiency Platform
EE:	Energy Efficiency
EEM:	Energy Efficiency Measures
ESCO:	Energy Service COmpany
EU:	European Union
GHG:	Greenhouse Gases
IRR:	Internal Rate of Return
ISO:	International Organization for Standardization
KPI:	Key Performance Indicators
MCDA:	Multi Criteria Decision Analysis
NA:	Not Applicable
NPV:	Net Present Value
PI:	Profitability Index
RES:	Renewable Energy Sources
SDG:	Sustainable Development Goals

Executive Summary

The present report updates the previous version of the Triple-A report, Deliverable D4.5: Triple-A Benchmarking and Evaluation, published in M21 – May 2021. The report focuses on the application of the Triple-A benchmarking and evaluation methodology for assessing ang categorising Energy Efficiency (EE) project ideas as potential investments to be undertaken by financing bodies. The result of the methodological application is the elaboration of EE project fiches which will be recognised and trusted by EE stakeholders. Focus has also been given to identifying the most bankable projects that investors should consider for financing.

The present report analyses the main steps, materials and methodology deployed for the formulation of the Triple-A Benchmarking, also displaying the respective results. To verify the Triple-A benchmarking, a pipeline of around **170 EE financially attractive projects** has been identified, which have been tested through the Triple-A Tools, while feedback on the benchmarking results has been received from relevant key actors, as well as and information on the potential further utilisation Triple-A tools outcomes. Relevant recommendations have been derived from the benchmarking for the Triple-A target groups and mainly project developers, investors and policy makers.

As expected, the proposed benchmarking is a non-one-dimensional approach, as Triple-A aspires to support projects in different sectors and all types of potential investors. So, the idea is to help investors to choose the project(s) that fits better to their strategy, in terms of CAPEX, technology, time, economic performance and other parameters.

It has to be mentioned that though the benchmarking procedure has been proven the need of Triple-A Tools and the value that can provide to the market. Specifically, Triple-A Tools provided a generic, but reliable solution for checking in short time any relevant project idea. This is important not only for avoiding mistakes, but mainly for setting up the frame and providing background information for a discussion between the project developers and investors.

1 Introduction

Deciding on capital investments in Energy Efficiency (EE) is a complex process, made even more difficult when considering the complexities of EE related projects [1]. A benchmarking procedure could allow financing institutions and investors to set up their relevant investment strategy and thus handle demanding investments.

The present report analyses the main steps, materials and methodology deployed for the formulation of the Triple-A Benchmarking. The main methodological steps of the benchmarking procedure are analytically elaborated along the main components such as Key Performance Indicators (KPIs), EU Taxonomy, Risks, Decision Making methods. This deliverable analyses the whole procedure, describing the KPIs selection for the efficient benchmarking of EE investments. The benchmarking results are also presented, along with feedback received by stakeholders and the next steps.

Aside from the Introduction section, the deliverable is structured as follows:

In Chapter 2, the context and benefits of the Benchmarking is analysed. In Chapter 3, the Benchmarking Methodology is presented. Chapter 4 holds the main characteristics and parameters used in the Triple-A Benchmarking. In Chapter 5, the results of the procedure are described, along with relevant policy recommendations, while Chapter 6 holds information on the utilisation of the projects' pipeline. A wrap up of the present document, along with conclusions are contained in Chapter 7.

2 Understanding of the Context and Benefits of Benchmarking

Standardisation is an essential element in various sectors in order to avoid conflict, duplication of effort and establish a common language and framework between different key actors. Even though the EE sector has been set as a high priority in the European Union, it lacks standardisation and common frameworks and methods among interested parties [2]. Standardisation in EE is also critical, since EE investments are usually not being realised due to lack of common understanding between stakeholders (e.g. project developers and investors). In addition, standardisation builds trust between investors and project developers and facilitates the underwriting procedure, which often fails to be completed. It is usual, EE project fiches do not evolve proper investment ideas, due to a lack of common framework on which projects are considered profitable and merit attention by the financing institutions.

The implementation of EE measures provides numerous benefits, except monetary savings, such as environmental and social, assisting also in facing energy poverty (such as the United Nations Sustainable Developments Goals). Having in mind their importance, effects, and overall impact, it should be clear why EE investments are considered “non-standard” and why they should not be evaluated by “normal” investment criteria [1].

Researchers, EU funded projects and companies around Europe have tried to set the ground and propose benchmarking and standardisation methods for EE project ideas. Various examples could be referenced, such as the H2020 Launch project [3], which aims to accelerate deal closure and pipeline growth for Sustainable Energy Assets through standardised material and the H2020 RenonBill project [4], that provides tools to address the residential sector’s energy renovation financing demand and assess and bundle investments based on a transparent methodology. Furthermore, the EE Financial Institutions Group (EEFIG) has developed the EEFIG Underwriting Toolkit [5] to assist financial institutions in scaling up their capital deployment into EE. EEnvest H2020 project [6] objectives are to secure investors´ trust in EE actions for existing buildings by developing a combined technical-financial risk evaluation framework focused on the renovation of commercial buildings. Also, E2DRIVER [7] project is developing a training platform that will boost the collective intelligence of the automotive industry on EE. The platform will also include energy and financial tools to be used by companies. In the scope of certification, X-tendo [8] and its toolbox introduce ten features of the next generation of energy performance certificates, to provide public authorities with improved compliance, reliability, usability and convergence of next-generation energy performance assessment and certification.

In the following table, a full list of H2020 projects, in which tools have been developed regarding standardization and evaluation of EE projects is presented.

Table 1 List of H2020 EE projects that develop relevant tools

Project	Benchmarking and standardisation approach
AmBIENCe	Provide new concepts and business models for performance guarantees of Active Buildings, combining savings from EE measures with additional savings and earnings resulting from the active control of assets leveraging for instance price-based incentive contracts (Implicit Demand Response).
ComAct	Develop and adapt financial tools that provide financing for low-income families.
DEESME	integrated tools to increase the awareness of all companies, motivates and supports them in the adoption of EE solutions, and finally support investments, filling the gap between the audit and the implementation of actions in large companies and SMEs.
E2DRIVER	Developing a training platform that will boost the collective intelligence of the automotive industry on EE. The platform will also include energy and financial tools to be used by companies. In the scope of certification
EeDaPP	Design and deliver a market-led protocol to enable the recording of data relating to energy efficient mortgage assets and which will be made accessible via the design of a common data portal.
EEFIG	EEFIG Underwriting Toolkit to assist financial institutions in scaling up their capital deployment into EE
EEnvest	Secure investors´ trust in EE actions for existing buildings by developing a combined technical-financial risk evaluation framework focused on the renovation of commercial buildings
EN-TRACK	EN-TRACK is to create a one-stop shop platform with standardized data related to the EE performance of the public and private building stock. Enabling interoperability with most currently active databases and tools, this will lead to an unambiguous data exchange-based services ecosystem with low transactional costs.
EU-GCC Clean Energy Network	EU-GCC Clean Energy e-Observatory is an online information service aiming at providing and presenting, in an organized manner, information material on clean energy developments in the GCC and in the EU.
EXCITE	Deliver a tool for attraction of additional private investment in energy and climate actions by local authorities.

iBroad	Tool for the evolution of the Energy Performance Certificates (EPCs) and energy audit systems, building renovation roadmaps will serve as a tool outlining a customised renovation plan with a long-term horizon for deep step-by-step renovation of individual buildings (iBRoad-Plan), combined with a repository of building-related information (logbook, iBRoad-Log).
ICCEE	Design and deliver a dedicated cold supply chain EE tool to support the decision-making processes of the supply chain companies in estimating their energy saving potential,
Launch	Accelerate deal closure and pipeline growth for Sustainable Energy Assets through standardised material
NOVICE	Develop a Tool to assess your buildings potential to adopt a process such as the NOVICE dual services model. Input the type of HVAC systems in your building bellow to receive advice and information on a specific combined EPC. The NOVICE model is a dual service business model, combining traditional EPCs with demand side response for a combined revenue stream.
Persephone	Integrated PERSEPHONE platform, a set of personalised applications, as well as the pilot validation and performance evaluation results in real settings close to small offices and houses environment.
POWERPOOR	Energy Poverty Mitigation Toolkit aims at providing an integrated solution to users and supporting them at identifying whether they suffer from energy poverty. In case they do the tool can propose changes (behavioural or low-cost EE interventions) they can take to improve their wellbeing. Finally, the tool can propose customised solutions regarding their involvement funding proposing the users' involvement in innovative funding schemes such as crowdfunding or participation in energy cooperatives.
QualitEE	Developed quality assessment criteria and assurance schemes that you can use with your clients to improve the outcome of their EE services investments. Improving service quality and trust aims to increase demand for EE services and associated consultancy work.
Quest	Developing a reliable and clear methodology for evaluating the risks associated with energy efficient and sustainable buildings investments by integrating effective quality management services into these projects.
RenonBill	Tools to address the residential sector's energy renovation financing Demand and assess and bundle investments based on a transparent methodology

SENSEI	Tool to combines pay-for-performance (P4P) arrangements with the Energy Performance Contracting (EPC) model and engages in negotiation games with preliminary stakeholders.
SMARTER Finance for Families	Develop a Street Lighting Financing Tool (SLFT) so that municipalities can find out the most suitable financing scheme for their Street Lighting project and an Online Assessment Tool can support estimation and analysis of the potential energy and CO_2 savings, as well as providing a straightforward cost-benefit overview for any locality, city or country based on their current street lighting technologies.
SMEm Power Efficiency	Develop 4 long lasting training tools: an advanced training handbook in 7 languages, a web platform for energy analytics, a tool for Monitoring & Targeting, a tool for Measurement & Verification.
SocialWatt	SocialWatt analyser helps utilities and energy suppliers efficiently identify energy poor households. The tool is designed in a way so that the user does not require neither specific expertise / technical skills nor substantial resources (financial, human, and computational). SocialWatt Plan enables utilities to develop innovative schemes to alleviate energy poverty, by identifying EE measures and renewable energy actions, evaluating their performance in terms of long-term energy savings, sustainability, risk and return of investment. SocialWatt Check assists utilities and energy suppliers effectively monitor the effectiveness of schemes and evaluate their actual impact in terms of EE and renewable energy production.
StreamSave	Develop a user-friendly online platform to facilitate the exchange of knowledge and experiences among stakeholders. This platform will provide all stakeholders with access to a community of experts and resources to better implement energy savings calculation methodologies. The streamSAVE platform will become a central point for experts searching for information and their peers on Priority Actions.
Triple-A	Triple-A Standardised Tools, facilitate project developers to benchmark their projects in a standardised way (Assess & Agree Tool), while also provide a hub to financers, bankers, and investors (Assign Platform) to finance bankable green projects.
U-CERT	Facilitate convergence of quality and reliability, using the EPB standards developed under the M/480 mandate, presenting the national and regional choices on a comparable basis.

X-tendo	Toolbox with features of the next generation of energy performance certificates, to provide public authorities with improved compliance, reliability, usability and convergence of next-generation energy performance assessment and certification.

The Triple-A benchmarking methodology, which is substantiated by the Triple-A Tools, brings a new approach to the standardised evaluation of EE projects. The methodology aims to build a structured evaluation procedure for EE projects, setting the pace for EE project developers and investors to establish a consensus on which EE potential investments are bankable. Unlike other approaches, the Triple-A methodology establishes an integrated approach, especially in terms of variety of investors and finances, taking into consideration all possible benefits of EE investments, providing awareness concerning their compliance with the EU Taxonomy, deploying KPIs and thresholds broadly used by the EE and financing sector, and providing a hub in which these projects could be financed.

3 Overview of the Triple-A Benchmarking Methodology

3.1 General Information

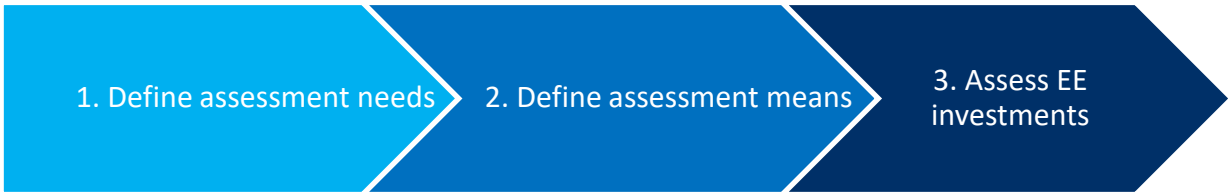
The Triple-A benchmarking methodology aims to roll out a standardised procedure to identify attractive project ideas for banks, funds, and other financing institutions or investors. The benchmarking deploys outcomes that have been emerged from lessons learnt, databases of already financed projects and from stakeholders' consultation to ensure that the evaluation is in line with the market needs. The Triple-A benchmarking is being reified through the Triple-A Tools [9], which provide a one-stop-shop approach for stakeholders, facilitating project developers to benchmark their projects in a standardised way while also providing a hub to financers, bankers, and investors to identify and evaluate bankable green projects. To verify the Triple-A benchmarking, a pipeline of around **170 EE financially attractive projects** has been identified, which have been tested through the Triple-A Tools, while feedback on the benchmarking results has been received from relevant key actors.

3.2 Defining Assessment Framework

As also presented in the previously submitted Deliverable D4.5: Triple-A Benchmarking and Evaluation, the following figure analyses the approach followed for defining the assessment framework so as to benchmark EE project in Triple-A project.

The first step is focused on the identification of the main axes needed to be assessed for the smooth and effective establishment of the assessment framework, beginning with literature review of best practise, similar application, and methodologies. Then follows the Triple-A stakeholder's consultation process, which is a fundamental pillar of the methodology, providing valuable feedback. Finally, the identification of EE project characteristics, such as the project sectors and countries that will be incorporated in the benchmarking is realised. Overall, the first step entails defining the main assessment needs, sectors, projects, and countries, in order to fulfil the evaluation's objectives.

Within the second step, all the parameters that have to be set for the evaluation procedure are determined. Namely, the key performance indicators and the multi-criterial decision support methodological steps to be used have been decided, as well as the EU Taxonomy technical criteria thresholds that will be used to check the projects' compliance. As outdoor lighting projects are not yet covered by the EU taxonomy, a relevant list of quantitative and qualitative criteria has been set. The scope of setting the EU Taxonomy check is to raise awareness of the new Regulation; avoid green washing, set the goal of the minimum expected environmental performance, and help investors that prefer to invest in sustainable projects. No reference has been done to the Do Not Significant Harm criteria and the Minimum Social Safeguards, as those are usually related to the operation of the company / investment. Thus, the compliance to the EU Taxonomy is indicative and therefore has not a Go / no Go approach.



1. Define assessment needs	2. Define assessment means	3. Assess EE investments
Identification of the main axes needed to be assessed • Literature review. • Triple-A stakeholders' consultation. • Identification of EE project characteristics, such as project sectors and countries.	Identification of main assessment means and indicators • Definition of the key performance indicators. • Definition of the multi-criterial decision support methodological steps. • Definition of the EU Taxonomy compliance thresholds.	Assessing of EE investment ideas • Triple-A stakeholders' consultation. o Bilateral Meetings o Information gathering via questionnaire and online survey tools. • Filtering of collected projects. • Insertion of the projects into the Triple-A Tools. • Evaluation of the benchmarking.
In this step, the main assessment needs, sectors, projects and countries are defined to serve the purposes of the evaluation.	In this step, the basic benchmarking system characteristics and input needed have been defined.	In this step, the actual assessment of the selected projects is being performed, followed by the evaluation of the benchmarking results. The stakeholder consultation plays an important role throughout the step realisation.

The final step is the core of the presented study, in which the assessment of the selected projects is being performed, followed by the evaluation of the benchmarking results. The key role for the evaluation of has been the stakeholder consultation that has been realised within Triple-A projects' activities. The stakeholder engagement plays the most important role throughout this step's realisation and to properly fine tune and define the benchmarking methodology and incorporate it in calculation algorithms of the Triple-A Assess and Agree tools. This interaction, focus on the optimisation of the Triple-A tools is critical, as the tools is the main mean though which is aspired to achieve the connection of the project developers and investors. Along with the consultation, the filtering of the collected projects and the insertion of these project into the Triple-A Tools has been performed. The consultation has been performed utilising various methods, such as bilateral meetings and structured interviews, information gathering via questionnaires and online survey tools, and workshops. The whole procedure has been done repeatably, taking into account a wide range of relevant comments and suggestions. The Triple-A team remained committed to continuous improvement till the end of the project period, in order to provide the optimum benchmarking methodology, through a practical way, taking advantage of the Triple-A Assess and Agree tools.

3.3 Triple-A Benchmarking Methodological Steps

The primary methodological steps for the effective benchmarking of the EE projects identified are presented in the following graph:

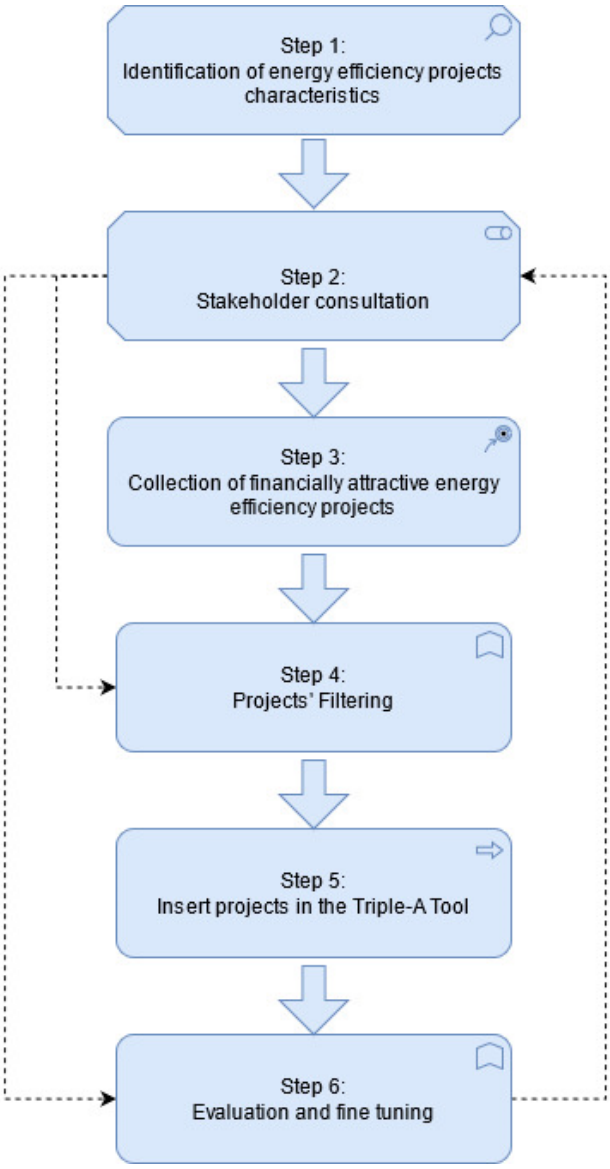


Figure 1: Benchmarking methodology, 6-step approach

Step 1: Identification of EE projects characteristics

The characteristics of the projects have been identified by consultation among project partners, in order to spotlight the project's aspects that are the most critical for the project's future technical and financial performance. The characteristics that have been prioritised are shortly presented below.

Technical data

In general, EE projects should fulfil EU Taxonomy Technical Report requirements. In the section below, the essential data that should be collected are presented:

Buildings

The technical parameters that are being collected are:

- Technology(ies) used (for example, heat pump and heat wheel recovery system)
- Energy performance characteristics for new construction / equipment (for example luminous efficacy of lamps / luminaires, EPC for new buildings)

In case of building renovations:

- Baseline of building's energy consumption, before the renovation
- Estimated energy consumption of the building, after the renovation
- Preferably information on CO_{2eq} emissions, before and after the renovation

In case of replacement of equipment:

- Energy coefficient of performance of existing equipment
- Energy coefficient of performance of new equipment

Manufacturing

The economic activities covered in Manufacturing include both 'greening of' and 'greening by' activities.

'Greening of' activities are those that account for a high share of industrial GHG emissions and offer large potential for GHG emissions reductions: the manufacturing of aluminium, the manufacturing of iron and steel, the manufacturing of cement and the manufacturing of chemicals.

The technical parameters expected to be collected from "Greening of" activities:

- Scope 1: All direct emissions related to the production per unit (tCO2e/t) (the process direct emissions and the emissions due to fuel use for energy production or electricity consumed)
- Scope 2: Electricity indirect GHG emissions. Indirect emissions from the use of electricity during the production process

In case of manufacture of Aluminium:

- Scope 2: Electricity consumption for electrolysis process and related emissions from the generation of the electricity used

In case of manufacture of Chlorine:

- Electricity use for chlorine manufacturing
- Average carbon intensity of the electricity that is used for chlorine manufacturing

In case of manufacture of organic metals:

- Carbon footprint
- Portion of production derived from renewable feedstock

'Greening by' activities include the manufacturing of low carbon technologies. For this, no criteria on the GHG emissions from manufacturing are given because the benefits these lead to are considered to outweigh their emissions.

The technical parameters collected from “greening by” activities include:

- Type of renewable energy or sectors products, components, equipment and machinery manufactured
- Estimated GHG emission reductions

In case of manufacture of vehicles, fleets and vessels:

- Carbon emission from the vehicles, fleets or vessels

In case of manufacture of energy efficient equipment for buildings:

- Energy performance characteristics of equipment and their components

Transportation

The technical parameters that are being collected include:

- Type of land transport activities (e.g., light rail transit, metro, tram, trolleybus, bus and rail)
- CO_{2e} emissions per tonne-kilometre (gCO_{2e}/tkm)
- In case of passenger cars and light commercial vehicles:
- Vehicles’ tailpipe emission intensity

District Heating / Cooling

The technical parameters that are being collected are:

- Percentage of renewable energy / waste heat / cogenerated heat or the combination of such energy and heat used in the district heat/cool system or the operating facility
- Emissions related to the production of electricity (gCO_2 per kWh) of power generation technologies
- Power-to-heat ratio of the cogeneration/production of heating/cooling and power technology
- In case of operations with heat pumps:
- Seasonal coefficient of performance (SCOP) of the heat pump

Outdoor lighting

The technical parameters that are being collected are:

- EE label of lighting appliances
- Quality parameters (specified in EN 13201)

In case of renovation and/or expansion of existing outdoor lighting installation

- Baseline of outdoor lighting energy consumption, before the renovation
- Estimated energy consumption of the outdoor lighting, after the renovation
- Preferably information on PDI and AECI (defined in EN 13201-5), before and after the renovation

Economic data

The economic parameters, which are being collected are:

- Type of asset owner (public, private)
- The total CAPEX of the investment (investment size)
- The percentage of the CAPEX that refers directly and indirectly to EE measures

- The financing tool(s) / structure that are foreseen and if possible, their major characteristics (interest rate, maturity, collateral type – if any)
- Total Investment Cost of EE measures (€)

Proposed Economic performance KPIs:

- Simple Payback Period
- Net Present Value
- Internal Rate of Return (IRR) - optional

Step 2: Stakeholder consultation

The stakeholder consultation process regarding the Triple-A Benchmarking has been realised utilizing various means. During stakeholder consultation Triple-A Tools demonstration and testing have been conducted. In bilateral meetings and small workshops, EE stakeholders have participated, such as EE companies and project developers, as well as financers interested in sustainable financing. The meetings have been implemented in the local languages of the Triple-A case study countries, facilitating stakeholders to participate actively and engage with the Triple-A project, breaking the language barriers. Through the 123 bilateral meetings and the 41 Advisory Board Member meetings, 723 Stakeholders have been identified, while 161 have been actively engaged.

Feedback on the Triple-A Methodology has been also received from 198 stakeholders from the dissemination of four Triple-A questionnaires. The questionnaires have been designed in such way to cover all aspects of the Triple-A Benchmarking Methodology, and to receive as most feedback possible by the stakeholders. The questionnaires are listed below:

1. Questionnaire for Building Sector[1] (indicative target groups: Companies / Project Developers with building stock portfolio, Other Property Valuers, Real Estate Agents, Notaries)
2. Questionnaire on EE Financing Risks & Evaluation Criteria[2] (indicative target groups: Financing Bodies, Companies / Project Developers, Researchers and Academia in Businesses and Technoeconomic fields, Other)
3. Questionnaire on EE Financing Schemes[3] (indicative target groups: Financing Bodies, Companies / Project Developers)
4. Questionnaire on Investors Preferences on EE Investments[4] (indicative target groups: Financing Bodies)
5. Questionnaire for the categorization of mitigation strategies, financing instruments and financial schemes[5] (indicative target groups: Companies / Project Developers, Financing Bodies)

Step 3: Collection of financially attractive EE projects

The projects have been collected through direct contact of Project's Partners with project developers in various countries, with two ways: (i) by using the Triple-A tool and (ii) where possible, by feeling the

[1] Available here: https://forms.gle/kqikyR7Nuek1GY7o9
[2] Available here: https://forms.gle/uTSVcq5YjgLx5QSd9
[3] Available here: https://forms.gle/WziGEmyterCamagK9
[4] Available here: https://t.co/uEFoJEtMyl
[5] Available here: https://forms.gle/2SHowiyyo9uWAhQS9

projects' template foreseen for Task 5.1. Doing so, it was able to have all needed information and a comparison between the economic performance indicators estimated by the Triple-A tool and the developers. Thus, has been done a quality control of the input data provided by the users and in addition an extensive debugging and optimization of the tool, using real projects data.

Step 4: Projects' Filtering

In order set up a pipeline of comparable projects, the expected projects were expected to have a number of minimum requirements. For each sector identified, the appropriate criteria are used with a Go/No-Go approach. The criteria for each sector are:

Building Sector

Installation of renewables on-site and professional, scientific and technical activities and individual renovation measures

- Minimum investment size: 100,000 EUR
- Maximum simple payback time[6],
    - On-site renewable energy installations: 20 years
    - HVAC (except BMS and metering systems): 15 years
    - Lighting: 12 years
    - BMS and metering systems: 12 years
    - Building skin elements: 25 years
- Taxonomy compliance (as specified in section above)

Major building renovations

- Minimum investment size: 100,000 EUR
- Maximum simple payback time: 25 years[7]
- Taxonomy compliance (as specified in section above)

Construction of new buildings

- Minimum investment size: 200,000 EUR
- Maximum simple payback time: 60[8]
- Taxonomy compliance (as specified in section above)

Manufacturing sector

Any investment should:

- achieve or contribute to significant improvement (in terms of market innovation) of the EE of equipment, machinery or/and renewable energy systems, taking into account the relevant EU Ecolabel Regulation[9] (where relevant), while the enchasing performance should be proven through the use of relevant EU or international standards from accredited laboratories.

[6] For simplicity reasons only 4 values are proposed. Especially for building skin elements the proposed value is shorter from the Average life expectancy of most of buildings' components

[7] Maximum common practice for a bank loan, as there is no reference on the maximum payback period

[8] As long as the new buildings is mandatory to be nZEB, the payback period will be estimated taking into account the national average energy consumption for buildings.

[9] Regulation (EC) No 66/2010 on the EU Ecolabel.

- achieve significant improvement of the EE and reduction of GHG emissions per unit of product of existing industrial or/and manufacturing production lines or/and procedures, while the improvement should be demonstrated through the provision of appropriate energy audit in accordance with EN 16247. In case of new production lines or/and procedures, the energy intensity of the line(s) should be compared with common market practice.

Transportation Sector

Public transport Sector

- Minimum investment size: 1,000,000 EUR
- Maximum simple payback time: 6 years
- Taxonomy compliance (if eligible project section above)

Passenger cars and light commercial vehicles

- Minimum investment size: 100,000 EUR[10]
- Maximum simple payback time: 6 years
- Taxonomy compliance (if eligible project section above)

District Energy Networks

- Minimum investment size: 1,000,000 EUR
- Maximum simple payback time,
  - New constructions: 40 years
  - Existing: 20 years
- Taxonomy compliance (as specified in section above)

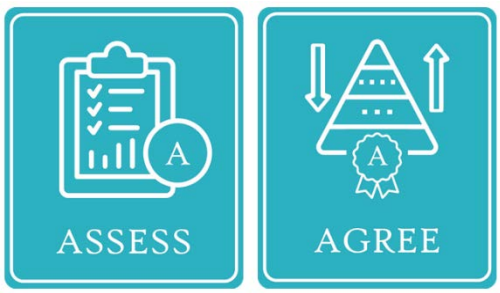
Outdoor Lighting

- Minimum investment size: 200,000 EUR
- Maximum simple payback time: 12 years
- Taxonomy compliance (if eligible project section above)

Step 5: Insert projects in the Triple-A Tool.

All projects have been inserted in the Triple-A Assess and Agree tool from the project developers, as they had to be provided information on:

- specific issues related mainly to risks estimation and
- energy performance information (in some cases, it has to be provided by filling the template of Task 5.1 too).



[10] The minimum investment size excludes individuals (buying just one vehicle) for Triple A project partners. In the future, support the replacement of taxi vehicles could be reviewed and added.

Especially for the district heating systems, in some cases, the Triple-A tool could not estimate the potential benefits. This happened in the cases that the project foreseen the replacement of the energy source - fuel, which provides insignificant or even zero energy savings. However, fuel's replacement could provide primary energy, CO_{2eq} and money savings. For resolving such problems, Triple-A Tool users, has the permission to declare as inputs, the CO_{2eq} and money savings.

Step 6: Evaluation and fine-tuning

The main scope of the Task is the evaluation fine tuning of projects benchmarking and in practice the optimization of the Triple-A Assess and Agree tools in order support the users to filter the projects that fits better to their expectations. The evaluation has been done, assuming that investors tend to invest in projects that have a specific size and/or technology and/or expect them to have a maximum repayment period/exit and/or they will be implemented in specific country. So, Triple-A tools should provide reliable output data

- in relation to the expected lifetime of the foreseen measures,
- for the efficient intercomparison of projects with similar CAPEX,
- for the efficient intercomparison of projects foreseen similar EE renovation measures – technology,
- for the efficient intercomparison of similar projects (sector, technology, CAPEX), implemented in different countries.

This has been achieved through the provision of a well-developed database, which is available to users in different formats. Once again, it is mentioned that it has been done an extended cross checking of Triple-A Tools outputs and the information provided from the first 100 projects, through the template of Task 5.1 or direct contact with project developers.

4 Triple-A Benchmarking

This section is presenting in detail the benchmarking methodology and the ability of Triple-A tools to support project developers and financing bodies through a multi-parameter and flexible approach. The methodology, input data, and KPIs will be presented, along with the possible results of the benchmarking procedure. The possibility to change the benchmarking weights, so each investor can set up its relevant investment strategy and, thus, handle EE investments, has to be highlighted.

The Key Performance Indicators and the threshold of the pilot phase, along with the assessment framework and the questions of the benchmark survey used for the benchmarking, will be presented and described.

4.1 EU Taxonomy

The establishment of the EU Taxonomy constitutes a decisive action from the EU aiming to establish a standardisation system for sustainable energy investments to enable investors to re-orient investments towards more sustainable technologies and businesses. The Triple-A benchmarking considers the EU Taxonomy compliance of the benchmarked projects, providing the EU Taxonomy Technical screening criteria based on the projects' sector. The EU Taxonomy criteria include technical thresholds regarding the Environmental performance of the projects. Outdoor lighting projects are not yet covered by the EU taxonomy. For consistency to other sectors, a relevant list of quantitative and qualitative criteria has been set, which are expected that ensure the high technical and environmental performance of the projects.

All projects included in the methodology will be assessed for their EU Taxonomy compliance. The non-EU taxonomy compliant project are not excluded from the projects pipeline, though they are marked with a respective indication, so as to highlight the compliant projects and inform stakeholders respectively. Even so, it is expected that all projects should support the transition to a lower carbon emission economy. Thus, the reduction of carbon emissions, the reduction of final energy consumption and money savings through the implementation of EE measures is prerequisite for characterizing a project as Triple-A or even Reserved.

The scope of setting the EU Taxonomy check is to raise awareness of the new Regulation; avoid green washing, set the goal of the minimum expected environmental performance and help investors This could be helpful for investors that that prefer to invest in sustainable projects.

4.2 Risk Assessment

The benchmarking methodology takes into consideration the total risk of the project under evaluation. The risk is calculated from specific Risk Factors that appertain to five main Risk Categories, as have been identified in the Triple-A Risk Report on EE Financing and Mitigation Strategies [10]. These Risk Categories are analysed below:

- **Financial risk,** which is related to the creditworthiness of the applicant for the loan/financing.
- **Behavioural risk,** which is related to the rebound effect that can exist in the context of the inspected EE investment.

- **Energy Market & Regulatory risk,** which is related to the energy prices and energy taxes volatility of the country in which the investment takes place and the request for issuing work permits that may exist in the context of the inspected project.
- **Economic risk,** which category is related to the economic environment of the country that the investment takes place.
- **Technological, Planning and Operational risk,** which is related to the technical complexity, the initial savings assessment, the implemented equipment, the project design, and the Operation & Maintenance of the inspected project.

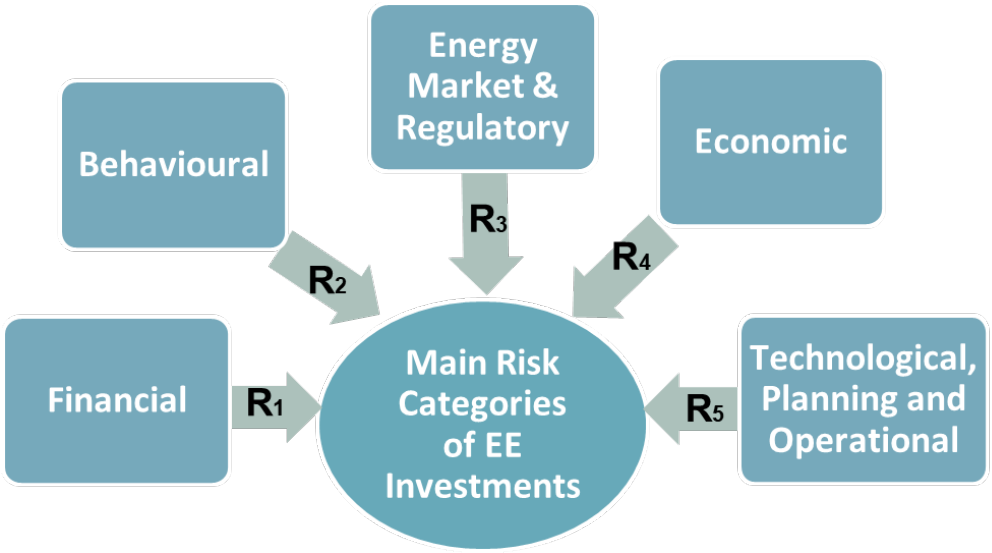


Figure 2 Triple-A identified Risk Categories

In addition, the **Country risk** is also taken into account. The total aggregated risk is calculated by averaging the values of the risk factors of which each category is composed. The total project's risk value is the weighted arithmetic mean of the risk categories' values.

4.3 Financial Key Performance Indicators

With the framework of Triple-A methodology for evaluating and benchmarking EE projects, a number of different financial KPIs were reviewed in order to select the most appropriate ones that better match our problem need and dimensions. For more information, please see deliverable D4.2 Final Standardised Triple-A Tools[11]. Please note, the estimated financial key performance estimators could differ significantly than those estimated by the projects' developers. This is expected and acceptable, as long as developers could provide a more detailed and accurate analysis for each project. The provision of the key performance indicators, estimated by the Triple-A Tool, is used for simplicity, for having common indicators for achieving the benchmarking and finally for facilitating the successful connection of projects' developers and investors.

In the following table, the Financial Key Indicators that the Triple-A Benchmarking utilises are presented.

[11] D4.2 Final Standardised Triple-A Tools: https://aaa-h2020.eu/sites/default/files/reports/D4.2%20Final%20Standardised%20Triple-A%20Tools.pdf

Table 2: Financial Key Performance Indicators

	Name	Description
A_1	*Net Present Value (NPV)*	NPV reflects the risk and cashflows discount by quantising it through the discount rate the profitability of the investment, by involving in the calculations the yearly income. It also reflects the operational costs and the initial investment.
A_2	*Discounted Payback Period*	The discounted payback period is the number of years necessary to recover the project cost of an investment while accounting for the time value of money. It is recommended since it allows for a quick assessment of the duration during which an investor's capital is at risk.
A_3	*Internal Rate of Return (IRR)*	IRR is a rate of return used in capital budgeting to measure and compare the profitability of investments. IRR provides a straightforward mean to compare different projects associated with benefits and risks.
A_4	*Cost-Effectiveness (or Avoidance Cost)*	Cost-effectiveness in its simplest form is a measure of whether an investment's benefits exceed its costs. In the proposed methodology, the Cost-Effectiveness is calculated based on the project cost per kWh saved during the average lifetime of measures.

4.4 Decision Making Process

The Triple-A Benchmarking is based on a Multi-Criteria Decision Analysis (MCDA) method, a general framework for supporting complex decision-making situations with multiple and often conflicting objectives that stakeholders groups and/or decision-makers value differently [11]. The benchmarking procedure exploits four (4) criteria which consist of several performance indicators (financial, SDG, and risk related). In detail, the first two criteria are financial (K_1 & K_2), followed by one aggregated risk criterion (K_3) and one SDG criterion (K_4). Different weight factors, taking into account the preferences of the users, are applied. Thus, the Triple-A Tools provide an efficient support to users' investing strategy.

The standardised procedure that implements the ELECTRE Tri MCDA method is conducted. ELECTRE Tri is an MCDA method used for classification problems and, more specifically, in discrete classification problems, where the alternatives of the problem should be classified into predefined categories. The classification is made using pair-wise comparisons between the alternatives and the reference profiles based on concordance and discordance checks [12], [13].

The KPIs used as criteria are either calculated based on EU Directives and Regulations on Cost-Benefit Analysis of Investment Projects or reflected directly from EU official statistics to provide a standardised, unbiased result. This builds confidence among investors and facilitates financing bodies and EE funds to rapidly detect and aggregate projects that meet the necessary criteria to be financed.

Financial criteria: A group of two Financial KPIs are applied, which are selected by the stakeholder to provide a personalised and flexible benchmarking.

Aggregated risk criterion: The value of the Total Risk of the investment, described in the previous section.

Aggregated SDG criterion: The Sustainable Development Goal (SDG)[12] criterion consists of an aggregation of SDG criteria. The benchmarking is oriented to evaluate EE investments based on the data, characteristics, and KPI's performance of each project.

[12] https://sdgs.un.org/

5 Triple-A Benchmarking Results and Evaluation

Within this section, the results from the Triple-A Benchmarking procedure are presented. An analysis of the results thought graphs and KPIs has been performed. In addition, an evaluation of the results has been realised, extracting key results and recommendation regarding the status quo of the design and financing of EE projects in the Triple-A case study countries.

5.1 Benchmarking Results

As it has already mentioned, the benchmarking is focused on proving an appropriate solution to all Triple-A Tool users, but especially the investors. Thus, the Triple-A approach for achieving the optimum benchmarking has been implemented taking into account the methodological approach presented in paragraph 3.3. The benchmarking[13] is presented mainly for building projects, as their number is much higher than any other sector and it is assumed that they provide a wide range of cases, which is statistically significant.

Considering the results provided by the Triple-A Tool, the projects could be presented taking into account the estimated cumulative risk against the estimated discounted payback period. In this case, it is expected that the discounted payback period should not be higher than the average lifetime of the foreseen measures and the cumulative risk is as low as possible. Longer payback periods could be accepted various cases, e.g. in the case that the EE project is part of wider renovation that allows the utilization of the asset.

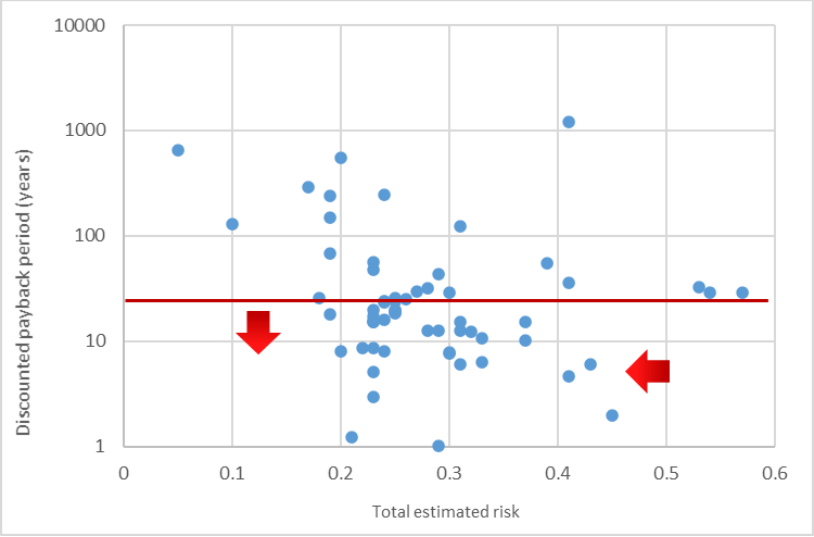


Figure 3. Total estimated risk against the discounted payback period

[13] The benchmarking results presented below are indicative that showcase the potential of the Triple-A Tool, based on the information provided by the project developers for the first 100 projects. Thus, the followings don't constitute an investment proposal or even express any preference to one project than another.

Excluding the projects that have a discounted payback period longer than the estimated average lifetime of the foreseen EE measures, we limit the number of potential interesting projects (Figure 4). It is obvious that projects with higher risk would be possible less desirable.

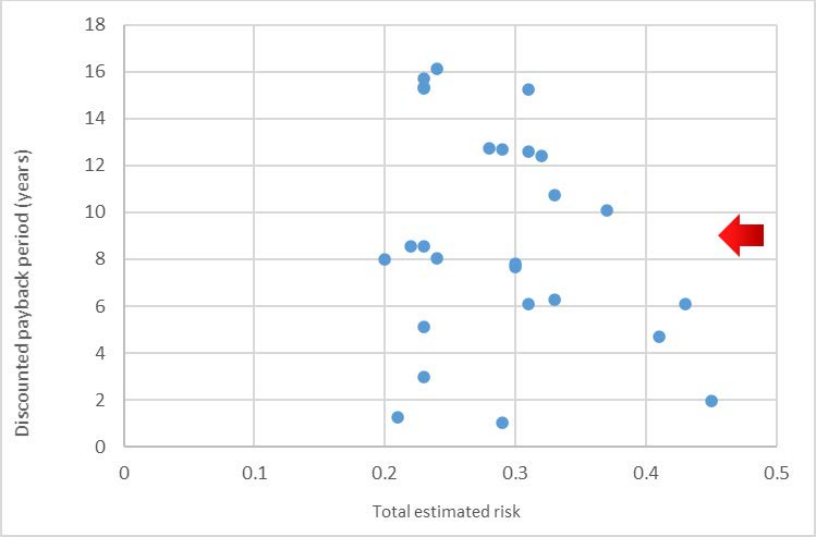


Figure 4. Projects with acceptable risk level and payback period

Additionally, investors could select the projects that fit better to their profile (size of the project, repayment period, maximum accepted and/or type of risks, pricing) and their preferences (country, EU Taxonomy alignment, ESG criteria).

Project size could be important parameter. For example, a large project would be interesting for a small fund, as even it can support it, it could potentially result to a concentration risk. In addition, single small size projects cannot attract the same fund due to its, comparative to the project, high operating cost.

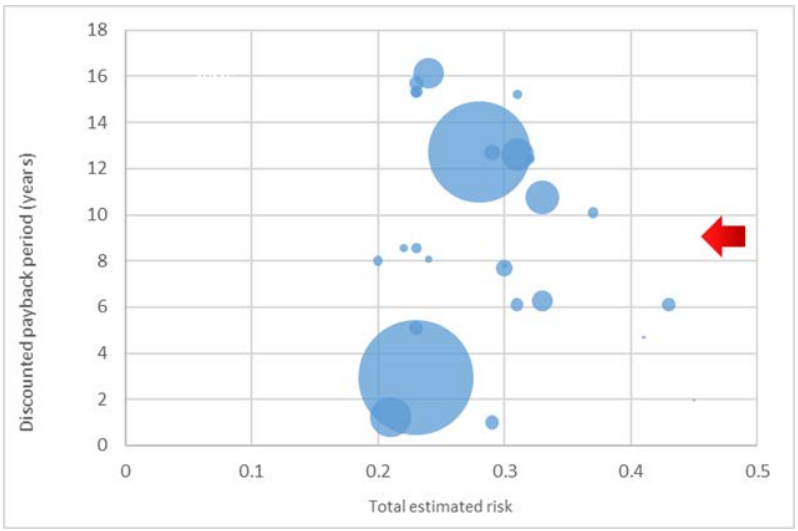


Figure 5. Total estimated risk against projects' size

Additionally, the selected projects could be filtered, taking into account the location (the country). This is important as national markets could have significant differences, while many stakeholders are active only to selected markets.

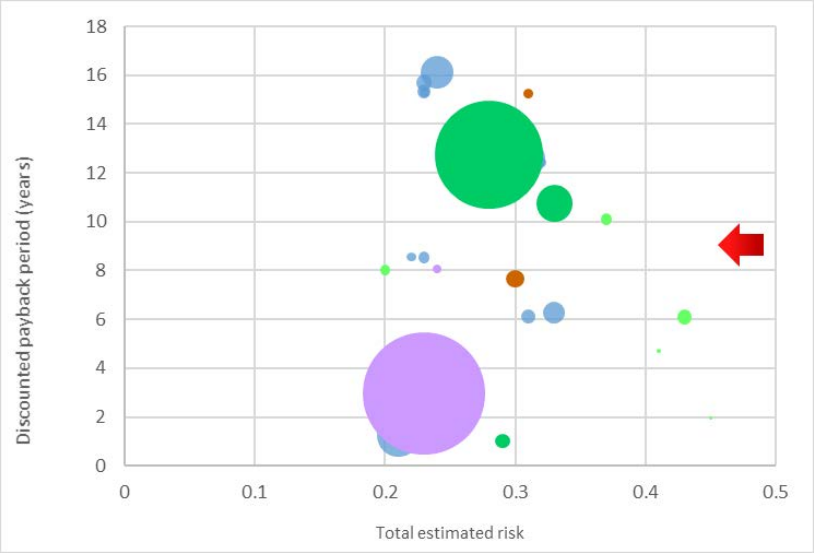


Figure 6. Total estimated risk against the discounted payback period, taking into account the location (each colour corresponds to different country)

The final benchmarking of the projects could be done by comparing the economic performance of the selected projects, taking into account the IRR or the NPV indexes, as estimated by the Triple-A tool. Some projects, could be characterized as “Rejected” (points with red colour in the following the graph), even they have acceptable risk level and payback period. This is because of the different limitations set up from the user.

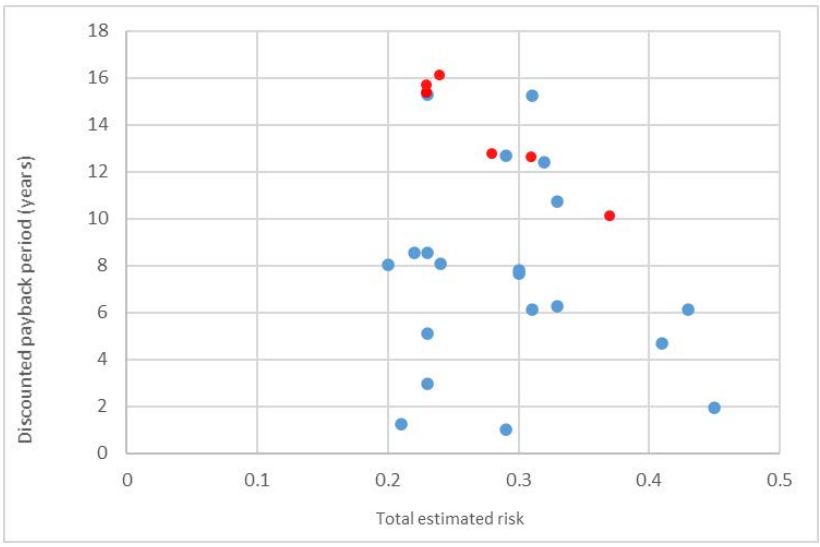


Figure 7. Projects with acceptable risk level and payback period and indications of the six “Rejected” project cases - points with red colour – according to the Triple-A tool assessment

5.2 Evaluation & Recommendations

This paragraph holds the overall evaluation of the analysis and benchmarking of the projects' pipeline, along with key results, valuable findings and recommendation regarding EE projects' design and financing. The evaluation has been focused on the EU Taxonomy [14] compliance of the projects, the estimated cashflows, potential recommendation to policy makers, while also minor comments and suggestion that could improve EE project design and foster EE projects' financing.

As observed by the input received by stakeholders through bilateral meetings and communication with EE project developers and financiers, the EU Taxonomy is not widely used yet. Although in several countries, stakeholders were aware of and supported the EE project alignment with the EU Taxonomy criteria, the majority of the participants declared that they do not take into consideration the EU Taxonomy when designing their EE projects. Further promotional actions, capacity-building webinars and incentives should be designed and promoted through European and National programmes in order to enhance the reception of stakeholders for **EU Taxonomy as the cornerstone of sustainable investments**.

Another key finding is the impact of fluctuating energy prices on the profitability of EE investments. The latest energy crisis has augmented this issue, creating **uncertainty about the estimated cash flows of EE projects** and disconcerting the profitability of these kinds of investments.

Regarding the recommendation to policy makers, it is clear that policymaking should stir towards the standardisation of project design to make the EE projects' replicability easier. Standardisation could be achieved by establishing a common (even pan-European) framework of EE project fiches, **EE project benchmarking and underwiring procedures.**

Concerning best practises in EE projects' design, the **replication of projects, either in terms of financing or/and technical solutions**, is highly desired. Similar projects allow project developers to demonstrate the proof of concept, promote them as a product, and minimise development costs.

Another significant instrument that has provenly assisted EE projects financing is project aggregation. **Aggregation of EE projects** seems to be more critical than other issues, as it has a positive impact on risk assessment and could provide economies of scale.

Also, **building confidence between project developers and investors** is critical for the implementation – and decision making of EE projects. This could be achieved by introducing standardised underwriting methods, standardised EE contracts and a stable economic environment regarding energy prices and/or energy taxes.

Significant comments

- Projects' economic performance estimated by the project developers could differ significantly from that estimated from the Triple-A Tools due to different energy prices assumptions.
- Some projects could achieve significant money and GHG emission savings, but not final energy savings.
- Many times, the CAPEX provided by the projects' developers incorporates and other costs than those directly related to EE interventions. This affects the economic performance of the project.
- The ownership (public, private) of the assets is a critical parameter which has been ignored in the assessment of the projects. In case of public assets, a relevant call of tender should be expected, which can be time consuming. This has been assumed that it is outside of the scope of the benchmarking.

6 Utilisation of the Project Pipeline

According to Triple-A Tool results and the information provided directly from the projects' developers, Triple-A Tools can support reliably and efficiently, both projects' developers and investors. The Triple-A tools asses the appropriate status of the projects ("Triple-A", "Reserved", "Rejected"), while they provide appropriate indicators regarding the economic performance of the projects.

Following is an analysis of project pipeline, as it was by the end of April 2022. The analysis showcases the efficient, flexible, and clear approach of Triple-A tools[14].

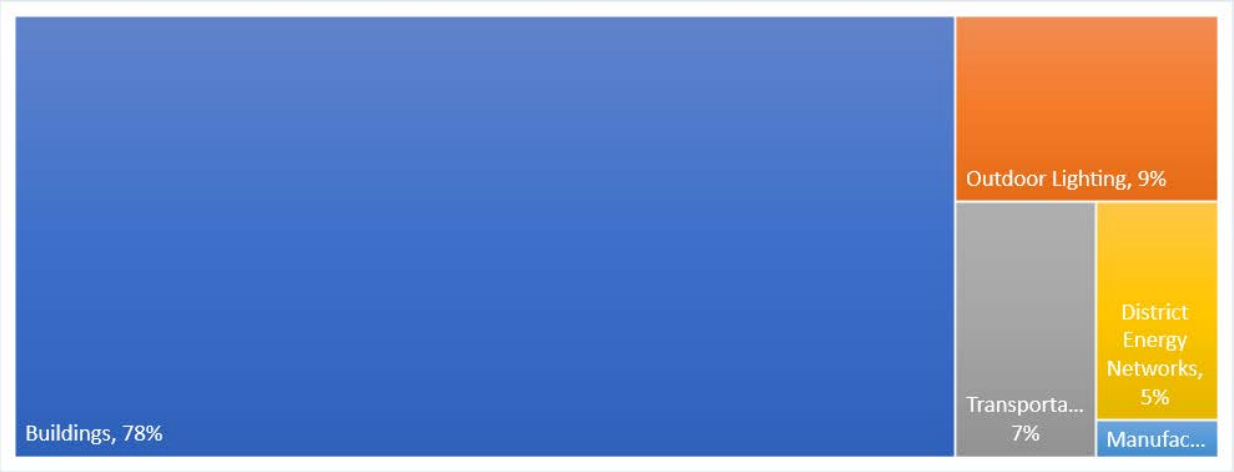


Figure 8: Statistical distribution of projects' types

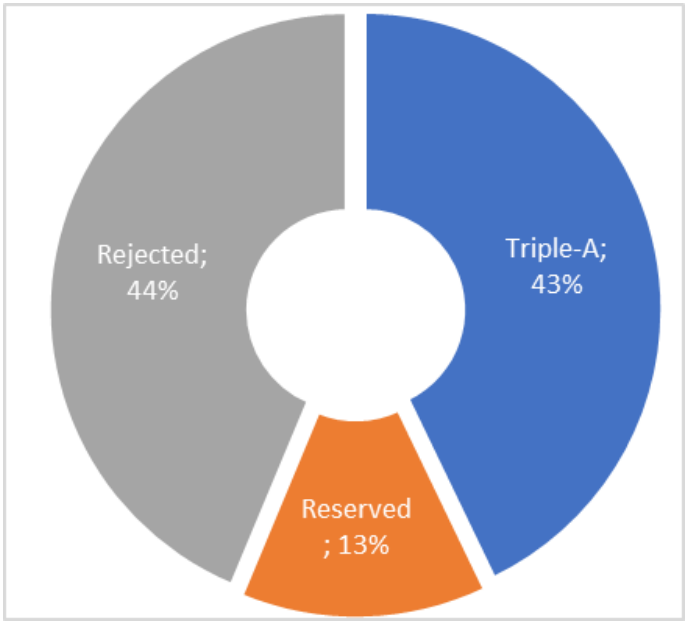
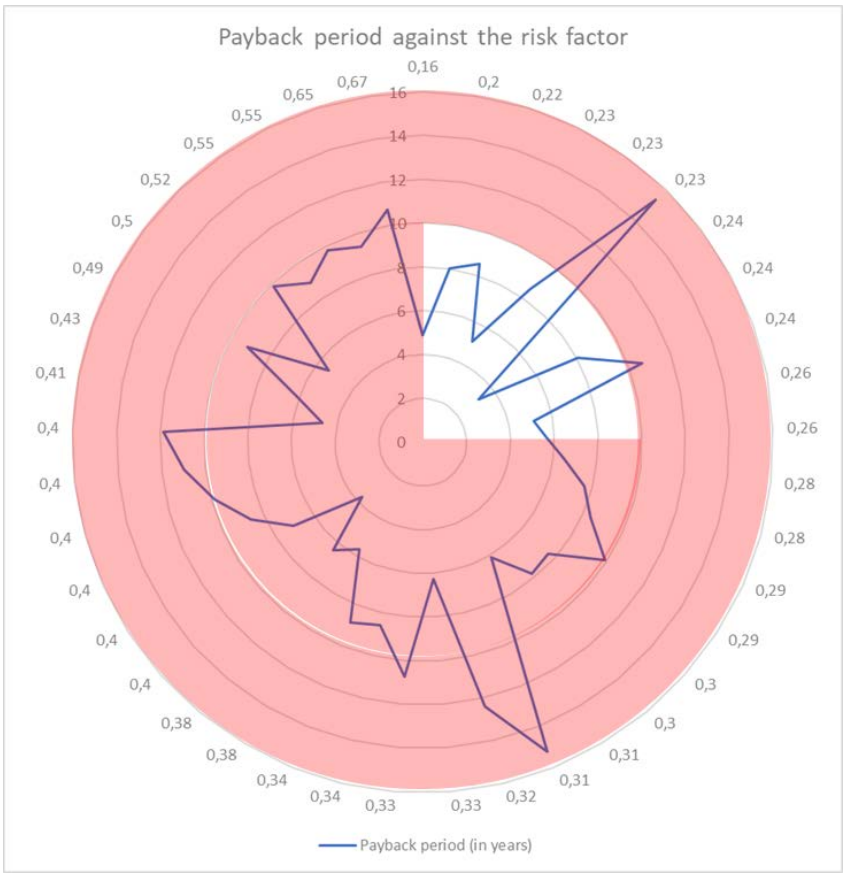


Figure 9: Statistical distribution of projects' status: "Triple-A", "Reserved", "Rejected"

[14] The followings don't constitute an investment proposal or even express any preference to one project than another.



The figure to the left shows the ability of the Triple-A tools to the selection of projects, taking into account the risk factor assessment and the payback period. The potential projects investments should have a discounted payback period lower than 10 years and a risk factor value, lower than 0.26.

Figure 10: Payback period against the risk factor

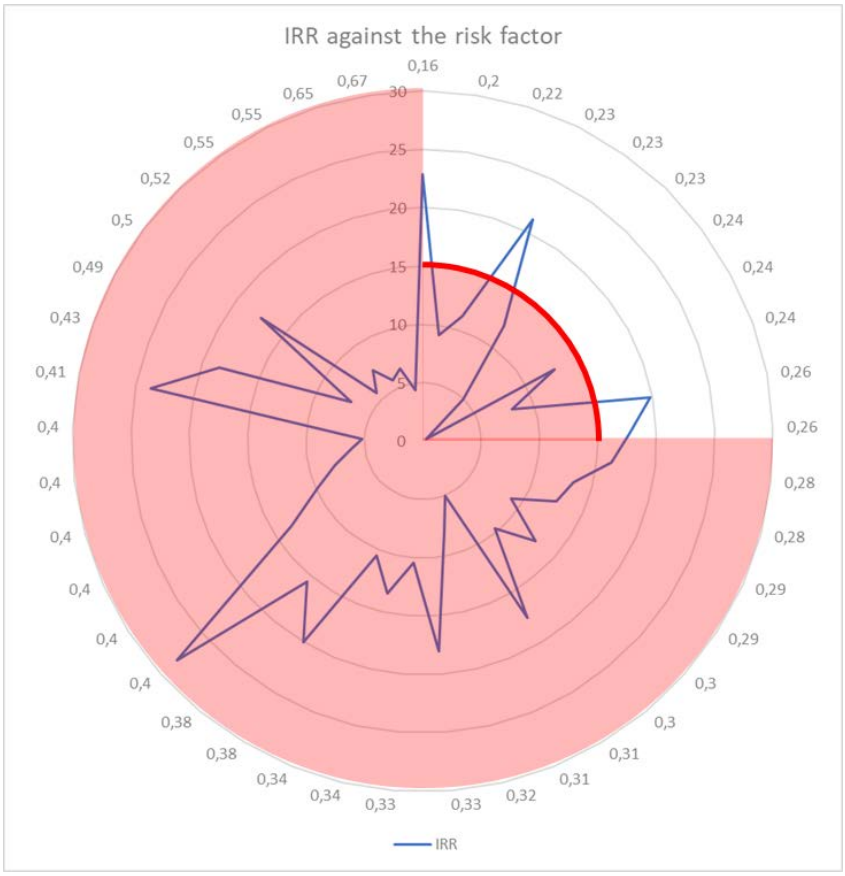
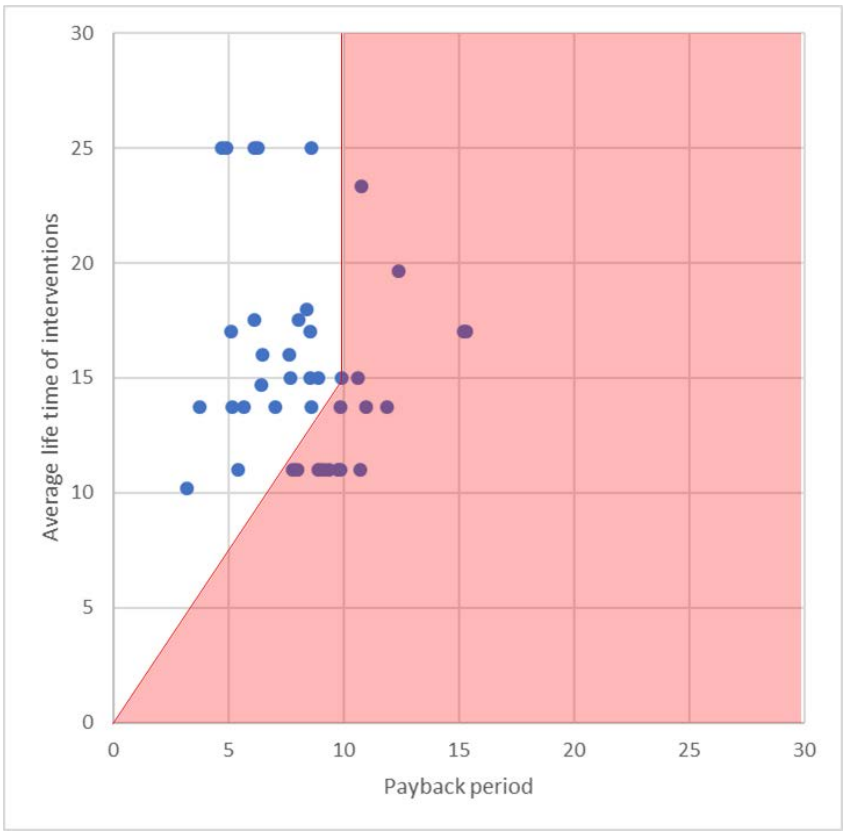


Figure 11: IRR against the risk factor

The figure to the left shows the ability of the Triple-A tools to the selection of projects, taking into account the risk factor assessment and the IRR. The potential projects investments should have an IRR higher than 15 and a risk factor value, lower than 0.26. This approach reduces significantly the number of attractive EE projects.



The figure to the left shows the ability of the Triple-A Tools to the selection of projects, taking into account the estimated payback period and the average lifetime of the foreseen interventions. The potential projects investments should have a discounted payback period lower than 10 years, while the average lifetime of the foreseen interventions should be at least 50% longer than the estimated payback period.

Figure 12: Payback period against the average lifetime of the interventions

7 Conclusions

Triple-A Tools have been developed, focusing on contributing to trigger the EE market by providing handy tools and reliable, but simplified procedures that can set the ground for initialising a discussion between projects' developers and investors. Therefore, Triple-A Partners are committed to the further developed and optimisation of the Triple-A Tool for achieving an appropriate projects' benchmarking, available to all types of users. So far, Triple-A managed to collect a significant number of EE projects, which could be all, potentially invested and provide significant energy savings and reduction of CO_2 emissions.

The benchmarking and evaluation have concluded that the projects' economic performance estimated by the project developers could differ significantly from that estimated from the Triple-A tool due to different energy prices assumptions. In addition, several projects could achieve significant money and GHG emission savings, but not final energy savings, while many times, the CAPEX provided by the projects' developers incorporates and other costs than those directly related to EE interventions. This affects the economic performance of the project. Finally, the ownership (public, private) of the assets is a critical parameter which has been ignored in the assessment of the projects. In case of public assets, a relevant call of tender should be expected, which can be time consuming. This has been assumed that it is outside of the scope of the benchmarking.

According to Triple-A Tool results and the information provided directly from the projects' developers it has been proven that the Triple-A Tools can support reliably and efficiently, both projects' developers and investors. The Triple-A tools recognizes, generally well the appropriate status of the projects ("Triple-A", "Reserved", "Rejected"), while it provides appropriate indicators regarding the economic performance of the projects. Triple-A Tools' estimations are affected by its simplified approach. This should be accepted as Triple-A Tools are a mostly a marketing tool, which focuses on triggering the market, by helping the identification and aggregation of projects, the efficient collaboration of project developers and financing actors, while it promotes EE first. Possibly, small technical improvements will be done even after the project period, for optimising users' experience and fix potential problems that have not yet reported.

Finally, through the benchmarking procedure and evaluation, key recommendations regarding EE projects' design and EE financing have emerged: the EU Taxonomy [14] is not widely used yet from stakeholders. European and National programmes are needed in order to enhance the reception of stakeholders for EU Taxonomy as the cornerstone of sustainable investments. The impact of fluctuating energy prices on the profitability of EE investments is high, creating uncertainty about the estimated cash flows of EE projects. In addition, policy making should stir towards the standardisation of project design to make the EE projects' replicability easier. The replication of projects, either in terms of financing or/and technical solutions, is highly desired and could improve drastically EE projects' design. Also, the aaggregation of EE projects could also assist EE projects' financing. Last but not least, building confidence between project developers and investors is critical for the implementation – and decision making of EE projects.

The proposed methodology incorporates successfully EE criteria and provides an appropriate benchmarking. This could be potentially further developed by introducing additional criteria, focusing on the ESG (Environmental Social and Governance) performance of the involved companies and/or projects implementation. Projects benchmarking will be affected accordingly, to reflect the new criteria.

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