TRIPLE-A

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

Deliverable 3.5:
Updated Web-Based Database on Energy Efficiency Financing and Supporting Documentation

May 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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Table of Contents

1 Introduction....1
2 Process Overview....3
3 Presentation of the Triple-A Web-Based Database....5
3.1 Data dimension....5
3.2 Content....7
4 Added-value to Triple-A's target groups....30
5 Conclusions....32
Appendix A....33
User Manual....33

Figures

Figure 1: Overview of the Triple-A Web-based Database's framework 4
Figure 2: Triple-A Web-based Database's Project Sectors and Categories 6
Figure 3: Main menus of the Triple-A Web-based Database....8
Figure 4: Submenus of the "Country Risks" section 9
Figure 5: "Country Risks" menu....9
Figure 6: "Total Country Risk" menu 11
Figure 7: "Energy Prices & Taxes Volatility" menu 12
Figure 8: "Weak Economic Environment" menu 13
Figure 9: "Lack of Incentives" menu 14
Figure 10: "Poor Energy Efficiency Labelling System" menu....15
Figure 11: "Energy Efficiency Projects Risk" menu 17
Figure 12: "Risk Mitigation Strategies" menu....19
Figure 13: Appropriate energy market and regulatory risk mitigation strategies per case study country 20
Figure 14: "IRR: Project's Perspective" menu 22
Figure 15: "IRR: Investor's Perspective" menu....24
Figure 16: "Financing Instruments" menu....25
Figure 17: "Financial Models" menu 26
Figure 18: "Sustainable Development Goals" menu....28
Figure 19: Triple-A Web-based Database Homepage....33
Figure 20: Triple-A Web-based Database Homepage - Country Risks 34
Figure 21: Country Risks....35
Figure 22: Total Country Risk....36
Figure 23: Triple-A Web-based Database Homepage - Energy Efficiency Projects Risk....37
Figure 24: Energy Efficiency Projects Risk....38
Figure 25: Triple-A Web-based Database Homepage - Risk Mitigation Strategies 38
Figure 26: Risk Categories Menu for the identified Risk Mitigation Strategies 39
Figure 27 Risk Mitigation Strategies Menu....40
Figure 28: Triple-A Web-based Database Homepage – IRR: Project's Perspective 40
Figure 29: IRR: Project's Perspective....41
Figure 30: Triple-A Web-based Database Homepage – IRR: Investor's Perspective....42
Figure 31: IRR: Investor's Perspective 43
Figure 32: Triple-A Web-based Database Homepage – Financing Instruments....44

Figure 33: Financing Instruments 44
Figure 34: Triple-A Web-based Database Homepage – Financial Models 45
Figure 35: Financial Models 46
Figure 36: Triple-A Web-based Database Homepage – Sustainable Development Goals 47
Figure 37: Sustainable Development Goals 48

Tables

Table 1: Triple-A Case Study Countries 5
Table 2: Project types with financial performance data 6
Table 3: Sustainable Development Goals Indices 28
Table 4: Summary of added-value per target group 30

Glossary

CPI:	Consumer Price Index
CSR:	Country Specific Risk
CV:	Coefficient of Variation
DEEP:	De-risking Energy Efficiency Platform
EE:	Energy Efficiency
EEMs:	Energy Efficiency Measures
ESCO:	Energy Service Company
HVAC:	Heating, ventilation, and air conditioning
IRR:	Internal Rate of Return
OECD:	Organisation for Economic Co-operation and Development
PSR:	Project Specific Risk
PSRS:	Project and Sector-Specific Risk
RISE:	Regulatory Indicators for Sustainable Energy
SDG:	Sustainable Development Goals
SMEs:	Small and medium-sized enterprises

Executive Summary

This presented report is the final version of the previously submitted deliverable D3.5 Updated Web-Based Database on Energy Efficiency Financing and Supporting Documentation in M20, April 2021. It aims to explain in detail the final version of the Triple-A Web-based Database in terms of the data reported within its context and functionalities provided to its users, while also descriptions of how the Database's interface can be navigated are included.

This final version of the Triple-A Web-Based Database[1] incorporates all new data and enhanced functionalities that enable the effective and interactive communication of the Triple-A methodology's results on the fundamental aspects of Energy Efficiency (EE) financing to the key involved actors. In that regard, it contributes significantly to upscaling EE investments, making them more attractive to capital providers on the one hand while providing a better understanding of their framework to those looking for capital on the other.

Investors, who are considered the most critical stakeholders for Triple-A, are the ones that could benefit the most from the Triple-A Web-based Database. At the heart of the design process of the final version of the Triple-A Web-based Database was the enhancement of its functionalities towards supporting mainly investors' decision making and involvement in EE financing. However, apart from investors, all the other involved actors in EE financing, such as project developers, policymakers, and researchers, could gain valuable knowledge and insights from the information included in Triple-A Web-based Database. As a matter of fact, the Triple-A Database on Energy Efficiency Financing has been visited by 1,239 users with 3,496 unique pageviews, while 211 downloads of the excel (.xls(x)) case study reports have been achieved.

In particular, the current version of the Triple-A Web-Based Database reports data on the following aspects: (i) implementation risks of EE projects, (ii) risk mitigation strategies, (iii) preferences of investors on EE investments, (iv) financial performance of successfully implemented EE projects, (v) financing models and instruments, (v) necessity of boosting EE per case study country and sector.

The final version of the Triple-A Database on Energy Efficiency Financing has been upgraded, incorporating data and results from Triple-A's stakeholder consultation activities. Specifically, based on extensive research and stakeholder engagement, the applicability of the identified Financial Models, Financing Instruments and Risk Mitigation Strategies for each case study country has been incorporated in the Database, presented in interactive maps. Moreover, an interoperability framework between the Triple-A Web-Based Database and the Triple-A Tools[2] has been established.

[1] Available online at: https://database.aaa-h2020.eu/
[2] Available online at: http://toolbox.aaa-h2020.eu/

1 Introduction

The outcomes of the Triple-A methodology on the fundamental aspects of Energy Efficiency (EE) financing support the market actors that have a direct interest in EE investments. By offering information on a range of risks and uncertainties that could endanger the successful implementation of an EE project, project developers could better understand the risky nature of EE investments, delivering more attractive proposals to financial institutions. On the other hand, capital providers, such as investors and funding institutes, could evaluate the potential of EE investments from a holistic point of view, connecting their profitability potential to the entailed risks. Therefore, they could make better decisions towards identifying the EE investments that merit attention and those that need to be rejected.

In this respect, by facilitating the involved actors from both sides of an investment, i.e., capital seekers and providers, Triple-A could foster EE investments substantially and contribute towards reaching the EU target of 2050 carbon-neutrality[3]. A prerequisite for this is the effective communication of the Triple-A results and methodology to key stakeholders that helps them substantially in their decision making.

The above objective is served by the Triple-A Web-Based Database[4], which is an online interactive application that communicates Triple-A results to relevant stakeholders, also providing advanced functionalities like interactive maps and graphs and cross-country analysis. Specifically, the Triple-A Web-Based Database incorporates the results of the Triple-A methodology regarding the main components in EE financing, as follows:

- The risks that could endanger the successful implementation of an EE project;
- The strategies that could mitigate these risks;
- The financial performance of successfully implemented EE projects;
- The preferences of investors on EE investments;
- The models and instruments that are usually used to finance EE projects;
- The necessity of boosting EE in the case study countries, considering their progress in terms of Sustainable Development Goals (SDG).

Triple-A Web-based Database is an open-source application, meaning that its users can navigate themselves to its interface without a subscription, while they can also download the data provided in an excel format. Moreover, it provides data about the eight Triple-A case study countries: the Czech Republic, Germany, Greece, Italy, Lithuania, Netherlands, Republic of Bulgaria, and Spain, since it focuses on these countries to apply its methodology. Its content is going to be updated every six months.

This deliverable updates the previously submitted deliverable in April 2021 (M20), namely the “D3.5: Web-Based Database on Energy Efficiency Financing and Supporting Documentation”. In that regard, it aims to present the final version of the Triple-A Web-based Database that provides a broader picture of the status quo in EE financing to its users compared to its initial version. In its context, the information included in the Database is described, along with the outline of the methodology followed for deriving these results. Moreover, suggestions about how these results could be exploited and interpreted by relevant target groups are also provided. In addition, a user’s manual that facilitates the users on how could be navigated through the Triple-A Database’s environment is provided (Appendix A).

[3] EC - European Commission (2020). 2050 Long-Term Strategy. Available online: https://ec.europa.eu/clima/policies/strategies/2050_en

[4] Available online at: https://database.aaa-h2020.eu/

The final version of the Triple-A Database on Energy Efficiency Financing has been upgraded both in terms of content and functionalities, incorporating data and results from Triple-A's stakeholder consultation activities. More specifically, based on extensive research and stakeholder engagement conducted via 123 bilateral meetings with 161 participants and questionnaires[5] disseminated to stakeholders, gathering 33 replies. Briefing results of the Questionnaire can also be found in Triple-A's 12th Briefing Note[6]. The updated data include the applicability of the identified Financial Models, Financing Instruments and Risk Mitigation Strategies for the Triple-A case study countries. An applicability analysis has been performed for Financial Models, Financing Instruments and Risk Mitigation Strategies, mapping their applicability for each case study country. This data has been incorporated into the Database and presented in user-friendly interactive maps. In addition, the webpage that hosts the Database has been upgraded with Google Analytics' functionalities so as to properly monitor the reach and impact of the Database on EE market actors.

Moreover, an interoperability framework between the Triple-A Web-Based Database and the Triple-A Tools has been established. The Triple-A Tools communicate with the Triple-A Database on Energy Efficiency Financing by deploying an automated dedicated Application Programming Interface (API) that interconnects these two interfaces and updates the values in the Triple-A Tools creating a harmonised environment for EE financing.

Except for this introductory section, this report is structured into five sections. More particularly, Section 2 provides an overview of the procedure followed for reporting and updating the information of the Triple-A Web-based Database. Section 3 presents the information provided by the Triple-A Database, along with the outline of the methodology from which it has been derived. Section 4 concerns the summary of the added value that Triple-A Web-based Database's content creates for each key target group, while Section 5 concludes the report and presents possible enhancements that could be realised in the Triple-A Database's environment by the end of the project.

[5] Available here: https://forms.gle/xfsbreBksGkwvFyBA
[6] Available here: https://aaa-h2020.eu/sites/default/files/2022-05/Triple-A%2012th%20Briefing%20Note_final.pdf

2 Process Overview

This section provides an overview of the procedure followed for updating the Triple-A Web-based Database in terms of the data reported and functionalities provided to its users. In this respect, Figure 1 depicts the methodological overview of how the Triple-A Web-based Database is updated. The primary input of the Triple-A methodology is composed of the following elements:

(i) Information from relevant databases for the purposes of Triple-A (e.g., De-risking Energy Efficiency Platform (DEEP))[7],
(ii) Information from project developers as this is provided through the Triple-A Tools[8], and
(iii) Results of the Triple-A stakeholder consultations[9,10, 11].

By exploiting this input, the Triple-A methodology is applied to a set of EE sectors and countries[12], producing the results on the main aspects of EE financing, such as the risks and mitigation strategies in EE financing. These results are incorporated into the Triple-A Database, being available to any involved actor in EE financing, from investors and project developers to policy or decision makers and research institutes.

As it can be observed in Figure 1, the Triple-A Web-based Database is dynamically updated, while stakeholders lie at the heart of this procedure. By inspecting the results of the Triple-A methodology through the Triple-A Database's interface, stakeholders provide their feedback via the relevant channels established within Triple-A on a regular basis. Based on this feedback, Triple-A Database's content and functionalities are updated, capturing stakeholders' needs and depicting the EE market's state of the art aspects.

[7] The De-risking Energy Efficiency Platform (DEEP) can be accessed online at: http://deep.eefig.eu

[8] Standardised Triple-A Toolbox: http://toolbox.aaa-h2020.eu/

[9] Triple-A (2021). Triple-A Survey on Investors Preferences on Energy Efficiency Investments, Briefing Note No.3, Horizon2020 Triple-A project, No. 846569.

[10] Triple-A (2021). Triple-A Survey on Building Sector: The Case of Greece, Briefing Note No.2, Horizon2020 Triple-A project, No. 846569.

[11] Available here: https://aaa-h2020.eu/sites/default/files/2022-05/Triple-A%2012th%20Briefing%20Note_final.pdf

[12] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.

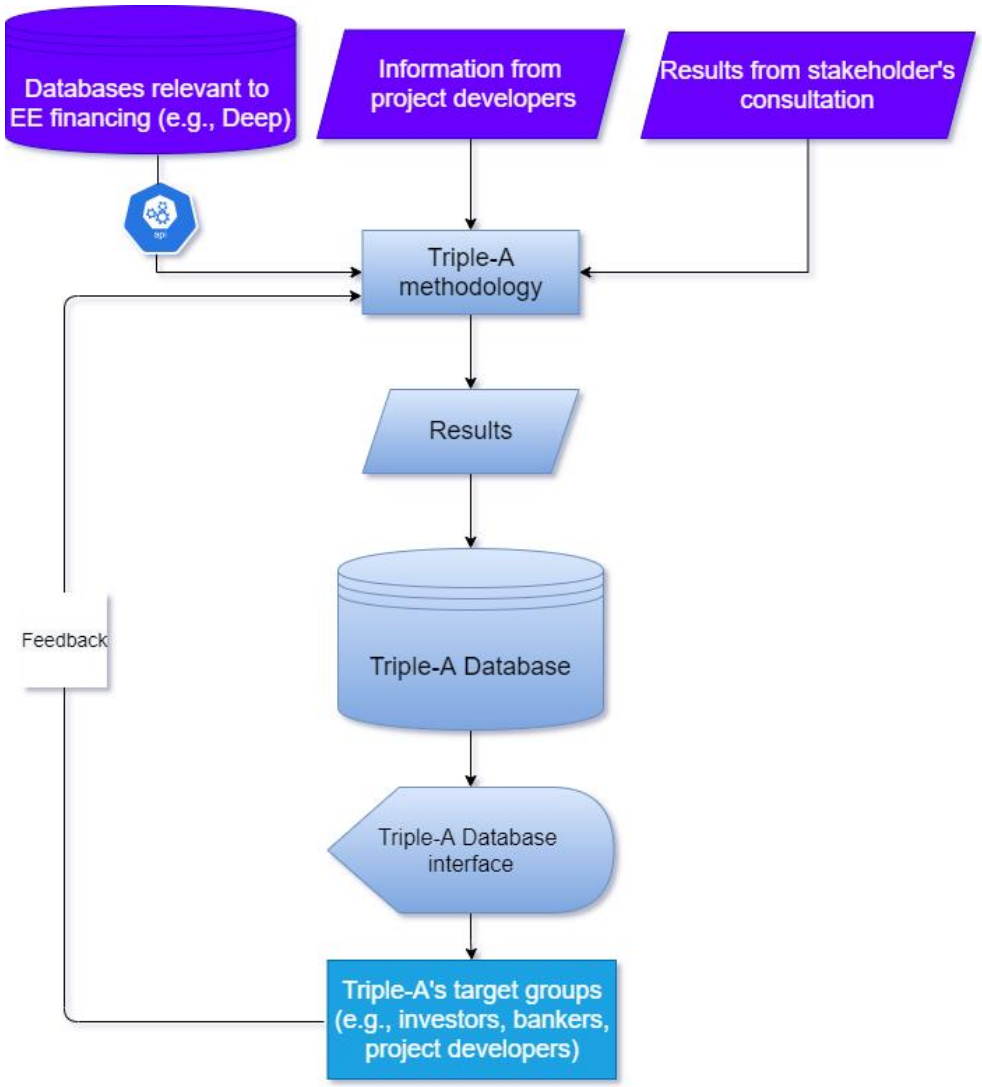


Figure 1: Overview of the Triple-A Web-based Database's framework

Also, it has to be highlighted that the Triple-A Database on Energy Efficiency Financing is interconnected with the Triple-A Tools[13]. The Triple-A Database provides values to the Triple-A Tools regarding the country-specific risk factors, such as the *Energy Prices and Taxes Volatility* and the *Weak Economic Environment*. These country-specific Risk Factors are calculated on a regular basis, in accordance with the Triple-A Methodology, as described in D4.7 Final Standardised Triple-A Package[14]. The outcome of the calculations is saved in and reported by the Triple-A Database of Energy Efficiency Financing. The Triple-A Tools communicate with the Triple-A Database on Energy Efficiency Financing by deploying an automated dedicated API that interconnects these two interfaces and updates the values in the Triple-A Tools to perform the Risk Assessment for each specific project.

[13] Available here: https://toolbox.aaa-h2020.eu/
[14] Available here: aaa-h2020.eu/results

3 Presentation of the Triple-A Web-Based Database

3.1 Data dimension

This section presents the dimension of the data reported by the Triple-A Web-based Database. It should be noted that the Triple-A Web-based Database contains the whole dimension of the data used under the Triple-A Tools, such as EE sectors, while in some cases, a higher level of classification of the entailed information is provided in view of increasing the representativeness of the results. For example, Triple-A Web-based Database contains more Energy Efficiency Measures (EEMs) compared to the ones covered by the Triple-A Tools.

In that regard, the Triple-A Web-based Database provides data of the eight (8) Triple-A case study countries (Table 1), in which the Triple-A methodology is applied. These countries have been selected to promote diversity across the selected countries, considering the macroeconomic environment, the innovation of the energy system, the country's geographical position, their progress in terms of SDG, and their strategic role in the EU.

Table 1: Triple-A Case Study Countries

A/A	Case Study Countries
C_1	Czech Republic
C_2	Germany
C_3	Greece
C_4	Italy
C_5	Lithuania
C_6	Netherlands
C_7	Republic of Bulgaria
C_8	Spain

Moreover, the sectors covered by the Triple-A Web-based Database are composed of the ***"Buildings"***, ***"Manufacturing"***, ***"Transportation"***, ***"District energy networks"***, ***and "Outdoor lighting"*** sectors (Figure 2). These sectors are related to the EEMs implemented within EE projects, something that is in line with the EU taxonomy sectoral coverage[15]. Thus, for example, the ***"Buildings"*** sector contains EE projects in which the EEMs implemented are related to the parts of a building or building's appliances, or construction of a new building takes place. Each of these sectors contains some related EEMs, as defined by EU Taxonomy, for which the Triple-A Web-based Database provides specific information about their risk nature. It should be noted that compared to the EEMs contained by Triple-A Tools, a higher level of classification is provided mainly for the ***"Manufacturing"*** sector (at Triple-A Tools, the

[15] EU Technical Expert Group on Sustainable Finance, "Taxonomy Report: Technical Annex" 2020. [Online]. Available: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf.

EEMs of this sector are represented by an aggregate EEM)[16], as well as one additional EEM is provided for the ***"Buildings"*** sector (***"Integrated Renovation"***).

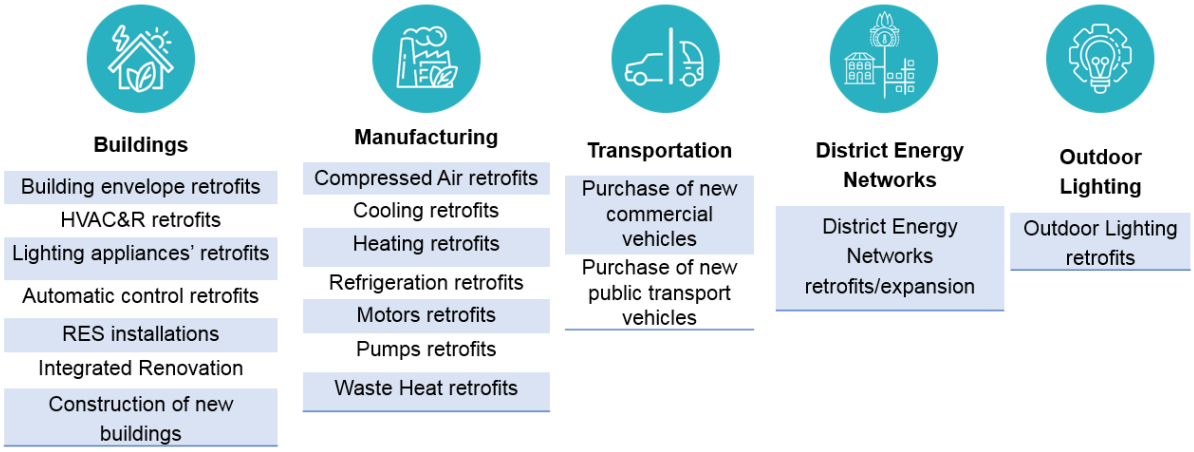


Figure 2: Triple-A Web-based Database's Project Sectors and Categories

Regarding the investors' profiles for which the Triple-A Database provides information, they are composed of the ***"Retail investor"***, ***"Institutional investor"***, ***"Impact investor"***, ***"ESCO"***, and ***"Fund"*** profiles[17]. The respective stakeholder consultation was conducted to collect their preferences derived from these profiles.

With regards to the projects for which the Triple-A Web-based Database provides evidence about their financial performance, they are presented in Table 2, where for each project, the country of implementation and the EEM implemented within its context are mentioned. Moreover, the number of implemented EE projects with available data of each type is mentioned. These data were extracted from the DEEP and the projects collected in the context of Triple-A.

Table 2: Project types with financial performance data

Projects	Number of projects	Sector
Germany-Building Fabric Measures	226	Buildings
Germany-HVAC Plant	929	Buildings
Germany-Lighting	586	Buildings
Germany-Compressed Air	475	Industry
Germany-Cooling	251	Industry
Germany-Heating	516	Industry
Germany-Motors	459	Industry

[16] Triple-A (2020). Final Standardised Triple-A Tools, Deliverable 4.2, Horizon2020 Triple-A project, No. 846569.

[17] Report on the Cost of Capital Estimation of Energy Efficiency Projects across Member State Countries, Deliverable 3.3, Horizon2020 Triple-A project, No. 846569.

Projects	Number of projects	Sector
Germany-Pumps	106	Industry
Germany-Waste heat (without power generation)	335	Industry
Bulgaria-Building Fabric Measures	123	Buildings
Bulgaria-Integrated Renovation	137	Buildings
Italy-Compressed Air	26	Industry
Italy-Heating	148	Industry
Italy-Motors	44	Industry
Italy-Refrigeration	18	Industry
Spain-HVAC Plant	80	Buildings
Lithuania-Integrated Renovation	335	Buildings
Bulgaria-Lighting	44	Buildings
Netherlands-Integrated Renovation	22	Buildings

It should be noted that the above-presented dimension of the data reported by the Triple-A Database, depicts the current picture of its content.

3.2 Content

This section presents the information presented in the final version of the Triple-A Web-based Database. More specifically, the current version provides information about the risks that could endanger the successful implementation of an EE project, the strategies that could mitigate these risks, the preferences of investors on EE investments, the financial performance of EE projects, the models and instruments that are usually used to finance EE projects, and the necessity of boosting EE in case study countries based on their progress in terms of SDG. In that regard, the Triple-A Web-based Database includes the following menus (Figure 3):

(i) ***"Country Risks"***;
(ii) ***"Energy Efficiency Projects Risk"***;
(iii) ***"Risk Mitigation Strategies"***;
(iv) ***"IRR: Project's Perspective"***
(v) ***"IRR: Investor's Perspective"***;
(vi) ***"Financing Instruments"***;
(vii) ***"Financial Models"***;
(viii) ***"Sustainable Development Goals"***.

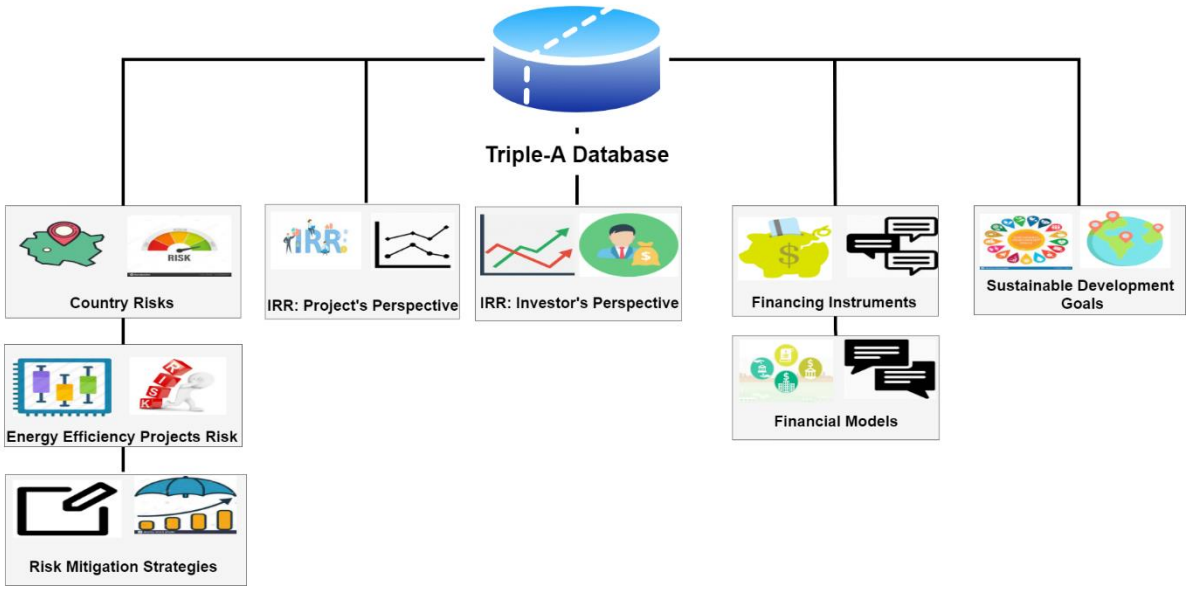


Figure 3: Main menus of the Triple-A Web-based Database

Below each of these menus is presented, describing the information provided within its context, as well as any of the sub-menus that they may contain. Moreover, the basic definitions of the relative aspects of each section and the outline of the entailed methodological framework are provided.

Country risks

This menu provides information about the country-specific risks that could hinder the implementation of an EE project, causing unexpected variations to the projected cash flows. These risks depend only on the country where the investment takes place and are related either to the macroeconomic environment, the energy market, or the governmental policies on EE implementation. More specifically, Triple-A Database provides information about the following country-specific risk factors (Figure 4): ***"Energy Prices & Taxes Volatility"***, ***"Weak Economic Environment"***, ***"Lack of Incentives"***, and ***"Poor Energy Efficiency Labelling System"***[18]. Therefore, it charts a wide range of uncertainties connected to the country of implementation that could endanger the successful implementation of an EE project. It should be noted that the values of the country-specific risk factors based on the data reported by global organisations and credit rating agencies are updated every six months.

In this regard, a user of the Triple-A Web-based Database could examine the characteristics of each case study country in terms of how risky it is. Therefore, this menu provides high added value mainly to investors, which compose the key target group for the purposes of Triple-A. When it comes to deciding about investing in a country or not or selecting the country to invest in, investors usually consider a respective index that reflects the macroeconomic risk of the country under examination. This index could be the long-term government bond yields, or the country credit ratings provided by official credit rating agencies. In contrast, based on the information provided by the Triple-A Database, investors could get a holistic view in terms of country risk since various aspects of country-specific uncertainties are considered that an investor could not have access to by consulting a single platform.

[18] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.

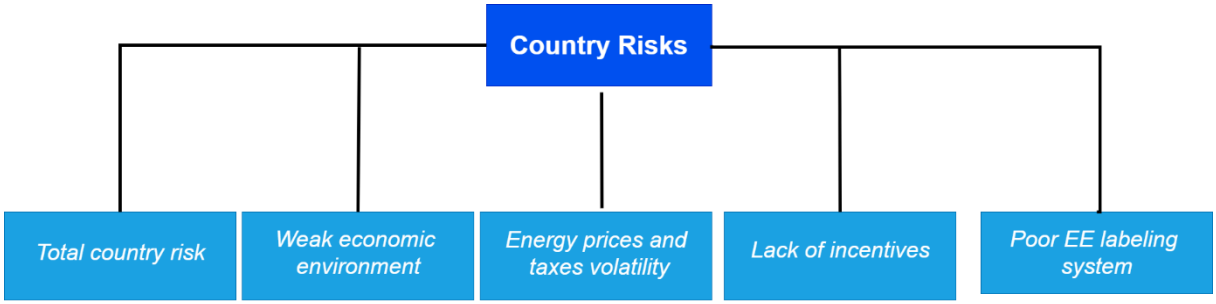


Figure 4: Submenus of the "Country Risks" section

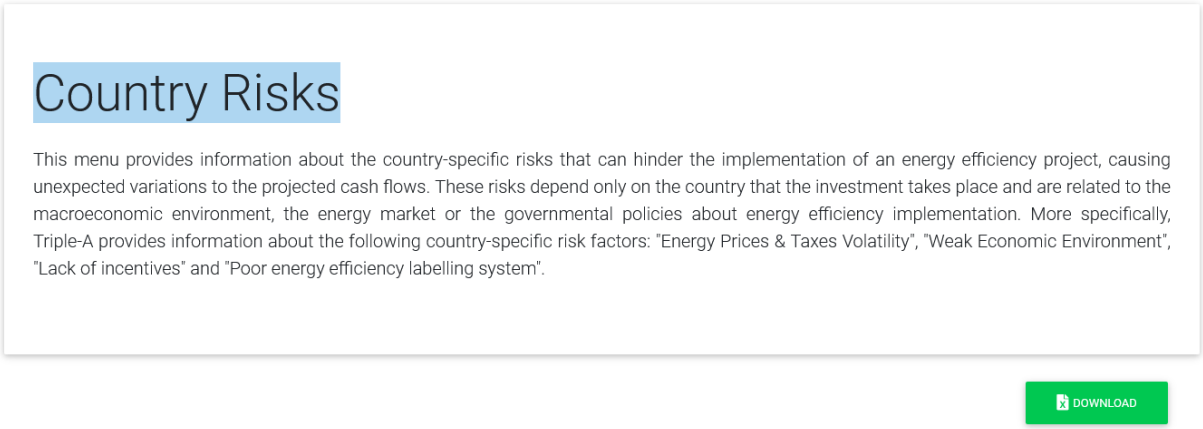


Figure 5: "Country Risks" menu

It should be noted that the Triple-A risk assessment methodology includes a multitude of risk factors, while a combination of qualitative and quantitative methods is employed. In that regard, the values of each individual risk factor have been set to the same range, while the linguistic values of the analysis

have been converted to numeric ones, in order to allow for aggregation and estimate the total risk of an EE project.

In particular, the risk values have been set to the range [0, 1], which can also be expressed as [0%, 100%], which is the conventional way when it comes to depicting risks. The 0%-risk value or "insignificant" risk, accounts for the lowest possible risk and the 100%-risk value or "very high" risk corresponds to the highest one. Moreover, in view of enhancing the representativeness of the results provided by the Triple-A Database, risks are classified over three classes, splitting them in a symmetric way. In this respect, the following risk classes are constructed:

(i) ***"Low-risk class"***;
(ii) ***"Medium-risk class"***;
(iii) ***"High-risk class"***.

The ***"low-risk class"*** accounts for risk values that belong to the [0%,33.33%) range, the ***"medium-risk class"*** stands for risk values that lie in the [33.33%-66.66%) range, and the ***"high-risk class"*** class involves risk values in the [66.66%-100%] range.

- ***Total country risk***

This risk factor indicates the total risk of the country in question, considering all the country-specific risk factors reported by the Triple-A methodology. In that regard, the values of this risk factor for each case study country are calculated by averaging the values of the individual country-specific risks, namely: ***"Energy Prices & Taxes Volatility"***, ***"Weak Economic Environment"***, ***"Lack of Incentives",*** and ***"Poor Energy Efficiency Labelling system"*** risk factors. As mentioned above, the risk values of the countries that present high risk tend to 100%, while the values of the corresponding ones that present low risk tend to 0%.



Figure 6: "Total Country Risk" menu

- ***Energy Prices & Taxes Volatility***

This risk factor reflects the energy market volatility of each case study country, considering the uncertainty about the level of energy prices. Energy prices are of paramount importance for the involved actors of an EE investment since they directly affect the monetary savings of the project and, in turn, the profitability of the investment[19]. Therefore, in case end-use energy prices exhibit significant volatility, the decision to undertake an EE investment could be affected. This risk factor is differentiated from country to country, and it has been derived by a custom estimation[20], through the use of the Consumer Price Index (CPI) of the energy sector as a reference for end-use energy prices of each case study country and the respective data supplied by the Organisation for Economic Co-operation and Development (OECD)[21]. To measure the volatility of the monthly values of CPI of each case study country for the last 15 years, the coefficient of variation (CV) is selected, which is defined as the ratio of the standard deviation to the mean.

[19] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.

[20] Triple-A (2020). Final Standardised Triple-A Tools, Deliverable 4.2, Horizon2020 Triple-A project, No. 846569.

[21] Available online at: https://data.oecd.org/price/inflation-cpi.htm (accessed Dec. 12, 2019)

In this respect, the CVs calculated for each case study country are scaled so as the lowest possible risk, i.e., 0%-risk value, to stand for the country with the lowest energy prices volatility from the OECD countries (the Netherlands), and the highest one, i.e., 100%-risk value, to correspond to the country with the highest energy prices volatility from the OECD countries (Turkey). It should be noted that the benchmarks for scaling the CVs have been defined by considering all the countries of the OECD, thus countries outside the Triple-A case study ones (Table 1), in order to enhance the representativeness of the information reported.

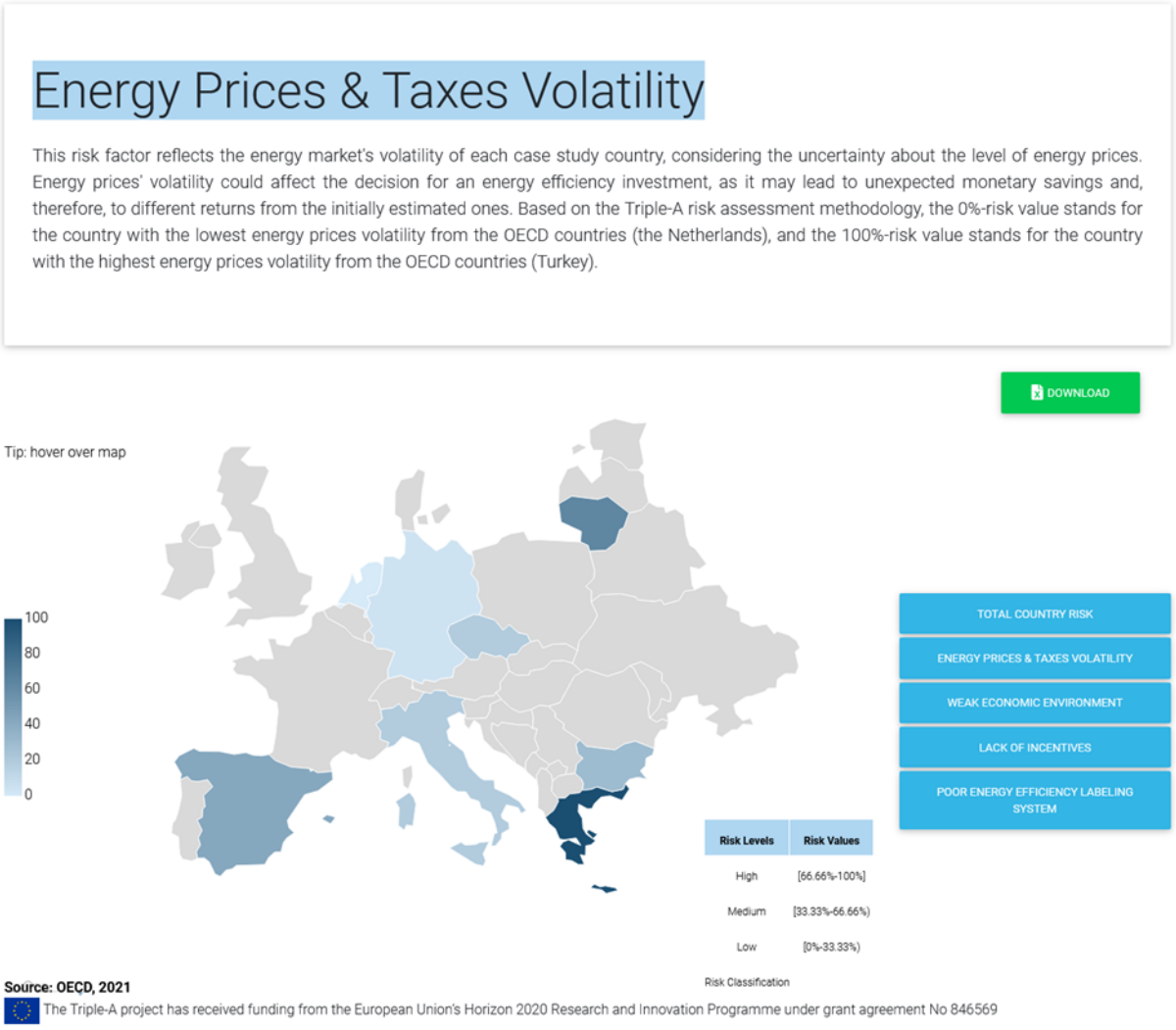


Figure 7: "Energy Prices & Taxes Volatility" menu

- ***Weak Economic Environment***

This risk factor reflects the macroeconomic risk of each case study country, considering macroeconomic factors like interest rates, inflation, and availability of finance, as these are evaluated by Standard & Poor's (S&P) for assigning credit ratings to each country. The poor economic environment could negatively influence an EE investment in many ways, such as affecting the investment's profitability through inflation or the performance indicators through increased interest rates. Based on the Triple-A

risk assessment methodology, the 0%-risk value stands for the highest assigned credit rating, i.e., “AAA” credit rating (e.g., Germany), and the 100%-risk value accounts for the lowest one, i.e., “D” credit rating.

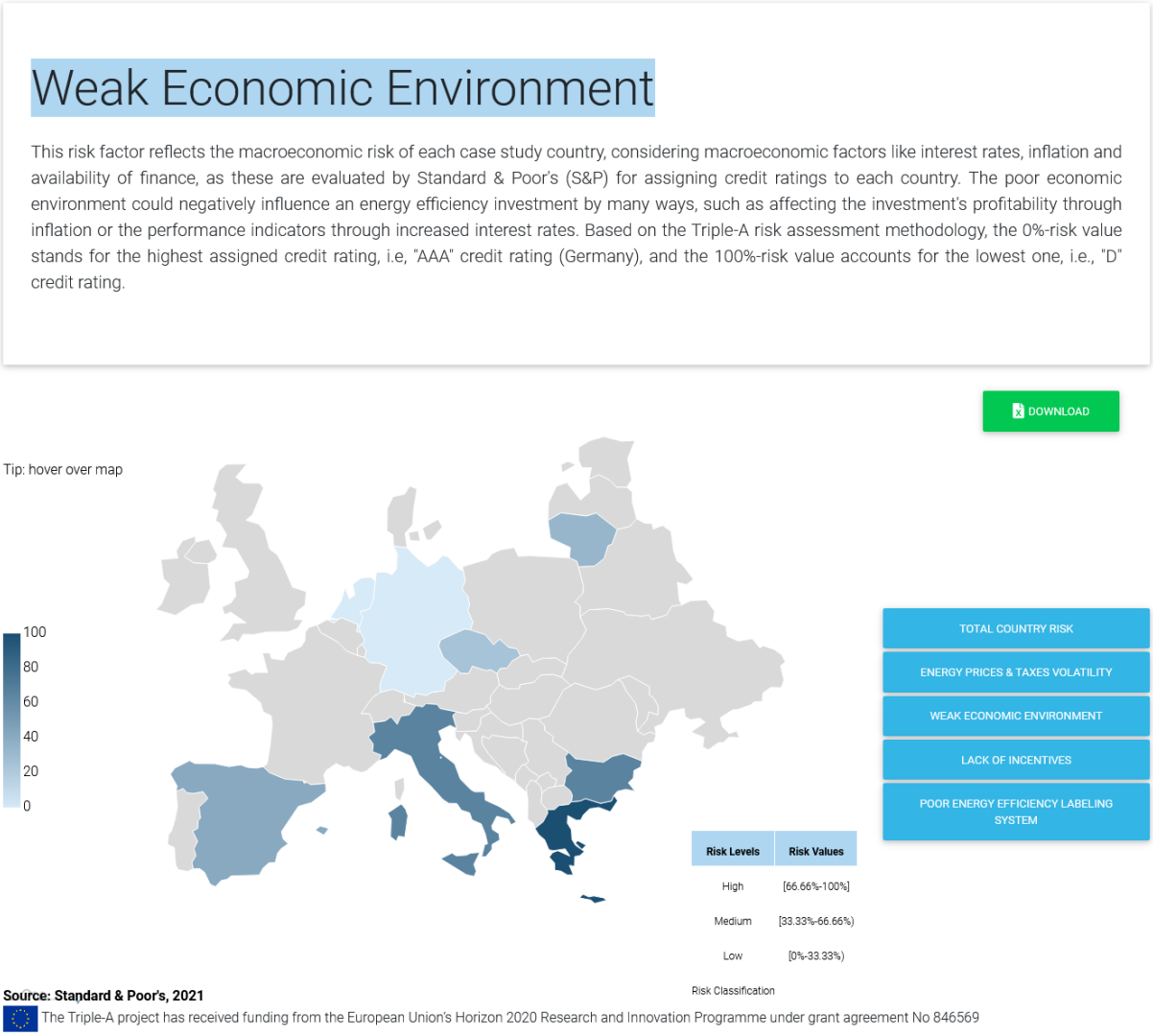


Figure 8: “Weak Economic Environment” menu

- ***Lack of Incentives***

This risk factor reflects the lack of incentives in case study countries about the implementation of EEMs. To evaluate this risk factor, the data provided by the Regulatory Indicators for Sustainable Energy (RISE) are utilised[22]. RISE assigns scores to countries, examining if programs that recognise the end-user’s energy savings achievements, awareness programs or publicised case study examples, and EE incentive programs for SMEs exist. RISE assigns scores to countries in the range of [0-100], where 0% is the score assigned to the country with the lowest performance on the indicator in question and 100% the one assigned to the country with the highest performance. Thus, in the context of the Triple-A risk

[22] Available online at: https://rise.esmap.org/about-us

assessment methodology, the 0%-risk value accounts for the best-performing score assigned by RISE (100%) and the 100%-risk value stands for the worst-performing one (0%).

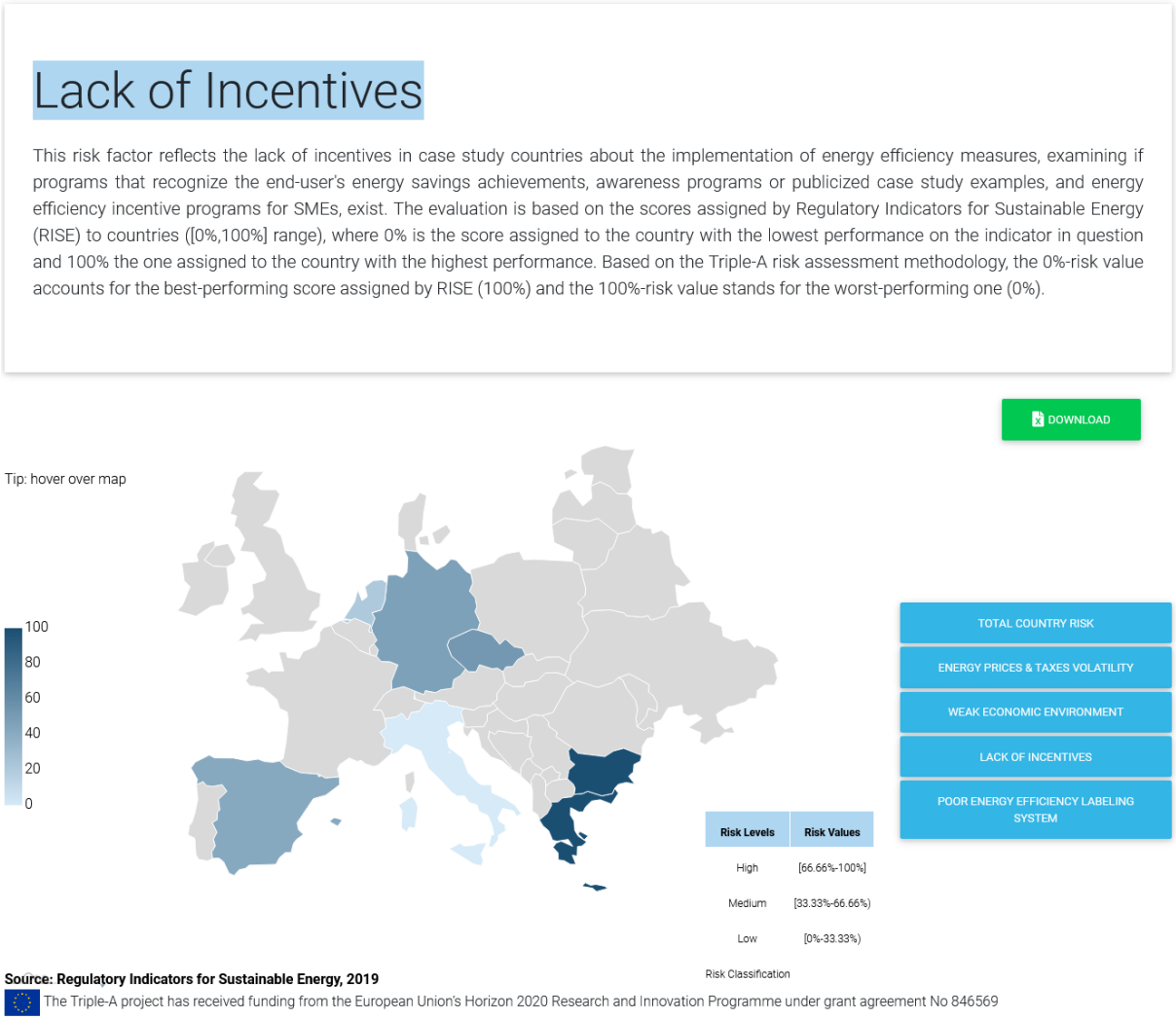


Figure 9: "Lack of Incentives" menu

- ***Poor Energy Efficiency Labelling System***

This risk factor reflects the quality of the policies adopted at national level for each case study country as regards the EE labelling system. Energy labelling system is an important factor towards reaching the optimal performance of energy measures[23], since it significantly decreases the risk of poor performance of the entailed equipment or technology.

This risk factor is evaluated based on the data reported by RISE, within the framework of which it is examined if EE labelling schemes for specific products have been adopted, in particular for the following

[23] European Commission, Energy label, 2021. https://europa.eu/youreurope/business/product-requirements/labels-markings/energy-labels/index_en.htm (Accessed April 6, 2021).

EEMs: "*Refrigerators*", "*HVAC*", "*Lighting equipment*", "*Industrial electric motors*", "*Other industrial equipment and/ or domestic appliances*", and "*Transport vehicles*". Also, it is inspected if the adopted energy labelling systems are voluntary or mandatory. As mentioned above, the scores assigned to countries range to [0%-100%] range, where 0% stands for the lowest-ranked performance, and 100% accounts for the highest one. In the framework of the Triple-A risk assessment methodology, the 0%-risk value accounts for the best-performing score (100%) and the 100%-risk value stands for the worst-performing one (0%).

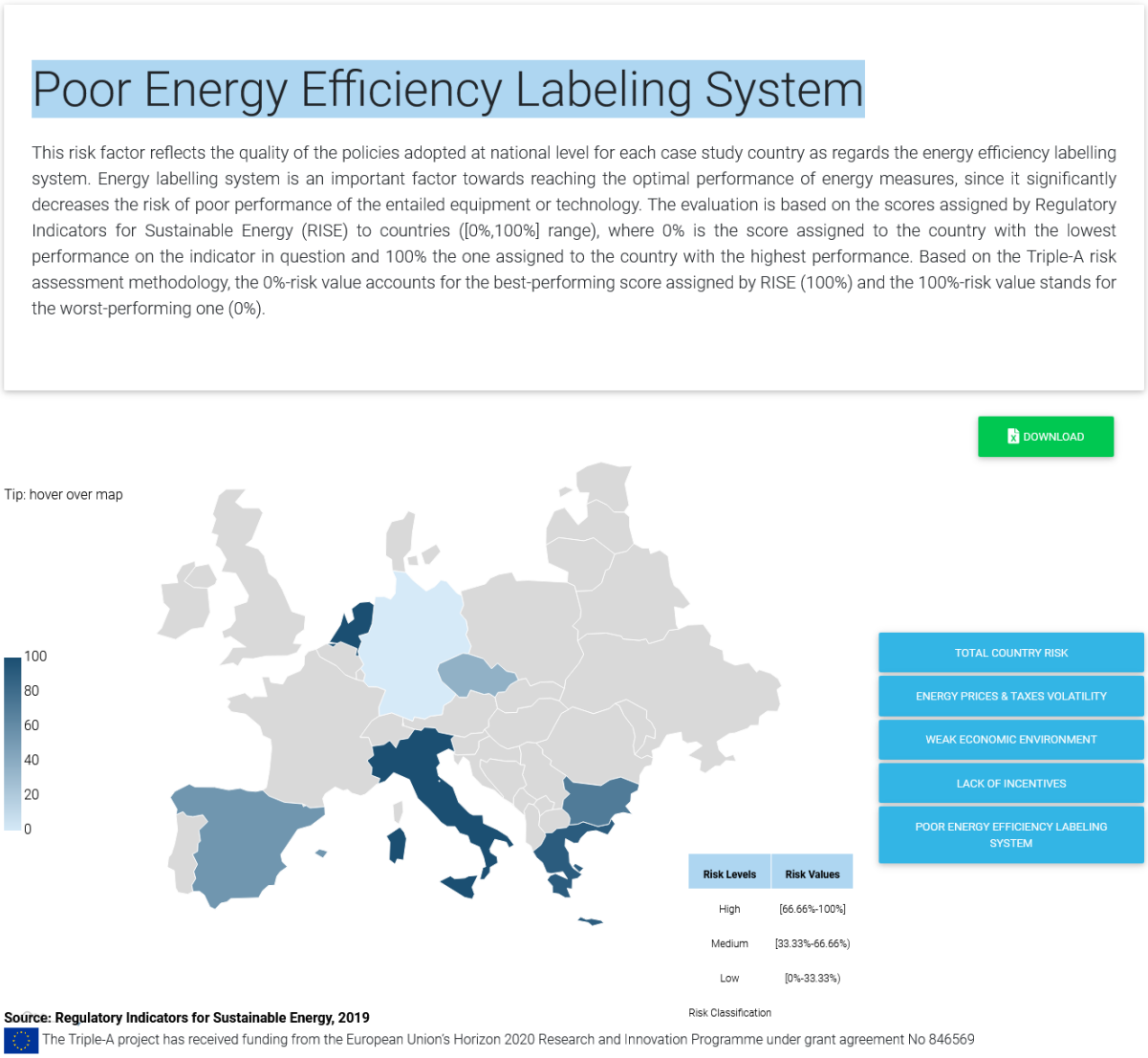


Figure 10: "Poor Energy Efficiency Labelling System" menu

Energy Efficiency Projects Risk

In the current version of the Triple-A Database, the total estimated risk of an EE project to fail meeting its predicted performance is depicted. It should be noted that based on the Triple-A risk assessment methodology, the total risk of an EE project is estimated by considering all the risks that affect the

successful implementation of an EE project[24], namely ***Sector and Project-category specific (PSRS), Country-specific risk (CSR),*** and ***project-specific risk (PSR)***. From these, the ***PSR*** depends on the ad-hoc characteristics of each project, such as the technical staff skills and experience and the end-users experience in operating the entailed equipment, irrespective of all its other features.

Thus, the ***PSR*** factors are evaluated at a project-level by receiving information from the persons in charge of managing the projects through a targeted questionnaire. As a result, the total risk of an EE project could not be reflected by a single value, but rather as a range of values. In that regard, the reported ranges are formed by the minimum and maximum risk values, where the minimum value accounts for the case that the project presents excellent project-specific characteristics, e.g., technology of high quality, while the maximum one corresponds to the case that it presents very poor characteristics, e.g., many parties are involved in project's implementation without defined roles[24].

In the context of the Triple-A risk assessment methodology, the total risk of EE projects is calculated by considering all the risk categories that could endanger their successful implementation, as follows[24]:

(i) ***"Behavioural"*** risk category (***"rebound effect"*** risk factor);
(ii) ***"Energy Market & Regulatory"*** risk category (***"energy prices and taxes volatility"*** and ***"request for issuing project permits"*** risk factors);
(iii) ***"Economic"*** risk category (***"economic environment"***);
(iv) ***"Policy"*** risk category ("***lack of incentives***" and "***poor energy efficiency labelling system***" risk factors);
(v) ***"Technological***, ***Planning and Operational"*** risk category (***"technical complexity"***, ***"initial savings assessment"***, ***"implemented equipment"***, ***"project design"***, and ***"Operation & Maintenance"*** risk factors).

This menu provides valuable information to all the involved actors in EE financing, and especially to project developers and investors. These target groups, by inspecting the total risk that an EE project could present and especially its value range, are in place to better understand the risk nature of each project type. Moreover, they could identify the potential that an EE project presents regarding how much its entailed risk could be alleviated. Specifically, they can inspect the minimum and the maximum values of the range that the risk of failure of a project lies inside and consider how much the entailed risk could be alleviated by incorporating appropriate measures, e.g., product warranties or evidence of the quality of the installed equipment. Finally, the framework used for risk assessing EE projects could be of interest for researchers, who may apply it to other fields outside the EE spectrum.

[24] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.

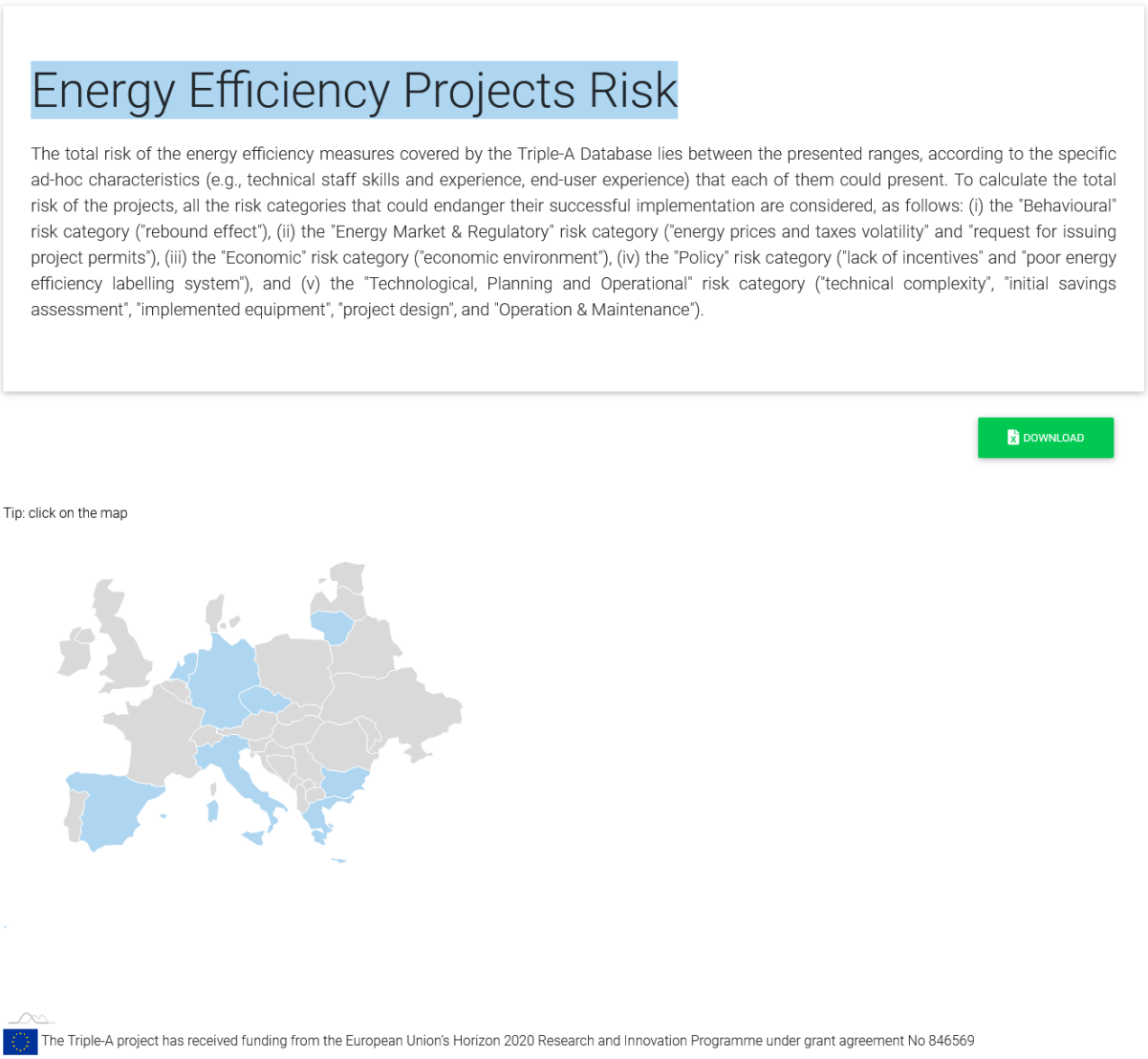


Figure 11: "Energy Efficiency Projects Risk" menu

Risk Mitigation Strategies

In the final version of the Triple-A Database, the main strategies that could mitigate the risks that arise in EE financing are presented, based on replies emerged from the Triple-A stakeholder consultation. In that regard, the users of the Triple-A Database could gain valuable knowledge about the strategies that should be adopted to deal with the EE financing underlying risks and their applicability for each case study country. Risk mitigation strategies help dealing with risk, by planning remediation activities for reducing the level of the risks' impact or probability of occurrence in the project[25], while they are classified per risk category identified. In that regard, for each risk category covered by the Triple-A methodology, a bunch of related mitigation strategies is reported, where some mitigation strategies could alleviate the risk of more than one category.

[25] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.

The risk categories covered by the Triple-A Web-based Database include the following categories[26]:

(i) ***"Financial"***;
(ii) ***"Behavioural"***;
(iii) ***"Energy Market and Regulatory"***;
(iv) ***"Economic"***;
(v) ***"Technological, Planning and Operational"***.

For all these risk categories, the entailed risk factors[27] are mentioned in the above section (***"Energy Efficiency projects risk"***), apart from the ***"Financial"*** risk category, which is related to the ***"credit worthiness of the applicant for the loan"*** risk factor. For more details regarding the identified risk categories and the respective risk mitigation strategies the reader can refer to the Triple-A's *Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology*[28].

This interactive graph represents the most appropriate risk mitigation strategies for each Triple-A risk category and case study country. The identification has been realised through a dedicated questionnaire[29] which has been disseminated to experts and stakeholders of the energy efficiency sector. Briefing results of the Questionnaire can be also found in Triple-A's 12th Briefing Note[30]. The data represent the percentage of the experts' replies for each Risk Mitigation Strategy per country and risk category.

[26] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.
[27] A risk factor is an individual risk that can be classified to a broader risk category and could not be seen as a distinct risk category.
[28] Available here: https://aaa-h2020.eu/sites/default/files/reports/D3.2%20Final%20Report%20on%20Risks%20of%20EE%20Financing%20and%20Mitigation%20Strategies%20typology.pdf
[29] Available here: https://forms.gle/xfsbreBksGkwvFyBA
[30] Available here: https://aaa-h2020.eu/sites/default/files/2022-05/Triple-A%2012th%20Briefing%20Note_final.pdf

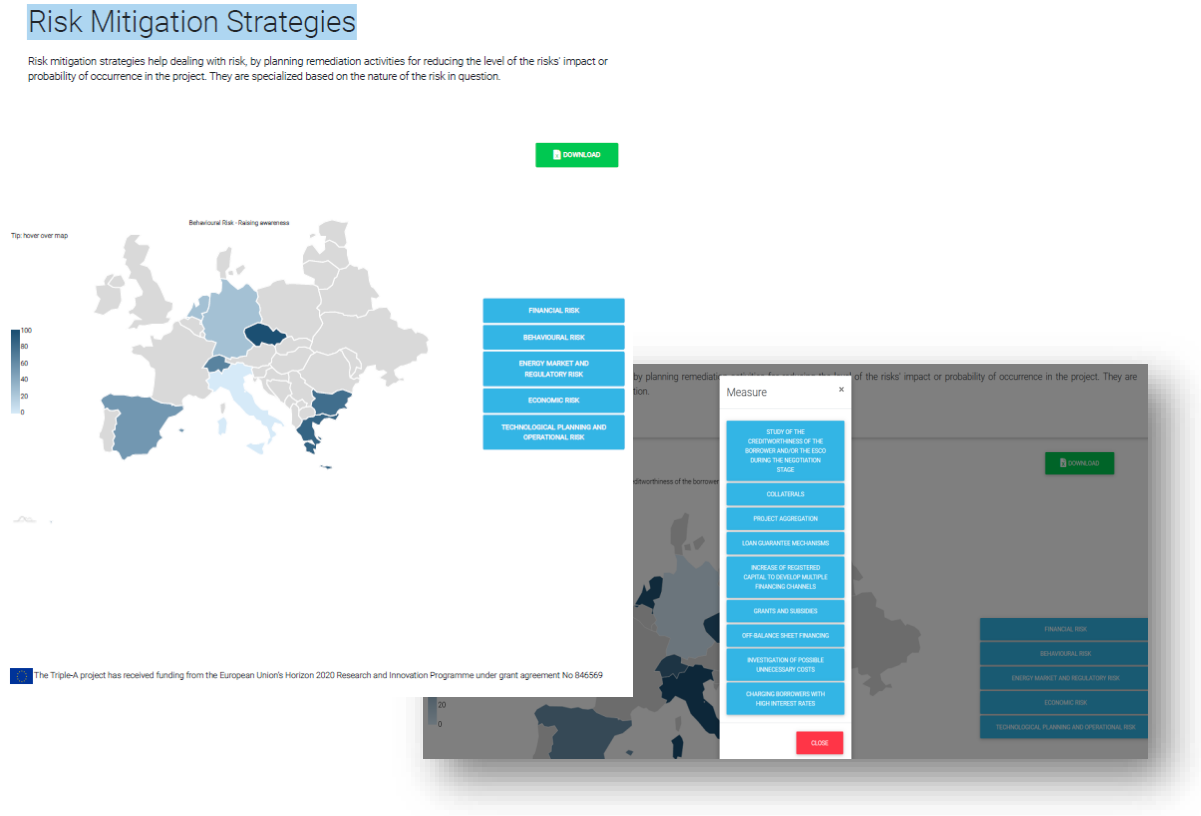


Figure 12: "Risk Mitigation Strategies" menu

The user is able to select the preferred Risk Category in order to view the respective risk mitigation strategies. The risk mitigation strategies identified for each risk category are:

Financial risk

- Careful study of the creditworthiness of the borrower and/or the ESCO during the negotiation stage
- Collaterals
- Project aggregation
- Loan guarantee mechanisms
- Increase of registered capital to develop multiple financing channels
- Grants and subsidies
- Off-balance sheet financing
- Investigation of possible unnecessary costs
- Charging borrowers with high interest rates

Behavioural risk

- Following sustainable lifestyles and consumer behaviour
- Consuming more efficiently, differently, and less

- Raising awareness
- Information provision
- Subsidies
- Energy price regulation
- Tradable permits

Energy market and regulatory risk

- Hedging with future contracts
- Clear long-term government tax policy on energy
- Fixed-price energy contracts
- Hedging with forward contracts
- Hedging with option contracts
- Setting aside risk reserve
- Hedging with swaps
- Establishing caps and floors on the energy price

Economic risk

- Hedging with option contracts
- Hedging with future contracts
- Long term fixed interest rates
- Hedging with forward contracts
- Hedging with swaps
- Setting aside risk reserve

Technological, planning, & operational risk

- Diagnostics
- Energy savings guarantees or insurances
- Performance bonds
- Standards in project development and documentation
- Maximum visibility into operational behavior
- Following the guidelines of operations manual
- Standardised and transparent M&V processes
- Insurances required by the law
- Equipment insurances
- Accreditation and certification of suppliers
- Efficiency as a Service models
- Adopting advanced and mature technology
- Reduction of delays caused by poor communication
- Selection of subcontractors with high reputation and good technology
- Standardised performance protocols
- Detailing risk and loss bearing in the contract
- Proper metering
- Model validation

This menu provides valuable information especially to project developers and investors. On the one hand, project developers could identify the strategies that should be adopted to alleviate the entailed risks and ensure the smooth operation of their projects. On the other hand, investors could get the knowledge about how to better evaluate EE projects, considering potential mitigation strategies that could be adopted in the context of the projects under examination.

IRR: Project's Perspective

Triple-A Web-based Database provides information about the financial performance of various EE project types through the demonstration of their project Internal Rate of Return (IRR) curves. These curves depict how the project IRRs vary over the different time horizons of the investments, i.e., the years that investors accept to hold their money on an investment before earning the required return[31]. It should be noted that the project IRR depicts the financial performance of the project in question for the case that the whole capital is leveraged by equity (i.e., investors), since financing costs are not considered in the projects' cashflows.

[31] Triple-A, 2021. Report on the Cost of Capital Estimation of Energy Efficiency Projects across Member State Countries, Deliverable 3.3, Horizon2020 Triple-A project, No. 846569.

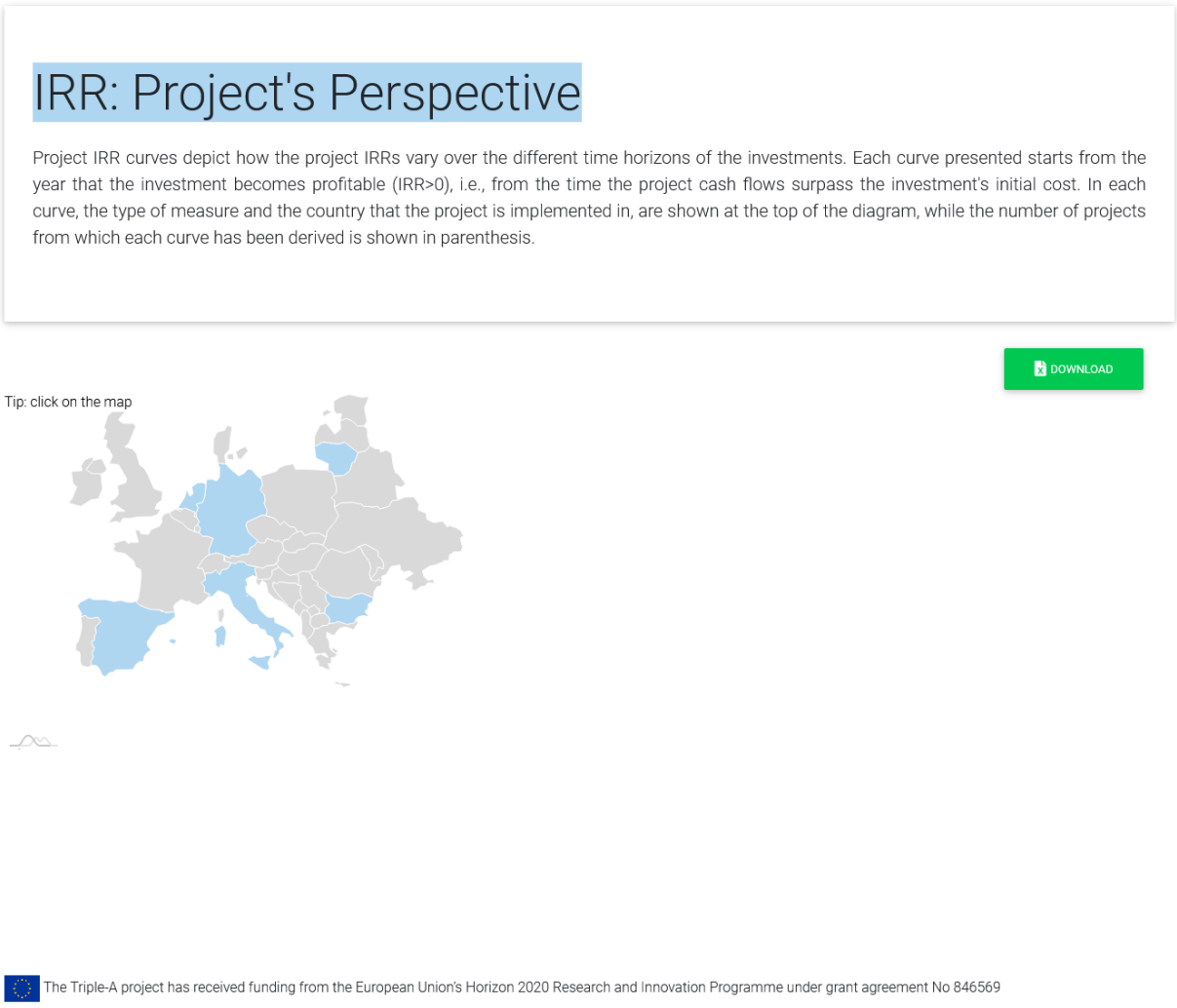


Figure 14: "IRR: Project's Perspective" menu

Each curve presented starts from the year that the investment becomes profitable (IRR>0), i.e., from the time the project cash flows surpass the investment's initial cost. In each curve, the type of measure and the country where the project is implemented in are shown at the top of the diagram, while the number of projects from each project type, for which data are available, is shown in parenthesis.

This menu provides valuable information to investors because the holding period of the investment is crucial for capital providers. Different holding periods of investment imply a distinct required return by investors, who may not accept holding their money for the whole horizon of an EE project, irrespective of the return achieved, and thus reject it. Therefore, investors, in the context of the Triple-A Database, could inspect the financial performance of a project as a function of the horizon of the investment.

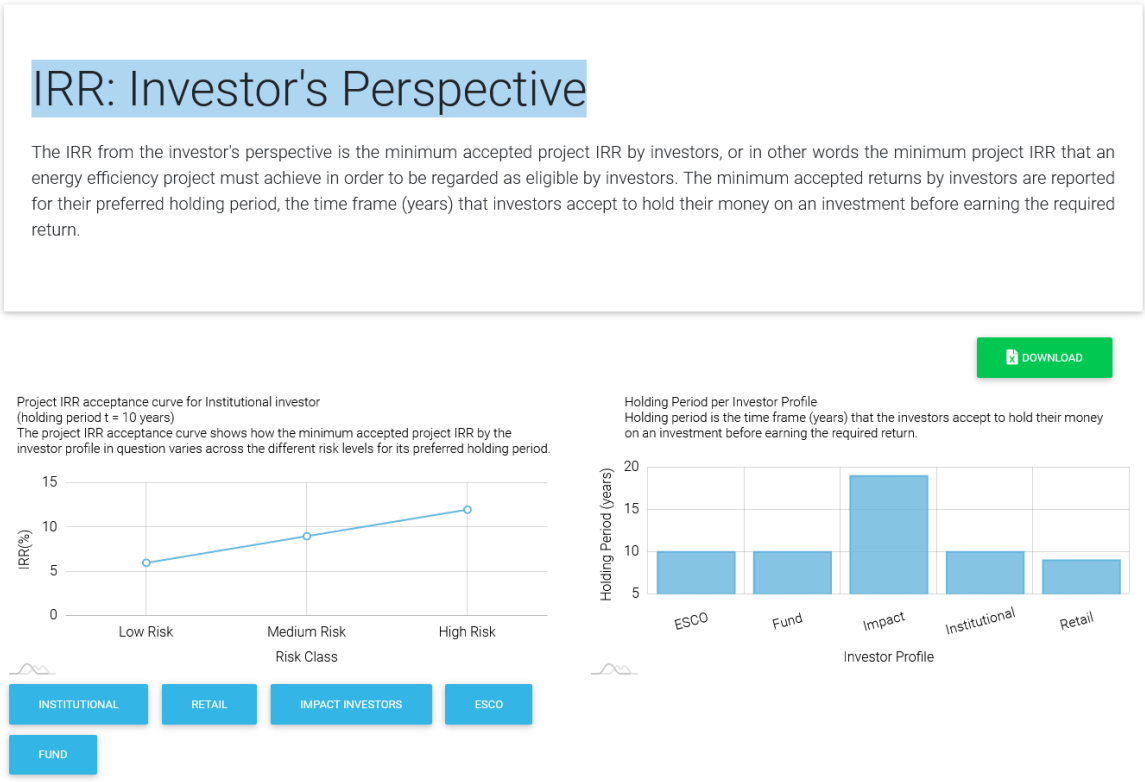
In addition, investors could adjust their holding period by inspecting these curves, identifying the turning point of the curves, from which a negligible improvement in terms of IRR increase for an additional year of investment is observed. Such information is also This value to project developers since it could serve as evidence of the EE projects' profitability potential. Therefore, it could be used by project developers to persuade capital providers to invest their money in their projects, thus contributing towards performing better proposals to investors.

IRR: Investor's Perspective

Triple-A Web-based Database provides information about the preferences of investors on EE investments in terms of minimum required returns at different risk levels (low, medium, and high) and holding period of investment. The investor profiles covered by the Triple-A Database include the ***"Retail investor"***, ***"Institutional investor"***, ***"Impact investor"***, ***"ESCO"***, and ***"Fund"*** *profiles*[32].

As regards the required returns of investors, Triple-A Database demonstrates the project IRR acceptance curves, which show how the minimum accepted project IRR by each investor profile varies across the different risk levels. These curves are depicted for the preferred holding period of investors, which are also depicted at this page.

This menu provides valuable information especially to project developers and to the involved stakeholders from the EE project's side, since it indicates the minimum project IRR that an EE project must achieve in order to be regarded as eligible by investors. Therefore, it acts as a benchmark of the performance that the project should achieve for attracting the attention of investors.



The Triple-A project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 846569

[32] Report on the Cost of Capital Estimation of Energy Efficiency Projects across Member State Countries, Deliverable 3.3, Horizon2020 Triple-A project, No. 846569.

Figure 15: "IRR: Investor's Perspective" menu

Financing Instruments

This menu presents the main financing instruments that are usually used to finance EE projects. Financing instruments are tradable assets that are usually used to finance EE projects, where these assets can be in form of cash, contractual rights related to cash transactions or another type of financial instrument, or evidence of owning an entity[33].

Financing instruments can be debt-based, reflecting a loan provided by a bank or investor to the asset owner, or equity-based, reflecting the financing from the owners of an asset, for example through issuing stocks. The financing instruments covered by the Triple-A Database include the following components:

(i) ***Grants/ Subsidies***;
(ii) ***Soft Loans***;
(iii) ***Loans***
(iv) ***Bonds***;
(v) ***Project Financing***
(vi) ***Green Bonds***
(vii) ***Leasing Agreements***;
(viii) ***Equity Based Financing***
(ix) ***Project Aggregation***
(x) ***Energy Efficiency Auctions***
(xi) ***Third Party Financing***
(xii) ***Energy Performance Contract***
(xiii) ***Specific Legislation Degree Bonuses***

The data are presented into an interactive graph which represent the applicability of the identified energy efficiency financing instruments for each Triple-A case study country. The identification has been realised through a dedicated questionnaire[34] which has been disseminated to experts and stakeholders of the energy efficiency sector. The data represent the percentage of the experts' replies for each financing instrument per country. For more information please refer to the Triple-A 12th Briefing Note[35].

This Database's section is of great importance especially to project developers, since they can inspect the whole range of instruments that could be used as means of financing for their project.

[33] Triple-A (2020). Final Report on Risks of Energy Efficiency Financing and Mitigation Strategies Typology, Deliverable 3.2, Horizon2020 Triple-A project, No. 846569.
[34] Available here: https://forms.gle/xfsbreBksGkwvFyBA
[35] Available here: https://aaa-h2020.eu/sites/default/files/2022-05/Triple-A%2012th%20Briefing%20Note_final.pdf



Figure 16: "Financing Instruments" menu

Financial Models

In this menu, the main financial models that are usually used to finance EE projects are presented. Financial models are innovative schemes for financing and implementing EE projects and, in their context, different financing instruments can be deployed. Most of the financial models have complex structures in terms of cash flow interdependencies among the actors participating in the projects and thus they could be considered as an innovative way of combining financing instruments towards implementing EE projects. For example, an investor could use debt-based financing or subsidies within Efficiency-as-a-Service (EaaS) model[36].

[36] EaaS is a business model whereby customers pay for an energy service without having to make any upfront capital investment.

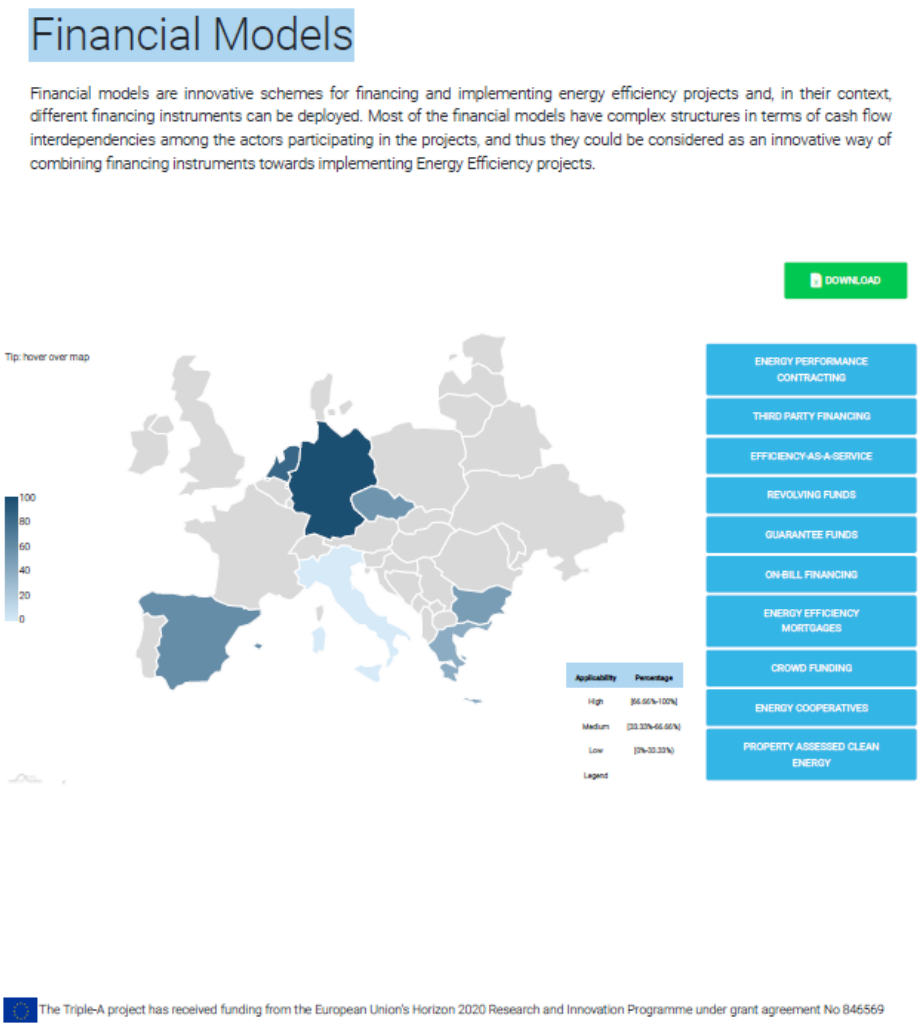


Figure 17: "Financial Models" menu

The financial models reported by the Triple-A Database include the following components:

(i) ***Energy Performance Contracting (EPC)***;
(ii) ***Third Party Financing (TPF)***;
(iii) ***Efficiency as a Service (EaaS)***;
(iv) ***Revolving Funds***.
(v) ***Guarantee Funds***;
(vi) ***On Bill Financing (OBF)***;
(vii) ***Soft Loans***;
(viii) ***Energy Efficiency Mortgages***;
(ix) ***Crowd Funding***;
(x) ***Energy Cooperatives***;
(xi) ***Property Assessed Clean Energy (PACE)***;

The data are displayed into an interactive map which represents the applicability of the identified energy efficiency financial models for each Triple-A case study country. The identification has been realised through a dedicated questionnaire which has been disseminated to experts and stakeholders of the energy efficiency sector. The data represent the percentage of the experts' replies for each Financing Model per country.

This menu provides valuable information especially to investors, who could identify innovative ways of combining financing instruments based on this information, towards optimally using the available capital sources and maximise their profits.

Sustainable Development Goals

This menu provides information about the necessity for energy efficiency in case study countries based on their progress in terms of SDG. The analysis is conducted in a quantitative fashion, examining indices that consist of Eurostat's statistical data. These data reflect the current situation of EE, energy poverty, and environmental pollution in the case study countries. By analysing the SDG indices and linking them with the Triple-A project sectors, the necessity of boosting EE in case study countries and in each sector, emerges. The process includes the evaluation and the comparison of the progress of the applicable SDG indices for each Triple-A sector, while the aggregated value is being calculated.

In that regard, for each Triple-A project sector, relevant SDG indices have been linked, aggregated, and compared between countries, so as to estimate the progress and the necessity of EE investments in these countries. The data have been normalised and presented in percentages, meaning that countries with values closer to 0% have lower necessity of boosting EE, i.e., lower energy poverty, fewer energy imports, less energy consumption, and lower levels of greenhouse gases pollution, while countries with values closer to 100%, have higher necessity, i.e., higher rates of energy poverty, energy-related pollution, and need for energy imports. The percentages are relevant to examined countries, meaning that the minimum and maximum values (0% and 100%) represent the values of the first and the last country of the sample of these 8 countries.

This piece of information could be of importance especially for policy makers, since they can inspect the level of necessity to promote EE implementation to each of the case study country as well as to particular sectors. Thus, policy makers could make more informed decisions about which EE sectors should be prioritised in terms of the investments channelled to them, in order to get the higher benefits.

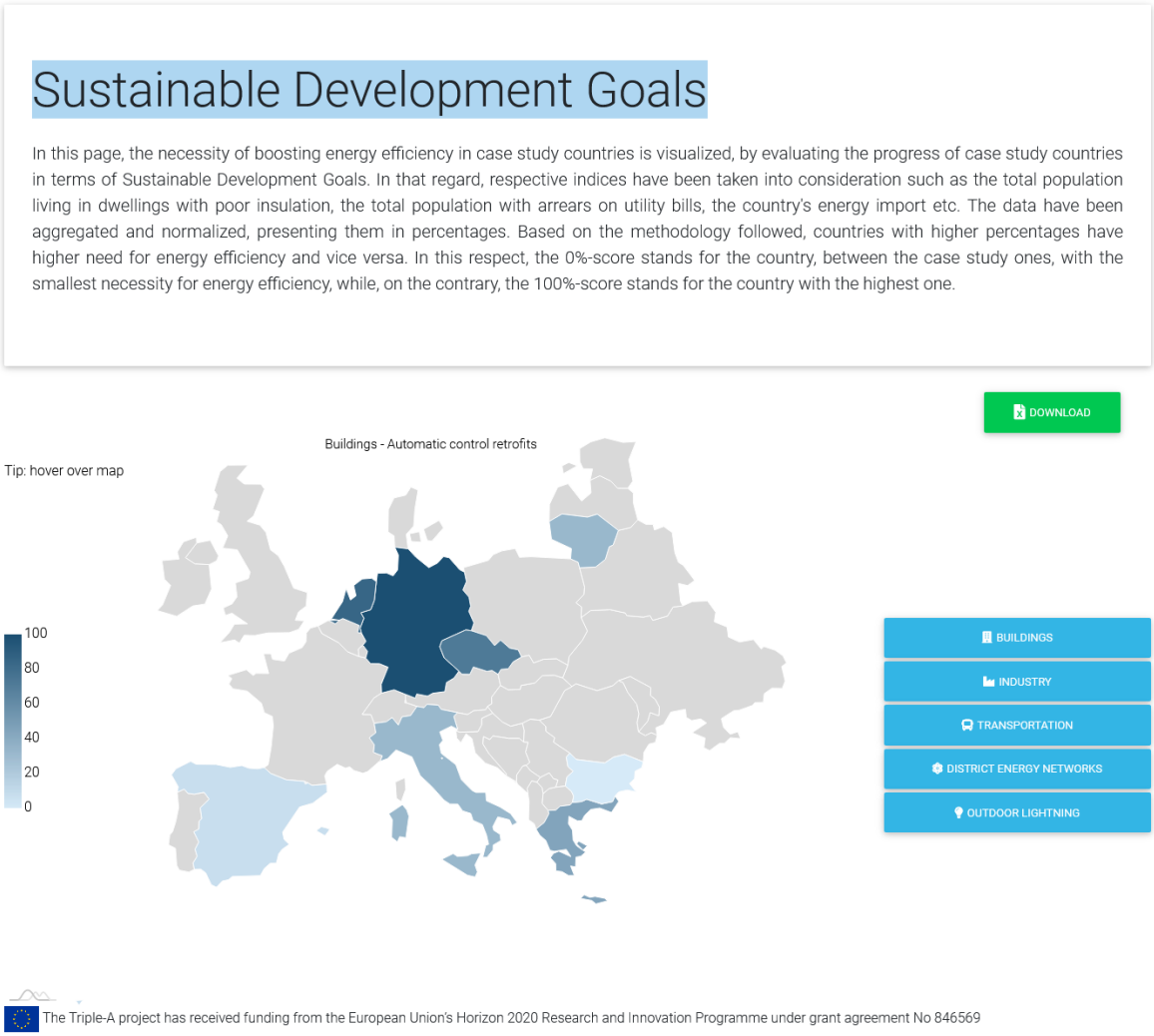


Figure 18: "Sustainable Development Goals" menu

The indices included in the methodology are presented in Table 3:

Table 3: Sustainable Development Goals Indices

	Name	Description
C_1	Arrears on utility bills	It reflects the share of (sub)population (%) having arrears on utility bills, based on the question "In the last twelve months, has the household been in arrears, i.e., has been unable to pay on time due to financial difficulties for utility bills (heating, electricity, gas, water, etc.) for the main dwelling?"
C_2	Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor	It indicates the share (%) of the population experiencing at least one of the following basic deficits in their housing condition: a leaking roof, damp walls, floors or foundation, or rot in window frames or floor.

C_3	Population unable to keep home adequately warm by poverty status	It indicates the share (%) of the population, who are unable to keep home adequately warm. Data for this indicator are being collected as part of the EU Statistics on Income and Living Conditions (EU-SILC) to monitor the development of poverty and social inclusion in the EU.
C_4	Primary energy consumption	It quantifies the Gross Inland Consumption in toe, excluding all non-energy use of energy carriers (e.g., natural gas used not for combustion but for producing chemicals).
C_5	Energy import dependency	The criterion shows the share (%) of the total energy needs of a country met by imports from other countries. It is calculated as net imports divided by the gross available energy
C_6	Final energy consumption in the industry sector	It includes all the energy supplied to the industry sector in toe; excluding deliveries to the energy transformation sector and the energy industries themselves).
C_7	Final energy consumption in the transportation sector	It measures the energy consumption of the transportation sector in toe, excluding deliveries to the energy transformation sector and the energy industries themselves.
C_8	Final energy consumption in other sectors or commercial and public services	It indicates the energy supplied to non-categorised sectors, commercial and public services in toe.
C_9	Final energy consumption in households per capita	The indicator measures how much electricity and heat every citizen consumes at home (kgoe/capita), excluding energy used for transportation. Since the indicator refers to final energy consumption, only energy used by end consumers is considered.
C_{10}	GHG emissions from energy consumption	The data are based on measures of the European Environmental Energy Agency and represent the GHG emissions caused by the energy sector in ktn $CO_{2\text{-eq}}$.
C_{11}	GHG emissions from the industrial sector	Similar to C_{10}, the C_{11} criterion contains the GHG emissions (in ktn $CO_{2\text{-eq}}$) caused by the industrial sector, as reported by the European Environmental Energy Agency.

4 Added-value to Triple-A's target groups

This section summarises the added-value that the relevant target groups to the scopes of Triple-A could derive from the information included in the Triple-A Web-based Database. Relevant target groups are composed of all the actors in EE financing, namely financing bodies (e.g., investors), project developers (e.g., ESCOs), policy makers, researchers, and other more general profiles (e.g., technology suppliers).

In this respect, Table 4 presents the main beneficiary/ies in the context of each menu of the Triple-A Web-based Database, along with a short description of the added-value's point produced within its context for the presented beneficiary. These points are discussed in more detail in Section 3, where each of the presented menus is extensively described.

Table 4: Summary of added-value per target group

Menu	Main Beneficiary/ies	Added-Value
Country Risks	Investors	Selecting country of implementation
Energy Efficiency Projects Risk	Investors	Understanding EE projects' risk nature, Identifying de-risking potential of EE projects
	Project Developers	
	Researchers	Employing the risk assessment framework
Risk Mitigation Strategies	Investors	Making better EE investments evaluations
	Project Developers	Identifying de-risking strategies
IRR: Project's Perspective	Investors	Examining EE projects' performance with respect to investment horizon, Identifying optimal holding period
	Project Developers	Acquiring evidence of EE projects' profitability potential
IRR: Investor's Perspective	Project Developers	Identifying the minimum required performance to be achieved
Financing Instruments	Project Developers	Identifying means of financing
Financial Models	Investors	Identifying innovative ways of combining financing instruments
Sustainable Development Goals	Policy Makers	Identifying EE sectors that need to be prioritised

As it could be seen from the Table above, Triple-A Web-based Database provides valuable information to many profiles from the ones involved in EE financing, which could be exploited for a variety of purposes. Of these profiles, project developers, and especially investors, are the ones that could extract the higher added value for their decision making, being able to make more informed and reasonable

decisions. As a result, Triple-A Web-based Database contributes significantly to fostering EE investments.

All target groups presented in Table 4 are going to be reached for providing suggestions about how the Triple-A Web-based Database could even more improve in terms of the added-value that produces, validating also the added-value that provides to them at its current form, as presented by the current report.

In addition, in order to expand the functionalities and exploit the valuable data included in the Database, an interoperability framework between the Triple-A Web-Based Database and the Triple-A Tools has been established. The Triple-A Tools communicate with the Triple-A Database on Energy Efficiency Financing by deploying an automated dedicated Application Programming Interface (API) that interconnects these two interfaces and updates the values in the Triple-A Tools creating a harmonised environment for EE financing.

In detail, values regarding the following indicators are automatically being sent to the Triple-A Tools. The Triple-A Tools exploit these data so as to perform a risk analysis and projects' benchmarking. For more information, please refer to the Triple-A **Final Standardised Tools** report[37].

Country Risks:

- Total Country Risk
- Energy Prices & Taxes Volatitily
- Weak Economic Environment
- Lack of Incentives
- Poor Energy Efficiency Labeling System

Sustainable Development Goals

- Buildings
- Industry
- Transportation
- District Energy Networks
- Outdoor Lighting

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

5 Conclusions

Many updates and enhancements have been incorporated in the final version of Triple-A Database, as well as a magnitude of new data that provide valuable knowledge and insights to the users of the Database, and especially to the key target groups for the purposes of Triple-A. From these, investors are the ones that could extract the highest added value from the information reported, since the latest version of the Database has been designed with a particular focus on facilitating their decision making and participation in EE financing. However, apart from investors, all the involved actors in EE financing, like project developers, policy makers, and academics, could exploit the information reported by the Triple-A Database for a variety of purposes.

In particular, the enhancements of the final version of the Triple-A Database can be summarised to the following points:

- A multitude of country-specific risk factors are reported in a cross-country analysis fashion, exploiting data from global organisations and credit rating agencies;
- The risk mitigation strategies of the main risk categories identified by the Triple-A methodology have been incorporated, being classified according to the risk alleviated per case;
- The total risk of EE projects is reported in a range format, indicating the minimum, maximum, and average values that it could take;
- The financial performance of EE project types is projected, considering also the horizon of the investment;
- The minimum financial performance required by investors is reported along with their preferred holding period, taking into account all the main investor profiles that are usually engaged in EE financing;
- The financing instruments that are usually used to finance EE projects are reported, along with the financial models that combine them in an innovative way, whose advantages and disadvantages are presented;
- The necessity of boosting EE in case study countries is reported based on a cross-country analysis, taking into consideration their progress in terms of SDG.

The final version of the Triple-A Web-based Database contributes significantly to upscaling EE investments, making them more attractive to capital providers on the one hand, and providing a better understanding of their framework to those looking for capital on the other. As a matter of fact, the Triple-A Database on Energy Efficiency Financing has been visited by 1,239 users with 3,496 unique pageviews, while 211 downloads of the excel (.xls(x)) case study reports have been achieved.

Appendix A

User Manual

Homepage

The Triple-A Web-based Database Homepage contains initial information about the content of the Database. Entering the Database, the users can access and navigate themselves to the homepage without subscription (Figure 19).

The users can start being navigated to the Triple-A Database's interface by clicking on the navigation bar at the top-left of the page, where a respective notification is provided for this scope. From that point, users are navigated to each menu of the Triple-A's Database by clicking on the respective homonymous button that corresponds to this menu (Figure 20).

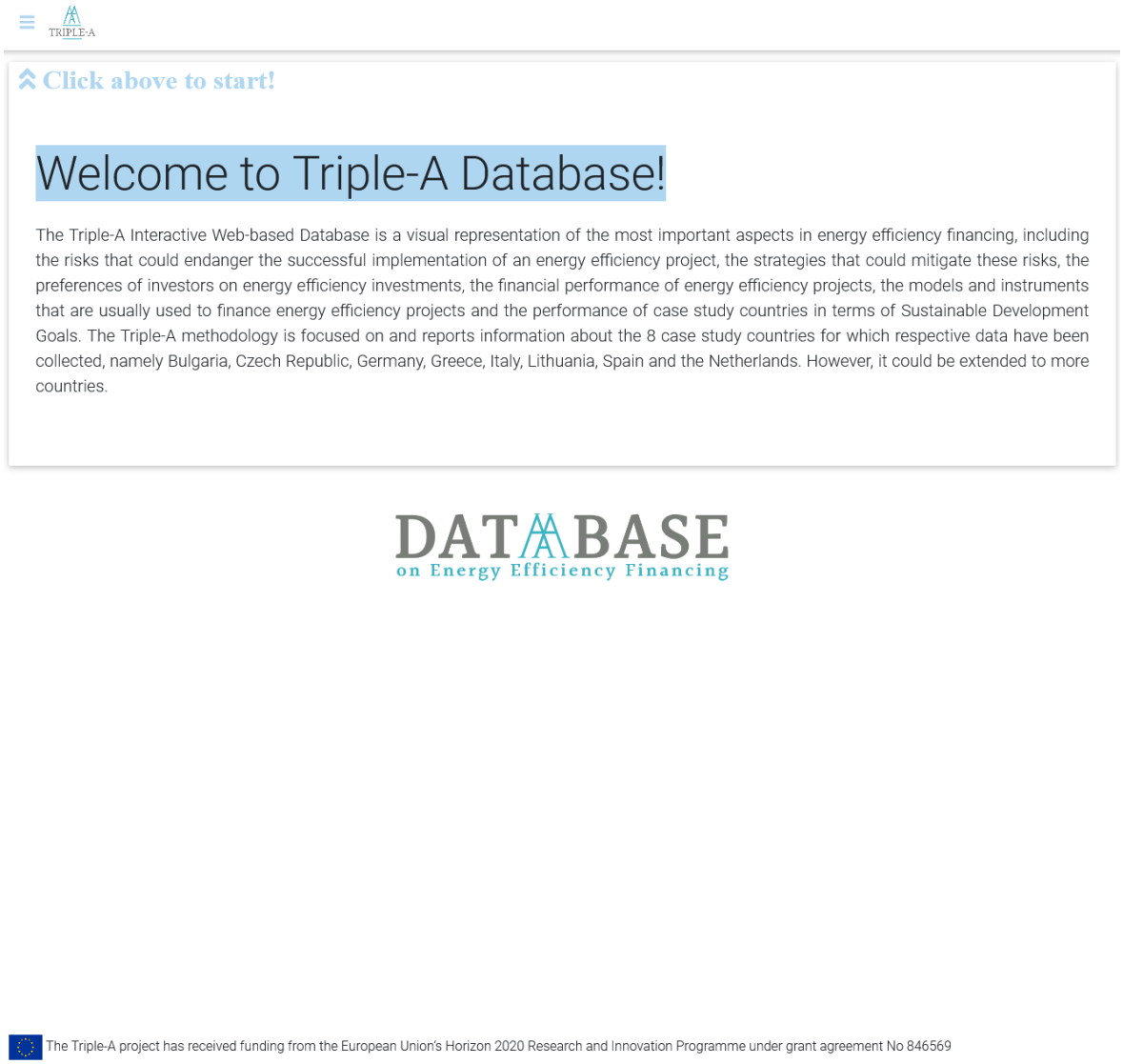


Figure 19: Triple-A Web-based Database Homepage

By doing so, the user is landed at the respective menu, where an explanatory text is displayed at the top of the page for the information provided in the selected menu.

Country Risks

The first menu is about the country risks (***"Country Risks"*** menu), at which users are navigated by clicking on the dedicated button at the navigation bar (Figure 20).

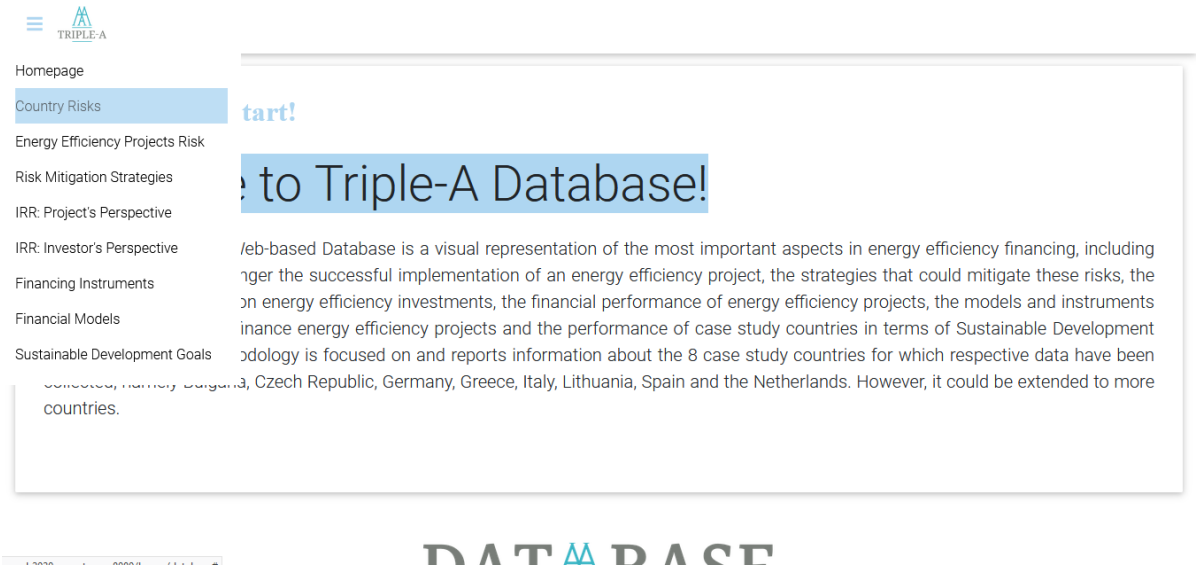


Figure 20: Triple-A Web-based Database Homepage - Country Risks

By doing so, users are landed at the respective menu, where some basic information regarding the country-specific risks reported by the Triple-A Database are provided at the top of the page (Figure 21). The user can start inspecting the risk values of each country-specific risk factor by clicking on the dedicated homonymous buttons that exist at the centre of the page (Figure 21; a respective notification is available).

Following, at the top of the page, a description of the risk factor selected along with the methodology followed is provided, while below this text, at the centre of the page, an interactive map is landed (Figure 22). By hovering on the map, users inspect the value that corresponds to each case study country for the risk factor selected. Users can download the data of the menu that inspect in an excel format by clicking on the respective button (***"Download"***; Figure 21).

The colours assigned to case study countries vary from dark blue, which accounts for the highest possible risk value, i.e., 100%, to light blue, which corresponds to the lowest possible risk value, i.e., 0%. The user can continue inspecting the rest of the country-specific risk factors by clicking on the respective buttons at the right of the map, each of which corresponds to a country-specific risk factor. By clicking on them, the view of the page is changed, with users being transferred to the respective menu of the risk factor selected.

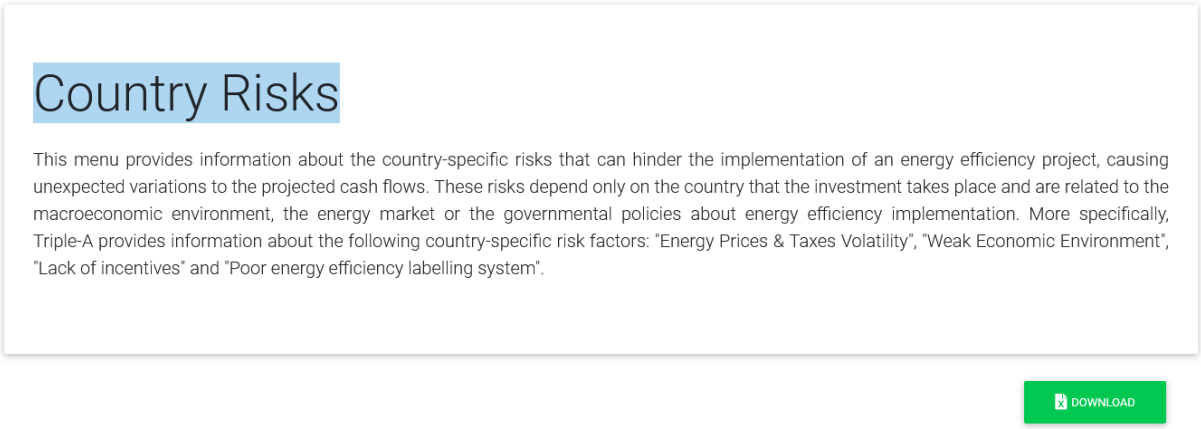


Figure 21: Country Risks

Total Country Risk



Figure 22: Total Country Risk

Energy Efficiency Project Risk

The next menu of the Database is about the risk that each Energy Efficiency (EE) project type displays (***"Energy Efficiency Projects Risk"*** menu). Users are navigated to this menu by clicking on the respective button at the navigation bar (Figure 23).

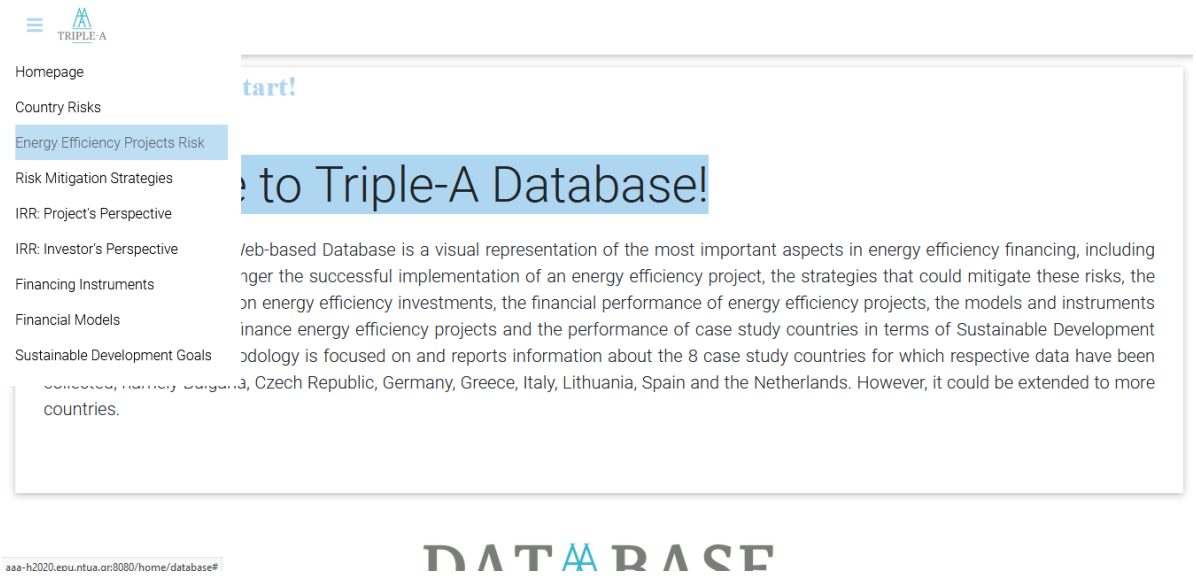


Figure 23: Triple-A Web-based Database Homepage - Energy Efficiency Projects Risk

By doing so, users are landed at the respective menu, where an explanatory text is displayed at the top of the page, describing to the user the process followed to estimate the total risk of an EE project.

Below this text, users should first click on the map in order to select the country of their interest, and then at the pop-up menu to select the sector of their interest (Figure 24). Following, users can view the range for each of the reported Energy Efficiency Measures (EEMs), within which their total risk is anticipated to range (Figure 24). Moreover, apart from the minimum and maximum values, the median of each range is displayed. Users can inspect these values by hovering on these ranges (Figure 24). Moreover, they can download the inspected data in an excel format by clicking on the respective button (***"Download"***; Figure 24).



Figure 24: Energy Efficiency Projects Risk

Risk Mitigation Strategies

The next menu is about the proposed mitigation strategies per risk category identified in the context of the Triple-A methodology (***"Risk Mitigation Strategies"*** menu). Users can access this menu by clicking on the homonymous button at the navigation bar (Figure 25).

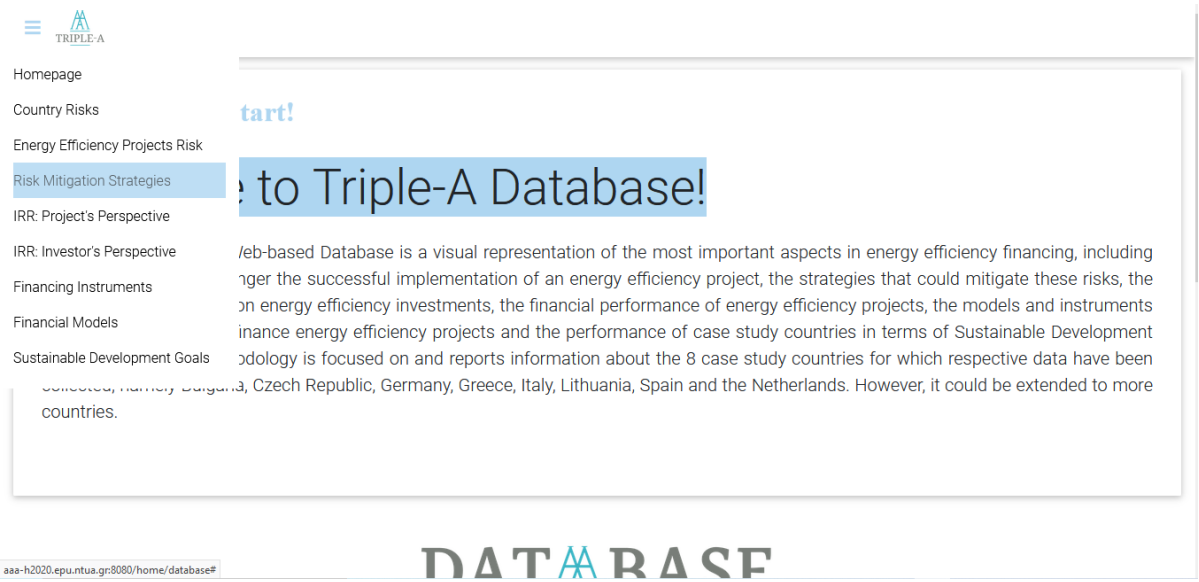


Figure 25: Triple-A Web-based Database Homepage - Risk Mitigation Strategies

Following, the user has to select the preferred Risk Category from the menu on the right side of the page.

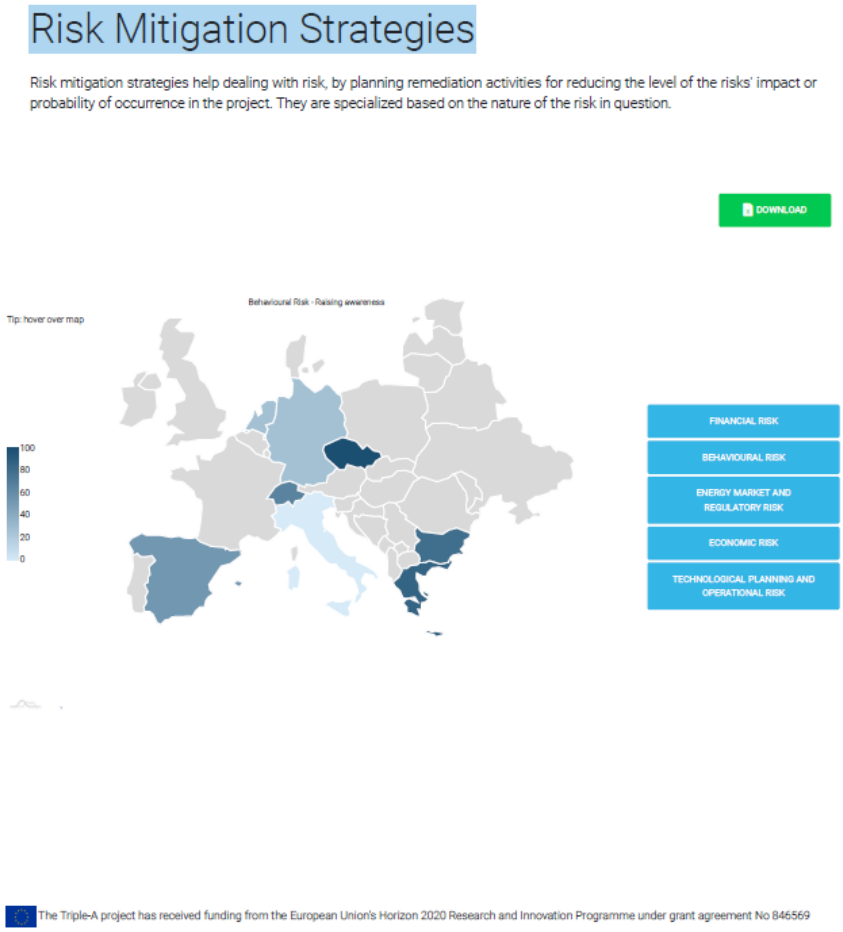


Figure 26: Risk Categories Menu for the identified Risk Mitigation Strategies

By doing so, an extra menu appears, which contains the available mitigations strategies for the selected Risk Category. By clicking on a mitigation strategy, the map is being updated and it provides the information regarding the applicability of that mitigation strategy to the case study countries.

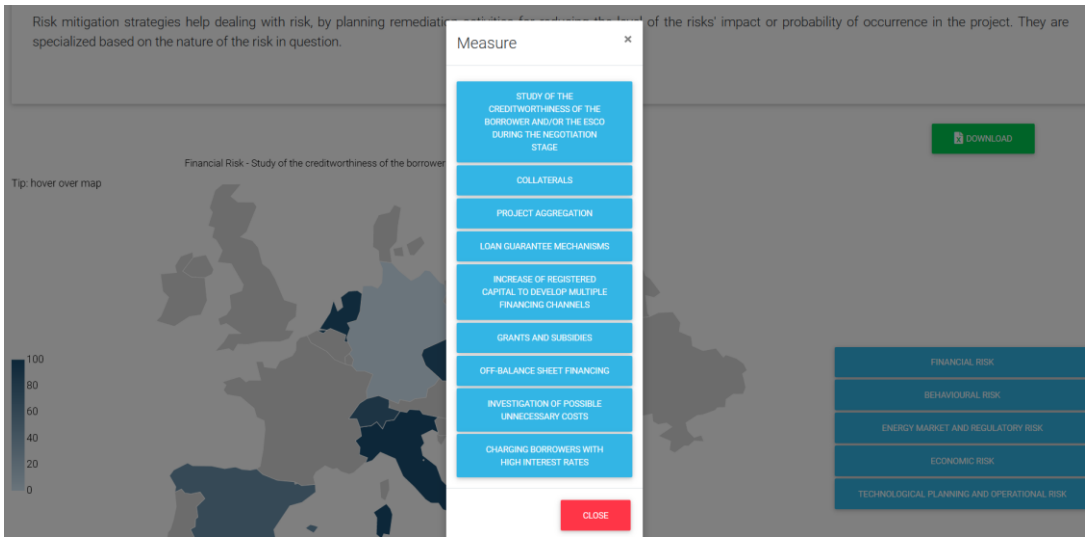


Figure 27 Risk Mitigation Strategies Menu

IRR: Project's Perspective

The next menu is about the financial performance of EE projects in terms of IRR, at which users are navigated by clicking on the respective button (***"IRR: Project's Perspective"***; Figure 28).

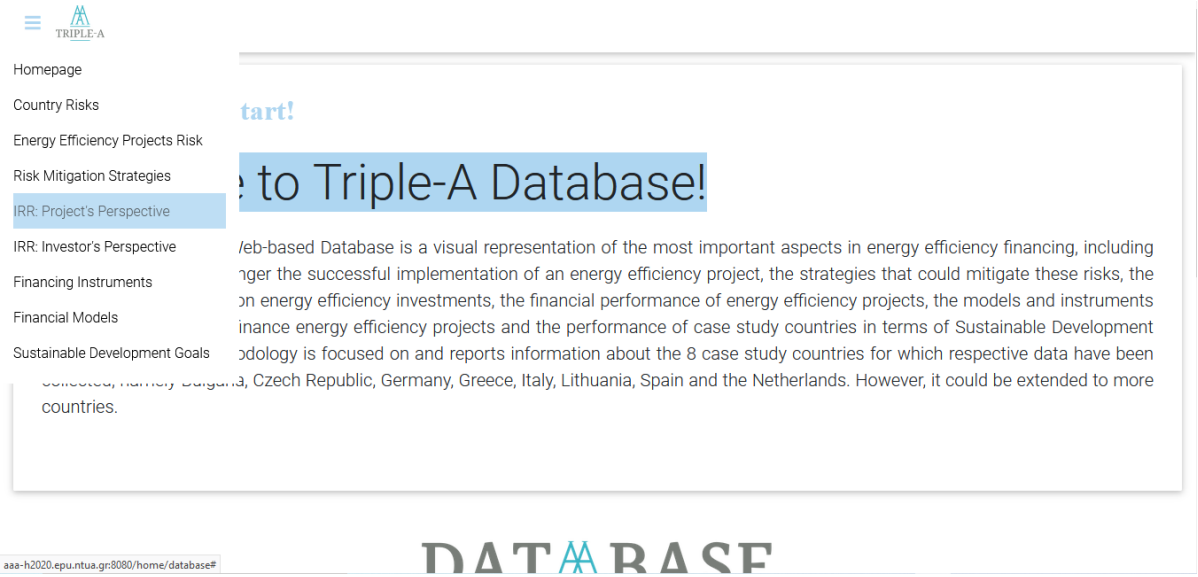


Figure 28: Triple-A Web-based Database Homepage – IRR: Project's Perspective

Following, users are transferred to the respective menu where at the top of the page the basic definitions for the selected menu are provided. Below this text, a map exists where users should click on, in order

to select the country, whose projects' data they want to inspect, while after that, a pop-up menu is landed, where users should select the sector of their interest (Figure 29).



Figure 29: IRR: Project's Perspective

By selecting the country and sector of their interest, they can inspect the respective project IRR curves that correspond to their choices (Figure 29). At these curves, users can inspect the project IRR achieved for the investment horizon that each point refers to by hovering on their points. By clicking on the buttons below the chart, users can view the curves of the other project types that belong to the selected country and measure (Figure 29). They can also download the data of this menu in an excel format by clicking on the respective button (***"Download"***; Figure 29).

IRR: Investor's Perspective

The next menu is about the investors' preferences on EE investments in terms of the minimum IRR an EE project must achieve in order to be regarded as eligible for them. Users are navigated to this menu by clicking on the respective button (***"IRR: Investor's Perspective"***; Figure 30).

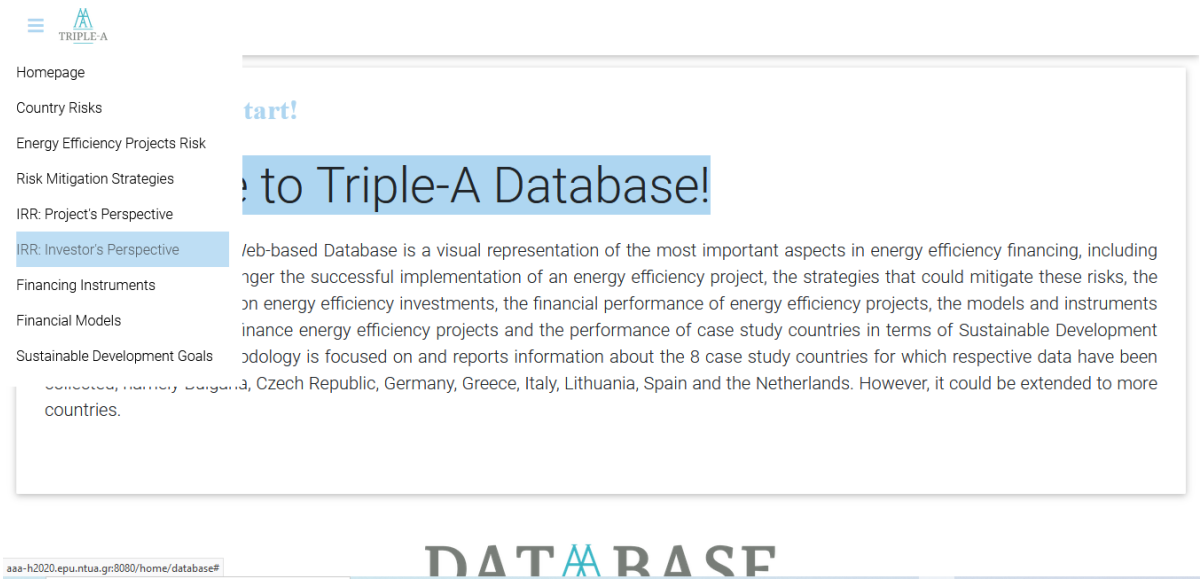
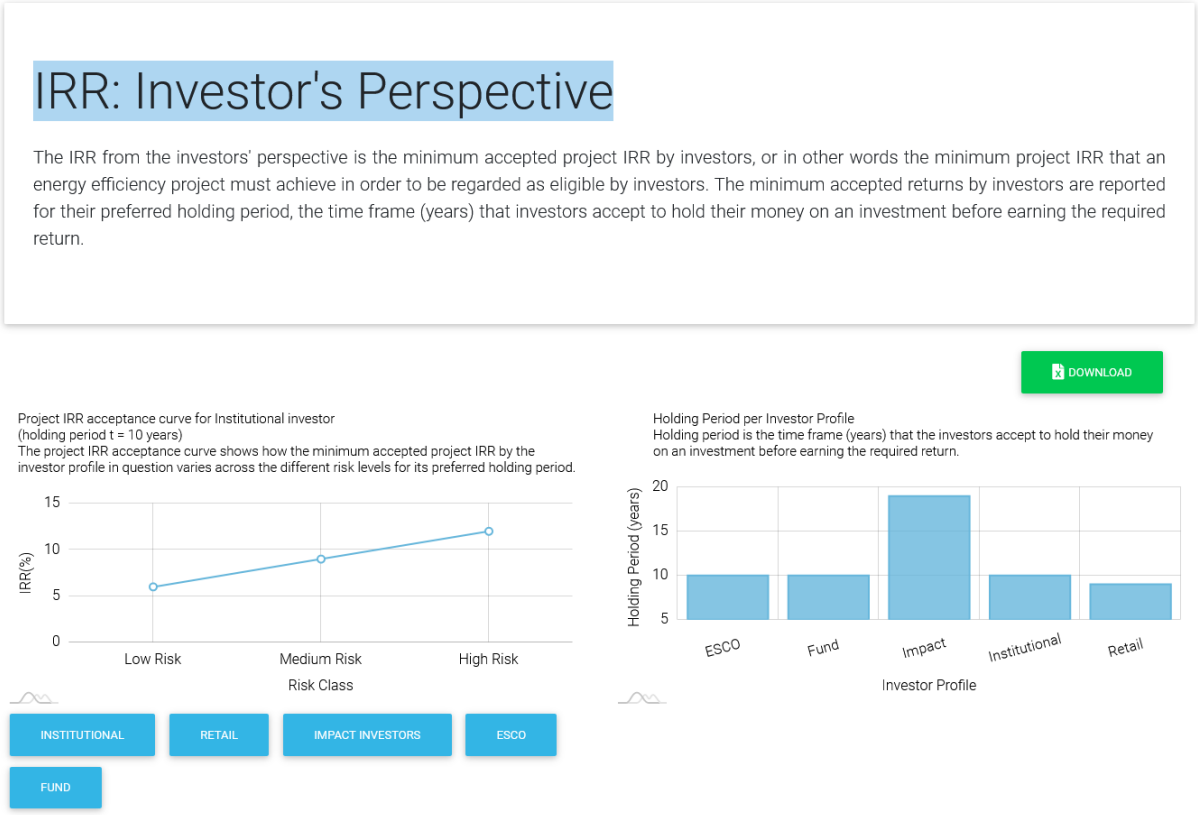


Figure 30: Triple-A Web-based Database Homepage – IRR: Investor's Perspective

By doing so, they are navigated to the respective page, where, at the top, some basic information is reported about the selected menu. At the left of the page, the project IRR acceptance curves are depicted for each investor profile covered by the Triple-A methodology, while by clicking on the buttons at the bottom of this graph, users can inspect the respective IRR curves for the other investors' profiles reported by the Triple-A Database. The project IRR acceptance curves are depicted for the preferred holding period of the investors, which are charted at the right of the page. Above each of these graphs, an explanatory description is provided (Figure 30). Users can download the data of this menu by clicking on the respective button (***"Download"***; Figure 30).



The Triple-A project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 846569

Figure 31: IRR: Investor's Perspective

Financing Instruments

The next menu is about the financing instruments that are used to finance EE projects, which can be accessed by clicking on the respective button (***"Financing Instruments"***) at the navigation bar (Figure 31)

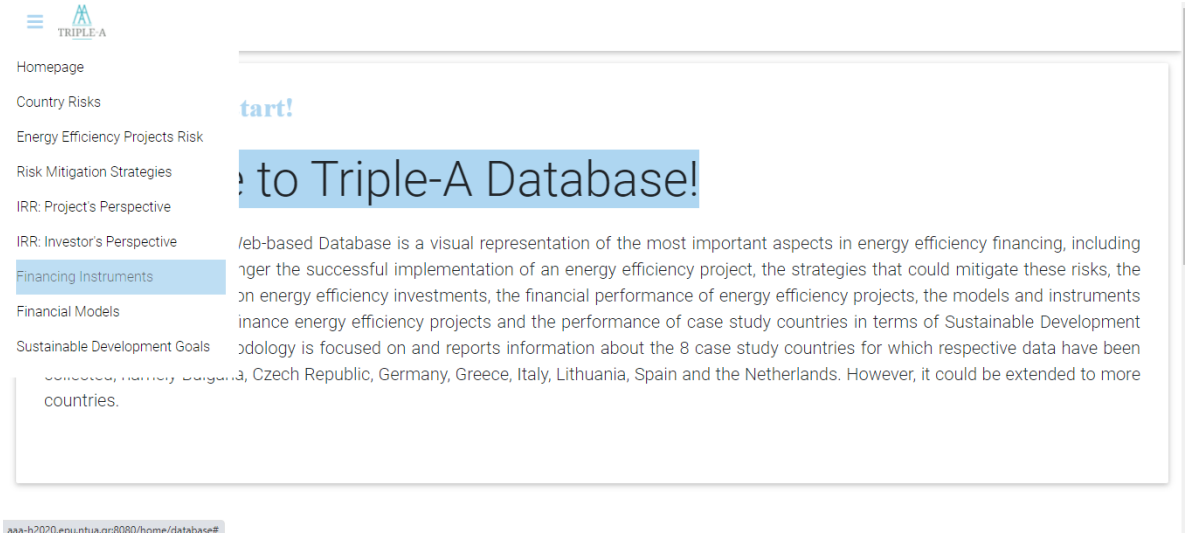


Figure 32: Triple-A Web-based Database Homepage – Financing Instruments

Following, users can change between the reported financing instruments by clicking on the respective buttons that correspond to them at the right pane of the page (Figure 33), being also able to download the data of this menu in an excel format by clicking on the respective button (***"Download"***; Figure 33).

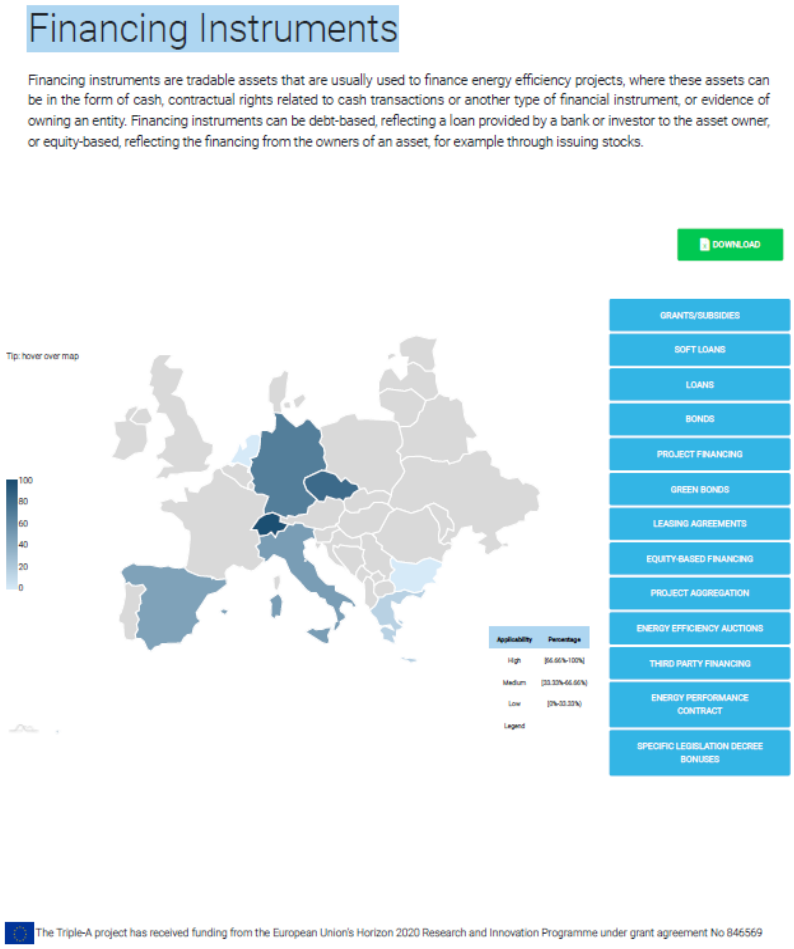


Figure 33: Financing Instruments

Financial Models

The next menu is about the financial models that are used to finance EE projects, which can be accessed from the Homepage by clicking on the respective button (***"Financial Models"***; Figure 34).

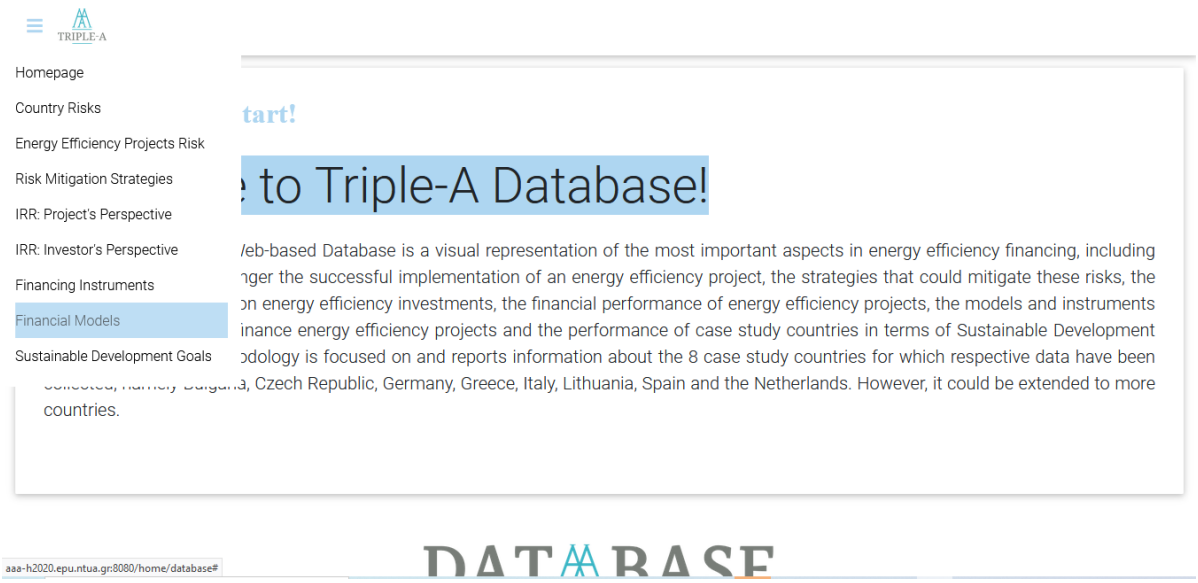


Figure 34: Triple-A Web-based Database Homepage – Financial Models

Accordingly, users can change between the reported financial models by clicking on the respective buttons that correspond to them at the centre of the page (Figure 35). Users can download the data of this menu by clicking on the respective button (***"Download"***; Figure 35).

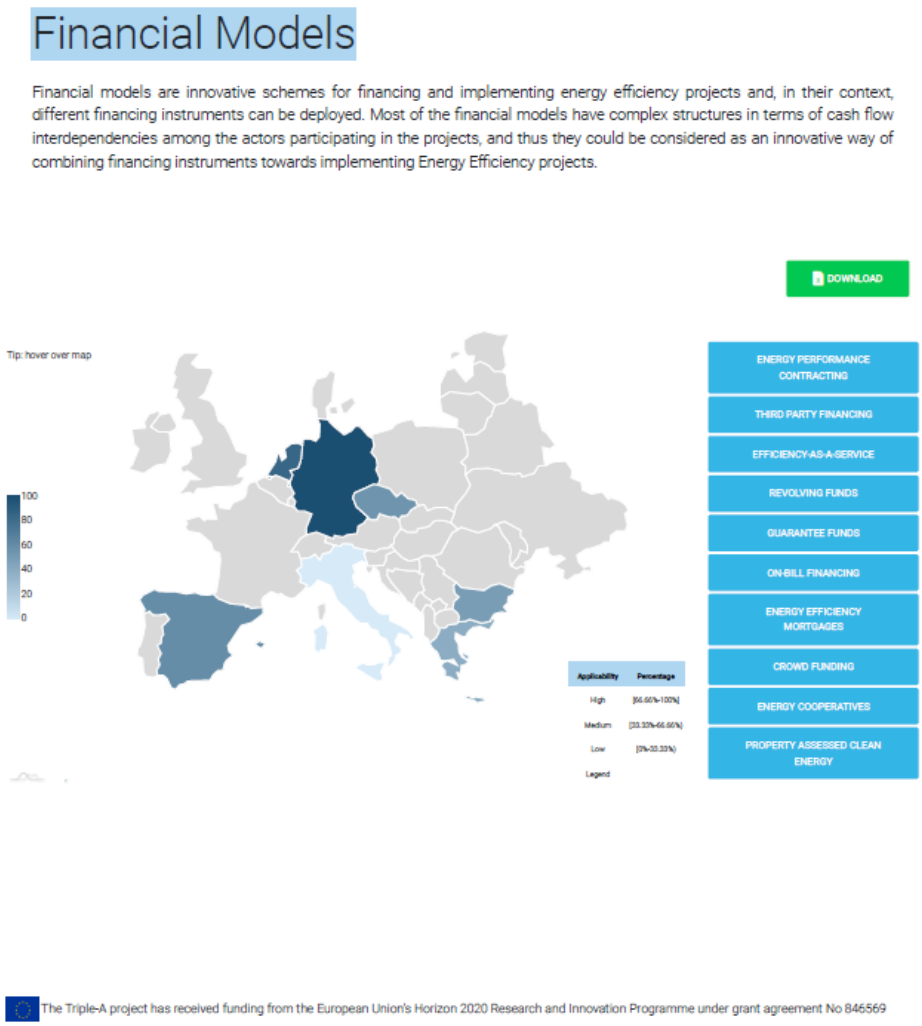


Figure 35: Financial Models

Sustainable Development Goals

The final menu is about the necessity of boosting EE in case study countries with reference to their progress in Sustainable Development Goal (SDG), at which users can be navigated by clicking on the respective button (***"Sustainable Development Goals"***; Figure 36).

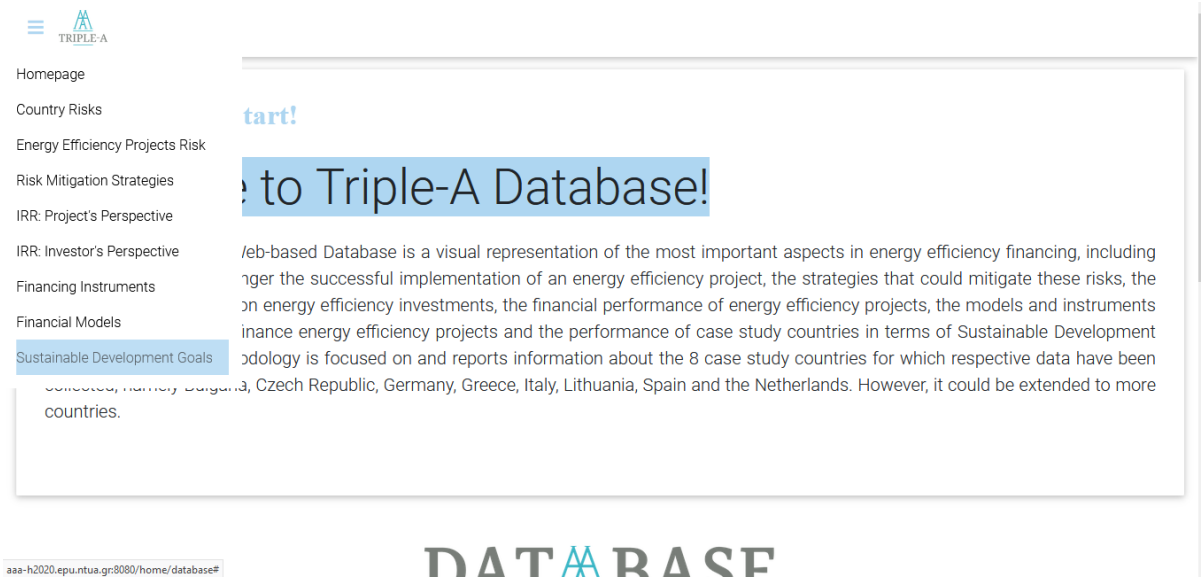


Figure 36: Triple-A Web-based Database Homepage – Sustainable Development Goals

By doing so, users are navigated to the respective menu, where at the top of the page some basic information is provided (Figure 35). Users should first select the sector and the EEMs of their interest by clicking on the buttons right to the map at the pop-up menu landed (Figure 35) in order to start inspecting the SDG scores of each case study country. Then, they can inspect the values that correspond to case study countries based on the Triple-A methodology, by hovering on the map above each country (Figure 35). They can also download the data of this menu by clicking on the respective button (***"Download"***; Figure 37).

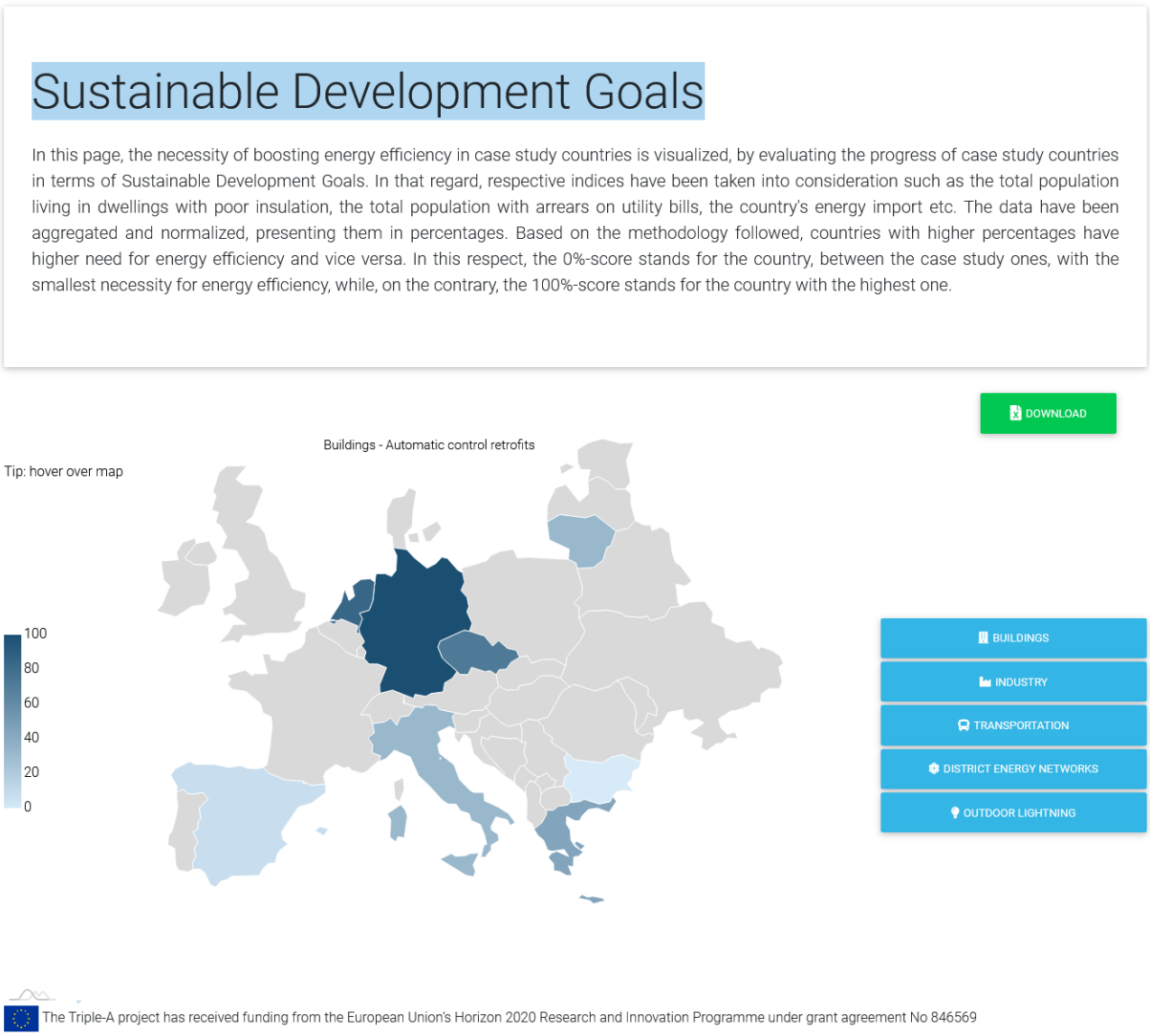


Figure 37: Sustainable Development Goals