SPEEDIER ENERGY EXPERT SUPPORT TOOL INTEROPERABLITY CONNECTIVITY – ITeC Better Practice Guide

Version 1.1

2nd December 2021

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Limitations and Status of the public document

This section contains the status of this document at the time of its publication (2nd/December/2021). Other versions of the document may supersede this document. This document may be used at user discretion as reference material or cited from another document and can be used to promote deployment to enhance functionality and interoperability across related platforms. The document defines the architecture and method for connectivity of the SPEEDIER Energy Expert Support Tool as declared by the creators of the SPEEDIER Tool, ITeC. Interested parties in connecting with the SPEEDIER tool are advised to contact ITeC for additional connection details.

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Introduction

This document presents an overview and background of the SPEEDIER Service in the context of Article 8 of the of Energy Efficiency Directive and the ITeC designed Better Practice Guide, which was prepared to enable interested parties to engage with ITeC and in particular, technically with the SPEEDIER Energy Expert Support tool. Article 8 of the Energy Efficiency Directive (EU EED) requires the European Member States (EU-27) to develop instruments (i.e., Projects, Tools and Policies) encouraging SMEs to undergo energy audits and to implement their recommendations in the process. The Better Practice Guide is centred on this directive and in particular at technical interoperability connectivity levels. The Guide declares a set of resources that defines technical practices needed to connect with the tool in line with ITeC security protocol. The Guide helps to enable users to integrate and extend the interfaces independently of the implementation. The document is also built in line with the European Commission Directive [COM (2017) 134] for the European Interoperability Framework – Implementation Strategy. Focused technical interoperability, the document provides background on the SPEERIER Service in connection to Article 8, details on the functionality of the SPEEDIER Expert Support tool and technical connectivity details.

Background

The European Green Deal set in motion an aim to be the first climate-neutral continent. It was built in coherence with two key international initiatives in the climate domain, namely the Paris Agreement, which is aimed at counteracting the climate change phenomena through the aim of limiting the increase in the global average temperature to below 2°C above pre-industrial levels. The second area is the United Nations 2030 Agenda for Sustainable Development (setting the 17 Sustainable Development Goals to be reached for eradicating poverty and achieving a global sustainable development by 2030). The Green Deal is mainly aimed at attaining EU's (27 members and the UK) climate neutrality by the year 2050, by coupling environmental protection and economic growth, which is fundamental for sustainability.

In 2018, the Intergovernmental Panel on Climate Change (IPCC) issued a report on the impact of global warming. It is a very important report. Based on scientific evidence, the report demonstrates that human-induced global warming has reached 1°C above pre-industrial levels. The estimate is that will increase at a rate of approximately 0.2°C per decade. The problem on is a global scale, but we all know that.

Without stepping up international climate action, global average temperature increase could reach 2°C shortly after 2060 and will continue rising afterwards to the decrement of planet earth, all of its

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inhabitants and across many facets of life with much loss of life and destruction. Future reports may present an even more damaging report as the applied methodology could be challenge in the future and temperature are rising at a more accelerate rate than what is presented today. Recently, (i.e., Summer, 2021) we note much higher-than-average temperatures in Canada, in the region of Lapland and the fires across many terrains, Turkey and Greece (July/August, 2021) being an example. It is in our hands now. To obtain a 1.5°C pathway involves a greenhouse emission (GHG) reduction from the start of 2020 and accordingly CO_2 emissions reaching zero level by the year 2055 if not sooner. This is the understood challenge that mankind regardless of economy, jurisdiction, background, religion of creed. We are all involved.

Our natural world too is fading! In climate terns the 'normality' as a word is fading into the distance for many of us, but what about our children or our children's children. Hopefully, this generation will be 'thanked'. We all have a role to play, at home, in industry and in commerce to reach the zero CO_2 emissions level by 2055 set by our world governing leaders, but even today this message can go unheeded. Overall, failing to take climate action seriously will make it almost impossible to ensure a sustainable development for Europe as well as to effectively deliver on the globally agreed UN Sustainable Development Goals. Human-induced global warming is happening. Climate change action is one of the United Nations Sustainable Development Goals (SDGs). It is broadly connected to sustainable development. An analysis of the CO_2 national trend emission increased in 2019. It indicated growth of 5% for China and 1.5% for India, which is primarily contributed to weather conditions and therefore, an increase in cooling and heating demands and needs. The European Union, on the other hand, actually reduced its emissions by 5%, which is most encouraging. The decrease was primarily driven by a fall of 8% in Germany, which was primarily attributed to the contraction in the use of coal and oil as well as to the increase in generation from renewable sources, particularly wind power (+11%). In 2019, we saw for the first time in this country where renewable energies actually produced more electricity than coal-fired power plants, with a share of more than 40% of the generation mix. This is positive. Further initiatives of this nature are encouraged across each EU member state jurisdiction and the UK, although any change has consequences. In this context, the development of actions taken by Small-to-medium sized enterprises (SMEs) plays a significant role in the implementation of the European Green Deal to respond to the urgent need for a reduction of greenhouse gas emissions and be in line with Article 8 of the of Energy Efficiency Directive. This is where the SPEEDIER project initiative, supported by the European Commissions, plays a contributing role to climate change and sustainable development. The SPEEDIER project runs from July 2019 to November 2021, Grant number 847034. The project revolves around the small-to-medium sized enterprises and the engagement of the Energy Expert community. The underlining quest of the project

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is to improve energy efficiency and therefore, contribute to a reduction of Greenhouse Gas emissions. The project is set against the backdrop of the European Green Deal targets for 2050 and the collective EED target for EU28 - 32.5% improvement in energy efficiency by 2030, whereby European industry and SMEs play a crucial role in meeting climate and energy policy objectives. Industry and SMEs support the implementation of policies for the achievement of set targets and drive technology progress for low-carbon, clean and energy efficient product development and solutions worldwide. In this context, SPEEDIER contributes to the creation of a cleaner energy future.

SPEEDIER (www.speedierproject.eu), is a highly innovative *one-stop-shop solution* that applies an integrated approach to energy management for SMEs, providing information, advice, capacity building, energy assessment, financing as well as the implementation of energy efficiency solutions and for the monitoring of implementation impacts. Project SPEEDIER, delivers a Service that is self-financing for outsourced energy management with several benefits for SMEs. The SPEEDIER Service enables energy, cost and carbon savings associated with the implementation of Energy Conservation Measures (ECMs) to be more readily realized. The composition of the SPEEDIER Service includes the development of a software energy expert support tool for use by the Energy Experts during an energy assessment process at an SME client. The tool provides a clear framework to assist Energy Experts to gather the data required to conduct a robust energy assessment and to enable them to present to their SME client a range of possible ECMs, classified into no-cost, low-cost, medium-cost and high-cost categories. The information gathered and entered into the SPEEDIER energy expert support tool by the individual experts identifies the package of ECMs that are most appropriate for an SME, calculates the likely energy and cost savings and it measures the actual savings post-ECM implementation against the baseline. A ring-fencing approach of the subsequent cost savings, delivered as part of the SPEEDIER Service, enables the involved SME to invest in further energy conservation measures. At policy level, Article 8 of Energy Efficiency Directive (2018/2002) is very relevant to SPEEDIER. This Article (no. 8) of the Energy Efficiency Directive (EU EED) requires the European Member States (EU-27) to develop instruments (i.e., Projects, Tools and Policies) encouraging SMEs to undergo energy audits and to implement their recommendations in the process. The policy framework was updated in 2018 to 2030 and beyond. The key element of the amended directive is a headline energy efficiency target for 2030 is to be of at least 32.5%. In absolute terms,

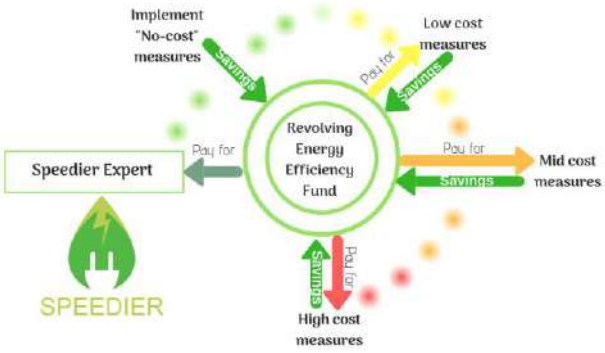

Figure 1- SPEEDIER Service self-financing mechanism

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this means that that EU energy consumption should be no more than 1,128 Mtoe of primary energy and no more than 846 Mtoe of final energy. The Directive allows for a possible upward revision in the target in 2023, in case of substantial cost reductions due to economic or technological developments.

Addressing the fulfilment of Article 8 is the cornerstone of the SPEEDIER project. Interoperability has been identified as a key characteristic for the SPEEDIER energy expert support tool to aid the implementation of the Article and it is also central to the development of this Better Practice Guide document. According to the International Energy Agency, energy efficiency is seen as a "first fuel".[1] It is recognized as a cost-effective way to concurrently improve the security of supply, as well as to enhance competitiveness and to contribute to the overall energy and climate goals[2],[3]. Interoperability capability at semantic level strengthens this intent. Meeting these goals necessitates an efficient and effective transposition of European energy policies[4] in the Member States (MS). Both energy audits, assessment and energy management systems have been identified as a helpful means to improve energy efficiency in companies [5] [6] [7] [8] [9]. With this EU EED directive, the EC enforced all large scaled companies, across member states to regularly conduct mandatory energy audits unless they implement an energy management system (Article 8 (4, 6) EED), but this is not the case for SMEs. The Better Practice Guide focuses on the integration component of the SPEEDIER software energy saving measures tool for SMEs. It addresses the tool architecture and the vocabulary and Application Programming Interface (API) constructs of a common information space for the sharing of knowledge at semantic level in line with ITeC protocol. This newly created defined capability can enable other related software tools and platforms to engage with the SPEEDIER energy expert support tool, which was developed in the SPEEDIER project by project partner, Institut De Tecnologia De La Construccion

1 IEA, 2019 https://www.iea.org/commentaries/energy-efficiency-is-the-first-fuel-and-demand-for-it-needs-to-grow

2 EC (European Commission), 2010. (ed.): Communication From the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions. Energy 2020 – A strategy for competitive, sustainable and secure energy. SEC (2010) 1326. COM (2010) 639 final.

3 EC (European Commission), 2014. (ed.): Communication From the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A policy framework for climate and energy in the period from 2020 to 2030.

4 https://www.sciencedirect.com/topics/engineering/european-energy-policy

5 Scheich, 2014, Do energy audits help reduce barriers to energy efficiency? An empirical analysis for Germany Int. J. Energy Technol. Policy, 2, pp. 226-239

6 T. Fleiter, J. Schleich, P. Ravivanpong, 2012, Adoption of energy-efficiency measures in SMEs—An empirical analysis based on energy audit data from Germany,

7 K. Wohlfahrt, W. Eichhammer, B. Schlomann, U. Mielicke, 2017, Learning networks as an enabler for informed decisions to target energy-efficiency potentials in companies J. Clen. Prod., 163 (2017), pp. 118-127.

8 M. Schulze, H. Nehler, M. Ottosson, P. ThollanderE, 2016, Energy management in industry e a systematic review of previous findings and an integrative conceptual framework
J. Clean. Prod., 112 (2016), pp. 3692-3708

9 A. Kluczek, P. Olszewski, 2017, Energy audits in industrial processes J. Clean. Prod., 142 (4) (2017), pp. 3437-3453

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De Catalunya (ITeC), Spain. Not to comprise their company security policy, direct contact to ITeC is necessary. However, the initiative strengthens the support for the take-up of the SPEEDIER Service, benefiting European based SMEs, contributing to climate re-address initiatives and sustainable development. The theme of this Better Practice Guide is also in line with the European Commission Directive [COM (2017) 134] for the European Interoperability Framework – Implementation Strategy. The capability of related energy management tools and platforms to share common information, to interconnect and communicate with the SPEEDIER software for energy saving measures, will further strengthen the ability of Energy Experts and the individual SME energy managers to accurately predict and measure the impact of the proposed Energy Conservation Measures (ECMs). This too contributes to the respond for the urgent need to reduce greenhouse gas emissions that lead to adverse climate conditions and in tandem to strengthen Europe sustainable development goals.

In terms of energy efficiency measures, SMEs are reported to be responsible for approximately 13% of total energy demand[10]. They account for 99.98% of European enterprises.[11] The SMEs are businesses whose personnel numbers fall below certain limits (Table 1). The abbreviation "SME" is used by international organisations such as the World Bank as well as the European Union, the United Nations and the World Trade Organization (WTO). Globally and economically, SMEs are very important for society, employment, trade investment and the environment. In the past, SMEs have not been given sufficient attention with regards to energy efficiency at European level. Today, they are more prevalent in this important societal and economic area. The magnitude of its importance has increased given today's pandemic. In Spain, which is one of the pilot regions for SPEEDIER, the current framework for energy and climate is based on the 2050 objectives of national climate-neutrality, with 100% renewable energy in the electricity mix and 97% renewable energy in the total energy mix. The focus for Spain is to develop renewable energy (solar and wind), energy efficiency, electrification, and renewable hydrogen. However, Spain's total energy mix is currently dominated by fossil fuels and the transport, industry and buildings sectors all have work ahead to meet the country's targets. In Ireland, which is another of the SPEEDIER pilot regions, initiatives are being setup to encourage SMEs to improved their energy efficiency and reduce cost. The SEAI scheme[12] presently offers vouchers of €2,000 to cover the cost of energy audits, which will provide tailored recommendations to cut energy bills and assess whether renewable energy technologies are a viable option for their businesses[13]. The Italian government has put energy and climate at the center

10 Accelerating Energy Efficiency in Small and Medium-sized Enterprises, 2015, International Energy Agency
11 Muller, P, et al; 2017; Annual Report on European SMEs 2016/2017, Focus on self-employment; European Commission
12 https://www.seai.ie/news-and-media/new-seai-scheme-will-supp/
13 https://twitter.com/TFCRIL/status/1425000960028467217

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of its political agenda. Their national energy plans have set ambitious targets for renewables by 2030, aiming for it to reach around 30% of the total energy consumption (International Energy Agency, 2021). Italy's energy policy is strongly pro-renewables. The country has experienced a large growth in the renewable energy sector, and its government is revising incentives and subsidies which are considered inefficient or misaligned with the decarbonization targets.[14] Italy is also a pilot region in SPEEDIER.

Going forward, the SME contribution to readdress climate change has never been greater and will be part of the global focal point for a sustainable world, once the pandemic virus has been eradicated or is under control. In Europe, as defined by the European Commission, SMEs are the enterprises that meet the following definition of staff headcount and either the turnover or balance sheet total definitions:

Table 1 - SME Categories

Company category	Staff headcount	Turnover	Balance sheet total
Medium-sized	< 250	≤ €50 million	≤ €43 million
Small	< 50	≤ €10 million	≤ €10 million
Micro	< 10	≤ €2 million	≤ €2 million

It is also worth noting that buildings account for 40% of wide energy consumption.

Better Practice Guide aims

To strengthen the SPEEDIER Service among SMEs and to be able to more readily realise market position at European level, this Better Practice Guide has been produced. It centres on the core interoperability component of the SPEEDIER energy expert support tool. It provides details on the architecture and data sets that enable other related tools to technically and semantically engage with SPEEDIER. It defines:

1. Resource Description – Vocabularies to describe the different types of resources to enable the different related energy management platforms, tools or ecosystem to technically exchange resources.

2. SPEEDIER Services Tool – Agree on a minimal set of APIs (Application Programming Interface) to be implemented by any platform / software tool operating in the energy efficiency domain, through which requests for services can be made.

[14] (International Energy Agency, 2021).

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3. Security & Accessibility Profile for Resources and Services – Set of security specifications to be associated with resources and services maintained on the SPEEDIER software energy expert support tool.

The undertaking strengthens the take up opportunity of the software energy expert support tool under the remit of the ring-fenced SPEEDIER Service. The Better Practice Guide provides appropriate technical details to help enable other platforms and tools to communicate with the SPEEDIER software tool at sematic level. It presents the software tool architecture defines a set of practices and ITeC engagement details to enable energy efficient software technical users to integrate their software product in line with ITeC engagement protocol. This Guide presents appropriate engagement technical details and in line with ITeC engagement protocol the complete specification will be ascertained when the interested party requests connectivity and API REST SPEEDIER integration.

Target audience

The target audience and stakeholders from the energy efficiency and climate domain primarily with information technology and/or energy management expertise and from the SMEs and Energy Experts community. The secondary targeted audience are the scientific research community, members of energy efficiency associations and the general public. The audience is global.

Methodology

The importance of interoperability in the quest for greater energy efficiency support tools cannot be understated. Enhanced connections, speed up reaction times as industry, people and energy experts can communicate more easily and gains being more readily realised as various software and computer systems link up with one another to automated data sharing. Interoperability refers to the basic ability of computerized systems to connect and communicate with one another readily, even if they were developed by widely different manufacturers in different industries. Being able to exchange information between applications, databases, and other computer systems is crucial for the modern economy. It is the interoperability connectivity between technologies and the shared information that will be a considerable driving force in this context to improve all walks of life and as of today to help in the battle for carbon neutrality by 2050. The SPEEDIER project partners, TFC Research and Innovation Limited (TFC), Ireland and ITeC, Spain, met on several occasions and discussed the impact of the project as well as the importance of Article 8 of the Energy Efficiency Directive (2018/2002). It was evident that interoperability was of considerable importance to the fulfilment of the project objective and would be a central attribute to the future of SPEEDIER, the Service take up and long-term sustainability. In this context, the Better Practice Guide was initiated and driven by TFC in close collaboration with ITeC. The deliverable is produced under the new mechanism for

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pre/standardisation, which is being driven by TFC Research and Innovation Limited. An agile approach to the development of the deliverable was adopted and is a 'living' document with updates anticipated beyond the life of the SPEEDIER project.

Language availability

This version of the Guide is solely available in English.

Limitation and Restrictions

The data generated and collected in the SPEEDIER project follows the FAIR data management policy (Findability, Accessibility, Interoperability, Reusability)[15]. This Guide defines relevant architectural and technical details for communications with the SPEEDIER energy expert support software tool in line with ITeC engagement protocol. General Data Protection Regulations (GDPR) compliance is also applicable with the users of the Guide (https://gdpr.eu/).

Sustainability and Maintainability

This ITeC driven document is a 'living' document. The latest version of the guide is available at: https://en.itec.cat/software/speedier

At this version release of the Guide, the SPEEDIER energy expert support tool is available at www.itec.cat. It is maintained by the Institut de Tecnologia de la Construcció de Catalunya (ITEC) Wellington 19 - ES08018, Barcelona – Tel: + (034) (0) 933 093 404 www.itec.cat.

The SPEEDIER Project

The Speedier Service and what the project is about

SPEEDIER is a highly innovative one-stop-shop solution that applies an integrated approach to energy management, providing information, advice, capacity building, energy auditing, financing as well as implementation of energy efficiency solutions and monitoring of impacts. SPEEDIER is expected to contribute to primary energy saving with approximately 6501 MWh/year and 941t CO_2/year. Within the lifetime of the project (2019-2021), SPEEDIER aims to train 305 staff members in the better approaches for energy saving and the project envisages building this capacity as well among 50 energy experts. The SPEEDIER Service will be available via energy experts to facilitate the uptake of energy audits and the subsequent implementation of energy efficiency measures in participating SMEs. The target groups for the SMEs are designated in four European regions as follows:

15 FAIR: https://en.wikipedia.org/wiki/FAIR_data

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1) In Spain, the initial pilot applied a location-based approach, engaging with SMEs based at a single business park to demonstrate the advantages of clustering SMEs to give them better access to the economies of large-scale projects;
2) In Ireland and Romania, regionally the pilots were applied SMEs both in the manufacturing and hospitality sectors;
3) In Italy, the initial approach was generic and aimed at accessing SMEs from a variety of sectors via Energy Service companies (ESCOs).

A ring-fencing approach is applied to the SPEEDIER Service. It enables the energy, cost and carbon savings associated with the implementation of Energy Conservation Measures (ECMs) to be more readily realized through the application of this approach. The composition of the SPEEDIER Service includes the development of software for energy saving measures for use by energy experts during the energy assessment process, as well as an app, which includes energy efficiency training details and gamifications features, to help with SME internal cultural changes towards energy efficiency. The software also calculates the likely energy and cost savings. Additionally, it measures the actual savings post-ECM implementation against the baseline. The Ring-fencing approach of the subsequent cost savings enables the SME to invest in further ECMs. That is the principal of the SPEEDIER Service.

Benefits of SPEEDIER

The Energy Efficiency Directive, Article 8, requires Member States to develop programmes encouraging SMEs to undergo energy audits and to implement the recommended energy-saving measures. However, the uptake of energy audits and implementation of ECMs among SMEs has been slow across Europe. Barriers to uptake of energy efficiency as cited are:

- lack of in-house expertise;
- lack of resource (time & money);
- perception that energy auditing is expensive;
- inability to act due to lack of control of services in the building they use;
- lack of willingness from landlords to act;
- inability to access finance due to the small nature of most projects.

The SPEEDIER project aims to assist SMEs to overcome these barriers. The self-financing outsourced energy management service helps SMEs to overcome lack of finance barriers. Outsourcing the role of Energy Manager to SPEEDIER Energy Experts, enables the individual SME to access the expertise needed at the required time and technical knowledge, leading to greater uptake of energy efficiency.

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The one-stop-shop solution provides information, advice, capacity building, energy auditing, financing as well as implementation of energy efficiency solutions and monitoring of impacts to the benefit of the SMEs and in tandem through the ring-fencing approach to the Energy Experts as well.

The SPEEDIER Service includes the following:

- Structured and standardised methodology for energy audit in SMEs and larger companies in EU;
- Training packages for different stakeholders: companies (SMEs and large enterprises), SPEEDIER Experts (Energy managers and Energy experts), SPEEDIER Trainers (Energy agencies, professional bodies);
- Case studies based on the piloting phase;
- Software tool to streamline the energy auditing process;
- A mobile app with gamification capabilities to be used as remote training tool for SME employees to build energy culture and bring behavioural changes within SMEs;
- Establishment of a roadmap to replicate SPEEDIER in other EU countries.

SPEEDIER Partners

The SPEEDIER project is led by the International Energy Research Centre (IERC) and involves the following partners:

Partner No.	Participant organisation name	Country	Website
1	International Energy Research Centre – University College Cork.	Ireland	http://www.ierc.ie/
2	Sustainable Innovations Europe SL.	Spain	https://sustainableinnovations.eu/
3	Limerick Institute of Technology.	Ireland	https://lit.ie/
4	Fundacion Corporacion Tecnologica de Andalucia.	Spain	https://www.corporaciontecnologica.com/es/
5	Parque Cientifico Y Tecnologico Cartuja SA.	Spain	https://www.pctcartuja.es/
6	Politecnico di Milano.	Italy	https://www.polimi.it/en/
7 *	Institut De Tecnologia De La Construccion De Catalunya.	Spain	https://itec.es/
8	TFC Research and Innovation Limited.	Ireland	https://tfcengage.com/

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9	Association “Agency for Energy Efficiency and Environmental Protection” Bucharest.	Romania	https://managenergy.ro/

Table 2 – SPEEDIER Table on who are the consortium partners

The SPEEDIER Energy Expert Support tool was developed by the Institut De Tecnologia De La Construccion De Catalunya (ITeC), Spain. ITeC is a private foundation at the service of society working in the construction sector. ITeC goals are to support and deploy innovation from information and knowledge as well as to provide technological services for the improvements of competitiveness of the construction sector agents: organizations, companies and professionals.

Among the classic points of conflict in the construction process, are project prescription and budgeting. ITeC contributed to its resolution through the developments of data bases, which initially acts as a reference point for extremely precise definitions of materials, construction elements and building works as well as an attempt to find a balance between common practices in the sector and regulatory requirements. Secondly, prices were assigned to all these elements to provide additional reference points for costing. The first operative database date was from the year, 1983. It was designed specifically for the building work promoted by the Barcelona City Council. A year later, the first book of building and town planning costing was published under the name of BEDEC (Structured Data Bank of Construction Elements). Since that period, ITeC has committed to extending, updating and perfecting the contents.

Since 2001, the BEDEC bank could be consulted from the ITeC web site. It has become the most visited digital resource specializing in construction throughout Spain.

The database is being expanded to accommodate the environmental sector as a way of facilitating the application of eco-design criteria in projects. This is the intention of the updated web site, which was realized in 2016. It offers consultation on environmental product and system information with more useful parameters for life cycle analysis. Unlike the initial versions of BEDEC where only generic data on environmental impact could be consulted, applied to a wide range of products, it is now possible to find specific data provided by each manufacturer permitting the drawing up of a more precise and environmentally more responsible prescription. ITeC is committed to maintaining this information in line with further investigations by the materials industry into their products’ life cycles, at the same time as widening the spectrum of quantifiable environmental parameters.

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SPEEDIER ENERGY EXPERT SUPPORT TOOL

Software for energy saving measures to streamline the energy auditing process and provide energy saving measures and its calculations

As mentioned ITeC, Spain developed a software tool for energy saving measures where SPEEDIER Energy Experts are able to provide input information on the participating SME. The tool automatically suggests a number of suitable energy conservation measures (ECMs) across each of the SPEEDIER cost category (i.e., no-cost, low cost, medium cost and high cost) by accessing the database and selecting solutions that match the constraints set by the individual SPEEDIER energy expert. The tool supports the SPEEDIER energy expert in applying their expertise to decide on the inclusion or exclusion of ECMs as deemed appropriate and importantly, to estimate the associated energy and cost savings. The categorisation is as follows:

Table 3 – SPEEDIER Energy Conservation Measures

ECMs measures	
No-cost:	Cost nothing to implement, yet result in energy and/or cost savings.
Low-cost:	Small cost associated with their implementation that are comparable to the cost of regular maintenance of the energy consuming equipment.
Medium-cost:	Some investment from the SME to implement while delivering a reasonable return on investment.
High-cost:	Large investment in order to implement, but can result in greater energy savings and therefore greater returns on investment.

By design, the software tool is linked to the information capture and the ITeC BEDEC databases, which will be used (such as economic data, energy …) and it describes how each of the various elements of the tool relate to each other. The information captured is used to perform the calculations using the information that the user fills up in the menu: use details, the economic data, the energy contributions and the building information. See the current Terms of Use of BEDEC, which is in Annex 2. The BEDEC, is a structural database of construction elements. It is the parametric bank that counted 860,000 elements of new work and maintenance on buildings, urbanization, civil engineering, rehabilitation and restoration, safety and health and quality controls. The database provides technical, environmental as well as economic information regarding all kind of elements used in every situation in the construction market.

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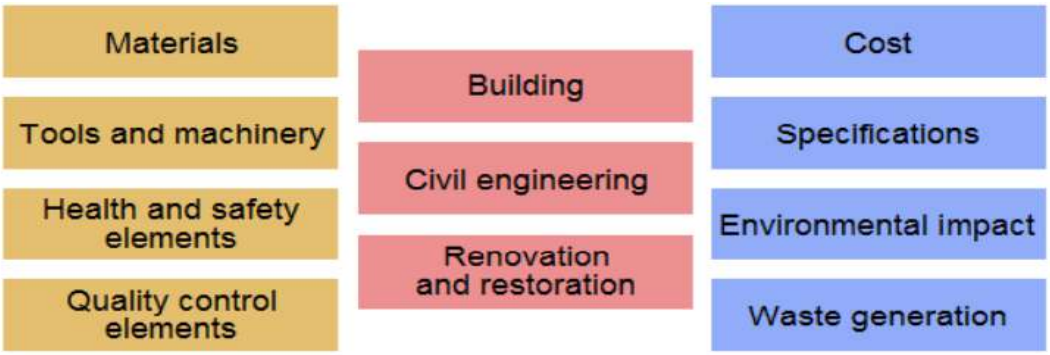
Figure 1 – ITeC database outline



Every element has a price, and is annually updated according to the market situation, and it includes a specification data sheet[16] that is based on the current standards and codes. Additionally, it has data on CO_2 emissions and embedded energy. The database also provides data on the type and amount (weight and volume) of waste that it will generate.

Features

Through the background support of the ITeC database, the SPEEDIER energy expert support tool includes the following features:

- Project management of each SPEEDIER Energy Expert,
- Creation of a project with the data from the previous energy audit,
- Characteristics of use of the building or floor of the SME,
- The economic data for the subsequent calculation of the measures,
- Building definition with all the characteristics of the envelope and building facilities,
- Proposed measures of energy savings according to the project data,
- Price, energy savings, CO_2 savings and economical return of each measure,
- Simulations of the selection of different measures,
- Application of a group of measures,
- Periodic monitoring of the application of the measures,
- Gamification of the results obtained according to the type of project or the measures applied.

For SPEEDIER Energy Experts, the SPEEDIER energy expert support tool is linked to the database of construction solutions and categorised ECMs. The tool subsequently delivers for the relevant

[16] A data sheet, technical sheet or datasheet, also data sheet or data sheet, is a document that summarizes the operation and other characteristics of a component or subsystem in sufficient detail.

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SPEEDIER Energy Expert, a proposal of a package of ECMs that would potentially be suitable for the client building. This is highlighted in the following Figure.

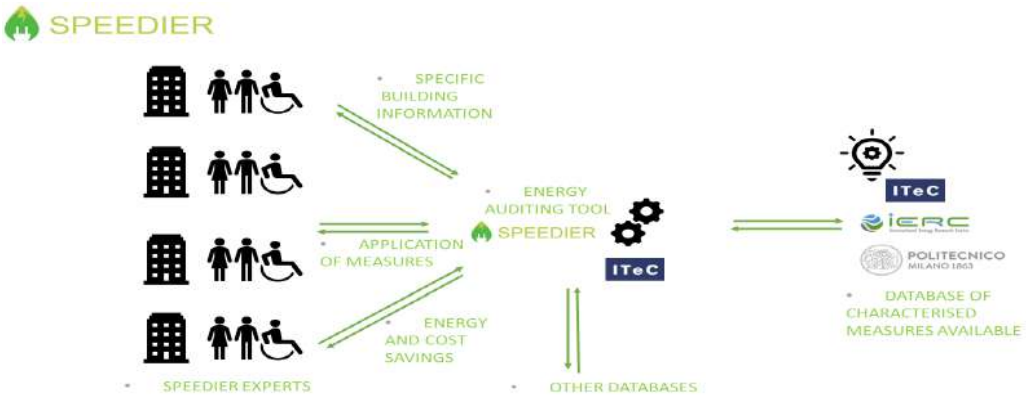

Figure 2 - SPEEDIER Expert Support tool for energy expert tool - dataflow

Simultaneously, the SPEEDIER software energy expert support tool can be used to:

- examine the cost of implementing the measures,
- provide an economic return and it,
- predict energy saving for the building.

Figure 3, below, describes the various data sources of information used by the tool. This includes building fabric, construction elements and climatic conditions. It also describes how the SPEEDIER Energy Expert will use the data to define the building. Figure 4, also below, shows how the tool will select suitable measures for the building and calculate the likely energy and cost savings for the specific building. Finally Figure 5, illustrates how the tool will keep learning from the data included and will provide a more accurate data in the future.

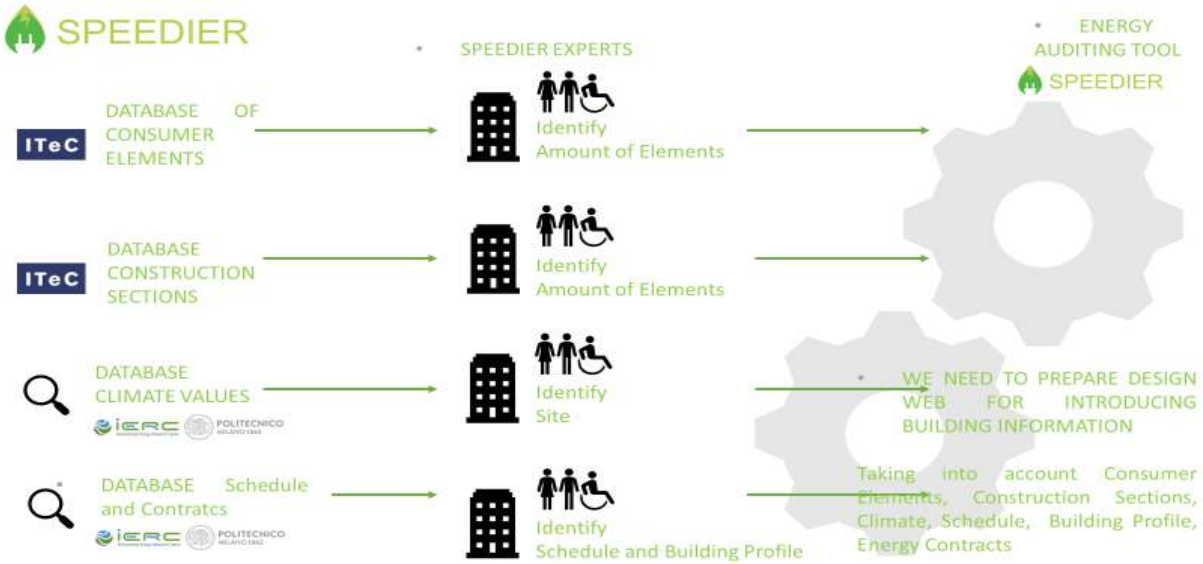

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Figure 3: Databases that will be needed to define and build the tool.

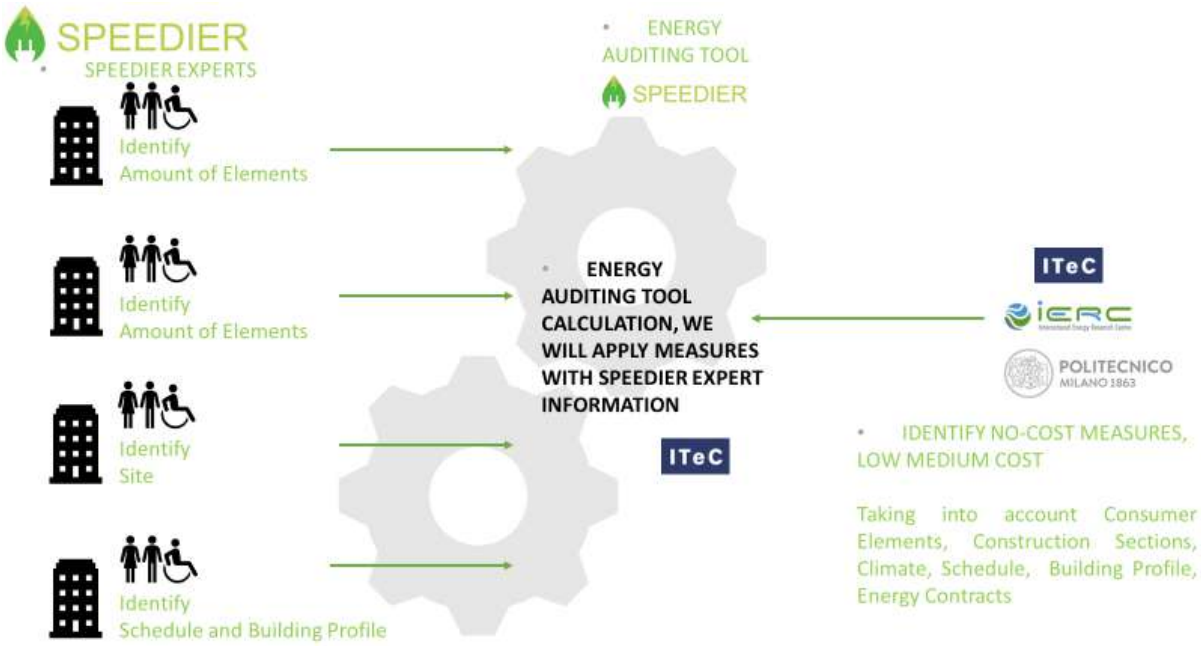

Figure 4: Proposed workflow of SPEEDIER Tool for Experts

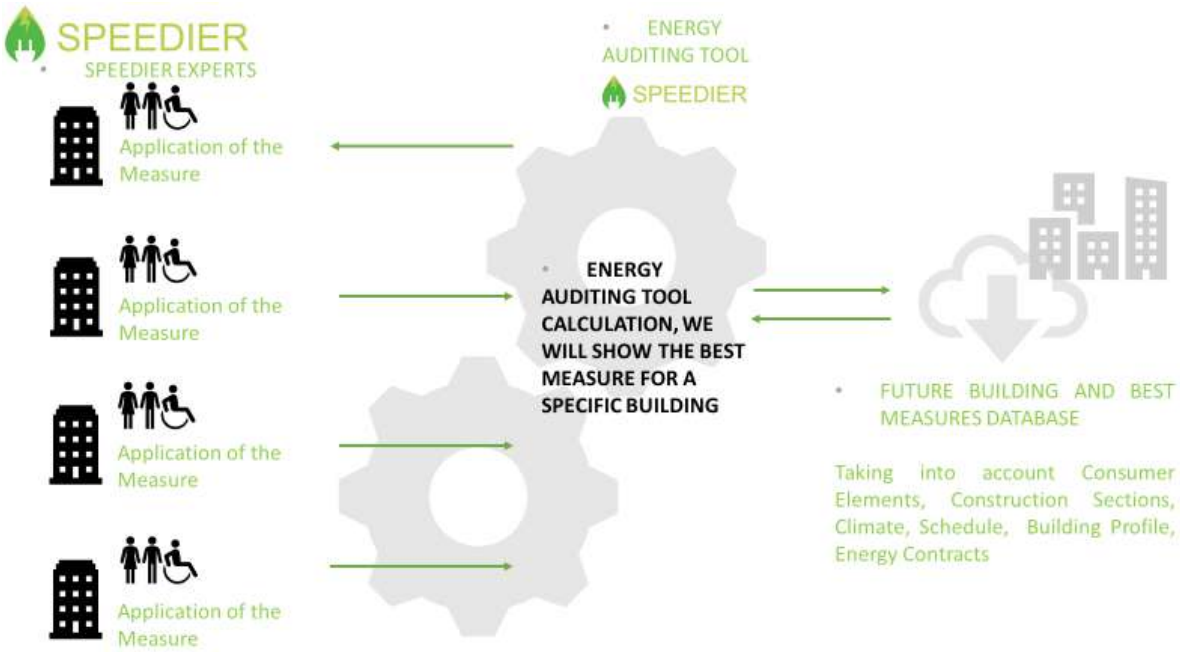

Figure 5: Proposed workflow of SPEEDIER Tool to improve solutions

The design of a tool is linked to the information and databases that will be used and describes how each of the various elements of the tool will be related to each other.

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In this chapter, the different elements of the tool will be defined including: the information needed to obtain a specification for the building or plant being assessed; the building facilities and equipment; and the current values of energy consumption, energy cost and related CO_2 emissions. Subsequently, by linking to the database of construction solutions and categorised ECMs, the tool will deliver a proposal of a package of ECMs that could be suitable for the building. Simulations can be run to examine the cost of implementing the measures, the economic return and the predicted energy saving.

Sign in

To begin using the tool, the SPEEDIER Energy Expert will first sign-in using a login screen. Once logged in, the user will then see a further screen showing a summary of the projects that the individual expert has registered for. The user will be able to manage these projects and configure their own user profile from this screen.

Log in

The log in screen is shown in Figure 6, below. After logging in, the SPEEDIER Energy Expert will be shown the Home Screen, which as mentioned will contain a list of their existing projects.

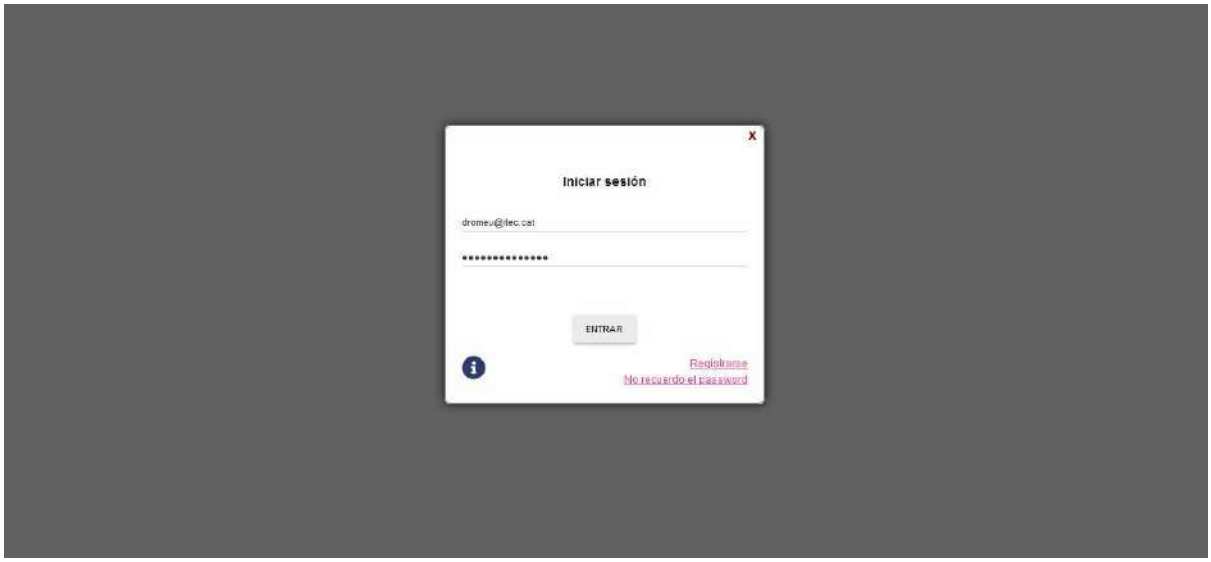

Figure 6: Log in screen

Manage projects

From the Home screen (Figure 7), the SPEEDIER Energy Expert will be able to create a new project by clicking on the 'New Project' button and manage each of the projects on which they work. Clicking on the 'New Project' button will take the SPEEDIER Energy Expert to the Project Information screen to complete basic information on the new project.

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Figure 7: Home screen

When managing a project through clicking on the 'Project Information' icon, a horizontal menu will show all the information about the project, displayed on a number of different screens. Each screen will be accessed through a horizontal menu, as is shown in Figure 8. Each item in the horizontal menu will either be enabled or disabled depending on the stage of data entry that the SPEEDIER Energy Expert has reached.

Figure 8: Horizontal menu showing project information

Entering data

Project information

On the Project Information screen, the SPEEDIER Energy Expert will complete basic information about the project including:

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- Project name
- Building name
- Building owner
- Location details
- Building type: to be selected from a closed list of types.

Based on the location details entered, the SPEEDIER energy expert support tool will determine the climate zone in which the building is located and the average outside temperature that will be used to calculate running hours of HVAC equipment.

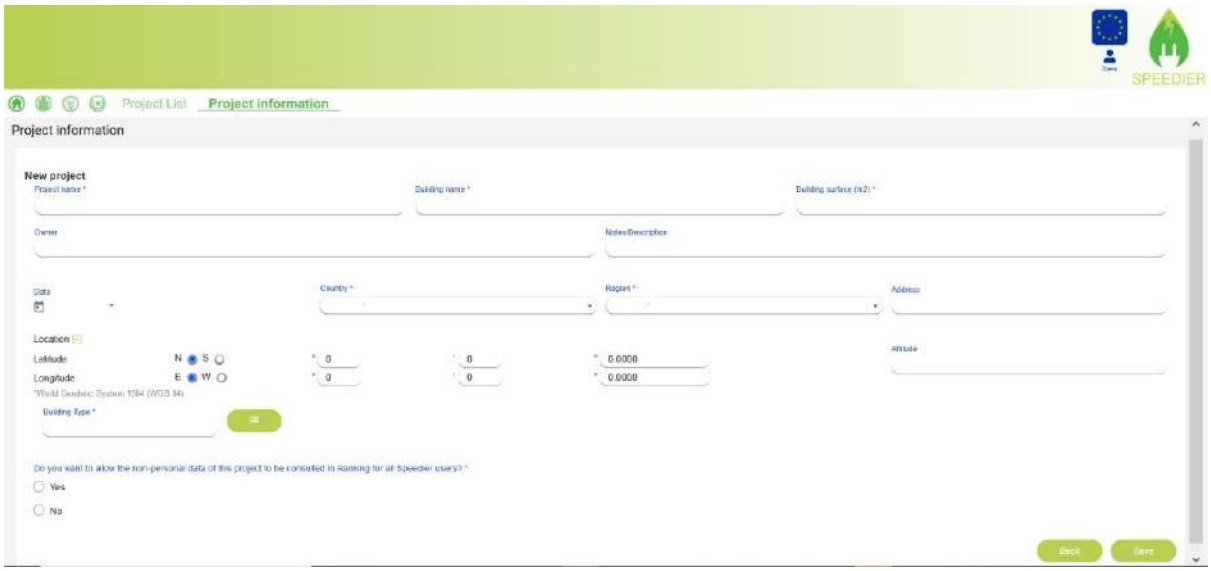

Figure 9: Project Information screen

Use details

On the Use Details screen (Figure 10), the SPEEDIER Energy Expert will complete the following details:

- Building activity – e.g., administrative, leisure, manufacturing, etc.
- Usage schedule – selected from the predefined list of schedules shown in Table 4. The tool will allow the user to enter directly a few hours a year if it does not conform to any schedule.
- Number of building users.

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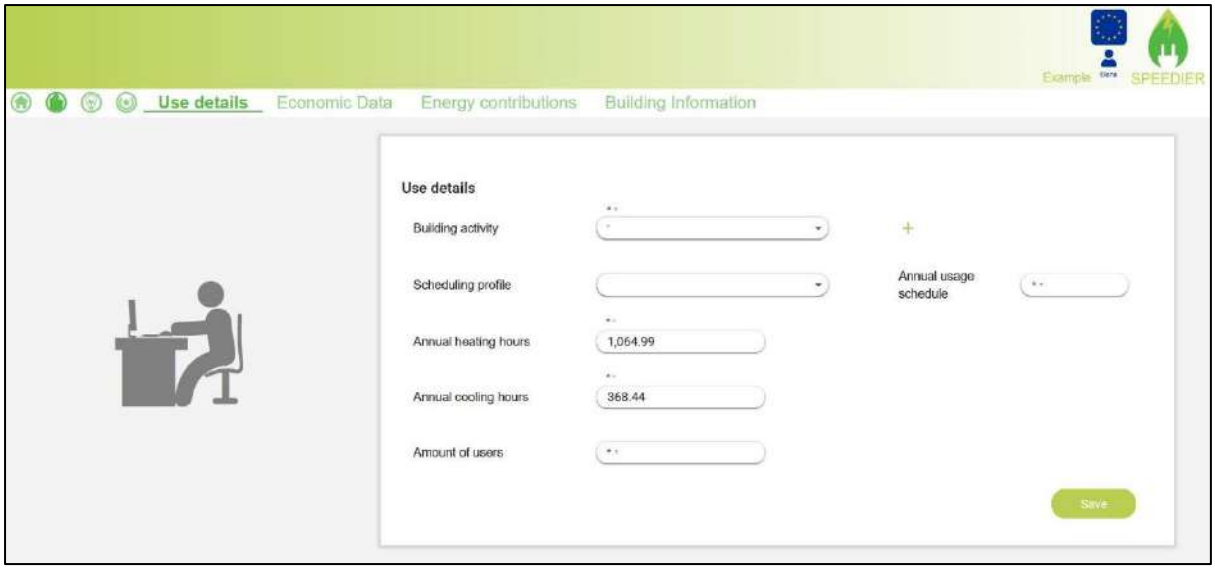

Figure 10: Use Details screen

SCHEDULE PROFILE	DAYS PER YEAR	HOURS PER DAY	TOTAL HOURS
2h/7d	365	2	**730**
8h/7d	365	8	**2920**
12h/7d	365	12	**4380**
16h/7d	365	16	**5840**
24h/7d	365	24	**8760**
8h/6d	298	8	**2384**
12h/6d	298	12	**3576**
16h/6d	298	16	**4768**
24h/6d	298	24	**7152**
8h/5d	248	8	**1984**
8,5h/5d	176	8,5	**1496**
12h/5d	248	12	**2976**
16h/5d	248	16	**3968**
24h/5d	248	24	**5952**

Schedule type

Table 4 - Predefined list of schedules

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Economic Data

On the Economic Data screen, the SPEEDIER Energy Expert can enter information about the prices. The SPEEDIER energy expert support tool proposes a baseline price reference to Spain because the database is from Spain. However, depending on the country and region of the user's project, it adjusts the price outcome. The Energy Expert has the option to accept or modify the proposal. This data is used to show the prices of the measures and the values of economical return. The design is shown at Figure 11.

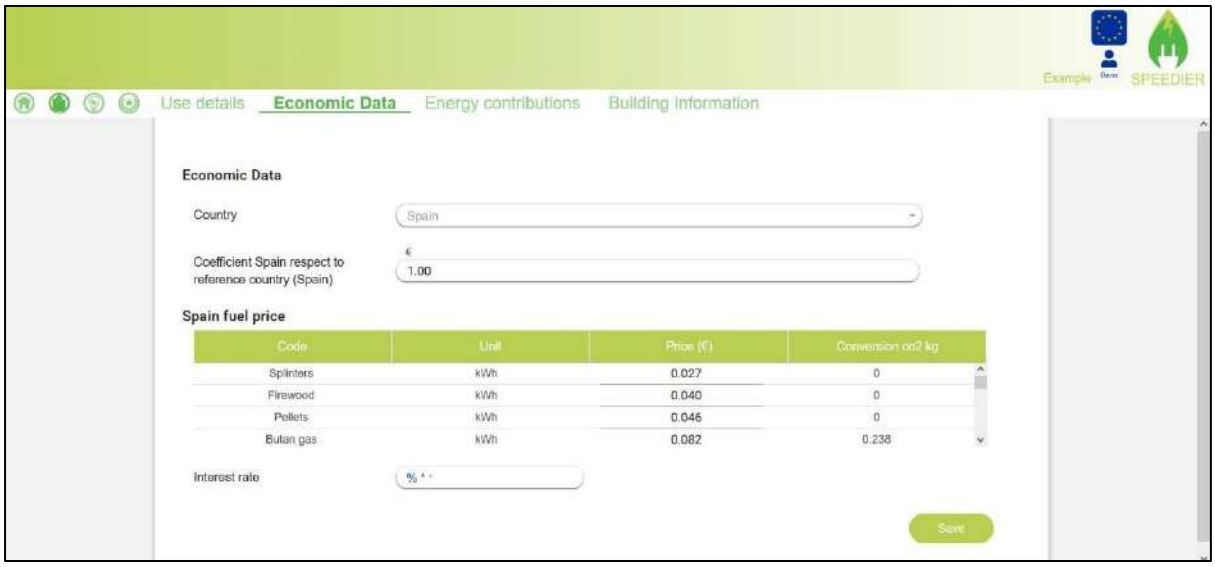

Figure 11: Economic data

Energy Contributions

On the energy contributions screen, the SPEEDIER Energy Expert will enter information about the solar panels (if any) and the details of the panel savings. See the illustration in Figure 12.

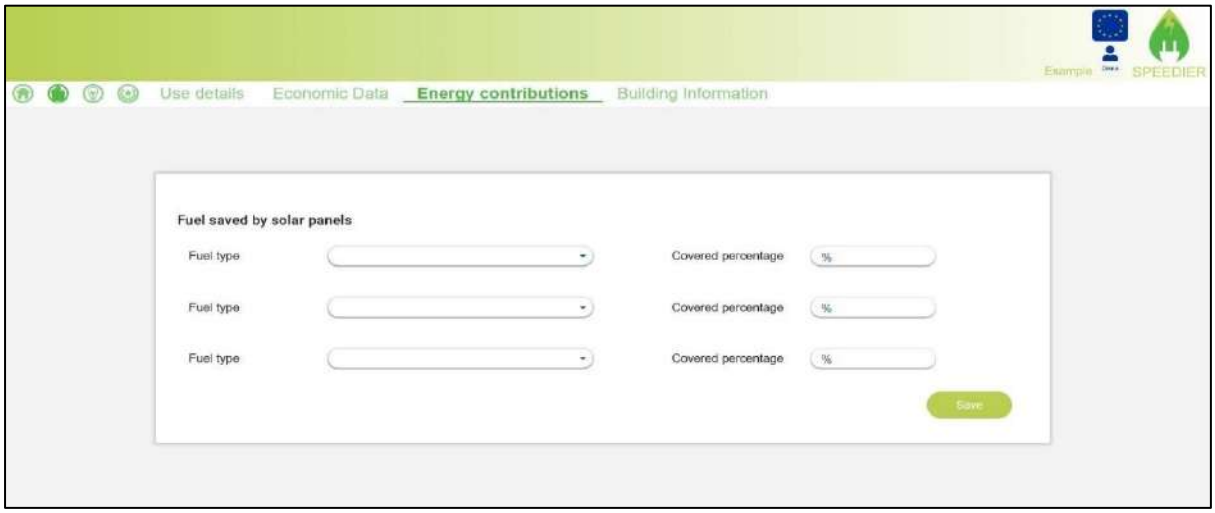

Figure 12: Energy contributions

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Building information

On the Building Information screen, the SPEEDIER Energy Expert can enter information on the building construction, which they gather during any site visits or from information provided to them by the SME client. To make the process of entering data as quick and easy as possible for the SPEEDIER Energy Expert, many of the fields will require the Expert to select an option from a drop-down list, pre-populated using the links to the other databases described below.

The Building Information screen is broken down further using a vertical menu on the left end side of the screen to define different elements of the building. The first level of the vertical menu separates the Building Envelope from the Energy Consuming Elements.

Building envelope

The Building envelope level has three further sublevels: facades, floor/slab and roof/deck.

Facades

The SPEEDIER Energy Expert will define each façade of the building. As shown in Figure 13, each façade will be given its own unique identifier so that the Expert can define as many façades as needed. For each façade, the Expert will need to define the following technical information: wall type, composition, main support, system and type of thermal insulation by selecting the appropriate option from a drop-down list. All these characteristics will be pre-defined using data from other databases in order to establish a simple but effective solution to enable characterization of all types of building. The available options for choosing facades are shown in Figure 14.

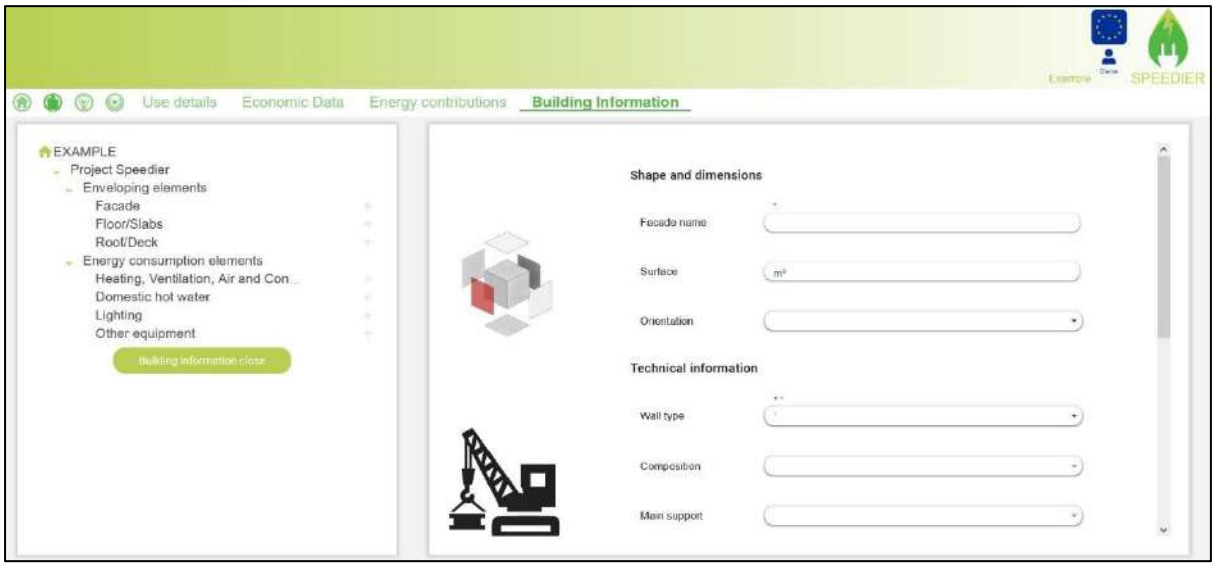

Figure 13: Building Information - Building Envelope, Facades

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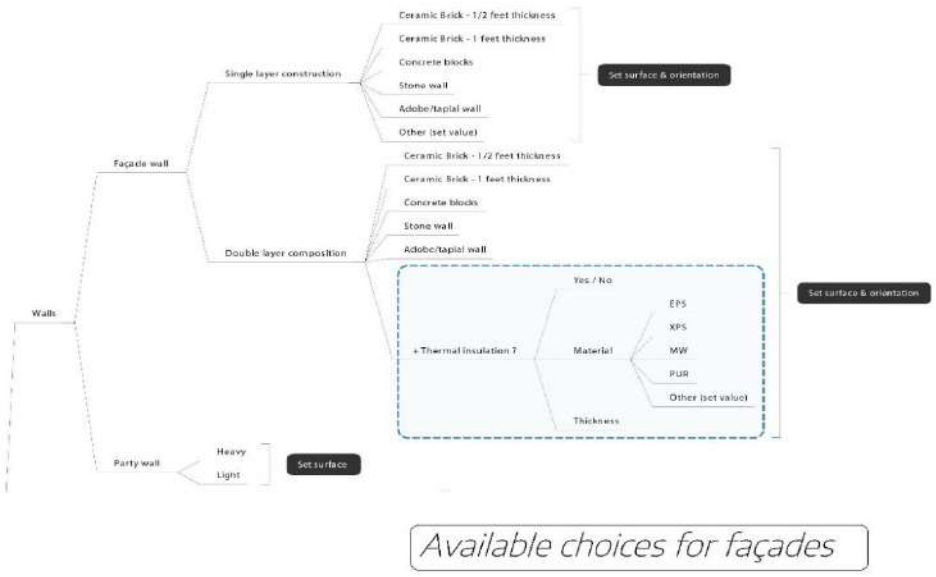

Enveloping element	Position	Composition (1)	Composition (2)	Ventilation - Thermal insulation	Set surface	Set orientation
Wall	Façade wall	Single layer	Ceramic Brick - 1/2 feet thickness	a) → Thermal insulation? Yes / No (check) a. → Material 1. EPS 2. XPS 3. MW 4. PUR 5. Other (set value) b. → Thickness c. → Ventillation 1. Non ventilated 2. Lightly ventilated 3. Ventilated	[m2]	N S E W NE NW SE SE
			Ceramic Brick - 1 feet thickness			
			Concrete blocks			
			Stone wall			
			Adobe/tapial wall			
			Other (set value)			
		Double layer	Ceramic Brick - 1/2 feet thickness			
			Ceramic Brick - 1 feet thickness			
			Concrete blocks			
			Stone wall			
			Adobe/tapial Wall			
	Party wall	Heavy ≥ 200 kg/m2	N/A	N/A	[m2]	N/A
		Light < 200 kg/m2				

Figure 14: Available options for defining facades

Floor

The SPEEDIER Energy Expert will define the floor of the building using the same data entry method as for facades. The screen for entering data about the floor is shown in Figure 15 and the available options for defining floors is shown in Figure 16.

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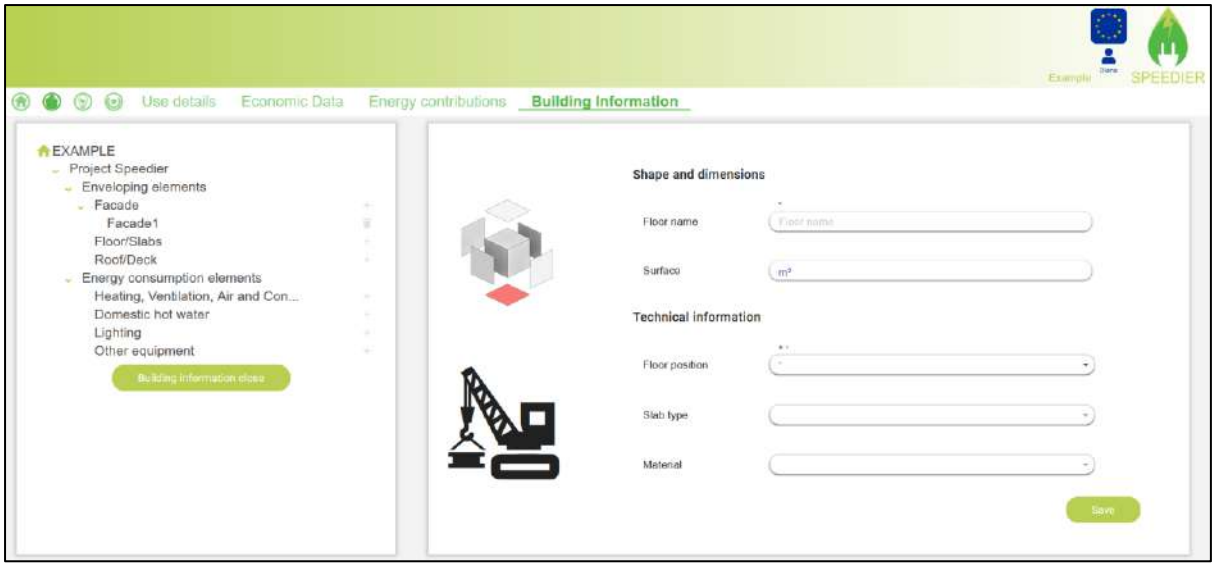
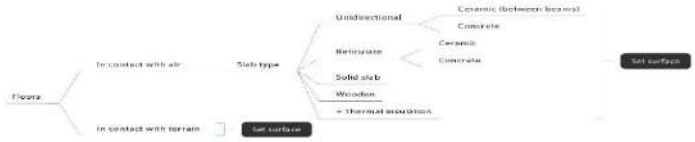


Figure 15: Building Information – Building Envelope, Floor



Available choices for floors

Floor	In contact with air outside	Unidirectional	Beamfill material: • Ceramic • Concrete Thermal insulation	a) Thermal insulation (Yes / No — Check) a. Material i. EPS ii. XPS iii. MW iv. PUR v. Other (set value) b. Thickness	[m2]	N/A
		Reticulate				
		Solid slab	N/A			
		Wooden	N/A			
	In contact with terrain	N/A	N/A	N/A	[m2]	N/A

Figure 16: Available options for defining floors

Roof

The SPEEDIER Energy Expert will define the roof of the building using the same data entry method as for facades and floor. The screen for entering data about the roof is shown in Figure 17 and the available options for defining roof is shown in Figure 18.

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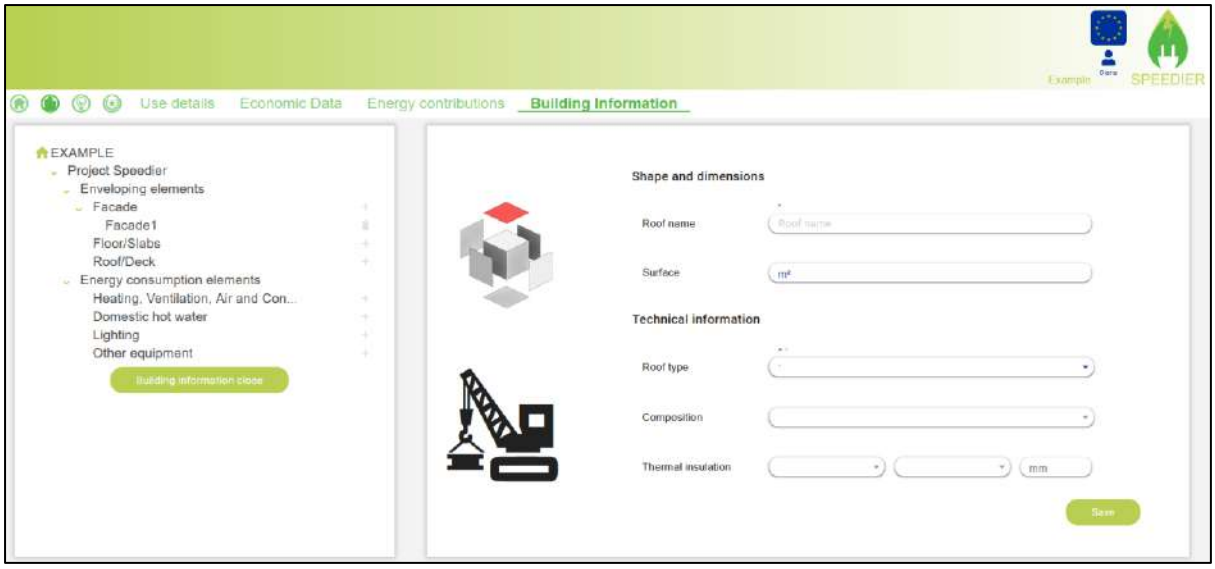
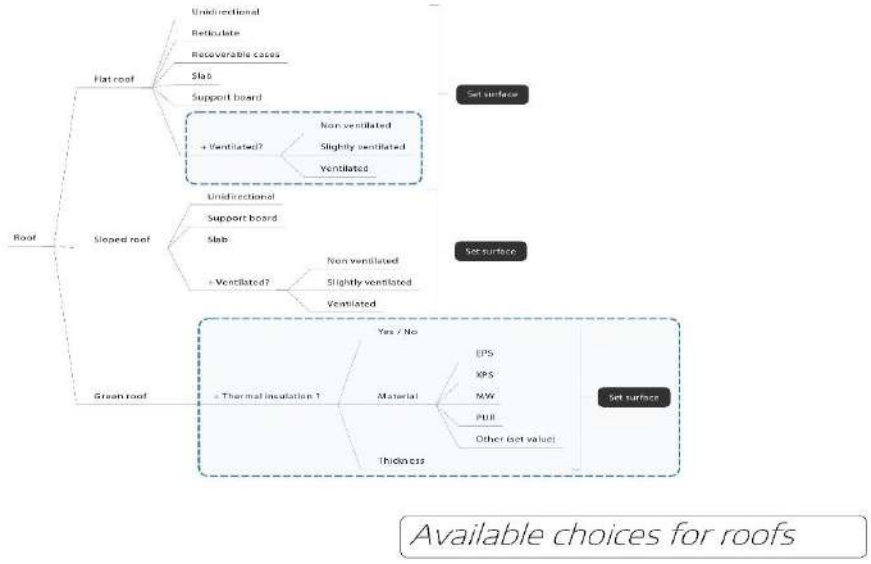


Figure 17: Building Information – Building Envelope, Roof



Roof¤	Flat·roof¤	Unidirectional¤	N/A↵ ¤	a)→Ventillated¶ a.→Non·ventilated¶ b.→Lighly·ventilated¶ c.→Ventilated¶ b)→Thermal·insulation·(Yes·/·No—Check)¶ a.→Material¶ i.→EPS¶ ii.→XPS¶ iii.→MW¶ iv.→PUR¶ v.→Other··(set·value)¶ b.→Thickness¤	[m2]¤	N/A¤
		Reticulate¤				
		Recoverable·cases¤				
		Slab¤				
		Support·board¤				
	Sloped·roof¤	Unidirectional¤				
		Slab¤				
		Support·board¤				

Figure 18: Available options for defining roofs

Energy Consuming Elements

The Energy consuming elements level has four further sublevels: HVAC, Lighting, Domestic hot water and other equipment. The SPEEDIER Energy Expert will be able to complete data about all the different

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types of energy consuming equipment found on site. For each type of equipment, some of the parameters will require the SPEEDIER Energy Expert to make a selection from a drop-down list pre-populated from one of the databases. The screens associated with each of the four sub levels can be found in Figure 19 through to Figure 22. The content of some of the dropdown menus will be populated according to a previous selection. The possible entries, and relationships between fields for each sub level can be seen in Table 2 through to Table 4.

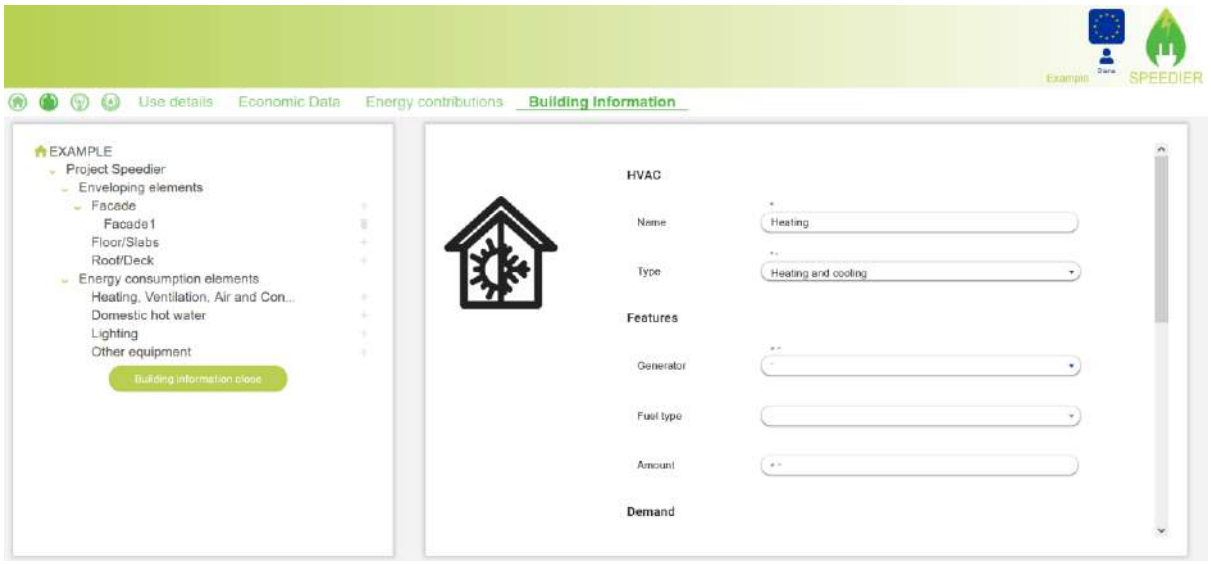

Figure 19: Building information- Energy consuming device, HVAC

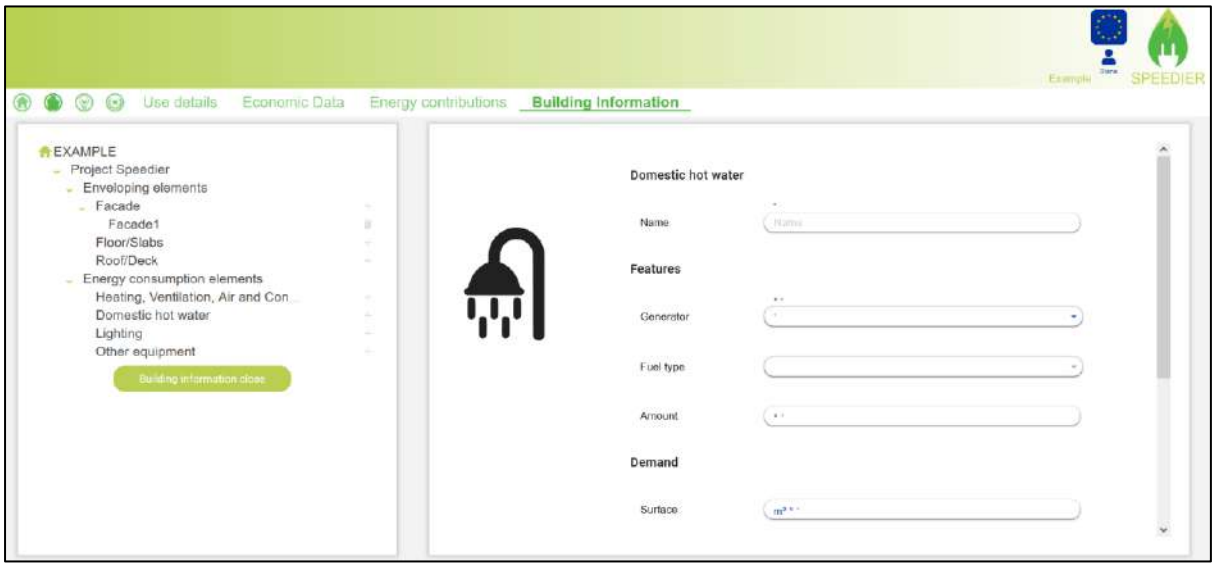

Figure 20: Building information – Energy consuming devices, Domestic hot water

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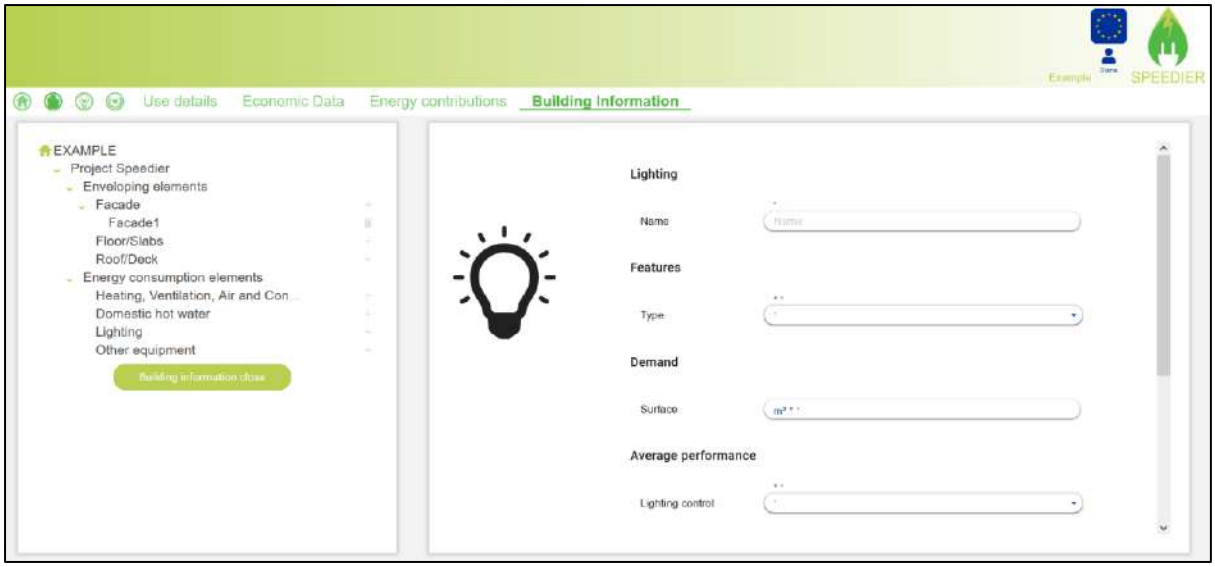

Figure 21: Building information – Energy consuming devices, Lighting

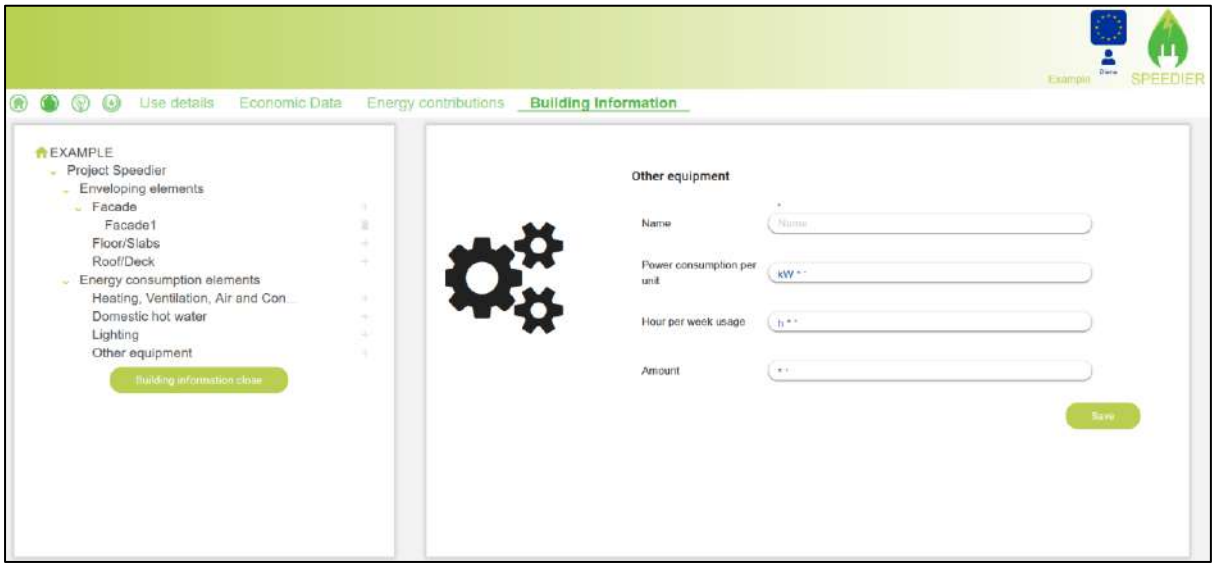

Figure 22: Building information – Energy consuming devices, Other equipment

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Table 2: Base table for each of the facilities

Types	Generator	Fuels
DHW Heating only Heating and DHW	Standard boiler	Natural gas Diesel C Electricity Liquefied petroleum gas (LPG) Coal Biofuel Undensified Biomass Densified biomass
	Low temperature boiler	
	Heat pump	
	Variable refrigerant flow heat pump	
	Joule Effect	
	Constant performance equipment	
Cooling only Heating and cooling Heating, cooling and ACS	Heat pump	
	Variable refrigerant flow heat pump	
	Constant performance equipment	

Table 3: HVAC and domestic hot water fields and possible entries

DHW	Generator	see Table 2
	Fuel	see Table 2
	Demand Surface	m2
	Percentage	%
	Nominal Power	kWh
	Efficiency	%

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Heating only	Generator	see Table 2
	Fuel	see Table 2
	Demand Surface	m2
	Percentage	%
	Nominal Power	kWh
	Efficiency	%
Cooling only	Generator	see Table 2
	Fuel	see Table 2
	Demand Surface	m2
	Percentage	%
	Nominal Power	kWh
	Efficiency	%
	Heat pump characteristics	Air -Air Air -water Air-Water Water-water
Heating and cooling	Generator	see Table 2
	Fuel	see Table 2
	Heating demand surface	m2
	Heating demand percentage	%
	Cooling demand surface	m2
	Refrigeration demand percentage	%
	Nominal Power	kWh
	Efficiency	%
Heating and DHW	Generador	see Table 2
	Combustible	see Table 2

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	Superficie de demanda	m2
	Porcentaje	%
	Nominal Power	kWh
	Efficiency	%

Table 4: Other equipment fields and possible entries

Heating, cooling, and DHW	Generator	see previous table 1.1		
	Fuel	see previous table 1.1		
	Superficie de demanda	m2		
	Porcentaje	%		
	Efficiency	%	Efficiency DHW	%
			Heating Efficiency	%
			Cooling Efficiency	%
			Installation age	
Energy contributions	Renewable energy sources	Yes/no	DHW percentage covered	%
			Covered heating percentage	%
			Covered refrigeration percentage	%
	Cogeneration Electricity generation through renewable	Yes/no	Electricity generated for self-consumption	kWh/year
			Heat recovered for DHW	kWh/year
			Heat recovered for heating	kWh/year
			Cold recovered	kWh/year
			Energy consumed	kWh/year

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			Fuel type	see previous table 1.1
Lighting equipment	Surface area	m2		
	Lighting control?	Yes/no	Surface with lighting control	m2
	Representation Zone	Yes/no		
	Activity	-		
	Installed potency	W		
	Average horizontal illuminance	Lux		
Primary air equipment	Ventilation flow	m3/h		
	Heat recovery?	Yes/no		
	Seasonal Efficiency	%		
Pumping equipment	Pump type	a/b	a) Constant flow pump b) Multi-speed pump	
	Service	a/b/c	a) DHW b) Heating c) Cooling	
	Electric power	kW		
	Number of demand hours	H		
	Does the pump work when there is no thermal demand?	Yes/no		
Cooling towers	Tower type	a/b	a) Constant speed b) Variable speed	
	Electric power	kW		
	Number of demand hours	H		

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Energy Conservation Measures

Once all the required information about the building and the equipment involved have been completed by the SPEEDIER Energy Expert, the tool will propose all the different ECMs that could be applicable to the building. These ECMs will be split into the four categories described previously: i.e., no *cost, low cost, medium cost and high-cost measures*. Each category of ECM will be displayed with a different colour (black, green, yellow and red respectively) so that the range of opportunities can be seen at a glance. For each ECM, the SPEEDIER Energy Expert will determine (using his/her own expertise) if it is appropriate for the SME and if it will be one of the measures that will be implemented.

For each measure, a chart will be displayed showing the likely energy saving per unit floor area. In addition, a new page will be displayed showing the cost to implement each measure and the likely economic return on investment (ROI), if the measure were to be implemented. The SPEEDIER Energy Expert will be able to compare a number of different scenarios in order to determine which package of measure is most suitable for the SME or to allow them to present several different options to the SME before making a final decision on which measures to implement.

Once the ECMs have been implemented, the Energy Expert can select the specific package of measures that was chosen and complete the data relating to the actual energy savings achievements. This will activate a new page where the project can be compared and ranked against all the other projects being run by the SPEEDIER Energy Expert. Figure 23, Figure 24 and Figure 25 illustrate the proposed screens relating to ECM selection.

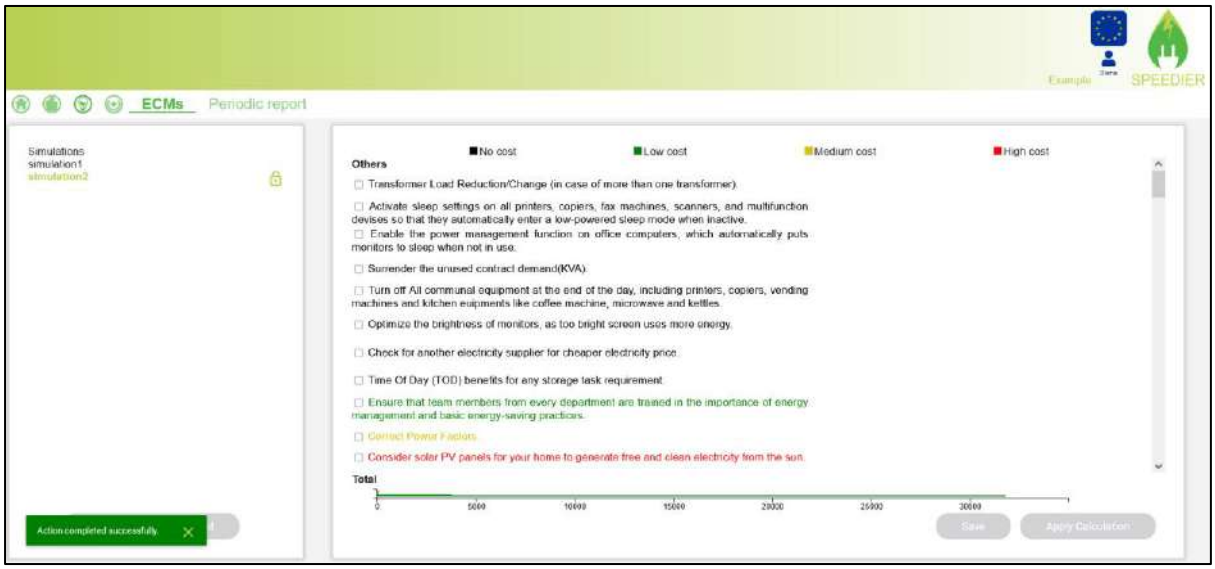

Figure 23: List of possible ECMs

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Figure 24: Report on actual cost savings achieved

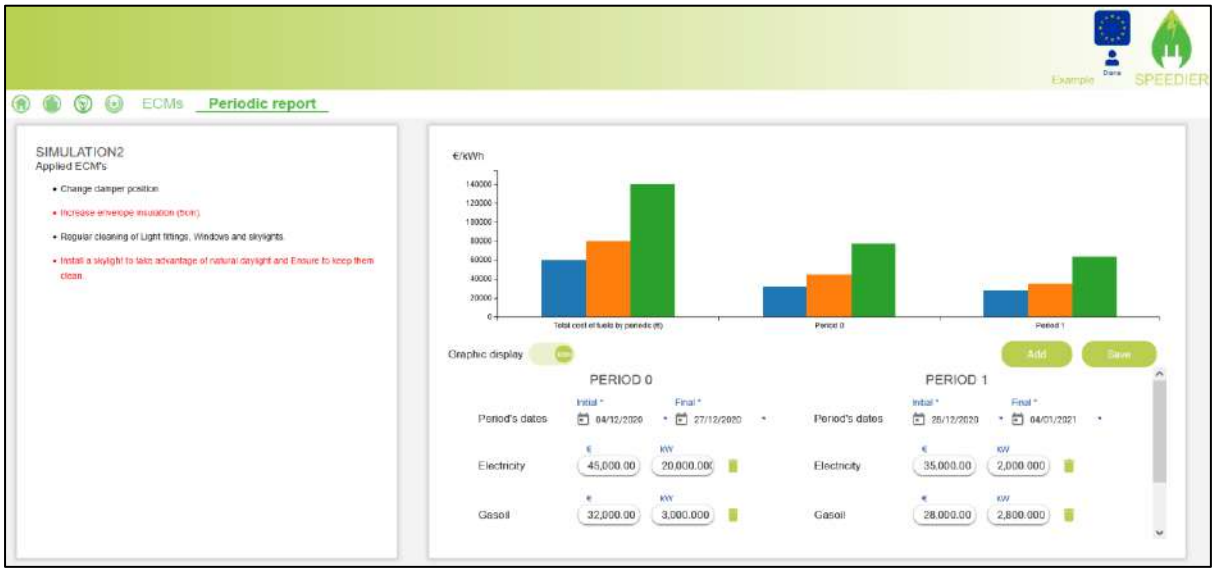

Figure 25: Report on actual energy savings achieved

Ranking

On this page of the SPEEDIER tool, illustrated in Figure 26, the SPEEDIER Energy Expert will be able to see the position of their client project with respect to that of their other projects and those of other SPEEDIER Energy Experts for benchmarking purposes. They will also be able to see which ECMs each organisation has applied and the resultant energy savings.

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Figure 26: Project ranking

Note: This image may be modified in the future by the programming department in ITeC

Applicable standards and technical background

The technical development of the tool there has been based on the CEM (Certified Energy Manager) methodology. The informatics develop of the tool has been implemented following the methodology agile (SCRUM). Agile software development involves an approach to decision-making in software projects, which refers to software engineering methods based on iterative and incremental development, where requirements and solutions evolve over time according to the need of the project. Thus, the work is carried out through the collaboration of self-organized and multidisciplinary teams, immersed in a shared process of short-term decision-making.

Each iteration of the life cycle includes planning, requirements analysis, design, coding, testing, and documentation. The concept of "finished" (done) acquires great importance, since the objective of each iteration is not to add all the functionality to justify the launch of the product to the market, but to increase the value through "software that works" (without mistakes).

To design the SPEEDIER energy expert support tool, different technology are used as follows:

Server part:

- relational database manager: POSTGRESQL
- database Access: HIBERNATE, JPA
- programming language: JAVA SE
- framework: SPRING

Client part:

- HTML5, JAVASCRIPT, CSS3, ANGULARJS

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Vocabularies applied in the SPEEDIER Energy Expert Support Tool

The vocabularies that are applied in the SPEEDIER energy expert support tool are as follows:

Terms	Meaning
Annual heating hours:	The total annual hours that the heating is running, it's calculate using the climate zone of each country and region.
Annual cooling hours:	The total annual hours that the cooling is running, it's calculate using the climate zone of each country and region.
Interest rate:	Is the proportion of a loan that is charged as interest to the borrower, typically expressed as an annual percentage of the loan outstanding. Its use to calculate economical return of the measures.
Scheduling profile:	The type of time that the SME is working per week. As example 8h/5d, eight hours working five days a week.
Annual usage schedule:	The totally hours during the year that de SME is working.
Envelope:	The envelope is the skin of the building.
SME:	Small-to-Medium sized enterprise.
Energy consumption elements:	They are the facilities that are included in the building.
ER Model	Database model that explains how and where SPEEDI|ER information is stored. It is useful to know how to reach needed information, it can be used to implement an API, allowing external clients to use SPEEDIER information.
API	Application Programming Interface allow to external client applications to ask SPEEDIER for perform some actions. (See below). It is a type of software interface, offering a service to other pieces of software. Actions can typically be getting information or perform some calculations and are defined below.

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SPEEDIER ENERGY EXPERT SUPPORT TOOL Technical Specification

API definitions

An Application Programming Interface (API) is a computing interface that defines interactions between multiple software intermediaries. It defines the kinds of calls or requests that can be made, how to make them, the data formats that should be used, the conventions to follow, etc. It can also provide extension mechanisms so that users can extend existing functionality in various ways and to varying degrees.[1] An API can be entirely customized, specific to a component, or designed based on an industry-standard to ensure interoperability. Through information hiding, APIs enable modular programming, allowing users to use the interface independently of the implementation.

Security Considerations

Software security for the SPEEDIER energy expert support tool is based on two parts: i/ authentication and ii/ authorization. The authentication part is performed through a user and password, knowing who accesses and then comes the authorization part that can do what functionalities can be used. This is done with a role-based system, which is a role that determines the set of functions being accessed and the type of access (i.e., write, read, delete). The following provides a brief explanation (Source: Source: https://www.restapitutorial.com/lessons/httpmethods.html):

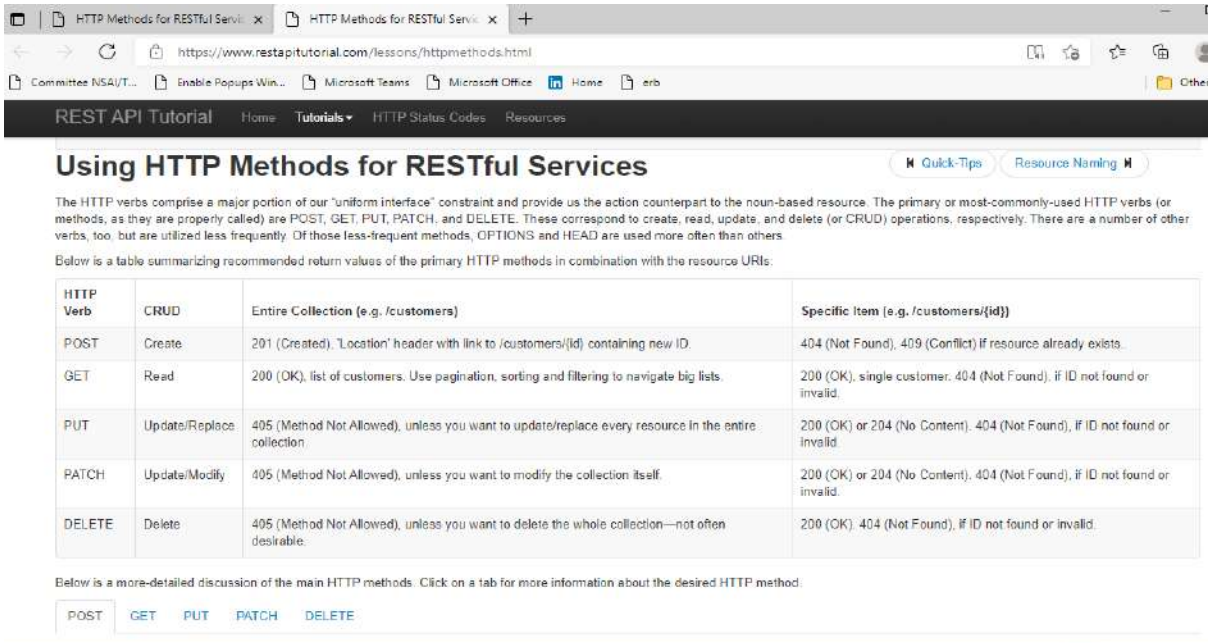

Figure 27 - HTTP Methods

A User can have one or more roles, and the associated set of roles is what determines what the user can do in the application. On a more technical level, all communication between client and server is encrypted with SSL (TLS).

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Integration

Integration with external clients is made using an API (Application Programming Interface). SPEEDIER will provide a rest API to clients so clients can make requests to API endpoints to get the SPEEDIER information.

Various clients will have different needs and thus, API customization will be needed. SPEEDIER will provide an API software that acts as a software template. Inside the template, some items have to be completed by filled with client software in order to customize what data information the client wants to get from SPEEDIER.

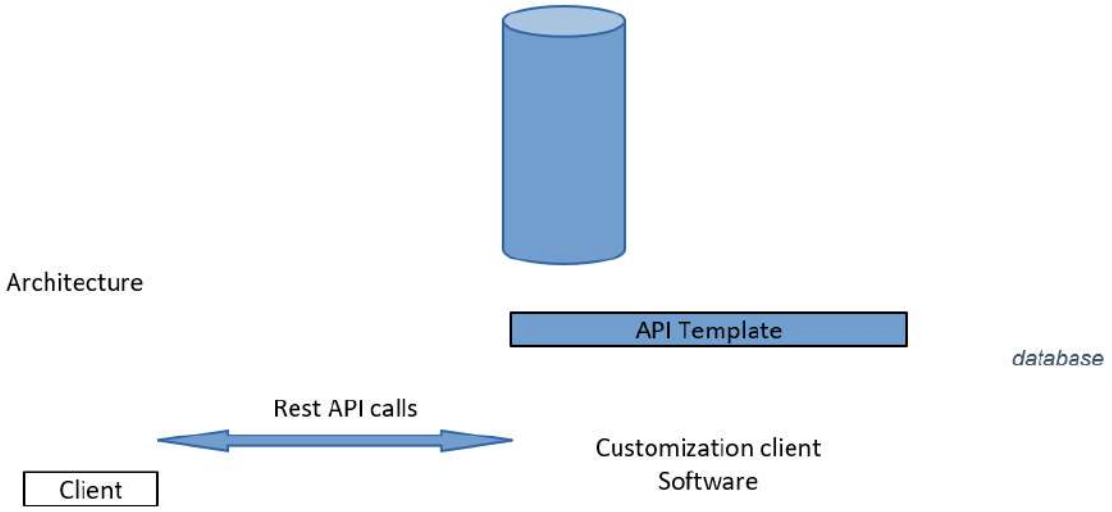

Figure 28 - Architecture

The API Template (proxy) manages security and authorization and provides database access. Customization client software provides database queries in order to get information from database and object models to hold this information.

The outline of the process is as follows:

- Client make a rest API call to get information,
- API Template endpoint receives rest API call,
- API Template checks for authentication and authorization,
- API Template calls to Custom Client Software,
- Customization client software execute database queries to get information,

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- Customization client software hold information in object models and return object models to API Template,
- API Template serializes objective models in JSON format and return information to Client.

Client Authentication

ITeC will provide to client with a ticket to uniquely identify the client. The Client has to present this ticket in every rest API call. Additional authentication systems may be required for specific client needs.

Rest API

REST (short for Representational State Transfer) is an architectural style defined to help create and organize distributed systems. A RESTfully organized distributed system, will experience improvement in the following aspects:

- *Performance:* The communication style proposed by REST is meant to be efficient and simple, making a more efficient use of the network and enabling higher performance perceived by the users.
- *Scalability:* the simple interaction proposed by REST contributes to this. The stateless communication between server and client guarantees that any request made by the client contains all the information needed (such as credentials for authentication), and that no information needs to be stored.
- *Simplicity of interface:* A simple interface allows for simpler interactions between systems.
- *Modifiability of components:* The distributed nature of the system, and the separation of concerns proposed by REST, allows for components to be modified without affecting the others, thus reducing costs and risks.
- *Portability:* REST can be implemented and consumed by any type of technology.
- *Reliability:* The stateless constraint allows for the easier recovery of a system after failure.
- *Visibility:* Supervising the system becomes easy when all the information required is inside the request.

REST architecture treats every content as a data resource. Resources define what the services provided by the API will be about. Despite the fact that a resource can be represented in different formats, JSON has been widely used as the standard Data Transfer Format. JSON has many advantages over other data formats, such as XML, previously popular in the domain. It is lightweight since most

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of the information it transports belongs to the actual data. Another advantage is that it is easily readable by humans, and it can transport many data types other than strings.

A client-server application is an important constraint of a RESTfull API. A server provides services that a client application will consume. The separation of concerns is thus, one of the main benefits of this architecture, since modifications on one side do not have impact on the other, as long as the services communication interface is not modified. This allows for a separation between backend and frontend code. However, this is not the only situation.

Secure channel: communication between the client SPEEDIER REST API is only possible by SSL (TLS).

REST API calls are made of:

- Headers: authentication token
- url: url to endpoint
- verb: GET
- body: additional parameters if needed.

REST API responses:

asked information is returned in JSON format.

Data Resources

Data resources should provide a unique way to be identified and accessed at any time, and a set of operations that can be performed over them. The HTTP protocol that most REST APIs rely on, provides a set of default actions that a client can perform on the different resources named GET, POST, PUT, DELETE, OPTIONS, and HEAD. Despite this fact, other operations over the resources can be defined, such as filtering, getting a subset of resources based on a set of restrictions. In REST-based APIs, data is exposed by means of endpoints.

Technology requirements

As Customization client software is a piece of API Template client software, it has to be compatible with technology used by API Template, therefore these conditions have to be accomplished:

- Programming language Java.
- Queries build in JPA.
- Objects models with JPA annotations where needed.

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- Technology versions change as time goes by so versions will be specified before client Software is going to be developed.
- Client source code has to be released to ITeC in order to:
  - Review what this code does.
  - Upgrade code in case is needed because technology changes or evolution.

What if I would like to collaborate with SPEEDIER software tool?

- Please contact ITeC (https://en.itec.cat/ +34933093404 Sustainable Department)
- Two collaboration models are possible:
  - ITeC develops code according to collaborator requirements.
  - Client develops code according collaborator requirements and ITeC technology requirements.

In both models, REST API definition will be done when collaborator requirements are released to ITeC.

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Annex

Annex 1 Acronyms and Definitions

API:	Application Programming Interface
CEM:	Certified Energy Manager
EMC:	Energy Conservation Measures.
HVAC:	Heating, Ventilation and Air Conditioning
HTTP:	Hypertext Transfer Protocol
JPA:	Java Persistence API
JSON:	JavaScript Object Notation
SME:	Small to Medium Sized Enterprises.
SSL:	Secure Socket Layer
TSL:	Transport Layer Security

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Annex 2 Terms of Use for Users of SPEEDIER Tool Using BEDEC

Version 1.0 - Valid at the 21st October 2021

Preamble

WHEREAS, **SPEEDIER** has implemented **BEDEC** in its SPEEDIER **Tool**

WHEREAS, **ITeC** licenses the use of BEDEC directly to the user of the Speedier Tool.

Definitions

The following defined terms capitalised and printed in bold letters shall have the same meaning in singular as well as in plural as well as their abbreviations

SPEEDIER, further in this document **S,** means the legal entity or organisation that has developed the **SPEEDIER TOOL**, further in this document **ST.**

Terms of use, further in this document **ToU,** means the terms of use stipulated in this document.

ST means the software application provided to **SPEEDIER TOOL USER,** further in this document **STU,** by **ITeC**.

STU means (end-) user of **ST** and licensee of **BEDEC.**

ESCS means results of de **Energy Savings for Constructive Solutions**.

Scope

1. These **ToU** supplement and apply to the contractual relationship between **S** and **STU,** in which **ITeC** licenses **BEDEC** to **STU.**

Intellectual Property and other Rights

1.**BEDEC** is solely owned by **ITeC**. **BEDEC** is only licensed, not sold.

2. **BEDEC** is protected by national and international laws, such as copyright laws, database rights and/or treaties. **ITeC** reserves all intellectual property rights in and to **BEDEC**. The **STU** is granted a right to use **BEDEC** as set forth herein or in the license of use contracted between the user and **IteC**

3. Subject to 0, **ITeC** grants **STU** (by user license) a non-exclusive, non-transferable, limited, revocable, and royalty-bearing right during the Term to use **BEDEC**, contractually established between the parties privately, for creating an unlimited number of internal or external, commercial or academic studies and reports

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Restrictions on Use

1. This rights granted in §3 do *not* include the right of **STU**, among others to

- use, copy, adapt, change, translate, modify, sub-license, sell or distribute all or any portion of **BEDEC** other than expressly licensed under these **ToU** or otherwise expressly required by mandatory law;
- reproduce, disseminate or publicly display **BEDEC**, or any portion or derivation thereof, other than granted in 0 (2);
- grant to any third party any rights regarding the **BEDEC** (e.g. sub-licensing right);
- publish or make available to others derivative databases or datasets or database-like products using all or any portion of **BEDEC** or derivation thereof from the **ST**. This means the creation and publication of **ESCS** databases form commercial purposes, which are only allowed for **STU**, prohibiting their commercialization
- prepare extracts of the **BEDEC**, or any portion or derivation thereof;
- use the **BEDEC** or any portion or derivation thereof, in any other product or service;
- use the **BEDEC**, or any portion or derivation thereof, to provide any service for third parties except for the studies and reports stipulate in 0 (3); and/or
- use web crawlers or any other types of software or hardware technology to automatically download or index **BEDEC;**
- reverse engineer, decompile and disassemble the **ST;**
- disclose the login details for access to the **ST** to any third party, or to allow third parties to access the **ST;**
- assign the rights under these **ToU** to any third party.

Term and Termination

1. The **STU** may extend his/her right under these **ToU** referring to **BEDEC** by concluding an agreement with **ITeC** for another Term.

2. **ITeC** may terminate the rights granted on **BEDEC** with immediate effect if the **STU** breaches these **ToU**.

3. Upon expiration or termination of the rights granted by **ITeC** over **BEDEC** to the **STU**, the **STU** shall be obliged to delete **BEDEC** or any part of **BEDEC** from his/her hard- and software devices and confirm unsolicited such deletion to **ITeC**.

Prices

1. The license fee for **BEDEC** is subject to the **ITeC**'s price list valid at the time of the order or subject to a written agreement between the parties regarding the price.

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Representations and Warranties

1. **BEDEC** is provided “as is”. It is within the responsibility of **STU** to verify and to assess the validity and integrity of **BEDEC** to its use, and to decide whether or not it fits for the intended use. **STU** uses **BEDEC** at its own risk. **S** disclaims any and all representations and warranties, expressed or implied, of **BEDEC** including, but without limitation, merchantability, fitness for any particular purpose, accuracy, completeness, correctness, infringement of third party intellectual property rights.

Governing Law and Venue

1. These **ToU** are subject exclusively to Spanish law, without regard to the conflict of law principles.

2. Disagreements regarding the interpretation of these **ToU** or other disagreements between the parties, regarding the above-described scope, shall be settled amicably first. In case no amicable settlement is reached, the disputes arising out of, or in connection with, these **ToU** shall be brought exclusively before the competent court of the city of Barcelona.

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ER Model:

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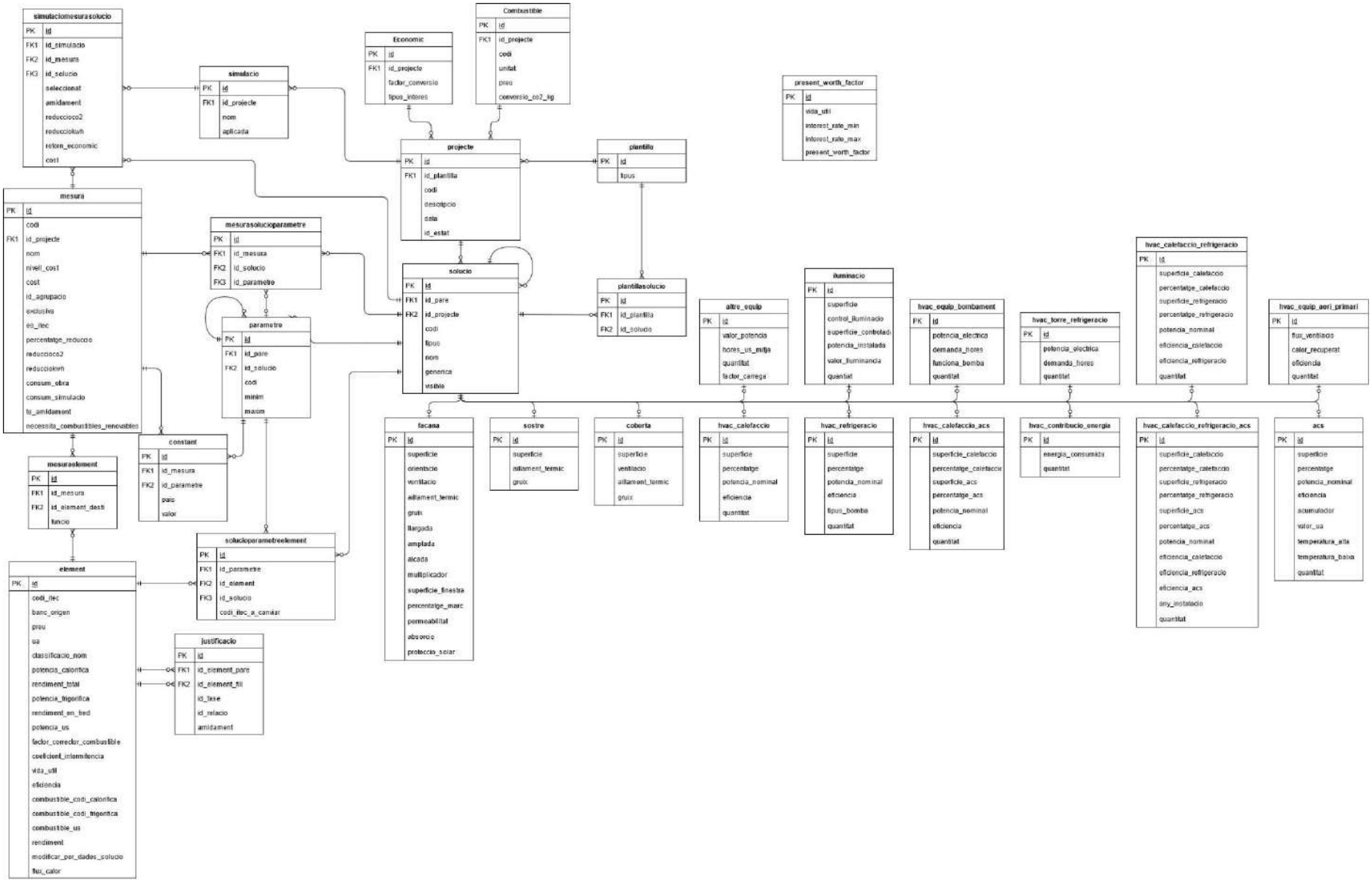

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plantilla

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	NO	Template identifier. is used in resource files to get the palntilla name translated.
tipus			NOT NULL	int2		Template type, ex: 0-Speedier, 1-Building, 2-hydraulic, 3- Hospitals, ...

projecte

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	Project identifier, is a sequence
id_plantilla	FK1	YES	NOT NULL	numeric		Template with which the project was created. Determine the available solutions
codi	UNIQUE	YES	NOT NULL	varchar(50)		code that the user gives to the project
descripcio			NULL	varchar(150)		project description entered by the user
data			NOT NULL	date		date of project creation. Default value current data

solucio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	solution identifier. It's a sequence
id_pare	FK1	YES	NULL	numeric		solution tree, the parent node is null
id_projecte	FK2 DELETE CASCADE, UNIQUE	YES, INDEX1(*), INDEX2(*)	NULL	numeric		solutions with NULL project are solutions that belong to templates. When it is created aproject is snapshot (copied) and assigned to a project
codi	UNIQUE	INDEX1(*), INDEX2(*)	NULL	varchar		solution code, is unique within a project or template. It is used in the resource file to get the nameof the solution.
nom			NULL	varchar		corresponds to the name of the concrete solutions, daughters of the generic solutions.
tipus			NULL	int2		Identifies the type of solutions: 0- Facade, 1- Floor, 2- Roof, 3- HVAC, 4- DHW, 5- Lighting, 6- Other equipment, ,7- Heating, 8- Cooling, 9- Heating and cooling, 10- Heating and DHW, 11- Heating, cooling and DHW, 12- Energy contributions, 13- Primary air equipment, 14- Pumping equipment, 15- Cooling towers
generica			NOT NULL	boolean		It indicates that it is a generic solution from which the concrete solutions hang.Ex: Facade is ageneric solution from which hang all the facades created by the user: north facade, south facade, ...
visible			NOT NULL	boolean		Indicates whether the solution should be displayed or not, in the case of measures that have no solutions then a solution with visible = false was added. By default this field is true

INDEX1(*): Partial index with id_projecte null and codi not null
INDEX2(*): Partial index with id_projecte not null and codi not null

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plantilla_solucio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	relationship identifier, is a sequence
id_plantilla	FK1	YES	NOT NULL	numeric		template that relates to the solution
id_solucio	FK2	YES	NOT NULL	numeric		solution that relates to the template

mesura

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	solution identifier. It's a sequence
codi	UNIQUE	INDEX1(*), INDEX2(*), INDEX3(*)	NULL	varchar		If the measurement is from itec it must have code. If the measurement is from then no
id_projecte	UNIQUE, FK1 DELETE CASCADE	YES,INDEX1(*), INDEX2(*), INDEX3(*)	NULL	numeric		project identifier, if the measurement is of a template its value is NULL
nom	UNIQUE	INDEX3(*)	NULL	varchar		Used only if the measurement is from user. Otherwise it is NULL
nivell_cost			NOT NULL	INT2		Cost level: 0- no cost, 1- low cost, 2- med cost, 3- high cost
cost			NULL	numeric		cost of measurement
reduccioco2			NULL	numeric		CO2 reduction obtained by applying a user measure
reducciokwh			NULL	numeric		reduction in kWh obtained by applying a user measure
consum_obra			NULL	numeric		consumption before applying the user measure
consum_simulacio			NULL	numeric		consumption after applying the user measure
percentatge_reduccio			NULL	numeric		
id_agrupacio			NOT NULL	smallint		
exclusiva			NOT NULL	boolean		true indicates that only this measurement can be selected within the group. false allows you to select this and others
es_itec	UNIQUE	INDEX1(*), INDEX2(*), INDEX3(*)	NOT NULL	boolean		true if the measurement is ITeC, false if the measurement is user
te_amidament			NOT NULL	boolean		false: when the user has to enter themeasurement value, true: if the user has to enter the measurement
necessita_combustibles_renovables			NOT NULL	boolean		true: when it is a measure that requires anotice to fill out the form energy contributions. False in all other cases

INDEX1(*): Partial index es_itec true and codi not null and id_projecte is null. mesasures from itec that belong to a template.
INDEX2(*): Partial index es itec true and codi not null and id_projecte not null. mesasures from itec that belong to a project.
INDEX3(*): Partial index es itec false and codi null and id_projecte not null and nom not null. measures from user, always belong to a project.

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mesura_solucio_parametre

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	relationship identifier, is a sequence
id_mesura	FK1,DELETE CASCADE	YES	NOT NULL	numeric		measure that relates to the solution
id_solucio	FK2,DELETE CASCADE	YES	NOT NULL	numeric		solution that relates to the measure
id_parametre	FK3,DELETE CASCADE	YES	NULL	numeric		parameter that relates to the measurement

simulacio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	simulation identifier, is a sequence
id_projecte	FK1, DELETE CASCADE,UNIQUE	YES, INDEX1	NOT NULL	numeric		project to which the simulation belongs
nom	UNIQUE	INDEX1	NOT NULL	varchar		name that the user gives to the simulation
aplicada			NOT NULL	boolean		It is true when it corresponds to the simulation applied and false for the rest ofthe cases

simulacio_mesura_solucio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	relationship identifier, is a sequence
id_simulacio	FK1, DELETE CASCADE, UNIQUE	YES, INDEX1	NOT NULL	numeric		simulation that relates to measurement and solution
id_mesura	FK2, UNIQUE	YES, INDEX1	NOT NULL	numeric		measure that relates to the simulation and solution
id_solucio	FK3, DELETE CASCADE, UNIQUE	YES, INDEX1	NOT NULL	numeric		solution that relates measurement and simulation
seleccionat			NOT NULL	boolean		true the user has selected the measurement
amidament			NULL	numeric		number of units entered by the user for this measure
reduccioco2			NULL	numeric		CO2 reduction obtained by applying this measure
reducciokwh			NULL	numeric		reduction of kWh obtained by applying this measure
retorn_economic			NULL	numeric		economic return obtained by applying the measure
cost			NULL	numeric		cost of applying the measure

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facana

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table. Ex: When theuser creates a facade, a hanging log is first created in the solution table of thegeneric facade. Then in the facade table the record is created with the data of of the user and with identifier the same as that of the solution table. Relationship 1-1
superficie				numeric		Facade surface
orientacio				int2		0-N, 1-S, 2-E, 3-W, 4-NE, 5-NW, 6-SE, 7-SW
ventilacio				int2		0-Non ventilated, 1-lightly ventilated, 2-Ventilated
aillament_termic				int2		0-No, 1- Yes
gruix				numeric		Thickness
llargada				numeric		Length
amplada				numeric		Width
alcada				numeric		Height
multiplicador				numeric		Multiplier
superficie_finestra				numeric		Window surface
percentatge_marc				numeric		Percentage frame window
permeabilitat				numeric		Permeabilty
absorcio				numeric		Absorcion
proteccio_solar				numeric		Solar protection

PK(*) relation 1-1 between primary keys. it's declare as primary key references solution.
ex: https://dba.stackexchange.com/questions/253429/when-the-primary-key-is-also-the-foreign-key-in-postgres

sostre

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie				numeric		Surface
aillament_termic				int2		0-No, 1-Yes
gruix				numeric		Thickness

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coberta

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie				numeric		Surface
ventilacio				int2		0-Non ventilated, 1-lightly ventilated, 2-Ventilated
aillament_termic				int2		0-No, 1-Yes
gruix				numeric		Thickness

altre_equip

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
valor_potencia				numeric		Power
hores_us_mitja				numeric		Use hours
quantitat				numeric		Quantity
factor_carrega				numeric		Load factor

hvac_calefaccio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie				numeric		Surface
percentatge				numeric		Percentage
potencia_nominal				numeric		Nominal power
eficiencia				numeric		Efficiency
quantitat				numeric		Quantity

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hvac_refrigeracio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie				numeric		Surface
percentatge				numeric		Percentage
potencia_nominal				numeric		Nominal power
eficiencia				numeric		Efficiency
tipus_bomba				int2		Pump type
quantitat				numeric		Quantity

hvac_torre_refrigeracio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
potencia_electrica				numeric		Electric power
demanda_hores				numeric		Demand hours
quantitat				numeric		Quantity

iluminacio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie				numeric		Surface
control_iluminacio				int2		0-No, 1-Yes
superficie_controlada				numeric		Controled surface
potencia_instalada				numeric		Installed power
valor_lluminancia				numeric		Illuminance
quantitat				numeric		Quantity

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acs

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie				numeric		Surface
percentatge				numeric		Percentage
potencia_nominal				numeric		Nominal power
eficiencia				numeric		Efficiency
acumulador				int2		Acomulator
valor_ua				numeric		Unit
temperatura_alta				numeric		High temperature
temperatura_baixa				numeric		Low temperature
quantitat				numeric		Quantity

hvac_calefaccio_acs

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie_calefaccio				numeric		Heating surface
percentatge_calefaccio				numeric		Heating percentage
superficie_acs				numeric		DHW surface
percentatge_acs				numeric		DHW percentage
potencia_nominal				numeric		Nominal power
eficiencia				numeric		Efficiency
quantitat				numeric		Quantity

hvac_calefaccio_refrigeracio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie_calefaccio				numeric		Heating surface
percentatge_calefaccio				numeric		Heating percentage
superficie_refrigeracio				numeric		Cooling surface
percentatge_refrigeracio				numeric		Cooling percentage
potencia_nominal				numeric		Nominal power
eficiencia_calefaccio				numeric		Heating efficiency
eficiencia_refrigeracio				numeric		Cooling efficiency
quantitat				numeric		Quantity

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hvac_calefaccio_refrigeracio_acs

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
superficie_calefaccio				numeric		Heating surface
percentatge_calefaccio				numeric		Heating percentage
superficie_refrigeracio				numeric		Cooling surface
percentatge_refrigeracio				numeric		Cooling percentage
superficie_acs				numeric		DHW surface
percentatge_acs				numeric		DHW percentage
potencia_nominal				numeric		Nominal power
eficiencia_calefaccio				numeric		Heating efficiency
eficiencia_refrigeracio				numeric		Cooling efficiency
eficiencia_acs				numeric		DHW efficiency
any_instalacio				numeric		Installation year
quantitat				numeric		Quantity

hvac_contribucio_energia

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
energia_consumida				numeric		Consumed energy
quantitat				numeric		Quantity

hvac_equip_aeri_primari

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
flux_ventilacio				numeric		Ventilation flow
calor_recuperat				int2		Heating recovered
eficiencia				numeric		Efficiency
quantitat				numeric		Quantity

hvac_equip_bombament

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK(*)	YES	NOT NULL	numeric	NO	This identifier is the same identifier as the solution table.
potencia_electrica				numeric		Power
demanda_hores				numeric		Demand hours
funciona_bomba				int2		Pump on
quantitat				numeric		Quantity

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parametre

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	parameter identifier, is a sequence
id_pare	FK1	YES	NULL	numeric		father parameter identifier, this forms the parameter tree. Root nodes are those that have id_pare null
id_solucio	FK2, DELETE CASCADE, UNIQUE	YES, INDEX1	NOT NULL	numeric		solution to which the parameters apply. It is the identifier to the solution generic (ex:facade) all the daughter solutions of the generic share the same parameters
codi	UNIQUE	INDEX1	NOT NULL	varchar		code that identifies a parameter within a solution
minim			NULL	numeric		Minimum value of the parameter range. If null all values are more smaller than the maximum value
maxim			NULL	numeric		Maximum value of the parameter range. If null all values are more greater than the minimum value

element

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	element identifier, is a sequence
codi_itec	UNIQUE	INDEX1	NOT NULL	varchar		code of an itec element, ex: 15A84567
banc_origen	UNIQUE	INDEX1	NOT NULL	varchar		database which the item belongs, example BEDEC2020
preu			NULL	numeric		Price
ua			NULL	varchar		Unit
classificacio_nom			NULL	numeric		Name classification
potencia_calorifica			NULL	numeric		Heating power
rendiment_total			NULL	numeric		Total efficiency
potencia_frigorifica			NULL	numeric		Cooling power
rendiment_en_fred			NULL	numeric		Cooling efficiency
potencia_us			NULL	numeric		Use power
factor_corrector_combustible			NULL	numeric		Fuel factor corrector
coeficient_intermitencia			NULL	numeric		Intermitance coefficient
vida_util			NULL	int4		Useful life
eficiencia			NULL	numeric		Efficiency
combustible_codi_calorifica			NULL	varchar		Heating fuel
combustible_codi_frigorifica			NULL	varchar		Cooling fuel
combustible_us			NULL	varchar		Use fuel
rendiment			NULL	numeric		Efficiency
modificar_per_dades_solucio			NOT NULL	bool		Data from solutions that has to be modify
flux_calor			NULL	numeric		Heating flow

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solucio_parametre_element

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	element identifier, is a sequence
id_parametre	FK1, DELETE CASCADE	YES	NOT NULL	numeric		parameter identifier
id_element	FK2	YES	NOT NULL	numeric		identifier of the element with which the parameter is related
id_solucio	FK3, DELETE CASCADE	YES	NULL	numeric		If informed, the solution corresponds to the parameter selected within one user-createdsolution. ex: in the north façade we select the concrete parameter blocks. Selecting aparameter to a solution duplicates the parameter relationships element andis assigned solution_id to indicate that the parameter is selected in the solution
codi_itec_a_canviar			NULL	varchar		itec code(ex: B800340A) that if it appears in the justification of the elementid_element has been to bereplaced by another element associated with another parameter associated withit solution.Ex: On the north façade we select the parameter Concrete blocks (E61BG511) with codeto change INSU0001, in the same solution we select the parameter Thermalinsulation EPS (E7C24124) seeds when generating the work The element INSU0001 which appears in the justification of E61BG11will be changed to E7C24124

mesura_element

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	element identifier, is a sequence
id_mesura	FK1, DELETE CASCADE	YES	NOT NULL	numeric		identifier of the measure associated with the element
funcio		YES	NOT NULL	smallint		Type offunction to be applied to related items. The function can be: 0 - replace, 1- add, 2- without functionality
id_element_desti	FK2	YES	NOT NULL	numeric		Element that will replace the elements related to the parameters related to the measure

justificacio

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	identifier of justification, is a sequence
id_element_pare	FK1, UNIQUE	YES,INDEX1	NOT NULL	numeric		Father element identifier
id_element_fill	FK2, UNIQUE	YES,INDEX1	NOT NULL	numeric		Son element identifier
id_fase	UNIQUE	INDEX1	NULL	varchar		Phase identifier
id_relacio	UNIQUE	INDEX1	NULL	int2		Relationship identifier
amidament			NULL	numeric		Measurement

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constant

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	identifier of the constant, is a sequence
id_mesura	FK1,DELETE CASCADE	YES	NOT NULL	numeric		constant measure identifier
id_parametre	FK2,DELETE CASCADE	YES	NULL	numeric		conditional parameter identifier
pais			NULL	varchar		conditional country name
valor			NULL	numeric		constant value

combustible

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	fuel identifier, is a sequence
id_projecte	FK1,DELETE CASCADE, UNIQUE	YES,INDEX1	NOT NULL	numeric		Project identifier
codi	UNIQUE	INDEX1	NOT NULL	varchar		Code
unitat			NULL	varchar		Unit
preu			NULL	numeric		Price
conversio_co2_kg			NULL	numeric		Kg CO2 conversion

economic

Field	Constraint	Index	Nullable	Type	Sequence	Description
id	PK	YES	NOT NULL	numeric	YES	economic identifier, is a sequence
id_projecte	FK1,DELETE CASCADE, UNIQUE	YES	NOT NULL	numeric		Project identifier
factor_conversio			NULL	numeric		Conversion factor
tipus_interes			NULL	numeric		Rate interest

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