POLITECNICO DI MILANO

School of Architecture Urban Planning Construction Engineering

Industrial and Information Engineering

Master's degree in

Management of the Built Environment

GREEN BIM – A LEAN APPROACH TO SUSTAINABILITY ASSESSMENT

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ABSTRACT

With the Europe 2020 strategy is required a new way of living, focused on the concept of sustainability and buildings are strictly connected with this value. However, the current situation in Europe is almost confused both in terms of built environment and in term of energy certifications accreditation.
As a matter of facts, the European built environment is very heterogeneous and generally speaking old (38% of buildings were built before the 1960 and 45% between the 1961 and the 1990), for that reason is necessary a system that allows a quick and effective environmental assessment.
Today exist lots of different rating systems, (LEED and BREEAM are the most widespread), but with the increasing of the project's complexity (due to technological developments, market demand and user's needs) and the use of several criteria and parameters for each system, it is even difficult making comparisons and evaluations among buildings.
In the last few years it is rising the CESBA protocol with the aim to harmonize most of the aforementioned criteria and parameters in order to ensure the effectiveness of certification labels.
The aim of this thesis is to use a streamline method to check CESBA requirements through COBIe (Construction to Operations Building Information exchange) on an existing building adopting a light BIM approach (avoiding the 3D model construction).
In this way, it will be created a data-base CESBA based, to do so it will be necessary define the BIM objects' attribute using information coming from the building, the user's needs and from CESBA requirements, to fulfill a considerable number of COBIe criteria attribute (about 85% of CESBA criteria will be translate in COBIe).
The created data base is useful not only for the automatic sustainability rating of the actual state of the building, but also for future maintenance interventions and not only for one specific case but for other buildings with the same function, because it is used a standardized procedure. Moreover, the use of a lean approach simplifies the decision-making phase, reduces design time and increase the flexibility in planning because allows a free choice of software, decreasing the plugin implementation.
The previous methodology will be illustrated through the case study of a sporting club located in the north of Italy, precisely in Gallarate in province of Varese.
This study could be used as an exemplification of the use of COBIe for a leaner approach to the project, and could be exported from the "green universe" to other field of application for example the facility world.

INTRODUCTION

In order to face the crisis that is affecting the Europe and the world, the European Union is called to respond with the feeling of responsibility about the future generation, looking out for the way we live today, because it generates the tomorrow inheritance.

With that prospective the European Union approved a new strategy of development called “Europe 2020” that has the aim of creating a new way of growth based on the sustainability, intended both as environmental, economic and social.

In particular, the objective of the thesis is to focus on the building sustainability and how to measure it through the environmental assessment, that discipline provides not only tools and methods for the evaluation of the life cycle of the building itself, but also the estimation of possible impacts of the construction on the surrounding. After a brief explanation of some protocols that are already used for the environmental assessment of the buildings (i.e. LEED and BREEAM) it is considered necessary to go deeper with the description of the CESBA tool, which, shortly, is a common initiative that promote the harmonization of sustainable building assessments for public buildings throughout Europe.

One of the principles of CESBA is the cooperation and the communication among all the participants, and it reflects the theory that lies at the basis of the BIM (Building Information Modeling), using the Green BIM, that is the application of BIM methodologies for the sustainable design of buildings, the aim of this thesis is to try to translate information coming from CESBA in a software-readable language, as it already happens for the technological information with the IFC, and make them exchangeable with the COBIe international standards.

In this way, it could be created an automated and standardized asset management tool, able to be applied on different cases, also it could be easily stored, because of the thematic reporting of the data. All these aspects are finally fundamental for the decision maker that, in this case can use a Decision Support System (DSS), to facilitate the best choice among a large amount of data.

With that prospective and with the help of a practical example, it would be finally interesting observe if it would be possible the use of a light BIM approach (without the creation of the 3D model) at the preliminary stage, with not only the savage of a lot of time and the stream-lining of the decision-making phase, but also with an increase in the standardization of the interoperability protocols and an improvement of the flexibility of projects with the usage of the favorite software that decrease the plugins implementations. All this work flow is summarized in the following conceptual map:

LOADING PLEASE WAIT...

Europe 2020 Strategy

- Smart growth
- Inclusive growth
- Sustainable growth

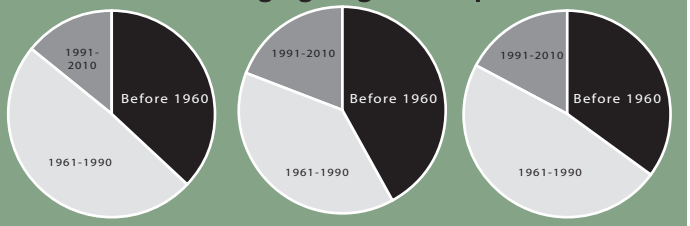
- -20% Greenhouse gas emissions
- +20% Consumption of renewable energy
- +20% Energy efficiency

Rating Systems

LEED
BREEAM
...

harmonization

Building ageing in Europe



Technological developents
Clients demand
User's needs

→ TOO COMPLEX

Lots of rating Systems with different criteria and parameters produce difficoulties in making comparison

Internet of things approach → BIM Building Information Modelling

Computational instrument in service lyfe assessment

- ✓ Results in the early stages of design stages;
- ✓ Single source of all the project info before its physical implementation;
- ✓ Geometrical, time scheduled, costs, energy, sustainability, facilities and management info;
- ✓ Green requirements' automatic evaluations(greenBIM);
- ✓ Exchange a huge amount of data.

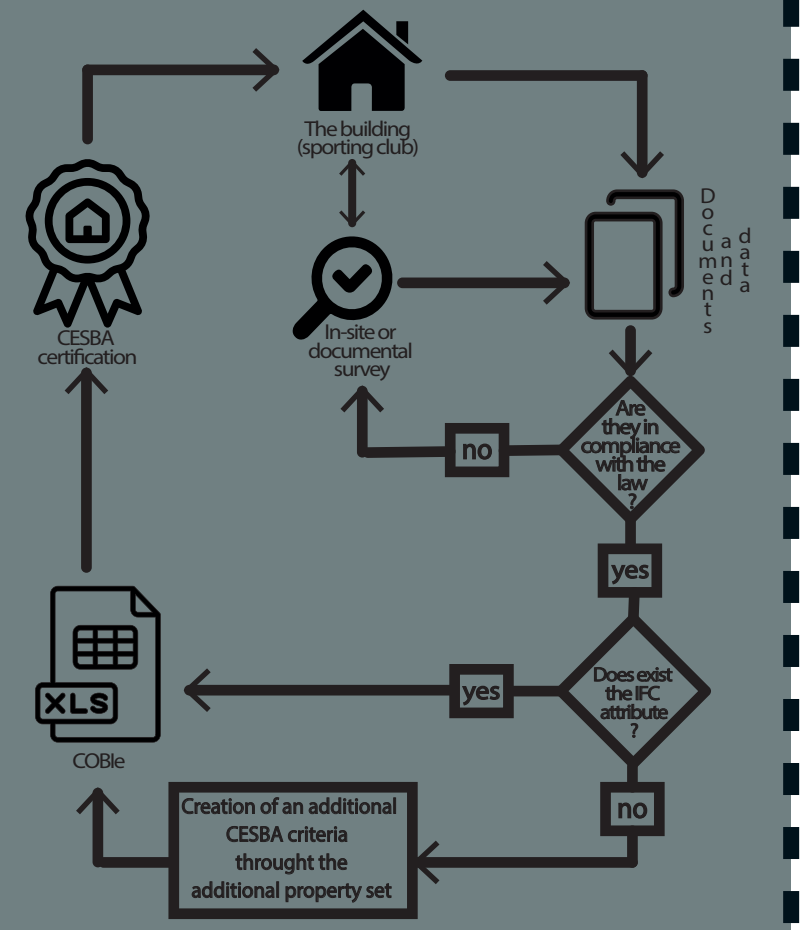
DATA-BASE
- Flexible
- Machine readable (not necessary based on 3D model)

Automatic toll

CESBA

OBJECTIVE

Streamline method to check CESBA requirements through COBIe (Construction to Operations Building Information exchange) on an existing building adopting a light BIM approach (avoiding the 3D model construction).



METHOD

LIGHT BIM PROCEDURE
- Information content
- Geometric info

COBIe
Standard exchange protocol

MVD

IFC
Most advanced non-proprietary data exchange format for the building sector

PRO

- ✓ Ease the approach to existing buildings evaluation and refurbishment due to the creation of a dictionary and ontologies connecting existing info from database to COBIe data models because 3D model or cloud points are not needed, it is posible organize info in a semantic structure, easily enriched overtime and connected with needs and targets, easily transferable in a 3D model
- ✓ Lean approach to building rating with the creation of sustainability reporting and the improvement of the asset management decision making during the whole lificycle

CONS

- X Some CESBA's criterion cannot be mapped (it is necessary the creation of new IFC property sets to be more effective in the computation of the final score of the rating protocol)
- X Not all the criterion's parameters can be directly matched through IFC (it would be possible through mathematical computation and further effort to achieve a proper level of automation)

1. STATE OF THE ART

The feeling of responsibility through the future generation should reflect the way we live today and how we use resources. With the strategy Europe 2020 European Union try both to mitigate the actual crisis that we are living in, and to ensure a more sustainable future for the generations. The real challenge is to do so using in a new way the tolls that we already have with the concept of "optimization" in mind.

1.1 EUROPE 2020 Strategy

During the early year of the financial and economic crisis, in 2010, the European Union politicians felt the responsibility to face the unpleasant situation, the objective is to see the difficulties as resources. As Einstein said:

"The crisis is the greatest blessing for people and Nations, because the crisis brings progress. Creativity is born from anguish as the day is born from the dark night. It's in the crisis that comes up with inventiveness, discoveries, and great strategies."[1]

It is with that prospective that is considered the concept of "sustainable future" with the strategy Europe 2020: offering to the society a new development direction based on the workforce, technologies and industries, on the internal market, on the single currency and on the tested social market economy.

The European commission suggest five measurable objectives for the 2020, that will guide the process and will be translate in National target.

Those aims will deal with occupation, innovation and research, the climate changing and energy, instruction and the fight against poverty. In the following paragraphs will be described in detail the strategy.

1.1.1 Aims & Priorities

The European Union with the project Europe 2020 wants to decide what will be the profile of the Europe from 2020 and with which structure will keep facing the XXI sec. with that purpose the commission suggests the following aims for the EU[2]:

- ☆ 75% of the 20-64 year-old should be employed;
- ☆ 3% of the EU's GDP to be invested in R&D;

[1] (Einstein, A. (1934). *The World as I See It.* (A. Harris, Trans.) New York: Covici-Friede)

[2] (Commission E. , Setting the medium-term policy horizon: results from the Europe 2020 public consultation and publication of the integrated economic and employment guidelines, 2015)

- ☆ greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990, 20% of energy from renewables, 20% increase in energy efficiency;
- ☆ reducing the rates of early school leaving below 10%, at least 40% of 30-34–year-olds completing third level education
- ☆ at least 20 million fewer people in or at risk of poverty and social exclusion.

The commission suggest that these aims will be included as national objectives of each European member state, in order to reach the threshold commonly among all the European states.

To reach the set goals, is necessary establish macro-categories of priorities in which it would be easier to operate and act[3].

The strategy "Europe 2020" tries to transform European Union in a clever economy, sustainable and inclusive characterized by elevated level of occupation, productivity and social cohesion. The strategy provides tree priorities that strengthen each other:

- **Smart growth**: developing an innovation and knowledge-based economy: improving the quality of education, enhancing research in Europe, promoting innovation and knowledge transfer throughout the Union, optimally using the information and communication technologies and make that innovative ideas became new products and services that stimulate growth, create quality jobs, and help address the challenges of European and global society
- **Inclusive growth**: promoting a high employment economy that fosters social and territorial cohesion. Inclusive growth means increasing people's participation through high levels of employment, investing in skills, fighting poverty and modernizing labour markets, training methods and social protection systems to help citizens prepare for change and manage and build a cohesive society. It is equally important that the benefits of economic growth extend to all parts of the Union, including the outermost regions, in order to strengthen territorial cohesion. The goal is to provide everyone access and opportunity throughout their lives. Europe needs to take full advantage from its workforce's potential to face the aging of the population and the increase in global competition. It will be needed also gender equality policies to be increased in order to increase participation in the labour market so as to foster growth and social cohesion.
- **Sustainable growth**: promoting a more efficient economy considering the resources profile, greener and more competitive. Sustainable growth means use the guide-role of the Europe to develop new processes and technologies, also green technologies, use the European network and

[3] (European Commission, EUROPE 2020: A European strategy for smart, sustainable and inclusive growth, 2010)

consequently increase advantages for the industries, give assistance to the customers in order to assess the resources efficiency.

In this way, it would be created a low CO2 emission perspective with constrained resources, avoiding, at the same time, environmental degradation, the loss of biodiversity, making stronger the economic, social and territorial cohesion. Acting in that direction means maximizing benefits coming from the pollution reduction and decreasing cost through the diffusion of innovative technological solutions.

Another key point for a sustainable growth is to split the growth and use of energy, in order to reduce the external row materials and base-products dependence.

1.1.2 Sustainable growth for "Europe 2020"

For the objective of the thesis the main aspect of the "Europe 2020" is the sustainable growth, moreover it has a key role the "2020climate & energy package" that establish an important deadline for the 2020: decrease of the 20% (with respect of the 1990 levels) the Co2 emissions and an increase of 20% of the renewable energy. With this deadline, Europe establish its will of develop a living culture even more oriented through the energy savings, because of the 42% of the energy consumption is represented by the residential and industrial buildings thermic management.

Specifically, the 68% consumption of the residential building is due to heating and ventilation system, the 11% is due to sanitary hot water consumption and the 6% is due to electricity.

In particular, the package sets three key targets[4]:

- ☆ 20**%** cut in **greenhouse gas** emissions (from 1990 levels);
- ☆ 20% of EU energy from **renewables;**
- ☆ 20% improvement in **energy efficiency.**

The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also headline targets of the "Europe 2020 strategy" for smart, sustainable and inclusive growth.

The EU is acting in several areas to meet the targets.

This covers the **following sectors, which** accounting for some **55% of total EU emissions**:

- housing;
- agriculture;
- waste;
- transports (excluding aviation).

[4] (Commission E. , Integrated guidelines for the economic and employment policies of the Member States, 2010)

EU countries have taken on binding annual targets until 2020 for cutting emissions in these sectors (compared to 2005), under the "Effort-sharing decision".

The targets differ according to national wealth – from a 20% cut for the richest countries to a maximum 20% increase for the least wealthy (although they were still projected to have to make efforts to limit emissions).

Progress is monitored by the Commission every year, with each country required to report its emissions.

The EU supports the development of low carbon technologies for example through the:

- **NER300** program for renewable energy technologies and carbon capture & storage[5];
- **Horizon 2020** funding for research & innovation[6].

However, the European built environment is so differentiated: at the same moment, we find new constructions that easily respond to the energy requirements and are also easy to monitor, beside them it's possible to find the opposite scenario: old buildings with the lowest energy class.

For that reason, it would be difficult to fulfill the European requirements without a new way of thinking. It is necessary find a new method to use tools that already exist, in order to optimize resources (intended as money and consequently time) and achieve objectives.

At the same time, it would be useful a method that with the assessment of the building allows properties in making strategic decisions considering the management of the construction during its entire life cycle, energy consumption and environmental impacts.

1.2 THE HISTORY OF GREEN

In 1995 architects were starting to use terms like "green" and "environmentally friendly" to describe their projects and project approaches. Dialogues, experiences, and marketplace transitions have allowed the people not only in the profession of architecture but also other professions involved in the design, construction, and operation of the built environment to acquire a better understanding of what green means.

Today when we "think-green" we are thinking in terms of sustainability.

The sustainable-thinking cold be considered as a long-standing mindset: if we look at the buildings from the past cultures, we can see that they were highly skilled at adapting the location and materials of their structures to climate and place.

[5] (NER300, T. E. (2011). *Programmeuropa.eu.* Retrieved from europa.eu: https://ec.europa.eu/clima/sites/clima/files/docs/)
[6] (Union, HORIZON 2020The EU Framework Programme for Research and Innovation, 2012)

Over time buildings assumed different functions: civic structure and time for play and leisure developed buildings of cultural and political significance. Humankind was no longer building for survival alone and therefore fight against climate agents.

While technological skills continued to develop, the building industry moved away from design that was specific to climate, culture, and place in favour of a standardization that could be suitable for all situations. As a matter of facts, the built environment in which we are living use building codes in order to ensure warranties both for clients and constructors. Most of our heating and cooling is mechanical, most of our lighting is artificial, and we get our building materials from anywhere in the world.[7]

The first time in history that officially appeared the concept of ecological awareness was in 1962 whit the assay of the biologist Rachel Carson "Silent Spring", in which she denounced the environmental damages caused by the use and the abuse of chemical insecticides, by deforestation and by the uncontrolled human action on the environment[8]. With her book, which is considered the manifesto of the ambientalism, Rachel Carson created a political movement joint by the ecologists of all over the world. It is thanks to her dedition and intense research activity if the ecological sensibility could spread among the population.

The EPA (Environmental Protection Agency) was also founded in 1970 by then-President Richard Nixon with the intent to protect human and environment health[9].

However, after the oil embargo and the Arab-Israeli and Vietnam wars ended in the middle part of the 1970s, the path of the ecological path stopped lying in that condition until the early 1990s.

It was at the beginning of the 1990s that the American Institute of Architects (AIA), the Committee on the Environment (COTE) and the U.S. Green Building Council (USGBC[10]) were founded, so the attention goes back on the topic that were faced for the first time thirty years before.

Nowadays if you told someone that you were designing a green building most of the people knows what are you talking about, or at least, they have the idea that a green building concerns less impact on the natural environment than the traditional buildings.

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[7] (Bradley, E. K. (2008). Successful Sustainable Design with Building Information Modeling. Indianapolis: Wiley Publishing, inc.

[8] (Carson, R. L. (1962). Silent Spring. Boston: Houghton Mifflin.)

[9] (EPA Agency: United States Environmental Protection. (2017). *U.S. Environmental Protection Agency*. Retrieved from epa.gov: https://www.epa.gov/)

[10] (Green Building Council. (2015). About USGBC. Retrieved from usgbc.org:https://new.usgbc.org/about)

1.2.1 Sustainability

For the industrial and building sector it is more precise using the term sustainable instead of green, because it makes you immediately conscious about what aspect of green is meant.
Sustainability considers a greater array of impacts than just those that burden the natural environment.
One definition of sustainability was provided by the World Commission on the Environment and Development, also known as the Brundtland Commission, in 1987 in the report addressed to the United Nations:

"Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs[11]."

From the definition, it is easily to understand that sustainability is not a simple and sectorial concept, it implies all the aspects of everyday-life. Sustainability could be considered as a state of mind, and, as such, needs a slow but deep change in every aspect of its development. It is possible to represent sustainability as the intersection among three main classes[12]:

- **environmental sustainability**: build, upkeep and manage estates with efficient use of natural resources and minimize the impact on environment;
- **social sustainability**: social cohesion, safe and healthy environment;
- **economic sustainability**: economic investments have to be faced in order to optimize the existing stock and to extend as possible the service life through Total Maintenance Scheme. It is also fundamental matching the effective requirements of the final user of the building.

1.2.2 Sustainable buildings

The building sector is one of the most resource consuming sectors. Looking at the whole life cycle of a building, from the extraction of materials, the manufacturing of construction products, construction, use and maintenance, buildings amount for about:

- 1/2 of extracted materials;
- 1/2 of energy consumption;
- 1/3 of water consumption;
- 1/3 of waste generated[13].

[11] (Bruntland Commission. (1987). Our Common Future. Oxford University Press.)
[12] (Bradley, E. K. (2008). Successful Sustainable Design with Building Information Modeling. Indianapolis: Wiley Publishing, inc)
[13] (Bing Dong, Z. O. (2014). A BIM-enabled information infrastructure for building energy Fault. Automation in construction, 15.)

In 2014, the European Commission adopted the Communication "Resource efficiency opportunities in the building sector" based on an Impact assessment roadmap. The general objective of this initiative is to reduce the environmental impact of buildings by improving the overall resource efficiency and, as a consequence, to improve the related competitiveness of construction businesses.
The idea is thus to: raise awareness of and demand for better environmental performing buildings, among private consumers, developers and public purchasers[14];
Generally speaking, a green building of the early 1990s might have contained some materials with some recycled content, a building of today that is approaching sustainability will consider the whole lifecycle of the product: designers, contractors, and owners consider raw material extraction, manufacture location and processes, durability, reuse, and ability of the material to be recycled.
The today's approach consists in improving knowledge and information regarding resource use and related environmental impacts in relation to buildings in order to support decision making among designers, architects, developers, construction companies, construction product manufacturers, investors, consumers, etc.
Organisation for Economic Co-operation and Development (OECD) has identifies five objectives for a sustainable building:

- **resource efficiency**;
- **energy efficiency** (including greenhouse, gas emissions reduction);
- **pollution prevention** (including indoor air quality and noise abatement);
- **harmonization with environment** (including environmental assessment);
- **integrated and systemic approaches** (including environmental management system)[15].

These five characteristics clarify the concept of sustainable building, showing in practical terms which aspects are involved in the design of a sustainable buildings. As already described, with the OECD Project is confirmed the idea of sustainability intended as an interconnection of numerous variables that involved not only the whole life cycle of the building but also the context in which it is located, the social aspect of the site and the impact that the construction of the building, and the building itself, has on the entire surroundings.

[14] (Commission E. , Communication from the Commission to the European Parliament, the Council, the European Economic and social committee nd the Committee of the Regions on Resource Efficiency Opportunities in the Building sector, 2014)
[15] (OECD. (2002). Design ofsustainable building policies. Retrieved from University of East Anglia: http://www.uea.ac.uk/env/)

1.2.3 Sustainable design

After the clarification of sustainability and sustainable building, it would be useful, for the final aim of the thesis, clarifying some aspects of sustainable design.

It was said that sustainability is a sort of evolution that affect all the aspects of the world life style, this is due to the rapid climate changes and the even more consciousness of people about the importance of resources optimization and reduction of waste. As the population is changing minds, also for designers and constructors that developing sustainable solutions is required an expansion of traditional thinking in order to better respond to the increasing demand of sustainability.

The fact is more complex than a simple answer to an increasing in the demand of some good.

It is because sustainability is such an all-encompassing topic that it is important to avoid the risk of settling a trend of the moment, but it is important to consider the development of the final product as a large-scale project that is performing over time, which can be integrated, and that always respects the balance of our delicate ecosystem, that has already been weakened abundantly.

It is necessary to include more input parameters and consider a longer period while making decisions during the design process. Krygiel suggested a scheme to follow for a conscious sustainable design:

- **understanding climate, culture, and place**: An example of a non-understood climate is the choice of putting the same glass tower in two cities with different climate conditions: Milan and Naples, whatever energy is necessary to keep the occupants comfortable with a mechanical system. Probably with a deeper analysis about climate condition makes arise different solutions. The local culture, it was also influenced by the climate, as a matter of facts it influenced the consumption of local resources (equilibrium between flora and fauna) and the development of different construction techniques., it is also useful understand how people feel the concept of community and how they use spaces, in order to respond to the local need and requirements.

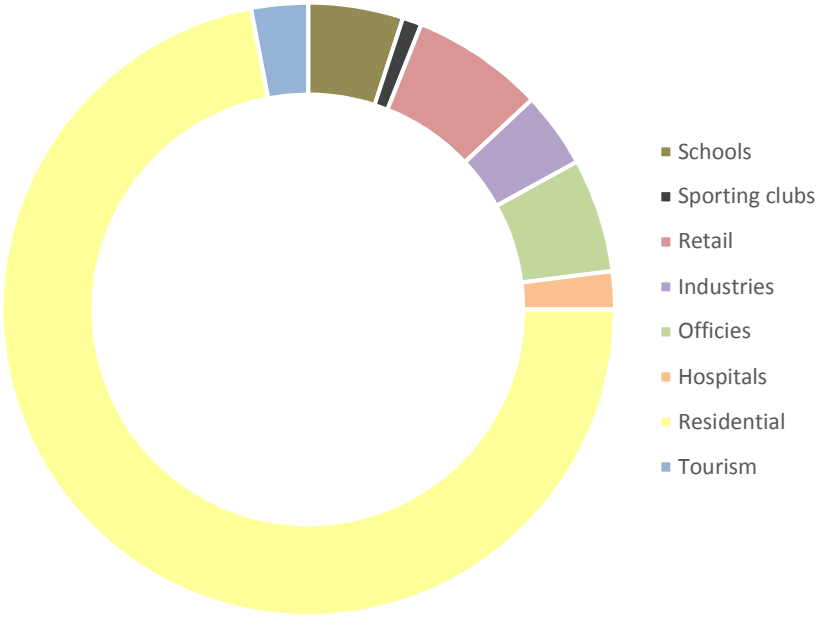
  Knowledges about climate help also in the localization of the project, basing on the solar exposure, optimizing energy consumptions, without forget factors connected to rain wind and possibility of natural disasters;

- **understanding the building type**: one it is figured out the type of construction (a house, a school, an hospital or an office) it is fundamental relate its function with the external environmental conditions and find solutions about how the building can optimize, looking if it is possible reducing waste of resources;

- **reducing the resource consumption need**: "the greenest building is the one that is not already built", in other terms it is advisable to construct only if it is necessary, in order to avoid consumption of land (space, impact on flora and fauna), materials and energy. However, in the case the construction would be necessary, at that point is important to adopt all the measure in order to avoid waste;
- **using free/local resources and natural systems**: energy can be reduced through material selections. By selecting products from the region, or using salvaged materials (wind, sun, water, rivers…) that are naturally (and freely) present locally. It is also right to say that they depend and random variables, but today it is possible to predict with a certain precision the trends of the rains or of the temperatures;
- **using efficient manmade systems**: The gaps between what can be acquired naturally and what must be provided by man-made systems will be larger in some regions depending on the building type and climate. However, the gap is smaller than it is felt. If the previous recommendations were followed the step is easily coverable by using mechanical inventions and trick that man has already designed in the past, or some new mechanical solution (Underfloor Air Distribution, solutions for plumbing, electric lighting, …);
- **applying renewable energy generation systems**: Renewable energy is energy from sources other than fossil fuels. As opposed to the finite resources that make up fossil fuels, renewable energy sources are constantly replenished and will never run out (Solar, wind, biomass, hydrogen, geothermal, ocean, hydropower). Each renewable system is not available for every location, however there is the choice);
- **offsetting remaining negative impacts**: all embodied energy can be equated to a carbon dioxide unit equivalent, which can be offset by supporting programs that compensate for reducing emissions. The goal is to achieve a neutral (net zero) result, negating the impact of designing and constructing the facility. It wouldn't hurt to have the owner agree to offset any remaining negative impacts from operations as well[16].

[16] (Bradley, E. K. (2008). Successful Sustainable Design with Building Information Modeling. Indianapolis: Wiley Publishing, inc.)

1.2.4 European building heritage



Graph 1: European Real Estate heritage classification.

European residential and commercial real estate heritage has been estimated to be 233 million buildings. Of these 72% of the total is intended for residential use, 6% for office use, 7% for retail, 5% for school buildings, 3% for hotels and restaurants, and 2% for buildings for health, plus the 4% for industrial use and 1% for sporting use[17] (Graph 1).

In the construction sector, the age of a building is often strongly linked to the level of energy used, especially for the majority of buildings that have not undergone renovation procedures to improve energy performance.

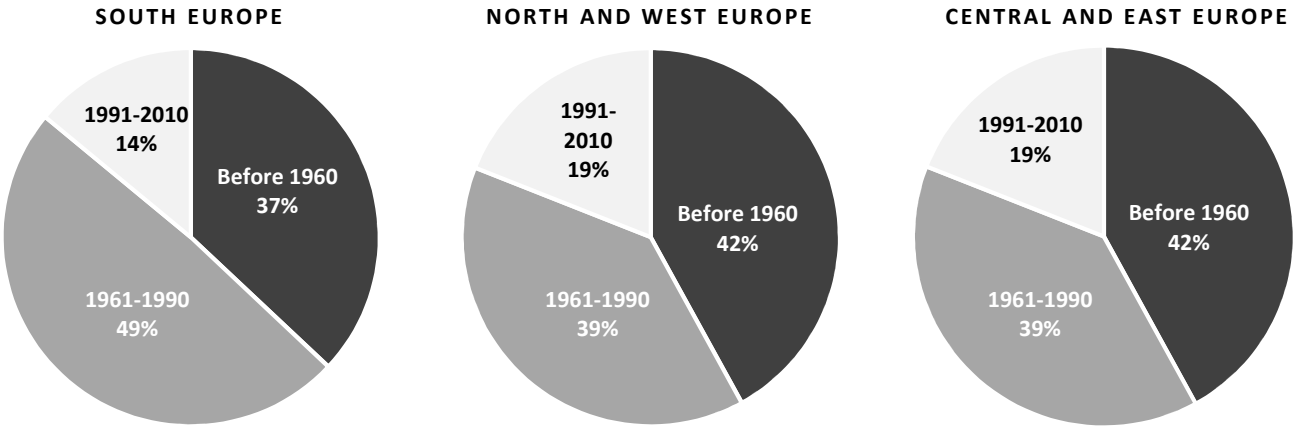
It is possible to say that the actual building heritage was built with performance criteria that do not respond to the current energetic standards, moreover their resilient criteria cannot be considered safe enough to face the latest environmental changes.

The following graph (Graph 2) summarize the chronological classification of buildings in three different classes according to the BPIE (Building Performance Institute Europe) survey[18]:

- Old: typically representing buildings up to 1960;
- Modern: typically representing buildings from 1960 to 1990;

[17] (Green Building Council. (2015). gbcitaly. Retrieved from GBC Italia: www.gbcitalia.org)
[18] (BPIE Building Performance Institution Europe. (n.d.). Retrieved from BPIE.eu: http://bpie.eu/focus-areas/buildings-data-and-tools/)

- Recent: typically representing buildings from 1991 to 2010.



Graph 2 European building stock age

One third of the European residential building stock was built before 1960, and almost 84% of buildings are over 20 years old.

It is commonly accepted that the construction sector is associated to different environmental pressions that comes with the distinct phases of the life cycle of the building: from the creation of the construction materials to the dismission of the edifice.

Therefore, there is a great energy saving potential in upgrading building envelopes and building systems to modern standards[19].

Consumption of resources and environmental impacts throughout a building's lifecycle can be reduced, for example[20]:

- promoting an integrated **design of the building** (or its upgrading) **that calibrates the use of resources** in relation to needs and functionality and considers selective demolition scenarios;
- **better site-planning** in order to ensure greater use of energy and energy-efficient products;
- promoting the manufacture of **more efficient construction products** from the point of view of resources, for example, using recycled materials, reuse existing materials;
- promoting a **more efficient resource-building and refurbishment**, in which building waste is reduced and recycled / reused materials and products;
- improving **the interconnection of the built-up urban scale**, considering the availability of services and promoting sustainable mobility;
- **reducing the water consumption** linked to construction and use of buildings;
- integrating best solutions to **produce electricity/heat from renewable sources**.

[19] (Annie R Pearce, K. K. (2009). Green BIM Approaches to Architectural Design for Increased Sustainability. (p. 9). ResearchGate.)
[20] (Bradley, E. K. (2008). Successful Sustainable Design with Building Information Modeling. Indianapolis: Wiley Publishing, inc.)

But the starting point is the evaluation of the building considering the environmental aspect.

1.3 ENVIRONMENTAL ASSESSMENT

The built environment plays a key role in the society of today, being a result of several social and economic processes for this reason it is decisive how we proceed through sustainable development of buildings. However, today society and its built environment use copious amounts of energy and materials, affecting the health of humans and the natural environment in negative manners. Thus, it is relevant to ask: "How 'green' is our built environment, and how could it be made 'greener' and more sustainable?"

With the rising interest and demand from policy makers to achieve a sustainable society the need for environmentally related information is increasing[21]. There has been an increasing interest in environmental assessments of the built environment and today we can find a considerable number of tools for environmental evaluation of the built environment, focusing on energy use in buildings, the sick building syndrome, indoor climate, building materials containing hazardous substances, and/or many other aspects in fragmented or integrated manners.

The following sections examine the evaluation means and methods behind the LEED, BREEAM, and CESBA protocols, in terms of their ability to promote, assess, and provide innovation for high performance green buildings.

1.3.1 Terminology

In general, it is possible to say that the environmental assessment is related to aspects of particular interest in the current assessment of assets, the principle is based on environmental liabilities: "polluter pays" in other words: who produces pollution has to pay for that. There are many standards that regulates that field such as the American Standard ASTM or the Environmental Code in Italy.

First of all, it is fundamental focus the attention on the terminology used, in order to avoid misunderstandings and errors in the further development of the thesis. The definition of terms connected to the environment are illustrated in the ISO 14001:2004, first published in 1994, after the conference of Rio (1992)[22]:

- **environment**: surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelations;

[21] (Anna Forsberga, Fredrik von Malmborgc. (2004). Tools for environmental assessment of the built environment. Elsevier. Retrieved from Science Direct: www.sciencedirect.com)

[22] (UNI - Ente Nazionale Italiano di Unificazione. (2004, Novrmbre). Environmental Management Systems - Requirements with guidance for use. UNI EN ISO 14001 - 2004.)

- **environmental aspects**: element of an organization's activities or products or services that can interact with the environment;
- **environmental impact**: any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.

Referring to the sustainability, the terminology is well explained in the BS EN 15643-1 "Sustainability of construction works. Assessment of buildings. Framework for the assessment of environmental performance[23]":

- **sustainability**: ability of a system to be maintained for the present and future generations. "System" comprises environmental, social and economic aspects;
- **sustainability assessment of buildings**: combination of the assessments of environmental performance, social performance, and economic performance, considering the technical requirements and functional requirements of a building or an assembled system (part of works), expressed at the building level.

1.3.2 Rating systems

The rating systems are used in the Architecture, Engineering and Constructions sector to promote sustainability through a quality certification of the buildings assessed checking lists of criteria in which points are gained by the compliance with specific parameters, defining the measure of the requirement[24]. Even though the single indicator is regulated by an assessment area it is surely connected with other requirements and consequently more advanced visualization techniques are beneficial to understand and to weight these kinds of unrevealed relationships ad interconnected outcomes.

Several studies carried out by Eu funded research projects (CABEE, CEC5, Enerbuild, IrH-MED, opEnHouSE, SuperBuildings or ViSiBlE) showed that dozens of different building assessment systems have been implemented in Europe at international, national and regional levels[25]. These systems differ in methods, frameworks, physical and temporal boundaries, issues considered, number of criteria, priorities and so on and so forth.

This lack of conformity makes the comparison of results impossible.

[23] (Bharat Stage BS Emission Norms EN. (2011). Sustainability of construction works. Assessment of buildings. Framework for the assessment of environmental performance. BS EN 15643-2:2011.)

[24] (Anna Forsberga, Fredrik von Malmborgc. (2004). Tools for environmental assessment of the built environment. Elsevier. Retrieved from Science Direct: www.sciencedirect.com)

[25] (Markus Berchtold, N. K. (2013). Cesba – a Collective Initiative for a New Culture of Built Environment in Europe. CESBA Guide. Voralberg: CEC5 project.)

LEED and BREEAM are international tools of the first generation (started 10-15 years ago) and their application leads to improve performance by multiple and interdisciplinary point of views (e.g. energy, comfort, environmental, pollution, transport, management, materials).

1.3.2.1 LEED

Figure 1: LEED logo

Leadership in Energy and Environmental Design (LEED) (Figure 1) is one of the most popular green building certification programs, the number are significant (Table 1)[26]:

Projects participating	Certificates	Registered countries
80000	32500	162

Table 1: LEED's numbers

Developed by the non-profit U.S. Green Building Council (USGBC) it includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighborhoods that aims to help building owners and operators be environmentally responsible and use resources efficiently.

In 1994 LEED starts to develop its own criteria, that were created firstly in order to give a common definition of “green building”, giving a common standard of measurement for the transformation of the buildings’ market and the increasing the constructors’ and properties’ awareness about the benefits of a green construction, maintaining both the maximum profit from the project and the maximum respect of the law terms. With the definition of “green building”, and the promotion of the green ethic, LEED will give an acknowledgement to the sector’s leaders who are aware about the environment. It also wants to stimulate the competition at the project level in order to promote the use of green materials and methods with the use of integrated management systems for the design of the entire building.

The “Green Building Council” members have developed a classification system[27] that is divided in seven major areas to which is assigned a score, for a maximum of 110 point, useful for the certification assignment, and is divided in sub-categories:

- **sustainability of the location** (26 pt.), intended as: Prevention against site activities, location selection, building density and proximity to services, requalification of contaminated location, access

[26] (Green Building Council. (2017). LEED by the numbers: 16 years of steady growth. Retrieved from USGBC: http://www.usbc.org/articles/leed-numbers-16-years-steady-growth)

to public transport and cycle lanes, parking capacity, habitat protection, maximization of external spaces, rain waters control, reduction of lazy pollution and control of the external surfaces.;

- **efficient waters management** (10 pt.) intended as: reduction of water usage, efficient water management for irrigation purpose and innovative technologies for wastewater;
- **atmosphere and energy** (35 pt.) intended as: basic commissioning of building energy systems, minimum energy performance, cooling fluids' basic management, energy performances' optimization, local renewable energy's production, energetic systems' advanced commissioning, advanced management of cooling fluids, green energy and measurements and testing;
- **materials and resources** (14 pt.) intended as: recyclable materials' collection and storage, reuse of buildings: maintenance of existing masonry, floors and roofs, 50% non-structural elements maintenance, waste construction management, materials' reuse, use of regional materials;
- **internal environment quality** (14 pt.) intended as: environmental control of tobacco smoke, monitoring of the air flow rate, increase in ventilation, construction phase management planning, use of low emissive materials during construction phase, control of chemical sources and indoor pollutants, control and management of the plants: lighting and thermal comfort, using natural light for 75% of spaces with an outside view for the 90% of the spaces;
- **design innovation** (6 pt.);
- **regional priorities** (4 pt.).

LEED certification can be obtained by the constructor after having sent a documentation in which is described the conformity with the required norms and after having paid a fee about the revision and certification expenses, evaluations of the criteria are made via web-based documentation by the project team showing how points were attempted to be earned. Upon completion of the project the building undergoes a cursory review process by which time the building is awarded certification. The four levels of certification and required points are shown in the Table 2[28]:

LEED Certification Level	Required points
LEED certified	40-49
LEED Silver	50-59
LEED Gold	60-79
LEED Platinum	80 and above

[28] (Green Building Council. (2017). Guide to LEED Certification. Retrieved from Guide to LEED Certification | U.S. Green Building Council: https://www.usgbc.org/cert-guide)

Table 2: LEED's four level of certification

The certification will be assigned only by the "Green Building Council", that is responsible of the elaboration and the institution of the particular LEED system used in the project.

1.3.2.2 BREEAM

Figure 2: BREEAM logo

BREEAM (Building Research Establishment's Environmental Assessment Method**)** **(**Figure 2**)**is a sustainability assessment method for masterplanning projects, infrastructure and buildings. It addresses a number of lifecycle stages such as New Construction, Refurbishment and In-Use.

It was used firstly in the United Kingdom in 1988, now adopted by many European and Asian countries as well as Canada. The Table 3 summarize some numbers of the BREEAM:

Registered Buildings	Certificates	Registered countries
2265685	562157	78

Table 3: BREEAM's numbers

The BREEAM assessment process evaluates the procurement, design, construction and operation of a development against targets that are based on performance benchmarks. Assessments are carried out by independent, licensed assessors, and developments rated and certified on a scale of Pass, Good, Very Good, Excellent and Outstanding.

BREEAM measures sustainable value in a series of categories, ranging from energy sector to ecology, in particular: the management sector, health and wellbeing intended as thermal comfort, acoustic performance, safety and security, transport (public transport accessibility, proximity to amenities), water, materials, waste and pollution (indoor air quality), land use and innovation. Each of these categories addresses the most influential factors, including low impact design and carbon emissions reduction; design durability and resilience; adaption to climate change; and ecological value and biodiversity protection. Within every category[29][30][31][32], developments score points – called credits – for achieving targets, and their final total determines their rating.

The principles of BREEAM are:

[29] (BREEAM, BREEAM-International New Construction-Technical Manual, 2014)
[30] (BREEAM, BREEAM-In Use International Construction-Technical Manual, 2015)
[31] (BREEAM, BREEAM-International Refurbishment and Fit-out -Technical Manual, 2015)
[32] (BREEAM, BREEAM-Communities-Technical Manual, 2015)

- **ensure environmental quality** through an accessible, holistic and balanced measure for environmental impacts;
- **use quantified measures** for determining environmental quality;
- **adopt a flexible approach**, avoiding prescriptive specification and design solutions;
- **use best available science and best practice** as the basis for quantifying and calibrating a cost-effective performance standard for defining environmental quality;
- reflect the **social and economic benefits** of meeting the environmental objectives covered;
- **provide a common framework of assessment** that is tailored to meet the "local" context including regulation, climate and sector;
- **integrate construction professionals** in the development and operational processes to ensure wide understanding and accessibility;
- **adopt third party certification** to ensure independence, credibility and consistency of the label;
- **adopt existing industry tools**, practices and other standards whenever possible, to support development in policy and technology, built on existing skills and understanding and minimize costs;
- **stakeholder consultation** to inform about the ongoing development in accordance with the underlying principles and the pace of change in performance standards (accounting for policy, regulation and market capability).

All those principles are strictly connected with the objectives of BREEAM that have as common denominator the impacts of the construction on the environment and the promotion of the sustainability philosophy.

In particular, one of the main goals is to mitigate the impact of the life cycle of a building on the environment and consequently provide a credible environmental label for constructions, stimulating the demand for sustainable building heritage and create a dedicated market, that could be innovative and offer cost-effective solutions that minimize the environmental impacts of buildings, in correspondence with the standards regulations. In this way, it would be consequent the increase in awareness among owners, occupants, designers and operators about the benefits coming from the green design.

1.3.3 CESBA

The previous two assessment tools, are only an example of the variety of evaluation systems and of their different methodologies, in Europe, there are a lot of different building assessment tools, varying in goals, methods, contextualization, indicators and range of application. In the Table 4 are illustrated

some other tools available for environmental building assessment without taking in consideration LEED and BREEAM protocols illustrated before[33]:

	Country	Building Target	Energy requirements
HQE	France	New and Renovation residential and non-residential buildings	- Reducing energy use through architectural design by proving a reduction in energy demand and reduction of primary energy consumption with a 10% of energy savings; - eco-construction, eco-management, wellness and health.
PASSIVHAUS	Germany	New and Renovation residential and non-residential buildings, offices, schools, swimming pool, hospitals cafeterias and commercial retail	Certification criteria are divided into four points: Primary energy (total specific primary energy demand and air tightness) heating and cooling.
MINERGIE and ECO-BAU	Switzerland	Non-residential buildings: administration, schools, retails, restaurants, meeting places, warehouses, sporting facilities, swimming pools	-Energy consumption per square meters; -building heating requirement; -illumination; -refrigeration; -renewable energy percentage;
GREEN STAR	Australia	New and Renovation residential and non-residential buildings, administrations offices, schools, swimming pool, hospitals cafeterias and commercial	-Management; -indoor environmental quality; -energy consumption and CO2 emissions; -transports; -water;

[33] (Anna Forsberga, Fredrik von Malmborgc. (2004). Tools for environmental assessment of the built environment. Elsevier. Retrieved from Science Direct: www.sciencedirect.com)

		retail, meeting places, warehouses	-soil consumption; -R&D and innovation
ITACA PROTOCOL	Italy	New and Renovation residential and non-residential buildings, administrations offices, schools, swimming pool, hospitals cafeterias and commercial retail, meeting places, warehouses	-Site quality and selection; -resources consumption; -ambient load; -indoor environmental quality; -service quality.

Table 4: Environmental building assessment tools

This lack of conformity makes the comparison of results difficult or, at least, impossible; furthermore, the current building assessment tools are not user-friendly enough, and they do not cover all phases in the life cycle of buildings and become consequently challenging setting political incentives.

It brings up the issue of creating a harmonization process at the European level in order to ensure the effectiveness of certification labels. This will serve as a tool to improve the building standard practice toward a better sustainability, and a consequent creation of a sustainable building market.

The CESBA (Common European Sustainable Building Assessment) protocol tries to overcome those issues. Launched with the involvement of more than 30 public and private European organizations from Austria, France, Italy, Spain, Czech Republic, Germany, Hungary, Poland, Slovenia, Slovakia, Switzerland and the UK, CESBA is more than the assessment of sustainable buildings; CESBA is a process towards new building and neighborhood standards in Europe[34].

The CESBA initiative started in 2011 as a non-profit, bottom-up process by stakeholders closely linked to the public sector (European regions and cities). Meanwhile it got attention from many organizations, including the European Commission.

The CESBA tools provide assessment to all the aspects along the building cycle: from planning to construction, from tendering to monitoring, furthermore, it integrates the certification processes, and the need for training and communication among all the stakeholders along the value chain (including builders, administrations and users), who need tools to evaluate both environmental and construction complexity, and a clear understanding of building rating systems.

[34] (Markus Berchtold, N. K. (2013). Cesba – a Collective Initiative for a New Culture of Built Environment in Europe. CESBA Guide. Voralberg: CEC5 project.)

1.3.3.1 CESBA cycle

CESBA focuses on the people who use buildings. On average people spend 90% of their lives inside buildings, the change that made CESBA is that: by putting the user at the centre of the initiative, the purpose become to design, construct, operate and maintain buildings to meet the functional and comfort requirements of users without too much waste of resources because the goals are clearly established.

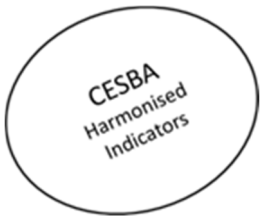


Figure 3: Key Performance Indicators

The core of CESBA Cycle are the **harmonized key performance indicators (KPI)** (Figure 3) for buildings, they helps stakeholders to define endpoints and measure the success in achieving the targets

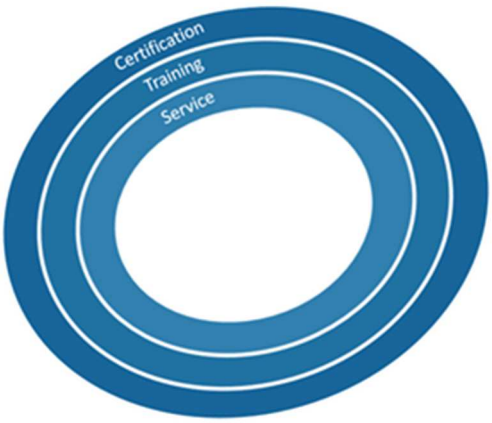


Figure 4: Services and Tools

The operative and effective use of the indicators has to be supported by **Services, Training and Certification** (Figure 4). Establishing clear targets also facilitates the dialogue with society. In other words, the **service packages** help municipalities providing them support for sustainable construction project.

Figure 5: Building Life Cycle

A building is the source of local, regional and global impacts start from the beginning of the **Life Cycle** (Figure 5) until its end with the deconstruction, demolition phase or also the conversion, with the begin of another Life Cycle. The assessment covers the entire Cycle and the evaluation has to be applied on all the sustainability aspects: environmental, economic and social.

1.3.3.2 Actors

The CESBA is a collective initiative for a new Culture of Built Environment in Europe: is targeted at a community of people and organizations who share a concern passion for the promotion of sustainable built environment and it also support the definition of qualities for the whole building life Cycle, it is a mass approach and open source method that puts the human being in its centre and for that reason is in dialogue with society. on regional and local levels.

CESBA offers harmonisation among building regulations at Eu and national levels leading to considerable simplification within administration procedures and creating a mutual understanding among the actors.

For these reasons, it is fundamental understand the possible stakeholders involved in the life cycle of the building and their needs and consequent requirements, in order to have a complete and general vision and provide a fulfilling assessment of the object.

Among the stakeholders it is possible to find out:

- **politicians** (regional and national legislative bodies and policy-makers);
- **citizens** (end users);
- **administrative staff** (public administration at regional and national level dealing with incentive systems and technical aspects of sustainable buildings, energy institutes and energy providers, universities and research institutions);
- **technicians** (architects and designers of buildings and their surroundings, builders and developers of existing and new buildings, construction-related SMEs and workers, sustainable building expert).

With their needs:

- quality of life;
- comfort, healthy environment;
- economical reputation;
- technical support.

CESBA offers an answer to the stakeholders' needs by promoting sustainable building culture, measuring quality of life and making value visible, through offering assistance to municipalities and administration with information and communication channels, technical and training support and a knowledge base.

As a mass-oriented approach CESBA wants to include as many partners as possible. Therefore, CESBA is free of charge, and uses a language which is understandable to non-experts and non-English

native speakers. To take advantages from the extensiveness, CESBA encourages stakeholders to actively participate improving CESBA data heritage, stimulating them in writing articles or commenting the existing ones by using a "discussion page". WIKI platform is a sort of knowledge container that can be consulted anytime, it contains material and information on a huge quantity of themes.

Using CESBA protocol means to participate in a European sustainable movement using a strategy and having common objectives shared with all the members who join CESBA, it allows also small communities to access the EU financing project and instruments[35].

1.3.3.3 Assessment method

CESBA gives guidelines to harmonize the assessment approaches, it could be possible to intend the CESBA protocol innovative in respect of the other building assessment tools because it changes the prospective: instead of the building it is put in the centre of the assessment process the users, with the intend of optimizing the quality in use. That aspect it is also important for what concern the contextualization both geographical, economic and social, as it happened in the ancient period in building construction (see chapter 1.2). For these reasons, it is unavoidable that CESBA protocol has specific characteristics:

- **simple to use**: that means that the assessment has not to be simplified: it as to find the right balance between the simplicity in use and the scientific/technical value;
- **open source**: possibility to creation of a networking of knowledge and promote the participation and cooperation among EU projects (WIKI platform);
- **transparent**: simple and transparent procedures (guideline, and an external certification body's control) guarantee the best possible quality of the assessment.

Building assessment tools are often multi-criteria analysis method: they assign a concise score to a building's overall performance starting from a set of criteria that deal with environmental, social and economic issues. The assessment procedure is articulated in three main steps:

- **characterization**: building performances are quantified through indicators regarding each criterion;
- **normalization**: indicator values are dimensioned and rescaled in a score;
- **aggregation**: normalized scores are combined to produce a final concise score with two possible method: the simple sum, or the weighted sum.

[35] (Markus Berchtold, N. K. (2013). Cesba – a Collective Initiative for a New Culture of Built Environment in Europe. CESBA Guide. Voralberg: CEC5 project.)

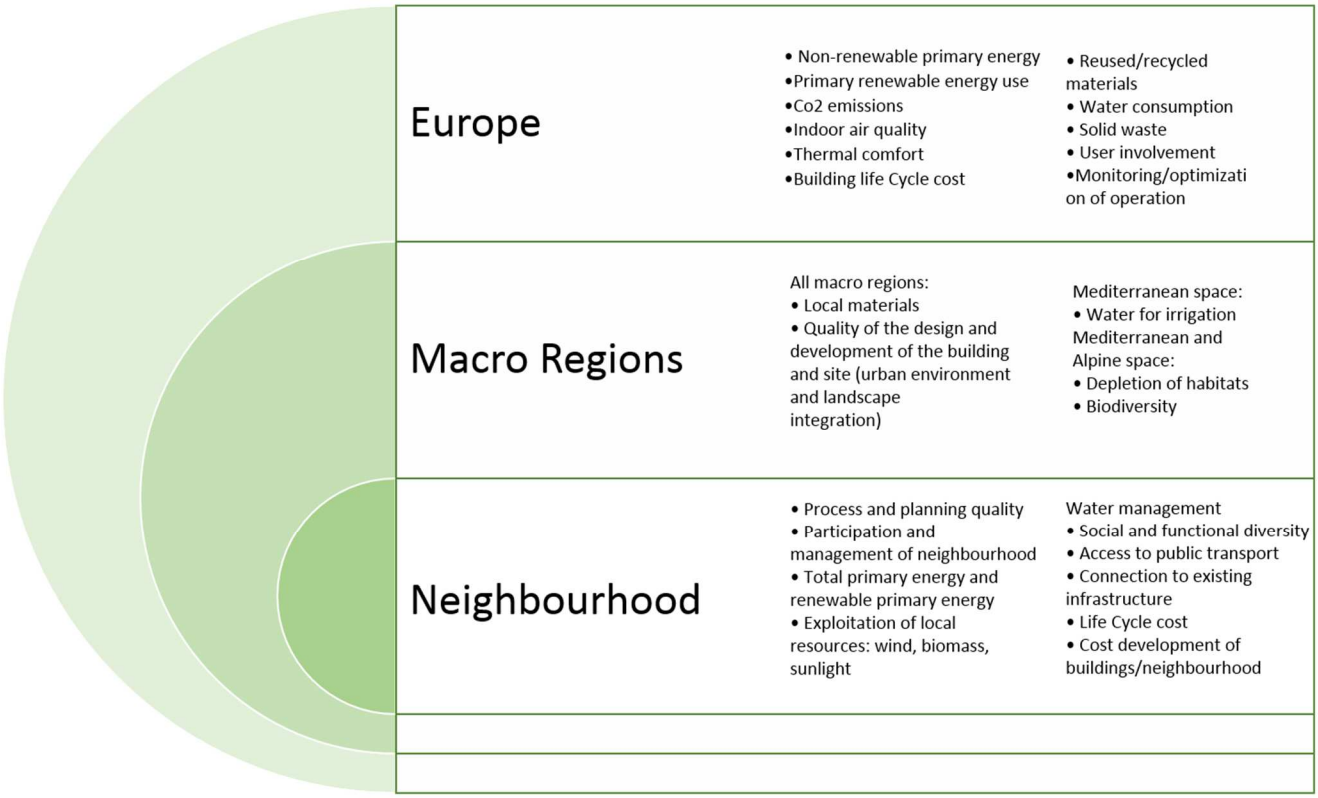
The results of assessments (environmental, social and economic performance) should be organised in the way they can be understood and interpreted in a transparent and systematic way.

1.3.3.4 KPIs (Key Performance Indicators)

CESBA's Key performance indicators (KPIs) intend to be a European common base for building sustainability assessment. Their adoption by the regional/national assessment systems will facilitate the communication between stakeholders and the comparability of performance results. KPIs will also support and facilitate the development of future assessment schemes.

They exist for different level at building scale (Graph 3):

- The KPIs at the European level have to be adopted by all the building assessment systems as they address the main issues of sustainable building;
- KPIs at macro region level (Alpine, Mediterranean, Central Europe, north Europe, etc.);
- KPIs at neighbourhood level.



Graph 3: CESBA's KPIs

The reference Life Cycle stages to be taken into account when evaluating the KPI are:

- **before usage stage**: product stage and construction stage;
- **use stage**: operative life;
- **end life stage**: deconstruction and disposal stages

1.3.3.5 RPIs (Reference Performance Indicators)

CESBA's RPIs indicators should be taken as a reference in the development of the specific regional assessment tools.

The indicators are organised by issues: site, process quality and the three aspects of sustainability, i.e. environmental quality, social quality, and economic quality. The number of indicators to be included in a specific assessment tool depends on its scope. The selection has to guarantee the CESBA assessment principles. Table 5 and Table 6 illustrates the CESBA's RPIs and how they are organized.

Building scale					
Location, territory and site	**Process quality**	**Environmental quality**		**Social quality**	**Economic quality**
Ecological quality of site	Decision making and determination of goals	Energy and emissions	Non-renewable primary energy	Accessibility	Building life Cycle cost
Risks at the site	Integrated planning		Primary renewable energy use	Health and Comfort	Economic efficiency
Circumstances at the site	Planning support for energetic optimization		Specific cooling demand	Indoor air quality	Construction cost
Options for transportation	Stakeholder involvement		Specific heating demand	Thermal comfort	Stability of value
Access to amenities	User involvement		Use of non-renewable primary energy (process energy)	Visual comfort	
Access to public transport	Evidence of sustainability during bid invitation and awarding		Use of renewable primary energy (process energy)	Acoustic comfort	
Protection or restoration of habitat on the site	Quality of the executing contractors/pre-qualification		Global Warming potential (GWp)	Daylight use	
Adjacent infrastructures and services	Quality assurance of construction execution	Water	Management of wastewater	Adaptability	
Construction site impact	Sourcing of materials and services		Water consumption	Impact on the neighbourhood	
Bicycle parking facilities		Waste	Solid waste	Quality of the design and urban development of the building and site	
			Hazardous waste to disposal	Aesthetics	
		Materials	Use of recycled materials	Emotional attraction	
			Risks from materials		
			Refurnishing and replacement of components		
			Deconstruction, recycling and dismantling potential		
		Service's quality	Monitoring/optimization of operation		
			Cleaning and maintenance		

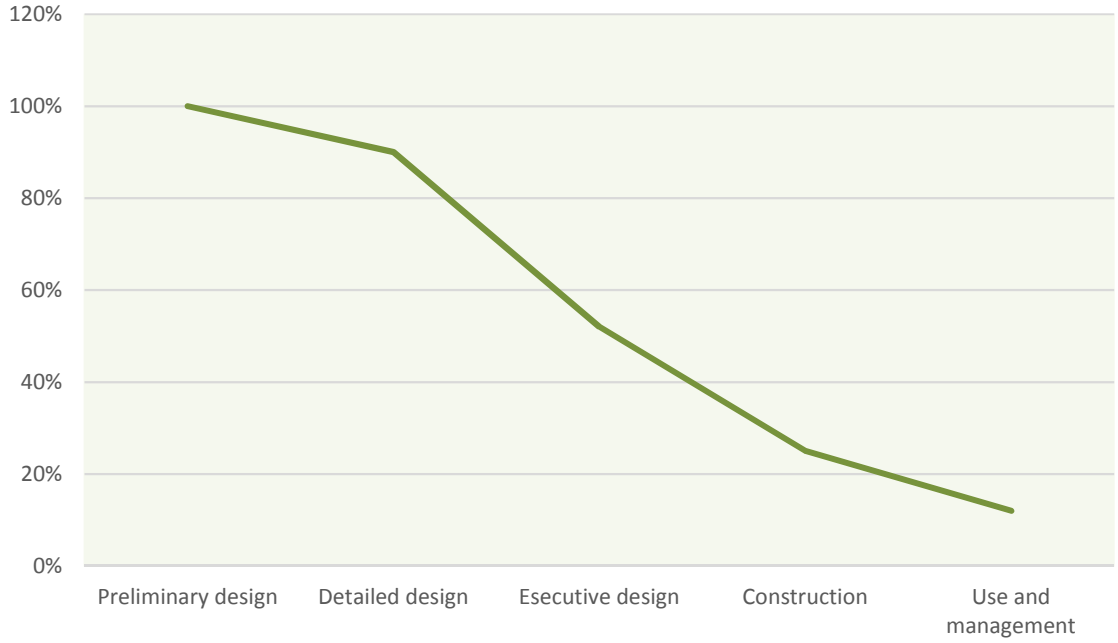
Table 5: CESBA's RPI-Building scale

Neighbourhood scale			
Environmental quality	**Social quality**	**Economic quality**	**Process quality**
Preservation of land and soil	Adjacent infrastructures and services	Life Cycle cost	Process and planning quality
Preservation of the built environment	Collective facilities and outsourcing of services	Planning and development costs	Participation
Occupancy of surface	Historic resource preservation and adaptive reuse	Appropriate investment costs	Communication and information management
Urban integration	Flexibility of usage	Affordability of housing property/rental	Integrated planning process
Climate change of city quarter	Connection to existing infrastructure	Stability of value	Construction site, construction process
Effects on other city quarters	Efficiency of infrastructure		Synergy management
Risk for local environment, protection of soil	Availability of green spaces		
Other effects on global environment	Housing and jobs proximity		
Permeability of land	Contiguity of bicycle and car routes		
Intensity of water treatment	Safety of pedestrian spaces		
Management of wastewater	Accessibility of pedestrian spaces		
Accessibility to waste sorting facilities	Infrastructure for individual sustainable mobility		
OI3 index (building materials and construction)	Barrier-free spaces		
Deconstruction, dismantling, and recycling potential	Access to public transport		
Exploitation of local resources: wind, biomass, sunlight	Local production of food		
Energetically optimized urban structure	Thermal comfort of outdoor areas in summer		
Primary energy for heating	Quality of external spaces		
Intensity of greenhouse gas emissions per capita	Prevention of noise		
Primary energy for cooling	Air quality monitoring		
Primary energy for public lighting	Light pollution		
Electric energy optimization through Virtual power System (VpS)	Social and functional diversity		
Total primary energy and renewable primary energy	Socio-cultural structure of neighbourhood		
	Objective/subjective safety		
	Access to broadband communication network		

Table 6: CESBA's RPI-Neighbourhood scale

1.4 BIM

Over the past 100 years, the design and building industry has changed exponentially: buildings have become much more complex with many more interrelated and integrated systems. During this period, it has been added a huge number of building systems and other layers of design that either didn't exist to the same level of complexity they did before or simply didn't exist at all.
These increase in the project's complexity generates also an improvement in competitions, so a higher specialization, but it has added time and cost to the process and lifecycle of the building.
With this new way of operating architects, owners, and contractors have had to adapt to these changes: data transmission cannot remain as fragmented as usual and cannot be more on paper, because this type of data communication could imply lots of error and incomprehension among building process' parties, and from these problems could rise cyclically late in delivery time, increasing in costs, and legal dispute.
For what concerns the decision-making process the data exchange basing on 2D information generates problems because analysis about management and maintenance costs, energy consumption costs and load bearing efficiency are not easily forecastable and transposed in the reality even though after the building construction, but at that time is too late to make some important change in the building[36].



Graph 4: Effectiveness of decision-making during design stages

[36] (C. Talamo, C. M. (2010). Procedimenti e metodi della manutenzione edilizia - Vol II. Sistemi Editoriali. Carson, R. L. (1962). Silent Spring. Boston: Houghton Mifflin.)

All the CAD Systems generates digital files, compose by vectors, lines and layers, with no significant innovations in the design stages and project's organization[37].

With the 3D design tools is not only possible to manage the geometrical information as a real object (parametric design), but also it could be possible associate to a specific element some features that could not be represented graphically[38]. In particular BIM is a modeling methodology that allow the creation of a data base specific for the building: drawings are not simple geometrical representation of the spaces, but operative tools able to talk about several aspects of the construction (from the spatial organization to the construction costs, from the used materials to the maintenance plan).

The potentiality of this modeling method is the capacity of reducing errors due to the ability to reflect automatically an eventual change in an aspect of the project in the entire design flow. This also produce a sort of revolution within the design approach to the project and how people involved in the entire life cycle of the building interact. It is possible to say that BIM generates a new way of communication among all the participants, allowing a bigger amount of data exchange than with the classical design approach. For that reason, it is possible to handle more complex buildings and projects[39].

Summarizing BIM is defined in the BIM Handbook as a modeling technology and associated set of processes to produce, communicate, and analyze building models[40].

Sometimes it is easy to hear that BIM is a software: nothing more wrong: as described before BIM is a methodology and makes changes in the core of the design modifying the logics and revolutioning the traditional and static workflow.

1.4.1 Interoperability

As a result of the BIM methodology definition communication and integration are the key-words of the methodology.

Integrated design is founded on the ability to share knowledge across different disciplines and the collaboration among all the participants allows to get best results from the project.

[37] (Berwald, S. (2008). From CAD to BIM: The experience of architectural education with building information modeling. AEI 2008: Building Integration Solutions.)

[38] (Osello, A. (2012). Il futuro del disegno con il BIM per ingegneri e architetti, The future of Drawing with BIM for Engineers and Architects. Palermo: Dario Flaccovio Editore.)

[39] (Azhar, S. (2011). Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry. Leadership and management in engineering.)

[40] (Charles M. Eastman, C. E. (2011). BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Constructors. John Wiley & Sons.)

The intrinsic features of a BIM project's building components make possible the innovative flow of the project:

- building components are **parametric** and interact each other in an intelligent way;
- building components contain **information about their behavior and performances**, based on the requirements (for example information about energy performances). That makes possible the realization of simulation about use of the building as a system of component that works together;
- **information** about building components **are coherent and not redundant**: in this way, it is possible to reduce at the minimum level errors due to wrong communication and avoid incomprehension.

With this kind of design, the work flow is totally innovated in respect to the old methodologies based on papers and 2D: data spread all over the participants and everyone can participate simultaneously. Obviously this methodology requires more than one single software and computer application, because more than one kind of data is handle at a time and different experts work together[41].

For this reason, interoperability of the building team and of tools is fundamental and lies at the basis of the BIM methodology and requires a new kind of files to make data exchange possible (DXF – Drawings eXchange Format and IGES for geometry).

It is also required a new and standardized language for data exchange, that is why ISO standards with industries start to make some clarification[42] and together create the EXPREESS data modeling language: it is machine readable and it has multiple implementation including a compact text file format, object database implementations and XML implementations.

The two main building product data models are:

- the Industry Foundation Classes (**IFC**) for building planning, design, construction and management;
- CIMsteel Integration Standard Version 2 (**CIS/2**) for structural steel engineering and fabrication.

Both IFC and CIS/2 represent geometry, relations, processes and material, performance, fabrication and other properties, needed for design and production, using the EXPRESS language.

[41] (Ning Gu, K. L. (2010). Understanding and facilitating BIM adoption in the AEC industry. Automation in Construction.)
[42] (Standardization, ISO 16739. Industry Foundation Classes (IFC) for data sharing in the construction and the construction and facility management industries, 2013)

If data exchange was to deal with models of complex objects with their geometry, attributes and relations, any fixed file exchange format quickly became so large and complex as to be useless. Tring to solve this problem International Standards Organization (ISO) in Geneva, Switzerland, initiated a Technical Committee, to develop a standard called STEP (STandard for the Exchange of Product Model Data), one of the main products of ISO-STEP was the EXPRESS language, that adopts many object-oriented concepts, including multiple inheritance. Object refers to a computer language concept that is broader than just representing physical objects, as a matter of facts, objects can be used to represent conceptual or abstracted objects, materials, geometry, assemblies, processes and relations, among other things.

EXPRESS has become the central tool to support the modeling of products across a broad range of industries: mechanical and electrical systems, process plants, shipbuilding, processes, furniture, finite element models, plus others, as well as the AEC. It also includes a large number of libraries of features, geometry, classifications, measurements and others to use as common foundations for product data models. Both metric and imperial measurements are supported. As a machine-readable language, it is excellent for computational use, but difficult for human users; thus, a graphical display version of the language was developed and is commonly used, called EXPRESS–G.

1.4.2 Benefits from BIM

BIM is a methodology that is growing, it has not the aim of a revolution but of an evolution, that means continuous development not a drastic change. The principal benefits that comes from BIM are[43]:

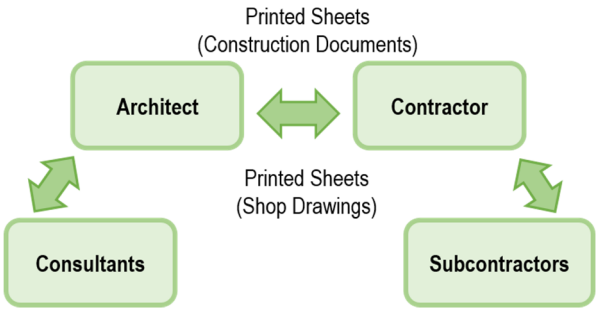
- **3D simulation vs 2D representation**: a 3D simulation goes beyond demonstrating how different building assemblies can be combined in the project. It can predict collisions, show environmental variables on different building designs, and calculate material and time quantities;
- **Accuracy vs estimation:** by being able to virtually construct the building before physical construction begins on site, BIM adds a level of accuracy to both building quantities and quality. Building materials and environmental variables can be demonstrated in real time rather than manually estimated;
- **Efficiency vs. redundancy**: by simply drawing building elements only once in the project instead of a drawing plan, then projecting elevation, then section, we can begin to capture time and focus that additional time on other design issues;

[43] (Kristen Barlish, K. S. (2012). How to measure the benefits of BIM — A case study approach. Automation in Construction.)

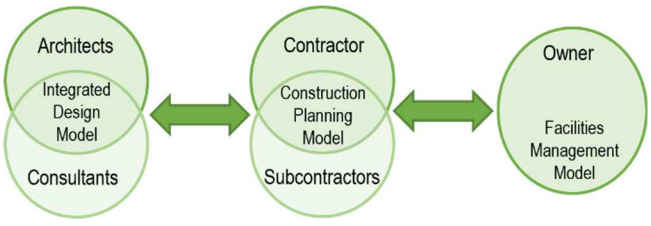
- **Integration vs separation**: the possibility to have simulations allows a direct integration of the project with costs estimation, project management and structural analysis. It makes possible a smarter decision-making process, declaring the different alternatives;
- **Partnership vs division**: multiple team members with multidisciplinary skills can collaborate together on the same project, with the use of BIM it is possible to integrate and incorporate many of the facets of the AEC industry typically regarded as individual building tasks.

Summarizing, it is possible to say that the BIM methodologies has started to change the traditional basic approach, based on the separation of roles among the project actors, preferring a method that promote cooperation, optimization and efficiency[44].

Traditional methodology (Graph 5)	BIM (Graph 6)
1- Architect starts drawing the building with the collaboration and information coming from consultants; 2- Consultants start working on the architect's drawing on their own for what concern their specialized field; 3- Architect collect the consultant works, put them together re-elaborating them within the architectural set; 4- All the project's (usually printed) documents are presented to the contractor, who will eventually spread them to different subcontractors; 5- The contractor creates a new series of drawings based on the originals but with more detail.	1- Architect start working on the project with the consultants, it could be done on a unique model or a model composed by interconnections and parts; 2- The model goes to the contractor, who, helped by building team, embellish and enrich the project; 3- Once the building is built the model can be adjusted in order to reflect the reality; 4- The BIM model is still useful for the owner, users, future maintenance interventions, evaluate performances, assess building impact on the environment and facilities management, because it contains data about object, materials element's installation, costs and performances



Graph 5: Traditional design approach



Graph 6:BIM design approach

[44] (Charles M. Eastman, C. E. (2011). BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Constructors. John Wiley & Sons.)

In general terms, we can say that BIM methodology, in all its aspects, is designed to promote a quick and as complete as possible communication among all the actors and during all the life cycle of the building[45].

1.4.3 GREEN BIM

Since this stage two main issues that have influenced the world of the design in the last decades have been faced separately. Also in the reality, these trends have progressed independently, many practitioners at the leading edge of both find that sustainability and BIM have remarkable synergies. Green design is best served by an integrated design process, with a holistic approach to all design and construction disciplines, and BIM adoption is in part based on its ability to facilitate integrated design. Also, green design and construction rely on improving building performance. Many of the tools of BIM, including energy use modelling and daylighting studies, provide better information on how design changes impact building performance than any traditional design tool[46]. BIM models can also provide more information to product manufacturers, allowing for greater use of prefabrication, which can eliminate waste and makes the construction process greener and faster.

In order to obtain the maximum results from the application of the BIM methodology on sustainable design it rises a new branch: the Green BIM.

The use of BIM to provide data for energy performance evaluation and sustainability assessment is defined Green BIM[47] and it could be considered a tool at the forefront for what concerns design organizations in terms of integration, construction and maintenance towards Net Zero Energy buildings.

Green BIM includes Building Energy Modelling dealing with project energy performance to identify options optimising building energy efficiency during the life cycle. By allowing revisions during the design phase, project teams can ensure that customers' green ambitions beyond regulation compliance can be realized, together with technical and economic requirements.

Thus, BIM can provide information to support the calculation of a number of credit points to define goal levels of sustainability related to rating systems.

[45] (Bradley, E. K. (2008). Successful Sustainable Design with Building Information Modeling. Indianapolis: Wiley Publishing, inc.)

[46] (Soltani, S. (2016). The Contributions of Building Information Modelling to Sustainable Construction. World Journal of Engineering and Technology, 7.)

[47] (Maltese, S., Tagliabue, L.C., Re Cecconi, F., Pasini, D., Manfren, M., Ciribini, A.L.C. (2016) Sustainability Assessment through Green BIM for Environmental, Social and Economic Efficiency. International High-Performance Built Environment Conference – A Sustainable Built Environment Conference 2016 Series (SBE16), iHBE 2016.)

At the core of Green BIM processes lie parametric modelling and building simulation tools that support either manual or automated data sharing, and furthermore, multidisciplinary design, optimization, and agent-based modelling technologies.

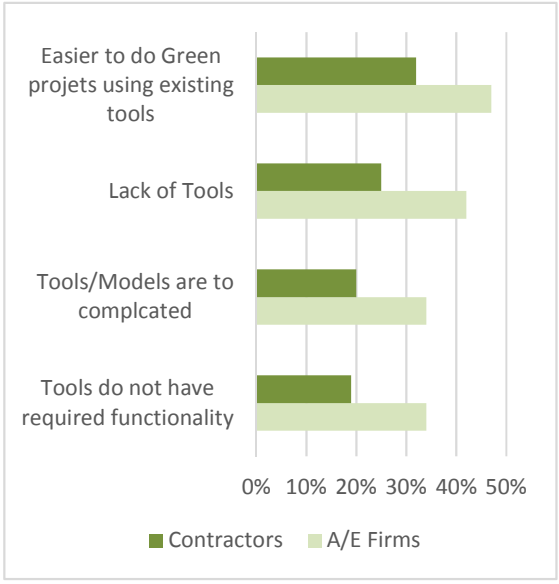
Quality sustainable design requires an understanding of how a building will perform after it is built, which in turn requires computer-based simulation software for rigorous building analysis.

The topic of Green BIM has raised a general awareness in the academic field, however the McGraw-Hill Construction building stock data- base reveals that despite of all the possibilities that Green BIM offers, it is already not so common in use for firms, that is probably caused by its infant stage of spread, it is foreseen that the use of BIM for green projects is expected to grow dramatically in the relative short term, due to its potentiality.

Nearly all firms involved in Green BIM use BIM for new green construction projects. The fact that firms use BIM for nearly twice the percentage of major green renovations as they do for minor green retrofits suggests that BIM is generally perceived as more applicable to larger, more complicated projects.

According to the findings in the Commercial and Institutional Green Building SmartMarket Report[48], only 35% of all industry players are specifying or using on-site renewable energy. These similar results indicate that most Green BIM practitioners are sophisticated BIM users and that most Green BIM A/e firm practitioners are more heavily involved in green. This suggests that as users become more involved in green building and in Green BIM practice, the application of these tools for on-site renewable energy design will likewise increase.

It is important to know why firms decide to not use Green BIM tool for achieving sustainable tools, in order to know how improve the next generation of Green BIM tools (Graph 7): the McGraw-Hill Construction building stock data-base find out that more than half (53%) of all firms not currently practice Green BIM report because they do not have a need to do it. That result could be influenced by a variety of factors, including lack of direct client demand and fewer green projects in their current



Graph 7: Influence of factors behind not using BIM for green projects (Construction, 2010).

[48] (McGraw-Hill Construction. (2010). How Building Information Modelling is contributing to green design and construction. SmartMarket Report (2010) Green BIM)

pipeline. A higher percentage of contractors (61%) felt this was an influential factor than A/e firms (42%). The remaining factors were all considered influential by a higher percentage of A/e firms than contractors. Functionality is again key for most of these issues, corresponding to the general trend that design firms are impacted more by functionality and contractors more by owner demand and market factors.

2. LEAN GREEN BIM APPROACH

As we could see the adoption of the Green BIM outside research and development or academic fields is facing not few problems. That is mainly due to the lack of compatible tools and, most of all, difficulty in use, mostly because of other informatic instrument are more linear and intuitive, in relation to the opinion of the firms that already use it (some software examples: Autodesk Ecotect Analysis, IES Virtual Environment, Graphisoft EcoDesigner). It is important take also in consideration the fact that due to its complexity users take lot of time to be comfortable with the Green BIM methodology.

This fact could run up against the development of the sustainability tool that we took in consideration. It will be significant to ensure to the users a smarter approach, that reduces time, creates a standard dictionary, which could be reused for different cases and allows the communication about all the project's stakeholder in the smartest way as possible for, at the end, achieving the sustainability rating certification and continuously improve their green level, as previous suggested in the chapter dedicated to the sustainable design.

In other words, from the data collected in the SmartMarket report[49], is clear the general need of a leaner Green BIM approach, in order to facilitate the adoption of the methodology, but also the approximating to the concept of sustainable design. In this way, with the larger adoption of green planning, the attention about environment will increase, due to the competition of the market, allowing the development of the subject, with a benefit for all (environment intended as ecological, economic and social).

The simplification of the Green BIM methodology has to start from its basic concept: communication and collaboration among all the actors participating to the project: it is necessary to provide to all the participants a tool able to extract the needed data (in this case data connected to sustainability, but it could be done also for maintenance data, facility data, management data and so on…) directly from the BIM model in order to forecast the sustainability rating in every step of the design phase and of the operational life of the building.

Data should not only be readily available to fulfil rating protocol paperwork in order to achieve the final ranking nevertheless they have also to be readable by a web server to publish a forecast of the sustainability rating when two or more design options are under investigation and evaluation to enable informed choices. The final objective is to satisfy the need of effortlessly available data and of more precise and reliable procedures to effectively work with BIM.

[49] (McGraw-Hill Construction. (2010). How Building Information Modelling is contributing to green design and construction. SmartMarket Report (2010) Green BIM)

However, it is not that easy because complexity and variety of both rating systems (as descripted before varying in kinds and parameters) and BIM software are growing as it is the amount of data to be handled (projects are getting even more complex not only in technological solutions and service, but also in the heterogeneity of requirements request by the increased number of project's actors). For that reason, it becomes crucial to have a common data exchange protocol one answer could be provided by the Industry Foundation Classes protocols that, summarizing, is a neutral, non-proprietary data format used to describe, exchange and share information. It is the international standard for building information modelling used for sharing and exchanging construction and facility management data across different software applications, or COBIe (Construction to Operations Building information exchange), which essentially is a Model View Definition (MDV) of IFC and it is helpful in the creation of the lean aspect of the methodology, that consists in the delivering assets data when geometrical information are not available, in other words, without the creation of the 3D model, with a consistent saving of resources in terms of time[50].

2.1 COBIe and IFC

As described in the previous paragraphs IFC stands for Industries Foundation Classes and it is well known as a data standard in the world of BIM.

Basically, IFC is an agreement about how things are and how we describe them in a computer: the semantic agreement about what a door is, a wall, a roof and the properties they have are the core of IFC. There are around 800 objects and 20.000 properties described in IFC. This is important, because it is not necessary to set new properties and new agreements every time and for every new project, it is just required to interface with one agreement, which make things standard[51].

The way IFC data is described is not important: data can be stored in STEP format, xml, or whatever. When IFC data are exported from a BIM software tool, it is not exported just IFC, but with many type of agreements, they are so extensive that are not all needed, that explain why people came up with the idea of model view definition.

The most used information model view definition (MVD) is the coordination view, in most BIM software tools, when is exported an IFC the tool creates the IFC data according to the coordination view definition.

[50] (Sebastiano Maltese, Nicola Moretti, Fulvio Re Cecconi, Angelo Luigi Camillo Ciribini. (2017). A Lean Approach to Enable Sustainability in the Built Environment through BIM. Techne, 10.)

[51] (buildingSMART International Ldt. (2017). IFC Specification Package. Retrieved from BuildingSmart International home of openBIM: http://www.buildingsmart-tech.org/specifications/ifc-overview/ifc-overview-summary)

There is also other model view definition, and everyone can even create their own. Some software tools have special model view exports made specifically to be imported in other software tools.
MDV allows to export a portion of the IFC information on a defined phase of the building process (e.g. structural design, system design)[52]. Thus, these tools are very effective to foster interoperability. One of the most common is the Construction Operations Building information exchange (COBIe).
COBIe could be considered a standardised method to collect information during the construction process avoiding redundancies and waste of time in collecting useless data. It is also convenient in economic terms and easy in use: it is a spreadsheet and could be read by common interfaces as Microsoft Excel, and for the same property it is machine readable, as a matter of fact it could be also integrated by Computer Maintenance and Management Systems (CMMS), as well as in many other design and facility management software[53].
Thus, all the object and properties in COBIe come from the IFC agreements. COBIe is a subset from IFC: data does not look the same, but they are so.
The IFC format is used to record data of a building that can be exchanged between different software, in other words it is designed for software-to-software exchange. Having a spreadsheet form of COBIe has the real benefit of allowing human-to-human understanding of the information needed.

[52] (buildingSMART International Ltd. (2017). Model View Definition Summary. Retrieved from buildingSmart Internationa home of openBIM: http://www.buildingsmart-tech.org/specifications/ifc-view-definition/summary)
[53] (Sebastiano Maltese, Nicola Moretti, Fulvio Re Cecconi, Angelo Luigi Camillo Ciribini. (2017). A Lean Approach to Enable Sustainability in the Built Environment through BIM. Techne, 10.)

2.2 IFC

The Industry Foundation Classes (IFC) was developed to create a large set of consistent data representations of building information for exchange between AEC software applications[54].

IFC has been designed to address all building information, over the whole building lifecycle, from feasibility and planning, through design (including analysis and simulation), construction, to occupancy and operation.

All objects are called entities. The conceptual organization of IFC entities[55] is diagrammed in Figure 6.

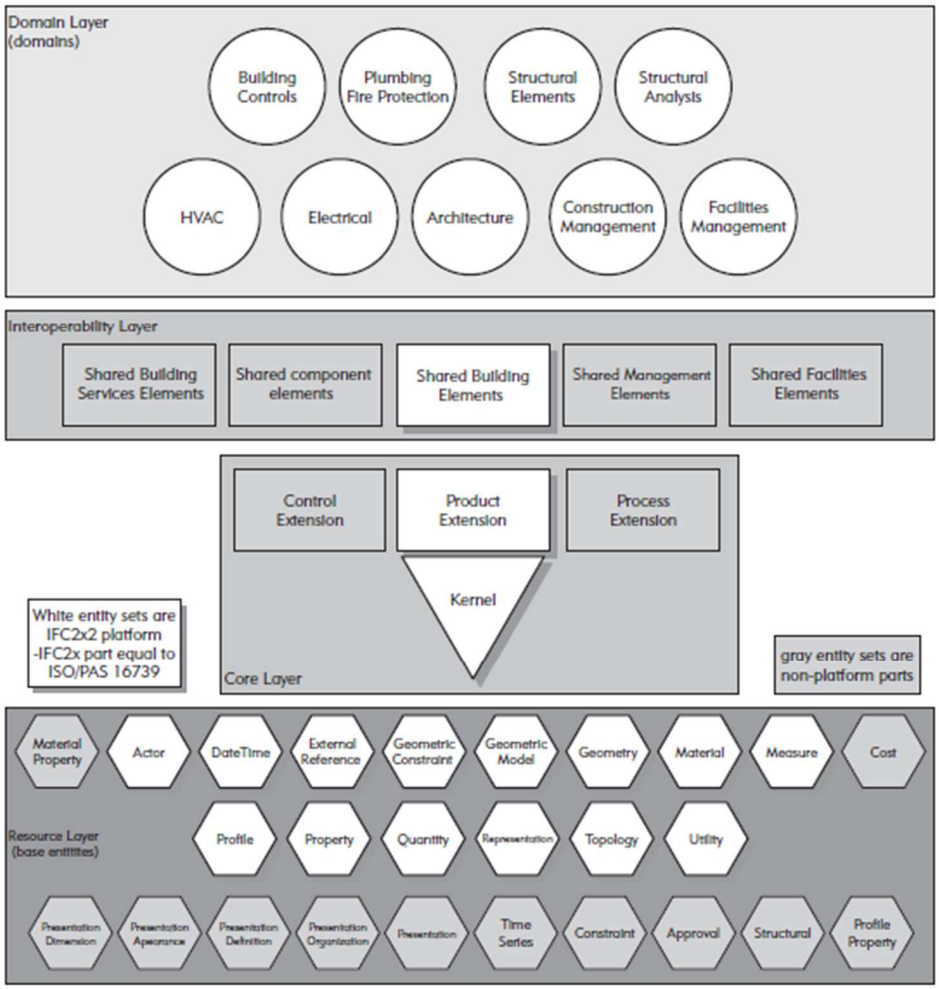


Figure 6: Organization of IFC entities

At the bottom are twenty-six sets of base entities, defining the base reusable constructs, such as Geometry, Topology, Materials, Measurements, Actors, Roles, Presentations and Properties, these are generic for all types of products.

[54] (buildingSMART International Ldt. (2017). IFC Specification Package. Retrieved from BuildingSmart International home of openBIM: http://www.buildingsmart-tech.org/specifications/ifc-overview/ifc-overview-summary)

[55] (Charles M. Eastman, C. E. (2011). BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Constructors. John Wiley & Sons.)

The base entities are then composed to define commonly used objects in AEC, called Shared Objects in IFC model. These include building elements, such as generic walls, floors, structural elements, building service elements, process elements, management elements, and generic features. Because IFC is defined as an extensible data model and is object-oriented, the base entities can be elaborated and specialized by subtyping to make any number of sub-entities.

The top-level of the IFC data model are the domain-specific extension: these deal with different specific entities needed for a particular use, for example Structural Elements and Structural Analysis extensions, Architectural, Electrical, HVAC, Building Control element extensions.

IFC divides all the activities in “rooted” and “non-rooted”. Rooted entities come from IfcRoot and has an identity concept, with name, description and revision’s check attributes. Non-rooted entities do not have and identity and they exist only if directly or indirectly related to a rooted entity. IfcRoot is divided in three abstract concepts:

- **IfcObjectDefinition**: catches presences and type of material objects. IfcObject describes the object’s presence, intended as the installation, with serial number and physical location in the building’s space. IfcTypeObject catches the type-definitions as the product type (the product’s shape, model number…). Presences and types are also divided in other six concepts:
    - actors (who): people or organizations;
    - checks (why): check rules, costs and quality (order of processing);
    - groups (what): objects collections based on particular scopes (electrical circuits);
    - products (where): presence in space, physical building elements and spatial position;
    - processes (when): events in time as activities, events or procedures;
    - resources (how): usage of something with limited availability as material, manpower or machinery.
- **IfcRelationship**: catches relationship between objects, and five types of relationships are individualized:
    - IfcRelDecomposes: catches a "part-of-a-all" relationship with exclusive restraint such as subdivision of a building into floors and rooms;
    - IfcRelAssigns catches assignment reports where an object consumes the services of another object, such as a workforce resource assigned to a task;
    - IfcRelConnects indicates connectivity between objects such as a slab connected to a beam or pipe connected to a sink;

  - IfcRelAssociates indicates external references of an object, for example, an external IFC library where the object is defined;
  - IfcRelDefines indicates a "case-of" relationship, such as a tube segment of a type.
- **IfcPropertydefinition**: catches objects' dynamic properties. A group of properties include one or more properties that could be a single value (a number or a unit of measure), a limited value (with minimum and maximum), an enumeration, a list of value, a table of value or a structured data. While IFC defines hundreds different groups of properties in specific types, customised group of properties that can be personalised by applications suppliers or by final users:
  - IfcPropertySet represents a property set associated to an object-event or to an object-type;
  - IfcPropertySetTemplate Catch properties definitions and related type of data.

IfcProduct is the base class for all physical objects and is subdivided into space elements, physical elements, structural analysis elements, and other concepts. Products can have associated materials, shape representations, and placement in space.
Spatial elements include IfcSite, IfcBuilding, IfcBuildingStorey, and IfcSpace.
Physical building elements can include IfcWall, IfcBeam, IfcDoor, IfcWindow, IfcStair, etc.
Distribution elements (Aeration, electrical, plumbing) have a concept of doors where elements can have specific connections for the various services and connected between Their cables, pipes, or ducts form a system. Various connectivity ratios are used for building elements, for example, walls with openings with doors or windows. Materials can be defined for a set of products, or by layers, profiles, or constituents only for specified parts.

- IfcMaterial: indicates a specific material with optional features (mechanical, thermal) and styles (such as colours, textures);
- IfcMaterialLayerSet: catches a list of layers, each indicates a specified thickness material;
- IfcMaterialProfileSet: catches a set of profiles, each one indicates a material in a specified section;
- IfcMaterialCostituentSet: catches groups of components, each group indicates a material used with a nominally shaped aspect.

IfcProcess is the base class for projects. It is divided in activities, events and procedures. Processes can have a duration and can be planned in a specified time. Processes can be organized in order to

have an activity that starts after the end of the previous one following the method of the critical path. Processes can be grouped in sub-processes, and can be assigned to products indicating the output produced by the work done.

IfcResource is the base class for resources and is divided in materials, workforce, machinery, subcontracts, equipment, etc. Costs, calendar and availabilities can be assigned to each resource, that can be assigned to a specific process.

IfcProject collects a global project and identifies: the project name, decryption, default unit, currency, coordinate system, and other contextual information. A valid IFC file must always include exactly an IfcProject instance, from which all other objects have direct or indirect relationship. A project can include more buildings, more participants, and/or more phases according to specific use.

In addition, a IfcProject can refer to external projects, that is included in a IfcLibrary

Given the IFC hierarchical object subtyping structure, the objects used in exchanges are nested within a deep sub-entity tree. For example, a wall entity has a trace down the tree:

IfcRoot -> IfcObjectDefinition -> IfcProduct -> IfcElement -> IfcBuildingElement -> IfcWall

Each level of the tree introduces different attributes and relations to the wall entity. IfcRoot assigns a Global ID and other identifier information. IfcObjectDefinition optionally places the wall as part of a more aggregate assembly, and also identifies the components of the wall, if these are defined. IfcProduct defines the location of the wall and its shape. IfcElement carries the relationship of this element with others, such as wall bounding relationships, and also the spaces (including exterior space) that the wall separates. It also carries any openings within the wall and optionally their filling by doors or windows.

Exist different format of IFC file, in order to allow every platform to read the document:

- IFC-SPF: is a text format defined by ISO 10303-21[56] (“STEP-File”),in which every line corresponds to a registered object. This is the more common format for IFC, with the advantage to be compact in dimensions with a readable text;
- IFC-XML: is a XML format defined by the ISO 10303-28 (STEP-XML)[57]. This format is useful for the interoperability with XML instruments and the exchange of partial building’s models. Due to the big dimensions of the building’s model, this kind of format is less common in the practice;

[56] (Standardization, ISO 10303 Part 21:Industrial automation systems and integration -- Product data representation and exchange -- Part 21: Implementation methods: Clear text encoding of the exchange structure, 2016)

[57] (Standardization, ISO 10303 PART 28: Industrial automation systems and integration -- Product data representation and exchange -- Part 28: Implementation methods: XML representations of EXPRESS schemas and data, using XML schemas, 2007)

- IFC-ZIP: is a compressed ZIP-format composed by an incorporated IFC-SPF file.

2.3 COBIe

Historically, information transmittals for a building under construction have been done on paper and therefore a significant portion of the information is lost once the building is completed, without considering the quantity of redundant data.

The Construction Operations Building information exchange (COBIe) is the information base for the United Kingdom's building information modeling (BIM) implementation. It keeps information about the building in a usable format for everyone to access throughout the building's life cycle.

The primary benefit of COBIe is that it enables information to flow from the design phase, allows information to be added anytime and is available to deliver the information to the facility manager upon completion.

In simple words COBIe adds the "I" to BIM.

COBIe is a performance-based specification: two main types of assets are included in COBIe: equipment and spaces. In simple words a COBIe spreadsheed makes possible to know what (with its characterists) is where. This is foundamental for the decision making stage (in the preliminary project's phases) or in the execution of the maintenance plan (for the operative phase) in ther words COBIe helps design and project's team both in the construction and in operative and management stages without asking additional effort after the design.

COBIe data may then be imported directly into asset management software, again at no cost.

The PDF, drawing, and building information model files that accompany COBIe are ordered in a way that they can be easily accessed through the office server

COBIe files are not intended for end-users: it provides system-to-system exchange of the space and equipment information without user intervention.

To make COBIe as useful as possible COBIe data is available in several formats:

- **software system exchanges** during the design process could use the STEP Physical File Format (ISO 10303 Part 21[58]) files conforming to the Industry Foundation Class (ISO 16739[59]) COBIe Model View Definition;

[58] (Standardization, ISO 10303 Part 21:Industrial automation systems and integration -- Product data representation and exchange -- Part 21: Implementation methods: Clear text encoding of the exchange structure, 2016)

[59] (Standardization, ISO 16739. Industry Foundation Classes (IFC) for data sharing in the construction and the construction and facility management industries, 2013)

- **user-friendly for people version** COBIe data can be translate from STEP file formats, into a spreadsheet[60].

Today COBIe has been included in design and construction contracts in the United States, United Kingdom, and Singapore, but it is going to have a very fast adoption, this is due to its semplicy in use and convenience in economic terms: it is sufficient have a computer with excel installed and the works is done in a precise and authomatic way.

The practical differences between a workflow with and without COBIe are illustrated in Table 7:

Without COBIe	With COBIe
1- at the financial completion of the construction, the construction manager collects all the information about the building in boxes full of paper or CDs containing e-papers and deliver it to the other managers (appointed for facilities or maintenance or for the management of the operative stage of the building);	1- information and documentation about the building are collected in every stage of the project: from the design stage to the dismission, in order to avoid redundancies, errors and waste of paper and efforts that comes from papers or CDs documentation;
2- data, more often than not, are delivered months or years later, or in other case never, or it possible that there is some lack of knowledge and information have to be collected directly in site with survey or inspection;	2- because of the immediate generation of the COBIe spreadsheet data are available anytime are needed and can be uploaded with updated version in real-time with the parallel development of the building;
3- after the collection of the information they have to be realaborate, most of the time from a different person from who has generated it, with the risk of error;	3- information about the building can be generate directly from the designer, the manufacturer, the constructor, the owner itself or whoever has useful data for the objective;
4- all kind of data are collected both useful both and useless.	4- COBIe spreadsheet is filled only with those information that are useful for the final aim.

[60] (Bill East, P. P. (2016, June). CONSTRUCTION-OPERATIONS BUILDING INFORMATION EXCHANGE (COBIE). Retrieved from WBDG - Whole Building Design Guide: http://www.wbdg.org/resources/construction-operations-building-information-exchange-cobie)

Table 7: Differences between a workflow with and without COBIe

In general, COBIe do not generates any significant change in the design and construction processes, but makes them more linear and lighter, reducing useless passages and redundancies optimizing the "paper-process". Information in COBIe are not an end onto themselves, but can be re-used through the project (Table 8).

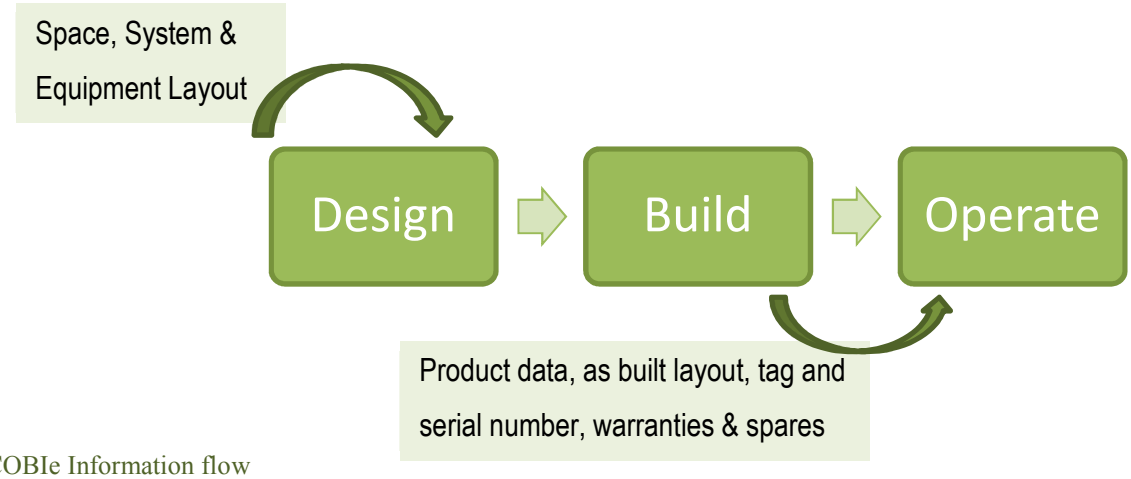


Table 8: COBIe Information flow

For example, during the early design Architects develop spaces based on the function needed for the activities that will be carried on in those spaces. Those data are elaborated in COBIe in the "space data sheet" with the characteristic of each room (i.e. usable area, height, volume, illuminating or aerating ratio) Beside the architects' work, Engineers design the systems that deliver the required services, such as electricity, water, appropriate temperature, fire protection, security to allow the activities to take place, this services fulfill the "facility data sheet" and linked each room with the required services it is possible to know where is what and how it performed or at least how it would have to perform.

In the end, we can say that COBIe was develop firstly in order to reduce costs and improve the quality of construction handover, in order to be used effectively by all the actors of the life cycle of a building.

2.4 Workflow

As described in the previous paragraphs, in the lasts years it was possible to see the growth of two main topics: the sustainability issue and the BIM methodology.

On one hand, the development of the green topic generates as a result the development of different rating systems, that differs one another for their application methods, parameters used, and for the criteria applied to assess each parameter. This caused a general confusion and makes comparisons arduous. Moreover, it would become even complex evaluate the sustainability value of a building due

to its increase in complexity both technological and for what concerned the number of people involved in the building life cycle.

On the other hand, Green BIM methodology allows a safer approach to the project, decreasing the possibility of errors, misunderstandings and redundancies in information exchange, but from the Smart Market report comes out that it is even hard for users and firms the approach to this kind of process for the sustainability assessment[61].

The purpose of the thesis is to submit a lean green BIM methodology for the sustainability assessment of buildings.

That it could be done by choosing the CESBA rating system criteria (because of its aim of harmonization among the main existent rating systems) to fulfil a significant number of COBIe specifications.

Using COBIe leads to a more interoperable and open access to data approach, which could be used by professionals in several software, in different moments of the building life, to empower collaborative environment and shared decisions, thanks to the characteristics exposed in the previous chapters.

Furthermore, for the final goal of the thesis, it could be considered too onerous the creation of a 3D model, because it takes lots of time and resources, of course it is not the case of a definitive project, and for the complete management of a building, because at that stage it would be anyway necessary the 3D graphic model, but we are talking about sustainability aspects and the same speech it could be done also for a preliminary stage or for the decision making stage, at which are not essential geometrical information, but are preferred more conceptual and semantic data.

Sebastiano Maltese, Nicola Moretti, Fulvio Re Cecconi, Angelo Luigi Camillo Ciribini, and John M. Kamara explain in their paper that for existing assets is possible to define specific attributes through a flexible and machine-readable database, not even based on a 3D model, to set a preliminary building's sustainability assessment[62].

There are also other scientific articles that talk about the adoption of similar approach, for example:

- Cheng J.C.P and Das M. presented a web-based building information modelling service that integrates the classical BIM data models like IFC with a more extensive coverage of the energy simulation domain. Cheng and Das realised that current IFC data base are not rich enough to

[61] (McGraw-Hill Construction. (2010). How Building Information Modelling is contributing to green design and construction. SmartMarket Report (2010) Green BIM.)

[62] (Sebastiano Maltese, Nicola Moretti, Fulvio Re Cecconi, Angelo Luigi Camillo Ciribini. (2017). A Lean Approach to Enable Sustainability in the Built Environment through BIM. Techne, 10.)

respond to all the real possible cases that can occur for the building sustainability simulation that they need. However, their methodology is still based on a 3D model[63].

- Lei, X., Kang M., et al. (2015) find out the real coverage of IFC in order to evaluate the sustainability aspect of five residential and non-residential buildings. The results show that IFC cover only the 57% of the requirements. This research confirms the doubts exposed by Cheng and Das in the 2014: that IFC data-base is not sufficient for the sustainability evaluation of buildings[64].
- El Asmi, E., Robert, S., et al confirm the fact that using only IFC is limitant for the realization of sustainability buildings- simulation. They try to find out some solutions that individualized in the IDM (Information Delivery Manual) and in MVD (Model View Definition) provided by BuildingSmart, in this way, using that kind of approach they affirm that guarantee an increased interoperability of the system.[65]

With the case study, it will be demonstrated the possibility to implement the relevant attributes into a lightweight COBIe model, being able to store and share information in a standardised format, as suggested by the literature.

[63] (Jack C.P. Cheng, M. D. (2014). A BIM-BASED WEB SERVICE FRAMEWORK FOR GREEN BUILDING ENERGY SIMULATION AND CODE CHECKING. Journal of Information Technology in Construction, 19.)
[64] (Xuechen Lei, M. K. (2015). Assessment of Industry Foundation Classes (IFC) in Supporting Building Energy Benchmarking. Proc. of the 32nd CIB W78 Conference (p. 10). Eindhoven: Researchgate.)
[65] (El Asmi, E. R. (2015). A standardized approach to BIM and energy symulation connection. International Journal of Design Sciences and Technology.)

3 CASE STUDY

The case study served as an example to prove the effectiveness of the proposed lean green BIM approach and also ensure that it is really possible to fulfil COBIe specification in order to achieve a significant number of CESBA'S satisfied criteria for the evaluation and for the final certification.

The building is a sporting club owned by the Società GARDEN 2 s.r.l. the project was developed by RIGAMONTI FRANCESCO S.p.A., INGEGNERIA. COSTRUZIONE-GESTIONE (**Errore. L'origine riferimento non è stata trovata.**).

Figure 7: Logo Rigamonti Francesco S.p.A.

3.1 LOCALIZATION

The building is located in the north of Italy, near Milan in the province of Varese, more precisely in Viale Lombardia 49, Gallarate (Figure 8).

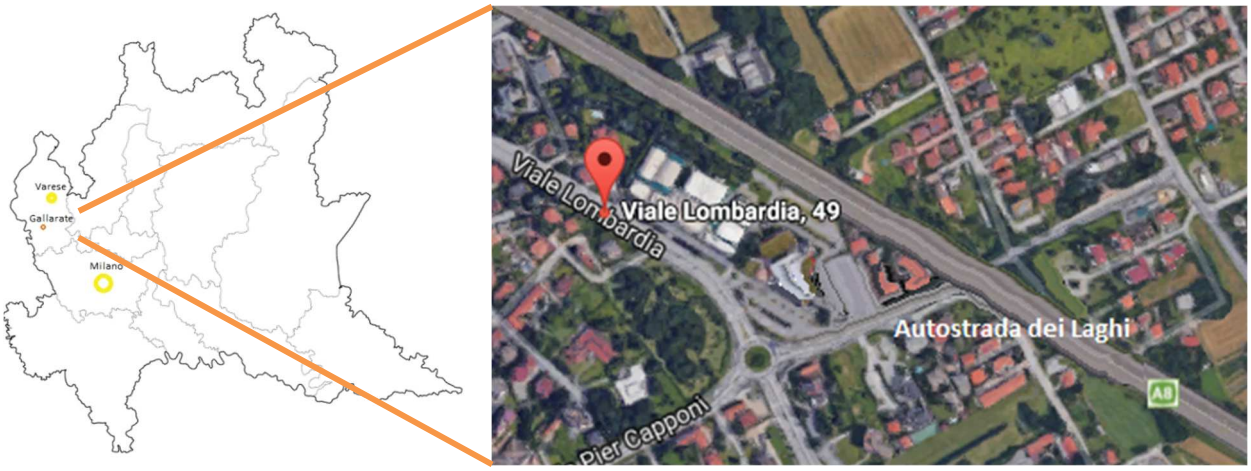


Figure 8: Case study localization

The environmental surrounding in which it is collocated is intended as an area of common interest: a service area at municipal level or sport equipment area, approved by the local regulation (P.G.T. whit D.C.C. n 28/2011). The interested area is characterised by a high level of landscape sensitivity and is located between the A8 highway and Viale Lombardia, it is marginal with respect of the urban context and is characterised by the presence of structures for services at municipal level.

3.2 THE INTERVENTION

The intervention consists in the refurbishment and in the enlargement of a building structure designated to sport equipment function. It was previously built between 1980 and 1990, and it was undermentioned for what concerned the qualitative and quantitative standards for the new management of the activities performed inside, and for the specific target of the gym' customers

(young people, seniors, children, etc…). The new functioning of the gym was suffering about a weak optimization of spaces, that cause a general negative perception of the spaces' quality.

The project's aim is to eliminate the technical and management weakness, previous explained, moreover it achieves to an enlargement of the customer's offering. The intervention, as shown in Figure 9 consisted in:

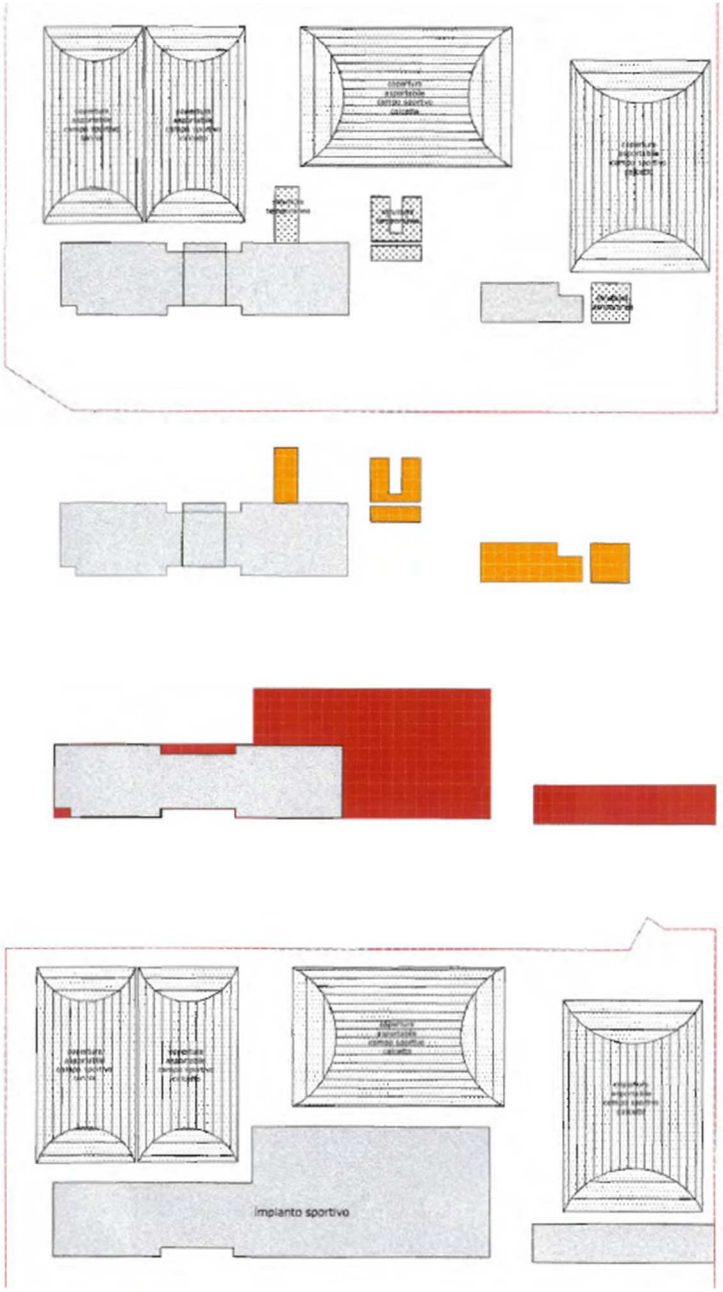


Figure 9: Project intervention phases

- an enlargement towards the south-east side;
- the creation of an underground floor for changing rooms / storage / wellness areas and refurbishment of external area (Figure 13);
- a redefinition of the street front on Viale Lombardia in order to harmonise the existing building with the expansion;
- a balancing between the full and empty spaces;
- a complete arrangement of internal distribution to optimize flows of people (Figure 14);
- an increase in the receptive capacity and the psychophysical welfare of users;
- improvement of the changing rooms for the football activity;
- an energy upgrading for matte casing (walls and cover) and transparent casing (window frames) of the existing building, with consequent efficiency of the whole technological plans.

Figure 10: State of the building before the intervention

Figure 11: The project

Figure 12: Today





Figure 13: External area

Figure 14:Internal area

3.3 DOCUMENT DUE DILIGENCE

As a starting point of the application of the lean green BIM methodology to a real case study, it was considered relevant a deep analysis of the overall documentation of the project.

We got in touch with more than 200 documents and for that reason it was important to establish an organization to adopt for the consultation and for making information available as comfortable as possible for the next steps.

It was decided to maintain the original subdivision and classification through a code for each paper.

The gerarchical relationship between documents was organized grouping the documents in seven categories, each of them divided in sub-categories with other sub-folders with the group of the documents. Each stage is identified by the addition of a new number in the code of the document. It makes easier the finding and identification of the paper within the numerous folders.

After the first check, it was obtained a list of 215 documents that are available for the project[66].

It is clear that not all the papers are useful for the final aim, so it was necessary to select which of them will be useful for the purpose and to do so it was helpful to assume some criteria.

First of all, we have to check if the project was in compliance with the law, in other words if it had all the mandatory documentations basing on the UNI10998 (Table 9) – "Archivi di gestione immobiliare" it was possible to classify all the documents in different classes:

Section A: real estate register:

- **A.1**_Archive management;
- **A.2**_Building system's identification;
- **A.3**_Building system's subjects;
- **A.4**_Building system's generic and synthetic description;
- **A.5**_Building system's graphic documents.

- **Section B**: Mandatory requirements:

[66] See Attachment 1: Documents List

  - **B.1**_Environmental protection;
  - **B.2**_Energy consumption's restraint;
  - **B.3**_Building hygiene and safety;
  - **B.4**_Building feasibility;
  - **B.5**_Fire Prevention;
  - **B.6**_Conservatory and Cadaster;
  - **B.7**_Real Estate restrictions;
  - **B.8**_Building's production and transformations;
  - **B.9**_Load bearing structure;
  - **B.10**_Technological plants.
- **Section C**: real estate exercise:
  - **C.1**_Economy and finance;
  - **C.2**_Real estate values;
  - **C.3**_ Context of performance and needs;
  - **C.4**_Real estate redevelopment;
  - **C.5**_Real Estate Maintenance

UNI 10998: archivi di gestione immobiliare		
Sections		Documents
Section A (Real Estate register)	A.1_Archive management	Real estate archive management and documents connected to the organization and management of the archive
	A.2_Building system's identification	Territorial information system, municipal toponomastic and real estate toponomastic
	A.3_Building system's subjets	Life-cycle significant subjects, to get in touch in case of emergency, pubblic entities or of public interest
	A.4_Building system's generic and synthetic description	Real estate management cards
	A.5_Building system's graphic documents	Photogrammetric representation, planimetry, grafic elaborations and plants' rapresentations
Section B (Mandatory requirements)	B.1_Environmental protection	EIA, asbestos components, waste management, hydrogeological protection
	B.2_Energy consumption's restraint	Plants' installation and refurbishment
	B.3_Building hygiene and safety	Hydrogeological features, finishing, fornitures, emergency fire plans
	B.4_Building feasability	Architectural barriers, building feasibility
	B.5_Fire Prevention	Certificates and Declarations of Fire Prevention
	B.6_Conservatory and Cadastre	Local Agency Documents
	B.7_Real Estate restrictions	Documents relating to historical-cultural, environmental and urban constraints
	B.8_Building's production and tranformations	Original and subsequent building concessions, DIA, definitive project permissions
	B.9_Load bearing structure	Geotechnical surveys and supporting structures
	B.10_Technological plants	Plants documentations
Section C (Real Estate Exercise)	C.1_Economy and finance	Millesimal subdivision, treatment and tax identification
	C.2_Real estate values	Value of cost, market, tax
	C.3_ Context of performance and needs	Requirements classes according to UNI 8290 consisting of the results of inspections on the condition of the building usage and the surrounding environment
	C.4_Real estate redevelopment	Maintenance interventions already performed
	C.5_Real Estate Maintenance	Maintenance's contracts, manuals, plans and programs

Table 9: Uni 10998: archivi di gestione immobiliare[67]

[67] See Attachment 2: UNI 10998

After it was ensured that the project is in compliance with the law, it could be possible to proceed with the check with the requirements expressed by CESBA indicators[68] for public buildings refurbishment[69].

The indicators are divided in five sections respectively:

- **section A**: Quality of location and equipment (Max point: 25)[70];
  - **A1_Bicycle parking**: the intent behind this indicator is to provide a technical background and relevance both for customer benefits and climate benefits. The aim of the provision of a bicycle parking is to encourage the use of bicycles for short and medium distances on order to reduce energy demand and environmental pollution. In order to promote the regular use of bicycles in everyday life, attractive bicycle-parking are essential. Attractive means: high prossimity to the entry of the building that it could be reachable by bike, with free and easy access to the bike once they've been parked (Table 11, Table 11);

A1	Bicycle Parking		
Parameter		Descripiton	Points
Quality of the bicycle parking			
Size of slot, spacing and manoeuvring area		Sheltered parking spots for user that stay longer (> 30 Min:utes)	
		Safety bike storage through a lockable room or a stand that allows bike lock attaching	
		Illuminated, reachable while cycling and close to the main entry of the buildind (<30 m) biclycle slot	
		Subterranean garages biclycle slot should be reachable while cycling with direct acces to the main building	
		Visitors/short time parking slots should be on the ground floor and have at least 50% roofing	
Size of slot, spacing and manoeuvring area			
	Distance between bikes under normal usage	Min: 80 cm	
	Distance between bikes with height offset	Min: 40-45 cm	
	Distance between bike and wall	Min: 35 cm	
	Lengths of bike-slot	Min: 2 m (parked vertically)	
		Min: 3.2 m (front wheel overlap)	
	Manoeuvring area to back out	Min: 1.8 m (depth)	

Table 10: Bicyle Parking (part A)

[68] See Attachment 3: CESBA indicators

[69] (Partners, C. P. (2013, September 30). CESBA Common European Sustainable Building Assessment - . Indicator Catalogue for Public Buildings Refurbishment.)

[70] See Attachment 4: CESBA_ Sec. A

Number of bicycle parking slots			
	Administration buildings	Min: Seats for stuff: 0,2 per employee seats for visitors: 0,1 per employee	15
		Top: Seats for stuff: 0,4 per employee seats for visitors: 0,2 per employee	25
	Kindergartens	Min: 0,1 per child + 0,5 per teacher	15
		Top: 0,2 per child + 0,9 per teacher	25
	Elementary schools	Min: 0,1 per student + 0,2 per teacher	15
		Top: 0,2 per student + 0,6 per teacher	25
	Secondary school	Min: 0,6 per student + 0,2 per teacher	15
		Top: 0,9 per student + 0,6 per teacher	25
	Retirement home/ nursing home	Min: seats for stuff 0,2 per employee seats for visitors: 0,05 per inhabitant	15
		Top: seats for stuff: 0,4 per employee seats for visitor: 0,1 per inhabitant	25
	Event hall (mainly used locally)	Min: 0,2 per employee + 0,1 per guest	15
		Top: 0,4 per employee + 0,2 per guest	25
	(used locally and regionally)	Min: 0,2 per employee + 0,05 per guest	15
		Top: 0,4 per employee + 0,15 per guest	25
	(used nationally)	Min: 0,2 per employee + 0,025 per guest	15
		Top: 0,4 per employee + 0,05 per guest	25
Evidences for building owner/contractor			
Additional documentation		Plan including the location as well as the furniture and the number of parking sites	+
		Pictures of the realized parking sites: bypass road to the parking sites, position regarding the entrance of the building, pictures of bicycle parking or bicycle storage rooms	+

Table 11: Bicyle Parking (part B)

- **section B**: Process and planning quality[71]
  - **B1: Decision making and examination of alternatives** (25 points): with this indicator, it would be provided an evaluation of the social compatibility and climate protection through the comparison of alternatives and of the functional users' requirements.

    The comparison between alternatives allows to optimize the building cubage, location, orientation and spatial concept. Besides economic considerations also urban development, social compatibility, accessibility, soil sealing, utility, energy efficiency and ecological constructing have to be taken into account (Table 12).

[71] See Attachment 5: CESBA_ Sec. B

B1	Descripiton Decision-making and examination of alternatives	
Parameter	Descripition	Points
Documents	Documentation of the decision-making process	8
Alternatives	Examination and evaluation of the alternatives	4
	Examination and validation of the zero option	4
DM scheme	Documentation of the evaluation scheme for the examination of alternatives	3
Themes	Urban development	2
	Accessibility and traffic (induced traffic)	2
	Landscape consumption – soil quality	2
	Energy efficiency	2
	Ecological use of materials	2

Table 12: Decision making and examination of alternatives

- **B2: Definition of verifiable energetic and ecologic objectives** (20 points): the definition of the energetic and ecological quality of a building can be evaluated only after the definition of precise objectives given by the client during for the planning phase. It has to be presented in written form otherwise the achievement of objectives cannot be examined (Table 13).

B2	Definition of verifiable energetic and ecologic objectives (M)	
Parameter	Descripition	Points
Thermal heat PHPP	Specific heating demand	
Cooling PHPP	Specific cooling demand	
Primary energy PHPP	Specific total primary energy demand (heating,	
CO2 EMISSIONS	Specific CO2 emissions (heating, cooling, hot	
Yield	Yield of a photovoltaic power plant	
n50	Air tightness n50	
Materials	Building materials to be excluded	
	Use of regional building materials	
Evidences for building owner/contractor		
Additional documentation	Target-performance comparison	

Table 13: Definition of verifiable energetic and ecologic objectives

- **B3: Simplified calculation of efficiency** (40 points): the scope of that indicator is to economically optimize the energy concept of a building. In order to avoid a not sufficient economic efficiency examination that cause a not implementation of energy data is suggested a simplified calculation of life cycle costs (Table 14);

B3	Simplified calculation of efficiency (M)		
Parameter	Descripition		Points
Average annual costs to take into account for the comparison with a building that fulfil the minimum requirements of national directives	Annuity of the building costs (at least in each case		
	Annuity of fees		
	Average annual maintenance costs		
	Average annual energy costs		
Assumptions for calculating efficiency (additional costs)	Life of constructional measures (insulation, windows, etc.)	40 a	
	Life of building services (heating, cooling etc.)	20 a	
	Calculation period = credit period	20 a	
	General inflation rate	2,50%	
	Rising prices for energy (all energy sources)	5,50%	
	Required rate of return	5%	
Evidences for building owner/contractor			
Additional documentation	Description of the technical data of the energy-related building components		
	Energy demand calculation for reference and improved variant(s)		
	Presentation of simplified efficiency calculations e.g. using the excel-tool mentioned below		

Table 14: Simplified calcolato of efficiency

- **B4: Product management – using low-pollutant and low-emission building materials** (60 points): the objective of these indicators is to avoid an increase concentration of pollutants in the building and especially in the air by introducing product management. Product management means to carefully chose and control building materials and chemicals to avoid ambient air pollutants (Table 16, Table 16).

B4	Product management - using low-polutant and low-emission building materials	
Parameter	Descripition	Points
Products to be considered	All building chemicals that are used on peripheral spatial surfaces (inside and outside)	
	All building materials that are used inside the room (airtight layer and all building materials in front of	
Ecological indicators (interior space)	Low-emission elastic floor coverings	
	Low-emission textile floor coverings	
	Low-emission flooring products	
	Avoiding emissions from insulation in the ambient	
	Avoiding emissions of formaldehyde from wooden composites	
	Avoiding emissions of VOC and SVOC from wooden composites	

Table 15:Product management – using low-pollutant and low-emission building materials (part A)

Ecological indicators (building materials)	Low-emission bituminous preparations	
	Substances, free from CMR	
	Preparations, free from heavy metals	
	Preparations, free from SVOC	
	Avoiding free formaldehyde	
	Avoiding acid-hardening coatings	
	Preparations, free from aromatic hydrocarbon	
	Preparations with low VOC	
	Low-emission sealing compound	
Evidence/Documentation building owner/contractor		
Ecological optimization of building components	Documentation in the frame of the schematic design, building application and detailed planning	10
Tendered trades considering pollutant content, boundary values for pollutant content, definition of	100 % of all trials are considering ecological aspects	20
	90 % of all trials are considering ecological aspects	15
	70 % of all trials are considering ecological aspects	10
Listed product of all trials	100 % of all trials have been listed	30
	90 % of all trials have been listed	20
	70 % of all trials have been listed	10
Ecological building inspection	yes/no	
Use of materials	Regular and documented	
Construction process	Complitely documented	20
	Partially documented	10

Table 16:Product management – using low-pollutant and low-emission building materials (part B)

- **B5: Energetic optimization during the planning** (60 points): the objective is to guarantee that the energetic quality determined by the contractor can also be achieved in practice by a continuous energetic optimization and by certifying the energetic quality (Table 18, Table 18);

B5	Energetic optimization during the planning	
Parameter	Descripition	Points
Evidence/Documentation building owner/contractor		
Room program	Set-up of a room program with room sizes, type, duration and intensity of use, required level of temperature	3
Aerial illumination ratio	Determination of the volume of air depending on the room considering hygiene requirements (see PHPP instructions for ventilation, section planning)	3
Intern heat sources	Detailed identifying of intern heat sources	1
Thermal bridges	Consideration of thermal bridges by detailed evidence of thermal bridges Default value (0.03 W/m²K)	3

Table 17: Energetic optimization during the planning (part A)

Energetic requirements in the tendering	Description of energetic requirements in the tendering (e.g. building physics values Uw, Ug, g-value for windows, heat provision level and air-specific power consumption for ventilation systems, thickness of insulation and thermal conductivity for the heat and warm water distribution lines)	1
Examination of the energetic aspects of the offer(s)	Examining the energetic aspects of the offers regarding the requirements given in the tendering	3
Local construction management and energetic aspects	Appointments at the construction site to support the local construction management regarding energetic aspects	3
Blower door tests	Report about the blower door tests	1
Ventilation system calibration	Report about the calibration of the ventilation system (see PHPP instructions for ventilation, section commissioning)	2
Hidraulic balancing heating	Report about the hydraulic balancing heating	2
Energy demand adjustment	Adjustment of the energy demand calculation after finishing the construction and implementation of an air tightness test	3
Effective energy demand	Detailed monitoring of the energy demand calculation	35

Table 18: Energetic optimization during the planning (part B)

- **B6: User information** (25points): Users have an important influence on the energy demand of buildings. The objective is to provide information for the main target group of users that show how buildings can be operated energy efficiently without losing comfort (Table 19);

B6	User information	
Parameter	Descripition	Points
Users' manual	Room temperature (regulation of heating/cooling)	
	Mechanical ventilation and window ventilation	
	Sunscreen and glare shield	
	General lightening and lightening at work	
	Efficient use of other energy consumers (Computer, printer, etc.)	
Information about	Information event when the building is ready to be used	

Table 19: User information

- **B7: Analysis of the building and weaknesses** (40 points): the analysis of the building stock and weak points is the basis for a comprehensive and sustainable modernization. It is fundamental to develop a modernization concept that is regarding the needs and possibilities and is still cost-effective and realizable (Table 20);

B7	Analysis of the building and weaknesses	
Parameter	Descripition	Points
Identifying of building elements of the stock (M)	Based on plans, surveys and local examinations	10
Energy performance	Calculation of the energy performance certificate	10
Identifying weak points and	Detailed analysis and report with (graphical) presentation of	10
Detection and recording of the existing building services including an analysis of weak points (M)	Heating, hot water, heat distribution, cooling, ventilation	10
Contaminant investigation	Investigation and recording according to ÖNORM S 5730	10
Evidence/Documentation building owner/contractor		
Additional documents	Energy performance certificate for the stock, report including	+

Table 20: Analysis of the building and weakneses

- **Section C**[72]: Energy demand and supply: the assessment of energy demand and supply is an essential part, since the reduction of energy demand and emissions is among the most striking ambitions when operating a building. In order to comply with these ambitions, the heating demand of the building should be reduced, while the efficiency of the energy supply should be enhanced and sources of energy that pollute the environment should be avoided. Additionally, the energy production of renewable energy from solar powered sources (for primary energy) demand can be assessed and accounted for.

  Energy performance indicators should be calculated by the PHPP Software.

  All sources of energy usage for primary energy demand in a building are assessed;

  - **C1: Heating demand PHPP** (125 points): decreasing heating demand is long-term effective and predictable measure to reduce energy usage and pollutant emissions. In addition, the reduction of energy usage for room temperature can benefit from an adequately insulated building with low transmission losses through opaque or transparent surfaces which promotes ease and comfort: higher surface temperature of the inner building envelope can lead to higher perceived temperatures – despite equal room temperature (Table 21);

[72] See Attachment 6: CESBA_ Sec. C

C1	Heating Demand PHPP (M)	
Parameter	Descripition	Points
Energy performance indicator for thermal heat PHPP (dependent from A/V ratio)	Energy performance thermal heat PHPP 80 kWh/m2 EBFa for buildings with A/V ratio of 0,8 or higher	25
	Energy performance thermal heat PHPP 60 kWh/m2 EBFa for buildings with A/V ratio of 0,2 or lower	
Maximum score independent from the	Energy performance thermal heat PHPP 25	125
Attestation / Documentation:		
Calculation of energy performance	PHPP Version 6.1 (2012)	

Table 21: Heating demand PHPP

- **C2: Cooling demand PHPP** (100 points): as part of optimizing energy demand, it is desirable to keep the energy used for cooling and air conditioning as low as possible (Table 22);

C2	Cooling demand PHPP (M)	
Parameter	Descripition	Points
Basic Parameter: the implementation of measures to reduce the cooling load and the reduction of solar gains	(Window sizes, - quality, - orientation, as well as temporary sun protection, reduction of internal sources of heat, activation of storage mass through night-time cooling	
	Frequency of overheating max. 10% (PHPP file	
	Area-specific cooling load 25 °C max. 10% (PHPP file	
Energy performance indicator cooling demand	Max. value of 15 kWh/(m2 TFA a)	10
	Max. value of 5 kWh/(m2 TFA a).	100
Attestation / Documentation:		
Calculation of energy performance	PHPP Version 8.2 (2013)	

Table 22: Cooling demand PHPP

- **C3: Primary energy demand indicator PHPP** (175 points): this indicator deals with reduction of energy demand of operating buildings under consideration of upstream process chains (Table 23);

C3	Primary energy demand indicator PHPP (M)	
Parameter	Descripition	Points
Primary energy indicator	Value of 300 kWh/m2 EBF a.	25
	Value of 140 kWh/m2 EBF a.	175
Attestation / Documentation:		
Calculation of primary	PHPP 2013, Version 8.2	

Table 23: Primary energy demand indicator PHPP

- **C4: Emissions of CO2-Equivalents according to PHPP** (75 points): this indicator deals with the minimization of CO2 emissions of CO2 equivalents of operating buildings (Table 24);

C4	Emissions of CO2-Equivalents according to PHPP	
Parameter	Descripition	Points
CO2-Equivalent-factors of PHPP	Value of 70 kg /m2 EBF a.	10
	Value of 35 kg /m2 EBF a.	75
Attestation / Documentation:		
Calculation of emissions	PHPP Version 8.2 (2013)	

Table 24: Emissions of CO2-Equivalents according to PHPP

- **C5: PV-Power plant CO2-Equivalents** (40 points): main purpose of this indicator is the highest possible energy generation through PV.

  All photovoltaic power plants that are connected to the grid will be considered in the assessment. These plants must be directly attached to the building or adjoining buildings such as carports etc. (roof-integration, facade-integration, erection on flat roofs). Free standing plants will not be considered (Table 25);

C5	PV-Power plant CO2-Equivalents	
Parameter	Descripition	Points
Annual yield	Value of 3,5 kWhEnd PV-current per m2 TFA.	10
	Value of 14 kWhEnd PV-current per m2 TFA.	50
Attestation / Documentation:		
Calculation of the gains through PV-power plant under consideration of local climate		
Datasheet of the chosen modules / components		
Graphical outline of the location and surface area of the solar modules		

Table 25: PV-Power plant CO2-Equivalents

- **C6: Differentiated documentation of Energy Consumption** (10 points): main purpose of this indicator is a detailed comparison of actual energy consumption in relation to initially predicted values in order to give a baseline for potential adjustments to technical equipment and systems.

  Requirement for an assessment in this indicator is a separated documentation of the following Energy Consumption figures: heating, cooling, water heating, auxiliary current for heating, water heating, possibly solar heats, auxiliary current for air conditioning, possibly humidification and dehumidification, lightening, IT-equipment or other power applications, possibly gains from PV-power plant (Table 26);

C6	Differentiated documentation of Energy Consumption (M)	
Parameter	Descripition	Points
Separated documentation of the following Energy Consumption figures	Heating	
	Cooling	
	Water heating	
	Auxillary current for heating, water heating, possibly solar heats	
	Auxillary current for air conditioning, possibly humidification and dehumidification	
	Lightening, IT-equipment or other power applications	
	Possibly gains from PV-power plant	

Table 26: Differentiated documentation of Energy Consumption

- **C7: Water consumption/use of rainwater** (20 points): this indicator aims to reduce the consumption of drinking water as well as ensuring water retention in case of intense rain falls (Table 27);

C7	Water consumption/ use of rainwater	
Parameter	Descripition	Points
Usage of water saving valves	Reduction of water consumption in comparison to standard valves of up to 50%	5
Usage of contact free valves	Usage of valves with an infra-red sensor	5
Double WC-flush e.g. Stop-function	Maximal flow rate 6l respectively 3l for urinals	5
Usage of waterless urinals	Solely waterless urinals are used	5
Usage of rainwater – outdoor area	Usage of rainwater (e.g. through cistern) for outdoor water usage	5
Rooftop greening	Utilization of rooftop greening (possibly gradation > 50% for flat roofs or semi flat roofs), minimum soil thickness: 7cm on average	5

Table 27: Water consumption/use of rainwater

- **Section D**[73]: Health and comfort: the production of pleasant indoor climate conditions contributes substantially to the well-being and the ability to work well in buildings and is planning the challenge especially when service buildings with high internal loads. The optimal combination of window surfaces, storage capacity, heating and ventilation, sun protection, heat insulation and other influencing factors allows the users comfortable internal environment all year round;
  - **D1: Thermal comfort in summer** (125 points): modern architecture and changes of use lead to, that also in our operating energy expenses in the summer of that in winter climate equals

[73] See Attachment 7: CESBA_ Sec. D

or even exceeds. One essential aspect of this are solar emissions, which cause the loss of thermal comfort in not appropriate or excessive energy consumption, to ensure this kind of comfort.

Before use active cooling systems (surface, air cooling) is necessary take a look to passive systems (such as night cooling, gravity ventilation in combination with efficient shipping shading devices - according to requirement as a result of the relevant emission-surfaces) for energy efficiency (Table 28).

D1	Thermal comfort in summer	
Parameter	Descripition	Points
Building with less than 35% of window area and without active cooling	Proof of respective state calculation system (the lower the cooling load, the higher points)	35-50
	Proof of PHPP, exceeding 26 °C < 5%	65
Dynamic building simulation (at least for critical facilities) taking into account the site climate, flexible loading and shading systems, as well as the uses expected	Exceeding 26 °C < 5% without active cooling system (E.g. free night cooling)	150
	Exceeding 26 °C < 10% without active cooling system (E.g. free night cooling)	50
	Exceeding 26 °C < 3% with active cooling system	75
	Detection to prevent draughts and tear (v < 0.1 m/s, ΔT < 2 K location)	75

Table 28: Thermal comfort in summer

- **D2: Comfort ventilation – hygiene and soundproofing** (50 points): comfort ventilation systems should contribute to improving the indoor air quality, and generally the quality of the stay in the room. Is also considered the noise pollution of the plant. Goal is that the basic noise level (maximum 1 dB) is not raised and perceived in normal operation, or in more common use of the rooms the ventilation noise is not disturbing (Table 29);

D2	Comfort ventilation – hygiene and soundproofing	
Parameter	Descripition	Points
Control room sound emission calculation (taking into account the use of space)	Forecast of the expected sound pressure level LA,nT < 30 dB and LC(50-4000),nT < 50 dB	20
Sound emission measurement in the most exposed rule workplace	LA,nT < 30 dB and LC(50-4000),nT < 50 dB	30
Sound emission measurement in the most exposed rule workplace	LA,nT < 30 dB and LC(50-4000),nT < 50 dB	40

Table 29: Comfort ventilation – hygiene and soundproofing

- **D3: Sunlight supply, daylight quotient** (50 points): this issue sets the calculation methods for the average daylight factor. The energy usage for artificial lighting and thus energy consumption throughout the entire building can be reduced when more sensible use of available sunlight. It aims to achieve a daylight factor of 5% in the working range. A daylight factor lower than 2% in the workplace is to be assessed as unfavourable (Table 30);

D3	Sunlight supply, daylight quotient	
Parameter	Descripition	Points
Ratio of available outdoor light to interior illuminance (in the room): daylight factor (D)	<2%	0
	2-3%	10
	3-4%	30
	5%	40

Table 30: Sunlight supply, daylight quotient

- **Section E**[74]: Building materials and construction: the ecological production expenses for a building with present building standard are about as high as the ecological expenses for heating a passive house for a period of 100 years. Therefore, the ecological optimization of the production expenses is a crucial element of building ecologically. Ecological optimization is the minimization of the material flows and emissions during the production process of the building and the building material;
  - **E1: Ecological value of the thermal envelope Eco-index 3** (200 points): the ecological optimization of the products expenses can be illustrated by the Ecological index 3 of thermal building envelope with the balance limit 3 (OI3BG3, BGF). Here, the ecological index 3 calculates only three important environment categories – the primary demand of non-renewable energy sources (Abbreviation: PEI n.e.), the global warming potential

[74] See Attachment 8: CESBA_ Sec. E

(abbreviation: GWP) and the acidification potential (Abbreviation: AP) – per square meter of a building component using a range of 100 points.

The value of the OI3BG3,BGF for the building is lower, the less non-renewable energy is used and the less greenhouse gases and other emissions were emitted when the building and building materials were produced. At this point arise the product management concept: the careful selection and control of construction products to prevent room air pollutants, for this resaon exist a list of ecological indicators for product (Table 31).

E1	Ecological value of the thermal envelope Eco-index 3	
Parameter	Descripition	Points
Ecological Index 3 of the thermal building envelope with the balance	Primary demand of non-renewable energy sources (Abbreviation: PEI n.e.) per square meters	100
	Global warming potential (abbreviation: GWP) per square meters	100
	Acidification potential (Abbreviation: AP) per square meters	100
Annex 1 „environmental indicators for the	„Ecological building and acquiring in the Lake Constance region (oeg)“ [Ökoleitfaden 2007]	
	„Eco buy Vienna“ AG 08 Interior [Ökokauf Wien]	
Interior	Low-emission resilient flooring	
	Low-emission textile floor coverings	
	Low-emission adhesives	
	Avoiding emissions from insulating materials in the air	
	Avoidance of formaldehyde emission from wood-based materials	
	Avoidance of VOC and SVOC emission from wood-based materials	
Choice of materials, construction materials	Low-emission bituminous preparations	
	Free of KMR materials	
	Heavy metal-free preparations	
	SVOCS-free preparations	
	Prevention of free formaldehyde	
	Avoiding acid-curing coatings	
	Preparations free from aromatic hydrocarbons	
	VOC-poor preparations	
	Low-emission sealants	

Table 31: Ecological value of the thermal envelope Eco-index 3

For each indicator's voice, it was made sure that there was almost an available document, however it was not possible respond to the relative parameter, so for some voices there are no information. After the selection of the useful documents it was reach an amount of 80 useful documents for the final aim of the thesis.

3.4 COBIe SPREADSHEET

Before explaining the structure of the used COBIe spreadsheet it would be useful specify that each sheet is characterized by several columns containing the specification of the sheet. Not all the columns have to be filled with data, but there are different type of column and they're individualized by colours:

- YELLOW: these columns should be filled with data, if there aren't data it has to be filled with "n/a" because a blank cell could cause problems during file exportation;
- PURPLE: these columns may contain data if needed, to link the data to external contractor (or COBIE) data, if cells could not be filled they would remain blank;
- GREEN: these columns may contain data, if specified in a hypothetical contract. Generally speaking if it is started to put some value or information in green columns it is expected that it would be done for all the correspondent value in rows, but it is not mandatory;
- ORANGE: these columns may contain referenced data, if needed.

It is also important that for each row it would be specified who created the row and when in the columns called "CreatedBy" and "CreatedOn".

The created COBIe spreadsheet is composed by the following sheet:

- **Document**[75]: with the list of the useful documentation (Table 32). Columns contains:
  - **DocTag**: (green column) the code of each document;
  - **Name**: (yellow column) the name of the document;
  - **CreatedBy**: (orange column) who create the row in the sheet;
  - **CreatedOn**: (yellow column) when the row is created in the sheet;
  - **ApprovalBy**: (orange column) which body (public or private) approved the documentation;
  - **Stage**: (orange column) if the document is current or it has expired, depending on its validity;
  - **ExtSystem, ExtObject, ExtIdentifier**: (purple column) information in these cells should be reported if they are generated by an automated system. In this case they remain empty.

[75] See Attachment 9: COBIe spreadsheet: Document sheet

DocTag	Name	CreatedBy	CreatedOn	ApprovalBy	Stage	ExtSystem	ExtObject	ExtIdentifier
CU01.01.01.04.01	CONVENZIONE USO IMPIANTO SPORTIVO_16.05.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU01.03.01.01.01	TIPO MAPPALE PER AMPLIAMENTO PROT. 139870-2014_20.09.2014	Eleonora_Idra	28-lug	Agezia delle Entrate	Current			
CU01.03.01.03.01	ESTRATTO MAPPA_25.02.2014	Eleonora_Idra	28-lug	Ufficio catastale Prov Varese	Current			
CU01.03.02.02.02	SCHEDE CATASTALI_PALESTRA_25.09.2014	Eleonora_Idra	28-lug	Catasto Fabbricati Varese	Current			
CU01.03.02.03.01	ELABORATO PLANIMETRICO_MAPPALE 3071_25.09.2014	Eleonora_Idra	28-lug	Catasto Fabbricati Varese	Current			
CU01.04.04.03.01	ESTRATTO CARTOGRAFIA PRG	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU01.04.04.03.02	LEGENDA ESTRATTO PRG	Eleonora_Idra	28-lug	Comune di Gallarate	Current			

Table 32: COBIe Document spreadsheet extract

- **Floor**[76]: with the list of the floor of the building (Table 33). Columns contain information about:
  - **FloorTag**: (green column) the code assigned to each floor;
  - **Name**: (yellow column) the name of the floor;
  - **CreatedBy**: (orange column) who create the row in the sheet;
  - **CreatedOn**: (yellow column) when the row is created in the sheet;
  - **ExtSystem, ExtObject, ExtIdentifier**: (purple column): information in these cells have to be reported if they are generated by an automated system. In this case they remain empty.
  - **Elevation**: (green column) the level at which lies the floor;
  - **Height**: (green column) the usable height of the floor expressed in meters.

FlorTag	Name	CreatedBy	CreatedOn	ExtSystem	ExtObject	ExtIdentifier	Elevation		Height	
Ext	ExternalArea	Eleonora_Idra	01-ago				0	m	2,70	m
-1F	BasementFloor	Eleonora_Idra	01-ago				-2,60	m	6,10	m
0F	GroundFloor	Eleonora_Idra	01-ago				0	m	3,48	m
1F	FirstFloor	Eleonora_Idra	01-ago				3,83	m	2,70	m

Table 33: COBIe Floor spreadsheet extract

- **Space**[77]: in that sheet are listed all the rooms and spaces of the building (Table 34). Columns reported information about:
  - **RoomTag**: (green column) the code assigned to each space;
  - **Name**: (yellow column) the name of the component;
  - **CreatedBy**: (orange column) who create the row in the sheet;
  - **CreatedOn**: (yellow column) when the row in created in the sheet;
  - **FloorName**: (yellow column) information in this column are linked with the sheet "Floor" in this way it is possible to know where each room is located;

[76] See Attachment 10: COBIe spreadsheet: Floor sheet
[77] See Attachment 11: COBIe spreadsheet: Space sheet

- **ExtSystem, ExtObject, ExtIdentifier**: (**purple column**): information in these cells should be reported if they are generated by an automated system. In this case they remain empty;
- **UsableHeight**: (**green column**) indicates the internal usable height of each room;
- **UsableArea**: (**green column**) indicates the usable internal area of each room;
- **UsableVolume**: (**green column**) contains the formula "UsableHeight"*"UsableArea" and the results is the volume of each room;
- **GlazedSurface**: (**green column**) indicates the glazed surface of each room;
- **IlluminatinRatio**: (**green column**) indicates the value of illumination of the room;
- **AeratingRatio**: (**green column**) indicates the value of the air exchange in each room;
- **MaximunAverageCrowd**: (**green column**) indicates the maximum number of people present in the room.

RoomTag	Name	CreatedBy	CreatedOn	FloorName	ExtSystem	ExtObject	ExtIdentifier	UsableHeight	UsableArea	UsableVolume	GlazedSurface	IlluminatingRatio	AeratingRatio	MaximumAverageCrowd
A	Sala_corsi1	Eleonora_Idra	29-lug	GroundFloor				3,20 m	183,60 mq	587,52 mc	23,04 mq	1/8	1/8	28 ppl
B	Sala_corsi2	Eleonora_Idra	29-lug	GroundFloor				3,20 m	99,82 mq	319,42 mc	11,16 mq	1/9	1/9	14 ppl
C	Sala_danza	Eleonora_Idra	29-lug	GroundFloor				3,20 m	99,82 mq	319,42 mc	12,96 mq	1/8	1/8	14 ppl
D	Sala_fitness	Eleonora_Idra	29-lug	GroundFloor				3,45 m	242,10 mq	835,25 mc	54,15 mq	2/8	2/8	40 ppl
E	Sala_corsionetoone	Eleonora_Idra	29-lug	GroundFloor				3,45 m	26,63 mq	91,87 mc	5,42 mq	1/5	1/5	3 ppl
F	Sala_corsi3	Eleonora_Idra	29-lug	GroundFloor				3,45 m	66,47 mq	229,32 mc	16,25 mq	1/4	1/4	7 ppl

Table 34: COBIe Space spreadsheet extract

- **Component**[78]: in that sheet are listed the component useful for the fulfilling of the sheet attribute. Not all the component in the building are considered. Every time it would be necessary the presence of an element for the satisfying of an attribute it was added at the list (Table 35). Columns contain information about component are the following:
  - **TagNumber**: (**green column**) the code assigned to each component;
  - **Name**: (**yellow column**) the name of the component;
  - **CreatedBy**: (**orange column**) who create the row in the sheet;
  - **CreatedOn**: (**yellow column**) when the row in created in the sheet;
  - **TypeName**: (**orange column**) in this column are reported information about the model and the producer brand name of the component
  - **Space**: (**orange column**) information in this column are linked with the sheet "Space" in order to indicate in which room the component is located.
  - **ExtSystem, ExtObject, ExtIdentifier**: (**purple column**) information in these cells should be reported if they are generated by an automated system. In this case they remain empty.

[78] See Attachment 12: COBIe spreadsheet: Component sheet

TagNumber	Name	CreatedBy	CreatedOn	TypeName	Space	ExtSystem	ExtObject	ExtIdentifier
CB1	CondensingBoiler_1	Eleonora_Idra	10-ago	VIESSMANN/ VITOMODUL 200-W 315	Locale_Tecnico			
CB2	CondensingBoiler_2	Eleonora_Idra	10-ago	VIESSMANN	Locale_Tecnico			
HP	HeatingPump	Eleonora_Idra	10-ago	CARRIER/ 61AF-045	Locale_Tecnico			
CCU	ClimateControlUnit	Eleonora_Idra	10-ago	VIESSMANN/ VITOTRONIC 200	Locale_Tecnico			
PCCU1	ProbesClimateControlUnit_1	Eleonora_Idra	10-ago	SIEMENS/ VXG	Sala_corsi1			
PCCU2	ProbesClimateControlUnit_2	Eleonora_Idra	10-ago	SIEMENS/ VXG	Sala_corsi2			
PCCU3	ProbesClimateControlUnit_3	Eleonora_Idra	10-ago	SIEMENS/ VXG	Sala_danza			
PCCU4	ProbesClimateControlUnit_4	Eleonora_Idra	10-ago	SIEMENS/ VXG	Sala_fitness			

Table 35: COBIe Component spreadsheet extract

- **Attribute**[79]: this sheet is the most relevant for the achieving of the final aim of the thesis. It contains the CESBA's criteria developed in the way that could be imported in COBIE.
  The sheet is divided in the same CESBA's sections illustrated before. The parameters will be transformed in the way that in the attribute name in COBIe could be exported and measured: in other words, they were simplified as in Table 36:

Original CESBA parameters	COBIe CESBA's attribute
D3_Sunlight supply, daylight quotient Ratio of available outdoor light to interior illuminance (in the room): daylight factor (D)	D3_Sunlight supply, daylight quotient NonPrimaryEnergyConsumption

Table 36: CESBA's criteria in COBIe

In this case the original parameters of the D3 criteria "Sunlight supply, daylight quotient" in CESBA was described as the "Ratio of available outdoor light to interior illuminance (in the room): daylight factor (D)" in order to describe it as an attribute in COBIe it was necessary translate the concept as: SUBJET (NonPrimaryEnergy)+ACTION (Consumption): in this way, the parameter is easy to measure and associate with eventual other characteristics.

Therefore, each parameter is associable with more than one space or component (Table 37):

- **Name**: (yellow column) the name of the attribute;
- **CreatedBy**: (orange column) who create the row in the sheet;
- **CreatedOn**: (yellow column) when the row in created in the sheet;

[79] Attachment 13: COBIe spreadsheet: Attribute sheet

- **SheetName**: (**orange column**) in this column are reported information about the sheet to which the attribute is linked (in this case document's sheet, component's sheet or space's sheet) and the attribute is referring;
- **RowName**: (**orange column**) in this column are reported information about the row of the sheet at which the attribute is referring;
- **Value**: in this column is possible to find the numerical value of the attribute, or in some cases (for example for the attribute referring to materials) the materials of the components the attribute is referring;
- **ExtSystem, ExtObject, ExtIdentifier**: (**purple column**) information in these cells should be reported if they are generated by an automated system. In this case they remain empty.

Name	CreatedBy	CreatedOn	SheetName	RowName	Value	Unit	ExtSystem	ExtObject	ExtIdentifier
B2_Definition of verifiable energetic and ecologic objectives									
TermalHeatingDemand	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	19,64	kg/mca			
TermalCoolingDemand	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	3,17	kg/mca			
PrimaryEnergyDemand	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	134,17	kg/mca			
CO2Emissions	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	2,72	kg/mca			
PhotovoltaicYield	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	30	Kw			
B3_Simplified calculation of efficiency									
BuildingServiceLife	Eleonora_Idra	30-lug	Component			Years			
B4_Product management - using low-polutant and low-emission building materials									
ExternalMaterials	Eleonora_Idra	30-lug	Component	ExternalPipesInsulation	iuav	n/a			
InternalMaterials	Eleonora_Idra	30-lug	Component	SmokingDuct	pps	n/a			
InternalMaterials	Eleonora_Idra	30-lug	Component	Chimney	inox	n/a			
InternalMaterials	Eleonora_Idra	30-lug	Component	InternalPipesInsulation	iuav	n/a			
B5_Energetic optimizaton during the planning									
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Sala_corsi1	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Sala_corsi2	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Sala_danza	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Sala_fitness	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Sala_corsionetoone	20	°C			

Table 37: COBIe Component spreadsheet extract

4 CONCLUSIONS AND FURTHER DEVELOPMENTS

Once explained how the criteria were elaborated in COBIe, it is possible sum up with some comments. Assuming that the building has all the necessary documentation, it could be possible to translate in COBIe the 85% of the CESBA criteria without the help of any other programs or expenses. The 15% of the criteria that cannot be directly translate needs a further elaboration with other tools, as required in the CESBA protocol[80]:

- **PHPP** (Passive House Planning Package): it was presented on the market in 1998 and it was uploaded every year since then. The spreadsheet that lying at the basis of PHPP are those connected to heating demand, to heating distribution and to the demand of electric energy and primary energy; those sheets are integrated with the windows' features, shadows and the behaviour of the building in winter and in summer.

  The tool provides results for what concerns:

  - yearly heating and cooling demand;
  - specific heating and cooling thermic loan;
  - overheating frequencies without any cooling system in summer;
  - renewable primary energy demand (EPR) and primary energy demand (EP);
  - renewable energy production.

  PHPP needs a license that costs about 650 €[81].
- **ECOSOFT** is a software for the environmental buildings assessment. It is developed by IBO and is available as an on-line tool on baubook Eco2Soft. It allows to quantify the environmental impact of new and refurbish buildings. Some specific of the software:

  - calculation of the impact of the life cycle of a building;
  - access to specific product's data produced by the www.baubook.info platform or to values about specific building products;
  - are taking in consideration also the usage duration and the transportation condition of building product in their life cycle.

  ECOSOFT costs 100 €/year[82].

[80] (Partners, C. P. (2013, September 30). CESBA Common European Sustainable Building Assessment - . Indicator Catalogue for Public Buildings Refurbishment.)
[81] (Passivehouse. (2017). Passiv House Institute. Retrieved from PHAI: www.passivehouse.com)
[82] (IBO. (2015). IBO / baubook eco2soft. Retrieved from IBO: www.ibo.at)

Considering that CESBA is a free platform in order to allows everyone to join it and contributing in the enrichment of information, the fact that for using it is necessary invest money in other assessment tool represent a weakness point, because if someone should purchase another toll there is no reason why to continue using CESBA. However, the problem is faced only for the 15% of the criteria, and for the aim of the thesis it could be sufficiently satisfying the 85% of available CESBA criteria on COBIe.
In the case study, not all the CESBA criteria were fulfilled because of the lack of documentation about. Moreover it was calculated the score of the building although it is a counterfeit result for the same reasons explained before. However the building with the owned documentation reached the following score (Table 38):

Maximum score	Building score
1000	424

Table 38: CESBA building score

The obtained value has not a lot of significance, because some of the more heavy data were not available, the value was reported only to be thorough.
However, it is important outline the strength of the used methodology: COBIe is a system that allows the standardized exchange of information, that reduces errors, and it would be unavoidable with the classical approach to the project. Moreover, COBIe is continuously up loadable in each stage of the project, it is rather suggested the simultaneous development: COBIe with the building. COBIe has also a plus quality in respect of IFC: it is customizable (not the process, that is standardized): for what concern the sheet Attribute is possible to exactly express the precise attribute that you intended, because sometime with IFC it is not possible to identify the precise features and that cause lack of knowledge.
In general it is possible to say that the COBIe methodology ease the approach to existing building environmental impact evaluation, developing a human and software-readable data base which is easily transferrable in a 3D model, with the additional creation of a sustainability report that can help the decision making in every stage of the design and the life cycle of the building and also allows the use of a DSS (Decision Support System) in the support of the decision making during the developing of the design.
Obviously, the development of the lean green BIM approach is at its start-up phase. It needs more exemplification through different case study from different building classes, to be demonstrate the fact that it could be interfaced also with residential units, hospitals, public administration buildings, in this

way it could allow the application of the methodology not only considering the requirements from UNI 10998 and CESBA criteria, but also with other norms.

Considering only the approach of COBIe without considering the CESBA point of view, and without the creation of a 3D model, it is possible to say that it could be interesting its application also in other fields, for example in the facility, with the integration of the COBIe protocols in CMMS (computerized maintenance management systems).

In literature are well known the benefits coming from the use of BIM in the facility management, especially for what concern space management, as demonstrated Graham Kelly, Michael Serginson & Steve Lockley in their survey about 32 non-residential buildings in Northumbria University's city campus[83], however were highlighted the necessity of a greater interoperability between BIM and FM and the need of a more standardized data-base for managers that have to work with a new set of mind moreover it has to be clarified roles, responsibilities, contract and liability framework.

Angela Lewis and Birgitta Foster have already suggested the use of COBIe in CMMS in 2013: "Managers can use COBie to improve organizational effectiveness by determining asset data to collect and support the population of CMMS with this data in order to make smart, proactive decisions"[84]. With the use of COBIe in facility management would be solved some of the problems expressed before, in these terms, CMMS were empowered: data extracted from BIM would be stored in a data-base since the early stage of the design avoiding interoperability problems[85].

Every research is 3D model based, and centring their attention in particular on geometrical information, a suggestion for further development could be the focus on semantic data, in order to avoid the creation of the graphical model and a consequent saving of time and resources.

[83] (Graham Kelly, M. S. (2013). Bim for Facility Management: a Review and a Case Study investigating the Value and Challenges. Proceedings of the 13th International Conference on Construction Applications of Virtual Reality, (pp. 30-31).)

[84] (Foster, A. L. (2013, May). Facilitiesnet - Facilities, Management, News and Education. Retrieved from Facilitiesnet: http://www.facilitiesnet.com/software/article/Tips-on-Maximizing-Your-CMMS--14050?source=next)

[85] (Sarel Lavy, S. J. (2014). A Case Study of Using BIM and COBie for Facility Management. International Journal of Facility Management 5.2.)

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CU02.01.02.09.06	RELAZIONE TECNICA AUT_26.10.2011	26/10/2011	-	A.5_Building system's graphic documents B.5_Fire Prevention B.10_Technological plants	B.7_Analysis of the building and weaknesses C.1_Heating Demand PHPP C.2_Cooling demand PHPP C.7_Water consumption/ use of rainwater
CU02.01.02.09.07	RELAZIONE TECNICA AUT_29.04.2014	29/04/2014	-	A.5_Building system's graphic documents B.5_Fire Prevention B.10_Technological plants	B.7_Analysis of the building and weaknesses C.1_Heating Demand PHPP C.2_Cooling demand PHPP C.7_Water consumption/ use of rainwater
CU02.01.02.09.08	RICHIESTA PARERE CONF VVF PROT_17.03.2014	17/03/2014	-	B.5_Fire Prevention	
CU02.01.02.10.01	DENUNCIA IMPIANTO MAT_19.11.1991	19/11/1991	-	A.5_Building system's graphic documents B.2_Energy consumption's restraint B.10_Technological plants	B.5_Energetic optimization during the planning C.3_Primary energy demand indicator PHPP C.5_PV-Power plant CO2-Equivalents
CU03.01.01.01.01	ALL. 01 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	29/09/2014	-	A.4_Building system's generic and synthetic description B.3_Building hygiene and safety B.8_Building's production and tranformations C.3_ Context of performance and needs	B.1_Decision-making and examination of alternatives B.5_Energetic optimization during the planning B.6_User information B.7_Analysis of the building and weaknesses C.2_Cooling demand PHPP D.1_Thermal comfort in summer D,2_Comfort ventilation – hygiene and soundproofing D.3_Sunlight supply, daylight quotient E.1_OI3TGH-lc Ecological value of

CU03.01.01.01.02	ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	29/09/2014	-	A.3_Building system's subjets A.4_Building system's generic and synthetic description B.2_Energy consumption's restraint B.3_Building hygiene and safety B.10_Technological plants	B.1_Decision-making and examination of alternatives B.3_Simplified calculation of efficiency B.4_Product management – using low-pollutant and low-emission building materials B.5_Energetic optimization during the planning B.7_Analysis of the building and weaknesses C.2_Cooling demand PHPP C.4_Emissions of CO2-Equivalents according to PHPP C.5_PV-Power plant CO2-Equivalents D.1_Thermal comfort in summer D.3_Sunlight supply, daylight quotient E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.01.01.01.03	ELABORATI GRAFICI COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	29/09/2014	-	B.8_Building's production and tranformations	
CU03.01.01.01.04	MODULO COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	29/09/2014	-	B.8_Building's production and tranformations	
CU03.01.01.03.01	AS BUILT ARCHITETTONICO COSTRUTTIVO_11.11.2014	11/11/2014	-	B.8_Building's production and tranformations	B.4_Product management – using low-pollutant and low-emission building materials B.6_User information B.7_Analysis of the building and weaknesses
CU03.01.01.03.02	AS BUILT ARCHITETTONICO DEFINITIVO_11.11.2014	11/11/2014	-	B.3_Building hygiene and safety B.8_Building's production and tranformations	B.6_User information B.7_Analysis of the building and weaknesses
CU03.01.01.03.03	AS BUILT ARCHITETTONICO ESTERNI_11.11.2014	11/11/2014	-	B.1_Environmental protection B.4_Building feasability B.8_Building's production and tranformations	B.3_Simplified calculation of efficiency B.6_User information B.7_Analysis of the building and weaknesses D.3_Sunlight supply, daylight quotient
CU03.01.01.05.01	CERTIFICATO DI COLLAUDO CARPENTERIA METALLICA_09.12.2009	09/12/2009	-	B.8_Building's production and tranformations B.5_Fire Prevention B.9_Load bearing structure	

CU03.01.01.05.02	DICHIARAZIONE DI CONFORMITA' E MANUALE COPERTURA CAMPI TENNIS IN LEGNO LAMELLARE_02.10.2009	02/10/2009	-	A.4_Building system's generic and synthetic description B.3_Building hygiene and safety	B.4_Product management – using low-pollutant and low-emission building materials B.6_User information B.7_Analysis of the building and weaknesses E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.01.01.05.03	DICHIARAZIONE DI CONFORMITA' TELO CAMPO DA TENNIS_19.10.2009	19/10/2009	-	B.3_Building hygiene and safety	B.4_Product management – using low-pollutant and low-emission building materials B.6_User information E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.01.01.05.04	SCHEDA TECNICA ERBA SINTETICA FINO AL 2012_29.08.2006	29/08/2006	-	B.3_Building hygiene and safety	B.4_Product management – using low-pollutant and low-emission building materials B.6_User information E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.01.01.05.05	SCHEDA TECNICA ERBA SINTETICA_01.04.2012	01/04/2012	-	B.3_Building hygiene and safety	B.4_Product management – using low-pollutant and low-emission building materials B.6_User information E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.01.01.05.06	SCHEDA TECNICA ERBA SINTETICA_02.12.2009	02/12/2009	-	B.3_Building hygiene and safety	B.4_Product management – using low-pollutant and low-emission building materials B.6_User information
				A.4_Building system's generic and synthetic description B.3_Building hygiene and safety B.10_Technological plants	B.2_Definition of verifiable energetic and ecologic objectives B.7_Analysis of the building and weaknesses C.3_Primary energy demand indicator PHPP

CU03.01.02.02.01	ATTESTATO DI PRESTAZIONE ENERGETICA_07.10.2014	07/10/2014	-		C.4_Emissions of CO2-Equivalents according to PHPP C.6_Differentiated documentation of Energy Consumption D.1_Thermal comfort in summer D,2_Comfort ventilation – hygiene and soundproofing D.3_Sunlight supply, daylight quotient E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.02.01.01.01	CERTIFICATI PROVE BARRE D'ARMATURA_12.02.2010	12/02/2010	-	B.9_Load bearing structure	
CU03.02.01.01.02	CERTIFICATI PROVE SU PROVINI DI CALCESTRUZZO_17.02.2010	17/02/2010	-	B.9_Load bearing structure	
CU03.02.01.01.03	CERTIFICATO DI PROVA DEI PROVINI_09.09.1992	09/09/1992	-	B.9_Load bearing structure	
CU03.02.01.01.04	COLLAUDO STATICO_DIA PROT 0014214 DEL 11.04.2014_02.10.2014	02/10/2014	-	B.9_Load bearing structure	
CU03.02.01.01.05	COLLAUDO STRUTTURALE IMPIANTO SPORTIVO-PRATICA 771_29.04.2010	29/04/2010	-	B.9_Load bearing structure	
CU03.02.01.01.06	RELAZIONE DI COLLAUDO RELATIVO ALLA CE 70-1989_08.01.1993	08/01/1993	-	B.9_Load bearing structure	
CU03.02.01.03.01	AS BUILT STRUTTURE IN CLS TAV01_11.11.2014	11/11/2014	-	B.9_Load bearing structure	
CU03.02.01.03.02	AS BUILT STRUTTURE IN CLS TAV02_11.11.2014	11/11/2014	-	B.9_Load bearing structure	
CU03.02.01.03.03	AS BUILT STRUTTURE IN CLS TAV03_11.11.2014	11/11/2014	-	B.9_Load bearing structure	
CU03.02.01.03.04	AS BUILT STRUTTURE IN LEGNO TAV01_11.11.2014	11/11/2014	-	B.9_Load bearing structure	
CU03.02.01.03.05	AS BUILT STRUTTURE IN LEGNO TAV02_11.11.2014	11/11/2014	-	B.9_Load bearing structure	
CU03.02.01.03.06	AS BUILT STRUTTURE IN LEGNO TAV03_11.11.2014	11/11/2014	-	B.9_Load bearing structure	
CU03.02.01.03.07	PROGETTO STRUTTURALE RELAZIONE DI CALCOLO PER LA TRIBUNA _02.05.1995	02/05/1995	-	B.9_Load bearing structure	
CU03.02.01.03.08	PROGETTO STRUTTURALE TRIBUNA_02.05.1995	02/05/1995	-	B.9_Load bearing structure	
CU03.02.01.03.09	RELAZIONE DI CALCOLO STRUTTURALE RELATIVA ALLA COPERTURA IN LEGNO_31.07.2014	31/07/2014	-	B.9_Load bearing structure	
CU03.02.01.03.10	RELAZIONE DI CALCOLO TRIBUNE PREFABBRICATE	-	-	B.9_Load bearing structure	
CU03.03.01.01.01	DICH DI CONFORMIT_CT CENTRO SPORTIVO_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.01.02	DICH DI CONFORMIT_CT SPOGLIATOI_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.01.03	DICH DI RISPONDENZA_CT UFFICIO P1_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.01.04	DICH DI RISPONDENZA_GENERATORI CAMPO B_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.01.05	DICHIARAZIONE DI CONFORMITA' CENTRALE FRIGO_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.01.06	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO RISTORANTE_30.09.2014	30/09/2014	-	B.10_Technological plants	B.5_Energetic optimization during the planning B.7_Analysis of the building and weaknesses
CU03.03.01.01.07	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO VAV_30.09.2014	30/09/2014	-	B.10_Technological plants	B.5_Energetic optimization during the planning B.7_Analysis of the building and weaknesses
CU03.03.01.01.08	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO_30.09.2014	30/09/2014	-	B.10_Technological plants	B.5_Energetic optimization during the planning B.7_Analysis of the building and weaknesses

CU03.03.01.01.09	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI RISCALDAMENTO_30.09.2014	30/09/2014	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.03.01.01.10	DICHIARAZIONE DI CONFORMITA IMPIANTO GAS RISCALDAMENTO PISTA PATTINAGGIO_16.02.1995	16/02/1995	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.03.01.01.11	DICHIARAZIONE DI CONFORMITA' LINEA GAS CALDAIA E FORNO PIZZA_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.01.12	DICHIARAZIONE DI CONFORMITA' POMPA DI CALORE_30.09.2014	30/09/2014	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.03.01.01.13	VERBALE DI COLLAUDO PROVA A TENUTA IMPIANTO GAS METANO_30.09.2014	30/09/2014	-	B.10_Technological plants	
CU03.03.01.02.01	AS BUILT IMPIANTO MECCANICO TAV01_11.11.2014	11/11/2014	-	A.5_Building system's graphic documents B.10_Technological plants	
CU03.03.01.02.02	AS BUILT IMPIANTO MECCANICO TAV02_11.11.2014	11/11/2014	-	A.5_Building system's graphic documents B.10_Technological plants	
CU03.03.01.02.03	AS BUILT IMPIANTO MECCANICO TAV03_11.11.2014	11/11/2014	-	A.5_Building system's graphic documents B.10_Technological plants	
CU03.03.01.02.04	PROGETTO ESECUTIVO - ELABORATI GRAFICI IMP GAS_01.10.2007	01/10/2007	-	A.5_Building system's graphic documents B.10_Technological plants	
CU03.03.01.02.05	PROGETTO ESECUTIVO - RELAZIONE TECNICA IMP GAS_01.10.2007	01-10-207	-	A.5_Building system's graphic documents B.10_Technological plants	
CU03.03.01.02.06	PROGETTO IMPIANTO IDRICOSANITARIO CON COLLETTORI SOLARI_01.09.2009	01/09/2009	-	A.5_Building system's graphic documents B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption C.7_Water consumption/ use of rainwater
CU03.03.01.03.01	BROCHURE IMPIANTO SOLARE TERMICO SIME	-	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.10_Technological plants	B.5_Energetic optimization during the planning
CU03.03.01.03.02	CERTIFICATO DI CONFORMITA COLLETTORE SOLARE IMPIANTO SIME_17.04.2009	17/04/2009	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.03.01.03.03	LIBRETTO COLLETTORE SOLARE SIME	-	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.2_Energy consumption's restraint B.10_Technological plants	B.3_Simplified calculation of efficiency B.6_User information C.6_Differentiated documentation of Energy Consumption D.3_Sunlight supply, daylight quotient E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
				A.4_Building system's generic and synthetic description A.5_Building system's graphic documents	B.3_Simplified calculation of efficiency B.6_User information

CU03.03.01.03.04	LIBRETTO MANUTENZIONE ED USO DELLA CENTRALINA DIFFERENZIALE TDC IMPIANTO SOLARE	-	-	B.2_Energy consumption's restraint B.10_Technological plants	D.3_Sunlight supply, daylight quotient E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.03.01.03.05	LIBRETTO USO E MANUTENZIONE IMPIANTO RISCALDAMENTO CAMPO TENNIS	-	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.2_Energy consumption's restraint B.10_Technological plants	B.3_Simplified calculation of efficiency B.6_User information D.3_Sunlight supply, daylight quotient E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.03.01.03.06	MANUALE INSTALLAZIONE BOLLITORE SIME	-	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.2_Energy consumption's restraint B.10_Technological plants	B.3_Simplified calculation of efficiency B.6_User information D.3_Sunlight supply, daylight quotient C.6_Differentiated documentation of Energy Consumption E.1_OI3TGH-lc Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)
CU03.03.01.03.07	MODULO GARANZIA COMPONENTI IMPIANTO SOLARE SIME_29.01.2010	29/01/2010	-	B.10_Technological plants	
CU03.03.01.04.01	RAPPORTO CONTROLLO TECNICO IMPIANTO SOLARE_29.01.2010	29/01/2010	-	B.10_Technological plants	
CU03.03.01.04.02	RAPPORTO CONTROLLO TECNICO IMPIANTO SOLARE_31.08.2010	30/08/2010	-	B.10_Technological plants	
CU03.03.02.01.01	DICH DI CONFORMIT_IDRICO SANITARIO CENTRO SPORTIVO_30.09.2014	30/09/2014	-	B.10_Technological plants	B.5_Energetic optimization during the planning B.7_Analysis of the building and weaknesses C.7_Water consumption/ use of rainwater
CU03.03.02.01.02	DICH DI CONFORMIT_IDRICO SANITARIO SPOGLIATOI CALCETTO_30.09.2014	30/09/2014	-	B.10_Technological plants	B.5_Energetic optimization during the planning B.7_Analysis of the building and weaknesses C.7_Water consumption/ use of rainwater
CU03.04.01.01.01	DICH DI CONFORMIT IMPIANTI ELETTRICI_02.09.2014	02/09/2014	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.04.01.01.02	DICH DI CONFORMIT MAT_02.09.2014	02/09/2014	-	B.10_Technological plants	
CU03.04.01.01.03	DICH DI CONFORMITA IMPIANTO ELETTRICO ASCENSORE_02.09.2014	02/09/2014	-	B.10_Technological plants	

CU03.04.01.01.04	DICH DI CONFORMITA IMPIANTO ELETTRICO NUOVA COPERTURA CAMPO TENNIS_04.11.2009	04/11/2009	-	B.10_Technological plants	
CU03.04.01.01.05	DICH DI CONFORMITA IMPIANTO ELETTRICO PISTA DI PATTINAGGIO_21.02.1995	21/02/1995	-	B.10_Technological plants	
CU03.04.01.01.06	DICHIARAZIONE DI CONFORMITA IMPIANTO ELETTRICO_28.10.2009	28/10/2009	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.04.01.02.01	AS-BUILT IELE_ELABORATI GRAFICI_11.11.2014	11/11/2014	-	A.5_Building system's graphic documents B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.04.01.02.02	AS-BUILT IELE_RELAZIONI TECNICHE_11.11.2014	11/11/2014	-	A.5_Building system's graphic documents B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.04.01.02.03	AS-BUILT IELE_SCHEMI REGOLAZIONI SIEMENS_11.11.2014	11/11/2014	-	A.5_Building system's graphic documents B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.04.01.04.01	COMUNICAZIONE AD ASL IN MERITO A RICHIESTE ASL DEL 29.06.2000_01.09.2000	01/09/2000	-	B.3_Building hygiene and safety	
CU03.04.01.04.02	REGISTRO PROVE DI VERIFICA IMPIANTO DI MESSA A TERRA_01.09.1999	01/09/1999	-	B.10_Technological plants	
CU03.04.01.04.03	VERBALE DI VERIFICA PERIODICA IMPIANTO MAT_01.04.1995	01/04/1995	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.10_Technological plants	C.3_Primary energy demand indicator PHPP C.6_Differentiated documentation of Energy Consumption
CU03.04.01.04.04	VERIFICA IMPIANTO DI MESSA A TERRA ESEGUITO DA ASL_29.06.2000	29/06/2000	-	B.10_Technological plants	
CU03.04.01.04.05	VERIFICA IMPIANTO DI MESSA A TERRA TRASMESSO AD USSL_07.04.1995	07/04/1995	-	B.10_Technological plants	
CU03.04.01.04.06	VERIFICA IMPIANTO DI MESSA A TERRA TRASMESSO AD USSL_27.01.1992	27/01/1992	-	B.10_Technological plants	
CU03.04.01.04.07	VERIFICA IMPIANTO DI MESSA A TERRA_30.09.1999	30/09/1999	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.10_Technological plants	C.3_Primary energy demand indicator PHPP C.6_Differentiated documentation of Energy Consumption
CU03.04.02.01.01	DICH DI CONFORMIT_IMPIANTI ELETTRICO GRUPPO ELETTROGENO_30.09.2014	30/09/2014	-	B.10_Technological plants	C.6_Differentiated documentation of Energy Consumption
CU03.04.02.01.02	DICH DI CONFORMIT_IMPIANTO RIVELAZIONE INCENDI_30.09.2014	30/09/2014	-	B.5_Fire Prevention B.10_Technological plants	
CU03.04.02.02.01	RELAZIONE DI CALCOLO DELLE PROBABILITA DI FULMINAZIONE DA SCARICHE ATMOSFERICHE_01.04.1995	01/04/1995	-	B.5_Fire Prevention B.10_Technological plants	
CU03.05.01.01.01	DICH DI CONFORMIT IMPIANTO ASCENSORE OTIS_24.09.2014	24/09/2014	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents	

				B.10_Technological plants	
CU03.05.01.04.01	MANUALE USO E MANUTENZIONE ASCENSORE OTIS_29.01.2014	29/01/2014	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.10_Technological plants	B.5_Energetic optimization during the planning B.6_User information
CU03.05.01.07.01	COMUNICAZIONE COMUNE NUMERO MATRICOLA E MESSA IN ESERCIZIO ASCENSORE_08.10.2014	08/10/2014	-	B.10_Technological plants	
CU03.05.01.07.02	DOMANDA PROTOCOLLATA PER MESSA IN ESERCIZIO ASCENSORE_29.09.2014	29/09/2014	-	B.10_Technological plants	
CU03.06.01.01.01	DICH DI CONFORMIT IMPIANTO ANTINCENDIO_30.09.2014	30/09/2014	-	B.3_Building hygiene and safety B.5_Fire Prevention	
CU03.06.01.01.01	RELAZIONE DI PROVA E COLLAUDO ANTINCENDIO_06.10.2014	06/10/2014	-	B.3_Building hygiene and safety B.5_Fire Prevention	
CU03.07.01.01.01	ALLEGATI ALLA DICH. AGIBILIT 2014_08.10.2014	08/10/2014	-	B.4_Building feasability B.5_Fire Prevention B.10_Technological plants	B.6_User information
CU03.07.01.01.02	CERTIFICATO DI AGIBILITA RILASCIATO SU ISTANZA DEL 21.09.1992_04.05.1994	04/05/1994	-	B.4_Building feasability	
CU03.07.01.01.03	DICH PROGETTISTA A SEGUITO DI SOPRALLUOGO COMUNE E ASL PER RILASCIO AGIBILITA_21.04.1993	21/04/1993	-	B.4_Building feasability	
CU03.07.01.01.04	DICHIARAZIONE AGIBILIT CENTRO AMPLIAMENTO CENTRO 2014_08.10.2014	08/10/2014	-	B.4_Building feasability	
CU03.07.01.01.05	RICHIESTA INTEGRAZIONI PER RILASCIO AGIBILITA CENTRO SPORTIVO RIF CE 70-1989_29.04.1994	29/04/1994	-	B.4_Building feasability	
CU04.02.01.02.01	AUT SCARICO IN FOGNATURA_AUT SCARICO N 12504-2014_01.04.2014	01/04/2014	-	B.1_Environmental protection	
CU04.02.01.02.02	INIZIO LAVORI ALLACCIO FOGNATURA PROT_AUT SCARICO N 12504-2014_01.08.2014	01/08/2014	-	B.1_Environmental protection	
CU04.02.01.02.03	RELAZIONE ALLEGATA ALLA RICHIESTA ALLACCIO FOGNATURA PROTOCOLLATA_24.03.2014	24/03/2014	-	A.4_Building system's generic and synthetic description B.1_Environmental protection B.3_Building hygiene and safety B.10_Technological plants	C.7_Water consumption/ use of rainwater
CU04.02.01.02.04	RICHIESTA AUT SCARICO PROT_24.03.2014	24/03/2014	-	B.1_Environmental protection	
CU04.02.01.02.05	TAVOLA ALLEGATA ALLA RICHIESTA ALLACCIO FOGNATURA PROTOCOLLATA_24.03.2014	24/03/2014	-	A.5_Building system's graphic documents B.1_Environmental protection	C.7_Water consumption/ use of rainwater
CU04.03.01.01.01	CERTIFICATO PREVENZIONE INCENDI_04.05.1994	04/05/1994	-	B.5_Fire Prevention	
CU04.03.01.01.02	CERTIFICATO PREVENZIONE INCENDI_30.07.2001	30/07/2001	-	B.5_Fire Prevention	
CU04.03.01.01.03	COMUNICAZIONE VVF PER RILASCIO DEL CERTIFICATO PREVENZIONE INCENDI_17.08.1993	17/08/1993	-	B.5_Fire Prevention	
CU04.03.01.01.04	DICHIARAZIONE PER OTTENIMENTO CPI_27.06.2001	27/06/2001	-	B.5_Fire Prevention	
CU04.03.01.01.05	DICHIARAZIONE SITUAZIONE NON MUTATA PER RINNOVO CPI_27.06.2001	27/06/2001	-	B.5_Fire Prevention	
CU04.03.01.01.06	PERIZIA GIURATA EFFICIENZA IMPIANTI PER RINNOVO CPI_27.06.2001	27/06/2001	-	B.5_Fire Prevention	
CU04.03.01.01.07	RICHIESTA SOPRALLUOGO VVF PER RILASCIO CPI_13.09.1993	13/09/1993	-	B.5_Fire Prevention	
CU04.03.01.03.01	ALLEGATI DICH DI NON AGGRAZIO VVF PROT_SCIA PROT N 17699_07.10.2014	07/10/2014	-	A.4_Building system's generic and synthetic description A.5_Building system's graphic documents B.5_Fire Prevention	C.4_Emissions of CO2-Equivalents according to PHPP C.5_PV-Power plant CO2-Equivalents C.6_Differentiated documentation of Energy Consumption

				B.10_Technological plants	D,2_Comfort ventilation – hygiene and soundproofing
CU04.03.01.03.02	ASSEVERAZIONE DI CONFORMITÀ VVF PROT_SCIA PROT N 17699_07.10.2014	07/10/2014	-	B.5_Fire Prevention	
CU04.03.01.03.03	DICH DI NON AGGRAVIO VVF PROT_SCIA PROT N 17699_07.10.2014	07/10/2014	-	B.5_Fire Prevention	
CU04.03.01.03.04	MODULO SEGNALAZIONE CERTIFICATA INIZIO ATTIVIT VVF_PROT N 17699_07.10.2014	07/10/2014	-	B.5_Fire Prevention	
CU04.03.01.04.01	CERT REI STRUTTURE PALESTRA_SCIA VVF PROT N 17699_30.09.2014	30/09/2014	-	B.5_Fire Prevention B.9_Load bearing structure	
CU04.03.01.04.02	CERT REI STRUTTURE SEPARANTI CALCETTO_SCIA VVF PROT N 17699_30.09.2014	30/09/2014	-	B.5_Fire Prevention B.9_Load bearing structure	
CU04.03.01.04.03	CERTIFICAZIONI PRODOTTI_03.10.2014	03/10/2014	-	B.5_Fire Prevention	
CU04.03.01.04.04	DICH PROD_SCIA VVF PROT N 17699_03.10.2014	03/10/2014	-	B.5_Fire Prevention	
CU04.03.01.04.05	DICH. CORRETTA POSA_03.10.2014	03/10/2014	-	B.5_Fire Prevention	
CU06.03.03.01.01	CONTRATTO PER STUDIO FATTIBILITA AMPLIAMENTO CENTRO SPORTIVO_26.07.2010	26/07/2010	-	C.2_Real estate values	
CU06.03.03.02.01	FATTURA PER PRESTAZIONE PROFESSIONALE PROGETTO DI AMPLIAMENTO CENTRO SPORTIVO_09.11.2012	09/11/2012	-	C.2_Real estate values	
CU06.03.03.02.02	FATTURA PER PRESTAZIONE PROFESSIONALE PROGETTO DI AMPLIAMENTO CENTRO SPORTIVO_22.05.2012	22/05/2012	-	C.2_Real estate values	
CU06.03.05.03.01	DICH. CONFORMITA COLLEGAMENTO GASOLIO GENERATORE_30.09.2014	30/09/2014	-	A.4_Building system's generic and synthetic description B.10_Technological plants	
CU07.01.01.04.01	CALCOLI URBANISTICI PER VERIFICA EDIFICABILITA' RESIDUA	-	-	B.8_Building's production and tranformations	
CU07.01.01.04.02	PIANO SCAVI TRASMESSO AGLI ENTI COMPETENTI_20.05.2014	20/05/2014	-	B.1_Environmental protection B.8_Building's production and tranformations	
CU07.01.01.04.03	PLANIMETRIA GENERALE IN ALLEGATO A CALCOLI URBANISTICI	-	-	B.8_Building's production and tranformations	
CU07.01.01.04.04	PROSPETTO FRONTE STRADA CENTRO TENNIS_10.09.1990	10/09/1990	-	B.8_Building's production and tranformations	
CU07.01.01.04.05	RILIEVO TUBAZIONI GARDEN 2	-	-	B.10_Technological plants	
CU07.01.01.04.06	TAVOLA DI PROGETTO PER RICHIESTA AUT NUOVI SPOGLIATOI_05.05.1997	05/05/1997	-	B.8_Building's production and tranformations	
CU07.01.01.04.07	TAVOLA PER RICHIESTA PARERE PREVENTIVO IN MERITO A CENTRO ESTETICO_01.07.2003	01/07/2003	-	B.8_Building's production and tranformations C.2_Real estate values	
CU07.01.01.04.08	TAVOLA PIANO TERRA CENTRO TENNIS AGGIORNATA_25.06.1990	25/06/1990	-		
CU07.01.01.04.09	VERBALE ATTIVAZIONE CONTATORE ENEL_23.11.2015	23/11/2015	-	B.10_Technological plants	
CU07.01.01.04.10	VERBALE ENEL PER ATTIVAZIONE IMPIANTO FOTOVOLTAICO_05.11.2015	05/11/2015	-	B.10_Technological plants	B.2_Definition of verifiable energetic and ecologic objectives
CU07.01.01.04.11	VERBALE ENEL PER ATTIVAZIONE IMPIANTO FOTOVOLTAICO_23.11.2015	23/11/2015	-	B.10_Technological plants	B.2_Definition of verifiable energetic and ecologic objectives
CU07.01.01.04.12	VERBALE SOSTITUZIONE-ATTIVAZIONE CONTATORE ENEL_05.11.2015	05/11/2015	-	B.10_Technological plants C.4_Real estate redevelopment	B.5_Energetic optimization during the planning
CU07.01.01.04.13	VISTA ASSONOMETRICA CENTRO TENNIS_08.10.1990	08/10/1990	-	B.8_Building's production and tranformations	
CU07.01.02.02.01	CONTRATTO DI LOCAZIONE FABBRICATO AD USO CENTRO SPORTIVO E RISTORANTE TRA GARDEN 2 S.R.L. E GYM'STUDIO S.R.L._04.10.2014	04/10/2014	-	C.2_Real estate values	
CU07.01.06.01.01	PRATICA ENEA ASSEVERAZIONE LAVORI_01.02.2010	01/02/2010	-	B.10_Technological plants C.4_Real estate redevelopment	B.5_Energetic optimization during the planning
CU07.01.06.01.02	PRATICA ENEA_31.01.2010	31/01/2010	-	B.10_Technological plants C.4_Real estate redevelopment	B.5_Energetic optimization during the planning

CU07.01.07.06.01	AUT TAGLIO ALBERI_04.04.2014	04/04/2014	-	B.1_Environmental protection B.8_Building's production and tranformations	
CU07.01.07.06.02	RELAZIONE AGRONOMO AUT TAGLIO ALBERI_04.04.2014	04/04/2014	-	B.1_Environmental protection B.8_Building's production and tranformations	
CU07.01.07.11.01	COMUNICAZIONE ASL IN MERITO A NUOVE PROCEDURE PER VERIFICHE_15.02.2002	15/02/2002	-	B.10_Technological plants	
QUADRO D'UNIONE		DWG			

UNI 10998: archivi di gestione immobiliare		
Sections		Documents
Section A (Real Estate register)	A.1_Archive management	Real estate archive management and documents connected to the organization and management of the archive
	A.2_Building system's identification	Territorial information system, municipal toponomastic and real estate toponomastic
	A.3_Building system's subjects	Life-cycle significant subjects, to get in touch in case of emergency, public entities or of public interest
	A.4_Building system's generic and synthetic description	Real estate management cards
	A.5_Building system's graphic documents	Photogrammetric representation, planimetry, graphic elaborations and plants' representations
Section B (Mandatory requirements)	B.1_Environmental protection	EIA, asbestos components, waste management, hydrogeological protection
	B.2_Energy consumption's restraint	Plants' installation and refurbishment
	B.3_Building hygiene and safety	Hydrogeological features, finishing, furniture, emergency fire plans
	B.4_Building feasibility	Architectural barriers, building feasibility
	B.5_Fire Prevention	Certificates and Declarations of Fire Prevention
	B.6_Conservatory and Cadastre	Local Agency Documents
	B.7_Real Estate restrictions	Documents relating to historical-cultural, environmental and urban constraints
	B.8_Building's production and transformations	Original and subsequent building concessions, DIA, definitive project permissions
	B.9_Load bearing structure	Geotechnical surveys and supporting structures
	B.10_Technological plants	Plants documentations
Section C (Real Estate Exercise)	C.1_Economy and finance	Millesimal subdivision, treatment and tax identification
	C.2_Real estate values	Value of cost, market, tax
	C.3_ Context of performance and needs	Requirements classes according to UNI 8290 consisting of the results of inspections on the condition of the building usage and the surrounding environment
	C.4_Real estate redevelopment	Maintenance interventions already performed
	C.5_Real Estate Maintenance	Maintenance's contracts, manuals, plans and programs

CESBA - Tool version 1.1			
Indicators for pubblic buildings (Modernization of Buildings)			
Sections	Requirements	Must-indicator (M)	Max points
Section A (Quality of location and equipment)	A.1_Bicycle Parking		25
Section B (Process and planning quality)	B.1_Decision-making and examination of alternatives		25
	B.2_Definition of verifiable energetic and ecologic objectives	M	20
	B.3_Simplified calculation of efficiency	M	40
	B.4_Product management – using low-pollutant and low-emission building materials		60
	B.5_Energetic optimization during the planning		60
	B.6_User information		25
	B.7_Analysis of the building and weaknesses		40
Section C (Energy demand and supply)	C.1_Heating Demand PHPP	M	125
	C.2_Cooling demand PHPP	M	100
	C.3_Primary energy demand indicator PHPP	M	175
	C.4_Emissions of CO2-Equivalents according to PHPP		75
	C.5_PV-Power plant CO2-Equivalents		40
	C.6_Differentiated documentation of Energy Consumption	M	10
	C.7_Water consumption/ use of rainwater		20
Setion D (Health and comfort)	D.1_Thermal comfort in summer		125
	D,2_Comfort ventilation – hygiene and soundproofing		50
	D.3_Sunlight supply, daylight quotient		50
Section E (Building materials and construction)	E.1_$OI3_{TGH-lc}$ Ecological value of the thermal envelope Eco-index (respective OI3BG3,BZF Ecological value of the total mass of the building)		200
MAXIMUM SCORE			1000

BUILDING SCORE	424

X Absent
V Present

A	Quality of location and equipment					
A1	Bicycle Parking			max Points: 25		
Parameter		Descripiton	Points	Document		
				Presence	Code	Title
Quality of the bicycle parking						
Size of slot, spacing and manoeuvring area		Sheltered parking spots for user that stay longer (> 30 Min:utes)		X		
		Safety bike storage through a lockable room or a stand that allows bike lock attaching		X		
		Illuminated, reachable while cycling and close to the main entry of the buildind (<30 m) biclycle slot		X		
		Subterranean garages biclycle slot should be reachable while cycling with direct acces to the main building		X		
		Visitors/short time parking slots should be on the ground floor and have at least 50% roofing		X		
Size of slot, spacing and manoeuvring area						
	Distance between bikes under normal usage	Min: 80 cm		X		
	Distance between bikes with height offset	Min: 40-45 cm		X		
	Distance between bike and wall	Min: 35 cm		X		
	Lengths of bike-slot	Min: 2 m (parked vertically)		X		
		Min: 3.2 m (front wheel overlap)		X		
	Manoeuvring area to back out	Min: 1.8 m (depth)		X		
Number of bicycle parking slots						
	Administration buildings	Min: Seats for stuff: 0,2 per employee seats for visitors: 0,1 per employee	15			
		Top: Seats for stuff: 0,4 per employee seats for visitors: 0,2 per employee	25			
	Kindergartens	Min: 0,1 per child + 0,5 per teacher	15			
		Top: 0,2 per child + 0,9 per teacher	25			
	Elementary schools	Min: 0,1 per student + 0,2 per teacher	15			
		Top: 0,2 per student + 0,6 per teacher	25			
	Secondary school	Min: 0,6 per student + 0,2 per teacher	15			
		Top: 0,9 per student + 0,6 per teacher	25			
	Retirement home/ nursing home	Min: seats for stuff 0,2 per employee seats for visitors: 0,05 per inhabitant	15			
		Top: seats for stuff: 0,4 per employee seats for visitor: 0,1 per inhabitant	25			
	Event hall (mainly used locally)	Min: 0,2 per employee + 0,1 per guest	15			
		Top: 0,4 per employee + 0,2 per guest	25			
	(used locally and regionally)	Min: 0,2 per employee + 0,05 per guest	15			
		Top: 0,4 per employee + 0,15 per guest	25			
	(used nationally)	Min: 0,2 per employee + 0,025 per guest	15			
		Top: 0,4 per employee + 0,05 per guest	25			
Evidences for building owner/contractor						
Additional documentation		Plan including the location as well as the furniture and the number of parking sites	+	X		
		Pictures of the realized parking sites: bypass road to the parking sites, position regarding the entrance of the building, pictures of bicycle parking or bicycle storage rooms	+	X		

X Absent
V Present

B	Process and planning quality					
B1	Descripiton Decision-making and examination of alternatives			max Points: 25		
Parameter	Descripition	Points	Document			
			Presence	Code	Title	
Documents	Documentation of the decision-making process	8	X			
Alternatives	Examination and evaluation of the alternatives	4	X			
	Examination and validation of the zero option	4	X			
DM scheme	Documentation of the evaluation scheme for the examination of alternatives	3	X			
Themes	Urban development	2	V	CU01.01.01.04.01	CONVENZIONE USO IMPIANTO SPORTIVO_16.05.2014	
				CU01.03.01.01.01	TIPO MAPPALE PER AMPLIAMENTO PROT. 139870-2014_20.09.2014	
				CU01.03.01.03.01	ESTRATTO MAPPA_25.02.2014	
				CU02.01.01.06.01	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014	
				CU02.01.01.06.02	ALL. 02 - ELABORATI GRAFICI_DIA 14214-2014_11.04.2014	
				CU02.01.01.06.03	ALL. 03 - CALCOLO CCC_DIA 14214-2014_11.04.2014	
				CU02.01.02.02.06	RELAZIONE AUTORIZZATA_AUT N 64-2014_19.05.2014	
				CU02.01.02.02.07	RELAZIONE AUTORIZZATA_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	
				CU02.01.02.02.08	RICHIESTA AUT PAESAGGISTICA SEMPLICATA PROTOCOLLATA_06.04.2016	
				CU02.01.02.02.10	TAVOLE AUTORIZZATE_AUT N 64-2014_19.05.2014	
				CU02.01.02.02.11	TAVOLE AUTORIZZATE_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	
	Accessibility and traffic (induced traffic)	2	V	CU02.01.01.06.05	ALL. 05 - BARRIERE ARCHITETTONICHE_DIA 14214-2014_11.04.2014	
				CU02.01.02.02.08	RICHIESTA AUT PAESAGGISTICA SEMPLICATA PROTOCOLLATA_06.04.2016	
				CU02.01.02.02.10	TAVOLE AUTORIZZATE_AUT N 64-2014_19.05.2014	
				CU02.01.02.02.11	TAVOLE AUTORIZZATE_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	
	Landscape consumption – soil quality	2	V	CU01.04.04.03.01	ESTRATTO CARTOGRAFIA PRG	
				CU01.04.04.03.02	LEGENDA ESTRATTO PRG	
				CU02.01.01.06.01	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014	
				CU02.01.01.06.02	ALL. 02 - ELABORATI GRAFICI_DIA 14214-2014_11.04.2014	
				CU02.01.01.06.03	ALL. 03 - CALCOLO CCC_DIA 14214-2014_11.04.2014	
				CU02.01.02.02.06	RELAZIONE AUTORIZZATA_AUT N 64-2014_19.05.2014	
				CU02.01.02.02.07	RELAZIONE AUTORIZZATA_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	
				CU02.01.02.02.08	RICHIESTA AUT PAESAGGISTICA SEMPLICATA PROTOCOLLATA_06.04.2016	
				CU02.01.02.02.11	TAVOLE AUTORIZZATE_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	
				CU02.01.02.02.10	TAVOLE AUTORIZZATE_AUT N 64-2014_19.05.2014	
	Energy efficiency	2	V	CU02.01.01.06.06	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014	

	Ecological use of materials	2	V	CU02.01.01.06.01	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014
				CU02.01.01.06.02	ALL. 02 - ELABORATI GRAFICI_DIA 14214-2014_11.04.2014
				CU02.01.01.06.06	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014
				CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014
				CU02.01.02.02.06	RELAZIONE AUTORIZZATA_AUT N 64-2014_19.05.2014
				CU02.01.02.02.07	RELAZIONE AUTORIZZATA_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014
				CU02.01.02.02.10	TAVOLE AUTORIZZATE_AUT N 64-2014_19.05.2014
				CU02.01.02.02.11	TAVOLE AUTORIZZATE_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014

B2	Definition of verifiable energetic and ecologic objectives (M)		max Points: 20		
Parameter	Description	Points	Document		
			Presence	Code	Title
Thermal heat PHPP	Specific heating demand		X		
Cooling PHPP	Specific cooling demand		X		
Primary energy PHPP	Specific total primary energy demand (heating, cooling, hot water, auxiliary current, other power applications)		X		
CO2 EMISSIONS	Specific CO2 emissions (heating, cooling, hot water, auxiliary current, other power applications)		V	CU03.01.02.02.01	ATTESTATO DI PRESTAZIONE ENERGETICA_07.10.2014
Yield	Yield of a photovoltaic power plant		V	CU02.01.01.06.06	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014
				CU07.01.01.04.10	VERBALE ENEL PER ATTIVAZIONE IMPIANTO FOTOVOLTAICO_05.11.2015
				CU07.01.01.04.11	VERBALE ENEL PER ATTIVAZIONE IMPIANTO FOTOVOLTAICO_23.11.2015
n50	Air tightness n50		X		
Materials	Building materials to be excluded		X		
	Use of regional building materials		X		
Evidences for building owner/contractor					
Additional documentation	Target-performance comparison		X		

B3	Simplified calculation of efficiency (M)			max Points: 40		
Parameter	Description		Points	Document		
				Presence	Code	Title
Average annual costs to take into account for the comparison with a building that fulfil the minimum requirements of national directives	Annuity of the building costs (at least in each case energy-related building components)			X		
	Annuity of fees			X		
	Average annual maintenance costs			X		
	Average annual energy costs			X		
Assumptions for calculating efficiency (additional costs)	Life of constructional measures (insulation, windows, etc.)	40 a		X		
	Life of building services (heating, cooling etc.)	20 a		V	CU03.03.01.03.03	LIBRETTO COLLETTORE SOLARE SIME
					CU03.03.01.03.04	LIBRETTO MANUTENZIONE ED USO DELLA CENTRALINA DIFFERENZIALE TDC IMPIANTO SOLARE
					CU03.03.01.03.05	LIBRETTO USO E MANUTENZIONE IMPIANTO RISCALDAMENTO CAMPO TENNIS

					CU03.03.01.03.06	MANUALE INSTALLAZIONE BOLLITORE SIME
	Calculation period = credit period	20 a		X		
	General inflation rate	2,50%		X		
	Rising prices for energy (all energy sources)	5,50%		X		
	Required rate of return	5%		X		
Evidences for building owner/contractor						
Additional documentation	Description of the technical data of the energy-related building components			V	CU02.01.01.06.06 CU03.01.01.01.02	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014 ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	Energy demand calculation for reference and improved variant(s)			V	CU02.01.01.06.06 CU03.01.01.01.02	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014 ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	Presentation of simplified efficiency calculations e.g. using the excel-tool mentioned below			X		

B4	Product management - using low-polutant and low-emission building materials	max Points: 60

Parameter	Descripition	Points	Document		
			Presence	Code	Title
Products to be considered	All building chemicals that are used on peripheral spatial surfaces (inside and outside)		V	CU02.01.01.06.01 CU02.01.01.06.07 CU03.01.01.01.02 CU03.01.01.03.01 CU03.01.01.03.03	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014 ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 AS BUILT ARCHITETTONICO COSTRUTTIVO_11.11.2014 AS BUILT ARCHITETTONICO ESTERNI_11.11.2014
	All building materials that are used inside the room (airtight layer and all building materials in front of it)		V	CU03.01.01.01.02 CU02.01.01.06.07 CU03.01.01.03.01	ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 AS BUILT ARCHITETTONICO COSTRUTTIVO_11.11.2014
Ecological indicators (interior space)	Low-emission elastic floor coverings		V	CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014
	Low-emission textile floor coverings		V	CU02.01.01.06.07 CU03.01.01.05.03	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 DICHIARAZIONE DI CONFORMITA' TELO CAMPO DA TENNIS_19.10.2009
	Low-emission flooring products		V	CU02.01.01.06.07 CU03.01.01.05.04 CU03.01.01.05.05	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 SCHEDA TECNICA ERBA SINTETICA FINO AL 2012_29.08.2006 SCHEDA TECNICA ERBA SINTETICA_01.04.2012
	Avoiding emissions from insulation in the ambient air		X		
	Avoiding emissions of formaldehyde from wooden composites		V	CU03.01.01.05.02	DICHIARAZIONE DI CONFORMITA' E MANUALE COPERTURA CAMPI TENNIS IN LEGNO LAMELLARE_02.10.2009
	Avoiding emissions of VOC and SVOC from wooden composites		V	CU03.01.01.05.02	DICHIARAZIONE DI CONFORMITA' E MANUALE COPERTURA CAMPI TENNIS IN LEGNO LAMELLARE_02.10.2009

Ecological indicators (building materials)	Low-emission bituminous preparations		X		
	Substances, free from CMR		X		
	Preparations, free from heavy metals		X		
	Preparations, free from SVOC		X		
	Avoiding free formaldehyde		X		
	Avoiding acid-hardening coatings		X		
	Preparations, free from aromatic hydrocarbon		X		
	Preparations with low VOC		X		
	Low-emission sealing compound		X		
Evidence/Documentation building owner/contractor					
Ecological optimization of building components	Documentation in the frame of the schematic design, building application and detailed planning	10	V	CU03.01.01.03.01 CU03.01.01.03.03	AS BUILT ARCHITETTONICO COSTRUTTIVO_11.11.2014 AS BUILT ARCHITETTONICO ESTERNI_11.11.2014
Tendered trades considering pollutant content, boundary values for pollutant content, definition of evidence	100 % of all trials are considering ecological aspects	20	X		
	90 % of all trials are considering ecological aspects	15	X		
	70 % of all trials are considering ecological aspects	10	X		
Listed product of all trials	100 % of all trials have been listed	30	X		
	90 % of all trials have been listed	20	X		
	70 % of all trials have been listed	10	X		
Ecological building inspection	yes/no		X		
Use of materials	Regular and documented		V	CU02.01.01.06.01 CU02.01.01.06.07 CU03.01.01.01.02 CU03.01.01.03.01 CU03.01.01.03.03	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014 ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 AS BUILT ARCHITETTONICO COSTRUTTIVO_11.11.2014 AS BUILT ARCHITETTONICO ESTERNI_11.11.2014
Construction process	Complitely documented	20	V	CU02.01.01.06.01 CU02.01.01.06.02 CU02.01.01.06.03 CU02.01.01.06.04 CU02.01.01.06.05 CU02.01.01.06.09 CU02.01.01.06.10 CU02.01.01.06.11 CU02.01.01.06.12	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014 ALL. 02 - ELABORATI GRAFICI_DIA 14214-2014_11.04.2014 ALL. 03 - CALCOLO CCC_DIA 14214-2014_11.04.2014 ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALL. 05 - BARRIERE ARCHITETTONICHE_DIA 14214-2014_11.04.2014 AVVIO PROCEDIMENTO DIA PROT 37761-2014 IN VARIANTE DIA 14214-2014_07.10.2014 COMUNICAZIONE INIZIO LAVORI RELATIVA A DIA PER OPERE INTERNE_29.03.2010 COMUNICAZIONE INIZIO LAVORI_DIA 14214-2014_26.05.2014 FINE LAVORI_DIA 14214-2014_02.10.2014
	Partially documented	10	-		

B5	Energetic optimization during the planning		max Points: 60		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Evidence/Documentation building owner/contractor					
Room program	Set-up of a room program with room sizes, type, duration and intensity of use, required level of temperature	3	V	CU02.01.01.06.04 CU03.01.01.01.01 CU03.01.01.01.02	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	Determination of the volume of air depending on the room considering			CU02.01.01.06.04	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014

Aerial illumination ratio	hygiene requirements (see PHPP instructions for ventilation, section planning)	3	V	CU02.01.01.06.06 CU03.01.01.01.02	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014 ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
Intern heat sources	Detailed identifying of intern heat sources	1	X		
Thermal bridges	Consideration of thermal bridges by detailed evidence of thermal bridges Default value (0.03 W/m²K)	3	X		
Energetic requirements in the tendering	Description of energetic requirements in the tendering (e.g. building physics values Uw, Ug, g-value for windows, heat provision level and air-specific power consumption for ventilation systems, thickness of insulation and thermal conductivity for the heat and warm water distribution lines)	1	V	CU02.01.01.06.06 CU02.01.01.06.04 CU03.01.01.01.01 CU03.01.01.01.02	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014 ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
Examination of the energetic aspects of the offer(s)	Examining the energetic aspects of the offers regarding the requirements given in the tendering	3	X		
Local construction management and energetic aspects	Appointments at the construction site to support the local construction management regarding energetic aspects	3	X		
Blower door tests	Report about the blower door tests	1	X		
Ventilation system calibration	Report about the calibration of the ventilation system (see PHPP instructions for ventilation, section commissioning)	2	V	CU03.03.01.01.06 CU03.03.01.01.07 CU03.03.01.01.08	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO RISTORANTE_30.09.2014 DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO VAV_30.09.2014 DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO_30.09.2014
Hidraulic balancing heating	Report about the hydraulic balancing heating	2	V	CU03.03.02.01.01 CU03.03.02.01.02	DICH DI CONFORMIT_IDRICO SANITARIO CENTRO SPORTIVO_30.09.2014 DICH DI CONFORMIT_IDRICO SANITARIO SPOGLIATOI CALCETTO_30.09.2014
Energy demand adjustment	Adjustment of the energy demand calculation after finishing the construction and implementation of an air tightness test	3	X		
Effective energy demand	Detailed monitoring of the energy demand calculation	35	X		

B6	User information		max Points: 25		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Users' manual	Room temperature (regulation of heating/cooling)		V	CU03.03.01.03.05	LIBRETTO USO E MANUTENZIONE IMPIANTO RISCALDAMENTO CAMPO TENNIS
	Mechanical ventilation and window ventilation		V	CU03.03.01.03.04	LIBRETTO MANUTENZIONE ED USO DELLA CENTRALINA DIFFERENZIALE TDC IMPIANTO SOLARE
	Sunscreen and glare shield		V	CU02.01.01.06.04 CU03.01.01.01.01	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	General lightening and lightening at work		V	CU02.01.01.06.04 CU03.01.01.01.01	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	Efficient use of other energy consumers (Computer, printer, etc.)		X		

Information about buildigng's events	Information event when the building is ready to be used		X		
B7	Analysis of the building and weaknesses			max Points: 40	
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Identifying of building elements of the stock (M)	Based on plans, surveys and local examinations	10	V	CU02.01.01.06.01 CU02.01.01.06.02	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014 ALL. 02 - ELABORATI GRAFICI_DIA 14214-2014_11.04.2014
Energy performance certificate (M)	Calculation of the energy performance certificate	10	V	CU03.01.02.02.01	ATTESTATO DI PRESTAZIONE ENERGETICA_07.10.2014
Identifying weak points and quantifying saving potentials (M)	Detailed analysis and report with (graphical) presentation of saving potentials and possible ways of modernization concepts	10	X		
Detection and recording of the existing building services including an analysis of weak points (M)	Heating, hot water, heat distribution, cooling, ventilation	10	V	CU03.03.01.01.06	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO RISTORANTE_30.09.2014
				CU03.03.01.01.07	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO VAV_30.09.2014
				CU03.03.01.01.08	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO_30.09.2014
				CU03.03.02.01.01	DICH DI CONFORMIT_IDRICO SANITARIO CENTRO SPORTIVO_30.09.2014
				CU03.03.02.01.02	DICH DI CONFORMIT_IDRICO SANITARIO SPOGLIATOI CALCETTO_30.09.2014
Contaminant investigation (with protocol)	Investigation and recording according to ÖNORM S 5730	10	X		
Evidence/Documentation building owner/contractor					
Additional documents	Energy performance certificate for the stock, report including an analysis of weak points and evaluated variants for modernization, protocol for the contaminant investigation.	+	X		

X Absent
V Present

C	Energy demand and supply					
C1	Heating Demand PHPP (M)			max Points: 125		
Parameter	Descripition	Points	Document			
			Presence	Code	Title	
Energy performance indicator for thermal heat PHPP (dependent from A/V ratio)	Energy performance thermal heat PHPP 80 kWh/m2 EBFa for buildings with A/V ratio of 0,8 or higher	25	X			
	Energy performance thermal heat PHPP 60 kWh/m2 EBFa for buildings with A/V ratio of 0,2 or lower		X			
Maximum score independent from the A/V ratio	Energy performance thermal heat PHPP 25 kWh/m2 EBFa	125	X			
Attestation / Documentation:						
Calculation of energy performance indicator for thermal heat	PHPP Version 6.1 (2012)		X			
C2	Cooling demand PHPP (M)			max Points: 100		
Parameter	Descripition	Points	Document			
			Presence	Code	Title	
Basic Parameter: the implementation of measures to reduce the cooling load and the reduction of solar gains	(Window sizes, - quality, - orientation, as well as temporary sun protection, reduction of internal sources of heat, activation of storage mass through night-time cooling		V	CU02.01.01.06.04 CU02.01.01.06.06 CU03.01.01.01.01 CU03.01.01.01.02	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014 ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	
	Frequency of overheating max. 10% (PHPP file Summer)		X			
	Area-specific cooling load 25 °C max. 10% (PHPP file cooling load)		X			
Energy performance indicator cooling demand	Max. value of 15 kWh/(m2 TFA a)	10	V	CU03.01.02.02.01	ATTESTATO DI PRESTAZIONE ENERGETICA_07.10.2014	
	Max. value of 5 kWh/(m2 TFA a).	100				
Attestation / Documentation:						
Calculation of energy performance indicator for cooling demand	PHPP Version 8.2 (2013)		X			
C3	Primary energy demand indicator PHPP (M)			max Points: 175		
Parameter	Descripition	Points	Document			
			Presence	Code	Title	
Primary energy indicator	Value of 300 kWh/m2 EBF a.	25	X			
	Value of 140 kWh/m2 EBF a.	175	X			
Attestation / Documentation:						
Calculation of primary energy performance indicator	PHPP 2013, Version 8.2		X			

C4	Emissions of CO2-Equivalents according to PHPP		max Points: 75		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
CO2-Equivalent-factors of PHPP	Value of 70 kg /m2 EBF a.	10	X		
	Value of 35 kg /m2 EBF a.	75	X		
Attestation / Documentation:					
Calculation of emissions	PHPP Version 8.2 (2013)		X		

C5	PV-Power plant CO2-Equivalents		max Points: 40		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Annual yield	Value of 3,5 kWhEnd PV-current per m2 TFA. This is approximately equivalent to a PV-surface of 0.035 m2 per m2 TFA.	10	V	CU03.01.01.01.02	ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	Value of 14 kWhEnd PV-current per m2 TFA. This is approximately equivalent to a PV-surface of 0.14 m2 per m2 TFA.	50		CU03.01.02.02.01	ATTESTATO DI PRESTAZIONE ENERGETICA_07.10.2014
Attestation / Documentation:					
Calculation of the gains through PV-power plant under consideration of local climate dates and local			X		
Datasheet of the chosen modules / components			X		
Graphical outline of the location and surface area of the solar modules			X		

C6	Differentiated documentation of Energy Consumption (M)		max Points: 10		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Separated documentation of the following Energy Consumption figures	Heating		V	CU03.03.01.01.09	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI RISCALDAMENTO_30.09.2014
				CU03.03.01.01.10	DICHIARAZIONE DI CONFORMITA IMPIANTO GAS RISCALDAMENTO PISTA PATTINAGGIO_16.02.1995
				CU02.01.02.09.01	ELABORATI GRAFICI AUT_26.10.2011
				CU02.01.02.09.02	ELABORATI GRAFICI AUT_29.04.2014
	Cooling		V	CU03.03.01.01.08	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO_30.09.2014
	Water heating		V	CU03.03.01.03.06	MANUALE INSTALLAZIONE BOLLITORE SIME
	Auxillary current for heating, water heating, possibly solar heats		V	CU03.03.01.01.12	DICHIARAZIONE DI CONFORMITA' POMPA DI CALORE_30.09.2014
				CU03.03.01.02.06	PROGETTO IMPIANTO IDRICOSANITARIO CON COLLETTORI SOLARI_01.09.2009
				CU03.03.01.03.02	CERTIFICATO DI CONFORMITA COLLETTORE SOLARE IMPIANTO SIME_17.04.2009
				CU03.03.01.03.04	LIBRETTO MANUTENZIONE ED USO DELLA CENTRALINA DIFFERENZIALE TDC IMPIANTO SOLARE
				CU03.03.01.03.05	LIBRETTO USO E MANUTENZIONE IMPIANTO RISCALDAMENTO CAMPO TENNIS
	Auxillary current for air conditioning, possibly humidification and dehumidification		X		
	Lightening, IT-equipment or other power applications		V	CU03.04.01.01.01	DICH DI CONFORMIT IMPIANTI ELETTRICI_02.09.2014
				CU03.04.01.01.06	DICHIARAZIONE DI CONFORMITA IMPIANTO ELETTRICO_28.10.2009
				CU03.04.01.02.01	AS-BUILT IELE_ELABORATI GRAFICI_11.11.2014

	Possibly gains from PV-power plant		V	CU03.04.01.02.02 CU03.04.01.02.03 CU03.04.02.01.01	AS-BUILT IELE_RELAZIONI TECNICHE_11.11.2014 AS-BUILT IELE_SCHEMI REGOLAZIONI SIEMENS_11.11.2014 DICH DI CONFORMIT_IMPIANTI ELETTRICO GRUPPO ELETTROGENO_30.09.2014
C7	Water consumption/ use of rainwater		max Points: 20		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Usage of water saving valves	Reduction of water consumption in comparison to standard valves of up to 50%	5	X		
Usage of contact free valves	Usage of valves with an infra-red sensor	5	X		
Double WC-flush e.g. Stop-function	Maximal flow rate 6l respectively 3l for urinals	5	X		
Usage of waterless urinals	Solely waterless urinals are used	5	X		
Usage of rainwater – outdoor area	Usage of rainwater (e.g. through cistern) for outdoor water usage	5	X		
Rooftop greening	Utilization of rooftop greening (possibly gradation > 50% for flat roofs or semi flat roofs), minimum soil thickness: 7cm on average	5	X		

X Absent
V Present

D	Health and comfort				
D1	Thermal comfort in summer		max Points: 125		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Building with less than 35% of window area and without active cooling	Proof of respective state calculation system (the lower the cooling load, the higher points)	35-50	X		
	Proof of PHPP, exceeding 26 °C < 5%	65	X		
Dynamic building simulation (at least for critical facilities) taking into account the site climate, flexible loading and shading systems, as well as the uses expected	Exceeding 26 °C < 5% without active cooling system (E.g. free night cooling)	150	X		
	Exceeding 26 °C < 10% without active cooling system (E.g. free night cooling)	50	X		
	Exceeding 26 °C < 3% with active cooling system	75	X		
	Detection to prevent draughts and tear (v < 0.1 m/s, ΔT < 2 K location)	75	X		
D2	Comfort ventilation – hygiene and soundproofing		max Points: 50		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Control room sound emission calculation (taking into account the use of space)	Forecast of the expected sound pressure level LA,nT < 30 dB and LC(50-4000),nT < 50 dB	20	V	CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014
Sound emission measurement in the most exposed rule workplace	LA,nT < 30 dB and LC(50-4000),nT < 50 dB	30	V	CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014
Sound emission measurement in the most exposed rule workplace	LA,nT < 30 dB and LC(50-4000),nT < 50 dB	40	V	CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014
D3	Sunlight supply, daylight quotient		max Points: 50		
Parameter	Descripition	Points	Document		
			Presence	Code	Title
Ratio of available outdoor light to interior illuminance (in the room): daylight factor (D)	<2%	0	V	CU02.01.01.06.04	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014
	2-3%	10		CU03.01.01.01.01	ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	3-4%	30		CU03.01.01.01.02	ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014
	5%	40		CU02.01.01.06.06	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014

X Absent
V Present

E	Building materials and construction					
E1	Ecological value of the thermal envelope Eco-index 3			max Points: 200		
Parameter	Descripition	Points	Document			
			Presence	Code	Title	
Ecological Index 3 of the thermal building envelope with the balance limit 3 (OI3BG3,BGF)	Primary demand of non-renewable energy sources (Abbreviation: PEI n.e.) per square meters	100	V	CU02.01.01.06.04 CU02.01.01.06.06 CU03.01.01.01.01 CU03.01.01.01.02	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014 ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014 ALLEGATO 1 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014 ALLEGATO 2 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	
	Global warming potential (abbreviation: GWP) per square meters	100	X			
	Acidification potential (Abbreviation: AP) per square meters	100	X			
Annex 1 „environmental indicators for the tender of low-emission and low emission construction products“	„Ecological building and acquiring in the Lake Constance region (oeg)“ [Ökoleitfaden 2007] www.baubook.info/oeg		X			
	„Eco buy Vienna“ AG 08 Interior [Ökokauf Wien]		X			
Interior	Low-emission resilient flooring		V	CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014	
	Low-emission textile floor coverings		V	CU02.01.01.06.07 CU03.01.01.05.03	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 DICHIARAZIONE DI CONFORMITA' TELO CAMPO DA TENNIS_19.10.2009	
	Low-emission adhesives		V	CU02.01.01.06.07 CU03.01.01.05.04 CU03.01.01.05.05	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014 SCHEDA TECNICA ERBA SINTETICA FINO AL 2012_29.08.2006 SCHEDA TECNICA ERBA SINTETICA_01.04.2012	
	Avoiding emissions from insulating materials in the air		X			
	Avoidance of formaldehyde emission from wood-based materials		V	CU03.01.01.05.02	DICHIARAZIONE DI CONFORMITA' E MANUALE COPERTURA CAMPI TENNIS IN LEGNO LAMELLARE_02.10.2009	
	Avoidance of VOC and SVOC emission from wood-based materials		V	CU03.01.01.05.02	DICHIARAZIONE DI CONFORMITA' E MANUALE COPERTURA CAMPI TENNIS IN LEGNO LAMELLARE_02.10.2009	
Choice of materials, construction materials	Low-emission bituminous preparations		X			
	Free of KMR materials		X			
	Heavy metal-free preparations		X			
	SVOCS-free preparations		X			
	Prevention of free formaldehyde		X			
	Avoiding acid-curing coatings		X			
	Preparations free from aromatic hydrocarbons		X			
	VOC-poor preparations		X			
	Low-emission sealants		X			

DocTag	Name	CreatedBy	CreatedOn	ApprovalBy	Stage	ExtSystem	ExtObject	ExtIdentifier
CU01.01.01.04.01	CONVENZIONE USO IMPIANTO SPORTIVO_16.05.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU01.03.01.01.01	TIPO MAPPALE PER AMPLIAMENTO PROT. 139870-2014_20.09.2014	Eleonora_Idra	28-lug	Agezia delle Entrate	Current			
CU01.03.01.03.01	ESTRATTO MAPPA_25.02.2014	Eleonora_Idra	28-lug	Ufficio catastale Prov Varese	Current			
CU01.03.02.02.02	SCHEDE CATASTALI_PALESTRA_25.09.2014	Eleonora_Idra	28-lug	Catasto Fabbricati Varese	Current			
CU01.03.02.03.01	ELABORATO PLANIMETRICO_MAPPALE 3071_25.09.2014	Eleonora_Idra	28-lug	Catasto Fabbricati Varese	Current			
CU01.04.04.03.01	ESTRATTO CARTOGRAFIA PRG	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU01.04.04.03.02	LEGENDA ESTRATTO PRG	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.03.03	TAVOLE PROT_CONCESSIONE EDILIZIA IN VARIANTE CE 70-1989_12.10.1990	Eleonora_Idra	28-lug	Ordine degli architetti di Varese Dott. Luigi Martegani	Current			
CU02.01.01.06.01	ALL. 01 - RELAZIONE TECNICA_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.02	ALL. 02 - ELABORATI GRAFICI_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.03	ALL. 03 - CALCOLO CCC_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.04	ALL. 04 - VERIFICHE IGIENICO SANITARIE_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.05	ALL. 05 - BARRIERE ARCHITETTONICHE_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.06	ALL. 06 - RELAZIONE EX LEGGE 10_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.07	ALL. 07 - RELAZIONE REQUISITI ACUSTICI_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.08	ALL. 08 - IMPIANTI MECCANICI RELAZIONE_DIA 14214-2014_11.04.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.09	AVVIO PROCEDIMENTO DIA PROT 37761-2014 IN VARIANTE DIA 14214-2014_07.10.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.10	COMUNICAZIONE INIZIO LAVORI DIA PER OPERE INTERNE_29.03.2010	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.01.06.11	COMUNICAZIONE INIZIO LAVORI_DIA 14214-2014_26.05.2014				Current			
CU02.01.01.06.12	FINE LAVORI_DIA 14214-2014_02.10.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.02.06	RELAZIONE AUTORIZZATA_AUT N 64-2014_19.05.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.02.07	RELAZIONE AUTORIZZATA_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.02.08	RICHIESTA AUT PAESAGGISTICA SEMPLICATA PROTOCOLLATA_06.04.2016	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.02.09	RICHIESTA AUT PAESAGGISTICA SEMPLIFICATA COMUNICAZIONE DI AVVIO PROCEDIMENTO_15.12.2015	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.02.10	TAVOLE AUTORIZZATE_AUT N 64-2014_19.05.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.02.11	TAVOLE AUTORIZZATE_AUT N 145-2014 VARIANTE AUT N 64-2014_01.09.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU02.01.02.09.01	ELABORATI GRAFICI AUT_26.10.2011	Eleonora_Idra	28-lug	Comando Provinciale Vigili Del	Current			
CU02.01.02.09.02	ELABORATI GRAFICI AUT_29.04.2014	Eleonora_Idra	28-lug	Comando Provinciale Vigili Del	Current			
CU02.01.02.09.06	RELAZIONE TECNICA AUT_26.10.2011	Eleonora_Idra	28-lug	Comando Provinciale Vigili Del	Current			
CU02.01.02.09.07	RELAZIONE TECNICA AUT_29.04.2014	Eleonora_Idra	28-lug	Comando Provinciale Vigili Del	Current			
CU02.01.02.10.01	DENUNCIA IMPIANTO MAT_19.11.1991	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.01.01.01.01	ALL. 01 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU03.01.01.01.02	ALL. 02 - COMUNICAZIONE ESEGUITA ATTIVIT PROT_29.09.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU03.01.01.05.02	DICHIARAZIONE DI CONFORMITA' E MANUALE COPERTURA CAMPI TENNIS IN LEGNO LAMELLARE_02.10.2009	Eleonora_Idra	28-lug	Moretti Interholz	Current			
CU03.01.01.05.03	DICHIARAZIONE DI CONFORMITA' TELO CAMPO DA TENNIS_19.10.2009	Eleonora_Idra	28-lug	Tomasini Srl	Current			
CU03.01.01.05.04	SCHEDA TECNICA ERBA SINTETICA FINO AL 2012_29.08.2006	Eleonora_Idra	28-lug	ItalGreen spa	Current			
CU03.01.01.05.05	SCHEDA TECNICA ERBA SINTETICA_01.04.2012	Eleonora_Idra	28-lug	ItalGreen spa	Current			
CU03.01.01.05.06	SCHEDA TECNICA ERBA SINTETICA_02.12.2009	Eleonora_Idra	28-lug	ItalGreen spa	Current			
CU03.01.02.02.01	ATTESTATO DI PRESTAZIONE ENERGETICA_07.10.2014	Eleonora_Idra	28-lug	Regione Lombardia	Current			

CU03.03.01.01.06	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO RISTORANTE_30.09.2014	Eleonora_Idra	28-lug	Marchesotti Idrotermica srl	Current			
CU03.03.01.01.07	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO VAV_30.09.2014	Eleonora_Idra	28-lug	Marchesotti Idrotermica srl	Current			
CU03.03.01.01.08	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI CONDIZIONAMENTO_30.09.2014	Eleonora_Idra	28-lug	Marchesotti Idrotermica srl	Current			
CU03.03.01.01.09	DICHIARAZIONE DI CONFORMITA' IMPIANTO DI RISCALDAMENTO_30.09.2014	Eleonora_Idra	28-lug	Marchesotti Idrotermica srl	Current			
CU03.03.01.01.10	DICHIARAZIONE DI CONFORMITA IMPIANTO GAS RISCALDAMENTO PISTA PATTINAGGIO_16.02.1995	Eleonora_Idra	28-lug	Biffi spa	Current			
CU03.03.01.01.12	DICHIARAZIONE DI CONFORMITA' POMPA DI CALORE_30.09.2014	Eleonora_Idra	28-lug	Biffi spa	Current			
CU03.03.01.02.06	PROGETTO IMPIANTO IDRICOSANITARIO CON COLLETTORI SOLARI_01.09.2009	Eleonora_Idra	28-lug	Ordine degli ingegneri di Varese Dott. Massimo Croci	Current			
CU03.03.01.03.01	BROCHURE IMPIANTO SOLARE TERMICO SIME	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.03.01.03.02	CERTIFICATO DI CONFORMITA COLLETTORE SOLARE IMPIANTO SIME_17.04.2009	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.03.01.03.03	LIBRETTO COLLETTORE SOLARE SIME	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.03.01.03.04	LIBRETTO MANUTENZIONE ED USO DELLA CENTRALINA DIFFERENZIALE TDC IMPIANTO SOLARE	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.03.01.03.05	LIBRETTO USO E MANUTENZIONE IMPIANTO RISCALDAMENTO CAMPO TENNIS	Eleonora_Idra	28-lug	ECOtennis srl	Current			
CU03.03.01.03.06	MANUALE INSTALLAZIONE BOLLITORE SIME	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.03.02.01.01	DICH DI CONFORMIT_IDRICO SANITARIO CENTRO SPORTIVO_30.09.2014	Eleonora_Idra	28-lug	Marchesotti Idrotermica srl	Current			
CU03.03.02.01.02	DICH DI CONFORMIT_IDRICO SANITARIO SPOGLIATOI CALCETTO_30.09.2014	Eleonora_Idra	28-lug	Marchesotti Idrotermica srl	Current			
CU03.04.01.01.01	DICH DI CONFORMIT IMPIANTI ELETTRICI_02.09.2014	Eleonora_Idra	28-lug	MONTALBETI ELETTROTECNICA	Current			
CU03.04.01.01.06	DICHIARAZIONE DI CONFORMITA IMPIANTO ELETTRICO_28.10.2009	Eleonora_Idra	28-lug	CDE Service snc	Current			
CU03.04.01.02.01	AS-BUILT IELE_ELABORATI GRAFICI_11.11.2014	Eleonora_Idra	28-lug	Rigamonti Francesco spa	Current			
CU03.04.01.02.02	AS-BUILT IELE_RELAZIONI TECNICHE_11.11.2014	Eleonora_Idra	28-lug	Rigamonti Francesco spa	Current			
CU03.04.01.02.03	AS-BUILT IELE_SCHEMI REGOLAZIONI SIEMENS_11.11.2014	Eleonora_Idra	28-lug	Siemens spa	Current			
CU03.04.01.04.03	VERBALE DI VERIFICA PERIODICA IMPIANTO MAT_01.04.1995	Eleonora_Idra	28-lug	S.I.M.E. srl	Current			
CU03.04.01.04.07	VERIFICA IMPIANTO DI MESSA A TERRA_30.09.1999	Eleonora_Idra	28-lug	Mec engineering srl	Current			
CU03.04.02.01.01	DICH DI CONFORMIT_IMPIANTI ELETTRICO GRUPPO ELETTROGENO_30.09.2014	Eleonora_Idra	28-lug	MONTALBETI ELETTROTECNICA	Current			
CU03.05.01.04.01	MANUALE USO E MANUTENZIONE ASCENSORE OTIS_29.01.2014	Eleonora_Idra	28-lug	Otis Elevator Company	Current			
CU03.07.01.01.01	ALLEGATI ALLA DICH. AGIBILIT 2014_08.10.2014	Eleonora_Idra	28-lug	Garden 2 srl	Current			
CU04.02.01.02.03	RELAZIONE ALLEGATA ALLA RICHIESTA ALLACCIO FOGNATURA PROTOCOLLATA_24.03.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU04.02.01.02.05	TAVOLA ALLEGATA ALLA RICHIESTA ALLACCIO FOGNATURA PROTOCOLLATA_24.03.2014	Eleonora_Idra	28-lug	Comune di Gallarate	Current			
CU04.03.01.03.01	ALLEGATI DICH DI NON AGGRAZIO VVF PROT_SCIA PROT N 17699_07.10.2014	Eleonora_Idra	28-lug	Comando Provinciale Vigili Del Fuoco Varese	Current			
CU07.01.01.04.10	VERBALE ENEL PER ATTIVAZIONE IMPIANTO FOTOVOLTAICO_05.11.2015	Eleonora_Idra	28-lug	Enel spa	Current			
CU07.01.01.04.11	VERBALE ENEL PER ATTIVAZIONE IMPIANTO FOTOVOLTAICO_23.11.2015	Eleonora_Idra	28-lug	Enel spa	Current			
CU07.01.01.04.12	VERBALE SOSTITUZIONE-ATTIVAZIONE CONTATORE ENEL_05.11.2015	Eleonora_Idra	28-lug	Enel spa	Current			
CU07.01.06.01.01	PRATICA ENEA ASSEVERAZIONE LAVORI_01.02.2010	Eleonora_Idra	28-lug	Ordine degli ingegneri di Varese	Current			
CU07.01.06.01.02	PRATICA ENEA_31.01.2010	Eleonora_Idra	28-lug	ENEA Agenzia nazionale per le	Current			

FlorTag	Name	CreatedBy	CreatedOn	ExtSystem	ExtObject	ExtIdentifier	Elevation		Height		UsableArea	
Ext	ExternalArea	Eleonora_Idra	01-ago				0	m	2,70	m	4823,75	mq
-1F	BasementFloor	Eleonora_Idra	01-ago				-2,60	m	6,10	m	1013,38	mq
0F	GroundFloor	Eleonora_Idra	01-ago				0	m	3,48	m	2035,40	mq
1F	FirstFloor	Eleonora_Idra	01-ago				3,83	m	2,70	m	95,19	mq

RoomTag	Name	CreatedBy	CreatedOn	FloorName	ExtSystem		ExtIdentifier	Usable Height		UsableArea		UsableVolum		Glazed Surface		IlluminatingRatio	Aerating Ratio	Maximum Average Crowd	
A	Courses_room1	Eleonora_Idra	29-lug	GroundFloor				3,20	m	183,60	mq	587,52	mc	23,04	mq	1/8	1/8	28	ppl
B	Courses_room2	Eleonora_Idra	29-lug	GroundFloor				3,20	m	99,82	mq	319,42	mc	11,16	mq	1/9	1/9	14	ppl
C	Dance_room	Eleonora_Idra	29-lug	GroundFloor				3,20	m	99,82	mq	319,42	mc	12,96	mq	1/8	1/8	14	ppl
D	Fitness_room	Eleonora_Idra	29-lug	GroundFloor				3,45	m	242,10	mq	835,25	mc	54,15	mq	2/8	2/8	40	ppl
E	Courses_roomonetoone	Eleonora_Idra	29-lug	GroundFloor				3,45	m	26,63	mq	91,87	mc	5,42	mq	1/5	1/5	3	ppl
F	Courses_room3	Eleonora_Idra	29-lug	GroundFloor				3,45	m	66,47	mq	229,32	mc	16,25	mq	1/4	1/4	7	ppl
G	Courses_room4	Eleonora_Idra	29-lug	GroundFloor				3,45	m	30,69	mq	105,88	mc	-	mq	-	-	3	ppl
H	Squash	Eleonora_Idra	29-lug	BasementFloor				6,05	m	61,53	mq	372,26	mc	-	mq	-	-	2	ppl
I	Changingroom1	Eleonora_Idra	29-lug	GroundFloor				3,20	m	26,06	mq	83,39	mc	-	mq	-	-	-	ppl
L	Changingroom2	Eleonora_Idra	29-lug	BasementFloor				3,00	m	103,82	mq	311,46	mc	4,68	mq	1/16	1/16	-	ppl
M	Changingroom3	Eleonora_Idra	29-lug	BasementFloor				3,00	m	101,61	mq	304,83	mc	4,68	mq	1/16	1/16	-	ppl
N	Deposit	Eleonora_Idra	29-lug	BasementFloor				3,00	m	46,98	mq	140,94	mc	-	mq	-	-	-	ppl
O	Changingroom_Staff_1	Eleonora_Idra	29-lug	BasementFloor				3,00	m	8,92	mq	26,76	mc	1,04	mq	1/9	1/9	-	ppl
P	Changingroom_Staff_2	Eleonora_Idra	29-lug	BasementFloor				3,00	m	7,11	mq	21,33	mc	1,04	mq	1/7	1/7	-	ppl
Q	Spinning_Room	Eleonora_Idra	29-lug	BasementFloor				3,00	m	68,15	mq	204,45	mc	2,88	mq	1/16	1/16	9	ppl
R	Wellness_Area	Eleonora_Idra	29-lug	BasementFloor				3,00	m	77,19	mq	231,57	mc	9,36	mq	1/11	1/11	10	ppl
S	Technical_Room	Eleonora_Idra	29-lug	BasementFloor				3,00	m	105,57	mq	316,71	mc	-	mq	-	-	-	ppl
SpRist	Changingroom_Staff_Restaurar	Eleonora_Idra	29-lug	GroundFloor				3,00	m	6,21	mq	18,63	mc	-	mq	-	-	-	ppl
T	Bar	Eleonora_Idra	29-lug	GroundFloor				3,00	m	157,20	mq	471,60	mc	35,28	mq	2/8	2/8	48	ppl
U	Kitchen	Eleonora_Idra	29-lug	GroundFloor				3,00	m	31,30	mq	93,90	mc	-	mq	-	-	-	ppl
V	Hall	Eleonora_Idra	29-lug	GroundFloor				3,00	m	13,98	mq	41,94	mc	9,26	mq	5/8	5/8	-	ppl
Z	Infirmary	Eleonora_Idra	29-lug	GroundFloor				3,45	m	16,00	mq	55,20	mc	-	mq	-	-	-	ppl
K	StorageCloset_1	Eleonora_Idra	29-lug	BasementFloor				2,30	m	24,90	mq	57,27	mc	-	mq	-	-	-	ppl
J	StorageCloset_2	Eleonora_Idra	29-lug	GroundFloor				3,00	m	15,93	mq	47,79	mc	-	mq	-	-	-	ppl
W	StorageCloset_3	Eleonora_Idra	29-lug	BasementFloor				3,45	m	13,27	mq	45,78	mc	-	mq	-	-	-	ppl
X	Offices	Eleonora_Idra	29-lug	FirstFloor				3,00	m	67,85	mq	203,55	mc	9,36	mq	1/7	1/7	2	ppl
WC1	WC1	Eleonora_Idra	29-lug	BasementFloor				2,40	m	6,09	mq	14,62	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC2	WC2	Eleonora_Idra	29-lug	BasementFloor				2,40	m	6,09	mq	14,62	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC3	WC3	Eleonora_Idra	29-lug	FirstFloor				2,40	m	3,50	mq	8,40	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC4	WC4	Eleonora_Idra	29-lug	GroundFloor				2,70	m	2,31	mq	6,24	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC5	WC5	Eleonora_Idra	29-lug	GroundFloor				2,70	m	2,31	mq	6,24	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC6	WC6	Eleonora_Idra	29-lug	GroundFloor				2,40	m	2,05	mq	4,92	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC7	WC7	Eleonora_Idra	29-lug	GroundFloor				2,40	m	4,58	mq	10,99	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
WC8	WC8	Eleonora_Idra	29-lug	ExternalArea				2,40	m	7,21	mq	17,30	mc	-	mq	int. Imp.	int. Imp.	int. Imp.	ppl
SpArb	Changingroom_Referee	Eleonora_Idra	30-lug	ExternalArea				2,70	m	14,30	mq	38,61	mc	0,60	mq	1/2	1/2	2	ppl
CT	ThermicCentralExt	Eleonora_Idra	30-lug	ExternalArea				2,70	m	9,26	mq	25,00	mc	-	mq	int. Imp.	1/19	int. Imp.	ppl
StC	StorageCloset_Football	Eleonora_Idra	30-lug	ExternalArea				2,70	m	3,05	mq	8,24	mc	-	mq	int. Imp.	1/19	int. Imp.	ppl
T1	Tennis1	Eleonora_Idra	30-lug	ExternalArea				-	m	684,25	mq	-	mc	-	mq	-	1/11	6	ppl
Sp1T1	Changingroom1Tennis1	Eleonora_Idra	30-lug	ExternalArea				2,70	m	21,36	mq	57,67	mc	1,12	mq	1/19	1/11	6	ppl
SP2T1	Changingroom2Tennis1	Eleonora_Idra	30-lug	ExternalArea				2,70	m	21,36	mq	57,67	mc	1,12	mq	1/19	1/11	6	ppl
T2	Tennis2	Eleonora_Idra	30-lug	ExternalArea				-	m	681,40	mq	-	mc	-	mq	-	1/11	6	ppl
Sp1T2	Changingroom1Tennis2	Eleonora_Idra	30-lug	ExternalArea				2,70	m	24,42	mq	65,93	mc	2,20	mq	1/11	1/11	6	ppl
Sp2T2	Changingroom2Tennis2	Eleonora_Idra	30-lug	ExternalArea				2,70	m	24,42	mq	65,93	mc	2,20	mq	1/11	1/11	6	ppl
C1	Football1	Eleonora_Idra	30-lug	ExternalArea				-	m	1038,22	mq	-	mc	-	mq	-	-	22	ppl
Sp1C1	Changingroom1Football1	Eleonora_Idra	30-lug	ExternalArea				2,70	m	24,55	mq	66,29	mc	2,20	mq	1/11	1/11	11	ppl
Sp2C1	Changingroom2Football1	Eleonora_Idra	30-lug	ExternalArea				2,70	m	24,55	mq	66,29	mc	2,20	mq	1/11	1/11	11	ppl

C2	Football2	Eleonora_Idra	30-lug	ExternalArea				-	m	1037,37	mq	-	mc	-	mq	-	-	22	ppl
Sp1C2	Changingroom1Football2	Eleonora_Idra	30-lug	ExternalArea				2,70	m	24,55	mq	66,29	mc	2,20	mq	1/11	1/11	11	ppl
Cp2C2	Changingroom2Football2	Eleonora_Idra	30-lug	ExternalArea				2,70	m	24,55	mq	66,29	mc	2,20	mq	1/11	1/11	11	ppl
Roof	Roof	Eleonora_Idra	30-lug	ExternalArea				-	m	1690,00	mq	-	mc	-	mq	-	-	-	ppl
EXTA	ExternalArea	Eleonora_Idra	30-lug	ExternalArea				-	m	1690,00	mq	-	mc	-	mq	-	-	-	ppl

TagNumber	Name	CreatedBy	CreatedOn	TypeName	Space	ExtSystem	ExtObject	ExtIdentifier
CB1	CondensingBoiler_1	Eleonora_Idra	10-ago	VIESSMANN/ VITOMODUL 200-W 315	Technical_Room			
CB2	CondensingBoiler_2	Eleonora_Idra	10-ago	VIESSMANN	Technical_Room			
HP	HeatingPump	Eleonora_Idra	10-ago	CARRIER/ 61AF-045	Technical_Room			
CCU	ClimateControlUnit	Eleonora_Idra	10-ago	VIESSMANN/ VITOTRONIC 200	Technical_Room			
PCCU1	ProbesClimateControlUnit_1	Eleonora_Idra	10-ago	SIEMENS/ VXG	Courses_room1			
PCCU2	ProbesClimateControlUnit_2	Eleonora_Idra	10-ago	SIEMENS/ VXG	Courses_room2			
PCCU3	ProbesClimateControlUnit_3	Eleonora_Idra	10-ago	SIEMENS/ VXG	Dance_room			
PCCU4	ProbesClimateControlUnit_4	Eleonora_Idra	10-ago	SIEMENS/ VXG	Fitness_room			
PCCU5	ProbesClimateControlUnit_5	Eleonora_Idra	10-ago	SIEMENS/ VXG	Courses_roomonetoone			
PCCU6	ProbesClimateControlUnit_6	Eleonora_Idra	10-ago	SIEMENS/ VXG	Courses_room3			
PCCU7	ProbesClimateControlUnit_7	Eleonora_Idra	10-ago	SIEMENS/ VXG	Courses_room4			
PCCU8	ProbesClimateControlUnit_8	Eleonora_Idra	10-ago	SIEMENS/ VXG	Squash			
PCCU9	ProbesClimateControlUnit_9	Eleonora_Idra	10-ago	SIEMENS/ VXG	Spinning_Room			
PCCU10	ProbesClimateControlUnit_10	Eleonora_Idra	10-ago	SIEMENS/ VXG	Wellness_Area			
PCCU11	ProbesClimateControlUnit_11	Eleonora_Idra	10-ago	SIEMENS/ VXG	Bar			
PCCU12	ProbesClimateControlUnit_12	Eleonora_Idra	10-ago	SIEMENS/ VXG	Hall			
PCCU13	ProbesClimateControlUnit_13	Eleonora_Idra	10-ago	SIEMENS/ VXG	Infirmary			
FC1	FanCoil_1	Eleonora_Idra	10-ago	Carrier 42N	Infirmary			
FC2	FanCoil_2	Eleonora_Idra	10-ago	Carrier 42N	Hall			
UTAR	UTARistorante	Eleonora_Idra	10-ago	Ferroli FTP	Bar			
UTAS1	UTASpogliatoi_1	Eleonora_Idra	10-ago	Ferroli FTP	Changingroom2			
UTAS2	UTASpogliatoi_2	Eleonora_Idra	10-ago	Ferroli FTP	Changingroom3			
UTAF	UTAFitness	Eleonora_Idra	10-ago	Ferroli FTP	Fitness_room			
UTASC1	UTASaleCorsi_1	Eleonora_Idra	10-ago	Ferroli FTP	Courses_room1			
UTASC2	UTASaleCorsi_2	Eleonora_Idra	10-ago	Ferroli FTP	Courses_room2			
SM	SmokingDuct	Eleonora_Idra	10-ago	n/a	Technical_Room			
Cmn	Chimney	Eleonora_Idra	10-ago	n/a	Technical_Room			
IntPI	InternalPipesInsulation	Eleonora_Idra	10-ago	n/a	BasementFloor			
IntPI	InternalPipesInsulation	Eleonora_Idra	10-ago	n/a	GroundFloor			
IntPI	InternalPipesInsulation	Eleonora_Idra	10-ago	n/a	FirstFloor			
ExtPI	ExternalPipesInsulation	Eleonora_Idra	10-ago	n/a	ExternalArea			
EP	ElectricPlant	Eleonora_Idra	10-ago	n/a	n/a			
PhP	PhotovoltaicPlant	Eleonora_Idra	10-ago	Sanyo N330	Roof			
M1	ExternalWall1	Eleonora_Idra	12-ago	PARETE ESTERNA VERSO CAVEDIO PIANO INTERRATO	Deposit			
M2	ExternalWall2	Eleonora_Idra	12-ago	PARETE VERSO DEPOSITO APERTO	StorageCloset_2			
M3	ExternalWall3	Eleonora_Idra	12-ago	PARETE CONTROTERRA PIANO INTERRATO	Spinning_Room			
M4	ExternalWall4	Eleonora_Idra	12-ago	PARETE VERSO RIPOSTIGUO	StorageCloset_3			
M5	ExternalWall5	Eleonora_Idra	12-ago	PARETE VERSO CAVEDIO PIANO INTERRATO	StorageCloset_3			
M6	InternalWall6	Eleonora_Idra	12-ago	PARETE VERSO LOCALE TECNICO	Technical_Room			
M7	InternalWall7	Eleonora_Idra	12-ago	PARETE VERSO FUTURA AREA WELLNESS	Wellness_Area			
M8	InternalWall8	Eleonora_Idra	12-ago	PARETE SQUASH VERSO RIPOSTIGUO	Squash			
M9	ExternalWall9	Eleonora_Idra	12-ago	PARETE SQUASH VERSO DEPOSITO APERTO	Squash			
M11	InternalWall11	Eleonora_Idra	12-ago	PARETE SPINNING VERSO FUTURA AREA WELLNESS	Wellness_Area			
M12	ExternalWall12	Eleonora_Idra	12-ago	PARETE ESTERNA A TELAIO IN LEGNO	Bar			
M13	ExternalWall13	Eleonora_Idra	12-ago	PARETE ESTERNA LA TERIZIO + CAPPOTTO	Changingroom1			
M14	InternalWall14	Eleonora_Idra	12-ago	PARETE VERSO ASOLA TECNICA	ThermicCentralExt			

P1	Floor1	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA - 3,50	Squash			
P1	Floor2	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA - 3,50	Changingroom_Staff_1			
P1	Floor3	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA - 3,50	Changingroom_Staff_2			
P1	Floor4	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA - 3,50	Spinning_Room			
P1	Floor5	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA - 3,50	Wellness_Area			
P1	Floor6	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA - 3,50	Technical_Room			
P2	Floor7	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA -2,60	WC1			
P2	Floor8	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA -2,60	WC2			
P3	Floor9	Eleonora_Idra	12-ago	PAVIMENTO VERSO DEPOSITO APERTO	StorageCloset_Football			
P4	Floor10	Eleonora_Idra	12-ago	PAVIMENTO VERSO RIPOSTIGLI	StorageCloset_1			
P4	Floor11	Eleonora_Idra	12-ago	PAVIMENTO VERSO RIPOSTIGLI	StorageCloset_2			
P4	Floor12	Eleonora_Idra	12-ago	PAVIMENTO VERSO RIPOSTIGLI	StorageCloset_3			
P5	Floor13	Eleonora_Idra	12-ago	PAVIMENTO VERSO LOCALE TECNICO	Technical_Room			
P6	Floor14	Eleonora_Idra	12-ago	PAVIMENTO VERSO FUTURA AREA WELLNESS	Wellness_Area			
P7	Floor15	Eleonora_Idra	12-ago	PAVIMENTO VERSO CAVEDIO	Deposit			
P8	Floor16	Eleonora_Idra	12-ago	PAVIMENTO CONTROTERRA NON COIBENTATO ±0,00	ExternalArea			
S1	Slab1	Eleonora_Idra	12-ago	COPERTURA PIANA IN LATEROCEMENTO + COIBENTAZIONE	ExternalArea			
S2	Slab2	Eleonora_Idra	12-ago	COPERTURA PIANA PREFABBRICATA IN LEGNO	ExternalArea			
S3	Slab3	Eleonora_Idra	12-ago	COPERTURA PIANA PREFABBRICATA IN LEGNO + CONTROSOFFITTO 50 CM	GroundFloor			
S4	Slab4	Eleonora_Idra	12-ago	COPERTURA PIANA IN LATEROCEMENTO + COIBENTAZIONE +CONTROSOFFITTO 45 CM	FirstFloor			
S5	Slab5	Eleonora_Idra	12-ago	COPERTURA PIANA IN LATEROCEMENTO + COIBEN TAZIONE+ CONTROSOFFITTO 95 CM	BasementFloor			
S6	Slab6	Eleonora_Idra	12-ago	COPERTURA PIANA PREFABBRICATA IN LEGNO + CONTROSOFFIITO J40 CM	Bar			

Name	CreatedBy	CreatedOn	SheetName	RowName	Value	Unit	ExtSystem	ExtObject	ExtIdentifier
B1_Descripiton Decision-making and examination of alternatives									
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU01.01.01.04.01	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU01.03.01.01.01	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU01.03.01.03.01	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.01	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.02	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.03	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.06	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.07	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.08	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.10	n/a	n/a			
UrbanDevelopmentDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.11	n/a	n/a			
AccessibilityDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.05	n/a	n/a			
AccessibilityDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.08	n/a	n/a			
AccessibilityDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.10	n/a	n/a			
AccessibilityDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.11	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU01.04.04.03.01	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU01.04.04.03.02	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.01	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.02	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.03	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.06	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.07	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.08	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.10	n/a	n/a			
LandscapeConsumptionDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.11	n/a	n/a			
EnergyEfficiencyDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.06	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.01	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.02	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.06	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.01.06.07	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.06	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.07	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.10	n/a	n/a			
EcologicalMaterialUsageDoc	Eleonora_Idra	30-lug	Document	CU02.01.02.02.11	n/a	n/a			
B2_Definition of verifiable energetic and ecologic objectives									
TotalTermalHeatingDemand	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	19,64	kg/mca			
totalTermalCoolingDemand	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	3,17	kg/mca			
TotalPrimaryEnergyDemand	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	134,17	kg/mca			
CO2Emissions	Eleonora_Idra	30-lug	Document	CU03.01.02.02.01	2,72	kg/mca			
TotalPhotovoltaicYield	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	30	Kw			
B3_Simplified calculation of efficiency									
BuildingServiceLife	Eleonora_Idra	30-lug	Component	CondensingBoiler_1	22	Years			
BuildingServiceLife	Eleonora_Idra	31-lug	Component	CondensingBoiler_2	22	Years			
BuildingServiceLife	Eleonora_Idra	31-lug	Component	HeatingPump	15	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	FanCoil_1	20	Years			

BuildingServiceLife	Eleonora_Idra	01-ago	Component	FanCoil_2	20	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	UTARistorante	52	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	UTASpogliatoi_1	52	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	UTASpogliatoi_2	52	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	UTAFitness	52	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	UTASaleCorsi_1	52	Years			
BuildingServiceLife	Eleonora_Idra	01-ago	Component	UTASaleCorsi_2	52	Years			
B4_Product management - using low-polutant and low-emission building materials									
PlantsMaterials	Eleonora_Idra	30-lug	Component	ExternalPipesInsulation	iuav	n/a			
PlantsMaterials	Eleonora_Idra	30-lug	Component	SmokingDuct	pps	n/a			
PlantsMaterials	Eleonora_Idra	30-lug	Component	Chimney	inox	n/a			
PlantsMaterials	Eleonora_Idra	30-lug	Component	InternalPipesInsulation	iuav	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor1	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor2	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor3	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor4	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor5	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor6	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor7	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor8	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor9	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor10	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor11	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor12	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor13	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor14	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor15	ceramic tiles	n/a			
FlooringMaterials	Eleonora_Idra	30-lug	Component	Floor16	ceramic tiles	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall1	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall2	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall4	mineral wool	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall5	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	InternalWall6	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	InternalWall7	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	InternalWall8	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall9	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	InternalWall11	mineral wool	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall12	mineral wool	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	ExternalWall13	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	InternalWall14	mineral wool	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor1	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor2	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor3	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor4	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor5	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor6	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor9	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor10	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor11	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor12	expanded synthesized polystyrene	n/a			

InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor13	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor14	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Floor15	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Slab1	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Slab2	mineral wool	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Slab3	mineral wool	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Slab4	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Slab5	expanded synthesized polystyrene	n/a			
InsulationMaterials	Eleonora_Idra	30-lug	Component	Slab6	mineral wool	n/a			
B5_Energetic optimizaton during the planning									
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room1	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room2	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Dance_room	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Fitness_room	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room3	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room4	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Squash	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom3	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Spinning_Room	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Wellness_Area	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Technical_Room	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Bar	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Kitchen	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Hall	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Infirmary	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Offices	20	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC2	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC3	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC4	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC5	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC6	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC7	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	WC8	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Referee	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Football1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Football1	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Football2	22	°C			
WinterSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Football2	22	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room1	26	°C			

SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room2	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Dance_room	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Fitness_room	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room3	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Courses_room4	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Squash	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom3	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Spinning_Room	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Wellness_Area	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Bar	25	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Kitchen	25	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Hall	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Infirmary	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Offices	26	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC2	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC3	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC4	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC5	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC6	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC7	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	WC8	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom_Referee	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Football1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Football1	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom1Football2	28	°C			
SummerSpaceTemperature	Eleonora_Idra	30-lug	Space	Changingroom2Football2	28	°C			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Courses_room1	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Courses_room2	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Dance_room	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Fitness_room	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Courses_room3	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Courses_room4	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Squash	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom2	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom3	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	0,00168	m3/s			

VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Spinning_Room	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Wellness_Area	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Bar	0,00112	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Kitchen	0,00112	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Hall	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Infirmary	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Offices	0,00084	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC2	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC3	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC4	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC5	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC6	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC7	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	WC8	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom_Referee	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom1Football1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom2Football1	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom1Football2	0,00168	m3/s			
VentilaltionAirFlowRate	Eleonora_Idra	30-lug	Space	Changingroom2Football2	0,00168	m3/s			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room1	5,9676644	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room2	3,2445112	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Dance_room	3,2445112	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Fitness_room	8,4839015	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	0,9331941	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room3	2,3293058	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room4	1,0754686	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Squash	3,7811510	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1	1,6940886	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2	6,3272356	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom3	6,1925488	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	0,5436230	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	0,4333139	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Spinning_Room	2,0766765	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Wellness_Area	2,3521447	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	0,3784640	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Bar	6,3869610	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Kitchen	1,2717041	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Hall	0,4260006	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Infirmary	0,5606874	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Offices	2,0675349	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC1	0,2969206	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC2	0,2969206	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC3	0,1706440	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC4	0,1267032	kW			

WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC5	0,1267032	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC6	0,0999486	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC7	0,2232999	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC8	0,3515266	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Referee	0,7843529	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	1,1715929	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	1,1715929	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	1,3394335	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	1,3394335	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football1	1,3465640	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football1	1,3465640	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football2	1,3465640	kW			
WinterTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football2	1,3465640	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room1	3,5805986	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room2	1,9467067	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Dance_room	1,9467067	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Fitness_room	5,0903409	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	0,5599165	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room3	1,3975835	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Courses_room4	0,6452811	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Squash	2,2686906	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1	1,0164532	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2	3,7963414	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom3	3,7155293	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	0,3261738	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	0,2599883	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Spinning_Room	1,2460059	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Wellness_Area	1,4112868	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	0,2270784	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Bar	3,8321766	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Kitchen	0,7630224	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Hall	0,2556003	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Infirmary	0,3364125	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Offices	1,2405209	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC1	0,1781523	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC2	0,1781523	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC3	0,1023864	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC4	0,0760219	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC5	0,0760219	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC6	0,0599692	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC7	0,1339799	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	WC8	0,2109160	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	0,7029558	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	0,7029558	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	0,8036601	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	0,8036601	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football1	0,8079384	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football1	0,8079384	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football2	0,8079384	kW			
SummerTotalSensibleLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football2	0,8079384	kW			

WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room1	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room2	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Dance_room	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Fitness_room	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room3	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room4	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Squash	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom3	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Spinning_Room	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Wellness_Area	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Bar	1,4936560	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Kitchen	1,4936560	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Hall	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Infirmary	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Offices	1,1202420	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC3	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC4	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC5	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC6	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC7	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC8	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Referee	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football2	2,2404840	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room1	7.958,6049325	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room2	4.326,9495881	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Dance_room	4.326,9495881	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Fitness_room	11.314,3126649	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	1.244,5276591	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room3	3.106,4120728	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room4	1.434,2678880	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Squash	5.042,6239397	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1	2.259,2728164	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2	8.438,1368882	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom3	8.258,5155964	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	724,9872957	kW			

SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	577,8766449	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Spinning_Room	2.769,5002357	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Wellness_Area	3.136,8704797	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	504,7277025	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Bar	8.517,7879588	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Kitchen	1.695,9717755	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Hall	568,1234526	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Infirmary	747,7447445	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Offices	2.757,3087453	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC1	395,9796082	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC2	395,9796082	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC3	227,5744875	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC4	168,9740569	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC5	168,9740569	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC6	133,2936284	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC7	297,7974721	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC8	468,8034441	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Referee	1.046,0298762	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	1.562,4614096	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	1.562,4614096	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	1.786,2971733	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	1.786,2971733	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football1	1.795,8065358	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football1	1.795,8065358	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football2	1.795,8065358	kW			
SummerTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football2	1.795,8065358	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room1	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room2	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Dance_room	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Fitness_room	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room3	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Courses_room4	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Squash	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom3	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Spinning_Room	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Wellness_Area	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Staff_Restaurant	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Bar	2,9873119	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Kitchen	2,9873119	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Hall	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Infirmary	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Offices	2,2404840	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC2	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC3	4,4809679	kW			

WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC4	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC5	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC6	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC7	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	WC8	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom_Referee	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football1	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom1Football2	4,4809679	kW			
WinterTotalRadiantLoad	Eleonora_Idra	30-lug	Space	Changingroom2Football2	4,4809679	kW			
B6_User information									
TotalCoolingLoad	Eleonora_Idra	30-lug	Component	HeatingCoolingPlant	14,23	kWh/m3			
TotalHeatingLoad	Eleonora_Idra	30-lug	Component	HeatingCoolingPlant	3,24	kWh/m3			
AuxiliaryEnergyConsumption	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	24,33	kW			
PrimaryEnergyConsumption	Eleonora_Idra	30-lug	Component	HeatingCoolingPlant	137,49	kWh/m3			
PrimaryEnergyConsumption	Eleonora_Idra	30-lug	Component	MechanicalPlant					
B7_Product management - using low-polutant and low-emission building materials									
NominalThermalPower	Eleonora_Idra	30-lug	Component	CondensingBoiler_1	193,06	kW			
NominalThermalPower	Eleonora_Idra	30-lug	Component	CondensingBoiler_2	96,53	kW			
NominalThermalPower	Eleonora_Idra	30-lug	Component	HeatingPump	43,5	kW			
NominalThermalPower	Eleonora_Idra	30-lug	Component	FanCoil_1	2000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	FanCoil_2	2000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	UTARistorante	39000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	UTASpogliatoi_1	36000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	UTASpogliatoi_2	36000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	UTAFitness	69000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	UTASaleCorsi_1	69000	W			
NominalThermalPower	Eleonora_Idra	30-lug	Component	UTASaleCorsi_2	69000	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	FanCoil_1	30	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	FanCoil_2	30	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	UTARistorante	2120	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	UTASpogliatoi_1	4220	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	UTASpogliatoi_2	4220	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	UTAFitness	9960	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	UTASaleCorsi_1	9960	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	UTASaleCorsi_2	9960	W			
NominalElecticPower	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	15,68	kW			
C5_PV-Power plant CO2-Equivalents									
PhotovoltaicAnualYield	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	30	kW			
C6_Differentiated documentation of Energy Consumption									
HeatingEnergyConsumption	Eleonora_Idra	30-lug	Component	HeatingCoolingPlant	14,23	kWh/m3			
CoolingEnergyConsumption	Eleonora_Idra	30-lug	Component	HeatingCoolingPlant	3,24	kWh/m3			
AuxiliaryHeatingEnergyConsumption	Eleonora_Idra	30-lug	Component	MechanicalPlant	103840	kWhe			
LightingEnergyConsumption	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	24,33	Kw			

D2_Comfort ventilation – hygiene and soundproofing

InternalSoundEmission	Eleonora_Idra	30-lug	Component	UTARistorante	45	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Component	UTASpogliatoi_1	45	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Component	UTASpogliatoi_2	45	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Component	UTAFitness	45	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Component	UTASaleCorsi_1	45	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Component	UTASaleCorsi_2	45	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Component	HeatingPump	80	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Space	BasementFloor	30	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Space	GroundFloor	30	dB			
InternalSoundEmission	Eleonora_Idra	30-lug	Space	FirstFloor	30	dB			
D3_Sunlight supply, daylight quotient									
IllumatingRatio	Eleonora_Idra	30-lug	Space	Courses_room1	1/8	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Courses_room2	1/9	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Dance_room	1/8	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Fitness_room	2/8	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Courses_roomonetoone	1/5	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Courses_room3	1/4	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom2	1/16	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom3	1/16	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom_Staff_1	1/9	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom_Staff_2	1/7	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Spinning_Room	1/16	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Wellness_Area	1/11	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Bar	2/8	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Hall	5/8	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Offices	1/7	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom_Referee	1/2	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom1Tennis1	1/19	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom2Tennis1	1/19	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom1Tennis2	1/11	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom2Tennis2	1/11	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom1Football1	1/11	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom2Football1	1/11	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom1Football2	1/11	n/a			
IllumatingRatio	Eleonora_Idra	30-lug	Space	Changingroom2Football2	1/11	n/a			
D3_Sunlight supply, daylight quotient									
NonPrimaryEnergyConsumption	Eleonora_Idra	30-lug	Component	PhotovoltaicPlant	24,33	kW			

ACKNOWLEDGEMENTS

I would like to remind and sincerely thank those who helped me in writing this thesis, who most directly and consciously, who in a more indirect way more blindly.

First of all, I would like to thank my supervisor: Prof. Mario Claudio Dejaco, who welcomed me in his office, listened and guided with dedication, entrusting me to my co-supervisor: Eng. Sebastiano Maltese, Eng. Nicola Moretti and Eng. Seyeda Amir Hakim: I thank them not only for their expertise and professionalism, but also because they have been able to join a strong humanity that is not always visible within the university environment. For your help and for your constant presence: thank you.

I also thank Prof. Giuseppe Rigamonti for providing the material for the case study and making possible to apply the theory of the thesis on a real case.

I continue with Gym's staff from Gallarate which has allowed me to access their building with enthusiasm for my project.

Thanks to my friends from Casale Monferrato, who have listened to hours and hours of stories about BIM and COBIe.

I thank my University colleagues, Catherine, Chiara and Daniele, for their sincere friendship, for laughs, for “Squisito’s” lunches and aperitifs, those already made and those coming, you gave me the boost when it seemed too difficult.

Thanks to Enrico, because there is always: when the climb is too steep, when the descent is free. Thank you because you never ask me why, but you throw yourself with me, because without asking you know.

In the end I leave the greatest thanks to my mom and my dad. Thank you for teaching me art of arranging, for preparing me to "no" more than yes, for showing me what is right and what not. Thank you for focusing on me even when I did not believe it much, for having spurred me to point to the top even though it is more tiring. This work is devoted to you.

RINGRAZIAMENTI

Desidero ricordare e sinceramente ringraziare chi mi ha aiutato nella stesura di questa tesi, chi più direttamente e consapevolmente, chi in modo più indiretto più inconsciamente.
Ringrazio anzitutto il mio relatore: il Prof. Mario Claudio Dejaco, che mi ha accolta all'interno del suo ufficio, ascoltata e guidata con dedizione, affidandomi ai miei co-relatori: l'Ing. Sebastiano Maltese, Ing. Nicola Moretti e l'Ing. Seyeda Amir Hakim: che ringrazio non solo per la loro competenza e professionalità, ma anche perché hanno saputo unire ad essa una forte umanità, non sempre riscontrabile all'interno dell'ambiente universitario, per il vostro aiuto e la vostra presenza costante: grazie.
Ringrazio anche il Prof. Giuseppe Rigamonti per avermi fornito il materiale relativo al caso studio e aver reso così possibile l'applicazione della tesi su un caso reale.
Proseguo con lo staff della palestra Gym's di Gallarate che mi ha consentito l'accesso ai loro locali con entusiasmo per il mio progetto.
Grazie ai miei amici di Casale Monferrato, che hanno ascoltato ore e ore di racconti sul BIM e sul COBIe.
Ringrazio i miei colleghi di università Catherine, Chiara e Daniele, per la loro sincera amicizia, per le risate, per i pranzi da Squisito e gli aperitivi, quelli già fatti e quelli che verranno, mi avete dato la spinta quando sembrava troppo difficile.
Grazie a Enrico, perché c'è sempre: quando la salita è troppo ripida, quando la discesa è libera. Grazie perché non mi chiedi mai il motivo, ma ti butti con me, perché senza domandare tu lo sai.
Alla fine lascio il ringraziamento più grande alla mia mamma e al mio papà. Grazie per avermi insegnato l'arte dell'arrangiarsi, per avermi preparato ai "no" più che ai sì, per avermi mostrato cosa sia giusto e cosa no. Grazie per aver puntato su di me anche quando io ci credevo poco, per avermi spronato a puntare in alto anche se è più faticoso. Questo lavoro è dedicato a voi.