"Antonio Brancati" Middle School

by Margherita Finamore / 2021-03-26 16:21:46 / International / 10640 / EN

Primary energy need :

26.8 kWhpe/m².year

(Calculation method :)

ENERGY CONSUMPTION

Economical building *Building*

< 50	A
51 à 90	B
91 à 150	C
151 à 230	D
231 à 330	E
331 à 450	F
> 450	G

Energy-intensive building

Building Type : School, college, university
Construction Year : 2018
Delivery year : 2020
Address 1 - street : Lamarmora 61122 PESARO, Italy
Climate zone : [Csb] Coastal Mediterranean - Mild with cool, dry summer.

Net Floor Area : 2 430 m² SHON
Construction/refurbishment cost : 3 175 579 €
Cost/m2 : 1306.82 €/m²

Certifications :

General information

This building was awarded the Energy & Temperate Climates Prize at the international level and a mention for the Sustainable Construction Grand Prize at the national level of the Green Solutions Awards 2020-21.

The new secondary school “Antonio Brancati” in Pesaro (Italy) got three first:

- The highest scoring “Schools” energy environmental certification in Europe;

- The third highest scoring “Schools” energy environmental certification in the world out of 1,733 certifications in LEED system;

- The highest scoring v4 “Schools” certification in the world.

This is a new school built on an abandoned urban area and it has a very important role also in terms of social sustainability, not only as an excellent green

building.

Since the beginning, the decision of the municipality was made to reuse the site for a school with zero land consumption by redeveloping the abandoned urban area, and replacing three old army barracks built in 1950 with the new middle-school.

This school building excellence is the result of the ambitious commitment of Pesaro municipality to preserve the environment and tackle climate change. The City of Pesaro has refocused the mandate of local construction on efficiency, sustainability, and responsibility.

In 2017, the City of Pesaro launched a pilot project with the aim of encouraging a holistic approach towards circular economy principles to ensure the building design responds to environmental protection, health and well-being and other social considerations.

The ambition of Pesaro City is to accelerate the transition towards a circular economy, enabling construction firms to use a new system beyond the current outdated ‘take-make-dispose’ model and contribute to mainstreaming the circular economy concept within and outside the city.

Instead of taking a traditional approach to developing works procurement, the city decided to adopt a more circular approach which would be to build a sustainable new school using the current asset.

The intent was to optimise circularity and enhance the use of sustainable building material and technologies, save raw materials, and minimise waste from the construction of the building.

The analysis of not only educational needs but also citizens expectations for use was the central theme: to make the building more circular in terms of its functionality and make sure that it can be used by everyone all day, every day to become a wonderful community space for all the citizens.

The call for tender describes technical specifications and provides measurable requirements against which the tenders can be evaluated. Performance-based criteria describe the expected results and which outputs are mandatory. In the case of this project, two criteria were selected as mandatory: (a) obtaining a nZEB school and (b) providing the environmental energy certification using the LEED certification scheme, achieving at minimum, the LEED Gold certification.

As a result, the tender includes technical specification on energy efficiency, product lifecycle, waste management, water efficiency, with attention paid to internal comfort to create the best indoor environmental conditions for the students and teachers. It is relevant not only the energy consumption reduction but also the indoor quality for the students and staff through acoustics, air quality and thermal comfort requirements. These results are guaranteed by the LEED environmental energy certification made mandatory in the tender notice obtaining the LEED v4BD+C with the score of 88 points.

The project is successful because it achieves the goal of a building that is extraordinary in every sustainable LEED evaluation area and the records achieved are the confirmation of this. The tendering process can be replicated by other municipalities to obtain not only energy efficiency buildings but above all to reduce the buildings’ carbon footprint.

This project provides the first concrete example in mainstreaming circular practices in public procurement. The innovativeness of this project is to take into practice circular principles within the public procurement and ensure that the procedure runs efficiently and obtains the expected results based on environmental and social requirements.

This project also demonstrates that the Green Public Procurement process where environmental requirements are made mandatory within the tendering process using predetermined award criteria is essential for delivering environmental social value, influencing the market towards sustainable materials and products, improving new skills on green jobs.

School requirements achieved:

Low impact school:

- construction and demolition waste management, and also waste management during the construction phase;
- zero land consumption;
- EPD material labelling.

Waste management:
During all the process 556,630 kg of waste were created and thanks to all material flows monitored 546,378 kg was recycled and recovered achieving a 98% recovered waste. The school is also equipped with separate collection bins for paper, metal, plastic and glass.

Architectural design:
The shape and position of the building was studied and orientated to best exploit solar radiation and optimize the free solar gains and natural lighting and shading;

Due to the mooth tone-in-tone colours of the facade, the building is harmonious within the context creating a friendly new space for all the citizens.

Labeling:
LEED Platinum with 88 points – nZEB standard

Comfort for all:

- Remote and customized temperature
- both natural and artificial light control
- high acoustic performance obtained to create the best environment for learning and teaching
- parking for bicycles, electric charging stations for cars
- indoor air quality by mechanical filtered ventilation climate system with a CO2 monitoring able to guarantee higher levels of indoor air quality with the air exchange of 5 volumes per hour
- natural ventilation thanks to opening in the upper window sections

Indoor air quality:
Mechanical filtered ventilation climate system with a CO2 monitoring able to guarantee higher levels of indoor air quality with the air exchange of 5 volumes per hour

Natural ventilation:
Thanks to openings in the upper window sections

Solar control:

Integrated and motorized shutters with sensors for light and overheating control

Green roof:
Made of Mediterranean plants with low water need to moderate the impact of high temperatures, capture storm water, abate pollution, and act as carbon sinks, while enhancing biodiversity

Reused rainwater:
Rainwater collecting tanks for green spaces, and the green roof

Water consumption reduction:
Water consumption has been reduced thanks to taps with aerators that reduce water flow by 50%, and flash-water tanks.

Envelope efficiency:
The ventilated wall made of modular porcelain stoneware avoids overheating, minimize losses, and also reduces the maintenance costs of the facade

Energy Consumption Reduction:
-59,07% considering TEP reduction compared to standard construction (UNI TS 11300 and UNI EN 15193) and - 34,8% reduction of annual costs thanks to:

- Envelope efficiency: the thermal insulation, the thoroughly study of thermal bridges, the green roof and ventilated wall made of modular porcelain stoneware avoids overheating, minimize losses and reduces also the maintenance costs of the façade
- the high efficiency heat recovery unit
- optimized lighting (LED)
- automatic consumption monitoring control system to make also friendly and easy the use of building

Renewable energy:
Optimal production of electric energy due to the PV panels

- Photovoltaic installation of 158,40 m2;
- n. 96 photovoltaic modules of 300Wph and 1,96 m2 each
- Photovoltaic power ratings 28,8 Kw continuous current
- Inverter Solaredge 27,6KW alternate current
- Not expensive PV system due to the envelope high performance
- 113,5 kW heat pump
- heating system: floor heating and VAV system (variable air volume)
- cooling system: floor cooling and VAV system (variable air volume)

See more details about this project

https://www.macrodesignstudio.it/?portfolio=nuova-scuola-secondaria-antonio-brancati-a-pesaro
https://gbcitalia.org/web/guest/-/a-pesaro-la-prima-scuola-leed-platinum-d-europa
https://www.ingenio-web.it/29662-risposta-ai-cambiamenti-climatici-della-citta-di-pesaro-la-scuola-brancati-edificio-piu-sostenibile-deuropa
https://www.ingenio-web.it/29463-primato-europeo-per-la-nuova-scuola-antonio-brancati-di-pesaro-certificata-leed-v4-platino
https://www.ilsole24ore.com/art/a-pesaro-scuola-certificata-leed-platinum-ADA3IKNB

Photo credit

Margherita Finamore photo credit
Formula Servizi & Idrotermica Coop (Sunset comunicazioni) video credit

Stakeholders

Contractor

Name : Pesaro Municipality
Contact : Margherita Finamore m.finamore[a]comune.pesaro.pu.it
http://www.comune.pesaro.pu.it/

Construction Manager

Name : Arch. Margherita Finamore
Contact : m.finamore[a]comune.pesaro.pu.it

Stakeholders

Function : Construction company

Idrotermicacoop

Michele Gardella gardella[a]idrotermicacoop.it

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technical assistant for mechanical plants

Function : Construction company

Formulaservizi

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Function : Construction company

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Function : Contractor representative

Pesaro Municipality

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Project Manager

Function : Construction company

CONSCOOP - CONSORZIO FRA COOPERATIVE DI PRODUZIONE E LAVORO - Formula Servizi - Forlì - Idrotermica Coop - Forlì - SIEM Impianti – Cesena (FC)

Mirco Valdifiori mircovaldifiori[a]formulaservizi.it - Forlì

Contracting method

Other methods

If you had to do it again?

I would study better the impacts of the materials to prove the circularity of the building, as if it was a bank of materials. I would improve the eco-design and the use of bio-based materials to assure that the building would be dismantled as much as possible, to maximize the quantity of re-usable materials. I would also improve the use of light structure assembly technology to have a clean and environmental friendly construction site.

Building users opinion

Users are generally very satisfied. Four categories are considered: the point of view of the teachers, the students, the school assistants, and the parents.
A campaign to collect data is already planned. It should consists of individual reports and interviews, but due to the present COVID-19 situation, it hasn't started yet.
All users appreciate the brightness of the natural and artificial light as desired, the acoustic comfort due to the absence of background noise in the classrooms or any noise disturbance from outdoor, the thermal comfort which is tailor-made in every classroom thanks to the sensors, and the view of the park surrounding the school.
The students appreciate very much the glass walls of the classes that allow them to see the other classes, thus generating a sense of community.
What users especially liked the most, particularly the parents, is the indoor air quality (especially considering the present COVID-19 situation) thanks to the mechanical filtered ventilation climate system, with a CO2 monitor, able to guarantee higher levels of indoor air quality, reducing the risk of contagion.
The general opinion is that this school creates an environment friendly spaces where students can be educated on sustainability, aware of being part of a community, and can understand how important the relationship between the human being and the environment is.

Energy

Energy consumption

Primary energy need : 26,80 kWhpe/m^2.year

Primary energy need for standard building : 55,10 kWhpe/m^2.year

Calculation method :

Breakdown for energy consumption : Energy consumption for Heating: 15.54 kWH/M2.YEAR; Energy consumption for Hot water: 0.89 kWH/M2.YEAR; Energy consumption for Cooling: 9.57 kWH/M2.YEAR; Energy consumption for Ventilation: 18.84 kWH/M2.YEAR; Energy consumption for Lighting: 15.58 kWH/M2.YEAR; Energy consumption for Lift: 0.25 kWH/M2.YEAR

Envelope performance

Envelope U-Value : 0,22 $W.m^{-2}.K^{-1}$

More information :

Wall1: outer wall M1 (area=197 m2) U=0.127 W.m-2.K-1; Ms=273 kg m-2; YIE=0.001 W.m-2.K-12: outer wall M2 (area=371 m2) U=0.163 W.m-2.K-1; Ms=736. kg m-2; YIE=0.008 W.m-2.K-13: outer wall M6 (area=296 m2) U=0.128 W.m-2.K-1; Ms=273. kg m-2; YIE=0.001 W.m-2.K-14: outer wall M7 (area=238 m2) U=0.164 W.m-2.K-1; Ms=273. kg m-2; YIE=0.001 W.m-2.K-15: floor P1 (area=1118 m2) U=0.117 W.m-2.K-1; Ms=163. kg m-2; YIE=0.073 W.m-2.K-16: green roof S7 (area=1116 m2) U=0.125 W.m-2.K-1; Ms=127. kg m-2; YIE=0.021 W.m-2.K-17: shed roof S9 (area=103 m2) U=0.133 W.m-2.K-1; Ms=63. kg m-2; YIE=0.043 W.m-2.K-1; WindowsSolar factor (EN 410): 50%W1 (area=241 m2) Uw=0,795 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W10 (area=24.7 m2) Uw=0,766 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W11 (area=25.6 m2) Uw=0,836 W.m-2.K-1 Ug=0,500 W.m-2.K-1; W12 (area=5.12 m2) Uw=0,836 W.m-2.K-1 Ug=0,500 W.m-2.K-1; W2 (area=4.2 m2) Uw=0,812 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W3 (area=16.8 m2) Uw=0,788 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W4 (area=6 m2) Uw=0,808 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W5 (area=10.8 m2) Uw=0,818 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W6 (area=3.23 m2) Uw=0,837 W.m-2.K-1 Ug=0,600 W.m-2.K-1; W7 (area=4.3 m2) Uw=0,797 W.m-2.K-1 Ug=0,600 W.m-2.K-1

Building Compactness Coefficient : 0,38

Indicator : EN 13829 - n50 » (en 1/h-1)

Air Tightness Value : 2,26

Users' control system opinion :

The school is equipped with a Class A building automation according to UNI EN 15232.

The system allows remote maintenance to be performed easily, and all the users (especially the teachers) are very satisfied about this friendly system.

More information

The school has been operational since the beginning of the school year, 17th Sept. 2020. The real consumptions and performances have been monitored by the Department of Industrial Engineering DIN (University of Bologna) for 4 years to check all the comfort data. At the moment the monitoring is in progress. A blower door test has been realized to assure the effectiveness of the envelope.

Real final energy consumption

Final Energy : 60,76 $kWhfe/m^2.year$

Renewables & systems

Systems

Heating system :

- Condensing gas boiler
- Heat pump
- Low temperature floor heating
- VAV System

Hot water system :

- Heat pump

Cooling system :

- Reversible heat pump
- VAV Syst. (Variable Air Volume system)
- Floor cooling

Ventilation system :

- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic
- Heat pump

Renewable energy production : 57,00 %

Other information on HVAC :

The air networks branch off to all the spaces with the presence of people (normal and special classrooms, library, teachers' room and presidency, canteen, etc.), so that students and staff always have constantly renewed air and high quality.

The only UTA (delivery and recovery: 15,000 m3/h) has EC plug fan fans (head: 300 Pa delivery; 200 Pa recovery), F8 filters (renewal air) and M5 (expulsion), plus a promiscuous battery for heating and cooling. The ridges run through the suspended ceilings of the corridors and branch off towards the individual rooms (maximum airspeed: 6,5 m/s for the main ducts; 4,5 m/s for the distributions). Instead of using galvanized sheet metal for the distribution channels, those installed are made with sandwich panels composed of :
- rigid foam of polyurethane foam as a structural element,
- coating on both sides with zeolite-treated aluminum foil to be antimicrobial.

The nanostructured coating returns a surface in contact with the extremely smooth air that, also thanks to the absence of sharp edges, giving the channels self-cleaning property, thus reducing the need for cleaning of the channels.

Also to the benefit of air quality, the surfaces of flexible ducts are treated with the technology effective against 600 strains of micro-organisms and certified for the reduction of the proliferation of pathogens. The plenums are equipped with linear vents (2 of discharge and 1 of recovery, for each classroom or large room, in order to contain noise emissions), installed on the wall or in special lowered ceilings inside some rooms.

The exhaust air extraction system from the toilets has also been extended to the service rooms (warehouses, cleaning).

The mechanical ventilation and heat recovery system optimize energy performance, with an improvement of 42% of the performance of the building compared to the reference project. The design of the ventilation system has been carried out with a BIM system, in order to solve in advance any interference.

A thermal generator with a backup function of the heat pump with a 150 kwt boiler (T sent 40°C) with modulating burner has been installed. It provides complete backup for the winter period, allowing not only to support the operation of the heat pump in periods of low outside temperatures, but also to face the entire thermal demand of the building.

The increase in power is also accompanied by an increase in efficiency, from 104.6 (50 to 30 °C) to 109.4 (40 to 30°C) and numerous other advantages, including:
- low start-up emissions due to modulating burner and high-water content of circuits,
- minimum climate-altering and polluting emissions from the surface burner;
- increase in thermal recovery from condensation (up to 6%);
- rapid adjustment of operating times;
- simplification of the methane distribution system, with a consequent reduction in safety risks;
- high thermal comfort thanks to the detection of external temperature and solar radiation (by weather forecast);
- control of management costs;
- low maintenance costs due to low emission combustion and self-cleaning Al/Fe heat exchanger.

The installation of the most powerful boiler did not involve changes to the layout of the technology plant, nor to the layout of the fluid distribution networks that, before reaching the terminals in the environment, are stored in an inertial accumulation (1,000 l). This has also reduced the consumption of electricity by the circulation groups, due to the high-water content of the circuits. The production of the ACS is entrusted to a boiler-type heat pump with double coil, integrated in its storage tank (295 l). There are also devices for water softening and dosage of polyphosphate salts and legionella disinfectants.

The air conditioning system consists of:
- heat-cooled main heat pump generator, installed on the roof, with an additional methane boiler located in the technology plant;
- thermostatic storage upstream of the fluid distribution networks, which supply the radiant floors and the primary air plant with heat recovery.

The renewable energy system installed has a decisive impact on the performance and overall quality of the services provided. It is installed an air/water high-efficiency reversible heat pump, with powers equal to 135 kwt (water to the condenser at 30 to 35°C and external air at 7°C b.s., that is 6°C b.u.) and 113.5 kWf (with water to the evaporator at 12 to 7°C and external air at 35°C), of the silenced type.

The heat pump can produce water up to 55°C with outdoor air temperatures even of -6°C, and up to 40°C with an outdoor temperature of -15°C (the winter design temperature for Pesaro is -2°C), so it can also work for pre-heating of the ACS upstream of the relevant kettle. In summer, the water can be produced at 7°C with outside temperature up to 46°C.

This system leads to a significant increase in the energy efficiency of the generator (COP 4.15; ESEER 4.03), even when operating at partial loads. Despite the extension to the entire building of the mechanical ventilation system, the improvement also achieves a significant step forward on the front of primary energy.

In addition to the air used for heat exchange, the electrical absorption necessary for the operation of the generator refrigerator comes from energy "green", through self-consumption of the production of the photovoltaic field placed on the cover of the school and withdrawal from the grid of electricity from certified renewable sources.

From an environmental point of view, the main advantages of the improvement is the drastic reduction of the consumption of fossil energy sources and CO2 emissions into the atmosphere. You have in detail (compared to the requirements of the race):
- 0 p.p.m. Nox (-100%);
- 0 p.p.m. CO2 (-100%);
- expected annual emissions of 2,420 kgco2 (-86%);
- expected annual economic savings of EUR 1,052 (-84%).

From the economic point of view, it also records a significant reduction in operating costs, further increased by the installation of an additional heat pump, the same type and size of that proposed as an improvement, to ensure continuity of service and increase in the useful life of the generator. The building is equipped with a photovoltaic generation system located on the roof and with a specific power of 28.8 kwp thanks to the installation of 96 monocrystalline silicon panels with a power of 300 Wp each. The PV system is installed on the central part of the roof of the school building, with an inclination equal to 8, with anchorage to the structure according to the indications in the structural tables and with monocrystalline silicon panels 300wp.

Renewable energy: Optimal production of electric energy due to the PV panels
•Photovoltaic installation of 158,40 m2;
•n. 96 photovoltaic modules of 300Wph and 1,96 m2 each
•Photovoltaic power ratings 28,8 Kw continuous current

•Inverter Solaredge 27,6KW alternate current
•113,5 kW heat pump
•heating system: floor heating and VAV system (variable air volume)
•cooling system: floor cooling and VAV system (variable air volume).
The electricity produced by the PV panels also feeds the boiler for hot water production.

Solutions enhancing nature free gains :
The shape and position of the building was studied and orientated to best exploit solar radiation and optimize the free solar gains and natural lighting and shading: the main axle is oriented in the north-south direction.

Smart Building

BMS :
The building has been provided with the installation of BEMS system for the control of the operation and the regulation of thermomechanical systems according to needs, which includes:
- continuous monitoring of weather conditions;
- detection and regulation of thermo
-hygrometric comfort parameters;
- hygienic replacement of air according to indoor CO2 levels;
- operation of thermo-refrigerators, UTA, networks and terminals. In particular, the motorized actuators of the KNX type valves allow a finer regulation of the operation of the radiant floor circuits (0 to 100% in continuous), depending on the temperature of the individual room, with the possibility of minimum attenuation (2 to 3°C), in case of short periods of occupant absence, and "energy savings" (4 to 5°C), in case of closure of the building.

BEMS is an integral part of a wider building automation system, which also deals with:
- management and control of electrical and special installations (artificial lighting controlled by brightness and presence sensors, supervision of photovoltaic installations, etc.);
- solar radiation and the operation of obscuring systems;
- accounting for electricity consumption from the grid and energy production by the photovoltaic system;
- accounting for thermal and water consumption;
- maintenance of installations.

The system used an ethernet network with Bacnet over IP protocol. The implementation resulted in a class A system (according to EN 15232), aligned to the requirements of the CAM and functional also to the LEED certification of the building. Smart grids will be developed to join the plant system of the new school gym that is going to be built at the end of 2021 and the new primary school that is planned to be destroyed and reconstructed with also the reconstruction of the multi-purpose new buildings that are around the school. Thanks to the PV system of these 4 buildings, the municipality aims to develop a smart grid to provide renewable energy in the neighborhood with the intent to develop a smart green pilot district to scale up all over the whole city.

Smartgrid :
The monitoring of local energy production and consumption drop scenario is in progress and it has been developed by the Department of Industrial Engineering DIN (University of Bologna).

Users' opinion on the Smart Building functions :

Students and teachers are very happy and enthusiast about the Smart Building functions: they realize how it is easy and friendly to obtain the best environment conditions in each classroom and lab.

Environment

Urban environment

The site of the Middle School "*Antonio Brancati*" is located in Pantano a vibrant neighbourhood near to the city center, in the immediate vicinity of 2 other schools. The nearby sports ground are equipped with a large parking space that can be used in the daytime by students, parents, and teachers, to reach the school.

The school is equipped with a library for both school and communal use, and is open to the neighbourhood community all day long with independent access from the outside.

The aim of the whole project is to create a new "school campus" equipped with the new middle school already finished, the school-gym at the design phase both located in the green area replacing the old military barracks, a new primary school that will replace the old one on the other side of the street in front of the new school and a new building for multi purposes activities for the neighbourhood community on the other side of the street at the back of the new school.

The main entrance is located on the courtyard to make access safer and the school is also equipped with service side access from the internal parking space and with another courtyard access that will link to the new gym by a porch.

The courtyard is equipped with sports facilities for playing volley outside.

As the school is built in an existent neighbourhood, there are shops located not far away, bars, and a supermarket.

The municipality provides the public transport service for students who need it.

Land plot area : 3 649,00 m^2

Built-up area : 23,50 %

Green space : 10 321,00

Products

Product

Heat pump NRL 0280/0750

AIRMEC

https://global.aermec.com/it/

Product category :

Air/water reversible heat pump

This product helps to achieve the LEED scoring on the minimum and enhanced energy performance

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ECP AHU - RHOSS AHU 6.02

RHOSS S.p.A. ITALY

https://www.rhoss.com/it/

Product category :

Air Handling Unit ADV

This product helps to achieve the LEED scoring on the minimum and enhanced energy performance and on air quality Minimum and IAQ Performance

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P3 DUCTAL CARE PLUS

P3 Italy

https://www.p3italy.it/

Product category :

air channels

Keratwin K20 - ventilated wall system AGROB-20

AGROB BUCHTAL

https://agrob-buchtal.de/en/architect-planner

Product category : Second œuvre / Peinture, revêtements muraux

extruded ceramic titles for wall coverings in outdoor areas used for the ventilated wall facade

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CELENIT AB

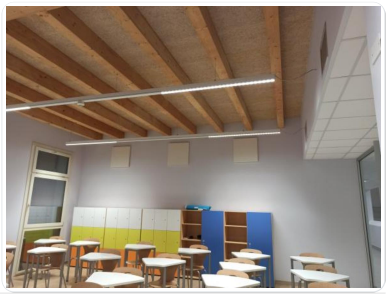
CELENIT S.p.A.

https://www.celenit.com

Product category : Second œuvre / Cloisons, isolation

Thermal and acoustic insulation in buildings - Suspended ceilings used in buildings

MR credit Product Disclosure and Optimization – Environmental Product Declarations



DOP VAEPLAN F / V FR / V

Derbigum

https://www.derbigum.it

Product category : Second œuvre / Cloisons, isolation

roof waterproof

SS credit Heat Island ReductionMR credit Product Disclosure and Optimization – Environmental Product Declarations

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smartroof_thermal

Knauf

https://www.knaufinsulation.it

Product category : Second œuvre / Cloisons, isolation

Rock mineral wool SmartRoof Base and SmartRoofThermal are used as a thermal, acoustical and fireinsulation product.

MR credit Product Disclosure and Optimization – Environmental Product DeclarationsMR credit Product Disclosure and Optimization – Sourcing of Raw Materials

FSD 20 / PLUS-E/PRO 80 / PRO 170 TIPO/ ROOF SOIL/SEDUM/STABILFILTER SFE

DAKU

https://www.daku.it

Product category : Second œuvre / Cloisons, isolation

green roof

SS credit Heat Island Reduction

COVER 80

MAYER & CO BESCHLAGE

https://www.maco.eu/it-IT/Maico

Product category : Second œuvre / Menuiseries extérieures

wooden windows

MR credit Product Disclosure and Optimization – Environmental Product DeclarationsMR credit Product Disclosure and Optimization – Sourcing of Raw Materials

Isover X60 VN + Isover Clima 34

Saint Gobein

https://www.saint-gobain.it

Product category : Second œuvre / Cloisons, isolation

wall insulation

MR credit Product Disclosure and Optimization – Environmental Product DeclarationsMR credit Product Disclosure and Optimization – Sourcing of Raw Materials

Costs

Construction and exploitation costs

Global cost : 3 707 579,00 €

Reference global cost : 4 647 540,00 €

Renewable energy systems cost : 36 965,00 €

Global cost/Pupil : 9886.88

Reference global cost/Pupil : 4647540

Cost of studies : 137 000 €

Total cost of the building : 2 886 890 €

Subsidies : 816 000 €

Additional information on costs :
2,886,890€ construction and materials cost
288,689€ VAT on construction cost
137,000€ professional services and studies
45,000€ M&O per year cost
350,000€ demolition and transportation cost

Energy bill

Forecasted energy bill/year : 12 575,00 €

Real energy cost/m2 : 5.17

Real energy cost/Pupil : 33.53

Life Cycle Analysis

The LCA was developed to analyse the whole building impact assessment according to the LEED v4 certification for achieving the needed credits. The LCA takes into account 6 benchmark as following: 1.Global warming potential (greenhouse gases) 2.Depletion
Material impact on GHG emissions :
508.3

Water management

Consumption from water network : 1 897,00 m^3
Consumption of harvested rainwater : 24,00 m^3
Water Self Sufficiency Index : 0.01
Water Consumption/m2 : 0.78
Water Consumption/Pupil : 5.06
LEED v4 BD+C: School – WEp Indoor Water Use Reduction

Indoor Air quality

The school is equipped with a mechanical filtered ventilation climate system HVAC with a CO2 monitor able to guarantee higher levels of indoor air quality with the air exchange of 5 volumes per hour.

The air networks branch off to all the spaces with the presence of people (normal and special classrooms, library, teachers' room and presidency, canteen, etc.), so that students and staff always have constantly renewed air and high quality.

The only UTA (delivery and recovery: 15,000 m3/h) has EC plugfan fans (head: 300 Pa delivery; 200 Pa recovery), F8 filters (renewal air) and M5 (expulsion), plus promiscuous battery for heating and cooling. The ridges run through the suspended ceilings of the corridors and branch off towards the individual rooms (maximum air speed: 6,5 m/s for the main ducts; 4,5 m/s for the distributions).

Instead of using galvanized sheet metal for the distribution channels, those installed are made with sandwich panels composed of:

- rigid foam of polyurethane foam as a structural element,

- coating on both sides with zeolite-treated aluminium foil to be antimicrobial.

The nanostructured coating of the coating returns a surface in contact with the extremely smooth air that, also thanks to the absence of sharp edges, gives the channels the self-cleaning property thus reducing the need for cleaning of the channels.

Also to the benefit of air quality, the surfaces of flexible ducts are treated with the technology effective against 600 strains of micro-organisms and certified for the reduction of the proliferation of pathogens. The plenums are equipped with linear vents (2 of discharge and 1 of recovery, for each classroom or large room, in order to contain noise emissions), installed on the wall or in special lowered ceilings inside some rooms.

The exhaust air extraction system from the toilets has also been extended to the service rooms (warehouses, cleaning).

The amount of volatile organic compounds (VOCs), such as formaldehyde, contained in construction materials are avoided by the requirements of the LEED certification and the Minimum Environmental Criteria mandatory in Italy. Most of the materials used are EPD certify.

Comfort

Health & comfort :

As LEED project, this one had to comply with a ventilation standard used to achieve high indoor air quality.

The school is equipped with a mechanical filtered ventilation climate system, with a CO2 monitor able to guarantee higher levels of indoor air quality. Please note that in Italy natural ventilation system in buildings is sufficient by law. Natural ventilation significantly depends on the temperature difference between the indoor and the ambient air and the current wind situation. As a result, a sufficient natural ventilation cannot be guaranteed at all times. The ratio of the HAVC system installed is 5 volumes per hour of air exchange to guarantee a high indoor quality, since poor indoor air quality leads to, among others, headache, fatigue, and reduced learning performance. This mechanical ventilation system installed in the school ensure a continuous air exchange throughout the year creating the best health conditions within the school to also reduce the risk of contagion.

Comfort for all is guaranteed by a remote and customized temperature in all classrooms thanks to the sensors for thermal comfort and indoor air quality ensured by mechanical filtered ventilation climate system with a CO2 monitoring, able to guarantee higher levels of indoor air quality with the air exchange of 5 volumes per hour. In every classroom, a both natural and artificial light control system has been installed, and a high acoustic performance is obtained to create the best environment for learning and teaching.

Natural ventilation is also ensured thanks to opening in the upper window sections. If the climate is appropriate, natural ventilation can be established by the opening of windows, which would also reduce the building operating costs.

The amount of volatile organic compounds (VOCs), such as formaldehyde, contained in construction materials are avoided by the requirements of the LEED certification and the Minimum Environmental Criteria mandatory in Italy. Most of the materials used are EPD certify.

Last but not least the shape of the building and the connection with the garden through the numerous windows, the colour used for the door and ceiling, the functionality of the classrooms and the labs, and the wide halls where students and teachers can meet and have a chat, make this school also friendly and smart.

Calculated indoor CO2 concentration :
The calculated indoor concentration is evaluated in according to UNI 13779:2005 “Ventilation for residential buildings – Performance requirements for ventilation and room conditioning systems”. The air volume flow per person is 21 m3/h person.

Measured indoor CO2 concentration :
the CO2 monitoring system inside each classroom did not show that the concentration of 1500 ppm was exceeded

Calculated thermal comfort : The Italian law “CAM” Criteri Ambientali Minimi (Minimum Environmental Criteria) required to evaluate the thermal comfort in according to EN ISO 7730, the PMV value is between -0.5 and +0.5 (PPD ≤10%)
Measured thermal comfort : a campaign of measures is being organized for the evaluation of thermal comfort

Acoustic comfort :

The acoustic comfort has been obtained in compliance with the indications of the Italian standards UNI 11367: 2010, UNI 11534-1: 2018 and UNI 11534-2: 2020.

From the in-situ measurements:

- weighted standardized sound level difference of façade D2m,nT,w is ≥48 dB

- weighted standardized sound level difference DnT,w between adjacent rooms is ≥50 dB

- weighted standardized sound level difference DnT,w between overlapping rooms is ≥55 dB

- weighted normalized impact sound pressure level in field L'nw is ≤ 53 dB

- equivalent A-weighted sound pressure level in room NORMALIZED WITH RESPECT TO REVERBERATION TIME is ≤ 28 dB (A)

- Speech transmission index in classroom is ≥0.55

- The clarity C50 (500-1000-2000 Hz) is ≥ 2 dB

- reverberation time is compliant with formulas and graphs from DIN 18041, the optimal reverberation time (depending on the volume) is referred to the furnished and occupied state at 80% of capacity.

Daylight factor : According to the Italian standard UNI 10840, the daylight factor is> = 3% in each classroom. Furthermore, according to the EN 12464 standard, an illuminance value of not less than 500 lux is guaranteed in each classroom through a sensor that integrates da

Carbon

GHG emissions

GHG in use : 9,66 $KgCO_2/m^2$/year

Methodology used :
ISO 14040 & ISO 14044 (CML 2002; Nov. 2012)

GHG before use : 520,40 $KgCO_2$ /m^2

Building lifetime : 60,00 year(s)

, ie xx in use years : 53.87

GHG Cradle to Grave : 579,70 $KgCO_2$ /m^2

The life cycle assessment was calculated using One Click LCA. The results are summarized in following table. The following LCA or EPD standards are all fully compliant with the requirements of ISO 14044, ISO 14025, ISO 21930, EN15804. The 'Gross Internal

Contest

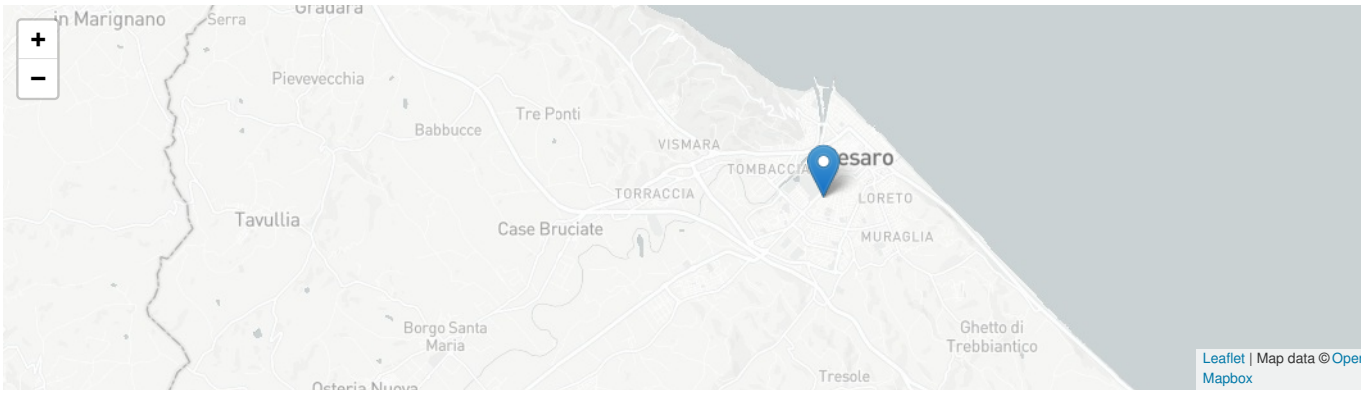
Building candidate in the category

Energy & Temperate Climates

Low Carbon

GREEN SOLUTIONS AWARDS
POWERED BY Construction21.org

Health & Comfort



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