



Advanced
Building
System

A background image showing two hands, one from the left and one from the right, cupping a small globe of the Earth. The hands are rendered in a realistic, painterly style with warm skin tones. The background is a dark, textured blue-grey. A semi-transparent dark blue rectangle is overlaid on the right side of the image, containing the text.

SUSTAINABILITY

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ENVIRONMENTAL SUSTAINABILITY

What is environmental sustainability?

The concept of sustainability is intrinsically linked to environmental protection, but over time it has undergone a profound evolution. It started from a vision focused almost exclusively on ecological aspects, which then evolved into a broader meaning that considers not only the environmental dimension, but also the economic and social impacts.



The term "Sustainability" was introduced during the first United Nations Conference on the Environment back in 1972, to be subsequently codified in 1987, with the publication of the so-called Brundtland Report. The document defines "sustainable" as *a development model capable of satisfying the needs of the present without compromising the ability of future generations to satisfy theirs*. It is a definition that arises from the consideration that the planet's resources are not infinite, as they must be carefully preserved, without waste, respecting ecosystems and biodiversity.

Environmental Sustainability is therefore one of the key aspects of the broader concept of sustainable development and corresponds to a rate of exploitation of resources and emission of pollutants that can be continued indefinitely, maintaining high environmental quality in the long term. Another aspect that can't be neglected (in addition to the social one) is also the **Economic Sustainability** that is implemented through products and services that must be economically advantageous for companies, individuals and society. Therefore, an investment must be designed and studied so that it certainly has environmental sustainability, but at the same time it must also guarantee a positive return on the economic indicators.

Given the above definitions, **the Emmedue Building System stands out by right as a sustainable investment** as it is our mission to ensure and preserve the three key macro-themes of Sustainability: Environmental, Economic and Social.

ENVIRONMENTAL SUSTAINABILITY APPLIED TO BUILDING

Environmental Sustainability relates to numerous sectors, including architecture and construction, in an attempt to propose new solutions with the aim of ensuring urban development with a low environmental impact.

Today, architecture is in fact moving towards a more respectful environmental style by creating sustainable houses and buildings which are thoughtfully designed by taking into account a number of parameters:

- Air quality
- The use of materials that are not harmful to health
- Integrating natural light for lighting
- The design of acoustic comfort through soundproofing barriers
- Using materials that reduce the emission of climate-altering gases

Sustainable architecture conceives functional buildings according to people's needs. The conscious practice of sustainability in design principles promotes a positive environmental impact, increases energy efficiency and the well-being and health of the inhabitants that are reachable through the integration of innovative structures and technologies into the building. However, the use of innovation and technology must safeguard the natural environment without distorting or damaging it: sustainable architecture therefore wants a harmonious insertion into the ambience.



When we talk about eco-compatibility, we can't only refer to the environmental impact of buildings, often referring only to the energy saving of a particular building, but we must also extend the concept to the **Life Cycle of the materials** that are used in each construction project. The environmental friendliness of a building material is not at all obvious: the construction sector alone produces 4500 billion tons of cement every year and is responsible for about 8% of CO2 emissions into the atmosphere.

The **Emmedue Building System** is an innovative construction system that, especially compared to traditional systems, **guarantees the achievement of those levels of environmental sustainability** that are nowadays increasingly required in the context of building regulations.

HOW TO ASSESS THE ENVIRONMENTAL IMPACT IN BUILDINGS?

THE LIFE CYCLE ASSESSMENT (LCA) AND CARBON FOOTPRINT

The **Life Cycle Assessment (LCA)** is an **analytical methodology that evaluates the environmental footprint of a product or service**, along its entire life cycle, analysing its various environmental impacts. The calculation ranges from the phases of extraction of the raw materials making up the product, to its production and distribution, up to its final use and disposal, returning the **environmental impact values associated with its life cycle**.

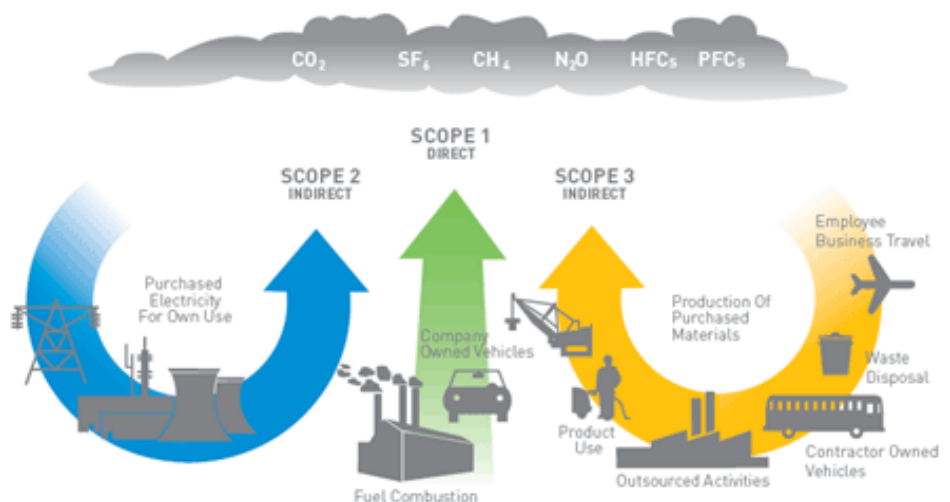


This is a method developed in the 1960s, driven by initial concerns about the exhaustion of natural and energy resources and the definition of which is contained in the ISO 14040 document that regulates the methodology.

Usually, the environmental impacts detected and measured in an LCA analysis refer to the emission of greenhouse gases, considered to be the main culprits of the planet's pollution (global warming, ozone hole, etc. ...). The growing concern around this issue has led to the creation of a particular variant of LCA, called **Carbon Footprint**.

This variant is nothing more than a traditional LCA study aimed solely at determining the impact on the environment due to greenhouse gas emissions. It is expressed in terms of CO₂ equivalent [Kg / CO₂e] and its quantification considers indicators such as the GWP (Global Warming Potential), which expresses the incidence of a given gas on the greenhouse effect.

The most widespread definition of Carbon Footprint, recognized by the Joint Research Center (JRC - the European Commission's science and knowledge service that provides scientific support for the development and control of European Union policies) identifies it as "the total amount of carbon dioxide and other greenhouse gases



associated with a product, good or service, throughout its life cycle.”

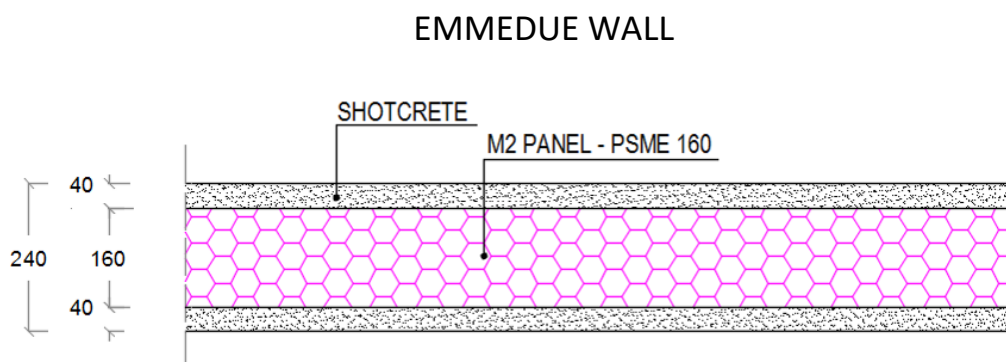
An LCA study is also able to provide the necessary energy consumption associated with a specific product and/or service. In this case, the energy data are expressed through the GER (Gross Energy Requirement) which represents the total energy spent. This indicator also considers the feedstock energy that is the amount of energy contained in the materials that can be recovered from the outgoing products (for example by burning the products, as it happens with plastic or paper). From an environmental point of view, low energy consumption is also an excellent indicator for assessing the environmental impact of a product: less energy means less use of any energy source.

The values provided by the University of Bath (UK) in the Inventory of Carbon & Energy (ICE 2011) can be used to estimate the GER and GWP. This database reports the values referring to the British manufacturer and does not include transport, as it is a variable that is a function of distance.

Through the LCA assessments, it is evident that the Emmedue Building System has a lower environmental impact than any traditional building method. Below is a comparison between a wall made with the Emmedue Building System and a traditional method. The comparison is limited to the estimation of the GER and the GWP (Carbon Footprint). It is therefore an LCA assessment that uses the 2011 ICE database and therefore it assesses, above all, the environmental impact due to the sum of the individual products making up the two walls.

The evaluation taken into reference are two walls characterized by the same thermal transmittance, using in the case of the traditional building method a reinforced concrete frame cladded with bricks.

For each solution, the mass of the different materials per unit of surface (wall) must be calculated. The collection of this data then makes it possible to trace the GER and GWP values through the ICE 2011 database which provides the respective values per unit of mass.



The wall is realized with an Emmedue Single Panel (PSME) with a thickness of 16 cm, EPS density of 25 Kg/m^3 and then finished on site with 4 cm of shotcrete (a structural mortar) on both sides. The total thickness is just 24 cm with a transmittance equal to $0.317 \text{ W / m}^2\text{K}$ (which considers the influence of the transverse connectors). This wall does not require the presence of a traditional reinforced concrete frame, as it is a load-bearing wall capable of supporting the loads acting on a

building. The Emmedue panel has two electro-welded galvanized meshes connected by cross connectors that are also galvanized. In completing the wall it is necessary to consider some additional materials, such as additional networks and reinforcement bars.

The GER and GWP values relating to the Emmedue wall are shown in the table.

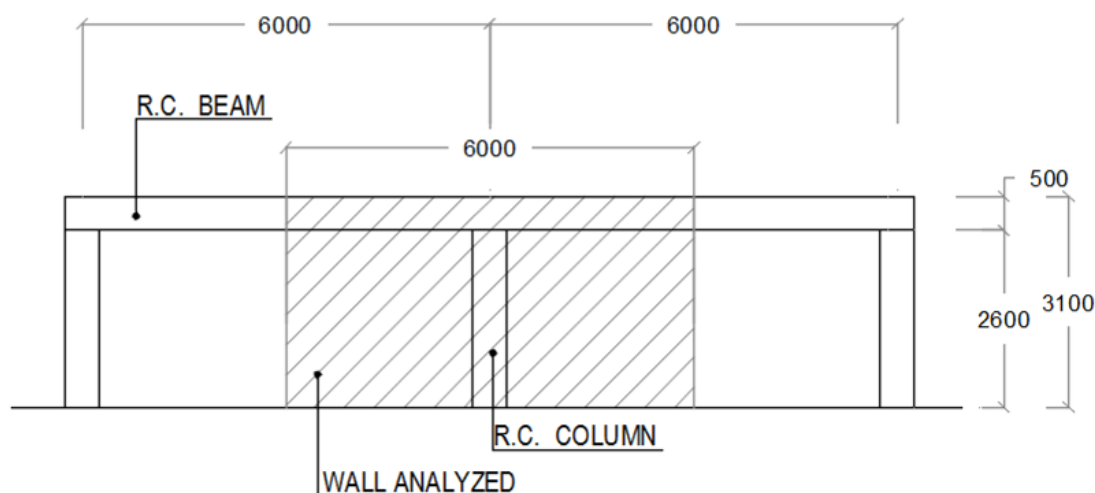
LAYER	WEIGHT [Kg/m ²]	GER			GWP		
		[MJ/Kg]	[MJ/m ²]	[%]	[Kg CO ₂ e/Kg]	[Kg CO ₂ e/m ²]	[%]
EXTERNAL SHOTCRETE	88,00	0,78	68,64	10,3	0,18	15,93	26,6
EPS LAYER	4,00	88,60	354,40	53,1	3,29	13,16	22,0
STEEL MESH	2,35	36,00	84,64	12,7	3,02	7,10	11,9
CONNECTORS	0,77	36,00	27,58	4,1	3,02	2,31	3,9
ADDITIONAL STEEL MESH	1,17	36,00	41,96	6,3	3,02	3,52	5,9
REINFORCEMENT REBARS	1,00	21,60	21,60	3,2	1,86	1,86	3,1
INTERNAL SHOTCRETE	88,00	0,78	68,64	10,3	0,18	15,93	26,6
TOTAL	185,28		667,46			59,81	

Once the weights of the single materials making up the wall are calculated, it is sufficient to report the unitary values of the GER and GWP. It is noted that the major impact on the production of gases harmful to the greenhouse effect is due to the shotcrete layers (for over 50%), as they represent almost the entire mass of the wall.

TRADITIONAL WALL

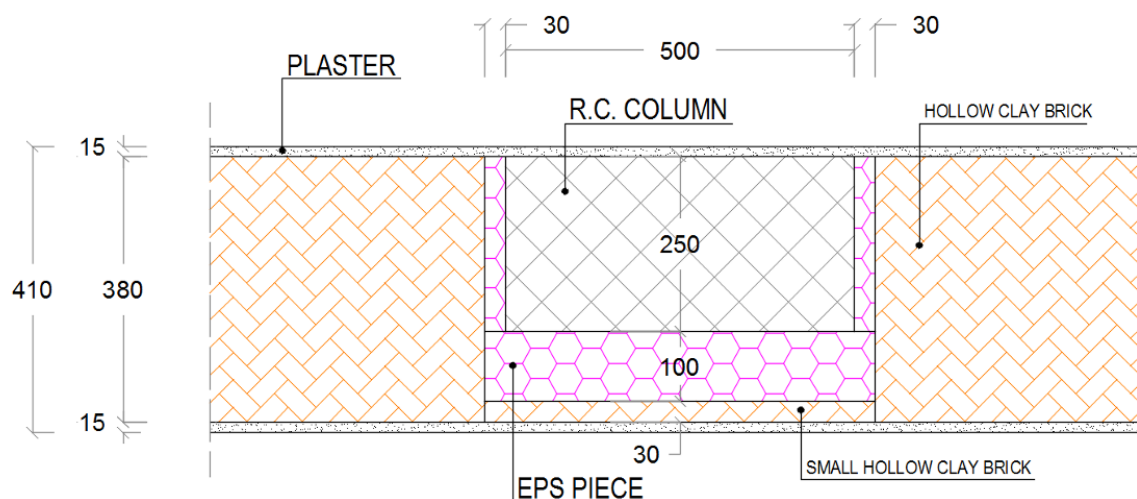
In this case, the analyzed wall is placed inside a reinforced concrete frame that performs the load-bearing function. By hypothesis, we consider a frame characterized by pillars placed at a distance of 6 meters with a net height of 2.6 meters. Pillars and beams have a size of 25 cm x 50 cm.

Here below we see the analyzed wall that measures a surface of 6 m x 3.1 m. In this case, given the presence of linear elements in correspondence with the frame, the total weights must be calculated and then compared to a unitary size so that we can make a comparison with the Emmedue system.



The wall is made with brick blocks with a thickness of 38 cm, with mortar along the horizontal layer of mortar with a thickness of 1 cm and is completed by two layers of traditional plaster of 15 mm. The total thickness is therefore 41 cm with a transmittance approximately equal to that of the Emmedue wall.

In order to reduce the thermal bridge of the frame, suitable pieces of EPS are applied as insulation in correspondence with the frame itself (see the image below). In front of the pillar and beam are also some suitable hollow clay brick.



The GER and GWP values relating to the traditional wall are shown in the table below, starting from the weight values referred to 1 square meter of the various materials.

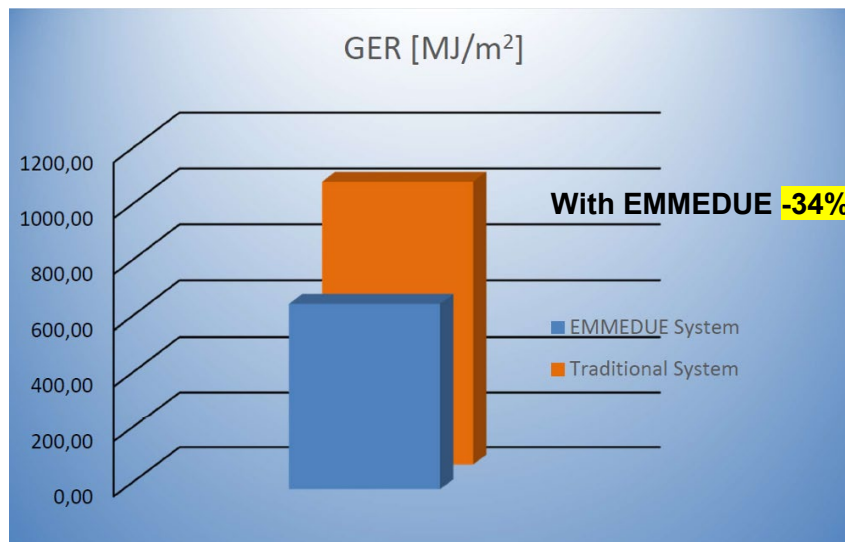
LAYER	WEIGHT [Kg/m ²]	GER			GWP		
		[MJ/Kg]	[MJ/m ²]	[%]	[Kg CO ₂ e/Kg]	[Kg CO ₂ e/m ²]	[%]
EXTERNAL PLASTER	30,00	1,80	54,00	8,1	0,12	3,60	6,0
HOLLOW CLAY BRICKS	181,85	3,00	545,56	81,7	0,24	43,64	73,0
MORTAR	21,25	0,97	20,61	3,1	0,16	3,31	5,5
EPS PIECES	0,73	88,60	64,96	9,7	3,29	2,41	4,0
CONCRETE - COLUMN	41,94	0,82	34,39	5,2	0,12	5,03	8,4
REBARS - COLUMN	2,01	21,60	43,40	6,5	1,86	3,74	6,2
CONCRETE - BEAMS	96,77	0,82	79,35	11,9	0,12	11,61	19,4
REBARS - BEAMS	4,64	21,60	100,16	15,0	1,86	8,63	14,4
SMALL HOLLOW CLAY BRICKS	6,21	3,00	18,63	2,8	0,24	1,49	2,5
EXTERNAL PLASTER	30,00	1,80	54,00	8,1	0,12	3,60	6,0
TOTAL	415,40		1015,06			87,07	

It is noted how the traditional wall has GER and GWP values higher than those of the Emmedue wall, both in terms of energy consumption and in terms of production of pollutants that have a decisive impact on the environment.

The analysis demonstrates that the **Emmedue Building System** is able to achieve a much higher performance in terms of environmental load compared to the traditional systems.

The analysis was carried out per unit area and the overall value of a building is obtained simply by multiplying its external surface (net of the windowed area) by the values shown above.

To properly make a comparison, we need to consider the percentage value that better defines the degree of relevance of one system compared to another, as shown in the graph on the next page.



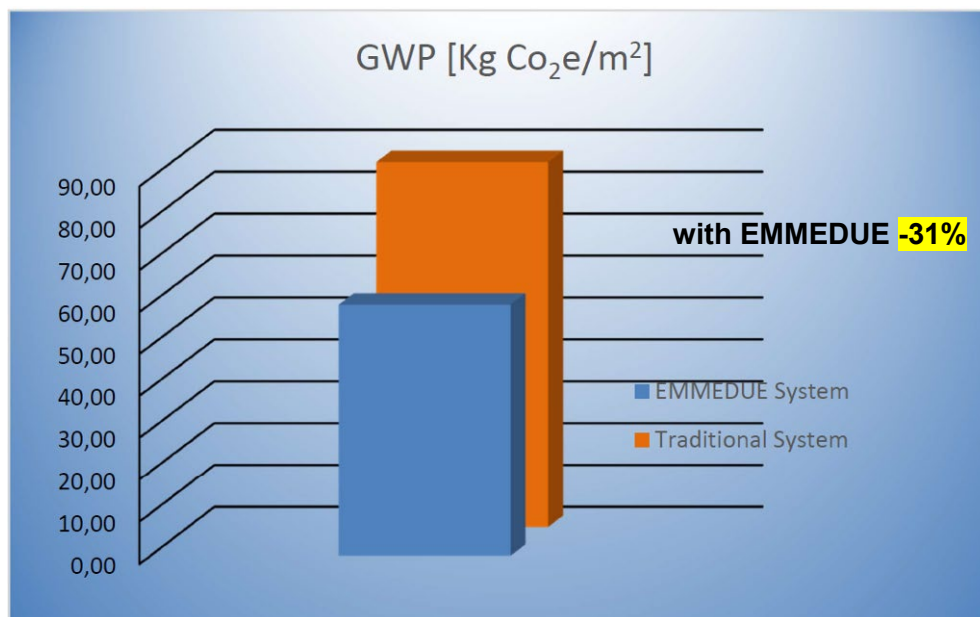
The EMMEDUE Building System allows savings in terms of primary energy of approximately 34% compared to the traditional system. This is due to the main material of the construction system that is EPS, which is actually made up of 98% air and only 2% polystyrene, the cells that contain air.

Therefore, if all constructions were built using the EMMEDUE System, we could reduce the energy required in the construction sector (limited to opaque walls and the production of materials) **by such a high percentage that it would also have a considerable political impact.** This way the national energy needs would be consistently reduced which is not a negligible aspect especially in those countries that need to import energy.

THE CARBON FOOTPRINT OF THE EMMEDUE SYSTEM

Considering the same analysis, we can evaluate the GWP values to compare the carbon footprint produced by the traditional system and by the EMMEDUE System. The graph below allows evaluating the significant reduction in harmful gas emissions that the use of the EMMEDUE System allows.

Indeed, we can affirm that limited to the materials production, the **EMMEDUE System has a Carbon Footprint with an impact equal to almost one third of the traditional system**: from an environmental point of view it is certainly a remarkable result.



ENVIRONMENTAL SUSTAINABILITY: REDUCTION OF THE ENERGY NEED IN BUILDINGS DURING THEIR LIFE CYCLE

During their life cycle, traditional buildings consume a higher amount of energy for their operation (thermal and electrical needs) than the one that is necessary for their construction. Improving energy efficiency in heating and/or cooling buildings is a priority action because it means having an impact on a sector that absorbs a huge amount of energy. These large consumptions can be reduced through careful design of the buildings and by using construction materials characterized by a high thermal resistance.



Thanks to their low thermal conductivity, insulating materials reduce or cancel the heat transfer towards the outside during the winter season and towards the inside during the summer season. Using an appropriate thickness of the insulating material, an external wall can reach high thermal resistance values, thus guaranteeing one of the fundamental parameters to achieve in the energy efficiency of a building.

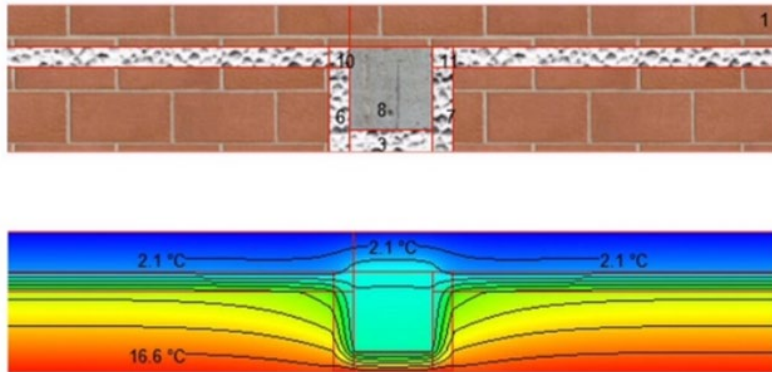
The Emmedue Building System guarantees high standards of energy efficiency, as Emmedue products are characterized by the continuous presence of an EPS sheet, which is an excellent insulating material thanks to the low thermal conductivity which can vary between 0.034 - 0.039 W/m²K.

As an example, wood has a thermal conductivity of about 0.13 W/m²K. Therefore, an Emmedue wall has a thermal resistance, compared to walls of the same thickness 4 times that of a wooden wall, which means that it has better thermal performance during the life cycle of a building.

It is important to remember that in the example shown above, the walls were evaluated with the same thermal resistance.

The Emmedue System allows to create walls with a thermal resistance typical of Passive Houses, as the Emmedue panels can be produced using EPS sheets with variable thickness, even up to 34 cm, thus allowing to achieve the thermal performance required by the project.

Achieving thermal resistances typical of Passive Houses means that the Emmedue Building System reduces the building energy needs during its life cycle, which is another fundamental aspect in LCA analyzes.



Another important aspect is the continuity of the Emmedue wall, which guarantees continuous thermal resistance without reductions in correspondence with the reinforced concrete frames as in the traditional method (see the figure that highlights the influence of thermal bridge, in correspondence with the reinforced concrete columns, which generates non-uniformity of the temperature values along the stratigraphy of the traditional wall).

It is known how thermal bridges (especially in the presence of very high insulation performance) lead to a loss of heat or cooling of about 20/30%, thus almost canceling the excellent contribution offered by the high-performance wall. **This penalization is absolutely absent in houses built integrally with the Emmedue Building System, thanks to the continuity of the insulating material that the Emmedue Building System guarantees throughout the structure.**

ENVIRONMENTAL SUSTAINABILITY: THE TRANSPORTATION OF MATERIALS TO THE CONSTRUCTION SITE

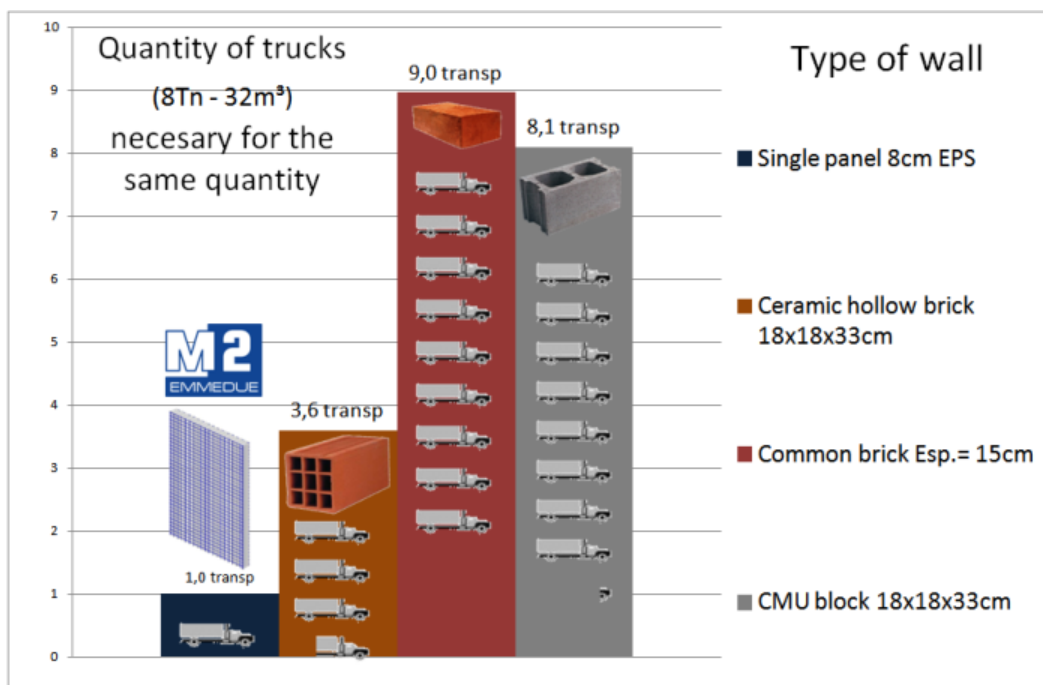
Even during transportation, the Emmedue Building System is a "friend of the environment". In fact, transport is conditioned by two parameters:

- The maximum weight that can be transported (the limit is due to the engine power);
- The maximum volume that can be transported (defined by local regulations and therefore it is not possible, for example, to increase the transported volume at will).

Given these two parameters, traditional methods are more penalized in transportation than the Emmedue System since the high weight of the elements used does not allow the optimization of the transported volume, as the weight parameter will limit the maximum amount of transportable material.

On the other hand, the Emmedue System, made of EPS which is a substantially lighter material (15-25 Kg/m³), maximizes the transportable volume. This enables a higher quantity of panels to be transported, which equates to a higher coverage of square meters of walls to be built per unitary transportation mean.

The graph below shows the number of transportation means necessary to create the same wall surface using the Emmedue panels or other construction elements typical of the traditional method.



Reducing the number of transportation means reduces CO₂ and gases emissions and gases that are harmful to the atmosphere and the environment. This is another aspect to keep in mind in a complete LCA analysis.

ENVIRONMENTAL SUSTAINABILITY: THE ON SITE ADVANTAGE OF THE EMMEDUE SYSTEM

The life cycle of a building must include every aspect from the production of materials, to their transportation, to the construction site where they will then be handled and assembled.



The lighter the material, the easier it is to handle it on site. Furthermore, its lightweight makes it possible to reduce and in some cases even avoid the use of mechanical means which are also energy consumers and therefore also producers of climate-altering substances.



By way of example, a 3-meter Emmedue panel, with a thickness of 80 mm, weighs only about 12 kg, therefore it is quite easy for a single worker to handle it and assemble it without the aid of special mechanical equipment.

EXPANDED POLYSTYRENE IS AN EXCELLENT ECO-FRIENDLY MATERIAL

The Sintered Expanded Polystyrene or EPS, which is one of the main components of the Emmedue Building System, has been tested and certified as an absolutely eco-friendly material by various competent organizations.

Among all, the BRE group is probably one of the most relevant and qualified organizations in the field. BRE is the UK's leading authority for sustainable construction and the "BRE Green Guide" is the most authoritative source of environmental certifications for materials.

It classifies materials according to their nature and application, based on 13 criteria ranging from the impact on climate change to ozone depletion, through eco-toxicity, depletion of fossil fuels, and so on.

The results of the research classify Polystyrene among the materials of type A +, the highest level in the BRE rating, and therefore one of the materials with the lowest environmental impact.

Below is an extract from the BRE website with the comparative classification of the material. The link to the BRE website is:

<http://www.bre.co.uk/greenguide/ggelement.jsp?buildingType=Housing&category=15&parent=0&elementType=10032>

Green Guide 2008 ratings

Building type >	<u>Domestic</u>
Category >	<u>Insulation</u>
Element type >	Insulation

	Element number	Summary rating
Cavity blown glass wool insulation - density 17 kg/m³	815320036	A+
Cavity blown stone wool insulation density 30 kg/m³	815320037	A+
Cellular glass insulation - density 100 kg/m³	915320051	A+
Cellular glass insulation - density 110 kg/m³	915320052	A
Cellular glass insulation - density 115 kg/m³	915320053	A
Cellular glass insulation - density 120 kg/m³	915320054	A
Cellular glass insulation - density 130 kg/m³	915320055	A

Cellular glass insulation - density 155 kg/m³	915320056	B
Cellular glass insulation - density 165 kg/m³	915320057	B
Cellular glass insulation - density 200 kg/m³	915320058	C
Corkboard insulation - density 120kg/m³	815320021	A
Dry blown recycled cellulose insulation - density 24kg/m³	815320035	A+
Expanded polystyrene (EPS) - density 15 kg/m³	815320022	A+
Expanded polystyrene (EPS) - density 20 kg/m³	815320023	A+
Expanded polystyrene (EPS) - density 25 kg/m³	815320024	A+
Expanded polystyrene (EPS) - density 30 kg/m³	815320025	A+
Extruded polystyrene (XPS) (HFC blown) density 35 kg/m³	815320027	E
Glass wool insulation - density 10 kg/m³	815320005	A+
Glass wool insulation - density 12 kg/m³	815320001	A+
Glass wool insulation - density 24 kg/m³	815320002	A+
Glass wool insulation - density 32 kg/m³	815320003	A+
Glass wool insulation - density 48 kg/m³	815320004	A+
Glass wool insulation - density 80 kg/m³	915320059	A
Rigid urethane (pentane blown) - density 32 kg/m³	815320017	A
Sheep's wool insulation - density 25 kg/m³	815320033	A
Stone wool insulation - density 100 kg/m³	815320011	A
Stone wool insulation - density 128 kg/m³	815320012	B
Stone wool insulation - density 140 kg/m³	815320013	B
Stone wool insulation - density 160 kg/m³	815320014	C
Stone wool insulation - density 33 kg/m³	815320007	A+
Stone wool insulation - density 45 kg/m³	815320008	A+
Stone wool insulation - density 60 kg/m³	815320009	A+
Stone wool insulation - density 80 kg/m³	815320010	A
Straw bale used as insulation	815320029	A
Strawboard thermal insulation (420kg/m³)	815320034	C
Wet blown recycled cellulose insulation -density 45 kg/m³	815320039	A+

As can be seen from the above ranking, the opinion expressed on polystyrene is better than the one expressed on many other insulating materials such as rock wool.

The 13 criteria used to classify the EPS as A+ are explained below.

These parameters can be found at the link:

<http://www.bre.co.uk/greenguide/ggelement2.jsp?buildingType=Housing&category=15&parent=0&elementType=10032&eid=15220>

Green Guide 2008 ratings

Building type >	<u>Domestic</u>
Category >	<u>Insulation</u>
Element type >	<u>Insulation</u>
Element	Expanded polystyrene (EPS) - density 15 kg/m ³
Element Number	815320022
Summary Rating	A+
Climate Change	B
Water Extraction	A+
Mineral Resource Extraction	A+
Stratospheric Ozone Depletion	A+
Human Toxicity	A+
Ecotoxicity to Freshwater	A+
Nuclear Waste (higher level)	A+
Ecotoxicity to Land	E
Waste Disposal	A+
Fossil Fuel Depletion	A
Eutrophication	A+
Photochemical Ozone Creation	C
Acidification	A

EPS is a fully recyclable material: it can be ground and then mixed with virgin expanded polystyrene to produce packaging and panels for walls. Furthermore, it can be optimally used as an inert material for the production of lightened screeds. EPS can also be used in recycling also for the molding of elements such as clothes hangers or even as a substitute for wood-based materials (fences, benches, etc.). It also finds its application to improve the qualities of the soil as a substrate and soil remediation.

ECONOMIC SUSTAINABILITY

As previously indicated, a project must be sustainable from an environmental point of view, but it must also be economically sustainable. From a general point of view, economic sustainability can be defined as the ability of an economic system to generate growth in economic indicators, through the creation of income and work for the livelihood of populations and through an effective combination of resources that limits, for example, the wastes.



In construction, economic sustainability refers to the overall containment of costs throughout the life cycle of the building.

From the point of view of economic sustainability alone, the Emmedue Building System has a double advantage:

- a structure built with the Emmedue Building System is less expensive during its life cycle than a structure built with any traditional system;
- the installation of an Emmedue Panel production plant guarantees in a few years the economic return on the investment made;

The Life Cycle Costing (LCC) is the method used to calculate the cost of the entire life cycle of a product or service, starting from the phases preceding the production phase up to its final disposal, in order to minimize production costs. The LCC model is conceptually similar to an LCA analysis with the substantial difference that it is concentrated from an exclusively economic point of view. In fact, the ultimate goal of the LCC is to provide an investor with a tool to help understand where/when to intervene when it comes to reducing the costs related to a product that, in our case, means the costs related to a building project.

The LCC method, according to the ISO 15686-5 standard, adds up all the relevant costs associated with each construction element that we will have to bear during the analysis period.

$$LCC = C_f + C_p + C_m + C_e + C_{fv}$$

where:

C_f = supply costs;

C_p = installation costs;

C_m = maintenance costs;

C_{fv} = end life costs (disposal costs).

With regards to the first two points (supply costs and installation costs), it is estimated that the **Emmedue Building System allows the construction of a building at a lower cost versus one built with any traditional method.**

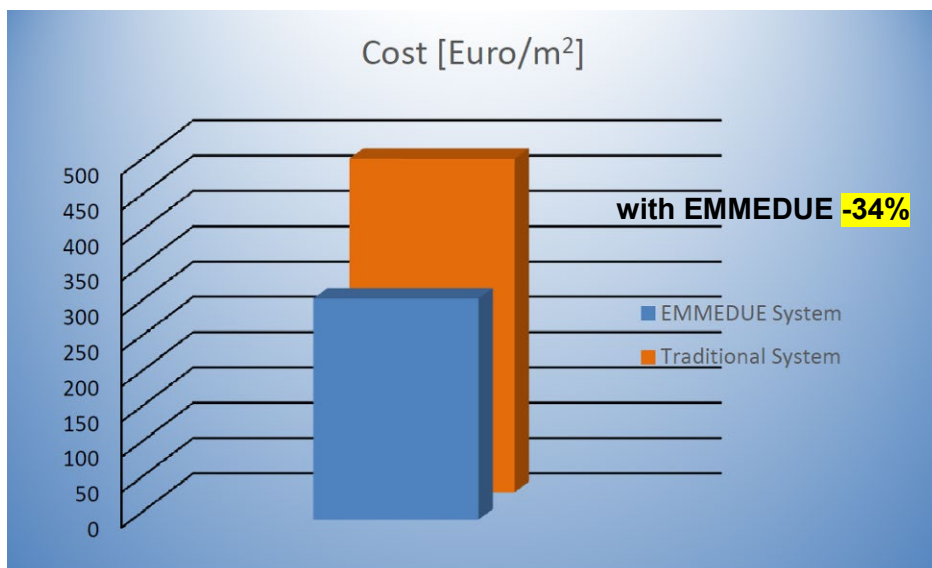
In this regard, the Emmedue Company has carried out a comparative study of a two-story single-family villa of approximately 190 sqm, considering the following hypotheses:

- Same thermal insulation performance of the external walls and roof;
- Evaluation of the raw building (i.e. finishing excluded);
- The foundation is not considered in the estimate (with the Emmedue System, being the building lighter than with traditional methods, savings will be obtained also in the foundations);
- Prices refer to the Marche Regional Price List 2015 (in Euro).

The result is shown in the table below and in the following graph.

BUILDING SYSTEM	TOTAL COST [Euro]	UNIT COST [Euro/m ²]
R.C. Frames System	88955	473
EMMEDUE Building System	58874	313

The economic savings obtained with the Emmedue Building System reaches about 34%.



Since the Emmedue Building System is characterized by a reduction in construction timing, this means that a project will be more economically sustainable, as it allows the return of the initial investment in a rather rapid time, thus favoring subsequent investments.

As for the other aspects, we can consider:

MAINTENANCE COSTS: from a structural performance stand point, structures built with the Emmedue Building System have similar, if not better, characteristics than those built with any traditional method. Therefore, there is no reduction in durability and, therefore, no increase in the maintenance costs of the buildings built with the Emmedue System. Indeed, it should be noted that the main material of the system, the EPS, it's a material capable of maintaining its physical-mechanical performance unchanged over time. If the EPS is used correctly, its applications could have a practically unlimited duration over time, without altering any of its original qualities.

END-OF-LIFE COSTS: end-of-life costs (disposal costs) are a function of what is reported in the context of the reuse of the material. Here we just need to remember that EPS can also be disposed of by using it as a combustion material with energy yield: 1 kg of EPS is equivalent to 1.2-1.4 liters of fuel oil. When it is burned in incineration plants, it produces only water and carbon dioxide, while when it is delivered to the landfill, favoring aeration, it accelerates the decomposition of the organic substances of the landfill and it is not harmful to the air or to the soil or to groundwater, since EPS is a substantially inert material.

It is also important to underline that with the use of the Emmedue System on site, waste of all kinds, including of EPS, is minimal.

In fact, the use of a hot air gun to create the traces for the electrical and hydraulic plants, significantly reduces the management of waste on site and, consequently, also the related timing and costs. Moreover, thanks to the use of the proprietary software M2Panelcad during the design phase, it is possible to optimize the production of the panels and their management in the construction site, reducing cuts and waste to a minimum, thus helping to reduce the costs and minimizing the environmental impact of the Emmedue Building System.

SOCIAL SUSTAINABILITY

While the first two pillars of sustainability (environmental and economic sustainability) have been extensively studied and elaborated over the years, social sustainability has only recently entered the context of discussions on sustainable development, becoming one of its fundamental pillars. This is the way to build a fairer society.

In particular, social sustainability concerns the right of a human being to be able to live in an environmental and socio-economic system that allows her/him to express individuality. This benefit is not only limited to the legitimate interest of every woman and man, but is generally linked to the broader goal of building a better society for the whole community.



The Emmedue construction system has a strong social impact. In fact, 80% of the operators can be unskilled workers who have never worked on a construction site. Emmedue supports its customers by providing them with its own technicians and engineers with the aim of training these new operators who will then be able to acquire technical skills. This way, Emmedue not only provides a sustainable building system from an environmental and economic point of view, but also supports the local populations from a cultural and educational point of view, also providing a concrete answer to the social problem of unemployment through easy and fast access to a job and therefore providing an economic solution for many families who have no economic support, especially in developing and population-intensive countries.

Furthermore, the Emmedue Building System is the perfect solution in social urban planning projects. The Emmedue Building System, in fact, has been used all over the world for the construction of large social urbanizations. Thanks to the Emmedue Building System, thousands of families have access to high quality houses that grant higher quality of life, and therefore these families own houses completely different from those typically attributable to social housing, sadly known for their low quality and reduced durability.



In addition to the well-being and satisfaction of the housing end-users, other requirements have an impact on social sustainability, such as:

- Reliability: the ability to provide the required performance over the life cycle of the building and under operating conditions;
- Durability: the ability to maintain an unchanged performance offered during its life cycle;
- Structural safety: the ability to guarantee the structural performances throughout the entire life cycle of the building without catastrophic consequences or damages;
- Structural strength: the ability to limit damages and consequences in the presence of exceptional situations, such as extreme natural or anthropogenic actions;
- Trustworthiness: the ability to be perceived as reliable and safe by users.

All these requirements are fully satisfied by the Emmedue Building System, as demonstrated by the countless certifications and laboratory tests carried out by Emmedue in different countries, as well as the hundreds of thousands of houses built all over the world and in various geographical areas under the most diverse environmental conditions and often subjected to violent natural disasters. These reasons alone are a testament to the high performance of the Emmedue Building System. These performances, together with the high approval rating of the millions of people living in homes built with the Emmedue System, demonstrate the high reliability and sustainability of structures built with the Emmedue Building System.

