THE RAW MATERIAL AND THE ENERGY EFFICIENCY

Klimapool – The new generation pool

Eng. Andrea Zanon

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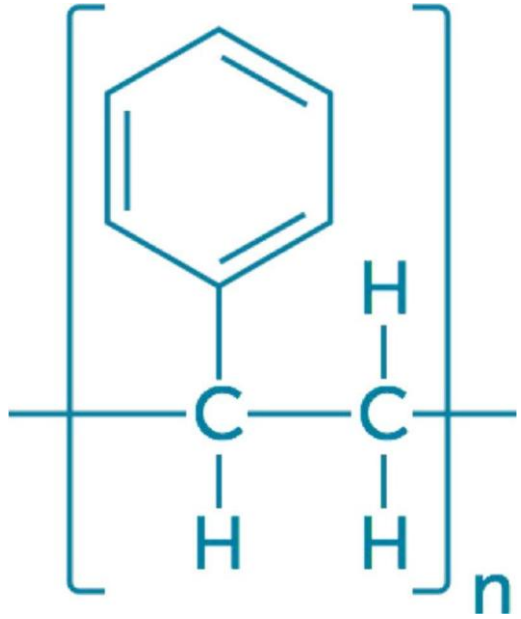
KLIMAPOOL is a new way to build and renovate pools.

Everything starts from the intrinsic characteristics of the material that is at the base of the system: the **EPS**.

EPS

- The EPS (acronym of Synthetized Expanded Polystyrene) is an expanded rigid material with reduced weight obtained from oil;
- Is composed only by hydrogen and carbon atoms;
- 98% is air;
- Is an excellent **THERMAL INSULATION**;



WHAT IS EPS

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- Through an industrial process from oil are obtained little spherical beads of polystyren.

- Inside of beads **pentan** is injectd, an un hydrocarbon you can find in nature that works as expanding gas because, at atmospheric pressure, already boils at ambient temperature

HOW IS IT PRODUCED?

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- Putting the expanded polystyrene beads obtained in contact with **water vapor** with a temperature higher than 90°C the pentan contained in them starts to expand, blowing up the beads until 20-25 times their initial volume.

- At the end of the process pentan evaporates completely

HOW IS IT PRODUCED?

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- The expanded polystyrene beads are later fastened each other by the **sintering** process
  Also this process takes place thanks to the action of water vapor.

HOW IS IT PRODUCED?

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Not all EPS are equal

Preformati Italia uses an EPS with thermal and mechanical superior qualities, produced specifically from a partner company leader in the field of expanded products to implement at the best the **Klimapool** system.

WHICH TYPE OF EPS IS USED BY KLIMAPOOL?

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Caratteristiche	Norma di riferimento	Simboli	Unità di misura	Risultati
Stabilità dimensionale in condizioni normali di laboratorio	EN1603	DS(N)	%	± 0.5
Modulo elastico a compressione	EN826	E	kPa	9000-10800
Resistenza alla flessione	EN12089	BS	kPa	≥ 350
Sollecitazione a compressione al 10% di deformazione	EN826	CS(10/Y)	kPa	≥ 250
Fattore di resistenza alla diffusione del vapore acqueo	EN12086	μ	-	40-100
		μ_{m^*}	-	70
Assorbimento d'acqua a lungo periodo	EN12087	WL(T)	%	≤ 2
Permeabilità al vapore d'acqua	EN12086	δ	mg/(Pa*h*m)	0,0010-0,024
Conduttività termica dichiarata a 10°C	EN12667	λ_D	W/(m*K)	0,033
Resistenza termica dichiarata	EN12667	R_D	(m²*K)/W	Vedi tabella 1
Capacità termica specifica	EN10456	C_p	J/(Kg*K)	≥ 1340

CHARACTERISTICS

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Concerning the energy efficiency, the most important characteristic is without doubts the **thermal conductivity.**

$$\lambda = 0{,}033 \text{ W/(mK)}$$

INSULATION ABILITY

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is a measure of a substance's ability to transmit heat, that is:

λ little

more insulating material

INSULATION ABILITY

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is a measure of a substance's ability to transmit heat, that is:

λ BIG

Less insulation material

INSULATION ABILITY

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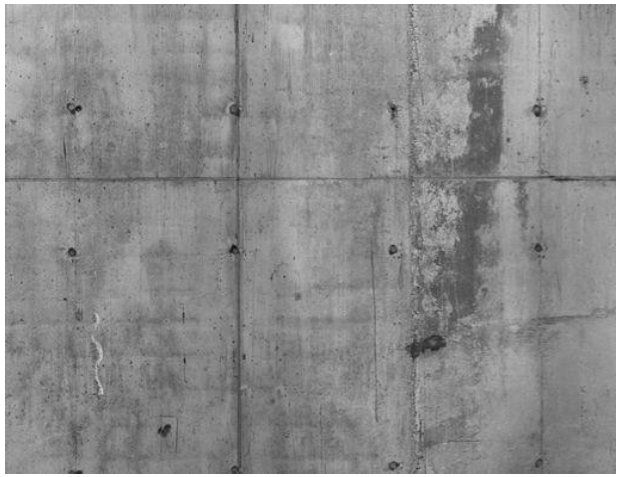
EPS

λ = 0,033 W/(mK)

REINFORCED CONCRETE

λ = 1,6 W/(mK)



EPS VS OTHER MATERIALS

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EPS

λ = 0,033 W/(mK)

REINFORCED CONCRETE

λ = 1,6 W/(mK)

STEEL

λ = 60 W/(mK)

EPS VS ALTRI MATERIALI

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Strategies

for energy saving:

- reduction of transmittance of the tank to cold areas
- deletion of thermical bridges

The structure realized by Preformati Italia take advantage by insulation properties of **raw material**, a **polymeric material with high quality standards, combined with waterproofing and reinforcing solutions.**

All the elements of the pool produced by Preformati Italia have infact an **higher energy yield** compared to the most diffused traditional technologies used until today.

HIGH ENERGY EFFICIENCY

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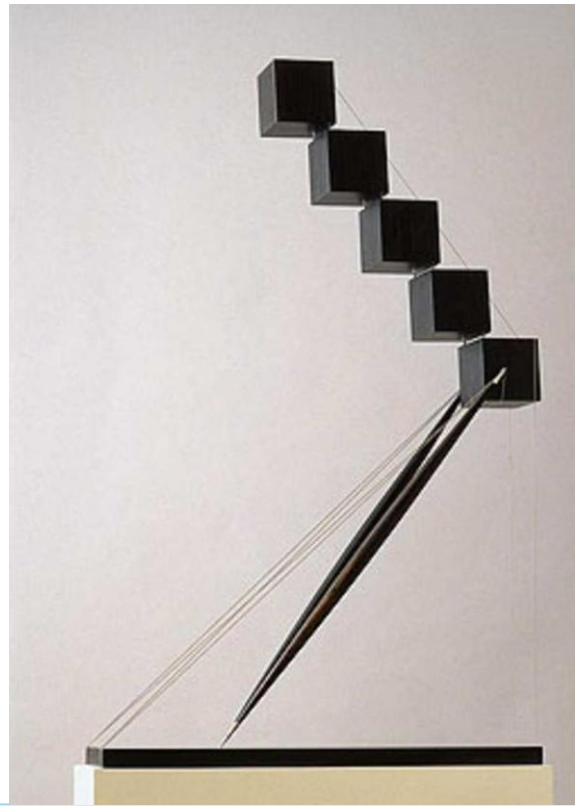
The EPS, combined with traditional construction materials, has highlighted **structural performaces of all respect**.



INNOVATIVE STATIC SOLUTIONS

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The never-ending theoric research supported by laboratory tests pursued during the years by Preformati Italia has allowed to analyze the structural subjects arriving in 2015 to the achievement of an **italian patent** on a particular self-supporting structure.

The process for an **europen patent** for another type of structure is nearing completion.

INNOVATIVE STATIC SOLUTIONS

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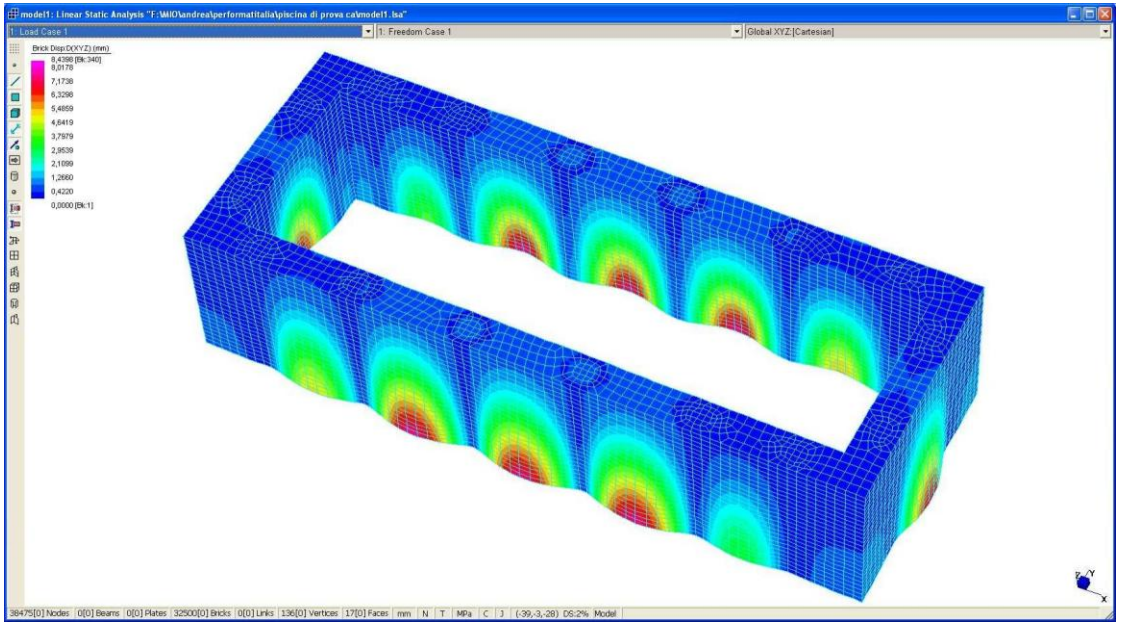
After an initial approximative design setting, pools are analyzed by a static point of view using the implementation of a detailed model of **calculation to finished elements (FEM).**



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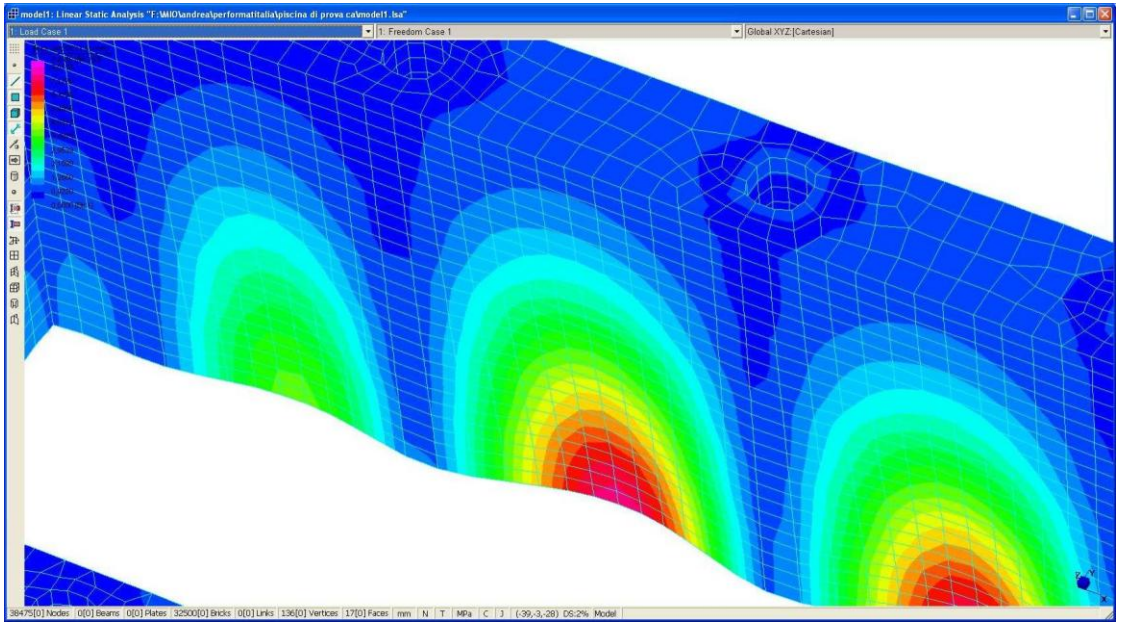

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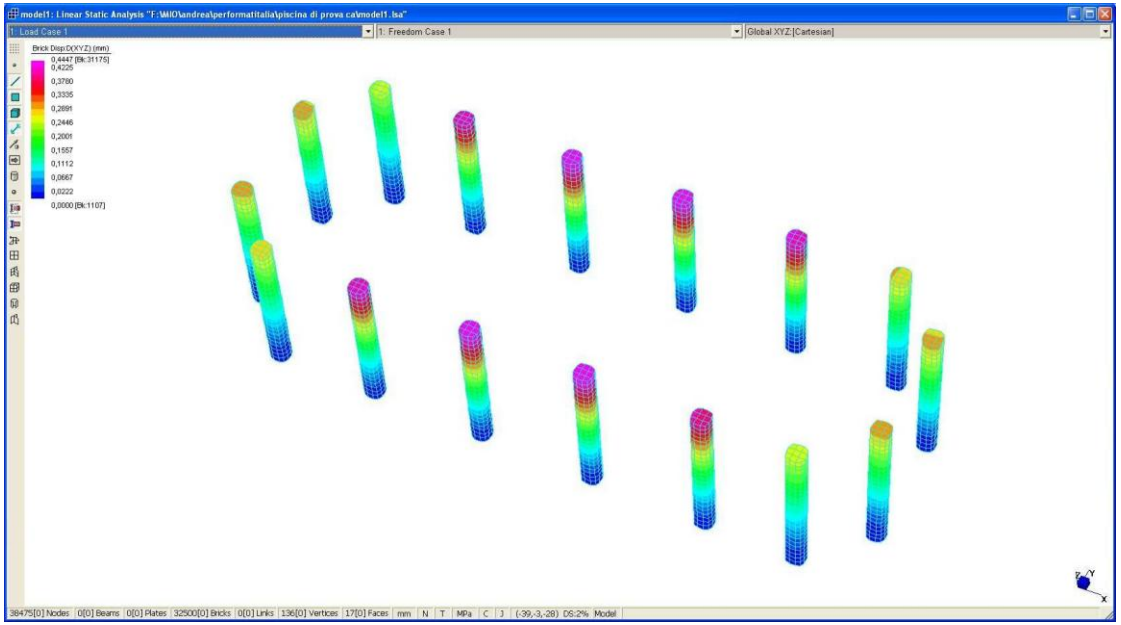

INNOVATIVE STATIC SOLUTIONS

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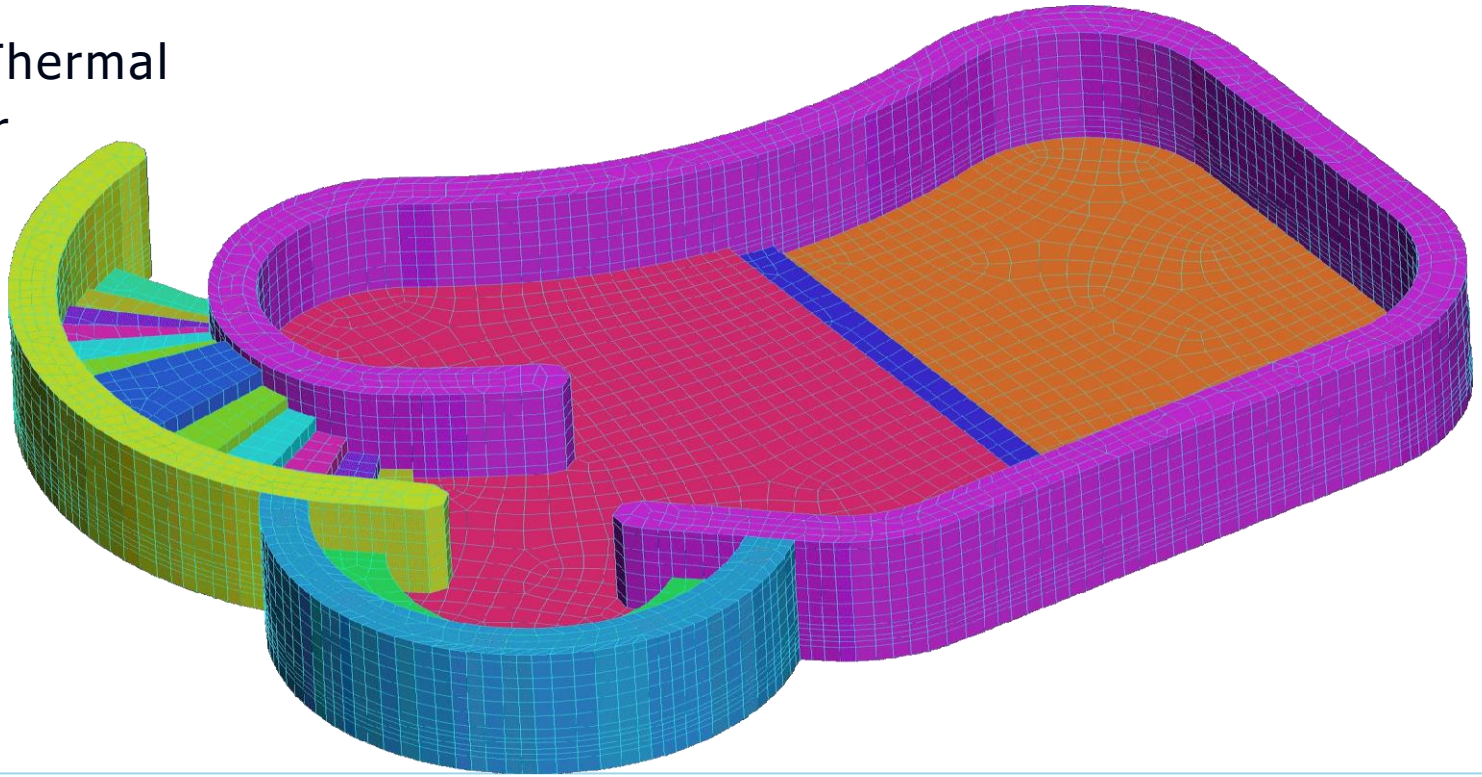
Pejo Thermal Center



INNOVATIVE STATIC SOLUTIONS

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Pejo Thermal
Center

INNOVATIVE STATIC SOLUTIONS

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INNOVATIVE STATIC SOLUTIONS

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Center

INNOVATIVE STATIC SOLUTIONS

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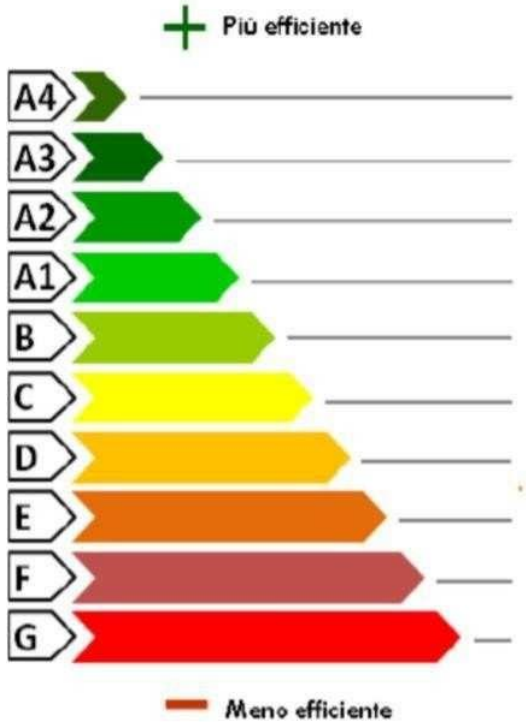
KLIMAPOOL is a new way to build and renovate pools

that concretizes itself in an ENERGY CLASSIFICATION similar to the one used for buildings.



PROJECT KLIMAPOOL

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PREFORMATIITALIA retains that also pools, on a par with buildings, must have an evaluation method to determinate the propensity towards **ENERGY SAVING**

PROGETTO KLIMAPOOL

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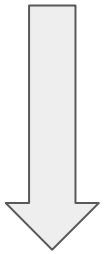
ENERGY RATING



ENERGY PERFORMACE INDEX

EP

PROJECT KLIMAPOOL

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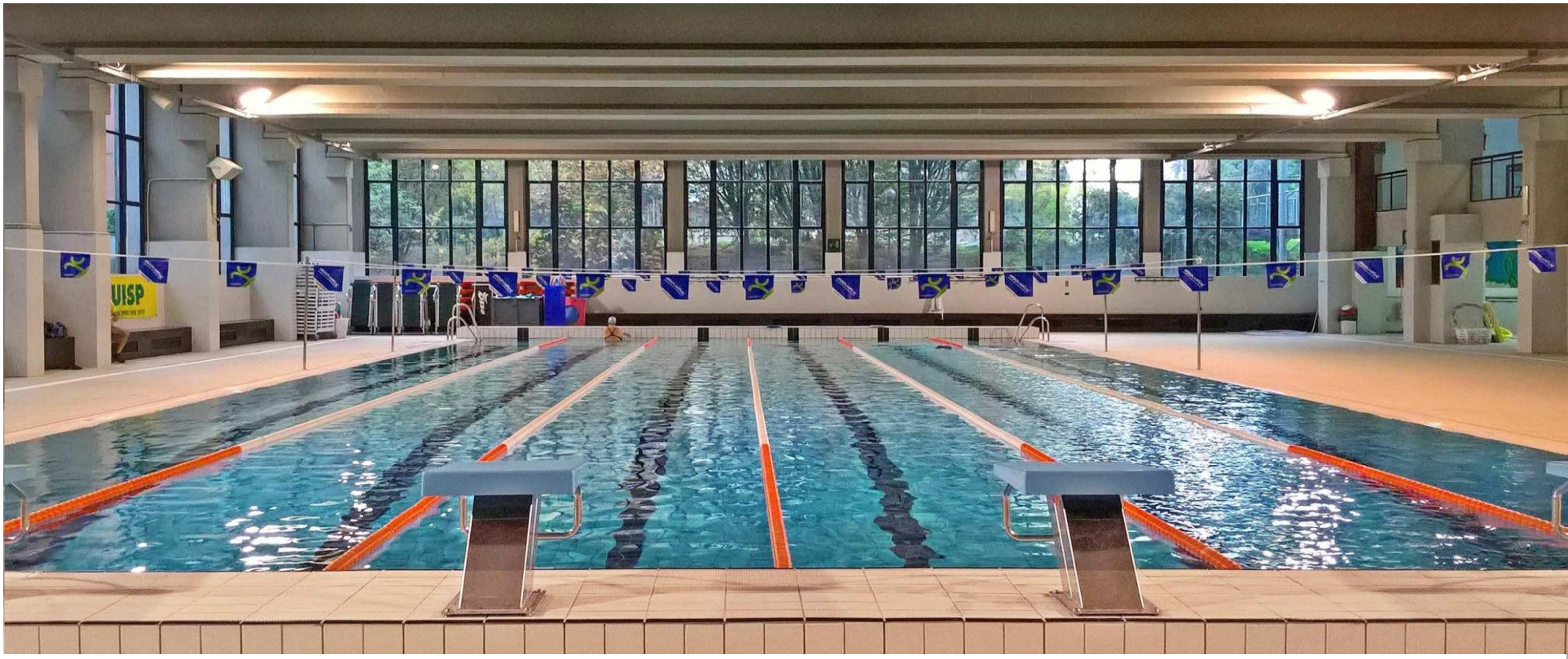
ENERGY EFFICIENCY PARAMETERS

- Energy consumption
- Energy performance
- CO2 emissions
- Energy Costs



CASE STUDY

AQUATIC CENTER TORRAZZA

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KLIMAPOOL

The swimming center “Torrazza”, situated in a school complex in the south zone of Turin and built in the 70s, has been object in 2016 of an important intervention of renovation which target was to legalise the old installations and improve the pools from the point of view of energy saving and aesthetic.

A STRUCTURE TO RENOVATE

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GOALS:

- Fuctionals
- Energy efficiency

GOALS
RIQUALIFICATION

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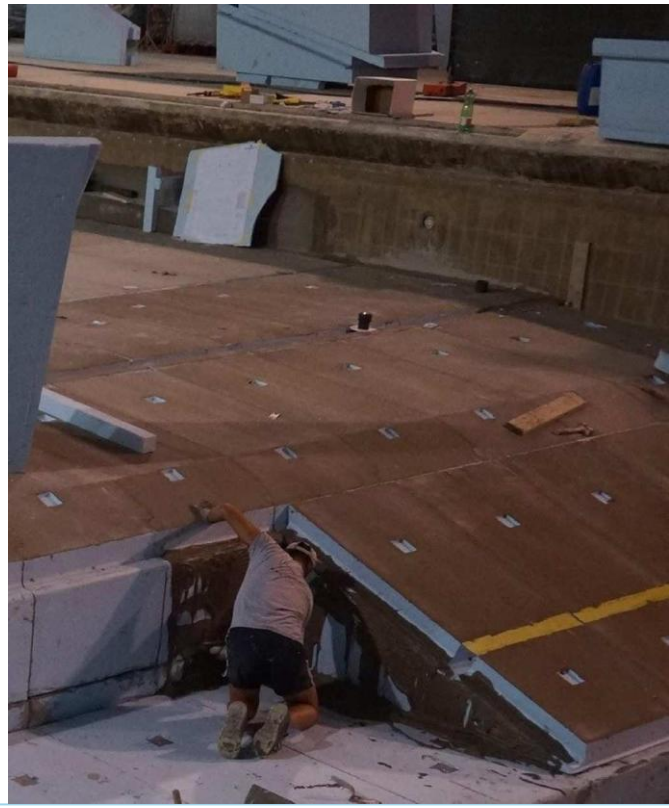
With the use of EPS **the bottom of the pool has been modified** to decrease the water volume and make flat more than half pool (the first 15m for the whole width), and after go down in progression until 3 meters depth, an ideal deepness for diving classes which are regularly held by the structure.



RE-FUNCTIONALIZATION

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Thanks to the use of **Klimapool** all parameters of energy efficiency have been improved.

Tipo di Piscina	Consumo Energetico [kWh/anno]	Prestazione Energetica EP [kWh/m³anno]	Classe Energetica	Emissioni CO2 [kg/anno]	Costi Energetici [€/anno)
Piscina stato attuale	76127	451,1	G	14299	4568
Piscina dopo intervento Klimapool	4427	26,23	A2	832	266

ENERGY EFFICIENCY

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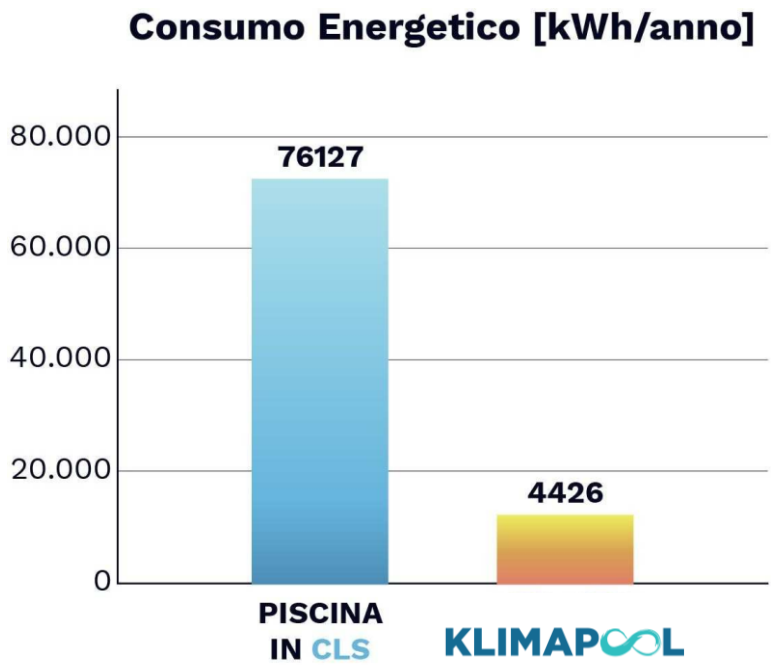

ENERGY CONSUMPTION

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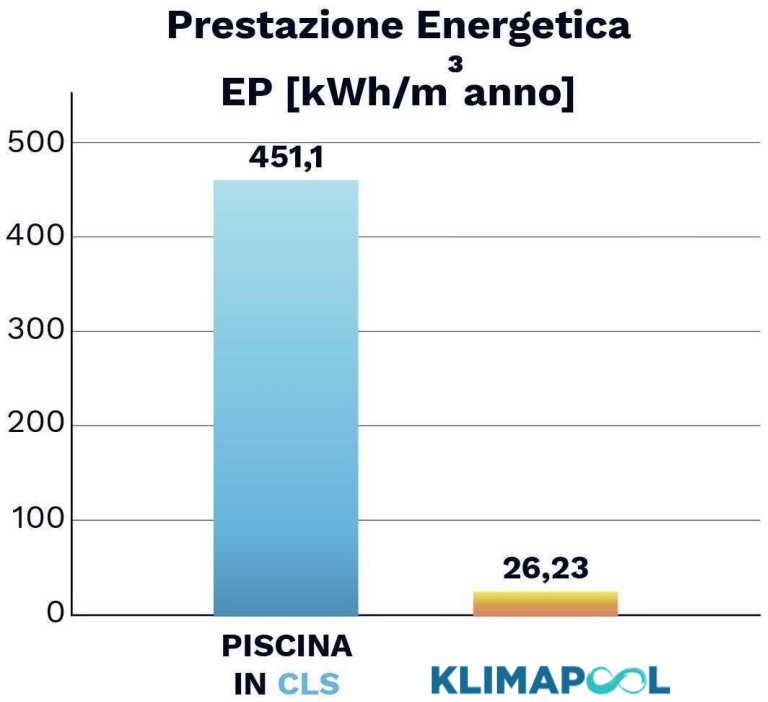

ENERGY PERFORMANCE

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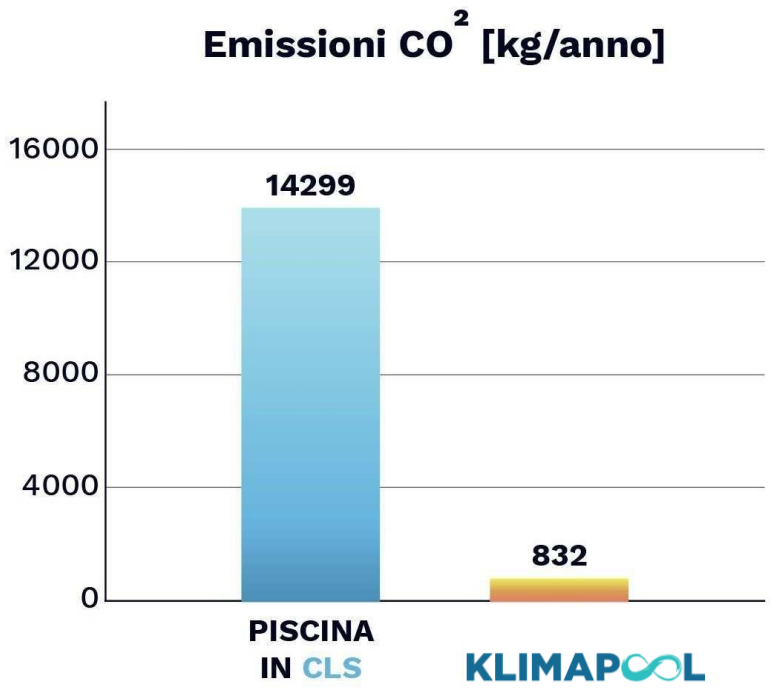

CO_2 EMISSION

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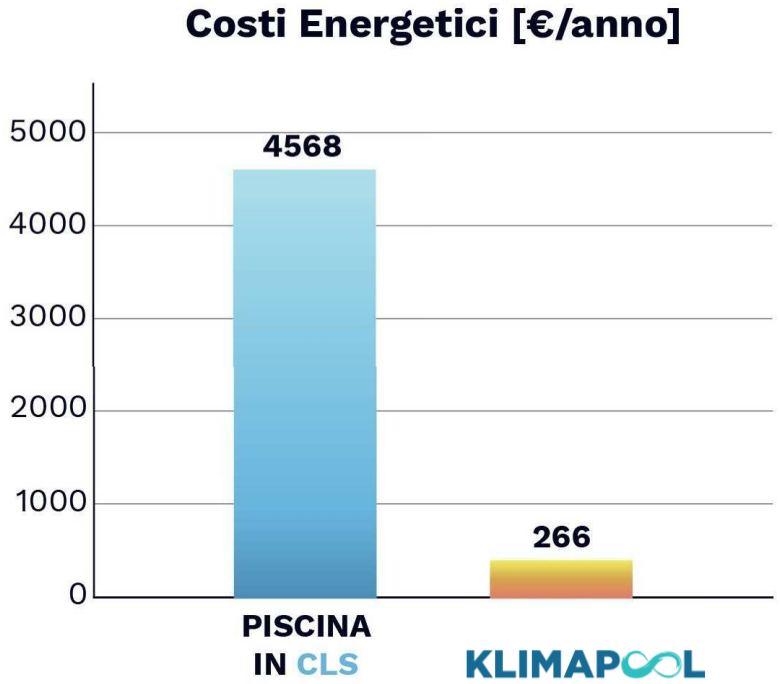

ENERGY COSTS

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WHAT IS THE WORST ENEMY FOR THE ENERGY INEFFICIENCY OF A POOL?

Most of the thermal dispersion in a pool takes place through the **water surface!**

DETAILED STUDY

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WHAT'S THE SOLUTION?

A **ROLLER SHUTTER** during the non-use periods of the pool.

DETAILED STUDY

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Which ENERGY BENEFITS you can expect from Klimapool?

In percentage, in a Klimapool structure with roller shutter, efficiency energy parameters are better of

70-80%

compared to a traditional pool

DETAILED STUDY

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LET'S GET CLEAR:

DISPERSION FROM WATER SURFACE (without roller shutter)

In the following examples we will examin several types of pools available on the market and we will **compare them, from an energy point of view**, with pools realized with **Klimapool** technology.

The point is to understand how the dispersion on water surface affects the energy efficiency.

DETAILED STUDY

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Geometry

- Rectangular map
- Internal dimensions 6,00x12,00m
- Water height 1,30m

Casing

1. **EPS** thickness 25cm
2. **CLS** thickness 25cm
3. **ACCIAIO** thickness 1cm

Position

A. Inground and in external spaces
B. Above ground and in external spaces
C. Above ground and in internal spaces

TYPE OF POOL

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The scenario assumed on calculations is the following:

A drop on water surface is always considered, assuming the presence of a roller shutter for 12 hours and its absence for the remaining 12 hours.

ASSUMED THEORIES

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The following parameters will determined and compared:

- Annual energy consumption
- Energy performace index
- Energy Class
- CO2 emissions
- Energy costs

COMPARATION

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Water surface and roller shutter declines- 12/12h

Tipo piscina	Consumo Energetico [kWh/anno]	EP [kWh/m^{3}anno]	Classe Energetica	Emissioni CO_2 [kg/anno]	Costi [€/anno]
EPS Interrata Esterna	531523	5679	A1	99836	31891
EPS Fuori terra Esterna	531540	5679	A1	99839	31892
EPS Fuori terra Interna	336889	3599	A1	63278	20213
CLS Interrata Esterna	592556	6331	F	111300	35553
CLS Fuori terra Esterna	592988	6335	F	111381	35579
CLS Fuori terra Interna	376124	4018	F	70647	22567
ACCIAIO Interrata Esterna	625981	6688	G	117578	37559
ACCIAIO Fuori terra Esterna	626676	6695	G	117709	37601
ACCIAIO Fuori terra Interna	397611	4248	G	74683	23857

RESULTS

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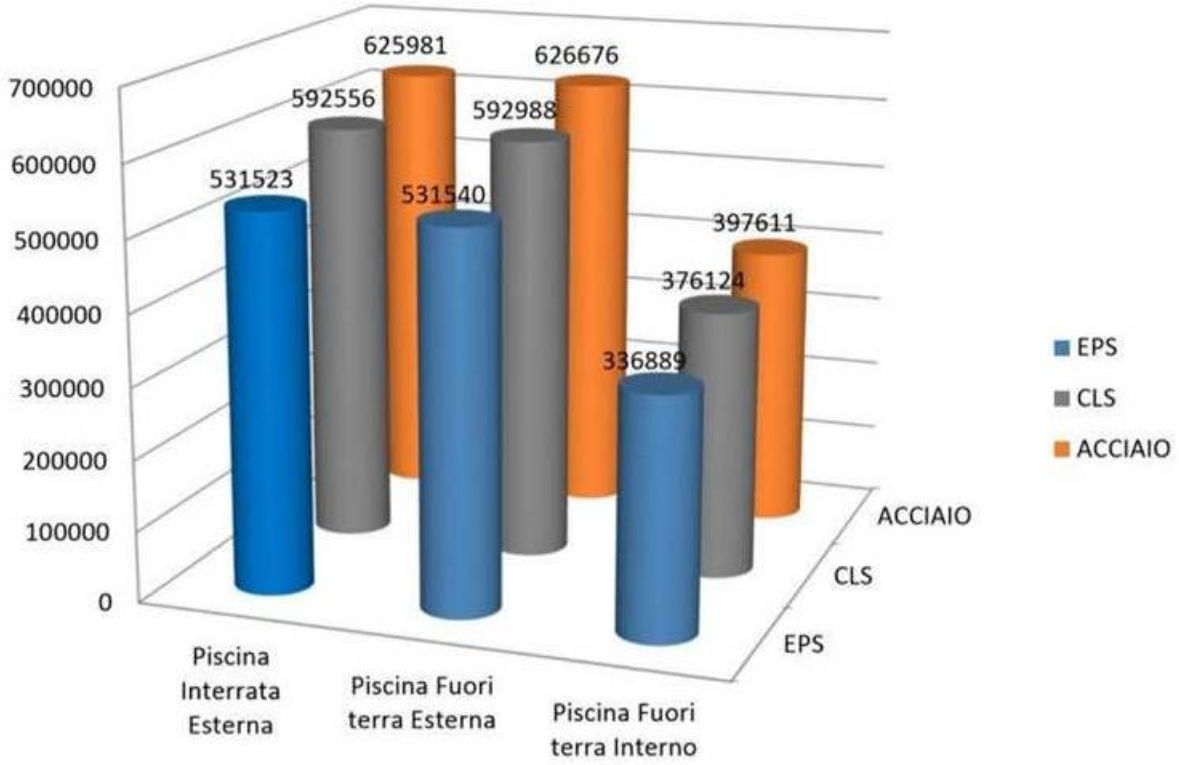

Annual Energy Consumption

kWh/year

RESULTS

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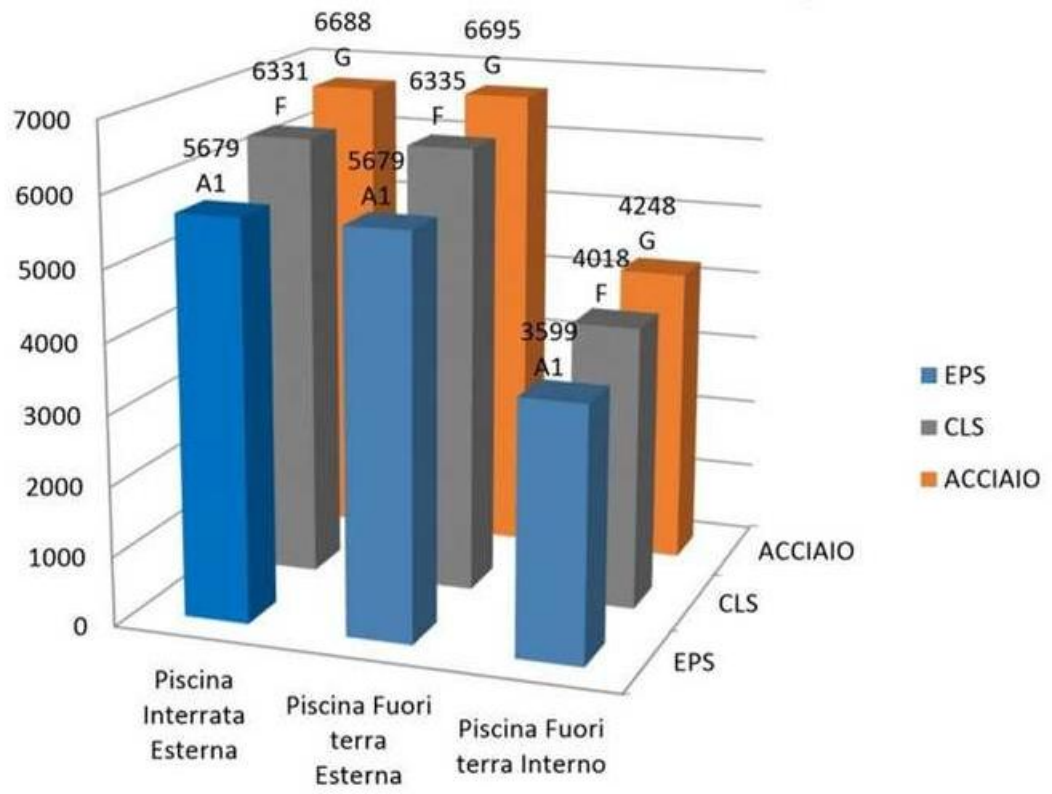

Energy Performance Index

Energy Class

RISULTATI

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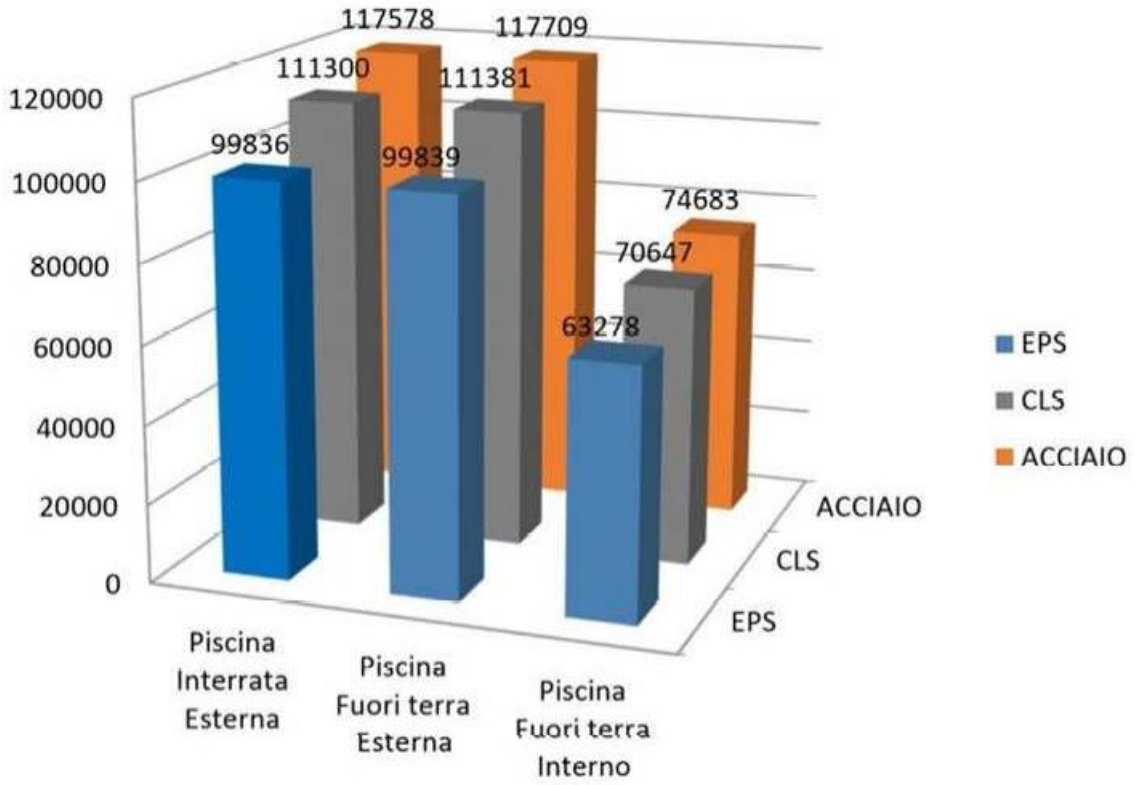

CO_2 Emissions

kg/year

RESULTS

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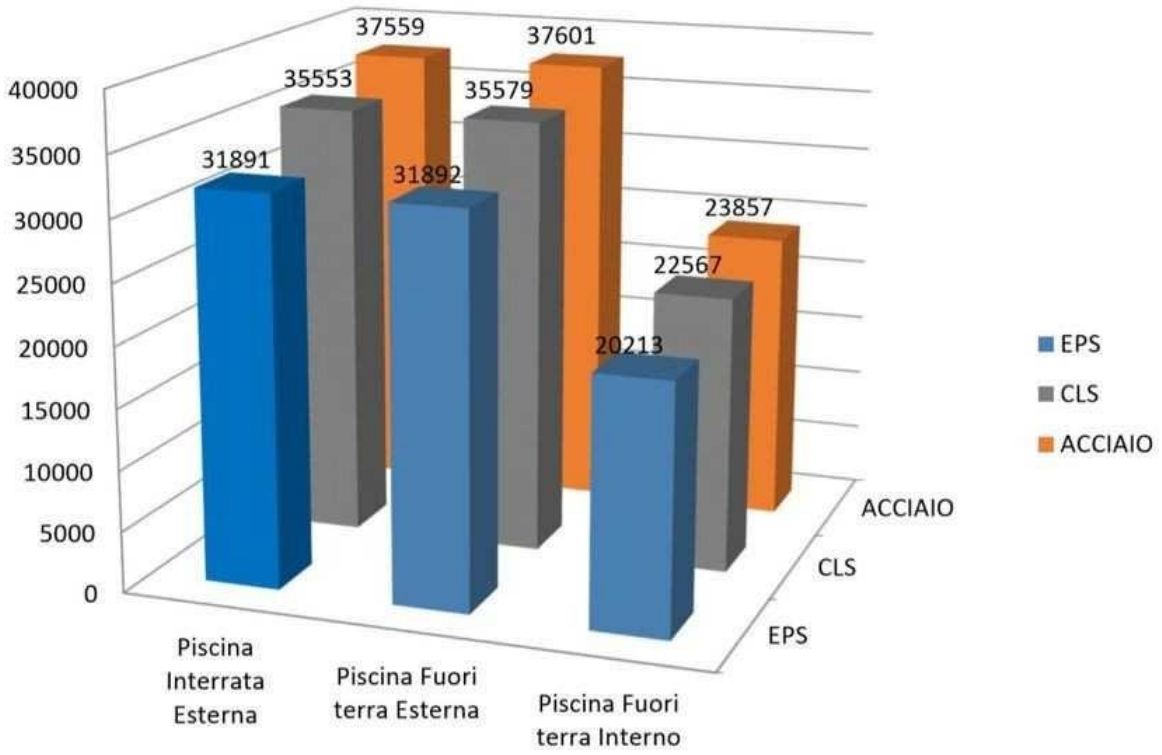

Energy Costs

€/year

RESULTS

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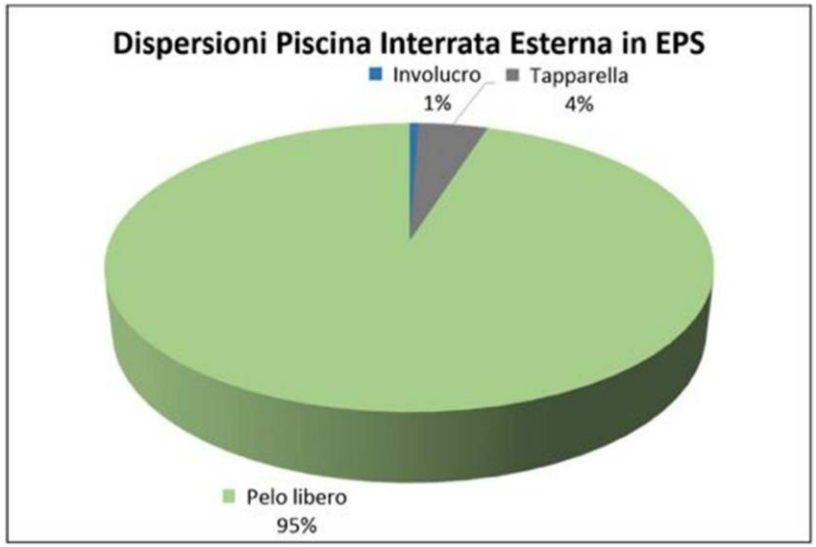
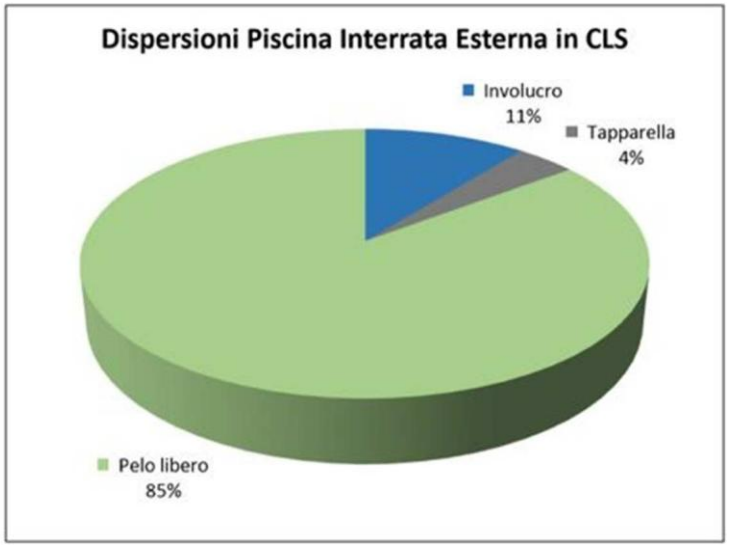
Who is responsible for dispersions?





RESULTS

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With **Klimapool** technology there are benefits in all parameters considered:

- Annual energy consumption
- Energy Performance Index
- Energy Class
- CO2 Emissions
- Energy Costs

CONCLUSIONS

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Concerning the costs for the maintenance for the temperature of the water, **saving** can be estimated as follows:

20% in relation to **concrete** pools

30% in relation to **steel** pools

CONCLUSIONS

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engineer Andrea Zanon

THANK YOU FOR YOUR ATTENTION

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