# Italian Precast Industry

IPHA
INTERNATIONAL PRESTRESSED HOLLOWCORE ASSOCIATION

Progress made towards meeting the new Green Deal sustainability requirements

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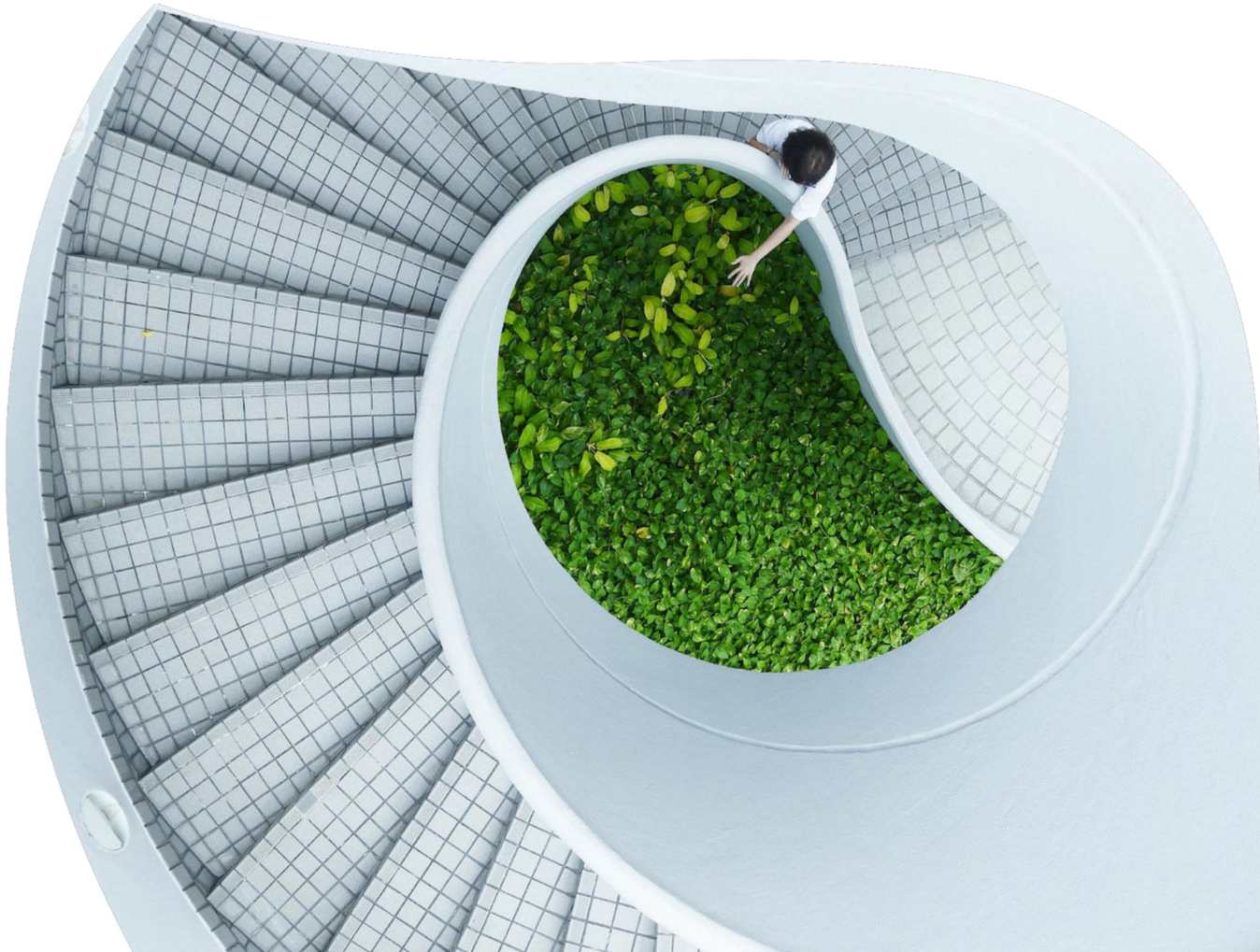
bibm CONGRESS
AMSTERDAM 2023

# Italian precast industry vision

The Italian precast industry main effort is committed to sustainability and is actively working to reduce environmental impact of precast concrete production and use.

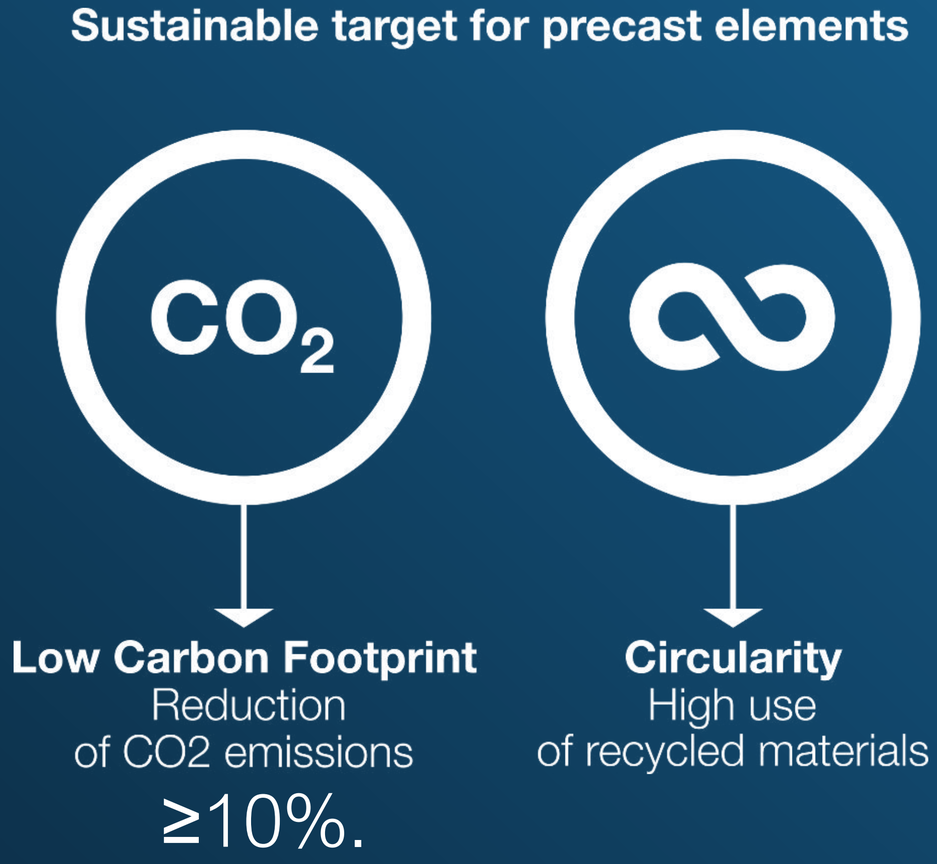
We’re doing this in several ways.

Reducing Carbon Footprint,
Waste Reduction and Recycling,
LCA, EPD Certification, Innovation…



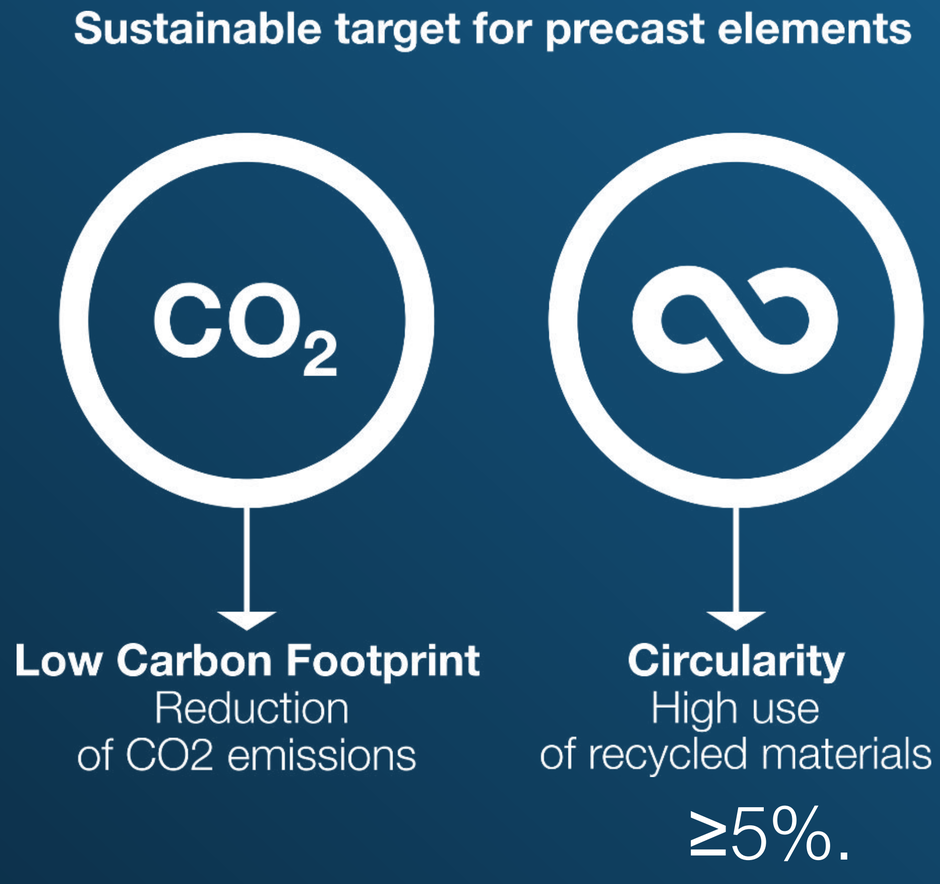
# Reducing Carbon Footprint

The industry is working to reduce the carbon footprint of precast concrete production by optimizing the manufacturing process, reducing energy consumption, using more sustainable materials. The use of recycled aggregates, fly ash and slag in cement production help reduce the carbon footprint of precast products.



# Waste Reduction

The industry is also working to reduce waste and increase recycling of materials. Waste reduction can be achieved through better inventory control, optimizing manufacturing processes, and using sustainable materials. Additionally, the use of precast concrete products can help reduce waste by reducing the amount of on-site waste generated.



# Certifications and Standards

The industry is working to obtain certifications and labels that attest the sustainability of precast products. For example, manufacturers are working to obtain the European Environmental Product Declaration (EPD type III) certification, which provides an assessment of the environmental impact of a product over its entire life cycle (LCA approach).

# Certifications and Standards

The industry is also working to be compliant to the new requirements imposed by national Standards (DM 23.06.2022 Criteri Ambientali Minimi and DM 17.01.2018 Norme tecniche per le Costruzioni). New public buildings' concrete precast elements must have at least 5% of recycled materials (up to 10% for same concrete strength class).

## CAM

(Minimal Environmental Criteria)


"Relazione CAM" - CAM SPECIFICATIONS

- Introduced since Design Phase
- Mandatory for BUILDING MATERIALS
- Winning during tender phase

# Innovation

Design: collaborating with architects and engineers to design precast elements that optimize material usage (including in situ foundations), reduce weight and enhance energy efficiency in buildings. Precast allows for the creation of complex and innovative designs that incorporate sustainability features, durability and resilience (especially in seismic zones).

# Innovation

Investing in R&D to develop new technologies: 3D printing, structural retrofitting in high seismic areas, low carbon steel reinforcement, materials and processes that enhance the sustainability of precast concrete production.
Market opportunities: Italian precast industry to take advantage of market opportunities. Differentiate and capture market shares.


# Our Strategy, a Customer Driven Sustainability

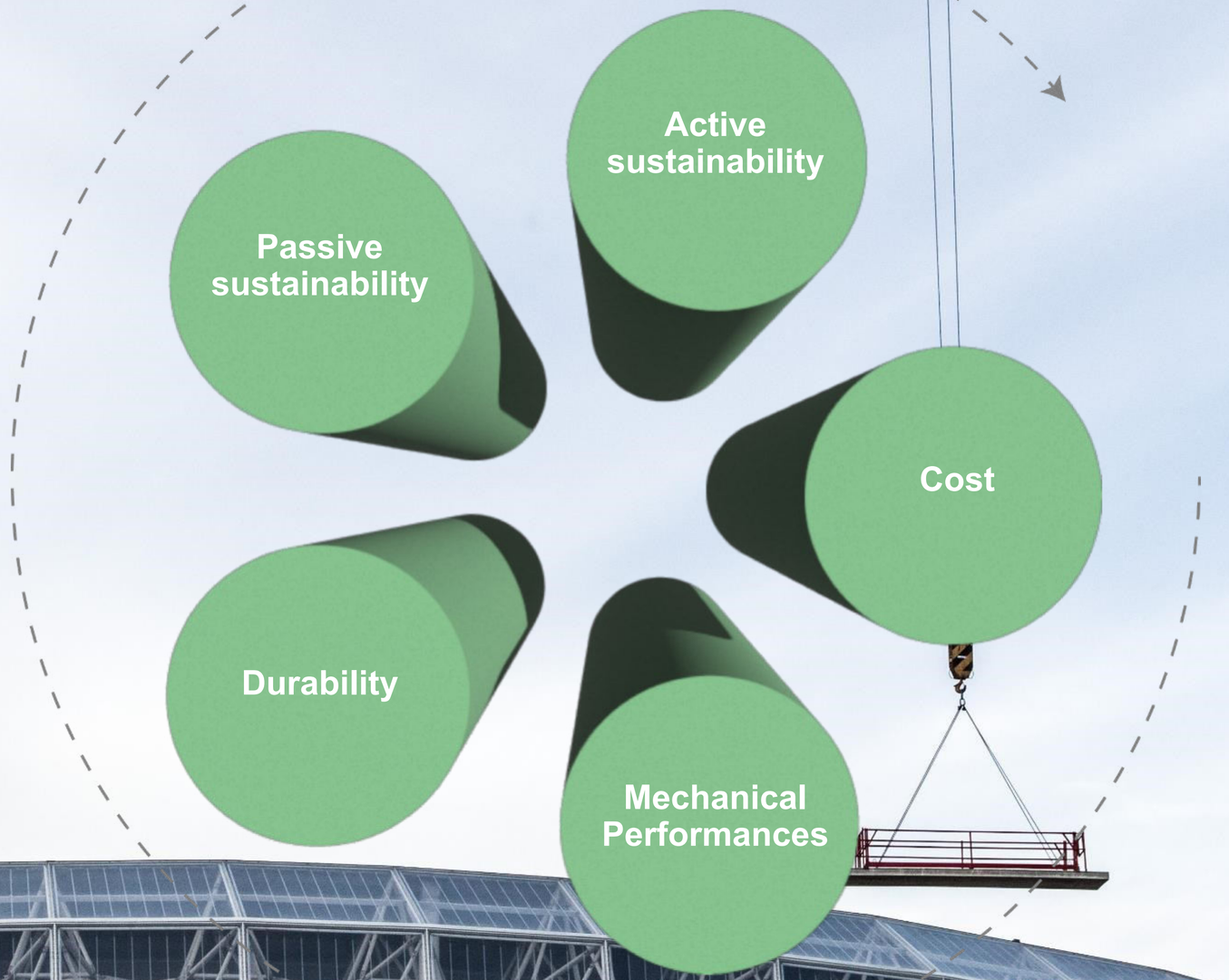
We are developing a multilevel approach to the market aiming at:

- building consciousness for stakeholders
- enhancing knowledge for designers
- creating value for customers

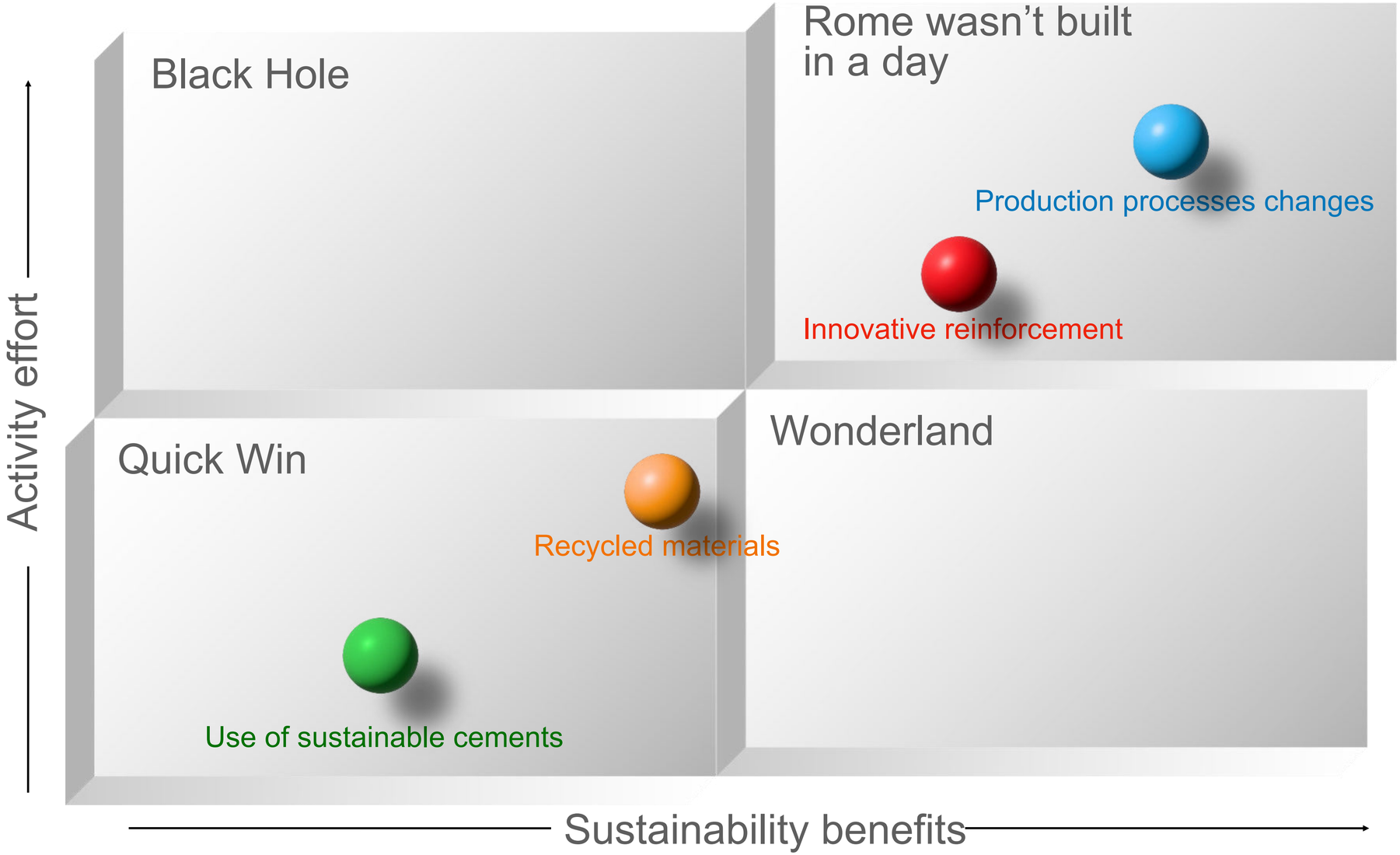
# Strategy – Sustainability in the Precast Industry

## Commitments 2030

**Sustainable Development, understood as the right balance between the creation of economic value, environmental protection and social responsibility**



# Customer Driven Sustainability




Sustainable solutions for customers.

Sustainable solutions are related to the sustainable benefits and the effort we must perform.

In order to achieve the maximum sustainable benefits, we need a **cultural change**.

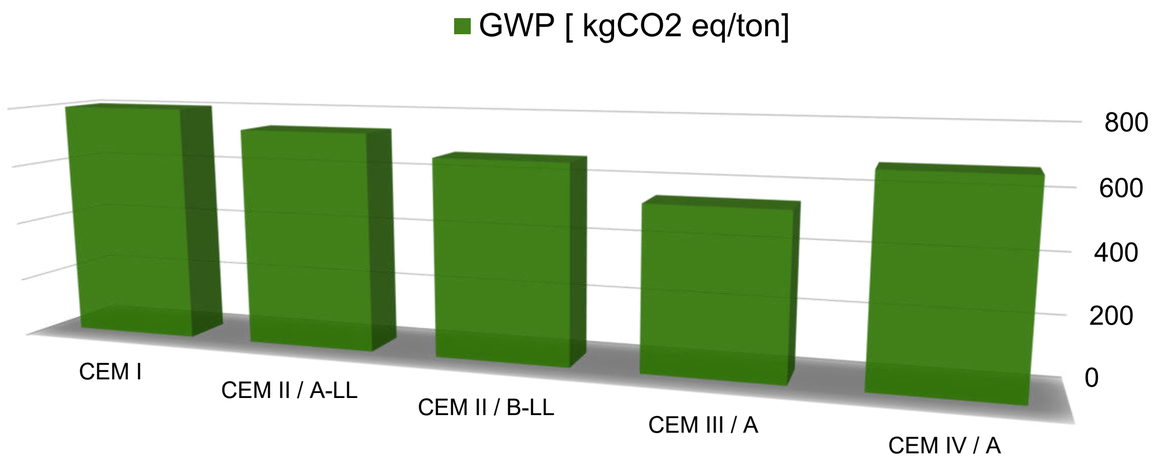
# Use of sustainable cements


$CO_2$ reduction from 10% to 40% - Recycled material > 5%

# Use of sustainable cements

Switch from CEM I to CEM III or CEM IV

- Significant carbon footprint reduction
- Higher level of durability
- Use of recycled material already inside CEM III and CEM IV




CO2 reduction from 10% to 40% - Recycled material > 5%

# Use of sustainable cements

In Italy is starting the commercialization of new cements complying
with new EN 197-5:
CEM II/C-M and CEM VI

- Lower clinker percentage
- EN 197-5 is not a harmonized standard

# Use of sustainable cements

**Table 1 — Portland-composite cement CEM II/C-M and Composite cement CEM VI**

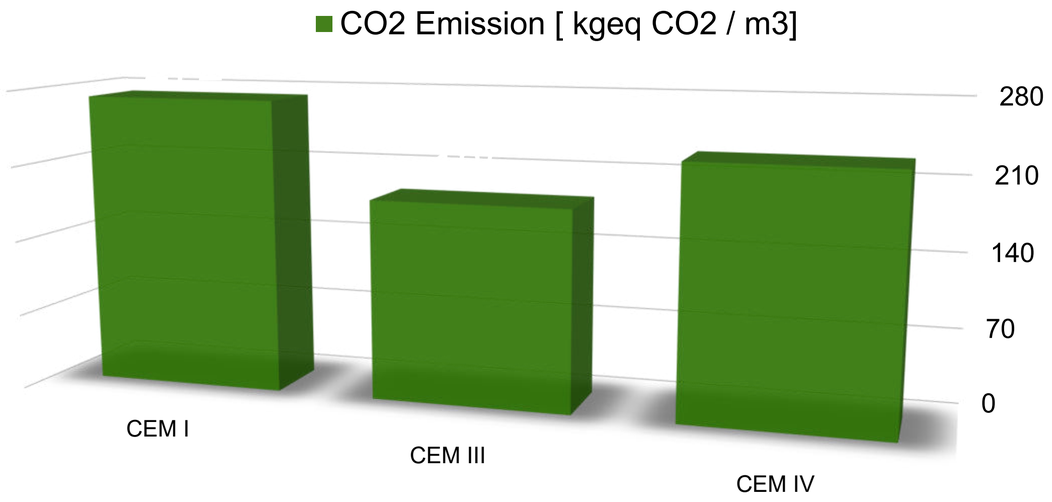
| Main types | Notation of the products (types of cement) | | Composition (percentage by mass[a]) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main constituents | | | | | | | | | | Minor additional constituents |
| | | | Clinker | Blast-furnace slag | Silica fume | Pozzolana | | Fly ash | | Burnt shale | Limestone | | |
| | | | | | | natural | natural calcined | siliceous | calca-reous | | | | |
| | Type name | Type notation | K | S | D[b] | P | Q | V | W | T | L[c] | LL[c] | |
| CEM II | Portland-composite cement[d] | CEM II/C-M | 50-64 | ‹---------- 36-50 ----------› | | | | | | | | | 0-5 |
| CEM VI | Composite cement[d] | CEM VI (S-P) | 35-49 | 31-59 | – | 6-20 | – | – | – | – | – | – | 0-5 |
| | | CEM VI (S-V) | 35-49 | 31-59 | – | – | – | 6-20 | – | – | – | – | 0-5 |
| | | CEM VI (S-L) | 35-49 | 31-59 | – | – | – | – | – | – | 6-20 | – | 0-5 |
| | | CEM VI (S-LL) | 35-49 | 31-59 | – | – | – | – | – | – | – | 6-20 | 0-5 |

a The values in the table refer to the sum of the main and minor additional constituents.
b The proportion of silica fume is limited to 6-10 % by mass.
c The proportion of limestone (sum of L, LL) is limited to 6-20 % by mass.
d The main constituents other than clinker shall be declared by designation of the cement (for examples, see Clause 6).

# Use of sustainable cements

Concrete examples
- Reference: CEM I 52,5R
- Compressive strength class C35/45

**The use of CEM III or CEM IV leads to higher durability than concrete with CEM I or CEM II**




# Recycled Materials

# Use of recycled materials

New Standard (2022): CAM (Criteri ambientali Minimi / Minimal Environmental Criteria)

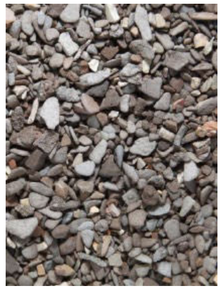
New requirements: a new public construction project precast concrete must contain at least 5% of recycled materials. Recycled materials can come from:

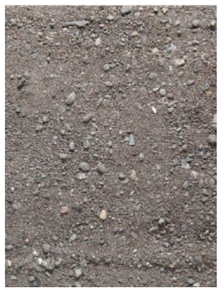
- Cement
- Aggregates (artificial or C&DW)
- Reinforcement steel

≥ 75%

*Example of hollowcore concrete scraps with strands previously removed ready to be crushed*

≥ 5%





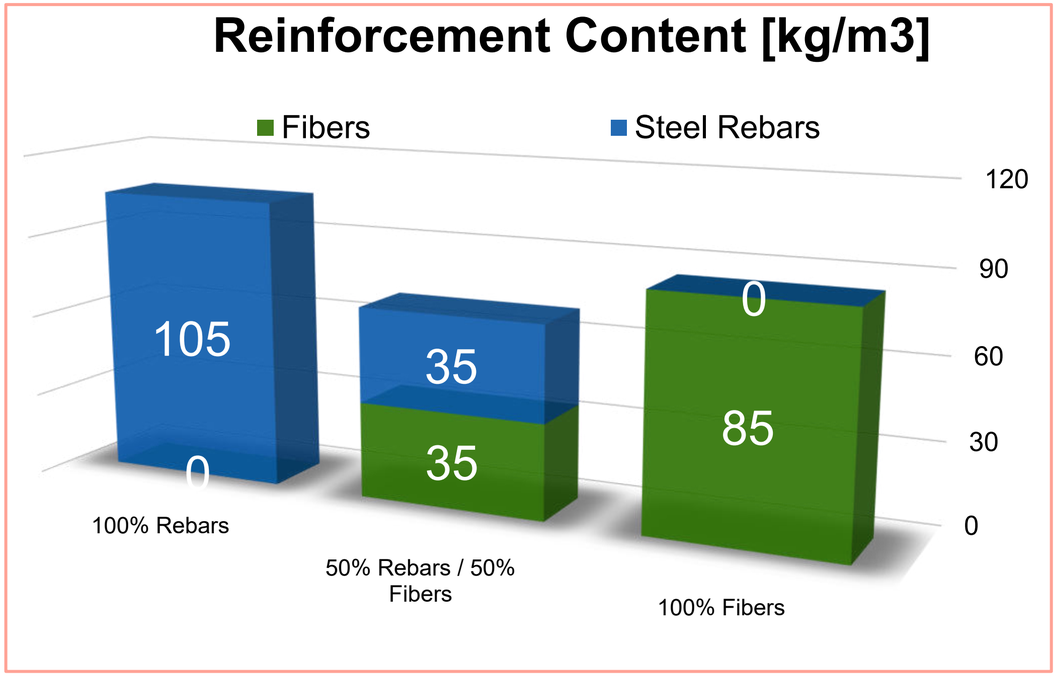
*But only CE marked recycled materials can be introduced*

# Innovative reinforcement

# Innovative reinforcements

Steel rebars substitution with fibers (steel, plastic, etc.)

Example1 – Slab with hybrid reinforcement (steel rebars and steel fibers)
The hybrid reinfrocement lead to a reduction of total steel per $m^3$




Example 2 – Precast tunnel segment with plastic fiber reinforcement
The fiber reinforcement can replace totally the traditional reinforcement

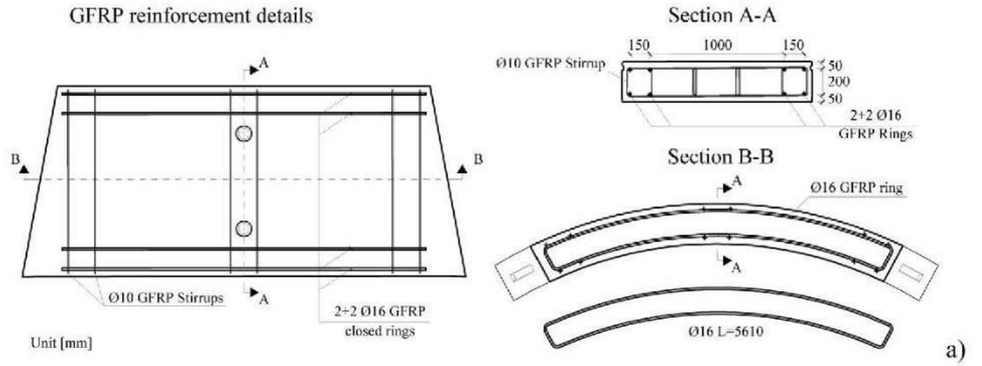
# Innovative reinforcements

## Steel rebars substitution with alternative materials
(Glass Fiber Reinforced Polymer, Carbon Fiber Reinforced Polymer)

Alternative reinforcement bars are suitable in particular applications. They are characterized by very high strength (more than steel) even if low ductility.

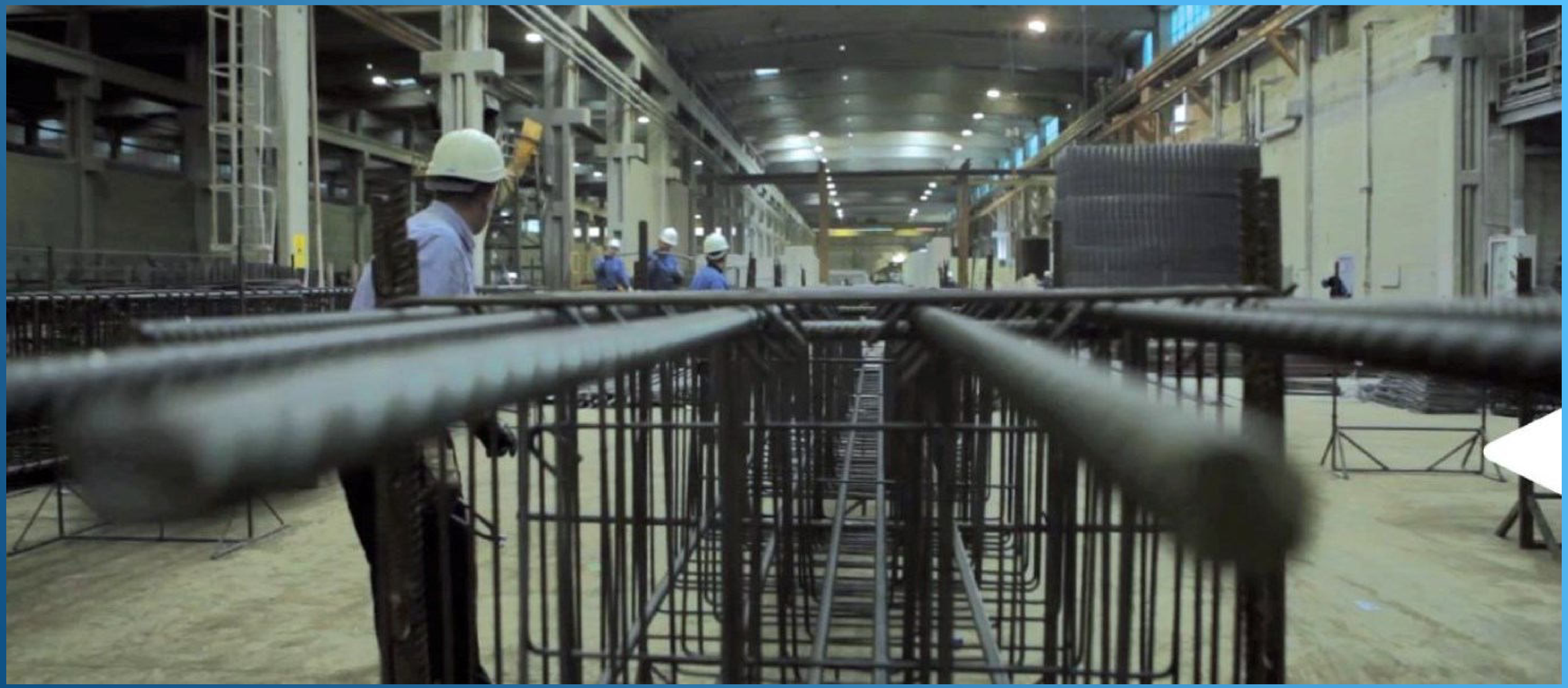
For applications with low ductility requirements, alternative reinforcements could be safer and cheaper than ordinary steel reinforcement.

| type of fibre | unit weight [kg/dm³] | tensile strength [MPa] | modulus of elasticity [GPa] | strain at fracture [‰] | alkali resis-tance [-] | max. tempera-ture [°C] | diameter [µm] |
|---|---|---|---|---|---|---|---|
| steel | 7.8 | 500-2600 | 200 | 5-35 | high | 1000 | 100-500 |
| alkali-resistant glass | 2.6 | 2000-4000 | 75 | 20-35 | med./ low | 800 | 12-20 |
| carbon | 1.75-1.91 | 2000-4000 | 200-450 | 4-15 | high | 3000 | 15 |
| polypro-pylene | 0.98 | 450-700 | 7.5-12 | 60-90 | high | 150 | 50 |
| polyvinyl alcohol | 1.3 | 800-900 | 26-30 | 50-75 | high | 240 | 13-300 |
| polyester | 1.4 | 800-1100 | 10-19 | 8-20 | med. | 240 | 10-50 |
| aramide | 1.42 | 700-3600 | 70-130 | 21-40 | med. | 600 | 12 |




Tunnel segment GFRP reinforcement
Meda et al. «Hybrid precast tunnel segments in fiber reinforced concrete with glass fiber reinforced bars»

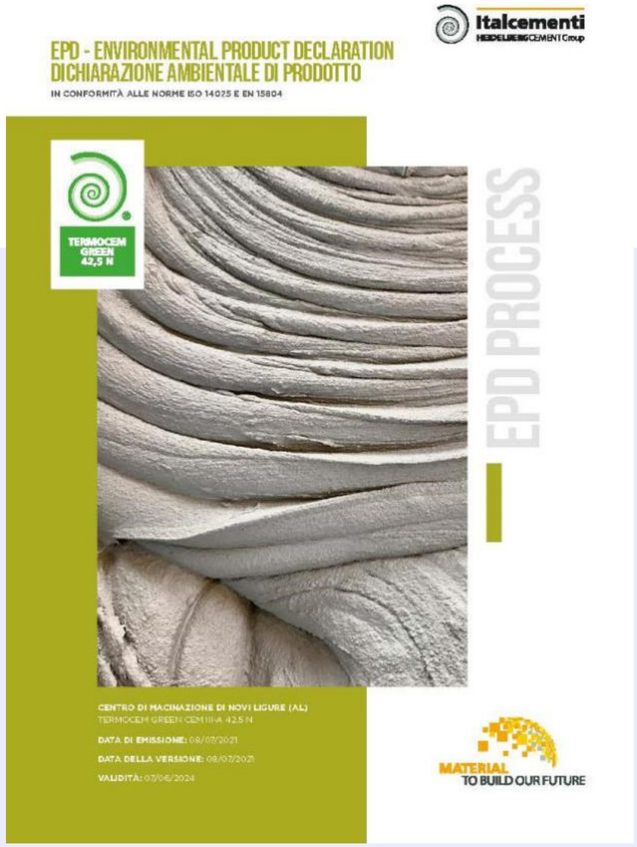
# Production processes changes

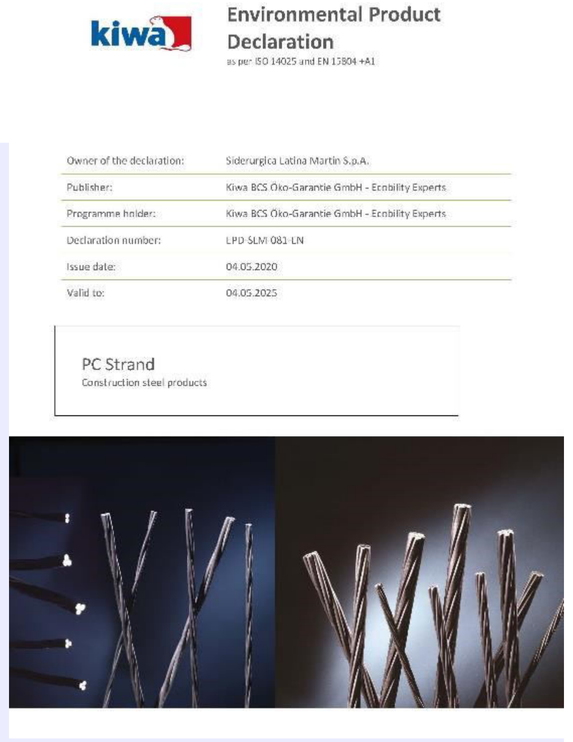


# EPD certified cement and steel suppliers

- Precast and cement industry: working hard to improve the efficiency of cement by maximizing hydration and by optimizing cement content to reduce embodied CO2 (from '90s to 2018 almost 20% of reduction in CO2 emissions from cement manufacturing). **EPD Certified cement suppliers**

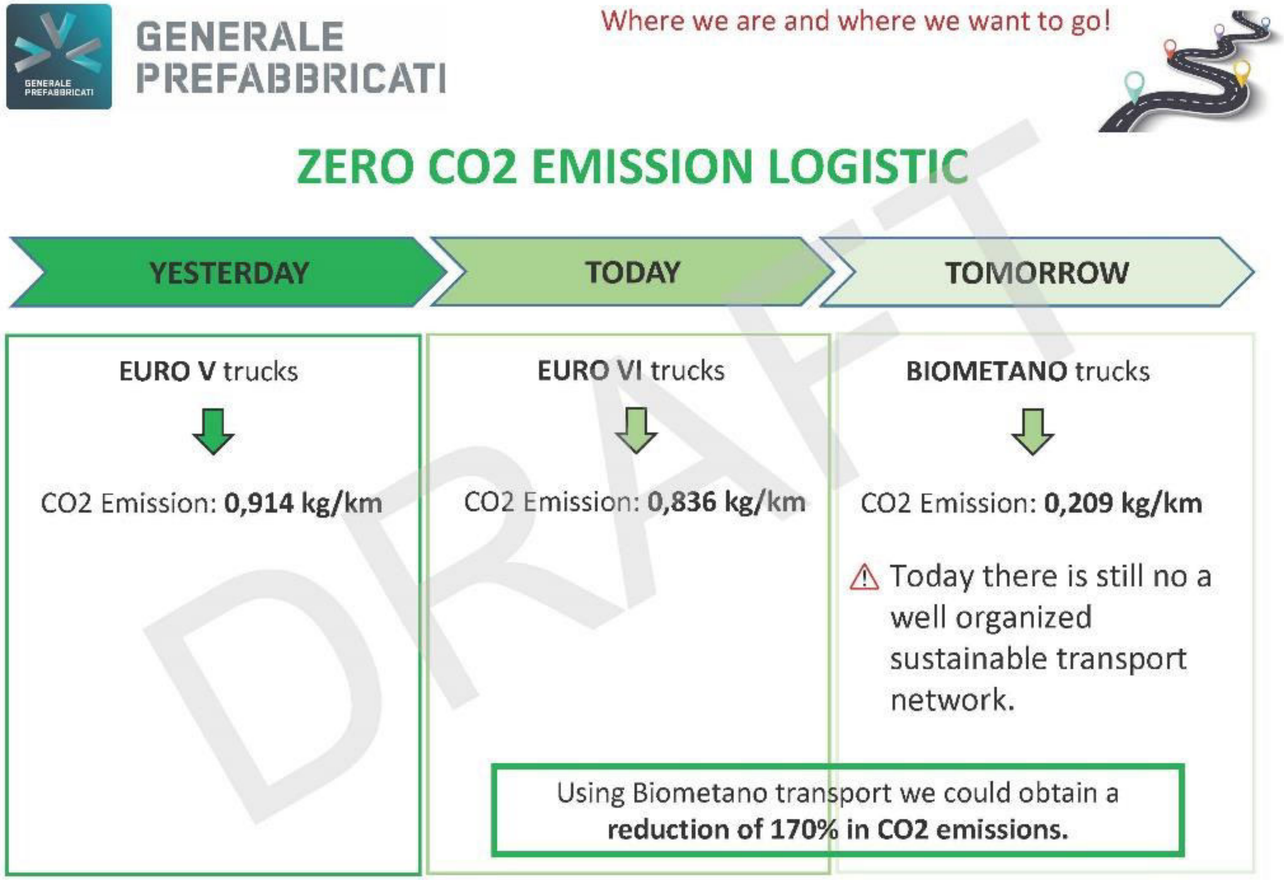
- Precast and steel industry: close to 100% of the steel reinforcement comes from recycled steel manufacturing industry. **EPD Certified steel suppliers**

# Next Steps

- Precast and transport to construction site: a sustainable approach improvement by introducing use of zero CO2 emission new trucks (natural gas fuel alimented/hydrogen).



# Next Steps

- Improving concrete mixes efficiency by introducing new admixtures. Testing phase progressing in close relationship with industry suppliers.

# Next Steps

- Promoting Precast sustainability benefits into LCA of large Infrastructure Works financed by National Recovery and Resilience Plan (NRRP)

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*www.infrastrutturesostenibili.org*

BUT, MOST IMPORTANT ACTION…

**Only by acting at every stage of the value chain, by sharing same vision with all industry actors/figures, by making a joint effort and define proactively THE ROADMAP from 2030 to 2050 NOW, a deep CO2 (measured on building's entire life cycle) cut emission can be achieved!**

INTERNATIONAL PRESTRESSED HOLLOWCORE ASSOCIATION

# Thank you


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