Green Building Council Italia

03 ottobre 2023

Dalla Tassonomia al PNRR: LCA e circolarità negli edifici per la decarbonizzazione dell'ambiente costruito

Paolo Cresci | Arup

Circolarità e decarbonizzazione: la necessità di un approccio integrato

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Circular Economy Policy Trends

Both regulatory and market demands are accelerating the shift to Circular Economy

Market Demand

Proactive market measures coming from Financers, Investors and Asset Managers

- ESG Ratings and new frameworks
- Green Bonds
- Building Certificates (LEED, DGNB, BREEAM, Zero Carbon)
- Voluntary Disclosure (TCFD, GRI)

Regulatory Demand

Interregional and regional policy drivers

- Paris Agreement
- UN Sustainable Development Goals
- Taxonomy
- Climate Actions Plans

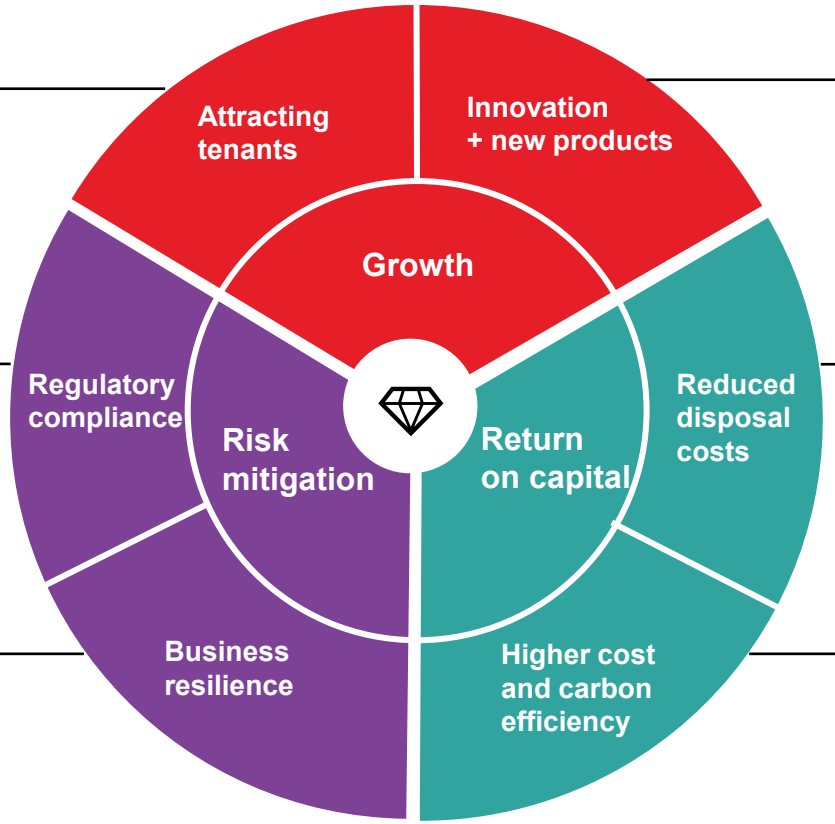
Circularity Outcomes for clients

What motivates clients in the real estate sector to prioritize Circular Economy principles

Clients **prioritize** assets with **reduced carbon** and according to circular economy principles

Mitigating **risks** associated with non-compliance – costs, unable to attract right **quality** of tenant

Clients like Schneider Electric or Edge aim to **decouple their growth** from non-renewable resources



Clients increasingly explore ways to innovate and capture value in a circular economic model

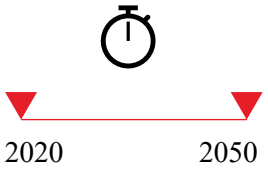
Disposal and demolition costs will become an important economic driver for clients in the RE sector

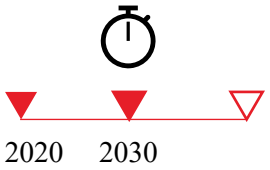
Increasing (embodied) carbon efficiency, increases cost efficiency along the building life cycle

Source: Internal and external interviews with Arup stakeholders, From principles to practices publication

CE more relevant than ever before

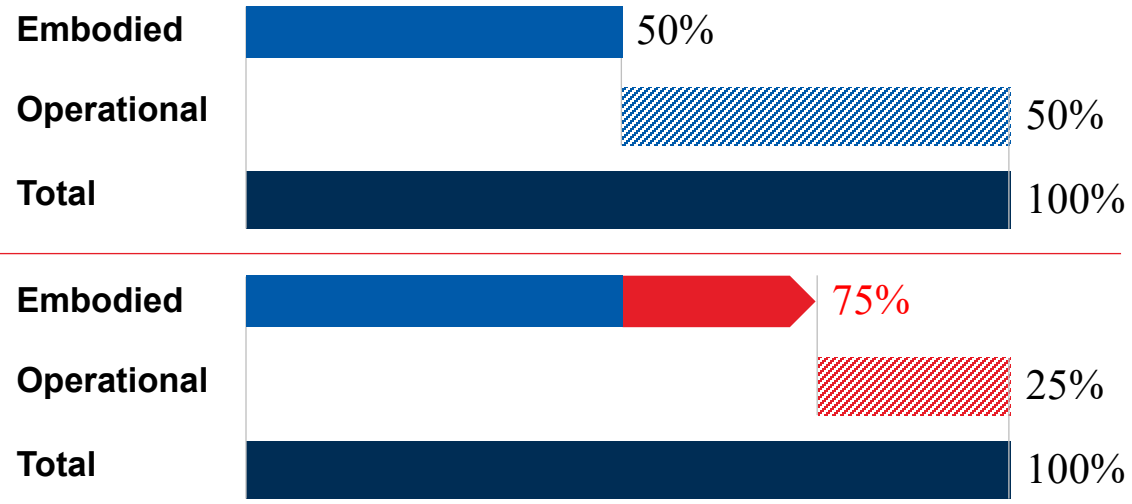
Timeline





New Building Emissions over Whole Lifecycle

Carbon



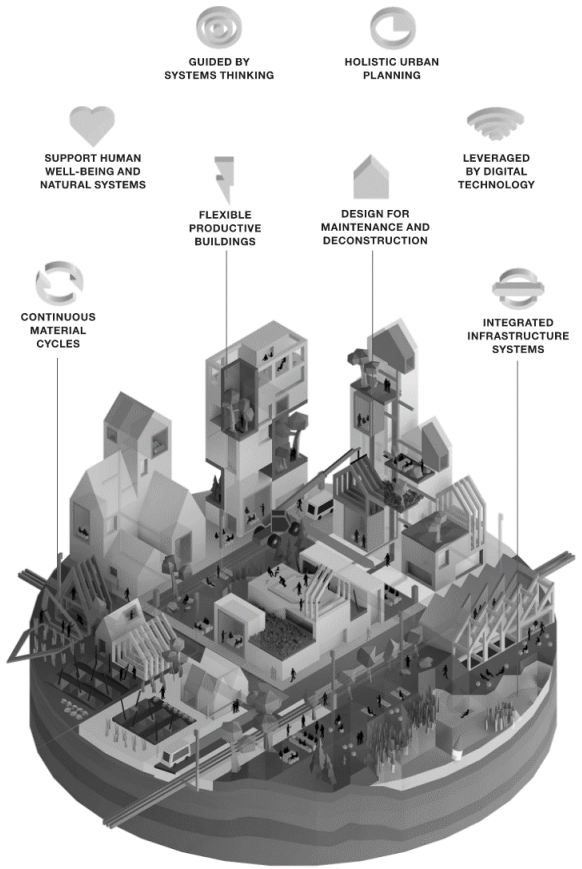
Source: Net Zero Buildings, Where do we stand? Arup, World Building Council for Sustainable Development WBCSD

Why Circular Economy Principles are important

- ✓ Whole lifecycle carbon assessments incorporate both embodied and operational carbon.
- ✓ 50% of the WLC emissions from buildings come from embodied carbon in the next 30 years, 75% in the next 10 years
- ✓ Yet embodied carbon remains routinely overlooked by the built environment sector.

What is a circular building?

Both regulatory and market demands are accelerating the shift to a circular economy



- In a circular economy, healthy low carbon materials are circulating in continuous cycles, eliminating waste and pollution and regenerating natural systems.
- Buildings and materials are easy to dismantle, can be separated by type and are thus fully recyclable, reusable or compostable.
- Circular buildings are flexible enough to meet multiple user needs across the day and week, and adaptable to different typologies across market cycles.
- Circular buildings are designed for deconstruction, achieving high residual value at the end of use cycles.

Source: Arup and the Ellen MacArthur Foundation, *First steps towards a circular built environment,* 2018

Embodied Carbon and Circular Economy

There will be a shifting focus towards embodied carbon in the next decades

Key Strategies to reduce embodied carbon	Key Strategies to reduce embodied carbon	CE Relevance	Added Client Value
Build nothing	Extension and repositioning of existing assets, deconstruct and reconstruct existing fabric		 ✓ Creates history & identity ✓ Reduces embodied carbon ✓ Reduces cost ✓ Reduces programme
Build for long-term use	Façade and structure designed for multiple typologies Passive services provision for multiple typologies anticipate user-adaptation and change		 ✓ De-risks exit strategy
Build efficiently	Choose sufficient grids, adopt off-site and digital fabrication		 ✓ Reduces cost ✓ Reduces embodied carbon
Build with the right materials	Where exposed, choose naturally durable materials, everywhere else, choose bio-based materials, avoid hybrids		 ✓ Healthier internal environments ✓ Creates local jobs ✓ Reduces waste ✓ Reduces embodied carbon

Source: Source - Arup/EMF circular building design toolkit, adapted from PAS2080?

Circular Building Design Strategy

1. Project Brief Definition

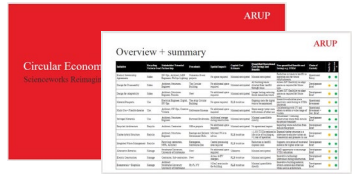
We engage with the client and architect at the pre-concept stage to shape the project brief so that it includes clear circular design requirements.

Key Outcomes and Outputs

- ✓ Reduced regulatory risks
- ✓ Higher cost-efficiency
- ✓ CE project brief
- ✓ …

2. Circular Design Strategy

We engage with the project team to identify specific strategies which are the most suitable for the project and issue a Circular Design Playbook for the project.



Key Outcomes and Outputs

- ✓ Circular Design Playbook
- ✓ Increased asset value retention
- ✓ Asset ready for performance disclosure (incl. WLC)
- ✓ Positioning as a front-runner

CIRCULAR BUILDING DESIGN

4. Asset Management

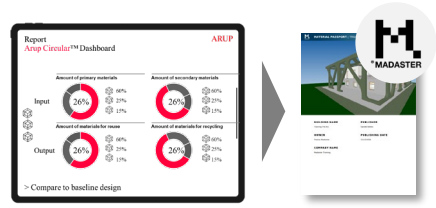
We support our clients throughout the asset operation, optimize ….

Key Outcomes and Outputs

- ✓ Increased asset value retention
- ✓ Asset ready for performance disclosure (incl. WLC)
- ✓ Full digital inventory of building components
- ✓ Material Passport

3. Detailed Design Advisory

Similar to green-building certification consulting, we provide detailed circular design advances throughout the entire project lifecycle.



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ELLEN MACARTHUR FOUNDATION Partner

Global Launch Event

Circular Buildings Toolkit

March 2022

Circular design framework

Circular fit-out in retail stores

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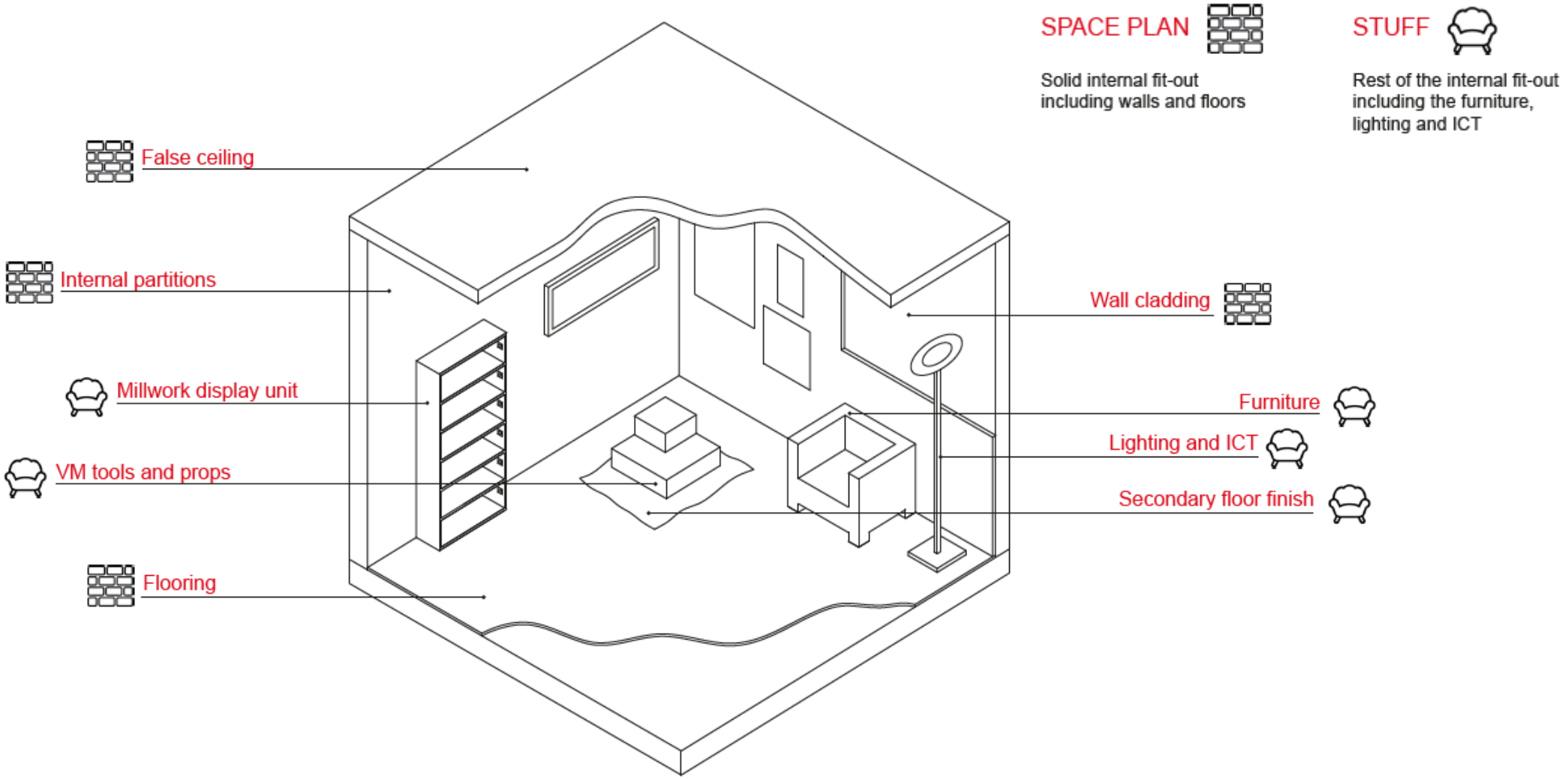
Circular fit-out in retail stores

Store fit-out elements



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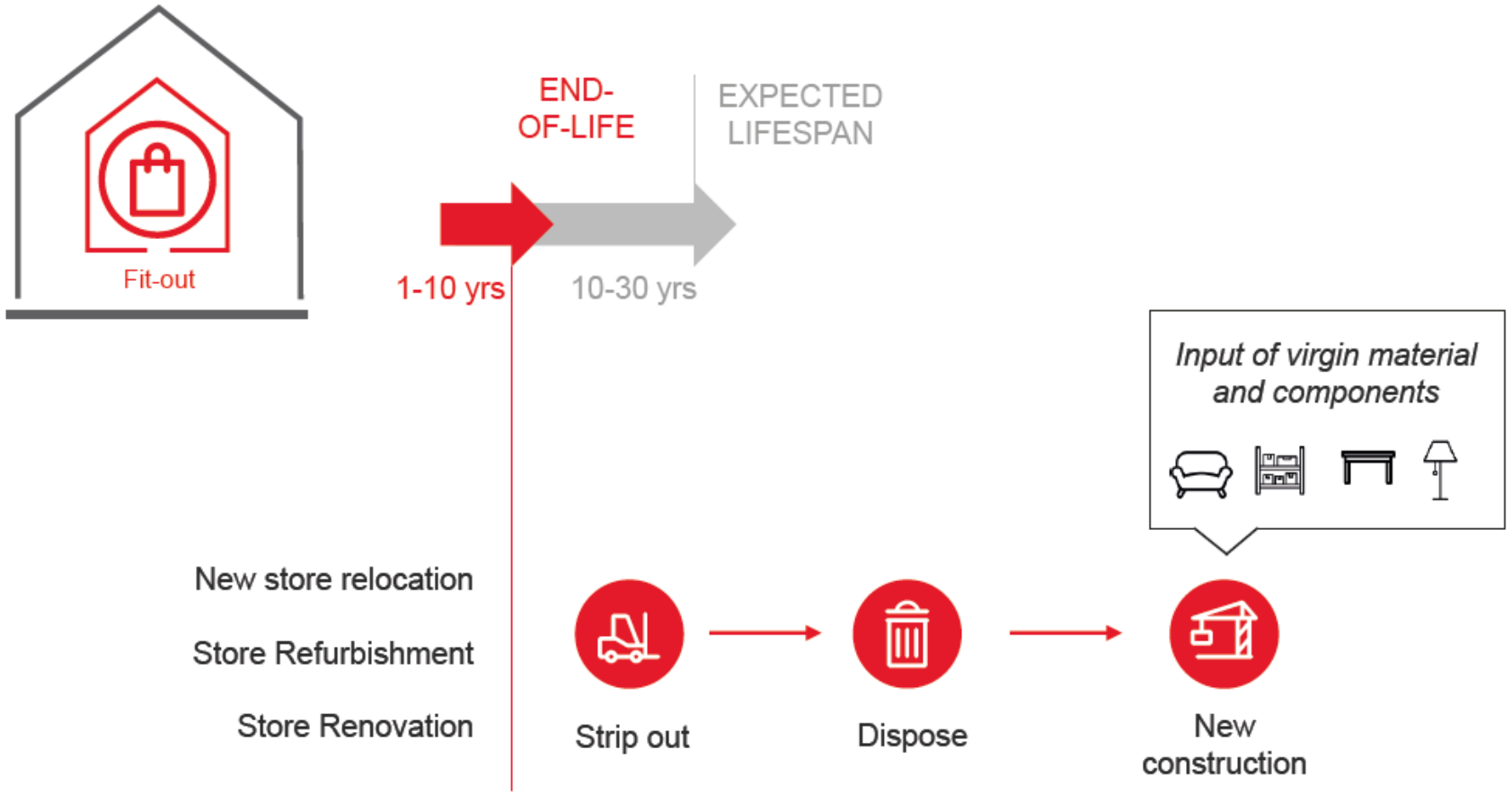
Circular fit-out in retail stores

The challenge



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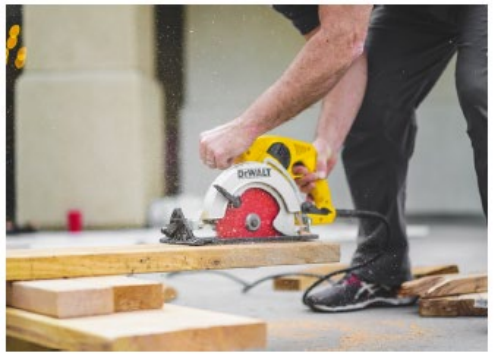
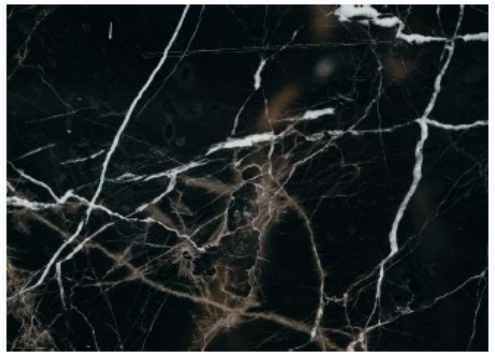
Circular fit-out in retail stores

Sources of lost value



Frequent stores' refurbishment

Retailers tend to dispose store's fit-out well before materials have depleted their intrinsic value, due to the frequency of store refurbishments.

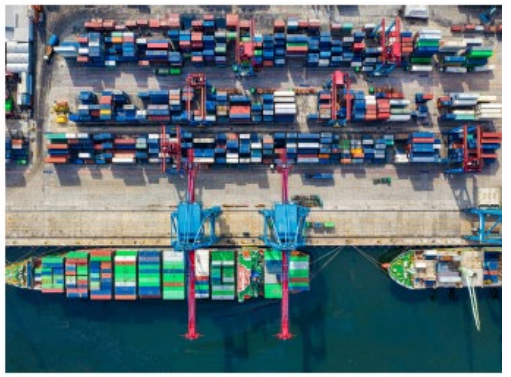


Material selection

Fit-out materials are often more durable than the expected lifespans for which they are designed.

Limited fit-out second life

During store refurbishment, fit-out components are rarely reused or redeployed, becoming waste going to landfill.



Logistics

Retail industry is characterised by frequent and long transportations to procure fit-out elements. They also require robust packaging, resulting in larger amount of materials disposed.

The Circular Building

London Design Festival

2016, UK

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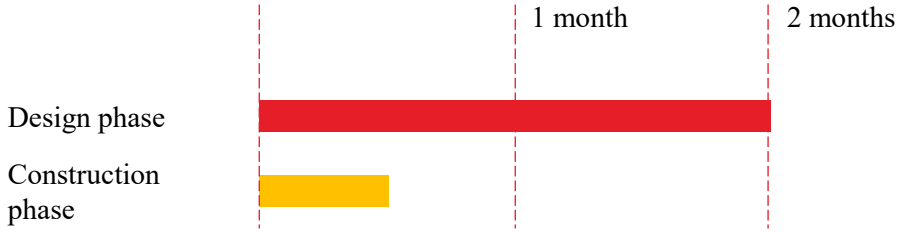
The Circular Building, London, UK

Timeline



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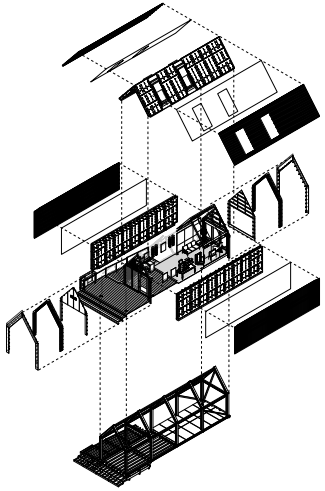
The Circular Building, London, UK

Design for Longevity



Building in layers

Design for reuse through 'building in layers' approach

Material passport

Materials passport enabled by QR codes of materials (size, weight, design specs) to enable maintenance and reuse

Leasing scheme

Leasing scheme for carpets – take back scheme

Durability

Heat treatment to enhance timber durability

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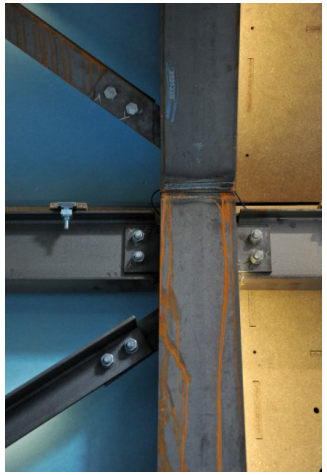
The Circular Building, London, UK

Design for Disassembly

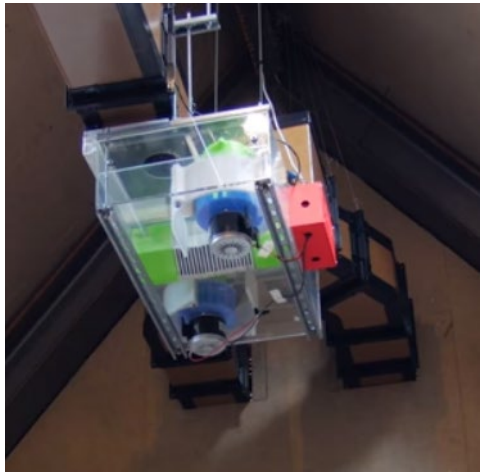
Prefabrication

Structurally integrated wall panels (SIPs), laser cutting through computational process to eliminate waste on-site



Reusable elements

Clamp connections between cladding and frame to avoid holes and enhance reusability



3D printing

3D printed mechanical ventilation system with heat recovery made with recycled PET filament

Assembly instructions

Easiness of construction and deconstruction

Mechanical connections

Mechanically fixed waterproof membrane

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The Circular Building, London, UK

Reduce the use of virgin and non-renewable materials

Cladding and decking

Timber for the cladding and decking

Structure

Recycled steel frame

Insulation

Rockwool insulation + recycled aerogel blanket to reduce thickness of panels

Systems

C2C water-based battery systems non-toxic and recyclable

Circular Design Framework

Fiorentina Stadium

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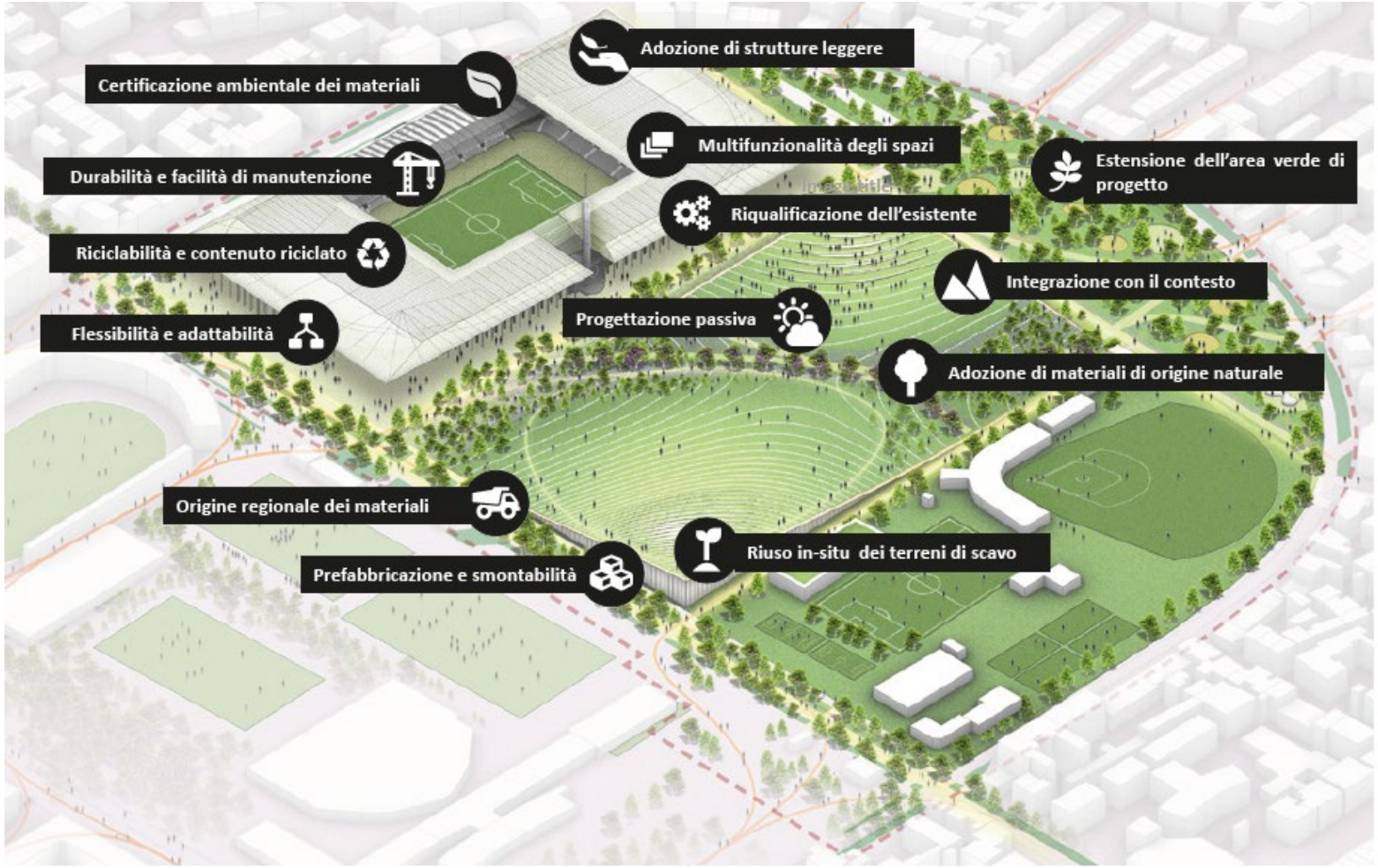
Fiorentina Stadium

A case study application of the Circular Design Framework



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Fiorentina Stadium

A case study application of the Circular Design Framework

Build nothing

1. Refuse unnecessary new construction

Reused floor area
[% of total GFA]

- Building renovation of existing structure and external areas
- Reduction of material and resources use
- Architectural heritage preservation (Pier Luigi Nervi structure)
- Extension of permeable green areas in the masterplan and preservation of existing natural elements

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Fiorentina Stadium

A case study application of the Circular Design Framework

Build for long term value

3. Design for longevity

EU Level(s) Whole Life Cycle Costs [$/m2/yr]

5. Design for disassembly

EU Level(s) Disassembly Potential Rating

- Durability of materials and easiness of maintenance
- Metal roof 100% dismountable fore recycle/reuse
- Kiosks and prefabricated concrete tribunes are modular and reusable
- Dry-assembled internal partitions are disassemblable
- Raised floor at floor level is disassemblable

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Fiorentina Stadium

A case study application of the Circular Design Framework

Build efficiently

6. Refuse unnecessary components

Material use intensity
per functional unit [kg/unit/yr]

7. Increase material efficiency

Material use intensity by area
[kg/sqm /yr]

- Integration with existing context to exploit architectural shapes (e.g. slope in the park)
- Lightweight metal roof and internal partitions to lower the impact on existing structures
- Passive design in the masterplan to exploit buildings' shape for solar shading, daylight and natural ventilation
- Re-use of excavated soil in situ for the morphological arrangements in the park

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Fiorentina Stadium

A case study application of the Circular Design Framework

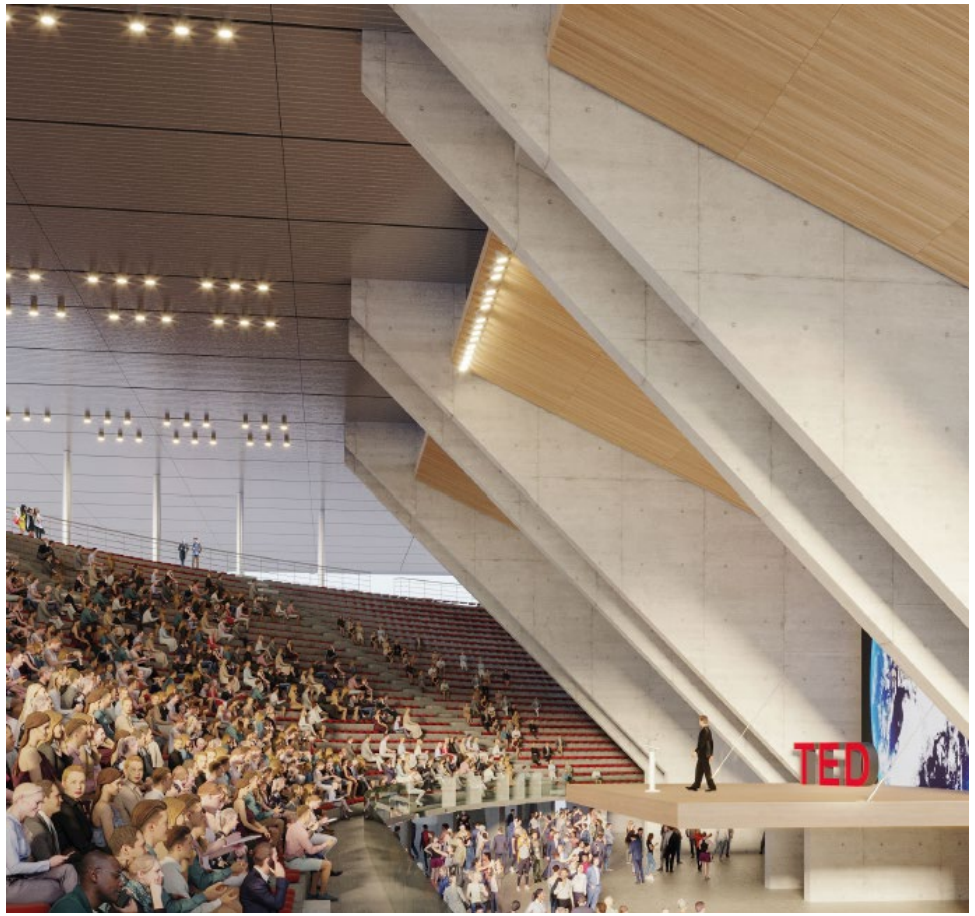
Build with the right materials

8. Reduce the use of virgin materials
EMF's Material Circularity Indicator (MCI)

9. Reduce the use of carbon intensive materials
Embodied Carbon Intensity [kgCO2eq/m2/year]

10. Design out hazardous/ pollutant materials
Environmental Impact Cost [€/m2/year]

- Natural and local materials e.g. prefabricated engineered timber elements
- Environmental product declarations (e.g. EPD, Cradle-to-cradle, PEFC/FSC)
- Recycled content (e.g. concrete reinforcements, tribune seats) and recyclability (e.g. steel structures)



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EU Taxonomy Framework

The requirements enforced during design stage for EUT compliance

What the type of investment required us to do as per national compliance to EU Regulation 241/2021

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Conclusions: how much extra effort?

EU Taxonomy DNSH case study: A. Franchi stadium, Florence, Italy

EUT objectives	Requirements (challenging?)	Application	Supporting documentation	responsibilities	Associated costs
Climate change mitigation	easy	easy	no	design team	no
Climate change adaptation	demanding	medium	yes	design team	yes
Transition to circular economy	medium	easy	yes	design team GC	yes
Water resource management	easy	easy	yes	design team GC	yes
Pollution prevention control	medium	medium	yes	design team GC	yes
Biodiversity and ecosystems	easy	easy	medium	design team GC	yes

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Grazie.

paolo.cresci@arup.com

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