Module 4

Circular Economy & Construction

Circular Economy in Construction

24 partners

12 countries

Date of Event

*Author/ **Institute***

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Circular Economy & Construction | Summary

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To equip the learner with the relevant knowledge required to understand how the transition to a circular economy will affect the construction industry

Circular Economy & Construction | Objectives

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1. Outline how the move to a circular economy will change the ecosystem and value chain around the **design, construction, operation, renewal and repurposing of buildings.**
2. Introduce a range of specific actions and targets to achieve a transition to **circular economy**
3. Introduce the circular impacts of the 2030 Agenda and the steps for **Sustainable Development Goals** (SDGs) relevant to the built environment.
4. Identify and outline possible **circular solutions** in terms of sustainable, green, energy, water and waste management using case studies
5. Outline the importance and impact of "**design-led" circular economy interventions** across the built environment value chain including SDGs.
6. Explain the principles of the **green building certification** schemes in relation to the construction supply chain and circular economy

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Topic 1 – Circular Interventions

Topic 2 – Green Certification Schemes

Topic 3 –Sustainable Development Goals

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1. Circular Interventions

The big shift

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- **The construction sector consumes 42 billion tonnes of resources annually, making it the most material-intensive sector**.
- The construction sector also produces about **one-third of all global waste**, most of which is not recycled or reused, but ends up in landfills.
- This is a known problem faced by actors across the industry value chain.

Image source: Waste today

Changing one of the largest industries in the world is no easy feat, but change is already happening.

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Transition to circular construction

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- Europe's construction sector will need to be more ambitious in its **waste management practices** if it is to fully embrace circular economy.

- Circular approaches are key to increasing the quality and quantity of recycling and reuse of construction and demolition materials.

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Principles of circular economy

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For a circular economy there are 3 principles of action applicable to the building sector:

1. **“Avoiding the generation of waste and pollution by design”.**

2. **“Keep products and materials in use for as long as possible”.**

3. **“Regenerate natural capital”**

CE in the Construction Sector

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There are **4 life cycle stages** in a construction project.
The four stages are:

1. Product Stage
2. Construction Stage
3. Use Stage
4. End-of-Life Stage

Each stage affects the environment differently, and depend on the factors such as:

- the characteristics of the surroundings,
- the **materials and construction techniques used**,
- the energy and water consumed,
- the waste generated, etc.

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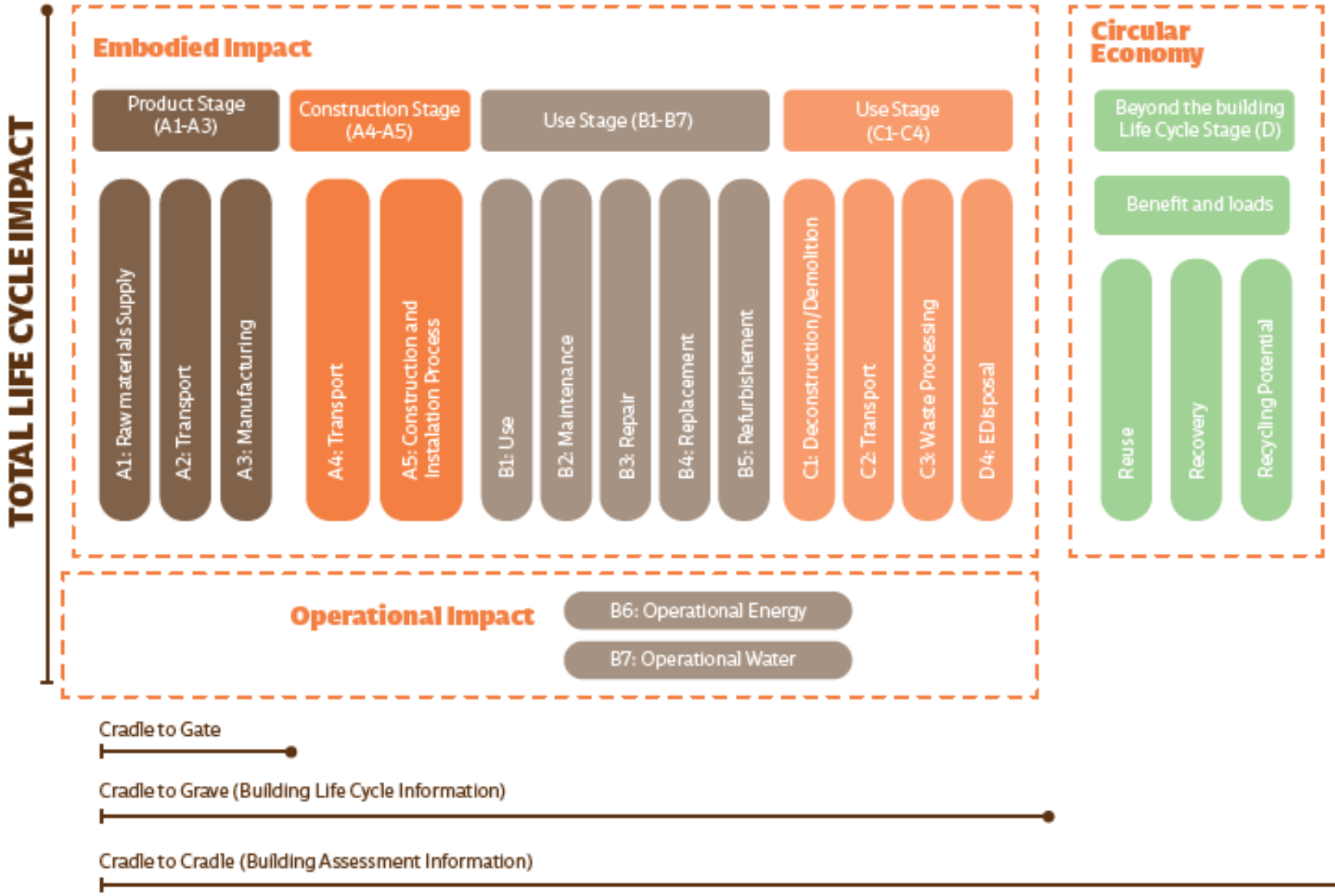

Source: Green Growth Project

Production Stage

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In the **production stage,** raw materials are extracted, transported and processed into building materials. This stage generates significant negative environmental impacts.
Many minerals and rocks are extracted in open-pit quarries and gravel pits, which implies, the elimination of vegetation, the loss of the organic matter layer of the soil and its exposure to erosion.

For example, traditional cement manufacturing generates approximately 8% of the world's CO_2 emissions. 60% of these emissions are due to chemical reactions during the process.

Cement factory

Source: Green Growth Project

Construction Stage

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In the **construction stage** the building takes shape and many agents are involved (public authorities, architects, **builders**, etc,.).

- This stage includes the transportation of materials to the site, the construction and installation process, and includes the environmental impact caused by the construction of the building on site:
  - **consumption of a large amount of materials**
  - **water and energy,**
  - **production of waste from discarded materials, packaging**, etc,.

Image source: Google images

Source: Green Growth Project

Use Stage

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The **use and maintenance stage** of the building is the longest-lived stage. It includes building use, maintenance, repair and renovation. It is associated with:

- consumption of water
- operational energy
- emission of pollutant gases as a consequence of the consumption of energy (from fossil fuels).

The **construction of energy efficient green buildings and the integration of local renewable energy systems**, significantly reduces the consumption of non-renewable energy. This is the case for **near-zero energy buildings (NZEB) (or net-zero energy buildings).**

At this stage**, circular strategies such as repair, repurpose and refurbishment extend the life of the building.**

Image source: Google images

Source: Green Growth Project

End-of-life Stage

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The **end-of-life stage** in a linear economy is **the demolition process, where materials become waste**. The possibility of reinsertion into the value chain of materials at the end of their useful life depends on:

- the type of materials and construction systems chosen in the design phase, and
- the **way in which demolition and waste management are carried out**.

In this phase, the environmental impact is related to the burning of fossil fuels from machinery and transport, as well as emissions related to landfill disposal.

Image source: Google images

Source: Green Growth Project

Impact

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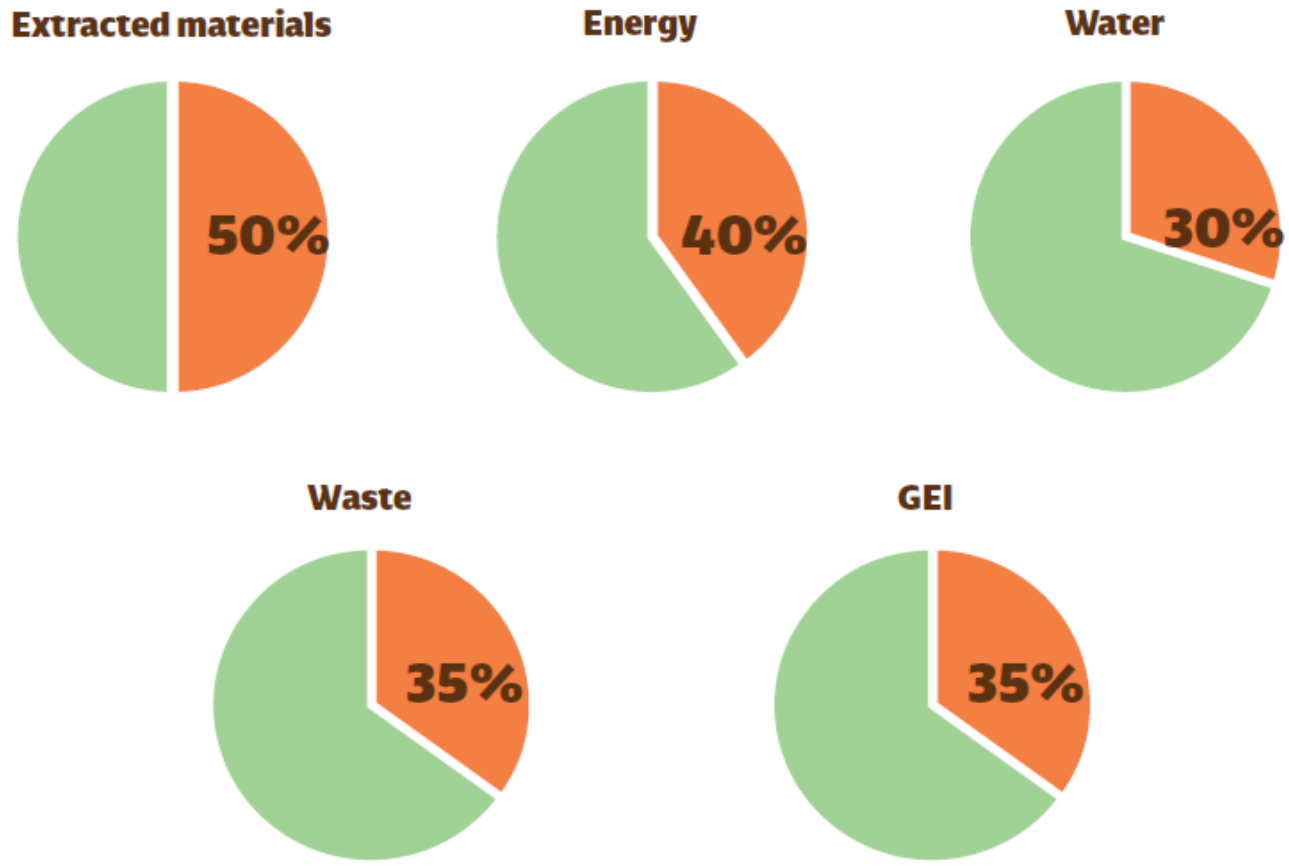
In Europe, in recent years, the data on the impact of the construction sector is as follows:



Impacts of the construction sector in Europe. Data source: Eurostat 2016 data. Green Building Council Spain. 2021.

Report on circular economy in building in Spain[TS2]

Source: Green Growth Project

Tools to measure circularity in construction

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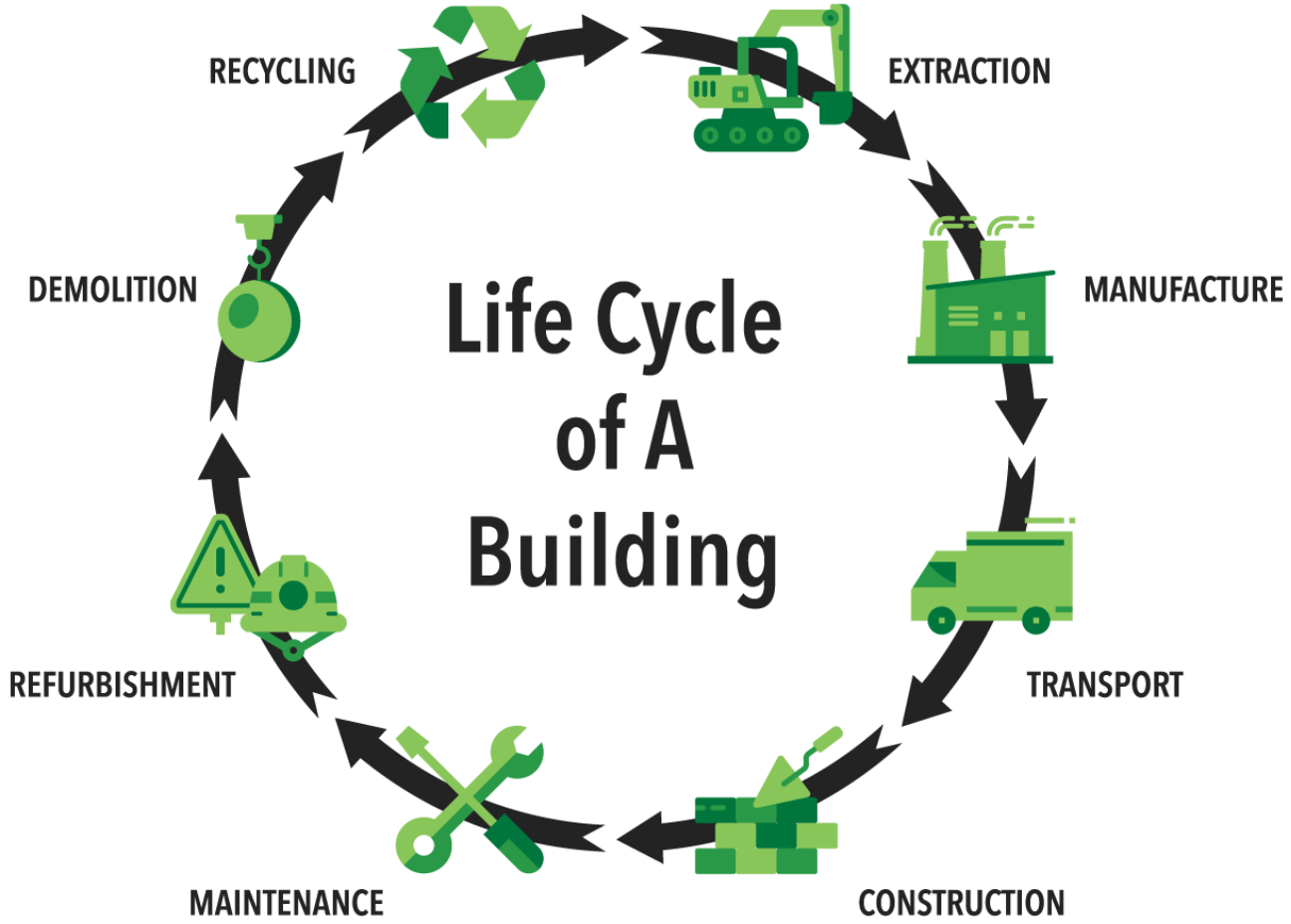
"What cannot be *measured, cannot be improved*".

Therefore, a series of tools have been designed to measure and compare in a verifiable way **the environmental performance buildings and materials,** and to **monitor the circular economy in the construction sector**.

Life Cycle Assessment (LCA) is a methodology that calculates the potential environmental impacts of any type of product or building throughout its entire life cycle, or parts of it.



Source: Green Growth Project

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Tools to measure circularity in construction

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- **Environmental Product Declarations (EPD)** are standardized documents that contain information on the environmental impact indicators of a product based on its LCA.
- The EPD information allows comparing the environmental performance of materials, products and services, such as maintenance. Its objective is to encourage demand for products and services that have a lower impact on the environment
- When a material or product, e.g. a window, has an EPD, it means that data on its environmental impacts can be compared with those of other similar products, i.e. other windows.

EPD

Environmental Product Declaration

European Standard EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

Tools to measure circularity in construction- EPD example

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EPD Hub

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

Louna, Carbon Neutral Wooden Design Door with Glass Opening
Kaskipuu Oy

EPD HUB, HUB-0041
Publishing date 23 May 2022, last updated date 23 May 2022, valid until 23 May 2027

One Click LCA Created with One Click LCA

EPD Hub

kaski

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Kaskipuu Oy
Address	Ovitie 1, 91300 Ylikiiminki
Contact details	myynti@kaski.fi
Website	https://kaski.fi/

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR version 1.0, 1 Feb 2022 EN 17213 Windows and doors
Sector	Manufactured product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4 and D
EPD author	Jori Jokela, Macon Oy
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ External verification
EPD verifier	S.V, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	Louna, Carbon Neutral Wooden Design Door with Glass Opening
Place of production	Ylikiiminki, Oulu
Period for data	2020
Averaging in EPD	No averaging

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 m2
Declared unit mass	40.28 kg
GWP-fossil, A1-A3 (kgCO2e)	38,1
GWP-total, A1-A3 (kgCO2e)	-30,1
Secondary material, inputs (%)	5,13
Secondary material, outputs (%)	100
Total energy use, A1-A3 (kWh)	255
Total water use, A1-A3 (m3e)	3,19

Source: EPD Hub

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2. Green Certification Schemes

Building Certification Schemes

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- The demand for EPDs in the market is increasing. For example, EPDs are required in the assessment criteria of building materials and products in the **building certification schemes** such as BREAM, LEED, GREEN etc.

- **Green building certification systems** are a set of rating systems and tools that are used to assess a building or a construction project's performance from a sustainable and environmental perspective.

- They give 3rd party verification of a process to ensure better quality sustainable buildings

- A certified building should integrate a **life cycle approach** in its design and construction, and satisfy the **UN Sustainable Development Goals** for the construction industry

- Buildings that have been assessed and are deemed to meet a certain level of performance and quality, receive a green certification

US EPA Kansas City Science & Technology Center. LEED Gold certified building

Image source: Wikipedia.org

Green Building Certifications

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3. Sustainable Development Goals

Construction and the SDGs

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- The construction industry has a strong and important role to play in reducing climate change, pollution and the use of natural, limited resources.
- The good news is: **just as we are part of the problem, we are also part of the solution.**

- On the following slides you will learn about the UN Sustainable Development Goals, what they are and how the construction industry can contribute to achieving these goals, making the world a better place!

Sustainable Development Goals (SDGs)

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- In September 2015, UN Member States adopted the **2030 Agenda for Sustainable Development ("Transforming our World").**

- The focus of the 2030 Agenda are the 17 Sustainable Development Goals (SDGs) set out as a "**universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity**".

- The SDGs address the key global challenges such as climate change, human health and wellbeing, inequality and justice, visioning and aiming for a better, more sustainable world for all.

Construction and the Sustainable development goals

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The following SDGs have relevance to the construction sector with 3 specific goals (SDG 6, 7 and 11), having a direct influence on 80% of the construction targets. Using circular and efficient solutions can help the construction industry to reach these goals.
Let's give them a closer look!

While these SDGs all have a different focus, the success of each goal is dependent on the successful completion of the rest.

Construction and the Sustainable development goals

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SDG 6: Clean Water and Sanitation

Globally, one in three people do not have access to safe drinking water, while two in five do not have a basic hand-washing facility. Water is scarce in many parts of the world, and in many areas, we see increasing desertification caused by climate change.

- Waste-water reclaim technologies can reduce our dependence on fresh water on a large scale
  - New construction projects must include waste-water reclamation systems like **greywater recycling or dual piping** to ensure that water from the residential and industrial buildings is recycled and reused for flushing, industrial processes and irrigation.
  - Many new projects also introduce **rainwater harvesting systems** to further reduce the general building water wastage.

Construction and the Sustainable development goals

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SDG 7: Affordable And Clean Energy

According to the UN, 13% of the world population still lacks access to modern electricity. Construction professionals play a great role in bringing reliable and affordable energy to people around the world. By

- by **decreasing energy consumption in newly built facilities**
- **increasing the share of renewable, clean energy sources in global energy sources**

Construction and the Sustainable Development Goals

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SDG 9: Industry, Innovation, Infrastructure

Play a key role in introducing and promoting new technologies, facilitating international trade and enabling the efficient use of resources.
SMEs consume 30% of global industry energy and have a higher potential of energy savings through cogeneration systems and improving process energy efficiency.
Introduce more sustainable construction materials and better new green solutions

- **On-roof solar PV panel installation, efficient lighting system design, reclaiming waste heat for cooling through absorption chillers, preheating water to boilers through heat reclaim from flue gases are some examples of energy conservation techniques**

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Construction and the Sustainable development goals

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SDG 11: Sustainable Cities and Communities

It is estimated that by 2030 **60%** of the world population will be living in cities. Cities are a source for great economic growth, but unfortunately, they also account for almost **70%** of all carbon emissions.

- **green, healthy buildings**, which introduce the solutions connected to energy and water efficiency, are key to making cities sustainable.
- The elements of a healthy building include good air quality achieved with **proper ventilation and filtration systems**, **sustainable thermal control**, making the most use of natural lighting and providing **high-quality artificial lightning,** ergonomic interior design and access to nature.
- Also measures such as flood protection to tackle extreme weather conditions are key to sustainable cities.

Construction and the Sustainable Development Goals

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SDG 12: Responsible production and consumption

Should the global population reach 9.6 billion by 2050, the equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles.
Focus is on sustainable consumption and production patterns **– doing better with less and wasting less.** As with water, the learning is **"reduce, reuse, recycle".**

- **reduce the amount of waste from construction by either improving materials management or ensuring recycling**
- **Design and install efficient use of natural resources.**

Construction and the Sustainable Development Goals

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SDG 13: Climate Action

Climate change is affecting every country on every continent. Weather patterns are changing, sea levels are rising, and weather events are becoming more extreme.
The most prominent facet of the sustainability agenda is to slow climate change, and this is the focus of SDG 13.
Turning to renewable, emission-free energy sources, water-saving technologies and sustainable buildings and cities. Reduce carbon emissions of the construction process.

- **Use of renewables in building design, energy efficient techniques and cutting-edge engineering and design can help slow down the climate change.**
- **Part of this involves ensuring that scarce resources are not squandered and the environment is not polluted.**

Construction Industry need to speak out, spreading awareness to the public and promoting sustainable policies and actions within the industry.

Construction and the Sustainable Development Goals

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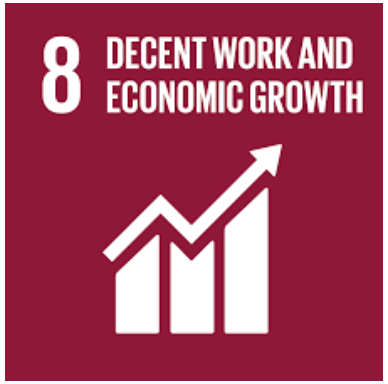
Other Relevant Goals linked to the construction industry…

SDG 3 : Good Health and Wellbeing

Ensuring healthy lives and promoting well-being is essential to sustainable development.



SDG 8 : Decent Work and Economic Growth

need for construction projects means that the construction sector will continue to create jobs also in the least developed areas

Assessment

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