Comfort & Energy in Construction Webinar Series

- **Every Wednesday and Thursday**
- **First Webinar: August 10th**
- **Final Webinar: September 22nd**

This project has received funding from the European Union's Horizon 2020

TUS
Technological University of the Shannon: Midlands Midwest
Ollscoil Teicneolaíochta na Sionainne: Lár Tíre Iarthar Láir



Agenda

- Circular Economy
- Construction Waste
- Examples of Irish Products
- Future Trends



Circular Economy & Waste

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What is A Circular Economy?

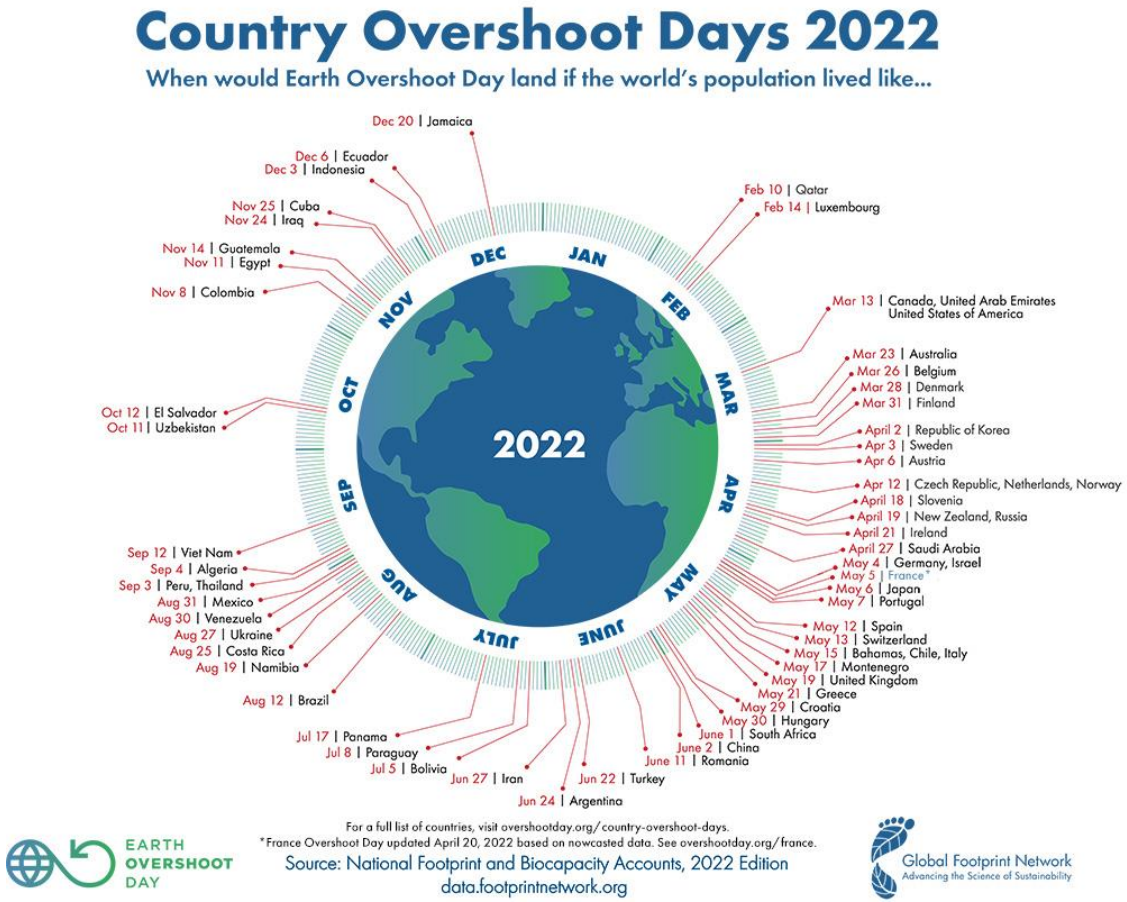
What does it mean for the construction sector?

Currently, the Earth's annual demand for resources due to anthropogenic activities exceeds its regenerative capacity. In 2019, humanity consumed an amount of natural resources equivalent to 1.6 Planets.

Earth Overshoot Day marks the date when humanity has used all the biological resources that Earth regenerates during the entire year.

This year, Earth Overshoot Day fell on July 28

In Ireland April 21st



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Circular Economy & Waste

The linear model is reaching the limit of its capacity and has resulted in significant negative environmental impacts that compromise the habitability of the earth for future generations.

Linear Economy

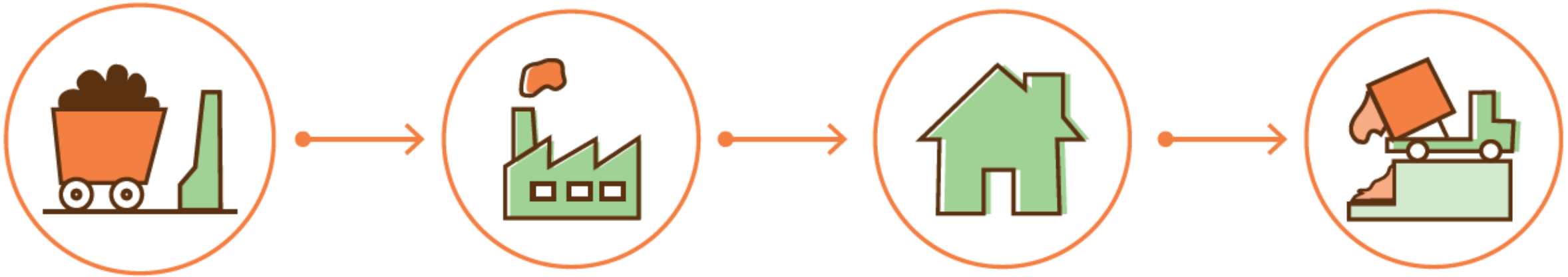
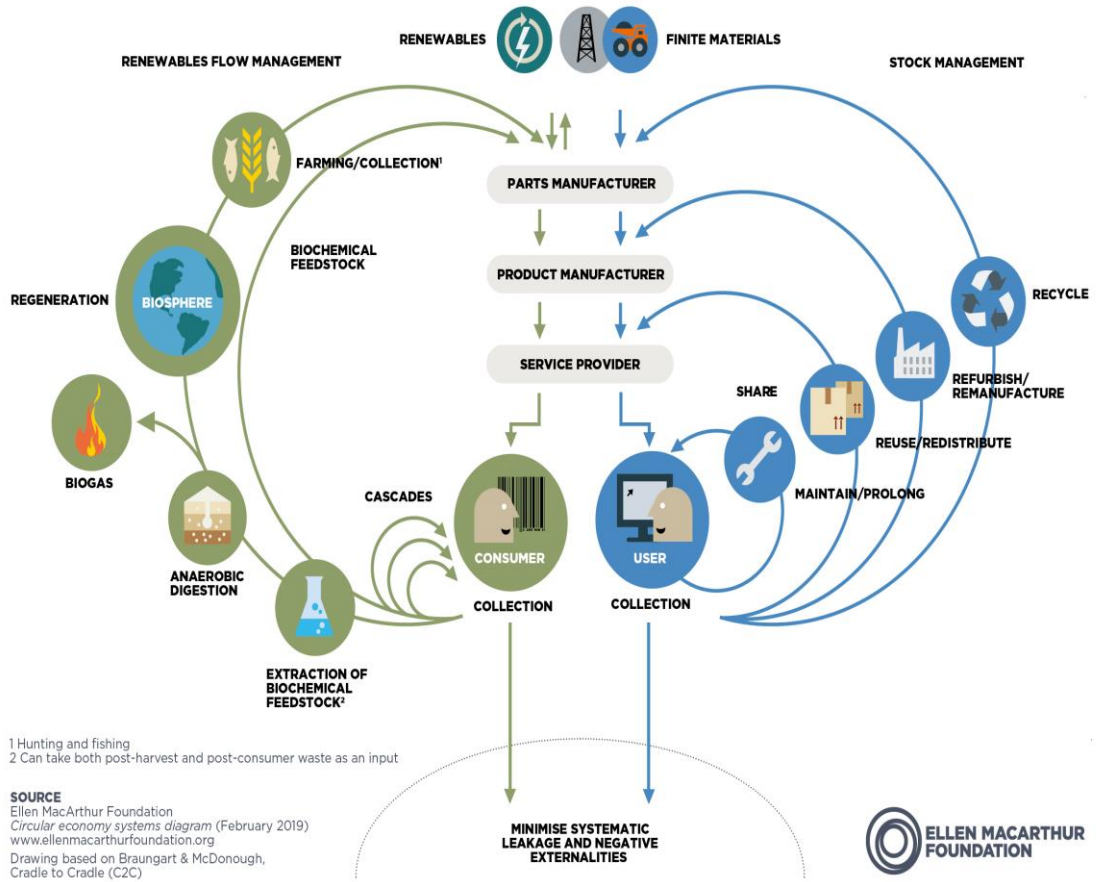


Diagram of linear economy. Source: GBCE. Circular economy in building.2021

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Circular Economy



Circularity gives us the tools to transform our linear economy into one where waste and pollution are eliminated, products and materials are reused, and nature is regenerated. If we integrate circular strategies into our economies, we will ultimately require fewer materials and emissions to live.

- USE LESS
- USE LONGER
- MAKE CLEAN
- USE AGAIN

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- The circular economy, as a new model of production and consumption, emerged as a **more sustainable alternative to the linear economy**.
- The objective of the circular economy is to achieve more efficient and resilient production and consumption systems, that **minimize the use of natural resources and preserve the ones they use within continuous cycles, maintaining or improving their value.**

The Circular Economy requires a new approach in the following areas:

- the design of products and services
- management and market models
- how to convert waste into resources
- national regulations
- the commitment of citizens to change their consumption habits

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9 Rs of Circular Economy

Refuse, Rethink and Reduce (R0 – R2

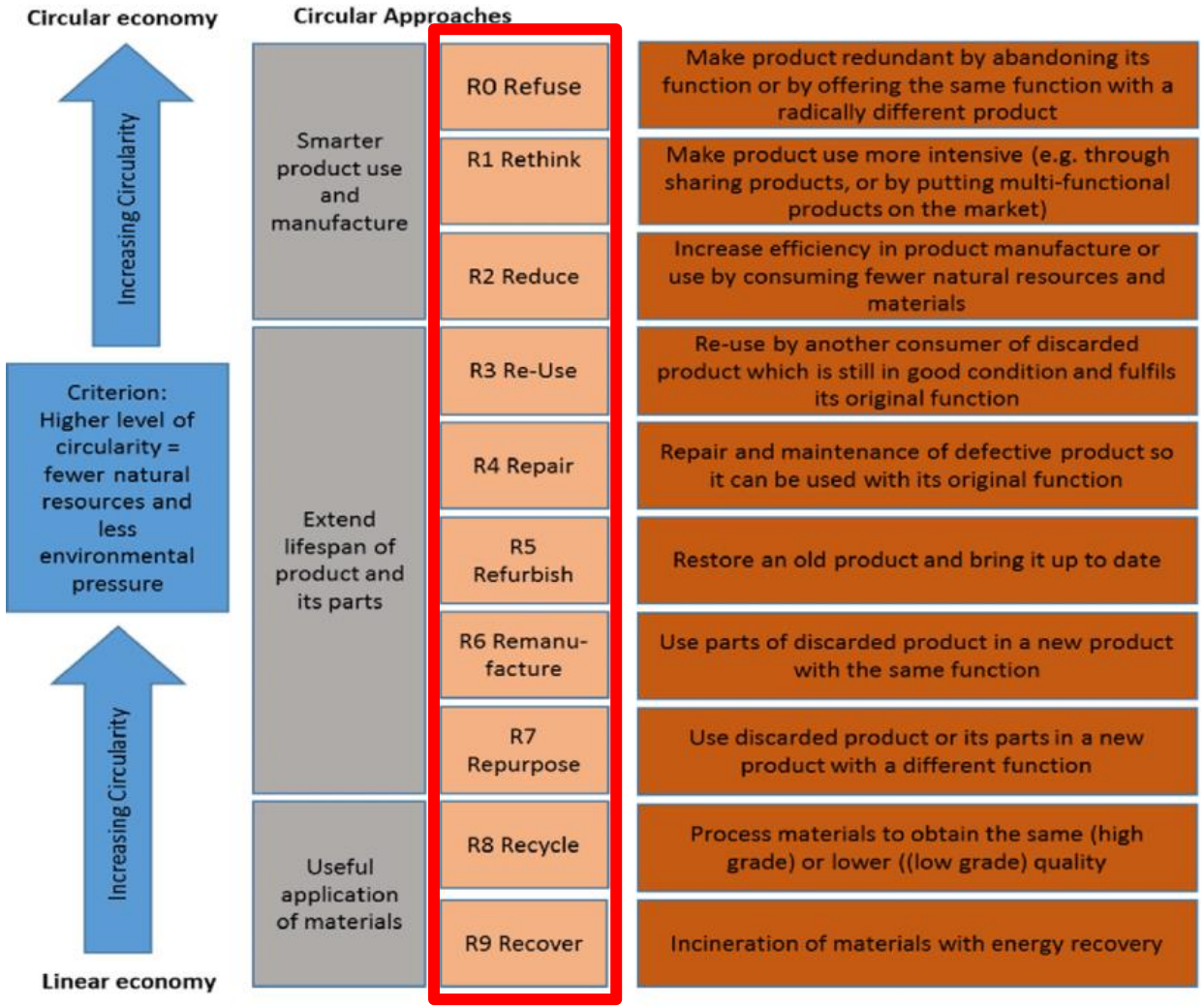
- Eliminating waste at the design stage. E.g. designing for disassembly.

Reuse, Repair, Refurbish, Remanufacture, and Repurpose (R3 – R7)

- Extending the lifespan of materials in a building. E.g reuse of windows

Recycle and Recovery (R8 – R9)

- applied to building products labelled ‘waste’ by the industry, requiring technical equipment and energy inputs to create a new value. E.g. recycling concrete by crushing it into rubble for road base.



The 9R Framework of Circular Approaches with the production chain in order of priority. Source: Adapted from Potting et al., (2017, p. 5) [64].

Circular Economy & Waste

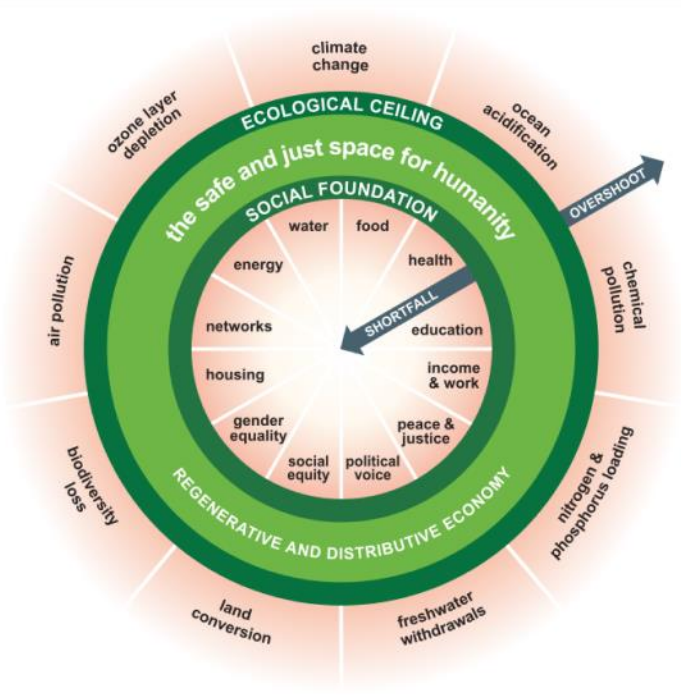
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Why? Circular Economy in the building industry

- as an alternative to a linear economy. Recent data about climate change and resource scarcity now point to a circular model as the only plausible approach.

- The construction industry has historically followed an approach of extracting raw materials, processing them, using them and then disposing them at the end of a building's lifetime.

- Since the introduction of landfill taxes, contractors have been encouraged to find alternative routes for demolition and construction waste. As the alternatives have mostly involved recycling, "waste" has begun to be seen as resource!



https://doughnuteconomics.org/about-doughnut-economics

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For a circular economy there are 3 principles of action which apply to the building sector

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



To achieve this, it is necessary to **reduce** the amount of raw materials, water and energy needed to meet the needs required at any given time, and prioritize the use of renewable energy and secondary raw materials



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

To achieve this, efficient management of the resources that are used is essential. The aim is to keep material resources in use for as long as possible and to recirculate them in the value chain as many times as possible through **reuse and recycling** ... Energy recovery should always be the last option and landfill is not envisaged in the framework of Circular Economy.



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3. Regenerate natural capital

This principle is essential to guarantee the supply of natural goods and services on which human survival and well-being depends.
The circular economy is regenerative, and is inspired by natural cycles, where everything that is born and grows returns to its point of origin, the earth, and is born again, forming a constant dynamic balance**. In nature there is no "waste", all elements have a function, and are reused and transformed to be used in different stages.**

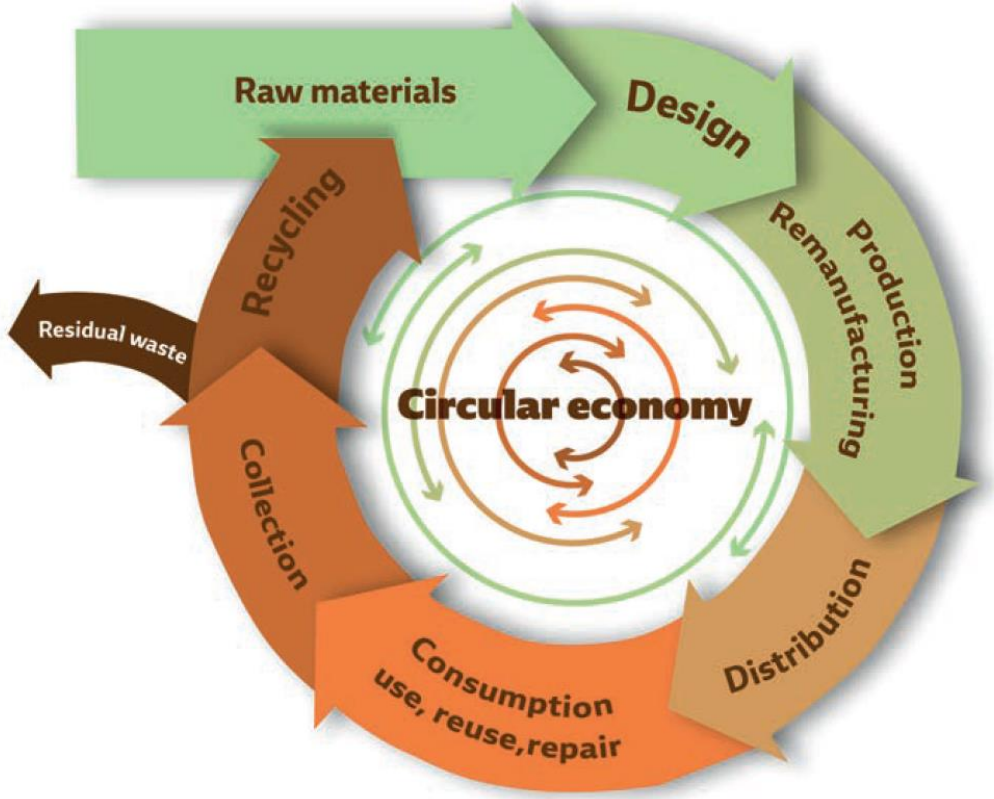


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- Not only does Circular Economy provide environmental benefits, it also **boosts competitiveness and employment generation**, with the creation of new business opportunities and innovation in products and services.

- key to achieving circularity is implementing digitalization and new technologies



Circular economy scheme. Source: Adapted from European Commission. COM (2014) 398 final

Image source: eumonitor.eu

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Impacts

- Raw material extraction and material processing is responsible for 90% of biodiversity loss and water stress.

  Need to make sustainable products, services and business models the norm and transform consumption patterns so that no waste is produced in the first place.

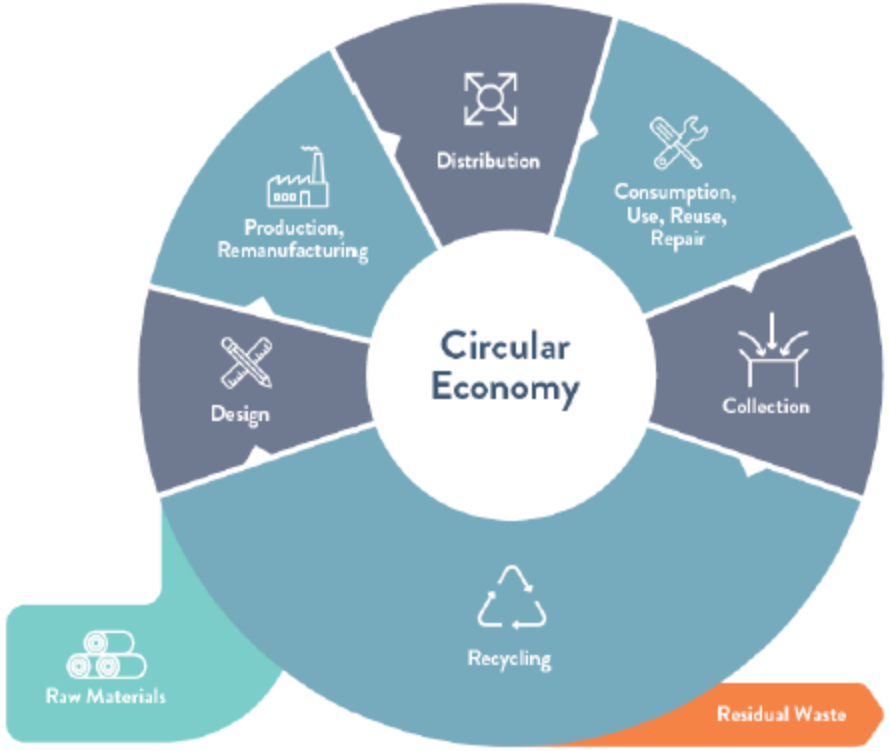


Image source: eumonitor.eu

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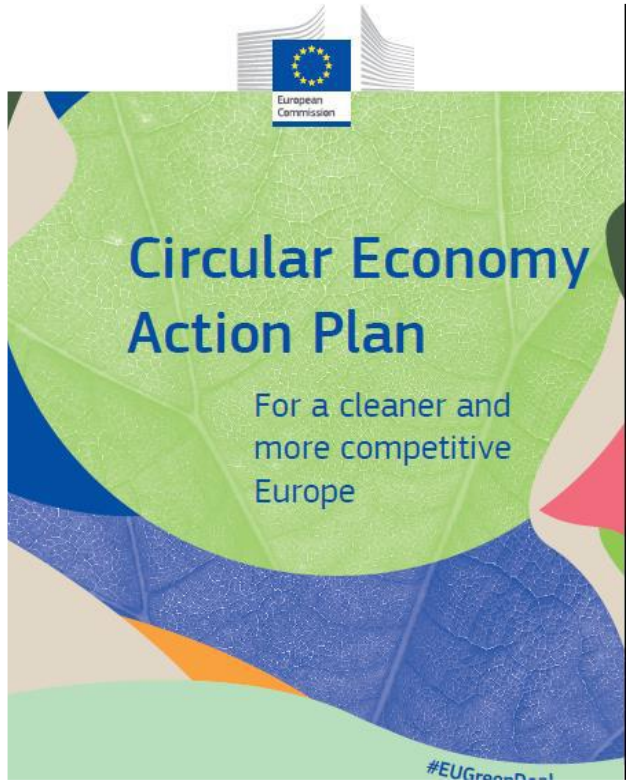
Circular Economy Policy

European, and National Policy

EU Green Deal

The Green Deal is a roadmap for achieving a sustainable, carbon-neutral, competitive and resource-efficient economy. Its objectives are:

- reduce net **greenhouse gas emissions to zero** by 2050
- Disconnecting idea of economic growth from resource consumption by **promoting the circular economy**
- improve the **quality of life** of all
- restore **biodiversity and reduce pollution**.



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EU Green Deal- Action Plan for the Circular Economy

An initiative of the Green Deal Aims to modernise the European economy through a **green and digital transformation**

The Plan proposes measures to achieve:

1. That the products marketed in the European Union are **sustainable**
2. That consumers receive information on the **durability** and repairability of the products they purchase
3. **Avoiding the production of waste**, and converting the waste produced into secondary raw materials.

Image source: eumonitor.eu

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Circular Economy in Ireland

On the measure of circularity, **Ireland currently lags behind** its EU peers.

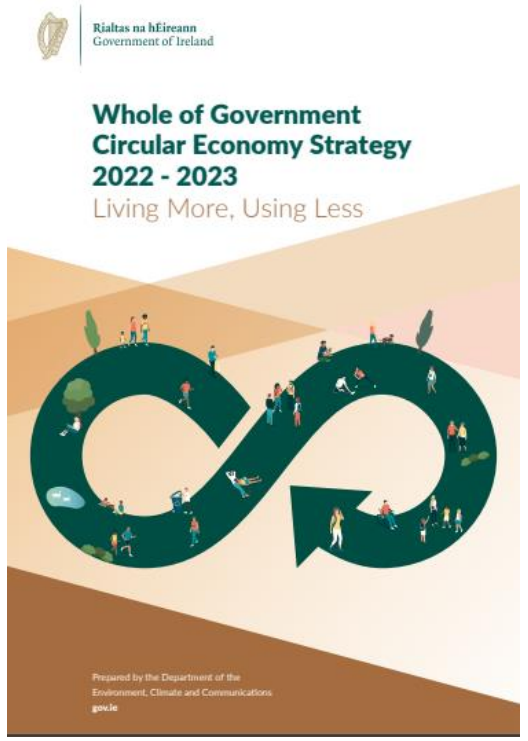
- In 2019, Ireland's circular material use rate (material recovered and fed back into the economy -saving extraction of primary raw materials) was the second worst in the EU according to Eurostat figures.
- Ireland's rate was **1.6%, compared to an EU average of 11.9%.** The best performing EU Member State, the Netherlands, achieved a rate of 28.5%.
- Countries which have been most successful in moving towards circularity appear to benefit from having **overarching national circular economy policies**



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Ireland: Circular Economy and Miscellaneous Provisions Act 2022

- Shifts Ireland away from a "take-make-waste" economy
- Incentivises the use of recycled and reusable alternatives to wasteful, single-use disposable packaging
- Moves Ireland closer to being among the first in the world to eliminate disposable drinks cups
- Tackles illegal fly-tipping and littering
- Signed into Law in July 2022



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Circular Economy Current Trends

Current Products, C&D Waste figures

- **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.





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

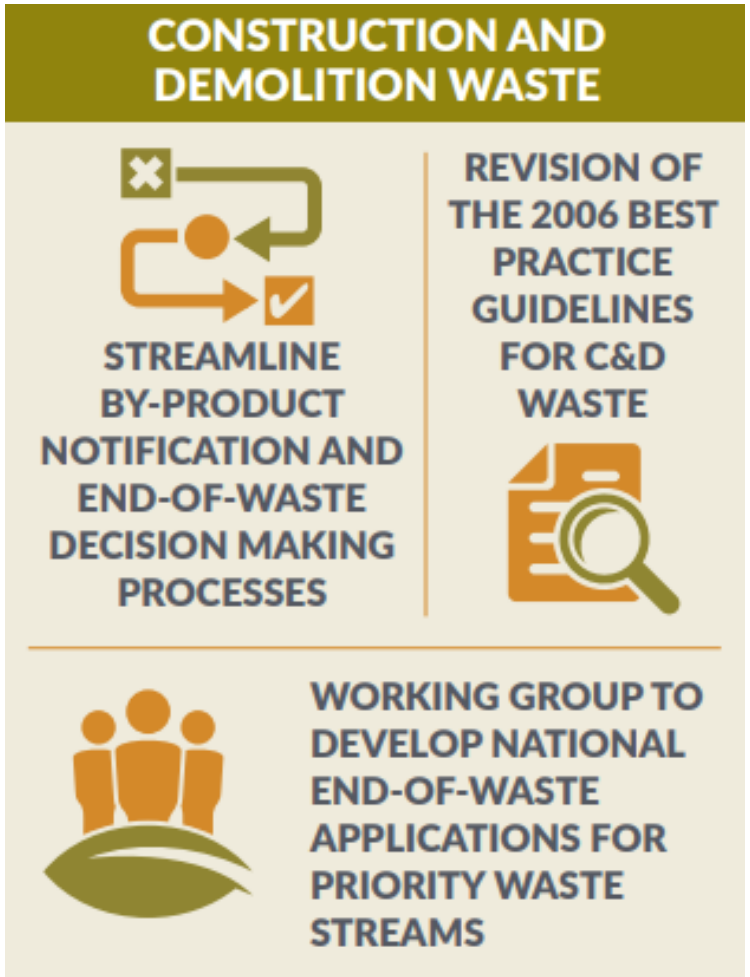
Circular Economy & Waste

Image source: Waste today

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Construction and Demolition (C&D) waste is waste from any building works, demolition and development (including transport infrastructure).

- The remainder includes concrete, brick, tiles, metal, glass, wood, plastic and metal.
- Excavated soil and stone is the largest element of construction and demolition waste at approximately 85%
- IThe quantity of C&D waste generated and collected in Ireland increased to 8.8 million tonnes in 2019

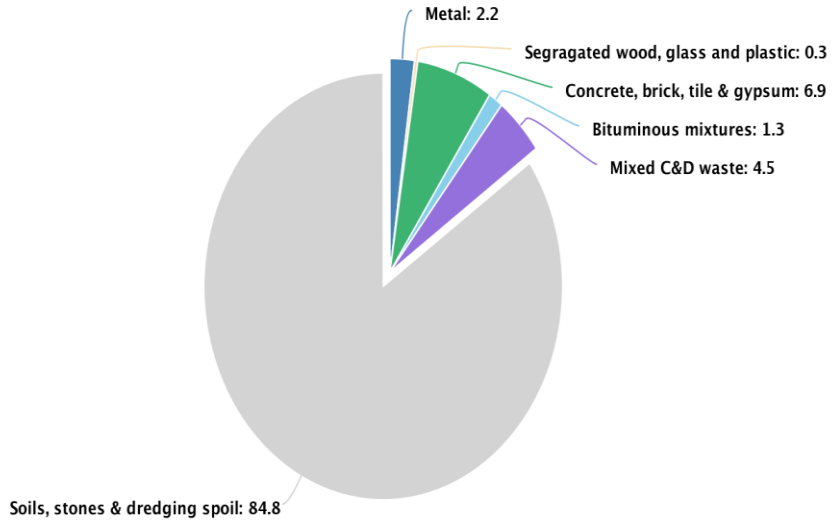


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- Most of the C&D waste collected in Ireland in 2019 was backfilled (82 %), while 10 per cent went for disposal and only 7% per cent was recycled. This reflects the large proportion of soil and stones in C&D waste.
- Recycling was the main treatment operation for metals (100%) and waste bituminous mixtures (64%).
- It is notable that only 39% of segregated wood, glass and plastic waste was recycled in 2019 while 54% went for energy recovery (incineration)

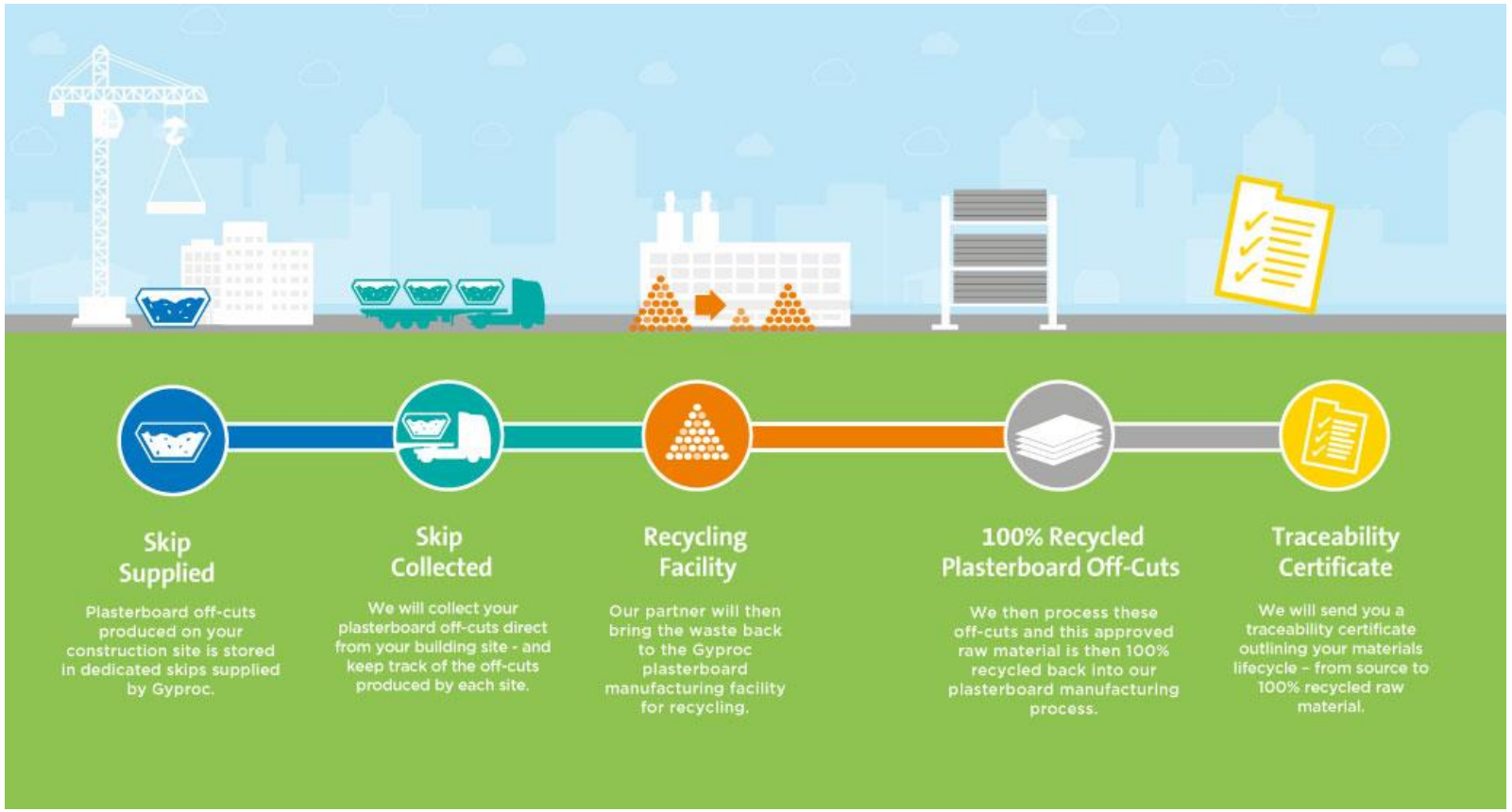
Figure 2. Composition of C&D waste material collected in Ireland, 2019



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Plasterboard Recycling Service (PRS)



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Expanded polystyrene (EPS)
used for packaging and insulation
Offcuts and waste are
shredded, then heated and
compressed which into a solid mass,
reduced to 10% of its' original size,
for resale and re-use.

It is exported to manufacture insulation to Spain, Portugal and Germany.
12% of EPS currently recycled globally





Recycling system at (LOETB) National Construction Training Centre at Mount Lucas

Waste Matters (Ireland) Ltd
https://www.youtube.com/watch?v=zDfdya7iUVY&ab_channel=WasteMatters

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Circular Products





SUPASOFT INSULATION







https://www.byfusion.com/byblock/
https://www.byfusion.com/wp-content/uploads/2022/04/BYFUSION_ByBlock_Build_Instructions_v2.1.pdf

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Circular Products













https://www.ecocel.ie/wp-content/uploads/2017/07/Review_of_Market_Potential_for_Cellulose_Insulation_Products.pdf
https://www.isocell.ie/products/insulation//view/58b0644283a745715ca971ac/cellulose-blown-insulation
https://www.airgreeninsulation.com/home-iso

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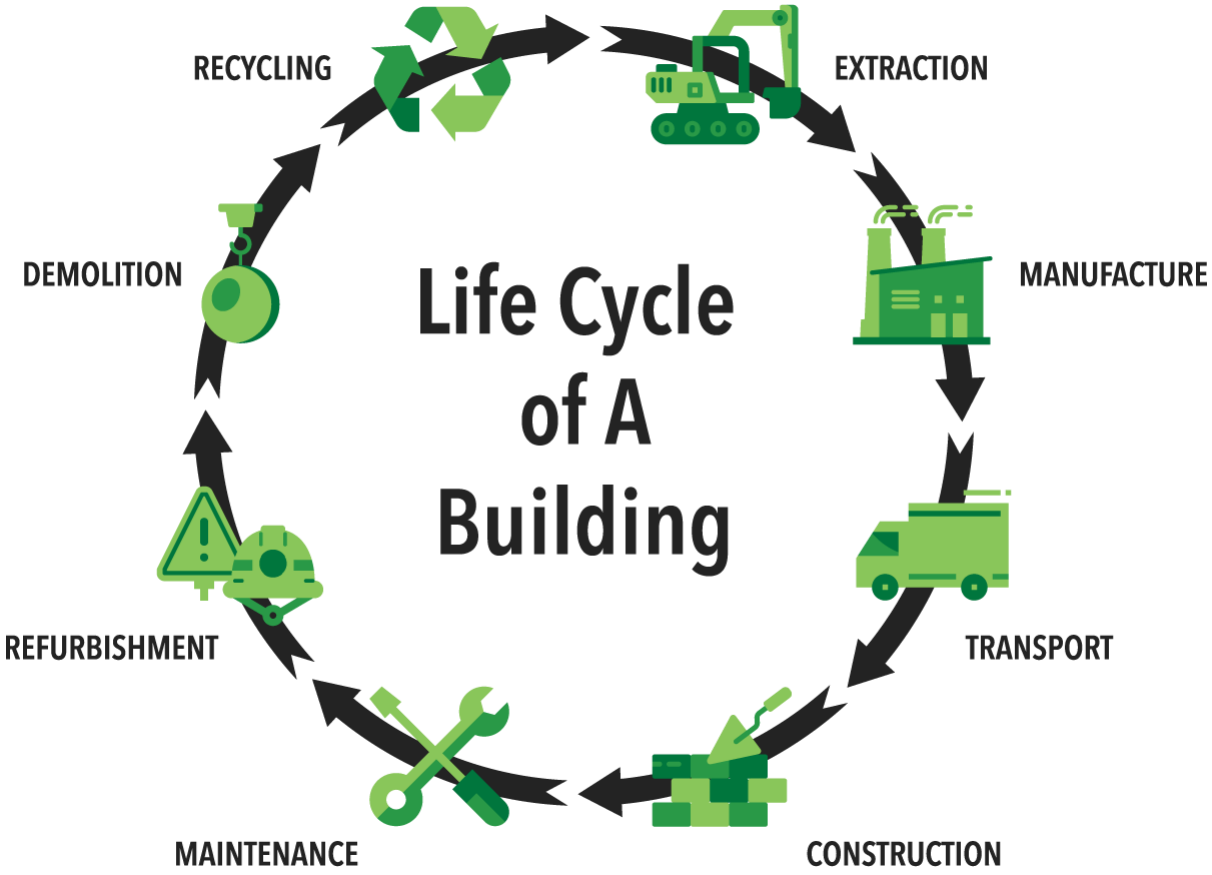
Circular Economy Future Trends

What lies ahead for the construction sector?

“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

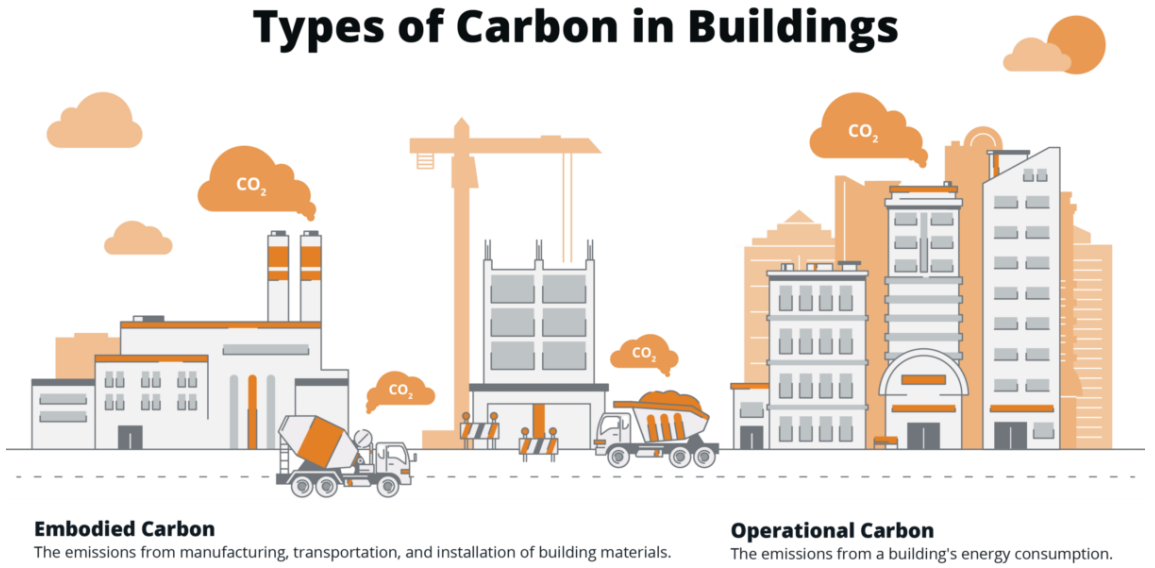
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What is Embodied Carbon?

Upfront embodied carbon refers to the emissions associated with all the activities of:

1. procuring, mining, harvesting raw materials,
2. transforming these materials into construction products,
3. transporting them to site and incorporating them into a building, and
4. maintaining, replacing and removing and disposing at the end of their life.



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- When reusing a product or a building, you are also **saving on embodied carbon.**
- This is the carbon dioxide emitted during the manufacture, transport and construction of new building materials, together with end of life emissions.
- Our **carbon footprint has a negative impact on the environment in multiple ways:** It is the main cause of human-induced climate change, it contributes to urban air pollution, it leads to toxic acid rain, it adds to coastal and ocean acidification, and it worsens the melting of glaciers and polar ice.



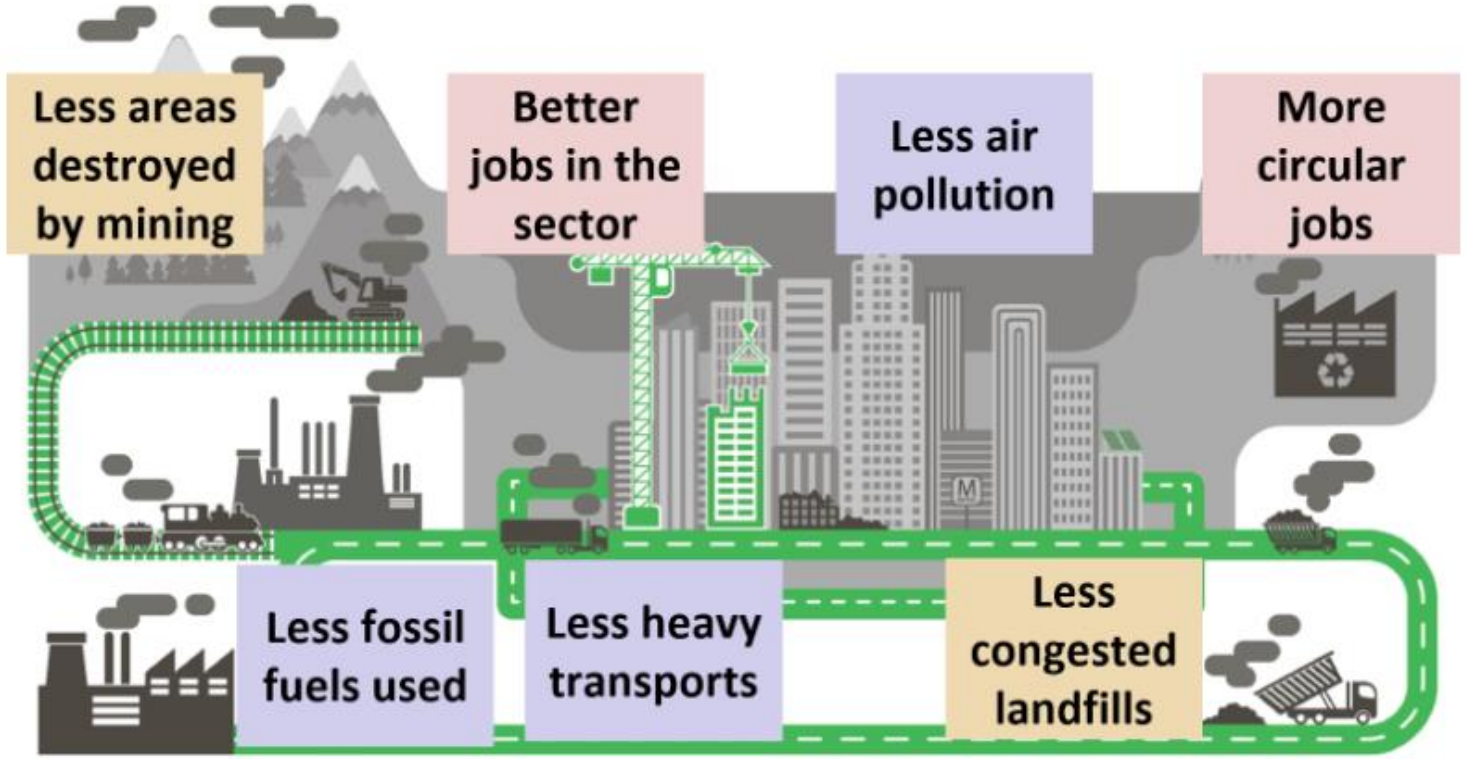




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Benefits of carbon reductions



Source: OneClick LCA

Embodied carbon reductions benefit the broader society in many ways.

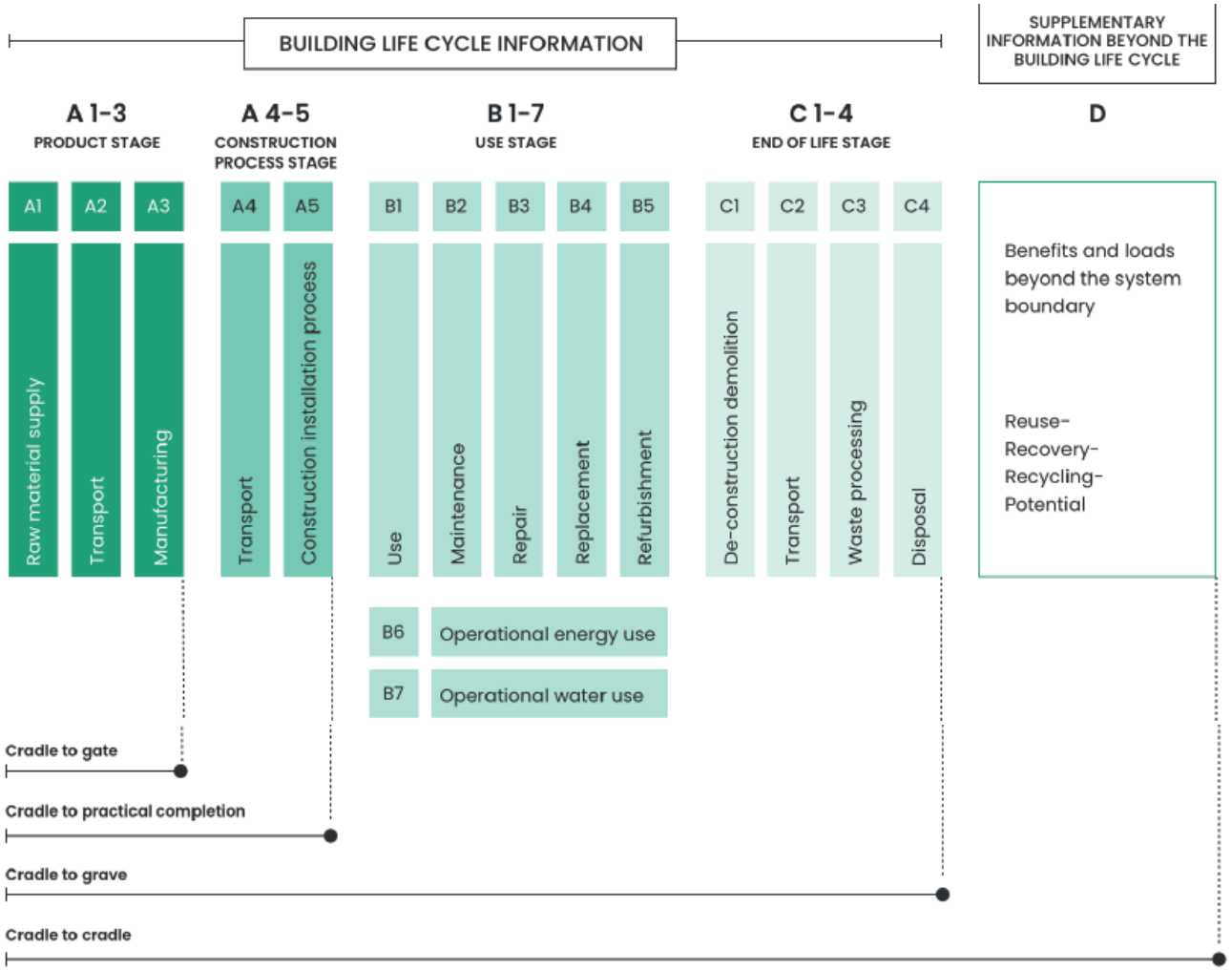
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Scope

For building LCA, the **life-cycle scope** is specified according to the standardised module designations (A1, A2, A3... Through to D) as defined in EN 15804 and ISO 21930.

Life-cycle scope specified according to the standardised module designations



Source: OneClick LCA

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- Level(s) is a common framework for sustainable buildings across Europe.

1. Greenhouse gas emissions along a buildings life cycle

Use stage energy performance (kWh/ M² /yr)

Life cycle Global Warming Potential (CO2 eq./M² /yr)

2. Resource efficient and circular material life cycles

3. Efficient use of water resources

3.1 Use stage water consumption (M3 /occupant/yr)

4. Healthy and comfortable spaces

5. Adaption and resilience to climate change

6. Optimised life cycle cost and value

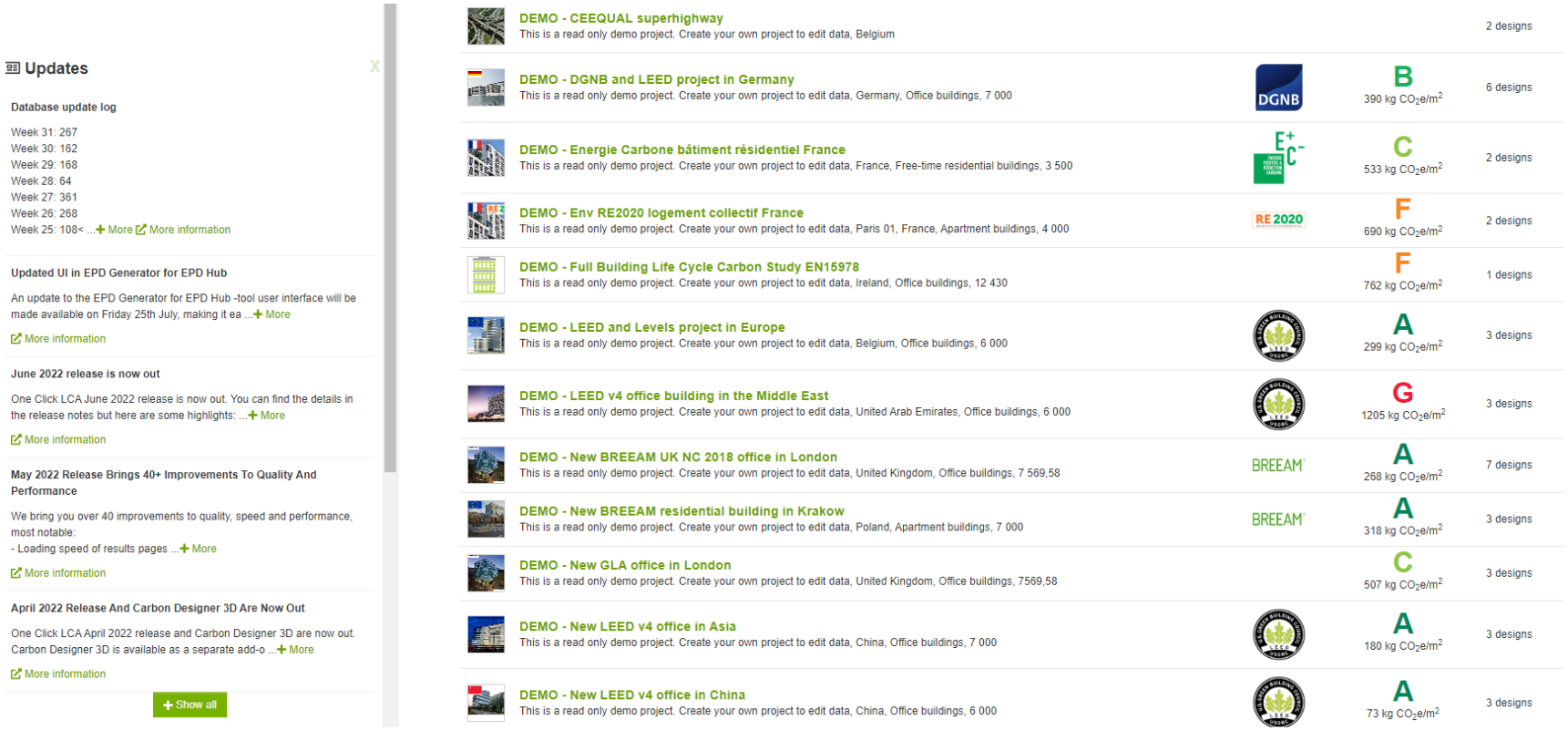
6.1 Life cycle costs (€/m²/yr)

Level(s)

https://environment.ec.europa.eu/topics/circular-economy/levels/lets-meet-levels/how-does-levels-work_en

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https://www.youtube.com/watch?v=rBmfNYjJpzY&t=2s&ab_channel=OneClickLCA

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Building Certification Schemes



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Modular Construction

- Modular construction is a way of building through the use of modular parts that are constructed in a factory and assembled on-site.
- Modular units can be used for any type of application, from entire houses to apartments to mobile site units, and more recently, home offices.

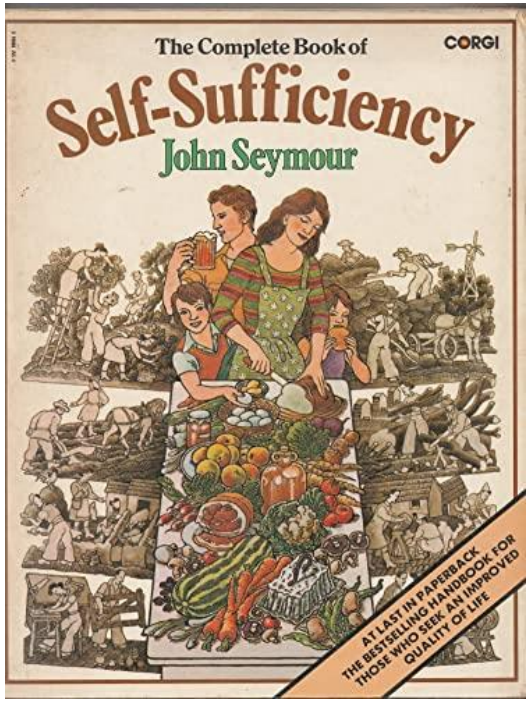


LEAN-
a way to do
“more and more, with less and less”.

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Thanks for Listening

Benny.McDonagh@lit.ie

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https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview
https://doughnuteconomics.org/about-doughnut-economics

Recycled material reduces environmental effects

Copper 85% less energy 65% less emissions
Aluminium 92% less emissions 95% less energy
Steel 60% less emissions- air pollution less 86% - water use less 40%- water pollution less 76%
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