Module 3

Introduction to Circular Economy

Circular Economy in Construction

24 partners

12 countries

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Introduction to Circular Economy | Summary

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To equip the student with the basic knowledge required to understand the principles of the circular economy across the built environment

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Introduction to Circular Economy | Objectives

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1. Define **Embodied Carbon** and importance for the life cycle of the built environment
2. Identify and outline **sustainability challenges** within the built environment in the context of circularity
3. Identify the **principles of circularity** and their application to the built environment
4. Identify and outline **issues** to maintain a circular economy strategy taking consideration of land and materials use, biodiversity, and air, water and soil pollution.
5. Identify and outline **circular challenges** within the built environment, and the associated environmental impacts

Introduction to Circular Economy | Content

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Topic 1 – Introducing Sustainability

Topic 2 – Principles of circular economy

Topic 3 – Embodied Carbon in the built environment

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1. Introducing Sustainability

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Introducing Sustainability

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- It is often cited that if everyone in the world consumed as much as the average Irish resident we would need **three planets to sustain ourselves**.

- Is it ethically acceptable to **take from nature without giving back**? This approach is not compatible with most definitions of sustainability.

- The realities of climate change, population growth, resource scarcity and fuel poverty urge both a transformation of business models at business level, and a change of lifestyle at individual level.

Introducing Circular Economy

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A circular economy aims to change the approach from **disposal** and encourage the approach of **replenishing**

*"A circular economy is one that is **restorative and regenerative by design,** and which aims to keep products, components and materials at their **highest utility and value at all times,** distinguishing between technical and biological cycles"*

- a definition first introduced by Ellen MacArthur Foundation, a global advocate and leader on this topic.

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An integrated approach

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- **Circular approaches require an integrated approach** from clients (investors, developers, property companies, house-builders, major occupiers) to advisors (architects, engineers, consultants), **contractors and product manufacturers** to all of us as users.

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2. Principles of Circular Economy

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What is it?

- It is a wider concept beyond just waste reduction that expands to **resources, products, materials, buildings, cities, infrastructure, processes and procurement**.

- Overall, the goal is to retain as much value as possible for as long as possible. Reuse, remanufacture, recycle, refurbish, regenerate, restore, circulate, cooperate... basically, **waste nothing.**

Consider how we manage resources, how we make and use products, and what we do with the materials afterwards.

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Why?

- Circular Economy was introduced 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!**

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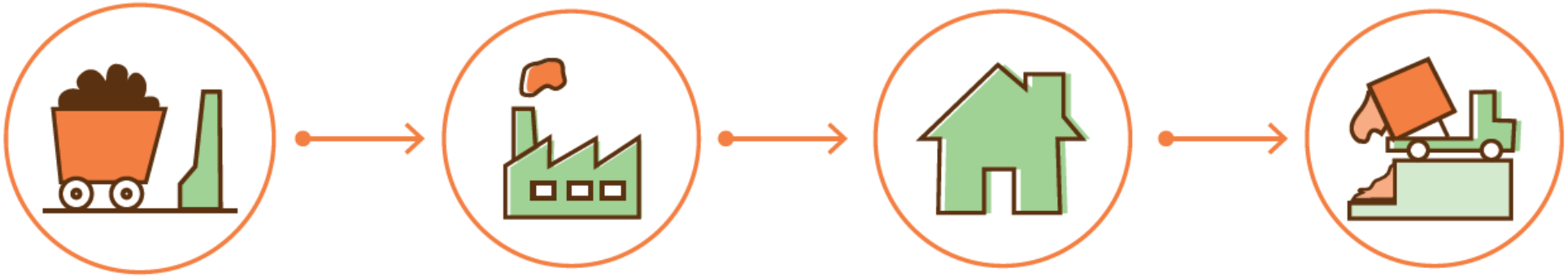
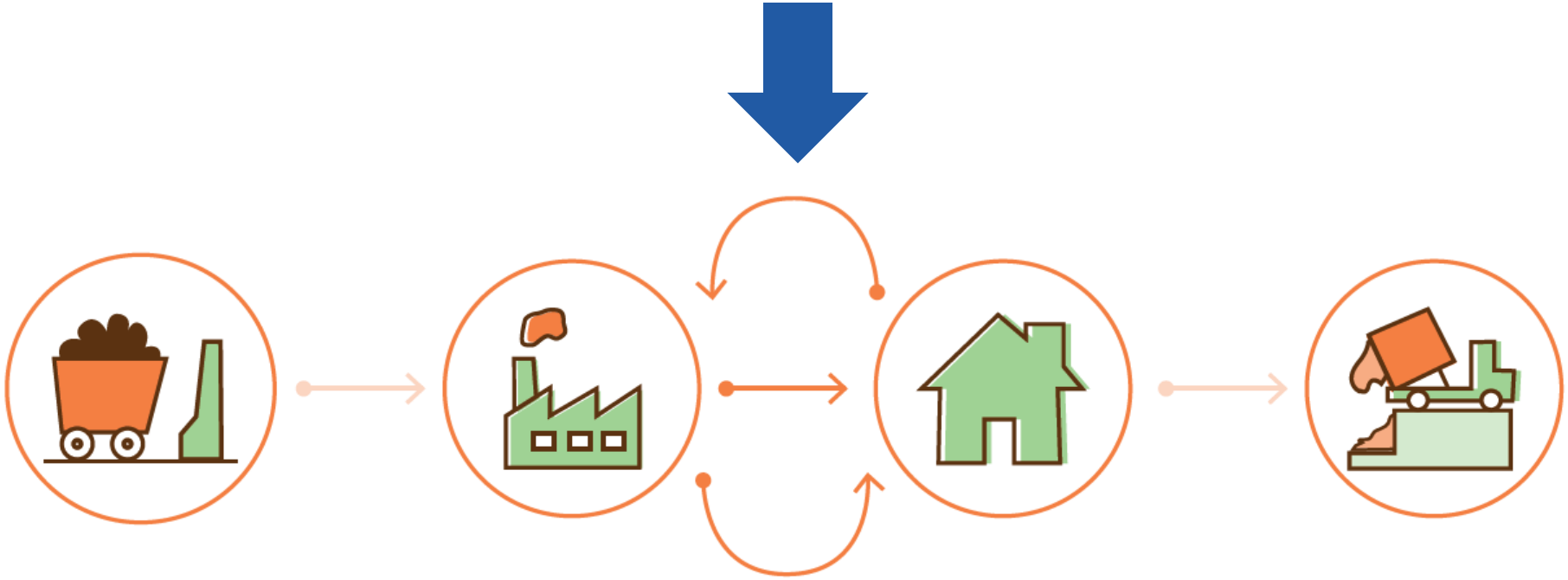


Diagram of linear economy. Source: GBCE. Circular economy in building.2021



Circular economy scheme. Source: GBCE. Circular economy in building.2021

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When?

- **When** should circular economy principles be applied? As in most of the principles of sustainability, **the earlier the better**. True circularity involves **considering future uses in the initial design stage**, which requires cooperation by everyone, from investors to clients to manufacturers and designers.

Who?

- **Who** can apply the circular economy in his/her practice?
  Basically **everyone!**

Circular Economy in the building industry

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Diagram: The circular economy vs. the linear economy approach.

9 Rs of Circular Economy

Refuse, Rethink and Reduce (R0 – R2)

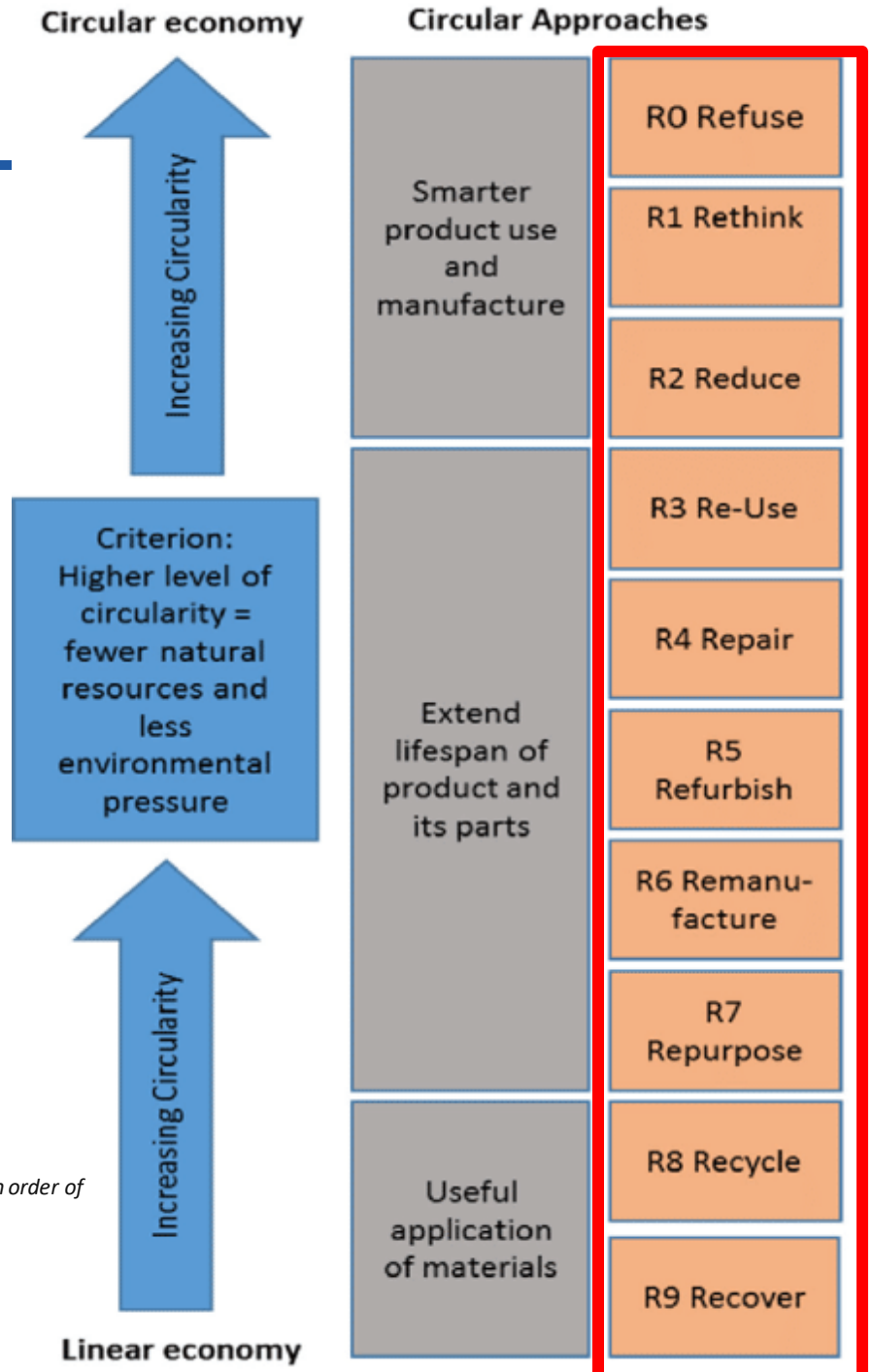
- Eliminating waste at the design stage. E.g. designing for disassembly.

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].

Challenges

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- Applying circular economy principles across the building industry is especially difficult, mainly because it requires a culture of inclusion and **collaboration, openness** and transparency across the **whole supply chain**.

- It also requires changing the way we have been taught to think about ownership and responsibility.

Challenges

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Some challenges with applying circular economy principles across the building industry are:

- **Technical:** ensuring the technical **integrity of materials when reusing them**, the need for advanced technological expertise when creating & recycling, the complexity of buildings, a lack of data about existing materials, and inflexible standards on recycled content
- **Structural:** **friction with the current business model**, harmonising data and benchmarking, lack of time and space for disassembly within standard deconstruction processes, lack of internal collaboration, lack of governmental support

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Challenges

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- **Economical**: **cost of recycling**, added cost of certified materials
- **Legal**: multiple ownership status, liability and legal issues associated with project risks
- **Cultural: changing mindsets** to see "waste" as "resource".

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Opportunities

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- The built environment presents a great opportunity for circular economy principles **to improve product life-cycle, reduce waste, increase reuse of materials,** but also allow for the testing of new solutions, and **innovation** across design, construction and manufacturing.

- The European Commission has adopted the Circular Economy Action plan 2020 as one of the main blocks of the European Green Deal.

Opportunities

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Some opportunities with applying circular economy principles across the building industry are:

- **Technical**: inspiring **innovation**, creating market disruptors, encouraging collaboration
- **Economic**: delivering greater operational efficiencies, saving costs of some new materials, commercial opportunities from circular economy based products and services, **competitive advantage**, enhanced asset value
- **Social**: supporting social value creation, **demonstrating leadership** in waste reduction

Conclusion

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- A circular approach to the built environment transcends simple resource efficiency and waste reduction .
- It include changes in entire business models and ways of thinking and doing. As such, it presents challenges spanning from the technical to the cultural.
- However, many of these challenges can be re-framed as opportunities for collaboration and innovation.

Learn more!

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Video- closing the loop https://youtu.be/6g0AYbEoOGk

Check out the suite of 8 videos explaining circular economy here

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3. Embodied Carbon in the built environment

Embodied Carbon

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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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What is Embodied Carbon?

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- **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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Graphic by Stacy Smedley, 2021

Understanding a Building's Carbon Footprint

Embodied Carbon

Manufacturing Emissions

(extraction through manufacturing of building product)

Why does this matter?

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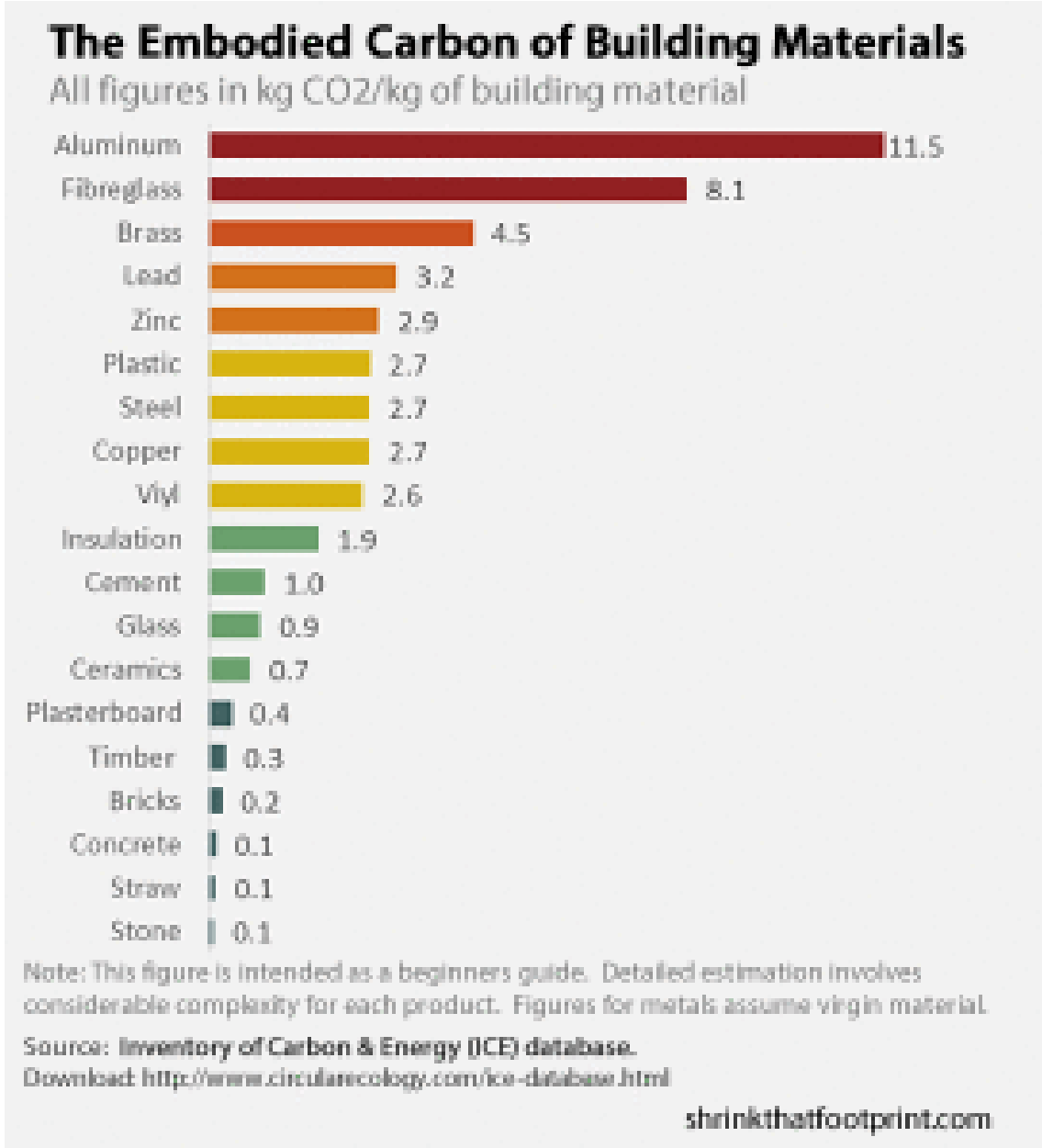
11% **of global emissions** are associated with upfront embodied CO_2 emissions from new **construction.**



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How do we solve this?

- Life cycle assessment or LCA is a methodology for **assessing environmental impacts** associated with all the stages of the **life cycle of a building, material or process.**

- The results can be compared to find which processes have the **least environmental impact.**

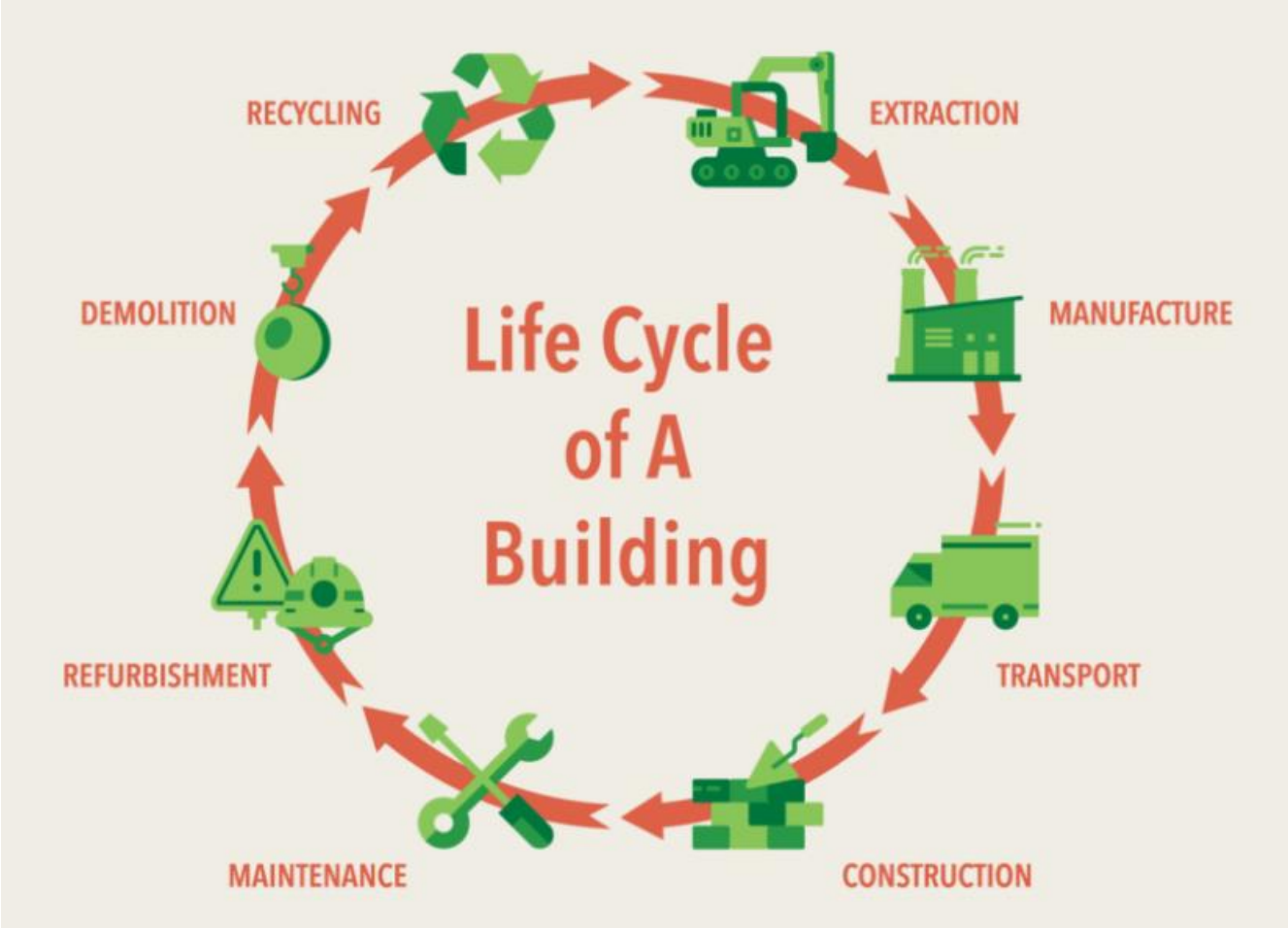

Image source: IGBC

Conclusion

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- A circular economy makes use of various strategies such as **reducing, reusing and recycling** that together **eliminate waste**, lower material and resource consumption and **reduce greenhouse gas emissions.**

- Because of this, as well as the social and economic benefits explained earlier, it is very important that **everyone in the construction industry** does their part to achieve a circular economy.

Image source: questgarden

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Assessment

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Thank You

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