



**A CIRCULAR  
FUTURE FOR  
THE EUROPEAN  
CONSTRUCTION SECTOR:  
LIGHT COMMERCIAL  
AND RESIDENTIAL  
BUILDINGS**

November 2022





We are a global impact organisation with an international team of passionate experts based in Amsterdam. We empower businesses, cities and nations with practical and scalable solutions to put the circular economy into action. Our vision is an economic system that ensures the planet and all people can thrive. To avoid climate breakdown, our goal is to double global circularity by 2032.



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# EXECUTIVE SUMMARY

**The European construction industry boasts high recycling rates but is only 30% circular today.** When buildings reach their end-of-life in Europe, the majority of materials are recycled—but only around 19% of construction materials for new buildings come from recycled or renewable sources. Downcycling—where valuable materials are crushed and used as aggregate for backfilling in roads, for example—is also prevalent. Boosting circularity isn't just about high recycling rates, but also about preserving materials' value and complexity to the highest extent possible—for as long as possible. This analysis focuses on the circularity of building materials in 'light' commercial buildings—offices, retail, restaurants and government buildings, for example—and residential buildings, and presents a viable path forward for a more circular and resilient future by adapting how the industry uses materials.

**Five key circular economy strategies can bridge the gap to net-zero—boosting the industry's circularity to 50% and cutting production-related greenhouse gas emissions by around 52%.** The strategies are: 1) Improving building utilisation and renovation, 2) Lightweighting building components, 3) Increasing renewable inputs, 4) Increasing circular inputs and, finally, 5) Mainstreaming recovery services and technology. Collectively, these strategies could boost the circularity of the industry by 21 percentage points. Also, there has been a steady rise in the inherently circular trend of improving building utilisation and renovation, and while this must continue, businesses working in the construction industry can more directly influence the other four key strategies. In summary, the levers with the greatest impact are boosting the use of renewable materials and high-value recycling and reuse.

**The industry has already begun its circular journey, so far focused on construction and demolition waste recycling and growing net-zero ambitions.** Europe is a front-runner in policy development supporting a circular built environment. Policy focused on end-of-life recovery and recycling, supported by the Waste Framework Directive, aimed for a 70% recycling rate for construction and demolition waste (C&DW) by 2020. Going a step further, the European Commission will consider material-specific targets for key streams of C&DW by 2024. Lastly, as part of the EU Circular

Economy Action Plan, renovation rates in Europe could double by 2030. Companies that prepare for and navigate the circular transition early will have a clear advantage. When it comes to greenhouse gas (GHG) emissions reduction efforts, companies have largely—and understandably—focused on promising low-carbon technologies and addressed the performance of buildings in their use phases. However, delivering on net-zero goals will also require a spotlight on the use of primary raw materials and their associated embodied carbon footprint—necessitating circular strategies that place pressure on material use.

**There is significant future earning potential for businesses in low-carbon and circular materials, increasingly a source of disruption for building materials companies.** The increased focus on more precise waste is driving downstream growth in the value chain. Technology is already enabling a more transparent and predictable end-of-life materials supply, which will contribute to higher rates of collection and recycling. The more that high-value recycling and reuse technologies scale, demand will grow for end-of-life materials in higher-value applications—thereby increasing the value of downstream services like C&DW processing. There will also likely be a continuation of the growth in off-site manufacturing—where modular design concepts can also drive potentially significant circularity benefits over the long-term.

**Circular economy strategies and business models are critical for the European construction industry to respond to rising consumer demand, reach net-zero goals and navigate material disruption.** The need for building materials to support refurbishment and new builds will continue in Europe. Yet the industry will face severe challenges responding to this demand in a business-as-usual scenario, such as increasing supply chain competition for materials. And tackling GHG emissions from operations alone won't get the industry to net-zero—28% of GHG emissions from buildings come from the carbon embodied in building materials. The five circular strategies mentioned above can allow businesses to meet these challenges head-on, satisfying the growing demand for buildings within industry and policy targets.

## THREE ACTIONS TO NAVIGATE MATERIAL DISRUPTION IN THE MOVE TOWARD A CIRCULAR AND LOW-CARBON INDUSTRY

### Harness circular materials and strategies to reach net-zero goals

There are five key circular opportunities for the European construction industry: 1) Improving building utilisation and renovation, 2) Lightweighting building components, 3) Increasing renewable inputs, 4) Increasing circular inputs and finally, 5) Mainstreaming recovery services and technology. Key growth opportunities for the European industry lie primarily within circular materials innovation and off-site manufacturing, as well as new business models such as end-of-life materials marketplaces that enhance value from recovery and recycling services.

### Optimise value and sales from circular materials to accelerate the transition

Circular materials have the potential to deliver strong financial, strategic and sustainability benefits. Many construction companies and building owners hold specific circularity or upstream scope 3 emissions targets: therefore, circular materials have great value and this should be reflected in customer propositions. Quantifying and refining this value could help to optimise pricing for circular offerings to improve sales and margins—as well as boost uptake as the benefits of circularity become better understood in the industry.

### Secure long-term and cost-competitive access to circular materials

As the transition continues, the demand for circular materials will likely outweigh end-of-life supply—thereby pressuring availability and driving up prices. Supply chain challenges will persist, further compounding these issues. Securing supply early can strengthen strategic, financial and sustainability value creation, while also decoupling from volatile primary materials and existing supply chain challenges.

# 1. THE BUILT ENVIRONMENT IN EUROPE AND THE WORLD

**The built environment provides essential, basic needs in the form of housing and infrastructure. To continue this on a global scale, the urban built environment would need to grow by a massive 60% by 2050.<sup>1</sup> Sustainably meeting this future demand will require pivoting away from a business-as-usual scenario that is resource- and carbon-intensive. The speed at which new infrastructure and buildings are being constructed, however, varies greatly across regions—presenting divergent challenges and solutions needed to address the circular transition and the decarbonisation agenda on a global level. Forecasted global expansion is especially concentrated in regions seeing rapid industrial and population growth, such as China and India. Other parts of the world, such as Europe, have a considerable share of their stock already built up and the expansion follows a more incremental pace. Nonetheless, Europe is an important market because in spite of the anticipated new builds, the continent is increasing renovation, which can improve energy efficiency and boost emissions reductions—as well as circularity. In this paper, we focus on Europe to explore a vision of a long-term circular future for the building materials industry, with a focus on commercial and residential buildings.**

## **Now is the time for rapid and accelerated climate action**

The materials flowing through the global economy have exceeded a massive 100 billion tonnes annually. Of all the materials we use across the globe—for food, manufacturing and mobility, for example—only 8.6% come from secondary sources.<sup>2</sup> This use of resources directly increases global GHG emissions: 70% of emissions are tied to material extraction, processing, use and disposal.<sup>3</sup> More than one-third of global material use—38.8 billion tonnes—is funnelled into meeting our societal need for housing, releasing more than one-fifth (23%) of all global emissions in the process.<sup>4</sup> These emissions arise both from the extraction, production and use of materials for construction and through the provision of heating and cooling and other operations like lifts and ventilation.

To have a chance of limiting warming temperatures to 1.5-degrees, as per the Paris Agreement, we need a circular economy where waste is designed out, materials' value is preserved at the highest value and complexity possible and natural systems are regenerated.<sup>5</sup> Significantly, 28% of GHG emissions from buildings come from embodied carbon in building materials.<sup>6</sup> The circular economy is particularly necessary for the construction industry, which is demanding more in a time where we need to use and consume substantially less.

## **The global built environment: big impacts getting bigger**

To continue meeting the world's societal needs, the urban built environment would need to grow by a massive 60% by 2050. The speed at which new infrastructure and houses are built, however, varies hugely between global regions. China, for example, is faced with the rapid expansion of its built environment, lifting millions of people out of poverty and into middle-class lifestyles. This sits in stark contrast with Europe, where the last century has already seen the build-up of housing stock and where a considerable focus—besides new building—is placed on maintenance and refurbishment. By 2050, the building stock of residential, commercial and infrastructure in China will increase by 135%, compared to just 13% in Europe.<sup>7</sup> Furthermore, not only is there a difference in the speed of growth, but the materials typically used in China are also more carbon-intensive than those in Europe.

## **The changing face of buildings: circular materials**

In the wake of covid-19, we have seen a decreased need for office space with the rise of flexible and remote working arrangements during and post-pandemic. These trends are expected to lead to office stock in excess of demand, opening up traditional office spaces to be retrofitted for a myriad of functions, such as community space or even housing,<sup>8</sup> as well as suppressing new builds. Meanwhile, improved building utilisation and increased renovations are trends already well underway in the industry. Ultimately, both shifts will directly impact decisions to develop new building projects and allow Europe, with its large build-up of stock, to make the most of what it already has.

There has also been a notable rise in the use of circular materials as a further means to seize decarbonisation and efficiency opportunities in construction. Circular materials can come from secondary sources, with existing building stock providing a wealth of materials for new construction projects, essentially acting as an urban mine: reclaimed wood, concrete, metals and aggregates from buildings slated for demolition, for example. The extent of materials that become available at end-of-use account for about a quarter of the new materials that flow into new build and renovation activities every year. This means that cycled materials from other sectors should also be considered to fulfil the demand. Another clear option is the use of materials that are regenerative in nature: sustainably produced timber, hemp and crop residues, used for the production of bio-based construction materials like cross-laminated timber (CLT). These have far lower embodied carbon and can even act as carbon sinks, sequestering emissions from the atmosphere. Through innovation, building materials can also be combined: bio-based fibres, such as hemp, wood or seaweed, can be mixed with cement to cut its impact, for example.<sup>9</sup> Such materials are currently a small but rapidly growing segment of the materials market. And for good reason: they are faster to install due to being fabricated off-site, likely emit fewer GHGs during production and installation, and deliver potential material cost savings compared to concrete, steel and masonry.

The next chapter will visualise how key materials flow through the European industry, allowing us to see how materials are processed, if at all, at end-of-use—or if they end up as waste, emitted or dispersed into the environment. It will provide a Circularity Metric and spotlight potential avenues for creating a more circular industry.

## 2. THE CURRENT STATE OF CIRCULARITY

**The European construction industry is estimated to be 30% circular today. We measure the circularity of the industry using the Circularity Transition Indicator, which comprises the percentage of material inputs that are from recycled or renewable sources, as well as the percentage of end-of-life material outflows that are recovered and recycled—including downcycling for use in other industries.\*<sup>10</sup> Measuring this is an important indicator of progress toward a well-established circular flow of materials and reduced dependence on continued raw material extraction. While this method has its limitations, including its inability to value material quality and address all circular loops, it provides a useful high-level insight that can be used as a benchmark across sectors.**

Europe has seen significant build-up of stock in the form of residential and commercial buildings, including homes, public buildings, offices, retail buildings, hotels and educational buildings, particularly over the last century, with approximately 74 billion tonnes of stock now in use. This material stock represents an estimated 52 billion square metres of floor space, with around 40 billion square metres of residential floor space and 12 billion square metres of commercial floor space. Every year, approximately 642 million tonnes of materials enter the European construction industry, around 21% of which are used for maintenance and renovation.

Of the 642 million tonnes of material input into the construction industry, concrete and bulk fillings account for 338 million tonnes (53%), plaster, screed, mortar and masonry account for 243 million tonnes (38%), steel for 28 million tonnes (4%) and other metals for 2 million tonnes, wood and panels for 16 million tonnes (2%), and other materials like insulation, glass, roofing, and sheeting for 15 million tonnes (2%). Of this, 26 million tonnes is recovered end-of-life construction waste that flows back into the built environment, while 79 million tonnes are secondary materials sourced from other industries.

### High (down)cycling but low circularity

On paper, the amount of construction and demolition waste (C&DW) from demolished or dismantled buildings that is recycled appears high: 83%. And the use of

recycled and renewable materials in new construction is high compared to other world regions, standing at 19%. Recycled and disposed materials are primarily concrete (41%) and masonry and mortar (42%).

However, of the recycled materials, the vast majority are downcycled or used for backfilling (recycled aggregates)—largely low-value applications. There is room for improvement here: secondary material use is still too low, and a high loss of value and complexity has become the norm. However, debate ensues over what constitutes ‘high-value’ cycling, with the needs of various stakeholders influencing the definition. The infrastructure and civil engineering sector, for example, relies on C&DW waste as aggregate for backfilling, therefore considering it a high-value feedstock. Many governments agree: aggregates are fundamental to creating high-quality and long-lasting infrastructure—roads, for example. Nonetheless, the goal of a circular economy lies in value retention—and where better opportunities for recycling exist, materials should be funnelled into meeting these purposes at end-of-use. And there is bang for your buck too, as recycled concrete doesn’t cost more than its virgin counterpart.<sup>11</sup>

### Limited potential to optimise recycling

There are four times as many materials flowing into the construction industry than come out as C&DW. This is due to high levels of new construction and refurbishment activity, coupled with the 50 to 100-year lifetimes of buildings. This constrains the opportunity for fully closed-loop cycling of materials within the industry: we can’t satisfy the material demand for new buildings with secondary materials alone.

Ultimately, only around 21% of recycled and renewable materials and 4% of total used in construction industry come from within the industry—the rest comes from other industries. The demand for new construction is so great that even making use of all materials from demolition at their highest value and scaling repair and renovation practices would see the industry fall short: such strategies would meet one-fifth of the

\* CTI is a consumption-based measure, expressed as a percentage, representing the weighted average of a fraction of an industry’s secondary inputs out of its total material consumption and its percentage of wastes and outflows that are reused or recycled.

total demand for building materials—illustrating the importance of extending buildings’ lifetimes and improving performance in-use through consistent maintenance and repair over new building projects. Sustainably-managed renewable material use will be critical for boosting circularity in the cases that virgin materials are needed.<sup>12</sup>

The composition of waste from the industry also complicates the picture: the complexity of the waste types makes high-value recycling more difficult as materials polluted with hazardous waste—like asbestos or chemicals—cannot be cycled. Removing hazardous substances from polluted ‘batches’ can be

### DESIGNING CIRCULARITY INTO STOCK WITH IMPROVED RECYCLING, CIRCULAR MATERIALS AND DIGITALISATION

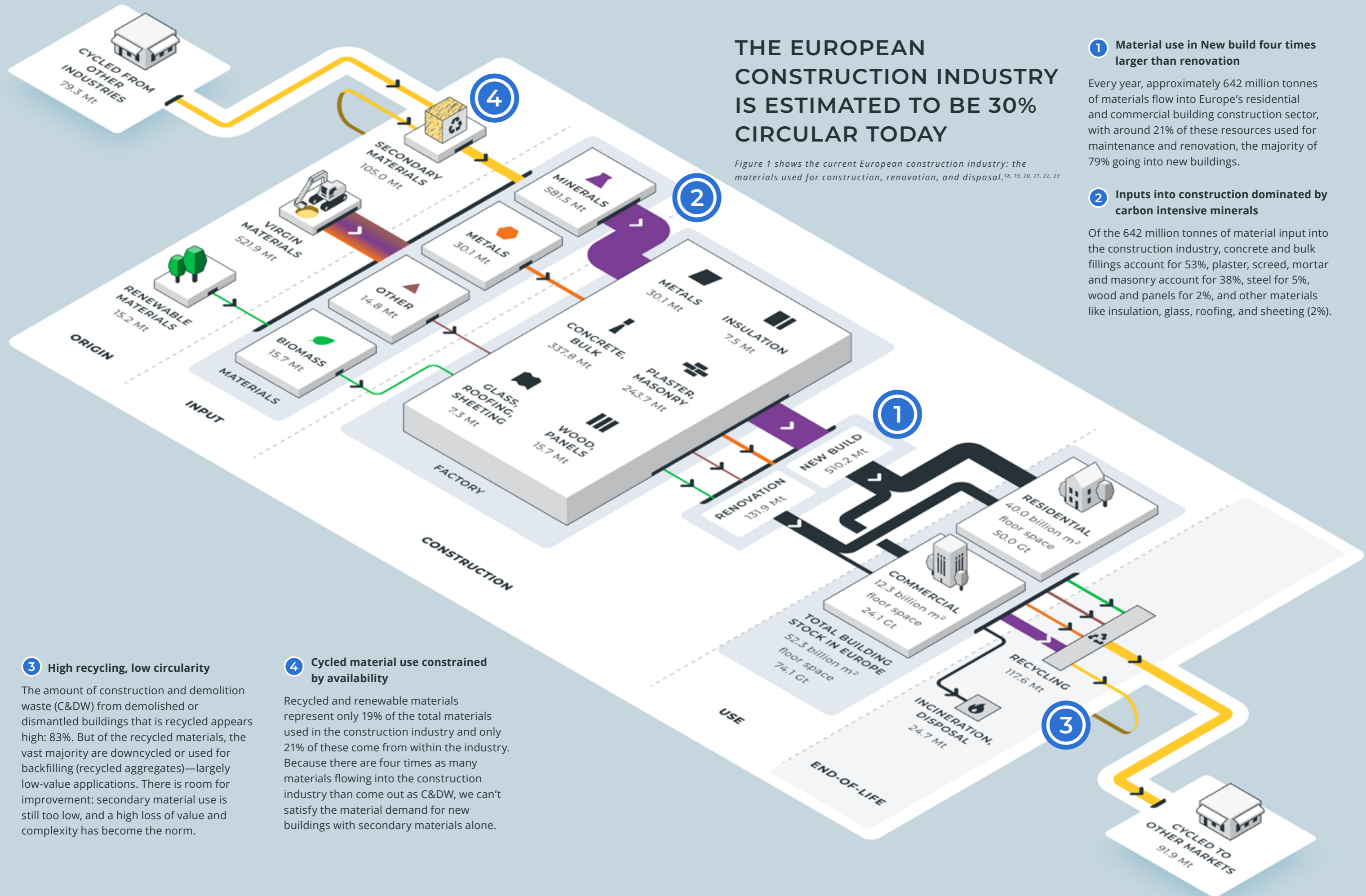
Innovations in circular materials improve recovery and recycling, reduce waste and cut greenhouse gas (GHG) emissions.

- Carbon-intensive concrete can be reverted to sand, gravel and cement with the **Smart Crusher** technology, which filters out the unused cement fraction so it can be reused as a cement binder in new concrete.<sup>13</sup>
- **Lekolabs** has introduced a state of the art timber and acoustic construction system that uses 40% fewer materials compared to conventional builds. The technology is enhanced by AI and robotic manufacturing—and cuts GHG emissions as it naturally sequesters carbon over its lifetime.<sup>14</sup>
- **BIOHM’s** innovative bio-based building materials are crafted from Mycelium, the vegetative root structure of mushrooms, and organic refuse biocompound (ORB)—both of which are made from difficult to reuse or recycle by-products. The materials are touted as being biodegradable, as well as toxin- and carbon-absorbing.<sup>15</sup>

costly, so landfilling or incineration are often favoured by the industry. And while demolition remains the primary process for buildings at the end of their functional lifetimes, over less destructive means like deconstruction or disassembly, the rate of high-value, closed-loop cycling is constrained. This brings two actions to the fore: it increases the need for other circular strategies to be mainstreamed alongside recycling to really make an impact in terms of the industry’s sustainability. It also necessitates that circular design is prioritised earlier in the process so that hazardous waste is not locked into future building material streams.

Massively improving materials’ end-of-life recovery in the construction industry will partly come down to rapid gains in the digitalisation space. Online registries for materials and products allow buildings to have ‘material passports’ showing the state and origin of all the materials used in their construction. Such digital platforms, like **Madaster**, enable the easy reuse of building materials, encourage smart design at projects’ onset and, ultimately, eliminate waste.<sup>16</sup> Each building has the potential to become a reservoir of easy-to-identify materials.

The advent of 3D printing is also cutting excess waste and increasing efficiency: MX3D is introducing 3D printing technology for large metal objects, aided by **WAAM** robotics. In construction, on-site 3D printing can reduce waste, and cut material, assembly and labour costs.<sup>17</sup>



# THE EUROPEAN CONSTRUCTION INDUSTRY IS ESTIMATED TO BE 30% CIRCULAR TODAY

Figure 1 shows the current European construction industry: the materials used for construction, renovation, and disposal.<sup>18, 19, 20, 21, 22, 23</sup>

**1 Material use in New build four times larger than renovation**

Every year, approximately 642 million tonnes of materials flow into Europe’s residential and commercial building construction sector, with around 21% of these resources used for maintenance and renovation, the majority of 79% going into new buildings.

**2 Inputs into construction dominated by carbon intensive minerals**

Of the 642 million tonnes of material input into the construction industry, concrete and bulk fillings account for 53%, plaster, screed, mortar and masonry account for 38%, steel for 5%, wood and panels for 2%, and other materials like insulation, glass, roofing, and sheeting (2%).

**3 High recycling, low circularity**

The amount of construction and demolition waste (C&DW) from demolished or dismantled buildings that is recycled appears high: 83%. But of the recycled materials, the vast majority are downcycled or used for backfilling (recycled aggregates)—largely low-value applications. There is room for improvement: secondary material use is still too low, and a high loss of value and complexity has become the norm.

**4 Cycled material use constrained by availability**

Recycled and renewable materials represent only 19% of the total materials used in the construction industry and only 21% of these come from within the industry. Because there are four times as many materials flowing into the construction industry than come out as C&DW, we can’t satisfy the material demand for new buildings with secondary materials alone.

### 3. MOVING THE INDUSTRY TOWARDS CIRCULARITY BY 2040

**With five key circular strategies that transform how materials are used and circulated in the construction industry in Europe, this analysis illustrates how the industry can become 50% circular by 2040. The circular strategies are based on a simple breakdown of the aims of the circular economy: narrowing flows (using fewer materials to produce products and services), slowing flows (using materials for longer and extending product life cycles), regenerating flows (using clean materials) and cycling flows (using materials again through recovery and recycling). On its own, each strategy may have limited impact on circularity, emissions reduction, but together they can deliver huge improvements. Building on this, our analysis finds that as the industry's circularity rises from 30% to 50% by 2040, this could deliver a 52% reduction in production-related greenhouse gas (GHG) emissions (over and above production based on renewable energy).**

A 50% circular industry by 2040 could meet rising demand for commercial and residential buildings with far fewer materials: the total material use could drop from its current 642 million tonnes to 590 million tonnes annually—a reduction of 8%.

**Utilisation and renovation** are ongoing trends that can improve circularity towards 2040. While the need for office floor space is expected to grow by 10% by 2040, new work modalities such as flex space and remote working can satisfy the demand for office floor space and even reduce it. Boosting flex space modality from 10% today to 40% in 2040 could improve circularity by 0.8 percentage points. It would also lead to an overall reduction in emissions through design, energy retrofits and circularity initiatives. Furthermore, when renovation—which typically requires fewer materials than new construction—is applied to rehabilitate idle spaces, circularity could increase by 1.7 percentage points by 2040. Joining the forces of utilisation and renovation could increase circularity by 2.5 percentage points in 2040 from 2020. By 2030, revenue for renovation in the European construction industry will reach €1 trillion—a 40% increase compared to 2020.

**Lightweighting** in construction can be applied to virtually all materials through innovation or design. New material development is a continuous process, but if innovations are scaled across material inflows, there is significant potential to improve the industry's circularity. New lightweight aggregates can be used to substitute concrete: they can be 30% lighter while maintaining safety and structural requirements.<sup>24</sup> Other material innovations in bricks, for example, can deliver material savings of up to 10% compared to traditional bricks—and they can also be manufactured from waste materials.<sup>25</sup> Smart design before construction also plays a crucial role in improving circularity through lightweighting: with careful design, the materials needed for construction can be reduced. Steel and its structural properties, for instance, can be far better utilised to cut costs and bring circularity benefits.<sup>26</sup> If lightweighting could be used to reduce the weight of building materials including insulation, roofing, masonry, concrete, plaster and bulk fillings, etc. by 20% in 2040, circularity could rise by 4.4 percentage points and emissions could be reduced by up to 15%—due to decreased use of emissions-intensive steel and concrete. Revenue wise, the industry will see higher margins driven by innovative design and circular materials, but lightweighting constricts overall demand.

**Recycled content** levels in building materials can be greatly improved by better and more consistent collection and high-value recycling. Opportunities for boosting the sector's circularity beyond 50% are however constrained by the availability of recycled inputs. The inflow of materials into the sector by 2040 is almost four times larger than the materials that become available through deconstruction at end-of-use. This means that increasing the use of recycled content is limited to 28% in 2040 compared to 16% today. Still this would boost circularity by 4.2 percentage points and could reduce the carbon footprint by up to 25% when paired with carbon capture and storage technology. The opportunity to increase this percentage beyond these forecasted rates is placing emphasis of circular design practices in

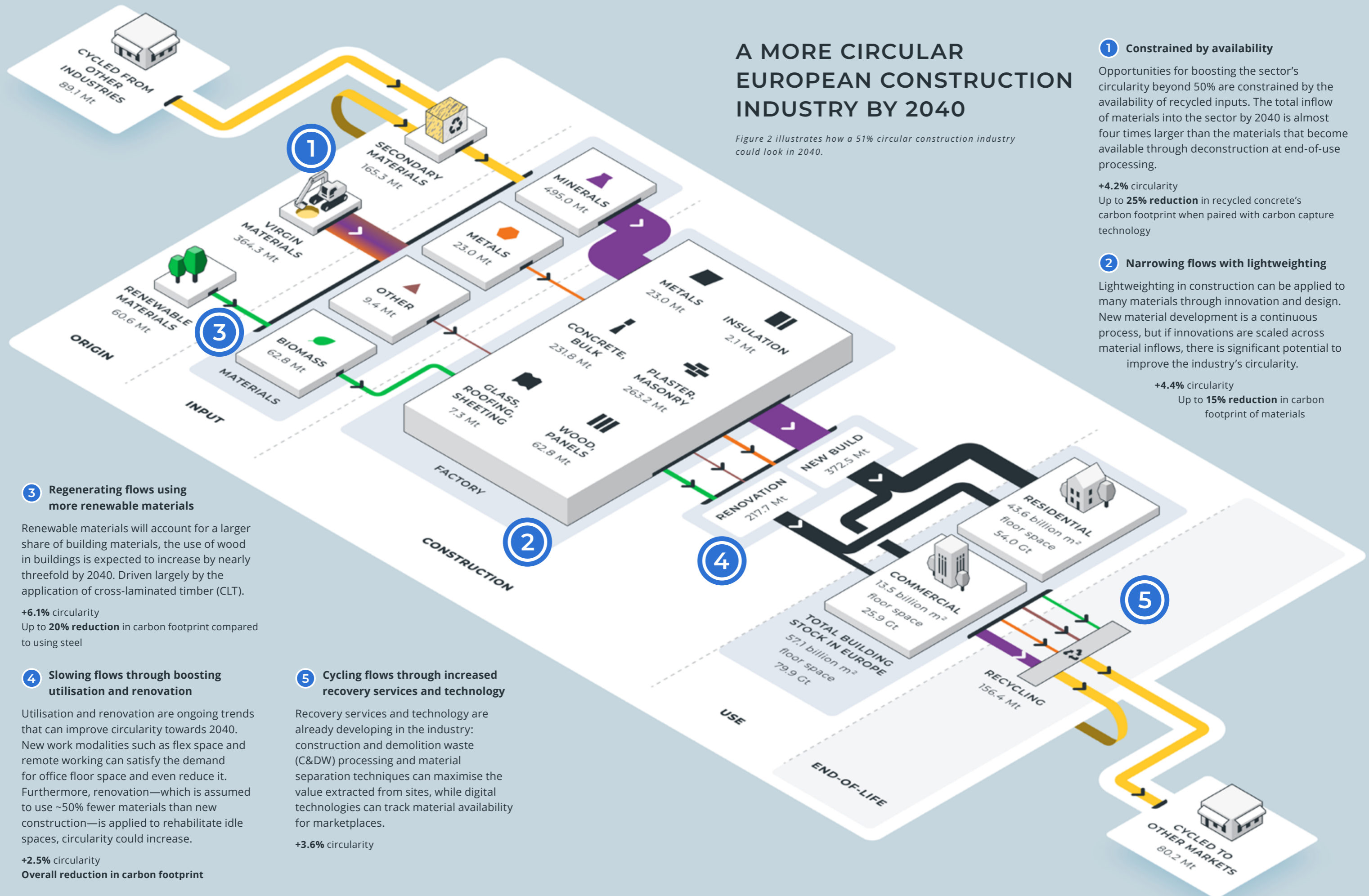
new buildings today so that their reuse and recycling can move beyond current levels. This will take several decades to become a sizable opportunity given the lifetime of buildings. Meanwhile, for concrete manufacturers, the increased use of recycled material in new production could drive up to €0.5 billion in additional profits by 2040. The extent of materials that become available at end-of-use account for about one-fourth of the new materials that flow into new build and renovation activities every year. This means that cycled materials from other sectors must also be maximised to fulfil the demand.

**Renewable materials** will account for a larger share of building materials—with advances in forestry practices and material design innovations, the use of wood in buildings is expected to increase by nearly threefold by 2040. Key here is cross-laminated timber (CLT). If the use of wood at its current rate is tripled—the industry would see a boost in circularity of 6.1 percentage points between 2020 and 2040 and up to a 20% reduction in GHG emissions compared to the carbon footprint if structural steel and concrete were to remain a core material. Financially, if CLT alone were to be mainstreamed, profits would be expected to reach €0.7 billion by 2040.

**Recovery services and technology** are already swiftly developing in the industry: construction and demolition waste (C&DW) processing and material separation techniques can maximise the value extracted from sites, while digital technologies can track material availability for marketplaces. By 2040, 100% of C&DW could be recycled, and 49%, up from 18% in 2020, would be reused in construction: overall boosting circularity by 3.6 percentage points. Financially, the market for C&DW is expected to grow at a rate 1.5 times that of the market for new construction, with industry wide profits of up to €5 billion by 2040.

# A MORE CIRCULAR EUROPEAN CONSTRUCTION INDUSTRY BY 2040

Figure 2 illustrates how a 51% circular construction industry could look in 2040.



**1 Constrained by availability**  
 Opportunities for boosting the sector's circularity beyond 50% are constrained by the availability of recycled inputs. The total inflow of materials into the sector by 2040 is almost four times larger than the materials that become available through deconstruction at end-of-use processing.

**+4.2% circularity**  
 Up to **25% reduction** in recycled concrete's carbon footprint when paired with carbon capture technology

**2 Narrowing flows with lightweighting**  
 Lightweighting in construction can be applied to many materials through innovation and design. New material development is a continuous process, but if innovations are scaled across material inflows, there is significant potential to improve the industry's circularity.

**+4.4% circularity**  
 Up to **15% reduction** in carbon footprint of materials

**3 Regenerating flows using more renewable materials**

Renewable materials will account for a larger share of building materials, the use of wood in buildings is expected to increase by nearly threefold by 2040. Driven largely by the application of cross-laminated timber (CLT).

**+6.1% circularity**  
 Up to **20% reduction** in carbon footprint compared to using steel

**4 Slowing flows through boosting utilisation and renovation**

Utilisation and renovation are ongoing trends that can improve circularity towards 2040. New work modalities such as flex space and remote working can satisfy the demand for office floor space and even reduce it. Furthermore, renovation—which is assumed to use ~50% fewer materials than new construction—is applied to rehabilitate idle spaces, circularity could increase.

**+2.5% circularity**  
**Overall reduction in carbon footprint**

**5 Cycling flows through increased recovery services and technology**

Recovery services and technology are already developing in the industry: construction and demolition waste (C&DW) processing and material separation techniques can maximise the value extracted from sites, while digital technologies can track material availability for marketplaces.

**+3.6% circularity**

## 4. THE WAY FORWARD

The European construction industry, and specifically material companies, can incorporate five key circular strategies into its operations to become 50% circular by 2040. Alongside this, our analysis finds that companies pioneering the transition so far do three things well—and this must be scaled: 1) Scan the existing value chain to identify the potential for improving circular flows, 2) Combine *today-forward* and *future-back* perspectives to capture new opportunities and 3) Scale the ecosystem for success.

### Scan the existing value chain to identify the potential for improving circular flows

While Figure one shows the materials used for production, maintenance, use and disposal at the industry level, the picture can look quite different for an individual company. Mapping material flows at the company level can help leaders identify resource use and waste in their own value chain and explore potential for improving circularity by enhancing utilisation, monetising waste streams, sourcing sustainable substitute materials and better cycling end-of-life construction materials.

### Combine *today-forward* and *future-back* perspectives to capture new opportunities

Grounded in an understanding of the current value chain and circular potential, leaders should apply *future-back* thinking to anticipate disruptions and navigate among potential futures. This helps inform them on how value creation can shift as the industry goes circular, and allows them to position around new control points in the value chain: matching supply and demand for recycled materials with solutions such as material passports, for example, and better integrating bio-based materials, such as Cross Laminated Timber (CLT), for example.

### Scale the ecosystem for success

Companies can't go circular on their own. Leaders are strengthening their ecosystems with a clear perspective on where to collaborate and where to compete. Industry coalitions can help them align on new standards while providing a platform for companies to build and strengthen their own partnership ecosystems, such as the World Green Building Council: a public-private collaboration that catalyses the uptake of sustainable built environment practices to transform the building and construction industry.



## REFERENCES

1. M. Swilling, B. Robinson, S. Marvin, & M. Hodson, Eds. (2013). *City-Level Decoupling - Urban resource flows and the governance of infrastructure transitions*, A Report of the Working Group on Cities of the International Resource Panel. UN
2. Circle Economy. (2021). *The circularity gap report 2021*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
3. Circle Economy. (2021). *The circularity gap report 2021*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
4. Circle Economy. (2021). *The circularity gap report 2021*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
5. Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press. Retrieved from: [IPCC website](#)
6. Circle Economy. (2021). *The circularity gap report 2021*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
7. Circle Economy. (2019). *The circularity gap report 2019*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
8. Clifford, B. (2021, June 3). Can unused office space solve the housing crisis? *World Built Environment Forum*. Retrieved from: [RICS website](#)
9. Hemp Collective. (n.d.). Retrieved from: [Hemp Collective website](#)
10. WBCSD. (2021, February 1). Circular Transition Indicators v2.0 – Metrics for business, by business. *World Business Council for Sustainable Development*. Retrieved from: [WBCSD website](#)
11. Gretler C. (2021, September 27). *How Zurich blazed a trail for recycled concrete*. Bloomberg CityLab. Retrieved from: [Bloomberg website](#)
12. Circle Economy. (2021). *The circularity gap report 2021*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
13. Slimbreker. (n.d.). Why Smartcrushers. Slimbreker. Retrieved from: [Slimbreker website](#)
14. LEKO LABS. (n.d.). Carbon negative construction. Retrieved from: [LEKO LABS website](#)
15. BIOHM. (n.d.). Regenerative biomanufacturing. Retrieved from: [BIOHM website](#)
16. Madaster. (n.d.). Madaster platform. Retrieved from: Madaster website
17. MX3D. (n.d.). WAAM for architecture and construction. Retrieved from: [MX3D website](#)
18. EU buildings database. (n.d.) Retrieved from: [European Commission website](#)
19. Information system built environment. (n.d.) Retrieved from: [IOER-BDAT website](#)
20. Deetman, S., Marinova, S., van der Voet, E., van Vuuren, D. P., Edelenbosch, O., & Heijungs, R. (2019, September). Modelling global material stocks and flows for residential and service sector buildings towards 2050. *Journal of Cleaner Production*, 118658.
21. Circle Economy. (2019). *The circularity gap report 2019*. Amsterdam: Circle Economy. Retrieved from: [CGRI website](#)
22. Cradle to Cradle Certified Required Percentages of Cycled and Renewable Content by Product and Material Type. (2021, March 16). Retrieved from: [Cradle2Cradle website](#)
23. European Commission. (2011). Service contract on management of construction and demolition waste -SR1. *European Commission*. Retrieved from: [European Commission website](#)
24. LYTAG concrete. (n.d.) Retrieved from: [Aggregate Industries website](#)
25. Sabah Abed, M., Fahad Resan, S., & Kamil Zemam, S. (2018). Developing Lightweight Clay Brick Units Using Waste Materials. *International Journal of Engineering & Technology*, 7(4.20). doi: [10.14419/ijet.v7i4.20.25939](#)
26. Moynihan, M. C., & Allwood, J. M. (2014). Utilization of structural steel in buildings. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 470(2168). doi: [10.1098/rspa.2014.0170](#)

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