# Circular Economy

## UKGBC Sustainability 360 survey findings 2017

## 1. Overview

This document has been compiled by UKGBC using research into the sustainability commitments of Gold Leaf members during 2017. Based on feedback from our Gold Leaf members in a 2016 membership survey, the topic of circular economy was identified as being one of the topics that most, if not all, wished to better understand in terms of both what it might imply for different parts of the sector, and where current thinking stands within the Gold Leaf community.

This analysis was therefore conducted as separate but complimentary research to the overall 360 Review covering Gold Leaf member commitments across climate change, resource use, nature and biodiversity, health and wellbeing, and socio-economic impact. The Leading the Way 2018 report[1] provides an overview of the results to this research.

As part of the research UKGBC interviewed 52 Gold Leaf member organisations and asked them what their organisation was doing around Circular Economy, what the opportunities, barriers and solutions were and finally what more UKGBC could do in this space.

The introductory section in this document sets out the importance of circular economy to sustainable businesses and provides some leadership examples both in and out of sector and a section for each built environment sub-sector – clients, advisors, contractors and product manufacturers. For each of these, we set out how each sub-sector within the built environment industry could go about applying circular economy thinking within their businesses and how Gold Leaf members are currently approaching circular economy illustrated with some examples.

As a reminder of what types of businesses are comprised by each of the four key sub-sectors:

- Clients – which include investors, REITS, property companies, developers, housebuilders and major occupiers (19 companies in total)
- Advisors – which include architects, engineers, agents, and multi-disciplinary consultants or advisors (11 companies in total)
- Contractors – which include tier 1 contractors and companies providing construction services (13 companies in total)
- Product manufacturers – which include suppliers of products or materials used in the building lifecycle (8 companies in total)

Whilst each organisation has a role to play in adapting their business model, this is undoubtedly a topic that requires systemic change with commitment and buy-in from all different players in the sector, partnerships and collaborations across industry sectors, and strong government intervention, both national and international.

[1] https://www.ukgbc.org/leadingtheway

# 2. Introduction to the Circular Economy

## 2.1 What it means

A circular economic model is one that is regenerative by design. Its goal is to retain as much value as possible from resources, products, parts and materials to create a system that allows for long life, optimal reuse, refurbishment, remanufacturing and recycling[2]. With systems thinking, industry collaboration and the skilful use of advanced technology, a circular economy offers an alternative approach to growth that is decoupled from the use of scarce resources and has a lower environmental impact.

## 2.2 Why it's important

As the world's population grows and economies expand, competition for raw materials is increasing. At the same time, growing awareness of the environmental costs of natural resource extraction is propelling a trend towards greater regulation and divestment from some industry sectors. With its focus on maximum resource efficiency, the circular economy can enhance resilience, reduce risk and lower financial and environmental costs, whilst at the same time improving the quality and value of products and offering wider potential socio-economic benefits[3].

What is more, by reviewing 120 case studies across a range of sectors, Accenture has observed that adopting circular economy principles is enabling companies to gain real competitive advantage[4]. Shifting to a circular economy model leads companies to innovate, cut out inefficiencies and create added value.

## 2.3 Business leadership

At a broad industry level, the Ellen MacArthur Foundation[5] has emerged as a global advocate and thought leader on this topic, working with businesses, governments and universities to accelerate the transition to a circular economy. It works with a number of companies which are pioneering circular economy business models, among them **Nike**, **H&M** and **Philips**. All three companies view the circular economy as creating significant business opportunities as well as supporting their journey to deliver long-term sustainable, resource-resilient businesses.

Nike views sustainability-orientated innovation as an engine for future growth. The company has set a vision for a low-carbon, closed-loop future, aiming to 'double its business with half the impact. 71 per cent of all Nike footwear and apparel already includes recycling materials and the company has pioneered new design techniques to reduce production waste. Its 'Reuse-A-Shoe' and 'Grind' projects enable around 1.5 million worn out trainers to be collected and recycled into sports courts and other products each year.

H&M has set the vision to become "100% circular and renewable" by 2030. This means including only recycled or other sustainably sourced materials in its production, exploring solutions to create a closed loop for textiles, and developing 'circular' stores. Its garment collection initiative, which started in 2013, has so far gathered more than 32,000 tonnes of garments for re-wear, re-use as new garments and downcycling into products like cleaning cloths and insulation fibres. In 2017 both H&M and Nike supported

[2]Kennis Kaarten, Ellen MacArthur Foundation (see https://kenniskaarten.hetgroenebrein.nl/en/knowledge-map-circular-economy/definition-circular-economy/)

[3] The London Waste and Recycling Board (LWARB) estimates that London could receive a net benefit of up to £7bn a year by 2036 if we accelerate the transition towards a circular economy model. It could also create 40,000 jobs (12,000 net additional jobs) in the areas of re-use, remanufacturing & materials innovation. See LWARB, 'London's Circular Economy Route Map: Executive Summary' (2017).
Arup anticipates that the engineering and construction industry in the EU could save £60bn by 2030 by reducing the use of primary resources and add £3-5bn to London's GDP by 2036. See Arup, 'The Circular Economy in the Built Environment' (2016)

[4]Accenture, 'Circular Advantage: Innovative Business Models and Technologies to Create Value in a World with Limits to Growth' (2014)

[5]https://www.ellenmacarthurfoundation.org/

the launch of the Ellen MacArthur Foundation's Circular Fibres Initiative, which brings together key industry stakeholders to build a circular economy for textiles[6].

Philips has a mission to pioneer circular economy innovation in the areas of healthcare, consumer lifestyle and lighting. Its circular economy strategy includes revising its design standards to facilitate repairability, upgradeability and modularity. The company is also experimenting with new, performance based business models. It is growing its refurbished systems business in healthcare and is working on implementing similar models for remanufacturing and parts harvesting in other business divisions.

## 2.4 Leadership in the Built Environment

The following bank of case studies are examples of applying circular economy thinking within the built environment at a product, building and city level. UKGBC wishes to gather further case studies, so please contact us if you have further case studies[7].

Pasona HQ, is a unique urban farm office building in Tokyo that grows food for its employees. Hydroponic and soil-based farming is interspersed throughout the office interior – including private offices and conference rooms – whist the exterior has been renovated to create a living façade which grows seasonal flowers and orange trees.

ReTuna Återbruksgalleria is a shopping centre in Sweden which sells only recycled, upcycled and repaired goods. It serves simultaneously as a recycling depot, shopping experience and education centre. Dropped off goods are sorted into various workshops where they are refurbished or repaired accordingly. Products are then sorted into 14 specialty shops that include furniture, computers, audio equipment, clothes, toys, bikes, and gardening and building materials. Many of ReTuna's stores also have a DIY showroom where customers can learn how to make or repair their household items.

Buiksloterham in Amsterdam is a neighbourhood that serves as a living lab for Circular, Smart, and Biobased development. It will incorporate 3,500 homes and 200,000m² of workspace and will be designed to be energy self-sufficient from renewable supply; have a 100% circular material flow and near 100% recovery from waste water. This will be done by construction of new units to Passive House standard, using rooftops for rainwater collection, biodiversity and solar energy generation and building different sewer systems for different water types, among other interventions.

Ecovative is a leading biomaterials company growing high performance, premium, award-winning products that are safe, healthy, and certified sustainable. Its products are based on mycelium technology, and include the organic, biodegradable bricks used to create The Living, the 'mushroom brick tower' in New York.

Armstrong Ceilings implemented an end-of-life take-back programme for its own mineral ceiling tiles starting in 2006. Ten years on, it has recovered over 500,000 m² of old ceilings across Europe, and has recycled over 15 million m² globally. It has also taken steps to ensure that products use materials which are safe and reusable, and endeavour to minimise resource consumption through the manufacturing process.

Dutch bank, ING, started the Orange Circle, ING's circular economy programme, which has the ultimate ambition to help clients make the transition from ownership to access. ING recognises it is more than just sharing or recycling. It is also a case of having a different approach to design, sales, value risk, and finance.

[6]For more information about H&M's approach to the Circular Economy, see https://sustainability.hm.com/content/dam/hm/about/documents/en/CSR/Report%202016/HM_group_SustainabilityReport_2016_CircularAndRenewable_en.pdf

[7] info@ukgbc.org

Within its own office, PWC has been taking steps towards a circular operational model. The firm reports that by recycling or reusing over 85% of its waste, it is generating over £500,000 a year in additional revenues and has gained useful insights which can now be shared with other businesses.

The London Waste and Recycling Board (LWARB) has created a Circular Economy route map[8] covering multiple sectors, including the built environment. Devised collaboratively with major built environment organisations, the route map uses the built environment hierarchy and gives examples where elements of the hierarchy have been implemented. The report also outlines the exploitable opportunities, from design through to operational stages of building, with a practical route map which sets out the actions and the corresponding required resources, expected outputs and outcomes and, ultimately, the impact. LWARB highlights that the circular economy represents the next major area of potential savings and contribute to GDP growth of between £3bn and £5bn annual by 2036.

The European Commission's "Roadmap to a Resource Efficient Europe"[9] outlines how Europe's economy can be transformed into a sustainable one by 2050. The Roadmap is a key document in resource efficiency work seeking to assist this transformation, such as the Europe 2020 Strategy and its flagship initiative "A Resource Efficient Europe". Improving Europe's buildings is a key sector and so the Roadmap identifies that existing policies could be strengthened in terms of resource efficiency across their lifecycles, whilst also considering lifecycle costs. The aim is that by 2020 the "renovation and construction of buildings and infrastructure will be made to high resource efficiency levels. The life-cycle approach will be widely applied; all new buildings will be nearly zero-energy and highly material efficient, and policies for renovating the existing building stock will be in place so that it is cost-efficiently refurbished at a rate of 2% per year. 70% of non-hazardous construction and demolition waste will be recycled".

Factor 10, WBCSD's new circular economy programme, aims to bring circularity into the heart of business leadership and practice. Their goal is to build a critical mass of engagement within and across business to move the circular Economy to deliver and scale solutions needed to build a sustainable world.

Peterborough Council is committed to creating a Circular Peterborough by 2050. The aim is that Peterborough will operate as a truly circular city: maximising the full potential of its resources and reconnecting people, places, businesses, organisations and communities. The council states this will be done by rethinking, redesigning, repairing, reusing, remanufacturing, recycling and recovering products and services. This will be linked to achieving the city's vision of ensuring people live longer, healthier, more prosperous lives with better skills in a safe and sustainable environment that only uses the resources of one planet.

David Cheshire, AECOM has researched and launched a book which, for the first time addresses circular economy principles in the built environment.[10]

Circle Economy[11] is a Dutch social enterprise, organised as a cooperative, which aims to accelerate the transition to circularity through action-focused development of practical and scalable solutions. It provides tools and programs designed to facilitate decision-making and action plans for businesses and governments in a wide range of sectors. Within the built environment sector, it is creating a new foundation for a circular built environment by:

- Collaborating on the development and inclusion of circularity assessment indicators in sustainable construction standards
- Developing the knowledge, insights, and (digital) tools needed for a circular built environment
- Building new, innovative ventures, and transforming existing ones

[8] https://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-CE-route-map_16.6.17a_singlepages_sml.pdf
[9] http://ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm
[10] https://www.aecom.com/uk/press-releases/circular-economy-approach-bring-cost-efficiency-environmental-benefits-built-environment-sector/
[11] https://www.circle-economy.com/

There are many more initiatives and organisations working in this space which have been mapped out by the Circular Economy Club, this group identified more than 3000 initiatives worldwide[12]. The Circular Economy Club (CEC)[13] is an international network of over 2,600 circular economy professionals including designers, engineers, economists and strategists, and represents organisations in over 60 countries. The club aims to accelerate circular economy principles and embed them into business practice via providing open tools and resources and events. Resources for the built environment sector include examples and case studies of circular cities as well as circular economy maps, directories, research, reports, guidance, podcasts and funding opportunities.

We are keen to hear of more initiatives and work together with these organisations.

[12] https://old.circulareconomyclub.com/circular-economy-mapping-week/
[13] https://www.circulareconomyclub.com/

# 3. Clients

## 3.1 Applying the concept

For investors, developers and asset owners, shifting to a circular economy business model essentially involves taking a longer-term, whole life cycle approach to the built environment, from design and assembly or renovation to operation; disassembly and repurposing or reuse.

From an operational perspective, it can encompass using bio-based or fully recyclable input materials and re-using construction and demolition materials. Optimising asset performance through resource efficiency measures and facilitating the reuse of natural resources such as energy and water are also in alignment with circular economy principles.

Many property investors are already pursuing a strategic approach that is in keeping with the circular economic model by focusing on urban regeneration, building retrofit and compact design. Others are actively seeking to prolong asset life by designing for flexible uses and/or dis-assembly and reuse of building components.

A step further in this vein would be to develop an asset strategy that maximises asset utilisation[14], such as by promoting multi-use assets; flexible lease arrangements; co-living schemes; shared services in multi-let buildings; 'out of hours' uses for offices or even using roof tops, interior walls and external façades for renewable energy generation; vertical or roof top food growing. Property investors, developers and asset owners would also investigate opportunities to integrate the activities of tenants, customers, suppliers and owners and occupiers of adjacent buildings and infrastructure into their circular economy model. At a more advanced stage, the built environment would be conceived as part of an urban ecosystem that is interconnected, co-operative and recycles resources in perpetuity – fully eliminating the concept of 'waste'.

## 3.2 Findings within Gold Leaf membership

Within the UKGBC Gold Leaf Member clients group, four companies are working internally to define what the Circular Economy means to their business, and three have already completed this process. For six companies, the primary focus of circular economy thinking is on tackling waste. Four companies view it as being fundamentally aligned to the resource efficiency strategies which they are already pursuing. Seven companies are taking a more holistic or 'whole value chain' approach to the concept and have a long-term vision of shifting to a circular built environment and/or business model. Three companies find the concept somewhat problematic either because it appears to be too broad a topic or because it is difficult to apply to their business model.

All companies within the client group are undertaking at least some activities which are aligned to the circular economy model. All are taking actions to optimise resource use in building construction and/or operations, and 11 (58%) are carrying out initiatives to increase the reuse of waste. At least eight companies (42%) are deploying strategies to increase long-term resource resilience such as integrating on-site renewable energy and/or water re-use systems.

Eight companies (42%) are innovating in design and construction techniques in order to reduce materials use or design out waste; increase asset flexibility and/or to enable disassembly at end of asset life. At least five companies have set or are setting procurement standards to increase the use of recycled or reused input materials.

[14]According to one study, 60-65% of European office space is under-utilised even during work hours (Miller, N. 'Workplace Trends in Office Spaces: Implications for Future Office Demand', University of San Diego, 2041). Hence there is considerable scope to increase resource efficiency through better use of space.

Three companies are investigating the potential to procure or offer rental services in place of products with regards to building equipment, infrastructure and/or tools; and two companies are exploring sharing economy models. Another two companies have pioneered closed-loop initiatives in collaboration with suppliers and customers.

### 3.3 Examples of circular economy in practice for clients

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| The Berkeley Group has developed the Berkeley Urban House concept, a model which enables twice as many homes to be built on a site compared to traditional terraced housing. Moreover, the Berkeley Urban House is designed to be flexible and capable of simple adaptation to accommodate changes in occupants' lifestyles and mobility over the years. To reduce energy use, it combines a highly efficient building fabric with a mechanical ventilation system and low carbon technologies. To reduce potable water use, it incorporates water efficient appliances and rainwater harvesting. The Berkeley Group reports that the first 22 homes of this prototype have been built on two streets at Kidbrooke Village, while others are under construction at Green Park Village in Reading. |
| Canary Wharf Group is taking advantage of the digitalisation of design to 'build' its projects in the virtual environment. This will help the Group to design-out waste and log materials used in construction, for potential recuperation at a later stage. Within its estate management business, the Group has engaged closely with retail tenants to identify ways to recycled and reuse greater volumes of waste. Among other initiatives this led to the launch of #WakeUpAndSmellTheCoffee, which enables coffee cups to be segregated and recycled on a closed-loop basis. |
| As part of its Heathrow 2.0 strategy, Heathrow Airport is seeking to deliver a resource efficient, zero waste airport and support a circular economy. This will involve changing airport wide culture to value resources and dis-incentivise waste; promoting 'sharing' models to make better use of resources; engaging with the supply chain and ensuring that all tenders for works or products include a circular economy opportunities assessment and influencing business partners' operations to encourage better outcomes for resource management. |
| In 2016 Standard Life Investments acquired a unit at Fokker Logistics Park Schiphol in the Netherlands, part of the The Fokker 7\|8 Distribution Centre, which claims to be the world's first Cradle to Cradle® inspired logistics building. Its modular design ensures it is fully flexible for potential future uses; it features a 480kWp rooftop solar array and its use of natural ventilation, energy-saving systems all promote resource efficiency in operation. Standard Life is now actively exploring the application of Cradle to Cradle® principles as part of its own new developments and refurbishments, and has updated its Sustainable Real Estate Investments Policy to enable this. |
| In 2014, to allow new access roads, SEGRO deconstructed an entire warehouse and rebuilt it at the Cambridge Avenue unit on its Slough Trading Estate. The steel frame, concrete beams and slabs were reused, as was the lift. The project is estimated to have saved SEGRO 25% on the cost of a new building and allowed for a 56% reduction of embodied carbon. |
| Having recently signed up the Ellen MacArthur Foundation CE 100, The Crown Estate will embark on a three-year partnership to embed the principles of the circular economy across the business and its activities. Building on existing initiatives, which have enabled 98% of waste diverted from landfill on current developments and the development of a waste consolidation programme across the central London portfolio, The Crown Estate is seeking to identify further opportunities to apply circular economy practices as part of its strategy to deliver a carbon-free, waste-free business by 2030. |

# 4. Advisors

## 4.1 Applying the concept

Designers and consultants have a key role to play in supporting clients to realise a circular economy approach in the building lifecycle. Examples of how clients can be supported is through early engagement of the rest of the value chain, including product manufacturers and contractors to find alternative approaches to reuse. It can also include having a long-term vision around the use, flexibility and eventual deconstruction of the building to allow for high value parts to be reused.
With the inevitable increase in the value of resources, clients will increasingly view material procurement and waste as a material high risk to their business model and require more innovative approaches to designing out waste, design for deconstruction and for flexibility of space use. This will require extensive upskilling of design staff to ensure clients receive the expertise they require.

Typically, designers base their business models around winning new projects rather than reusing existing buildings and being restorative and adopting a circular business model. Some forward-thinking advisors are starting to think about what their business model will look like in time to ensure they are providing a service that supports a collaborative and circular approach to the built environment.

## 4.2 Findings within Gold Leaf members

Out of the eleven Gold Leaf member advisors around five considered circular economy to be a wider concept beyond just resource efficiency. One thought the focus should be on resource efficiency. The others were struggling with defining the concept and felt there was no incentive to invest in the topic without the drive from clients.

Three advisors were doing their own internal research to establish a position on CE and considering whether they should invest in dedicated resources and review their business model. Three advisors suggested they were looking at CE principles relating to their internal operations such as donating IT/telecomms equipment to charities and recycled content in paper. All advisors are currently looking at CE in terms of resource use and advising around issues such as recycled content, reuse of secondary materials, reuse of demolition material, recycling of waste to avoid landfill. None talked extensively about designing buildings to allow for disassembly, flexibility, or off-site manufacturing.

### 4.3 Examples of circular economy in practice for advisors

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| Arup has set out five commitments to promote the circular economy, including developing projects and sharing research that can challenge the industry to apply circular economy principles. The organisation has worked with a number of clients to implement circular economy principles on its projects. For example, Arup designed the Sky "Believe in Better" Building, a timber construction using modular, prefabrication techniques which meets Passive House standard due to its energy systems and materials selection. It has also piloted the SolarLeaf house which integrates bioreactive façades onto buildings to generate renewable energy from algal biomass and solar thermal heat. |
| A BRE audit found that more than 95% of demolition materials from a 1960s housing estate could be profitably diverted from landfill, with further earnings to be made from other reclaimed materials. |
| AECOM founded the Major Infrastructure–Resources Optimisation Group (MI-ROG) in 2013 as a forum for the UK's infrastructure operators to collaborate across the circular economy theme and to meet the challenge of delivering major infrastructure in a constrained economy. MI-ROG members are senior representatives of Anglian Water, Centrica, EDF Energy, the Environment Agency, Heathrow Airport, Highways England, HS2, National Grid, Network Rail, Thames Tideway Tunnel and United Utilities. MI-ROG has inspired and facilitated workflows on asset life cycle, carbon performance, circular economy planning, critical materials availability, materials exchange and sustainable procurement and supply chains. |

JLL UK has set a target to "support the transition to a circular economy through our services, workplaces and public affairs activities" by 2020. The company aims to achieve zero waste to landfill in JLL UK corporate offices by 2020, with at least 70% of all waste recycled. JLL UK has established an internal circular economy task force to develop its strategy, which will encompass integrating "circular economy thinking" and innovations into day-to-day work with clients; embedding circular economy principles within its corporate sustainability strategy and offering circular economy services and advice through Upstream (and ultimately all key service lines). The company is beginning to sell circular economy services for the first time across various service lines. To date, this has included working with consultants to explore partnership opportunities with furniture and glass remanufacturers on circular economy pilots on The Crown Estate's central London portfolio, and delivering planning advice to the University of St Andrews on the circular reuse of a former papermill site as a new biomass energy centre and hub of a district heating network at its Guardbridge campus. Through its participation in the BITC Circular Office campaign, JLL is committed to testing circular innovations within its own workplaces and sharing one case study.

# 5. Contractors

## 5.1 Applying the concept

Traditionally the construction industry follows a linear process of extracting materials, processing them and then disposing at the end of the buildings life. This has come about due to the low cost of taking resources out of the ground and not considering their inherent value beyond being fixed into a building. However, in recent years with the introduction of the landfill tax more contractors are looking to find alternative routes for waste, mainly recycling which can also include incineration.

For contractors looking to establish a circular economy business model requires a smarter approach to procurement and a closer working relationship with clients and design teams to integrate circular economy thinking early in the project. Modular and offsite construction is a tried and tested approach to reducing waste onsite, ensuring waste is designed out and allows for design for deconstruction in the inevitable scenario that the building reaches the end of its service life, however this concept is not routinely applied to projects. Many building construction projects don't consider end of life and typically apply construction techniques that do not allow for deconstruction and reuse such pouring concrete rather than modular elements. A big challenge for contractors in reusing elements is the storage of materials on construction sites. A number of initiatives have been in operation such as National Industrial Symbiosis Programme[15] or are being set up to enable the sharing of resources between construction sites such as LOOP[16]. Many contractors already look to share left over materials, especially paints with local community groups.

Forward thinking construction companies are looking to set targets beyond waste to landfill and aiming to achieve zero waste generation. There are big wins relating to the demolition of buildings and reuse of building elements.

Reviewing opportunities through BIM is a helpful way of reducing waste at the design stage and should help record which components can be deconstructed, reused, and sent for take back.

## 5.2 Findings within Gold Leaf members

Within the UKGBC Gold Leaf Member Group, only one contractor organisation, BAM, has a specific circular economy related target set with Board level support, and is also the only contractor in the Ellen MacArthur CE100 group. Three contractors are already working with clients to define and apply circular economy thinking to projects. Two contractors are upskilling staff internally on the concept of circular economy. Four contractors are actively exploring what it means to their business, holding regular internal workshops to define the topic. Three contractors are cynical about the concept of circular economy – either they are never asked about it by clients or think it is a complication to the bigger picture of creating a sustainable built environment. Many don't see the commercial value of applying circular economy thinking and it isn't conducive to current linear business models.

Currently all contractors are focussing on resource efficiency rather than necessarily the wider concept of maximising the value of resources.

There was concern within the group that the term Circular Economy could confuse the industry in terms of how it relates to sustainability.

[15] http://www.nispnetwork.com/
[16] https://loop-hub.co.uk/

## 5.3 Examples of circular economy in practice for contractors

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| Skanska is working with customers and suppliers to develop detailed project carbon profiles. This helps to identify savings, evolve designs and specifications to reduce emissions, promote low carbon solutions and demonstrate the economic case for low carbon construction. |
| Laing O'Rourke's approach to using Design for Manufacture and Assembly means that many of its building products have lower embodied carbon. For example, precast columns contain 39 per cent less reinforcing steel than in-situ alternatives. |
| Carillion reports that by finding new ways to reuse materials, it is enabling competitive tenders and creating savings for customers. Where it has demolition and construction projects within close proximity of each other, it has endeavoured to create a localised circular economy, such as between Paradise Circus (demolition) and the new Midlands Metropolitan Hospital (construction) in Birmingham. |
| BAM has been part of a number of initiatives to test and drive CE thinking. This includes Circl, the Circular Pavilion in Amsterdam, which is heralded as The Netherland's first circular building. Developed by ABN AMRO, BAM construction firm and architects CIE, circular options were considered at every step of the design process. All material components used are recyclable. Among other elements it encompasses walls made from coal waste and insulation made from 16,000 pairs of old jeans. |

# 6. Product Manufacturers

## 6.1 Applying the concept

For product manufacturers, shifting to a circular economy model requires a step change away from the traditional process of resource extraction; production; distribution; use and disposal as waste. Instead, a longer-term, whole life cycle approach must be considered, that places production (based on recycled or renewable resources), repair, reuse and recycling at the heart of a cyclical process.

At a more advanced stage, manufacturers might re-think their commercial model, potentially shifting from 'product' to 'service' provider by leasing, maintaining, repairing and reselling products on behalf of clients. They would work within an industrial ecology system that is interconnected, co-operative and recycles resources in perpetuity - thereby eliminating the concept of 'waste' – and exploiting all available opportunities to commercialise by-products such as waste energy or secondary materials. They may pursue a 'net zero' or 'net positive' approach to materials and natural resource consumption, meaning that the manufacturing process results in no net depletion fossil fuels, water or virgin materials and/or generates more renewable energy or restores more biological resources than it consumes.

## 6.2 Findings within Gold Leaf members

All product manufacturer companies within the UKGBC Gold Leaf member group are already implementing at least one type of circular economy intervention as part of their sustainability and/or core business strategies, such as:

- Products based on renewable materials, and/or are in themselves durable, flexible and reusable.
- Products that enable greater energy or water efficiency through their use.
- Advanced software and intelligent packing solutions to optimise logistics.
- Optimising energy and water consumption and/or using renewable energy to manufacture products.
- Integrating energy exchange into the manufacturing process, for example enabling another organisation to use waste energy generated or vice versa.
- Eliminating production waste, or enabling 'waste' material or by-products to be reused by another organisation.
- Implementing 'take-back' schemes to incentivise customers to return products for repurposing and reuse.
- Developing systems to enable the electronic tracking of products to provide users with transparent information about their life cycle characteristics and to facilitate repair and reuse.
- Cradle-to-cradle product certification to meet client specifications.

Among the eight product manufacturing companies within this sub-group, seven companies are focusing on materials, waste and resource efficiency from a circular economy perspective. A further three companies are taking a more holistic view of the concept: one company views it as a 'whole economic movement'; another has mapped its core business model against the circular economy model and a third is considering how it might engage with customers to deliver a circular built environment in a broader sense.

Our engagement with the product manufacturers highlight four key drivers in relation to the circular economy: risk management and long-term resource resilience; demonstrating leadership; increasing efficiency in production and reducing waste and product and process innovation. Indeed, six out of eight companies are seeking to pioneer circular economy leadership within their industry and/or embed circular economy principles within product design.

A range of circular economy practices are already being implemented by companies within this group. These include developing products with secondary product to reduce raw materials use (seven companies); developing new products with circular economy credentials (five companies) and take-back schemes for customers to facilitate re-use (four companies).

At least four companies are engaging with consumers to promote circular economy 'thinking' and three companies are exploring leasing or services business models.

With regards to operations, at least four companies are applying resource efficiency approaches such as life cycle analysis or closed loop recycling and two have renewable energy facilities on some manufacturing sites. All are optimising resource use through energy and water efficiency initiatives.

### 6.3 Examples of circular economy in practice for product manufacturers

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| Aggregate Industries is using the by-products of other industries in concrete mixes, including china clay waste and crushed green bottle glass, both of which may be used to replace virgin materials in mix designs. Aggregate Industries is also seeking to embed circular economy principles within product design through the Life brand sustainable product range. |
| AkzoNobel has established its Chemical Island concept based on circular economy principles. The company set up chemical facilities at its customers' pulp mills. These factories make use of excess renewable energy from the pulp mill and AkzoNobel provides the mill with the chemicals it needs. The Pulp and Performance Chemicals business is part of a potentially fully renewable value chain based on abundant salt, renewable energy and renewable fibres. |
| Rockwool has identified the Circular Economy as one of four themes where it can have greatest sustainability impact. Rockwool states that 100% of its production waste is recycled and ROCKWOOL products themselves are 97% recyclable. Approximately one-third of its raw materials is repurposed waste from amongst others the steel and aluminium industries, power plants and municipal waste water treatment. Rockwool takes back around 16,000 tonnes of used product at 16 factories across Europe, Russia and China and aims to roll out internal closed loop stone wool recycling to further countries over the next decade. |
| Tata Steel won a Steelie Award from the World Steel Association for its role in the construction of the cradle-to-cradle distribution centre at Schiphol in The Netherlands. Recognising the 'circular' properties of steel, which can retain its value or even be improved by recycling, the Park 2020 developer Delta Development Group worked together with Tata Steel to create a building which can be fully disassembled, with all materials data saved in a Building Materials Passport. |

## 7. Survey of UKGBC Gold Leaf members

The following section sets out the *Circular Economy Opportunities, Challenges and Solutions as identified by UKGBC Gold Leaf Members.*

| Opportunities | Challenges | Solutions |
|---|---|---|
| • Meeting waste targets and demonstrating leadership in terms of waste reduction and reuse<br>• Delivering greater operational efficiencies<br>• Saving costs<br>• Offering added value to customers<br>• Developing win-win partnerships with suppliers and customers<br>• Supporting social value creation<br>• Long-term resource resilience<br>• New commercial opportunities from circular economy-based products and services<br>• Competitive advantage<br>• Enhancing asset value<br>• Demonstrating industry leadership | • Communicating and clarifying the concept and links to other standards/definitions<br>• Lack of action/ engagement within the supply chain<br>• Lack of proven business case<br>• Financial implications<br>• Friction with the current business model<br>• Lack of internal collaboration<br>• Lack of support from government<br>• Changing mind-sets to see 'resource' not 'waste'<br>• Maintaining product quality with alternative materials<br>• Findings routes for product reuse at end of life<br>• Articulating the life cycle value of the product<br>• Inflexible standards on recycled content<br>• R&D cost<br>• Logistics – trade-off between recycling and transporting in relation to take-back schemes<br>• Lack of time and space for disassembly within standard (de)construction practices<br>• Multiple owners over life makes it difficult to have long term invested | • Clear definition of how the concept applies to the built environment, what the opportunities are and guidance on how to proceed<br>• Proof of concept and business case, with practical case studies<br>• Industry engagement, particularly involving the supply chain<br>• Industry R&D<br>• Employee engagement<br>• Customer and wider community engagement<br>• Government support<br>• Better communication with end-user, including engagement with clients to inform their purchasing decisions<br>• Government incentives and R&D investment<br>• Supportive standards and common methodologies that can be used to articular for life cycle analysis and/or circular economy credentials of products<br>• Supply chain engagement<br>• Industry collaboration<br>• Widespread use of Building Information Modelling (BIM) |

## 8. Next steps for UKGBC

Further to the interviews we have conducted with UKGBC Gold Leaf members on circular economy, many businesses have expressed a desire to be more collaborative and get involved in initiatives that might advance collective thinking within the sector. These businesses see UKGBC as a key organisation to convene such initiatives, while needing to ensure differentiation with any other circular economy related built environment programmes. There were a number of specific suggestions for how UKGBC might help deliver the solutions listed in the table above, including the development of further detailed case studies, supporting clients in specifying a circular economy approach, as well as further awareness-raising and education for professionals.

UKGBC will continue to work with its members to explore these opportunities and, subject to appetite for member involvement, aim to take forward a programme of work specifically on circular economy in the coming years.

For more information about progress on Circular Economy at UKGBC please see our website[17].

[17] https://www.ukgbc.org/ukgbc-work/circular-economy/