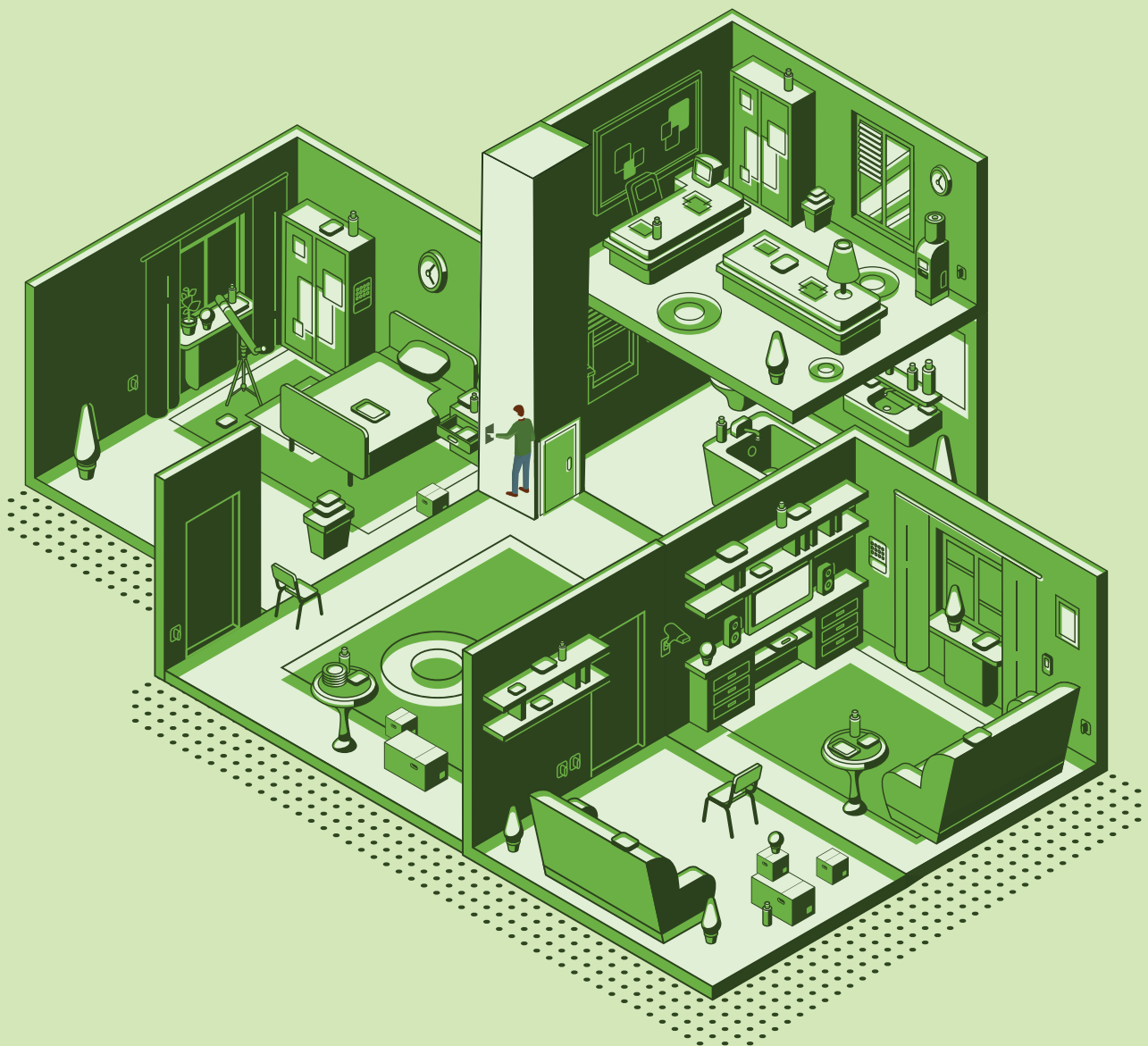


FUTURE OF THE SUSTAINABLE HOME AND OFFICE

From 15-minute cities to reinventing materials, global innovations are powering the rapid evolution of the home and office – and the ways we'll live and work sustainably post-pandemic



ARITCO REPORT 2022



POWERED BY
**SPRING
WISE**

REPORT OVERVIEW

PURPOSE

This report was co-created by Springwise and Aritco to explore the ways sustainable design is impacting the places where we live and work. It offers valuable insight into key trends, the latest technologies, and innovations from around the globe – revealing how our most familiar places and spaces are being transformed in the most exciting ways.

CONTENT

This report explores the future of the sustainable home and office through the lens of net zero and circularity – and the innovators working to incorporate this thinking into their work. In particular, it looks at sustainable solutions that tackle the world's biggest environmental concerns today, and how these can be seamlessly integrated to benefit people as well as the planet.

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NEXT LEVEL LIVING

Aritco is a Swedish lift company that mixes efficiency, aesthetics, Scandinavian design and safety for homes, schools, offices and retail stores. Sustainability has been a natural part of our DNA and ways of thinking since the company was founded, as solutions are often connected to regenerative applications.

In 2016, we launched the Aritco HomeLift which consumes less energy per year than a dishwasher or washing machine. Each lift is crafted from 95% recyclable materials and magnelis coating is applied to steel elements to prevent rusting, thereby extending the life of our lifts. From a consumer standpoint, our lifts futureproof homes for multi-generational living and an ageing population, reducing the cost, waste and energy of moving house.

Every year we carry out a CO2 audit to review our processes in order to reduce our carbon footprint and

increase energy efficiency. As a result, our headquarters outside Stockholm are now net zero as we only use solar energy and geothermal heat pumps, and when additional electricity is needed, only fossil-free electricity is used. All of the lights in the building use sensor driven LED technology rather than fluorescent bulbs, and 70% of our office furniture is second-hand. We also constantly monitor our manufacturing and distribution processes. Most of our international shipping is now done by sea, rather than by air freight and we have streamlined our logistics to ensure shipments to international markets like Asia include as many lift units as possible. Recently we launched a new packaging concept using only natural materials - 20% of our lifts are now shipped in wooden crates and customers can return them to us for re-use and receive a refund.

As all companies in the world are discovering, the transition to a sustainable, net zero future is long

and complex. We consistently drive and challenge ourselves in all aspects of sustainability. Our next challenge will be to change our entire future product portfolio architecture in the next five years to further increase material efficiency and reduce waste to achieve a circular life-time solution.

We hope you enjoy this report which highlights some of the global innovations that will support more sustainable homes and offices in 2022 and beyond. Watch this space for news from Aritco about how our lifts will become increasingly sustainable and will continue to revolutionize how we move around our homes and offices in safety, comfort and style.

David Schill
Marketing Director, Aritco Lift
aritco.com





INNOVATION FOR ACCELERATING CHANGE

While it can be hard not to despair at catastrophic climate change predictions, we at Springwise have reasons to stay cautiously optimistic. That's because, every day, we're seeing positive innovations created in response to the world's most pressing environmental and societal issues. And some of the most promising sustainability solutions are targeted at the home and office, as you'll see in the pages that follow.

But first, a few words about Springwise. We're the global innovation intelligence platform for positive and sustainable change, providing foresight into the most innovative thinking and ideas on the planet. We've been serving our community by publishing the most interesting business innovations since 2002.

We're the place of record for innovations that matter – spotting the innovators, the entrepreneurs, the original thinkers, the disruptors, and the outliers from across the

developed and developing world, and bringing these new ideas to a wide readership. Access to our daily innovations, and extensive database of more than 11,000 solutions, is free for all, via our website, daily and weekly email newsletters, and the Springwise Innovation smartphone app.

We're based in Somerset House, in London, alongside Re_Set – a next-generation consultancy helping enlightened leaders navigate the challenges of today and tomorrow. Where Springwise highlights innovations, Re_Set uses them and other insights to spark world-class strategies and action plans for global businesses.

We're a proud Certified B Corporation and members of 1% For The Planet. And we take a purpose-driven approach to all the work we do, including this report, which we've proudly compiled on behalf of our friends at Aritco.

Sustainable innovations are making our homes and offices better in every sense of the

word. A focus on achieving net-zero, highlighted by the recent COP26 summit, has led to clever solutions for saving energy, while thinking in terms of circularity is leading to ever-more sophisticated ways of reducing, reusing and recycling. From the personal level to the societal, these innovations combine to offer a glimpse of an exciting future – one that's fit for generations to come.

The global innovations we've spotted are proof that designers and architects are ideally equipped to think sustainably while still creating things that are functional and beautiful. And that's good for people, society, and the planet. We hope you find our take on the future of the home and office informative as well as inspirational.

Hannah Hudson,
Content Director, Springwise
springwise.com

POWERED BY
SPRINGWISE

NET ZERO THE NEW NORMAL FOR HOME AND WORK

The places we go to work and the places we come home to will come under increased scrutiny as countries around the world race towards net zero. How will our everyday spaces be rethought as places that contribute positively to the state of the planet?

What does net zero have to do with the way we live and work? More than we probably realize as we go about our day-to-day activities. That's because, every time we boil the kettle, switch on the heating, drive to the office, or power up our laptop, we're contributing, incrementally, to carbon dioxide levels in the atmosphere.

Net zero refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. Most scientists agree that to prevent the worst climate damage, global net human-caused emissions of CO2 need to fall by about 45 percent from 2010 levels by 2030 – reaching net zero around 2050. In the meantime, if

global emissions remain higher than zero, the planet will keep heating – and climate damage will continue to escalate.

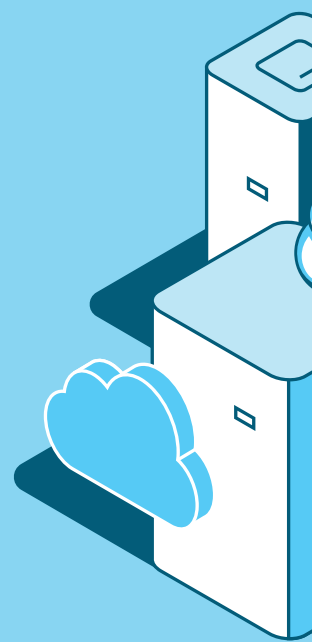
So, here's the problem. We still want to drink hot coffees, heat our homes and offices, get from A to B and use our computers, phones, and other technology. Our modern existence requires us to consume energy one way or another. That's why the challenge is to find ways to do it all more efficiently, and to do it in spaces that are equally as efficient.

Think of your own home or office. You can probably already guess the issues that cause a block to any net zero aspirations: clunky old radiators or air-conditioning units, colleagues cracking open

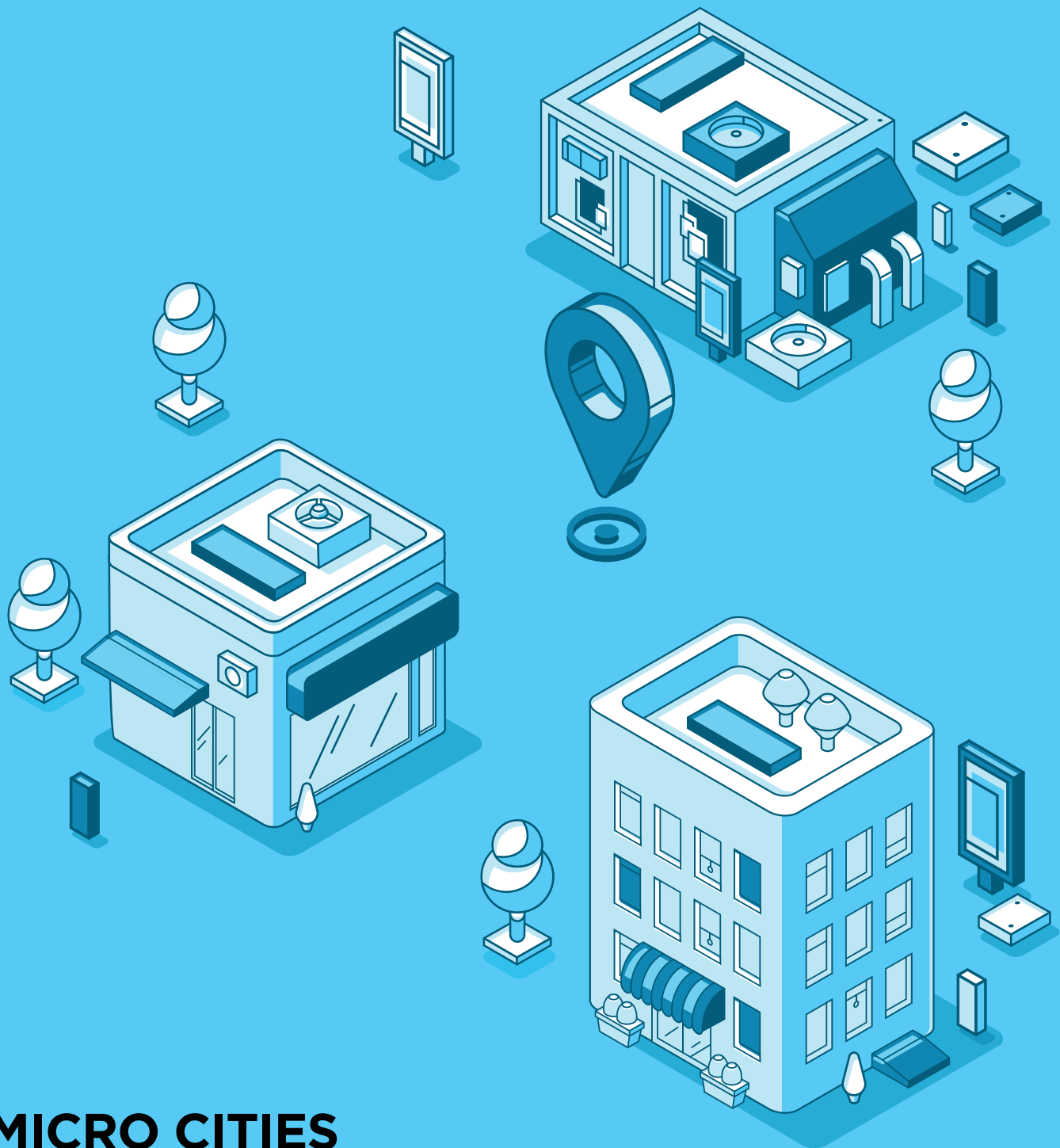
a window when the air conditioning is running, your children leaving the lights on in rooms when nobody is there.

Look more broadly at your community or city and you'll see more of the same, with cars stuck at traffic lights, pumping out fumes, and green spaces being paved over.

Clearly our homes, offices, neighborhoods, and cities will all need to be adapted, reconfigured and, in some cases, completely reinvented if we're to stand a chance of meeting climate change goals. Fortunately, innovators around the world are stepping up to fill the pipeline with ideas, products, and services to solve the sustainability issues around where we live and work.







MICRO CITIES

Long commutes and time spent in traffic jams could soon be a thing of the past. From shops and schools, to where we work – everything we need is coming closer, within an ever-decreasing radius by foot or bike.

The theory behind the 15-minute city is that most people's needs

would be within a quarter-hour of where they live. This would reimagine the city as a place where people walk, cycle, and live – rather than drive to and through. Paris is the first major city to trial the concept, creating for itself what it calls 'a city of proximities'. Now, leaders in Barcelona, Detroit, London,

Melbourne, and Milan are all working towards similar visions.

In Sweden, thinkers are going one step further by considering the one-minute or micro-city. "By transforming cities at hyperlocal level, street by street, the idea is that residents can develop a meaningful relationship with their immediate

neighborhood," says Dan Hill, an urban planner at Swedish innovation agency Vinnova.

"They can become co-architects of the change," he adds. "They can talk to each other, their neighbors or other street users about what the city means for them and about their role in it."

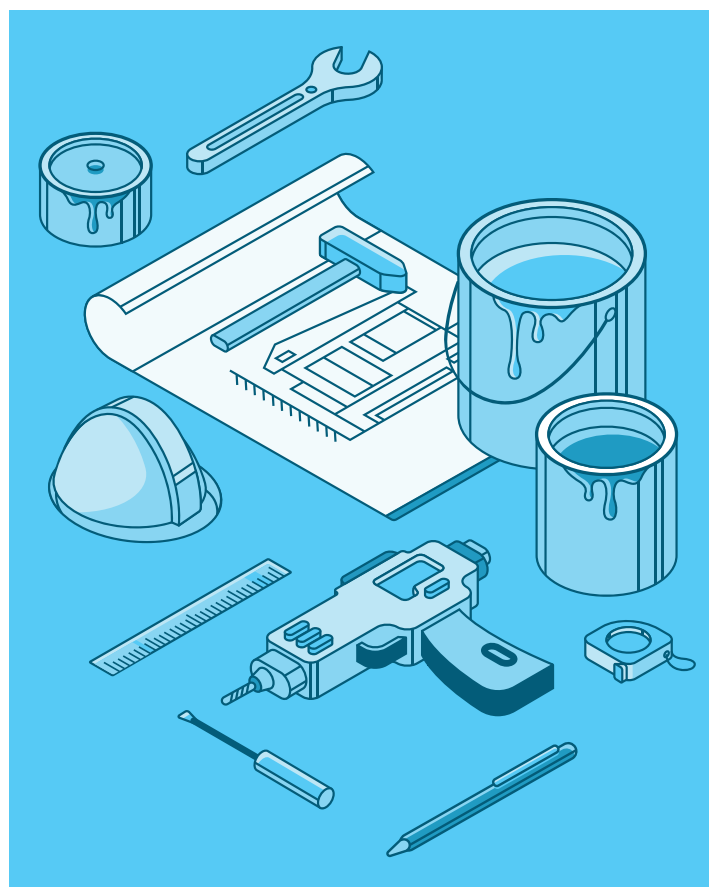
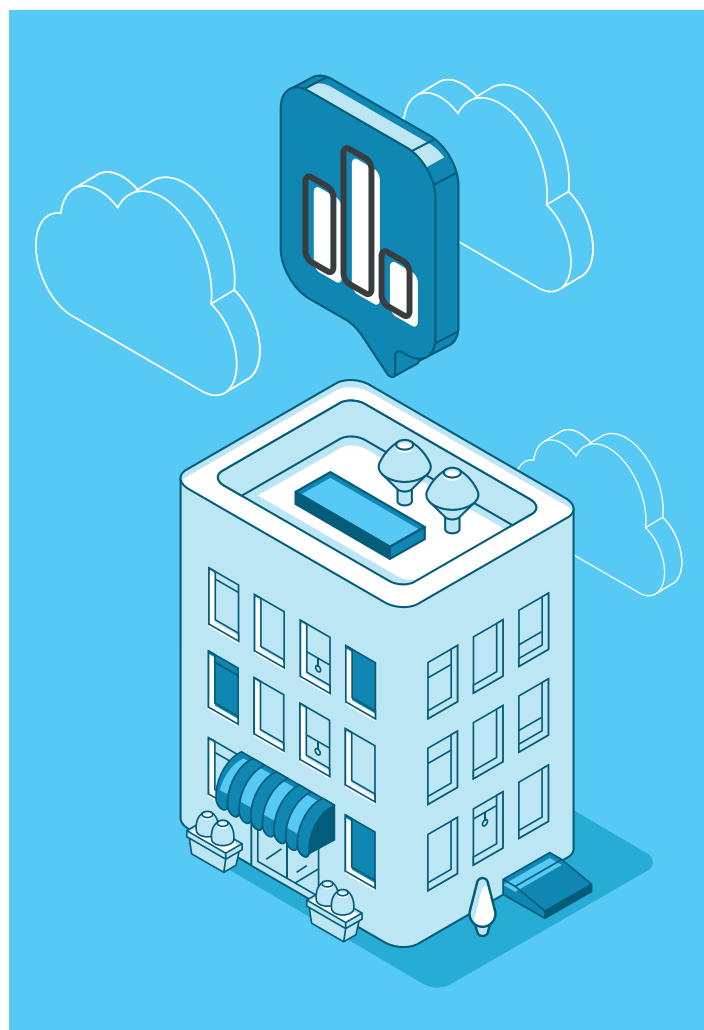
SMART-POWERED SPACES

While construction is notoriously bad for the environment (the sector is responsible for 23 percent of air pollution, 50 percent of climatic change, 40 percent of drinking water pollution, and 50 percent of landfill waste globally), what's often forgotten is the impact of people and consumer energy on buildings. Specifically, the way certain behaviors can create a massive waste of energy in homes and office buildings.

In 2020, the average household electricity consumption for a residential house in the US was 29.8 kilowatts per day. What's needed are spaces that automatically do the most energy efficient thing,

without the need for (or despite) human usage. And innovations can help. From chargeable wooden flooring to a paint that cools buildings, tech is enabling the next generation of energy-efficient homes and offices.

An architecture studio in the UK has released an open-source digital tool called FCBS Carbon that will help in designing more efficient buildings. The tool helps architects to estimate the whole-life carbon emissions of a planned building. The platform was developed in response to the RIBA 2030 Climate Challenge, which calls for all new and retrofitted buildings to achieve net-zero whole-life carbon.



UNEXPECTED MATERIALS

The materials used in the construction of a home or office can account for an estimated 25 percent of the total lifetime emissions of that building. That's a huge amount. Concrete is one major example. It's estimated that Portland cement (a key ingredient in concrete) contributes as much as seven percent of global human-caused CO2 emissions each year.

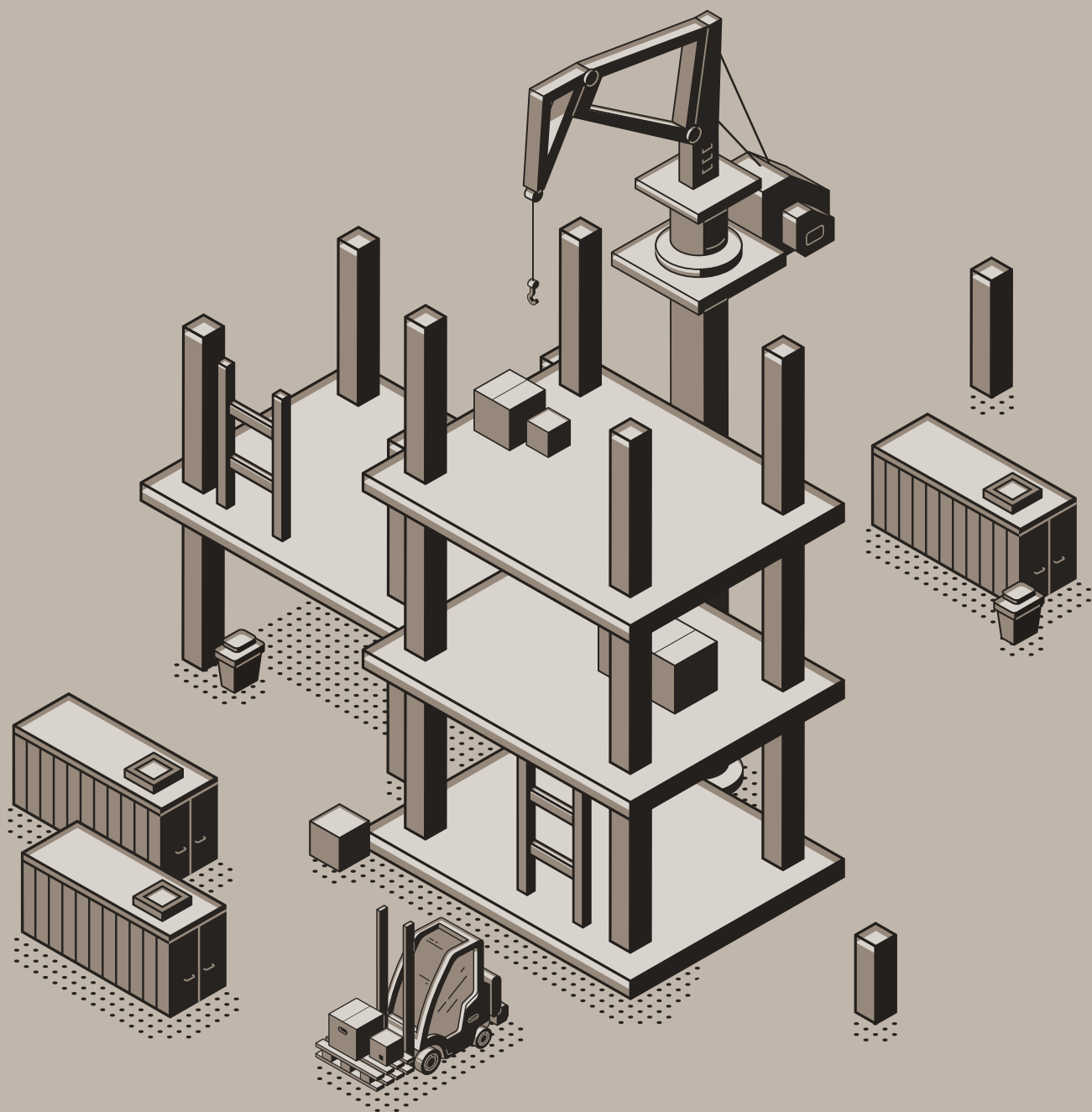
The good news is that plenty of innovation is happening in the space of low-carbon materials – from new cement alternatives to the use

of natural materials, including timber, hemp, and straw. Wood-based materials may even offer the potential for negative emissions. Cross-laminated timber (CLT) for example can 'lock up' carbon in buildings that was removed from the atmosphere by trees.

And with more than \$6 trillion of global infrastructure investment needed each year to satisfy the UN's Sustainable Development Goals (SDGs) by 2030, the impact on climate change objectives of these new materials alone can't be understated.

INNOVATIONS

NET ZERO



CREDIT: ISTOCK



Cities



Energy



Materials



CREDIT: JAKE NEBOV ON UNSPLASH, INNENCO

WHAT

New energy concept harnesses a building's thermal mass to reduce its energy

WHO

Innenco

WHERE

Sweden

NEW CONCEPT GIVES ANY BUILDING NET-ZERO ENERGY

Harnessing a building's thermal mass makes it six times more efficient

Malmö-based company Innenco has created a new energy concept that harnesses a building's thermal mass to reduce its energy - enabling it to become a net-zero energy structure. This has the dual benefit of helping both the environment and the user's energy bills.

Innenco, or 'Innovative Energy Concept', uses active elements systems, heat pumps, chillers, and solar panels, and can be installed during a new build or retrofitted. Pipes are integrated into the building's

frame, which Innenco say gives the user up to six times the efficiency of a traditional system.

It works in practice too, as Innenco has already trialed the system extensively in schools, offices, homes, and industrial buildings in several countries around Europe - with plans to eventually expand into the United States. In the test results the percentage of improvement ranged from 60 percent for schools, up to 85 percent for industrial buildings.



TAKEAWAY

As the need for housing grows, many smart innovators are developing ways to reduce the carbon footprint of housing. A Ukrainian startup has designed a 3D-printed and fully solar-powered house, while the Putney School in Vermont built its own net-zero field house. Could we one day see a day when all new housing has a net-zero rating?



**WHAT**

Oslo boasts one of the most environmentally friendly tall buildings on the planet

WHO

Vollark Arkitekter

WHERE

Norway

ECO-FRIENDLY BUILDING USES TIMBER INSTEAD OF STEEL OR CONCRETE

As strong as steel, but much better for the environment, timber is being used to spectacular effect in Norway

Architects in Norway have built the world's tallest timber building, which boasts a radically reduced carbon footprint. The 18-storey Mjøstårnet (Mjøsa Tower) is in a town two hours north of Oslo, and was opened in March 2019, after two years of construction.

The tower is constructed primarily of glulam, which is composed of small sheets of spruce bonded together with structural adhesives to form columns and beams. Glulam stands up to extreme weather and earthquakes, and tests show that it is as resistant

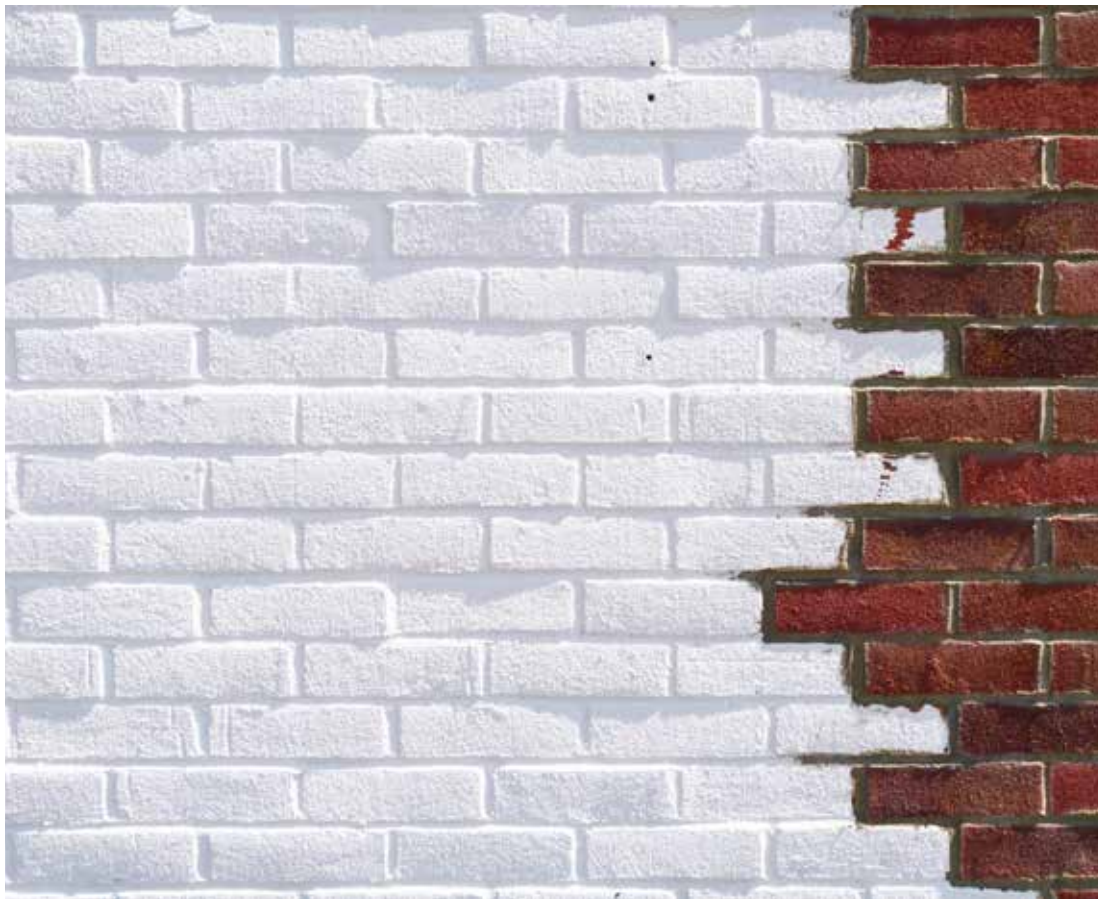
to fire as concrete. While global steel and concrete production accounts for nearly one sixth of the world's carbon emissions, using timber as a building material cuts these emissions dramatically.

Mjøstårnet was built using the prefabricated construction method – with modules built in factories before being installed on site. This is a cost-efficient, environment-friendly method which reduces waste of materials, facilitates re-use, and saves energy at the building site itself.

**TAKEAWAY**

Mjøstårnet is proof that it is possible to construct tall buildings with local resources. This is good for the environment and good for people too: studies show that timber buildings can improve indoor air quality, while the aesthetic properties of wood help to relieve stress.





CREDIT: VIKTOR FORGACS ON UNSPLASH

WHAT

White paint made more reflective to cool buildings passively

WHO

UCLA

WHERE

USA

ULTRA-WHITE PAINT COOLS BUILDINGS AND SAVES ENERGY

More reflective paint helps with passive cooling

A team led by UCLA materials scientists has developed a white paint that can reflect as much as 98 percent of incoming heat from the sun. If widely applied to rooftops and buildings, the new paint could significantly reduce cooling costs.

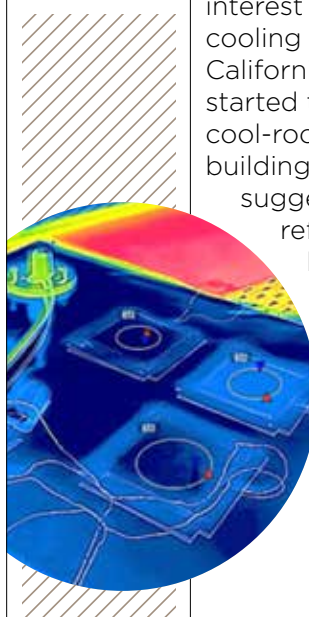
While the best-performing white paints typically reflect around 85 percent of solar radiation, the research team has demonstrated that replacing the titanium oxide commonly used in these paints with ingredients such as barite and polytetrafluoroethylene—also known as Teflon—

can help the paint to better reflect UV light, keeping the building cooler. The researchers showed that the new paint could reflect as much as 98 percent of incoming radiation.

Anything that reduces the need for air conditioning is good news for net-zero goals. Air conditioning is both expensive and energy inefficient – leading to a large amount of CO2 emissions. Perhaps most encouraging is the fact that replacing the ingredients in white paint is already within the capabilities of the paint and coatings industry.

**TAKEAWAY**

City governments around the world have been showing interest in passive methods for cooling buildings and cities. Both California and New York City have started to encourage the use of cool-roof technologies in new buildings. The researchers also suggest that large-scale use of reflective paints could even have a positive effect on climate change.



**WHAT**

Wooden floors could be charged with footsteps to power electronic devices

WHO

ETH Zurich

WHERE

Switzerland

CHARGEABLE WOODEN FLOORING COULD POWER ELECTRICAL DEVICES

New system would enable lightbulbs to be powered by footsteps

Scientists from ETH Zurich are developing a wooden flooring system that generates energy to power electronics. The system has already been demonstrated by powering a lamp with footsteps.

In a study, published in the journal *Matter*, the innovative charging system consists of two thin layers of treated wood with electrodes layered below. As people walk across the flooring, the electrodes vibrate through what's known as the triboelectricity effect. In other words, electricity is generated by friction, leading to materials becoming electrically charged.

Scientists experimenting with this new flooring system used one piece of wood coated with silicone that readily gains electrons upon contact. The other piece of wood was embedded with metal ions and organic molecules more likely to lose electrons.

According to the researchers, the process caused the timber to generate an electric current 80 times stronger than the current naturally generated by normal wood. An A4-sized sheet of this flooring was sufficient to power both household LED lamps and calculators after being repeatedly pressed for a few seconds.

**TAKEAWAY**

The sci-fi dream of generating electricity by walking on the street or by driving cars on the road is closer to being a reality. ETH Zurich's innovation presents a significant step towards the next generation of sustainable power supplies in smart buildings.





CREDIT: MAYNARD ARCHITECTS

WHAT

A self-powered home that also acts as a power station, supplying electricity to the grid

WHO

Austin Maynard

WHERE

Australia

SELF-POWERED HOME IN MELBOURNE GIVES BACK TO THE GRID

Sustainability is at the heart of a home that generates 100 kilowatt-hours a day

While one-quarter of Australian homes have rooftop solar panels, the 'Garden House' built on a long block in a historic Melbourne suburb, generates all its own electricity using solar power – and gives back to the grid too.

The house produces 100 kilowatt-hours daily and stores it using batteries. This provides enough power not only for the house's climate-controlled heating, a digital entertainment system, and a heated swimming pool, but also to charge an electric car and feed the local power grid.

Sustainability has been

built into the rest of the house design, with recycled 1950s bricks used in the construction and design principles that don't rely on technology, including facing the northerly aspect, maximizing natural light, and focusing insulation at the top of the property to trap heat as it rises.

Additional sustainability features include heat recovery ventilation that constantly brings in fresh air that is conditioned to the same temperature of the house's interior, a vegetable patch, compost, and a water tank that irrigates the garden and toilets.

**TAKEAWAY**

With many countries around the world exploring ways to provide alternatives to the polluting coal industry, it's likely there will soon be a market for smart houses that can reduce their carbon footprint as much as possible.



**WHAT**

A passive ventilation system that regulates building temperature and reduces energy usage

WHO

Gensler

WHERE

USA

BREATHABLE FAÇADE COOLS ECO-FRIENDLY OFFICE TOWERS

A tower that uses a passive ventilation system to control temperature, provides offices with fresh air and reduces energy usage

US-based Gensler has created a passive ventilation system that 'breathes' to regulate building temperature. The facade of the tower in Pittsburgh, Ohio, works by having a 'double skin' where two panes of glass are separated, creating a cavity that fresh air can flow into.

When sensors determine the weather conditions and temperature to be optimal, they open the cavity, cooling the building with fresh air. A solar chimney works in tandem to create a ventilation system, pulling stale air through

open windows as it warms and rises.

While most buildings require air-conditioning that recycles stale air, or actively pumps it outside, Gensler's system requires zero net energy. The natural ventilation system is independently activated by solar, which is predicted to work 42 percent of the year. Combined with other eco-friendly features such as large amounts of natural light and rain-capture recycling, this building can reduce energy consumption by 50 percent.



TAKEAWAY

We are seeing more examples of architecture that marry sustainability with design. Gensler's ventilation system will massively reduce energy consumption, especially in sunny climates. Could this work in high-rise apartments, too?





CREDIT: CPLUSC

WHAT

A smart rooftop garden and interior glass wall combine to create a carbon neutral house

WHO

CplusC
Architectural
Workshop

WHERE

Australia

CARBON NEUTRAL HOME USES PLANT BEDS AS PART OF THE BUILDING'S FRAMEWORK

The carbon neutral structure has passive thermal regulation throughout

Designed as a direct response to the Earth's climate emergency, the Welcome to the Jungle House in Sydney, Australia, is carbon neutral. Plant beds situated between the internal glass wall and the outer facade cool the interior while also acting as braces for the external wall. Meanwhile, greenery situated in the windows and covering the roof provide both thermal regulation and structural reinforcement.

Designed by New South Wales-based CplusC Architectural Workshop, the home includes a solar panel facade and

rooftop planters. The steel planter beds at the top of the house provide natural cooling for the home and are irrigated by the fishpond. The pond contains edible silver perch, adding an interesting additional home-grown food source.

The need for a mechanical means of cooling is negated by the passive thermal regulation throughout the structure. Windows on all levels let in large amounts of natural light without overheating the home, and many can be opened at different angles for varying amounts of airflow.

**TAKEAWAY**

The International Organization for Standardization (ISO) recently announced its plans to develop a global standard for carbon neutral architecture and design. As a means of differentiating between true sustainability in construction and inaccurate or false claims of net zero, the standard will provide creators worldwide with a goal to meet.



**WHAT**

Bike rack system could collect the kinetic energy generated by cyclists

WHO

Guillaume Roukhomovsky and Blaž Verhnjak

WHERE

Netherlands

BIKE RACK COLLECTS ENERGY GENERATED BY CYCLISTS

A new sustainable design for a cycle rack could harness kinetic energy

Around 68 percent of people in Amsterdam commute to work or school by bicycle, accounting for around 1.25 million miles of cycling a day. All these cyclists generate an estimated 19.5 million watt-hours of energy each day. This would be enough energy to power thousands of homes – if it could be captured. Now, two Dutch designers think they may have found a way.

Designers Guillaume Roukhomovsky and Blaž Verhnjak have created S-Park, a bike rack system that can use kinetic energy from cycling to charge batteries. The system was proposed as part of Amsterdam's Clean Energy Challenge. As

the rider bikes around the city, their front wheel produces kinetic energy, which is stored in batteries on the bicycle.

When done riding, cyclists park the bike in a communal bike rack that's connected to the electricity grid. The energy that the batteries stored during the ride is then discharged into the electrical grid. The system includes a front wheel that can be popped into any bike frame. The designers estimate that each bike rack could generate about one kilowatt-hour of energy per day. Amsterdam is planning to invest about €90 million in biking infrastructure by 2020, and the team hopes S-Park can be part of it.

**TAKEAWAY**

S-Park joins other innovative clean energy projects including energy-generating mushrooms. What other ways could there be to generate clean energy and achieve net zero from everyday actions?





CREDIT: JAN ANTONIN KOLAR ON UNSPLASH; SPOTLESS

WHAT

A non-toxic, bio-inspired surface cleaner repels sticky dirt

WHO

Spotless Materials

WHERE

USA

BIO-INSPIRED SURFACE CLEANER MAKES TOILETS SELF-CLEANING

An engineered coating saves water, as fewer flushes are needed

A non-toxic, bio-inspired surface cleaner repels sticky dirt. When applied to a toilet, this means fewer flushes are required, with a significant amount of water being saved each time it's used.

Created by a team of Penn State University researchers, the two-step spotLESS materials spray creates nanoscopic hairs coated with lubricant, forcing sticky substances to slide off the coated surface. The spray is quick to apply and easy to use, acts in only five minutes, and its main ingredient is

silicone, which naturally biodegrades into carbon dioxide, silica, and water.

The inspiration behind the design is the carnivorous pitcher plant, which was developed in the university's Wong Laboratory for Nature Inspired Engineering. Ideal for use in regions of the world experiencing water scarcity, the team also envisions the spray being used to make waterless toilets safer, by preventing the build-up of bacteria. Users can choose a 'low-volume flush' option or to displace water in the tank.

**TAKEAWAY**

Sanitation is crucial to good health. The 2015 target set in the United Nations' Millennium Development Goal (MDG) – to halve the proportion of people without sustainable access to basic sanitation – was not met. The updated target is now for everyone to have adequate and equitable sanitation by 2030. This is an area desperately in need of innovation, and with so many entrepreneurs interested in unique ways of benefiting society, such projects could significantly change many communities' daily lives for good.



VIRTUOUS CIRCULARITY APPLYING THE CIRCULAR ECONOMY TO OUR HOMES AND OFFICES

In a world reimagined without waste, a circular way of thinking brings with it exciting opportunities for our most-used spaces

The circular economy is a way of building a world with no waste. In a circular economy, once the user is finished with the product, it goes back into the supply chain, instead of into landfill. While most buildings and products are produced on a linear timeline of 'take, make, use, dispose', the circular economy calls for a more cyclical approach.

And the home and office are ripe targets for circularity because they create so much waste. While the last decade has seen some progress in eco-initiatives for the workplace and home, it's quickly become clear that recycling schemes and energy-saving lighting don't go far enough. After all, it's

no good using recycled materials if you use them in a way that means they can't be recycled again. Neither is it helpful to build a low-energy house using materials that already have a high carbon footprint.

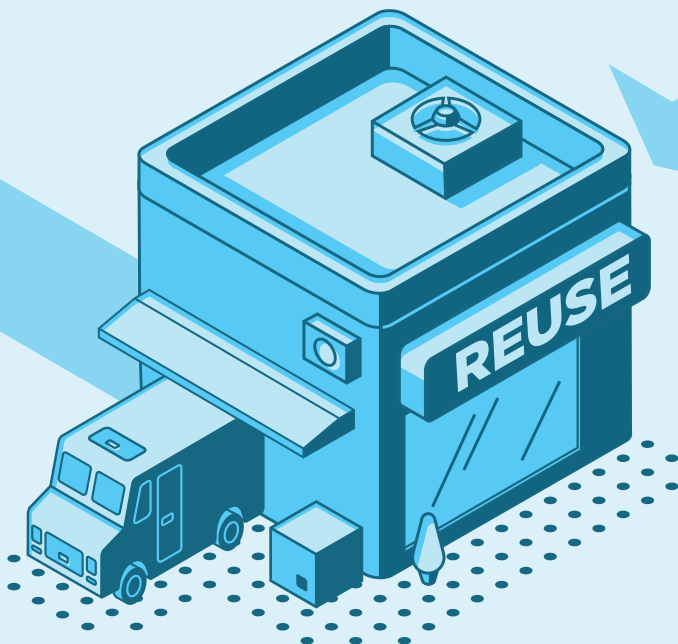
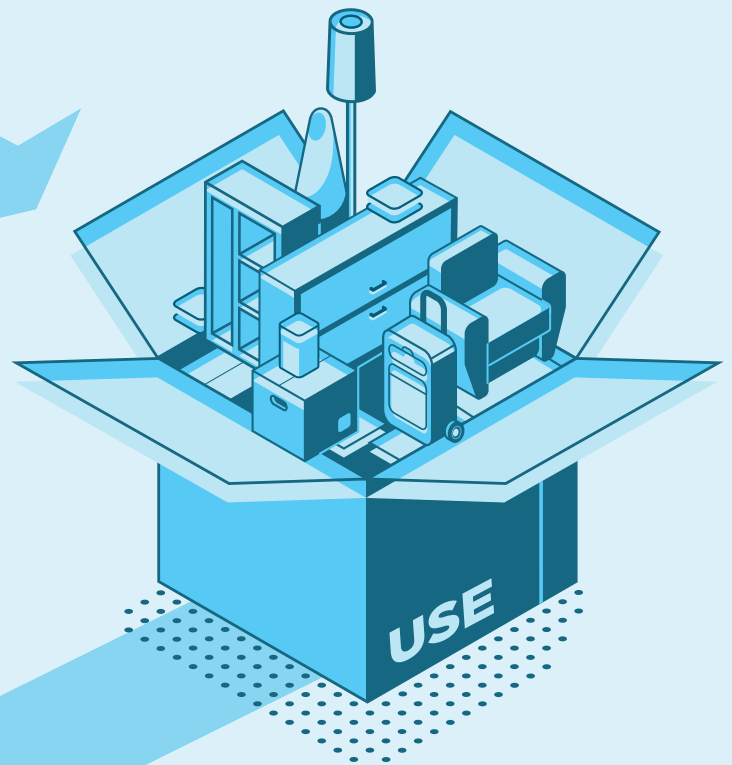
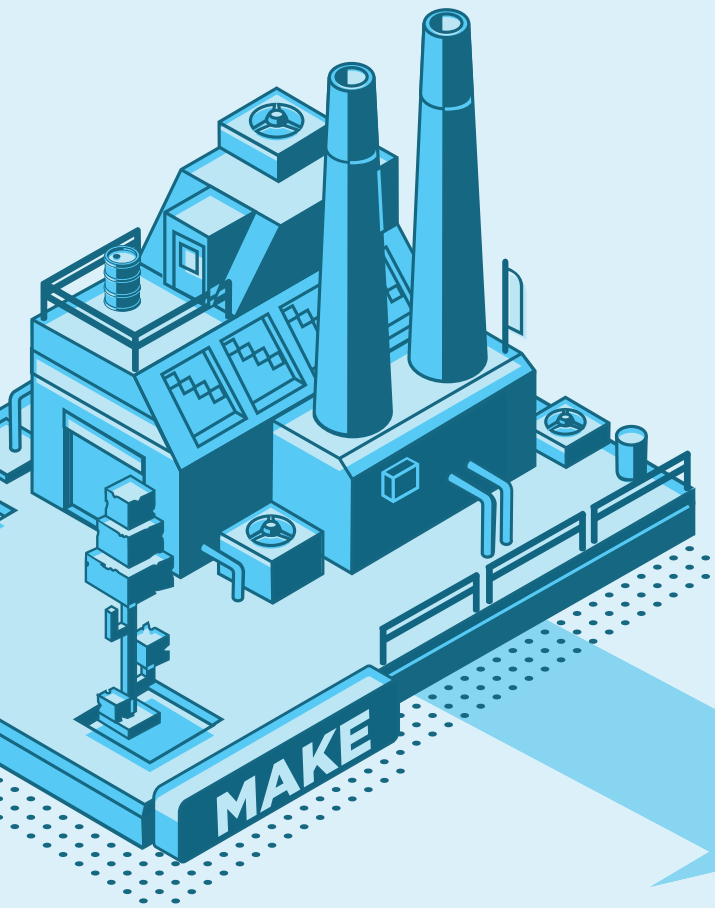
Circularity offers a solution

for rethinking the entire lifecycle of a product or building and developing ways to repurpose items already in circulation.

Pioneers are already operating in this space. Herman Miller, for example, has a repurpose program to divert tonnes

of products from landfill. It works with customers to plan for asset disposal (resale, recycling, donation, relocation) – and has diverted more than 27,000 tonnes of product from landfill and generated \$18 million in charitable donations since 2009.







BIODIVERSITY UP-CLOSE

The natural world offers powerful lessons on building a circular economy. In non-human ecosystems, everything is reused or repurposed. At the end of its lifetime, everything becomes a source for something else.

Yet, the planet's very biodiversity is under attack. Today, more

than 90 percent of biodiversity loss is due to the extraction and processing of natural resources. To stop this loss, innovators are exploring ways to transform the way we produce, use, and consume our products and food. And the circular economy can play an important role.

"While the well-known 3Rs of circularity – reduce, reuse, recycle – focus on reducing the negative impacts of humans, a second set of 3Rs – remediation, restoration, and regeneration – shift the focus to the positive impacts of reversing the world's degrading ecosystems," explains Patrick Schröder, a

Senior Research Fellow in the Environment and Society Programme at British think tank, Chatham House.

Regenerative models, in particular, look to reintroduce green spaces to cities and enable spaces in our homes and neighborhoods where nature can re-establish its presence.

WASTE NOT

One man's trash is another man's eco-friendly material. And finding creative new uses for materials and new homes for unwanted products is circularity in action.

Furniture waste, in particular, is a growing problem. Often overlooked because it's generated less frequently than other types of waste, its waste disposal is highly problematic. Items can't easily be thrown out or recycled like other types of waste,

it often gets dumped illegally, with up to 80 percent of old furniture ending up in a landfill.

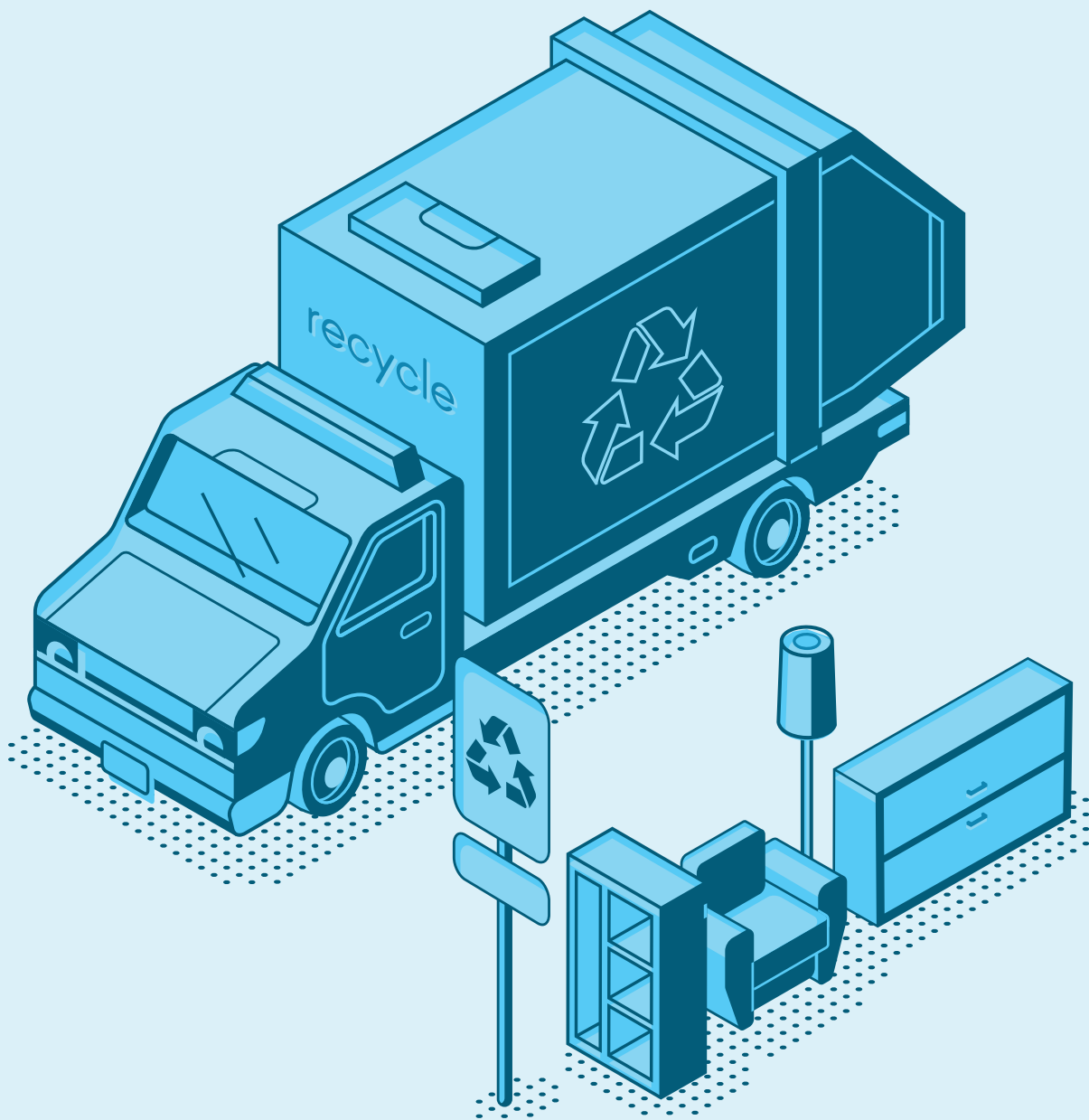
In 1960, the US sent 2 million tonnes of furniture to landfill. Today, Americans throw away 12 million tonnes of furniture each year, an increase that far outpaces the country's population growth.

These figures haven't been helped by the COVID-19 pandemic, which triggered a surge

in demand for new home office equipment as large swathes of people began working from home during lockdowns. These lockdowns have also been responsible for further furniture and other home purchases, as people found themselves spending more time within their own four walls.

The circular economy provides an elegant solution to this waste problem, and innovators are already putting these principles into action.

One striking example is the headquarters for the Carlsberg Group in Copenhagen, Denmark. Designed by CF Møller Architects to be both sustainable and durable, the building is clad with 100 percent recycled copper slats which give it superior thermal properties and can last hundreds of years. Furthermore, the large glass walls that clad the building give staff maximum access to daylight, reducing the need for electric lighting.



THE HARDWORKING HOME

“If you want a golden rule that will fit everything, this is it,” declared British textile designer William Morris, famously. “Have nothing in your houses that you do not know to be useful or believe to be beautiful.” If Morris were around today, perhaps he might update his maxim to include ‘or intend to be circular’.

In the home and office of the future, our appliances, furniture, and systems will all need to conform to circular principles, increasingly serving more than one purpose. While appliances have slowly been delivering higher efficiency standards, the future will see the need for efficiency applied at more than just the user phase.

Circularity can be enhanced through all the life stages of a device, beginning with the raw materials, followed by the design of the product, through production, use and consumption, repair, and recycling. At this final stage, recycled waste is injected back into the economy as a secondary raw material and the cycle begins again.

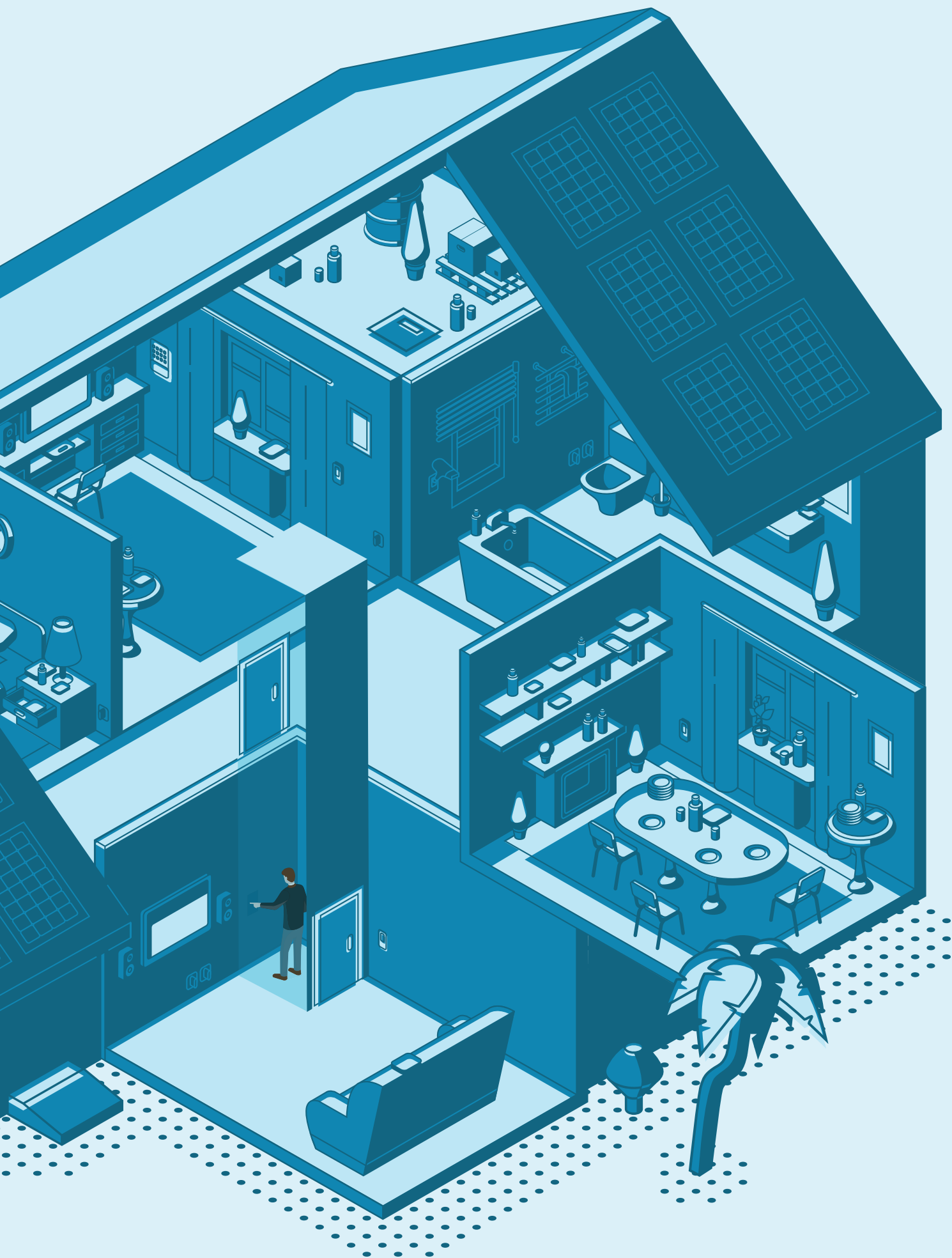
In Europe, eco-design measures for products including

refrigerators, washing machines, dishwashers, and televisions help implement the ‘Energy efficiency first’ principle of the EU’s Energy Union priority. These measures include requirements for repairability and recyclability, contributing to circular economy objectives by improving the life span, maintenance, re-use, upgrade, recyclability, and waste handling of appliances. In other words: a circular model.

“Whether it is by fostering repairability or improving water consumption, intelligent eco-design makes us use our resources more efficiently, bringing clear economic and environmental benefits,” says Jyrki Katainen, European Commission Vice-President for Jobs, Growth, Investment and Competitiveness.

Seeing an opportunity, UK architecture and design firm Perkins & Will is working on creating a searchable directory of sustainable and circular products, to help minimize the carbon footprint of its interior design projects, while ensuring that its interior spaces are all fully circular.





INNOVATIONS

CIRCULARITY



CREDIT: ISTOCK



Biodiversity



Waste



Tech



CREDIT: ELISA CALVET B AND MICK HAUPT ON UNSPLASH

WHAT

A vertical garden kit unfolds to provide an array of different green functions for urban spaces

WHO

Piuarch

WHERE

Italy

POCKET URBAN GARDEN CONCEPT

Garden folds out vertically to bring nature to the smallest of spaces

For individuals and organizations, finding new ways to incorporate greenery into everyday living is a near-constant project – especially when space is at a premium. Italian architectural firm Piuarch is tackling this challenge with its urban gardener's survival kit. The kit is a fold-out structure that expands vertically to provide an array of different functions and spaces.

Designed as part of Milan Design Week 2021, the garden kit concept supports a hydroponic garden complete with solar panels, charging ports, a workstation, chairs, and even room to store a yoga mat. The team behind the design is considering a range of materials, with two possibilities

being recyclable bio-composites and smart packaging.

Pocket gardens are popular design features as architects, designers, and planners work to make the most of available spaces.

The garden design fits into the broader themes of rewilding – a movement that wants to 're-green' large swathes of the world. An innovation project in Switzerland is building super-dense forests in cities. At the other end of the scale are ambitious urban redevelopment plans such as those in the UK and Amsterdam that are striving for a complete rejuvenation of industrial areas that have fallen into disuse or disrepair.

**TAKEAWAY**

As more and more bio-based and composite materials are used in buildings both public and private, there are opportunities for marked improvements in many communities' rates of access to aspects of the natural environment.



**WHAT**

Replacing single-use plastic with packaging made from biodegradable seaweed and plants

WHO

Notpla

WHERE

UK

EDIBLE SEAWEED-BASED PACKAGING TO REPLACE SINGLE-USE PLASTIC

Biodegradable packaging offers more sustainable alternative to bioplastics

London-based startup Notpla has created a range of biodegradable packaging from seaweed. In a partnership with a British online food-delivery service, the company has developed seaweed-lined takeaway containers, which are home compostable and provide grease proofing without adding plastic. This means they can be recycled, unlike many plastic-lined takeaway containers.

Seaweed is an excellent sustainable base material. It grows quickly, requires no additional resources, and is very good at sequestering carbon. It is also naturally biodegradable, meaning that, just like food, it can degrade in any natural setting without processing or the need for a catalyst. This is very different from the industrial compostable certifications on bioplastic packaging.

This isn't Notpla's first foray into sustainable packaging. Its Ooho product is edible packaging for liquids. Ooho resembles a bubble of water and can be made in sizes varying from 10 to 100 milliliters. Carbon calculations carried out by the company based on its emissions factors revealed that Ooho has up to 90 percent less carbon impact than an equivalent plastic container.

Next up for the company is to fully commercialize their initial products. Following several trials and early-stage partnerships with brands such as Lucozade and Just Eat, Notpla is now looking for more manufacturing partners and will focus on selling commercially, with plans to expand across Europe and into the US soon.

**TAKEAWAY**

A common misconception is that bioplastics are more eco-friendly than traditional plastics. They're not – not only do they result in greater amounts of pollutants than traditional plastics, but the space required to grow the corn crops involved in their manufacture reduces the space available for food production. Therefore, developing truly eco-friendly alternatives to plastic packaging is much needed.





CREDIT: MIRVAC'S PAVILIONS, FREEPIK

WHAT

'Green ceramics' made from waste are used as construction materials

WHO

Mirvac, the UNSW Centre of Sustainable Materials Research and Technology (SMaRT), and UNSW Professor Veena Sahajwalla

WHERE

Australia

APARTMENT BUILT WITH PRODUCTS MADE FROM WASTE

'Green ceramics' used to make everything from floor tiles to dining tables

In March 2021, Australian property group, Mirvac, unveiled a two-bedroom unit in Sydney's Olympic Park made using waste materials. Clothing, plastic packaging, and discarded glass have all been transformed into 'green ceramics'.

These ceramics, never employed as a construction material before, were used throughout the apartment for everything from floor tiles and the kitchen splashback, to the dining table, light features, and artwork. They are the result of a collaboration that began in 2019 between

Mirvac and the UNSW Centre of Sustainable Materials Research and Technology (SMaRT), led by UNSW Professor Veena Sahajwalla, a global pioneer in waste technology.

Months of testing were required to perfect the aesthetics and performance of the product. The material complies with the Building Code of Australia and passes tests for slip and fire resistance and acoustics. It also meets Mirvac design standards, proving its ability to stand up to normal household wear and tear and inevitable kitchen spills.



TAKEAWAY

This collaborative project provides insight into how the circular economy could transform the way we build homes. In the EU, the building industry generates over 450 million tonnes of construction and demolition waste every year.

The collaboration between

Mirvac and the SMaRT has birthed a whole new business model that allows us to value the resources made by other products, while doing it in a way that will continue to create jobs across the regions.



**WHAT**

Sustainable concrete substitute made from invasive species

WHO

Brigitte Kock and Irene Roca Moracia

WHERE

UK

BIO-CONCRETE MADE FROM WEEDS AND CRAYFISH SHELLS

The development cuts carbon emissions and gives new economic and ecological value to invasive species

Two graduates from Central Saint Martins College of Art in London have created concrete-like tiles made from Japanese knotweed and shells from American signal crayfish. Brigitte Kock and Irene Roca Moracia aim to create a substitute to concrete, which is a major carbon emissions culprit, while simultaneously giving new economic and ecological value to invasive species.

Crayfish are among the top five non-native species that are causing the most ecological and economic damage in the UK. By adding value to them, Kock and Moracia hope to incentivize their removal and help to restore local biodiversity.

The knotweed, which is incinerated after removal, acts as the ash binder, while pulverized crayfish shells are used as the aggregate instead of the traditional rocks or sand, as these can contain fossilized carbon. Combined with water and gelatin, these ingredients create a strong, homogenous material that cures and hardens without the need for added heat or synthetic coloring.

The project was commissioned as part of the Maison/O graduate program by the LVMH group, which includes Dior and Louis Vuitton among its brands. The program aims to develop a sustainable alternative to current building materials that could be used in luxury store interiors.



TAKEAWAY

While concrete is the most widely used building product in the world, it's also a major source of pollution. Repurposing waste materials as a concrete substitute is a circular way to solve two problems at once.





CREDIT: TWIG

WHAT

Banking platform enables users to trade unwanted possessions for cash

WHO

Twig

WHERE

UK

BANKING APP POWERS THE CIRCULAR ECONOMY

Platform enables users to trade their things for cash and offset carbon

UK-based fintech company Twig has launched a free banking app that allows users to trade their things for cash. By doing so, the company aims to contribute to the circular economy and ensure that items don't end up in landfill.

The trading process is simple: once customers have uploaded descriptions of their unwanted possessions to the app, Twig's AI-powered algorithm calculates how much they are worth. If the user accepts the offer, they can cash out their items. The process aims to reduce the uncertainty, waiting, and irritation that is normally associated with selling unwanted items.

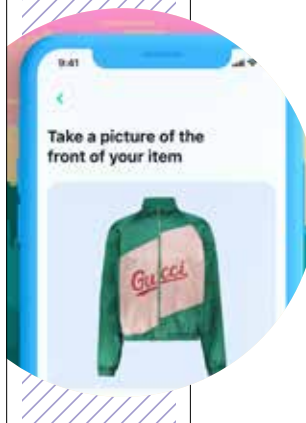
As part of the company's

aim to power the circular economy, Twig also offers a carbon offsetting subscription as an add-on service for customers to offset the carbon footprint of their entire lifestyle. Twig is among the first UK banking companies offering such a service.

Twig was among 2021's Top 50 Fintech companies named by startup news site, TechRound, while Sifted declared it the European Fintech to Watch this year. Recognized for its commitment to the environment and sustainability, the company soon hopes to join the B-Corp community, which certifies companies that meet the highest standards of social and environmental performance.

**TAKEAWAY**

According to the company, the last 15 years have witnessed around €5.82 trillion worth of possessions disposed of worldwide, with 59 percent of this done for convenience. Twig provides the potential to marry personal financial aspirations with collective environmental objectives. Making sustainability the economically sensible choice will increasingly be the way to encourage buy-in from individuals and businesses.



**WHAT**

Fabrics made from castor beans are a step towards more sustainable textiles

WHO

Rubelli

WHERE

Italy

BIO-BASED FABRIC MADE FROM CASTOR BEANS

Luxury Italian brand turns to an alternative textile source for its latest collection

The Italian, family-owned fabric house, Rubelli, has recently announced a new range of eco-friendly fabrics made entirely from natural materials. The fabric is a combination of co-viscose and an eco-polyamide made from castor bean extract.

Castor beans grow easily and are a crop not used as food. Moreover, they do not require large amounts of water. In terms of practicality, a fabric made from castor beans offers elasticity, thermal protection, and quick drying. Moreover, because the fiber does not provide a favorable environment for bacterial growth, it is

good at minimizing odor from sweat.

Studio head, Alberto Pezzato, told Homes and Gardens that the brand recognizes the importance of living and buying ethically. According to Alberto, Rubelli only took one year to produce the new fabric. The collection includes five eco-fabrics, ranging from contemporary to classical patterns, all of which, according to the brand, match the luxurious texture and quality of fabrics made from man-made fibers – the sole difference being that Rubelli's fabrics are sustainable.

**TAKEAWAY**

As landfills near their limit, 'sustainability' takes on a new meaning and urgency. In the textile industry, the biodegradability of a product will be fundamental to its success, minimizing the overall environmental damage caused.



**WHAT**

Italian designers repurpose food waste to create eco-friendly designs

WHO

Krill Design

WHERE

Italy

A 3D-PRINTED LAMP MADE FROM ORANGE PEELS

Italian designers combine tech and food waste to create eco-friendly designs

A Milan-based startup is using Sicilian orange peels to print lamps that can be composted at the end of their lifespan. Each 'Ohmie' lamp is printed using 3D technology and requires the discarded peels of two or three oranges.

Krill Design decided to use orange peels because of the citrus' ubiquity in Sicily. It sources them from a family-owned Sicilian food producer and then mixes the ground dried orange peels with a biopolymeric base made from vegetable starch to create pellets. From the pellets, the designers then extract a 'filament' of biomaterial,

which is what is used to 3D print with.

The 3D printer uses a technique called 'Vase Mode', in which it deposits the biomaterial filament in a continuous spiral-like movement, creating a ribbed feel. The result is a velvety and sturdy material that retains an orange-skin pattern. By using a 3D-printed method to create the lamps, unnecessary waste is avoided, and production can also take place on demand.

After its lifecycle, the lamp can be added to the household's organic waste and turned either into compost or biofuel.



TAKEAWAY

Innovators are finding increasingly creative ways to reuse waste of all kinds. By applying technology such as 3D printing, and a designer's eye, circular solutions can be smart and beautiful as well as eco-friendly.



**WHAT**

High-quality remanufactured office furniture saves money and carbon emissions

WHO

Rype

WHERE

UK

OFFICE FURNITURE THAT SAVES MONEY AND THE PLANET

Rype Office applies the principles of circular economy and sustainability to office furniture

Furniture is the biggest source of carbon emissions in a commercial building. Rype aims to reduce this by 80 percent while saving money for its clients and creating jobs for local long-term unemployed people with disabilities.

Through remanufacturing, it returns high-quality used furniture to as-new condition and makes innovative furniture from waste materials. While refurbished furniture has had work done on key problems, such as replacing worn upholstery, remanufactured office furniture is disassembled and rebuilt according to the original design, using a combination

of reused and repaired elements as well as new parts.

This is cost-effective because it checks, resurfaces, and redeploys the long-life components of furniture (like steel frames), which are expensive to make from virgin resources. Remanufactured furniture is typically less than half the cost of new, with no loss of quality.

It also provides social value. Because remanufacturing occurs locally, it creates jobs. The disassembly, remanufacturing, and reassembly required creates twice as many jobs as assembling from virgin materials.



TAKEAWAY

Rype uses the principles of the circular economy to create an office that is comfortable, beautiful, sustainable, and affordable. This shows that these demands don't need to sit at odds with each other – design can incorporate all of them to create solutions that work for everyone.





CREDIT: NIDIA DIAS ON UNSPLASH, TREX

WHAT

'Wooden' decking made almost entirely from waste plastic

WHO

Trex

WHERE

USA

'WOODEN' DECKING MADE FROM PLASTIC BAGS

A decking company has developed a way to turn recycled plastic bags into a composite that can replace wood

Wood decking is beautiful and versatile, but not very sustainable. However, a Virginia-based company has developed a way to make 'wooden' decking made almost entirely from waste products. The company turns reclaimed sawdust and plastic bags into composite deck boards. It's now one of the largest plastic bag recyclers in the US.

Trex's process is green from start to finish. Its processing method first cleans plastic film and grinds it into granules. These are then combined with sawdust reclaimed from factories, and the mixture is heated to give it a soft, pliable consistency. The mixture is then formed into boards, which are cooled and cut to the desired length.

A standard, 16-foot board will use around 2,250

plastic bags, most of them the hard-to-recycle, thin-film type that are often used as sandwich bags, overwrap on kitchen rolls, and as newspaper sleeves. To source the plastic, the company had to set up its own nationwide recycling program, with drop off points outside stores and in local communities and schools. Trex also pays businesses that generate a lot of plastic waste to take the waste off their hands.

In comparison with a standard, pressure-treated lumber, the manufacture of the Trex boards releases 36 percent fewer greenhouse gas emissions and 47 percent fewer toxic pollutants, while using 84 percent less energy. Trex also operates a sustainable supply chain, with approximately 95 percent of its supply vendors based in the US.



TAKEAWAY

Plastic has become a modern scourge, so it's no surprise that innovators are working on new ways to keep the material out of landfills and water. Some recent ideas include deodorant made from recovered ocean plastic and a fashion house that designs exclusively with recovered landfill plastic. At around 140,000 plastic bags per 500 square-foot deck, Trex has found a way to turn unwanted and unsustainable materials into a useful product.



**WHAT**

Hemp biowaste is combined with water and lime to create a strong, lightweight concrete alternative

WHO

Barrault Pressacco

WHERE

France

SOCIAL HOUSING IN PARIS USES HEMPCRETE TO LOWER CARBON

Hempcrete is an excellent insulator and a more lightweight building material than concrete

A new wood-framed building in Paris's 18th Arrondissement uses hempcrete instead of concrete for the walls. Designed by French architecture firm, Barrault Pressacco, the structure conforms to newly enacted government regulations regarding the sustainability of all new public construction projects.

The hempcrete is applied as a spray in layers within the frame before being finished with an interior of lime rendering. Hempcrete is an excellent insulator and is a more lightweight building material than concrete. The lightness of the material makes it

much easier to transport and move, and for regions that experience regular extreme weather conditions, it is much safer than concrete. Concrete is brittle whereas hempcrete can flex without breaking.

In addition, hemp is one of the few substances able to continue absorbing carbon after being used in construction. It can also absorb moisture, making it particularly useful in humid climates, and as a means of reducing the likelihood of interior mold.

The building is home to 15 social housing apartments and two ground floor shops.



TAKEAWAY

Designers and architects are increasingly using hempcrete. Although the material cannot bear as much weight as concrete, its eco-credentials far outweigh that drawback. Add in the ease with which hemp grows, and our ability to use hemp plant waste in construction, and the possibilities for its use appear numerous.





CREDIT: MADE IN SITU, ISTOCK

WHAT

Furniture collection made from waste cork highlights the beauty and versatility of the natural material

WHO

Noé Duchaufour-Lawrance

WHERE

Portugal

SALVAGED CORK TURNS INTO BEAUTIFUL HOME FURNITURE COLLECTION

Designer highlights the versatility of this eco-friendly material

Portuguese designer Noé Duchaufour-Lawrance has created a limited edition Burnt Cork furniture collection in homage to the resilience and beauty that can arise from the destruction of forest fires. Made from waste cork, each piece of furniture transitions from a rough-hewn finish at the bottom to a smooth, fine-grained finish at the top. The look is reminiscent of the trunks of trees.

The cork used in the collection is upcycled waste remnants, cork itself being an eco-friendly material with which to work. Cork's utility arises from its exceptional thermal

and acoustic qualities, water-resistance, and hypoallergenic and antimicrobial properties. Because it can be harvested from living trees, it is an especially replenishing, naturally occurring material. It is also particularly drought and fire-resistant, which in today's climate of ever-increasing weather extremes, makes it an exceptionally useful crop.

There are seven pieces in the Burnt Cork collection, including a dining room table, chairs, and chaise longues. Duchaufour-Lawrance worked with two family-run businesses to achieve the final look.



TAKEAWAY

A few construction materials that are less hazardous to the environment, including cork and bio-based carbon fiber, are nearly as good as the petroleum-heavy polluting materials they have been designed to replace. The increasing number of these new materials indicates it may soon be possible to build more widely with much smaller carbon footprints.



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