

Creating a Regenerative City

Insights from the Centre for Liveable Cities-
Ramboll Urban Lab

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The Urban Lab initiative aims to support government officials, urban planners, and the private sector with the knowledge and skills necessary to identify, prioritise and implement regenerative urban planning principles in the cities they work for. The main objective of the initiative is to develop a planning concept, roadmap, and toolbox on regenerative urban development approaches. The Urban Lab will initially focus on Singapore and look to scale the application of the outcomes internationally at a later stage.

Prior to the Urban Lab in Singapore, Ramboll has initiated Urban Labs in Copenhagen and New York, generating valuable insight in sustainable urban development in collaboration with cross-sector partners.

Creating a Regenerative City: Insights from the CLC-Ramboll Urban Lab

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Cover photo

Bishan Ang Mo Kio Park, Singapore (Source: Ramboll)

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Foreword by Hugh Lim

Executive Director, Centre for Liveable Cities



The regenerative concept is a potential approach for densely populated cities like Singapore to carry out urban planning and development in an ecologically-friendly and carbon-sensitive manner which provides good quality of life for residents.

[Climate change](#) is one of the biggest challenges facing the world today. Scientists have confirmed that 2023 was the warmest year on record for planet Earth, and the third National Climate Change Study published by the Centre for Climate Research Singapore warned that Singapore itself should expect more weather extremes which can have adverse effect on our city's liveability. Nevertheless, Singapore has set ambitious targets in the Singapore Green Plan 2030 which outlines concrete actions for building

climate resilience, peaking emissions before 2030 and achieving net-zero emissions by 2050.

[The regenerative concept](#) is a potential approach for densely populated cities like Singapore to carry out urban planning and development in an ecologically-friendly and carbon-sensitive manner which provides good quality of life for residents. Beyond business as usual or "doing less harm" in urban development, the regenerative concept conveys a vision for cities,

like Singapore, to take steps towards positive climate action.

[Singapore's long-term planning approach](#), innovative urban policies and cross-sectoral collaborations do incorporate a significant element of regenerative design principles. The Urban Redevelopment Authority and National Parks Board have been driving long-term planning and conservation efforts to rejuvenate our city, to steward our natural resources and to move towards our vision of being a City in Nature. We

also have specific sectoral policies and programmes by the Building and Construction Authority, Housing & Development Board and Public Utilities Board, such as the Green Mark Scheme, Biophilic Towns, and Active, Beautiful, Clean Waters (ABC Waters) Programme, to restore nature in buildings, urban spaces and industrial estates. Whilst agencies have all done well in their respective sectors, we can harness even greater synergy and effect transformational impact when we take on a systems

view by strengthening the links among our eco-system of stakeholders.

[The Centre for Liveable Cities-Ramboll Urban Lab](#), which was launched in January 2024, brought together stakeholders from across the public, private and academic sectors on a collective journey of learning and discovery regarding regenerative design. I would like to thank Søren Brøndum, World Cities Summit Knowledge Council Member

and Ramboll's Managing Director (Buildings), for his close collaboration with CLC in unpacking the concept of regenerative design with us and bringing the Urban Lab to fruition. This publication crystallises key insights from the Urban Lab, offering a starting point for understanding the concept of regenerative design as a way to create climate-positive cities of the future. I wish you an enjoyable read.



Foreword by Jens-Peter Saul

Executive Board CEO, Group CEO Ramboll



Regenerative design is sometimes defined as **‘going beyond net zero’**. But even when cities align with the ambitions of the Paris Agreement, is that enough to meet the challenge of the climate crisis?

This question helped kick off the [collaboration](#) between Singapore’s Centre for Liveable Cities and Ramboll at COP28. The global stock take in Dubai was a painful reminder that we are nowhere near achieving the 1.5-degree pathway.

Furthermore, cities globally are far from achieving net-zero status.

We need to cut greenhouse gas emissions and deal with the wider environmental impacts of urbanization. Doing so requires regenerative design hand in hand with curbing emissions at pace and scale.

[Cities will need to move beyond the existing tunnel vision focus](#) on only reducing carbon emissions, and equally prioritise reversing

biodiversity loss, avoiding resource depletion, and halting and addressing environmental pollution.

[By adopting regenerative design principles](#), cities can move beyond net zero and become catalysts for ecological regeneration, creating thriving urban environments that contribute to the health and well-being of the planet.



Regenerative cities go beyond sustainability, aiming to heal the environment. This means expanding green spaces, utilizing carbon capture for reuse, and supporting practices that store carbon naturally. It is about closing the loop with a circular economy and designing with nature in mind - what is known as biophilic design. And it is about including all voices: of residents, businesses,

and even nature itself, in creating a thriving future.

[We are delighted that Ramboll’s partnership with Centre for Liveable Cities](#) is enabling a first-of-its-kind collaboration on regenerative design thinking. Our jointly established Urban Lab explores what it will take to move from sustainable to regenerative in an urban planning perspective.

With this report, we share what we have learned, with the aim of scaling both learnings and solutions to cities worldwide. I look forward to seeing how these insights will nurture a global movement towards more regenerative design in cities everywhere.

Introduction

Potential of Regenerative Design for Cities

Guided by the Paris Agreement, the global consensus is to reduce greenhouse emissions and limit global warming to well below 2°C above pre-industrial levels. Cities are seen as the key actors towards achieving this target as they account for 70% of global emissions, while occupying only 3% of the Earth's land surface.

What should cities seek to regenerate and how is it relevant to climate change? How should policymakers weigh the different values of nature and biodiversity, resources, climate resilience and human well-being? Is the idea of 'net-positive impact' too good to be true with our limited land and the need to accommodate other essential needs like housing and jobs? Is it a form of greenwashing by the planners and architects, given the significant carbon footprint both in the buildings' supply chain and operations that may seem impossible to be offset by nature within the city?

These are some of the questions the Centre for Liveable Cities asked when it embarked on a knowledge collaboration with global engineering, architecture and consultancy company Ramboll. Suffice to say, no one has all the answers.

Nonetheless, regenerative design is a worthwhile concept to explore. Rooted in the biological science and landscape architecture fields since the infancy of the environmental movement, the key principles of regenerative

design have been articulated by generations of thinkers and practitioners. While urban regeneration is a well-known concept focusing on the rejuvenation of built-up spaces and infrastructure assets, regenerative design is framed as an even more strategic approach, to create a more symbiotic relationship whereby development gives back more than it takes from the natural ecosystem. The application of regenerative design to the urban built environment comprises key elements such as the use of nature-based solutions for heat and flood mitigation and to prioritise health and well-being, as well as resource circularity and the adaptive re-use of buildings that assists in our efforts towards decarbonisation.

As a city-state, Singapore faced land and resource constraints from day one of its nation-building. To overcome these challenges and strike a delicate balance of liveable and sustainable development, Singapore has developed an integrated long-term planning and dynamic urban governance system to implement concerted policies and plans across its built environment, so as to meet its housing, commerce, transport, recreation, water supply and sanitation needs. Furthermore, it has had to accommodate nature conservation, industry development and even national defence needs – which are typically not urban functions in other big countries – all within its 734.3km² of land space.

With the intensifying challenge of climate change, regenerative design may now be increasingly important to facilitate Singapore's efforts to meet its population's needs while enhancing urban resilience. This is why the Centre for Liveable Cities-Ramboll Urban Lab brought together stakeholders from across the public, private and academic sector to share and discuss the concept of regenerative design, and how it could be applied to different urban domains in the context of Singapore. We look forward to sharing what we have learnt with you in the following pages.



Defining & Applying Regenerative Design

Key concepts & principles of degeneration and regeneration:
An anatomy



The complexity of regenerative design lies in the multitude of design drivers that must be considered simultaneously for each project. These design drivers include water, vegetation, air, biodiversity, and many others.

Dr Hossein Rezai,
Global Design Director, Ramboll



Prelude: The story of two halves

There have been many well-intended initiatives by committed individuals and organizations, not least the UN over the past 50 years or so, to reduce or cap such harmful and deleterious emissions into the atmosphere.

The following key milestones are noteworthy:

- 1979: First World Climate Conference,
- 1987: Brundtland Report 'Our Common Future',
- 1990: First IPCC Assessment report,
- 1995: First UN Climate Change Conference,
- 2005: Kyoto Protocol entered into force,
- 2009: Copenhagen Accord,
- 2015: Paris Agreement adopted.

There were also a multitude of Conference of Parties (COPs), including-COP26 in Glasgow (2021), COP27 in Sharm Al Shaikh (2022), COP28 in the UAE (2023). The 6th IPCC Report (AR6 Synthesis Report: Climate Change 2023) was also published.

These resources provide valuable insights generated by highly dedicated scientists as well as individuals, corporations, and governments globally, highlighting the risks of inaction on climate change. They also propose strategies

Trends in atmospheric CO₂ Vs Global Temperature change

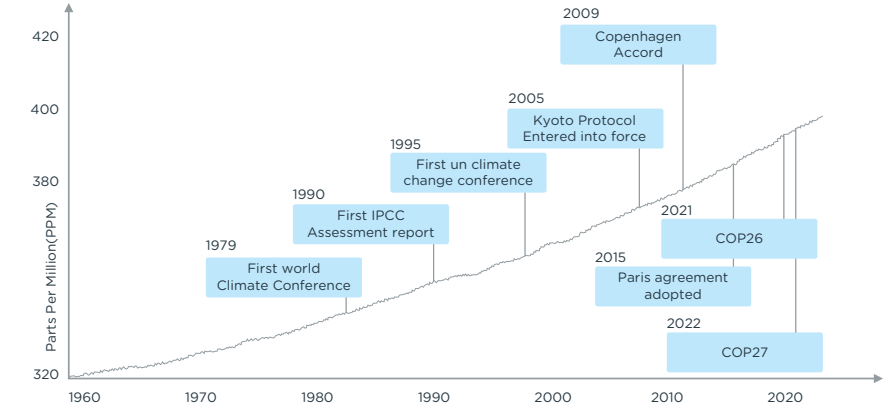


Figure 1: Trends in atmospheric CO₂ VS Global temperature change.
(Source: Ramboll, adapted from Keeling et al., 2005)

for reducing and eliminating harmful gases emitted into the atmosphere. These initiatives prioritize practices aligned with planetary limits and promote harmonious coexistence and collaboration with nature.

The concentration of such gases in the atmosphere has relentlessly continued to go up, and exponentially. Carbon dioxide (CO₂) concentration, measured in parts per million (ppm), reached 422 ppm in December 2023. This marks an increase of over 70 ppm since 1984, a rate of growth

comparable to that observed over the preceding 200 years from the late 1700s in Figure 1.

Similarly, degenerative tendencies are observed in all environmental indicators. From the decline in biodiversity and deforestation to the acidification of our oceans, it is as if the good intentions and deeds of the scientists, activists and agencies are occurring on a separate planet from the one we inhabit, where harmful gases are continuously being released and accumulating in the atmosphere.

The total greenhouse gas emissions are currently hovering around 50 gigatons per year. However, under a business-as-usual scenario, this figure could soar to as much as 170GtCO₂e by 2100, leading to catastrophic consequences. The sustainability agenda may manage to stabilize the emissions at the current level, but this approach still carries significant long-term consequences. The only alternative that bends the curve and points towards zero emissions by 2100, is depicted by the regenerative curve in Figure 2.

2100 Warming Projections
Emissions and expected warming based on pledges and current policies

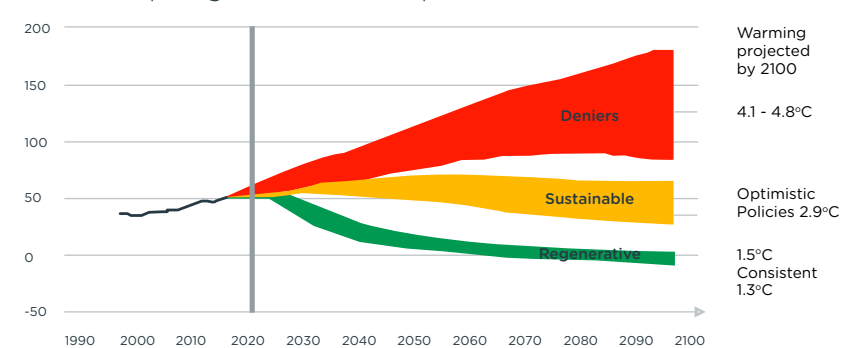


Figure 2: 2100 Global warming projections.
(Source: Ramboll, adapted from Climate Action Tracker, viewed May 2024)

Regenerative Thinking: The Journey from the horizontal to the vertical

Just under 20 years ago, internationally recognized planning consultant Bill Reed drew a horizontal line in Figure 3. He then divided it into five segments from degenerative to regenerative. He then superimposed a diagonal line and came up with this most iconic representation of regenerative design and regenerative thinking.

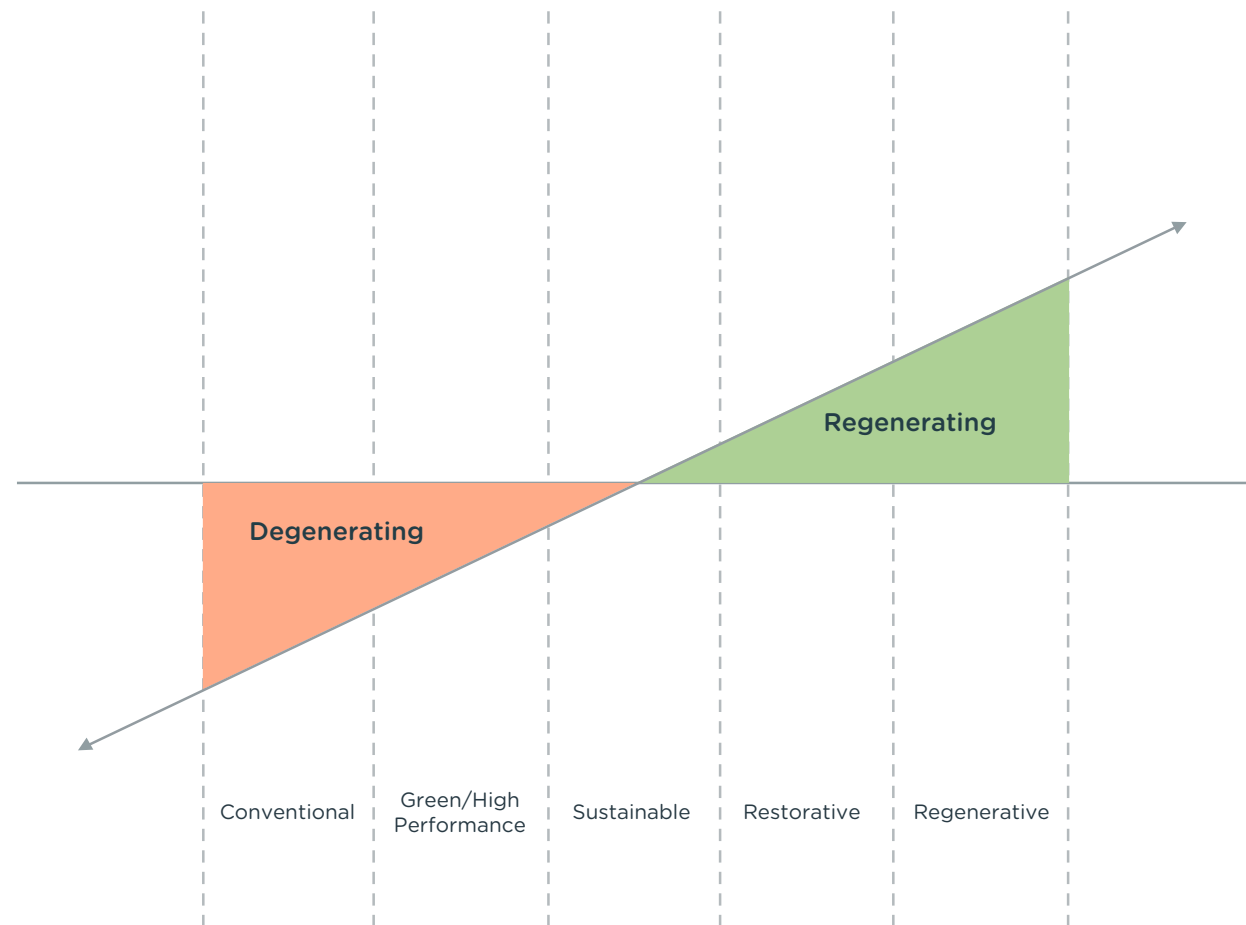


Figure 3: The paradigm-shift of regenerative design. (Source: Ramboll, adapted from Reed, B., 2007)

Over the past 20 years, several revisions have been applied to this renowned diagram. One significant modification is the horizontal line that is shifted upwards placing all aspects of sustainability below the zero-harm line.

The evolution of this graph delineates distinct spheres of sustainability and regeneration. There is a contention that there is a discontinuity between the two spheres that needs to be appreciated. Merely striving for sustainability may not automatically lead towards regeneration.

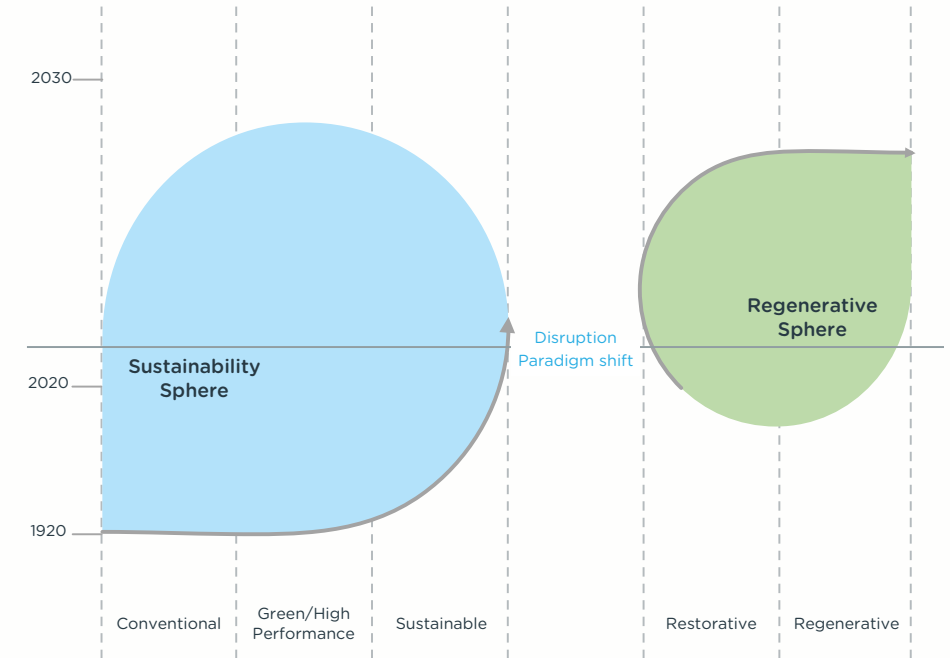


Figure 4: The paradigm-shift of regenerative design. (Source: Ramboll, adapted from Reed, B., 2007 and Craft et al., 2017)

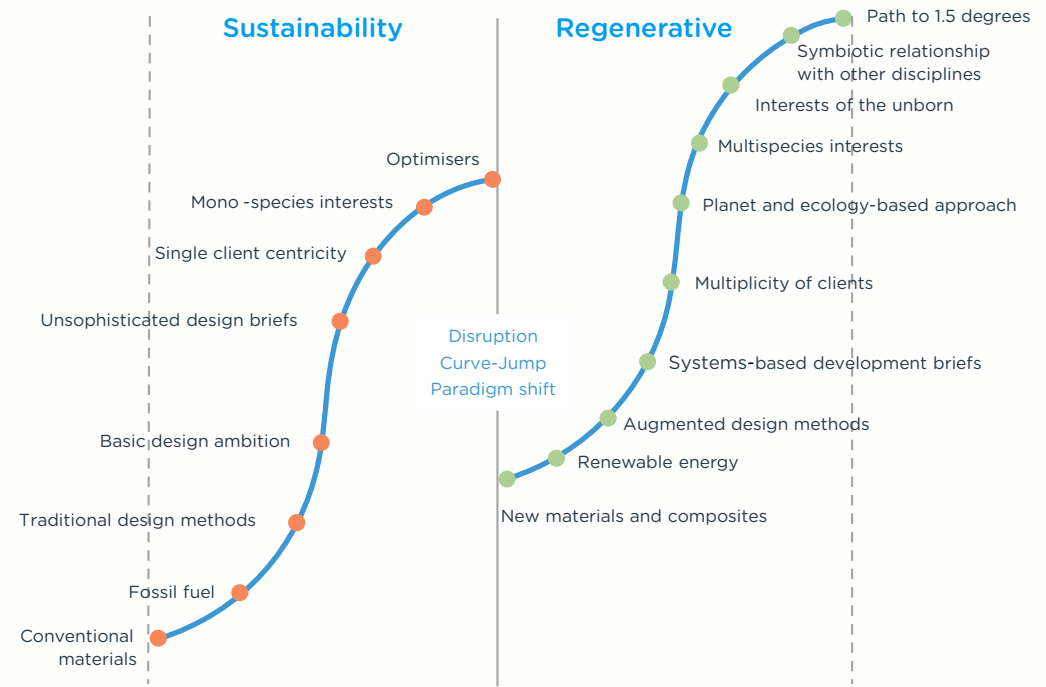


Figure 5: Sustainable vs Regenerative design curve. (Source: Ramboll, 2024)

This paradigm shift is best represented with two curves on either side of a vertical line, each with distinctly different drivers and lexicon. This is the journey from Reed to Ramboll.

The multiplicity of clients

To expand on one of these concepts — the multiplicity of clients, the Pompidou Centre in Paris can be used as an example. The notion of the diversity of clients suggests that in our business-as-usual practice, operating within the framework of a sustainable development, each project has a contractual client who approaches with the location, a brief and an ambition. It is our responsibility to assist the contractual client to achieve their development goals. However, many of us limit our focus to this aspect, believing that fulfilling these objectives fulfils our professional obligations.

The concept of the multiplicity of clients asserts that the streets themselves are our clients; we are

obligated to ensure that they improve because of our projects. Similarly, the neighbourhood is our client, and our projects should contribute to uplifting the entire community.

We consider the urban grid as a client. If there is a precinct or district under our influence of which we have control over, and the grid of the city has been broken, it becomes our responsibility to rectify and enhance it. The whole city is our client. Sometimes, through a single project, one can elevate the whole city — the Bilbao effect. In fact, the whole country is our client; we have a duty of care to the country in which we work and of course, ultimately we have a duty of care to the planet.

When we express concern about the environment, we should prioritize the interests of the planet in the same manner. The planet and the trees surrounding our sites, the birds nesting in the trees and even the ladybirds residing on the site are our clients. Therefore, we advocate for biodiversity conservation; we have a responsibility to care for everyone and everything. Nine out of these ten clients are recurring and are relevant to nearly every project, with only one client — the paying client — varying from one project to another.

With this perspective, Ramboll's approach to our clients and projects may deviate slightly from the conventional business-as-usual or sustainability paradigms.



Source : Adobe stock, Westend61 / Werner Dieterich

Regenerative design: The big how

One method to attain regeneration involves examining the past to set ambitions for the future. Figure 6 illustrates a potential restoration of biodiversity on a site to its 1980 levels by the year 2025. The selection of these dates is determined by the designers and the level of ambition for regeneration.

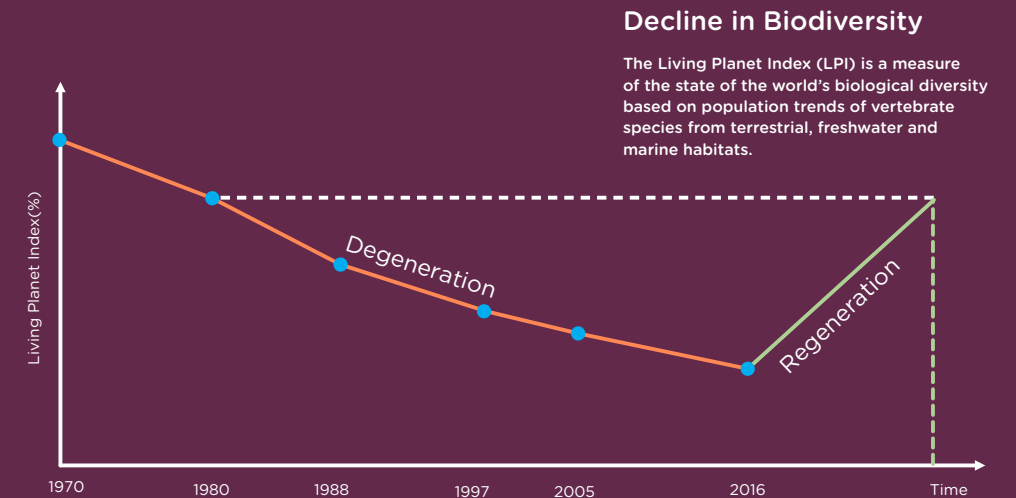


Figure 6: Decline in biodiversity. (Source: Ramboll, adapted from WWF, 2022)

The degeneration-regeneration cycle

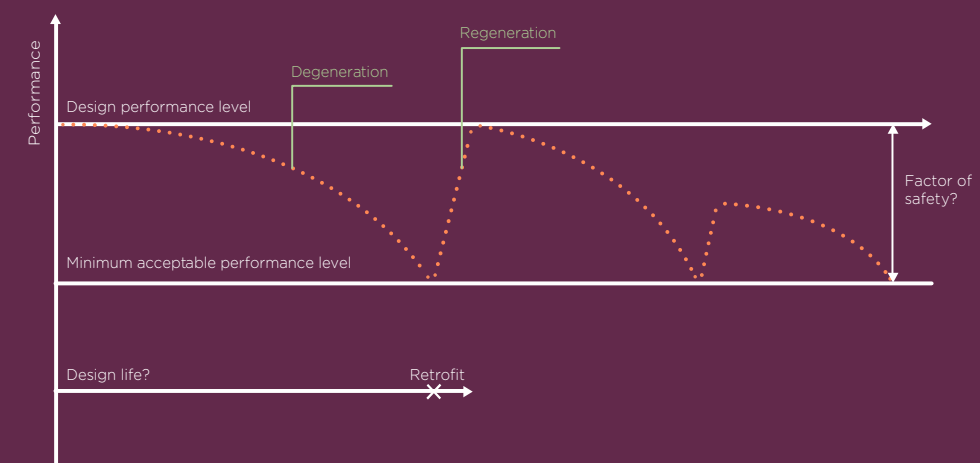
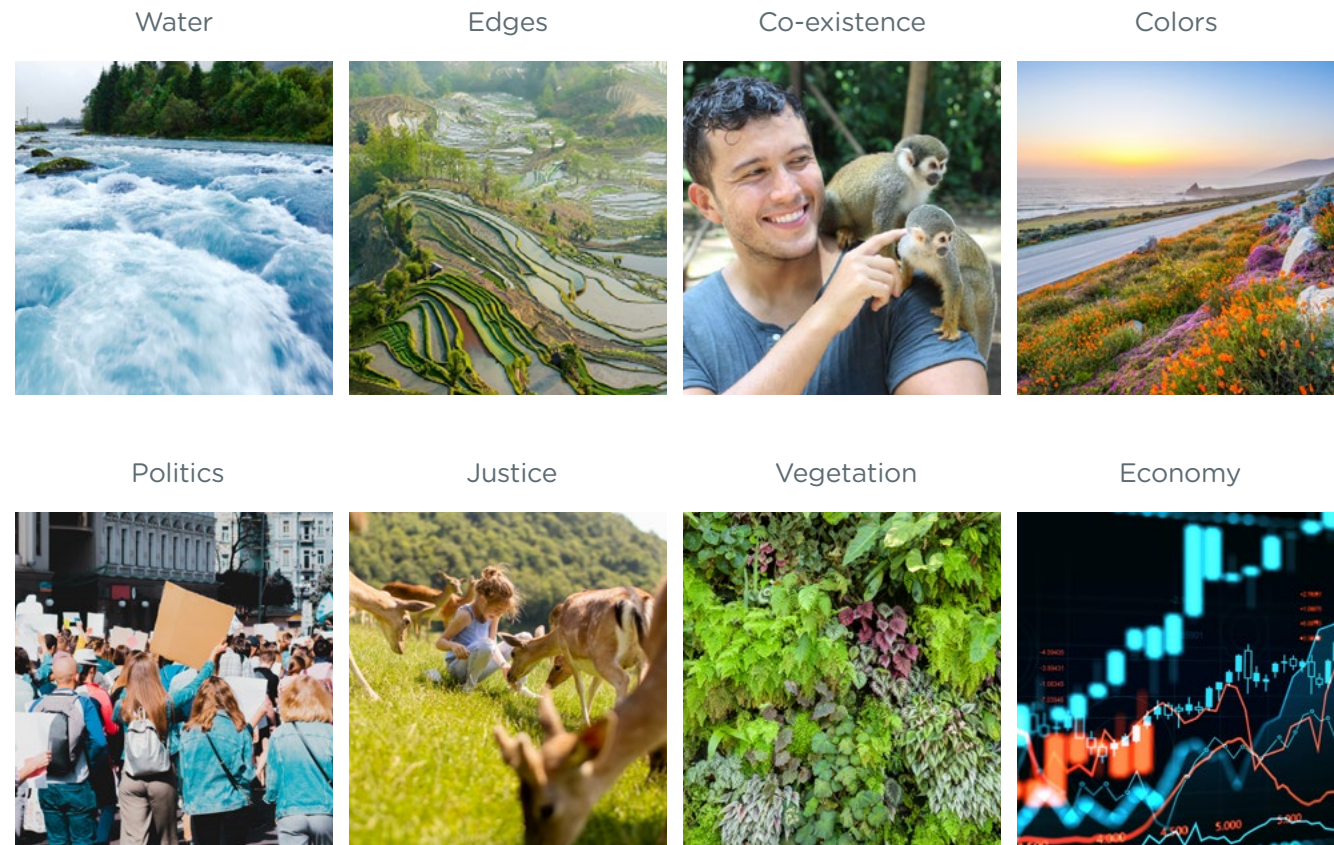


Figure 7: Design life of existing buildings. (Source: Ramboll, 2024)

The degeneration of existing buildings starts from the day construction is completed. The journey continues until the performance level drops below the minimum level. This concept is described within the context of Design Life in Figure 7. Retrofitting at this stage, or even earlier, constitutes an act of regeneration. This regenerative process can continue multiple times to ensure that our existing buildings are continuously retained and repurposed.

Embracing complexity

Our relationship with the natural environment is complex and effective solutions must acknowledge and address this complexity. Complex issues do not have a simple solution; the complexity of regenerative design lies in the multitude of design drivers that must be considered simultaneously for each project. These design factors include water, vegetation, air, biodiversity, and others (refer to image below).



16 drivers of Regenerative design. (Source: Ramboll, adapted from Reed, B., 2007)

Of advocacy, agency and activism

The following are three commitments we have made as part of our Advocacy, Agency and Activism to deal with environmental challenges, some of which were outlined above.



Commitment one

All existing buildings have the right to be heard and retained. We are committing to compiling a visual inspection report for all existing buildings on all our projects.



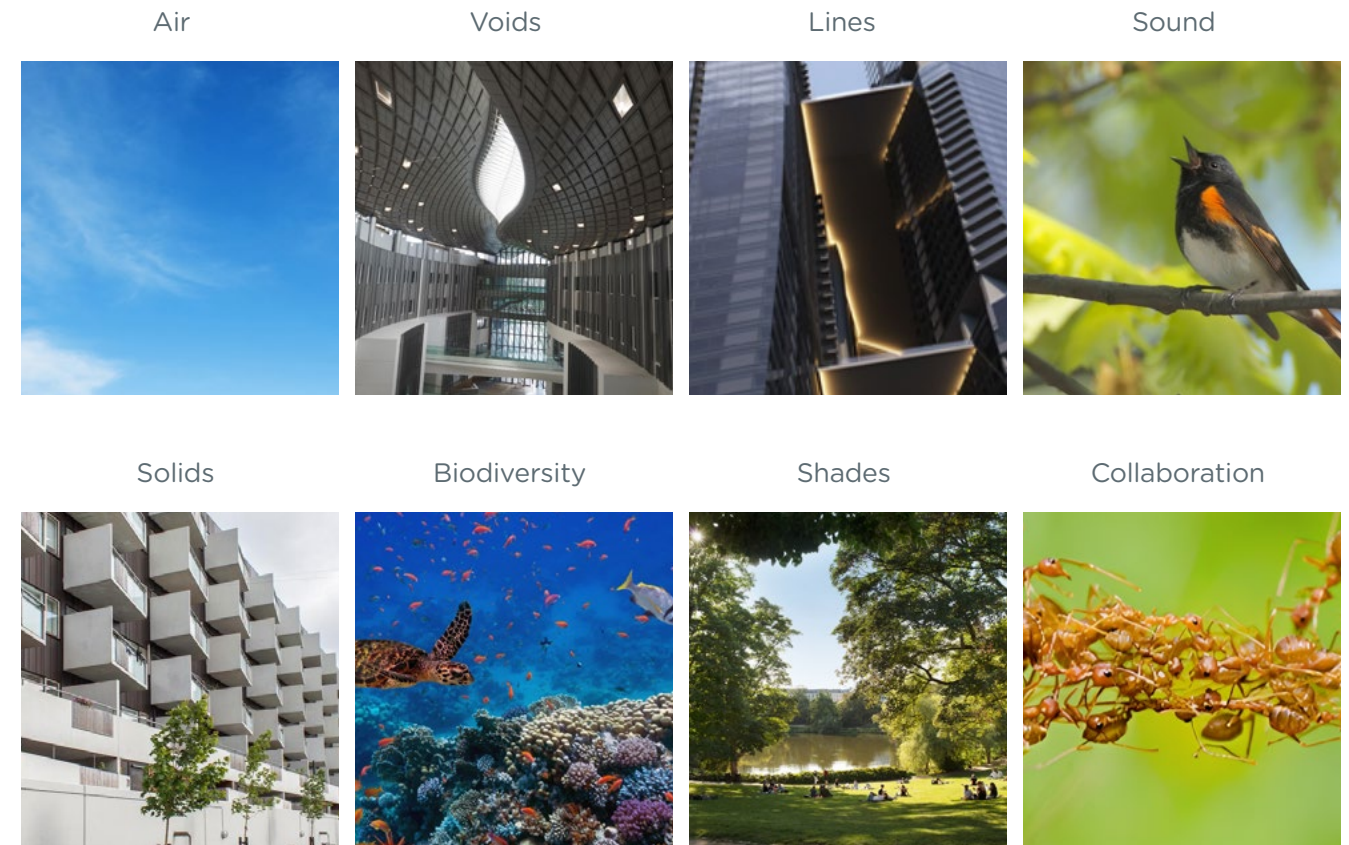
Commitment two

No Ramboll structures (A1-A3) will have an embodied carbon of more than 150kgCO₂e/m². This is to be halved to 75kgCO₂e/m² by 2030.



Commitment three

We will not double our chemical footprint leading up to 2030.



The Living System Approach

For too long, urban planning has operated under a mechanistic worldview, viewing cities as machines to be optimized. This approach prioritizes efficiency and control, often at the expense of long-term sustainability and ecological harmony. However, a new paradigm is emerging: regenerative design, which draws inspiration from living systems. This paradigm considers cities as dynamic ecosystems, where human society thrives in a mutually and

reciprocal beneficial relationship with the world around us, living and non-living.

The regenerative design philosophy emphasizes several key principles that refer to the interconnectedness of our mindsets, our processes and our designs. These principles can be communicated and grouped in numerous ways. In our understanding of regenerative design, we are highlighting four that we refer to as:

- Design with place,
- Become gardeners,
- Co-create conditions, and
- Reconnect as nature.

These principles are inspired by several leading organizations and individuals within regenerative and systems thinking, including the Regenes Group, Building Conversations, Donella Meadows, U School for Transformation, Laura Storm & Giles Hutchins, Bill Reed, and Daniel Wahl to name a few.



Trine Stausgaard Munk,
Head of Sustainability, Ramboll Water

Design with place

Regenerative design starts with the unique characteristics and essence of a place – its past, present, and future. It is place-sourced. Each place represents a proximate whole that is part of a greater whole.

Living and non-living systems exist within a place but also beyond it. Regenerative design is best addressed at the precinct scale – a level larger than individual buildings but smaller than the entire city. With everything born out of the uniqueness of place, there is little potential in standards. Rather, community-led designs tailor-made for a place are required to aspire to regeneration. Interventions need to be at the right relation and right scale. Such design processes and interventions demand new mindsets, new structures, and new behaviours. It requires that we do things differently. It requires new knowledge, new organizations, and new skills to develop, appropriately care for and maintain tailor-made interventions.

Become gardeners

Instead of seeing ourselves as architects or engineers of a system or a place we should see ourselves as gardeners working with the systems, rather than against them. By doing so, we need to resist the urge to control – control the systems, the conversations, the processes, and many other aspects of our daily life. Traditional planning processes are often highly controlled and tailored towards specific predefined success criteria that have little connection to place.

Traditionally, projects also often only engage with an exclusive group of living human stakeholders as part of the design process. Instead, regenerative design recognizes the inherent rights and values of all living as well as non-living stakeholders that could characterize a place: the fish in the rivers, our ancestors who inhabited the lands for generations before us, the bees that pollinate our gardens, the unborn that will live in a place long after we are gone, the water that sustains life, and the mountains that define the landscape. By using different methods, we can increasingly 'sense' a place to also

identify more conceptual aspects such as community aspirations, money, and tradition.

These conceptual 'actants' also influence decision-making today less inclusively and transparently. By inviting them in as proper stakeholders along with water, the unborn, and the mountains we can host completely new conversations, new decisions made, and different designs developed. With less controlled and more inclusive conversations and design, we can explore where water would like to flow (rather than where we would want it to go), what our ancestors hoped for this place, what the unborn dreams about, what the bird needs to thrive in place, or what legacy thinks of the future. Instead of intervening from outside, we can co-create from within in concert with a much broader set of stakeholders to co-create conditions for a place to co-evolve.



Co-creating life-affirming conditions

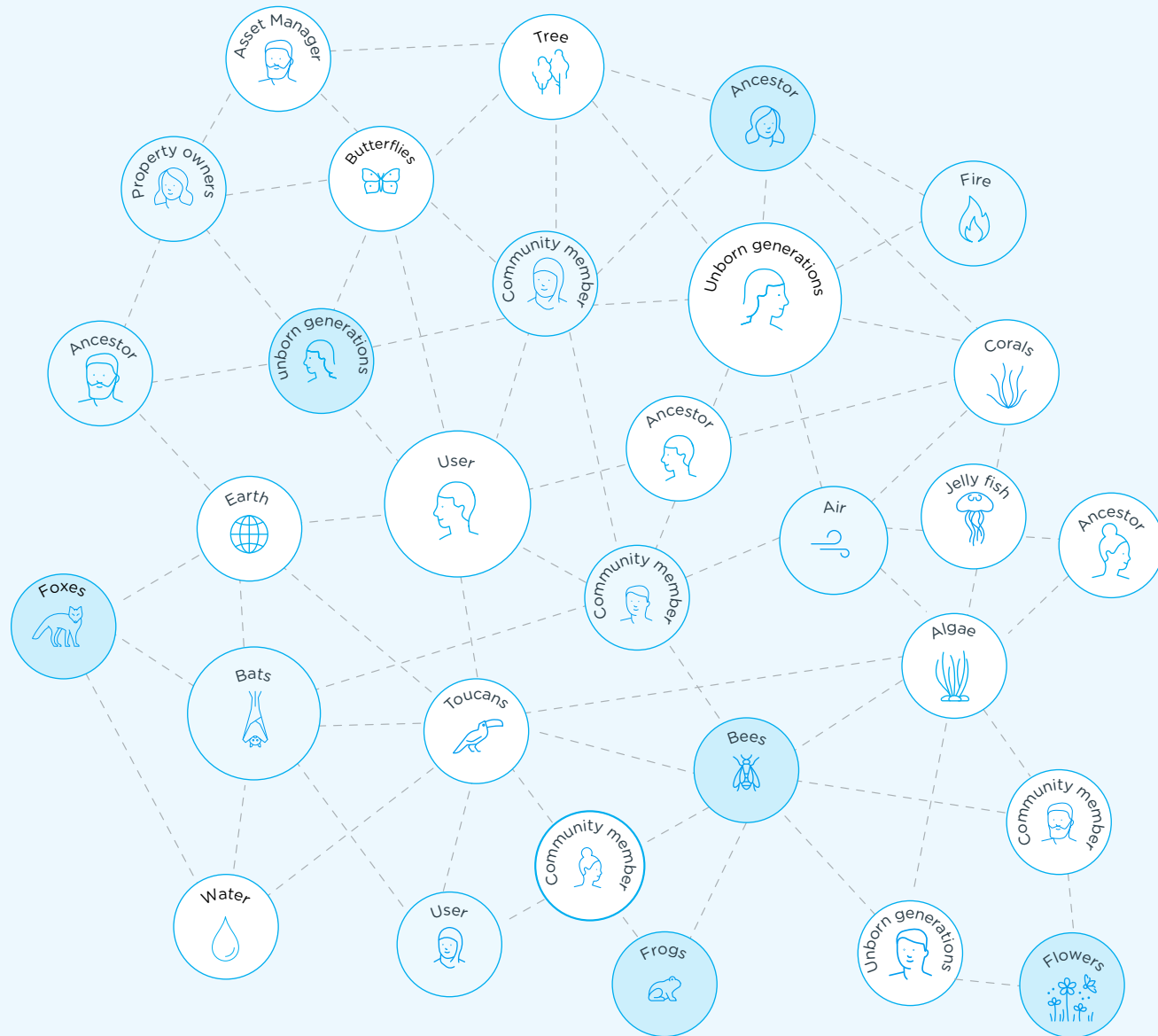


Figure 8: Co-creating life-affirming conditions. (Source: Ramboll, 2024)

Co-create conditions

For too long we have designed for static outcomes in conflict with the systems of place. Concrete flood walls, highways, or other infrastructure do not have an appropriate relationship with the living systems in which they co-exist. (Figure 8) Regenerative designs focus on creating conditions where life can create conditions for more life. It stems from the recognition that we are intervening in systems that existed long before us, and that our designs will outlive us.

A place is a complex web of interconnected systems. Accepting that complexity cannot be fully mapped or modelled, regenerative design introduces methods that allow us to sense into the systems and relationships of place. Techniques like [Theory U](#) is an awareness-based

method for changing system by Otto Scharmer focusing on grounding and “presencing” which involves connecting to the deepest source of self and allowing future to emerge from the present moment – leading to the peak of awareness and presence. It helps us let go, to let come and activate an open mind, open heart, and open will. The act quiets our overly active analytical minds, reconnecting with and expanding our full sensing capabilities, and grounding ourselves in the interconnectedness of all beings. “Presencing” is key to unlocking the paradigm & mindset shifts required of the regenerative practice. By the use of presencing, we can sense a place, its systems, its relationships and conceptual actants, and our own biases, our conceptions, and mental models that would shape decision-making.

Instead of a mechanistic control and command approach, regenerative design embraces a living system thinking recognising that in complex living systems, the whole is greater than the sum of its parts. This also means that the reciprocal relationships and exchanges of energies within and between the systems are what make it regenerative. These connections cannot be forced or controlled. Instead, they can emerge when the right scale, the right relationship and the right conditions are facilitated. To do so, we need to be in tune with the place, and with the systems and much like acupuncture, identify stagnated energies or high-potential nodes where we can assist the systems in creating the right conditions for emergence.

Reconnect as nature

We, as humans, are but one species on this planet. We recognize that we are nature and that our connection with our natural environments is what makes us thrive, both physically and mentally. For generations we neglected to nurture the ecosystems around us that sustain all life, our life. We forgot that our interdependence with them is what makes us thrive on the planet. Through regenerative design we reactivate this knowing. We change the structures around us that limit our reconnection with nature, as nature, and we reintroduce living systems thinking in our language, our daily lives, and our designs.

By changing structures and contexts we actively invite in and facilitate a new mindset where we are one with

nature and where our co-existence is at the heart of our decision-making. Embracing with this new mindset, we rethink our needs for continued development and growth. With this mindset, we start with a planetary purpose, one of inclusivity of all life, and let it guide our decision-making, our design processes, and our physical interventions. We reintroduce natural processes, native materials, and flexibility and resilience in our organizations, processes, and design. Natural systems adapt to their local context and surroundings, and so do we.

Long way to regenerative design

We have a long way towards regenerative design. It is as much an internal journey as it is external. With our current mindset and hierarchical structures, we are unable to enable a regenerative design process. Skipping these important steps in our urge to explore the physical looks of regenerative design will ultimately remove focus from the true journey that we are on. However, each person or organization diving into regenerative thinking will start a tailor-made journey. Similar to any other project, understanding the baseline and the ultimate goal will help teams navigate their journeys from where they are towards our common whole. Co-conceptualizing this unique journey within the organization will be the very first and groundbreaking task for future redevelopment.

12 leverage points to intervene in a system

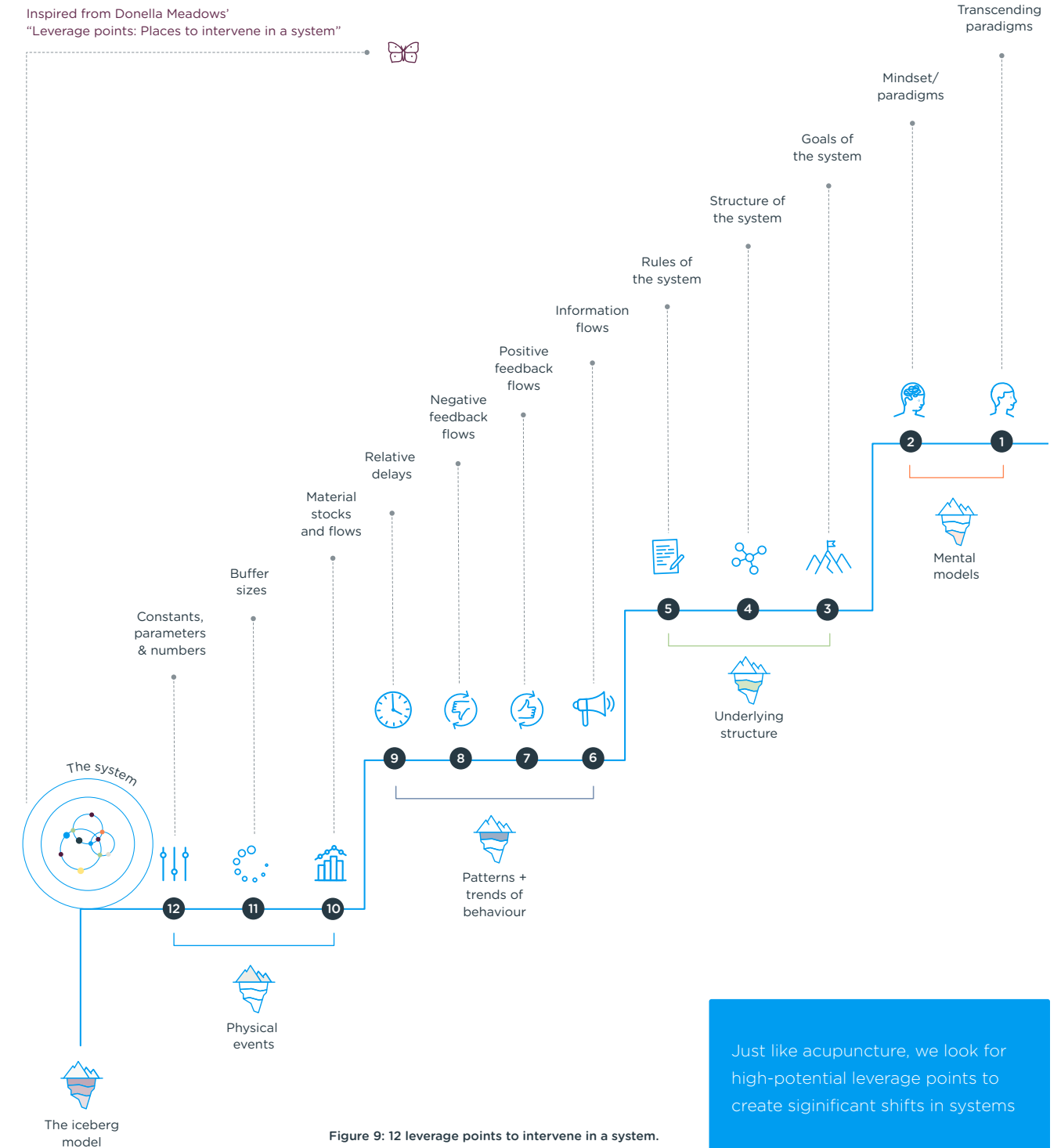


Figure 9: 12 leverage points to intervene in a system. (Source: Ramboll, adapted from Meadows, 1999)

What Does This Mean for Regenerative Design?

When we employ systems thinking throughout the design process of a project, we are able to pioneer examples of how the principles of regenerative design can be translated into a large-scale urban development project. By prioritizing biodiversity and place-based solutions, we aim to create a community that thrives in harmony with the natural environment. This can be a testament to the power of the living system approach in shaping a more sustainable and resilient future for our cities.

Green infrastructure network

A network of parks, green roofs, bioswales, and rain gardens can be woven throughout the development. These green spaces will not only provide recreational opportunities for residents but also manage stormwater runoff, improve air quality, and create habitat for wildlife.

Renewable energy integration

Prioritize the use of renewable energy sources such as solar panels and wind turbines to power the community's buildings. This reduces dependence on fossil fuels and contributes to a lower carbon footprint.

Water conservation and reuse

Consider water-efficient fixtures and appliances throughout the development. Additionally, explore greywater recycling systems to capture and reuse wastewater for non-potable purposes like irrigation.

Walkable and bikeable streets

Prioritize pedestrian and cycling infrastructure, encouraging residents to choose active modes of transportation. This reduces reliance on cars, lowers air pollution, and fosters a more vibrant and connected community.



Beyond Carbon Emissions

The key principles of regenerative design



While carbon emissions are a significant concern, it is important to recognize the biodiversity crisis as another critical challenge and extend focus beyond carbon reduction to encompass a broader spectrum of environmental issues.



Søren Brøndum,
Managing Director, Ramboll Buildings

Beyond sustainability: Regenerative design

We need to define a new starting point and acknowledge the limitations of traditional sustainability practices. This is a regenerative design journey, and part of this is exploring a more holistic approach to our places and cities that aims for positive environmental and social impact. This goes beyond just minimizing harm.

Combating crises beyond carbon

While carbon emissions are a significant concern, it is important to recognize the biodiversity crisis as another critical challenge and extend focus beyond carbon reduction to encompass a broader spectrum of environmental issues. Ramboll's approach to regenerative design is guided by three key principles:

- Nature as a partner:** This principle views nature not just as a resource, but as a collaborator and key stakeholder. It advocates for a paradigm shift where nature is central to design decisions, fostering a harmonious relationship between humans and the environment.
- Future generations:** This principle emphasizes long-term thinking, considering the impact of design decisions on

future generations. It involves respecting planetary boundaries, building resilience, and fostering adaptability.

- Everything as a nutrient:** This principle promotes a circular approach, minimizing waste and maximizing resource efficiency. It encourages finding new uses for existing materials and creating positive environmental benefits.

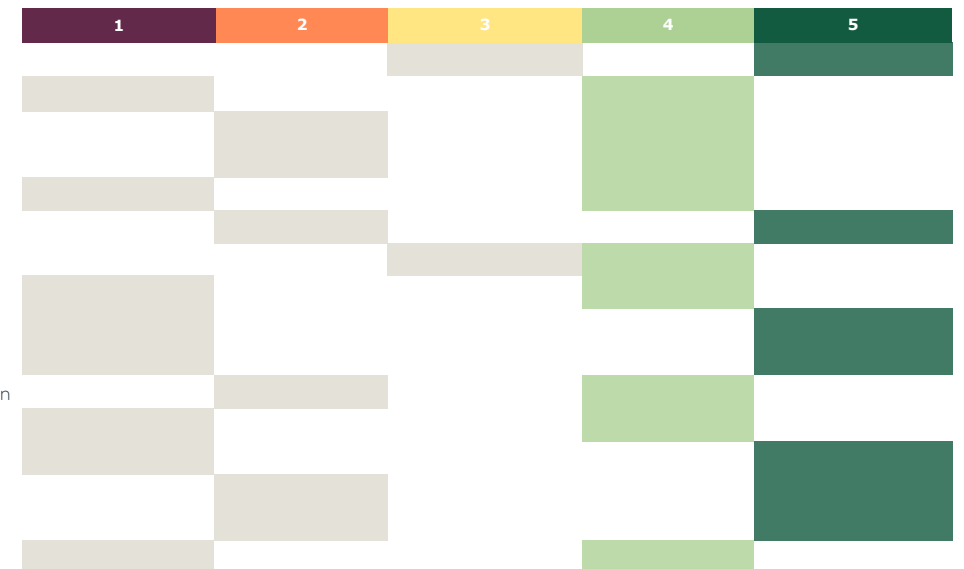
Tools for transformation

Ramboll has developed tools to support the implementation of regenerative design principles:

- Regenerative design chart:** This tool (see Figure 10 below) allows project assessment across various parameters based on the three core principles. It helps measure progress towards a regenerative outcome. It can also help map opportunities that a project may offer to enhance the 16 design drivers identified by Ramboll.
- Regenerative design thinking tool:** This tool guides project discussions and helps tailor project ambitions beyond the initial brief. It provides a library of questions promoting innovation and alignment with regenerative themes.

Opportunity Matrix

- Water
- Air
- Light
- Soil
- Vegetation
- Waste
- Carbon
- Biomimicry
- Integrated Connectivity
- Natural Systems
- Massing and Fragmentation
- Sound
- Biodiversity
- Collaboration
- Social Equity
- Coexistence



Trends in atmospheric CO₂ Vs Global Temperature change

Figure 10: Regenerative design chart. (Source: Ramboll, 2024)

Case studies in action



Aarhus Old Municipal Hospitals, Denmark (Source: AART Architects)

There are examples of projects that showcase how it is possible to work with promoting regenerative design principles:

- VTT Campus, Helsinki: This project aspires to be the world's most sustainable campus, integrating agriculture and acting as a living laboratory. Ramboll utilized the design tools to assess and guide the project towards a regenerative outcome.
- Aarhus Old Municipal Hospital, Denmark: This project involved the sensitive renovation and transformation of a historic building into a central hub for a new city district. Reusing the existing structure saved significant resources and embodied carbon emissions.
- Toronto District Neighborhood: This project focuses on creating a vibrant community with a balance between people, place, and nature. It involves transforming a former airbase into a residential and transit hub with sustainable features.
- Copenhagen North Harbour Development: This project aims to create a 'five-minute city' where residents have easy access to amenities within a short distance. It utilizes existing industrial buildings, promotes low-carbon construction, and employs smart city solutions.

The Helsinki campus exemplifies the potential for integrating green spaces and urban agriculture into high-density developments. The sensitive renovation of the Aarhus

hospital highlights the importance of adaptive reuse to conserve resources and heritage. Toronto's district regeneration demonstrates how to prioritize community needs while

incorporating sustainable practices. Finally, Copenhagen's 'five-minute city' showcases the benefits of walkable, mixed-use neighborhoods.



Copenhagen North Harbour Development. (Source: Ramboll)

Decarbonisation and Regenerative Building Design

From good to great

“

Multi-criteria decision-making tools that can accommodate a diverse array of factors will be important to help implement regenerative design.

Paul Astle,
Decarbonisation Lead,
Ramboll Buildings



The concept of regenerative design is an opportunity to reset our relationship between the built environment, nature and society. Regenerative design promises to not only mitigate environmental harm but also to restore and revitalise ecosystems allowing us to survive, thrive and co-evolve.

Regenerative design embodies a holistic approach that seeks to restore and enhance ecosystems, going beyond mere sustainability to actively regenerate natural systems, including our own societies. However, the transition towards regenerative practices in the building sector is far from straightforward. Ever since the Kyoto protocol there has been an ever-increasing push to measure, control and ultimately reduce

greenhouse gas emissions. It has taken decades for these efforts to translate into the regulations we are now seeing around the world with respect to energy efficiency and, increasingly, embodied carbon.

However, reduced energy consumption and lower carbon materials still have some impacts, they are in effect, 'less bad'.

Is 'less bad' good enough?

Embracing regenerative design calls for integrated approaches that consider both carbon reduction and ecosystem restoration, recognizing that the two are not mutually exclusive but rather complementary aspects of our longer-term transition to a healthier planet.

It is crucial to recognise that this transition is not a binary choice between good and bad. Rather, it involves navigating through a spectrum of possibilities.

For instance, while energy-efficient buildings reduce carbon emissions, they might not contribute to ecosystem regeneration, or could require more carbon intensive materials in the first instance.

We cannot let the desire for a perfect answer paralyse our ability to make progress. We must recognise that on a given project we can make progress in some areas but not all. What matters though, is our long-term transition.

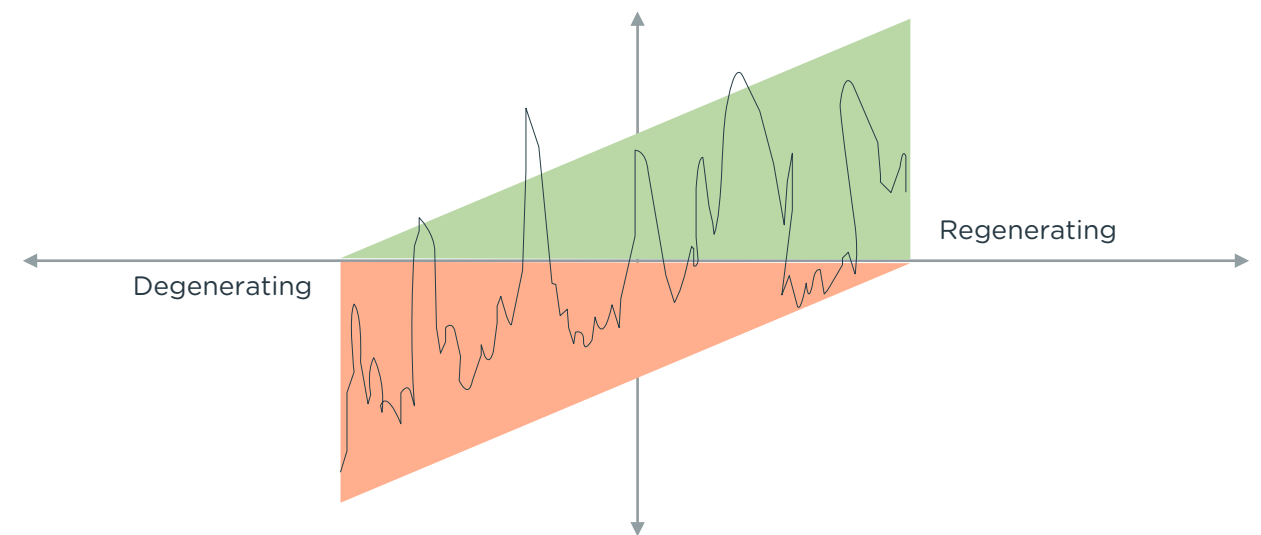


Figure 11: Recognising that both degenerative and regenerative activities are likely to occur on a given project. Progress will be messy, but our long term trajectory is to maximise the regenerative activities and minimise the degenerative ones. (Source: Ramboll, adapted from Reed, B., 2007)

Emerging policies and interconnectedness

RAMBOLL	2015	2016	2017	2018	2019	2020
Denmark Danish Building Regulation - Bygningsreglementet (BR18)						
Germany Assessment System for Sustainable Buildings - Bewertungssystem Nachhaltiges Bauen (BNB)						
Finland Method for the whole life carbon assessment of buildings - Rakennuksen vähähiilisyden arviointimenetelmä						
Sweden Climate Declaration - Klimatdeklarationen						
European Union EU Taxonomy Energy Performance of Buildings Directive (EPBD)						
Norway Technical requirements for construction works - Byggteknisk forskrift (TEK17)						
United Kingdom London Plan WLCA 2022						
Netherlands Environmental Performance of Buildings - MilieuPrestatie Gebouwen (MPG)						
United States California Green Building Standards Code						
France Environmental regulation - Réglementation environnementale (RE2020)						
Canada Vancouver Building By-law Toronto Green Standard v4						
Singapore Green Mark 2015						
Green Mark 2021						

The scope of carbon assessment and carbon limit varies

Requirement of carbon assessment

Voluntary carbon assessment

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

Implementation of carbon limit

Carbon reference value

¹ Carbon limit TBA

² Carbon limit currently up for review, with its implementation latest in 2027

Figure 12: Carbon assessment and target regulatory status in selected countries and cities. (Source: Ramboll, 2024)

To achieve a transition to regenerative thinking, there is a need for suitable policies and regulations, beyond those in place today.

Energy efficiency regulations in new buildings are relatively mature with nearly all national standards requiring a minimum performance, though there remains a gap in improving the performance of existing buildings.

There is an emerging landscape of regulation with respect to embodied carbon, the carbon associated with the extraction, manufacturing, transportation, and installation of building materials. Some countries have started to require the measurement of whole life carbon, which includes both the embodied

carbon, as well as the operational carbon associated with the energy consumed. Ramboll developed a building benchmarking database for carbon footprints, which accommodates variations across regions and countries in **Life Cycle Assessment methods**.

In addition, the need to measure the 'circularity' of a building is also starting to be considered in regulatory frameworks such as the EU Taxonomy, California state's CalGreen regulations and in many city level regulations, Amsterdam being a notable example.

We are now also starting to see attention on the ecological impacts of buildings and construction.

The ecological impacts outside a site are also starting to be considered, with the UK Green Building Council publishing some initial guidance on embodied ecological impacts last year.

Whilst these established and emerging policies are all a positive step, what is yet to be addressed is the interconnectedness of these different items and how the industry can make the 'best' collective decision?

The necessity of multi-criteria decision tools in regenerative design

In regenerative thinking, given the multitude of factors at play, traditional decision-making frameworks may fall short in capturing the full spectrum of considerations.

Furthermore, the metrics that are used may need to consider the dependency of place and some will be subjective and relative rather than objective and absolute. There may be

a need to answer the question, 'What does good feel like?', as well as 'What does good look like?'

Decision-making framework

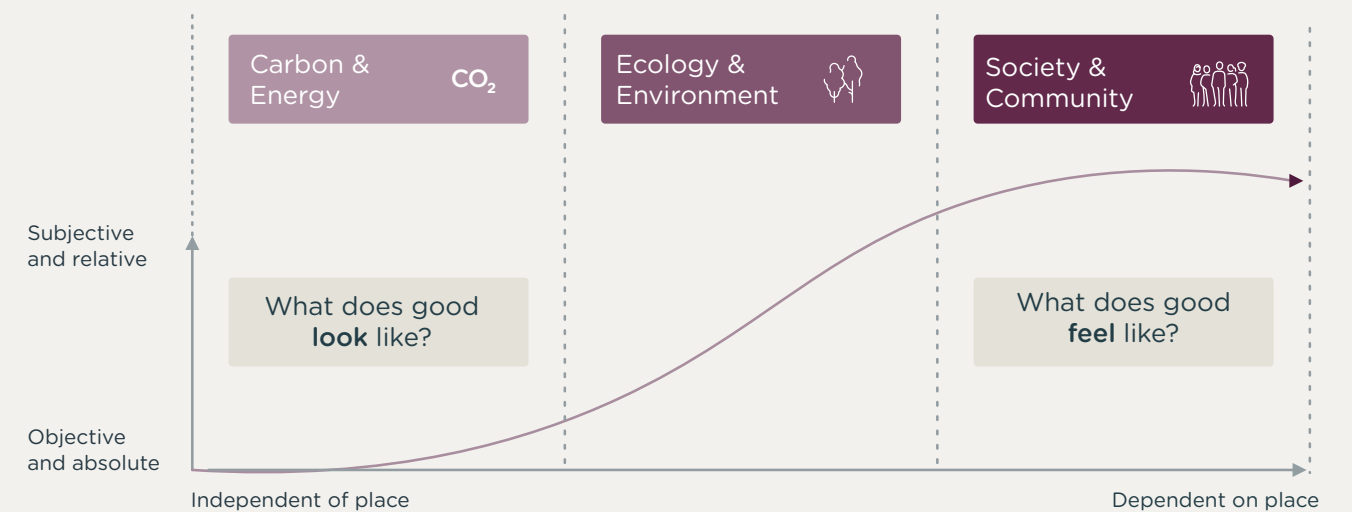


Figure 13: This graphic shows the need to recognise the different types of metric that should be considered when seeking to make a holistic assessment of a project. (Source: Ramboll, 2024)

Decarbonisation as the key to regenerative thinking

We stand at the cusp of a transition towards regenerative thinking. Whilst this transition will be messy requiring us to navigate a complex landscape of metrics, we must not get lost by trying to solve everything at once.

Decarbonisation can serve as the key to unlocking regenerative systems thinking, and whilst we may still be delivering things which are 'less bad', tackling carbon is a prerequisite to allowing us to deliver a regenerative

future. In doing so, we not only mitigate environmental harm but also embark on a journey of regeneration, where buildings become catalysts for positive change.

Insights from CLC -Ramboll Urban Lab

The CLC-Ramboll Urban Lab was organised to provide a platform for stakeholders across multiple sectors to discuss regenerative design and planning in Singapore's context. Held in January 2024 as a one-day workshop, the Urban Lab involved more than 60 representatives from academic institutions, private corporations, and public sector agencies. The public sector was represented by agencies responsible for managing the built environment, urban planning, environment, energy, and transportation sectors in Singapore.

Workshop design and facilitation process

To allow participants to discuss regenerative design and planning principles with reference to concrete examples, Singapore's Jurong Lake District (JLD) was used as a case study throughout the Urban Lab. Jurong Lake District (JLD) aims to be a model sustainability district by achieving net-zero emissions for new developments by 2045. Representatives from the Urban Redevelopment Authority and the National Parks Board gave brief presentations on their vision and climate-positive aspirations for Jurong Lake District (JLD), including the Jurong Lake Gardens. These presentations set the context for participants to explore the application of regenerative planning in greater depth, through small group discussions that were jointly facilitated by CLC and Ramboll.

Participants were organised into six groups of seven to eight people, with each group comprising a mix of representatives from various sectors and agencies to encourage diverse perspectives. Each of the groups also focused on a specific Infrastructure & Environment (I&E) domain integral to the application of regenerative design. Thus, the following domains were examined: Planning, Mobility, Resource Infrastructure (e.g., Energy/Water/Waste), Buildings, Parks/Nature, and Finance/Industry.

To guide the discussion, participants were asked to imagine how concepts related to regenerative design and planning could be applied to Jurong Lake District (JLD) in the listed domains.

For example, participants in the Mobility group explored key attributes or characteristics that would make transportation in Jurong Lake District (JLD) more regenerative. They also discussed possible ideas to enable such a shift, including policies, programmes, or innovations that agencies or organisations could undertake. Following this, participants in each group were asked to vote for one idea to focus on for the next segment of the workshop, where they discussed how successful implementation of the idea could be measured or assessed, and any potential challenges they may encounter.



Group discussion during the Urban Lab. (Source: Ramboll)

The final part of the workshop invited each group to share their ideas with all participants, who then engaged in a wider conversation on how ideas could be assessed and integrated across the different I&E domains.

This approach leveraged on a system thinking framework and allowed participants to consider how regenerative outcomes could be achieved in a more holistic manner, given synergies across the

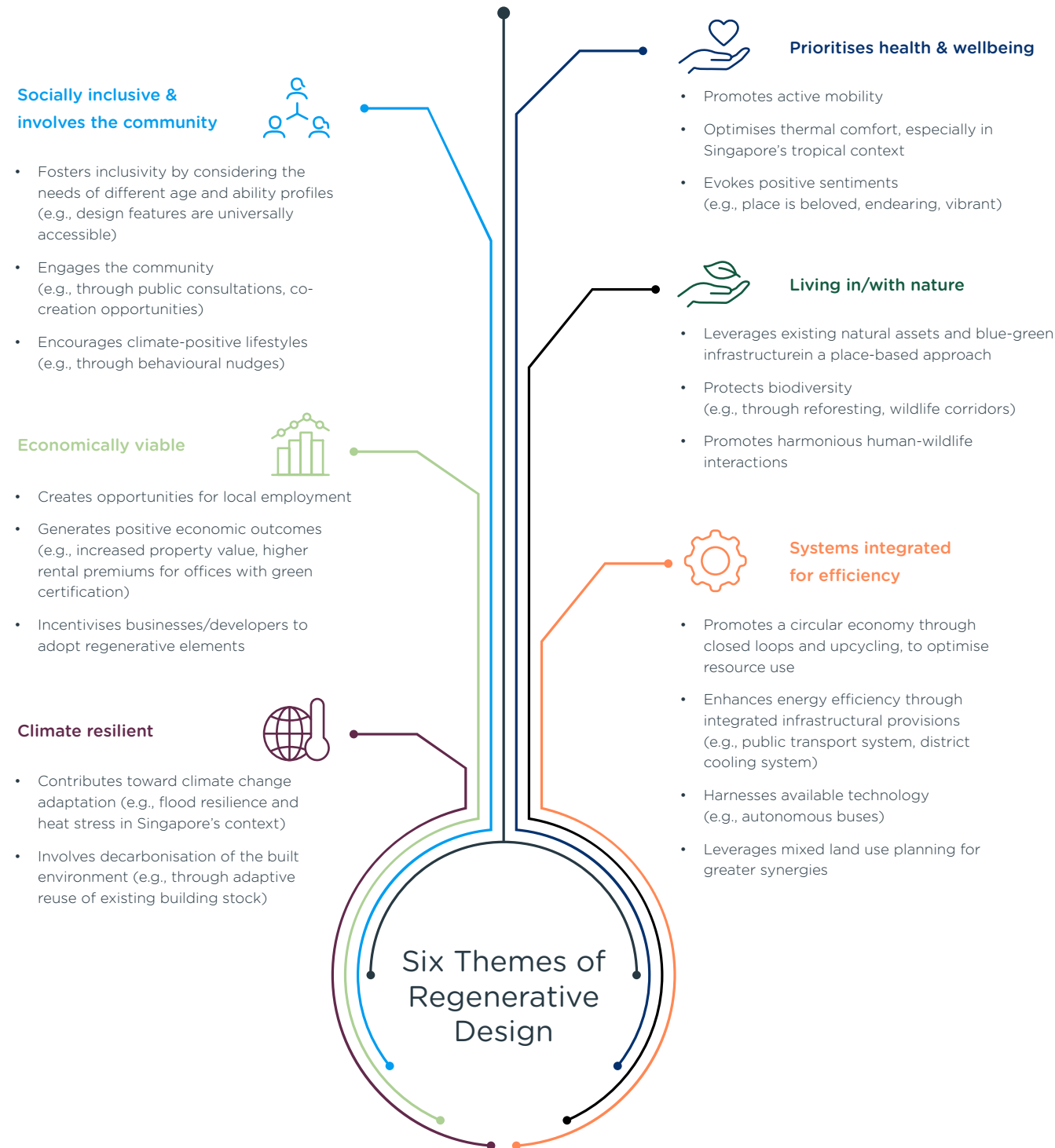
I&E domains. Ramboll facilitators with relevant expertise in applying regenerative design were also invited to comment on the themes and ideas shared by participants.



Group discussion during the Urban Lab. (Source: CLC)

Key elements of regenerative design

Using Jurong Lake District (JLD) as a case site, participants discussed in small groups on the key attributes that are considered integral to the application of regenerative design. These have been categorised into six broad themes:



Source: Ramboll

Box Stories

Lakeside Garden in Jurong Lake Gardens, Singapore

Living in/with Nature

Nestled in the Jurong Lake District (JLD), Jurong Lake Gardens is Singapore's third national and the first in the heartlands. In 2019, the National Parks Board (NParks) opened 53 hectares of Lakeside Garden*, one of three gardens within the Gardens. A green recreational node with a distinctive lakeside setting, Lakeside Garden advances the Gardens' vision of being a people's garden by providing more spaces for recreation amidst lush greenery, restored wetlands and habitats for biodiversity, and offering vibrant programming for the community.

From concrete canal to natural wonder

One remarkable transformation is the evolution of Neram Streams. Through innovative bioengineering techniques, what was formerly a 300m-long concrete canal was transformed into a 1.3km naturalised braided waterway to convey rainwater from the surroundings to Jurong Lake. The banks are designed and bioengineered to ensure slope and hydraulic stability, resulting in 100% stormwater catchment through natural drainage. This also increased the capacity of the Gardens' drainage system, while returning spaces for community and ecology rejuvenation.

Close to biodiversity and nature

Drawing visitors closer to nature, Rasau Walk is a restored freshwater swamp habitat with over 50 different species of native plants and a 300m boardwalk that meanders along the edge of Jurong Lake. The wetland habitat is inundated with water based on the water levels in the lake, creating zones for water birds to forage, and for visitors to observe biodiversity in their natural habitat.



Rasau Walk in Singapore first heartland national garden, Jurong Lake Gardens. (Source: National Parks Board)

Play experiences inspired by nature

The 2.3 ha Forest Ramble is the largest nature playgarden in the heartlands, offering a unique play experience with 13 adventure stations where children can explore and mimic the motions of animals that inhabit a freshwater swamp forest. Children can also engage in educational water play at Clusia Cove, where they can learn about tidal patterns and experience water movements that mimic the surface ripples and directional currents of coastal shores. The water is cleansed through a closed-loop system of eco-ponds, natural filters, and cleansing biotopes before being circulated back to the play area. Clusia Cove is the first closed-loop water playground that utilises these features as part of the recycling process.



Neram streams in Jurong Lake Gardens. (Source: National Parks Board)

As NParks' Living Lab, Jurong Lake Gardens showcases how smart technology and regenerative design elements that foreground our connections with nature can come together to create public spaces that all can enjoy. These efforts are also in line with the Singapore Green Plan 2030, to transform Singapore into a City in Nature.



Children playing in Clusia Cove. (Source: National Parks Board)

*This excludes the 7-ha northern section of Lakeside Garden, which opened in 2023.

Box Stories

Marmormolen, Copenhagen

Climate resilience through decarbonisation

Marmormolen, also known as The Marble Pier, will be one of the largest contemporary timber buildings ever constructed in Denmark showcasing the retrofit of traditional building material to lower carbon impact and increase liveability. Together with Henning Larsen, an interdisciplinary practice working across architecture, landscape and urbanism, and real estate entrepreneur Pihl Hoffmann, working closely with AP Pensions, one of Denmark's largest pension funds, Ramboll was responsible for the multidisciplinary project from concept to construction, including a full lifecycle assessment.

Reducing carbon with timber

By using wood, Marmormolen's CO₂ load is reduced by approximately 50% compared to a traditional concrete structure. The use of wood results in 9,500 tonnes fewer total emissions. Of this, 3,000 tonnes of emissions are avoided by using wood instead of concrete, and 6,500 tonnes are subsequently bound by the wood throughout the building's lifetime.

Urban greenery

Located on the waterfront of Copenhagen, Marmormolen will be a sustainable multifunctional development with a cantina and auditorium, which doubles as an open space for events and flea

markets. The upper levels will host workspaces, enjoying the uninterrupted view of the skyline of Copenhagen. Urban greenery can be found at the rooftops and green plazas provide guests and residents a chance to enjoy a break in the natural environment. The gardens simultaneously double as oases for biodiversity, with insects finding a home in the garden.

Marmormolen is aiming for the highest rating in building sustainability in Denmark, known as DGNB Platinum (for commercial property), and the WELL Platinum 2020, which is the highest level of certification for promoting health and well-being in buildings.



Marmormolen on the waterfront of Copenhagen will be one of the largest contemporary timber buildings in Denmark. (Source: Henning Larsen)

Box Stories

Bishan-Ang Mo Kio Park, Singapore

A climate resilient project

Bishan-Ang Mo Kio (AMK) Park is a testament to Singapore’s innovative and integrated approach to urban development. Through thoughtful design and planning, nature is prioritized to protect the rich biodiversity in the park, paving the way for a future where cities can thrive alongside nature.

The redevelopment has had a significant social and economic impact on the area. The park attracts over six million visitors annually, generating an estimated socioeconomic value of 83 million SGD per year. The park also provides

several other socioeconomic benefits, including reduced commuting costs for visitors who live nearby, increased sales for local businesses near the park, increased property values in the surrounding area and reduced healthcare costs due to the physical and mental health benefits of spending time in nature.

Rejuvenating Kallang River at Bishan-AMK Park

Kallang River, which runs through Bishan-AMK Park, is the flagship project of the Active, Beautiful, Clean Waters (ABC Waters) Programme, a strategic initiative launched in

2006 that reimagines water bodies as a vibrant space for community and recreation, transcending their traditional roles of drainage and water supply. Once a concrete canal running through Bishan-AMK Park, a 3km-stretch of the Kallang River was naturalised into lush, meandering waterway. This project showcases how our utilitarian drains can be integrated holistically into the urban environment to promote multifunctional use of space. The redesigned river channel was conceptualised based on a floodplain concept. Water flow during dry weather periods is confined to a

narrow stream in the middle of Kallang River, while the park area doubles up as a conveyance channel during a storm.

ABC Waters @ Bishan-AMK Park also draws on principles of regenerative design to minimize waste and improve resource circularity. A combination of plants, natural materials such as rocks and civil engineering techniques were introduced to soften the edges of the waterway, giving it a natural appearance, and preventing soil erosion. Cuttings from plant species used to construct these techniques can be harvested for other construction projects or the re-planting of existing projects.

Improved Ecology and Biodiversity

The vegetation, plants and natural materials used form natural habitats that enrich the biodiversity of the park. The restoration of Kallang River has created a huge variety of micro-habitats within the river and surroundings and has fostered a thriving ecosystem with an estimated 30% increase in biodiversity. Over 90 species of birds and 60 species of flora has been recorded at the park. This increase in biodiversity enriches the park’s aesthetics but further strengthens the ecological resilience.

Prioritising Proximity of Place

The reconfigured park design prioritises the proximity of places

and pathways to the water, with various features including three new bridges, a terraced riverside gallery, river platforms, stepping-stone paths and a water playground. Other facilities include two new playgrounds, two new restaurants, public toilets and “Recycle Hill”, a park landmark and look-out point built from blocks of concrete recycled from the old channel.

Bishan-AMK Park serves as a model for urban development across the globe and showcases the potential of transforming utilitarian spaces into vibrant and resilient hubs for recreation, community use, and ecological well-being.



Bishan-Ang Mo Kio Park, Singapore - the pilot project of ABC Waters Programme. (Source: Henning Larsen)

Box Stories

Kristian Augusts Gate 13, Oslo

Promoting a Circular Economy



Using 80% of recycled building materials, Kristian Augusts Gate 13, Norway. (Source: Mad Architects - Kyrre Sundal)

Kristian Augusts Gate 13 is the first building in Norway where recycling of building materials and circular solutions have been used on such a large scale. With up to 80% reuse of materials, Kristian Augusts Gate 13 has reduced greenhouse gas emissions from the project by 70% and has made reuse a theme for the entire construction industry.

Learnings from this development are being incorporated into other Ramboll buildings projects and are leading to changes in regulations in Norway to encourage the reuse of building materials.

Reducing carbon through reuse

The old office spaces were initially to be demolished, however, the developer decided to preserve the structure of the original building and reuse building materials from other projects. The overall aim of the project was a CO₂-reduction of 50%, calculated using the FutureBuilt Framework. FutureBuilt is a 10-year program with an aim to develop 50 pilot projects, including buildings and city areas, that reduce greenhouse gas emissions from transport, energy and material consumption by at least 50%.

Adaptive reuse

The project's focus was on the reuse of building parts from the existing building as well as other projects, including support systems, radiators and the reuse of internal surfaces.

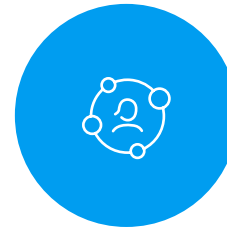
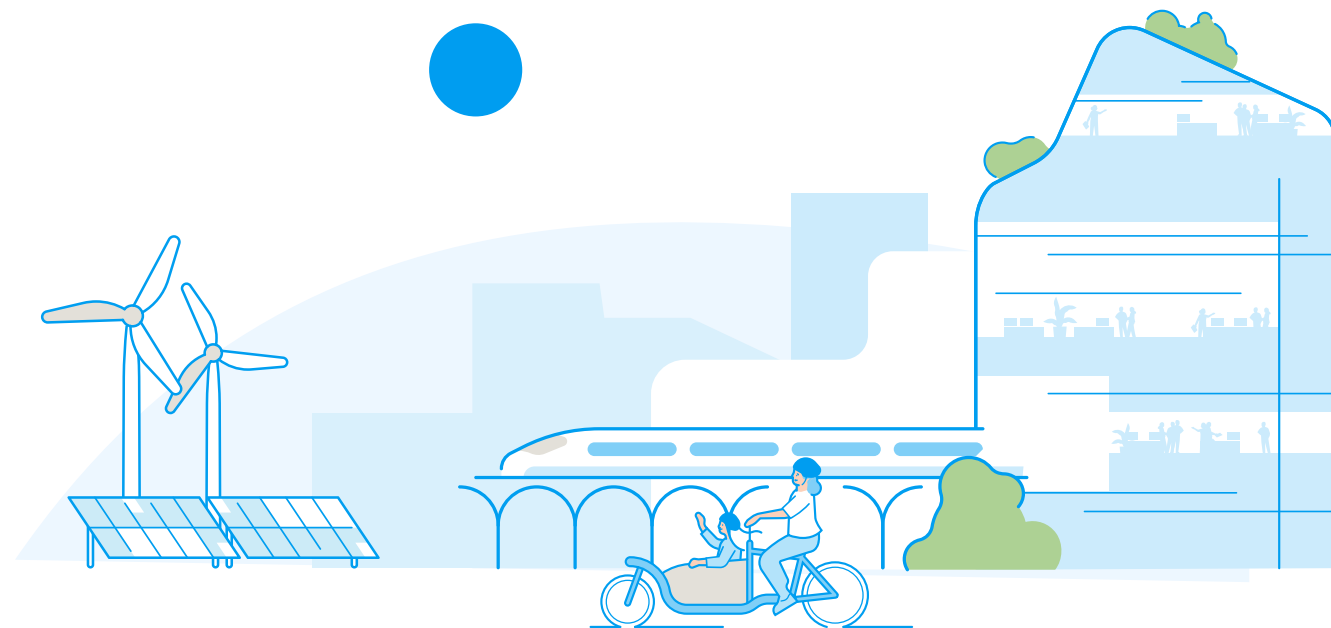
Rehub, Ramboll's online marketplace, was responsible for the delivery of two building materials. The materials included concrete slabs assessed by Ramboll's structural engineers as well as kitchen units and outdoor steel cladding found through Rehub. Teardown projects were used as resource databases and mapped by Rehub through which necessary information was reported to make preliminary choices.

Conclusion

Towards a Regenerative Future for Cities

The CLC-Ramboll Urban Lab has discussed the potential of regenerative strategies for Singapore, and other cities, to carry out ecologically-friendly and carbon-sensitive urban development while maintaining high liveability. This approach focuses on creating a mutually beneficial relationship between nature and communities, through identifying new and innovative ways of approaching infrastructure design and construction.

Creating a regenerative city will require commitment and effort across a rich ecosystem of stakeholders, from designers and architects to urban planning authorities and the wider community. To enhance the overall impact of regenerative strategies, developing collaborations and synergies across sectors will become increasingly important. Productive partnerships can be facilitated through a range of strategies, including multi-stakeholder platforms, open data sharing, and incentivising collaboration.



Multi-stakeholder platforms

Creating forums where government agencies, businesses, community organizations, and residents can come together to discuss challenges, share ideas, and co-create solutions is essential. For example, **the Jurong Lake District Innovation Challenge** was organised by several government agencies in 2023 to generate novel solutions for reducing carbon emissions and resource use, optimising energy efficiency, and promoting a car-lite environment. These themes respond to Challenge statements that were set by stakeholders in the District, including the Land Transport Authority, Science Centre, and a real estate investment company. Winning teams were awarded a cash price of \$50,000 Singapore Dollars to develop prototypes for piloting.

These strategies to encourage cross-sectoral partnerships provide an excellent starting point for creating a regenerative city. As we delve deeper into the regenerative concept and aim for net-zero, additional questions and new challenges are bound to emerge. For instance, how should we prioritise our efforts across the building, district, city, and national scales? Which indicators are appropriate in measuring our progress, and how can we collect consistent and reliable data for these indicators? What benchmarks should we apply when considering the rejuvenation of ageing infrastructure, and how will these be different from our approach for new-built projects? How can we better localise regenerative strategies? These are exciting questions that warrant further exploration, and we invite you to undertake the collective journey of discovering, learning, and actioning with us.



Data sharing and open access

Making data on environmental factors, resource usage, and social indicators readily available can empower stakeholders to base their decisions on a shared understanding of the city's needs. **Data.gov.sg** is an open repository of data collected by 70 public agencies in Singapore. It is freely accessible to citizens and developers, and sees about 350,000 visitors monthly. Such platforms empower the wider community to co-create solutions for a regenerative city through the use of credible data.



Incentivizing collaboration

Developing funding mechanisms, awards, and recognition programs that reward collaborative projects can encourage stakeholders to work together towards regenerative goals. For example, the **SG Eco Fund** was established in 2020 to support projects that promote environmental sustainability while engaging the local community. Projects are assessed based on their environmental benefit, ability to enable community action, innovation, and sustained impact. The Fund is open to applicants from the People, Private and Public (3P) sectors, and encourages collaboration across partners.

Annex

Brainstorming Ideas for a Regenerative City



This visual was created by a graphic facilitator during the CLC-Ramboll Urban Lab and showed highlights from the group discussions.

Group discussion during the CLC-Ramboll Urban Lab



Group discussion during the Urban Lab. (Source: CLC)



Group photo with Urban Lab participants from across the public, private and academic sector. (Source: CLC)

Reference

Page 13

Keeling, C.D., Piper, S.C., Bacastow, R.B., Wahlen, M., Whorf, T.P., Heimann M., and Meijer, H.A. (2005) Atmospheric CO₂ and ¹³CO₂ exchange with the terrestrial biosphere and oceans from 1978 to 2000: observations and carbon cycle implications, pages 83-113, in "A History of Atmospheric CO₂ and its effects on Plants, Animals, and Ecosystems", editors, J.R., Ehleringer, Cerling, T.E., Dearing, M.D., Springer Verlag, New York.

Page 13

Climate Action Tracker (n.d.) Climate Action Tracker. Available at <http://climateactiontracker.org> (viewed May 2024).

Page 14, 15, 18, 33

Reed, B. (2007) Shifting from 'sustainability' to regeneration, *Building Research Information*, 35:6, 674-680.

Page 15

Craft, W., Ding, L., Prasad D., Partridge L., Else D. (2017) Development of a Regenerative Design Model for Building Retrofits. *Procedia Engineering*, 180. 658-668.

Page 17

WWF (2022) Living Planet Report 2022 – Building a nature-positive society. Almond, R.E.A., Grooten, M., Juffe Bignoli D., Petersen, T. (Eds). WWF, Gland, Switzerland.

Page 25

Meadows, D. (1999) *Leverage Points: Places to Intervene in a System*. Hartland: The Sustainability Institute.