

CREATING A BETTER WORLD TOGETHER:

FINANCING AND BUILDING REGENERATIVE DESIGN



THE AMERICAN INSTITUTE OF ARCHITECTS



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About the American Institute of Architects

As the largest design organization in the world, AIA is transforming the day-to-day practice of architecture to achieve a zero-carbon, resilient, healthy, just, and equitable built environment, for everyone. Founded in 1857, AIA and its more than 100,000 members work to create more valuable, healthy, secure, and sustainable buildings, neighborhoods, and communities. Through more than 200 international, state, and local chapters, AIA advocates for public policies that promote economic vitality and public wellbeing. AIA provides architects with tools and resources to assist them in their careers and business and to engage civic and government leaders to find solutions to pressing issues facing our communities, institutions, nation, and world. AIA members adhere to a code of ethics and conduct to ensure the highest professional standards.

About this report

Creating a Better World Together: Financing and Building Regenerative Design is a practical guide for architects and policymakers on getting regenerative projects built. Organized around AIA's Five Pillars of Regenerative Design, it surveys the policies and financing tools that make these projects bankable and presents six case studies that span project type, geography, climate zone, and culture. It closes by offering a policy and practice agenda for architects.

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A LETTER FROM THE AIA PRESIDENT

We live in an era of overlapping shocks and stresses, climate disruptions, housing challenges and economic uncertainty. Each one alone would be significant, and together they place extraordinary pressure on our communities. We have all played a role in creating these conditions, through the ways we build, extract, consume, and expand, and it is our responsibility to reverse the damage.

Regenerative design offers a path forward. It is not simply about doing less harm. It's about doing more good. It strives to integrate buildings within their natural and social environments, actively restore ecosystems, and strengthening communities. It is the difference between curing symptoms and healing entire cities.

A regenerative future is one where natural and human systems work together rather than compete. Where wetlands protect neighborhoods and forests reduce flood risk. Where a building contributes more than it consumes, and where communities are stronger because of the investments we make today.

For me, this is personal. My practice is rooted in regenerative design, and I took on the role of President of the American Institute of Architects because I felt called to serve: to help shape a better world, for my family and for the generations that will inherit it. I was always taught that if you see something wrong, you have to push back. It doesn't matter how large or small it may seem. You have to stand up.

Around the world, leaders are standing up and embracing the need for change. As President, I have witnessed architects, the stewards of the built environment, working with community leaders to deploy regenerative design strategies across the United States. Institutions like the World Bank are making large investments in resilience. National adaptation plans are being developed at scale. Capital is moving. Policy is shifting. There is growing recognition that we cannot continue in the same patterns.

This moment requires more of us. It calls for active empathy, transformative thinking, decisive action, and a shared commitment to designing a better world together. Future generations will live with the consequences of what we choose to do – or choose not to do. We cannot leave this problem for them.

Leadership cannot wait.

Illya Azaroff FAIA

2026 President

The American Institute of Architects

EXECUTIVE SUMMARY

We are at an inflection point and bold action is needed. Our planet is warming rapidly, with major weather events occurring more frequently and with greater intensity each year. The current cycle of recovery and rebuilding is unsustainable. Local businesses are dormant for extended periods of time, critical social support networks are severely disrupted, and vulnerable populations are repeatedly displaced.

On top of these growing challenges, we are also experiencing increased social disharmony and facing emerging technologies that may have a profound influence on nearly every aspect of our lives. This can all feel overwhelming, like civilization itself may be teetering on a knife’s edge, as we attempt to balance overlapping energy, climate, housing, and affordability crises, along with the deterioration of the civic anchors that bind us together.

This report aims to provide a guide for architects and policymakers interested in building a better world; one where the built environment is in balance with the natural environment and actively contributes to the greater good of the planet.

An Introduction to Regenerative Design

Regenerative design offers a path forward. By striving to address these complex, interrelated challenges holistically, and moving from simply reducing harm to active repair and restoration, regenerative design shines a light on ancient wisdom. As Ubuntu, a Bantu African philosophy, tells us “the earth is not inherited from our ancestors but borrowed from our children.”

AIA’s Five Pillars of Regenerative Design

Section 2 presents AIA’s Five Pillars of Regenerative Design as a framework for architects and policymakers, and grounds the topic in a historical context, spanning diverse cultures and environments. It outlines existing local, state, federal and international policies and programs, demonstrating how nations have supported regenerative strategies for generations. While many of these policies focus on project financing, the report also examines programs that provide technical assistance or other support.

Getting Regenerative Projects Built

Section 3 Getting Regenerative Projects Built describes how project teams, led by architects, can rethink the design process, expand their scope of work, and engage with new partners to deliver positive outcomes for individual building users and the greater community. It provides a how-to guide for assembling a project team equipped to take on this challenge, outlines options for funding and financing projects, and reimagines the architect’s core services and responsibilities.

Case Studies

Section 4 presents case studies from six exemplary built projects, each addressing an urgent environmental or societal problem, and showcasing how architects are leading ground-breaking teams, expanding their roles and delivering concrete results.

Each case study highlights the funding and financing structures that made these projects possible, and how each team embraced the Five Pillars of Regenerative Design. For architects and developers looking to incorporate regenerative design strategies into their own work, these case studies serve as a practical guide.

Policy Action Framework

Section 5 introduces a policy action framework to drive regenerative design forward, increase market adoption and encourage regenerative strategies on many more projects.

Practice Action Agenda

Section 5 also addresses ongoing AIA efforts to equip its members to meet this challenge, through continued education and resources.

Call to Action

The report concludes with a call to action and key takeaways for architects, developers and policymakers. Building on the call for mainstreaming regenerative design that AIA made in the USCM-AIA Disaster Risk Reduction and Resilient Cities Report, it underscores the urgent need to address the accelerating global crises of these times. This concluding section highlights the holistic approach, shared commitment, and transformative thinking that we must inspire across allies, industry partners, and governments at all levels in order to meet this moment and build a better world.

AN INTRODUCTION TO REGENERATIVE DESIGN

History

Regenerative development is not new. Throughout most of human history, people have developed shelter, community, cities, and civilizations in harmony with the ecosystem that they depend on to survive and thrive. Indigenous cultures across every continent share similar principles that go beyond resource conservation and speak to a way of living with nature, both historically and in modern practice.

The Haudenosaunee tribe, whose traditional homelands span present-day New York, Ontario, and Quebec, share the concept “in every deliberation we must consider the impact on the seventh generation.” Generations Qualla initiative from the Eastern Band of the Cherokee in North Carolina calls for decision-makers “to strike a balance between natural, cultural, spiritual, and economic needs, now and for the next seven generations.” Ubuntu, a Bantu African philosophy, reminds us that “the earth is not inherited from our ancestors but borrowed from our children”. Buen vivir, which translates to “living well, in balance with earth,” was written into Ecuador’s 2008 constitution, granting rights of nature, and in Bolivia’s Law of Mother Earth, nature itself is recognized as an entity with legal rights. These concepts underpin regenerative development as a way to meet development needs while enabling a thriving ecosystem.

These core principles, were also shared by historic figures in United States history. Thomas Jefferson wrote that “the earth belongs in usufruct (the legal right to use property that belongs to someone else) to the living.” James Madison, in

Julia Watson, in her books Lo-TEK and Lo-TEK Water, catalogs regenerative design and development projects globally that incorporate technical ecological knowledge (TEK) from indigenous wisdom. Remote Khasi villages in India continue to use an ancient method of training roots of the local rubber fig tree to form bridges and ladders that strengthen over time and are highly adapted to the monsoon flooding. This way of building with nature even plays a role in the Khasi origin story, in which their ancestors descended from a living root ladder that connected heaven and earth.

his Address to the Agricultural Society of Albemarle, argued that humans disturb the balance of nature at their own peril, cataloging soil exhaustion, erosion, and deforestation in Virginia. Theodore Roosevelt, said “The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation, and not impaired in value,” Franklin Roosevelt remarked about the Dust Bowl in 1937, “A nation that destroys its soils destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people.”

The pattern of living and building within the means of available resources reached a tipping point in the early 1970s, when, according to the Global Footprint Network, humanity’s demand for resources exceeded the planet’s capacity to regenerate them. Until that point, the Earth could regenerate in a year what people consumed in the same year. In 2026, Earth Overshoot Day fell on July 30, meaning humanity now consumes about 1.7 times what the planet can regenerate in a year.¹ 1970, the year of the first Earth Day, was also when pollution of air, water, and soil started to be regulated in the United States after disasters like the Cuyahoga River fire.



▶ Photo courtesy of Julia Watson Lo-TEK: Design by Radical Indigenism (2019). Photo credit: Amos Chappelle

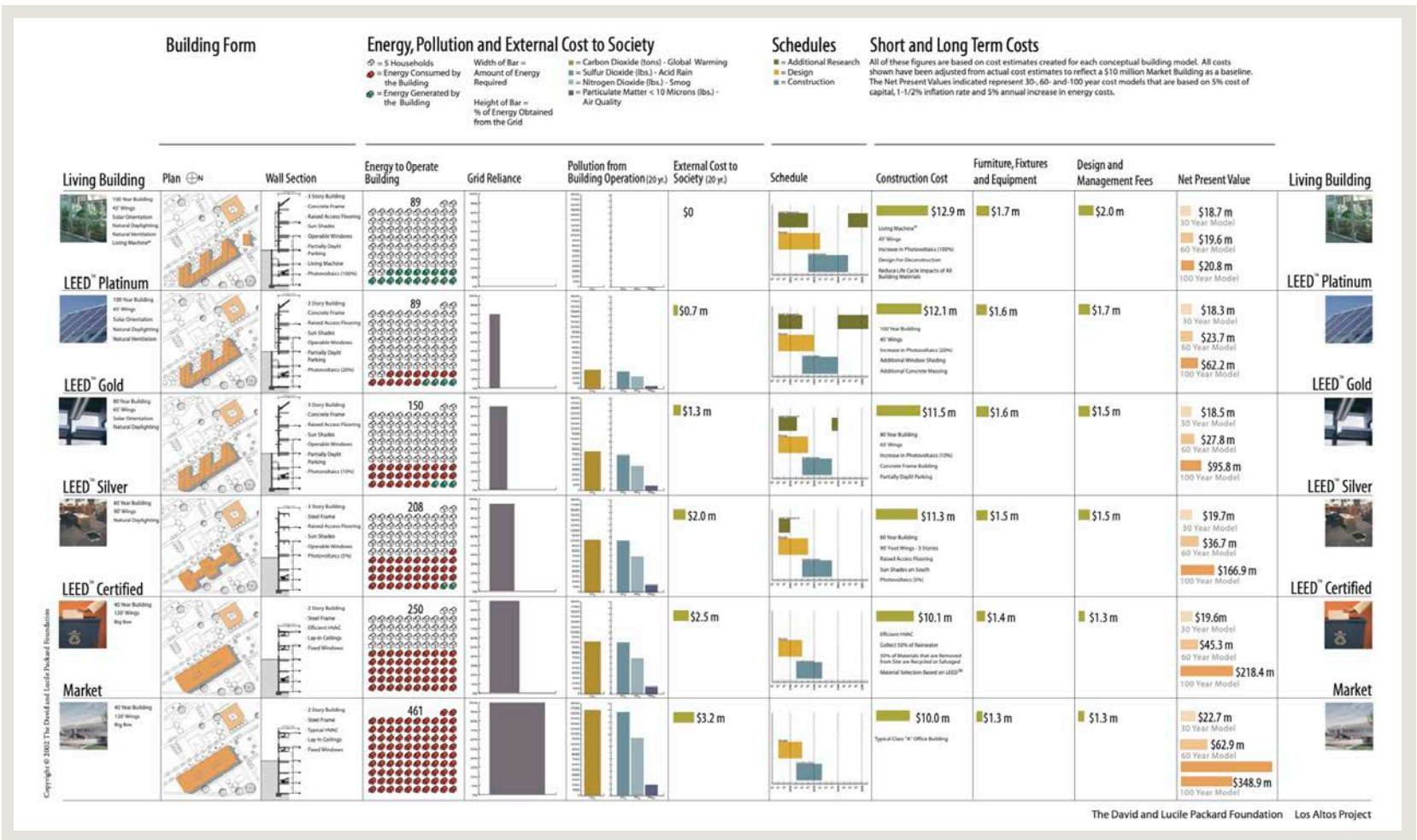
With growing concern about the unintended negative impacts of the building industry, architects began to provide leadership beyond the design of individual projects. The American Institute of Architects Committee on the Environment (COTE) was established in 1990, and AIA launched the COTE Top Ten Awards in 1997 to recognize projects that integrated and advanced the principles of sustainability. Shortly thereafter, US Green Building Council convened its first meeting at the AIA Boardroom.

Building for Sustainability | Sustainability Matrix

Architects served on the founding board and helped develop and launch the LEED Rating System in 1998, which provided a framework for the broader building community to adopt a shared language and to accelerate the market's uptake and transformation. Regenesys released Designing From Place, in 2012 which continues to serve as a foundational framework for regenerative design, along with John Tillman Lyle's Regenerative Design for Sustainable Development.² Both urge architects and developers to take the next step on the journey from conventional to sustainable, to restorative, to regenerative.

The Living Building Challenge was launched by the Cascadia Green Building Council based on work from architecture firm BNIM for the EpiCenter in Bozeman, Montana and the Packard Matrix. Cascadia later became the International Living Future Institute and is now Living Future. Their Living Building Challenge and its associated programs, including the Living Product Challenge, Declare Label, Zero Carbon, and Zero Energy, provide a similar framework for regenerative development that LEED provides for sustainable development.

In developing these frameworks, architects' leadership went well beyond individual projects; they built effective coalitions, co-designed a shared vision, and helped bring a vision into reality to transform the building industry and, eventually, the built environment itself.



BNIM's Sustainability Matrix for the David and Lucile Packard Foundation's proposed Los Altos headquarters compared six scenarios, from a market-rate building through LEED Certified, Silver, Gold and Platinum to a Living Building, on building form, energy and pollution, external cost to society, schedule, and short- and long-term cost. The Living Building scenario became the seed of the Living Building Challenge. Source: BNIM Architects, Building for Sustainability Report (2002).

Current Policy Landscape

International Programs

Shortly after the United States began measuring pollution and grappling with the need to develop actionable strategies to reverse the negative impacts development was having on the ecosystem and the communities that rely on it, the United Nations came together in Stockholm, Sweden in 1972 for the first UN Environmental Summit. That seminal meeting led to a wide range of global agreements and strategic plans. From addressing ozone depletion with the Montreal Protocol in 1987, which remains one of the most effective global policy collaborations, to the 1992 UN Framework Convention on Climate Change (UNFCCC), to the Kunming-Montreal Agreement to reach “a world living in harmony with nature by 2050,” the United Nations works to build global consensus about challenges that no individual country can solve for itself or others. Countries can then sign on to international agreements, become parties to the agreement, and work together at meetings called conferences of the parties (COPs) to develop specific policy or financial commitments to address shared challenges. The importance of international agreements to individual developments may seem abstract, but they drive major financial and policy actions that affect the building industry. The cost of building materials can be directly or indirectly impacted in markets with different forms of carbon pricing. The proceeds of these carbon disincentives are used to offset the higher costs by subsidizing transit and affordable housing, as is the case in California’s Affordable Housing and Sustainable Communities Program, or to fund first-of-a-kind infrastructure like low-carbon steel and cement plants through the European Union’s Innovation Fund, which is financed with Emissions Trading System revenues.³ Refriger-

erants used in HVAC systems and blowing agents in foam insulation are being phased down under the American Innovation and Manufacturing Act, which will affect project specifications.⁴

The upcoming 31st meeting of the Conference of the Parties to the 1992 UN Framework Convention on Climate Change (COP31) will focus on the buildings and construction which are responsible for around 37% of global energy- and process-related carbon dioxide emissions.⁵

The President of the proceedings, Murat Kurum of Türkiye, has set a non-binding “35 by 35” goal to increase electrification globally to 35% of final energy, up from 20% today. Another nonbinding goal is to reduce energy consumption intensity in buildings by at least 25% by 2035.⁶ While the federal government announced in January 2026 that the United States will withdraw from the UNFCCC,⁷ many cit-

ies and states will be actively taking part in global dialogue about realistic goals for energy efficiency in new and existing buildings as well as effective policy and financial strategies to achieve those goals.

The Kunming-Montreal Global Biodiversity Framework (GBF) was developed and adopted at the 15th Conference of Parties to the UN Convention on Biological Diversity (COP15) in 2022.⁸ While the United States remains the only UN member not to have ratified the Convention on Biological Diversity, the framework can still influence regenerative development in the US, with funding mechanisms that are more widely available, and policies that are being adopted at the local and state level which share the objective of the GBF to prevent the loss of over 1 million species.

Target 19 in the Global Biodiversity Framework (GBF) includes a goal to mobilize \$200 billion per year, leveraging impact funds, ecosystem services, green bonds, biodiversity offsets, benefit-sharing mechanisms, and other blended project finance tools.⁹ Some of these specific financing mechanisms have been used in the case studies that follow.

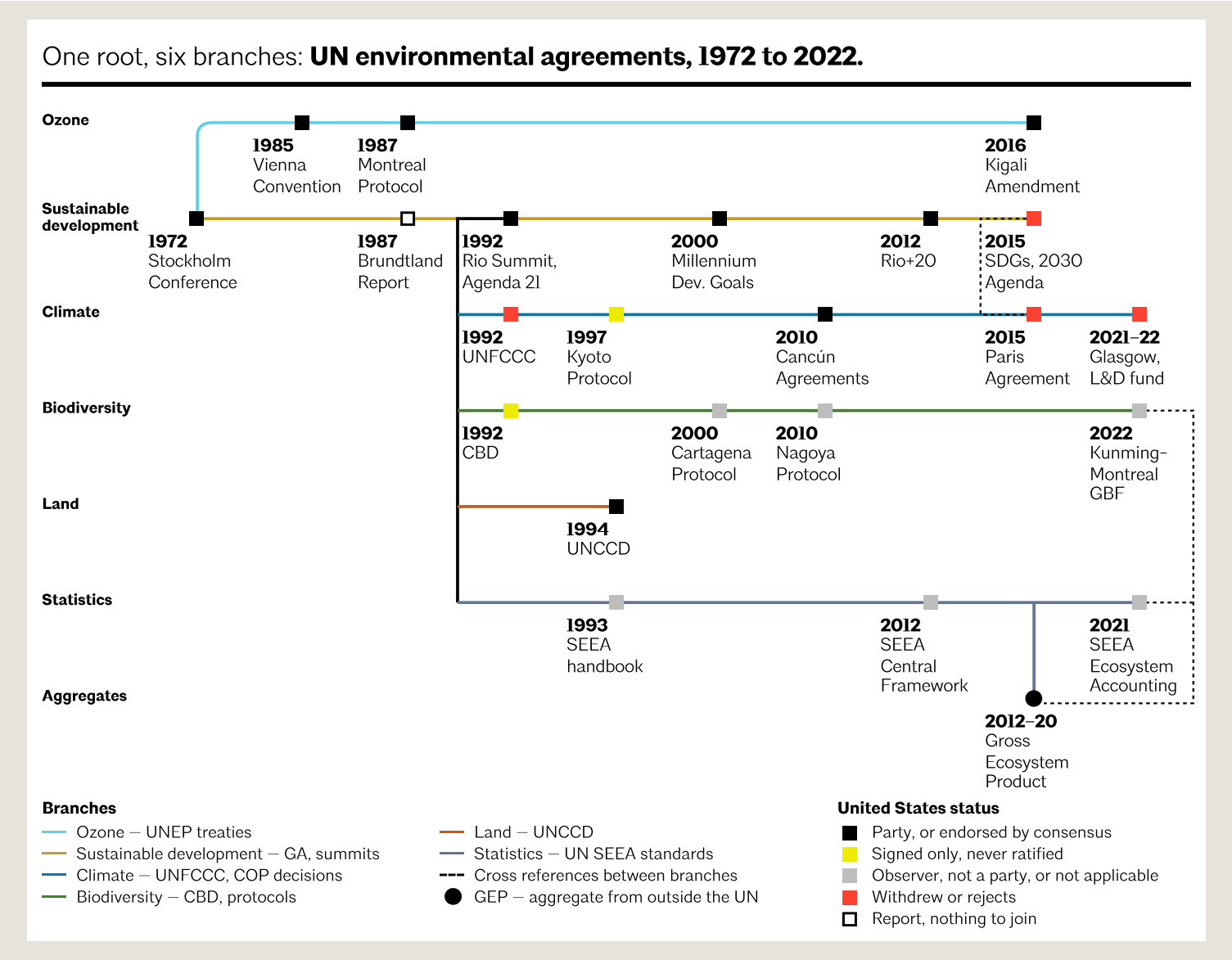


As part of the C40 Cities initiative the development of Barangaroo actively works toward meeting UN goals for sustainable development. Photo credit: Brett Boardman

To help countries, states, cities, or other signatories track performance in a standardized way, the UN developed a System of Environmental-Economic Accounting (SEEA).¹⁰ As tools emerge to measure and monetize ecosystem impact, projects can build a large capital stack to pay for regenerative strategies.

A wide range of precedents is emerging, including the UK’s Biodiversity Net Gain, which requires a 10% increase of “biodiversity units,” a combination of the surface area, importance, and health of the habitat that existed before a development occurs.¹¹ In 1996, Costa Rica banned conversion of natural forest to other uses and created the Pago por Servicios Ambientales (PSA) program, launched in 1997 as the world’s first national-scale payment for environmental services program. Using 3.5 percent of the national fuel tax, the program¹² proactively pays for services that deliver greenhouse gas mitigation, water protection, biodiversity protection, and scenic beauty for tourism and science. In 2022, China’s National Development and Reform Commission and National Bureau of Statistics issued trial national guidelines for Gross Ecosystem Product (GEP) accounting, modeled on the UN SEEA framework, to measure nature’s contribution to economic activity in regions piloting ways to realize the value of ecological products.¹³ These systems are focused on measuring progress countries are making toward their commitments to international agreements.

UN Environmental Agreements



► One root, six branches: the 1972 Stockholm Conference gave rise to six families of United Nations environmental agreements, on ozone, sustainable development, climate, biodiversity, land and environmental statistics, through 2022. Each node notes whether the United States is a party, a signatory, or has withdrawn.

Major global market-led initiatives also exist that are not officially part of a UN framework but coordinate closely with UN entities. These include:

- **The Taskforce on Nature-related Financial Disclosures** (TNFD) is a voluntary reporting standard adopted by major global financial institutions, insurers, and asset managers. Like LEED for buildings, it provides a standard way to document how assets in an investment portfolio (including but not limited to real estate) depend on nature and impact nature, and how they may be affected by things like climate change. These data can then be reported to interested investors, governments, the United Nations, or other stakeholders. As of September 2026, 802 organizations, including financial institutions with \$26.6 trillion in assets under management, had committed to TNFD-aligned disclosure, and more than 1,000 organizations had published TNFD-aligned reports.¹⁴
- **The Carbon Disclosure Project** (CDP) provides a platform for companies, cities, states, and other non-federal government entities to track and disclose environmental data, standardized with the TNFD. More than 22,100 companies and more than 1,000 cities, states, and regions disclose through CDP at the request of over 540 capital markets signatories holding more than \$110 trillion in assets.¹⁵
- **The Science Based Targets initiative** (SBTi) was founded by a consortium of the CDP, UN Global Compact, World Resources Institute (WRI), and the World Wildlife Fund (WWF) as a third-party validation of corporate greenhouse gas reduction progress. The related but separate Science Based Targets Network (SBTN) focuses on validating impacts to land and water

based on the aforementioned Kunming-Montreal framework.

- **The Global Real Estate Sustainability Benchmark** (GRESB) provides a way for owners of real estate and infrastructure portfolios to aggregate sustainability performance and compare it to peer portfolios of similar scale and asset mix. Investors can use GRESB benchmarking to allocate assets to portfolios that match their investment principles and strategy.

Domestic Programs

In the United States, regenerative design has been supported by a mix of federal environmental laws, agency programs, and professional frameworks that together enable projects to restore ecosystems, improve resource use, and deliver net-positive outcomes. Currently, the United States utilizes over 70 federal environmental policy instruments, including regulatory policy that guarantees measurable environmental protection, market-based incentives that provide permits or subsidies to encourage sustainability, and voluntary programs such as energy labeling on appliances and buildings. Notable programs include EPA’s brownfields redevelopment programs, Community Development Block Grant Disaster Recovery (CDBG-DR) funds allocated by HUD, FEMA’s Building Resilient Infrastructure and Communities (BRIC) grant program, GSA’s standards for public buildings, the joint EPA-DOE ENERGY STAR® program, and federal programs that support wetlands and coastal restoration led by EPA, NOAA, and the U.S. Army Corps of Engineers.

Several funding resources and climate commitments have been rescinded by the Trump-Vance Administration, most notably, the withdrawal of the United States from the



David Baker Architects helped build a complex capital stack mixing local, state, and federal funding programs to renew an ecosystem and a community at Coliseum Place in Oakland California. Photo credit: Bruce Damonte

international Paris Climate Agreement and the freezing of funds associated with the Greenhouse Gas Reduction Fund (GGRF). The green building market in the United States, however, continues to grow at a rapid pace, with a market projected to reach \$270 billion in 2035, more than double its 2025 value.¹⁶ Strong consumer demand for sustainable projects combined with significant economic benefits and operational savings continue to drive growth in this sector.

In the absence of robust federal support, many states and cities are increasing their own commitments and aggressively pursuing climate and regenerative design goals. A recent report from the University of Maryland Center for Global Sustainability found 1,406 energy- and climate-related policies across 157 cities in 48 states.¹⁷ Many of these policies target brownfield redevelopment, resilient infrastructure investments, biodiversity and habitat restoration, improved building performance and adaptability, and reducing administrative barriers to regenerative practices.

Rather than building on new sites, many states and cities offer incentives to encourage developers to remediate contaminated brownfield sites and repair damaged natural habitats, water, or soil. These brownfield redevelopment programs may include tax credits, technical assistance, or tax-increment financing (TIF), and are often designed to pair with EPA Brownfield Grants. Similarly, many state and local historic preservation offices support adaptive reuse of existing buildings and encourage investment in energy efficiency upgrades and resilience.

Many states, cities, and regions are also actively developing coordinated climate and resilience plans, with particular attention to land use, transit, water, and energy opportunities. During the past two years, California, Delaware, Hawaii,



▶ The Construction Career Center was a public private partnership and hosts building industry meetings including the local AIA Chapter. Photo Credit: Holt Webb

Maine, New Jersey, Oregon, and Vermont have each released new or updated climate plans.¹⁸ Jurisdictions like Hoboken, NJ have invested heavily in assessing climate risks to critical infrastructure and improving stormwater systems to account for heavier rainfall, while creating vibrant public spaces for the community.¹⁹

State-level initiatives, like the Massachusetts biodiversity conservation goals, are setting ambitious targets for protecting and restoring habitat, including 30 percent of lands and waters protected by 2030, 40 percent by 2050, 75 percent of key habitats restored by 2050. The plan recommends innovative financing mechanisms such as biodiversity credits and expedited permitting for restoration and nature-based solutions projects.²⁰ Similarly, local laws, such as the Seattle Green Factor, DC's Green Area Ratio, and Portland Central City's Ecoroof programs set minimum landscape, site design, or green roof requirements and give credit for native plant species.²¹ Maryland's Forest Act, as amended in 2023, requires forest cleared for development

to be replanted at a 1:1 ratio (1/2:1 in priority funding areas) or a fee paid into the Forest Conservation Fund, effective July 1, 2026,²² and California's Proposition 4 authorized a \$10 billion bond in 2024, including \$1.2 billion for biodiversity and nature-based climate solutions.²³

Cities and states have also adopted land use and zoning policies to incentivize private developers to invest in climate- and community-responsive, regenerative design strategies. The incentives may include density bonuses, expedited permitting or fee waivers, for significantly reducing energy or water use, exceeding affordability goals, or delivering all-electric, low-carbon designs. On city-owned projects, jurisdictions are incorporating climate and resilience metrics, often through third-party certifications, into project requirements. For example, Wisconsin's Division of Facilities Development adopted sustainability guidelines for state capital projects that adapt the AIA Framework for Design Excellence to address environmental and community needs.²⁴ Cincinnati Public Schools' Community Learning Centers and Wilmington, Delaware's Community Education Building co-locate schools with health, dental, vision, and mental health clinics, early learning, and family and workforce services in trusted community facilities.²⁵

State lawmakers are not only advancing land use policies to protect communities and ecosystems, but are also creating durable pathways for financing regenerative design. Local leaders across the country have adopted more than 500 policies to provide funding or financing support, including energy loans and credit enhancements, green banks, resilient infrastructure banks, green bonds, social infrastructure bonds, environmental impact bonds, commercial property assessed clean energy (C-PACE), and revolving loan funds.

AIA'S FIVE PILLARS OF REGENERATIVE DESIGN

The American Institute of Architects defines regenerative design as the holistic approach to enhancing and restoring buildings, communities, and nature, which integrates buildings within their natural and social environments to actively restore ecosystems, strengthen communities, and create a net-positive environmental impact.

Buildings consume a tremendous amount of natural resources, from the raw materials, energy, and embodied carbon used to construct them, to the energy, water, and materials used to operate them. Architects can limit and even reverse these impacts by shifting from a mindset of reducing damage to one of creating positive impacts.

Regenerative design moves from treating buildings as isolated objects to an understanding that they are part of living systems and designing for adaptability and evolution. This shift has tremendous potential to improve the environment, as well as the social and financial performance of buildings and cities.

AIA identifies five interconnected pillars that underpin the practice of regenerative design:



WHOLE SYSTEMS THINKING:

Planet, ecosystems, and communities are interconnected.



OPTIMIZE CARRYING CAPACITY:

Aligning decisions with a place's ecological limits and opportunities.



SPIRIT OF PLACE:

Design emerges from ecological and cultural context.



ACTIVE RENEWAL:

Design restores water cycles, enriches biodiversity, and generates more energy than consumed.



DESIGN EVOLUTION:

Design for adaptability so performance improves over time.



▶ The Kendeda Building in Atlanta, GA. Photo Credit: Gregg Willett



Whole Systems Thinking

PLANET, ECOSYSTEMS,
AND COMMUNITIES ARE
ALL INTERCONNECTED

Regenerative design is fundamentally focused on moving from an extractive mindset to an abundance mindset. In nature, all loops are closed. Everything that we think of as waste, is a feedstock for another organism. The leaves of an oak tree, after converting sunlight to energy for growth for a season, feed the soil for the next generation of trees and other species. Rather than fighting the heat from the sun, why not use it to sustain life? Rather than forcing rain directly into storm drains, how can we use it for water buildings need before it replenishes aquifers? Rather than using virgin materials from halfway around the world, with tons of embodied carbon, can we use reclaimed materials from another nearby building?

Regenerative design is not only about reducing resource consumption, it goes beyond, to heal ecosystems and the people that inhabit them. It draws the circle of required resources: energy, water, and materials, as tight as possible around the project and reframes challenges as opportunities.



Optimize Carrying Capacity

ALIGNING DECISIONS
WITH A PLACE'S ECO-
LOGICAL LIMITS AND
OPPORTUNITIES

Regenerative design calls for a reframing of the relationship among humans, and the built, and natural environments. Often, nature is cast as an external force to be controlled, protected, or mitigated. Regenerative design sees people and buildings living in and contributing to the ecosystem, enabling and encouraging biodiversity, providing habitat, and building relationships.

To avoid future catastrophic outcomes and continue to meet residents' needs, cities must build differently. Rather than destroying habitat, installing impervious surfaces that raise temperatures and prevent water from refilling aquifers, buildings and landscapes must be designed to repair ecosystems.

Regenerative design understands that buildings exist within an ecosystem and must be engaged, active partners rather than dominating or subjugating. Regenerative design requires moving from measuring success purely based on project economics to considering ecosystem services, which measure the value of goods and services that ecosystems contribute to human well-being.



Spirit of Place

DESIGN EMERGES FROM
ECOLOGICAL AND CULTURAL
CONTEXT

Regenerative design is about moving beyond reducing negative outcomes and moving toward positive financial, environmental and social outcomes rooted in a particular place. Instead of doing less damage or losing less money, regenerative design looks for solutions that actively improve societal, environmental, and economic conditions simultaneously.

Great projects begin well before pen meets paper. Community engagement is critical and must begin as soon as possible to explore the needs, concerns, and fears of residents and other affected stakeholders. In the best cases, these conversations lead to tangible outcomes that evolve with the project and provide guaranteed, structural benefits to the community.

One key to ensuring that social and environmental impacts are considered is to include costs that extend beyond the project boundaries. Development that generates incremental tax revenue is often seen as a good thing. However, as cities develop further from existing infrastructure, the incremental cost of serving the building, with roads, power, water, sewer, schools, and waste services, can far exceed the revenue generated from property taxes and introduce negative social outcomes.



Active Renewal

DESIGN RESTORES WATER CYCLES, EN-
RICHES BIODIVERSITY, AND GENERATES
MORE ENERGY THAN CONSUMED

According to the National Institute of Building Sciences, federally funded mitigation grants save roughly \$6 for every \$1 invested.²⁶ The indirect cost of not preparing is much steeper. According to a recent report from the US Chamber of Commerce and Allstate Insurance, "every \$1 not invested in disaster resilience today can cost communities up to \$33 in lost future economic activity."²⁷

During disasters, social cohesion and civic infrastructure are critical to ensuring that neighbors know where to go and who needs help getting there. Regenerative buildings with self-contained energy, water, and waste systems, in accessible locations, allow communities to have safe and secure spaces during a disaster.

The recovery phase after an event can be a disaster in its own right. From preventing waterborne diseases to looting, regenerative design strategies around active renewal can support local relief efforts. Furthermore, it is essential to ensure that recovery efforts not only replace what existed but also build back better and adapt to the new normal.



Design Evolution

DESIGN FOR ADAPTABILITY
SO PERFORMANCE IMPROVES
OVER TIME

Buildings, like cities, are not static objects fixed in time. They and their occupants learn, evolve, and grow with time and changing needs. Strategies or systems that made sense may need to be adapted or removed entirely. Regenerative design requires measuring what matters, sharing information, and ensuring that those lessons are applied to future projects.

When the Institute for Market Transformation and NRDC launched the City Energy Project in 2014 and helped the first cohort of cities adopt benchmarking, the data showed how widely energy performance varies among outwardly similar buildings. An earlier New Buildings Institute study of 121 LEED-certified buildings found that measured energy use in more than half of them deviated by over 25 percent from design projections.²⁸ This kind of transparency, while potentially embarrassing, leads to real learning and accountability. When we measure what matters, it becomes possible to improve project outcomes and shape policy decisions.

At the city scale, new tools are emerging to deploy digital twins to model the potential impact of policy interventions. AutoBEM, a software suite developed by Oak Ridge National Laboratory, automatically generates a building energy model, a digital twin, for every building in the United States.²⁹ Singapore built a national 3D digital twin, Virtual Singapore, designed to let agencies simulate scenarios such as flood impacts and emergency evacuations.³⁰

GETTING REGENERATIVE PROJECTS BUILT

Every regenerative development has a unique story, a unique combination of development drivers, and a unique blend of funding sources that made the project possible. In many cases, the architect plays a direct role in the creative problem-solving that made the project possible.

Regenerative design, and the expanded services architects provide to facilitate it, requires a reframing of the design and development processes most architects know it. Most of the time, a client brings a site, a budget, and a preliminary program. Architects assemble a team of engineers, landscape architects, interior designers, and work with the client and their team to provide the traditional design services. They will then work with the contractor to deliver the project that the client needs. Regenerative design is less linear, emerges from a broader set of conditions, and facilitates a process of synthesis. As Bill Reed AIA of Regensis puts it “Your project is not the project; the project is life itself and every development is an opportunity to create the conditions for it to thrive.” The expansive nature of regenerative development requires an expansion of many aspects of the project.

Expanding the Team

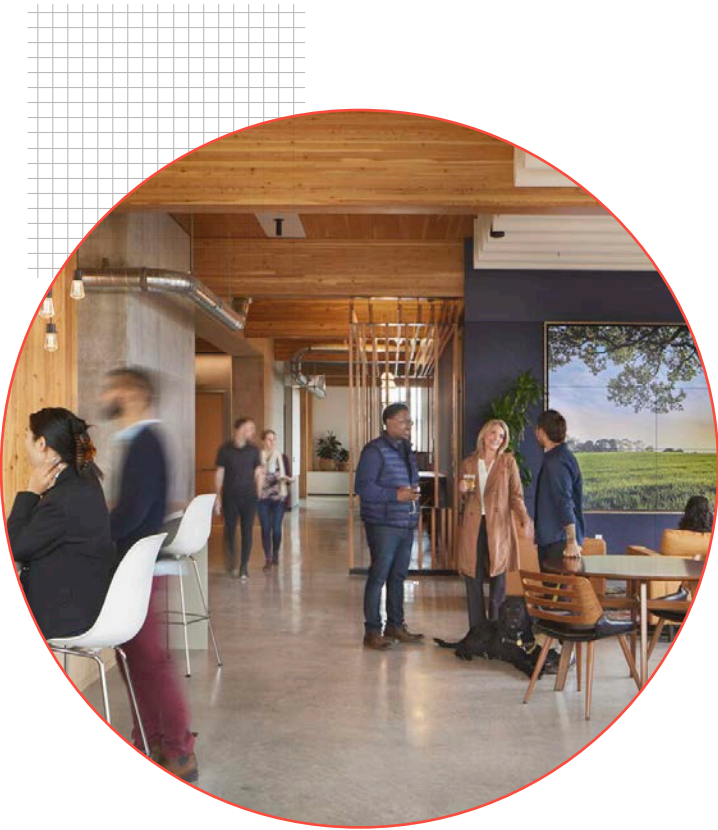
Setting each project within the larger goal of creating the conditions for life to thrive requires whole systems thinking and a holistic approach to the development process. As such additional stakeholders and experts are needed, along with additional commensurate scope and fees.

Cultural advisors, specifically elders with indigenous knowledge, are critical to understanding the history and lived experience of a place and its ecosystem. They can identify opportunities for the regeneration of relationships between communities and between people and the ecosystem. These knowledge-holders should be compensated team members with their contributions acknowledged. Nathaniel Smith of the Partnership for Southern Equity reminds us, “Change moves at the speed of trust.” As we see trust erode, so too has the speed of development in communities across the country.

Community engagement specialists, sociologists, and human-centered design professionals with community facilitation experience can also help build productive, meaningful relationships with a wide range of stakeholders, increasing the likelihood of success.

Biologists, ecologists, and foresters, among others, spend their careers researching, documenting, and sometimes rebuilding the specific conditions that various forms of life need to thrive. These professionals can help assess the existing conditions that support or inhibit a diverse ecosystem from thriving and make specific recommendations for opportunities to support particular species or habitats that are at risk.

Grant writing professionals and project financial advisors can identify potential grants or project finance mechanisms for regenerative design strategies or for the development as a whole. They monitor application windows, develop and maintain relationships with program officers, execute the proposal or application process, and maintain compliance with reporting requirements. The more complex the application process, and more stringent the compliance requirements, the more likely it is the team will need to include these roles.



Expanding the team: regenerative projects bring cultural advisors, ecologists, grant writers and finance advisors to the table alongside the architect, engineers and contractor. ZGF Architects and PAE Engineers enlisted biologists at Biohabitats to design the water and wastewater ecosystem. Photo credit: Benjamin Benschneider

Moving every project toward regenerative design.

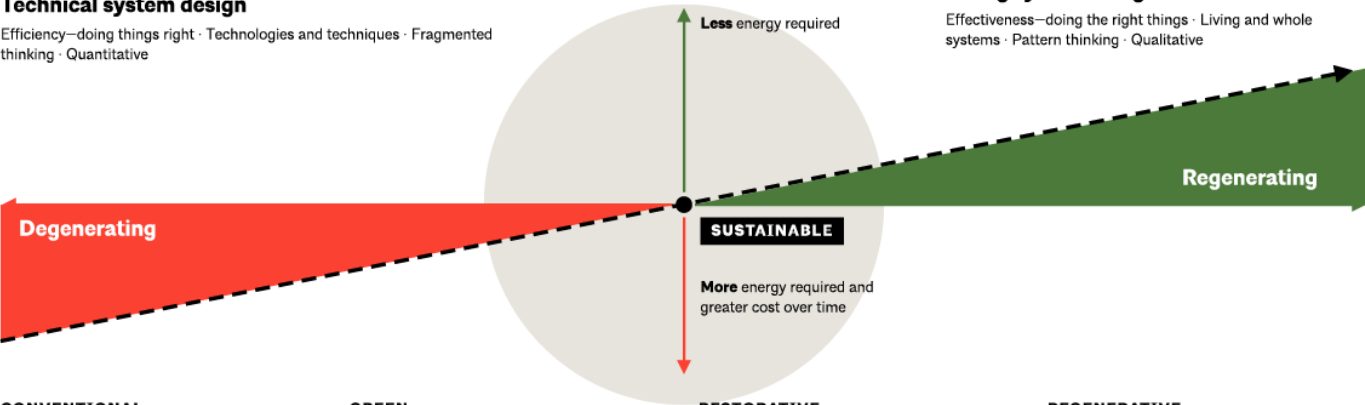
Where a client starts on the spectrum shapes the architect's role—from advocating beyond code to delivering ecosystem services.

Technical system design

Efficiency—doing things right · Technologies and techniques · Fragmented thinking · Quantitative

Living system design

Effectiveness—doing the right things · Living and whole systems · Pattern thinking · Qualitative



CONVENTIONAL

CODE AS THE STANDARD

Building codes are seen as the standard for delivery.

All too often building codes are seen by clients as the standard for delivery. This limits the possibilities for better buildings, lower operating costs, higher quality of life for the occupants, and a higher value environment. In these instances, firms can still advocate at the local level for higher standards, incorporating green construction codes or development bonuses, and for creative problem-solving for local environmental challenges like using an environmental impact bond to pay for green roofs or other green infrastructure to reduce sewer overflows.

GREEN

A NICE-TO-HAVE

Sustainable features are treated as eliminable.

In many cases, clients may see sustainable features as a "nice-to-have" but eliminable element and are hesitant to increase the scope of services or budget to include them. Moving these projects toward regenerative design often means presenting compelling opportunities and ideas to the client, along with strategies for funding them. To do this, architects need to understand financial projections for upfront costs that could be reduced with tools like grants or C-PACE, and operating costs like energy, water, or sewer fees that could be reduced or capped by integrating regenerative strategies.

RESTORATIVE

READY TO GO FURTHER

Clients value sustainability but may not see what's possible.

In some cases, clients may understand the value of sustainable design but may not realize they could go further and push the envelope toward regenerative design. These projects offer some of the best opportunities for architects to demonstrate leadership and value by seeking out regenerative strategies and opportunities early, using a systems-based and holistic approach, connecting funding dots for their client, or accelerating zoning approvals by building genuine community relationships early and incorporating their feedback into the design.

REGENERATIVE

ECOSYSTEM SERVICES IN SCOPE

Clients demand ecosystem services—and budget for them.

Increasingly, clients explicitly demand ecosystem services as part of the project, and the scope of work and budget include them. These are the portfolio-making projects that firms fight for, but only the firms with a track record of incorporating regenerative design on less ambitious projects are likely to win them. From restoring landscapes to creating habitat for native species and measuring biodiversity, the scope for ecosystem services can be expansive. However, it is incumbent on architects to become familiar with the emerging class of financing tools described later that enable regenerative development.

Spectrum adapted from the regenerative design trajectory by Regenes Group. Used with credit to Regenes Group.

AIA

Expanding the Scope

As the team expands, so too does the standard scope of services they provide. While the professional standard of care expects architects to coordinate a design that includes energy, water, and materials, regenerative projects go beyond code minimums and brings in entirely new areas of practice. The project timeline and budget need to account for this expanded scope of service, but it presents the architect with entirely new opportunities to add value to the project through regenerative design. Architects are uniquely positioned to lead this expansion of scope, facilitate a regenerative process, and shape regenerative design strategies.

Energy

Designing a project to meet net-positive energy goals, either on site or at the district scale by leveraging off-site renewable energy resources, is no small feat. Energy modeling is now available in most BIM design software, and many firms use additional tools for more accurate modeling, but the energy model must be symbiotic with the project design itself, with back-and-forth feedback loops as decisions are made with everyone on the project team. Buildings may miss their energy targets because the owner uses them differently than expected. Developing and maintaining an accurate energy model takes substantial time, which must be accounted for when scoping project design fees.

Ecosystem

Regenerative development begins with research, assessment, and an understanding of the site’s relationship with the bioregion, a geographic area defined by its unique flora and fauna that have adapted to a particular climate zone. Does the site currently support the bioregion, or is it a liability to the bioregion? How have indigenous people traditionally worked with the bioregion to provide shelter, heating, cooling, food, water, and resilience and what can you learn from this wisdom?

Then teams consider the watershed upstream and downstream from the development. How and where does water naturally come to the site? Is there sufficient rainfall or another balanced water system to support the proposed use? If not, should the use change, or should the location change?

Finally, teams work with the specific microclimate of a site, and existing or potential new structures to enhance the larger ecosystems while meeting the programmatic needs that catalyzed the project.

Development can enable growth, increase biodiversity, add biomass, and support vitality, or it can diminish the quality of natural resources like air, water, and land, slowing or even preventing growth.

Ecosystem services are the direct and indirect benefits that ecosystems provide humans. They can be broken down into four categories:

PROVISIONING

Provisioning services: the material or energy outputs from an ecosystem, including food, forage, fiber, fresh water, and other resources

REGULATING

Regulating services: benefits obtained through moderation or control of ecosystem processes, including regulation of local climate, air, or soil quality; carbon sequestration; flood, erosion, or disease control; and pollination

SUPPORTING

Supporting services: services that maintain fundamental ecosystem processes, such as habitat for plants and wildlife, or the maintenance of genetic and biological diversity

CULTURAL

Cultural services: the non-material benefits that ecosystems provide to human societies and culture, including opportunities for recreation, tourism, aesthetic or artistic appreciation, and spirituality

“PwC and WEF estimate that \$44 trillion of economic value generation, more than half of the world’s total GDP, is moderately or highly dependent on nature.”³²

– “World Economic Forum and PwC, Nature Risk Rising, 2020”

As architects, it is our professional responsibility and ethical imperative to “thoughtfully consider the social and environmental impact of our professional activities” and move every project a little further down that spectrum toward regenerative development. As we expand the scope of services for regenerative design, we can begin to incorporate “ecosystem services”.

Ilya Azaroff, FAIA
2026 President, American Institute of Architects

Water

Water infrastructure on regenerative projects goes even further than energy in terms of additional services. Permitting on-site wastewater treatment is often reported as the number one challenge for regenerative development according to David Baker Architects, who participated in the Living Building Challenge Affordable Housing Pilot. The primary driver of building codes is protecting public health, and water quality is one of the leading regulatory challenges every jurisdiction faces. As such, any new approach or technology will understandably be handled slowly and carefully during permitting and during building operation, especially if wastewater is treated on-site with anything other than a traditional septic system. Teams must ensure their scope of work includes both the design of more sophisticated water capture, storage, and treatment systems, and the regulatory burden.

Carbon

Regenerative design projects that try to minimize greenhouse gas emissions begin and end with carbon accounting, as they work to get as close to zero embodied and operating carbon as possible. Regenerative developments go further to repair the built environment’s relationship with the carbon cycle through net positive lifecycle carbon emissions not only through regenerative construction and operation, but also by taking responsibility for the living carbon cycle of the site.

Scope 1: Direct emissions from building operations

Regenerative developments use onsite and offsite renewable energy paired with energy storage, generally batteries,

along with active ecosystem services that absorb CO2, produce oxygen, and help replenish soil health with solutions like composting toilet systems or living machines. Transportation also falls under this category so consideration is needed to ensure that the development facilitates walking, biking and other forms of low- and ideally no-carbon transportation.

Scope 2: Indirect emissions from purchased electricity

Regenerative developments avoid purchasing electricity from the grid, especially in parts of the country that rely heavily on coal and natural gas. Sometimes, however, district-scale renewable energy systems can provide the opportunity to achieve net positive energy, as presented in several case studies.

Scope 3: Embodied emissions from downstream and upstream sources

Beyond the carbon that was emitted in the life cycle of all of the building materials from extracting and transporting the raw materials, processing them into the product such as a steel furnace, a brick kiln, or a cement plant, and shipping the final product to the site via cargo ship, rail, or truck, Scope 3 emissions also cover activities like employee commuting, business travel, purchase of operational supplies, and more. This much broader scope is where the most truly regenerative solutions exist. Because while carbon accounting scopes are helpful tools for measuring and confirming a net-positive relationship with the carbon cycle, they are insufficient on their own. Regenerative systems perform multiple functions simultaneously rather than provide single solutions.

The World Bank’s catalogue of nature-based solutions outlines the multi-faceted functions and benefits of a wide range of regenerative approaches to the carbon cycle.³⁷



▶ The PAE Living Building was the first traditional developer-financed net-positive-carbon office building. Photo Credit Lara Swimmer.

Materials

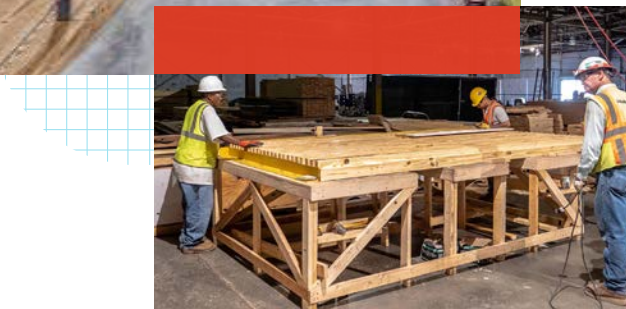
Material selection in regenerative development goes beyond simply reviewing environmental product declarations. Teams should focus on the use of biobased locally sourced materials that are found in the traditional vernacular of the region. Architect Kathryn Larsen developed a prefabricated panel modeled after the seaweed thatched roofs used by the Læsø which can weather the harsh climate on the island in the North Sea for up to two hundred years with insulation values comparable to mineral wool.³³

Other resources that teams may use to guide material selection for regenerative design include Living Future's Living Product Challenge, Declare Label, Red List, the Bio-Based Materials Collective, and Pharos. All of these tools consider both environmental and health performance.³⁵

For the Kendeda Building (pictured far right), the integrated design and construction team of Miller Hull, Lord Aeck Sargent, and Skanska found that at the time the cost and schedule to source FSC-certified Cross Laminated Timber (CLT) was prohibitively expensive. Driven by cost reduction, they worked with the Lifecycle Building Center, which warehouses reclaimed materials, much of it from the burgeoning film industry in Atlanta, and LBC's workforce development program to build up slabs of Nail Laminated Timber (NLT). These are assembled by sistering and nailing dimensional lumber alternating between 2x4 and 2x6, which created a beautiful shallow relief for the ceiling.



The Kendeda Building for Innovative Sustainable Design at Georgia Tech, Atlanta (The Miller Hull Partnership with Lord Aeck Sargent; Skanska, builder). The atrium ceiling is nail-laminated timber assembled from salvaged lumber, much of it from Atlanta's film industry, supplied through the Lifecycle Building Center. Photo: Jonathan Hillyer



Crews assemble nail-laminated timber panels for the Kendeda Building, sistering and nailing alternating salvaged 2x4s and 2x6s to produce a shallow-relief ceiling. The panels were fabricated through the Lifecycle Building Center's workforce development program. Photo: Ken Edelstein

AIA's Materials Pledge

The AIA recently released the Materials Pledge³⁴, calling for participants to select materials that protect:

- **Human health** by preferring products that support and foster life throughout their life cycles and seek to eliminate the use of hazardous substances.
- **Social health** and **equity** by preferring products from manufacturers that secure human rights in their own operations and supply chains, positively impacting their workers and the communities where they operate.
- **Ecosystem health** by preferring products that support and regenerate the natural air, water, and biological cycles of life through thoughtful supply chain management and restorative company practices.
- **Climate health** by preferring products that reduce carbon emissions and ultimately sequester more carbon than emitted.
- A **circular economy** by reusing and improving buildings and by designing for resiliency, adaptability, disassembly, and reuse, aspiring to a zero-waste goal for global construction activities.

To participate, visit <https://www.aia.org/design-excellence/climate-action/zero-carbon/materials-pledge>

From Resilience to Regeneration

Regenerative development incorporates resilience as a natural response to external conditions. Incorporating resilient design goes beyond considering known risks and siting or hardening the building to respond to them; it considers the context of the community and ecosystem in which the development is located and emerging risks from events that may not have been historically prevalent.³⁸

Architect Mohammed Rezwan in Bangladesh draws inspiration from the indigenous baira, floating agricultural islands that historically provided vegetable farms during monsoons to design and build schools with libraries, clinics, and other public infrastructure that would remain accessible even when the roads flood seasonally.³⁹

Research from Eric Klinenberg in Palaces for the People shows that the social infrastructure that buildings can facilitate is as important as, if not more important than, the physical infrastructure designed to reduce disaster impacts and accelerate recovery.⁴⁰ For a building to truly serve as a resilience hub, community members need to know it exists, when to go there, and how to get there. They also need to know who in the community would likely need help to get there quickly. AIA’s Resilience Design Toolkit, Resilient Project Process Guide, and ROI: The Economic Case for Resilient Design give practitioners step-by-step guidance for this work.⁴¹

After considering how the building’s design and operation can begin building resilience, the design team should work with local and regional agencies responsible for regional resilience planning to create a project-specific resilience plan.⁴² These plans must be carefully coordinated to ensure FEMA’s eight community lifelines are provided during and after a disaster event.

**FEMA’s
8 COMMUNITY LIFELINES**

- **SAFETY AND SECURITY**
- **FOOD, HYDRATION, SHELTER**
- **HEALTH AND MEDICAL**
- **ENERGY**
- **COMMUNICATIONS**
- **TRANSPORTATION**
- **HAZARDOUS MATERIALS**
- **WATER SYSTEMS**



FEMA’s eight Community Lifelines, the services a community must restore first after a disaster. Source: Federal Emergency Management Agency.



Prefabricated eelgrass thatch panels by architect Kathryn Larsen, developed at the Copenhagen School of Design and Technology (KEA) and modeled on the centuries-old seaweed roofs of Læsø, Denmark. Eelgrass is naturally fire and rot resistant, becomes waterproof within about a year, and insulates comparably to mineral wool. Photo credit: Helene Høyer Mikkelsen

Expanding the Capital Stack

The greatest challenge in building a regenerative development is rarely the architect’s creativity or the client’s aspiration. The greatest challenge is almost always finding ways to pay for the investments that go well beyond business as usual. Living Futures has resources that share some best practices for building an internal business case for regenerative design, especially to communicate non-financial value generation.⁴³ Some investments generate cash flow that can be used to underwrite various forms of project finance. Others provide benefits that are hard to capture in monetary terms and thus can be difficult to build into a traditional real estate pro forma. The regenerative projects that get built almost always have a blended capital stack layering a wide range of financing tools.

Federal Funding

Federal Tax Credits

A wide range of federal tax credits exist to incentivize development. Some are specifically designed to support regenerative strategies. Others are flexible enough to support regenerative strategies. Architects who understand how tax strategy affects the design, construction, and operation of a development can bring more value to their clients and will likely be consulted earlier in the process.

New Market Tax Credits (NMTC) are a popular tool for developers to make tax-advantaged investments in historically disadvantaged neighborhoods. Developers can receive a credit of up to 39% of the capital investment, claimed over seven years.⁴⁴

Private investments are made into Community Development Entities (CDE) which are certified by a Community Development Financial Institution (CDFI) and then serve as an intermediary for competitive investments in projects in communities that meet a range of criteria to qualify as disadvantaged. New Market Tax Credits can be expensive to set up, so they are generally limited to projects with more than \$5M of investment. However, they are a commonly used tool by developers in communities across the country and serve as low-cost debt for the project.

Opportunity Zone Tax Credits are similar to New Market Tax Credits in that they encourage private investment in underserved communities, but have smaller geographic boundaries and are selected by governors from eligible census tracts. OZ funds are patient capital focused on opportunities for meaningful appreciation over 10 years, and investors can avoid paying taxes on those gains if they follow all the rules.

Focusing on returns, rather than lower cost up-front capital, limits how useful these funds can be in enabling a project. While the original legislation enabling OZ funds is expiring, it was recently made permanent, and governors are refreshing OZ zone boundaries in their states every 10 years.

The IRS has incentivized the deployment of emerging energy technologies with an Investment Tax Credit and Production Tax Credit (ITC/PTC). The specific technologies that qualify, the amount of the credit, and opportunities for bonus credits have varied over the years, but the current list of eligible technologies includes several that regenerative projects can leverage, including geothermal, fuel cells, and energy storage (batteries and thermal).



▶ The Mill19 renovated a quarter-mile-long former coke plant in Pittsburgh’s Hazelwood neighborhood into a regenerative mixed-use complex with flex-office space housing an advanced robotics manufacturing program run by Carnegie Mellon.

The developer, the Regional Industrial Development Corporation of Southwestern Pennsylvania (RIDC), a nonprofit, financed the roughly \$43 million first phase largely with New Markets Tax Credit allocations from several community development entities, including Pittsburgh Urban Initiatives, the Urban Redevelopment Authority of Pittsburgh’s CDE, and the Pennsylvania Housing Finance Agency’s Commonwealth Cornerstone Group, with PNC as tax credit investor providing about \$13.5 million in NMTC financing.⁴⁵ Photo credit: Michael Savisky

Importantly for architects, these tax credits can be monetized in several ways. Because nonprofits rarely have tax liability that can be offset with ITC/PTC, they have had limited use for the tools. Two recent pathways address this problem: transferability and direct pay. ITC and PTC tax transfers are a simpler way to transfer the tax benefit to another party, and direct pay allows the U.S. Treasury to issue a check to qualified nonprofits or other eligible entities. This makes these tax credits essential for regenerative developments, regardless of the type of entity developing the project.

EPA Brownfield Grants and loans

The EPA estimates, relying on a 2004 Government Accountability Office study, that there are between 450,000 and one million brownfield sites in the United States.⁴⁶ These sites represent perhaps the best opportunities for regenerative development. The EPA partners with local jurisdictions in several phases of the project to support the redevelopment of these sites. Initially, targeted funding goes to sites or districts that cities or counties identify as a high priority for assessment. Even if a site is not targeted, a private developer can apply for and receive grants to assess a property's contamination, along with an outline of the work required to remediate the site. Public and nonprofit owners can apply for further EPA cleanup grants and developers can apply for cleanup loans for remediation from a Revolving Loan Fund.

Phipps Center for Sustainable Landscapes in Pittsburgh, PA is an example of a brownfield revitalization that revived or healed the land. The site was a 2.9-acre former City of Pittsburgh public works yard, portions of which were classified as a brownfield.

Certified as a Living Building in March 2015, the project treats all storm and sanitary water on site with cisterns, a lagoon, rain gardens and constructed wetlands, managing all rainfall on the site.⁴⁷

EPA Clean Water State Revolving Fund Green Project Reserve

A separate EPA program, the Clean Water State Revolving Fund provides support to states for large clean water infrastructure projects such as wastewater treatment plants.

Under annual appropriations language in place since 2012, states must, to the extent there are sufficient eligible applications, use at least 10% of their capitalization grants for green infrastructure, water or energy efficiency, or other environmentally innovative projects through a set-aside called the Green Project Reserve.⁴⁸ According to a guide to using SRF funds for green infrastructure produced by American Rivers, a wide range of water projects, from typical water efficiency to regenerative habitat protection and restoration, can qualify.⁴⁹

Small Business Administration 504 Green Loans

The U.S. Small Business Administration, an independent federal agency, allows 504 loans of up to \$5.5 million for projects that meet its energy public policy goals, such as reducing energy consumption by at least 10% or generating renewable energy.⁵⁰ For smaller projects for clients that qualify, this can be a helpful slice of a small capital stack.

USDA Business and Industry Loans (and REAP Grants)

The US Department of Agriculture is one of the world's largest funders of regenerative infrastructure. Beyond the programs offered for regenerative agriculture, USDA business and industry loan guarantees (B&I Loans) and the Rural Energy for America Program (REAP) provide a wide range of funding opportunities for regenerative energy, water, and ecosystem projects in census tracts that qualify as rural. B&I Loans offer long-term, low-cost project finance for almost any commercial building or equipment investment, as well as land acquisition and other development costs. Applicants work with a participating commercial bank that applies to the USDA for the loan guarantee, so developers can work with the bank to underwrite the project. REAP Grants have historically provided attractive matching grants for a wide range of renewable energy technologies from solar and wind to biomass and battery energy storage. The window to apply usually opens annually, and the program accepts applications as long as funds are available. A mapping tool on the USDA website can quickly determine eligibility.⁵¹

State and Local Policy

DSIRE

The Database for State Incentives for Renewable Energy, called DSIRE, provides a directory of programs in states across the country for specific incentive programs that states offer for a wide range of renewable energy and energy efficiency technologies, as well as a wide range of reports on emerging policies from virtual power plants to energy affordability. A program of North Carolina State University, the N.C. Clean Energy Technology Center, which runs

DSIRE, also provides⁵² research and consulting services and can support local or state-wide advocacy efforts with technical assistance.

Green Banks

A green bank is an umbrella term for a wide range of financial institutions that provide capital solutions for investments with environmental benefits. Some green banks are structural parts of a state, regional, or local government. Others are nonprofits with government funding or other direct support. Still others are entirely private with varying degrees of coordination with governments. They may also go by other names, such as infrastructure banks, clean energy centers, or green finance authorities. Some traditional banks have green lending programs, and some community institutions like Community Development Financial Institutions also have similar programs. Regardless of their title, green banks can play a wide range of roles in regenerative development depending on their programs.

Credit enhancement is when a green bank makes it more attractive for a traditional bank to support a project using methods other than a direct loan. This can include providing a loan loss reserve, where, if a project does not produce as much cash flow for a period of time as projected, the green bank covers the debt service, or similar, up to a limit.

Green banks may also lend to projects using technology so new that traditional banks do not know how to underwrite it. In that case, they will lend directly to cover just that equipment. Or they may invest in projects that serve low- to moderate-income tenants, which affect the risk profile of the entire project.

The most important thing green banks offer regenerative development is creativity and flexibility. Because they share the project's core mission, if they don't have a financing solution on hand, they may be able to build one specifically for the project.

Michigan Saves, which began with a loan loss reserve, has supported about \$778 million in private lender financing for nearly 60,000 homes and businesses.⁵³ The Minnesota Climate Innovation Finance Authority (MnCIFA), the state's green bank, made its first loan, \$4.7 million, to The Heights Community Energy to build a district aquifer thermal energy system serving a mixed-use redevelopment in Saint Paul planned for 1,000 homes, bridging the period before federal clean energy tax credit payments arrived.⁵⁴ NY Green Bank has committed \$31 million to Good Carbon Co., including a \$20 million investment tax credit bridge facility closed in 2025, to finance more than 25 geothermal systems at all-electric affordable multifamily buildings in Buffalo.⁵⁵ The U.S. Green Bank 50 (GB 50), the membership organization of state, local, and regional green banks, reports in its inaugural 2026 Impact Report that its members have deployed \$5.16 billion of their own capital across more than 180,000 projects and mobilized nearly \$30 billion in total capital. The report reviews these and other projects made possible by green banks across the United States.⁵⁶ In addition to GB 50, the Coalition for Green Capital and its American Green Bank Consortium also support a wide and growing network of financial institutions built to fund regenerative development.⁵⁷

Development Incentives

As cities and states better understand and value the benefits of regenerative development, they are leveraging a wide range of incentives to encourage and reward develop-

ers who pursue regenerative design. The most common incentives reward preserved or created green space to reduce the heat island effect, reduce stormwater runoff, or provide public benefits through parks. Often, these incentives are effective ways to test the building market's ability to cost-effectively produce certain outcomes, like on-site water treatment. After market adoption is demonstrated, strategies can more easily be incorporated into the building or zoning code.



Seattle's Living Building Pilot Program helps incentivize projects like the Aegis Living Lake Union by Ankrom Moisan Architects. It is an assisted living and memory care community that achieved Living Building Challenge Petal Certification. Photo Credit: Magda Biernat Photography

Seattle, Washington, has a Green Building Standard that is required for certain buildings, and an expedited permit process for projects pursuing a wide range of green building certifications outside of those required. Further, it developed a Living Building Pilot that grants 12-25 feet of additional height and 25-30% more floor area for projects that go through a design review to demonstrate how they plan to achieve Water, Energy, or Material Petal Certification or full Living Building Challenge Certification.⁵⁸

Commercial Property Assessed Clean Energy

Commercial Property Assessed Clean Energy (C-PACE) combines local and state policy. At its core, it is a clever mezzanine finance solution that addresses a common problem: incorporating regenerative energy, water, and resilience features into commercial property when the payback period may be longer than the building's holding period for initial investors. If developers want to sell the building in 3-5 years, how do they justify an investment with an 8-10 year payback? C-PACE turns the repayment of capital expenses of certain qualifying energy efficiency, renewable energy, water efficiency, and, in some states, low-carbon or resilience investments into a property tax instead of a construction loan. Those capital expenditures come out of the construction budget and are financed separately, generally over a much longer period of time, 5-35 years depending on the jurisdiction. The most innovative part is that repayment survives the sale of the building, whereas a traditional loan would need to be fully paid off at closing, if not sooner. C-PACE is used on both new construction and renovations of existing buildings. Often, the sum of regenerative design investments needs to be more than \$1M for C-PACE to make sense, but exceptions exist in several states with lenders that can serve smaller projects.

C-PACE must be enabled by state governments, then activated at the local level by a jurisdiction that has property tax authority. The taxing authority decides whether to administer the program itself or use a third-party administrator. A small industry of PACE lenders exists alongside traditional banks and CDFIs to serve projects using C-PACE. So, while local government is involved on paper, private investment usually funds the projects.

Tax Increment Finance

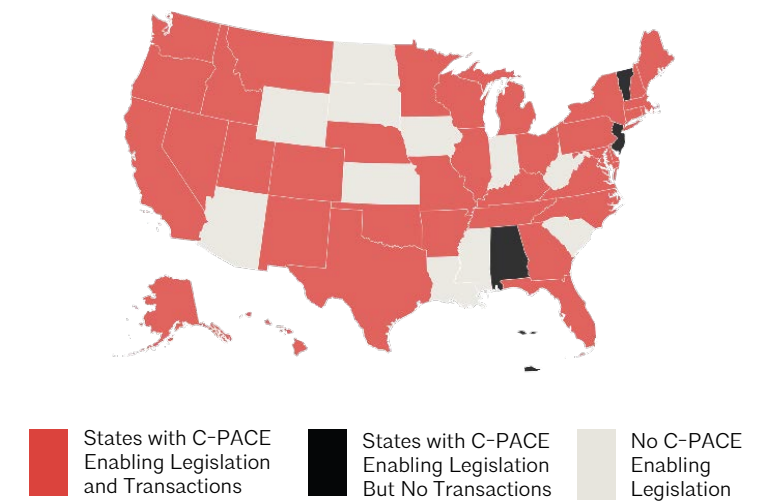
Cities frequently use an instrument called tax increment finance (TIF) to support a wide range of economic development activity, and increasingly cities are looking to this tool to support regenerative development. Tax increment financing focuses on a specific geographic boundary, often a district the city is targeting for investment. The city benchmarks tax revenue from that district, often primarily property tax, but in some cases they consider other tax revenue as well. Then it projects the future tax revenue after the development plan is implemented. The incremental difference can be borrowed against to make infrastructure improvements that enable the development plan.

In 2006, Chicago created a \$500,000 Green Roof Improvement Fund, financed with Central Loop TIF revenue, offering matching grants of up to \$100,000 for green roof retrofits on existing downtown buildings.⁵⁹ Chicago's Sustainable Development Policy, updated in 2017 and 2024, requires projects receiving \$1 million or more in TIF or other City assistance to meet a sustainability point threshold, with green roofs among the point-earning strategies.⁶⁰ In Chicago or other cities with significant TIF programs, a large regenerative development district would likely be able to leverage TIF for components within the district infrastructure.

Payment In-Lieu of Taxes

Another broad economic development tool used to support regenerative development is payment-in-lieu-of-taxes (PILOT), a tax abatement structure most commonly used to promote affordable housing.

States with C-PACE



September 2026. Red states have C-PACE programs running. Black states have enabled C-PACE but have not financed projects to date. Source: C-PACE Nation.

For projects the city or county wants to incentivize, they transfer the ownership of the property title to a public entity, such as an Industrial Development Board, which removes the property tax liability. The developer then leases the property back from the public board for an amount that is a fraction of the original tax liability. The amount is tied to certain components of property tax that they don't want developers to avoid like funding for schools.

Cincinnati's residential Community Reinvestment Area abatement exempts 100% of the increased value for 5 to 15 years depending on neighborhood tier and project type, with higher caps for LEED Gold, LEED Platinum, or Living Building Challenge projects; commercial projects can receive up to a 67% net abatement for up to 15 years after paying the school district 33% of the abated taxes.⁶¹

Cap-and-Invest

Policymakers in the 1990s developed a market-based solution to incentivize the implementation of new technologies that could reduce pollution. The platform would set a regulatory cap on those emissions and then let companies purchase or trade allowances so that industries were highly incentivized to develop and deploy emission-reducing solutions. They found that this process resulted in greater emissions reductions at the lowest possible cost to the country's economy.⁶² This cap-and-trade system, established under President George H.W. Bush, effectively eliminated the pollution that was causing acid rain, and which had been leading to massive losses of forest canopy, destruction of river and lake ecosystems, and serious human health impacts. As these programs were adapted to other sources of pollutants, policymakers began looking for ways to offset the increased costs to the most vulnerable communities and turned it into a cap-and-invest system that proactively funds certain kinds of regenerative development and regenerative design solutions.

Currently, California, Washington State, as well as a network of 11 states in the East (the Regional Greenhouse Gas Initiative states) use various cap-and-invest mechanisms that direct proceeds to targeted investments often intended to mitigate the impact of higher energy costs.⁶³ Oregon's Climate Protection Program sets a declining cap on emissions from fossil fuels and lets regulated fuel suppliers meet part of their obligation by funding Community Climate Investments, which DEQ-approved entities will direct to projects that cut emissions and benefit environmental justice communities, such as clean energy and building and transportation decarbonization.

Each state decides how to invest the proceeds of their auctions. Two of the following case studies leverage different versions of cap-and-invest. Coliseum Place in Oakland, California was funded in part by the Affordable Housing and Sustainable Communities program while Resilient Hampton in Virginia leveraged the state's Resilience Fund.

Utilities

Utility involvement in financing regenerative design has continued to increase as the pace of electric load growth across the United States has outstripped utilities' ability to build central power plants and update aging transmission and distribution infrastructure. While data centers fill the headlines, industrial and manufacturing development, electrification of industrial and commercial heating, and electric vehicle expansion have driven more load growth than data centers according to a recent analysis from the Electric Power Research Institute (EPRI).⁶⁵

Because of the structural limits in the supply chains to adding new large central power generation, and the declining cost of new technologies like battery energy storage, utilities are increasingly turning to distributed energy resources (DERs) as the only viable option to add capacity at scale within 1-2 years as compared to 5-7 years for a traditional gas power plant. Many utilities across the United States have historically run demand response programs that relied on varying degrees of antiquated communication, including automated phone calls to large commercial and industrial customers asking them to curtail energy consumption.

These programs have been effective because of their scale, especially during emergencies, but have a limited role

because there are limits to how frequently users are willing to curtail their load.

Compare that to modern virtual power plants, made up of large or small networks of automated battery control systems, building automation systems, and other distributed energy resources that can be used on a daily basis and respond to utility signals in fractions of a second. Companies like Voltus provide centralized dispatch and work with the utility, electricity customers, and large incoming loads like new industries or data centers to pay for all or some of the asset and installation costs. Other companies like PearlX specialize in particular project types like multi-family residential where they lease energy rights to the building from the landlord to install solar and battery energy storage, reducing electric bills for tenants. PearlX owns and operates the energy assets to sell power to the grid during peak demand each day, but can provide battery backup to the building in case of an outage.

While the programs vary widely by geography, utility programs play a critical role in funding energy efficiency, renewable energy, energy storage, and resilience investments. In most states the Public Utility Commission plays a key role in establishing incentive programs that can benefit regenerative design.

Philanthropy

Several of the most well known regenerative projects, like the Bullitt Center and the Kendeda Building, have been financed directly by philanthropic foundations like the Bullitt Foundation and the Kendeda Fund, respectively. While some may criticize these projects for not being affordable or replicable, in nearly every community there are foundations that operate at the local, regional, or national level that may be interested in supporting projects that align with their mission. Many are eager to hear new ideas and explore new ways of deploying capital.⁶⁶

Most philanthropies fall under the 501(c)3 foundation designation, and are required to deploy a minimum of 5% of their capital in “qualified distributions” to retain their nonprofit status. If the principal is traditionally invested and earns 5-10% on its portfolio and gives away 5% that same year, with some used for overhead, it can continue to grow and make grants year after year. Some foundations, like the Kendeda Fund, structured their giving as a “spend down,” meaning they gave away 100% of the principal over the period until their sunset.

Increasingly, however, philanthropies are looking for investment opportunities that still align with the foundation’s mission and vision, but where the money is intended to be paid back. Program Related Investments (PRI) are funds from the foundation’s obligated 5% that the foundation expects to be repaid over time. PRI is generally considered concessionary capital because it is often invested below market rate, with especially flexible tenors or terms, or is forgivable under certain circumstances.

Mission Related Investment (MRI) can be larger than grants and is a more traditional capital investment, deployed from the foundation’s 95% corpus at market rate into projects aligned with the foundation’s interests. MRI’s attractiveness often lies in its flexibility in the kind of capital needed for the project. It can be deployed as equity, debt, loan guarantees, loan loss reserves, or even pay-for-success impact bonds, which are applicable across environmental and social outcomes.

The key to foundation funding is relationship development. Tools like ProPublica Nonprofit Explorer can help you identify nearby foundations that have invested in similar project types and will generally list key personnel. Some foundations may only have a board of trustees or directors; others may have a staff executive director, and larger foundations will have a program officer, if not entire teams, dedicated to each priority sector that they invest in. The key to success is building relationships with key individuals, most often program officers, sharing the kind of work you do or want to do, and learning about their grant-making or investment strategy. With the support of an expanded team including grant-writers, you can co-develop the proposal with foundations so that when they are ready to present it to their board, they know the project inside and out.



The Bullitt Center was the first commercial office building to receive Living Building Challenge Certification. Photo Credit: Nic Lehoux

Environmental Impact Bonds

Since the 1970s a class of investment opportunities called Environmental Impact Bonds (EIBs) has emerged for private investors to invest in cash-flowing programs that also provide non-economic benefits in addition to paying back the initial investment. Investors intend to get paid back through these vehicles, so they are not “buying” environmental impact as much as they are “enabling” it by sharing the risk that the strategy may not produce as much impact as planned. Two helpful examples of impact investment with regard to the built environment both involve DC Water:

DC Water worked with Goldman Sachs, Calvert Impact Capital, and Quantified Ventures to de-risk the effectiveness of its strategy to comply with an EPA consent decree to improve water quality. The hypothesis was that a series of targeted green infrastructure improvements would measurably improve water quality. The DC Clean Rivers Project EIB offering in 2016 let DC Water raise \$25M up front and then pay back more or less depending on the effectiveness of the project.⁶⁷ If the project performed within the expected range of stormwater runoff reduction, DC Water would pay the principal and interest on a normal schedule. If the project exceeded expectations and DC Water benefited from reduced long-term infrastructure costs, the investors would get a larger payout from a 3.3M escrow that was established. However, if the project led to underperformance on stormwater runoff reductions, the 3.3M escrow would go to DC Water to help cover the costs of infrastructure remediation.

An independent analysis in Spring 2021 determined that the project successfully reduced stormwater runoff by nearly 20%.

This fit within the expected project goals so the bonds were repaid on their normal schedule with no other special payments. The success of this EIB program has led to a series of other similar EIB funded projects across the nation including in Atlanta, Buffalo, Hampton VA, Baltimore, and regional EIB programs such as the Louisiana Coastal Protection Restoration Authority.

Another pioneering example of market-based resilience financing is the DC Stormwater Retention Credit (SRC) Trading Program managed by the DC Department of Energy and Environment (DOEE).

Established in 2013 to comply with EPA water quality mandates, major new developments and renovations in Washington, D.C., are required to retain up to 1.2 inches of stormwater on-site. Recognizing structural limitations in dense urban areas, the DOEE created a compliance market allowing developers to meet up to half of this obligation off-site by purchasing certified SRCs from property owners who voluntarily install green infrastructure (GI) elsewhere. This market actively drives wider use of highly effective building design features, including extensive and intensive green roofs, bioretention rain gardens, permeable pavers, and cistern-based rainwater harvesting systems. To help grow this market, The Nature Conservancy and Prudential Financial formed District Stormwater LLC, a specialized vehicle that proactively funded large-scale GI retrofits—such as rain gardens at Mount Olivet Cemetery—to generate and sell credits for profit.

The program has successfully accelerated climate resilience without relying on municipal debt, achieving over 1.7 million credits traded and capturing more than 40 million gallons of polluted runoff annually. Furthermore, it drives spatial equity in city planning.

By design, this market shifts private sector investments out of impervious downtown areas and redistributes green infrastructure into historically under-resourced neighborhoods and high-priority watersheds. While dense urban projects often maximize their green roof footprints to simultaneously meet DOEE stormwater mandates and local Green Area Ratio (GAR) zoning laws, the trading system allows developers to offset their remaining obligations. The market is backstopped by a \$10.5 million DOEE Price Lock Program Revolving Fund that buys credits during slower periods, providing a credit pricing floor for investors. The success of this market approach has led to similar programs being established in the Chicago Metro Area and Grand Rapids (MI) and there are related Stormwater Fee and Credit systems in Philadelphia and Chattanooga.



▶ The PAE Living Building in Portland, Oregon, utilizes a robust stormwater retention strategy, which captures and recycles rainwater three times. Photo credit: Lara Swimmer

Energy as a Service

Many industries have found that customers are more likely to make investments if the payment is structured over time rather than as an up-front investment. This has led to approaches like software-as-a-service or “energy-as-a-service.” These platforms provide a solution that may have previously been purchased outright as a capital expense but can also be structured as an ongoing operational expense.

Beyond paying an electric utility company for electricity or power, energy-as-a-service describes a wide range of financing mechanisms that let developers avoid the capital expense of generating and distributing their own energy.

Power purchase agreements (PPAs) are a common contracting mechanism for purchasing non-standard electricity from third parties. They let a developer invest in an energy asset and pay a set amount for the power produced within certain terms and guarantees.

Energy performance contracting (EPC) became widely popular for federal and other public agencies after 1992, when it was officially established as a procurement pathway. It was especially useful during capital budget freezes to pay for needed upgrades through shared savings rather than new capital allocations. An industry of energy savings companies (ESCOs) exists to serve mostly large public and private institutions with building portfolios. They begin with an investment-grade energy audit, then propose energy conservation measures aligned with the client’s organizational needs. After installation and commissioning, the most important phase, and the one that is the source of the most conflict with this funding mechanism, is measurement and verification.

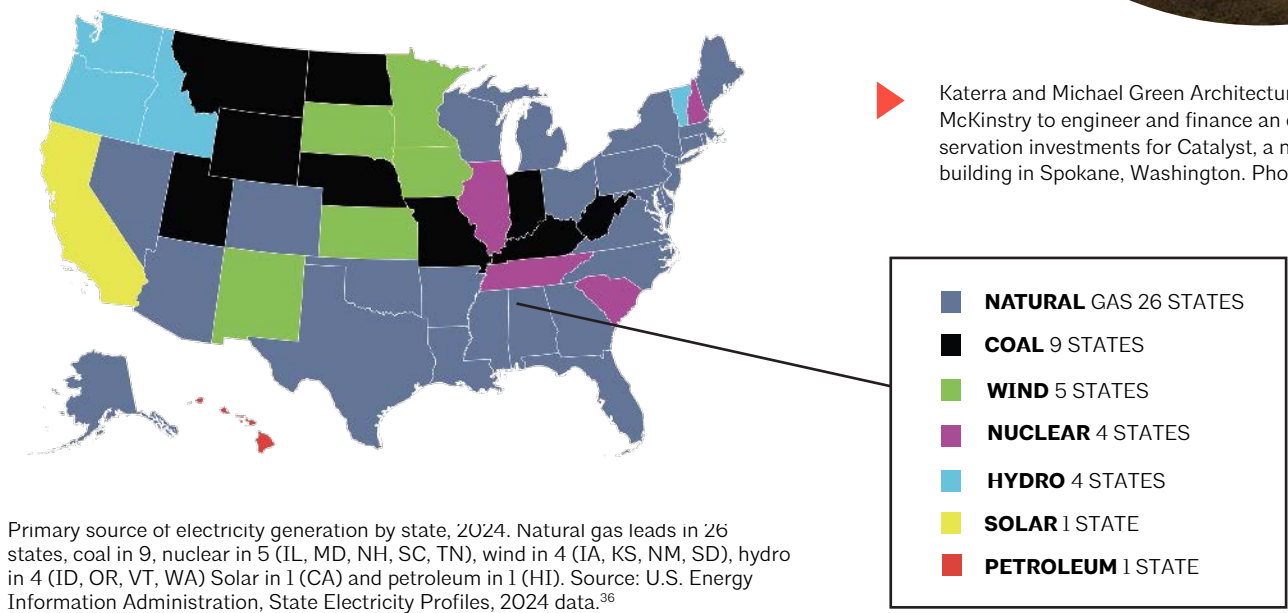
Especially when the contract includes guaranteed savings as part of the funding mechanism, the methodology for measuring savings must be clear and easy for a third party to audit.

Another variant is heat-as-a-service or cooling-as-a-service, which are monetized based on a unit of thermal output rather than electricity and are common for centralized district-scale heating and cooling investments that serve multiple buildings.

Architects can explore various strategies for collaborating with project developers to arrange PPAs and partnering with developers and ESCOs to enable larger-scale energy solutions for buildings.

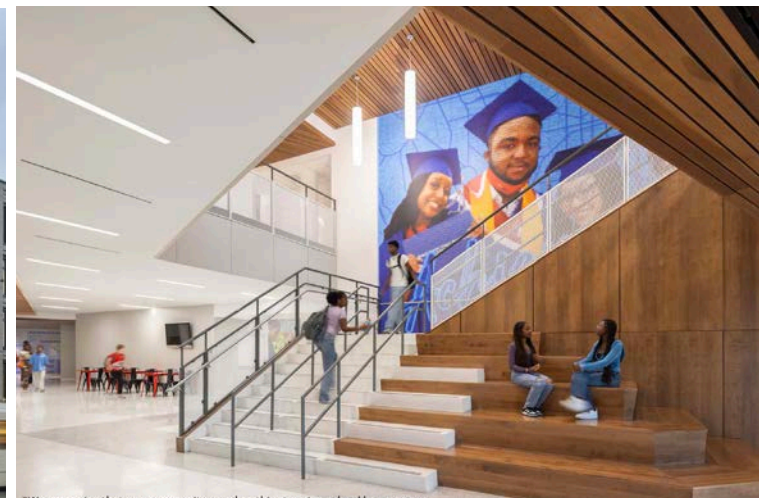


Leading source of electricity generation, **by state.**



Primary source of electricity generation by state, 2024. Natural gas leads in 26 states, coal in 9, nuclear in 5 (IL, MD, NH, SC, TN), wind in 4 (IA, KS, NM, SD), hydro in 4 (ID, OR, VT, WA) Solar in 1 (CA) and petroleum in 1 (HI). Source: U.S. Energy Information Administration, State Electricity Profiles, 2024 data.³⁶

▶ Kattera and Michael Green Architecture worked with energy service company McKinstry to engineer and finance an energy district and other energy conservation investments for Catalyst, a net zero energy and carbon commercial building in Spokane, Washington. Photo Credit: Benjamin Benschneider.



CASE STUDIES

Regenerative design considers both outcomes and processes; the “what” as much as a “way”. The following case studies from a wide range of project types, climates, countries, and political contexts explore how architects have applied AIA’s five Pillars of Regenerative Design, as well as the funding mechanisms that made the development possible. In some cases, funding drove the design; in others, regenerative strategies created funding opportunities. In every case, the architect did more than deliver traditional design services. From convening communities to restoring habitat and biodiversity, they added value the client recognized and enabled more life to thrive in the place.

Barangaroo

Sydney, Australia

Owner: New South Wales Government; delivered by the Barangaroo Delivery Authority (2009 to 2019), now Infrastructure NSW, with Placemaking NSW managing the public domain

Developer: Lendlease (Barangaroo South, appointed December 2009); Aqualand (Central Barangaroo)

Architect: Rogers Stirk Harbor + Partners (Barangaroo South and International Towers); Hill Thalys Architecture + Urban Projects with Paul Berkemeier Architect and Jane Irwin Landscape Architecture (2006 competition-winner); Renzo Piano Building Workshop with PTW Architects (One Sydney Harbor)

Engineer: Robert Bird Group and Aurecon, civil and structural, with Douglas Partners, geotechnical, and Hyder Consulting, marine (Barangaroo Reserve); Arup, structural (International Towers)

Landscape Architect: PWP Landscape Architecture (Peter Walker) with Johnson Pilton Walker (Barangaroo Reserve); ASPECT | OCULUS (Barangaroo South public domain)

Other team members: Gadigal of the Eora Nation, Traditional Custodians; Aden Ridgeway of Cox Inall Ridgeway, Indigenous Adviser to the Barangaroo Delivery Authority; Metropolitan and La Perouse Local Aboriginal Land Councils, consulted on place names; Stuart Pittendrigh, horticulturalist; Simon Leake of SESL Australia, soil scientist; Peter Emmett, history and arts; Lendlease (formerly Baulderstone), Barangaroo Reserve contractor



▶ **BEFORE** East Darling Harbor before redevelopment: the container terminal and concrete apron on Sydney's western waterfront, which the NSW Government announced in 2003 would close as port operations moved to Port Botany. Photo Credit: Coptercam

In Sydney, Australia, the contaminated brownfield of East Darling Harbor had served as a commercial shipping hub and as Australia's first gas works. Eventually, the site's constraints made it obsolete for shipping and the New South Wales (NSW) government decided to offer it for commercial development. However, the site's conditions were that it be developed at "no net cost" to the government, 50% be preserved as public open space, and that the land remain public after a hundred-year ground lease. While the brownfield property was severely contaminated, its proximity to downtown Sydney made it an economic development target.



▶ **AFTER** Barangaroo Reserve from the air, with the Sydney Harbor Bridge beyond. The reconstructed headland restores the natural landform that existed before the shoreline was cut back and leveled for shipping. Photo Credit: Coptercam

The New South Wales government facilitated the development of a masterplan through deep engagement with both the nearby community and the Gadigal tribe, which had traditionally inhabited the region. In 2009, Lendlease, with master plan architect Rogers Stirk Harbor + Partners,⁶⁸ pitched a vision for the redevelopment including commercial office towers, residential apartments, retail, an international award-winning public waterfront and parks, and artistic, cultural and entertainment facilities that honored the ecological and social history of the site with a goal of carbon neutrality and direct investment in ecosystem restoration.

Environmental Restoration

► “In reconstructing the headland, careful attention was paid to the recognition of the history of indigenous occupation and dispossession that is also part of the story of the site.” Photo Credit: Richard Milnes

By incorporating regenerative strategies, the team won the bid and developed the project with a creative capital stack that leveraged the value of the 99-year ground lease.

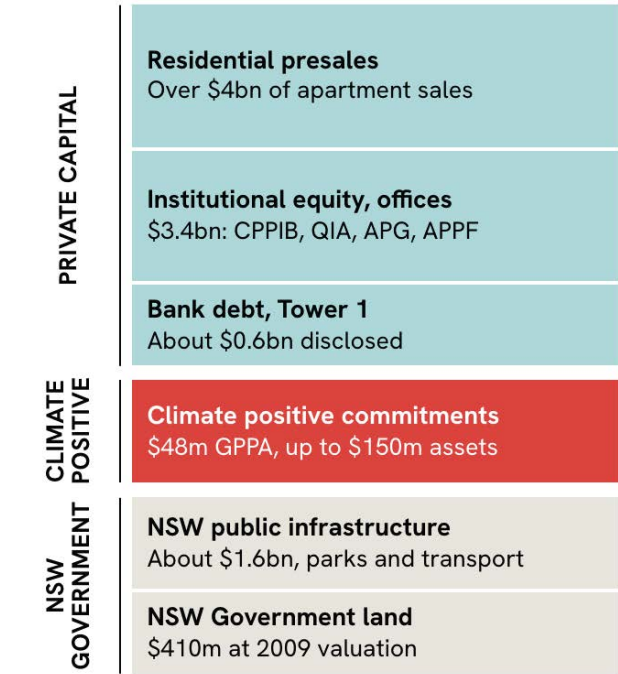
A critical feature of their winning bid was a capital fund focused on carbon reduction through on-site mitigation during and after construction, four utility-scale solar energy installations, and the purchase of certified carbon credits to offset what couldn’t be reduced. The developers initially backed the fund, but it received ongoing support through a revenue share of lease payments from commercial tenants in the development. According to Craig van der Laan, chief executive of the Barangaroo Delivery Authority from 2015 to 2019, which administered the fund, one of the authority’s investments was the development of Headland Park, a six-hectare restoration of the natural landscape and wildlife habitat that existed before the site was originally developed.⁶⁹



The project’s capital stack totaled over \$10B, with around \$1B coming from government land and \$1.7B from parks and transportation. The remainder was privately financed, based on the property commanding some of the highest premiums in Sydney, thanks in no small part to the environmental branding, which van der Laan said was becoming increasingly a “must” rather than a “nice-to-have.”⁷⁰

Barangaroo shows the potential for even very large scale dense urban development to incorporate regenerative design

Barangaroo Capital Stack



▼ About \$1bn in lease payments for public works

■ Private capital ■ Climate positive, levy funded
■ Public sector

Layer heights are approximate and layers are not additive: land at valuation, infrastructure at spend, offices at equity raised, apartments at sales.

Environmental Restoration



▶ The terraces look over the reconstructed bushland habitat and frame the view from the Reserve out to other areas of the Sydney Harbor foreshore, including areas with more intact bushland environments. Photo Credit: Natalie Board



Whole Systems Thinking

Initially, East Darling Harbor severed its relationship with the people who lived there, then with the ecosystem, and when shipping finally ended, it was no longer economically viable. The Headland Park helped reestablish native flora and fauna that had no home for decades. By balancing places for diverse commerce and places for diverse culture, it enabled community.



Optimize Carrying Capacity

Barangaroo was Australia’s first net-zero carbon development of this scale and a founding participant in the C40 Climate Positive Development Program.⁷¹ All on-site direct carbon emissions are offset annually. The development has a zero-waste commitment, with 80% of operational waste diverted from landfill.⁷²



Spirit of Place

The development name Barangaroo itself came from a community engagement process to master plan the site. More than half of the development was dedicated to public open space, planted with native species, creating opportunity for connection between people and nature.



Active Renewal

The development generates more clean energy than it uses through a combination of on-site solar and battery energy storage and four utility-scale off-site solar arrays. An on-site water treatment plant treats on-site and off-site wastewater and distributes greywater for all non-potable uses, such as toilet flushing and irrigation. Rainwater is also captured, stored, and reused for irrigation.



Design Evolution

Because of the development’s decades-long time horizon, the team designed centralized, district-scale infrastructure to scale up and down with water, energy, and thermal needs, with central infrastructure that can be upgraded as new technology develops to improve the performance of the entire district.

PAE Living Building

Portland, Oregon

Owner: First and Pine LLC, a partnership of Downtown Development Group (landowner), PAE, Edlen & Co., ZGF Architects, Walsh Construction Co. and Apex Real Estate Partners

Developer: Edlen & Co. (formerly Gerding Edlen), development management

Architect: ZGF Architects

Engineer: PAE, mechanical, electrical and plumbing; KPFF, structural and civil

Landscape Architect: ZGF Architects

Other team members: Walsh Construction Co., general contractor; Biohabitats, rainwater and composting water systems; Brightworks Sustainability and Integrated Eco Strategy, Living Building Challenge and Red List consultants; LUMA, lighting design; RDH, building envelope; REACH Community Development, owner of Renaissance Commons, host of the off-site solar array; PACE Loan Group, C-PACE lender

▶ Art commissioned from a native Yakama Nation Tribe Member. Exposed FSC-Certified wood builds relationship with nature for the occupants. Photo credit: Benjamin Benschneider



The PAE Living Building was the first developer-led living building and remains one of the world's largest commercial Living Buildings.⁷³ After their involvement in designing the Bullitt Center in Seattle, the first Living Building Challenge-certified commercial office building, PAE Engineers needed to develop their own corporate headquarters. PAE commissioned ZGF Architects to help them demonstrate that the traditional project finance tools available were sufficient to develop a Living Building. PAE worked with the real estate development firm Gerding Edlen (now Edlen & Company) to develop a Living Building of which PAE would be the anchor tenant, paying a 10% rent premium, which they considered an investment in employee wellbeing, attraction, and retention. The original landowner, another developer, took equity in the project instead of a cash sale. The design team also offered their fees as equity in the project. These investments were anticipated to provide a 10% internal rate of return.⁷⁴

New Construction – Office

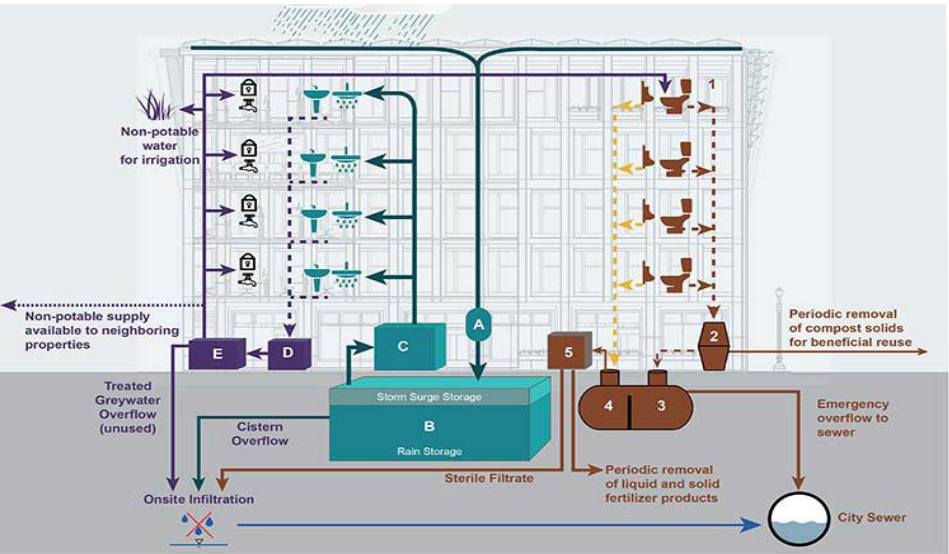
Two critical components of the capital stack were Commercial Property Assessed Clean Energy (C-PACE) and an Opportunity Zone Fund that lets the appreciation of the equity investments be realized tax-free after the 10-year hold period.

Because the building was located in a historic district, the PV solar canopy was not able to extend past the roof of the five-story building. To achieve sufficient production capacity for annual net-positive energy, and to add social benefits on top of the environmental benefits, the developer installed an additional rooftop PV system on a nearby affordable housing project, providing \$20,000 in annual energy savings to the housing project owner. These two systems produced 8.7% more energy than the building consumed over the course of a year.⁷⁵ When the on-site PV produces more energy than the building uses, it stores the excess in an on-site battery energy storage system for use when the building consumes more energy than the solar can produce. In addition to saving the building money, this also helped avoid the expense of upgrading the grid interconnection, which would have been undersized to accept all the power generated by the solar system.

The PAE Living Building uses a 71,000-gallon underground cistern buried under the building’s footprint to capture treated rainwater, offsetting the need to purchase potable water from the city. After the treated rainwater is used for sinks, showers, and dishwashers it becomes greywater and is recycled again for toilet flushing and irrigation of planters on the roof. Finally, the super-efficient vacuum flush toilets route sewage to a commercial composting system,

avoiding steep sewer fees and generating about \$35,000 a year by selling urine-derived fertilizer⁷⁶. Using the same resource three times before it goes on to create more life is a powerful example of regeneration.

ZGF selected a cross-laminated timber floor structure and glulam columns and beams instead of steel for several reasons. The material comes from sustainably managed forests in the region, connecting the building to the ecosystem in which it exists and limiting the carbon emissions associated with transportation. Research has also shown that the aesthetic benefit of exposed wood supports physical and mental health, a concept known as biophilia.



The PAE Living Building’s water treatment system collects rainwater, uses it three times before it infiltrates back to the groundwater. Diagram Credit: Biohabitats

PAE Living Building Capital Stack

PUBLIC SUPPORT	Public incentives Energy Trust, ODOE, city SDC leeway
	Outside cash equity About half; Opportunity Zone deferral
EQUITY	Core team equity PAE, ZGF, Walsh, Edlen, DDG, Apex
	Commercial PACE, mezzanine \$2.5m, 25 years, PACE Loan Group
DEBT	Senior construction loan Bank loan at 2.82%, amount not public

▼ PAE pre-lease of floors 3 to 5 at a 10% rent premium underwrites the debt

- Public sector
- Private capital
- C-PACE, repaid through the property tax bill

Total cost \$40.2m, of which \$25.2m hard cost. Only the PropertyFit PACE loan and the total are public; the other layers are undisclosed, so heights are not to scale. Pro forma: 10% IRR over a 10 year hold.

New Construction – Office

As with any project that achieves the Living Building Challenge, ZGF and PAE had to demonstrate how the project is regenerative across the seven performance areas, including:

Place: Revitalizing neighborhood and building on a former parking lot rather than greenfield.

Water: 100% of water demand is collected and treated onsite and used multiple times before on-site sewage treatment and return to groundwater.

Energy: Renewable energy produces 113% of the building’s needs including onsite and offsite resources.⁷⁷ Batteries store excess solar energy and use it when demand exceeds production.

Health: Increased visibility of daylight, natural materials, operable windows and avoiding problematic chemicals promotes health of the occupants and the environment.

Materials: Sourcing FSC-certified and regionally sourced cross-laminated timber ensures the ecosystem can sustainably restore what was harvested for construction.

Equity: The project directly benefits affordability of housing with its off-site renewable energy investment and commissioned art from a Yakama tribal member.

Beauty: Using inspiration from biophilic design and historic context improves the experience of both the neighborhood and the interior of the building.



Whole Systems Thinking

The PAE Living Building design process focused on balancing systems with a traditional commercial development capital stack. The project balances carbon, water, energy, community, and economy with a building design and development model that can be replicated nearly anywhere.



Optimize Carrying Capacity

ZGF used FSC-certified cross-laminated timber as the building’s primary structure. Sustainable managed forests in the region absorb carbon from the atmosphere, and then the building stores it. With the fertilizer production from the commercial composting system, the building contributes to the ecosystem every month.



Spirit of Place

ZGF commissioned Toma Villa, a local artist who was a member of the Yakama Nation who lived in Portland. His wood carving was inspired by the indigenous basketry used by his tribe who lived along the Columbia River. The developers also worked closely with the Old Town Historic Community Association to ensure the new building had a positive relationship with the place it was built.



Active Renewal

By installing its expanded solar PV array on a nearby affordable housing project, the developers were able to meet their net positive energy goal while simultaneously reducing the energy bills for low-income families.



Design Evolution

PAE Engineers continuously monitor the energy and water systems as well as human comfort to learn from the building and apply those lessons to every new project they design. The flexible floor plan allows the building to easily be adapted in the future.

Construction Career Center

Chattanooga, Tennessee

Owner: Building and Construction Workforce Center, a nonprofit led by the Associated General Contractors of East Tennessee with Hamilton County Schools and Chattanooga State Community College;

Architect: Tinker Ma

Engineers: March Adams & Associates

General Contractor: T.U. Parks Construction

Other team members: Southface Institute, green|spaces, Build it Green, GoodUse grant and technical assistance; Hamilton County Schools and TCAT Chattanooga at Chattanooga State Community College, training programs; City of Chattanooga, Hamilton County and the State of Tennessee, funders



▶ The Construction Career Center is a net-positive-carbon trade school for high school students and adult learners. Courtesy Tinker Ma. Photo Credit: Holt Webb

In 2018, the Associated General Contractors of East Tennessee decided to build a new office that could also serve as a workforce training facility for its members, which include commercial general contractors and subcontractors. They began their development process with broad community engagement, working with the city and county governments, the local K-12 school system, the local community college, local foundations, and local nonprofits. The K-12 school system and community college offered to develop an entirely new dual-track construction trade training program to serve high school students and adult learners. The county school system also offered



▶ **BEFORE** The vacant Mary Ann Garber School before renovation. Built in 1954 in a historically African-American neighborhood, the original structure was salvaged while a 1970s addition was demolished. Photo Courtesy Construction Career Center. Photo Credit: John Shearer

Adaptive Reuse



▶ The Construction Career Center under construction before the solar canopy was installed over “the yard” where students build large mock-ups and learn how to operate equipment. Photo credit: Holt Webb

to donate an abandoned elementary school that had historically served an African-American neighborhood and was adjacent to a 1950’s public housing project which had also been abandoned and then demolished. During the design process, the consortium met with neighborhood residents to discuss their priorities for the project, including preserving the historic school, which held deep significance for residents who attended it as youth. The original 1954 elementary school structure was salvaged, while an addition from the 1970s was demolished because of structural concerns.

The city, county, and state governments contributed funding to support workforce and economic development

in a disadvantaged neighborhood. The local utility helped design, install, and finance a 300kW solar array and a battery energy storage system so that the building could serve as a resilience hub for the neighborhood. Local foundations and the Southface Institute agreed to provide grants to help the project push the envelope of regenerative design.⁷⁸

The trade school design planned to use one existing wing to house mechanical, electrical, and plumbing system training, with a second wing housing masonry, steel, concrete, and carpentry training. Each discipline would have a classroom and a workshop outfitted with state-of-the-art tools. The two wings meet at the former school gym, which was converted into offices and a large meeting and training room used by the Associated General Contractors, the Home Builders Association, and AIA Chattanooga for their meetings and events.

AGC commissioned the Southface Institute in Atlanta to calculate the embodied carbon credit from the salvaged material and to carefully select new materials with lower embodied carbon to ensure the building’s construction and operation would balance. The team added new high-efficiency windows, LED lighting, high-volume fans, and a variable refrigerant flow mechanical system with energy recovery for fresh air to maximize the building’s energy efficiency.

After deep community engagement, what was initially envisioned as a small office and training workshop with a \$1M budget became a 30,000 sf, \$10M carbon-neutral, zero-energy, state-of-the-art trade school that serves all professional building industry associations and the neighborhood as a resilience hub.

Construction Career Center
Capital Stack

PRIVATE AND PHILANTHROPIC	Foundations and private donors \$2m; split not published
	AGC East Tennessee \$2m
	Southface GoodUse grant Efficiency measures; amount not published
ZERO CARBON	Solar and battery storage Utility financed; cost not published
PUBLIC SECTOR	State of Tennessee \$2m grant
	Hamilton County \$2m grant
	City of Chattanooga \$2m grant
	Hamilton County Schools building Former Garber school, no cost to TCAT

▼ AGC East Tennessee led the \$10m campaign; no debt reported

- Philanthropy ■ Private capital
- Utility financed energy systems ■ Public sector

Public record: \$10m total per AGC East Tennessee, \$2m each from the city, county and state, building provided at no cost. Project team: AGC's \$2m share, about \$2m from foundations and private donors, utility financing of the solar and battery, Southface funding for efficiency. Building value, Southface and energy amounts not published; heights approximate.

Adaptive Reuse



► The municipally owned utility EPB set up a lease structure for the Construction Career Center to amortize the cost of the solar and battery energy storage. Image courtesy of Green Wave Solar



Whole Systems Thinking

The Construction Career Center’s zero-embodied-carbon construction and zero operating carbon, plus connecting structural pathways to careers for youth and adults, creates generational opportunities for people, place, and the ecosystem.



Optimize Carrying Capacity

Most of the development was an adaptive reuse of an existing building, while still incorporating modern, efficient systems and achieving net-positive energy. Over half of the site was preserved as green infrastructure to allow stormwater to naturally infiltrate back into the ground, reducing the risk of combined sewer overflows which are an issue in the neighborhood.



Spirit of Place

The process of renovating and restoring an emblematic, abandoned and collapsing neighborhood elementary school, which holds strong sentimental value, into a hub for the entire regional building industry restored broken trust with the community. It also built new relationships between building industry professional organizations and neighborhood organizations.



Active Renewal

On-site solar generates more energy than the site consumes. Preserved open space, permeable gravel pads, and green infrastructure allow stormwater to infiltrate. While the project could not provide on-site water and sewage treatment, it is located in a balanced water system that draws from the Tennessee River and returns it to the watershed.



Design Evolution

On-site solar generates more energy than the site consumes. Preserved open space, permeable gravel pads, and green infrastructure allow stormwater to infiltrate. While the project could not provide on-site water and sewage treatment, it is located in a balanced water system that draws from the Tennessee River and returns it to the watershed.

Coliseum Place

Oakland, California

Owner: Coliseum Place, LP; Resources for Community Development, developer and general partner (RCD GP, LLC)

Architect: David Baker Architects (Katie Ackerly, AIA, principal; Daniel Simons; Chelsea Johnson; Billy Forrest)

Engineer: KPFF Consulting Engineers, civil and structural; EDesignC, mechanical, electrical and plumbing

Landscape Architect: Form/Work Landscape Architecture

Other team members: Nibbi Brothers General Contractors; Redwood Energy, energy analysis and sustainability; Hyphae Design and Integral Group, water and energy consultants for the Living Building Challenge feasibility study funded by Enterprise Community Partners; City of Oakland, co-applicant for the Affordable Housing and Sustainable Communities award; John Stewart Company, property management



BEFORE: Resources for Community Development and David Baker Architects came together to bring life to a site that was heavily polluted from illegal dumping and previous use as a paint warehouse. Image courtesy David Baker Architects.



Coliseum place restituted a broken edge of a community, providing habitat for both people and wildlife where there was none before. Photo credit: Bruce Damonte

In 2014, a blighted and contaminated former paint warehouse in Oakland, California, frequently used for illegal dumping, located between a single-family neighborhood and a Bay Area Rapid Transit parking lot, was put up for sale. The nonprofit Resources for Community Development purchased the land, engaged David Baker Architects, and together joined the Living Building Challenge Affordable Housing Pilot.⁷⁹ The team completed a Living Building feasibility study, worked with the City of Oakland to engage the community, and successfully applied for an Affordable Housing and Sustainable Communities (AHSC) grant to help fund a multi-family affordable housing project, improve transit accessibility by adding a bus rapid transit stop, and improve walkability by adding sidewalks and tree canopy.

Affordable Multifamily Housing



▶ The Hawley Street entry, with bioretention planting that filters runoff from the site. Photo Credit: Bruce Damonte.

Katie Ackerly, AIA with David Baker Architects shared her methodology for working with affordable housing developers in an AIA California guide for “Making the Case for Sustainable Housing.”

- Step 1. Develop your own stance on sustainable design within your practice area
- Step 2. Listen to and understand the client’s priorities
- Step 3. Lead with a project vision
- Step 4. Set the tone of a mutual learning process
- Step 5. Have courageous conversations
- Step 6. Don’t go soft on the metrics internally
- Step 7. Grow partnerships into broader action

A \$14 million Affordable Housing and Sustainable Communities award to the City of Oakland and RCD,⁸⁰ paid for by carbon Cap-and-Trade (now called Cap-and-Invest) auction proceeds and covering the housing loan along with bus rapid transit and greenway improvements, was paired with a wide range of additional incentives including the Low Income Housing Tax Credit, loans and grants from the City of Oakland and Alameda County, and support from the Federal Home Loan Bank. Even with these other incentives, the project didn’t pencil without the AHSC program, and incorporating regenerative design helped unlock funding where the same project had been unsuccessful just a few years earlier without it.

Coliseum Place Capital Stack

EQUITY	LIHTC investor equity \$20.6m; \$2.07m annual credits at \$0.994
	Sponsor equity and deferred fee \$0.25m GP equity, \$0.75m deferred fee
PUBLIC SOFT LOANS AND GRANTS	Alameda County Measure A1 loan \$9.4m, 2016 county housing bond
	HCD AHSC loan and HRI grant \$6.5m of a \$14m cap-and-trade award
	HCD NHTF and IIG \$2.6m trust fund, \$1.9m infill grant
	City of Oakland and County HOPWA \$1.6m city loan, \$0.7m HOPWA
FHLB	FHLB Affordable Housing Program \$0.6m
SENIOR DEBT	Wells Fargo permanent loan \$8.3m, tax exempt bonds via CMFA

▼ 37 project-based Section 8 vouchers from Oakland Housing Authority carry the senior loan

■ Private capital ■ Public sector

Permanent sources at application per the July 2019 CTCAC and CDLAC staff reports; total \$53.4m, \$904,974 per unit. Closing amounts may differ. Heights are proportional, with the thinnest bands enlarged to fit labels. FHLB AHP is Federal Home Loan Bank money rather than government funds.

Affordable Multifamily Housing



On-site solar produces all of the energy required for house loads.
Photo Credit: Jeff Durkin

In 2014, the Affordable Housing and Sustainable Communities program was created to subsidize transit-oriented affordable housing with proceeds from auctions from the Cap-and-Trade program.⁸¹ Design strategies included an on-site solar PV array that offsets all house loads, an all-electric high-efficiency HVAC system, unconditioned and open-air circulation spaces, water-efficient landscaping and plumbing fixtures, and a restoration of tree canopy and habitat.

The first-floor units were elevated for security and to prevent flooding. In addition to linking the building to the new bus rapid transit stop and the nearby light rail stop, new sidewalks, bicycle parking and maintenance infrastructure, and EV charging infrastructure facilitate additional carbon-neutral transportation.



Whole Systems Thinking

The project was funded by proceeds from carbon auctions and focused on improving transportation connectivity. The project was located next to light rail and was co-funded with a new bus-rapid transit stop. It also intentionally improved walkability with new sidewalks and shade trees, and improved bikability with bike maintenance, charging, and storage.



Optimize Carrying Capacity

By participating in the Living Building Challenge Affordable Housing Pilot, David Baker Architects focused on using as many durable, healthy, and recycled materials as possible. The project balanced its site net-zero energy goal with the need for housing density near transit to lower the region's overall emissions.



Spirit of Place

The development is deeply rooted in the community and ecosystem needs by renewing a contaminated property commonly used for illegal dumping and creating habitat for both people and for wildlife.



Active Renewal

The project goes beyond reducing the harms the site caused to the neighborhood and environment by providing biofiltration for all runoff. Site infrastructure improvements mitigate frequent flooding, and water system literacy is designed into the building, educating residents by tracing the watershed.



Design Evolution

The first-floor units were elevated to accommodate the potential for future flooding. The building incorporates all-electric mechanical systems so it can easily adopt new technology to further reduce its carbon footprint. David Baker Architects use their experience to educate firms throughout AIA California about regenerative affordable housing.

Resilient Hampton

Hampton, Virginia

Owner: City of Hampton, Community Development Department

Architect: Waggonner & Ball Architecture/Environment, New Orleans, prime consultant (David Waggonner, FAIA); a design studio within Moffatt & Nichol since 2023

Engineer: Moffatt & Nichol, engineer of record, biologist, and lead of the design consortium; Timmons Group, permitting

Other team members: BoschSlabbers (Netherlands), urban design consultation; Quantified Ventures with the Chesapeake Bay Foundation, environmental impact bond structuring and outcome metrics, supported by a challenge grant matched in part by The Kresge Foundation; Davenport & Company, municipal advisor; Morgan Stanley, underwriter; Wells Fargo, co-manager; Kutak Rock, bond counsel; Royal Netherlands Embassy (Dale Morris) and the Hampton Roads Planning District Commission, Dutch Dialogues Virginia, 2015; Langley Air Force Base, partner on the LaSalle Avenue corridor study

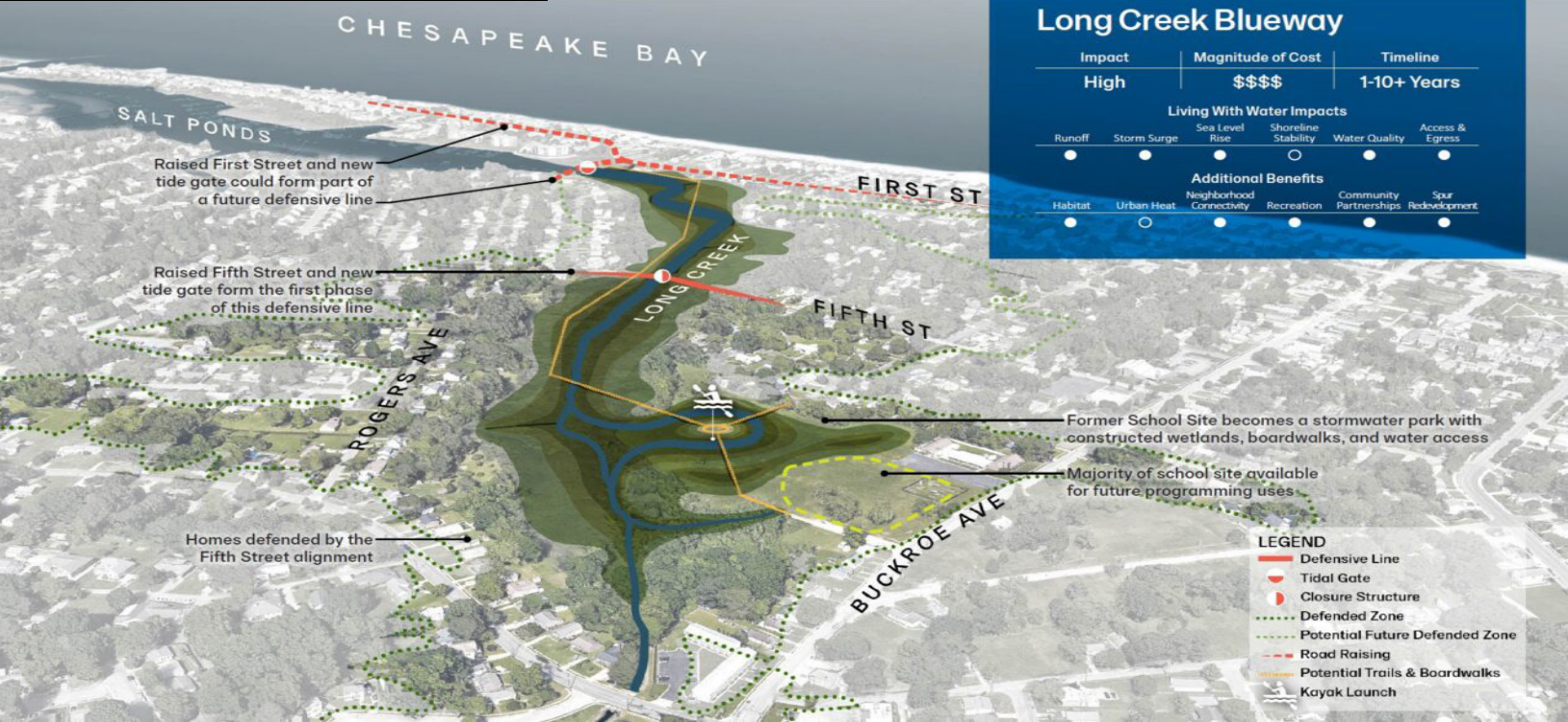
► **AFTER:** Regenerative design helps trans-form an exist-ing artificial pond into a bird sanctuary, greens-pace with boardwalks, and crit-ical storm-water infrastructure to prevent frequent flooding in adjacent neighborhoods. Photo courtesy Waggonner & Ball Architects



► **BEFORE:** A van pushes through standing water as a storm drain surcharges in Hampton, Virginia. Photo courtesy Waggonner & Ball Architects

After Hurricane Katrina in 2005, David Waggonner FAIA of Waggonner & Ball Architects traveled with a group of Louisiana leaders to the Netherlands to explore flood mitigation strategies. About 26% of the country is below sea level, and had experienced catastrophic levee failures with similar loss of life.⁸² This cultural exchange led to the Dutch Dialogues, a series of workshops convened in New Orleans from 2008 by Waggonner & Ball with Dale Morris of the Royal Netherlands Embassy and co-sponsored by the American Planning Association.⁸³ They eventually held three of these Dutch Dialogues, and in 2018, Waggonner and Morris presented at the APA National Planning Conference on how “budgeting, appropriation, procurement, and governance processes impede truly integrated, comprehensive urban-water, resiliency, and climate-adaptation projects.”⁸⁴

Resilient Infrastructure



One of the first community-led projects facilitated by Resilient Hampton was the Long Creek Blueway that connected students to schools with safe trails and improved the performance of the ecosystem to accommodate more life. Graphic courtesy Waggonner & Ball.

In 2015, Waggonner and Morris partnered with the Hampton Roads Planning District Commission and the cities of Norfolk and Hampton to organize the Virginia Dutch Dialogues as Norfolk and Hampton increasingly dealt with flooding. After the event, David Imburgia, Hampton’s Resiliency Officer, hired Waggonner & Ball for Living with Water Hampton to assess the landscape and produce a strategy document. They approached the Chesapeake Bay Foundation with the strategy and received a grant to structure a \$12M environmental impact bond with support from Quantified Ventures, a firm that helps construct a wide range of pay-for-success bonds from climate and

water to outdoor recreation and land conservation.⁸⁵ With these resources, they commissioned Waggonner to design Resilient Hampton and pursue more funding from the Virginia Community Flood Preparedness Fund.

The CFPF is funded through a cap-and-trade program similar to California’s AHSC program. Virginia participates in the Regional Greenhouse Gas Initiative (RGGI), which provides a regional auction for eleven states in the Mid-Atlantic and Northeast. While RGGI runs the quarterly auctions, each state keeps the proceeds and reinvests them in its own state according to its priorities. Generally,

Resilient Hampton Capital Stack

PHILANTHROPY	Chesapeake Bay Foundation EIB design and RAIN pilot; donor and Kresge
STATE AND FEDERAL GRANTS	Virginia Community Flood Preparedness Fund \$12.3m, Rounds 1, 2 and 4; RGGI proceeds FEMA Hazard Mitigation Grant Program \$13m, Lake Hampton and North Armistead Virginia Department of Transportation Nearly \$5m, including \$0.67m SMART SCALE
CITY OF HAMPTON	Environmental Impact Bond, 2020 \$12m city debt; Morgan Stanley, Wells Fargo City bonds and stormwater fees Recurring; share not itemized

Investors receive annual disclosure on 8.6m gallons of planned storage

- Philanthropy
- Public sector
- City debt sold to impact investors

The three Newmarket Creek pilot projects were reported at about \$34m in August 2023. The Community Flood Preparedness Fund total covers Hampton awards verified in Rounds 1, 2 and 4; FEMA and VDOT figures per the city and WHRO. CBF work was funded by an anonymous donor challenge grant matched in part by Kresge, amounts not published. City cash share not itemized. Heights approximate.

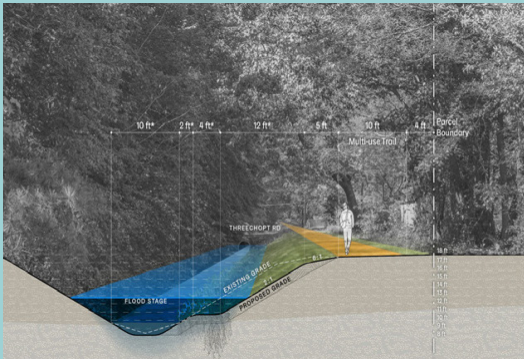
Resilient Infrastructure

investments go into a mix of renewable energy, emissions reductions, and resilient infrastructure. In Virginia, 50% goes to low-income energy efficiency, 45% to the flood fund, and 5% to fund administration.⁸⁶

The design began by analyzing the water forces affecting the city, including storm surge, tidal action, stormwater runoff, and groundwater. Pilot projects for a tidal urban waterway transformed a drainage ditch into a linear park, elevated a roadway while building a shared-use trail, and retrofitted a traditional detention pond into a biodiverse nature park that could store more water.

In order to move Hampton forward in a resilient way, a set of guiding principles was established to inform decision-making in *Living With Water Hampton*:

- Create Value-Driven Solutions
- Reinforce Assets
- Layer Public Benefits
- Strengthen Partnerships
- Use Good Data
- Share Knowledge and Resources



These principles led to a way of working by, with, and through water, providing accomodation for it when needed and using the ecosystem benefit the water brings to improve the quality of place. Diagrams courtesy Waggonner & Ball



Whole Systems Thinking

Resilient Hampton connected both carbon and water system interventions by leveraging carbon cap-and-trade funding to mitigate the increasing impacts of flooding on the community. The Resilient Hampton plan builds an approach to site-specific, area-specific, and city-wide improvements.



Optimize Carrying Capacity

As development increases impervious surface area, sea levels rise, and extreme storm events become more frequent, the water system becomes more constrained each year. Resilient Hampton increases this capacity by providing ecological and structural solutions to both regular flooding and storm surge during extreme weather events.



Spirit of Place

Waggonner & Ball facilitated deep community engagement through the Dutch Dialogues process, extensive research into the community’s history, and a series of public workshops and community meetings to build a cultural understanding of Hampton’s relationship with water.



Active Renewal

Resilient Hampton restores the natural water cycle by going beyond simple flood-mitigation interventions and reframing the city’s relationship with water to work with it rather than against it. Creating space and opportunity for water to exist and expand during storms, along with rebuilding ecosystems that once thrived in the region, enables regenerative growth for the community and nature.



Design Evolution

After Hampton, Virginia proactively engaged with Dutch Dialogs to learn from other communities, Waggonner & Ball produced a range of resources to demonstrate design and funding pathways for the built environment to evolve with the challenges it faces through their Living With Water framework.

Benjamin Banneker Academic High School

Washington, DC

Owner: District of Columbia Department of General Services, for DC Public Schools

Architect: Perkins Eastman DC, prime architect; Moody Nolan, associate architect for interiors; Dan Curry Architects, associate architect

Engineer: CMTA, mechanical, electrical, energy modeling and commissioning; SK&A, structural; Bowman Consulting Group, civil; Engenium Group, plumbing and fire protection; ECS Capitol Services, geotechnical and environmental

Landscape Architect: Bradley Site Design

Other team members: MCN Build, design-builder; Perkins Eastman, sustainability consultant; EcoRise, sustainability curriculum integration; John Lewis Elementary School (Perkins Eastman DC for DGS), the paired net-zero school that shares its surplus solar generation

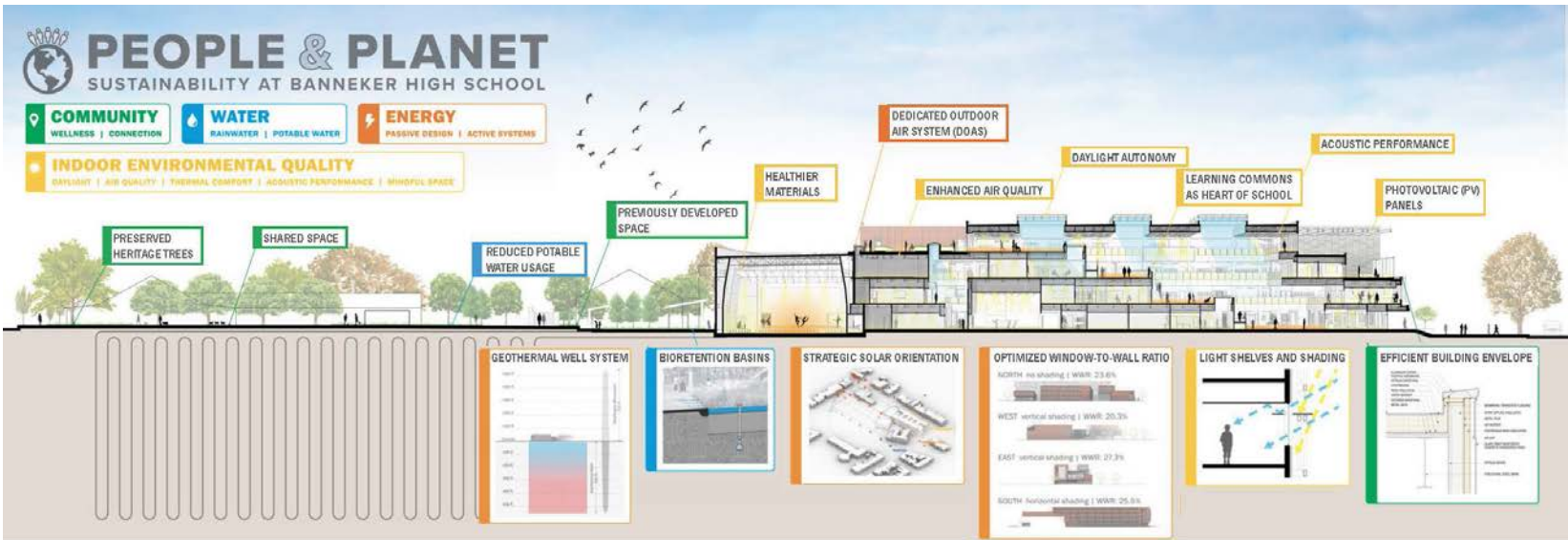
▶ The students of Benjamin Banneker Academic High School fought to keep it in the Shaw neighborhood it was historically located in. The building responded to that place and context with its massing and materials. Photo credit: Joseph Romeo Photography



▶ Perkins Eastman incorporated living learning laboratories for students to have immersive experiences in the ecosystem the development enabled to thrive. Photo credit: Joseph Romeo Photography

Benjamin Banneker Academic High School is a nationally-ranked magnet school in the Shaw neighborhood. On May 24, 2019, over 100 Banneker students in Washington D.C. marched on City Hall demanding the fulfillment of a promise made by the District of Columbia government years earlier: a new building to replace the aging and undersized former middle school which had been built in 1872 next to Howard University. The historic building, formerly the Sumner School, was one of the first schools in the country dedicated to educating African-American youth.

The District of Columbia became the first major city in the U.S. to mandate LEED Gold for all publicly funded schools as well as private projects over a certain size when they passed the Green Building Act of 2006. This was quickly followed by the Clean and Affordable Energy Act of 2008,



► “People & Planet,” an environmental graphics wall in the school, explains the energy, water, material and ecosystem strategies at work in the building. Graphic courtesy of Perkins Eastman

which instituted benchmarking that mandates public disclosure of each building’s annual energy use intensity over a certain size, with requirements that decreased over time. DC schools took this a step further by publishing the BuildSmart DC online dashboard, which shows 15-minute interval data for schools and other public buildings. The Clean and Affordable Energy Act also established funding mechanisms for energy efficiency and renewable energy, including the Sustainable Energy Trust Fund and the DC Sustainable Energy Utility. Armed with such fine-grained data, they could quickly see and monetize the impact of energy efficiency and renewable energy measures. They could also prioritize low-performing buildings for renovations or replacements.

In this context, the District Department of General Services (DGS) issued an RFP for Benjamin Banneker High School and John Lewis Elementary School that required LEED Gold, with a preference for LEED Platinum, but made no mention of net-zero performance.⁸⁸ The design-build team of Perkins Eastman DC, CMTA, SK&A, Bowman Consulting, and Engenium proposed a design that could achieve LEED Platinum and net-zero energy that was competitive with the budget for LEED Gold without net-zero energy.

Solar PV was installed on the roof on self-ballasted racking and sawtooth skylights, on south facade shading devices, and on canopies over the bleachers and staff parking lots. Because the site was very constrained in a dense residential neighborhood, a district energy strategy

Banneker Academic High School
Capital Stack

PRIVATE CAPITAL, PUBLIC OFFTAKE	On-site solar under a DGS PPA Third-party owned; terms not published
	▼ Owner keeps tax credits and RECs; DGS buys the power
DISTRICT OF COLUMBIA BALANCE SHEET	DC general obligation bonds \$135.1m, 100% of the building; \$125.8m design-build GMP inside
	▼ Appropriated FY2019 to FY2021; repaid over 20 to 30 years

■ Third-party owned, public offtake ■ Public sector

Building: FY2019 DC capital plan, project YY101, estimated full funding cost \$135,143,000, all new GO bonds (\$9.7m FY2019, \$38.3m FY2020, \$84.9m FY2021, plus \$2.2m prior); ENR reported \$137m. Solar: DGS bid the array separately from the design-build contract; the Banneker provider, capacity, rate and term are not published. Heights are not to scale. Operating cost is \$100,000 a year below the old building despite 30,000 more square feet.

Public Buildings – Education

was developed to add additional solar PV to the net zero John Lewis Elementary School (another great case study) being developed simultaneously on an adjacent parcel, the surplus of which would go to offset energy use at the high school. The system was financed through a power purchase agreement with a third-party developer who is able to sell the scarce, and thus highly valuable, solar renewable energy credits to the utility while DGS pays for the energy and separate, unregulated renewable energy credits to claim the carbon reduction while still benefiting from the arbitrage in value.

Geothermal ground-source heat pump wells provide energy- and cost-efficient heating and cooling. The material selection minimized both the environmental impact and health risks by analyzing Environmental Product Declarations and Health Product Declarations.



▶ The sawtooth skylights also provide daylight for a series of light wells that bring daylight deep into the building and reduce the need for artificial lighting, and the PV shading devices block direct light when the building is being cooled but let it in when the building is being heated. Photo Credit: Joseph Romeo Photography



Whole Systems Thinking

Perkins Eastman’s design for Benjamin Banneker Academic High School uses environmental graphics to educate some of the best and brightest students in the District of Columbia about the energy, water, material, and ecosystem strategies deployed in the school.



Optimize Carrying Capacity

Because of its extremely limited geography and consistently high density, the District of Columbia faces one of the most difficult challenges in balancing residents’ energy needs with renewable energy within the district. The design leverages both a wide range of on-site generation applications (Self-ballasted, sawtooth skylights, shading devices, and parking canopies) as well as district-scale systems.



Spirit of Place

From its founding in the Sumner School, one of the first buildings dedicated to the education of African American children in Washington, D.C. to the fulfilled demands of students for the district not to move the school to another neighborhood, the design honors its history throughout the building.



Active Renewal

Perkins Eastman used on-site and adjacent-site solar arrays paired with 150 geothermal wells to deliver a net-positive energy school, achieving LEED Platinum, within the budget of the original RFP that had only required an energy efficient LEED Gold school.



Design Evolution

Perkins Eastman asked, “What if the whole school was a learning commons?” and delivered a diverse ecosystem of learning spaces beyond classrooms, including an outdoor learning laboratory. Furniture is reconfigurable to adapt to the rapidly evolving needs of one of the highest-performing schools in the country.

POLICY ACTION FRAMEWORK

Key Strategies

The American Institute of Architects strives to advance regenerative design through targeted advocacy and member engagement, endeavoring to promote regenerative strategies as a practical framework for creating buildings, places, and communities that restore ecological systems, strengthen communities, and deliver lasting value.

The AIA Advocacy Framework outlines four strategic objectives, each aligned with AIA’s five pillars of regenerative design. These objectives inform specific policy recommendations to advance regenerative outcomes at federal, state, and local levels.

The framework demonstrates AIA’s commitment to advancing the principles of regenerative design through meaningful policy action.

Create development incentives to encourage regenerative design strategies.

A holistic, inclusive approach is essential. Buildings and their sites must strive to work in harmony with natural systems, respond to current and future community needs, and promote a balanced stewardship of resources. Policies should aim to accelerate adoption of regenerative development strategies and improve long-term environmental, economic and social outcomes.

Policy objectives:

- **Increase funding** for federal, state, and local brown-field redevelopment grant programs.

- **Expand the use of federal tax credits**, such as the Low-Income Housing Tax Credit (LIHTC), New Market Tax Credits (NMTC), and state programs to support regenerative design.

- **Adopt land use, zoning, and building code reforms** to promote high performance design, encourage water conservation, support renewable energy, and reduce operational and embodied carbon.

- **Reform FEMA** and reimagine federal, state and local strategies for disaster risk reduction. Encourage a holistic, coordinated, and inclusive approach to adaptation, resilience and mitigation, across all levels of government.
-

Expand access to green capital.

A persistent barrier to regenerative development is the limited availability of financing for non-traditional building investments, such as stormwater management, energy storage, and resilience infrastructure. Policies should aim to expand access to financing that has demonstrated success in supporting regenerative design, while providing long-term value for developers, building operators, and communities.

Policy objectives:

- **Establish and expand funding** for green and resilience infrastructure banks.
- **Increase availability of green bonds** and social infrastructure bonds.
- **Strengthen property tax-based financing tools**, including C-PACE and Tax Increment Financing (TIF) to support regenerative design.
- **Allow pay-for-success financing** mechanisms, such as Environmental Impact Bonds.

Eliminate barriers to on-site resilient infrastructure.

Closed loop building systems enable facilities to operate independently for extended periods and serve as critical community hub during and after severe weather events. Policies should aim to reduce regulatory barriers, encourage the deployment of on-site infrastructure, and support systems that improve resilience while restoring energy and water resources above the levels consumed.

Policy objectives:

- **Allow on-site collection**, treatment, and storage of rainwater and wastewater.
 - **Accelerate the deployment** of on-site renewable energy generation, microgrids and energy storage systems.
-

Promote the design of community buildings as resilience hubs.

Public and community-facing buildings often function as neighborhood anchors before, during, and after emergencies. Policies should aim to encourage the integration of regenerative design principles into public development processes to ensure these facilities provide long-term community value, resilience, and environmental benefits, while remaining operational through critical events.

Policy objectives:

- **Incorporate regenerative design** into public procurement processes, including Requests for Information (RFIs), and Requests for Proposals (RFPs).
- **Provide funding** to ensure resilience hubs are designed and built to be trusted facilities, equipped to provide wrap-around services to vulnerable communities.

PRACTICE ACTION AGENDA

The American Institute of Architects is advancing regenerative design as a practical framework for creating buildings, places, and communities that restore ecological systems, strengthen resilience, and deliver lasting value. Regenerative design asks architects to consider how every project can improve the health of people, communities, and natural systems while responding to climate and social challenges.

AIA is seeking to help architects translate this ambition into everyday practice. ***To realize this, AIA will expand education, so practitioners understand regenerative principles and apply them across project types and scales.*** These learning opportunities will aim to build fluency within the profession and connect broad concepts to the design decisions architects make with clients, consultants, and communities.

i. To support implementation, AIA is developing practical resources that move regenerative design from aspiration to action. Case studies, award-winning project examples, and practitioner guidance can show how regenerative outcomes are achieved in diverse communities and building types. These resources will also help architects communicate the value of regenerative strategies to clients, stakeholders, and the public, making it easier to align design decisions with measurable environmental, social, and economic benefits.

ii. A stronger business case is essential for wider adoption. AIA will accelerate practice change by promoting examples that demonstrates the benefits of regenerative approaches, identifying financial models and funding pathways, and helping practitioners connect projects to climate, resilience, infrastructure, and recovery opportunities. Grounding regenerative design in evidence and value will help architects make a more compelling case for investment and implementation.

iii. AIA’s national, state, and local network gives the organization a platform for connecting local action to national impact. By supporting AIA chapters, AIA can expand access to regenerative design resources, highlight community-based projects, and support architects working across geographic, political, and ecological contexts. This distributed approach ensures regenerative design is relevant to communities facing different climate, economic, and social conditions.



iv. Research and innovation will also be central to moving the profession forward. Through initiatives such as the Upjohn Research Initiative, AIA can support work on climate adaptation, disaster risk reduction, ecosystem restoration, material innovation, and net-positive performance. Collaboration among researchers, practitioners, policymakers, and community leaders can close knowledge gaps and produce guidance that is credible, actionable, and relevant to practice.

v. AIA can also use its convening power to shape the future of architectural practice. Conferences, summits, partnerships, reports, and thought leadership can bring architects together with policymakers, researchers, industry leaders, and community stakeholders to define shared priorities and advance collective action. These efforts position architects as leaders in creating regenerative, climate-positive communities.

Looking ahead, AIA’s goal is to make regenerative design practical, accessible, and scalable across the profession. By combining education, tools, research, case studies, funding pathways, and cross-sector partnerships, AIA can help regenerative design become a defining framework for practice and a catalyst for healthier, more resilient communities.

▶ The Catalyst Building, located in Spokane, Washington, utilizes raw cross-laminated timber (CLT) panels as the building’s floor diaphragms, eliminating the weight, construction time, and substantial carbon footprint of poured concrete. Photo credit: Benjamin Benschneider

CALL TO ACTION

Our nation and planet have reached a crucial inflection point. Accelerating climate disruption, economic uncertainty, and societal strain are pushing human and natural ecosystems into a deep crisis. As this report demonstrates, we must now shift away from a mindset of short-term extraction, reimagine our relationship with nature, and create positive, long-term outcomes through our interventions in the built environment.

Regenerative Design offers a vital path forward, with proven solutions that actively restore ecosystems and strengthen communities. AIA’s Five Pillars of Regenerative Design — Whole Systems Thinking, Optimize Carrying Capacity, Spirit of Place, Active Renewal, and Design Evolution — provide a framework for building transformative projects that heal communities, repair ecosystems, and create lasting environmental, social and economic value. The case studies, policy recommendations, and financing strategies in this report provide a clear roadmap for policymakers and architects alike, demonstrating how to incentivize and deliver regenerative development that creates robust value and builds natural and social infrastructure. By building upon the information found here, we have an opportunity to ensure that every project increases human thriving.

To expand the reach and scale of regenerative design, we must engage with local, state, federal, and international governments, NGOs, and community leaders. Working with these allies, we can accelerate adoption of policies and financing mechanisms that accurately value ecosystem services and support regenerative processes.

In this time of urgency, we have an opportunity to push forward boldly, with a clear vision and proven solutions.

Working together, we can meet this crucial moment and build a better world.

Key Takeaways

Purpose

The central objective of regenerative design is to establish built systems that repair, strengthen, and blend seamlessly with their natural environment – enabling people and ecosystems to thrive.

Engagement and Empathy

Regenerative design begins with building relationships, engaging with local knowledge, respecting existing ecosystems and communities, understanding the capacity of readily available natural resources, and identifying well-aligned funding sources.

Shared Commitment

Architects have an opportunity to leverage a growing set of regenerative design strategies to ensure every project empowers communities and individuals to thrive, in balance with nature.

Transformative Thinking

Regenerative design requires local, state and federal governments to assign an accurate value to the foundational role of healthy ecosystems in a thriving society and economy. Scaling up regenerative design will require new economic tools and a rightful accounting of ecosystem services.

Decisive Action

With a relentless effort that meets the urgency of the moment, we must demonstrate the fundamental benefits of regenerative solutions. We must inspire allies, industry partners and governments at all levels to move away from a mindset of managed decline, and toward one that creates enduring value.

ENDNOTES

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