ARUP

Sustainable Development Report 2017/18

Introduction

We are pleased to share the 2017/18 edition of our sustainable development report. This report presents a selection of exceptional projects we have delivered across our five regions over the past financial year. These projects highlight the way our firm positively impacts so many lives across the world.

The UN Sustainable Development Goals (SDGs) provide us with a roadmap and common language for sustainable development. On 25 September, 2015, the 194 countries of the UN General Assembly adopted the 17 goals and 169 targets as part of the 2030 Development Agenda. The goals are a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity.

Over the past year, the Group Board made a commitment by 2030 to have meaningfully and demonstrably contributed to sustainable development as defined by the SDGs and secured our firm's future by being recognised as the leading consultant and critical partner in the quest for a safe, inclusive, sustainable and resilient future for all. The UN's goals resonate with our own commitment to shaping a better world.

In addition to highlighting our projects, we are also proud to share our progress in relation to our goals for diversity and community engagement and to reduce our environmental impacts and resource use. Our work in sustainable development takes many forms, as this report highlights, and shows how we stay true to our values and help shape a better world.

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Arup's Cork Office

Sustainable development goals

As a global firm of over 14,000 staff with a broad diversity of skills, we continue to work across the full spectrum of sustainable development on a wide variety of project types and scales ranging from major infrastructure projects and strategic planning for cities to low carbon, healthy buildings.

In June of this year, a group of our leaders gathered in Boston, MA (USA), to spend two days thinking through how we realize our commitment to align our business with the SDGs and embed them in our work, our thinking and processes. One of the key conclusions was the consensus view that our work aligns and can contribute to all 17 of the goals, not just a select few.

Although we are in the early stages of our planning, we have taken action to raise awareness of the SDGs throughout the firm, the detailed goals and their associated targets. We have launched training courses and a team site to share knowledge and best practice projects and the 2018 Global Reserach Challenge has focused on goals 6 and 7. The SDGs were also, a major topic at our annual meeting of the firms' leadership. Most importantly, we have developed a framework to align our business with the UN SDGs over the next three to five years. Our plan is focused on four critical areas of activity driven by a global coalition of staff.

The projects selected for our annual report demonstrate the positive impacts of our work contributing to a more sustainable world.

Case studies

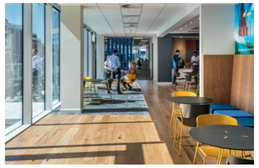
The projects showcased here highlight the work we have done over the past year to demonstrate leadership in the realm of sustainable development, delivering innovative solutions to meet today's challenges. The projects represent the breadth of our work across water, energy, cities and transport, and how this work is benefiting society and shaping a better world. This year, each case study highlights the sustainable development goal and targets it is positively contributing to.

EASING CONGESTION IN SYDNEY'S SECOND CITY

Parramatta Light Rail, Sydney

AN ICONIC NEW WALKWAY

Rainbow Bridge at Seaside Way, California



PUTTING PEOPLE FIRST

Arup Cork office & Arup Frankfurt office

CREATING THE FUTURE OF ECO-LIVING

Mount Pavilia, Hong Kong, China

PLANNING SUSTAINABLE GROWTH

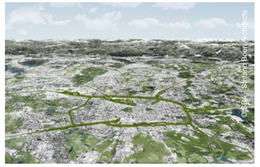
Challenging the norm for a climate positive development

ENSURING FOOD SECURITY IN THE TROPICS

International Center for Tropical Agriculture, Colombia

DESIGNING FOR URBAN CHILDHOODS

Urban planning for inclusive cities that work for everyone.



A MODEL OF RESILIENT REGENERATION

Fiume Verde, Italy

PROTECTING A VALUABLE WATER RESOURCE

Tung Chung New Town Extension (West), Hong Kong

ACCOUNTING FOR CONSUMPTION

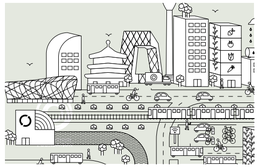
Understanding how a city's impact extends beyond their boundaries.

CREATING A YEAR-ROUND COMMUNITY SPACE

Shibata City Hall, Japan

SHAPING TONGA'S ENERGY FUTURE

Tonga Energy Roadmap, South Pacific



FACILITATING THE TRANSITION TOWARDS A CIRCULAR ECONOMY

Circular Economy Opportunity for Urban and Industrial Innovation in China

PROTECTING NEW YORK CITY'S WATERBODIES

New York City green infrastructure programme

ENHANCING A NATURAL ASSET

Seeing a constraint as an asset to guide a masterplan

ADAPTIVE WATER PLANNING TO UNLOCK POTENTIAL

Regional water blueprint in Northern Queensland, Australia

Easing congestion in Sydney's second city

Parramatta Light Rail, Sydney

By 2036, it is estimated that more than half of Sydney's inhabitants will live in Western Sydney, a population shift that is pulling metropolitan Sydney to the west and elevating Parramatta's status as Australia's next city. However, the existing public transport and road network lacks sufficient capacity to support development. Parramatta Light Rail (PLR) seeks to address this.

The 12-kilometre-long PLR will be part of an integrated transport network, linking precincts within Greater Parramatta and connecting them with key centres. Transport interchanges will facilitate access to the wider network and the light rail system will complement existing rail, bus, ferry and active transport modes. The new transport spine through this expanding area will support growth and opportunity, and also help shape the area into a truly great city.

The light rail system will reduce travel times and crowding, as well as address road congestion issues. Improved cycling and pedestrian environments will deliver health benefits by encouraging active transport, improving amenity for customers and residents.

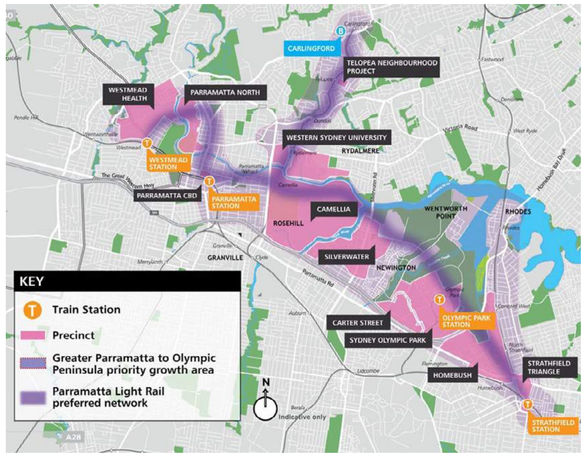
Additionally, PLR will help to reduce urban sprawl and socio-economic disadvantage, and improve housing affordability.

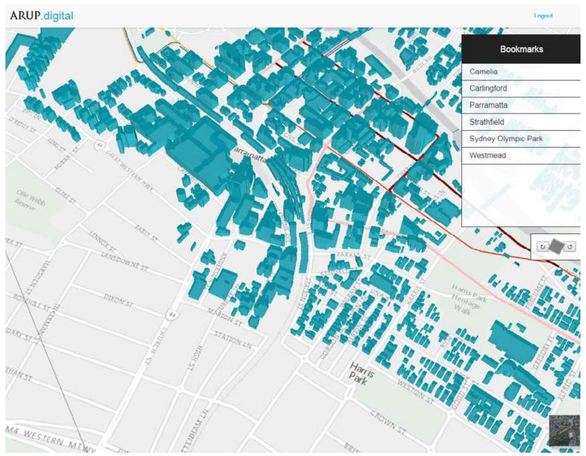
PLR will reduce transport and logistics costs for businesses, yielding significant productivity benefits and accelerating economic growth, as well as facilitating the transition to a knowledge economy.

From the outset, Arup has worked closely with Transport for New South Wales to ensure sustainability is embedded throughout the design. By incorporating the sustainability strategy in the contract documents, we have made sure that the sustainability aspirations will be delivered.

Related UN SDGs:

The project is contributing to targets 7.2, 9.1, 9.4, 11.2, 12.2, 12.5 and 13.1.





An iconic new walkway

Rainbow Bridge at Seaside Way, California

The 605ft-long Rainbow Bridge at Seaside Way in Long Beach fills a missing segment in the network of pedestrian bridges that link cultural and civic icons along its main thoroughfare. Arup was the main bridge engineering design consultant and engineer-of-record for structural, mechanical, electrical, and plumbing engineering services, and served as the lighting design consultant for the new walkway.

The shape of the bridge is an artistic interpretation of a breaking wave, and its deck brings together strands of disparate elements that typify a boardwalk: paving, seating and landscaped areas. At night-time visitors are immersed in a dynamic light show thanks to colour-changing programmable LED lights. The distinctive lighting also ensures that the bridge stands out in the Long Island urban landscape after dark.

Light levels on the walk path have been optimised to provide adequate brightness to enhance safety, while minimising power consumption. Almost all of the fixtures can be dimmed if lower light levels are desired, resulting in additional energy savings. Stormwater design solutions integrate with the bridge's landscape. Stormwater is directed to the planters on the bridge deck to capture, attenuate and filter it before discharge to underground drainage systems via the column downpipes. The underground systems also capture runoff from the sidewalk areas to filter and infiltrate stormwater.

The bridge is an elegant structure that contributes to the economic growth, sustainable infrastructure, and social needs of the local community and visitors; an attraction in its own right, the bridge provides an inviting space for pedestrians, as well as a functional and safe travel path that links the Performing Arts Center Plaza with the Convention Center Promenade along Seaside Way.

Related UN SDGs:

The project is contributing to targets 9.1, 11.3 and 11.

AWARDS

Engineering Excellence Award, National and State Level, American Council of Engineering Companies Awards, 2018

Putting people first

Arup Cork Office & Arup Frankfurt Office

WELL™ is a performance-based system for measuring and certifying features of the built environment that impact human health and well-being. Arup's Cork office earned the distinction based on seven categories of building performance: air, water, nourishment, light, fitness, comfort and mind. Arup's new Frankfurt office is also seeking WELL certification.

The Cork office has been designed with spaces that enable employees to adopt different working locations, postures and environments, such as sit-stand desks, huddle spaces, booth seating and relaxed meeting spaces. The variety of working locations encourages employees to move around throughout the day, thus increasing individual comfort and focus, and facilitating interaction.

Specialised acoustic design throughout the open-plan areas reduces background distractions which helps to increase privacy levels without the need for physical walls. Other design features include low VOC materials; additional water filtration to enhance water quality and taste; light fixtures that provide appropriate lux levels to prevent eye strain and align with the body's circadian rhythm; and carefully selected air diffusers to maintain excellent air quality.

By specifically focusing on including well-being features, we can create work spaces where people are happier, healthier and more productive. Early staff surveys at our Cork office indicate a 25% improvement in performance.

Arup's new Frankfurt office is looking to be the first WELL certified project in Germany. To encourage a healthy lifestyle there is no onsite parking. Instead, staff are encouraged to take advantage of the good public transport links and to use active transport modes. The office design follows WELL criteria and aims to achieve 30% energy savings, it also includes a large proportion of recycled materials.

"It is industry leaders like Arup that are putting people at the centre of design decisions and helping to advance this movement [WELL™] globally. "

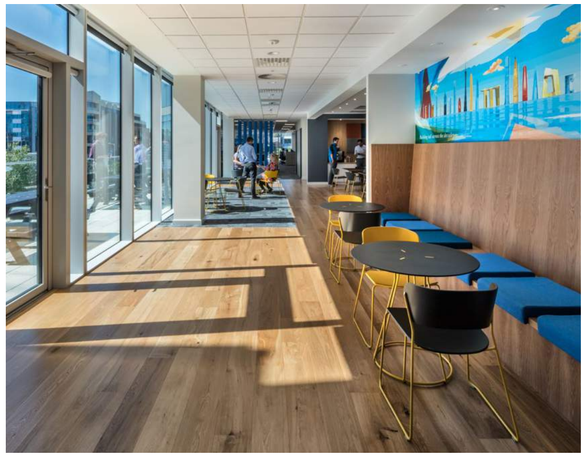
Rick Fedrizzi, Chairman and CEO of IWBI

Related UN SDGs:

The project is contributing to targets 3.4 and 3.9.

AWARDS

Winner, Cork Limerick Engineering Malcolm Ryan Award, 2018



Creating the future of eco-living

Mount Pavilia, Hong Kong, China

Mount Pavilia is a low density residential development that aims to create a blueprint for the future of eco-living. Located on the Sai Kung peninsula, often referred to as 'Hong Kong's back garden', the 66,800m^2 site consists of 27 blocks providing 680 units, retail space and clubhouse facilities. Arup has provided a comprehensive sustainability framework covering energy, water, food, wellness and waste.

A 145m^2 aquaponics system is embedded into the landscape design of Mount Pavilia. This recreates a balanced aquatic ecosystem whereby fish pond water containing plant nutrients is used for hydroponic farming, and the effluent from hydroponics is filtered and fed back to the fish pond, reducing the need for water and fertiliser. Residents are encouraged to participate in planting activities, enabling them to experience urban farming and interact with nature.

The framework proposes renewable energy systems based on site context, natural resources and anticipated demand. Thirteen 3kW wind turbines and 80m^2 of PV panels supply all the energy requirements for the main lobby lighting. In addition, 30m^2 of solar hot water panels provide enough hot water for 50 showers a day.

For the residential units, wellness-oriented design, including cross-ventilation, daylighting and solar control, is emphasised to promote a lifestyle that embraces the natural environment. A bike-sharing system and a 950m cycling track are provided for residents, encouraging an active lifestyle and low-carbon transportation.

A food waste conversion unit and reverse vending machines enable waste to be reused and recycled on site. For example, residents' organic food waste can be used to feed the fish in the park's aquaponics system.

Related UN SDGs:

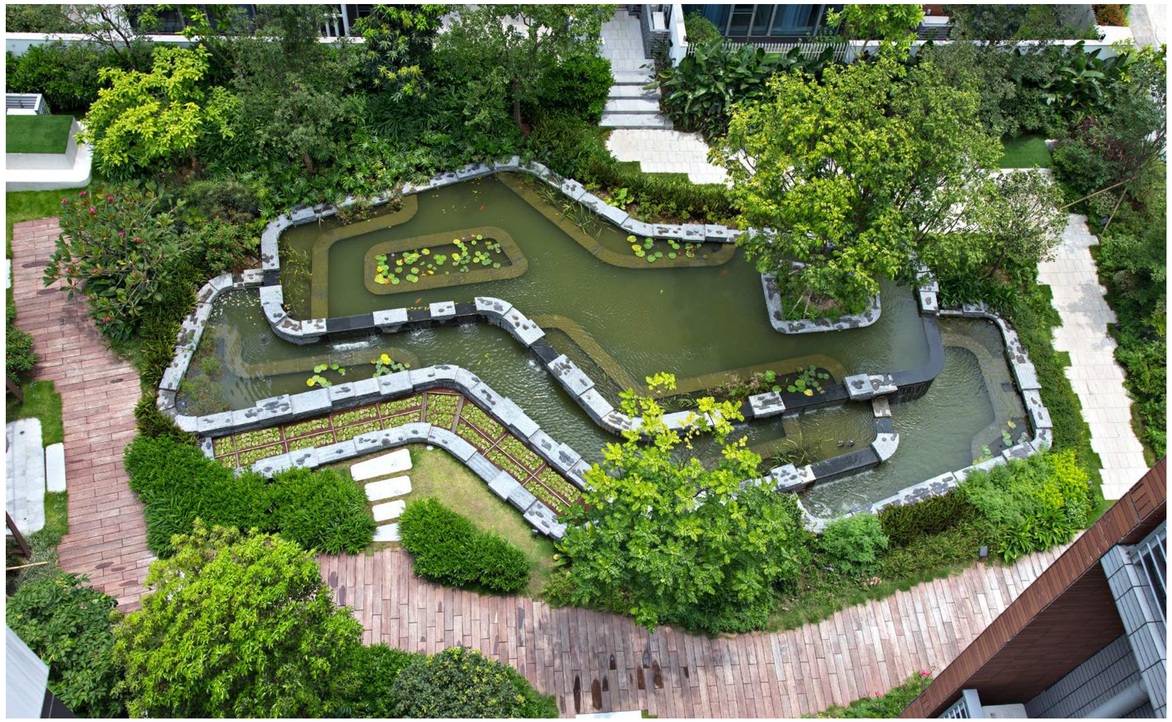
The project is contributing to targets 2.4, 3.9, 7.2, 11.6, 12.3 and 12.5.

AWARDS

Interior Design Awards 2018, Winner of Sustainability Engineer – Residential Hong Kong

FuturArc Green Leadership Award 2018, Merit of Residential – Multiple Houses

Quality Building Awards 2018, Merit of Hong Kong Residential Multiple Building



Planning Sustainable Growth

Challenging the norm for a climate positive development

Around the world, cities are demonstrating that large-scale expansion doesn't have to come at the expense of sustainability, resilience, or liveability. In fact, as the Mahindra World City in Jaipur (MWCJ) in Rajasthan shows, expansion can be an opportunity to enhance all these things.

Conceived as a C40 development, Arup was commissioned by Mahindra to develop proposals to integrate residential and community infrastructure into the existing business cluster. The scheme challenges existing norms around open spaces, mixing of land uses and walkability. MWCJ combines retail, cultural and educational land uses together through new residential communities. Our plan envisages two new universities and up to 25,000 homes in about ten communities, each with its own shaded plaza and local shops.

MWCJ is the first project in Asia and the largest project in the world (by population) to receive C40 Stage 2 'Climate Positive Development' certification. This is in recognition of its detailed plans for reducing energy, waste and transportation-related carbon emissions onsite, and for extending the impact to the surrounding community to achieve a climate positive outcome. In Rajasthan's hot climate, our plan maximises thermal comfort, provides a good environment for walking and cycling, and reduces building energy use through natural ventilation and effective orientation. Aligning the development with the prevailing wind patterns captures cooling breezes, while colonnades and other structures shade public spaces.

Providing access to nature, the central Nevata Park is structured around a dry water course that stores stormwater during the monsoon. Four green corridors connect to the park, providing stormwater drainage and ensuring people will never be more than a 5-minute walk from an open space.

Related UN SDGs:

The project is contributing to targets 3.6, 3.9, 11.1, 11.2, 11.3, 11.6 and 11.B.

Ensuring food security in the tropics

International Center for Tropical Agriculture, Colombia

The International Center for Tropical Agriculture (CIAT) is a non-profit research organisation that aims to reduce hunger and poverty and improve human nutrition. To expand its research capabilities, CIAT is looking to build a gene bank focused on researching yucca, beans and grasses. Arup has been working with CIAT to help move them closer to this goal.

Known as Future Seeds, the gene bank aims to be a global hub for crop diversity and to ensure the long-term conservation of vital crops, encouraging their use to enrich diets and to help climate-proof food supply in the tropics.

CIAT launched a design competition for the gene bank, won by Colombian architecture firm, AEV Arquitectos. The winning concept is both flexible and sustainable; state-of-the-art, it aims for a net zero, high performing building suitable for a hot and humid climate. The design includes a canopy that acts as a breathable façade, and accommodates modular laboratories and a learning centre that will be open to the public.

Arup worked with AEV and CIAT to determine how best to achieve the project's goals, in particular those related to sustainability and implementation. Working closely with the architects and CIAT's microclimate consultant, Arup detailed the canopy and lab façades, and provided design assistance with respect to the mechanical, electrical and plumbing systems, as well as the microclimate assessment.

With CIAT's high sustainability standards in mind, Arup helped the team understand the path to LEED® Platinum certification; Labs21 benchmarking; and also introduced The Living Building Challenge, a regenerative design framework, as an additional avenue to achieving rigorous sustainability standards.

Related UN SDGs:

The project is contributing to targets 1.4, 1.5, 1.A, 2.1, 2.4, 2.5, 2.A and 3.9.

Designing for Urban Childhoods

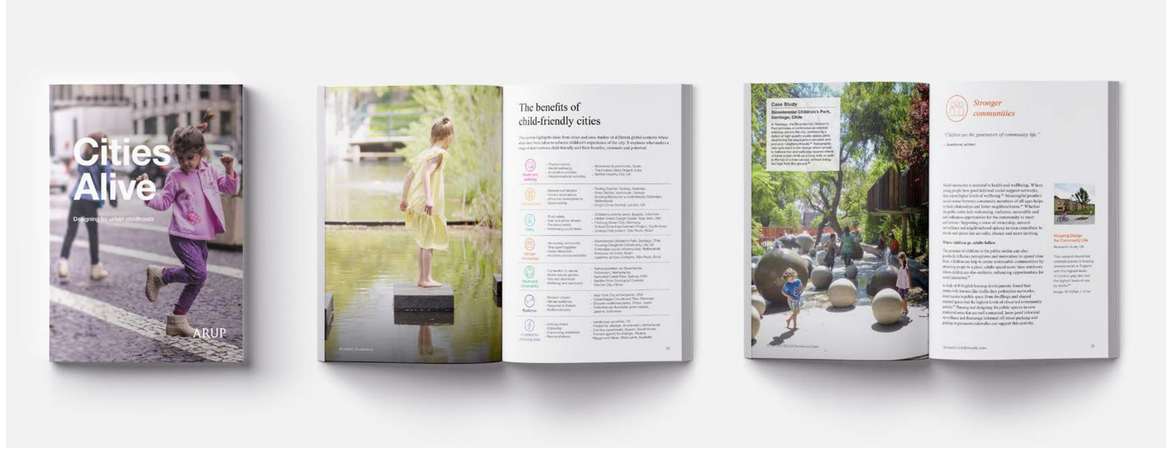
Urban planning for inclusive cities that work for everyone

Access to open space is important for adults and children alike, and by 2050 the majority of urban inhabitants will still be children. The quality of life experienced by urban populations will determine our global future. So a child-friendly approach to urban planning creates inclusive cities that work for everyone.

Arup's report Cities Alive: *Designing for Urban Childhoods* inspires a positive response to these challenges, and sets out actions to help create a more child-friendly future – well beyond simply providing playgrounds. With streets and spaces in front of homes making up, on average, at least 25% of a city's area, it's these spaces that have the greatest potential to encourage everyday freedoms and social interaction.

The evidence we gathered shows that the amount of time children spend playing outdoors, their ability to get around independently, and their level of contact with nature are strong indicators for how a city is performing. If cities fail to address children's needs, they risk economic and cultural impacts as families move away.

Our report draws on 40 global case studies, making 14 recommended interventions and 15 actions for city leaders, developers, investors and built environment professionals. It shows how we can create competitive, resilient, healthier and more inclusive cities for everyone to live, work and grow up in.



Related UN SDGs:

The project is contributing to targets 3.4, 3.9 11.2, and 11.7.

A model of resilient regeneration

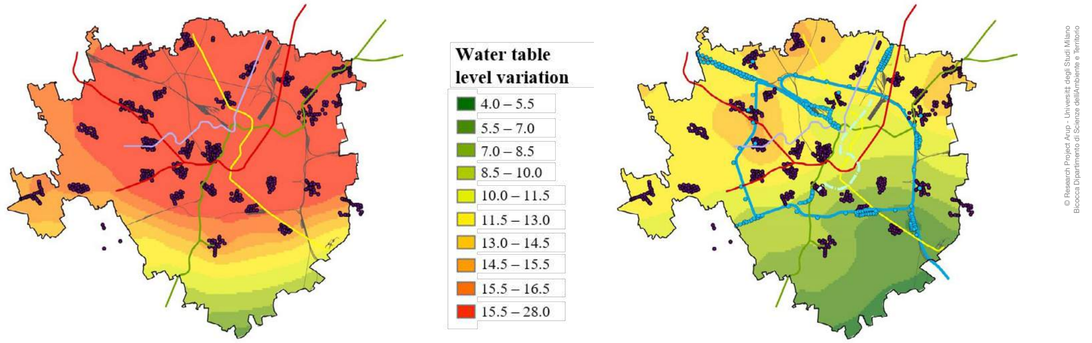
Fiume Verde, Italy

Fiume Verde (Green River) is an urban reforestation project that aims to regenerate Milan's disused railway yards. Envisioned as a continuous system of forests, oases, gardens and orchards, as well as parks for sport and leisure, the linked green infrastructure will transform the former railway freight terminals.

The masterplan for Green River includes 45km of accessible green space, fringed with a high density urban area. The regeneration project is an opportunity for Milan not only to create an extensive green corridor, but also to add much-needed social housing, residential areas for young people and students, as well as create workspaces, public amenities and support services.

The masterplan integrates with city-scale infrastructure and includes an urban mobility ring, an extension of Milan's metro system; once completed, this will give Milan one of the most extensive public transport networks in Europe. Proposals include using the naturally occurring aquifer that runs underneath the proposed development area to provide fresh water, and to generate heating and cooling via a water-to-water heat pump. This will increase the resilience of Milan and produce an estimated 400,000 MWh/year of renewable energy.

The green infrastructure will improve air quality and help protect urban biodiversity; it has been estimated that Green River will save 130,000 tCO_2 by fostering the use of green energy and will absorb 59,000 tCO_2 annually, allowing also for an additional saving due to its cooling action. A model of resilient regeneration, Green River offers Milan a unique opportunity to enhance the city.



Related UN SDGs:

The project is contributing to targets 6.1, 6.4, 7.1, 7.2, 8.3, 8.4, 9.1, 11.1, 11.6, 11.7, 12.2, 13.1, 13.2, 15.1, 15.5, and 15.9.

Protecting a valuable water resource

Tung Chung New Town Extension (West), Hong Kong

Arup is formulating a development scheme for Tung Chung New Town Extension (TCNTE) under a Hong Kong government initiative. Once complete, TCNTE will provide over 49,000 residential flats and provide 877,000m^2 for commercial use. By adopting first principles based on conservation, Arup is ensuring that nearby Tung Chung Stream will be protected from pollution and flooding.

A section of the development, TCNTE (West), is located at Tung Chung Valley, alongside the ecologically sensitive Tung Chung Stream. Arup is implementing a comprehensive regional Sustainable Urban Drainage System (SuDS), which is a first for a new town in Hong Kong.

Tung Chung Stream is one of the few relatively large streams in Hong Kong that still retains its natural setting, although the downstream section of the stream is currently channelised. The aim is to revitalise this stream section by restoring it to its natural state, thereby providing ecological connectivity for the entire stream. Elements such as fish ladders, instream refugia and flow deflectors will also enhance biodiversity.

By installing SuDS devices such as roadside bioswales, roadside infiltration planters, permeable pavements and wetlands, polluted stormwater runoff will be collected, attenuated and treated before discharging to the stream, thereby protecting the high ecological value of Tung Chung Stream.

Part of the development includes a river park which will give visitors the opportunity to experience and learn about the local ecology. Plans include a visitor centre, butterfly garden, bird hide and botanic gardens, as well as stream crossings to improve accessibility.

To enhance safety and ensure flood protection for residents, we will also be undertaking an analysis of the stream's hydraulic performance and providing flood control measures, including real-time alerts.

Related UN SDGs:

The project is contributing to targets 6.4, 6.5, 6.6, 8.7, 11.3, 11.7, 11.B, 13.1, and 13.3.

Accounting for Consumption

How a city's impact extends beyond their boundaries

Detailed carbon emissions data is a vital weapon in the fight against climate change. A new study has, for the first time, enabled 79 of the world's leading cities to understand how their impact on climate change extends beyond their boundaries.

The study, conducted by Arup, University of Leeds, University of New South Wales and C40, calculated each city's consumption-based greenhouse gas emissions. The City Consumption-Based Emissions Inventories take into account emissions from the products and services cities consume, such as food or clothing made elsewhere.

If a t-shirt is made in Bangladesh and sold in New York, then, under consumption emissions, we attribute the emissions from its manufacture to New York rather than to Bangladesh. The study used models to trace connections between cities and the rest of the world, broken down by economic sector.

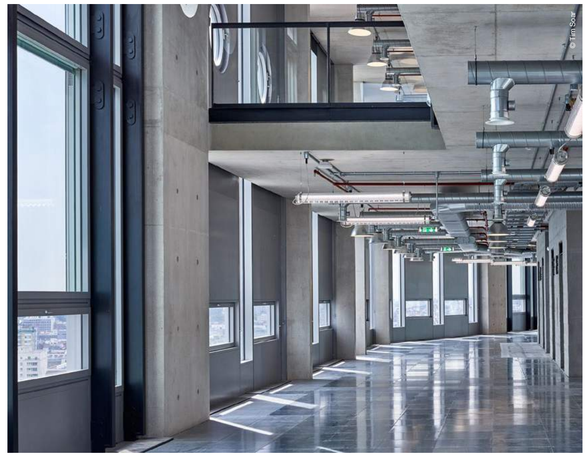
This approach revealed that consumption emissions from the 79 cities are significant, making up 7% of global annual emissions. In fact, 63 of the 79 C40 cities have more emissions from consumption than from production - the true scale of their impact is under-represented using more common reporting methodologies.

Yet the picture is uneven, with consumption emissions across the 79 cities ranging from 2 to 26 tCO2e/capita. This is because wealthy cities such as London, New York and Sydney consume considerably more goods than cities in India, Pakistan, and Bangladesh. The Consumption-Based Emissions Inventories highlight a close link between consumption emissions and GDP.

The study challenges all cities to address how they can reduce their impact. A follow-up project will recommend achievable targets for consumption emissions.

Related UN SDGs:

The project is contributing to targets 11.6, 11.A 11.B, 12.2, and 12.8.



Creating a year-round community space

Shibata City Hall, Japan

The new city hall in Shibata City, Niigata brings all of the local government functions conveniently under one roof. But the new building is more than just an administrative centre, it is a catalyst for revitalisation for this historic city and a place for its citizens to relax and enjoy themselves.

Designed as a place for all, since its opening in 2017, the new Shibata City Hall has held numerous weekend events and has welcomed thousands of visitors to the Fuda no Tsuji, an open community space. On weekdays, students gather here to read and study. Retractable roller shutters and an underfloor heating system to control microclimate ensure the new space remains attractive and comfortable year-round.

The new building needed to provide extensive office space while fitting in with its low-rise surroundings. To achieve this, the building was designed with a 'cloud-like' upper level, a light structure with a pale grey glass façade that reflects the sky, and a heavier concrete lower level. In this earthquake prone region, this created the biggest structural engineering challenge as it was essential to minimise earthquake vibration impact on the light upper levels of the building.

Arup's solution was to arrange isolator devices between the upper and lower levels, a subtle variation on conventional design. This provided the most economical solution as it allowed us to minimise the structural frame size requirement, while making the most of the limited architectural space and safeguarding access for inspection and maintenance.

Surrounded by paddy fields, the city is also at risk of floods. To reduce this risk, rain water is harvested and stored in a tank in the basement. This acts as runoff control and provides water for flushing and irrigation. Additionally, a number of strategies reduce energy consumption and enhance thermal comfort, such as double-skin façades, combined heat and power, chilled ceilings, and solar chimney natural ventilation.

Related UN SDGs:

The project is contributing to targets 6.5, 6.6, 11.6, 13.1 and 13.3.

Shaping Tonga's energy future

Tonga Energy Roadmap, South Pacific

It's not every day that you get the opportunity to drive the redesign of an entire country's energy network. And so it is for us with the Kingdom of Tonga, the remote South Pacific island nation. It is currently dependent on diesel generation (90%). We are working with them on a transformational project to ensure an orderly transition to greater levels of renewable energy penetration.

Our roadmap enables them to achieve 58% renewable energy generation by 2020, with the maximum possible by 2030 — much more than previously thought feasible.

The Kingdom of Tonga, like us, can see the possibilities. Aside from a reduction in greenhouse gases and greater energy security, Tonga will make significant cost savings allowing them to reinvest that money back into their people.

A unique opportunity

Tonga had a ten-year Renewal Energy Roadmap but with three years left to meet their 2020 target of 50% renewable energy, they asked us to assist. What sort of assets are needed? What will it cost? How can we attract donors, independent power providers?

Beyond technical assistance, taking a 'total design' approach, we worked out that 58% renewables were achievable within three years and in fact cheaper than aiming for 50%. We also advised on a possible 91% figure for 2030 to ensure maximum renewable energy efficiency, and to enable grid reliability and stability.

A game-changer for the people of Tonga

For Tonga, low-cost, green, reliable energy is a game-changer. The economic impact of achieving the projected outcomes extends beyond decoupling imported fuel cost from the Tongan economy. A reliable and sustainable energy source can enable Tonga to make new plans — improve agricultural productivity, develop the tourism industry and invest in upskilling their own people. We continue to work with the Kingdom of Tonga, helping them to achieve their targets.

Related UN SDGs:

The project is contributing to targets 7.1, 7.2, 7.A, 7.B, 9.1, and 9.4.

Facilitating the Transition towards a Circular Economy

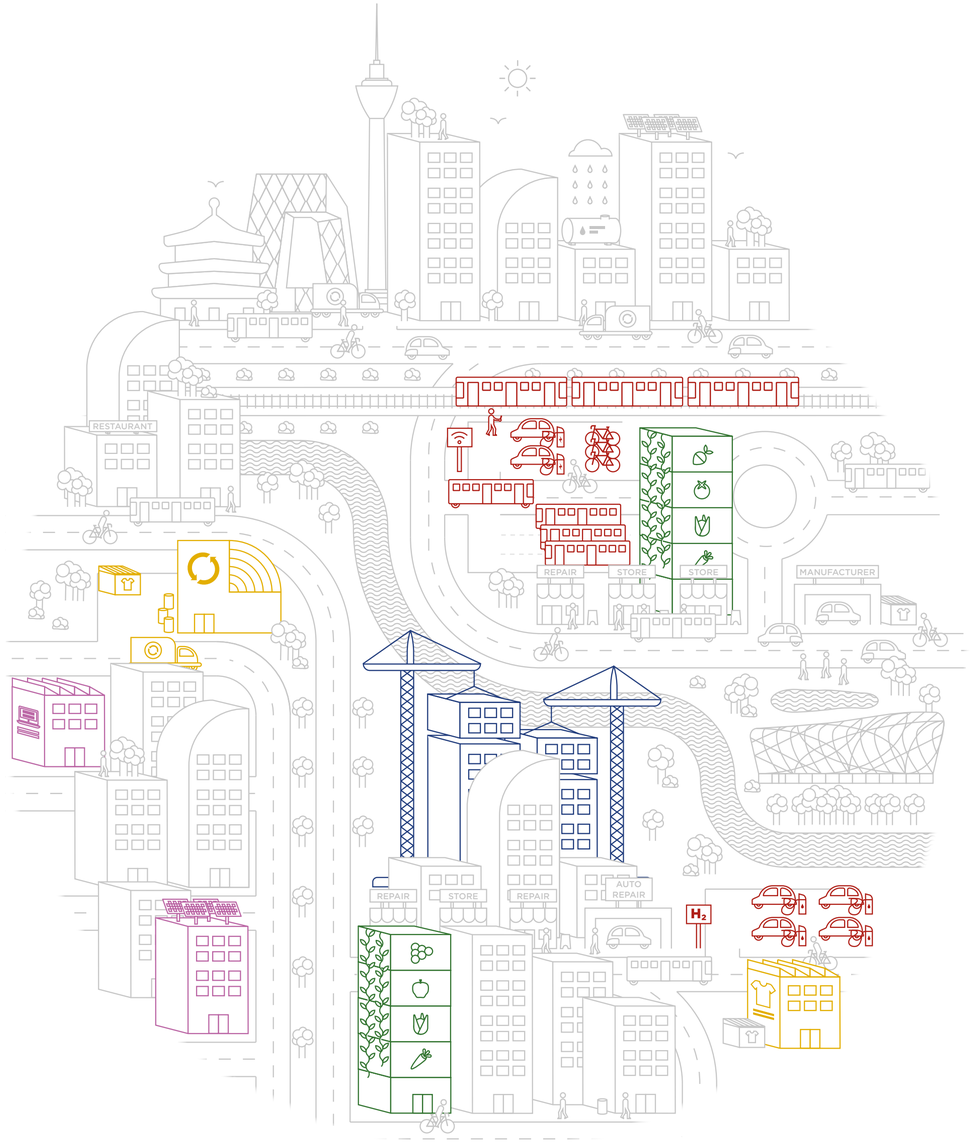
Circular Economy Opportunity for Urban and Industrial Innovation in China

At Arup, we are convinced that a circular economy can drive the shift towards more sustainable forms of economic growth, urban life and value creation. As knowledge partner for the built environment for Ellen MacArthur Foundation (EMF), we are sharing knowledge and collaborating with partners globally to accelerate this shift.

In collaboration with EMF and McKinsey, Arup contributed to *The Circular Economy Opportunity for Urban and Industrial Innovation in China*, a report that demonstrates the huge potential a circular economy has for China in terms of environmental, material and operating cost reduction in 2030 and 2040. It calls for an ambitious, systematic approach to applying circular economy principles and embedding various measures across five high-impact areas: the built environment, mobility, nutrition, textiles and electronics.

China has long been a frontrunner on circular economy policies, having experienced the detrimental effects of rapid urbanisation in terms of pressure on resources, high rates of waste and pollution, and inequality. But to fully realise the transformative effects of a circular economy, it is imperative that China's decision-makers are convinced of the scale of the economic opportunity.

To this end, the report has been used as a tool to initiate dialogues with local stakeholders from government, business and academia, and engage stakeholders along the supply chain to capitalise on China's existing circular economy initiatives and policies. The report's aim is to increase momentum and focus, and to inspire decision-makers by demonstrating how they can contribute to urban and industrial innovation in China.



Related UN SDGs:

The project is contributing to targets 9.5, 12.2, 12.5, and 17.1.

Protecting New York City's Waterbodies

New York City green infrastructure programme

Like many urban areas, New York City has combined sewer systems that carry both stormwater and wastewater, and during heavy rains, these systems can overflow into waterways. The New York City Department of Environmental Protection (NYCDEP) is implementing a large-scale green infrastructure (GI) programme to improve water quality and deliver on its obligation to reduce its combined sewer outflows (CSO).

BENEFITS OF GREEN INFRASTRUCTURE

GI manages stormwater by absorbing rainfall at the source and reducing rainfall runoff that would contribute to CSO. GI also provides many environmental and social co-benefits, including improving air quality, reducing the heat island effect, absorbing carbon emissions, providing jobs in construction and maintenance, and increasing green space across the City.

CHALLENGING PROGRAMME

NYCDEP's goal is to reduce the amount of CSO by 1.67 billion gallons of stormwater per year by 2030 through capturing the first inch of rainfall on 10% of the impervious areas in combined sewer watersheds using GI. Arup was appointed to oversee the design solutions for 1,365 acres within three different sewersheds in New York City. The aim was to retrofit existing city streets with as many right-of-way raingardens as possible, as well as design various GI within multiple city public properties including six city parks, two public housing campuses and one public school.

AMBITIOUS INNOVATION TO MEET AN AMBITIOUS PROGRAMME

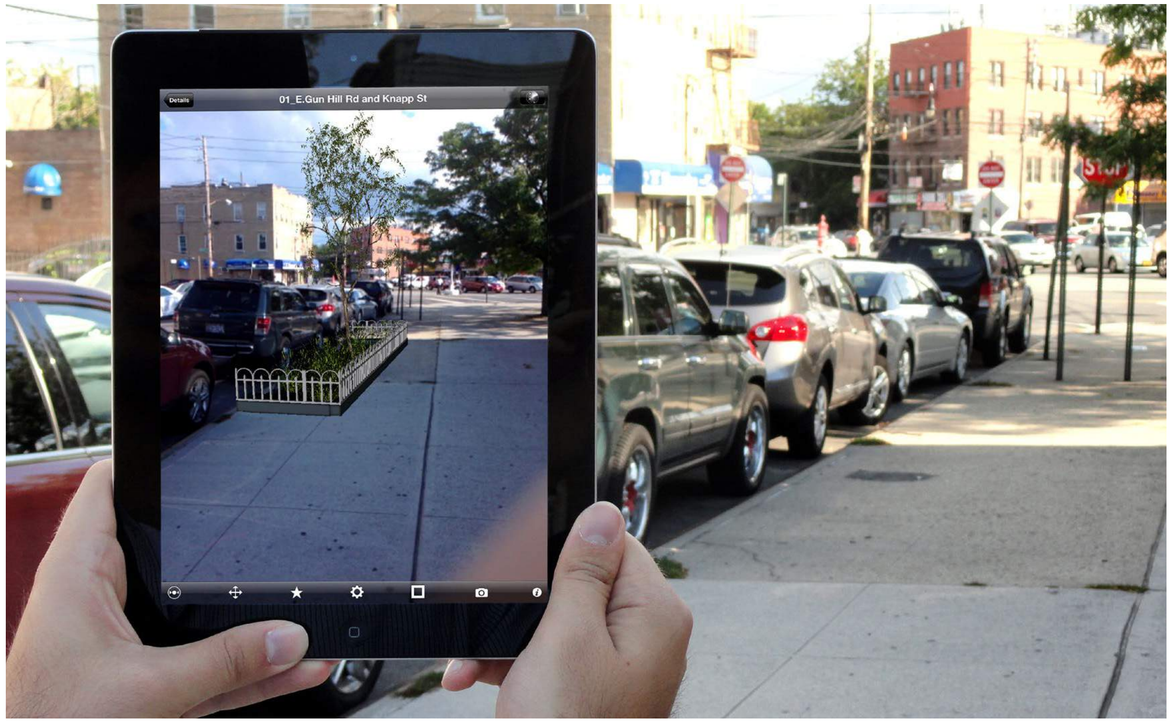
Managing such a large-scale GI programme, the largest of its kind in any US city, required that we adopt a cutting-edge approach. To appraise each potential location, we utilised the latest in mobile data collection technologies to increase efficiency, reduce human error, and collect records of locations linked to a mapping and data management system. We leveraged our expertise with BIM principles to then seamlessly translate data collected from the field into the design drawings.

Related UN SDGs:

The project is contributing to targets 6.5, 9.1 and 11.6.

AWARDS

Silver Award, Category F: Waste and Stormwater, ACEC New York Engineering Excellence Award, 2017



Enhancing a Natural Asset

Seeing a constraint as an asset to guide a masterplan

With the right approach, large-scale development can create opportunities to enhance ecosystems. Our masterplan for one of Abu Dhabi's key growth areas retains and enhances an area of mangroves, salt-tolerant trees, preserving this environmental asset for future generations.

Our masterplan for the 105-hectare Reem Downtown area of Reem Island creates a walkable new urban district that employs sustainable placemaking to drive behavioural change through measures such as providing shading to over 80% of the streetscape. Key to our approach was to view the large area of mangroves as an asset, rather than a constraint. They are an important nursery area for many species of fish and protect the coast from erosion and storms, and had previously been much more widespread in the area.

To safeguard the mangroves, we worked with other stakeholders to relocate a proposed bridge that would have encroached on the area. Our waterfront design proposed soft edges where sea walls are not essential, and a unique transition from urban area to mangroves using a naturalised canal instead of a heavily engineered waterway.

At our suggestion, a Mangroves Education Centre will bring residents closer to nature and educate them on the value of this unique asset, which they will be able to explore along pedestrian and cycle links. Our approach now forms an integral part of a mangrove rehabilitation initiative agreed by all Reem Island developers and government authorities.

Related UN SDGs:

The project is contributing to targets 11.6, 14.1, 14.2 and 15.5.

Adaptive water planning to unlock potential

Regional water blueprint in Northern Queensland, Australia

Arup, in partnership with Deloitte, provided a future water solutions blueprint for the Burdekin region of Northern Queensland using Arup's 'foresight' horizon-scanning methodology. By analysing regional, Australian, and global trends and drivers, we were able to determine the major influences on the area's future.

Northern Queensland is rich in resources and land suitable for agricultural development, but uncertainty around water requirements and future constraints is a barrier to growth. Adaptive water infrastructure planning can unlock this potential and enhance regional prosperity. However, deciding on the right mix of solutions is a challenge.

Our output enriches the knowledge base underpinning long-term water infrastructure planning and decision making in the region, as well as supports the State government's initiatives to make better use of existing resources. It puts the region in a better position to unlock supply side constraints and respond appropriately to meet future water demand.

Four 'plausible visions of possible futures' were explored and developed, including triggers for each scenario, and how best to respond to changes in the policy environment, natural environment and/or local and global market conditions that influence water demand and supply in the Burdekin. We created a decision-making framework to assess and rank promising options based on both their commercial feasibility and benefit to the local economy.

The approach has included a fresh review of previously considered alternatives and identified which options are more suitable for each of the possible future scenarios, essentially resetting the agenda by testing previous thinking. It also assesses which of the water solutions currently under consideration to fast-track.

Related UN SDGs:

The project is contributing to targets 6.1, 6.4, 9.1, 12.2, 13.1, 13.2, 13.3, and 17.14.

Our Performance

We monitor and report on our performance annually to track progress against our targets. Each year we report on 15 key performance indicators (KPIs). Global results are provided below, as well as region-specific data in relation to our global targets. Our Community Engagement initiative is also provided to highlight achievements beyond our KPIs.

This data covers performance from 1 April 2017 to March 31 2018 across all five regions: Americas, Australasia, East Asia, Europe and UKIMEA.

Global Results | *Regional Results* | *Community Engagement*

COMMUNITY INVESTMENT

£3,080,000 invested in community engagement
(paid staff time and donations) compared to 2,400,000 in 2016/17
19,700 hours of pro-bono advice and volunteer work
compared to 16,000 hours in 2016/17

CARBON EMISSIONS

3.0 tC02e/employee/year scopes 1, 2+3 business travel
5% reduction from 2016/17

SUSTAINABILITY TRAINING

1.2 hours sustainability training per employee
compared to 1.3 hours in 2016/17

DIVERSITY

20.4% of management positions occupied by females (grades 7-9)
compared to 18.4% in 2016/17
33.2% management staff completed diversity and inclusion training
compared to 19.6% in 2016/17

CARBON EMISSIONS

Source of scope 3 emissions;
42% project travel, 52% Arup internal
travel and 6% job possible travel

PROJECTS

30% of projects over £150k
report specific sustainability objectives
compared to 40% in 2016/17

PAPER USE

18.8 kg paper / employee / year
compared to 22.8 kg in 2016/17

ENERGY USE

208 kWh/m2/year
compared to 236 kWh/m2/yr in 2016/17

MANAGEMENT SYSTEMS

99.3% of staff in offices certified to
ISO 14001 Environmental Management System
compared to 99.8% in 2016/17

Our Performance 2017/2018

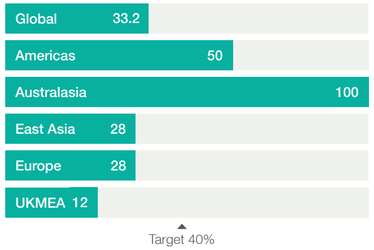
A look at global and regional KPI results for the past financial year.

This data covers performance from 1 April 2017 to 31 March 2018 across all five regions: Americas, Australasia, East Asia, Europe and UKIMEA.

Global Results | Regional Results | Community Engagement

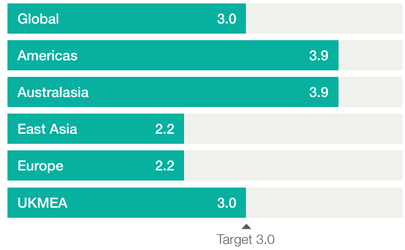
DIVERSITY AND INCLUSION TRAINING

(% grades 7-9)



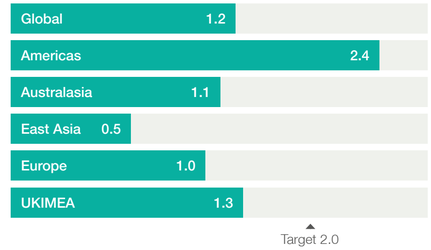
CARBON EMMISONS

(tCO_2e / employee / year)



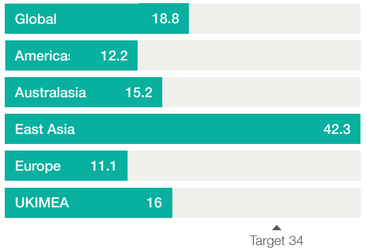
SUSTAINABILITY TRAINING

(hours / employee / year)



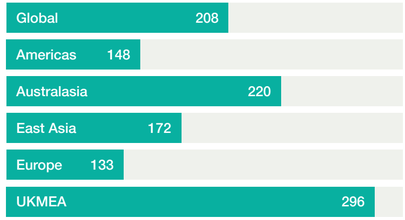
PAPER CONSUMPTION

(kg / employee / year)



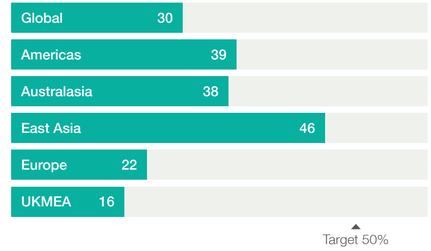
ENERGY USE

(kWh / m^2 / year)



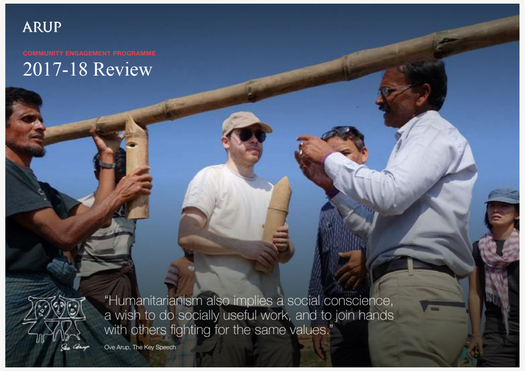
PROJECTS SETTING SUSTAINABILITY OBJECTIVES

(% projects with fee > £150,000)



Community Engagement

Our firm has always placed social usefulness high among its values. Through our Community Engagement work, we actively encourage and support our people to participate in charitable activities as a key part of our contribution to shaping a better world.



www.arupcommunity.org

Our approach is rooted in trusted partnerships and we thank the range of small to large organisations, companies and political institutions that have joined their expertise with our own to give our Community Engagement the greatest possible impact.

We released a community engagement programme review that highlights our contributions and our three-year plan which at its core will ensure that the investment of resources, trust and support in our Community Engagement continues to have the impact it deserves.

Over the next three years we will continue to evolve the programme so that even more people can get involved and the communities we support can receive the greatest possible benefit.

We will encourage more people from a broader spectrum of disciplines – and more people from senior grades – to take part. Increasing awareness of the programme will also help the firm recruit and retain talented people – many already cite Community Engagement as a reason for choosing Arup.

To ensure our people can make the biggest possible impact, we will carefully target our Community Engagement effort in line with key UN SDGs, focused on the poorest and most marginalized populations which will be an important part of the broader firm's commitment to these goals.

In 2017/2018

COMMUNITY ENGAGEMENT ACTIVITIES INCLUDED 170+ MAJOR PROJECTS ACROSS 38 COUNTRIES

1 IN 7 ARUP EMPLOYEES PARTICIPATED IN COMMUNITY ENGAGEMENT ACTIVITIES

10,300 HOURS OF ADDITIONAL UNPAID TIME CONTRIBUTED BY STAFF TO COMMUNITY ENGAGEMENT ACTIVITIES

ARUP