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Sustainability Report 2016/17
UK, Middle East & Africa Offices

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Foreword

Welcome to our fifth annual sustainability report showcasing some of the many ways we have brought innovation to our clients’ projects to deliver improved environmental performance and increased wellbeing.

Arup continues to take its commitment to the Paris Pledge very seriously, working to enable a world in which climate change is limited to a maximum of 2°C. Our recently relaunched Global Strategy confirms environmental issues as central to our approach. Each of our four key markets – cities, transport, energy and water – have clear links with the UN Sustainable Development Goals which we are now using as reference points within our projects.

Our efforts to positively impact the sustainability of our projects sit alongside initiatives to reduce the environmental impact of our facilities and promote community engagement work with strategic partners. We are also very proud of the innovative products that are being brought to market through our Ventures team, each of which has a strong sustainability component.

This year sees the launch of our partnership with ClimateCare. Around 20,000 fuel-efficient stoves will be distributed in Kenya to reduce carbon emissions and significantly improve the indoor air quality for families previously using open fires to cook. This initiative was driven by our Group Board, demonstrating our commitment to this agenda at the highest level in our firm.

This report has been prepared for the first time to align with the Sustainability Standards of the Global Reporting Initiative (GRI) as part of our drive to increase transparency. It covers work in the 16/17 financial year and includes projects carried out by our UK, Middle East and Africa offices. It shows just a small number of the ways in which we continue to stay true to our values, and shape a better world.

Derville Mitchell
UKMEA Region Chair, Arup
Sustainability at Arup

Arup’s global reach and the diversity of our skills means that we work on a wide variety of project types, from engineering input on heavy infrastructure projects in developed countries to providing long-term strategic advice to emerging cities. As a result sustainability can take many forms.

Instead of relying on a relatively small proportion of experts, our aim is for every one of our staff to be able to understand their projects impacts in terms of sustainability and what could be done to reduce adverse effects and maximise benefits. To help us do this we are using the UN’s Sustainable Development Goals (SDGs) as a framework against which to set project aspirations and targets for the most important aspects of social, economic and environmental sustainability. The Goals are deliberately high-level and all-encompassing: as such, we have found it useful to use a level of interpretation to increase their direct relevance to the type of work we do.

The Goals provide a structure that enables us to identify the issues which each of our projects can have the greatest impact on. This allows us to focus on specific actions to drive improvements, avoiding the problem of being overwhelmed by the very breadth of issues encompassed within the term ‘sustainability’. This report draws out 10 themes that reflect some of the main business areas we have been working on this year. They directly relate to a number of the Goals (as indicated within each section), using project examples to highlight how our work can have positive impacts. Outside of our project work, we are also focusing on embedding the Goals into our own operations.
Healthy living & improved wellbeing

The built environment is increasingly expected to help individuals, organisations and communities to thrive. Why? Because modern lifestyles and workplaces mean the majority of people spend most of their time indoors. At Arup we understand this, and help the built environment fulfil its potential to promote health and wellbeing.

Related UN SDGs:

> Continue reading
Patient-centred design
For patients undergoing medical treatment, wellbeing is particularly important. This is why Guy’s and St Thomas’ NHS Foundation Trust wanted its New Cancer Care Centre to be patient-friendly. Our team was instrumental in achieving this despite the very specific engineering performance requirements for the centre’s radiotherapy and linear accelerator treatment areas, a research laboratory and complex services.

To combat the unease many patients feel in hospitals, the building is arranged on a human, almost domestic, scale. Building services and technical complexity are hidden from view – an approach which made the engineering design more challenging.

For any single visit, a patient should only need to attend one of the self-contained treatment villages, which have naturally lit consultation rooms at the front and highly serviced treatment rooms at the back. Planting, balconies and terraces provide relaxing spaces, and artworks offer focal points for contemplation, rest and inspiration.

The building includes six linear accelerators (LINACs) for radiotherapy. LINACs are typically sited on the ground floor or in basements due to the weight of the equipment and shielding required. At the request of the Patients’ User Group, the New Cancer Centre at Guy’s is the first in Europe to accommodate linacs above ground so that patients can wait for their radiotherapy treatments in naturally lit spaces.

The building is rated as BREEAM ‘Excellent’. This was achieved through a well-shaded façade and connection to the hospital campus energy centre.

Understanding wellbeing
With more people living and working in cities, it’s becoming increasingly important to understand how buildings can contribute to wellbeing – and to identify where improvements can be made. To enhance such knowledge and understanding, Arup and The Crown Estate recently took part in the UK Green Building Council’s Wellbeing Lab.

This seven-month knowledge-exchange programme was designed to guide participants through the measurement and implementation of best practice health and wellbeing principles. This included using sensors to measure physical parameters in the spaces, such as air quality, and gathering feedback from occupants to understand user experience.

For the lab, we examined a building office space in The Crown Estate’s portfolio. By combining building performance engineering with the science of environmental psychology and human factors, we explored just how healthy this office space was for the tenant’s staff and its business. We also identified potential improvements in areas such as air quality and lighting.

Reducing freight emissions
An individual building can only do so much; the wider urban environment also needs to promote health and wellbeing. To help improve urban air quality, Transport for London (TfL) has run a series of initiatives to improve air quality – such as retiming and consolidation of deliveries, and promoting low emission vehicles. These initiatives aim to reduce emissions from vans and lorries in the city.

We developed a tool that enables TfL to determine just how effective these initiatives are. The FLEET tool covers emissions, air quality, costs and health impacts. As well as assessing past and ongoing measures, FLEET can help assess schemes before they go into operation – ensuring they really will deliver the expected benefits.
Water resource management & efficiency of use

Water is life. The world depends on it for drinking, agriculture and industry. But population growth, climate change and increasing demand are causing problems associated with both too much and too little water, such as flooding and drought. This is why Arup focuses on water, and why we work across the water cycle, developing vital engineering solutions to manage water resources.

Related UN SDGs:

> Continue reading
Local water management

As climate change leads to more variable rainfall, flooding is threatening more homes around the world. In response, we are working with clients on solutions to reduce flood risk and protect people and their property.

In the city of Hull, we have helped Yorkshire Water to reduce flood risk through our design of Bransholme Surface Water Pumping Station. This is a unique, and sensitively designed, structure which incorporates on-site renewable energy generation and increased biodiversity.

In 2007, around 1,000 homes in the catchment were badly affected when catastrophic flooding hit the city of Hull. Since then we have worked with Yorkshire Water at the site to help aid the area’s recovery by building emergency capacity at the pumping station and develop a long-term strategy for safeguarding the area.

The new station provides four times the pumping capacity of its predecessor. It reduces flood risk for over 15,000 properties using a system of pumping, storage and release as part of the River Hull Integrated Catchment Strategy.

As well as enabling new development and housing to the north of the city, the pumping station protects some of the most deprived communities in Hull. It also showcases how a major infrastructure project on a sensitive site, if well designed, have a positive impact on surrounding communities.

Re-landscaping the site with meadows and trees, and installing the largest movable green roof in the UK, achieved a net increase in biodiversity. The roof also includes photovoltaic panels to provide renewable energy to the facility, while large windows bring plenty of natural light into the building.

The result is a robust and reliable pumping station that makes a positive contribution to the local environment.

National water management

Cities have a vital role to play, but water also needs to be managed effectively at a national scale. Our strategic advice is helping water companies such as Dŵr Cymru Welsh Water prepare for the challenges ahead.

Welsh Water wanted to know how it could withstand the shocks and stresses facing the water industry between now and 2050. Such stresses include population growth, ageing infrastructure, changing regulations and customer expectations. We worked with Welsh Water to develop a pioneering Resilience Framework and Strategy to anticipate, adapt, respond to, and recover from the challenges they know about – as well as the ones they don’t – so they can continue to meet their customers’ needs and expectations. The best practice resilience framework draws on our global experience of resilience planning for cities and infrastructure.

We applied the resilience framework through workshops with Welsh Water to identify areas of best practice and areas for improvement. Together, we developed actions to improve their resilience, including taking a more active role with other stakeholders in managing water catchments to promote better raw water quality at source. We created a programme of green infrastructure to address urban flooding and pollution across Wales and developed a circular economy and carbon plan. We are helping our client to be an energy neutral business through improving the efficiency of its assets, deploying smart control systems, installing on-site renewable energy generation and creating energy storage facilities.

The Resilience Framework and Strategy will help Welsh Water to achieve its long-term vision to “earn the trust of customers every day”. The work was recognised at the 2017 Management Consultancies Association Awards.
The world is becoming increasingly hungry for energy. As a result, the issues of energy security, sustainability and affordability are coming to the fore. How can this energy ‘trilemma’ be tackled? It requires approaches that are sympathetic to each country’s stage of development, and which consider appropriate generation, efficiency and storage. Against this backdrop, we target the areas where we know we can make a real difference.

Clean & efficient energy generation & delivery

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Related UN SDGs:
Creating energy-efficient buildings

Minimising a building’s energy use is a huge challenge – particularly for buildings that have historically been energy-intensive, such as research laboratories. It is a challenge that requires expertise in both building design and operation.

Our teams are putting this into action on projects such as The Francis Crick Institute in London. A partnership between six leading biomedical and academic organisations, the building brings 1,250 scientists together under one roof to form the largest biomedical research institute of its kind in Europe.

So how are we helping The Francis Crick Institute to be more energy-efficient? The design of the building follows a tiered “be lean, be clean, be green” approach to carbon reduction, in accordance with the London Plan. Lean design, highly efficient plant and extensive sub-metering combine to save more than 35,000 tonnes of CO₂ per year.

This efficiency also brings financial benefits. Using a combined heat and power (CHP) engine to provide electricity, steam and two grades of hot water cuts utility costs by over £1m every year. Electricity also comes at a discounted rate via a connection to Camden’s district heating and power scheme.

Some 810 photovoltaic panels are incorporated into the building’s roof. Each has its own inverter to maximise performance. The result is a building that sets a new benchmark, not only in collaborative research, but also in energy-efficiency for this type of facility.

Developing low-carbon technology

Even with dramatic improvements in energy-efficiency, the world must still find new, low-carbon ways to meet future demand. As well as helping clients implement established renewables such as wind and solar power, our work is influencing the development of cutting-edge technologies such as wave power.

For example, we enabled Dŵr Cymru Welsh Water to install a new 2.5MW wind turbine at its Nash Wastewater Treatment Works - overcoming the challenge of getting the huge components to site.

After examining all the alternatives – including using a helicopter – we recommended to the client the turbine be delivered by ship to a nearby steelworks. A lorry then carried the turbine along a temporary road to the treatment works. Finally, we dealt with connecting the turbine to the grid – a challenge that involved interfacing with a switchgear built decades ago.

The turbine will provide the bulk of power required on the site and help the company achieve its target of generating 100GWh of renewable energy across its sites by 2020.

Whilst wind is a proven option for low-carbon power, wave energy’s potential remains largely untapped. The UK’s embryonic wave energy sector suffers from technical challenges and the high costs of early stage product development.

Our experts have helped to address this through our work with Wave Energy Scotland. Drawing on best practice from other offshore industries, we created a guidance document summarising a recommended methodology for assessing the loads and structural integrity of wave energy devices. This will help to create a consistent standard, reassuring potential investors and stakeholders that the devices can withstand the hostile ocean environment.

Wave Energy Scotland also used our report to guide a £2.5m initiative, investigating how novel materials could reduce the capital cost of devices and improve their durability.
Despite marked progress in reducing poverty over the last decade, roughly half the world’s population still lives on the equivalent of about US$2.50 a day. Economic growth needs to be broader and deeper in order to promote inclusive and sustainable development. To help bring this about, we apply our expertise to engineering and development projects to bring lasting benefits to communities around the world.

Positive development & growth

Related UN SDGs:
Creating safer schools

Education is key to tackling poverty. Yet every year natural disasters such as cyclones, earthquakes and floods destroy or damage school buildings around the world. This destruction and damage injures or kills thousands of students and teachers, while many more students have their education significantly disrupted.

The world needs safer schools that can withstand such disasters. But what makes a school safer? The World Bank Group asked us to examine this question to support their Global Program for Safer Schools (GPSS) which aims to prioritise investment in making school buildings safer and providing quality learning environments. We became a key technical adviser for the GPSS initiative, working collaboratively with the World Bank, development partners and academic institutions to shape a robust and consistent approach in multiple countries across the world.

One of our key contributions has been in the development of the Safer Schools Roadmap which provides a comprehensive approach to identifying and addressing the key risks that affect school safety. As well as looking at the integrity of school buildings, the Roadmap examines other factors affecting safety: it identifies opportunities to enhance regulatory procedures and the skills and capacity of people who plan, design, implement, operate and maintain school facilities.

The Roadmap is part of a suite of tools that enables the World Bank to engage governments to address the critical issues that affect the safety of school facilities and provides a pathway for the development of a national school safety programme.

To date, the Roadmap has been implemented in more than ten countries including Mozambique, Mongolia, Indonesia and Vanuatu, and has highlighted key areas to achieve a safer school building stock. In Indonesia for example, the Roadmap helped identify and prioritise 225,000 existing schools that are vulnerable to natural hazards, which has enabled the government to target investment where it is needed most.

A full copy of the report can be found here.

A bridge to prosperity

Sometimes the barriers that keep people in poverty are physical. In Kukibuye, Rwanda, the only way across the river for thousands of people was an unsafe bridge made of four large logs. In just one year, two people were killed and seven injured whilst attempting the crossing.

Volunteers from Arup and Bechtel worked with the charity Bridges to Prosperity to create a safer crossing for the local community. Now 12,000 people in Kukibuye have permanent, safe, year-round access to schools, markets, and healthcare facilities on the other side of the river.

With limited construction equipment and expertise available locally, the Arup-Bechtel team worked to upskill the local community, delivering maintenance workshops with the local bridge committee. All materials were locally sourced or recycled, with the steel bridge towers made in the engineering department at the university in Kigali.

The project was completed in three months, with the superstructure constructed in just nine days. The team worked hard to create a culture of safety with no accidents on site.

The project shows how something like a bridge, which many places take for granted, can promote the long-term sustainable, economic and social development of a community.
Transport networks keep society moving, providing global, regional and local connections for people and goods. But they can also bring pollution and congestion, and are not always accessible to everyone – creating inequalities. Tackling climate change and creating healthy, vibrant, safe communities with clean air demands a new direction. We are helping our clients to transform cities by creating smart and resilient solutions for moving people and goods.

Accessible & safe transport networks

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Related UN SDGs:
Towards a walking world

Walking is a convenient, healthy and enjoyable way to travel short distances – or it would be if only cities were better designed. Our research, Cities Alive: Towards a walking world, investigates the role of walkability in developing more liveable, sustainable, healthy, safe and attractive cities.

The report highlights 50 benefits of walking, explored through 16 distinct themes. Beyond improvements in air quality, this includes a whole range of social, economic, environmental and political benefits. Did you know, for example, that people who frequently walk are more likely to report better mental health? And that walking boosts local economic activity, because pedestrians spend more than drivers locally?

Informed by a catalogue of 80 international case studies from Seoul to San Francisco, our work lists 40 actions that city leaders can consider in walking policy, strategy and design. These include car-free days, health campaigns, encouraging walking, and economic incentives such as congestion charging. We even found that public art can help to foster an environment where pedestrians have priority.

The report has stimulated dialogue about transport planning and human-centric urban design with major city leaders and key decision-makers in the built environment. Following publication, we are continuing to champion human-centred design that puts walking first.

A copy of the full report can be found here.

Smart solutions for the last mile

One of the major challenges for any transport network is the last mile. When a passenger steps off the train or bus in a city centre, how can they travel the last mile to their home, office or other destination safely and sustainably?

Not everyone can walk or cycle, so this is an opportunity to get people out of cars and onto low-carbon public transport instead. This is where driverless cars could come in, and Arup is leading a trial to establish their potential for short-distance city transport.

The trial is part of Arup’s work as programme leader and lead technical coordinator for UK Autodrive – a three-year consortia project part-funded by the government, through which we will trial autonomous vehicles in real-life applications, appraising the social, economic, environmental and political aspects as well as the technology readiness.

In spring 2018, 40 driverless electric pods will take to the streets of central Milton Keynes. Members of the public – including people who find it hard to access other modes of transport – will be able to hail and ride the pods, helping the consortia test the potential of such a transport system at city scale.

There’s a lot of work to do before the trial can begin. In the run-up, we’re coordinating a number of increasingly stringent tests on the vehicles and the autonomous control system they will use to navigate. We are also setting up the mechanics of the trial, including the appointment of an operating company to manage the system and the fleet of vehicles.

With everything in place, the trial will help establish the engineering and business case for low-speed autonomous transportation systems.
Resilient cities people love

By 2050, cities will be home to 70% of the world’s population. To support urban communities in the face of changes to infrastructure, climate and demography, cities must endure, adapt and transform – becoming more resilient. Our expertise in the research, planning and design of cities is shaping great places for people to live and work in.

Related UN SDGs:
Global collaboration

City resilience is a critical urban agenda, but how can it be made tangible and practical for cities? How can they build sound strategies and prioritise investment?

Over the past four years, supported by The Rockefeller Foundation, we have developed the City Resilience Index (CRI) – a tool to help policy-makers and stakeholders understand and plan for resilience in a systematic way. The CRI generates a resilience profile that reveals a city’s strengths and weaknesses, creating a baseline to plan from and to measure future progress against.

Traditional disaster risk management looks at a city’s physical assets. The CRI goes further. It recognises the interdependence of physical city systems and the less tangible, but critical, aspects linked to human behaviour. For example, perhaps a lack of economic opportunity has allowed crime to gain a foothold, perhaps falling budgets have compromised flood defences.

The cornerstone of The Rockefeller Foundation’s resilience programme, the CRI is already used by around 120 cities that are learning from one another’s experiences. Our ambition is for more cities to be using the index within the next 18 months, and for it to become the preferred tool for resilience-focused cities globally.

“IT [CRI] has given direction to the discussion and helped to get us to where we are with understanding resilience in Glasgow quicker than we otherwise would have.”

Alastair Brown, Head of Sustainability and the Environment, and Chief Resilience Officer, Glasgow

A copy of the full report can be found here.

Reducing city flood risk

As climate change leads to more variable rainfall, flooding is threatening many cities around the world. In response, we are working with city leaders to build resilience and develop practical and innovative engineering solutions.

In the UK we have worked with Leeds City Council, the Environment Agency, the Canals and Rivers Trust and Yorkshire Water to develop the Leeds Flood Alleviation Scheme.

Recent flooding is thought to have cost the Leeds economy as much as £450m, with homes, businesses and infrastructure regularly threatened. The new scheme will regenerate socially deprived areas near the river and enhance the economic core of the city centre.

Sensitive to Leeds’ historic centre, the scheme offers protection from a 1-in-100 year flood event. It stretches 4.5km along the River Aire and integrates linear defences into the existing fabric of the city. Innovative moveable weirs artificially maintain the river at a manageable level during normal river conditions but can be lowered to significantly improve flow during high rainfall events, resulting in reduced river levels and risk of flooding.

We consulted extensively with local people and organisations, using our 3D city model to communicate how the scheme would work, and acted on their feedback. We also worked hard to minimise the project’s environmental impact, designing special passes for the moveable weirs so fish can still move freely along the river.
Since the industrial revolution, the world’s economy has followed a largely linear take-make-use-dispose model. Materials are sourced, made into products, used and then disposed of. This approach is becoming increasingly unviable as resources dwindle. Resource-hungry sectors such as the built environment are particularly vulnerable. As a global knowledge partner of the Ellen MacArthur Foundation, we are leading the way in applying circular principles to the built environment.
Planning circular communities

A circular economy makes perfect sense in theory, but how do you apply the principles on a real-life community-scale development? We have put theory into action, producing a scoping study that could see the regeneration of an entire West London community using circular economy principles.

Our study shows the benefits of a circular economy approach at Old Oak and Park Royal. It could reduce costs, generate revenues, cut waste, conserve resources, safeguard the environment and help build healthy and successful business and residential communities.

Refurbishing existing buildings instead of demolishing them could save nearly 700,000 tonnes of materials over 32 years. New assets and services would be designed for flexible uses, rather than one fixed end-use. Buildings would be designed for pro-active maintenance and easy disassembly – the components could be swapped out, repaired, replaced and eventually reused.

Locally sourced biomass could meet up to 20% of the development’s electricity demand, while up to 60% could come from locally sourced refuse-derived fuel. The community’s waste could be put to use in other ways too. The 25,000 tonnes of organic waste generated every year in the development would produce enough compost to grow at least 20% of the fresh vegetables households needed, helping to close the organic material loop.

Mobility would be transformed, with car sharing halving the number of vehicles on the road. Meanwhile, local digital platforms would help the community share resources, products and learning.

A full copy of the report can be found here.

Designing circular buildings

As well as reimagining communities, making a circular economy a reality also requires transforming building design. Is it really possible to design a building where, at the end of its life, all its components and materials can be re-used, re-manufactured or recycled?

Locally sourced biomass could meet up to 20% of the development’s electricity demand, while up to 60% could come from locally sourced refuse-derived fuel. The community’s waste could be put to use in other ways too. The 25,000 tonnes of organic waste generated every year in the development would produce enough compost to grow at least 20% of the fresh vegetables households needed, helping to close the organic material loop.

Asking this question profoundly alters design and construction priorities. Engagement is critical, with both designers and suppliers challenged to think differently about materials and construction processes.

Last year, we helped put this new way of thinking into practice. The 2016 London Design Festival showcased a prototype building designed and constructed with the aim of returning all its materials and components to their suppliers at the end of the festival. Developed by Arup in collaboration with Frener & Reifer, BAM Construction and The Built Environment Trust, The Circular Building was an experiment in applying circular economy thinking to the built environment.

Intelligently designed and constructed, the full-scale prototype contained materials that could be removed with minimum damage, meaning each component retained its value. Everything, from window frames to individual fixings, was tagged with a QR code linked to an online materials database containing the information required for the component to be reused.

The database, which can be linked to the building information model, points the way forward for the industry. We hope The Circular Building, by showing what is possible, will help accelerate the transition to a circular economy.
Climate change is already exacerbating serious hazards such as heatwaves and flooding. What can be done? Limiting temperature increases to 2°C could slow the rate of change, but this requires leaving fossil fuels in the ground and finding other ways to power society. At Arup, one of the biggest contributions we can make to this goal is designing a low-carbon built environment that can adapt to a changing climate.
Rising to the challenge

Durham University’s new Ogden Centre for Fundamental Physics shows what low-carbon, low-impact design can do to even the most difficult sites and most energy-intensive buildings.

The University wanted the new centre to bring scientists together and enable inter-departmental collaboration. They also wanted to build an architecturally striking, modern building, incorporating cutting-edge engineering and sustainability features. The only site available was an unpromising, constrained car park on the University campus. Existing utilities, high groundwater levels, reduced accessibility and infrastructure capacity all made construction difficult.

We worked with architects Studio Daniel Libeskind to bring this ambitious project to life. The design ensured the building envelope is extremely thermally efficient, enclosing a form and structure that enabled us to embed passive environmental strategies. A ground source heat pump provides the vast majority of heating for the building, whilst an integrated photovoltaic array provides 35% of the building’s annual electricity consumption. In total, approximately 50% of the building’s energy demand is met by low- or zero-carbon sources.

We also worked to reduce the building’s impact in other ways: A rainwater harvesting system means it uses less potable water; the drainage system has been designed to mitigate climate change impacts; and facilities and bike racks make it easier for people to walk or cycle to work.

The result is a building that has achieved BREEAM ‘Excellent’ and an ‘A’-rated Energy Performance Certificate (EPC), despite housing energy-intensive activities. It also exceeds the client’s brief to provide 15% of its energy from low-and zero-carbon generation.

Adapting to the future

As well as reducing carbon emissions and other impacts, the built environment must be able to cope with the inevitable effects of climate change. These include periods of intense rainfall that could overwhelm combined sewers carrying both sewage and stormwater, leading to flooding and environmental damage.

What can be done? Building new, larger storage tanks to hold the excess stormwater is one option, but this is expensive and carbon-intensive.

Our solution for Dŵr Cymru Welsh Water was to use Smart Control and Pump Systems to manage flow through the existing sewer system during times of stress.

This has helped reduce the frequency of spills from combined sewer overflows along an environmentally sensitive coastline by 30%. In places, we were able to reduce spill frequency by 60% by bringing disused storage tanks back online to work with the new controls.

There are other advantages to this approach too: The construction process is up to 70% cheaper than building new infrastructure, and it generates only 5% of the carbon emissions.

The project demonstrates how smart technology can be used to help adapt existing assets for the future. Indeed, the system is also set up so that it can form part of a predictive catchment management approach that prepares the network for stress before storms arrive.
Ecosystems are incredibly valuable. It is estimated that they are worth up to US$145tn each year, with over 3 billion people dependent on marine and coastal biodiversity alone for their livelihoods. Diverse animal and plant species create resilient ecosystems. Human activities are causing mass extinctions at rates not seen in the last 65 million years. This is why we seek to conserve, restore and promote the sustainable use of ecosystems and their services across our work.

Related UN SDGs:
Improving water quality and soil health

Catchment management can go hand in hand with the business objectives of an organisation. We have helped Yorkshire Water to demonstrate that a long-term Nitrate Catchment Management approach can safeguard drinking water supplies as well as supporting soil health and biodiversity.

Since the 1970s, nitrate concentrations in groundwater have been rising across Yorkshire, which increases the level of treatment required to make the water drinkable. To date, the company has met quality standards by blending water from different sources and using advanced treatment. But as nitrate concentrations continue to rise, there are fewer blend sources available and a more sustainable alternative to expensive conventional treatment must be found.

We carried out studies to understand the geological characterisation and agricultural practice in three catchments. This demonstrated the viability of working with farmers and other stakeholders to reduce nitrate leaching, whilst maintaining profit margins through management interventions instead of building hard infrastructure.

Over 100 potential interventions were identified, including encouraging farmers to plant cover crops instead of leaving land bare over winter. This can reduce leaching and benefit farmers by protecting soil from erosion and improving its structure.

Other interventions included growing buffer strips of wildflowers that reduce nitrate loading and enhance biodiversity.

A quantitative appraisal of the suggestions revealed that the ten most effective interventions can deliver 85% of the potential nitrate reductions identified.

Transforming a lake

The key to unlocking multiple benefits in this way is taking a catchment-wide approach. This is what lies at the heart of our vision to transform Ulsoor Lake in Bangalore, India, from a polluted eyesore to a valuable water resource that enhances the local environment and community.

Over the last 100 years, Ulsoor Lake has become polluted with raw sewage. Dead fish float on its surface as dirty water backs up during the monsoon season. And it’s a health hazard for the local community, who have to ship their drinking water in from 100km away.

Working with the developer, we recognised that it was vital to tackle not just the 40ha lake itself but, by engaging with local government and other stakeholders, the entire 19km² catchment area. The strategy we created halts flows of raw sewage and increases the lake’s capacity to reduce flooding and provide a resilient, year-round supply of water.

To achieve this, we suggested 20 projects to be delivered by 2020 – including aerating the lake to prevent excessive algae growth and enhance the fish population. Our landscape design guidelines include richly planted wetlands that promote biodiversity and clean the lake water as it is filtered by gravity. Meanwhile, densely vegetated islands would provide habitats for native animal species as part of citywide ecological corridors.
Sustainability touches every aspect of design and engineering. So it relies on different organisations collaborating to magnify their impact and champion the concept. We believe that, by working with others from inside and outside our industry, we can lead the way. We can break down misconceptions about sustainability and give vocal support to calls for urgent action on the most pressing issues.

Inclusive partnerships & positive leadership

Related UN SDGs:

© Wild West End
Collaborating on new green space

Working together on sustainability is something that is easy to say but often harder to achieve. We are putting it into action on projects such as **Wild West End**, the first city-centre green infrastructure partnership of its kind worldwide.

Wild West End is a collaboration between London landowners The Crown Estate, Grosvenor Britain and Ireland, Shaftesbury, The Portman Estate and Howard de Walden to promote green infrastructure in the capital’s West End. We are facilitating and providing technical support to the initiative, in which the Mayor of London and London Wildlife Trust are strategic partners.

With our guidance, the partners are adopting a long-term approach to increasing the value of existing green space and creating new green space on buildings and in the public realm. This includes green roofs, walls, parklets, planters and street trees. The Crown Estate, for example, now has 50 times more green space across its portfolio than it did in 2012.

The new green infrastructure will enhance the local environment, encouraging species to return to central London and connecting people with nature through community awareness and education programmes. Research has shown that city dwellers with access to more green space experience significantly lower mental distress and higher wellbeing. Yet competing demands on land in cities mean that creating new green space can be challenging.

In bringing together five neighbouring landowners to work towards a vision of a green corridor in one of London’s busiest and most polluted districts, Wild West End has achieved something unique.

**Helping cities tackle climate change together**

Collaboration on a city scale is vital to tackling climate change. Arup has worked with the C40 Cities Climate Leadership Group, which together represent 650 million people, since 2009. This year, we delivered a landmark piece of research to help the C40 cities act together.

Our report, **Deadline 2020**, provides vital evidence about the scale and significance of city-level climate action required to keep global climate change within 1.5 degrees of pre-industrial average temperatures. The report enables cities in the C40 group to develop targeted action plans to ensure they meet their commitment to the Paris Agreement, and achieve net zero emissions by 2050.

Our work shows that cities only have until 2020 to put in place the plans, policies and actions to start “bending the curve” of the emissions graph. It highlights that developed cities must take the immediate burden of emissions reductions, but also that developing cities cannot wait too long, or they will face even greater challenges than developed cities.

Launched at the C40 Mayoral Summit in Mexico City in December 2016, the findings and analysis from Deadline 2020 now underpin the C40’s latest business plan. They set the stage for the C40’s engagement with its cities and non-city actors, the priorities for research and knowledge dissemination. This work sets the pathways for cities to deliver tangible action towards achieving a climate-safe world.

A full copy of the report can be found [here](#).
Investing in the future

While we are proud of our firm’s history and achievements, we are also focussed on the challenges the future holds. We are always looking ahead to find new ways to develop our services and work more efficiently. Investing in Arup University helps us to do exactly that.

Fostering a culture of excellence and sharing

Set up in 2009 to help the firm excel and think about the future, Arup University provides a holistic framework designed to: direct the development of specialist skills in line with strategic business priorities; rapidly accelerate capabilities in new business areas; and ensure that learning activities are an integral part of knowledge sharing. The university’s services and resources are available to all Arup staff to explore technical and design ideas, and learn new skills in a swift and efficient manner.

Split into four key areas – Learning, Skills and Knowledge, Information Management, and Foresight, Research and Innovation (FRI) – the university is able to create integrated solutions which are specifically tailored to the needs of our projects and clients. A network of over 400 technical training courses provides employees with strategic learning opportunities, whilst 43 cross organisational Skills Networks encourage the informal sharing of knowledge across regions and disciplines.

Facilitating conversations about change

The Foresight, Research and Innovation Team was established to help Arup, and our clients, understand the future of the built environment. The team explores the fundamental social, technological, environmental, economic and political drivers of change; enabling our clients to plan more proactively in order to anticipate possible risks and leverage potential opportunities.

The Team pioneered the concept of ‘foresight by design’, which uses innovative tools and techniques to bring new ideas to life, and engage clients and stakeholders in conversations about change. Other tools and platforms to support creative thinking, foresight, strategy and innovation programmes include The Drivers of Change Cards, focusing on global issues and trends, and the online Inspire Insights database of emerging ideas.
**Ventures**

Arup’s Venturing Team seeks to build on our in-house professional expertise and research and development capabilities to commercialise products, software, apps and business ideas. Our aspiration is that our Ventures initiatives will help contribute to a world that is safer, cleaner and more resource efficient.

**Vertical Meadow: greening construction sites**

*Vertical Meadow* is a revolutionary way to create temporary living walls around construction sites. Installing it on scaffolding or hoarding reduces noise and dust from building work, cuts stormwater runoff, increases biodiversity and provides a life-enhancing natural amenity for the local community.

The meadow uses specially selected plants grown from seed that are sown into its fabric, rather than pre-grown in off-site greenhouses. So its lower cost, lower maintenance, less carbon-intensive and easier to install than other systems.

By encouraging greater use of green walls, Vertical Meadow can help to green densely populated cities and make them more liveable.

**Artus: reinventing air conditioning**

*Artus* is an innovative new air conditioning product invented by Arup and licensed to Airedale. A hybrid fan coil unit, Artus saves energy, money and space. It combines the flexibility of traditional fan coil units with the low energy use of a chilled beam – at a comparable or reduced cost.

Artus can reduce heating, ventilation and air conditioning (HVAC) energy consumption by 12% compared with traditional fan coil units – enough for an extra three or four BREEAM credits. It is also more compact, which makes it ideal for smaller ceiling voids and can be wrapped into the interior design of a space.

**arcoBridge: making light work of footbridges**

*arcoBridge* is Arup’s patented design for the world’s first lightweight glass fibre reinforced plastic (GFRP) modular footbridge system.

Weighing 70% less than a conventional steel span, it’s especially suited to difficult sites where large cranes and heavy machinery cannot be used. Capital costs are comparable with steel, but GFRP’s durability will reduce costs over a bridge’s 120-year design life.

The first bridge has been installed for Network Rail at a Site of Special Scientific Interest near Oxford, and the first manufacturing licensee, Mabey, has launched the bridge to its customers under the brand name Pedesta.
Our performance

Our impacts

We strive to embed sustainable practices into our own operations. Each year we look to see where change is needed to improve our performance, and how to realise this. This ongoing learning gives us first-hand experience to share with our clients.

Water use per employee has reduced by 4% compared to 2015-16. In addition, the implementation of rainwater harvesting systems at a number of our offices has resulted in a 57% increase in the volume of water which has been collected and recycled on-site.

Our office space and employee numbers have increased by 4% over the past year. In addition, our London office experienced a cold winter and warm summer which increased heating and cooling demands which resulted in an overall increase in energy consumption. To reduce energy consumption whilst meeting the practical demands of our highly populated office spaces, we are focussing on continuing to adopt agile working practices which will lead to more efficient estate utilisation.

Over the past three years, the proportions of waste treatment have stayed largely static, with 87% diverted from landfill. The increasing adoption of digital media, and the promotion of recycling and reuse in offices, have resulted in a 13% reduction in paper use per employee and a 6% reduction in the overall volume of waste generated.

This data covers performance from 1 April 2016 to 31 March 2017 in 22 buildings across the UK and Middle East. Previous data has been updated where new data has become available. Energy, water, waste, paper and carbon figures exclude our 5 African offices where data collection remains challenging.

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Energy use

<table>
<thead>
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<th>2016/17</th>
<th>2015/16</th>
<th>2014/15</th>
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<tr>
<td>scope 1</td>
<td>15,285</td>
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<td>13,942</td>
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<tr>
<td>Scope 2</td>
<td>272</td>
<td>273</td>
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<tr>
<td>Target: 31 CO2e per employee</td>
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Carbon emissions

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<tr>
<td>Scope 1</td>
<td>0.44</td>
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<tr>
<td>Scope 2</td>
<td>0.12</td>
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<td>Scope 3</td>
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<td>Scope 3 (Business Travel)</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Target: 31 CO2e per employee</td>
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Water use

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<tr>
<td>m3 per m2</td>
<td>0.65</td>
<td>0.72</td>
<td>0.69</td>
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<tr>
<td>m3/employee</td>
<td>7.3</td>
<td>7.3</td>
<td>7.2</td>
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Waste management

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<th>2016/17</th>
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<tbody>
<tr>
<td>Office waste diverted from landfill</td>
<td>13%</td>
<td>26%</td>
<td>13%</td>
</tr>
<tr>
<td>Waste to energy</td>
<td>87%</td>
<td>87%</td>
<td>87%</td>
</tr>
<tr>
<td>Recycled/composted</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
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Paper use

<table>
<thead>
<tr>
<th></th>
<th>2016/17</th>
<th>2015/16</th>
<th>2014/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg of office paper used per employee</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
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Our people and communities

We recognise that in order to produce work of quality, maintain our reputation for innovation and creativity, and continue to understand and delight our clients we need to fully embrace the skills, abilities and knowledge that only a diverse and inclusive workforce can deliver.

We are committed to promoting diversity and equality throughout our firm. Our senior leaders ensure we create an inclusive environment based on fairness, respect and merit. This creates equal opportunities for everyone to grow and develop within the firm.

The health and safety of all our employees, including temporary and contract staff, and of other persons affected by our actions, is paramount. We have set objectives to provide health and safety training, specialist advice, information instruction, and supervision, to personnel at all levels in order to ensure a safe and secure working environment.

Investing in our people is a key part of the firm’s approach to business. A rigorous technical training programme, which includes specific sustainability training, equips our employees with the skills and knowledge to provide innovative solutions to some of the world’s most challenging projects. Our emphasis on training and technical excellence allows us to continually attract and retain many of the world’s best engineers and designers.

Our people are driven to build a more sustainable future, for everyone. As Ove Arup, our founder, said: “Our lives are inextricably mixed up with those of our fellow human beings, and [...] there can be no real happiness in isolation.”

Our community engagement programme actively encourages and supports employees to participate in charitable activities as a key part of our contribution to shaping a better world. Some examples of the community engagement work that we have been involved with over the past year are included on the following page.

**Diversity**
- Female:Male ratio - employees 32:68  management 19:81
- 9.1% managers completing diversity training

**Sustainability training**
- 1 hour of sustainability training received per employee per year
- 241 staff received specialist H&S training

**Management systems**
- 100% offices certified ISO 14001 EMS
- 29% of projects over £150,000 setting specific sustainability objectives

**Community investment**
- £553,981 invested in charities and community organisations
- 4,893 hours of pro-bono and volunteer work
Supporting vital water projects
Our 2016 strategic partner FRANK Water has one goal: safe water for all. We have supported FRANK Water through fundraising and by donating our technical skills.

During summer 2016, 12 Arup staff from Bristol, Cardiff, Leeds and London raised over £30,000 by selling more than 4,000 refillable bottles at festivals around the UK. We have also developed a tool that will enable FRANK Water and its partners to assess the environmental implications of water, sanitation and hygiene projects.

Reducing emissions, improving health
Arup has partnered with ClimateCare to develop a new community project in Kenya to distribute 20,000 efficient cookstoves. By using 60% less fuel, the stoves will provide verifiable reductions in carbon emissions (80,000tCO2 over four years).

Significant indoor air quality improvements will benefit the health of around 100,000 people. The locally manufactured stoves are being distributed through small distributors and local community micro-finance organisations to maximise the impact of the projects and provide economic benefits.

Creating a set for a community musical
In 2016, community interest company Birdsong Live Productions staged a musical to commemorate Liverpool’s experience during the Blitz. To support the set design process, our team facilitated meetings between the producer, director, set designer, lighting designer and scaffolding firm contracted for the works.

This ensured the finished set reflected the design vision. Birdsong now intends to tour the show, Liver Birdsong: The Liverpool Blitz Musical, around local communities to raise funds for future productions.

Inspiring young engineers at the V&A
Children attending the Victoria & Albert Museum in London during May 2016 had the chance to take part in hands-on workshops designed by Arup staff. The events were part of the exhibition ‘Engineering the World: Ove Arup and the Philosophy of Total Design’.

Children explored how to use different materials in construction by building their own small house. Then they played different roles – from clients to contractors – as they collaborated on building a cardboard house.