Global Sustainability Report 2015/16
We are pleased to share the 2015/16 edition of our sustainability report. This report presents a selection of exceptional projects we have delivered across our five regions over the past year. These projects highlight the way our firm touches so many lives across the world. The wide variety of our work in sustainability takes many forms as this report highlights, with three common themes that are central to Arup: delivering sustainable solutions that respond to our clients’ priorities, encouraging innovation, and sharing knowledge.

We are also proud to share our progress as it relates to our internal goals for our projects, environmental impacts and resource use, diversity, and community engagement.
Case studies

The projects showcased here highlight the work we have done over the past year to demonstrate leadership in the realm of sustainability as we continue to deliver 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.
Saving on air-conditioning
To further reduce solar gain, the skylights are set at an angle to the orientation of the roof: north facing, they maximise natural lighting as well as save on air-conditioning. The air-conditioning system uses recycled water in its highly efficient chillers.

An optimum solution using BIM
Developed using Building Information Modelling (BIM), we used innovative 3D tools, such as wind flow modelling, air traffic control sightlines and walk-through checks to synchronise delivery of all disciplines in a coordinated and clash free manner.

Green features
To optimise efficiency and sustainability, Arup introduced 35 green features to the concourse design, including low-energy lighting systems, high performance glazing panels, seawater for flushing, and 1,200m² of solar panels to harness renewable energy.

Reducing solar gain
The concourse adopts an environmentally responsive building form; its roof shape and glazed façades are optimised based on the building’s orientation, and a deep protective overhang to the west of the building provides solar shading.

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Designing to inspire
Energy Academy Europe building

Arup has helped create the most sustainable education building in the Netherlands. Our solutions, developed together with our client and other partners, are based on a philosophy of maximising the use of natural elements and minimising energy consumption of the 14,819m² building. The building has been awarded BREEAM-NL ‘Outstanding’, has a negative EPC-score and is energy self-sufficient.

Creating awareness
Influencing occupant behaviour was a key component of the energy strategy. Energy usage is measured by floor and displayed publicly. The lighting sensors are activated manually, which encourages users to consider whether lighting is necessary before initiating the system.

Buffer zones to enhance comfort
To minimise the impacts of climate on occupant comfort, thermal buffer zones have been integrated into the design. On the south side of the building, a winter garden separates the education space from the outside, reducing heat loss and cooling demand. A large open atrium designed to maximise daylight in the offices creates an additional thermal buffer zone.

Hybrid ventilation system
A balanced ventilation system ensures a healthy and comfortable internal environment; the system runs in natural ventilation mode for almost half the year. External air flows into a thermal labyrinth beneath the building before the air enters the building, soil surrounding the labyrinth modifies the air temperature, cooling it in summer and warming it in winter. Used air is drawn out of the building by a solar chimney.

Low-carbon cooling and heating
Groundwater is used to provide low-carbon cooling and heating to the building, climate ceilings are connected to this system to minimise the use of heating and cooling while giving high levels of comfort directly to users where needed.
New green technologies for supermarkets
H-E-B Austin Mueller, US

Supermarkets and the catering industry use more energy per square metre than any other commercial building sector. To fulfil our client’s ambition to create a new benchmark for the industry, Arup devised an ambitious range of sustainability strategies for a new pilot store, many of which had never been used in an American supermarket before.

A new benchmark for efficiency
The new 83,587ft² Mueller Market District store not only meets LEED® Retail and Austin Energy Green Building guidelines, it is also 50% more energy efficient than a typical H-E-B store and 64% more efficient than the US grocery store median.

Propane refrigeration system
HVAC and refrigeration together make up the majority of a store’s energy load, so offered the biggest opportunity for energy savings. Radiant cooling and heating were used along with an efficient chiller cooling system. We also used an innovative propane refrigeration system with zero ozone depletion potential.

Optimising daylighting
To optimise energy performance, daylight autonomy, and uniformity, we conducted a skylight study to identify the ideal glazing geometry. North-facing rooftop light monitors with clerestory windows provide glare-free indirect daylight; this is supplemented with electric lighting as required.

Automated LED lighting
An all LED lighting strategy was used throughout the project, including the car park, building exterior and interior, walk-in coolers and freezers, and refrigerated display cases, which are controlled based on store hours and daylight conditions.
A dynamic intelligent façade saves energy
Hotel Amstelkwartier, Netherlands

Hotel Amstelkwartier has been designed with the ambition of becoming the first hotel in Europe to achieve LEED® Platinum certification. Arup’s integrated approach to sustainability is ensuring that as well as offering high-quality accommodation, the four-star hotel will achieve this internationally recognised sustainability standard.

The challenge
Located within a redevelopment area of Amsterdam, the hotel building’s shape and orientation had been fixed during the urban planning process, precluding the option of using solar energy. One of our challenges was to find another way to deliver energy savings.

An intelligent façade
We achieved this through a dynamic intelligent façade. This is made up of a series of panels that slide on horizontal rails attached to the building’s glazed façade; there are 300 panels in total, one per room, and each one operates independently.

Preventing heat loss or gain
Sensors detect when a guest leaves their hotel room via their electronic key card, and the panels are programmed to respond to the internal and external conditions while the room is unoccupied. During summer the panels close to keep the room cool, in winter they remain open to take advantage of passive solar heating.

Low-carbon energy
As well as sustainability features to save energy, the building generates energy using biomass from hotel food waste. In addition, blackwater from toilets is used in a digester to generate energy to help heat the building, and a long-term energy storage system is used for heating and cooling.

65% energy saving
for heating thanks to the dynamic façade
A lifecycle approach to sustainability
Great Northern Highway (GNH), Australia

GNH forms part of the Perth to Darwin National Highway that links Perth with the northern parts of Western Australia and the Northern Territory. Arup, as part of an integrated project team with joint venture partner Jacobs and Main Roads WA, is working on a major upgrade to the 218km Muchea to Wubin link.

Improving safety
GNH is a major freight route with heavy vehicles accounting for a third of its traffic. The highway upgrade will create a safer route with increased vehicle capacity, improved facilities and more predictable travel times.

Seeking certification
The project has registered under the Infrastructure Sustainability Council of Australia’s IS rating scheme; this includes a commitment to assess the energy use and greenhouse gas (GHG) emissions across the lifecycle of each stage of the construction works.

Ensuring a positive impact
We worked with the design team to ensure we went beyond assessment to encourage the adoption of initiatives to reduce energy and emissions. This included a proposal to use solar PV for site offices to publically demonstrate the project’s commitment to sustainability.

Looking beyond the obvious
Worker travel to site is not usually included in emissions calculations for road construction projects. However, our calculations revealed that on this particular project these emissions warrant consideration. We recommended that appropriate measures, such as carpooling incentives, should be put in place.
Creating an adaptable city
Water-Sensitive Urban Design, China

The 15.3 km² Baotou shanty area retrofit in Inner Mongolia is a national demonstration project, and of strategic importance to China under its ‘Sponge Cities’ initiative. Using our knowledge of water-sensitive urban design (WSUD), we are developing guidelines and planning for Baotou to help solve water-related issues.

Addressing critical issues
Baotou suffers from water scarcity due to wide seasonal variations in rainfall, and flooding owing to its unique geography and poor drainage. The major rivers are all seasonal rivers, serving flood release and drainage functions only, while the river water quality is poor due to pollution discharge. Arup is helping Baotou adapt to these challenges.

Smart water management
Using the latest modelling techniques, we have carried out research to optimise drainage and flood resilience. In addition, we are investigating the feasibility of a smart network and a monitoring system to improve flood control, water quality monitoring and water utilisation.

Integrating green infrastructure
Green infrastructure is a key element of the design framework. Natural rivers, green corridors, open space, parks and pocket gardens will help to manage rainfall, provide routes for extreme rainfall and mitigate urban flood risks.

Improving ecological potential
The river will be revitalised to provide an attractive setting for public recreation spaces, while being designed and managed to accommodate flooding. We are also exploring the use of reclaimed wastewater to maintain ecological base flows to re-establish river habitats.
An exemplar of sustainability
Nobel Center, Sweden

The Nobel Center is the new home for the Nobel Prize in Stockholm. Once complete, it will provide public activities around the award’s combination of subject areas: natural sciences, literature and peace. Arup has supported the architects since initial competition stage to fulfil the project’s aim to be an exemplar of sustainability.

Working with stakeholders
To help the Nobel institution formulate their ambitions into a clear sustainability strategy, we facilitated workshops with key stakeholders using Arup’s horizon scanning methodology, Drivers of Change, to stimulate debate.

Going beyond BREEAM
The resultant strategy goes beyond the Nobel Center’s initial BREEAM Outstanding goal. It includes ambitious targets for design, environmental leadership, operational strategies, responsible purchasing, openness and transparency, community cohesion and wellbeing.

Guiding decision-making
Five underpinning principles were identified. These will guide the project through the design, construction and operational phases, influencing the long-term management strategy, policy and business plans, as well as enabling external stakeholders to understand the organisation’s true value.

Exemplary low energy design
The design team responded to the sustainability principles with innovative and efficient strategies to drastically reduce energy demand and provide a comfortable indoor environment. We also supported the architects in modifying their winning scheme to reduce its scale.
A showcase for sustainability
T-PARK, Hong Kong

Arup has delivered a dedicated sludge facility in Hong Kong to provide an innovative and eco-friendly solution for the problem of sewage sludge facing the city. With the capacity to dispose of up to 2,000 tonnes of sewage sludge per day, it is one of the largest sludge incinerators in the world.

Sympathetic to the environment
The facility is housed in an iconic building with a distinctive wave-like façade. The roof, which is 400-metres long by 50-metres wide, was designed to enhance the aesthetics of the building whilst being sympathetic to the environment.

Simplifying the complex design
We designed a structural system that delivered the complex geometry required for the building envelope using a simple and repeatable support system. By involving the contractor early, we also made sure the structural design suited the proposed fabrication and construction strategy.

Self-sufficient operation
The heat generated from the incineration process is recovered for power generation using steam turbines, and power surplus to plant operation requirements is exported to the regional electricity grid.

Advanced water recycling
A seawater desalination plant produces potable water, while rainwater is collected for non-potable use. To help protect the environment, there is zero discharge of wastewater from the site; wastewater is treated and reused on site, including for the irrigation of the soft landscaping.
Encouraging active travel modes

University College Dublin Cycle Audit, Ireland

As part of our ongoing work with UCD, which includes the Campus Framework Commuting Strategy, Arup has carried out a cycle audit to identify ways to improve facilities for cyclists and further encourage a shift away from the car.

Better provision for cyclists
The proposals include dedicated cycle routes along key corridors, an increase in cycle parking in critical locations, improvements in signage, and provision of official routes to help create natural pathways.

Positive impact
By improving provision for cyclists, the proposals will increase the uptake of cycling and, given the large number commuting to UCD daily, a positive impact will be felt on the surrounding area as well as on the campus itself.

Regional Cities Bike Share, Ireland

Bike share systems offer a low-carbon means of public transport, as well as encourage a healthy active lifestyle.

Three new bike share schemes
Arup’s Smarter Mobility team combined their in-depth experience of technology projects with their passion for cycling to deliver bike share schemes to three cities in Ireland: Cork, Limerick and Galway.

High-quality facilities
Our involvement from Feasibility Study, through technical specification and detailed design to procurement, construction and operations management, has resulted in high quality on-street facilities with a seamless back office system.

Ensuring ease of use
The back office operates, controls and manages the bike-share scheme. It provides real-time occupancy information to the bike-share website and apps, making it easy for users to login and hire the bikes.

Engaging with end users
Going beyond requirements, we undertook non-Statutory Public Consultations in each of the cities and used the feedback to refine the locations and sizes of the bike docking stations.

Overcoming existing issues
Although cycling is already a popular choice for travel to University College Dublin (UCD), of a student and staff population of nearly 30,000 it has a 20% mode share, commuting by car continues to cause issues with parking provision, congestion and health.

Detailed site analysis
Arup conducted a detailed assessment of the campus to highlight the potential improvements. Through site visits, GIS analysis, and integration with regional and national strategies, we developed a series of targeted improvement proposals.
Enhancing economic growth
Northern Regional Trails Strategy, Australia

Working in partnership with a number of local councils, Arup has been commissioned to develop the Northern Regional Trails Strategy. The strategy provides a blueprint and strategic framework for the development and maintenance of a recreational off-road cycle network across the north of metropolitan Melbourne.

Prioritising opportunities
We used advanced GIS modelling to analyse demographic, social and economic data across the seven municipalities and produce a comprehensive geodatabase of key indicators. From this, we identified where the opportunities lay for expanding the existing network based on regional economic, social and health benefits.

Cost-benefit analysis
Our analysis spanned 780 kilometres of off-road bicycle trails, 120 existing and 96 proposed. The cost-benefit analysis we conducted demonstrated that the entire trail network would deliver combined benefits equal to its cost over the first twelve months.

Enabling fundraising
The proposed trail network will support and enhance economic growth, social wellbeing and environmental quality across the north of Melbourne. To facilitate discussions with key stakeholders and state government around funding opportunities, we delivered an advocacy paper to convey its benefits.

Ensuring long-term success
We also delivered guidance around design elements, governance and funding opportunities for the ongoing management, maintenance and success of the trails network to ensure its successful long-term implementation.
Improving rail network resilience
Power Futures Strategy, Australia

Arup has leveraged its knowledge and experience in rail and energy supply and demand to help our client develop a 21st century energy strategy for its rail system. The research-based project looked at generation and network assets, as well as traction and non-traction loads to develop 35 potential interventions.

Supporting increased operations
Considering the global context of climate change issues, urbanisation and the need for public mass transit, we worked with our client to develop a strategy to support an increase in train operations whilst reducing the cost of energy and improving network resilience.

Identifying potential interventions
We worked closely with the operator’s strategy team, subject matter experts and external stakeholders to develop, discuss, rank and assess the initiatives. The 35 potential interventions were then grouped across ten areas of strategic initiative and ranked using a multiple-criteria decision analysis (MCDA) process.

Timeframe for change
The initiatives were set against three notional timelines: incremental, easy to implement in the next 3-5 years; optimised, requiring significant change and a timeframe for implementation to 2030; optimal, a step-change in operations to an automated digital railway.

Far-reaching effects
The strategy has the potential to deliver more than just reduced costs: it can drive business performance improvements through its effect on operations, maintenance, sustainability, customer satisfaction and stakeholder perception.
Innovative substation design
Highbury Substation, London, UK

Arup’s solution for Highbury Substation enabled a completely enclosed substation with increased security, improved visual amenity and the potential to recover otherwise rejected heat. Thanks to its sustainability credentials, the substation was granted planning consent on the first attempt.

Low-carbon heat for local use
Transmission transformers used in substations usually expel significant quantities of waste heat. Arup put forward an alternative cooling system with an innovative control philosophy: by maintaining the transformer core temperature at 72°C, heat can be harvested displacing natural gas consumption.

Reduced design footprint
The low-carbon heat will be supplied to the local school and social housing development. Thanks to the new compact transformer and cooling system, the substation footprint has been reduced by 40%, resulting in significant savings on land costs.

An economical solution
The combined oil-water cooling system requires 1,000 litres less oil to be kept on site, minimising space and costs. Lighter than a traditional cooling system, it eliminates the need for a separate concrete plinth, reducing material costs and embodied carbon.

A blueprint for the future
Arup’s solution delivers substantial environmental savings, and can be replicated on future substation infrastructure. As such, it has attracted considerable political interest, including visits from the Energy Minister and National Grid CEO.

- 34 tonnes of CO₂ saved per year thanks to harvested heat
- 820MWh of heat reclaim potential which is equivalent to 200 households’ use
LEED® certified eco-community
Double Cove, Hong Kong

The Double Cove residential development, located on the shore of Tolo Harbour, is Hong Kong’s first LEED-certified community project. To fulfill the architect’s design concept of ‘Living in a park’, Arup has integrated natural features throughout the development to support sustainable living.

A sense of space
The residential towers are positioned along the perimeter of the development to maximise the coastal location; residents benefit from a sense of space and uninterrupted views. Community, retail and leisure facilities enhance the site.

Social cohesiveness
Designed as an eco-community, active modes of transport and outdoor living are encouraged. Myriad walkways and cycle paths connect the community, and public open spaces are interspersed throughout the development to promote social cohesiveness.

Connecting with the environment
Community, retail and leisure facilities are located beneath a central elevated park. Glass curtain walls at the mall and clubhouse let in natural daylight and help create a connection with nature even when residents are indoors.

Transport connectivity
As well as access to nature, residents benefit from proximity to a host of transport options. A covered footpath allows residents to move freely through the development. This connects with the Mass Transit Railway system and a public transport hub.
Enhancing adaptation planning in cities
CRAFT

Arup in collaboration with C40 Cities Climate Leadership Group and Bloomberg Philanthropies has created a bespoke framework to enable cities to report local climate hazards and impacts, risk and vulnerability assessments, and adaptation planning and implementation: CRAFT (Climate Risk and Adaptation Framework and Taxonomy).

Preparing for climate change impacts
Climate change impacts are being felt in cities around the world, and are expected to become more frequent and severe. Standardised reporting on city adaptation is at an early stage and there is a lack of evidence about the degree to which cities have progressed. CRAFT has been developed to fill this gap.

Climate adaptation expertise
Leveraging our expertise in cities, climate adaptation and planning, we worked with C40 and Bloomberg to create the CRAFT framework. This provides a valuable diagnostic tool for cities to assess their adaptation plans.

Assessing adaptation plans
CRAFT acts as a learning and benchmarking toolkit. City officials can compare their own processes and actions with best practice planning principles embedded in the reporting framework. This enables city officials to confirm whether they are making progress.

Enhancing and accelerating action
Data collected through CRAFT can provide insights to enhance and accelerate action at a local level. It helps to increase knowledge sharing and collaboration to improve urban adaptation strategies, and builds a stronger understanding of city climate action.

40 experts engaged in the development of CRAFT
500+ cities currently using CRAFT
Designed for wellbeing
Believe in Better building, London, UK

Sky’s Believe in Better building provides a home for its training and schools work, as well as office space and a restaurant. Designed by Arup Associates, it is one of the most unusual commercial buildings in the UK, being the first multi-storey, all-timber office. The building incorporates extensive environmental innovations.

Reducing carbon in construction and use
The glulam timber frame helped to cut the building’s embodied carbon by 120%. Lighter and quicker to construct than a conventional concrete frame, smaller foundations were needed. PassivHaus levels of insulation and air-tightness in façade panels, together with mixed-mode ventilation capability, reduce in-use energy consumption.

Enhancing wellbeing
Research suggests that timber buildings contribute to improved wellbeing of building users; the design team enhanced this advantage with measures such as tree and shrub planting, and using materials with low or no airborne chemicals.

Natural air and daylight
Alongside the extensive use of natural materials, our design maximises access to daylight and natural ventilation. Created around the people who will use the building and its intended use as a training centre and creative space, social interaction and collaboration are at the core of the design.

Commitment to excellence
With an ambitious timeframe, just 12 months from project inception to successful building completion, collaboration between the full design team was key. Success relied on a high degree of trust and a shared commitment to excellence.

Winner
WAN Wood in Architecture, 2015

Best Low Energy Project
 Structural Timber Awards, 2015

Best Building
Institution of Civil Engineers, 2015
A holistic approach to development
SGR enabled a holistic approach to the development of Taiwan’s Taoyuan Aerotropolis, which effectively combines conservation of the area’s waterways with an increase in the capacity of the transport network, as well as improvements to the health and wellbeing of people living in the area.

Adopted in Hong Kong
The concept has been successfully applied to a number of other projects in Asia and has been adopted by the Hong Kong government’s Planning Department as the city’s ‘new planning vision’.

A new approach to urban planning
Smart Green Resilient Planning Concept

*Smart Green Resilient* (SGR) presents a vision for urban planning based on holistic thinking and an understanding of a city as an interconnected system. Leveraging Arup’s knowledge across sustainable development and planning, resilience and digital technology, it provides a conceptual framework to enhance urban planning.

Finding the optimum solution
SGR enables planners to unify conflicting requirements into coherent goals and objectives. It is a comprehensive approach that systematically examines non-tangible and service systems, such as governance and health care, and considers their interaction with physical and tangible systems, such as infrastructure and waste.

Realising a city’s potential
Compared to traditional approaches, SGR thinking can realise the full social and economic potential of an area; it links human factors, smart city principles, sustainable development and resilience together to maximise available resources.

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Adaptation planning for crucial services
Partners HealthCare Resilience Report, US

Partners HealthCare is the largest provider of healthcare services in Massachusetts and has the largest hospital-based research programme in the US. It is crucial for the region’s wellbeing that the system continues to function, even during extreme events. Arup is leading climate risk assessments across 30 of Partners’ facilities to support this mission.

Guiding investment
The Partners HealthCare Facility Resiliency and Operational Impact Study provides an analysis of probable risks and consequences to the operations of the facilities assessed. The findings are intended to inform future capital investment, and to enhance emergency operations taking into consideration the effects of climate change.

Identifying key vulnerabilities
The initial phase of the study has resulted in the identification of key climate vulnerabilities across Partners’ portfolio and set the stage for the next phase of work which will prioritise risk within each campus, across the Partners’ system and other healthcare providers in the area.

Determining exposure
To better understand this risk, the facilities’ exposure to four climatic factors was assessed: sea-level rise and storm surge, precipitation, temperature (heat), and wind. A fifth, seismic exposure, was included to further inform the evaluation. Larger regional implications, especially with respect to operational capacity, were also addressed.

A broad perspective
Our initial assessment reports are presented in a visual format to make the findings accessible. This approach makes the highly technical information easy to understand and clearly illustrates the current level of exposure, as well as for 2030 and 2070 time horizons. The work is supported by numerous technical and scientific studies from a broad range of subject matter experts.
Facilitating urban transformation
Fishermans Bend Environmental Footprinting

Fishermans Bend is a transformational urban renewal project covering more than 400 hectares in Melbourne, Australia. Arup worked with the City of Port Phillip and the City of Melbourne to develop an evidence-based set of objectives, quantitative targets and requirements to inform planning, infrastructure and development for the project.

Modelling scenarios
The scale of Fishermans Bend poses particular challenges. We engaged a range of stakeholders to define four alternative scenarios for the project based on anticipated land use schedules, densities and population forecasts; these were then modelled using our Integrated Resource Management (IRM) tool.

Facilitating communication
IRM facilitates masterplanning; it is a lifecycle assessment model with thousands of links to represent the integrated nature of city systems. By framing the IRM study on four scenarios, we helped shape the vision for Fishermans Bend and provided a simple way to communicate the development plans.

Level of intervention
The four scenarios involve different combinations of building control and infrastructure delivery coordination: market-led, “business as usual” approach; building-led, with requirements set by government; precinct-led, with proactive delivery of precinct-scale infrastructure; and integrated, a combination of building and precinct-led.

Analysing sustainable outcomes
The model analysed the impacts of each scenario at a mid-point and full build-out stage, with the ability to toggle between the various interventions and compare the impacts of each. We also produced a report with the results and our recommendations.
Measuring and communicating performance
Sustainability of universities

The higher education sector required new mechanisms to evaluate sustainability, as previously none provided the sector with a tool focused on sharing best practice. Working with the Association of University Directors of Estates, Arup has developed Green Scorecard, a bespoke appraisal process for university estates.

A new way to measure performance
Those leading estates functions in the higher education sector were looking to develop a new way of measuring and communicating institution performance against sustainability targets. Existing tools were inflexible and did not encourage collaboration.

Identifying key sustainability factors
Central to the development of Green Scorecard has been defining the key sustainability factors that universities need to address as part of their operations. Once we established the topics for consideration, we undertook extensive consultation with over 100 universities to define them.

Deeper comparison and understanding
Many sustainability metrics result in a single overall score. This then becomes the focus for comparison, hiding complexities. By contrast, Green Scorecard provides a visual output that invites deeper comparison and understanding, supporting knowledge sharing.

Ensuring buy-in and participation
Green Scorecard offers a new way of evaluating sustainability that has been driven by the needs of the sector, ensuring extensive buy-in and participation. The wide scope of the tool enables a broad approach to sustainability.

Green Scorecard provides a visual output that invites deeper comparison and understanding.
**Reducing hazardous emissions**

We then assessed the architect-specified materials against this strategy and substituted lower emission products where possible. We were able to source many low emission alternatives without any cost increase.

**Enhancing future projects**

As well as reducing emissions on this project, the experience gained is being developed into an innovative Materials and IAQ policy that can be applied on all future client projects. We are also developing Materials and IAQ guidance for the client’s wider sustainability policy framework.

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**Air quality and health**

Up to 50% of potentially harmful airborne chemicals is thought to be attributable to construction materials as they gradually release volatile compounds. At high concentrations these compounds have been associated with leukaemia, childhood asthma and many other illnesses, but also at lower concentrations with symptoms such as headaches and drowsiness.

**Material-specific strategies**

Using our knowledge of the potentially harmful content of products and emissions, current legislation and third party certification, we developed material-specific strategies to improve air quality to enhance the wellbeing of residents.

**50% emissions reduction for specified products**

with lower emission alternatives found for many others
A healthy office environment
18 King Wah Road, Hong Kong

18 King Wah Road (KWR) is a 23-storey office building, intended to provide a healthy workspace. Arup’s design creates synergy between the building, its occupants and the environment. It focuses on strategies relating to air quality, water, sustainability, fitness and comfort to enhance wellbeing and productivity.

State-of-the-art air filtration
To improve health, KWR uses a three-stage air purification system to remove outdoor pollutants and harmful airborne chemicals. External conditions are monitored by an on-site weather station and when conditions allow, the building operates in natural ventilation mode.

Solar-responsive façade
The most iconic architectural feature of KWR is its solar-responsive façade. The angle and shape of the external shadings automatically adjust in response to changes in the sun’s position, enhancing thermal comfort and harvesting natural light, while maintaining views of the harbour.

Encouraging a healthy lifestyle
The curvature of the building enhances air circulation of the surrounding neighbourhood, boosted by a promenade to the front of the building. A landscaped passageway connects to the harbourside, creating links to the community and encouraging a healthy lifestyle.

Smart facility management
A web-based smart system is configured to provide a healthy work environment for occupants. The system records users’ preferences and gives suggestions and options based on the prevailing local conditions.

LEED® Platinum (pre-certification)  BEAM Plus Platinum (PA)  3-Star rating
China Green Building Design Label

Green Building Award (Merit)
Hong Kong Green Building Council
A new concept for Caracas
La Rinconada Masterplan, Venezuela

Caracas is a vulnerable city, at high risk of heavy weather events, flooding and earth tremors. The city also suffers from a lack of safe housing, poor access to energy, and high levels of poverty and violent crime. La Rinconada masterplan seeks to address these issues and improve the urban environment for its residents.

Ensuring health and safety
La Rinconada masterplan defines a sustainability framework with resilience as a core driver, including adaptation to climate change and mitigation strategies. It also acts as a tool for defining economic and social strategies, the foundation for development of the area, with health and safety a priority.

Building on the city’s assets
The area benefits from a well-developed transport system and rich natural surroundings; the masterplan builds on these strengths promoting public and active modes of transport. By working closely with key city stakeholders, it also integrates existing urban policies with community needs and interests.

A catalyst for regeneration
The planned development includes housing, parks, a 55,000-seat football stadium, a 35,000-seat baseball stadium and the retrofitting of the city’s architectural gems. The aim is to create a socially inclusive city, and to act as a catalyst for regeneration and change.

Aspiration for ‘Total Architecture’
Initially briefed as the relocation of a bus interchange, the project developed into a unique opportunity to create a whole new concept for West Caracas. The overall project is pursuing the aim of ‘Total Architecture’ supported by a joint team with Rogers Stirk Harbour + Partners and a close relationship with our client to create new ways of collaboration.
Resilient design
Red Hook Houses, New York

New York City Housing Authority’s (NYCHA) Red Hook Houses in Brooklyn, New York were severely impacted by Hurricane Sandy in October 2012, with floodwaters destroying most of the mechanical, electrical and plant (MEP) systems. Working collaboratively, Arup is developing a new resilient site-wide MEP system.

A flagship project
At the time the project was initiated, NYCHA was in the process of overhauling its operations; we seized the opportunity to introduce new approaches to turn this into a flagship resiliency project for the Housing Authority’s rebuilding efforts.

Carbon reduction
We introduced ideas beyond the basic project scope including a micro-grid and a combined heat and power (CHP) system. We also rationalised the energy plants, successfully reducing the proposed plants from seven to two, and simplified infrastructure requirements, saving energy and carbon.

Alleviating flood risk
Floodwaters rose to more than 6ft (1.8m) in some parts of the Houses following the storm, the majority of building basements were flooded, as were many ground floors. To help protect the buildings in the future, we utilised vacant open space to introduce a number of green infrastructure schemes for stormwater management.

Community engagement
With federal funding secured, the project offered residents a once in a lifetime opportunity to address multiple site-wide issues. As part of the project team, we engaged with the community to elicit feedback from residents on design choices.

| 8,000 residents across 28 buildings | 25% reduction in energy | $450 million in federal funding |
Scalable urban greening
Living Wall Façade System

Green infrastructure plays an important role in efforts to mitigate roadside pollution, increase biodiversity, attenuate stormwater and enhance urban wellbeing. Arup’s Living Wall Façade System (Living Wall) offers a cost-effective, sustainable option for developers, enabling them to bring these benefits to their projects.

A cost-effective option
Living Wall overcomes the drawbacks of traditional systems, which tend to be heavy, expensive to install and require extensive maintenance. By contrast Living Wall is light, thin and easy to install, and has the unique advantage of growing plants from seed in-situ.

Reduced water consumption
Living Wall is based on a traditional curtain walling façade panel. It uses a hydroponic system for water and nutrient delivery rather than an earth-based system. This reduces water consumption by up to 90%.

A practical solution
Growing plants from seed improves the resilience of species once established. It also eliminates the cost, carbon and logistical issues associated with growing plants in greenhouses and transporting them to the construction site.

Future plans for Living Wall
Arup is working with partner DesignLaw to develop Living Wall. Following several small-scale trials, a 15m² demonstration wall has been installed in a facility in Germany, and a patent has been granted for the concept. We are also engaging with potential partners to bring Living Wall to market.

90% less water
than with an earth-based system

Living Wall is light, thin and easy to install
plus plants are grown in situ, making them more resilient
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 context to our global targets. Community Engagement and Diversity and Inclusion initiatives are also provided to highlight achievements beyond our KPIs.

This data covers performance from 1 April 2015 to 31 March 2016 across all five regions, Americas, Australasia, East Asia, Europe and UKMEA.

### Global Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community investment</td>
<td>£1,660,000 invested in community engagement</td>
</tr>
<tr>
<td></td>
<td>(paid staff time and donations)</td>
</tr>
<tr>
<td></td>
<td>12,027 hours of pro-bono advice and volunteer work</td>
</tr>
<tr>
<td>Diversity</td>
<td>18.3% of management positions occupied by females (grades 7-9)</td>
</tr>
<tr>
<td></td>
<td>23.8% management staff completed diversity and inclusion training</td>
</tr>
<tr>
<td>Carbon emissions</td>
<td>3.2 tCO2e/employee/year scopes 1, 2+3 business travel</td>
</tr>
<tr>
<td></td>
<td>5% reduction from 2014/2015</td>
</tr>
<tr>
<td>Sustainability training</td>
<td>1.0 hours sustainability training per employee</td>
</tr>
<tr>
<td>Paper use</td>
<td>28.5kg paper / employee / year</td>
</tr>
<tr>
<td></td>
<td>9% decrease from 2014/2015</td>
</tr>
<tr>
<td>Energy use</td>
<td>223 kWh/m²/year</td>
</tr>
<tr>
<td></td>
<td>5% increase from 2014/2015</td>
</tr>
<tr>
<td>Projects</td>
<td>38% of projects over £150k</td>
</tr>
<tr>
<td></td>
<td>report specific sustainability objectives</td>
</tr>
<tr>
<td></td>
<td>15% increase from 2014/2015</td>
</tr>
<tr>
<td>Management systems</td>
<td>99.3% staff in offices certified to ISO 14001 Environmental Management System</td>
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</tbody>
</table>
Our Performance 2015/2016

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

This data covers performance from 1 April 2015 to 31 March 2016 across all five regions, Americas, Australasia, East Asia, Europe and UKMEA.

Global Results  |  Regional Results  |  Community Engagement  |  Community Engagement Activities

**Energy use**

<table>
<thead>
<tr>
<th>Region</th>
<th>Global</th>
<th>Americas</th>
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<tbody>
<tr>
<td>kWh/m²/year</td>
<td>223</td>
<td>203</td>
<td>225</td>
<td>162</td>
<td>147</td>
<td>273</td>
</tr>
</tbody>
</table>

**Carbon emissions**

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<tbody>
<tr>
<td>tC02/employee/year</td>
<td>3.5</td>
<td>5.5</td>
<td>5.5</td>
<td>2.6</td>
<td>3.5</td>
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</table>

**Diversity and Inclusion training**

<table>
<thead>
<tr>
<th>Region</th>
<th>Global</th>
<th>Americas</th>
<th>Australasia</th>
<th>East Asia</th>
<th>Europe</th>
<th>UKMEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>% grades 7-9</td>
<td>1.0</td>
<td>1.3</td>
<td>0.4</td>
<td>1.6</td>
<td>0.9</td>
<td>0.8</td>
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</tbody>
</table>

**Projects setting sustainability objectives**

<table>
<thead>
<tr>
<th>Region</th>
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<th>Americas</th>
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<th>East Asia</th>
<th>Europe</th>
<th>UKMEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>% projects with fee &gt; £150,000</td>
<td>24</td>
<td>60</td>
<td>51</td>
<td>24</td>
<td>34</td>
<td>24</td>
</tr>
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</table>

**Carbon emissions**

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<tbody>
<tr>
<td>tC02/employee/year</td>
<td>5.0</td>
<td>3.2</td>
<td>5.5</td>
<td>2.6</td>
<td>3.5</td>
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</table>

**Paper consumption**

<table>
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<tr>
<th>Region</th>
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<tbody>
<tr>
<td>kg/employee/year</td>
<td>3.2</td>
<td>28.5</td>
<td>16.3</td>
<td>20.9</td>
<td>44.5</td>
<td></td>
</tr>
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</table>

**Energy use**

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Community Engagement

Our aim is to deliver a programme of Community Engagement activities that is inclusive, integrated, inspiring and impactful. Together with our partners, we are working towards the day when no person goes hungry, lacks shelter or clean water and sanitation, faces social and economic exclusion or lives without access to basic health services and education.

Shaping a better world
Our founder, Ove Arup, said: “Our lives are inextricably mixed up with those of our fellow human beings, and that there can be no real happiness in isolation.” Social usefulness continues to be one of our core values and part of this is our ongoing commitment to charitable causes. Through our Community Engagement programme, as well as direct donations, we actively encourage and support our staff to participate across a broad range of activities as part of our contribution to shaping a better world.

Enhancing prospects and improving livelihoods
In many parts of the world, communities face unimaginable challenges every day. We feel a responsibility to support these communities, to help them become more self-reliant and resilient and not suffer in isolation. By providing technical assistance and support to our partners, we focus on passing on valuable skills that have a practical impact on communities, enhance prospects and improve livelihoods.

Working in partnership to leave a lasting legacy
We partner with organisations across the globe who share our values and whose resources best complement our potential contribution. These partnerships enable us to provide an ongoing programme of support and are formed with the medium to long-term in mind, maximising the impact of what we can achieve together.

In 2015/2016
Community Engagement activities included 153 major projects in 39 countries

1 in 10 Arup employees participated in Community Engagement activities

6,500 hours of additional unpaid time contributed by staff to Community Engagement activities

www.arupcommunity.org
Community Engagement Activities

We partner with organisations who share our values and whose resources best complement our potential contribution. These partnerships enable us to provide an on-going programme of support and are formed with the medium to long-term in mind; maximising the impact of what we can achieve together. Below is a snapshot of just a few of the projects we’ve helped deliver in the past 12 months:

In partnership with Engineers for Overseas Development

Women’s co-operative grain store, Bukedea, Uganda

Seven Arup volunteers worked with EfOD to build a new grain store in Eastern Uganda. The grain store is constructed from unfired bricks pressed from locally arising murram mixed with cement, thereby reducing its energy footprint. The thermal mass of the bricks helps keep the grain store cool, and clay plaster rendering helps to moderate humidity, creating ideal storage conditions.

In partnership with People Oriented Design

A new bridge at Atiofi Hospital, Solomon islands

Arup partnered with People Oriented Design to design a new pedestrian footbridge linking key buildings of a Community Hospital on the Solomon Islands. The bridge design responds appropriately to local construction capabilities and makes use of available materials as much as possible.

In partnership with NSET

Post disaster mission to Nepal

Two Arup engineers visited Nepal to share learning on retrofitting buildings for seismic resilience. They worked with NSET structural engineers to explore alternative approaches, such as steel bracing, FRP, base isolation and shear walls, for RC framed buildings typical to Nepal.

In partnership with FRANK Water

Future proofing WASH, India

Arup is developing a methodology to assess and improve the environmental impact and performance of Water, Sanitation and Hygiene (WASH) programmes in India. The methodology will embed environmental considerations in the planning of essential WASH services, ensuring that solutions are sustainable and resilient long-term.

In partnership with Berlinovo

Refugee housing prototype, Germany

Arup is advising German housing provider Berlinovo on the development of a modular residential unit prototype for refugee housing. The project will see 13,000 housing units built over the next few years in two phases, the first of which is now complete.
Looking forward

As Arup is now closely associated with the carbon reduction commitments made at COP 21 earlier this year, and also with the initiatives undertaken by organisations such as C40 to address climate change, it is important that we not only look to reduce the impacts our projects have on the environment, but to also have in place a robust approach towards our own emissions.

To this end we are implementing a carbon reduction strategy that initiates direct action to deal with emissions we have control over as well as actions that support reducing our emissions where our control is more limited.

Key initiatives include addressing the purchase of electricity for our facilities, the design of our offices, and, most importantly, tackling emissions through the deployment of Arup funds towards new projects that have significant carbon savings and social impact.

We look forward to sharing more details as the strategy develops in the coming year.

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