

# Shaping a better world 2014/2015

Social usefulness is one of the six core aims of our firm. Through our work, we aspire to enhance people's access to basic needs such as food, shelter and water, as well as to higher needs including education, healthcare and mobility. We create environments and facilities that are safe, healthy, productive and enjoyable for those using them whilst being economic and efficient for those responsible for operations and maintenance.

Our clients range from individuals and communities to corporations, institutions and governments. In all cases, we choose our work carefully, to find an involvement where we can positively impact project outcomes.

This short report gives an overview of the breadth of our work with particular emphasis on social usefulness and how this work is benefiting society and shaping a better world. It also provides details of our diversity and inclusion and community engagement programmes, and efforts to make our internal operations more sustainable. It provides insights into how our firm touches so many lives across the world through its work.

We are proud to share these stories with you and look forward to increasing our beneficial impact in the years to come.

# Delivering Solutions

Meeting our clients' objectives is our top priority. Whether we are working to fulfil an organisation's vision, drive efficiencies, build resilience against an uncertain future or to deliver on a social agenda, our aim is to provide practical solutions that help clients achieve their goals. We offer an approach that is highly responsive and collaborative, seeking to resolve challenges in a creative and efficient way to deliver successful projects.

# Meeting the big data challenge

NTT Wonder 9 Data Centre, Hong Kong

*Wonder 9 is a new data centre that incorporates state-of-the-art building infrastructure design and networking equipment. It achieves a number of firsts in the Asian industry and has been designed to target Uptime Institute Tier IV certification for quality and reliability, the highest rating possible.*

## Innovative emergency cooling

To cater for the unusual power density and heat levels, equivalent to 62 transformers and sufficient to power ten 24-storey grade-A office buildings, the data centre is designed with an innovative emergency cooling strategy: Thermal Energy Storage (TES) tanks that employ water stratification principles have been installed to provide stable cooling performance, a first in Hong Kong.

**30,000m<sup>2</sup>** of Gross Floor Area

**4,000** racks

**68MVA** planned duty power

**Best Project Award**, 2015  
Institution of Mechanical Engineers  
(IMechE) Hong Kong Branch

## Resilience and flexibility

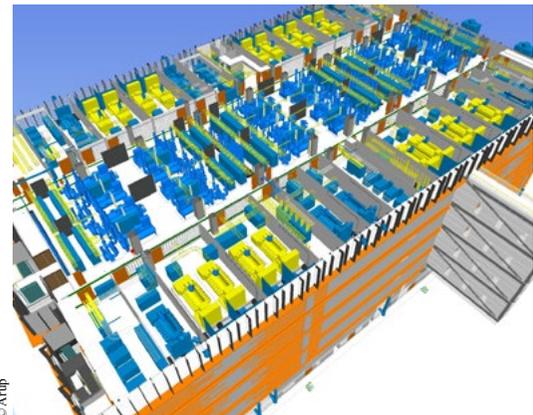
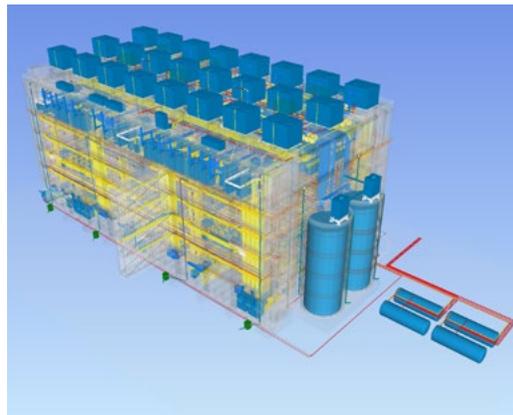
On-site energy generation and the pioneering TES tanks support non-stop business throughout the year, eliminating the need for downtime during fault resolution or maintenance, and ensuring the highest quality and reliability.

## Green credentials

Green credentials including energy-efficient air-conditioning units, the use of a water economiser in winter and efficient plant design mean the power usage effectiveness (PUE) value can be maintained as low as 1.5 in summer and 1.3 in winter, compared with the regional average of 2.3.

## Efficiency throughout the design life cycle

A first for the local data centre market, a fully Building Information Modelling (BIM) methodology was utilized, throughout the whole design life cycle, facilitating a truly collaborative design process, enabling design optimisation, improved efficiency and co-ordinated delivery of work.



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# Water resources for economic growth

Feasibility study for Foxwood Dam, South Africa

*The proposed development of a multi-purpose dam at the Foxwood site on the Koonap River near Adelaide in South Africa, is a strategic initiative to stimulate socio-economic development in this rural, economically depressed region.*

## Alignment with broader national plans

By working closely with a number of government departments, the vision for the dam has been aligned with South Africa's National Development Plan and National Water Resource Strategy.

## Development of a sustainable model

Arup established an Agricultural Technical Working Group to engage with all agricultural stakeholders; the aim of the consultation was to establish an agricultural

model that would be economically sustainable in the long term, a prerequisite for the feasibility of the dam project.

## Optimisation of dam size and type

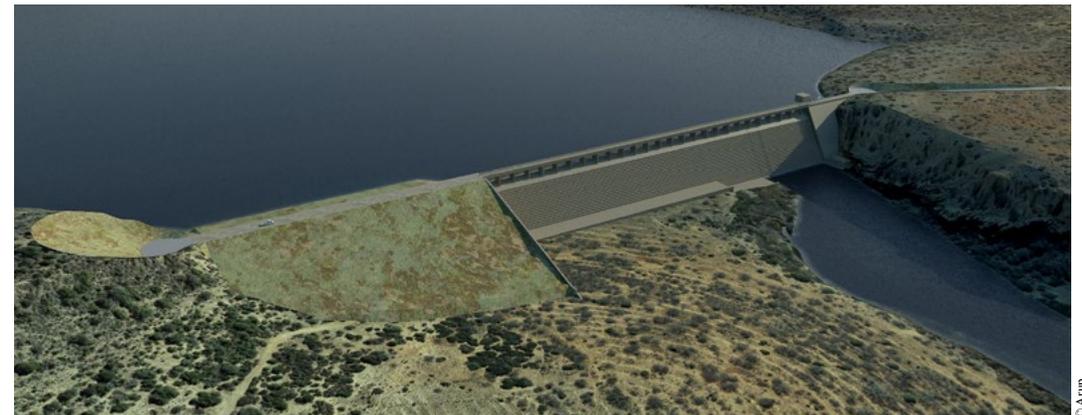
Our proposed solution, a composite gravity concrete and earth embankment dam, is economical to build, promotes natural spilling to provide required flood flows downstream and yields sufficient water for irrigation for farming, which will create long-term jobs for the region.

## Design and feasibility

Our role included the technical concept design of the proposed dam, development of a number of potential irrigated agricultural models and the economic impact assessment of both schemes.



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**1,900** long-term jobs estimated to be created on completion

**80%** of gross value added Projected to account for 80% of total gross value added in the municipality's agriculture sector by year 10

# A synergistic approach to design

Advanced Resource Recovery Facility, California

*The redevelopment of Recology's Tunnel and Beatty site is being undertaken to enable the City of San Francisco's ambitious plans to achieve zero waste to landfill by 2020. Approximately 3,000 tonnes of waste and recyclables will be transferred through the site every day.*

## High waste diversion rate

Recology is the largest organics compost facility operator by volume in the United States. Their work has helped San Francisco to achieve one of the highest waste diversion rates in the world, over 75%.

## Maximising practical benefits

Recology's new Advanced Resource Recovery Facility will take the next major step toward zero waste by processing the residual waste stream to extract all recyclables and organics and divert them from landfill. The aim is to attain the highest and best use for each resource recovered.

## New cohesive design

Having expanded progressively since opening in 1989, the existing facility needed rethinking to create a cohesive, efficient design that would accommodate the area's growing needs, and changes to legislation and technology.

## Combining technical expertise

Arup has combined expertise on resource recovery systems, sustainability, SMEP, transportation, civil and geotechnical services to produce an integrated net positive solution. We have also ensured that integrated sustainability performance remains in the forefront for all decisions.

## Optimising the site

To optimise site building and road layouts for the new facility, we provided strategic advice on advanced waste treatment technologies and assessed building sizes, energy, by-product generation and transportation impact.

## Realising synergies

Our design realises the synergies between these activities and integrates them on one site to deliver multiple waste treatment solutions. The result is projected to be a net positive facility that produces enough renewable energy to power Recology's full operation and potentially export additional biogas.



# Driving regeneration

A465 Heads of the Valley dualling, UK

*The A465 trunk road forms part of the Welsh Government's strategic transport corridor across south Wales. It is being upgraded to dual carriageway to improve journey time reliability, safety and network resilience. Arup worked with Carillion for the design and construction of the 7.8km section between Brynmawr and Tredegar.*

### Holistic approach to carbon assessment

We undertook a carbon emissions modelling exercise to help demonstrate the benefits of the scheme. Using traffic micro-simulation modelling, we demonstrated that free-flow traffic on the new road would reduce annual in-use CO<sub>2</sub>e by 10%.

### Economical and sustainable design

Arup and Carillion developed the scheme to optimise earthworks movements. 950,000m<sup>3</sup> of soil, topsoil and rock

was excavated during construction, all of which was retained on site, with no disposal to tips, to build an embankment rather than a viaduct.

### Consideration of social impacts

We assessed the wider economic benefits for the scheme on local labour markets and businesses. This enhanced assessment demonstrated an additional 16% of total scheme benefits and showed improved access to employment opportunities for local residents.

### Sympathetic to the surroundings

The scheme includes 3km of new cycle ways and safe walking routes to schools. At Garn Lydan, the highpoint of the Heads of the Valley road, a rest area provides a viewpoint, and new mounding screens properties and creates ecological habitat.



© Arup



© Carillion PLC

**18,000** tonnes of in-use carbon estimated to be saved from 2015 to 2030

**3km** of cycle tracks

# Innovative design solution meets exacting standards

Bayerischer Landtag, Germany

*The northern extension to the Bavarian Parliament Building (Bayerischer Landtag) in Munich, is the first government building to meet the demanding Passivhaus Institut (Passive House Institute) standard. The standard, which requires significantly reduced heating energy demand and air infiltration, has rarely been achieved for offices or public buildings.*

## The energy concept

The requirements for the six-storey office building were set deliberately high to showcase outstanding performance. The energy concept is based on airtight façades with very high thermal insulation qualities, a building envelope free of cold bridges and much-reduced ventilation heat losses.

## Pioneering solution through collaboration

Arup worked closely with architects Léon Wohlhage Wernik to meet the challenge

of achieving the required comfort levels within the Passivhaus standards. The jointly developed solution is a concrete core activation system that utilises the large building mass, combined with a sophisticated control system that allows rapid user adjustments.

## Maximising daylight

Box-windows provide excellent levels of daylight, while avoiding the risk of overheating inside the building. External louvres offer shade and are protected by single-pane glass panels, making them suitable for use in all weather conditions.

## Highly efficient mechanical ventilation

To ensure clean, fresh air, operable windows are supplemented with a low-energy mechanical ventilation system. The system has been designed with a highly efficient heat exchanger that recovers more than 75% of the heat from extracted air.



© Christian Riehers



© Christian Riehers



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**European Prize** for Architecture, 2012, Energy + Architecture, European Centre for Architecture Art Design and Urban Studies

**Certified Passive House**, 2012, Passivhaus Institut

# A world first in green certification

Star Harbour, Shanghai

*Star Harbour, strategically located along the Huangpu River shoreline in Shanghai, is Asia's largest green building cluster. The size of the development is unprecedented: it consists of 34 Grade-A office buildings spread over almost two kilometres, with a total gross floor area of 3Mm<sup>2</sup>.*

## Triple green certification

The Star Harbour development is the first in the world to obtain three major green certification labels: US LEED® Gold certification, UK BREEAM® and the China 3-Star system certification. Arup's role is building sustainability and LEED® consultant for the project.

## A practical approach

Contrary to convention in China, Arup is playing a key role throughout all stages of the development, from design to

construction and management. Our focus has been on embedding as many green strategies as feasible within the design, ensuring they can be achieved during the construction process.

## Sustainable design strategies

Green strategies include a central energy plant, ice-storage system and river water source heat pump units, rainwater and greywater harvesting and reuse, as well as waste recycling and the use of recycled materials.

## Minimising carbon footprint

The buildings make use of transitional season free cooling, heat recovery, indoor fresh air CO<sub>2</sub> monitoring, and feature skylights, sunken plazas and building management systems to conserve energy and minimise carbon footprint.



© Star Bund



© Star Bund

# Balancing in-use and embodied carbon

Reid Building, Glasgow School of Art (GSA)

*The new Reid Building provides the GSA with a high-quality environment to inspire creative education and research in the visual disciplines of the 21st century, and is a worthy neighbour to the prestigious Mackintosh Building (the Mack). The building uses 20% less carbon than the building regulations required and has decarbonised the wider campus' heating.*

## Going beyond the brief

We developed and implemented a strategy for decarbonising not only the new development, but also the wider campus, including the listed Mack building, which posed particular challenges. We upgraded the district heating system to biomass to serve the existing facilities and the new building.

## Minimising embodied carbon

High cement replacement percentages were specified to reduce the carbon content of the concrete. In addition, using the concrete structure as the finished form minimised the number of follow-on trades, and reduced waste and embodied energy.

## Demonstrating long-term benefits

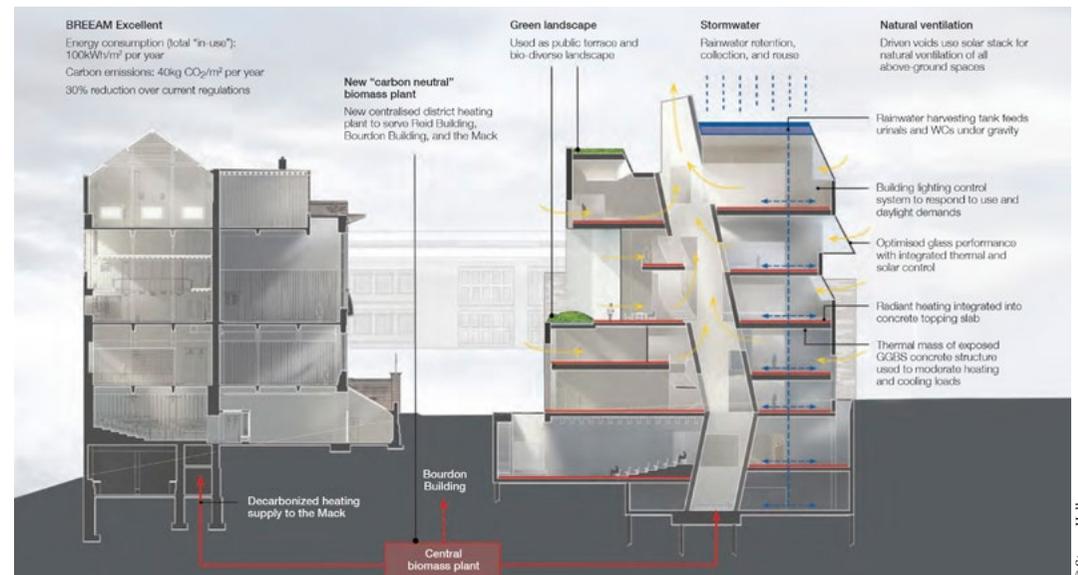
Using a bespoke Arup tool, we evaluated embodied CO<sub>2</sub> to benchmark the scheme against various constructions, and to help define the balance of in-use and embodied carbon to demonstrate the lifetime environmental benefits of the project.

## Quantifying the environmental benefits

The carbon assessment demonstrated that it would take just 11 years for the savings in operational emissions to 'pay back' the carbon invested in the construction. Against the new building's 60-year design life, this represents a much-reduced environmental impact.



© Alan McAtter



© Steven Hall

# Encouraging Innovation

We live in a rapidly changing world. The issues we face globally are increasingly complex and their potential effects far-reaching. That is why we invest our time and money to find innovative ways to meet these challenges and pre-empt their effects, to help build resilience not just for our clients but also on a larger scale for cities and their communities, and for regions and their assets. We consistently challenge what we do and the way we do it, always seeking a better way.

# Cooler air, cleaner air

Arup's Venturing Initiative



*Arup's Venturing Initiative seeks to commercialise products, software, apps and business ideas that contribute to designing a world that is safer, cleaner and more resource-efficient.*

## Air Induction Unit

Arup's Air Induction Unit (AIU) is an innovative device that combines form and function for ventilation in a semi-outdoor space.

## Improving human comfort

A bladeless fan with an attractive minimalist design, the AIU uses aerodynamic principles to create a continuous but gentle, large-volume airflow to improve human comfort in a semi-outdoor environment.

## Energy-efficient and low maintenance

By contrast to conventional mechanical fans, the AIU can ventilate a much larger area, and is more energy-efficient and quieter during operation. With no blades or other detachable parts, the device is safe, and easy to clean and maintain.

## A multitude of applications

The simple design makes the fan suitable for many applications such as restaurant and railway facilities; it has already been installed in a semi-outdoor restaurant area in The Green Atrium, a multi-purpose community centre in Hong Kong.

## Award-winning design

The AIU was awarded the Grand Prize under 'Category I: an invention' of the 2015 Hong Kong Institution of Engineers (HKIE) Innovation Awards for Young Members.

## City Air Purification System



*The city air purification system, which takes the form of a bus stop, provides purified air to anyone standing near it.*

## Creating cleaner air

Jointly developed by Arup and Sino Green, the bus stop sucks in exhaust fumes from an inlet at the bottom, the air current then passes through a filter to remove pollutants before being pumped out of a louvre air vent overhead.

## Keeping pollutants out

The system has been designed using the principles of fluid mechanics: the build up of positive pressure creates an air curtain that keeps pollutants out of the bus shelter. The air quality at the bus shelter can be monitored remotely.

## Prototype testing

The first prototype was set up in one of the busiest streets in Hong Kong where data was collected for two months. It is now being tested in Beijing, in collaboration with Tsinghua University.

## Enhancing the system

Further planned enhancements include smart controllers to manage operating hours more efficiently, solar panels and energy floors to generate renewable energy and a mist cooling system for summer months.

Selected media coverage: Forbes, Bloomberg, Guardian, CCTV.

**50%** reduction in the concentration of air pollutants.

# Working towards net zero energy communities

CIRE (Community Integrated Renewable Energy), San Francisco

*California leads the US in the deployment of renewable generation. The state's ambitious target is for 12,000MW of distributed renewable power to be generated by projects sized no larger than 20MWs by 2020. The city of San Francisco has an even more ambitious goal: to be 100% renewably powered.*

## New models of energy generation

To meet the states local energy goal, new models of energy generation are needed, such as local renewable power, which reduces system losses, gives greater energy security and defers the need for transmission lines.

## Community-based projects

Arup is assessing the feasibility of increasing CIRE projects and how these developments can be shared as a community microgrid. Such projects are currently rare, not least because of regulatory barriers and ownership issues.

## Benefits for the community

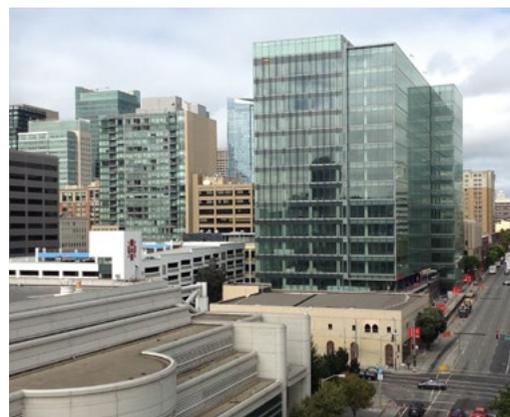
CIRE projects allow community members to have some or all of their electricity needs supplied from renewable sources that are installed either within a building or local area. They also give greater local control and can reduce energy bills. With right-sized generation, net zero energy communities could be created.

## A roadmap for renewable energy

Our research and workshops have clearly demonstrated that there is a need for CIRE projects in California. Furthermore, our roadmap documents the benefits, barriers, and potential regulatory challenges to developing such projects throughout the state.

## Further study commissioned

Our work has led to recognition of the importance of CIRE in California's energy mix. The California Energy Commission (CEC) who funded the feasibility study has now commissioned us to develop project implementation plans. We are also working on a project to design solar and energy storage installations to power critical San Francisco city buildings during an emergency.



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# Climate change adaptation planning

Northern Alliance for Greenhouse Action, Australia

*Arup developed a profile of Melbourne's North (the NAGA region), identifying potential vulnerabilities to projected climate change across six sectors: human services, emergency management, infrastructure, industry, natural ecosystems and planning. From this a risk assessment of sector vulnerabilities was drafted and an adaptation plan proposed.*

## Focusing on local initiatives

NAGA is a coalition of nine northern metropolitan councils in Victoria and the Moreland Energy Foundation Ltd. The purpose of the coalition is to develop and implement innovative projects to reduce carbon emissions and help member councils adapt to the local impacts of climate change.

## A holistic approach

During the first phase of the project we developed a profile of the NAGA region and identified the potential vulnerabilities

to projected climate change across six sectors: human services, emergency management, infrastructure, industry, natural ecosystems and planning.

## Engagement of multiple stakeholders

We worked with experts from across our firm as well as from key industry organisations. During a series of sector-specific workshops the potential vulnerabilities were appraised and tested, and a longlist of adaptive actions identified. The list was subsequently reviewed and prioritised by local government representatives.

## Planning for the future

Arup's research and detailed assessment will form the basis for NAGA's future work in adaptation. As the first adaptation plan for Melbourne's North, the assessment and proposed actions will be reviewed on a regular basis to build resilience within all six sectors across the whole region.



© City of Yarra



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# Unlocking a programme of regeneration

Programme Delivery Dashboard, UK

*London Borough of Croydon (LBC) set Arup the challenge of planning how to deliver their ambitious five-year regeneration programme, which will transform Croydon as a place to live, work and visit, while keeping the town moving. Instead of a conventional static report or timeline, Arup proposed a real-time web-based dashboard tool.*

## Tracking progress in real time

Arup's Programme Delivery Dashboard is a powerful interactive digital tool that allows LBC to easily visualise, monitor and manage the regeneration programme, comprising over 160 construction projects, in real time.

**Winner** Innovation Award, Management Consultancy Association Awards, 2015

**8,000+** homes projected by 2021

**23,000+** jobs projected by 2021

"The Five Year Delivery Plan and its dashboard form a powerful mechanism for driving delivery and change in the Croydon Metropolitan Area."  
Jo Negrini, Executive Director, Development & Environment at LBC

## Mapping a growing and changing programme

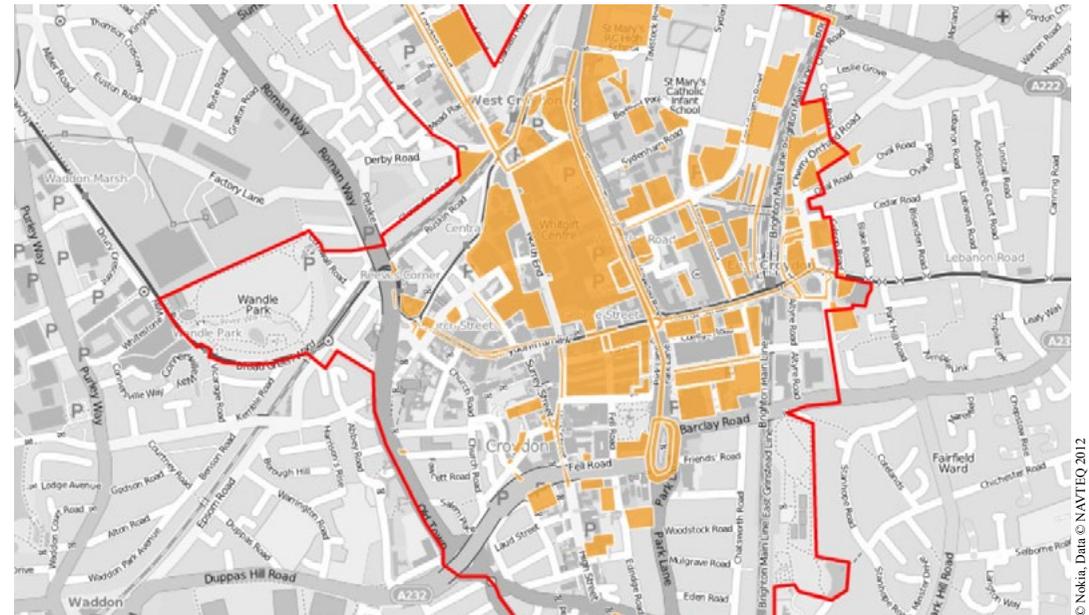
The Arup team recognised the fluid nature of the regeneration programme; it was growing and changing continually as projects in the pipeline were consolidated for the first time. But, with the Dashboard, the cumulative effects of multiple projects can be easily understood and balanced.

## More than a management tool

The Dashboard provides a crucial management tool, but its impact has gone far beyond this. It has engaged and reassured stakeholders, enabling them to bring forward projects and grasp new opportunities, and it has allowed for areas of infrastructure requiring further investment to be identified.

## Catalyst for infrastructure regeneration

The Dashboard has become the main communication tool and catalyst to negotiate co-operation and funding commitments, without which significant infrastructure upgrades were at risk of stalling, or lacking the funding to proceed.



# Value chain carbon footprint assessment

Unlocking scope 3 carbon savings

*Arup carried out a study to quantify the value chain greenhouse gas emissions associated with WPP, the British multinational advertising and public relations company, UK operations. For many business sectors these scope 3 emissions account for the majority of their carbon emissions and offer significant opportunities for savings.*

## Looking at value chain carbon emissions

While WPP has been measuring its operational carbon emissions for many years, the premise of this study was to enable WPP to understand its total carbon emissions, arising from advertisements placed for clients, and goods and services bought.

**15%** of CO<sub>2</sub>e from goods and services bought

**81%** of CO<sub>2</sub>e from ads placed for clients

**1.2** million tonnes CO<sub>2</sub>e full carbon footprint

**4%** of CO<sub>2</sub>e from day-to-day activities

## The results of the analysis

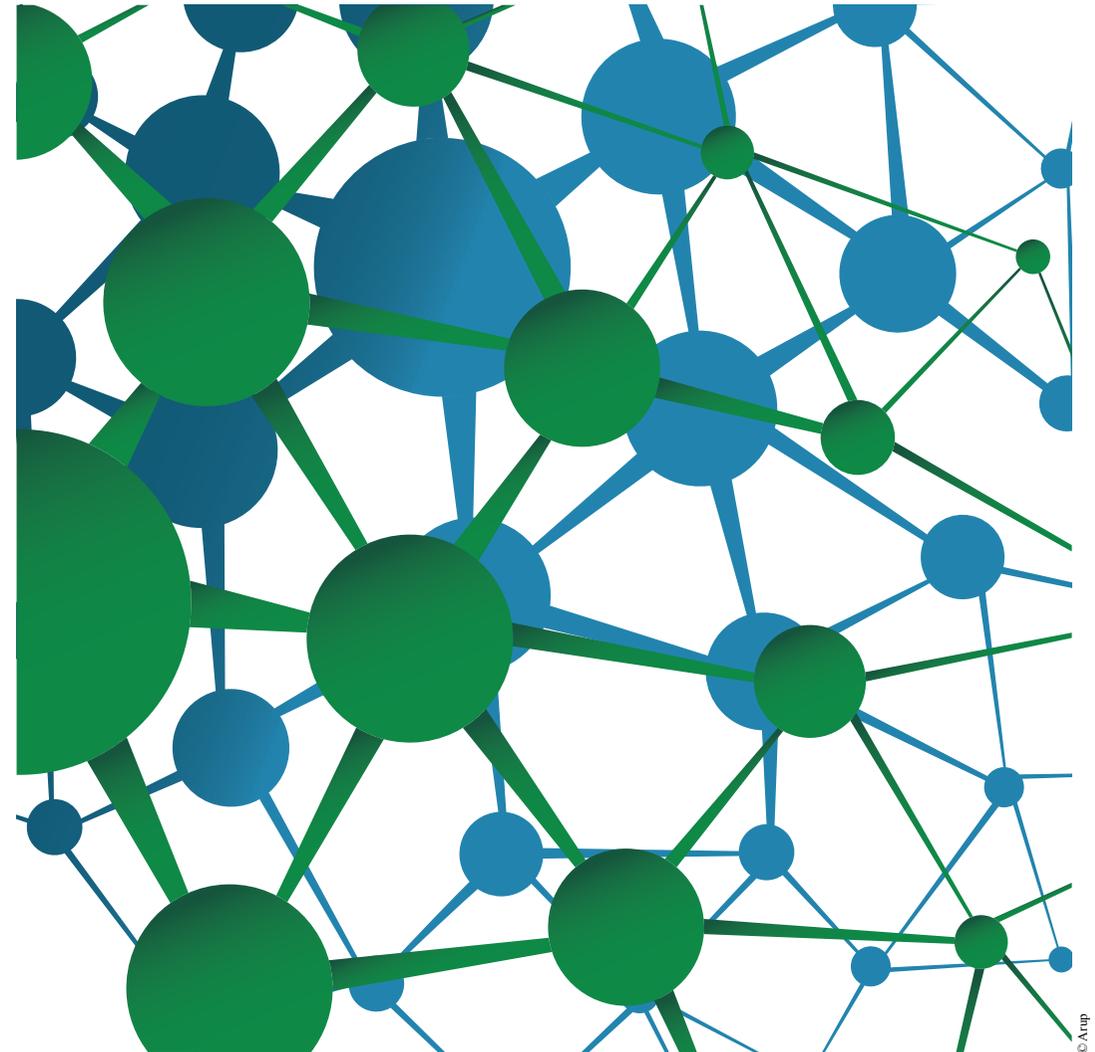
The study highlights that media creation and distribution, at the scale at which WPP operates, create a significant amount of greenhouse gas emissions. The advertisements placed by WPP for clients account for over 80% of WPP's total carbon emissions of 1.2m tonnes of CO<sub>2</sub>e.

## Reducing supply chain emissions

Goods and services bought equate to 15% of emissions: WPP can now review its procurement strategy and identify how it can integrate the results of this analysis into its internal purchasing tools, and focus its efforts on carbon hotspots.

## Developing low-carbon media campaigns

The study analysed the carbon footprint of various media channels, including press, TV/radio, internet and outdoor. It gives WPP and its media investment management unit, GroupM, sufficient data to include carbon metrics in clients' media plans and discuss the opportunity for low-carbon media campaigns.



# From waste to energy

Organic Waste Treatment Facility, Hong Kong

*Arup has a contract to design, build and operate a food waste anaerobic digestion treatment facility, the first of its kind in Hong Kong. The facility will help to replace the use of fossil fuels for electricity generation and reduce greenhouse gas emissions by 25,000 tonnes annually.*

**228 tonnes of waste per day**

The Organic Waste Treatment Facility will receive and treat 228 wet tonnes of biodegradable waste per day, comprising food and other organic wastes generated from commercial, industrial and institutional establishments.

**Renewable energy and compost products**

The waste will be treated with anaerobic digestion and composting technologies to create biogas and high-quality compost products. Surplus electricity, estimated to

be 28M kWh per year, will be fed to the grid, sufficient to supply enough power for 3,000 homes.

**Minimising environmental impact**

Odorous gas from the facility will be treated within a centralised air purification control system so it meets environmental and operational health requirements. Wastewater will also undergo an advanced wastewater treatment process before being discharged.

**Sustainable building form**

The external building envelope has been designed to be as compact as possible to balance function and sustainability, facilitating more efficient waste handling and composting processes, and reducing construction materials, pipework, ancillary plant and equipment.



© OSCAR Bioenergy JV



© OSCAR Bioenergy JV



© OSCAR Bioenergy JV

**28** million kWh per year

**3,000** homes' electricity equivalent supplied back to the grid.

**7,000** tonnes compost per year

# 6-star ‘World Leadership’ rating

Caloundra South, Australia

*Caloundra South is a new greenfield urban and residential community on the Sunshine Coast, catering for 50,000 people. It is the largest project to achieve a 6-star ‘World Leadership’ rating under the Green Building Council of Australia’s (GBCA) Green Star Communities Pilot tool.*

## Formal testing of GBCA Pilot tool

Arup led the development of the sustainability strategy and delivery of the accreditation consultancy services. We actively piloted the Green Building Council’s new tool, which is Australia’s first independent, precinct-wide sustainability rating tool, working in partnership with our client and the GBCA.

**700** hectares of land to be rehabilitated

**19,500** direct jobs to be created

‘15-minutes community’ created with an active walking and cycling network

“Caloundra South embodies the future of Australian communities.”  
Romilly Madew, Green Building Council of Australia

## An impartial approach

A combination of integrity, objectivity and diligence enabled us to remain loyal to the evolving visions of the community, whilst benchmarking performance impartially against the rating scorecard, which covered the areas of governance, design, liveability, economic prosperity and environment.

## A community focus

We focused on pursuing ideas that offered multiple benefits, addressed site resilience, stimulated awareness and provided meaningful outcomes for the community, as well as fostered an innovative and creative approach to sustainability.

## Increase in habitat connectivity

Our strategy examined and quantified the increase in local habitat connectivity for significant native species, such as the wallum sedge frog, Lewin’s rail and the long-nosed Potoroo: habitat connectivity is expected to increase by a magnitude over three times that of the existing site.



© Stockland

© Stockland

# Sharing Knowledge

Knowledge is at the heart of progress. Sharing knowledge can save time, resources and empower communities. It can spawn innovation and in doing so help to create a better future. Large-scale solutions are only achievable through collaboration, which is why we welcome partnering and sharing ideas through open dialogue. Within Arup, we look to engender a diverse and inclusive culture, which facilitates open communication and sharing ideas across the firm.

# Governing cities in the digital age

Delivering Smart Cities

*Delivering the Smart City, written by Arup in collaboration with University College London (UCL) defines a seven-step framework to support national and local governments with the implementation of smart city initiatives. The organisers of the 2014 Barcelona Smart City Expo commissioned the report for launch at the Expo to maximise its reach.*

## Defining the smart city

Around the world political leaders are thinking about what it means to be a smart city, looking at how cities are using the latest wave of digital technology such as social media, the Internet of Things (internet connected devices) and data analytics.

## People-centred benefits

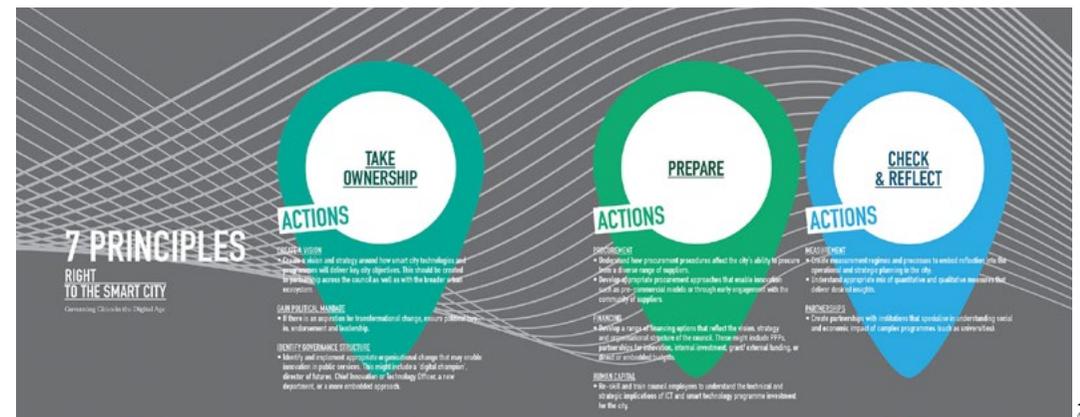
Thoughts about the smart city are shifting. The original focus was on using this new technology to optimise city operations, but now the more people-centred benefits of smart technology, such as creating jobs and empowering local communities, are being recognised.

## Seven principles for smart city governance

We researched eight global cities that are role models for governing smart technology. From this, we defined seven principles to guide city authorities in their smart technology investments: clarify the opportunity, take ownership, engage, prepare, act, check and reflect, and repeat and share learning.

## Achieving a city's objectives

Our guidance includes defining a vision of how technology can help to achieve a city's objectives, deciding which smart benefits they want to pursue, and creating a governance structure that enables efficient cross-department working.



700 downloads from the Arup website

"I welcome this important report from Arup and UCL which clarifies the fundamental concept of the smart city, outlines what cities can and have achieved and offers practical and grounded insights into the challenges they face."

Stephen Hilton, Director of Sustainable & Innovative Urban Futures, Bristol City Council

# Skills for the future

Community School in Thnouch Village, Cambodia

*Sponsored by Arup Cause, a team of Arup volunteers worked with the charity Project Little Dream (PLD) to deliver Phase 2 of the Thnouch Village School Project, comprising a kindergarten, library and sanitation facility.*

## Providing access to education

Thnouch Village is one of the poorest villages in Southern Cambodia, lacking even a basic electricity and water supply, and until the PLD-initiated project it had no public school in the vicinity. As a result only a fraction of the community's school-age children were receiving an education.

## Improving hygiene for all

The new facilities go beyond benefiting just the children though. The inclusion of a courtyard and rainwater system within the school is providing secure access to clean water for the local community, improving hygiene for all.

## Strengthening the community

The school library is also open to the public, helping to imparting knowledge to the whole of the village. It also serves as a meeting place for villagers, thus strengthening the ties of the community.

## A catalyst for enhancing living standards

A central aim of the project has been to maximise the exchange of knowledge. We ensured that the skills and construction methods were passed on to the local craftspeople, so the sustainable design can be replicated beyond the boundaries of Thnouch Village and act as a catalyst for enhancing living standards across the region.



© Project little dream



© Tony Wong



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# A new benchmark for infrastructure projects

Regional Rail Link, Melbourne

*The sustainability approach of the Regional Rail Link (RRL) in Melbourne, from design through to construction, has been one its outstanding features, culminating in the project winning the 2014 Premier’s Sustainability Awards for Buildings and Infrastructure.*

## Transforming the rail network

The RRL has transformed Melbourne’s metropolitan rail network and doubled the capacity of the regional network. Arup played a pivotal role in the project contributing more than 15 engineering services over five years and set a new benchmark for sustainability outcomes that exceeded industry best practice.

## A step-change for infrastructure projects

The approach to sustainability was established by Arup during the design

**20%** reduction in construction-phase energy and carbon

**80%** recycling/reuse of construction and demolition waste achieved

**4-star** Green Star rating from the Green Building Council of Australia for the new railway station at West Footscray

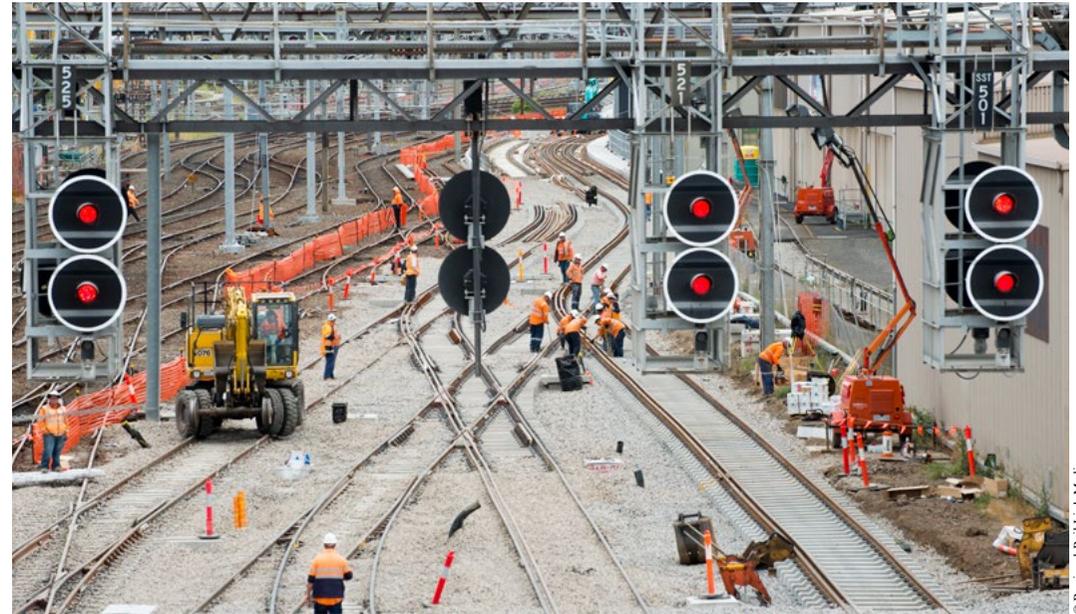
phase and represented a step-change to the integration of sustainability targets within large infrastructure projects in Australia. This emanated from the RRL Authority Sustainability Policy and associated vision, objectives and targets.

## Clearly defined targets

The Policy defined seven objectives for the project, further clarified through the establishment of 22 supporting targets. These targets were identified through Arup-led research, which built on our extensive understanding of the sustainability opportunities within the infrastructure sector.

## Embedding sustainability from the outset

Our focus was to define targets that rewarded outcomes, rather than processes, and ensure that the responsibility for meeting these was placed with the relevant design and contracting teams. In a break with previous infrastructure projects, the targets were included as a Minimum Condition of Satisfaction.



© Regional Rail Link Media



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# Identifying and protecting vulnerable people

## Reducing urban heat risk

*Cities are getting hotter and extreme hot weather events more frequent. In the UK alone, heat-related stress currently accounts for more than a thousand premature deaths each year. Arup's Reducing urban heat risk report looks at how hot weather affects cities, its impact on health, and interventions to reduce the risk.*

### Understanding the risk of hot weather

Decision-makers, including housing and public health professionals, planners and developers, and local politicians, need to be well-informed about the risks of hot weather and understand how they can protect the most vulnerable people.

### How to reduce urban heat risk

The report identifies the factors that contribute to urban heat risk and presents the steps that can be taken to reduce the risk

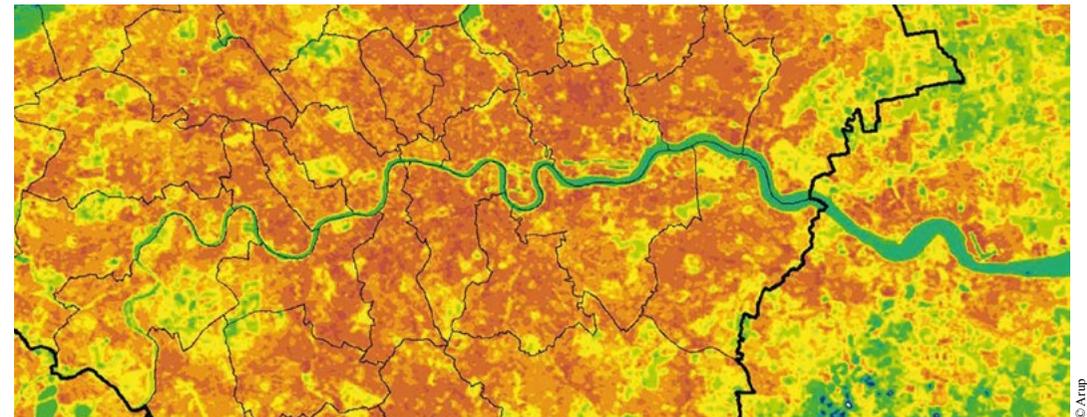
in a clear and visual way. Recommendations are categorised as physical, social, strategic or operational interventions and by the scale of implementation.

### Identifying the most vulnerable people

The project highlights 'triple risk hot spots' which are the areas and buildings where the most vulnerable people, such as the very young, older people or those with a chronic disease, could be at greatest risk.

### Collaborative research

The Reducing urban heat risk report and associated infographic are the result of a collaborative research project between Arup, the Greater London Authority, the London Climate Change Partnership, University College London and the London Borough of Islington.



**2-8°C** reduction in air and land surface temperatures in cities achievable through trees and green spaces

# Boosting healthcare in the Caribbean

## Energy Retrofit Guide for Caribbean Hospitals

*The Energy Retrofit Guide for Caribbean Hospitals is a retrofit guide that is specific to Caribbean building types, climate, and economic considerations. The guide provides a standard roadmap for planning, selecting, and implementing proven, cost-effective measures that enhance building energy efficiency and resilience in existing hospitals.*

### A clear retrofit design process

The guide gives decision-makers and hospital owners a clear retrofit design process to follow, eliminating the need for extraneous research and analysis. The standardised procedures help to streamline project assessments, encouraging time-efficient processing and implementation.

### A catalyst for securing investment

By directing retrofit efforts toward proven, low-risk projects and practices that

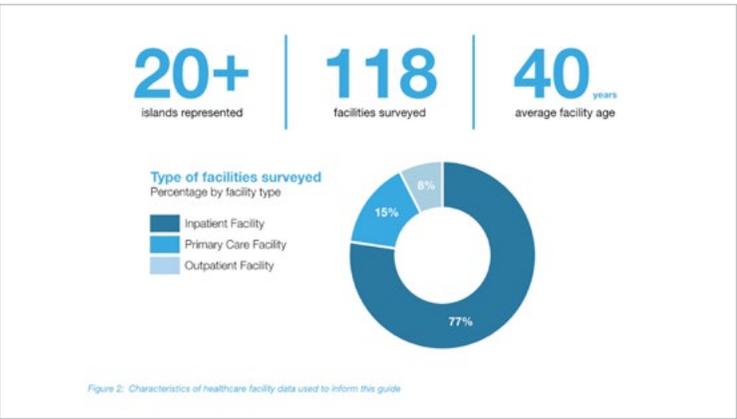
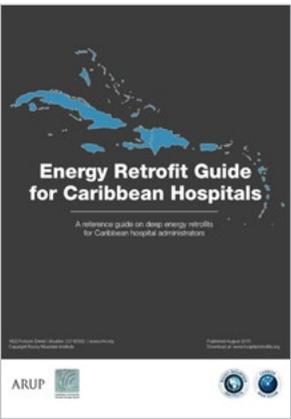
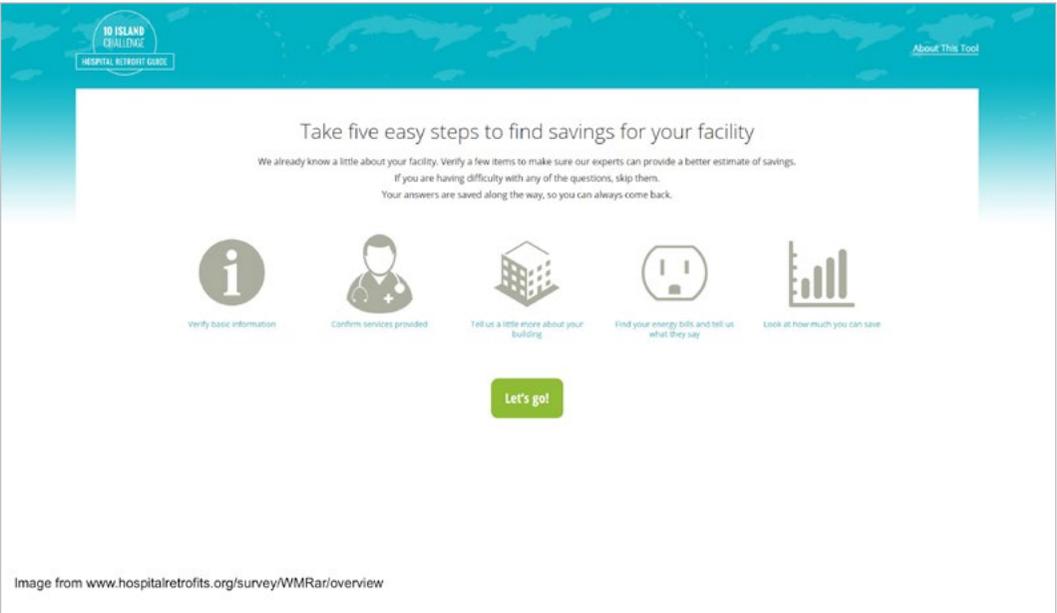
are easy to replicate, the guide will also contribute to secure funding commitments by helping to mitigate the perceived risks of investment.

### Encouraging engagement

In addition to a published guide, an easy-to-use online tool provides a simple 5-step approach to enable hospital administrators to assess current performance and identify potential energy efficiency measures, promoting greater engagement with the retrofit process.

### Working in partnership

The project, which is intended to boost Caribbean economies and improve healthcare services, is the result of a partnership between Carbon War Room, Rocky Mountain Institute, the Caribbean Community Climate Change Centre and Arup.



# Integrating green space into urban environments

Greening Laneways Assessment, Melbourne

*A landmark green infrastructure project that identifies green infrastructure opportunities across the City of Melbourne's characteristic laneways is helping to support the city's objectives for urban forest, wellbeing, water catchment and climate change resilience.*

## Countering the challenges of urban density

Melbourne's urban population is projected to soar to almost eight million by 2050. Finding innovative ways to integrate green space into increasingly dense urban environments will be a key strategy for sustaining a healthy and resilient city.

## User-friendly interface

Arup's innovative audit tool and assessment framework addresses the unique and complex challenges of laneway environments. The tool has a user-friendly interface and offers step-by-step guidance. As such, the green infrastructure opportunity assessments can be carried out without the need for specialist technical input.

## Successful pilot project

We successfully implemented the framework as a pilot assessment across a city block, paving the way for rollout across Melbourne's central business district. A map interface for the results has been embedded into City of Melbourne systems, enabling integration with capital works planning processes.

## Extensive research undertaken

Considerable research was undertaken to understand the requirements of different green infrastructure types and how these align with the specific characteristics of an urban laneway environment. Our analysis included solar access, microclimate, drainage and surface flow characteristics, vehicle access and local character.



# Is refurbishment a sustainable option for buildings?

Carbon Life Cycle Assessment, UK

*Arup worked with Stanhope, the owner of the Halo Building in central London, to understand the carbon impacts of their decision to refurbish this 1970s, 11-storey office tower. The findings provide Stanhope with useful data as well as a deeper understanding of the carbon impacts of refurbishment versus new build.*

## Replacing guesswork with calculations

Stanhope recognised the usefulness of learning whether refurbishment offers measurable carbon savings, rather than relying on guesswork. They commissioned Arup to undertake a carbon life cycle assessment (LCA) of the Halo Building for a 50-year period.

## Evidence-based approach

Using LCA protocols, Arup provided evidence of the carbon savings achievable through refurbishment, and demonstrated

that refurbishment was, in fact, the lowest carbon option for the site. Leaving the building as it was or replacing it with a new building were both shown to have higher carbon emissions.

## Useful data for future decisions

The findings provided Stanhope with useful information for making future decisions about other buildings they own. This work also adds to Arup's knowledge of the scale and nature of carbon emissions arising from refurbishment, as compared to other building development options.

## Quantifiable savings

Arup calculated that refurbishment of the building, by Bennetts Associates Architects, would save 5,344 tCO<sub>2</sub>e over a 50-year period compared with new build. The refurbished building has been awarded BREEAM 'Very Good' at construction stage.



# Bringing an architectural icon into the 21<sup>st</sup> century

Miesian Plaza, Dublin

*As the result of sensitive retrofitting, the Miesian Plaza, Baggot Street Office development will retain its architectural integrity, while benefitting from modern performance standards with high energy and water efficiency. The development is on track to achieve LEED®v4 Platinum Core & Shell.*

## A high-performance façade

Due to its listed status, it wasn't a requirement to upgrade the performance of the façade in Miesian Plaza, but recognising that this would be the single-most effective method of energy conservation, improving the performance of the building fabric without compromising the historic aesthetic became a top priority for the design.

## Preserving original features

New bronze coloured glass, in keeping with the original, incorporates a high-performance solar control coating which, combined with motorised solar control

blinds, helps minimise solar gain. Careful refurbishment of the façade framing improves its u-value and weathering performance, and prevents thermal heat loss.

## Ensuring the building's longevity

Arup's new design of the mechanical and electrical systems has been based on a multi-tenancy to allow greater flexibility and help future-proof the building. To minimise the service-risers impact on the building's footprint, the central cores have been re-configured, eliminating the need for prohibitive structural changes, while maximising energy-efficiency and the net lettable space.

## Water conservation

As water treatment and supply costs are increasing in Ireland, water conservation is now more critical. We have taken a whole-building approach that includes recycling, conservation and metering, as well as a rainwater reclamation strategy.



**40%** estimated energy cost savings

# Our performance in perspective 2014/2015

We monitor and report on our performance annually to track progress against our targets. We report annually on fifteen (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.

## Our annual performance results:



### Community investment

**£796,000 donated**  
to charities and community organisations

**£642,000 invested**  
in pro-bono engagement

**9,216 hours**  
of paid pro-bono advice and engagement



### Diversity

**17% of management positions**  
occupied by females (grades 7-9)

**27% management staff**  
completed diversity and inclusion training



### Carbon emissions

**3.4 tCO<sub>2</sub>e/employee/year**  
scopes 1,2+3 business travel

**13% reduction**  
from 2013/2014



### Energy use

**212 kWh/m<sup>2</sup>/year**  
1% reduction from 2013/2014



### Staff sustainability training

**1.7 hours** sustainability training per employee  
22% increase from 2013/2014



### Paper use

**31.4kg**  
paper / employee / year

**34% decrease**  
from 2013/2014



### Projects

**33.6% of projects over £150k**  
report specific sustainability objectives



### Management Systems

**99% staff in offices certified to**  
ISO 14001 Environmental Management System

# Our performance 2014/2015

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

## Energy use (kWh / m<sup>2</sup> / year)



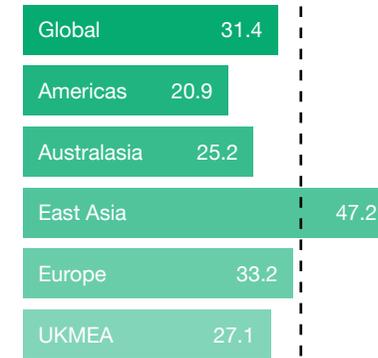
## Carbon emissions (tCO<sub>2</sub>e / employee / year)



Target 3.0

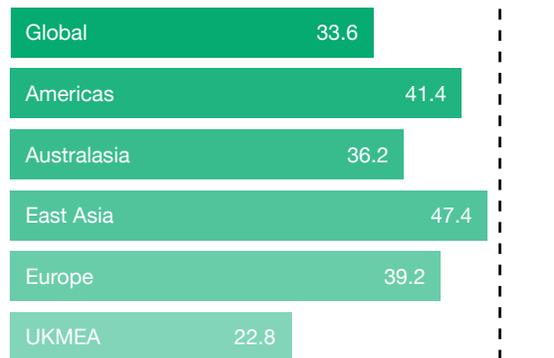
Note: figures exclude offsetting initiatives

## Paper consumption (kg / employee / year)



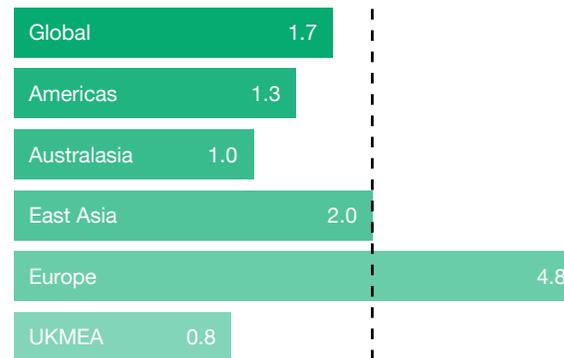
Target 34.0

## Projects setting sustainability objectives (% projects with fee > £150,000)



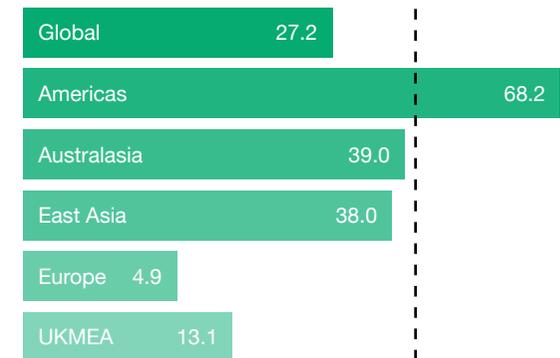
Target 50%

## Sustainability training (hours / employee / year)



Target 2.0

## Diversity and Inclusion training (% grades 7-9)



Target 40%

# 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

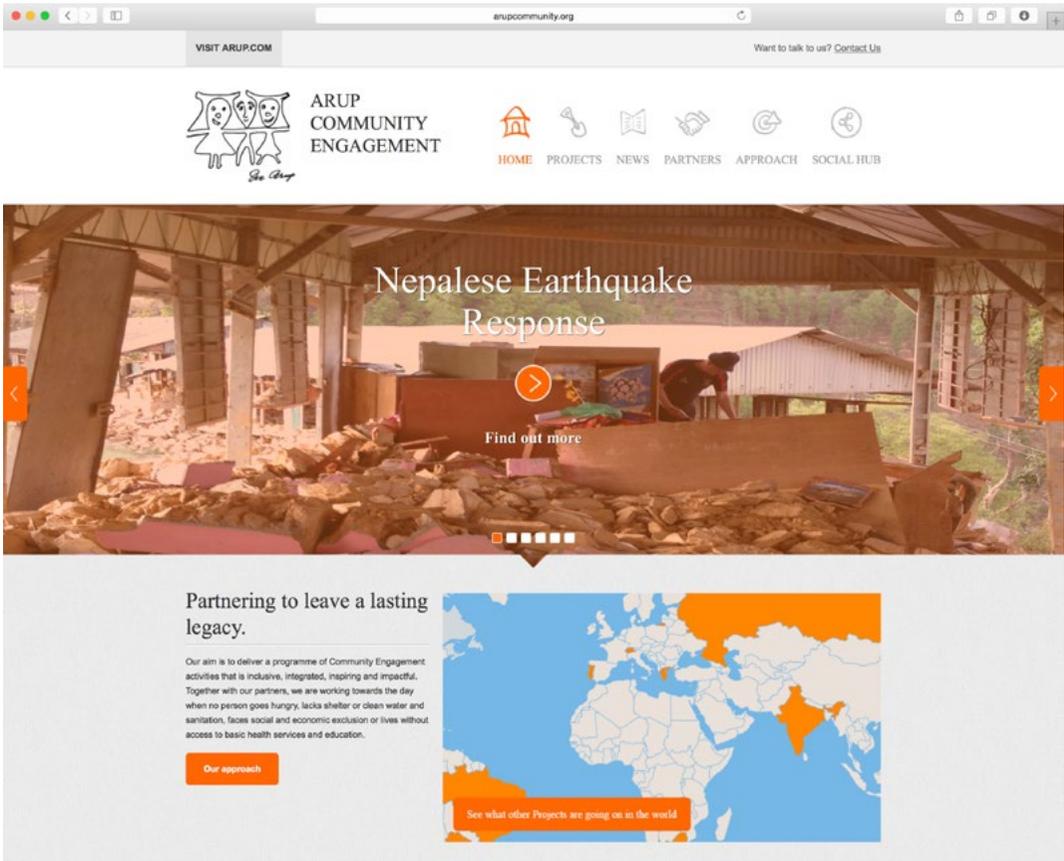
Our founder, Ove Arup, said: “Our lives are inextricably mixed up with those of our fellow human beings, and that there can be no real happiness in isolation.” Social usefulness continues to be one of our core values and part of this is our ongoing commitment to charitable causes. Through our Community Engagement programme, as well as directly donating a percentage of our profits each year, 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 each and 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.



For more information on the work and impact we are making around the world, please visit [www.arupcommunity.org](http://www.arupcommunity.org)

# Diversity and inclusion

Our staff are the bedrock of our business and we see it as a priority to engender a culture of creativity and to embrace diversity. We seek out people with different backgrounds, skills and abilities to join our 12,000-strong community. We welcome challenging opinions and new and innovative ways of thinking.

## Equal opportunities for all

We are committed to creating an inclusive work environment based on fairness, respect and merit, irrespective of gender, ethnicity, sexuality and age. This creates equal opportunities for everyone to grow and develop within the firm, as well as enabling us to be adaptable and innovative, and maximising outcomes for our clients.

We have an active programme to build on our founding principles and ethos of diversity and to ensure that a spirit of creativity continues to thrive.

## An initial focus on gender diversity

We are committed to improving all areas of diversity and inclusion at Arup, with our initial focus being on improving gender diversity.

To drive continued improvement in gender balance, we have developed a global framework that includes five specific strategies. The framework outlines our guiding principles, which can then be developed into region-specific initiatives.

## Five strategies to guide regional initiatives:

1. Mentoring
2. Flexible working
3. Networking
4. Senior women's journeys
5. Inclusive leadership training

## Connecting employees

Connect Cultures is Arup's internal cultural, religious, and ethnic diversity network. The network was set up to foster an inclusive and equal opportunity work environment that respects individual differences and values what each person brings to our firm. It also provides a platform for networking and connecting people.

## Enabling staff to reach their full potential

The network focuses on the specific opportunities and challenges associated with cultural difference, and looks to find opportunities to promote the benefits this diversity offers our employees and the wider Arup working environment.

## Events to facilitate dialogue

At the network's launch in the UK, guest speaker David Lammy, Member of Parliament for Tottenham, led discussions exploring the topic of cultural diversity and shared his personal experience. At another event, speakers from South Africa gave an insight into the country's Heritage Month.

## Informing a better working environment

A recent event named Cultural Intelligence delved deeper into the impact of cultural diversity on the workplace, project environment and employee experience, with a view to taking these lessons learned to inform a better working environment.

## Nurturing a culturally diverse workplace

Connect Cultures aims to build on our founding principles and ethos of diversity, to enable inter-cultural understanding, challenge preconceptions, and ensure a spirit of creativity continues in our firm by encouraging different ways of thinking.

# Contacts

A list of staff to contact for further details is provided below.



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## Global Sustainability Team

**Director of Global Sustainability**  
Mahadev Raman

### Regional Sustainability Directors

- Mahadev Raman, *Americas*
- Marianne Foley, *Australasia*
- Sam Tsol, *East Asia*
- Mark Chown, *Europe*
- Ian Rogers, *UKMEA*



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## Community Engagement

**Director of Community Engagement**  
Gregory Hodkinson

**Head of Community Engagement**  
Sarah Bowden

### Regional Community Engagement Leaders

- Jon Hurt, *Americas*
- Samantha Webb, *Australasia*
- Ellen Lee, *East Asia*
- Annette Schoo/Henning Czujack, *Europe*
- Alison Ball, *UKMEA*



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## Diversity & Inclusion

**Director of Diversity & Inclusion**  
Alan Belfield

### Regional Diversity & Inclusion Leaders

- Erin McConahey, *Americas*
- Sarah Elkhatib, *Australasia*
- Young Wong, *East Asia*
- Paul Coughlan, *Europe*
- Martin Radley, *UKMEA*