

The logo consists of a large, bold, dark blue 'A' followed by a smaller '2' in the same color, set against a white square background.

A2

NEW DIMENSIONS FROM ARUP | NO.8

The background of the entire page is a vibrant blue image of Earth as seen from space. A bright sunburst or light flare emanates from the horizon, creating a sense of depth and energy. The rays of light spread across the sky, illuminating the planet's surface.

Emerging opportunities: **what's next?**

Inside this issue: The markets, the business models and the innovations fuelling growth today and tomorrow

FINDING NEW OPPORTUNITY



Welcome to the latest edition of A², Arup's business magazine. As a forward-looking firm, it seems right that we take this chance to consider new opportunities in the built environment: those that are happening now and those that will emerge next.

From HSBC chief economist Dennis Turner's views on emerging markets, to the opportunities presented by the way we run our cities, I hope this edition will give you food for thought about the potential that remains to be unlocked. And all despite the economic climate.

As always, we don't just welcome your comments, we encourage them.

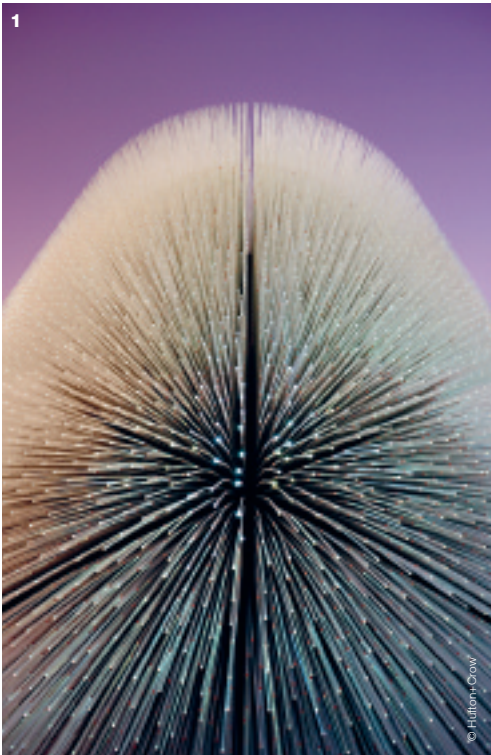
Please feel free to contact us about any of the issues in A².

Philip Dilley
Chairman, Arup

For more information on any of the topics featured in this magazine, please visit www.arup.com or email a2@arup.com

CONTENTS

-
- 03 News**
The latest stories from the built environment – and beyond
 - 06 Opportunities abroad**
HSBC chief economist Dennis Turner on why emerging markets are vital
 - 08 How to build an adaptive organisation**
Ensuring your business succeeds in a constantly changing world
 - 10 Too good to waste**
Why technologies that turn waste into energy are increasingly in demand
 - 12 Time for a new ownership model?**
Would companies be better if they were owned by their employees?
 - 14 Electric dreams**
Are electric cars and smart technology the future of urban transport?
 - 16 Into Africa**
Making the most of infrastructure opportunities in an emerging continent
 - 20 Healthy futures**
How health services must change radically to care for an ageing population
 - 23 The big green deal**
How cities that are tackling climate change are creating opportunities for business
 - 26 Smart cities**
Using information technology to run cities as a system as part of modern infrastructure investment
 - 28 Ten trends changing our world**
New research reveals the trends every leader needs to know about



SUSTAINABLE SHOWCASES FOR SHANGHAI WORLD EXPO

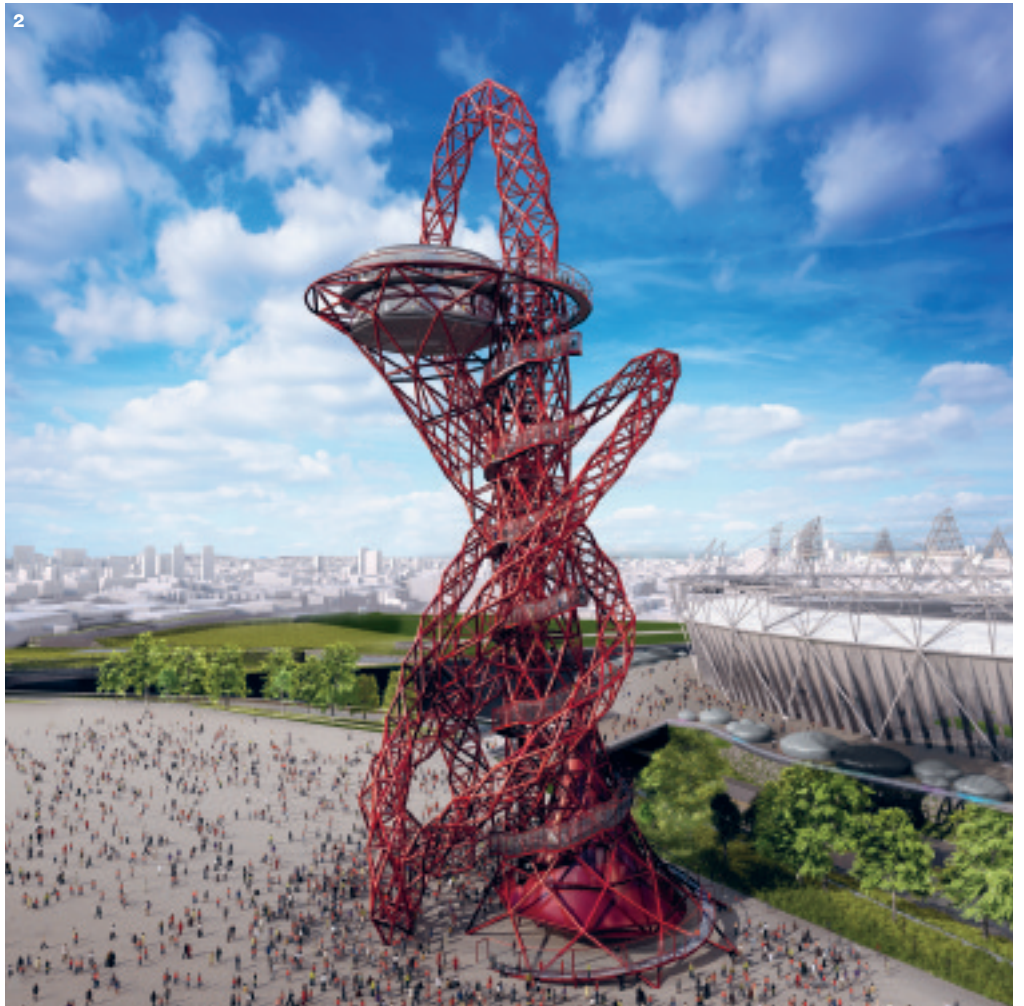
Working with some of the world's most creative architects, Arup has helped to realise a range of innovative projects for the Shanghai World Expo – the largest ever world fair.

Arup's involvement in the Expo goes back to 2004 when the firm won the masterplanning competition together with Richard Rogers (now Rogers Stirk Harbour + Partners). Their winning design incorporates renewable energy sources and low-energy solutions such as passive cooling measures.

Arup's multi-disciplinary team also brought its expertise to the design of pavilions for Denmark, Korea, Singapore, and to provide design reviews for the UK and China.

"These projects are not just one-time showpieces, but both an epitome and a platform for promoting sustainable urban living," said Arup director and Shanghai office leader Michael Kwok. "We've shown what can be achieved through modern design methods, passive energy-saving and cooling measures, and efficient building materials."

The Expo runs until 31 October.



ARCELORMITTAL ORBIT WILL BE UK'S LARGEST SCULPTURE

Award winning London-based artist Anish Kapoor has been given the commission of a lifetime to design a spectacular new piece of public art in the Olympic Park. The stunning artwork, known as 'The ArcelorMittal Orbit', was designed in collaboration with a team at Arup's advanced geometric design unit, led by Cecil Balmond and Daniel Bosia. It will ensure the Park remains an unrivalled visitor destination following the London 2012 Olympic and Paralympic Games, providing the legacy that Mayor of London Boris Johnson and ArcelorMittal Chairman and CEO Lakshmi Mittal envisaged for east London.

The breathtaking sculpture – thought to be the tallest in the UK – will consist of a continuous looping lattice of tubular steel. Standing at a gigantic 115m, it will be 22m taller than the Statue of Liberty in New York and will offer unparalleled views of the entire 250 acres

of the Olympic Park and London's skyline from a special viewing platform.

Cecil Balmond said: "Being invited to collaborate on a tower for London was an irresistible challenge. What is new in this piece is the geometry and how it's been put together. We want people to forget the engineering, the construction, the materials and simply experience it."

"All tower structures are pyramidal, but we wanted to see if we could create a structure with a non-linear form – an orbit that turns and gathers strength from each loop."

1 United Kingdom pavilion, Shanghai World Expo 2010, China

2 ArcelorMittal Orbit sculpture by Anish Kapoor, Olympic Park, Stratford



HELSINKI GETS €60M LOW CARBON DEVELOPMENT

Working as part of an international team, Arup has won the competition to design a €60m low-carbon housing and commercial building complex in Helsinki.

Run by Sitra, the Finnish Innovation Fund, the Low2No competition challenged teams to design a building complex for Jätkäsaari, a reclaimed goods harbour to the west of the city. The 22,000m² project, developed by Sitra in partnership with construction company SRV and housing services provider VVO, will create new homes, offices and shops.

"The project will provide a replicable example of how transitional decarbonisation strategies

can be put in place in existing cities," says Alejandro Gutierrez, Arup's consortium manager for the project.

"This a rare opportunity to develop solutions to many of our key urban development challenges holistically, thoroughly and realistically," comments Arup project director Adrian Campbell.

The winning team also includes Berlin-based Sauerbruch Hutton as lead architects and Italian consumer behaviour-change strategists Experientia.

Work began in April 2010, with completion scheduled for the end of 2012.

ARUP IN AFRICA

Arup has strengthened its presence in the southern African region with the integration of Arup South Africa into Arup Group on 1 April.

The company joins our existing Arup Group operations in Botswana and Mauritius to provide Arup with a strong foundation for business in the southern Africa region.

Fast facts: Arup in Africa

The Johannesburg office was opened on 1 May 1954 by civil engineers Jack Zunz and Mick Lewis.

Arup has offices in Johannesburg, Durban (opened in 1958) and Cape Town (1965).

There are more than 380 Arup staff working in South Africa.

South Africa's construction industry supports approximately 11% of the country's workforce.

Read more about infrastructure opportunities in Africa on page 16.



ARUP TACKLES CLIMATE CHANGE WITH THE C40

Arup's partnership with the C40, a group of 40 of the world's largest cities committed to tackling climate change, has seen the firm run action-oriented workshops with the leaders of Toronto, Melbourne, São Paulo and Ho Chi Minh City.

Arup UrbanLife workshops address a specific issue faced by each city, resulting in a strategic plan for action. Arup's technical expertise, sustainable integrated thinking and policy consulting helps each city realise solutions that will help reduce greenhouse gas emissions and/or adapt to climate change.

The workshops held to date have focused on energy, information communications technology (ICT), waste and water strategies. Insight from each workshop will be shared in a series of reports launched later in 2010.

POCKET HABITAT MARKS NEW ERA FOR GREEN ROOFING



Launched in June by Arup and Sky Gardens, Pocket Habitat is the only modular planting system designed to promote biodiversity on new or existing roofs, or provide temporary greening at ground level.

Each module is made from environmentally friendly material and contains recycled substrates and wildflower seeds. The modules link together to form a carpet of vegetation, but can still be moved easily.

Ideal for use by roofers and waterproofing manufacturers, the Pocket Habitat is also used by landscapers. The easy installation and removal means no expert knowledge is needed.

Rebecca Stewart of Arup said: "The Pocket Habitat allows a green roof to be easily retro-fitted to existing buildings. It's also getting a lot of interest from developers for temporary greening of development sites."



3 Proposed development for Jätkäsaari, Finland

4 Arup Johannesburg office, South Africa

5 Pocket Habitat on display at the recent launch event

ARUP OFFICE SETS NEW STANDARD IN WORKPLACE DESIGN

New £42m offices opened at 8 Fitzroy Street, London, provide Arup with six floors of office space, meeting rooms and conference facilities as well as a reception area, café, library and public exhibition space.

The design incorporates innovative sustainable features, including glazing panels that optimise the amount of natural daylight entering the building, while reducing solar heat gains. Other features include a chilled beam heating and cooling system, solar heated hot water supply and rainwater collection.

The energy consumption for the building will be displayed in the reception area as part of Arup's drive to monitor and reduce its energy use. "We wanted to set a new standard for our workplace environment," says Arup's shared services director, Dick Lee.

6 Arup offices, 8 Fitzroy Street, London

7 Terry Hill, leader of global transport market



RISING STARS NAMED YOUNG ENGINEERS OF THE YEAR

Three employees from Arup's Bristol office have been named Young Engineers of the Year by the Society of Public Health Engineers (SoPHE).

The energy-efficient rainwater harvesting system designed by Yewande Akinola, Liam Poole, and Grzegorz Jaroszewicz triumphed in the society's 2010 competition, the theme of which was conserving energy within public health systems in buildings.

The system has now been patented and is being pursued commercially by the firm.

ARUP RANKED TOP FOR TUNNELLING, PORTS, HARBOURS AND CANALS

The 2010 Consultants File from New Civil Engineer (NCE) magazine sees Arup maintain its position as the top UK-based consultant for tunnelling, ports, harbours and canals. The publication also lists the firm as second for building – up one place from 2009.

NCE subscribers can access the Consultants File at: <http://www.nce.co.uk/market-data/consultants-file>

TERRY HILL TO LEAD INVESTIGATION INTO COST OF MAJOR INFRASTRUCTURE PROJECTS

Terry Hill, leader of Arup's global transport market, has been appointed by the UK Treasury's Infrastructure UK to chair a steering group investigating ways of reducing the cost of major infrastructure projects in the UK. The appointment was announced by the chancellor of the exchequer, George Osborne, as part of the June 2010 emergency budget.

The investigation is based on initial evidence that suggests that the costs of building

infrastructure in the UK are higher than in other countries. It aims to identify a series of actions to reduce costs and will report initial findings in the autumn, with the final recommendations being issued by the end of the year.

"Identifying the reasons for the higher costs of civil engineering works in the UK is fundamental if we are to build a platform for future development and help the country regain a competitive edge," says Hill.



OPPORTUNITIES ABROAD

Manufacturing exports to emerging markets can drive growth, says HSBC chief economist

Dennis Turner

“What can we learn from the recession?” asks Turner. “We can learn not to repeat the mistakes of the past. In the UK, we relied on consumers and governments who borrowed too much and spent too much. We neglected investment and exports and the result was an unbalanced, unsustainable economy. So if we’re going to come out of recession and stay out of recession, we have to do things differently. That means investment and it means exports.”

Manufacturing is vital

Turner acknowledges that services will play an important part in the recovery but believes manufacturing is vital. He points to recent Purchasing Manager Index (PMI) surveys which show manufacturing activity at a 15-year high.

“Now we need to sustain this growth as re-stocking runs its course,” he says.

“To do that, we’ve got to look overseas – which is why the competitive pound is incredibly important. It represents a massive opportunity for exporters, a one-off opportunity. Unfortunately, it’s also an opportunity we’re not making the most of.”

“For understandable reasons, many companies are using a weak exchange rate to rebuild profit margins by selling at the same sterling price instead of cutting their prices. You can’t blame them, of course, but this is a short-term policy. They’ve got a one-off opportunity to establish themselves in new markets and there’s a risk they could miss it.”

Emerging markets are key

“The other big problem for the UK is that 50% of our exports go to Europe,” Turner continues. “We export more to Greece than we do to Brazil. It’s a problem because, aside from the current turmoil in Europe, the future is in emerging markets like Brazil, Russia, India and China. In the next 10-15 years, the UK needs to redirect its export efforts to these countries.”

Countries like China represent good opportunities because they also need to re-balance their economies, Turner argues. “China built double-digit economic growth on the back of investment and exports and now it needs to stimulate domestic consumption,” he says.

“As China develops further, the goods its people consume are just as likely to come from the west as they are from the

country’s own manufacturing industry. Why? Because emerging markets quickly become mature markets.”

“As companies in emerging markets begin to incur the same costs as those in mature markets (in areas such as pensions and healthcare), I expect the cost differential between the goods they produce will start to disappear.”

Asia will be an important market

Where will businesses find these emerging markets?

“Asia has some unique advantages: a highly motivated and disciplined labour force, willingness to take risks, governments that understand how the markets work and have ways of making them work smoothly. Latin America also has some potential.”

Turner points out that as companies look for growth abroad, they must also understand the changing market at home. “The UK market is still here, we just can’t bank on it to produce the profits and the growth opportunities that it did before the recession,” he says.

Grey spending power will increase

“I expect spending power in the UK to shift away from the government and the young towards grey power – because older people are more likely to have higher incomes and lower levels of debt. Businesses need to respond to this change in the marketplace.”

Whether they’re pursuing the grey pound at home or emerging markets abroad, Turner believes there are good reasons for businesses to be optimistic. “We shouldn’t get obsessed about national debt,” he says. “It’s the cost of servicing debt that’s important and that is still less than we were paying in the 1990s. Instead, we need to focus on making sure the rest of our economy is in good shape.”



HOW TO BUILD AN ADAPTIVE ORGANISATION

To succeed in a constantly changing world, organisations must be ready to adapt

Social, technical and economic changes mean markets are moving too fast for many organisations to respond. By the time you've gone through a traditional top-down change process, the world has moved on and left you behind. But build an adaptive organisation and you can anticipate changes and respond quickly.

“Successful organisations will stand out by effectively managing networks, knowledge and innovation,” explains Arup change management specialist Tim Hawley. “People in adaptive organisations like ConocoPhillips, Nokia or Reuters work across boundaries. They tap into collective expertise. And they innovate.”

These are businesses where people are encouraged to connect, think and be creative. “People can pick up ideas from their informal networks and capitalise on them without having to go up a rigid chain of command,” says Hawley. “It’s about giving people the resources and support they need to respond to the market. So you become more focussed on measuring their outputs rather than their inputs - what they produce rather than the hours they put in between nine and five.”



THREE STEPS TOWARDS BUILDING AN ADAPTIVE ORGANISATION

Although every organisation will have different needs, you can follow some simple steps to help your business become more adaptive.

1

EMBRACE A LOOSER STRUCTURE

Adaptive organisations must carefully balance governance and flexibility so that teams can quickly form around opportunities or products. As they change, people can re-form around new ones. A clear vision, strategy and set of values will enable people to make the right decisions by showing them what the business wants. The more richly detailed and visual the image is, the more compelling it will be. Within this guiding framework, people have the freedom to work towards the organisation's goals and make the necessary day-to-day decisions.

Top tools: clear vision aligned with the organisation's values and culture.

2

EMBRACE A MORE MOBILE WORKFORCE

Office footprints are shrinking as the desk-bound culture gradually disappears. With companies recognising that presenteeism doesn't guarantee productivity they are trusting their people to work more flexibly. You can use technology like unified communications or virtual private networks (VPNs) to give people access from anywhere and create a highly mobile workforce that's better able to respond to changes in the market – for example by quickly forming new virtual teams. You can adapt your office space by including more hot desks and more places to meet and collaborate, both formally and informally.

Top tools: mobile devices, VPN, video, VoIP.

3

EMBRACE COLLABORATIVE WORKING AND TECHNOLOGY

With document management, communities, forums, blogs and wikis, people can easily connect with others in the organisation. They can harness collective capability by sharing useful knowledge, working collaboratively and co-creating. This technology is now available off-the-shelf or over the internet – often referred to as cloud computing. Microsoft recently launched a cloud version of its Office software and the approach is proving highly attractive for start-ups as it's relatively easy to implement over existing infrastructure.

Top tools: web 2.0 collaborative technology such as blogs and wikis.

CASE STUDY: TECHNOLOGY KEEPS MTR ON TRACK

MTR Corporation in Hong Kong builds and operates one of the world's leading railways. Carrying 3.7m passengers every day, the MTR network's nine lines serve Hong Kong Island, Kowloon and the New Territories. After merging with the Kowloon-Canton Railway, MTR Corporation found itself needing to manage multiple projects at the same time – involving millions of documents and thousands of staff working together. Arup worked with MTR's projects division to develop and implement a new knowledge and information management infrastructure. Based on Microsoft SharePoint 2007 and branded as iShare, the system helps people share knowledge, work collaboratively and capture lessons learnt. As well as an information library, iShare contains personal profile pages and searchable discipline and skills areas linked to interactive charts of the organisation. Blogs, forums and wikis all help knowledge sharing and collaborative working. And a communications programme encourages people to use the system. "Knowledge and information management is becoming embedded into the culture of the organisation," says Daniel Blessis from the MTR knowledge management team. "iShare is promoting the sharing of knowledge and experiences, classification and retention of information, and professional networking throughout the organisation." MTR's iShare went live in June 2009 and they expect to see a return on their investment within two years.

TOO GOOD TO WASTE

With countries around the world looking for new ways to manage the mountains of things we throw away, innovative and proven technologies to generate energy from waste are in demand. The UK alone will need £10bn of new infrastructure over the next ten years to comply with EU legislation, and plants using waste to produce electricity, heating, cooling or gas for fuel could attract substantial investment.

“The attitudes of waste managers vary on a global and local scale,” says Dr Robin Szmids of Küttner UK, a firm specialising in anaerobic digestion. “But the general trend is away from a throwaway mentality towards a focus on resource utilisation.”

Experts agree that new waste to energy technology must be part of a joined-up approach to waste management. “The ultimate goal is an integrated waste management strategy,” says Allan Barton, leader of Arup’s global resource and waste business. “That means designing products that don’t produce waste and returning them to the cycle when we’ve finished with them so the materials they contain can be used again.”

For Barton, the key to an integrated

approach is combining different techniques effectively by:

- Reducing the volume of waste by designing it out of products
- Separating and recycling valuable materials (plastic PET drinks bottles are worth £80-90 per tonne)
- Composting or anaerobically digesting organic waste to produce methane for electricity generation
- Using advanced thermal treatment to get energy from the remaining mix of plastic, food and other material that cannot be separated

The potential for using technology in waste management varies from country-to-country, and even from city-to-city. For example, in the developing world,

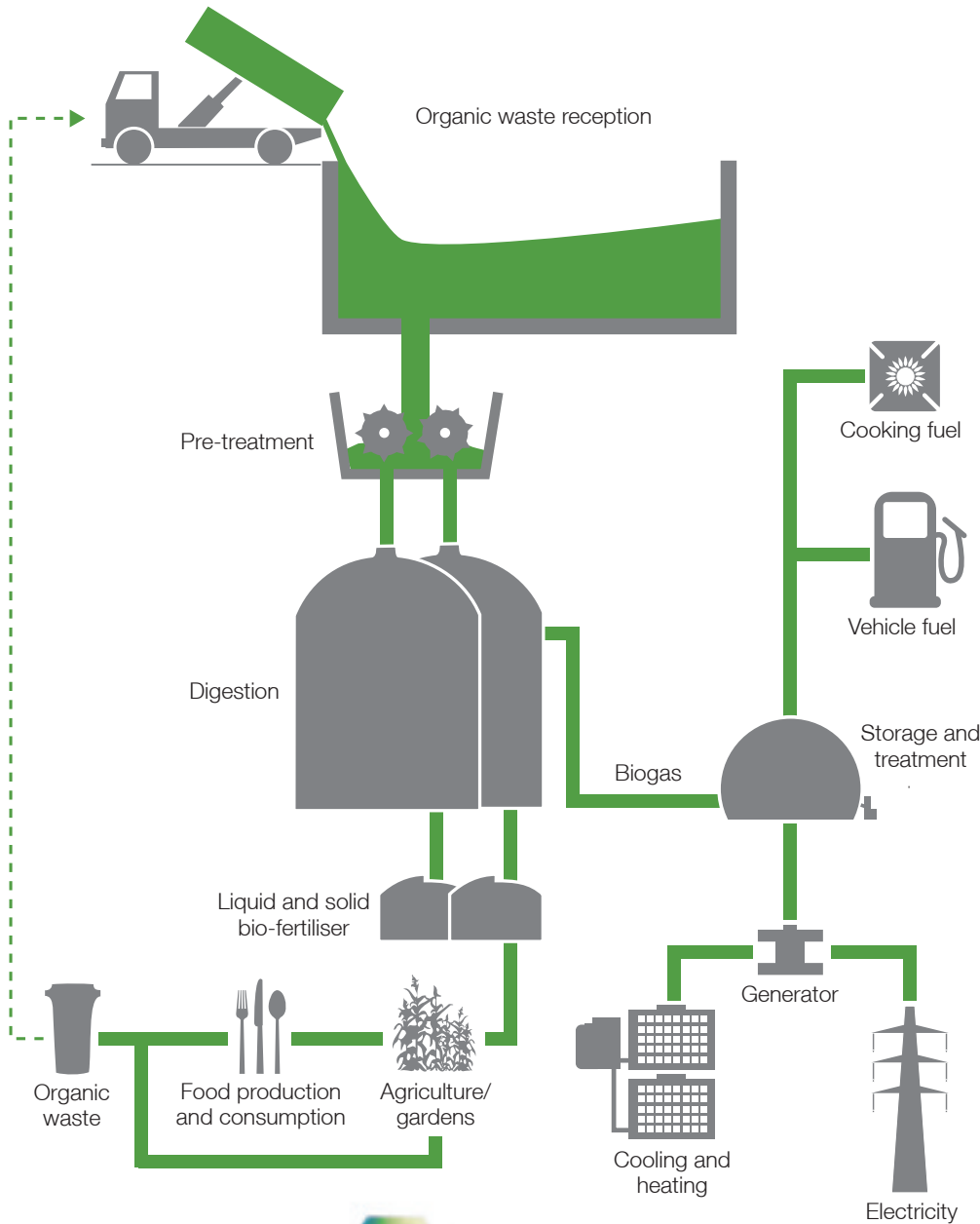
landfills contain a greater proportion of organic waste, so composting and anaerobic digestion could play a greater role. In São Paulo, Arup is advising city authorities on how they can use anaerobic digestion to generate electricity.

Peter Head OBE, leader of Arup’s global planning practice, believes waste to energy technology could play an important role in retrofitting cities around the world to tackle climate change. “Urban retrofit would mean that as well as getting renewable energy from the surrounding area, a community could have its own waste to energy plant to provide gas and electricity,” he explains.

Arup is working with the Institute for Sustainability to pilot large-scale retrofitting in an area of a UK city.



ANAEROBIC DIGESTION PROCESS



WASTE TO ENERGY

While incinerators focus on disposal, the priority for waste to energy plants is generating steam and electricity through combined heat and power (CHP). A modern plant with a throughput of 250,000 tonnes of waste per year produces enough electricity to power 40,000 homes. “Waste to energy provides clean, renewable energy and saves space in local landfills,” says Christian Müller, the managing director of Convis, a German engineering firm that specialises in the technology.

ANAEROBIC DIGESTION

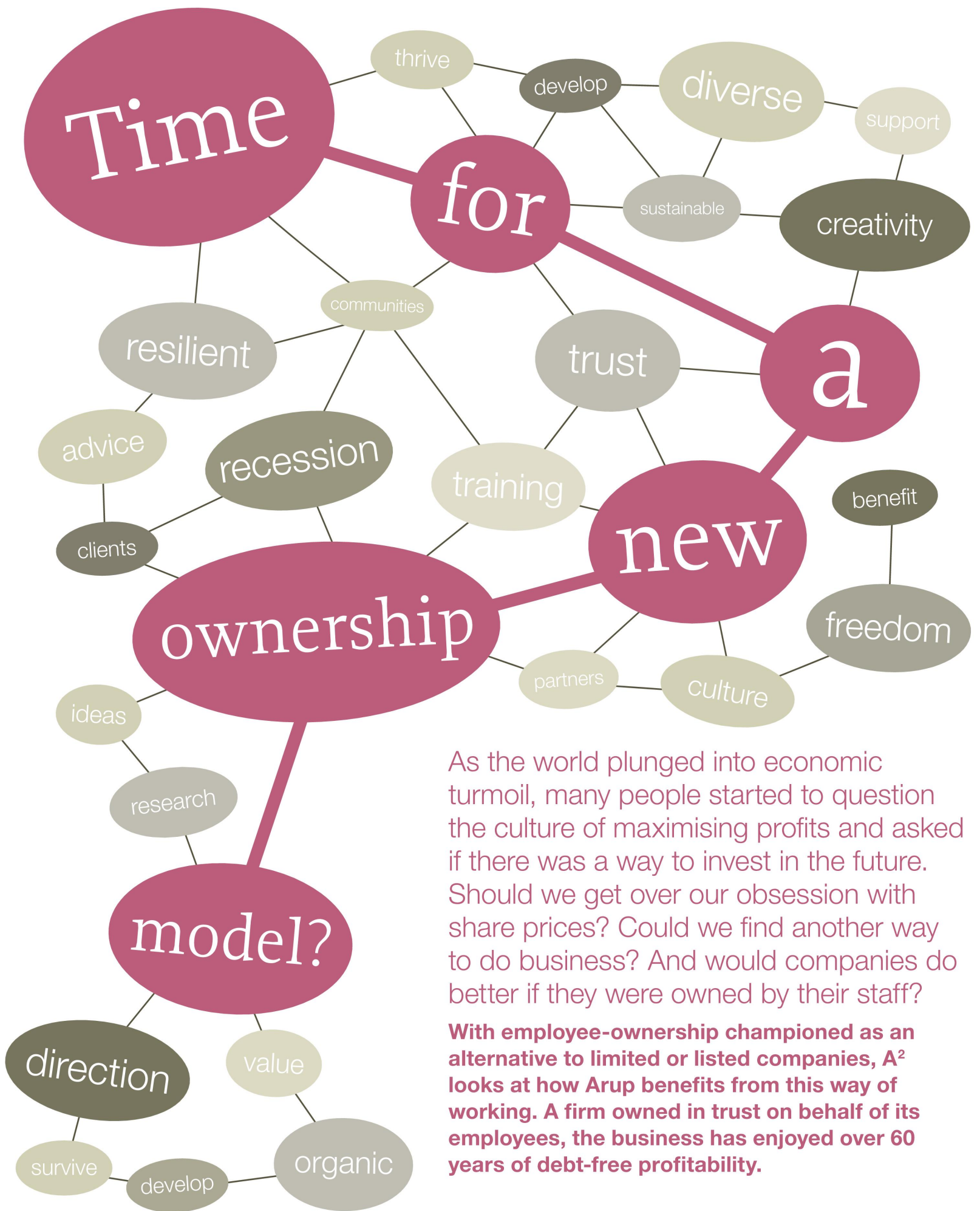
When organic waste degrades, it produces methane – a greenhouse gas. By enclosing the waste in a digester, this can be captured and used to generate power. In Switzerland, organic waste collected from households, supermarkets, hotels and food outlets is anaerobically digested to produce biogas. This is used for heat and electricity generation, to fuel vehicles, or to inject into the gas network. With over 100 large-scale anaerobic digestion plants already in operation worldwide treating the organic fraction of municipal solid waste, advocates argue the technology is proven and ready to go.¹

ADVANCED THERMAL TREATMENT (ATT)

ATT applies techniques such as gasification and pyrolysis to generate energy from waste (although they are not suitable to process mixed municipal solid waste). Pyrolysis uses a similar process to charcoal-making, heating waste without oxygen to produce a combustible syngas. Gasification produces syngas by heating waste at higher temperatures with some oxygen. Although pyrolysis has a limited track record, there are already more than 30 gasification plants worldwide. These are mainly in Japan and use solid fuel recovered from municipal waste but experts believe the technology has wider potential. “Advanced thermal treatment has a role to play,” says Paul Frith of Frith Resource Management. “Although the current environmental benefit is small, there is potential for significant improvement.”

Reference

1. Based on University of Glamorgan (Nov 2007). ‘Anaerobic Digestion of Biodegradable Municipal Wastes: A European Perspective’.



As the world plunged into economic turmoil, many people started to question the culture of maximising profits and asked if there was a way to invest in the future. Should we get over our obsession with share prices? Could we find another way to do business? And would companies do better if they were owned by their staff?

With employee-ownership championed as an alternative to limited or listed companies, A² looks at how Arup benefits from this way of working. A firm owned in trust on behalf of its employees, the business has enjoyed over 60 years of debt-free profitability.

Financial strength

Arup has been less affected by the recession than many of its competitors. But can this resilience be attributed to its trust-ownership model?

Terry Hill, Chairman of Arup's board of trustees, says being trust-owned has helped Arup become a diverse and resilient firm. "The biggest reason that Arup will survive and thrive is because we work in diverse markets and locations," he comments. "And that's a product of our ownership model."

Both Hill and Arup Chairman Philip Dilley attribute this diversity to the firm's approach. "Arup has grown by fostering creativity and a culture of freedom," Dilley explains. "We allow people to develop areas of interest that will benefit the firm in the long term."

Freedom and creativity

What's the secret to successfully fostering this creativity and freedom? Like other members of the Employee Ownership Association, Arup's leaders believe the firm's structure is vital.

The model means Arup doesn't have shareholders to satisfy, simply our clients and our people. "Because Arup doesn't have shareholders, we're in business for our clients, for the communities we work in, and for ourselves," says Dilley.

"It means Arup's leaders are free to concentrate on long-term relationships with clients," Hill agrees. "For a professional services firm like ours, that's vitally important. It's what creates the value in our business. We can focus on single-mindedly giving clients the most efficient and most advanced designs and advice."

"This approach has allowed Arup to create projects like High Speed 1 – the £5.8bn rail line between London and the Channel Tunnel," he continues. "It's enabled us to invest heavily in research into advanced techniques such as computational fluid dynamics (CFD). And it's meant we have grown organically to become the market leader in many countries."

Employee-ownership has also freed Arup to pursue initiatives that are valuable to clients but might not generate an immediate return on investment. Hill highlights the example of Drivers of Change, a research-based publication developed by Arup to help its business and clients identify and explore what will affect our world in the future.

Global scale

For Hill and Dilley, this shows it makes perfect sense for a global company like Arup to be employee-owned. "All our members enjoy the benefits of our ownership structure, no matter where they are," says Hill. "Who wouldn't want to work for a firm that helped you thrive, invested in your training, and wanted you to enjoy your work?"

Involving staff in this way can also give the firm's leaders more support, says Dilley. "Because we encourage our people to be free-thinking, it means we need to harness their support to take the firm in a particular direction," he explains. "Of course this takes time. But it means that when we do get this support, we're in a much stronger position because our people own the ideas."

"Employee-ownership is a balance between freedom and direction," he continues. "Getting that balance right is crucial. We want to give freedom without having a free-for-all."

An idea whose time has come

So what's stopping more companies from adopting employee-ownership? With interest in the model growing, other businesses are keen to learn from Arup's experience. Dilley has been invited to speak to leaders of the Sunday Times TopTrack 100 private companies, and more recently to The Good Work Commission about the firm's success.

He acknowledges that listed companies would find it hard to become employee-owned. "Arup's structure is a result of the generosity of the original partners," he says. "They could easily have sold their equity and gone away richer people. But they put the firm in trust for the benefit of its members, past, present and future."

The result is a firm focussed on long-term benefits. "Employee-ownership encourages a sharing culture within the firm," says Hill. "It helps us to attract world-class people who are interested in long-term benefits, not short-term bonuses."

Although shareholder-owned companies must also think long-term, Dilley points out that Arup is free from many of the short-term pressures such businesses face. "Of course Arup has an annual planning cycle but we're free of annual shareholder pressure and can look at the longer term," he says. "We can research issues such as

the impact of technology on our business, and the changing socio-economic patterns affecting our markets."

For Arup, trust ownership is as much a commercial proposition as it is an ethical one. "Our approach and preference is to invest in a model of growth that is organic and sustainable, as opposed to acquisitive," says Hill. "We believe in creating value for clients rather than simply building market share for us."

Employee-ownership facts

"Employee-owned companies currently contribute some £25bn to the British economy. According to an annual index compiled by a leading law firm, they outperform the FTSE by roughly 10% each year."

The Guardian, Tuesday 16 March 2010

"Studies have shown that employee-owned businesses generally outperform non-employee-owned businesses where employees do not have a significant stake in ownership or the right to participate in decision-making."

Cass Business School, January 2010

How did Arup become employee-owned?

Arup is an employee-ownership success story. In 1946, philosopher and engineer Ove Arup set up his consulting engineering business in London. In its first two decades the firm expanded rapidly and earned a reputation for devising advanced and economical solutions for buildings – a reputation it still enjoys today. As Ove Arup and the other founding partners retired, they transferred ownership of the firm. And in the years that have followed, the business has grown into an international consulting firm of unparalleled scope, owned in trust for its employees.

Other employee-owned companies

- John Lewis Partnership (retail)
- Make (architecture and interior design)
- St Luke's Communications (advertising and communications)
- Loch Fyne Oysters (seafood, meat and game)
- Dreamhost (web hosting)
- Tribune company (media)
- Kantega (technology)

Rapid population growth and increasing urbanisation mean we must find new ways to move around our crowded cities. So could clean electric cars and intelligent transport systems (ITS) be the future of urban travel?

ELECTRIC DREAMS

Clever and clean: the future of personal mobility in cities

“Electric vehicles and ITS offer the opportunity to increase the capacity of roads while reducing carbon emissions and congestion,” says Arup board director John Miles. “And the new technologies and business models we’ll need to run them could create opportunities for the next generation of entrepreneurs.”

“For urban transport, electric vehicles are just about perfect,” says Lance Bradley, managing director of Mitsubishi Motors UK. “Even at their current range of around 80 miles, they’re suitable for most city journeys. People are already switching to smaller vehicles for city driving and small electric vehicles are the next step.”

To get more electric cars on the road, it’s important to understand the infrastructure they will need. This is something Arup is working on with The Energies Technologies Institute. The firm is building sophisticated computer models that will show how and where infrastructure should be provided – whether people will want to charge their cars at home, at work or on the street.

Developing this charging infrastructure will open up new business opportunities, says Neil Butcher of Arup’s advanced

technology and research practice. Butcher points to the need to bill electricity through charging points and the emerging technology of wireless induction charging – as well as opportunities to supply electric cars and their components.

“There are also huge opportunities within the business community for developing new models of car ownership: things like shared ownership, clubs and car pools,” comments Miles.

Bradley agrees that electric vehicles could encourage more car clubs, because – at around £1 for a full charge – running costs become less of an issue. With Mitsubishi’s first electric car, the i-MiEV, going on sale in January 2011, he’s confident that electric cars will become cheaper to buy as the technology matures and production volume increases.



© Jason Hawkes

“I EXPECT THAT BY 2050 WE’LL HAVE BATTERY TECHNOLOGY THAT INCREASES THE RANGE OF ELECTRIC CARS TO NEARLY THAT OF PETROL OR DIESEL VEHICLES.”

“At the moment, batteries for electric vehicles are expensive,” admits Bradley. “But all new technologies are expensive. When flat-screen televisions first came out they cost thousands of pounds and now you can buy them for hundreds. The reduction in the cost of batteries might not be this dramatic, but they will get cheaper.”

As we switch to electric cars, we’ll also have to work out how to fit more vehicles onto our urban roads. Two-thirds of the world’s population is expected to be living in cities by 2050 and roads will need to accommodate more traffic. This is where ITS comes in: helping us to use existing roads more efficiently.

“ITS is information that’s collected from the transport network and used to provide

services,” says Tim Gammons, an ITS specialist at Arup. “It can reduce congestion and resulting emissions by doing things like cutting the number of secondary incidents after an accident. If there’s a crash ahead, you can display warnings on signs to get people to slow down.”

“At the moment we can apply technology in discreet ways, such as reducing delays on a particular bus route by prioritising the traffic signals. But to get the maximum value out of it we need to have a vision for what we want to achieve and then develop an architecture that will allow the technologies to work together.”

National road pricing could provide this architecture and create commercial opportunities for businesses, says Gammons: “If we have national road pricing, every vehicle will have technology

that communicates with a central location. Service providers will be able to overlay services such as satellite navigation, music downloads or advertising.”

So what will it be like to drive in this intelligent, electric future? “I expect that by 2050 we’ll have new battery technology that increases the range of electric cars to nearly that of petrol or diesel vehicles,” predicts Butcher. “I’d be very surprised if induction charging wasn’t standard. And I think we’ll see dynamic induction charging, so vehicles will charge automatically as we drive them along motorways.”

“I also suspect that there’ll be a lot more intelligence in the vehicle – guidance systems which will take over some of the control from drivers. And I think we’ll be using ITS to redirect vehicles away from black-spots to keep traffic moving.”

According to the World Economic Forum, in 2009 70% of global growth came from developing and emerging market countries, with Africa ranked third after China and India in terms of growth rates.¹ Investment in the infrastructure needed to sustain this growth is creating opportunities across the continent.

INTO AFRICA

AN EMERGING CONTINENT

Arup director Mark Bostock spent his early career in the region and continues to work on projects in Africa. “Today, there is a much greater appreciation that infrastructure is key to economic development than in previous decades,” he says. “The huge opportunities China has unlocked by buying minerals have created an awareness of the importance of roads, railways and other infrastructure. There is now an amazing range of projects on the table, some of them hugely ambitious.”

“If you can think outside of traditional business models, there are lots of opportunities in Africa,” agrees Sanmit Ahuja, chief executive of ETI Dynamics, an economic development firm focused on emerging and high-growth markets. “For example, where governments don’t have a policy framework, a typical investor might see a lot of risk. But we see an opportunity to work with governments to recommend a policy framework.”

Ahuja’s firm is developing environmental, waste, power, water, transport, health and education projects across the continent. “We work with \$50m companies that want to become \$500m companies but don’t have the know-how or capital to do it,” he explains. “That’s where the opportunities are: for businesses that are willing to bring

knowledge and capital to Africa.”

Arup opened an office in South Africa in 1954 and also has bases in Botswana and Mauritius. The firm’s global leader for infrastructure, David Singleton, believes now is a good time to be working in the continent – particularly in South Africa. “An infrastructure renaissance is re-acquainting South Africa with the way to develop modern, user-friendly roads, railways, airports and ports,” he says.

“At the moment, our work here is driven mainly by infrastructure clients,” says Damane Hlalele, Arup’s group leader for South Africa. “Africa comes from a low base in terms of infrastructure and there’s a huge drive from the public sector, but there are also opportunities in the private sector. As a firm, we’re looking to achieve a balanced client base.”

Arup director Des Correia has worked in Africa for much of his career and believes there are good rewards for companies that are willing to build businesses in the continent. “For companies, this is a chance to be involved in infrastructure on a considerable scale and make a real difference to communities,” he says. “For people within firms, it’s a chance to challenge themselves and get responsibility early in their careers.”



Across Africa, real GDP increased by an average of 4.9% a year between 2000 and 2008, compared with just 2.4% a year during the 1990s.⁴

500 African companies have been growing at more than 8% a year since 1998.⁵

The annual flow of foreign direct investment (FDI) into Africa in 2008 increased to \$62bn, from \$9bn in 2000.³

The United Nations Economic Commission for Africa (ECA) says the continent needs \$93bn a year over the next decade to develop basic infrastructure.²

Dams

Due to its semi-arid climate, Botswana faces a challenge to provide enough water for irrigation and drinking. The Letsibogo Dam is part of the Government's focus on large water-resource development projects that will enable the population to access clean water and will diversify the economy by creating agricultural opportunities. Arup, in a joint venture with Snowy Mountains Engineering Corporation, undertook a review of background information, preliminary design studies and conducted an assessment of the project hydrology.



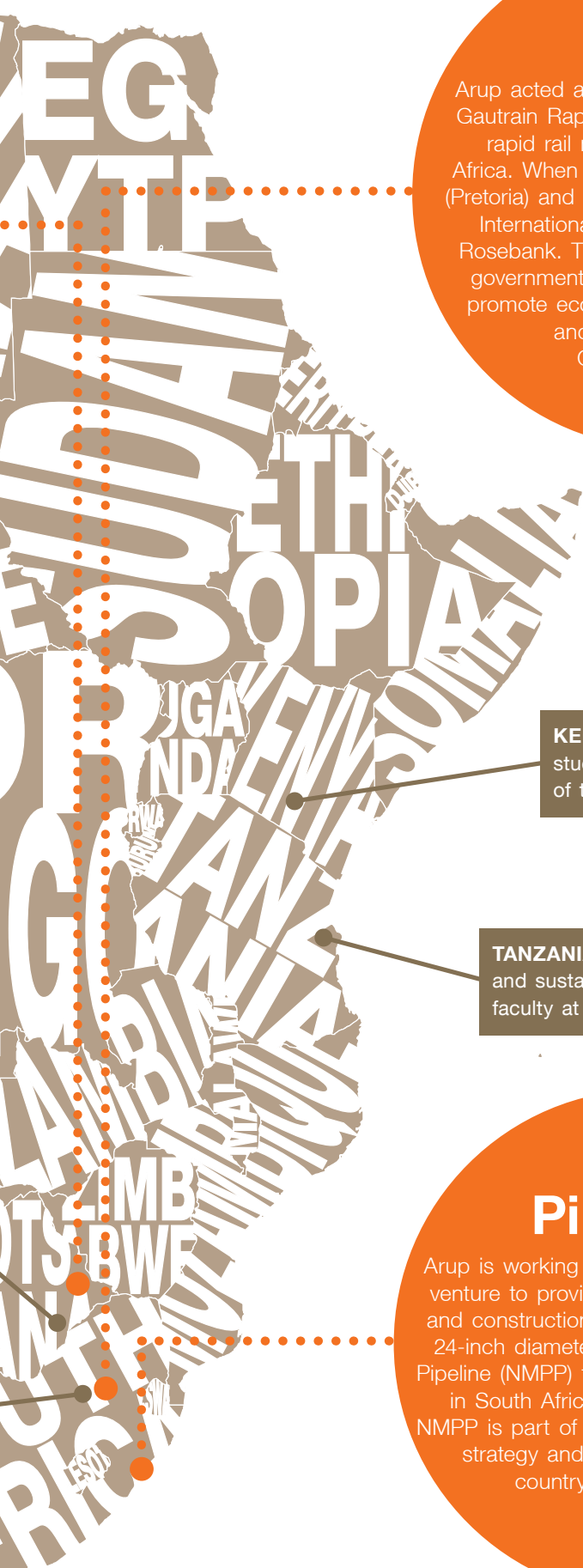
GHANA: Designing and building a prototype sustainable kindergarten with the Sabre Trust and Davis Langdon.⁶

BOTSWANA: Identifying dam sites on the Lower Notwane River and its tributaries, a major water resource.⁶

Freight

As part of an integrated transport policy study in Botswana, Arup assessed freight distribution throughout the country. The Government and private sector operators will use the findings to collaborate on developing options for lower-cost transport solutions in remote parts of the country and to investigate the use of road train technology for livestock and mineral transportation.

SOUTH AFRICA: Acting as independent certifier for the state-of-the-art Gautrain Rapid Rail Link in Gauteng.⁶



Rail

Arup acted as independent certifier for the Gautrain Rapid Rail Link, a state-of-the-art rapid rail network in Gauteng, South Africa. When fully open, it will link Tshwane (Pretoria) and Johannesburg, and OR Tambo International Airport with Sandton and Rosebank. The project is part of the local government's 'Blue IQ' initiative and will promote economic growth, development and job creation in the Gauteng province.

KENYA: Carrying out a pre-feasibility study for the complete rehabilitation of the Nairobi commuter rail network.⁶

TANZANIA: Providing design, engineering and sustainability services for a new faculty at Aga Khan University.⁶

Pipelines

Arup is working for Tansnet as part of a joint venture to provide engineering, procurement and construction management services for a 24-inch diameter, \$2bn New Multi-Products Pipeline (NMPP) from Durban to Johannesburg in South Africa. The development of the NMPP is part of South Africa's energy security strategy and will help by ensuring the country has enough petrol.

One of the success stories in African infrastructure is the development of mobile telecoms. In Kenya, mobile payments have revolutionised banking in a country where, before their introduction, 80% of people were excluded from the formal financial sector.⁷

Known as M-Pesa, or mobile money, the branchless banking service allows users to send money to each other by SMS message. A recent innovation even enables farmers to buy insurance using their mobile phones. M-Pesa was developed by Safaricom and Vodafone and is now also available to mobile users in Tanzania.⁸

"The development of mobile infrastructure in Africa is way ahead," says Bostock. "I've visited people out in the field prospecting for oil and they can use their mobiles to communicate with the world and, in Kenya, they can use them for banking too. I think that's so exciting. In Nairobi, a tomato-seller can ring up a producer outside the city and pay for his stock and transport using the mobile phone. The technology is affordable."

Emerging markets like Africa, offer more of these kinds of opportunities, says Ahuja. "If you have cutting edge technology or processes, it's much harder to implement them in markets like the UK because of the competitive environment," he explains. "But if you can go to places like Africa, transfer the technology and lower costs by manufacturing locally, it offers you a fantastic opportunity."

Ahuja believes many firms miss out on opportunities like these in Africa because they don't take the right approach to doing business there. "Africa is a very cost-conscious market and a lot of firms – particularly UK firms – tend to go in with a premium product or service," he says. "It's important for companies to build relationships and develop a management team that can understand the way business is done in Africa."

References

1. http://www.weforum.org/en/knowledge/KN_SESS_SUMM_3097Url=/en/knowledge/KN_SESS_SUMM_30970
2. <http://www.engineeringnews.co.za/article/malawi-electricity-2010-04-16>
3. http://www.mckinseyquarterly.com/Economic_Studies/Productivity_Performance/Checking_Africas_vital_signs_2606
4. http://www.mckinseyquarterly.com/Economic_Studies/Productivity_Performance/Checking_Africas_vital_signs_2606
5. Emerging groups make 'African lions' roar by William Wallis in Casablanca, Financial Times, 31 May 2010
6. Examples of Arup projects in Africa
7. <http://www.guardian.co.uk/money/2007/mar/20/kenya.mobilephones>
8. <http://en.wikipedia.org/wiki/M-Pesa#Tanzania>



HEALTHY FUTURES



© Dreamstime

The number of people in the world aged 80 or over is expected to almost quadruple by 2050, rising to 395 million (4.3% of the global population). With older people more likely to experience chronic conditions such as poor mobility, sensory losses and dementia, experts say health services must change radically.

“In the UK and elsewhere, getting the healthcare system fit for the future means transforming the built environment to suit older people,” says Stephen Pollard of Arup’s healthcare business. “It means adopting new technologies. It will require strong leadership and getting different services to work effectively together.”

Built environment

What will the hospitals of 2050 look like?

“We’ll have to get past our obsession with A&E,” says Pollard. “It’s the last place many people with chronic conditions need to be.”

“Instead of focussing on A&E, we’ll need to redeploy services to appropriately designed facilities that can treat people in the community or at home.”

Investment could also go into retrofitting homes for older people, he argues:

“Evidence points to the fact that patients suffering from stroke and other long-term conditions are best cared for at home.”

“With more patients likely to suffer from these conditions, houses need to be re-engineered to give them as much independence as possible.”

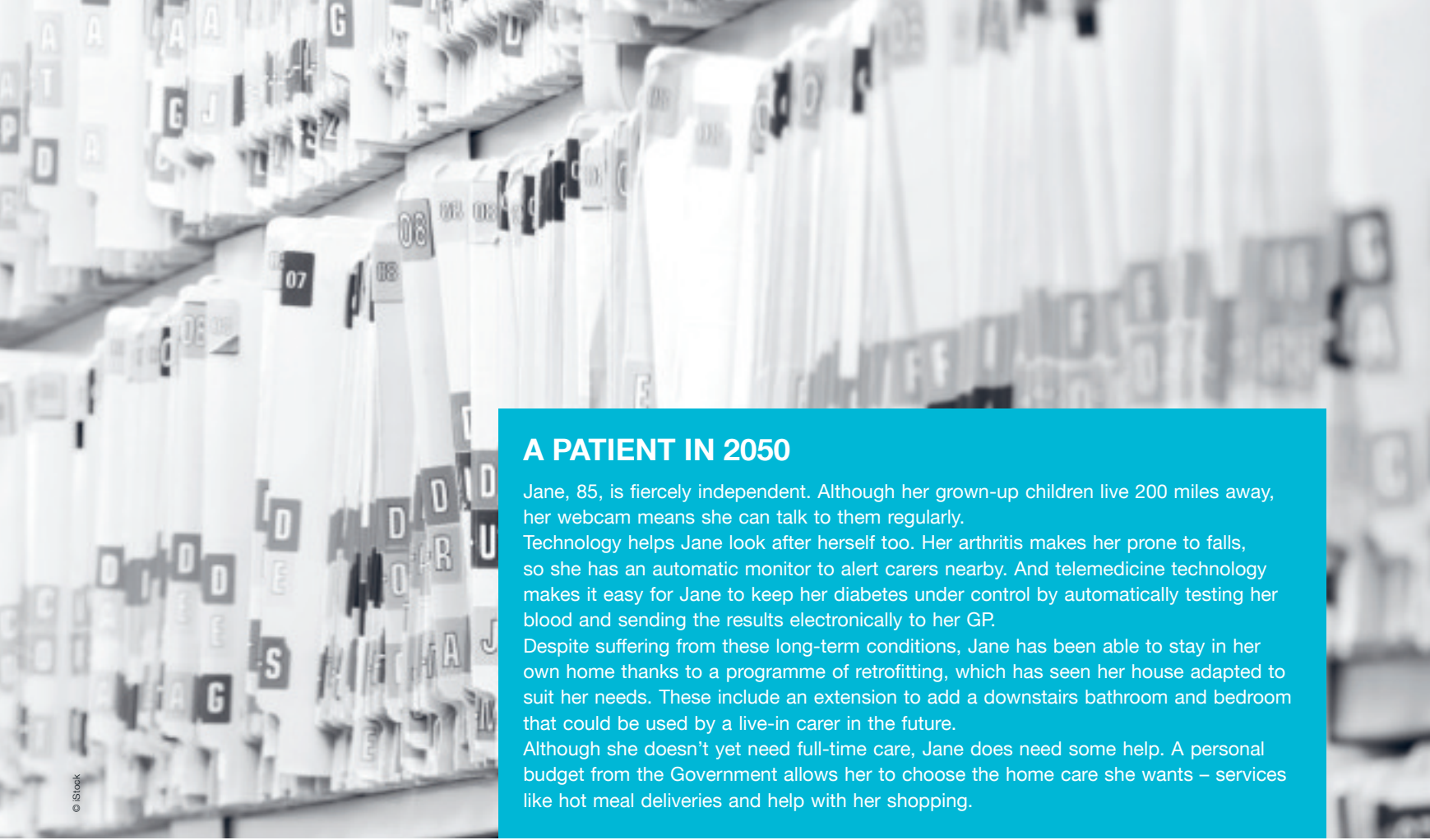
Leadership

But new hospital buildings and retrofitted homes are no use without people to lead the services we could all need one day. In a recent BBC television programme, businessman Sir Gerry Robinson exposed leadership shortcomings in dementia care homes.

What lessons can healthcare leaders learn from the programme?

“Managers of care homes need to lead from the front, emphasise the importance of treating residents with dignity and respect, and offer staff appropriate training and support,” says Arup consultant Pam Turpin. “If staff feel valued, then morale improves and sickness rates and staff turnover reduce. Happy, well-trained employees deliver better care for residents.”

“The Gerry Robinson example shows we need to define quality measures based on the patient experience, not just health and safety,” adds Pollard.



A PATIENT IN 2050

Jane, 85, is fiercely independent. Although her grown-up children live 200 miles away, her webcam means she can talk to them regularly.

Technology helps Jane look after herself too. Her arthritis makes her prone to falls, so she has an automatic monitor to alert carers nearby. And telemedicine technology makes it easy for Jane to keep her diabetes under control by automatically testing her blood and sending the results electronically to her GP.

Despite suffering from these long-term conditions, Jane has been able to stay in her own home thanks to a programme of retrofitting, which has seen her house adapted to suit her needs. These include an extension to add a downstairs bathroom and bedroom that could be used by a live-in carer in the future.

Although she doesn't yet need full-time care, Jane does need some help. A personal budget from the Government allows her to choose the home care she wants – services like hot meal deliveries and help with her shopping.

Managing quality

To help improve the quality of end-of-life care, Arup has devised the End-of-Life Care Quality Management Diagnostic Tool. Piloted in a foundation trust last autumn, the tool uses a clear traffic light scoring system that allows hospitals or care homes to benchmark the quality of the care they provide and improve their services.

Technology

New technology is already enabling patients to look after themselves – from detectors that summon assistance if they fall, to telehealth technology for remote blood testing. “Although we must never forget the importance of human contact, the right technology used in the right way can help people stay independent and live safely within communities,” says Turpin.

Pollard believes it's in the technology behind the scenes where most change will be needed. “Currently, information is locked in silos – whether it's hospital records or GP notes,” he says. “IT needs to work across patient pathways so that commissioners and service providers can get hold of the information they need to deliver quality care. We must continue with IT and patient records projects to allow access from trusted partners in a more open way.”

Service

In the UK, the Department of Health estimates that by 2025 the number of people with at least one long-term condition will rise by 3 million to 18 million. Supporting them will require a joined-up approach from health and social care services, says Turpin.

“When you're talking about older people, health and social care go together,” she says. “So a multi-agency approach is important. At the moment health and social care don't always work together as effectively as they should. I know of an elderly patient with throat cancer who lived alone and when he was discharged from hospital at Christmas, he found his promised package of care had not been set up. He had to rely on his neighbours to help him over the holiday period. Patients need to be assured that high quality multi-agency care is available 24/7 to support and empower people to feel safe and secure in their own homes.

“Ultimately, this comes down to how well we want people to live,” says Pollard. “The scale of change needed is enormous and will affect society: the built environment must change, we need new services, and we need new technology. It will test the ability of the leaders in our health service to deliver this change.”



2 Medical Touchscreen Instrument

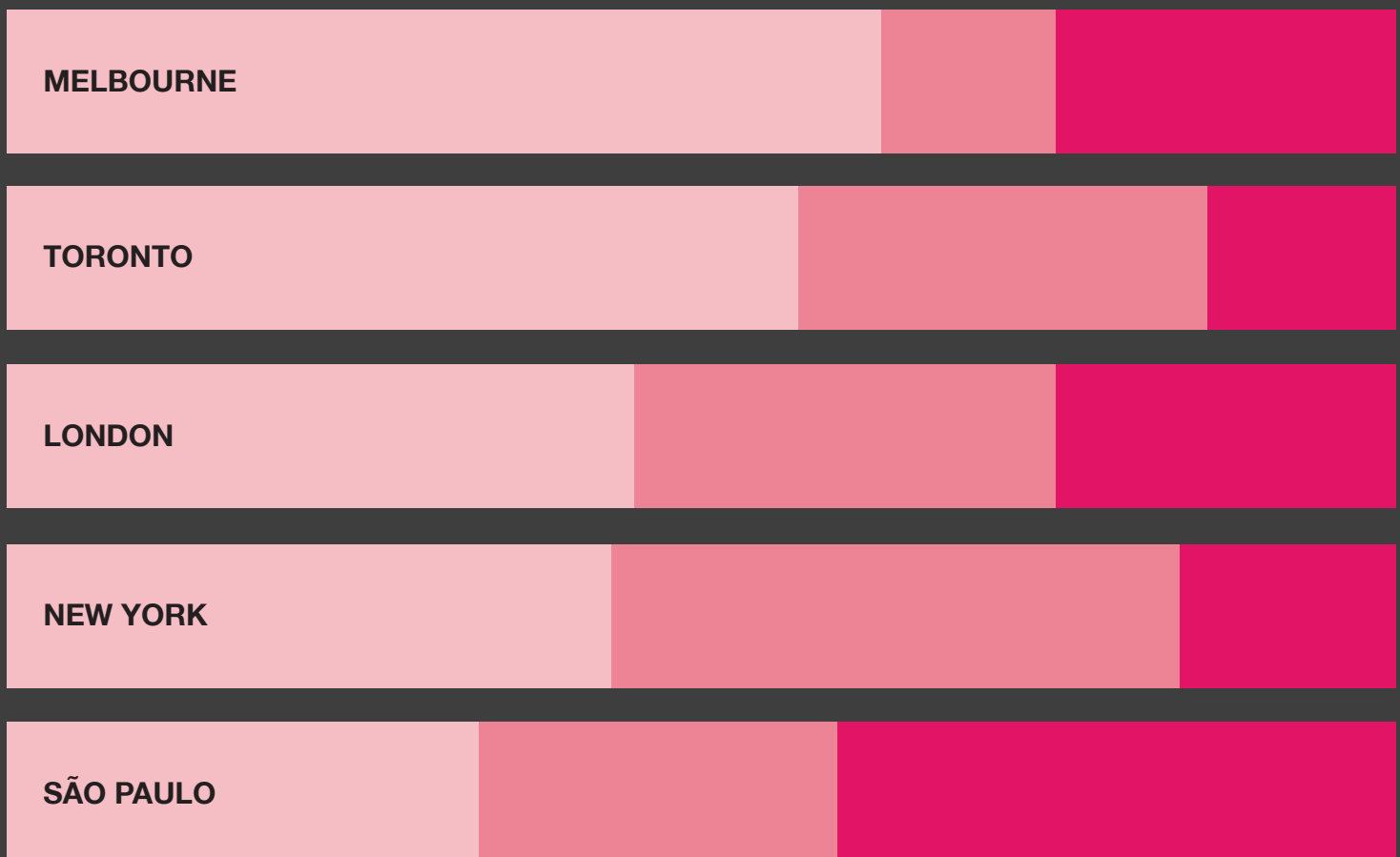
3 In the US, webcams are fitted to home televisions to keep patients in contact with hospital consultants, a technology which could be adopted in UK

THE BIG GREEN DEAL

Cities tackling climate change

Cities around the world are taking the lead on climate change, with London aiming for a 60% reduction in CO₂ emissions by 2025. Their leaders know that meeting these demanding targets will require investment and partnership from IT companies, renewable energy manufacturers and others across the private sector.

Arup is supporting the C40 group of major world cities and the Clinton Climate Initiative (CCI) to help leaders make the most of these opportunities. “We’ve focussed on cities because they’re at the cutting edge,” says Mark Watts, an Arup director and former lead on climate change and sustainable transport for the Mayor of London. “It’s a huge opportunity for them and their private sector partners.”



AVERAGE NUMBER OF TRIPS BY TRAVEL MODE

■ PRIVATE VEHICLES ■ PUBLIC TRANSPORT ■ CYCLING/WALKING

**TORONTO:
ELECTRIC CARS**

Toronto aims to get at least 300 plug-in hybrids and pure electric vehicles into public and private fleets by 2012. Several city departments already use plug-in vehicles.

NEW YORK: FOOD

New York is one of the first metropolises to develop a city-wide food supply and distribution strategy. Urban food is being used as part of a broader urban regeneration agenda, with communities empowered to develop local growing projects.

**BOGOTÁ: PUBLIC
TRANSPORT**

Bogotá's cost-effective rapid bus transit system, the Transmilenio, carries 1,400,000 passengers every day – reducing travelling time by 32%.

**LONDON: COMBINED
HEAT AND POWER**

Part of the city's commitment to move 25% of energy supply off the grid by 2025, the London Thames Gateway Heat Network will use heat from Barking Power Station to supply up to 120,000 homes.

**BARCELONA:
INTEGRATED
RENEWABLE ENERGY**

City authorities developed planning regulations that make it compulsory to use solar energy to supply 60% of running hot water in all new buildings.

**SÃO PAULO:
WASTE TO ENERGY**

The city already generates 7% of its electricity using biogas emitted from landfills. The Arup C40 UrbanLife workshop considered how São Paulo could use waste to energy technology to generate more.

"C40 Mayors have already demonstrated political commitment to tackling climate change and are regulating to cut emissions. Now it is up to the private sector to work with cities in order to provide new initiatives to help deliver further cuts in a way that improves economic performance and raises the quality of life for citizens."

Simon Reddy, Executive Director - C40 Secretariat

**LONDON:
CONGESTION CHARGE**

London was the first major city to introduce road pricing which has contributed to a 5% shift from private car usage to public transport.

**BERLIN:
BUILDING RETROFIT**

By 2007, Berlin's retrofitting programme had reduced energy consumption in 1,400 governmental buildings by 26% – saving 60,000 tonnes of CO₂ and €10,000,000 on energy bills.

PARIS: CYCLING

Vélib, the 24/7 cycle hire service makes it cheap and easy for people to go by bike. Two months into the scheme, 100,000 users were making 300,000km of journeys each day.

TOKYO: URBAN COOLING

New guidelines combat the urban heat island effect, which – together with climate change – has increased the city's temperature by around 3°C over the past 100 years.

**HO CHI MINH CITY:
FLOOD PROTECTION**

By 2030, 95% of the city will be threatened by serious flooding. Flood protection measures could save up to \$6.68bn in the case of an extreme flood.

**MELBOURNE:
SMART CITY**

For Melbourne to take the next step in reducing carbon emissions the Mayor is examining the role that information technology could play in changing behaviour and improving energy supply efficiency.



SMART CITIES

As you'll read on page 23, 40 of the world's largest cities (the C40) are working together to reduce carbon emissions in a collective effort to protect our future.

Arup is the sole strategic adviser to the C40 Group, and it is clear to us that their drive to reduce carbon emissions by 80% over the next 40 years is going to seed new thinking, innovation and whole new industries. According to market intelligence commissioned by the UK's Department for Business, Innovation and Skills, the global market value of the low carbon and environmental goods and services sector had already reached around £3.2 trillion in 2008/09.

CASE STUDY: MELBOURNE

As part of Arup's partnership with the C40, a group of 40 of the world's largest cities committed to tackling climate change, the firm worked with the City of Melbourne in Australia to produce a workshop on smart cities. Held in March 2010, the workshop looked at how a smart city could reduce greenhouse gas emissions as part of a broad urban sustainability agenda. It focussed on how ICT could foster community engagement and encourage people to change their behaviour. Arup's consultants worked with senior City of Melbourne officials and external stakeholders to consider smart ticketing for transport, green infrastructure mapping and a city-wide ICT strategy.

Learn more about Arup's work with the C40 here http://www.arup.com/Homepage_C40.aspx and read more on how other C40 cities are tackling climate change on page 23 of this edition.

Add this to the significant spending needed to modernise infrastructure over the next 20 years, as estimated in a study by CIBC World Markets, and the size of the challenge becomes clear – as do the stakes. So how should cities both decarbonise and invest wisely in new infrastructure?

One approach is to look at the city as a total system, applying technology to measure the performance of the city to help make smarter decisions. "We know from the business world that taking a systems approach and then using technology such as ICT can make complex systems more efficient," says

"Many leaders tell me they need more information to benchmark and understand the impact that projects to tackle climate change will have on their cities. So the first step is using technology to understand the city as a system; the second is using it to optimise that system."

Volker Buscher, a director with Arup's management consulting practice.

It can do the same for cities too. Information and data on consumption can highlight patterns and show how you can achieve economies of scale, enable performance and optimise the use of resources.

Molly Webb, head of strategic engagement at The Climate Group, agrees. "The first opportunity for ICT in creating smart cities is to give leaders better information to act on," she says.

"Many leaders tell me they need more information to benchmark and understand the impact that projects to tackle climate change will have on their cities. So the first step is using technology to understand the city as a system; the second is using it to optimise that system."

The use of ICT to create and run a smart city requires strategic, integrated thinking, as demonstrated during the C40 UrbanLife

workshop with the City of Melbourne. New technology will provide people, utility and transport companies and city leaders with the ability to use resources, networks and buildings more efficiently.

However, cities shouldn't just focus on environmental drivers when developing smart solutions. ICT is also a key differentiator when businesses and people choose where to live and work. Smart solutions can improve access to superfast broadband, use social media to support local communities and enhance the delivery of business and government services.

"If you want to install smart energy

meters in a city, you need to decide what they should do," says Buscher, who leads Arup's work on ICT and resource efficiency. "Do you want them just to display and transmit data or should they control appliances in your property to help you use less energy or water? It's vital that city leaders can answer these questions if they are going to reduce carbon emissions and get the best value from infrastructure investment."

Thanks to advances in technology and the internet of things – everyday objects that collect and use data online – this is now possible, says Buscher. "Going further, it will enable city planners and developers to make better judgements and design places that perform."

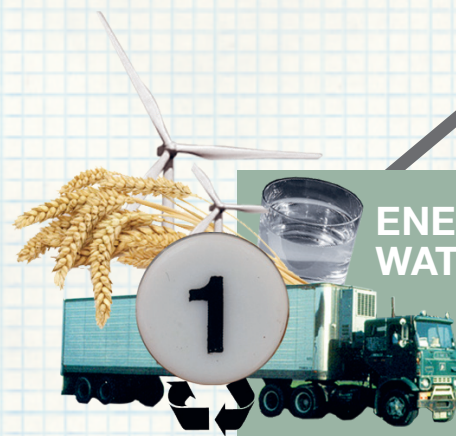
How soon could we see the benefits of a smarter approach to city infrastructure? "In Manchester in the UK, they're hoping smart grid pilot schemes will deliver economic growth, including job growth, within the next ten years," says Webb.

TEN TRENDS CHANGING OUR WORLD

Issues every leader needs to know about

In the first of a series of research papers, Arup director for Foresight + Innovation, Dr Chris Luebke and his team are looking at issues affecting the way we live and work. Here, Luebke previews ten drivers that are changing our world.

“The papers address issues that are important today and will be significant drivers of change over the next 20-30 years,” he explains. “These are issues that receive less attention than they should. Open the Economist, the Financial Times, or the Guardian and you won’t find these topics covered enough. But they’re important for our firm – and business leaders around the world – to understand.”



ENERGY: FOOD: WATER

*Why a crisis in
one is a crisis in
all three*

Modern life relies on the often hidden linkage between energy, food and water. Industrialised food production requires fertilisers made from natural gas. And it takes energy to pump water to the vast fields. So viewed in isolation, an energy crisis looks serious. But when you consider the impact on food and water, it becomes clear that it is far broader than just that.

OPEN INNOVATION

How you can work with a billion brains

There are always more smart people outside your company than there are inside it - billions of them, in fact. How can you work with them to solve your problems? That's what open innovation is about - opening your business up to others. It's not abdicating the final decision on what to do and how to do it. Open innovation means using new ways of partnering that reach out beyond what you think is your business right now.



INTERNET OF THINGS

When things know where they are (and can tell you)

The term has been around for 20 years, but modern technology means the internet of things is now becoming a reality. Bathroom scales that connect to the internet to help you monitor your weight. Fridges that order your shopping. Transport that knows where you need to go and helps you get there. How will things like these affect our lives? We need to understand them.



INNOVATION BLOW-BACK

What's left for the West?

Western societies have assumed they would innovate while eastern societies produced. But the West abdicated productive capacity and now they've lost the lead on innovation. Companies are opening innovation centres in countries like China and India while closing those in places such as the US. Businesses should be asking: are we located in the right places?



THE CHANGING FACE OF IMPERIALISM

Acquiring new empires

Nations with sovereign funds are purchasing the territory they need to ensure their own countries survive and thrive. The Saudis and Chinese have already bought vast tracts of land in Africa and productive capacity in other parts of the world to safeguard their supply of food and essential minerals. These new empires are changing the markets for businesses around the world.



CLICKIZENS

Understanding a digital generation

Clickizens are people aged 35 and under who have learned by clicking instead of flipping. Older people might flip open a dictionary to look up a word; this group clicks on dictionary.com. Clickizens click to find friends, they click to get tickets, they click for just about everything. They're a fascinating group whose expectations, needs and desires vary wildly from the baby boomers who are attempting to lead them.



WOMENOMICS

A female force to count on

Some industries, organisations and corporations remain dominated by men. But the facts show how vital women are to economic success. Women make 80% of consumer goods purchasing decisions in the US. In Canada, they start 70% of new businesses. By 2025, women in the UK are expected to own 60% of all personal wealth. And women now earn 40% of the world's GDP. What does this mean for the workplace? And are there ways that companies can more successfully retain their top female talent?



OCEAN HEALTH

Why the seas are sick and what it means

Oceans are the major protein source for the majority of the world's population. And our actions are affecting them drastically. Acidification is killing plankton and coral reefs. We've eaten 90% of the big fish – Blue Fin Tuna will be gone in two years. An anticipated one-metre sea level rise by 2100 will make 30% of world ports inoperable, with another 50% needing massive reconstruction to be viable. We face an immediate retrofitting challenge.



2050

The world we thought we knew

By 2050, we will be experiencing the effects of things like population growth and climate change. How can we respond?

In 2011, Arup will invite technologists, sociologists, NGOs, energy providers, government officials and others to three-day workshops around the world. Participants will use four scenarios of the world in 2050 developed by Arup to come up with positive responses.



ECONOMIC GROWTH AND OUR ADDICTION TO IT

It's a story of stuff, not cash

Developed by Arup physicist Simon Roberts, 4see is an economic modelling technique based on the flow of stuff, not money. This means that – unlike other economic models – 4see can look forward and doesn't use fudge factors. Simon shows us why we're addicted to growth.



The ten topics featured here are the first of dozens of themes to be addressed by Luebke and his team. Following research throughout 2010, the first Foresight papers will be published. To be notified when the papers are available, register your interest at: chris.luebke@arup.com

NEXT ISSUE

Powering The Planet:

An Energy Special Issue



Editor: Beth Hurren
Sub-editor: Polly Grant
Writer: Matthew Blackbourn
Designers: Matt Cox, Katharine Horgan, Charlotte Svensson

Published by: Arup,
13 Fitzroy Street,
London, W1T 4BQ.
Printed by: Beacon Press using
pureprint, their environmental
printing technique.

ARUP